Updated Technical Appendix 7.2 (Tracked)
Methodology for Modelling of Traffic Emissions

The West Midlands Rail Freight Interchange Order 201X

Regulation 5(2)(a)

Ramboll: August 2019

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:

$$A = -18.5 + 0.00145 \times \text{annual mean}^3 + (206/\text{annual mean})$$

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 NO_2 concentrations to 1-hour mean NO_2 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 human health receptors used in the modelling assessment are set out in Table 7.2.1 below and shown in Figure 7.2.1. Updates to the human health receptor locations are prefixed with 'PS' to the original receptor numbering. Table 7.2.1 is arranged by local authority to facilitate the interpretation of the results and therefore Table 7.2.1a-g completely replace the previous Table 7.2.1.

For the ecological receptors, transect 4 in Doxy Tillington Marshes was a repeat of transect 3 and has therefore been removed.

Table 7.2.1a: Updated Human Receptors used in Modelling Assessment – Cannock Chase Council

Receptor ID Number	Receptor type	Land use	Short Address	X	Y	Height m
PS_CC_BAMS	Automatic, roadside	Commercial Property	Bridgtown Automatic Monitoring Station (triplicate), Watling St	398010	308560	2.5
PS_CC_4b	Long term public exposure	Residential Property	Mia Court	397628	310363	1.5
PS_CC_36a	Long term public exposure	Residential Property	Penkridge Bank Rd	401623	317194	1.5
PS_CC_37a	Long term public exposure	Residential Property	210 Watling St	397782	308680	1.5
PS_CC_37b	Long term public exposure	Residential Property	25 Watling St	398272	308390	1.5
PS_CC_39a	Long term public exposure	Residential Property	2A Mill St	398165	310048	3.5
PS_CC_39b	Long term public exposure	Residential Property	Cromwell House	398172	310058	3
PS_CC_54WS	Monitoring site receptor (eg facade)	Residential Property	54WS	398250	308428	2.5
PS_CC_67WS	Monitoring site receptor (eg facade)	Residential Property	67WS	398052	308513	1.5
PS_CC_268WS	Monitoring site receptor (eg facade)	Residential Property	268WS	400727	307423	2

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Table 7.2.1b: Updated Human Receptors used in Modelling Assessment – Stafford Borough Council

Receptor ID Number	Receptor type	Land use	Short Address	X	Y	Height - m
PS_St_1a	Long term public exposure	Residential Property	M6, Stafford	389720	323623	1.5
PS_St_3	Diffusion tube	Roadside Monitoring Location	Lethridge Gardens	390130	321700	1.5
PS_St_33	Diffusion tube, roadside	Roadside Monitoring Location	Barn Bank Lane	392167	319968	5
PS_St_35 a	Long term public exposure	Residential Property	Camp Rd	396652	318652	1.5
PS_St_46 a	Long term public exposure	Residential Property	1351 A513, Milford	398641	321165	1.5
PS_St_46 b	Long term public exposure	Residential Property	Leasowes House, Stafford	399049	321290	1.5
St_1b	Long term public exposure	Residential Property	74 Burton Manor Rd	391580	320688	1.5
St_1c	Long term public exposure	School	Stafford Grammer Sch	391500	320650	1.5

Table 7.2.1c: Updated Human Receptors used in Modelling Assessment – Shropshire Council

Receptor ID Number	Receptor type	Land use	Short Address	X	Y	Height - m
PS_Sh_11 a	Long term public exposure	Residential Property	Burlaughton Farmhouse	377635	310882	1.5
PS_Sh_64 a	Long term public exposure	Residential Property	The Stables	380095	306695	1.5

Table 7.2.1d: Updated Human Receptors used in Modelling Assessment – South Staffordshire Council

Receptor ID Number	Receptor type	Land use	Short Address	X	Y	Height - m
PS_PE	Monitoring site receptor (eg facade)	Residential Property	PE	393180	313867	2
PS_HA2+08b	Long term public exposure & Monitoring site receptor (eg facade)	Residential Property	Oak Hollow, HA2	394777	309758	2
PS_HA5	Diffusion tube, roadside	Outside Residential Property	Watling Street	394831	309737	2
PS_HA6	Diffusion tube, roadside	Outside Residential Property	Watling Street	394905	309708	2
PS_SA2+38a	Long term public exposure & Monitoring site receptor (eg facade)	Residential Property	The Croft, SA2	396717	308742	2
PS_SA5	Monitoring site receptor (eg facade)	Residential Property	SA5	396705	308673	2
PS_SA6+38b	Long term public exposure & Monitoring site receptor (eg facade)	Residential Property	44 Wolverhampton Rd, SA6	396702	308613	2
PS_ES4	Monitoring site receptor (eg facade)	Residential Property	ES4	396958	303269	12.5
PS_ES6	Monitoring site receptor (eg facade)	Residential Property	ES6	396999	303440	12.5

Receptor ID Number	Receptor type	Land use	Short Address	X	Y	Height - m
PS_02a	Long term public exposure	Residential Property	213 A449	392762	317948	1.5
PS_04a	Long term public exposure	Residential Property	Cannock Rd	394424	313332	1.5
PS_05a	Long term public exposure	Residential Property	A5, Penkridge-1	392633	310258	1.5
PS_06a	Long term public exposure	Residential Property	A5, Penkridge-2	393657	310052	1.5
PS_09a	Long term public exposure	Residential Property	Gailey Bridge	392023	310403	1.5
PS_10a	Long term public exposure	Residential Property	A5, Penkridge-4	390940	310667	1.5
PS_13a	Long term public exposure	Residential Property	Four Ashes Pub	391287	308305	1.5
PS_14a	Long term public exposure	Residential Property	Vicarage Rd-1	393088	309444	1.5
PS_14b	Long term public exposure	Residential Property	Vicarage Rd-2	392395	308853	1.5
PS_15b	Long term public exposure	Residential Property	Cottage, 2 Straight Mile	393511	308799	1.5
PS_15c	Long term public exposure	Residential Property	11a Straight Mile	394405	308794	1.5
PS_17a	Long term public exposure	Residential Property	180 Station Dr	391311	308290	1.5
PS_17b	Long term public exposure	Residential Property	Station Dr	391497	308342	1.5
PS_18a	Long term public exposure	Residential Property	Four Ashes Rd	390487	308679	1.5
PS_20a	Long term public exposure	Residential Property	Old Stafford Rd	391374	307615	1.5

