A38 Derby Junctions

TR010022

Volume 6

6.3 Environmental Statement Appendices

Appendix 5.2: Air Quality Methodologies

Regulation 5(2)(a)

Planning Act 2008

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

April 2019

Infrastructure Planning

Planning Act 2008

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

A38 Derby Junctions Development Consent Order 202[ ]

6.3 Environmental Statement Appendices
Appendix 5.2: Air Quality Methodologies

Regulation Number	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010022
Application Document Reference	6.3
Author	A38 Derby Junctions Project Team, Highways England

Version	Date	Status of Version
1	April 2019	DCO Application

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Appendix 5.2: Air Quality Methodologies

1 Detailed modelling for local air quality assessment for operation and construction

1.1.1 Local air quality impacts have been assessed using traffic data provided by the Scheme transport planners – details are discussed in Chapter 5: Air Quality [**TR010022/APP/6.1**] as well as in the Transport Assessment Report [**TR010022/APP/7.3**].

1.1.2 For the local operational and construction assessments, the Scheme and all affected roads have been assessed at a detailed level of assessment due to the complexity of the road network and the high nitrogen dioxide (NO_2) concentrations at properties in Derby city centre. A detailed level assessment uses dispersion modelling to estimate pollutant concentrations more accurately, taking into account additional variables such as local meteorological data and the variation in traffic speeds throughout the day, that are not examined in a simple level assessment.

1.1.3 The detailed assessment of local air quality has used the Atmospheric Dispersion Modelling System (ADMS) Roads dispersion model (version 4.1.1) to predict road pollutant contributions at identified sensitive receptors. ADMS-Roads is a modern dispersion model that has an extensive published track record of use in the UK for the assessment of local air quality impacts, including model validation and verification studies (CERC, 2018).

1.1.4 Predictions have been made for the following scenarios:

- Baseline year 2015.
- Future baseline construction year 2021 without construction (Do-Minimum).
- Construction year 2021 with construction (Do-Something).
- Future baseline opening year 2024 without the Scheme (Do-Minimum).
- Opening year 2024 with the Scheme (Do-Something).

1.1.5 On the basis of these predictions, the change in key pollutant concentrations (NO_2, PM_{10} and $PM_{2.5}$) associated with the Scheme was established.

1.1.6 Vehicle emission rates of NO_x and PM_{10} were obtained from Interim Advice Note (IAN) 174/13 (Highways Agency, 2013) for speed banded emissions. Highways England considers that these emissions provide a good representation of emissions during congested periods.

1.1.7 A key element of the detailed assessment is the rate of improvement in air quality over time as cleaner road vehicles enter the national vehicle fleet. The methodology outlined within IAN 170/12 (Highways Agency, 2013) on the assessment of future NO_x and NO_2 projections, was used in this assessment. The method considers Defra's advice on long-term trends related to roadside NO_2 concentrations, which suggests that there is a gap between current projected vehicle emission reductions and projections on the annual rate of improvements in ambient air quality as previously published in Defra's technical guidance and observed trends. Consequently Highways England developed a set of NO_2

projection factors to inform scheme air quality assessments. The methodology, known as 'Gap Analysis', involves the completion of air quality modelling and verification, to correct verified modelled total NO_2 concentrations. Following verification of the modelled results, the results are then adjusted to represent the observed long-term trend profile described in IAN 170/12. The results from the gap analysis method for NO_2 are included in Appendix 5.3 [**TR010022/APP/6.3**]. Results produced using the gap analysis method are more conservative than Defra's forecasts. The significance of local air quality effects has been determined on the basis of the gap analysis method as this is currently considered by Highways England to be the most reasonable worst-case representation of future air quality. NO_2 concentrations were also predicted using Defra's forecasts and these results are referred to where exceedances are predicted, as additional information.

1.1.8 Table 1 summarises the key model inputs utilised in the ADMS-Roads modelling.

Table 1: Model input parameters

Variables	Model input
Surface roughness at source	1m
Terrain types	Flat
Receptor location	x,y coordinates determined by GIS
Emissions	NO_X, PM_{10}
Emission factors	As per IAN 185/15 (updated emission factors using speed banding)* $PM_{2.5}$ vehicular emissions were assumed to be the same as PM_{10}
Meteorological data	1 year (2015) hourly sequential data from East Midlands Airport Meteorological Station
Emission profiles	Emissions have been calculated for am peak, inter-peak, pm peak and off peak periods
Receptors	Selected receptors
Model output	Long-term annual mean NOx concentrations (µg/m^3) Long-term annual mean PM_{10} concentrations (µg/m^3)

* updated IAN 185/15 emissions tool issued by Highways England

1.1.9 Four of the roads in the study area were set up as street canyons in the model due to the built up nature of those roads which reduces dispersion. These roads are in the city centre and are London Road, Friar Gate, Curzon Street and part of Stafford Street.

