

**M42 Junction 6 Improvement
Scheme Number TR010027
Volume 6
6.3 Environmental Statement
Appendix 6.1 Local Air Quality
Methodology**

Regulation 5(2)(a)

Planning Act 2008

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

January 2019

Infrastructure Planning

Planning Act 2008

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

**M42 Junction 6 Improvement
Development Consent Order 201[-]**

**6.3 Environmental Statement
Appendix 6.1 Local Air Quality Methodology**

Regulation Number	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010027
Application Document Reference	6.3
Author	M42 Junction 6 Improvement Project Team and Highways England

Version	Date	Status of Version
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1 Determination of sensitive air quality receptors

Construction phase receptor locations

- 1.1.1 Sixty nine sensitive receptors have been identified within 200m of the Scheme, with the majority of these located within the village of Bickenhill.
- 1.1.2 The majority of sensitive receptors located near to the route are located in the village of Bickenhill, Pitt Lane, along the B4438 Catherine de Barnes Lane (Catherine-de-Barnes Lane), Clock Lane, Shadowbrook Lane and the B4012 Solihull Road (Solihull Road).
- 1.1.3 Within Bickenhill, Glebe Farm, Ivy Cottage, Harpsford and Church Garth are located on St Peters Lane to the north west of Church Lane in Bickenhill, adjacent to the new slip road on the eastern side of the Scheme. On Church Lane, there are a number of receptors, including St Peters Church, Church Farm, Green Court, Yew Tree Farm and Grove House. There are other receptors located on St Peters Lane to the south east of Church Lane, including Grange Farm and The Croft. On the southern section of St Peters Lane there are other receptors, including Ashdene and Goldenacres.
- 1.1.4 The Avon Caravan Park is to the north of Bickenhill on Catherine de Barnes Lane. This has been designated as a Travellers Site by Solihull Metropolitan Borough Council (under the name The Haven). Further receptors are located on Clock Lane to the north.
- 1.1.5 Braceys Nursery is located to the south of Bickenhill along Catherine de Barnes Lane. Braceys Nursery consists of a number of glasshouses for plants. Glasshouses are considered to be highly sensitive receptors to the effects of construction dust, as increases in dust deposition can lead to a reduction in light available to plants within the glasshouse.
- 1.1.6 Four Winds is located to the west of the Scheme along Catherine-de-Barnes Lane.
- 1.1.7 There are a number of sensitive receptors located along Shadowbrook Lane to the east of the Scheme, including Plack Nurseries Travellers Site, Oak Tree Lodge, Swift Lodge and Heath Farm.
- 1.1.8 Heath End House is located at the junction between Catherine-de-Barnes Lane and Shadowbrook Lane, however this property would be located on the route of the Scheme and has therefore not been considered in the assessment.
- 1.1.9 To the north, Myrtle Cottage Farm is located adjacent to the junction improvements at Junction 6 as part of the Scheme, with Elm Gables and Rose Cottage in Middle Bickenhill slightly further to the north.

Operational phase receptor locations

1.1.10 During the operational phase, there is the potential for the Scheme to affect receptors further than 200m from the Scheme. 64 receptor locations have been selected across the study area in order to assessment the potential impacts of the scheme on the wider study area. Receptors have been selected in order to represent potential worse case locations near to the Scheme, while those further than 20m from the Scheme are selected in order to represent an area. These locations are detailed in **Table 1** and are shown on **Figure 6.2 [TR010027/APP/6.2]**.