Receptor ID Number	Receptor type	Land use	Short Address	X	Y	Height - m
PS_21a	Long term public exposure	Residential Property	Brewood Rd	390005	307602	1.5
PS_21b	Long term public exposure	Residential Property	42 Poplars Farm Way	390904	306749	1.5
PS_23a	Long term public exposure	Residential Property	24 Lawn Ln	390857	306474	1.5
PS_23b	Long term public exposure	Residential Property	Wobaston Rd	389601	303779	1.5
PS_29a	Long term public exposure	Residential Property	33 Bargate St	388155	308866	1.5
PS_29b	Long term public exposure	Residential Property	2 Kiddemore Green Rd	386050	308839	1.5
PS_30a	Long term public exposure	Residential Property	38 The Pavement	388642	308617	1.5
PS_30b	Long term public exposure	Residential Property	38 Sandy Ln	388385	308789	1.5
PS_31b	Long term public exposure	Residential Property	The Dingle, Coven Rd	388521	308369	1.5
PS_32a	Long term public exposure	Residential Property	Wolgarston Way	392881	313304	1.5
PS_32b	Long term public exposure	Residential Property	8 Boscomoor Ln	392295	313337	1.5
PS_33a	Long term public exposure	Residential Property	The Willows	392175	313722	1.5
PS_34a	Long term public exposure	Residential Property	Stafford Rd	391863	312753	1.5
PS_34b	Long term public exposure	Residential Property	66 Stafford Rd	391472	311414	1.5
PS_40b	Long term public exposure	Residential Property	4 Bursnips Rd	396968	303231	11.5

Receptor ID Number	Receptor type	Land use	Short Address	X	Y	Height - m
PS_40c	Long term public exposure	Residential Property	1 Bursnips Rd	397081	303758	1.5
PS_42a	Long term public exposure	Residential Property	M6, Stafford	393064	318029	1.5
PS_42d	Long term public exposure	School	Wolgarston High School	393453	313891	1.5
PS_61a	Long term public exposure	Residential Property	2 Church Road	394711	306107	1.5
PS_62a	Long term public exposure	Residential Property	Hobnock Road	396430	303935	1.5
PS_64b	Long term public exposure	Residential Property	Lane House	391311	304543	1.5
02b	Long term public exposure	Residential Property	Bridge Terrace	392248	314318	1.5
03a	Long term public exposure	Residential Property	Teddesley Rd-1	393514	315344	1.5
03b	Long term public exposure	Residential Property	Teddesley Rd-2	393588	315468	1.5
08a	Long term public exposure	Residential Property	A5, Penkridge	393709	309998	1.5
08c	Long term public exposure	Residential Property	Tudor Cottage	395563	309470	1.5
09b	Long term public exposure	Residential Property	A5, Penkridge-3	391373	310587	1.5
10b	Long term public exposure	Residential Property	20 A5	380491	310902	1.5
12a	Long term public exposure	Residential Property	Stafford Rd	391038	309778	1.5
13b	Long term public exposure	Residential Property	Stafford Rd, Coven	391294	308606	1.5

Receptor ID Number	Receptor type	Land use	Short Address	X	Y	Height - m
15a	Long term public exposure	Residential Property	1 Straight Mile	393952	308799	1.5
16a	Long term public exposure	Residential Property	Vicarage Rd	392253	308734	1.5
19a	Long term public exposure	Residential Property	148 Stafford Rd	391192	307869	1.5
19b	Long term public exposure	Residential Property	Stafford Rd	391180	307756	3
19c	Long term public exposure	Residential Property	Streamway House	391166	307978	3
20b	Long term public exposure	Residential Property	160 Old Stafford Rd	391805	306305	1.5
22a	Long term public exposure	Residential Property	2 St Paul	391296	306562	1.5
22b	Long term public exposure	Residential Property	Stafford Rd	391286	306497	1.5
24a	Long term public exposure	Residential Property	New Buildings	391484	305158	1.5
24b	Long term public exposure	Residential Property	886 Stafford Rd	391561	304774	1.5
31a	Long term public exposure	Residential Property	94 Coven Rd	388699	308026	1.5
32c	Long term public exposure	Residential Property	7 Athelstan Cl	393196	313942	1.5
33b	Long term public exposure	Residential Property	2 Clay St	392260	314069	1.5
35b	Long term public exposure	Residential Property	Springslade Lodge	397879	316495	3
41a	Long term public exposure	Residential Property	91 Vernon Way	397924	302249	1.5

Receptor ID Number	Receptor type	Land use	Short Address	X	Y	Height - m
42b	Long term public exposure	Residential Property	6 Oakley Cl	393215	314068	1.5
42c	Long term public exposure	Residential Property	Gailey Lea Ln	393069	311115	1.5
43a	Long term public exposure	Residential Property	Dog and Partridge Pub	394142	308793	3
43b	Long term public exposure	Residential Property	1 Saredon Ln	394660	308499	1.5
44a	Long term public exposure	Residential Property	1 Hobnock Rd	396541	304005	1.5
45a	Long term public exposure	Residential Property	16 Watling St	399536	307876	1.5
CHRa	Short-term exposure	Reservoir	Calf Heath Reservoir	392710	310233	1.5
CHRb	Short-term exposure	Reservoir	Calf Heath Reservoir	392962	310165	1.5
CHRc	Short-term exposure	Reservoir	Calf Heath Reservoir	393002	310067	1.5
CHRd	Short-term exposure	Reservoir	Calf Heath Reservoir	393060	309914	1.5
CPAa	Short-term exposure	Community Park	Croft Lane Community park	391582	310507	1.5
CPAb	Short-term exposure	Community Park	Croft Lane Community Park	391999	309966	1.5
CPAc	Short-term exposure	Community Park	Calf Heath Community Park	392390	308839	1.5
CPAd	Short-term exposure	Community Park	Calf Heath Community Park	392579	308811	1.5
CPAe	Short-term exposure	Community Park	Calf Heath Community park	393306	308823	1.5

Table 7.2.1e: **Updated** *Human Receptors used in Modelling Assessment – Telford & Wrekin Council*