1.1.10 Representative sensitive receptors were selected at locations expected to experience the greatest impacts due to the Scheme and so were located at properties or community facilities closest to the affected road network. The receptors assessed include 251 residential properties (denoted by the prefix R), 20 educational facilities (denoted by the prefix S), six medical facilities (denoted by the prefix H) and 17 community facilities (denoted by the prefix C) which includes

outdoor areas. The receptors are shown in Table 2 (refer to Figures 5.2a to 5.2c and 5.3a to 5.3c) [**TR010022/APP/6.2**].

Table 2: Receptor locations

Receptor number	OS Grid Ref.		Height (m)	Location	Included in which phase	
	X	Y			Operational	Construction
R1	435446	342440	1.5	14 Eaton Bank	✓	✓
R2	435639	342105	1.5	Eaton Bank	✓	✓
R3	435738	341747	1.5	111 Duffield Road	✓	✓
R4	435846	341605	1.5	95 Duffield Road	✓	✓
R5	436136	341321	1.5	24 Duffield Road	✓	✓
R6	436206	341090	1.5	14 Duffield Road	✓	✓
R7	436275	341001	1.5	2A Duffield Road	✓	✓
R8	436334	340912	1.5	Alfreton Road	✓	✓
R9	436675	341631	1.5	Morley Lane	✓	✓
R10	436739	341558	1.5	Cuckoo Wood Farm	✓	✓
R11	436650	341478	1.5	Morley Lane	✓	✓
R12	436373	340066	1.5	Ford Lane Mobile Home Park	✓	✓
R13	436358	340056	1.5	Ford Lane Mobile Home Park	✓	✓
R14	436294	340054	1.5	Ford Lane Mobile Home Park	✓	✓
R15	435828	340241	1.5	51 Lambourn Drive	✓	✓
R16	435287	340290	1.5	Duffield Road	✓	✓
R17	435318	340249	1.5	556 Duffield Road	✓	✓
R18	435332	340180	1.5	Ford Lane	✓	✓
R19	435787	339984	1.5	Wharfedale Close	✓	✓
R20	435778	339940	1.5	Wharfedale Close	✓	✓
R21	435631	339860	1.5	89 Derwent Drive	✓	✓
R22	435485	339728	1.5	225 Lambourn Drive	✓	✓
R23	435253	339521	1.5	Fountains Close	✓	✓
R24	435216	339493	1.5	Fountains Close	✓	✓
R25	435112	339445	1.5	Lambourn Court	✓	✓
R26	435118	339794	1.5	484 Duffield Road	✓	✓
R27	435051	339628	1.5	Duffield Road	✓	✓
R28	435075	339572	1.5	452 Duffield Road	✓	✓
R29	435022	339580	1.5	Duffield Road	✓	✓
R30	434977	339500	1.5	60 Gisborne Crescent	✓	✓
R31	435047	339457	1.5	Lambourn Court	✓	✓
R32	434957	339405	1.5	28 Kingscroft	✓	✓
R33	434971	339252	1.5	3 Church Lane North	✓	✓
R34	434863	339172	1.5	Birchover House, Church Lane North	✓	✓
R35	434863	339172	4.5	Birchover House, Church Lane North	✓	✓
R36	434863	339172	7.5	Birchover House, Church Lane North	✓	✓
R37	434863	339172	10.5	Birchover House, Church Lane North	✓	✓
R38	434822	339136	1.5	Birchover House, Church Lane North	✓	✓
R39	434822	339136	4.5	Birchover House, Church Lane North	✓	✓

Receptor number	OS Grid Ref.		Height (m)	Location	Included in which phase	
	X	Y			Operational	Construction
R40	434822	339136	7.5	Birchover House, Church Lane North	✓	✓
R41	434822	339136	10.5	Birchover House, Church Lane North	✓	✓
R42	434842	339247	1.5	Apartments in Drum CLose	✓	✓
R43	434842	339247	4.5	Apartments in Drum Close	✓	✓
R44	434842	339247	7.5	Apartments in Drum Close	✓	✓
R45	434762	339147	1.5	Ashford House, 23 St George's Close	✓	✓
R46	434762	339147	4.5	Ashford House, 23 St George's Close	✓	✓
R47	434762	339147	7.5	Ashford House, 23 St George's Close	✓	✓
R48	434684	338814	1.5	4 Abbeycroft Lane	✓	✓
R49	434587	338711	1.5	1 Finningley Drive	✓	✓
R50	434324	338374	1.5	18 Alstonfield Drive	✓	✓
R51	434161	338201	1.5	Wessington Mews	✓	✓
R52	434123	337979	1.5	Leylands Estate	✓	✓
R53	433861	337650	1.5	Kedleston Old Road	✓	✓
R54	433914	337587	1.5	Clovelly Court, Longford Street	✓	✓
R55	433914	337587	4.5	Clovelly Court, Longford Street	✓	✓
R56	433914	337587	7.5	Clovelly Court, Longford Street	✓	✓
R57	433990	337517	1.5	Abbey Court, Cedar Street	✓	✓
R58	434455	337262	1.5	82 Kedleston Road	✓	✓
R59	434420	337251	1.5	105 Kedleston Road	✓	✓
R60	434981	336688	1.5	St Helen's Street	✓	✓
R61	434739	336306	1.5	Burleigh Mews, Stafford Street	✓	✓
R62	434725	336222	1.5	37 Stafford Street	✓	✓
R63	434701	336176	1.5	55 Stafford Street	✓	✓
R64	434688	336152	1.5	59A Stafford Street	✓	✓
R65	433699	337114	1.5	32 Queensway	✓ (Do-Min)	
R66	433685	337100	1.5	30 Queensway	✓ (Do-Min)	
R67	433671	337087	1.5	26 Queensway	✓ (Do-Min)	
R68	433657	337074	1.5	24 Queensway	✓ (Do-Min)	
R69	433648	337067	1.5	22 Queensway	✓ (Do-Min)	
R70	433636	337056	1.5	20 Queensway	✓ (Do-Min)	
R71	433620	337043	1.5	18 Queensway	✓ (Do-Min)	
R72	433603	337032	1.5	16 Queensway	✓ (Do-Min)	
R73	433593	337024	1.5	14 Queensway	✓ (Do-Min)	
R74	433580	337016	1.5	12 Queensway	✓ (Do-Min)	
R75	433565	337003	1.5	10 Queensway	✓ (Do-Min)	
R76	433549	336994	1.5	8 Queensway	✓ (Do-Min)	
R77	433540	336984	1.5	6 Queensway	✓ (Do-Min)	
R78	433526	336976	1.5	4 Queensway	✓ (Do-Min)	