Table 1: Sensitive human health receptors

Receptor ID	Description	Coordinates	
		X	Y
R1	Residential property on Coleshill Heath Road	418707	285791
R2	Residential property on Bell Lane	416490	286096
R3	The Radleys	416477	286032
R4	Residential property on Hatchford Brook	416597	286008
R5	St Giles Care Home	416187	286297
R6	Residential property on Bell Lane	416749	285624
R7	Residential property on Chelmsley Road	418788	286122
R8	Residential property on Bickenhill Road	418107	285092
R9	Residential property on Bickenhill Lane	418485	284939
R10	Holiday Inn	419454	285113
R11	Residential property on Coleshill Road	417988	285581
R12	Residential property at Common Farm	420048	284911
R13	Residential property on Packington Lane	421044	284462
R14	Residential property on Middle Bickenhall Lane	420220	283235
R15	Residential property on Church Lane	419343	282727
R16	Arden Hotel and Leisure	419093	283047
R17	Residential property on Clock Lane	418493	282881
R18	Ibis Hotel NEC	418655	284111
R19	Gables Hotel Solihull	417280	283114
R20	Residential property on Old Station Road	419812	282855
R21	National Motorcycle Museum	420087	283032
R22	Residential property at Pickington Estate House	422279	283180
R23	Stonebridge Golf Course	421800	283115
R24	Somers Fishing Lake	422195	282146
R25	Residential property on Meriden Road	420908	281550
R26	Residential property on Meriden Road	420327	280871
R27	Residential property on Eastcote Lane	420036	280242

Receptor ID	Description	Coordinates	
		X	Y
R28	The Courtyard Nursery School	419306	279258
R29	Residential property on Barston Lane	419770	278806
R30	Residential property on Bradnocks Marsh Lane	421973	278516
R31	Knowle Care Home	417172	278272
R32	Residential property on Blythewood Close	416894	278427
R33	Residential property on Avenbury Drive	416347	279561
R34	Solihull Islamic and Community Centre	416321	279020
R35	Residential property on Kendrick Close	416619	280895
R36	Residential property on Markham Cres	416539	282078
R37	Residential property on Hampton Lane	417000	280003
R38	Residential property on Barbers lane	418129	280501
R39	Residential property at Hampton Lane Farm	418610	280613
R40	Residential property on Shadowbrook Lane	418624	281610
R41	Residential property on Shadowbrook Lane	418982	281424
R42	Residential property on Catherine De Barnes lane	418415	281253
R43	Residential property on Catherine De Barnes Lane	418545	281744
R44	Páirc na hÉireann	418390	281565
R45	Residential property on St Peter's Lane	418588	281930
R46	Residential property on St Peter's Lane	418663	282398
R47	Residential property on Shadowbrook Lane	419534	281305
R48	Residential property on Barston Lane	418024	279007
R49	Residential property on Friday Lane	418539	279877
R50	Residential property on Berwicks Lane	418090	285870
R51	The Avon Caravan Park, Catherine De Barnes Lane	418542	282510
R52	Residential property on St Peter's Lane	418861	282302
R53	Residential property on Solihull Road	419259	280608
R54	Residential property on Warwick Road	416819	278484
R55	Brooklands Hospital	417931	285605
R56	Spire Parkway Hospital	416279	280318
R57	Marsden Green Juniors School	417096	285440
R58	Marsden Green Infants School	417009	285353
R59	Marsden Green Recreation Ground	417723	285519
R60	Bickenhill Playing Field	418844	282547
R61	Rayner House & Yew Trees Care Home	416346	280387
R62	Yew Tree Primary School	416351	280474
R63	Sillhillians Sports Club	417626	278717

Receptor ID	Description	Coordinates	
		X	Y
R64	Hampton in Arden Recreation Ground	420294	281275

Designated ecological sites

- 1.1.11 Bickenhill Meadows Site of Special Scientific Interest (SSSI) is split into two units, both within 200m of the Scheme. One unit is located to the north of Shadowbrook Lane (known as Shadowbrook Meadows) and to the east of the Scheme, adjacent to Plack Nurseries Travellers Site, while the second unit is located to the west of the Scheme (known as First Castle Meadow) (see Chapter 9 Biodiversity [TR010027/APP/6.1] for further information).
- 1.1.12 The River Blythe SSSI is located approximately 400m to the south of the Scheme, and the Coleshill and Bannerly Pools SSSI is located approximately 1.4km to the north. Both of these ecological sites are located adjacent to roads that are likely to be within the Affected Road Network, and have been included in this assessment.
- 1.1.13 There are a number of non-designated sites within the study area which have also been included within this assessment, including Local Nature Reserves (LNR) and Local Wildlife Sites (LWS). These sites may be of local importance, and have been included to provide a complete assessment of the impacts of the scheme on ecological sites within the study area.
- 1.1.14 The details of the ecological sites included in this assessment are presented in **Table 2**, and shown on **Figure 6.2** [TR010027/APP/6.2]. For a number of sites, the Scheme removes the receptor location. In order to provide an assessment of the ecological site, an alternative receptor location has been used in the 2023 Do-Something scenario. The alternative location is the closest point of the ecological site to the Scheme and the original location. The coordinates for the alternative location are shown in brackets in **Table 2**.

