Document 6.2

The West Midlands Rail Freight Interchange Order 201X

Technical Appendix 7.2 - Methodology for Modelling of Traffic Emissions

Regulation 5(2)(a)

Ramboll - July 2018

West Midlands Interchange

Four Ashes Ltd

Appendix 7.2 – Methodology for Modelling of Traffic Emissions

Modelling Approach

Potential impacts on air quality due to local traffic emissions have been predicted using the ADMS Roads dispersion model (version 4.1, released February 2017). This is a commercially available dispersion model and has been widely validated for this type of assessment and used extensively in the Air Quality Review and Assessment process.

The model uses traffic flow data and vehicle related emission factors to predict road specific concentrations of NOx, PM10 and PM2.5 at sensitive receptors selected by the user. The predicted concentrations of NOx have been converted to NO2 using the 2017 LAQM calculator available on the DEFRA air quality website (http://uk-air.defra.gov.uk).

Meteorological Data

Meteorological data, such as wind speed and direction, is used by the model to determine pollutant transportation from the point of release and levels of dilution by the wind.

2016 meteorological data from Cosford Airport has been used within the assessment. This is the nearest meteorological site to the study area.

Emissions Data

The latest EFT emissions data and DEFRA background data, published by DEFRA in October 2017 (EFT2017_V8.0 and 2015 background maps) have been used for the assessment.

The ADMS model cannot predict short-term concentrations of NO2 or PM10. However, the following approach has been set out by DEFRA in LAQM.TG(16) to calculate the number of exceedences of 50 µg/m3 as a 24-hour mean PM10:

A = -18.5 + 0.00145 x annual mean ^{3}+ (206/annual mean)

where A is the number of exceedences of 50 μgm^{-3} as a 24-hour mean PM10 concentration.

LAQM.TG(16) does not provide a method for the conversion of annual mean NO2 concentrations to 1-hour mean NO2 concentrations. However, research has concluded that exceedences of the 1-hour mean objective are generally unlikely to occur where annual mean concentrations do not exceed 60 µg/m3. This approach has been taken within this assessment.

Sensitive Receptors

Concentrations have been predicted at a number of sensitive human receptors identified adjacent to the road network considered within the study area. The receptors have been identified based on worst-case exposure to traffic emissions along each road link. A number of receptors have also been selected to represent local authority monitoring sites which are representative of relevant exposure.

The receptors used in the modelling assessment are set out in Table 7.2.1 below and shown in Figure 7.2.1.

Table 7.2.1: Human Receptors used in Modelling Assessment

Receptor ID Number	Receptor type	Land use	Local Authority Area	Short Address	X	Y	Height - m
4b	Long term public exposure	Residential Property	CCC	Mia Court	397630	310366	1.5
36a	Long term public exposure	Residential Property	CCC	Penkridge Bank Rd	401629	317194	1.5
37a	Long term public exposure	Residential Property	CCC	210 Watling St	397783	308683	1.5
37b	Long term public exposure	Residential Property	CCC	25 Watling St	398274	308392	1.5
39a	Long term public exposure	Residential Property	CCC	2A Mill St	398165	310046	3.0
39b	Long term public exposure	Residential Property	CCC	Cromwell House	398171	310057	3.0
67WS	Monitoring site receptor (eg facade)	Residential Property	CCC	67WS	398050.2	308510.4	1.1
54WS	Monitoring site receptor (eg facade)	Residential Property	CCC	54WS	398248.8	308426	1.2
268WS	Monitoring site receptor (eg facade)	Residential Property	CCC	268WS	400730.7	307418.1	2.25
1a	Long term public exposure	Residential Property	SBC	M6, Stafford	389719	323625	1.5
1b	Long term public exposure	Residential Property	SBC	74 Burton Manor Rd	391580	320688	1.5
1c	Long term public exposure	School	SBC	Stafford Grammer Sch	391500	320650	1.5
35a	Long term public exposure	Residential Property	SBC	Camp Rd	396653	318654	1.5
46a	Long term public exposure	Residential Property	SBC	1351 A513, Milford	398644	321168	1.5
46b	Long term public exposure	Residential Property	SBC	Leasowes House, Stafford	399066	321291	1.5

Receptor ID Number	Receptor type	Land use	Local Author-ity Area	Short Address	X	Y	Height - m
11a	Long term public exposure	Residential Property	SC	Burlaughton Farmhouse	377635	310882	1.5
64b	Long term public exposure	Residential Property	SC	The Stables	380095	306695	
2a	Long term public exposure	Residential Property	SSC	213 A449	392764	317950	1.5
2b	Long term public exposure	Residential Property	SSC	Bridge Terrace	392248	314318	1.5
3a	Long term public exposure	Residential Property	SSC	Teddesley Rd-1	393514	315344	1.5
3b	Long term public exposure	Residential Property	SSC	Teddesley Rd-2	393588	315468	1.5
4a	Long term public exposure	Residential Property	SSC	Cannock Rd	394426	313338	1.5
5a	Long term public exposure	Residential Property	SSC	A5, Penkridge-1	392634	310259	1.5
6a	Long term public exposure	Residential Property	SSC	A5, Penkridge-2	393650	310058	1.5
8a	Long term public exposure	Residential Property	SSC	A5, Penkridge	393709	309998	1.5
8b	Long term public exposure	Residential Property	SSC	Oak Hollow	394768	309763	1.5
8c	Long term public exposure	Residential Property	SSC	Tudor Cottage	395563	309470	1.5
9a	Long term public exposure	Residential Property	SSC	Gailey Bridge	392020	310405	1.5
9b	Long term public exposure	Residential Property	SSC	A5, Penkridge-3	391373	310587	1.5