Receptor number	OS Grid Ref.		Height (m)	Location	Included in which phase	
	X	Y			Operational	Construction
R79	433509	336962	1.5	2 Queensway	✓ (Do-Min)	
R80	433464	336923	1.5	259 Ashbourne Road	✓ (Do-Min)	
R81	433472	336918	1.5	257 Ashbourne Road	✓ (Do-Min)	
R82	433483	336912	1.5	255 Ashbourne Road	✓	✓
R83	433490	336908	1.5	253 Ashbourne Road	✓	✓
R84	433501	336901	1.5	14 Sutton Close	✓	✓
R85	433521	336890	1.5	1 Sutton Close	✓	✓
R86	433491	336883	1.5	13 Sutton Close	✓	✓
R87	433487	336876	1.5	12 Sutton Close	✓	✓
R88	433653	336841	1.5	Travellers Rest , Ashbourne Road	✓	✓
R89	433868	336732	1.5	Burgess Mill, Ashbourne Road	✓	✓
R90	433914	336714	4.5	Ashbourne Road/Surrey Street	✓	✓
R91	433928	336722	4.5	98 Ashbourne Road	✓	✓
R92	434030	336679	1.5	62 Ashbourne Road	✓	✓
R93	434056	336672	1.5	Merchant Street/Ashbourne Road	✓	✓
R94	434055	336647	1.5	AppleTree Cottage, Ashbourne Road	✓	✓
R95	434118	336787	1.5	129 Markeaton Street	✓	✓
R96	434174	336592	1.5	Summer Cottage, Ashbourne Road	✓	✓
R98	434139	336499	1.5	Slater Avenue	✓	✓
R99	434145	336283	1.5	41B Uttoxeter Old Road	✓	✓
R100	434103	336247	1.5	130 Uttoxeter Old Road	✓	✓
R101	433921	335893	1.5	89 Uttoxeter Old Road	✓	✓
R102	433872	335796	1.5	203 Uttoxeter New Road	✓	✓
R103	433861	335792	4.5	207 Uttoxeter New Road	✓	✓
R104	433779	335776	1.5	266 Uttoxeter New Road	✓	✓
R105	433733	335727	1.5	241 Uttoxeter New Road	✓	✓
R106	433528	335623	1.5	342 Uttoxeter New Road	✓	✓
R107	433317	335470	1.5	388 Uttoxeter New Road	✓	✓
R108	433338	335436	1.5	383 Uttoxeter New Road	✓	✓
R109	433446	335415	1.5	62 St Wystan's Road	✓	✓
R110	433184	335205	1.5	19 Manor Road	✓	✓
R111	433132	335272	1.5	4 Manor Road	✓	✓
R112	433175	335320	1.5	433 Uttoxeter New Road	✓	✓
R113	433228	335356	1.5	423 Uttoxeter New Road	✓	✓
R114	433249	335421	1.5	400 Uttoxeter NewRoad	✓	✓
R115	433181	335373	1.5	416 Uttoxeter New Road	✓	✓
R116	433163	335375	1.5	418 Uttoxeter New Road	✓	✓
R117	433120	335338	1.5	426 Uttoxeter New Road	✓	✓
R118	433177	335429	1.5	Cannock Court, Uttoxeter New Road	✓	✓
R119	433177	335429	4.5	Cannock Court, Uttoxeter New Road	✓	✓
R120	433177	335429	7.5	Cannock Court, Uttoxeter New Road	✓	✓
R121	433171	335520	1.5	47 Kingsway	✓	✓
R122	433252	335545	1.5	California Gardens	✓	✓