Table 2: Sensitive ecological receptors

Receptor ID	Description	Type	Coordinates	
			X	Y
E1a – E1j ^a	Bickenhill Meadows (transect)	SSSI	418765	281600
E2a – E2ja	Bickenhill Meadows (transect)	SSSI	418302	282025
E3	River Blythe	SSSI	418592	279501
E4	River Blythe	SSSI	418622	279481
E5a – E5j ^a	Coleshill and Bannerly Pools (transect)	SSSI	419794	285613
E6	Road Side Hedge	LWS	418828	281443
E7	Greens Ward Piece	LWS	418604	281584
E8	Castle Hill Farm Meadows	LWS	418288	281601

Receptor ID	Description	Type	Coordinates	
			X	Y
E9	Castle Hill Farm Meadows	LWS	418533 (418497)	282346 (282361)
E10	Holywell Brook	LWS	419913	283658
E11	Holywell Brook	LWS	419875	283648
E12	Dissused Railway and Sidings	LWS	420505	283032
E13	Dissused Railway and Sidings	LWS	420573	283203
E14	Castle Hill Farm Meadows	LWS	418454 (418383)	282153 (282027)
E15	Castle Hill Farm Meadows	LWS	418427 (418369)	281813 (281817)
E16	Castle Hill Farm Meadows	LWS	418436 (418374)	281763 (281764)
E17	Greens Ward Piece	LWS	418560 (418575)	281483 (281494)
E18	Greens Ward Piece	LWS	418642	281570
E19	Aspbury's Copse	LWS	419066 (419049)	280603 (280605)
E20	Aspbury's Copse	LWS	419108 (419119)	280579 (280578)
E21	Trinity Park Grasslands	LWS	418658	283015
E22	Trinity Park Grasslands	LWS	418777	283186
E23	Aspbury's Copse	LWS	419066 (419049)	280603 (280605)
E24	Road Side Hedge	LWS	419261	281253
E25	Wayside Cottage Meadow	LWS	419296	281542
E26	Holywell Brook	LWS	419867	283646
E27	Holywell Brook	LWS	419911	283658
E28	Aspbury's Copse	LWS	419108 (419119)	280579 (280578)
E29	Marston Green Park	LNR	417648	285535
E30	Marston Green Millennium Wood	LNR	418394	285050
E31	Elmdon Manor	LNR	416550	282509
E32	Elmdon Coppice	LNR	416800	281565
E33	Malvern & Brueton Park	LNR	416391	278515

^a Coordinates of transects are for location of first point only. Locations of all transect locations are illustrated on **Figure 6.2** [TR010027/APP/6.2].

2 Additional local air quality methodology

2.1.1 This appendix sets out the detailed modelling inputs used in the assessment of air quality impacts due to the proposed scheme.

2.2 Detailed model inputs

2.2.1 **Table 3** outlines the key model inputs utilised in the ADMS-Roads modelling local air quality assessment.

Table 3: Model Input Parameters

Variable	Model Input
Surface roughness at source	0.5m
Minimum Monin-Obukhov length for stable conditions	30m
Terrain types	Flat
Receptor location	x,y coordinates determined by GIS, z height of 1.5m for human health receptors, 0m for ecological receptors.
Emissions	NO _x , PM ₁₀ and PM _{2.5}
Emission factors	For NO _x and PM ₁₀ , see IAN 185/15 For PM _{2.5} , emissions are derived from EFT v8.0.1 (Defra)
Meteorological data	1 year (2016) hourly sequential data from Birmingham Airport Meteorology Station
Emission profiles	Emissions have been calculated for AM, Inter Peak (IP), PM and Off Peak (OP) periods.
Receptors	Selected receptors
Model output	Long-term annual mean NO _x concentrations (µg/m ³) Long-term annual mean PM ₁₀ concentrations (µg/m ³)