Receptor ID Number	Receptor type	Land use	Local Author-ity Area	Short Address	X	Y	Height - m
10a	Long term public exposure	Residential Property	SSC	A5, Penkridge-4	390940	310669	1.5
10b	Long term public exposure	Residential Property	SSC	20 A5	380491	310902	1.5
12a	Long term public exposure	Residential Property	SSC	Stafford Rd	391038	309778	1.5
13a	Long term public exposure	Residential Property	SSC	Four Ashes Pub	391289	308334	3.0
13b	Long term public exposure	Residential Property	SSC	Stafford Rd, Coven	391294	308606	1.5
14a	Long term public exposure	Residential Property	SSC	Vicarage Rd-1	393094	309451	1.5
14b	Long term public exposure	Residential Property	SSC	Vicarage Rd-2	392397	308856	1.5
15a	Long term public exposure	Residential Property	SSC	1 Straight Mile	393952	308799	1.5
15b	Long term public exposure	Residential Property	SSC	Cottage, 2 Straight Mile	393512	308801	1.5
15c	Long term public exposure	Residential Property	SSC	11a Straight Mile	394406	308796	1.5
16a	Long term public exposure	Residential Property	SSC	Vicarage Rd	392253	308734	1.5
17a	Long term public exposure	Residential Property	SSC	180 Station Dr	391313	308293	3.0
17b	Long term public exposure	Residential Property	SSC	Station Dr	391507	308346	1.5
18a	Long term public exposure	Residential Property	SSC	Four Ashes Rd	390488	308681	1.5

Receptor ID Number	Receptor type	Land use	Local Author-ity Area	Short Address	X	Y	Height - m
19a	Long term public exposure	Residential Property	SSC	148 Stafford Rd	391192	307869	1.5
19b	Long term public exposure	Residential Property	SSC	Stafford Rd	391180	307756	3.0
19c	Long term public exposure	Residential Property	SSC	Streamway House	391166	307978	3.0
20a	Long term public exposure	Residential Property	SSC	Old Stafford Rd	391368	307624	1.5
20b	Long term public exposure	Residential Property	SSC	160 Old Stafford Rd	391805	306305	1.5
21a	Long term public exposure	Residential Property	SSC	Brewood Rd	390005	307604	1.5
21b	Long term public exposure	Residential Property	SSC	42 Poplars Farm Way	390905	306751	1.5
22a	Long term public exposure	Residential Property	SSC	2 St Paul	391296	306562	1.5
22b	Long term public exposure	Residential Property	SSC	Stafford Rd	391286	306497	1.5
23a	Long term public exposure	Residential Property	SSC	24 Lawn Ln	390858	306476	1.5
23b	Long term public exposure	Residential Property	SSC	Wobaston Rd	389602	303779	1.5
24a	Long term public exposure	Residential Property	SSC	New Buildings	391484	305158	1.5
24b	Long term public exposure	Residential Property	SSC	886 Stafford Rd	391561	304774	1.5
29a	Long term public exposure	Residential Property	SSC	33 Bargate St	388154	308868	1.5
29b	Long term public exposure	Residential Property	SSC	2 Kiddemore Green Rd	386050	308841	1.5
30a	Long term public exposure	Residential Property	SSC	38 The Pavement	388645	308618	1.5
30b	Long term public exposure	Residential Property	SSC	38 Sandy Ln	388385	308791	1.5
31a	Long term public exposure	Residential Property	SSC	94 Coven Rd	388699	308026	1.5
31b	Long term public exposure	Residential Property	SSC	The Dingle, Coven Rd	388522	308370	1.5
32a	Long term public exposure	Residential Property	SSC	Wolgarston Way	392880	313306	1.5
32b	Long term public exposure	Residential Property	SSC	8 Boscomoor Ln	392297	313340	1.5
32c	Long term public exposure	Residential Property	SSC	7 Athelstan Cl	393196	313942	1.5
33a	Long term public exposure	Residential Property	SSC	The Willows	392176	313722	1.5
33b	Long term public exposure	Residential Property	SSC	2 Clay St	392260	314069	1.5
34a	Long term public exposure	Residential Property	SSC	Stafford Rd	391865	312753	1.5
34b	Long term public exposure	Residential Property	SSC	66 Stafford Rd	391475	311414	1.5
35b	Long term public exposure	Residential Property	SSC	Springslade Lodge	397879	316495	3.0
38a	Long term public exposure	Residential Property	SSC	The Croft	396717	308745	1.5

Receptor ID Number	Receptor type	Land use	Local Author-ity Area	Short Address	X	Y	Height - m
38b	Long term public exposure	Residential Property	SSC	44 Wolverhampton Rd	396702	308599	1.5
40b	Long term public exposure	Residential Property	SSC	4 Bursnips Rd	396968	303231	1.5
40c	Long term public exposure	Residential Property	SSC	1 Bursnips Rd	397082	303760	1.5
41a	Long term public exposure	Residential Property	SSC	91 Vernon Way	397924	302249	1.5
42a	Long term public exposure	Residential Property	SSC	M6, Stafford	393067	318029	1.5
42b	Long term public exposure	Residential Property	SSC	6 Oakley Cl	393215	314068	1.5
42c	Long term public exposure	Residential Property	SSC	Gailey Lea Ln	393069	311115	1.5
42d	Long term public exposure	School	SSC	Wolgarston High School	393435	313799	1.5
43a	Long term public exposure	Residential Property	SSC	Dog and Partridge Pub	394142	308793	3.0
43b	Long term public exposure	Residential Property	SSC	1 Saredon Ln	394660	308499	1.5
44a	Long term public exposure	Residential Property	SSC	1 Hobnock Rd	396541	304005	1.5
45a	Long term public exposure	Residential Property	SSC	16 Watling St	399536	307876	1.5
ES4	Monitoring site receptor (eg facade)	Residential Property	SSC	ES4	396958.4	303268.5	3
ES5	Monitoring site receptor (eg facade)	Residential Property	SSC	ES5	396978.7	303265.3	3
ES6	Monitoring site receptor (eg facade)	Residential Property	SSC	ES6	396998.4	303441.5	3
HA2	Monitoring site receptor (eg facade)	Residential Property	SSC	HA2	394775.5	309754.9	3
PE11	Monitoring site receptor (eg facade)	Residential Property	SSC	PE11	393504.7	315335.9	3
SA2	Monitoring site receptor (eg facade)	Residential Property	SSC	SA2	396713.7	308742.1	3
SA5	Monitoring site receptor (eg facade)	Residential Property	SSC	SA5	396705.4	308672.7	3
SA6	Monitoring site receptor (eg facade)	Residential Property	SSC	SA6	396701.1	308613	3
64b	Long term public exposure	Residential Property	SSC	Lane House	391310	304546	1.5
63a	Long term public exposure	Residential Property	SSC	Mseley Old Mill Lane	393192	304481	1.5
62a	Long term public exposure	Residential Property	SSC	Hobnock Road	396426	303930	1.5
60a	Long term public exposure	Residential Property	SSC	6 Cannock Road	394205	304919	1.5
60b	Long term public exposure	Residential Property	SSC	27 Cannock Road	394302	305302	1.5
60c	Long term public exposure	Residential Property	SSC	Watt Meadow Farm	394581	305817	1.5
61a	Long term public exposure	Residential Property	SSC	2 Church Road	394709	306109	1.5