Receptor number	OS Grid Ref.		Height (m)	Location	Included in which phase	
	X	Y			Operational	Construction
R123	433227	335609	1.5	46 Albany Road	✓	✓
R124	433236	335779	1.5	53 Trowels Lane	✓	✓
R125	432715	336991	1.5	Fenchurch Walk	✓	✓
R126	433005	337033	1.5	Ravenscourt Road	✓	✓
R127	433221	336987	1.5	Harringay Gardens	✓	✓
R128	433269	336967	1.5	Harringay Gardens	✓	✓
R129	433173	336912	1.5	70 Enfield Road	✓	✓
R130	433233	336888	1.5	64 Enfield Road	✓	✓
R131	433259	336882	1.5	62 Enfield Road	✓	✓
R132	433210	336868	1.5	2 Greenwich Drive North	✓	✓
R133	433196	336828	1.5	6 Greenwich Drive North	✓	✓
R134	433184	336816	1.5	8 Greenwich Drive North	✓	✓
R135	433108	336742	1.5	24 Greenwich Drive North	✓	✓
R136	433140	336679	1.5	119 Windmill Hill Lane	✓	✓
R137	432956	336690	1.5	9 Brentford Drive	✓	✓
R138	432975	336606	1.5	Greenwich Gardens apartments, 34 Greenwich Drive North	✓	✓
R139	433063	336578	1.5	150 Thurcroft Close	✓	✓
R140	432955	336543	1.5	Greenwich Gardens apartments, 34 Greenwich Drive North	✓	✓
R141	432915	336508	1.5	Greenwich Gardens apartments, 34 Greenwich Drive North	✓	✓
R142	432827	336428	1.5	58 Brackensdale Avenue	✓	✓
R143	432856	336392	1.5	37 Brackensdale Avenue	✓	✓
R144	432843	336349	1.5	Greenwich Drive South	✓	✓
R145	433048	336526	1.5	25 Kingsway	✓	✓
R146	433067	336513	1.5	4 Raleigh Street	✓	✓
R147	433015	336495	1.5	170 Kingsway	✓	✓
R148	433075	336462	1.5	2 Seymour Close	✓	✓
R149	433082	336414	1.5	66 Lyttelton Street	✓	✓
R150	433056	336413	1.5	1 Raleigh Street	✓	✓
R151	433230	336421	1.5	26 Lyttelton Street	✓	✓
R152	433324	336408	1.5	7 Lyttelton Street	✓	✓
R153	433177	336392	1.5	33 Lyttelton Street	✓	✓
R154	433072	336383	1.5	45 Lyttelton Street	✓	✓
R155	433044	336361	1.5	92 Cheviot Street	✓	✓
R156	432996	336382	1.5	80 Lyttelton Street	✓	✓
R157	432975	336347	1.5	53 Kingsway Park Close	✓	✓
R158	433025	336261	1.5	119 Cheviot Street	✓	✓
R159	432657	336086	1.5	Greenwich Drive South	✓	✓
R160	432504	336059	1.5	Greenwich Drive South	✓	✓
R161	432506	335064	1.5	11 Fulmar Close	✓	✓
R162	432324	335115	1.5	Swift Close	✓	✓
R163	431941	335038	1.5	54 Girton Way	✓	✓
R164	431910	334812	1.5	254 Uttoxeter New Road	✓	✓
R165	431672	334565	1.5	3 Little Longstone Close	✓	✓