2.3 Meteorological Data

2.3.1 Meteorological data from Birmingham Airport for 2017 has been used in the assessment. This meteorological site is located within the M42 Junction 6 air quality study area. A wind rose for this site is presented in **Figure 1**

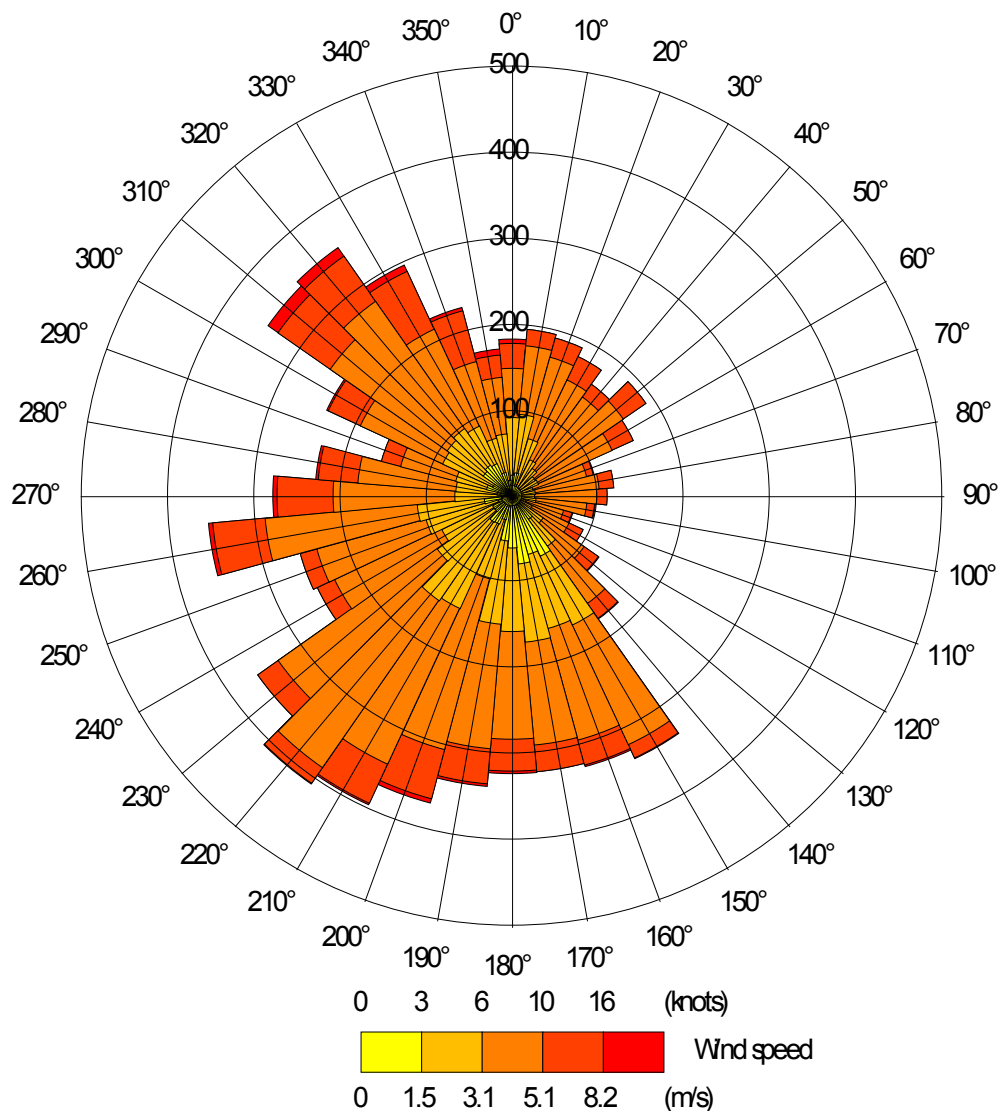


Figure 1: 2016 Windrose for Birmingham International Airport Meteorological Station

