

Appendix 7.1: Detailed Methodology, Modelling Approach and Data

Dust Risk Assessment Methodology

Table 1.1 – Determining Dust Emission Magnitude

Large	Medium	Small
Demolition		
- total building volume >50,000 m³ - potentially dusty construction material (e.g. concrete) - on-site crushing and screening - demolition activities >20 m above ground level	- total building volume 20,000m³ – 50,000 m³ - potentially dusty construction - demolition activities 10-20 m above ground level	- total building volume <20,000 m³ - construction material with low potential for dust release (e.g. metal cladding or timber) - demolition activities <10 m above ground - during wetter months
Earthworks		
- total site area >10,000 m² - potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size) >10 heavy earth moving vehicles active at any one time - formation of bunds >8 m in height - total material moved >100,000 tonnes	- total site area 2,500 m² - 10,000 m² - moderately dusty soil type (e.g. silt) 5-10 heavy earth moving vehicles active at any one time - formation of bunds 4 m – 8 m in height - total material moved 20,000 - 100,000 tonnes	- total site area <2,500 m² - soil type with large grain size (e.g. sand) <5 heavy earth moving vehicles active at any one time - formation of bunds <4 m in height - total material moved <20,000 tonnes - earthworks during wetter months
Construction		
- total building volume >100,000 m³ - piling - on-site concrete batching - sandblasting	- total building volume 25,000 m³ - 100,000 m³ - potentially dusty construction material (e.g. concrete) - piling - on-site concrete batching	- total building volume <25,000 m³ - construction material with low potential for dust release (e.g. metal cladding or timber)
Trackout		

Large	Medium	Small
• >50 HDV (>3.5t) movements in any one day • potentially dusty surface material (e.g. high clay content) • unpaved road length >100 m	• 10-50 HDV (>3.5t) movements in any one day • moderately dusty surface material (e.g. high clay content) • unpaved road length 50 m – 100 m	• <10 HDV (>3.5t) movements in any one day • surface material with low potential for dust release • unpaved road length <50 m

Table 1.2 – Determining Receptor Sensitivity

High	Medium	Low
Sensitivities of People to Dust Soiling Effects		
• users can reasonably expect enjoyment of a high level of amenity; or • the appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. • indicative examples include dwellings, museums and other culturally important collections, medium and long term car parks and car showrooms.	• users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or • the appearance, aesthetics or value of their property could be diminished by soiling; or • the people or property would not reasonably be expected to be present continuously or regularly for extended periods as part of the normal pattern of use of the land. • indicative examples include parks and places of work.	• the enjoyment of amenity would not reasonably be expected; or • property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or • there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. • indicative examples include playing fields, farmland(unless commercially-sensitive horticultural), footpaths, short term car parks and roads.
Sensitivities of People to the Health Effects of PM₁₀		
• locations where members of the public are exposed over a time period relevant to the air quality objective for PM₁₀ (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). • indicative examples include residential properties, hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.	• locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM₁₀ (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). • indicative examples include office and shop workers, but will generally not include workers occupationally exposed to PM₁₀, as protection is covered by Health and Safety at Work legislation.	• Locations where human exposure is transient. • indicative examples include public footpaths, playing fields, parks and shopping streets.
Sensitivities of Receptors to Ecological Effects		

High	Medium	Low
Sensitivities of People to Dust Soiling Effects		
- locations with an international or national designation <i>and</i> the designated features may be affected by dust soiling; or - locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List For Great Britain. - indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.	- locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or - locations with a national designation where the features may be affected by dust deposition. - indicative example is a Site of Special Scientific Interest (SSSI) with dust sensitive features.	- locations with a local designation where the features may be affected by dust deposition. - indicative example is a local Nature Reserve with dust sensitive features.