Receptor number	OS Grid Ref.		Height (m)	Location	Included in which phase	
	X	Y			Operational	Construction
R166	431388	336696	1.5	95 Radbourne Lane	✓	✓
R167	430866	336081	1.5	Starflower Way	✓	
R168	430852	335865	1.5	Whistlestop Close	✓	
R169	430852	335549	1.5	Mickleross Close	✓	
R170	435659	335733	4.5	73 London Road/Traffic Street	✓	✓
R171	435743	335769	1.5	1 Carrington Street	✓	✓
R172	434762	336314	1.5	12 Stafford Street	✓	✓
R173	433972	335991	1.5	152 Uttoxeter Old Road	✓	✓
R174	434336	336533	1.5	68 Friar Gate	✓	✓
R175	433554	336943	1.5	House in Royal School for the Deaf	✓	✓
R176	433557	336949	1.5	House in Royal School for the Deaf	✓	✓
R177	433636	337010	1.5	Residences in Royal School for the Deaf	✓	✓
R178	433637	336886	1.5	Residences in Royal School for the Deaf	✓	✓
R179	433645	336915	1.5	Residences in Royal School for the Deaf	✓	✓
R180	434752	336363	1.5	NW corner of Stafford Street	✓	✓
R181	434773	336356	1.5	12 Stafford Street	✓	✓
R182	434688	336152	1.5	61 Stafford Street	✓	✓
R183	434551	336051	1.5	31 Uttoxeter New Road	✓	✓
R184	434477	336046	1.5	Rowleys Mill, Uttoxeter New Road	✓	✓
R185	433887	335801	1.5	197 Uttoxeter New Road	✓	✓
R186	433829	335797	4.5	248 Uttoxeter New Road	✓	✓
R187	433872	335843	1.5	210 Uttoxeter Old Road	✓	✓
R188	433921	335893	1.5	91 Uttoxeter Old Road	✓	✓
R189	434310	336533	1.5	14 Uttoxeter Old Road	✓	✓
R190	434329	336528	4.5	1 Uttoxeter Old Road	✓	✓
R191	434336	336555	1.5	8 Ashbourne Road	✓	✓
R192	434387	336519	1.5	71 Friar Gate	✓	✓
R193	434464	336519	1.5	61 Friar Gate	✓	✓
R194	434547	336589	1.5	10 Bridge Street	✓	✓
R195	434717	336489	1.5	14 Agard Street	✓	✓
R196	434688	336049	1.5	10 Talbot Street	✓	✓
R197	434745	336329	1.5	Burleigh Mews, Stafford Street	✓	✓
R198	434926	336230	4.5	Curzon Street	✓	✓
R199	434882	336330	4.5	Friar Gate	✓	✓
R200	435508	335793	4.5	London Road	✓	✓
R201	432398	337441	1.5	Old School House, Markeaton Lane		✓
R202	432259	337275	1.5	Roehampton Drive		✓
R203	432350	337246	1.5	34 Vauxhall Avenue		✓
R204	432108	337319	1.5	Roehampton Drive		✓
R205	431970	337380	1.5	10 Radbourne Lane		✓
R206	431441	337606	1.5	82 Ashbourne Road		✓
R207	431558	336903	1.5	53 Radbourne Lane		✓

Receptor number	OS Grid Ref.		Height (m)	Location	Included in which phase	
	X	Y			Operational	Construction
R208	431857	337258	1.5	17 Radbourne Lane		✓
R209	432506	336479	1.4	118 Brackensdale Avenue		✓
R210	432509	336551	1.5	8 Streatham Road		✓
R211	432491	336519	1.5	6 Streatham Road		✓
R212	432450	336521	1.5	2 Highgate Green		✓
R213	432540	336688	1.5	34 Streatham Road		✓
R214	432657	336942	1.5	82 Brentford Drive		✓
R215	432556	336792	1.5	27 Mornington Crescent		✓
R216	437014	339680	1.5	15 Brookside Road, Breadsall		✓
R217	436916	339699	4.5	2 Rectory Lane, Breadsall		✓
R218	435537	338491	1.5	7 Folly Road		✓
R219	435646	337531	1.5	236 Mansfield Road		✓
R220	435209	338509	1.5	14 Old lane		✓
R221	434888	339078	1.5	406 Duffield Road		✓
R222	434841	339048	1.5	Duffield Road		✓
R223	434736	338501	1.5	201 Duffield Road		✓
R224	434772	338472	1.5	Duffield Road		✓
R225	434768	337956	1.5	173 Duffield Road		✓
R226	434812	337847	1.5	206 Duffield Road		✓
R227	434778	337263	1.5	Queen Mary Court, Duffield Road		✓
R228	434806	337240	1.5	132 Duffield Road		✓
R229	434906	336962	1.5	17 Duffield Road		✓
R230	435211	336779	1.5	St Mary's Court		✓
R231	435583	336645	1.5	63 Nottingham Road		✓
R232	434895	336156	1.5	20 Newland Street		✓
R233	434887	336172	1.5	16 Newland Street		✓
R234	434741	335673	1.5	18 Woods Lane		✓
R235	434753	335693	1.5	7 Arbor Close		✓
R236	434754	335532	1.5	48 Woods Lane		✓
R237	433639	336235	1.5	201 Slack Lane		✓
R238	433466	336255	1.5	7 Cheviot Street		✓
R239	433726	336219	1.5	158 Slack Lane		✓
R240	430032	338394	1.5	Ashbourne Road		✓
R241	431389	334128	1.5	Brierfield Way, Mickleover		✓
R242	430658	333853	1.5	1 Ardleigh Close		✓
R243	431136	333381	1.5	69 Maypole Lane		✓
R244	431059	333371	1.5	49 Haven Baulk Lane		✓
R245	430909	333733	1.5	10 The Hollow		✓
R246	431254	333638	1.5	31 Allan Avenue		✓
R247	433075	335247	1.5	449 Uttoxeter New Road		✓
R248	433021	335259	1.5	442 Uttoxeter New Road		✓
R249	432900	335128	1.5	513 Uttoxeter New Road		✓
R250	435103	336761	1.5	McAuley Court		✓
R251	436403	338561	1.5	25 Elmwood Drive		✓
S1	436359	341482	1.5	Little Eaton Primary School	✓	✓
S2	436291	337784	1.5	Beaufort Primary School	✓	✓