2.4 Traffic data

- 2.4.1 The traffic data for the links modelled in the local air quality assessment for the baseline year and the proposed scheme opening year have been generated as detailed in Section 2.8.
- 2.4.2 The speed data used in the air quality impact assessment will be derived following the methodology set out in IAN 185/15. This IAN sets out the methodology by which the speed of a given section of road is assigned to one of 3 or 4 speed “bands”, which have an average pollutant emission rate assigned to them. Highways England have produced a Speed Band Emissions Factors tool (v3.1) for use with speed bands (Highways England, 2017b), to produce emission rates for NO_x and PM₁₀. For PM_{2.5} emission

rates, the Defra EFT has been used, with the speed for each speed band taken from Annex A of IAN185/13.

- 2.4.3 Variations in traffic flow during the day will be reflected in varying period flows between the AM period (3 hours), Inter-peak (6 hours), PM Peak (3 hours) and Off-Peak (12 hours).

2.5 Background concentrations

- 2.5.1 Background concentrations of nitrogen dioxide were taken from measurement data generated as part of this assessment. The annual mean nitrogen dioxide concentration reported at diffusion tube M42_007 was used to represent baseline concentrations across the study area, as this location is away from major roads and other sources of pollution in Bickenhill. Future year annual mean concentrations of nitrogen dioxide were calculated based on the predicted improvements in air quality reported in Defra’s background pollution maps. For each grid square, the ratio between the base year (2016) and the future year (2023) was determined, and this ratio was applied to the background concentration used for the base year. A summary of the background annual mean nitrogen dioxide concentrations is reported in **Table 4**.

- 2.5.2 Annual mean background concentrations for PM₁₀ and PM_{2.5} were taken from Defra’s most recent 1km x 1km background maps, and adjusted by removing road source contributions within each grid square. The data used in the assessment are presented for the centre of each 1km x 1km grid square in **Table 4**.

Table 4: Background Map Pollution Estimates (Adjusted Annual Mean)

OS Grid Ref.		Annual Mean NO ₂ (µg/m ³)		Annual Mean PM ₁₀ (µg/m ³)		Annual Mean PM _{2.5} (µg/m ³)	
X	Y	2016	2023	2016	2023	2016	2023
418500	285500	23.9	18.3	13.7	13.0	9.3	8.6
416500	286500	23.9	18.6	14.2	13.6	9.6	9.0
416500	285500	23.9	18.9	13.9	13.3	9.5	8.9
418500	286500	23.9	18.0	14.4	13.8	9.6	9.0
418500	284500	23.9	18.7	14.0	13.3	9.5	8.8
419500	285500	23.9	18.1	15.6	15.0	10.2	9.6
417500	285500	23.9	18.6	13.8	13.1	9.4	8.7
420500	284500	23.9	17.5	15.8	15.2	10.2	9.6

OS Grid Ref.		Annual Mean NO ₂ (µg/m ³)		Annual Mean PM ₁₀ (µg/m ³)		Annual Mean PM _{2.5} (µg/m ³)	
X	Y	2016	2023	2016	2023	2016	2023
421500	284500	23.9	17.6	14.6	13.9	9.6	9.0
420500	283500	23.9	17.7	16.7	16.3	10.0	9.4
419500	282500	23.9	17.7	15.9	15.4	10.3	9.7
419500	283500	23.9	17.9	15.6	15.1	10.2	9.6
418500	282500	23.9	17.8	14.8	14.2	9.8	9.2
417500	283500	23.9	18.9	14.7	13.9	10.0	9.2
422500	283500	23.9	17.7	13.6	13.0	9.1	8.5
421500	283500	23.9	17.7	15.7	15.1	10.1	9.5
422500	282500	23.9	17.8	13.2	12.6	8.9	8.3
420500	281500	23.9	17.7	13.5	12.9	9.2	8.6
420500	280500	23.9	17.9	13.3	12.7	9.1	8.5
419500	279500	23.9	18.0	13.2	12.6	9.0	8.5
419500	278500	23.9	18.0	12.8	12.3	8.8	8.2
421500	278500	23.9	18.2	13.1	12.5	8.9	8.4
417500	278500	23.9	17.8	15.2	14.6	10.0	9.4
416500	278500	23.9	17.9	14.9	14.4	9.8	9.3
416500	279500	23.9	17.8	13.6	13.0	9.2	8.6
416500	280500	23.9	18.3	13.0	12.5	8.9	8.3
416500	282500	23.9	18.7	13.6	13.0	9.3	8.7
417500	280500	23.9	18.1	13.1	12.5	8.9	8.3
418500	280500	23.9	17.8	15.0	14.5	9.9	9.3
418500	281500	23.9	17.7	13.4	12.8	9.0	8.5
419500	281500	23.9	17.8	16.0	15.4	10.3	9.8

