A46 Coventry Junctions (Walsgrave) Scheme number: TR010066

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Appendix 5.1 Air Quality Modelling Process

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

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ENVIRONMENTAL STATEMENT APPENDICES
Appendix 5.1 Air Quality Monitoring Process

Regulation Number	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010066
Application Document Reference	TR010066/APP/6.3
Author	A46 Coventry Junctions (Walsgrave), Project Team & National Highways

Version	Date	Status of Version
Rev 0	November 2024	Application Issue

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1. Air quality modelling process

1.1. Introduction

1.1.1. This appendix provides an overview of the air quality modelling process utilised for the operational phase air quality assessment for the Scheme. Details are provided relevant to the dispersion modelling software and associated parameters, treatment of air pollutant background levels, and the methodology for addressing long term trends in roadside levels of nitrogen dioxide (NO_2).

1.1.2. The Atmospheric Dispersion Modelling System (ADMS) Roads dispersion modelling software has been used in this project, which is 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.

1.2. Modelling parameters

1.2.1. The following model input parameters were used for this assessment.

Road geometry

1.2.2. ADMS Roads requires inputs of road widths and, where relevant, heights of street canyons, although no street canyons were identified for this project. Road widths were determined using the Ordnance Survey Mastermap data within ArcGIS. The roads were also realigned to match the real-world using Ordnance Survey Mastermap data within ArcGIS to accurately represent distances between road alignments and sensitive receptors.

Surface roughness

1.2.3. Surface roughness is a parameter used to represent the unevenness of the surface throughout the model domain, which influences the vertical mixing of pollutants through enhancing mechanical turbulence. The surface roughness length was set to 0.5m across the modelled study area, which is equivalent to parkland and open suburbia land uses and is representative of the study area.

1.2.4. The meteorological site used to source meteorological data for this project was in a relatively rural, open area than the Scheme. Therefore, the surface roughness length was set to 0.3m at the meteorological site.

Monin-Obukhov length

1.2.5. 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 2m 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 in urban areas, resulting in a typical minimum value of 30m.

1.2.6. A minimum Monin-Obukhov length of 10m was set for this study area, given it is not located within an urban centre, but is on the fringes of Coventry. The meteorological site is in a relatively rural location, resulting in a lower minimum Monin-Obukhov length of 5m at the meteorological site.

Terrain

1.2.7. The study area was treated as being flat given the lack of significant variations in terrain.

1.3. Background concentrations

1.3.1. Background pollutant concentrations for the 1km x 1km grid squares encompassing the operational phase study area were sourced from Defra's published background pollutant maps. Specifically, annual mean NO_x, NO_2 and PM_{10} data were sourced for years 2018 (Baseline) and 2028 (Scheme opening year) for use in the operational phase air quality modelling. To ensure contributions from road traffic were not 'double counted', the relevant background road sectors were removed.

1.3.2. A breakdown of the background concentrations per 1km square of the study area can be found in Table 1-1.

Table 1-1: Background annual mean concentrations for years 2018 and 2028 for the 1km x 1km grid squares encompassing the study area

Grid square	2018 Background concentrations (µg/m^3)			2028 Background concentrations (µg/m^3)		
	NO_2	NO_x	PM_{10}	NO_2	NO_x	PM_{10}
436500_275500	19.2	14.1	15.5	13.0	9.9	14.2
430500_277500	23.3	16.6	14.7	17.0	12.5	13.4
442500_291500	16.8	12.5	14.7	12.0	9.2	13.4
440500_284500	18.1	13.4	14.6	12.0	9.2	13.2
441500_275500	13.6	10.3	13.7	9.7	7.5	12.4
438500_274500	14.4	10.9	13.9	10.0	7.8	12.6
439500_277500	16.9	12.6	14.0	11.8	9.0	12.7
437500_274500	15.1	11.4	14.2	10.6	8.2	12.9