Receptor ID Number	Receptor type	Land use	Short Address	X	Y	Height - m
PS_TW_11b	Long term public exposure	Residential Property	A5, Telford	372952	310890	1.5
PS_TW_11b	Long term public exposure	Residential Property	A5, Telford	372952	310890	1.5
PS_TW_55a	Long term public exposure	Residential Property	Castle Farm Way-1	372115	310178	1.5
PS_TW_55b	Long term public exposure	Residential Property	3 Aralia Cl	371947	310359	1.5
PS_TW_55c	Long term public exposure	Residential Property	Castle Farm Way-2	371833	310454	1.5
PS_TW_56a	Long term public exposure	Residential Property	Tarmacked Dr	370744	309988	1.5
PS_TW_56b	Long term public exposure	Residential Property	A5, St George	370872	310593	1.5
PS_TW_57a	Short term public exposure	Residential Property	Park Inn By Radisson Telford	369928	309414	3

Table 7.2.1f: **Updated** *Human Receptors used in Modelling Assessment – Walsall District Council*

Receptor ID Number	Receptor type	Land use	Short Address	X	Y	Height - m
PS_W_RWC1	Ecological	Nature Reserve	Bentley Haye Local Nature Reserve	398890	300393	0
PS_W_RWC2	Ecological	Nature Reserve	Bentley Haye Local Nature Reserve	398600	301285	0
PS_W_RWC3	Ecological	Nature Reserve	Bentley Haye Local Nature Reserve	397951	302374	0
PS_W_7a	Long term public exposure	Residential Property	343 Darlaston Rd	399210	297512	1.5
PS_W_7b	Long term public exposure	Residential Property	367 Darlaston Rd	399168	297514	1.5

Receptor ID Number	Receptor type	Land use	Short Address	X	Y	Height - m
PS_W_7c	Long term public exposure	Residential Property	308 Darlaston Rd	399163	297542	1.5
PS_W_41a	Long term public exposure	Residential Property	265-369 Essington Rd	397100	302071	1.5
PS_W_41b	Long term public exposure	Residential Property	M6, Willenhall WV12	398502	301332	1.5
PS_W_41c	Long term public exposure	Residential Property	32 Murdock Way	398981	300366	1.5

Table 7.2.1g: Updated Human Receptors used in Modelling Assessment – Wolverhampton City Council

Receptor ID Number	Receptor type	Land use	Short Address	X	Y	Height - m
PS_WC_BIL1	Monitoring site receptor (eg facade)	Day nursery	BIL1	395058	296541	2
PS_WC_BIL2	Monitoring site receptor (eg facade)	Residential Property	BIL2	395089	296476	3
PS_WC_BIL3	Monitoring site receptor (eg facade)	Dental Practice	BIL3	395095	296491	2
PS_WC_BIL4	Monitoring site receptor (eg facade)	Residential Property	BIL4	395118	296455	2.5
PS_WC_BRI	Monitoring site receptor (eg facade)	Residential Property	BRI	388195	298787	3
PS_WC_DUD	Monitoring site receptor (eg facade)	Primary Care Centre	DUD	391531	297313	2.5
PS_WC_HOR	Monitoring site	Residential Property	HOR	392116	298607	2
	receptor (eg facade)					
PS_WC_STA1	Monitoring site receptor (eg facade)	Residential Property	STA1	391391	299805	2.5
PS_WC_STA5	Automatic monitoring site	Roadside Monitoring Location	Church Road	391261	302199	2
PS_WC_STA9	Monitoring site and receptor (eg facade)	Residential Property	Stafford Road	391541	303373	2.5
PS_WC_STA9A	Monitoring site and receptor (eg facade)	Residential Property	STA9A	391535	303346	2.5
PS_WC_WIL1	Monitoring site and receptor (eg facade)	Residential Property	Willenhall Road	394187	298451	2.5
PS_WC_25b	Long term public exposure	Residential Property	722 Stafford Rd	391554	303425	1.5
PS_WC_26a	Long term public exposure	Residential Property	176A Winchester Rd	391272	303438	1.5
PS_WC_26b	Long term public exposure	Residential Property	5A Redhurst Dr	391054	303473	1.5
PS_WC_27a	Long term public exposure	Residential Property	Stafford St	391391	299804	4.5
PS_WC_27b	Long term public exposure	Residential Property	626 Stafford Rd	391455	303005	1.5
PS_WC_28a	Long term public exposure	Residential Property	12 Three Tuns Ln	391417	302532	1.5
PS_WC_28b	Long term public exposure	Residential Property	1 Elston Hall Ln	391780	302386	1.5
PS_WC_47a	Long term public exposure	Residential Property	4 Compton Rd	390516	298659	1.5

Receptor ID Number	Receptor type	Land use	Short Address	X	Y	Height - m
PS_WC_47b	Long term public exposure	Residential Property	9 Crawford Rd	390179	298682	1.5
PS_WC_48a	Long term public exposure	Residential Property	1 Pennant Ct	390890	297632	3
PS_WC_48a	Long term public exposure	Residential Property	Penn Road	390708	297281	1.5
PS_WC_48b	Long term public exposure	Residential Property	The Leylands	390232	296548	1.5
PS_WC_49a	Long term public exposure	Residential Property	3 Elm Farm Rd	391543	297358	1.5
PS_WC_49b	Long term public exposure	Residential Property	1 Knox Rd	391643	296928	1.5
PS_WC_50a	Long term public exposure	Residential Property	510 Wolverhampton Rd E	391990	296250	1.5
PS_WC_50b	Long term public exposure	Residential Property	1 Sherrans Dell	391941	295524	1.5
PS_WC_51a	Long term public exposure	Residential Property	255-257 Birmingham Rd	391741	297393	1.5
PS_WC_51b	Long term public exposure	Residential Property	281 Birmingham Rd	391769	297277	1.5
PS_WC_52a	Long term public exposure	Residential Property	215 Bilston Rd	392840	297683	1.5
PS_WC_52b	Long term public exposure	Residential Property	35 Navigation St	392228	298134	1.5
PS_WC_53a	Long term public exposure	Residential Property	405 Bilston Rd	393490	297244	1.5
PS_WC_53b	Long term public exposure	Residential Property	224 A41	393882	297034	1.5
PS_WC_54a	Long term public exposure	Residential Property	Horseley Fields	392131	298602	1.5