Receptor ID Number	Receptor type	Land use	Local Author-ity Area	Short Address	X	Y	Height - m
CHRa	Short-term exposure	Reservoir	SSC	Calf Heath Reservoir	392710	310233	1.5
CHRb	Short-term exposure	Reservoir	SSC	Calf Heath Reservoir	392962	310165	1.5
CHRc	Short-term exposure	Reservoir	SSC	Calf Heath Reservoir	393002	310067	1.5
CHRd	Short-term exposure	Reservoir	SSC	Calf Heath Reservoir	393060	309914	1.5
CPAa	Short-term exposure	Community Park	SSC	Croft Lane Community park	391582	310507	1.5
CPAb	Short-term exposure	Community Park	SSC	Croft Lane Community Park	391999	309966	
CPAc	Short-term exposure	Community Park	SSC	Calf Heath Community Park	392390	308839	
CPAd	Short-term exposure	Community Park	SSC	Calf Heath Community Park	392579	308811	
CPAe	Short-term exposure	Community Park	SSC	Calf Heath Community park	393306	308823	
11b	Long term public exposure	Residential Property	TWC	A5, Telford	372954	310891	1.5
55a	Long term public exposure	Residential Property	TWC	Castle Farm Way-1	372116	310179	1.5
55b	Long term public exposure	Residential Property	TWC	3 Aralia Cl	371948	310360	1.5
55c	Long term public exposure	Residential Property	TWC	Castle Farm Way-2	371835	310457	1.5
56a	Long term public exposure	Residential Property	TWC	Tarmacked Dr	370744	309988	1.5
56b	Long term public exposure	Residential Property	TWC	A5, St George	370873	310595	1.5
57a	Poss Long term public exposure	Residential Property	TWC	Park Inn By Radisson Telford	369932	309415	3.0
7a	Long term public exposure	Residential Property	WDC	343 Darlaston Rd	399210	297513	1.5
7b	Long term public exposure	Residential Property	WDC	367 Darlaston Rd	399168	297516	1.5
7c	Long term public exposure	Residential Property	WDC	308 Darlaston Rd	399163	297552	1.5
40a	Long term public exposure	Residential Property	WDC	265-369 Essington Rd	397103	302069	1.5
41b	Long term public exposure	Residential Property	WDC	M6, Willenhall WV12	398502	301331	1.5
41c	Long term public exposure	Residential Property	WDC	32 Murdock Way	398981	300369	1.5
25a	Long term public exposure	Residential Property	WCC	723 Stafford Rd	391572	303622	1.5
25b	Long term public exposure	Residential Property	WCC	722 Stafford Rd	391556	303429	1.5
26a	Long term public exposure	Residential Property	WCC	176A Winchester Rd	391272	303441	1.5
26b	Long term public exposure	Residential Property	WCC	5A Redhurst Dr	391054	303475	1.5
27a	Long term public exposure	Residential Property	WCC	Stafford St	391393	299807	1.5
27b	Long term public exposure	Residential Property	WCC	626 Stafford Rd	391456	303005	1.5
27c	Long term public exposure	Residential Property	WCC	416 Stafford Rd	391210	302045	1.5
28a	Long term public exposure	Residential Property	WCC	12 Three Tuns Ln	391419	302534	1.5
28b	Long term public exposure	Residential Property	WCC	1 Elston Hall Ln	391781	302389	1.5