Table 1.3 – Determining Sensitivity of the Area - Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 1.4 – Determining Sensitivity of the Area – Human Health Impacts

	Annual Mean PM ₁₀ concentration	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m ³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	>28-32 µg/m ³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	>24-28 µg/m ³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m ³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium		>1	High	Medium	Low	Low	Low

	Annual Mean PM ₁₀ concentration	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
Low		>1	Medium	Low	Low	Low	Low

Table 1.5 – Determining Risk of Dust Impacts - Demolition

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table 1.6 – Determining Risk of Dust Impacts - Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 1.7 – Determining Risk of Dust Impacts – Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

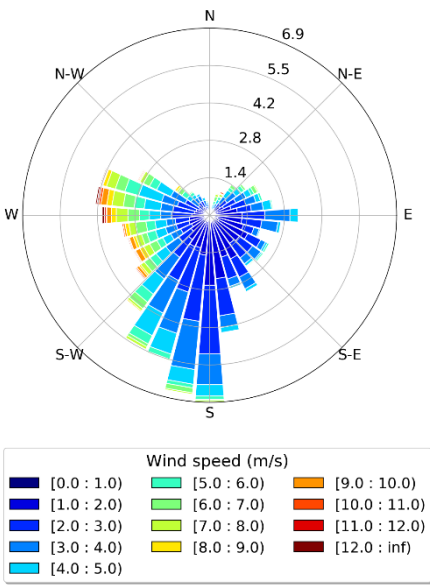
Table 1.8 – Determining Risk of Dust Impacts –Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Model Inputs and Results Processing Tools

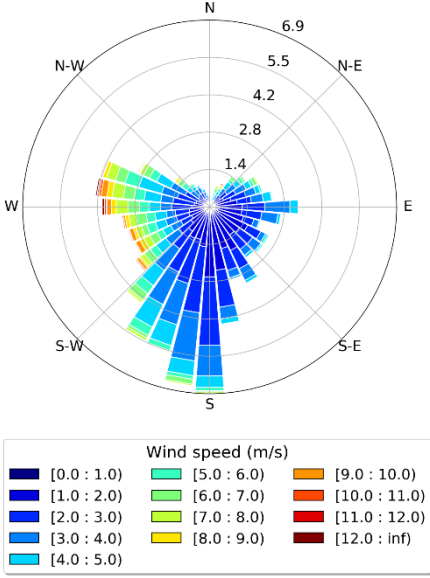
- 1.1. The model requires the user to provide various input data, including the Annual Average Daily Traffic (AADT) flow, the proportion of HGV, road characteristics (including road width and street canyon height, where applicable), and the vehicle speed. AADT flows and the proportions of HGVs, for roads within 250 m of the site, air quality monitoring sites, and the extension of the modelled area, are presented in Table 1.12. Traffic emissions were calculated using the Emission Factor Toolkit (EFT) v11 embedded in the ADMS model, which utilises nitrogen oxides (NO_x), PM₁₀ and PM_{2.5} emission factors from the European Environment Agency COPERT 5.3 emission tool¹. The traffic data were entered into the ADMS roads model, along with speed data to provide combined emission rates for each of the modelled road links.
- 1.2. The model was run using 2019 meteorological data from Manchester Airport meteorological station, which is considered to be the most representative meteorological monitoring station to the site.
- 1.3. The predicted concentrations of roadside NO_x were converted to roadside NO₂ using the LAQM conversion calculator available from the Defra air quality website².
- 1.4. Further information on the model set up is provided in Table 1.9.

Table 1.9 – Roads Emissions Model Inputs

Meteorological Data	2019 Hourly meteorological data from Manchester Airport meteorological station has been used in the model. The wind rose is shown below. 
ADMS	Roads Version 5.0.1.3
Latitude	53.4

¹ Department for Environment Food and Rural Affairs. Emissions Factors Toolkit. <https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.htm>.