Receptor ID Number	Receptor type	Land use	Short Address	X	Y	Height - m
PS_WC_54b	Long term public exposure	Residential Property	414 Willenhall Rd	394386	298415	1.5
WRE	Monitoring site receptor (eg facade)	Education Centre	WRE	392090	296095	3
25a	Long term public exposure	Residential Property	723 Stafford Rd	391572	303622	1.5
27c	Long term public exposure	Residential Property	416 Stafford Rd	391210	302045	1.5
47c	Long term public exposure	School	Wolverhampton Grammer School	389904	298697	1.5
48c		School	Royal Junior School Wolverhampton	390660	297262	1.5

Table 7.2.2: Updated 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

Receptor Location	Designation	Distance Into Transect (m)	X	Y	Height - m
		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

Receptor Location	Designation	Distance Into Transect (m)	X	Y	Height - m
		75	389803	324509	0
		100	389826	324499	0
		150	389872	324480	0
		200	389917	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.
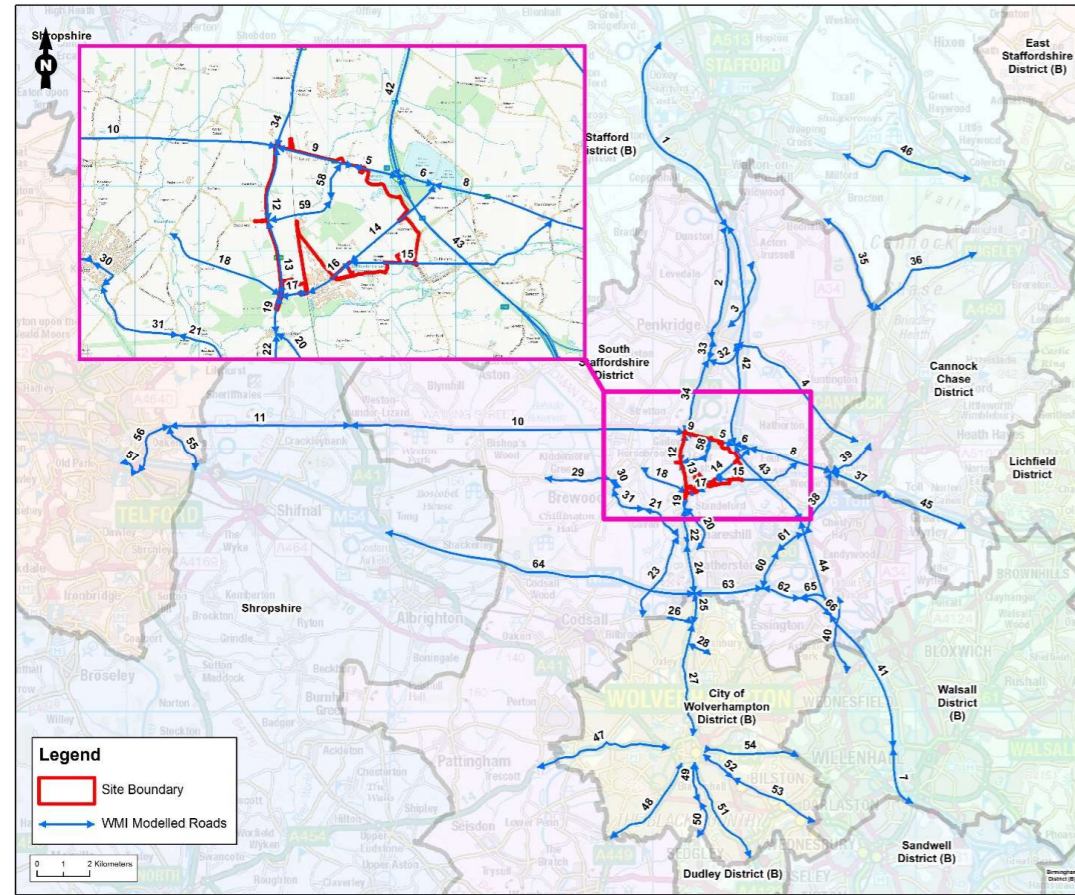
Data from both models has been used to inform the AQ assessment, however, as set out above, the models are independent of each other and use different base data although the area of coverage overlaps. Both models are validated and supported by HE and therefore it is reasonable to use data from both models for the purposes of this assessment.

The Traffic Data used within the assessment is set out in Table 7.2.3~~1~~ (previously omitted) 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

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Table 7.2.3: Modelled Traffic Data

Road Link	Link Name	Speed (kph)	Future Base (With No Development)		Future Base Plus Development 2021		Future Base Plus Development 2028		Future Base Plus Development 2030	
			All Vehicles	% HDV	All Vehicles	% HDV	All Vehicles	% HDV	All Vehicles	% HDV
Road001	M6 (between Junction 13 and 14)	105	154,704	16.1	155,088	16.1	155,832	16.3	156,216	16.4
Road002	A449 Stafford Road (between M6 J13 and Pinfold Lane)	82	16,176	6.4	16,680	6.6	17,664	7.2	18,168	7.4
Road003	Teddesley Road between Marsh Lane and Penkridge Road	67	3,360	0.7	3,360	0.7	3,360	0.7	3,360	0.7
Road004	Cannock Road (between Wolgarston Way and A34)	63	15,864	5.6	16,056	6.0	16,392	6.4	16,560	6.8
Road005	A5 Watling Street (between M6 J12 and Proposed Site Access)	71	21,264	6.4	23,736	12.6	29,016	15.1	31,584	16.9
Road006	A5 Watling Street (between Vicarage Road and M6 J12)	65	19,032	13.9	19,944	16.0	22,464	17.2	23,616	18.1
Road007	M6 (between Junction 9 and 10)	85	227,424	12.7	228,192	12.9	229,704	13.3	230,448	13.5
Road008	A5 Watling Street (between Vicarage Road and A4061)	71	20,808	12.6	21,288	14.0	23,064	13.4	23,808	13.6