Receptor ID Number	Receptor type	Land use	Local Author-ity Area	Short Address	X	Y	Height - m
47a	Long term public exposure	Residential Property	WCC	4 Compton Rd	390517	298662	1.5
47b	Long term public exposure	Residential Property	WCC	9 Crawford Rd	390178	298685	1.5
47c	Long term public exposure	SChool	WCC	Wolverhampton Grammer School	389904	298697	1.5
48a	Long term public exposure	Residential Property	WCC	1 Pennant Ct	390890	297635	1.5
48b	Long term public exposure	Residential Property	WCC	The Leylands	390233	296550	1.5
48c		School	WCC	Royal Junior School Wolverhampton	390660	297262	1.5
49a	Long term public exposure	Residential Property	WCC	3 Elm Farm Rd	391544	297359	3.0
49b	Long term public exposure	Residential Property	WCC	1 Knox Rd	391643	296930	3.0
50a	Long term public exposure	Residential Property	WCC	510 Wolverhampton Rd E	391992	296252	1.5
50b	Long term public exposure	Residential Property	WCC	1 Sherrans Dell	391942	295525	1.5
51a	Long term public exposure	Residential Property	WCC	255-257 Birmingham Rd	391743	297389	1.5
51b	Long term public exposure	Residential Property	WCC	281 Birmingham Rd	391768	297282	1.5
52a	Long term public exposure	Residential Property	WCC	215 Bilston Rd	392841	297686	1.5
52b	Long term public exposure	Residential Property	WCC	35 Navigation St	392230	298137	1.5
53a	Long term public exposure	Residential Property	WCC	405 Bilston Rd	393490	297246	1.5
53b	Long term public exposure	Residential Property	WCC	224 A41	393883	297035	1.5
54a	Long term public exposure	Residential Property	WCC	Horseley Fields	392135	298605	1.5
54b	Long term public exposure	Residential Property	WCC	414 Willenhall Rd	394387	298417	1.5
BIL1	Monitoring site receptor (eg facade)	Day nursery	WCC	BIL1	395058	296541	3
BIL2	Monitoring site receptor (eg facade)	Residential Property	WCC	BIL2	395087	296477	3
BIL3	Monitoring site receptor (eg facade)	Dental Practice	WCC	BIL3	395102	296499	3
BIL4	Monitoring site receptor (eg facade)	Residential Property	WCC	BIL4	395121	296460	3
STA1	Monitoring site receptor (eg facade)	Residential Property	WCC	STA1	391389	299803	3
STA9A	Monitoring site receptor (eg facade)	Residential Property	WCC	STA9A	391529	303347	3
BRI	Monitoring site receptor (eg facade)	Residential Property	WCC	BRI	388199	298782	3
DUD	Monitoring site receptor (eg facade)	Primary Care Centre	WCC	DUD	391529	297312	3
HOR	Monitoring site	Residential Property	WCC	HOR	392115	298605	3

Receptor ID Number	Receptor type	Land use	Local Author-ity Area	Short Address	X	Y	Height - m
	receptor (eg facade)						
WRE	Monitoring site receptor (eg facade)	Education Centre	WCC	WRE	392090	296095	3

Table 7.2.2: Ecological Receptors used in Modelling Assessment

Receptor Location	Designation	Distance Into Transect (m)	X	Y	Height - m
Belvide Reservoir	SSSI	0	386762	310735	0
		5	386762	310730	0
		10	386762	310725	0
		15	386762	310720	0
		20	386763	310715	0
		35	386763	310700	0
		50	386763	310685	0
		75	386764	310660	0
		100	386765	310635	0
		150	386766	310585	0
		200	386767	310535	0
		10	378165	310874	0
		15	378166	310870	0
		20	378167	310865	0
		35	378170	310850	0
		50	378173	310835	0
		75	378178	310811	0
		100	378183	310786	0
		150	378193	310737	0
		200	378203	310688	0
Doxy Tillington Marshes 1	SSSI	0	390039	324986	0
		5	390043	324983	0
		10	390047	324980	0
		15	390051	324977	0
		20	390055	324973	0
		35	390066	324964	0
		50	390078	324955	0
		75	390098	324939	0
		100	390117	324923	0
		150	390156	324892	0
		200	390195	324861	0
Doxy Tillington Marshes 2	SSSI	0	389786	324688	0
		5	389790	324685	0
		10	389795	324682	0
		15	389799	324680	0
		20	389803	324677	0
		35	389816	324669	0
		50	389828	324661	0
		75	389849	324647	0
		100	389870	324634	0
		150	389912	324607	0
		200	389954	324580	0
Doxy Tillington Marshes 3	SSSI	0	389734	324539	0
		5	389739	324537	0
		10	389743	324535	0
		15	389748	324533	0
		20	389752	324531	0
		35	389766	324525	0
		50	389780	324519	0
		75	389803	324509	0
		100	389826	324499	0
		150	389872	324480	0
		200	389917	324460	0
Doxy Tillington Marshes 4	SSSI	0	389734	324540	0
		5	389739	324538	0
		10	389744	324536	0
		15	389748	324534	0
		20	389753	324532	0
		35	389767	324526	0
		50	389780	324520	0
		75	389803	324510	0
		100	389826	324500	0
		150	389872	324480	0
		200	389918	324460	0

Traffic Data

Traffic data for use in the ADMS model has been provided by the traffic consultants WSP.

The traffic data provided for the AQ assessment has been produced using two traffic models, both developed, owned and validated by Highways England (HE). These are the M54 / M6 / M6 Toll Link Road SATURN Model (M54/M6SM) and the South Staffordshire VISSIM Model (SSVM). The M54/M6SM is validated for a base year of 2012 and the SSVM is validated for a base year of 2015. The M54/M6SM has also been developed for future years of 2021 and 2036. The M54/M6SM is a strategic model covering an area stretching from Stafford in the north, Tamworth in the east, Birmingham in the south and Telford in the west. The SSVM is a more detailed local model covering an area including M6J11 and 12, Gailey roundabout and M54 J1 and 2. For the purposes of this assessment it has been expanded to include Station Drive / Station Road / Vicarage Road and its junctions in more detail. M54/M6SM has been used to distribute WMI traffic to the wider highway network, with HE's SSVM then distributing it across the local highway network, more accurately reflecting the local conditions. The SSVM is then used as a tool to assess the operation of the highway network.

It was agreed with the Highway Authority's that the area covered by the SSVM should form the assessment cordon to be considered in order to identify the highway impact of WMI but the M54/M6SM has been used to understand traffic flows beyond this.

In the absence of an announcement of the preferred route of the M54/M6/M6 Toll link, it has been agreed with the Highway Authorities that modelling at this stage should not consider a 2036 forecast year. Once the announcement of the preferred route has been made then this additional forecast year assessment of 2036 can be undertaken. Until them, all traffic data is based on a 2021 forecast year. In the event that a preferred route has not been announced by the time of the submission of the WMI Development Consent Order, an alternative assessment approach has been agreed with HE and SCC which adds localised growth to key junctions in order to assess them. Without the route announcement it is not possible to run the models or carry out a wider assessment of traffic patterns in 2036.