Grid square	2018 Background concentrations (µg/m^3)			2028 Background concentrations (µg/m^3)		
	NO_2	NO_x	PM_{10}	NO_2	NO_x	PM_{10}
438500_279500	18.1	13.4	16.0	12.2	9.3	14.6
438500_278500	19.6	14.4	15.5	13.2	10.0	14.1
437500_279500	21.1	15.4	14.5	14.3	10.8	13.1
437500_280500	24.0	17.1	14.7	16.7	12.4	13.3
438500_277500	21.1	15.2	15.5	15.0	11.2	14.2
437500_276500	18.0	13.3	15.3	12.2	9.3	13.9
437500_278500	20.7	15.1	14.6	14.0	10.6	13.2
439500_283500	20.0	14.7	15.8	12.9	9.8	14.5
439500_284500	17.7	13.1	15.9	11.8	9.1	14.5
440500_285500	17.1	12.7	16.1	11.5	8.8	14.8
440500_286500	17.0	12.7	15.8	11.4	8.8	14.5
441500_288500	15.7	11.8	15.3	10.7	8.3	14.0
442500_289500	15.6	11.7	15.4	10.7	8.3	14.1
442500_290500	16.0	11.9	16.0	11.0	8.5	14.7
443500_291500	16.4	12.2	15.0	11.1	8.6	13.7
433500_275500	20.3	14.9	15.1	13.5	10.2	13.8
433500_274500	19.5	14.3	15.1	13.3	10.1	13.8
432500_274500	17.1	12.7	15.8	11.8	9.0	14.5
432500_273500	16.4	12.3	15.7	11.2	8.6	14.4
438500_281500	22.0	15.9	15.4	15.0	11.2	14.0
437500_281500	22.0	15.9	14.7	14.9	11.2	13.2
434500_275500	19.2	14.1	15.7	12.9	9.8	14.4
435500_275500	20.5	14.9	15.3	13.9	10.5	14.0
436500_276500	20.6	15.0	14.3	13.9	10.5	12.9
438500_276500	17.2	12.8	13.7	11.7	9.0	12.4
437500_277500	20.3	14.9	14.3	13.9	10.5	12.9
443500_290500	16.5	12.3	15.6	11.2	8.6	14.3

2. Addressing long term trends in roadside NO_2

2.1.1. To account for uncertainties in predicted future roadside NO_2 concentrations, the Design Manual for Roads and Bridges LA 105 Air quality (National Highways, 2019) standard requires that a 'gap analysis' be completed. The 'gap analysis' aims to address the difference between the assumed rates of reduction in roadside NO_x and NO_2 levels when compared to real-world observed roadside monitoring trends. This is to ensure future annual mean NO_2 roadside predictions are not overly optimistic.

2.1.2. An additional model scenario within the air quality assessment was required, referred to as 'the projected base year', which used the base year (2018) traffic data with the opening year (2028) vehicle emission factors and background concentrations. The results from this scenario and those from the base year (2018) scenario were used in tandem with the National Highways Long Term Gap Analysis Calculator v1.1 to derive appropriate 'gap factors' that were applied to the 2028 DM and DS opening year scenario results for NO_2.

2.1.3. The derived gap factors are presented in Table 2-1.

Table 2-1 : Annual mean roadside NO_2 gap factors derived for the Scheme air quality assessment

Receptor	Annual mean NO_2 ($\mu g/m^3$)				Ratio A (projected base year / base year)	Ratio B (opening year projection factor (2028)/ base year projection factor (2018))[1]	Gap factor (ratio B / ratio A)	2028 DM (Do minimum x gap factor)	2028 DS (Do something x gap factor)
	Base 2018	Future base 2028	DM 2028 prior to gap analysis	DS 2028 prior to gap analysis					
R1	18.7	11.1	11.1	11.0	0.59	0.8	1.35	15.0	14.9
R2	19.5	11.7	11.7	11.7	0.60	0.8	1.34	15.7	15.7
R3	20.7	12.1	12.1	12.1	0.58	0.8	1.38	16.6	16.7
R4	21.3	12.2	12.3	12.3	0.58	0.8	1.39	17.1	17.1
R5	20.9	12.1	12.1	12.2	0.58	0.8	1.38	16.7	16.8
R6	23.7	13.1	13.2	13.3	0.55	0.8	1.45	19.2	19.3
R7	16.4	10.3	10.4	10.3	0.63	0.8	1.27	13.2	13.1
R8	22.5	13.3	13.5	13.0	0.59	0.8	1.36	18.3	17.6
R9	25.8	14.5	14.8	14.2	0.56	0.8	1.43	21.1	20.2
R10	16.2	10.2	10.2	10.2	0.63	0.8	1.26	12.9	12.8
R11	22.3	13.3	13.3	12.8	0.59	0.8	1.35	17.9	17.3
R12	23.0	14.4	14.5	14.2	0.63	0.8	1.27	18.5	18.1
R13	24.3	15.0	15.1	14.9	0.62	0.8	1.30	19.7	19.4
R14	24.6	15.1	15.2	15.0	0.61	0.8	1.30	19.9	19.6
R15	23.3	13.6	13.8	13.2	0.58	0.8	1.38	19.0	18.2
R16	19.5	12.2	12.3	11.8	0.62	0.8	1.28	15.8	15.2
R17	23.1	12.5	12.5	12.7	0.54	0.8	1.48	18.6	18.7
R18	22.8	12.4	12.4	12.7	0.54	0.8	1.48	18.4	18.8