OS Grid Ref.		Annual Mean NO ₂ (µg/m ³)		Annual Mean PM ₁₀ (µg/m ³)		Annual Mean PM _{2.5} (µg/m ³)	
X	Y	2016	2023	2016	2023	2016	2023
418500	279500	23.9	18.0	15.8	15.3	10.3	9.8
419500	280500	23.9	17.7	15.1	14.5	9.9	9.3

2.5.3 Background annual mean NO_x concentrations and nitrogen deposition rates were obtained from the Air Pollution Information System (APIS, see www.apis.ac.uk) for each SSSI, and for each receptor location in the case of LNRs and LWSs. A summary of the backgrounds used for each receptor location is shown in **Table 5**.

Table 5: Ecological Sites Background Map Pollution Estimates

Site	Receptor ID	OS Grid Ref.		Annual Mean NO _x (µg/m ³)		Nitrogen Deposition Rate (kg N/ha/yr)
		X	Y	2016	2023	2016
Bickenhill Meadows SSSI	E1, E2	- ^a	- ^a	28.8	20.6	20.6
River Blythe SSSI	E3, E4	- ^a	- ^a	38.2	27.9	20.6
Coleshill and Bannerly Pools SSSI	E5	- ^a	- ^a	41.8	30.6	35.3
Road Side Hedge LWS	E6	418828	281443	28.3	20.3	20.6
Greens Ward Piece LWS	E7	418604	281584	28.3	20.3	20.6
Castle Hill Farm Meadows LWS	E8	418288	281601	28.3	20.3	20.6
Castle Hill Farm Meadows LWS	E9	418533	282346	34.8	25.1	20.6
Holywell Brook LWS	E10	419913	283658	43.3	31.4	20.6
Holywell Brook LWS	E11	419875	283648	43.3	31.4	20.6
Disused Railway and Sidings LWS	E12	420505	283032	34.3	24.6	56.1
Disused Railway and Sidings LWS	E13	420573	283203	34.3	24.6	56.1
Castle Hill Farm Meadows	E14	418454	282153	34.8	25.1	20.6

Site	Receptor ID	OS Grid Ref.		Annual Mean NO _x (µg/m ³)		Nitrogen Deposition Rate (kg N/ha/yr)
		X	Y	2016	2023	2016
LWS						
Castle Hill Farm Meadows LWS	E15	418427	281813	28.3	20.3	20.6
Castle Hill Farm Meadows LWS	E16	418436	281763	28.3	20.3	20.6
Greens Ward Piece LWS	E17	418560	281483	28.3	20.3	20.6
Greens Ward Piece LWS	E18	418642	281570	28.3	20.3	20.6
Aspbury's Copse LWS	E19	419066	280603	32.6	23.5	20.6
Aspbury's Copse LWS	E20	419108	280579	32.6	23.5	33.5
Trinity Park Grasslands LWS	E21	418658	283015	36.0	26.1	20.6
Trinity Park Grasslands LWS	E22	418777	283186	36.0	26.1	20.6
Aspbury's Copse LWS	E23	419066	280603	32.6	23.5	20.6
Road Side Hedge LWS	E24	419261	281253	36.6	26.5	33.5
Wayside Cottage Meadow LWS	E25	419296	281542	36.6	26.5	20.6
Holywell Brook LWS	E26	419867	283646	43.3	31.4	20.6
Holywell Brook LWS	E27	419911	283658	43.3	31.4	20.6
Aspbury's Copse LWS	E28	419108	280579	32.6	23.5	33.5
Marston Green Park LNS	E29	417648	285535	34.9	26.2	36.4
Marston Green Millennium Wood LNR	E30	418394	285050	34.7	25.6	36.4
Elmdon Manor LNR	E31	416550	282509	30.9	23.4	33.5
Elmdon Coppice LNR	E32	416800	281565	30.2	22.5	33.5
Malvern & Brueton Park	E33	416391	278515	37.1	26.9	33.7