Receptor number	OS Grid Ref.		Height (m)	Location	Included in which phase	
	X	Y			Operational	Construction
S3	434558	338524	1.5	Saint Benedict Catholic Voluntary Academy playing field	✓	✓
S4	434478	338351	1.5	Saint Benedict Catholic Voluntary Academy	✓	✓
S5	434068	338247	1.5	Lawn Primary School grounds	✓	✓
S6	434027	337963	1.5	University of Derby	✓	✓
S7	434137	337436	1.5	Markeaton Primary School grounds	✓	✓
S8	434376	337032	1.5	Whitecross Nursery School	✓	✓
S9	434121	336821	1.5	University of Derby-Britannia Mill	✓	✓
S10	434018	336650	1.5	Ashgate Primary School	✓	✓
S11	434156	336393	1.5	Ashgate Nursery School	✓	✓
S12	433636	337009	1.5	Royal School for the Deaf	✓	✓
S13	433574	336925	1.5	Royal School for the Deaf	✓	✓
S14	432773	336486	1.5	Brackensdale Primary School	✓	✓
S15	432848	336472	1.5	Brackensdale Primary School playing field	✓	✓
S16	433676	335726	1.5	Derby Montessori School	✓	✓
S17	433589	335607	1.5	The Bemrose School	✓	✓
S18	432126	335079	1.5	St Clare's School grounds	✓	✓
S19	432051	335022	1.5	St Clare's School	✓	✓
S20	431666	334649	1.5	The Cottage Day Nursery	✓	✓
H1	432863	335942	1.5	Kingsway Hospital	✓	✓
H2	432748	335868	1.5	Kingsway Hospital	✓	✓
H3	433073	335190	1.5	The Royal Derby Hospital	✓	✓
H4	433103	335171	1.5	The Royal Derby Hospital	✓	✓
H5	432747	334997	1.5	The Royal Derby Hospital	✓	✓
H6	432630	334922	1.5	The Royal Derby Hospital	✓	✓
C1	435945	341562	1.5	Little Eaton Village Hall grounds	✓	✓
C2	436136	337692	1.5	Racecourse Park	✓	✓
C3	436070	336955	1.5	Aspect Centre For Autism Day Care grounds	✓	✓
C4	436243	336775	1.5	Derbyshire County Cricket Club	✓	✓
C5	434866	336598	1.5	Willows Sports Centre and Megazone	✓	✓

Receptor number	OS Grid Ref.		Height (m)	Location	Included in which phase	
	X	Y			Operational	Construction
C6	434285	337086	1.5	Markeaton Recreational Ground	✓	✓
C7	434291	337074	1.5	Markeaton Recreational Ground	✓	✓
C8	434144	336891	1.5	West End Community Centre	✓	✓
C9	434127	336807	1.5	Derby West End Bowls Club	✓	✓
C10	434083	336456	1.5	Ashgate Primary Sportsfield	✓	✓
C11	433794	337560	1.5	Markeaton Park	✓	✓
C12	433620	337139	1.5	Markeaton Park	✓	✓
C13	433393	337107	1.5	Markeaton Park	✓	✓
C14	432715	336068	1.5	Mackworth Park	✓	✓
C15	432038	335333	1.5	Homerton Vale Park	✓	✓
C16	431846	335235	1.5	College Green Park	✓	✓
C17	430982	336408	1.5	Mickleover Sports Club playing field	✓	

1.1.11 Meteorological data from East Midlands Airport for 2015 was used in the assessment. This meteorological site is located approximately 14km south-east of the Scheme.

1.1.12 Annual average background concentrations were taken from Defra's most recent 1x1km background maps (Defra, 2018) and adjusted using Defra's adjustment tool removing emissions from road traffic following motorways and primary or trunk A roads as described in LAQM.TG(16) (Defra, 2016). The maximum background concentrations across the study area are presented in Table 3. The maximum concentrations occurred at OS grid reference 437500, 334500. Background concentrations appropriate for the locations of the receptors were used in the assessment.

Table 3: Background map pollution estimates

Year	Pollutant	Maximum concentration (µg/m^3) Adjusted annual average
2015	NO_x	57.1
	NO_2	33.2
	PM_{10}	18.2
	$PM_{2.5}$	12.1
2021	NO_x	47.4
	NO_2	29.0
	PM_{10}	17.5
	$PM_{2.5}$	11.3
2024	NOx	44.4
	NO_2	27.5
	PM_{10}	17.4
	$PM_{2.5}$	11.2

1.1.13 The air quality assessment has utilised Annual Average Hourly Traffic data for the am peak (07:00 to 10:00), inter peak (10:00 to 16:00), pm peak (16:00 to 19:00) and off peak (19:00 to 07:00) time frames within the local assessment detailed predictions. This allows the effect of increased emissions during busy periods to be taken into account in the assessment. Traffic flows in Stafford Street which is the focus of DCiC's traffic management measures to improve air quality are presented in Table 4 for each of the scenarios.