Table 7.2.3: Modelled Traffic Data

Road009	A5 Walting Street (between A449 and Proposed Site Access)	54	22,320	7.8	24,000	11.2	22,224	11.4	22,224	12.7
Road010	A5 Walting Street (between A449 and A41)	82	19,920	4.8	20,088	5.1	20,784	6.2	21,072	6.7
Road011	A5 Walting Street (between A41 and A4640 Redhill Way)	80	11,616	8.7	11,688	9.2	11,808	10.0	11,880	10.5
Road012	A449 (between A5 and Gravelley Way)	72	22,296	3.8	22,440	7.4	22,488	8.2	22,536	9.7
Road013	A449 (between Gravelly Way and Station Drive)	89	20,712	3.0	22,296	8.1	26,520	8.1	28,464	9.3
Road014	Vicarrage Road (between Site Access and A5)	85	5,784	7.1	6,360	13.6	8,040	20.9	8,808	24.0
Road015	Straight Mile between Vicarage Road and Oak Lane	69	1,680	1.4	1,680	1.4	1,680	1.4	1,680	1.4

Table 7.2.3: Modelled Traffic Data

Road016	Station Road / Vicarage Road between Enterprise Drive and Proposed Site Access	71	5,688	7.2	6,192	9.3	5,688	7.2	5,688	7.2
Road017	Station Drive (between A449 and Enterprise Drive)	71	9,120	6.1	9,480	8.1	8,616	8.1	8,448	8.8
Road018	Four Ashes Road between A449 and Claygates Road	49	1,968	2.4	2,088	3.4	2,088	3.4	2,112	3.4
Road019	A449 (between Station Drive and Brewood Raod)	89	28,992	3.5	30,144	6.7	32,784	5.6	34,032	6.1
Road020	Old Stafford Road between A449 and New Road	58	2,328	2.1	2,328	2.1	2,328	2.1	2,328	2.1
Road021	Coven Road / Brewood Road / Poplars Farm Way between Lawn Lane and Tinkers lane	62	3,528	0.7	3,528	0.7	3,528	0.7	3,528	0.7

Table 7.2.3: Modelled Traffic Data

Road022	Poplars Farm Way (between A449 and and Lawn Lane	49	7,752	2.2	7,776	2.5	8,016	2.4	8,088	2.4
Road023	Lawn Lane between Brewood Road and Wobaston Road	71	4,512	1.1	4,512	1.1	4,512	1.1	4,512	1.1
Road024	A449 Stafford Road (between M54 J2 and Brewood Road)	78	27,696	3.7	28,776	7.0	31,080	5.8	32,184	6.3
Road025	A449 Stafford Road (between M54 J2 and Wobaston Road)	51	37,920	3.3	38,712	5.0	40,008	4.4	40,680	4.8
Road026	Wobaston Road (between Stafford Road and The Droveway)	55	25,920	1.7	25,968	1.8	25,920	1.7	25,920	1.7
Road027	A449 Stafford Road (between Wobaston Road and A460)	58	36,288	2.4	37,152	4.2	38,232	3.6	38,856	4.0

Table 7.2.3: Modelled Traffic Data

Road028	Church Road between A449 Stafford Road and Three Tuns Lane	37	960	0.0	960	0.0	960	0.0	960	0.0
Road029	Bargate Street, Brewood	37	2,736	0.9	2,736	0.9	2,736	0.9	2,736	0.9
Road030	Sandy Lane / The Pavement, Brewood	40	3,168	0.8	3,168	0.8	3,168	0.8	3,168	0.8
Road031	Coven Road, Brewood between The Pavement and Tinkers Lane	45	4,944	0.5	4,944	0.5	4,944	0.5	4,944	0.5
Road032	B5012 Wolgarston Way (between Cannock Road and A449)	55	7,632	5.0	7,824	4.9	8,232	5.0	8,424	4.8
Road033	A449 Wolverhampton Road (between Boscomoor Lane and Pinfold Lane)	55	13,296	9.0	13,776	8.9	14,784	8.6	15,264	8.5
Road034	A449 Wolverhampton Road (between Boscomoor Lane and A5)	55	22,656	3.6	22,848	4.1	23,808	4.9	24,192	5.4

Table 7.2.3: Modelled Traffic Data

Road035	Camp Road between Penkridge Bank Road and A34	66	4,032	0.6	4,032	0.6	4,032	0.6	4,032	0.6
Road036	Penkridge Bank Road between Broadhurst Green Road and Marquis Drive	72	5,472	1.8	5,472	1.8	5,472	1.8	5,472	1.8
Road037	A5 Watling Street (between A4601 and M6 toll)	64	26,256	14.7	26,448	15.0	26,784	15.4	26,952	15.6
Road038	A4601 Wolverhampton Road (between A5 and M6 toll)	52	19,680	12.2	19,704	12.2	19,776	12.3	19,800	12.2
Road039	A4601 Wolverhampton Road (between A5 and Longford Road)	47	16,992	6.9	17,064	7.0	17,208	7.3	17,280	7.4
Road040A	Bursnips Road	80	10,008	6.7	10,008	6.7	10,008	6.7	10,008	6.7
Road041	M6 between Junction 10 and 10a-SB	113	195,096	16.0	196,200	16.2	198,408	16.6	199,512	16.9
Road042	M6 between Junction 12 and 13	113	146,688	14.7	147,120	14.8	147,936	14.9	148,368	15.0
Road043	M6 between Junction 11a and 12	113	140,448	14.8	142,104	15.3	145,392	16.1	147,024	16.6
Road044	M6 between Junction 10a and 11	113	112,248	19.5	113,472	19.9	115,920	20.5	117,168	20.8
Road045	A5 between A34 and B4155	60	29,520	11.5	29,544	11.5	29,640	11.7	29,664	11.8
Road046	A454 Bridgnorth Road	108	14,040	1.4	14,064	1.5	14,136	1.7	14,136	1.7
Road047	A449 Penn Road	91	21,264	2.6	21,336	2.8	21,456	3.2	21,528	3.5
Road048	A459 Dudley Road	44	16,344	0.7	16,440	0.9	16,632	1.0	16,728	1.1
Road049	A459 Wolverhampton Road East	89	12,504	1.3	12,504	1.3	12,504	1.3	12,528	1.3
Road050	A4123 Thompson Ave	36	20,568	2.0	20,616	2.1	20,688	2.3	20,736	2.4
Road051	A41 Bilston Road (Between Bilston St Island (A4150) and A4126)	43	21,336	2.9	21,360	2.9	21,408	2.9	21,432	2.9
Road052	A41 Bilston Road (Between A4126 and District Boundary)	50	22,056	2.7	22,080	2.7	22,080	2.7	22,080	2.7
Road053	A454 Willenhall Road	37	27,960	7.6	27,984	7.6	28,032	7.6	28,056	7.6
Road054	Castle Farm Way	47	16,560	3.9	16,584	4.1	16,656	4.5	16,704	4.7