Site	Receptor ID	OS Grid Ref.		Annual Mean NO _x (µg/m ³)		Nitrogen Deposition Rate (kg N/ha/yr)
		X	Y	2016	2023	2016
LNR						

a Background data for SSSIs is the average for the complete site, and is specified for individual SSSIs.

2.6 Model Post Processing

2.6.1 To accompany the publication of the guidance document LAQM TG(09) (and latterly LAQM.TG(16)), a NO_x to NO₂ converter was made available as a tool to calculate the road NO₂ contribution from modelled road NO_x contributions. The tool comes in the form of an MS Excel spreadsheet and uses borough specific data to calculate annual mean concentrations of NO_x. This tool was used to calculate the total NO₂ concentrations at receptors from the modelled road NO_x contribution and associated background concentration. Due to the location of the proposed development, the 'All other urban UK traffic' setting has been selected.

2.7 Model Verification

2.7.1 The model performance has been verified against measurement data. The adjustment factors used to adjust raw model outputs to produce the final predicted concentration values are presented in **Table 6**, and bias adjustment graphs presented in **Figure 2**.

Table 6: Verification Details

Description of Area Applied	Adjustment Factor	Root Mean Square Error (RMSE)	Fractional Bias
Areas within 100m of Junction 6 and Clock Junction	7.89	2.5	-0.03
Areas beyond 100m of the M42 and A45	2.55	3.2	-0.02
Areas within 100m of the M42 and A45	1.34	1.2	0.01
Overall Model Performance		2.7	0.0

- 2.7.2 The above adjustment factors were applied to the predicted annual mean road NO_x concentrations prior to the conversion of road NO_x to road NO₂ and the addition of NO₂ annual mean background concentrations to provide predicted total NO₂ annual mean concentrations at the receptors.
- 2.7.3 The adjustment factors applied to the predicted road contributions of the primary pollutant NO_x, were also applied to the predicted road contributions of the primary pollutants PM₁₀ and PM_{2.5}, in the absence of any monitoring data within the study area with which to calculate particulate matter specific adjustment factors. The approach is consistent with acceptable methods set out in LAQM TG16.