Table 4: Traffic Flows in Stafford Street

Scenario	AADT flow (veh/day)
2015 Baseline (without traffic management)	20,733
2021 Do-Minimum (with traffic management)	18,679
2021 Construction Scenario 0 (with traffic management)	18,738
2021 Construction Scenario 2 (with traffic management)	18,553
2021 Construction Scenario 4 (with traffic management)	18,165
2024 Do-Minimum (without traffic management)	23,530
2024 Do-Something (without traffic management)	22,392

1.1.14 The objectives and limit values to protect human health are for NO_2 rather than NO_x so the modelled vehicle NO_x emissions were converted into NO_2 using a spreadsheet tool developed by Defra (Defra, 2016). Due to the location of the Scheme, the 'All other urban UK traffic' setting was selected.

1.1.15 The model predictions presented have been verified against measured annual mean NO_2 concentrations from 45 monitoring locations across the study area. The verification factor used to adjust raw model outputs is presented in Table 5.

Table 5: Verification details

Description of area applied	Adjustment factor	RMSE pre-verification	RMSE post-verification	Fractional bias post-verification
All study area	2.14	15.8	4.9	0.0

1.1.16 The accuracy of the model was considered via the calculation of the Root Mean Square Error (RMSE) and fractional bias as described in LAQM.TG(16). The RMSE was reduced post verification and the fractional bias reduced to 0.0 demonstrating that the application of the adjustment factor had improved model performance.

1.1.17 The above factor was applied to the predicted road NOx concentrations prior to the conversion of road NO_x to road NO_2 and addition of NO_2 background concentrations to provide predicted total NO_2 concentrations at the receptors.

1.1.18 The factors were also applied to the predicted road PM_{10} and $PM_{2.5}$ concentrations in the absence of any monitoring data within the study area with which to calculate specific verification factors for PM_{10} and $PM_{2.5}$.

1.1.19 Table 6 contains details of the monitoring sites used within the verification and the adjusted model results. Modelled concentrations were within 10% of the measured values at approximately half of the sites. 42 out of the 45 monitoring locations had predicted concentrations within 25% of the measured values. However, the difference between modelled and measured concentrations was more than 25% at three sites, these sites all being near the city centre (DT39, DT41 and DT62), where the model overestimated concentrations. Concentrations at DT62 which is on the corner of London Road and Traffic Street measured concentrations close to the objective and limit value so an overestimated modelled NO_2 concentration could result in an exceedance being predicted where none is likely to occur.

Table 6: Model performance post verification

Site ID	OS grid ref X	OS grid ref Y	Monitored total NO_2 ($\mu g/m^3$)	Modelled total NO_2 after adjustment ($\mu g/m^3$)	% difference modelled/ monitored
DJ003	431872	334778	41.4	38.0	-8.2
DJ004	431746	334771	25.0	22.6	-9.9
DJ005	432545	334974	30.0	29.3	-2.1
DJ006	433112	335327	42.6	36.1	-15.4
DJ007	433196	335812	43.0	38.2	-11.1
DJ008	432654	336133	22.1	24.6	11.4
DJ009	432838	336337	27.1	29.1	7.3
DJ010	432985	336435	35.5	34.8	-2.1
DJ011	433156	336694	38.6	33.6	-12.9
DJ012	433087	336718	30.4	32.3	6.0
DJ013	433506	336955	39.7	43.7	10.1
DJ014	433479	336929	51.9	46.7	-10.0
DJ015	433063	337009	23.4	21.6	-7.8
DJ016	433685	337128	37.7	44.8	19.0
DJ017	433834	337646	31.4	28.1	-10.3
DJ018	434036	337783	24.2	29.1	20.0
DJ019	434310	338380	22.1	25.4	15.2
DJ020	434555	338695	20.9	24.7	18.0
DJ021	434792	339262	24.5	22.2	-9.3
DJ022	434863	339101	30.3	24.8	-18.3
DJ023	434952	339402	32.4	27.1	-16.6
DJ024	435587	339839	21.5	24.6	14.4
DJ025	436336	340050	31.9	31.3	-2.0
DJ026	436661	341585	23.4	22.9	-2.3
DJ030	433086	336628	39.9	39.1	-2.0
DJ032	433058	336655	45.1	44.2	-2.0
DJ034	433274	335400	33.6	32.5	-3.3
DJ035	433207	335134	33.6	38.7	15.2

Site ID	OS grid ref X	OS grid ref Y	Monitored total NO_2 ($\mu g/m^3$)	Modelled total NO_2 after adjustment ($\mu g/m^3$)	% difference modelled/ monitored
DJ036	433326	334899	29.5	27.9	-5.2
DJ037	432923	335147	51.4	39.9	-22.3
DJ038	433070	335288	39.4	40.3	2.3
DJ039	433239	335633	27.6	26.0	-5.8
DV34	433225	335127	29.0	34.4	18.8
DV35	433003	335212	59.0	48.6	-17.6
DV36	433247	335420	29.0	33.2	14.3
DV37	433785	335778	39.0	37.8	-3.0
DT33	433119	336650	28.0	34.0	21.4
DV39	433083	336608	28.0	36.5	30.4
DV40	433943	335829	39.0	35.2	-9.6
DV41	434733	336112	25.0	34.3	37.1
DV42	434691	336159	40.0	41.7	4.3
DT50	435652	335710	39.0	52.3	34.0
DV78	434386	336520	38.0	36.5	-4.0
DT63	434500	336510	36.0	38.8	7.8
DV87	434744	336245	31.0	33.3	7.6

1.1.20 The predicted number of exceedances of $50\mu g/m^3$ for the 24-hour PM_{10} was calculated from the predicted annual average value using the relationship defined in the DMRB and LAQM.TG(16). This number can then be compared with the 35 days permitted in the objective and limit value.