Table 7.2.3: Modelled Traffic Data

Road055	A5 Between Redhill Way and A442	50	-	-	48	100.0	168	100.0	240	90.0
Road056	Rampart Way	48	-	-	24	100.0	72	100.0	120	100.0
Road057	A513 between Brocton Road and A51	78	10,032	1.4	10,128	1.7	10,296	1.9	10,368	1.9
Road058	New route Between A5 and A449 - A5 End	20	-	-	3,192	36.8	9,240	28.6	12,336	28.6
Road059	New route Between A5 and A449 - A449 End	20	-	-	5,232	31.7	10,440	23.7	13,896	23.7
Road060	A460 N of M54 J2	113	23,544	9.8	23,832	10.5	23,640	9.8	23,640	9.8
Road061	A460 South of M6 J12	113	22,392	12.0	22,728	12.4	22,440	12.0	22,488	12.1
Road062	M54 between J1 and M6	113	80,472	11.5	80,568	11.5	80,808	11.6	80,952	11.7
Road063	M54 between J1 and M6	113	113,592	10.0	113,688	10.0	113,856	10.0	113,928	10.0
Road064	M54 between J1 and M7	113	73,728	10.2	73,704	10.2	73,704	10.2	73,704	10.2
Road062e	M54 between J1 and J3	113	36,456	12.4	36,576	12.5	36,816	12.8	36,936	12.9
Road062w	M54 between J2 and J4	113	43,992	10.6	43,992	10.6	43,992	10.6	43,992	10.6

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 NO_x 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 NO_2 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-NO_x (i.e. the component of total NO_x coming from road traffic) has been compared with the 'measured' road-NO_x (Figures 7.2.2, 7.2.54, 7.2.8 and 7.2.116). The 'measured' road NO_x has been calculated from the measured NO2 concentrations by using the DEFRA NO_x from NO_2 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-NO_x concentrations at the Cannock Chase monitoring sites. An adjustment factor has therefore been determined as the ratio between the measured road-NO_x contribution and the modelled road-NO_x contribution, forced through zero (1/0.3022 =3.31.9689). This factor has been applied to the modelled road-NO_x concentration for each location to provide an adjusted modelled road-NO_x concentration.

The annual mean road-NO_2 concentration has then been determined using the DEFRA NO_x:NO_2 spread sheet calculation tool and added to the background NO_2 concentration to produce a total adjusted NO_2 concentration. Figure 7.2.3 shows the adjusted modelled monitored total NO_2 vs adjusted modelled monitored NO_2. 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: *Updated Comparison of modelled Road NO_x with Measured Road NO_x in Cannock Chase*
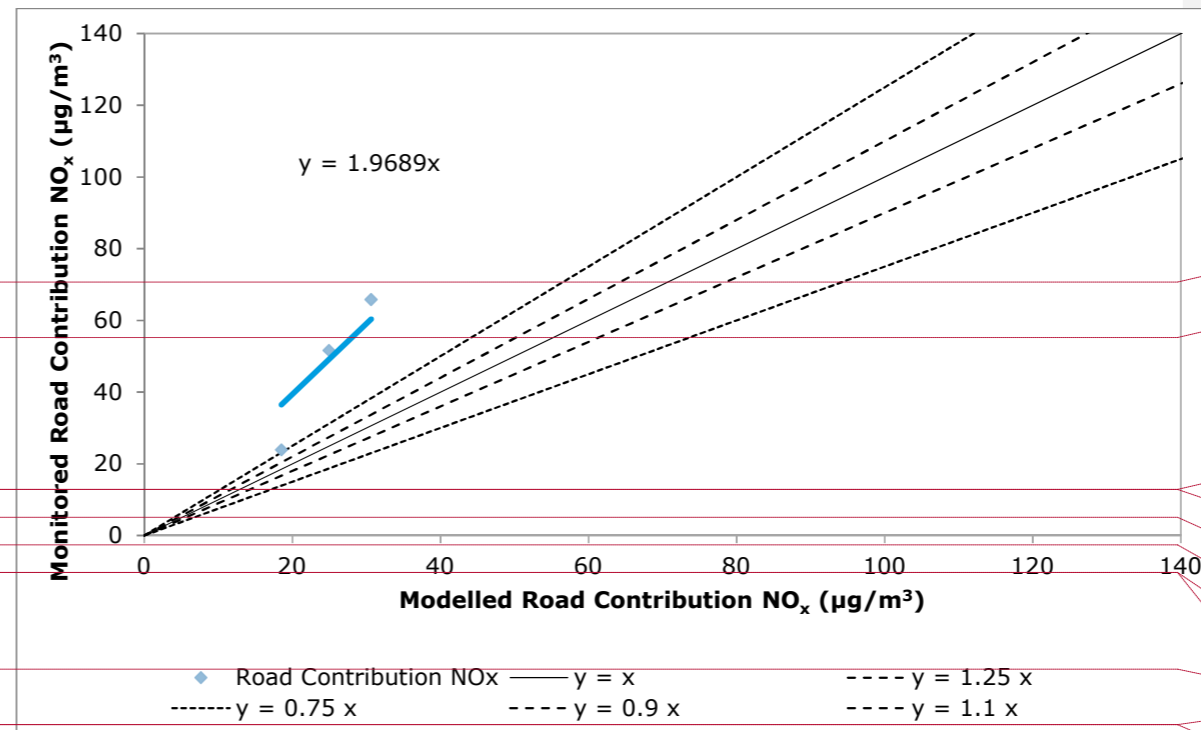
Figure 7.2.43: *Updated Comparison of final modelled NO_2 with Measured NO_2 in Cannock Chase*