² Department for Environment Food and Rural Affairs. NO_x to NO₂ calculator. <https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc>

Meteorological Data	2019 Hourly meteorological data from Manchester Airport meteorological station has been used in the model. The wind rose is shown below. 
Surface Roughness	A value of 0.5 for Parkland, open suburbia was used to represent the modelled area and a value of 0.2 for Agricultural areas (min) to represent the meteorological station site.
Minimum Monin-Obukhov length	A value of 30 for Mixed urban/industrial was used to represent the modelled area and the meteorological station site.
Emission Factor Toolkit (EFT)	V11. Road type England Urban
Diurnal Factor	A 2019 diurnal factor was applied as the 2019 DfT national transport statistics are not currently available ³ .
Street Canyon	No canyons were included in the model.
NO_x to NO₂ Conversion	NO _x to NO ₂ calculator version 8.1. Traffic Mix All UK traffic.
Background Maps	2018 reference year background maps ⁴

Terrain

- 1.5. The terrain in the vicinity of the Proposed Development is flat with no slopes more than 10%, and therefore terrain effects have not been included within the modelling

Background Concentrations

- 1.6. It is necessary to add an estimate of background pollutant concentrations to modelled concentrations to obtain the total concentration for comparison against the air quality objectives.
- 1.7. Background concentrations for the site have been defined using the national pollution maps published by Defra. These cover the whole country on a 1x1 km grid.

³ Annual daily traffic flow and distribution (TRA03). <https://www.gov.uk/government/statistical-data-sets/road-traffic-statistics-tra>.

⁴ <https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018>

- 1.8. To reflect background concentrations more accurately across the study area, Defra mapped background concentrations have been compared against concentrations measured at the Trafford Metropolitan Borough Council (TMBC) Trafford (TRAF) urban background automatic monitoring site in 2019 to produce a calibration factor, which has been applied to background concentrations across the study area for NO₂ and PM₁₀ (Table 1.10 and Table 1.11). The PM₁₀ adjustment factor has been used for the PM_{2.5} background adjustment as no PM_{2.5} monitoring is undertaken at the TRAF site.

Table 1.10 – DEFRA NO₂ Background Mapping Adjustment factors (µg/m³)

Station	Local Authority	Distance from Site (km)	Data Capture	2019 Measured Concentrations	2019 Defra Background	Factor
Trafford	TMBC	5	99.0	19	17.4	1.09

Table 1.11 – DEFRA PM₁₀ Background Mapping Adjustment factors (µg/m³)

Station	Local Authority	Distance from Site (km)	Data Capture	2019 Measured Concentrations	2019 Defra Background	Factor
Trafford	TMBC	5	99.0	15	12.2	1.23

Traffic Data and Modelled Road Network

Traffic Data

- 1.9. The traffic data provided by the Applicant's Traffic consultant, Curtins, is summarised in Table 1.12.

Table 1.12 – Traffic Data Used Within the Assessment (Annual Average Daily Traffic)

Road Link	2019 Baseline & 2024 Future Baseline		Scenario 3: Future Baseline 2024 + Proposed D1 Development		Scenario 4: Future Baseline 2024 + Proposed D1 Development + temporary parking on the D2 Development site		Scenario 4 Development Net Traffic	
	LDV	HGV	LDV	HGV	LDV	HGV	LDV	HGV
Barlow Moor Road (E)	21,004	373	21,237	373	21,246	373	241	0
Site Access	2,506	29	5,089	29	5,188	29	2,682	0
Barlow Moor Road (W)	22,333	388	24,683	388	24,774	388	2,441	0
Nell Lane (E)	7,748	43	7,748	43	7,748	43	0	0
A5103 Princess Road (S)	63,882	1,494	64,425	1,494	64,445	1,494	563	0
Nell Lane (W)	10,872	79	11,104	79	11,113	79	241	0
A5103 Princess Road (N)	57,096	1,443	57,406	1,443	57,418	1,443	322	0
A5145 Barlow Moor Road (E) - Westbound	13,026	115	14,141	115	14,184	115	1,158	0