1.1.21 The DMRB and LAQM.TG(16) advise that the hourly average NO_2 objective and limit value is unlikely to be exceeded if annual average concentrations are predicted to be less than $60\mu g/m^3$. Where predicted concentrations are below $60\mu g/m^3$, it can be concluded that the hourly average NO_2 objective of ($200\mu g/m^3$ NO_2 not to be exceeded more than 18 times per year) is likely to be achieved.

Impact descriptors

1.1.22 An evaluation of the significance of the local air quality assessment findings at sensitive receptors for human health has been undertaken in accordance with guidance IAN 174/13 (Highways Agency, 2013).

1.1.23 For a change of a given magnitude (increase or decrease) in pollutant concentrations between the Do-Something and Do-Minimum scenarios, the guidance contains descriptors of the magnitude of change at individual sensitive receptors. For example, a change in predicted annual average concentrations of NO_2 or PM_{10} of less than $0.4\mu g/m^3$ is considered to be so small as to be imperceptible. A change (impact) that is imperceptible, given normal bounds of variation, would not be capable of having a direct effect on local air quality that could be considered to be significant.

1.1.24 The magnitude of change is divided into four classes as defined in Table 7. The magnitude of change classes for $PM_{2.5}$ were derived in the same way based on the $PM_{2.5}$ objective and limit value.

Table 7: Magnitude of change in ambient pollutant concentrations (IAN 174/13)

Magnitude of change (µg/m^3)	Value of change in annual average NO_2 and PM_{10}
Large (>4)	Greater than 10% of the air quality objective/ limit value (4µg/m^3)
Medium (>2 to 4)	Greater than 5% (2µg/m^3) but less than 10%(4µg/m^3) the air quality objective/ limit value
Small (>0.4 to 2)	More than 1% of objective (0.4µg/m^3) and less than 5% (2µg/m^3).
Imperceptible (≤0.4)	Less than or equal to 1% of the objective/ limit value (0.4µg/m^3)

1.1.25 The impact descriptors are used with the number of properties affected and whether the objectives and limit values are exceeded to determine significance as discussed in Section 5.3 in Chapter 5: Air Quality [**TR010022/APP/6.1**].

2 Local air quality compliance risk assessment

2.1.1 The compliance risk assessment considers the potential effect of Scheme operation upon the future compliance of zones as reported by Defra to the European Commission.

2.1.2 An assessment of compliance with the EU Directive on Ambient Air Quality (2008/50/EC) has been undertaken using IAN 175/13 (Highways Agency, 2013). The assessment has used the results of the local air quality modelling overlaid on the Defra compliance network provided to Highways England to establish whether, for each road, the change in NO_2 concentrations, would result in:

i. A compliant zone becoming non-compliant; and/or

ii. Delay Defra's date for achieving compliance for the zone i.e. the change on a road link would result in a concentration higher than the existing maximum value in the zone; and/or

iii. An increase in the length of roads in exceedance in the zone which would be greater than 1% when compared to the previous road length.

2.1.3 This assessment enables assessors to undertake and report on the risk of a scheme being non-compliant with the EU Directive. The evaluation of significance also includes information on compliance risks in relation to the EU Directive.

3 TAG plan level assessment

3.1.1 The DMRB states that the assessment of air quality in relation to highways schemes should report the results of the local air quality TAG appraisal (plan level), as completed in line with the guidance set out by The Air Quality Sub Objective.

3.1.2 The plan level TAG appraisal provides an indication of the overall change in exposure at properties as a result of the operation of the Scheme in the opening and design years. This is estimated by calculating the change in concentrations near each affected road link and multiplying that by the number of properties near that road link. Pollutant concentrations near each affected road link were predicted using the DMRB Screening Method v1.03c.

3.1.3 The TAG methodology follows a number of steps, including:

i. Identification of the affected road network, which is the same as the DMRB local air quality affected road network.

ii. Quantification of the number of properties within 0 – 50 m, 50 – 100 m, 100 – 150 m and 150 – 200 m bands, from the affected roads.

iii. The calculation of concentrations within each band at 20m, 70m, 115m and 175m from the road centreline using the DMRB spreadsheet tool.

iv. Calculation of property weighted NO_2 and PM_{10} concentrations.

v. Calculation of the total numbers of properties that improve, worsen or stay the same for each pollutant.

vi. Calculation of an overall assessment score for NO_2 and PM_{10}.

3.1.4 An overall positive score indicates an overall worsening air quality, whilst an overall negative score indicates an overall improvement in air quality.