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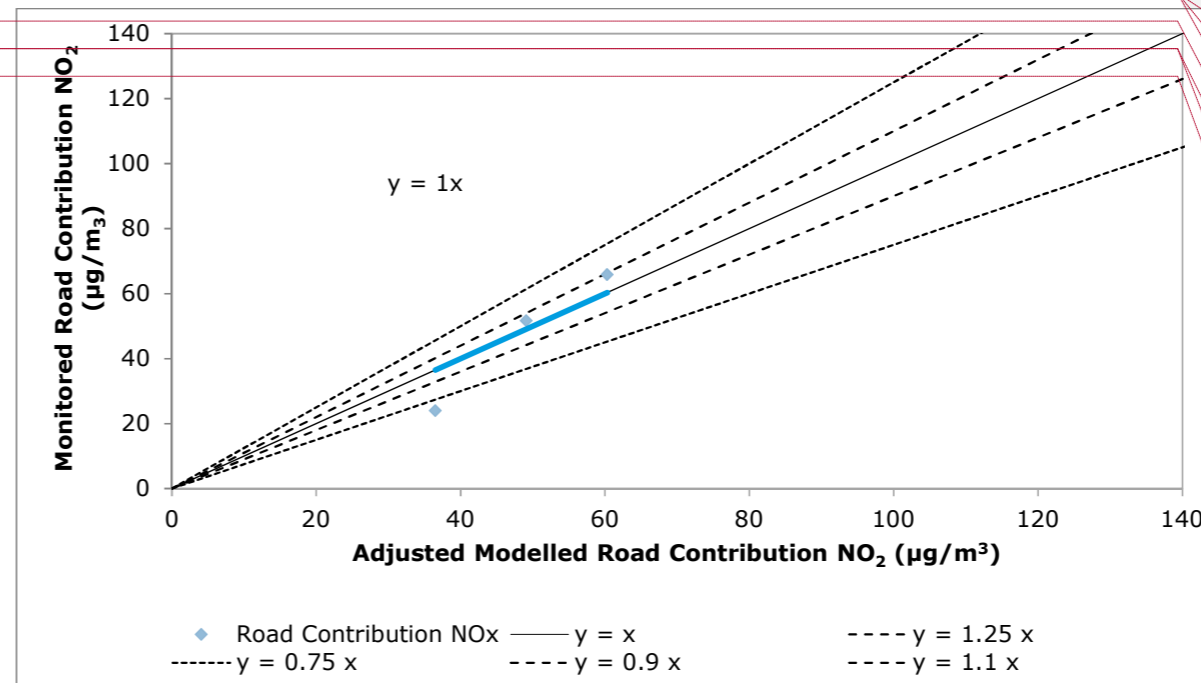
South Staffordshire

Figure 7.2.~~5~~4 shows that the ADMS model is under-predicted the road-NO$_x$ concentrations at the South Staffordshire monitoring sites. An adjustment factor of ~~2.18 (1/0.4584)~~1.3833 has been determined.

Figure 7.2.~~6~~5 shows the ~~adjusted modelled~~ monitored total NO$_2$ vs ~~adjusted modelled~~ monitored NO$_2$. ~~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~~4: *Updated* Comparison of modelled Road NO$_x$ with Measured Road NO$_x$ in South Staffordshire
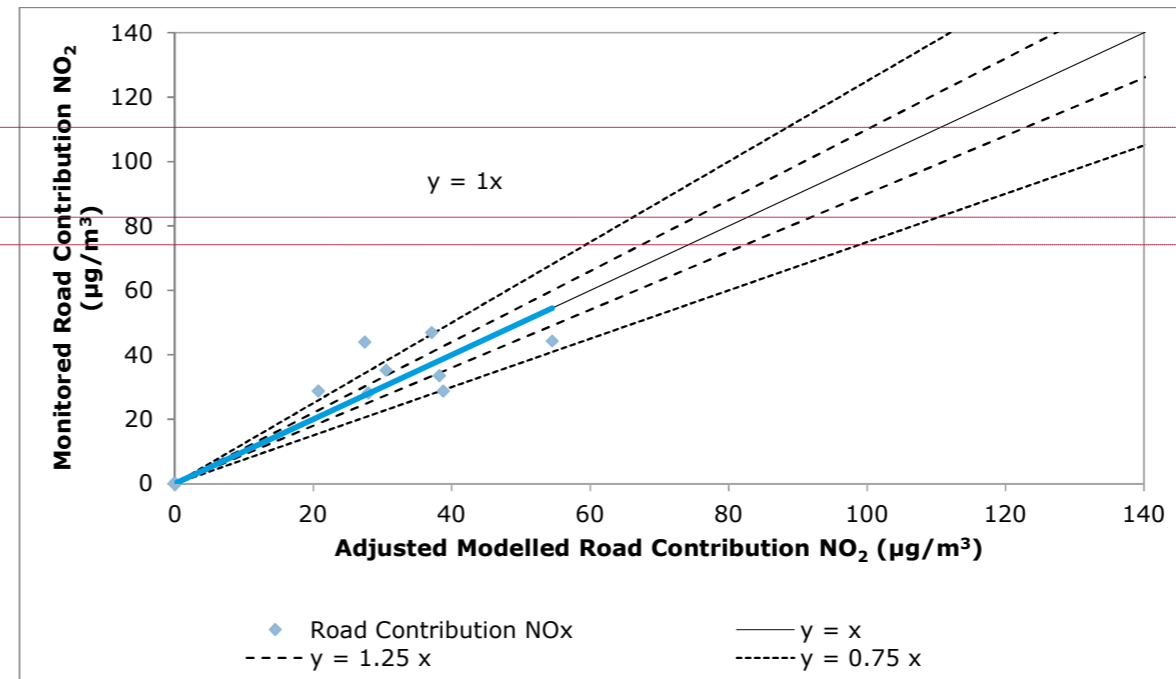
Wolverhampton

Figure 7.2.~~11~~6 shows that the ADMS model is under-predicted the road-NO$_x$ concentrations at the majority of the Wolverhampton monitoring sites. An adjustment factor of 1.~~93 (1/0.5182)~~0036 has been determined.