Road Link	2019 Baseline & 2024 Future Baseline		Scenario 3: Future Baseline 2024 + Proposed D1 Development		Scenario 4: Future Baseline 2024 + Proposed D1 Development + temporary parking on the D2 Development site		Scenario 4 Development Net Traffic	
	LDV	HGV	LDV	HGV	LDV	HGV	LDV	HGV
A5145 Barlow Moor Road (E) - Eastbound	10,118	237	11,379	237	11,428	237	1,310	0
Princess Road (S) - Northbound	40,573	790	41,423	790	41,455	790	883	0
Princess Road (S) - Southbound	45,858	905	46,609	905	46,638	905	780	0
A5145 Barlow Moor Road (W) - Eastbound	13,744	172	13,868	172	13,873	172	128	0
A5145 Barlow Moor Road (W) - Westbound	12,775	151	12,884	151	12,888	151	113	0
Princess Road (N) - Southbound	32,652	890	32,940	890	32,951	890	299	0
Princess Road (N) - Northbound	31,245	675	31,499	675	31,509	675	264	0

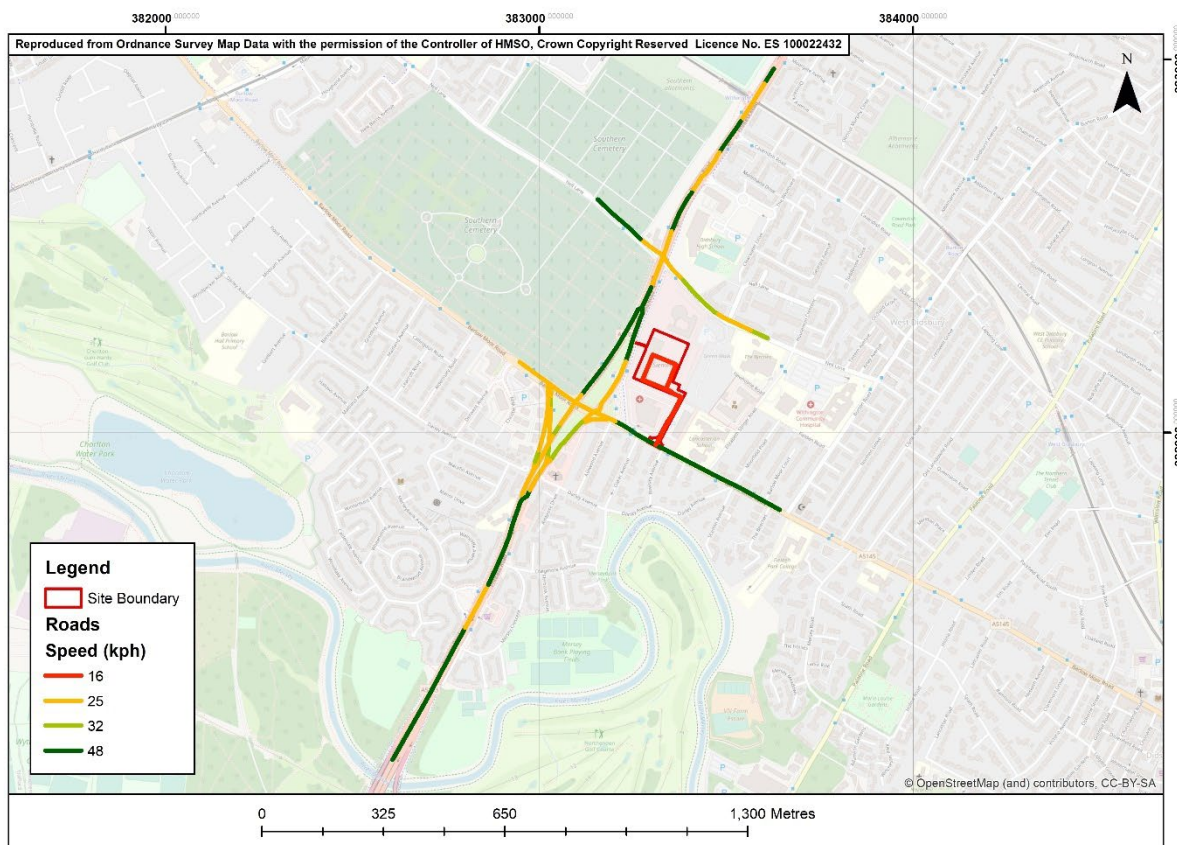


Figure 1.1: Modelled Road Network and Road Link Speed

Model Verification

Nitrogen Dioxide

1.10. The model has been run to predict the 2019 annual mean road-NO_x contribution at four monitoring locations (identified in Table 1.13).

Table 1.13 – Traffic Data Used Within the Assessment (Annual Average Daily Traffic)

Monitor	Measured NO ₂ µg/m ³	Unadjusted Modelled NO ₂	% Unadjusted Difference Modelled/Measured NO ₂	Measured Road NO _x µg/m ³	Modelled Roadside NO _x µg/m ³	Ratio Measured NO _x /Modelled Road NO _x	Total NO ₂ after adjustment µg/m ³	% Difference in NO ₂ after adjustment
DT37	38.7	32.2	-17%	40.9	26.8	1.5	37.4	-3%
MAN 1-2	35.8	34.4	-4%	34.5	31.3	1.1	40.3	12%
MAN 1-3	50.1	40.7	-19%	68.0	45.3	1.5	48.6	-3%
MAN 1-5	41.1	33.8	-18%	46.4	30.2	1.5	39.6	-4%

1.11. The model output of road-NO_x has been compared with the 'measured' road-NO_x, which was calculated from the measured NO₂ concentrations and the background NO₂ concentrations within the NO_x from NO₂ calculator.