The M54/M6SM 2021 has been used to provide demand forecasting to the SSVM and has been updated and expanded to include all relevant committed development. In respect of the 2021 with WMI scenario, WMI development traffic has been included within the model, based upon the development traffic generation and distribution agreed with the highway authorities. The model was also expanded to allow for the provision of the public route through the Site connecting the A5 and the A449, however this only applies to the 2028 and 2036 scenarios as the link road would not be completed in the earlier 2021 scenario. Following completion of the M54/M6SM modelling the 2021 SSVM, with and without WMI, was developed.

Data from both models has been used to inform the AQ assessment, however, as set out above, the models are independent of each other and use different base data although the area of coverage overlaps. Both models are validated and supported by HE and therefore it is reasonable to use data from both models for the purposes of this assessment.

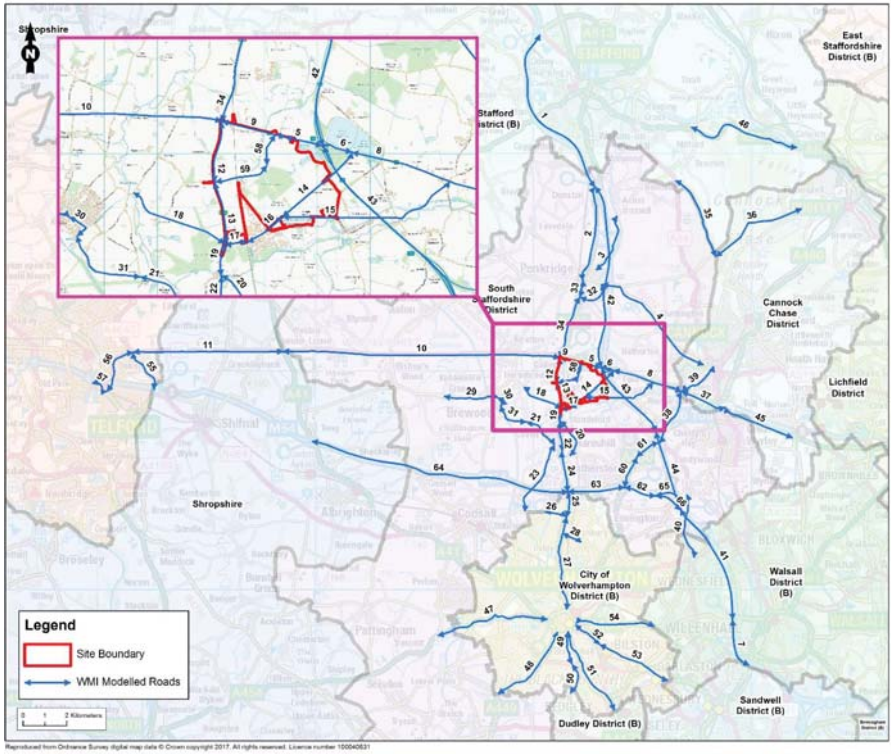
The Traffic Data used within the assessment is set out in Table 7.2.1 and the road links are shown in Figures 7.2.1.

Background Concentrations

Background concentrations for use within the modelling assessment has been obtained from the DEFRA 2015 UK background maps. Concentrations have been extracted and applied to each relevant grid square included within the study area for the 2016, 2021, 2028 and 2036 assessment years.

The data is set out in Table 7.8 of the air quality chapter.

Figure 7.2.1: Location of road links used in modelling assessment



Model Verification

It is recommended that road traffic modelling results are compared with measured data to determine whether the model results need adjusting to more accurately reflect local air quality. This process is known as verification.

LAQM.TG(16) recommends that model predictions should be within 25% (preferably 10%) of monitored concentrations for the model to be predicting within an acceptable margin of accuracy. Also, the guidance recommends that any adjustment factors applied to model results should be calculated based on verification using monitoring sites in a similar location i.e. roadside, intermediate or background sites.

To verify model results, the ADMS model has been used to predict NOx concentrations at a number of monitoring sites identified within each local authority area. The verification process found the ADMS model to be over and under predicting annual mean NO2 concentrations by more than 25% at a number of locations. Adjustment of the model results is therefore considered necessary. Adjustment of the results has been carried out following the method set out within LAQM.TG(16).

The model verification and adjustment process has been carried out separately for each local authority area.

For each area the model output of road-NOx (i.e. the component of total NOx coming from road traffic) has been compared with the 'measured' road-NOx (Figures 7.2.2, 7.2.5, 7.2.8 and 7.2.11). The 'measured' road NOx has been calculated from the measured NO2 concentrations by using the DEFRA NOx from NO2 calculator available on the UK-AIR website. The separate varication and adjustment for each area is set out below.

Cannock Chase

Figure 7.2.2 shows that the ADMS model has under-predicted the road-NOx concentrations at the Cannock Chase monitoring sites. An adjustment factor has therefore been determined as the ratio between the measured road-NOx contribution and the modelled road-NOx contribution, forced through zero (1/0.3022 =3.31). This factor has been applied to the modelled road-NOx concentration for each location to provide an adjusted modelled road-NOx concentration.

The annual mean road-NO2 concentration has then been determined using the DEFRA NOx:NO2 spread sheet calculation tool and added to the background NO2 concentration to produce a total adjusted NO2 concentration. Figure 7.2.3 shows the adjusted modelled total NO2 vs monitored NO2. There is good agreement, but the best fit line forced through zero still has a slight departure from a 1:1 line, thus a secondary adjustment factor, to be applied to the adjusted modelled total NO2, was calculated (1/1.0297 = 0.971).

After carrying out an initial adjustment there was a need for only a very small secondary adjustment of NO2. The final adjustment modelled values are shown in Figure 7.2.4.