Figure 7.2.~~12~~7 shows the ~~adjusted~~ monitored ~~modelled~~ total NO$_2$ vs ~~adjusted modelled~~ monitored NO$_2$. ~~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.~~

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Figure 7.2.~~11~~6: Updated Comparison of modelled Road NO$_x$ with Measured Road NO$_x$ in Wolverhampton

Figure 7.2.~~12~~7: Updated Comparison of final modelled NO$_2$ with Measured NO$_2$ in Wolverhampton
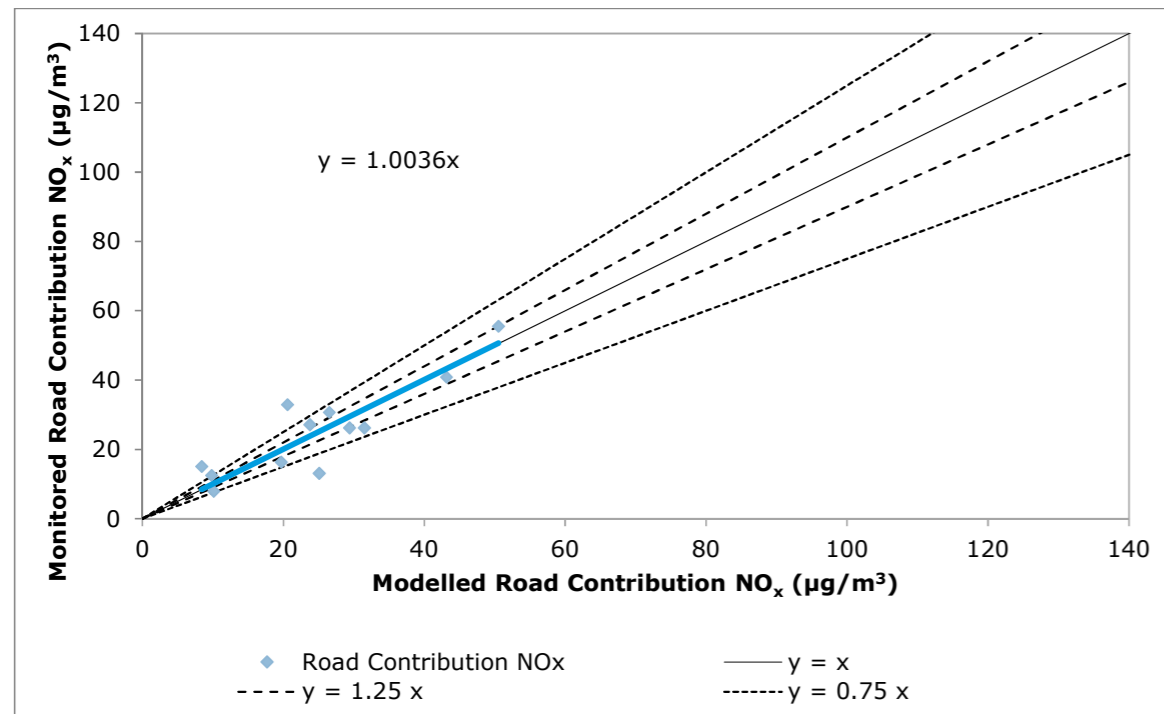
Staffordshire Stafford, Shropshire, Walsall and Telford and Wrekin

No appropriate monitoring sites were identified to allow verification of the model to be carried out for these areas. The model results for Stafford, Shropshire, Walsall shire 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 PM$_{10}$ or PM$_{2.5}$ data to allow verification of the particulate model results. However, LAQM.TG (16) suggests applying the NO$_x$ adjustment factors to modelled road-PM where no appropriate verification against particulate matterPM data can be carried out. The calculated primary and secondary adjustment factors have therefore been applied to the predicted PM$_{10}$ and PM$_{2.5}$ results for each local authority area.

Model Post-processing

Nitrogen oxides and nitrogen dioxide

The ADMS Roads model has predicted NO$_x$ 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 NO$_2$ concentrations, to calculate the NO$_2$ 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 NO$_2$ 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 NO$_2$ and this is calculated outside the model from predicted NO$_x$ concentrations.
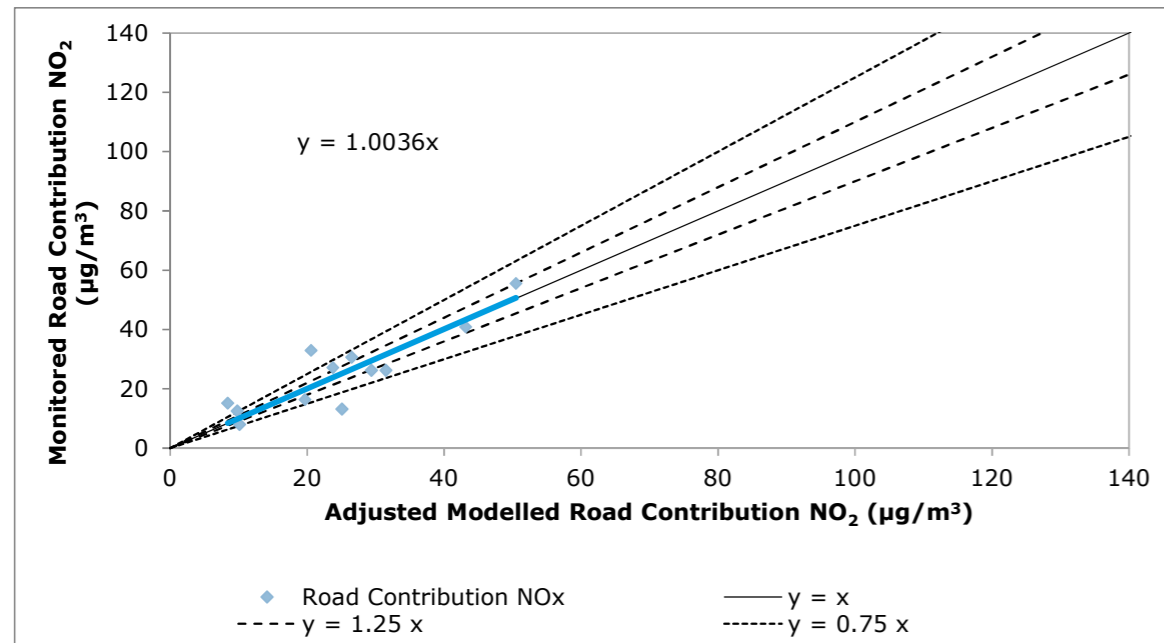
Guidance produced by the Environment Agency on assessing emissions to air in relation to the Habitats Directive (AQTAG06)[1] sets out empirical methods for calculating nitrogen deposition (N-deposition) rates based on calculated NOx concentrations and deposition velocity using the following formula:

Dry deposition flux (μg/m^2/yr) = ground level concentration (μg/m^3) 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[2].

Wet deposition has been discounted from the calculations given the low solubility of NO_2 which means any scavenging of this gas by rain droplets would be negligible.

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

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