- 1.12. The ADMS Roads modelling software estimates concentrations arising from emissions on the local roads. It is necessary to add an estimate of the background concentrations to obtain the total concentration for comparison against the air quality objectives.
- 1.13. To provide an estimate of NO₂ concentrations in the vicinity of the site, local authority monitoring data in background locations was examined.
- 1.14. A primary adjustment factor was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution (Table 1.14, Figure 1.2). This factor was then applied to the modelled road-NO_x concentration for each monitoring site to provide adjusted modelled road-NO_x concentrations. The total nitrogen dioxide concentrations were then determined by combining the adjusted modelled road-NO_x concentrations with the predicted background NO₂ concentration within the NO_x from NO₂ calculator. A secondary adjustment factor was finally calculated as the slope of the best fit line applied to the adjusted data and forced through (Table 1.14, Figure 1.3).
- 1.15. The following primary and secondary adjustment factors have been applied to all modelled nitrogen dioxide data:

Table 1.14 – Verification factors

Primary Adjustment Factor	1.4262
Secondary adjustment factor	0.9974

- 1.16. The results imply that overall, the model was under-predicting the road-NO_x contribution. This is a common experience with this and most other models. The final NO₂ adjustment is minor.
- 1.17. Figure 1.4 compares final adjusted modelled total NO₂ at each of the monitoring sites, to measured total NO₂, and shows the 1:1 relationship, as well as ±10% and ±25% of the 1:1 line.
- 1.18. Table 1.15 presents the Model uncertainty, which has been estimated by calculating the root mean square error (RMSE). The calculated RMSE is within the suggested value (10% of the objective being assessed) in LAQM.TG(16). The model has therefore performed sufficiently well for use within this assessment.