Figure 7.2.2: Comparison of modelled Road NO_x with Measured Road NO_x in Cannock Chase

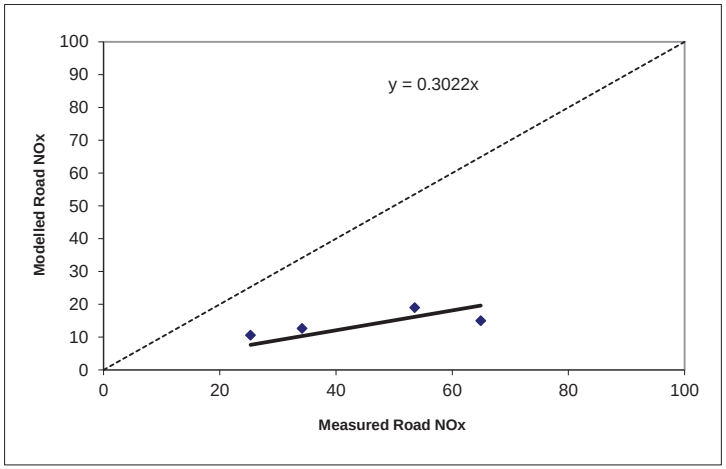


Figure 7.2.3: Comparison of modelled NO_2 with Measured NO_2 in Cannock Chase

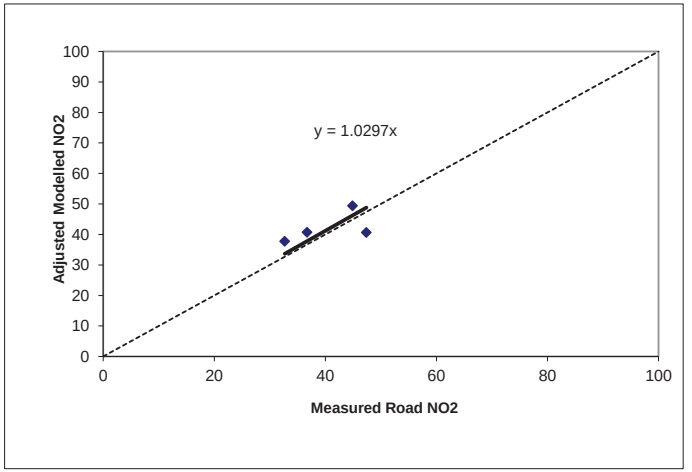
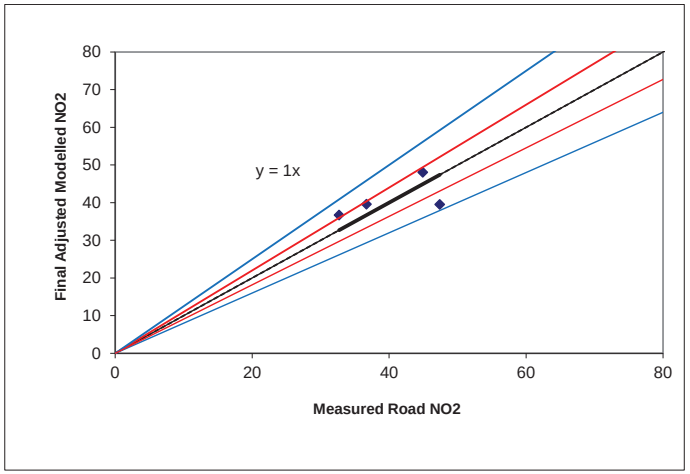


Figure 7.2.4: Comparison of final modelled NO_2 with Measured NO_2 in Cannock Chase



South Staffordshire

Figure 7.2.5 shows that the ADMS model is under-predicted the road-NOx concentrations at the South Staffordshire monitoring sites. An adjustment factor of 2.18 (1/0.4584) has been determined.

Figure 7.2.6 shows the adjusted modelled total NO2 vs monitored NO2. A secondary adjustment factor of 1.003 (1/0.9968) has subsequently been determined with the final adjusted modelled results shown in Figure 7.2.7.

Figure 7.2.5: Comparison of modelled Road NO_x with Measured Road NO_x in South Staffordshire

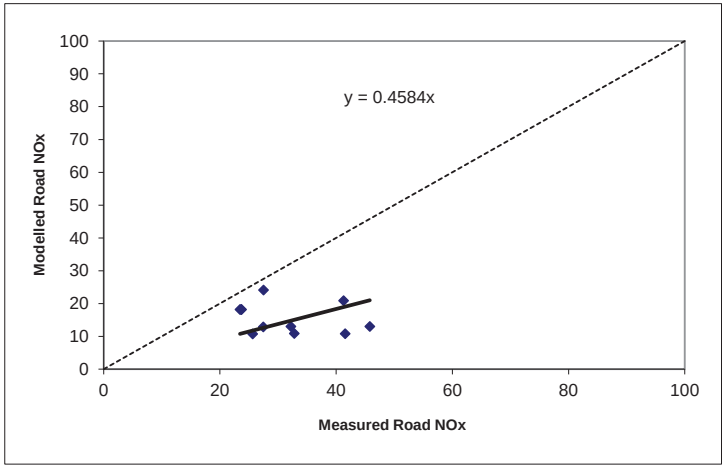


Figure 7.2.6: Comparison of modelled NO_2 with Measured NO_2 in South Staffordshire