Receptor	Annual mean NO_2 ($\mu g/m^3$)				Ratio A (projected base year / base year)	Ratio B (opening year projection factor (2028)/ base year projection factor (2018))[1]	Gap factor (ratio B / ratio A)	2028 DM (Do minimum x gap factor)	2028 DS (Do something x gap factor)
	Base 2018	Future base 2028	DM 2028 prior to gap analysis	DS 2028 prior to gap analysis					
R19	20.9	12.1	12.0	12.1	0.58	0.8	1.38	16.5	16.7
R20	20.5	12.0	11.8	11.9	0.58	0.8	1.37	16.1	16.3
R21	22.0	12.5	11.9	12.2	0.57	0.8	1.41	16.8	17.1
R22	28.2	14.7	13.3	13.7	0.52	0.8	1.54	20.5	21.0
R23	20.7	12.1	11.7	11.9	0.58	0.8	1.37	16.0	16.3
R24	22.8	12.8	12.7	12.8	0.56	0.8	1.43	18.1	18.2
R25	23.5	12.6	12.7	13.4	0.53	0.8	1.50	19.0	20.1
R26	23.8	12.7	12.7	13.4	0.53	0.8	1.50	19.2	20.2
R27	20.1	11.5	11.5	11.4	0.57	0.8	1.40	16.1	15.9
R28	20.1	11.5	11.5	11.5	0.57	0.8	1.40	16.1	16.1
R29	21.7	12.0	12.1	12.2	0.55	0.8	1.45	17.4	17.6
R30	21.8	12.1	12.1	12.1	0.55	0.8	1.45	17.5	17.4
R31	28.1	16.4	16.7	16.3	0.58	0.8	1.37	22.9	22.4
R32	29.4	16.8	17.4	17.1	0.57	0.8	1.40	24.4	24.0
R33	32.5	18.0	18.5	18.1	0.56	0.8	1.44	26.7	26.1
R34	27.1	16.0	16.3	16.0	0.59	0.8	1.36	22.1	21.7
R35	26.2	15.6	15.9	15.6	0.60	0.8	1.34	21.3	20.9
R36	28.8	16.6	16.9	16.6	0.58	0.8	1.39	23.5	23.1
R37	29.3	16.7	17.3	17.0	0.57	0.8	1.40	24.3	23.9
R38	29.8	17.0	17.5	17.2	0.57	0.8	1.41	24.7	24.2

Receptor	Annual mean NO_2 ($\mu g/m^3$)				Ratio A (projected base year / base year)	Ratio B (opening year projection factor (2028)/ base year projection factor (2018))[1]	Gap factor (ratio B / ratio A)	2028 DM (Do minimum x gap factor)	2028 DS (Do something x gap factor)
	Base 2018	Future base 2028	DM 2028 prior to gap analysis	DS 2028 prior to gap analysis					
R39	26.6	15.8	16.1	15.9	0.59	0.8	1.35	21.6	21.3
R40	25.3	15.3	15.5	15.4	0.61	0.8	1.32	20.5	20.2
R41	23.8	13.8	13.9	13.4	0.58	0.8	1.38	19.2	18.4
R42	22.5	14.3	14.3	14.0	0.64	0.8	1.26	18.1	17.6
R43	22.4	14.3	14.3	13.9	0.64	0.8	1.26	18.0	17.5
R44	20.7	12.7	12.7	12.3	0.61	0.8	1.31	16.6	16.0
R45	24.2	14.3	14.0	14.1	0.59	0.8	1.36	19.1	19.1
R46	26.1	13.4	13.9	14.1	0.51	0.8	1.56	21.7	22.1
R47	25.8	13.3	13.6	13.8	0.52	0.8	1.55	21.0	21.4
R48	26.7	14.2	14.4	14.4	0.53	0.8	1.51	21.7	21.8
R49	26.0	13.9	14.1	14.2	0.54	0.8	1.49	21.1	21.2
R50	19.5	11.8	11.8	11.5	0.60	0.8	1.33	15.6	15.3
R51	20.4	13.0	13.0	12.8	0.64	0.8	1.26	16.3	16.0
R52	22.8	13.3	13.5	13.2	0.58	0.8	1.37	18.5	18.1
R53	19.6	10.9	11.0	11.5	0.56	0.8	1.44	15.9	16.5
R54	22.7	13.3	13.4	13.2	0.58	0.8	1.37	18.4	18.0
R55	25.7	13.3	13.5	13.7	0.52	0.8	1.55	20.9	21.2
R56	29.9	14.8	15.7	15.2	0.49	0.8	1.62	25.4	24.6
R57	20.9	11.8	12.5	12.0	0.56	0.8	1.42	17.6	17.0
R58	30.9	14.9	15.3	15.4	0.48	0.8	1.66	25.3	25.6