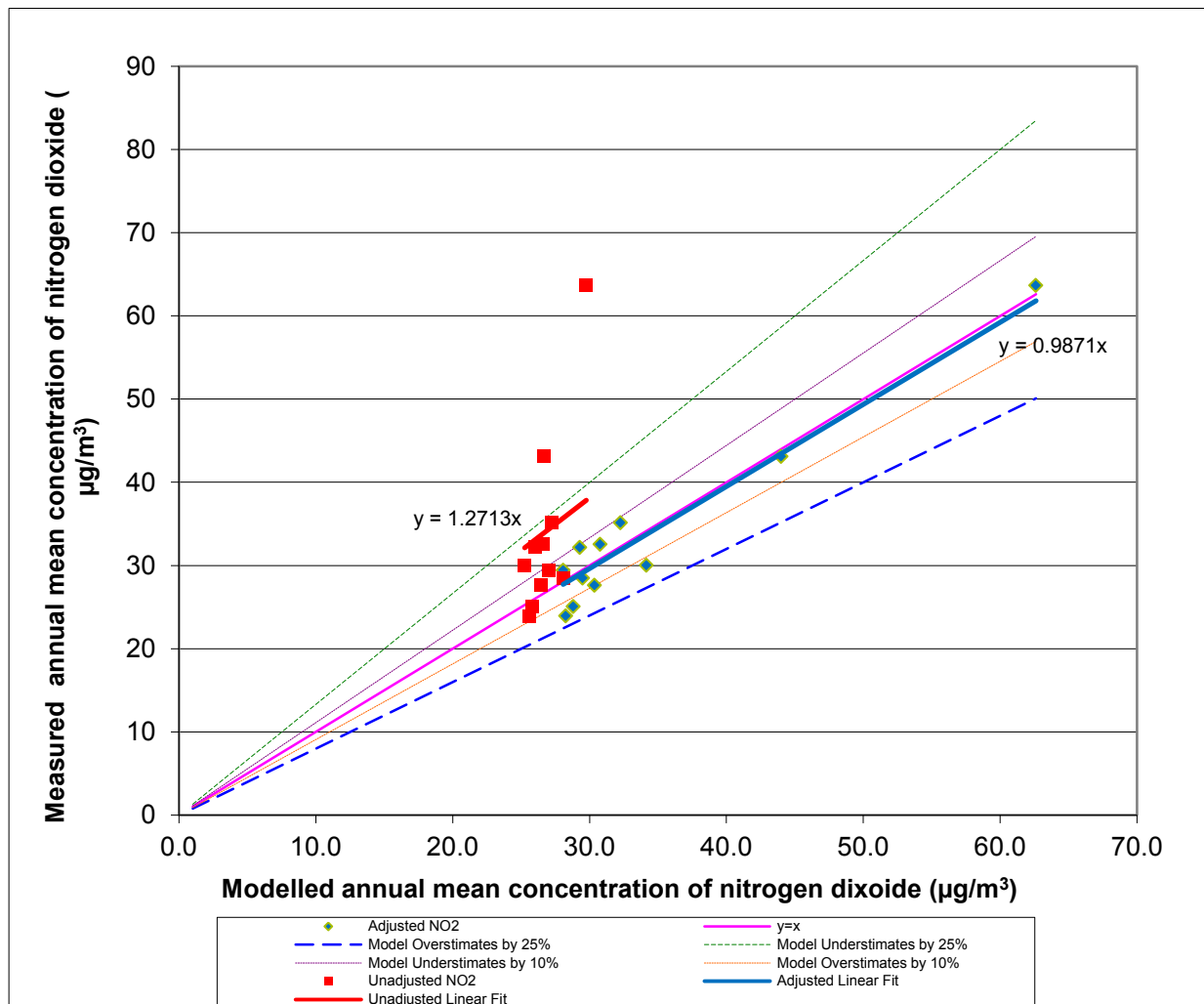


Figure 2: Performance of Unadjusted and Adjusted Model

2.7.4 **Table 7** contains details of the all measurement sites used within the verification, including the verification zone for which they have been used to calculate model adjustment factors.

Table 7: Measurement Data Used in Model Verification

Site ID*	X	Y	Verification Zone	Monitored Total NO ₂ (µg/m ³)	Modelled Total NO ₂ Before Adjustment (µg/m ³)	Modelled Total NO ₂ After Adjustment (µg/m ³)
M42_003	419850	282925	Zone 1	63.7	29.8	62.6
M42_004	419858	282850	Zone 1	43.1	26.7	44.0
M42_005	418505	282884	Zone 1	30.1	25.3	34.2

Site ID*	X	Y	Verification Zone	Monitored Total NO ₂ (µg/m ³)	Modelled Total NO ₂ Before Adjustment (µg/m ³)	Modelled Total NO ₂ After Adjustment (µg/m ³)
M42_006	418572	282476	Zone 2	32.6	26.7	30.8
M42_008	418532	281791	Zone 2	32.2	26.0	29.3
M42_009	418434	281234	Zone 2	24.0	25.6	28.3
M42_010	418084	280447	Zone 2	27.6	26.5	30.4
M42_011	419251	280625	Zone 2	25.1	25.9	28.8
M42_012	420318	280868	Zone 2	35.1	27.3	32.3
M42_013	416857	278508	Zone 3	28.5	28.1	29.5
M42_014	416921	278428	Zone 3	29.4	27.0	28.1