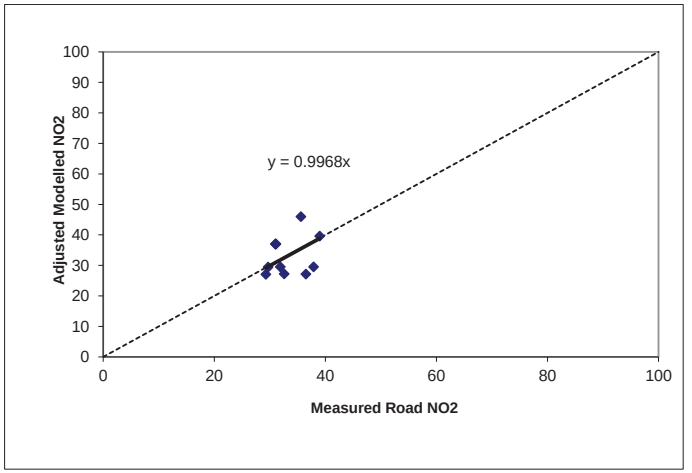
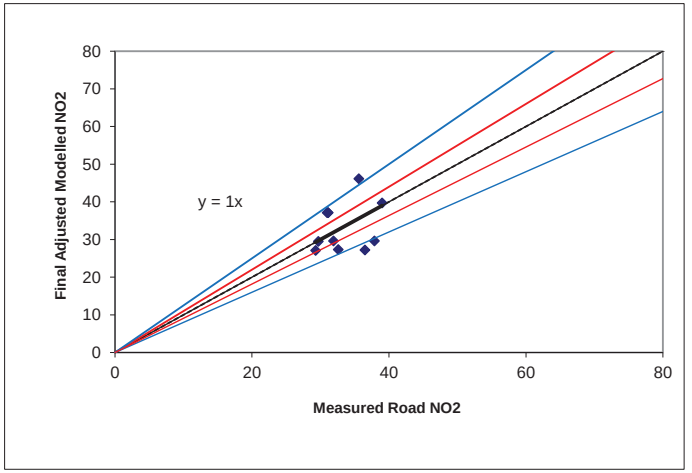


Figure 7.2.7: Comparison of final modelled NO_2 with Measured NO_2 in South Staffordshire



Shropshire

Figure 7.2.8 shows that the ADMS model is under-predicted the road-NOx concentrations at one of the Shropshire monitoring sites but over-predicting at the other. An adjustment factor of 0.77 (1/1.2969) has been determined.

Figure 7.2.9 shows the adjusted modelled total NO2 vs monitored NO2. A secondary adjustment factor of 1.018 (1/0.9825) has subsequently been determined with the final adjusted modelled results shown in Figure 7.2.10.

Figure 7.2.8: Comparison of modelled Road NO_x with Measured Road NO_x in Shropshire

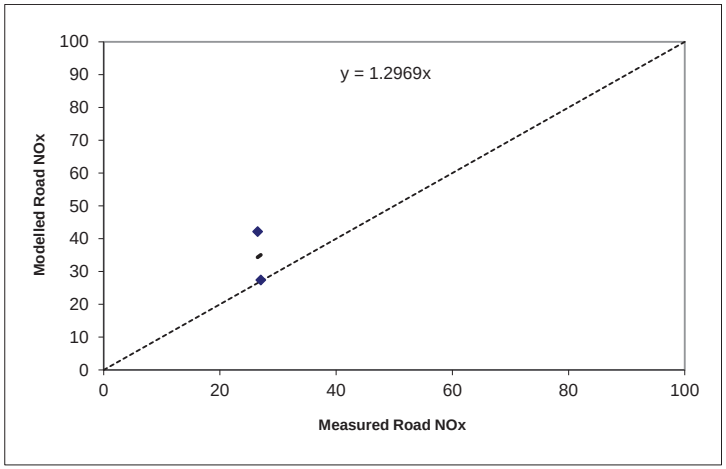


Figure 7.2.9: Comparison of modelled NO_2 with Measured NO_2 in Shropshire

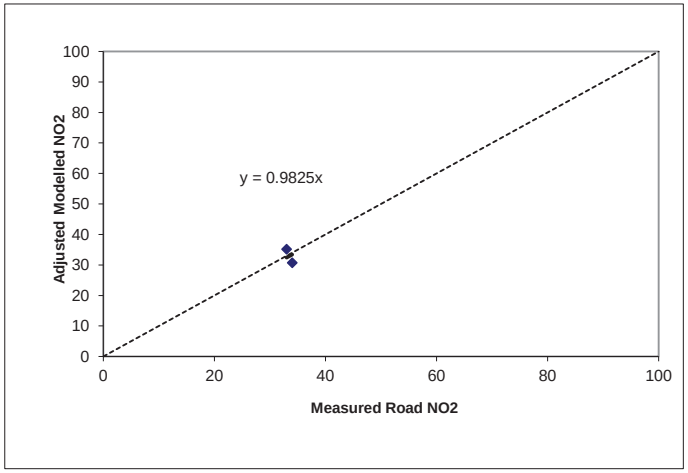
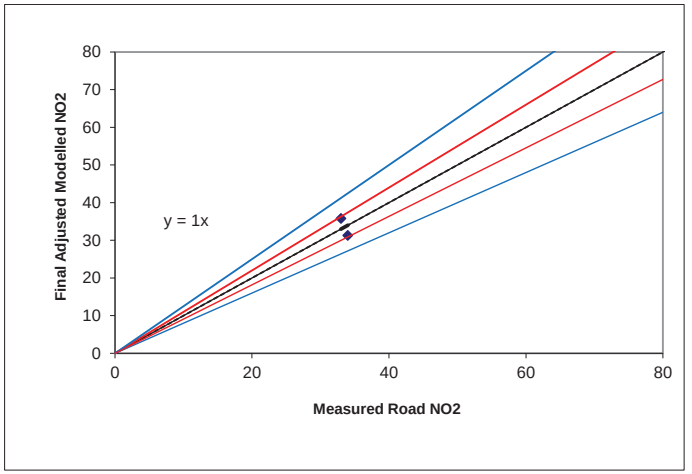


Figure 7.2.10: Comparison of final modelled NO_2 with Measured NO_2 in Shropshire



Wolverhampton

Figure 7.2.11 shows that the ADMS model is under-predicted the road-NOx concentrations at the majority of the Wolverhampton monitoring sites. An adjustment factor of 1.93 (1/0.5182) has been determined.

Figure 7.2.12 shows the adjusted modelled total NO2 vs monitored NO2. A secondary adjustment factor of 0.998 (1/1.0025) has subsequently been determined with the final adjusted modelled results shown in Figure 7.2.13.