Receptor	Annual mean NO_2 ($\mu g/m^3$)				Ratio A (projected base year / base year)	Ratio B (opening year projection factor (2028)/ base year projection factor (2018))[1]	Gap factor (ratio B / ratio A)	2028 DM (Do minimum x gap factor)	2028 DS (Do something x gap factor)
	Base 2018	Future base 2028	DM 2028 prior to gap analysis	DS 2028 prior to gap analysis					
R59	26.9	13.6	13.9	14.0	0.51	0.8	1.58	22.0	22.2
R60	39.9	18.2	18.9	19.1	0.46	0.8	1.76	33.2	33.5
R61	22.0	12.0	12.2	12.2	0.54	0.8	1.47	17.9	18.0
R62	34.2	16.1	16.6	16.8	0.47	0.8	1.70	28.3	28.5
R63	29.1	14.3	14.7	14.8	0.49	0.8	1.63	23.9	24.0
R64	17.3	10.3	10.4	10.4	0.59	0.8	1.35	14.0	14.1
R65	19.5	11.0	11.2	11.2	0.56	0.8	1.42	15.9	15.9
R66	15.0	9.3	9.4	9.4	0.62	0.8	1.29	12.1	12.1
R67	20.1	10.9	11.2	11.2	0.54	0.8	1.47	16.4	16.5
R68	20.3	11.1	11.3	11.3	0.55	0.8	1.46	16.5	16.4
R69	35.5	17.2	15.6	15.7	0.49	0.8	1.65	25.7	25.9
R70	32.9	16.2	15.3	15.4	0.49	0.8	1.63	25.0	25.0
R71	28.3	14.8	15.1	15.0	0.52	0.8	1.53	23.2	23.0
R72	37.5	18.4	18.8	18.8	0.49	0.8	1.64	30.8	30.8
R73	30.4	15.5	15.6	15.6	0.51	0.8	1.57	24.4	24.4
R74	22.6	12.8	12.9	12.9	0.57	0.8	1.41	18.2	18.2
R75	28.0	14.7	14.6	14.7	0.52	0.8	1.53	22.3	22.4
R76	29.9	15.4	15.5	15.5	0.51	0.8	1.56	24.1	24.1
R77	33.5	16.7	16.6	16.7	0.50	0.8	1.61	26.7	26.8
R78	17.4	10.6	10.5	10.6	0.61	0.8	1.32	13.9	13.9

Receptor	Annual mean NO_2 ($\mu g/m^3$)				Ratio A (projected base year / base year)	Ratio B (opening year projection factor (2028)/ base year projection factor (2018))[1]	Gap factor (ratio B / ratio A)	2028 DM (Do minimum x gap factor)	2028 DS (Do something x gap factor)
	Base 2018	Future base 2028	DM 2028 prior to gap analysis	DS 2028 prior to gap analysis					
R79	25.1	13.7	13.7	13.8	0.55	0.8	1.46	20.1	20.1
R80	16.4	10.0	10.1	10.0	0.61	0.8	1.32	13.2	13.2
H1	22.6	14.3	14.4	14.2	0.63	0.8	1.26	18.2	17.9
H2	22.2	14.2	14.3	14.1	0.64	0.8	1.25	17.9	17.6
H3	22.0	14.1	14.2	14.0	0.64	0.8	1.25	17.7	17.5
H4	22.5	14.3	14.4	14.2	0.64	0.8	1.26	18.1	17.9
H5	22.2	14.2	14.3	14.1	0.64	0.8	1.25	17.9	17.6
H6	20.7	13.7	13.7	13.5	0.66	0.8	1.21	16.6	16.4
H7	19.6	11.8	11.8	11.6	0.60	0.8	1.33	15.7	15.4
S1	19.5	12.2	12.2	11.9	0.63	0.8	1.28	15.6	15.2
S2	17.4	11.0	11.0	10.8	0.63	0.8	1.26	13.9	13.6
S3	28.3	13.7	14.1	14.2	0.48	0.8	1.66	23.4	23.6
S4	21.7	12.7	12.5	12.5	0.58	0.8	1.37	17.1	17.1
S5	21.0	12.4	12.3	12.2	0.59	0.8	1.35	16.5	16.5
S6	22.3	12.8	12.8	12.8	0.57	0.8	1.40	17.9	17.9
S7	26.4	14.1	14.1	14.0	0.53	0.8	1.50	21.2	21.0

[1]Base and Opening Year Projection Factors provided within National Highways Long Term Gap Analysis Calculator v1.1