Figure 7.2.11: Comparison of modelled Road NO_x with Measured Road NO_x in Wolverhampton

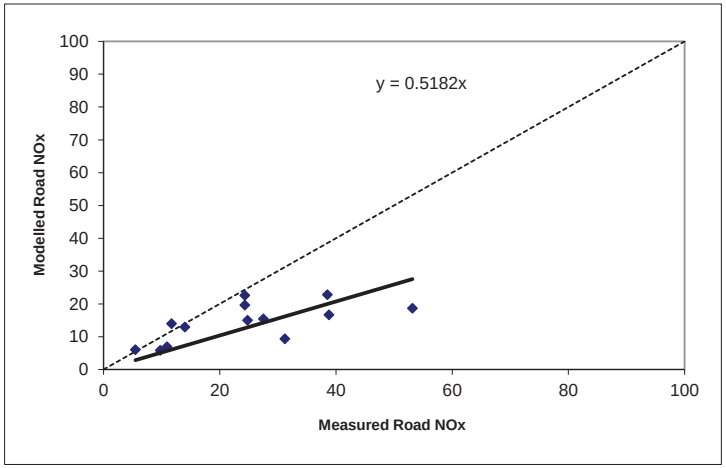


Figure 7.2.12: Comparison of modelled NO_2 with Measured NO_2 in Wolverhampton

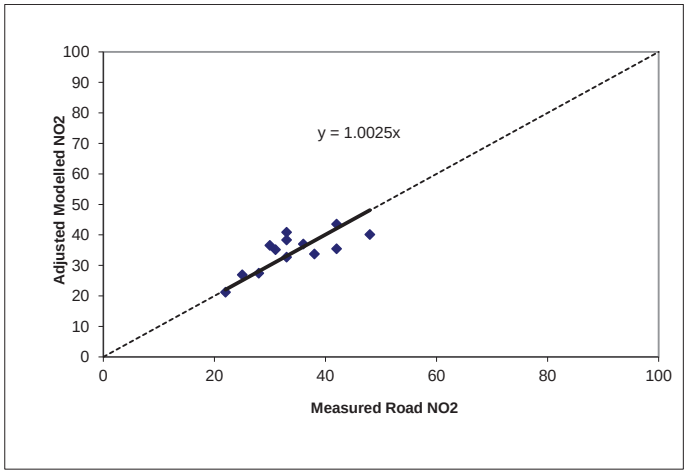
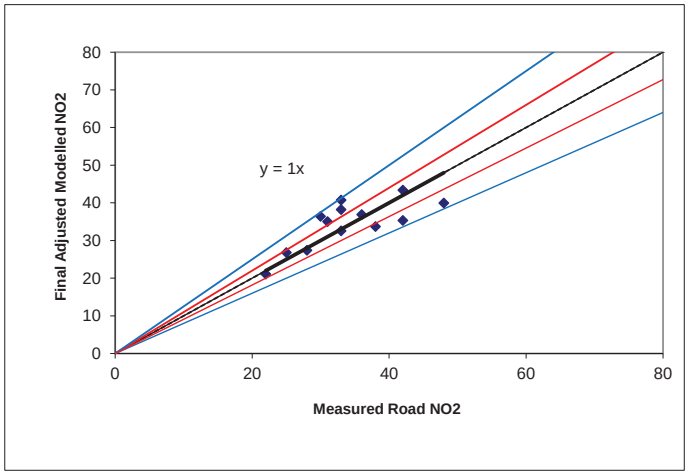


Figure 7.2.13: Comparison of final modelled NO_2 with Measured NO_2 in Wolverhampton



Staffordshire and Telford and Wrekin

No appropriate monitoring sites were identified to allow verification of the model to be carried out for these areas. The model results for Staffordshire and Telford and Wrekin have therefore been adjusted using the adjustment factors calculated for Cannock Chase.

PM_{10} and $PM_{2.5}$

There is no suitable monitoring of PM10 or PM2.5 data to allow verification of the PM model results. However, LAQM.TG (16) suggests applying the NOx adjustment factors to modelled road-PM where no appropriate verification against PM data can be carried out. The calculated primary and secondary adjustment factors have therefore been applied to the predicted PM10 and PM2.5 results for each local authority area.

Model Post-processing

Nitrogen oxides and nitrogen dioxide

The ADMS Roads model has predicted NOx concentrations at each selected receptor location. These concentrations have been adjusted using the primary adjustment factor. The DEFRA NO_x from NO_2 calculator has then been used, in conjunction with the relevant background NO2 concentrations, to calculate the NO2 concentrations at each location. The traffic mix within the calculator has been set to 'All UK Traffic', which is considered suitable for the study area. The calculated NO2 concentrations has then been adjusted by the secondary adjustment factor.

PM_{10} and $PM_{2.5}$

As detailed previously, the predicted PM_{10} and $PM_{2.5}$ concentrations have been adjusted using the primary and secondary NOx adjustment factors.

The number of exceedences of the 24-hour objective of 50µg/m^3 have then been calculated from the predicted annual mean concentrations using the given previously in this section.

Deposition Rates

Deposition has not been included within the ADMS dispersion model as the principle component of concern for this assessment is NO2 and this is calculated outside the model from predicted NOx concentrations.

Guidance produced by the Environment Agency on assessing emissions to air in relation to the Habitats Directive (AQTAG06)[3] sets out empirical methods for calculating nitrogen deposition (N-deposition) rates based on calculated NOx concentrations and deposition velocity using the following formula:

Dry deposition flux (µg/m2/yr) = ground level concentration (µg/m3) x deposition velocity (m/s)

The AQTAG06 guidance only provides deposition velocities for grassland (0.0015 m/s) and forest habitats (0.003 m/s). The relevant deposition rats have been applied to each receptor based on the habitat identified in that location.

The resulting dry deposition rate can be converted to N-deposition in kg/ha/yr by multiplying by a factor of 96.

Acid (N) deposition has been calculated from the predicted N-deposition rates using basic chemical and mathematical rules[4].

Wet deposition has been discounted from the calculations given the low solubility of NO2 which means any scavenging of this gas by rain droplets would be negligible.

[3] Environment Agency (2006) Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air

[4] For example 1kg N/ha/yr = 0.071 keq/ha/yr