Table 1.15 – Model Uncertainty

RMSE	2.55 µg/m ³
% NAQO	6%

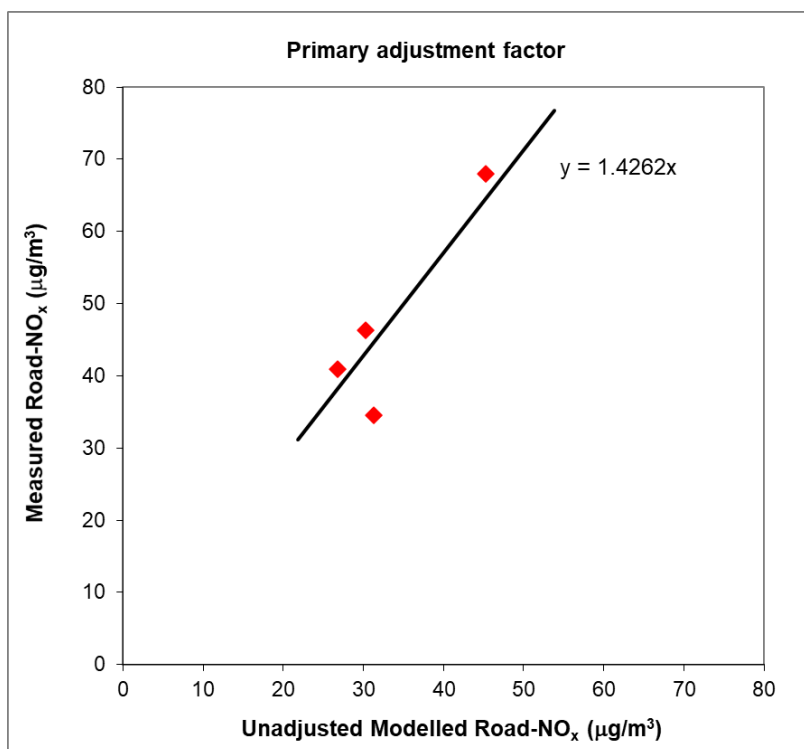


Figure 1.2 – Comparison of Measured NO₂ with Unadjusted Adjusted Modelled NO₂

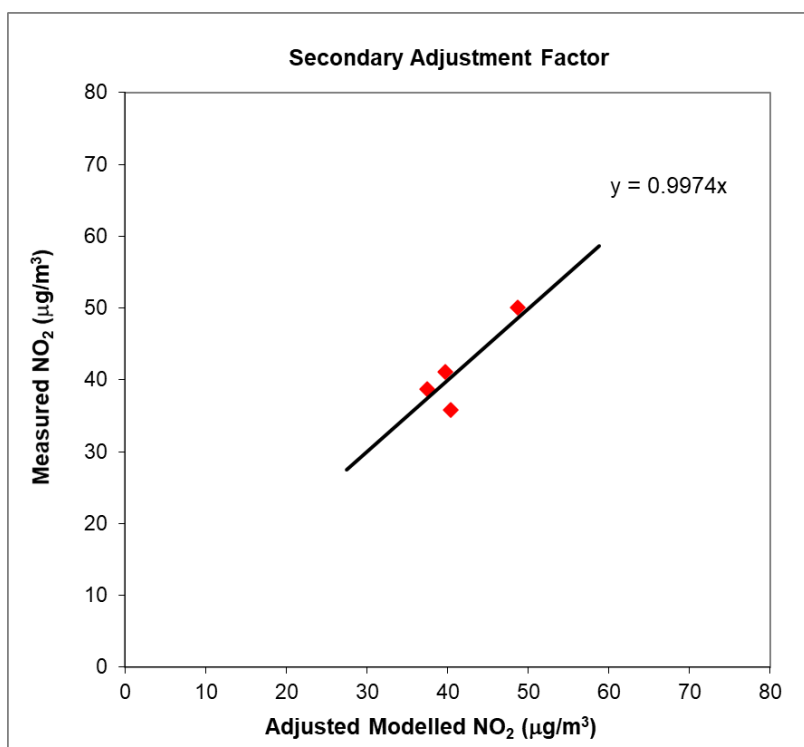


Figure 1.3 – Comparison of Measured NO₂ with Primary Adjusted Modelled NO₂ Concentrations

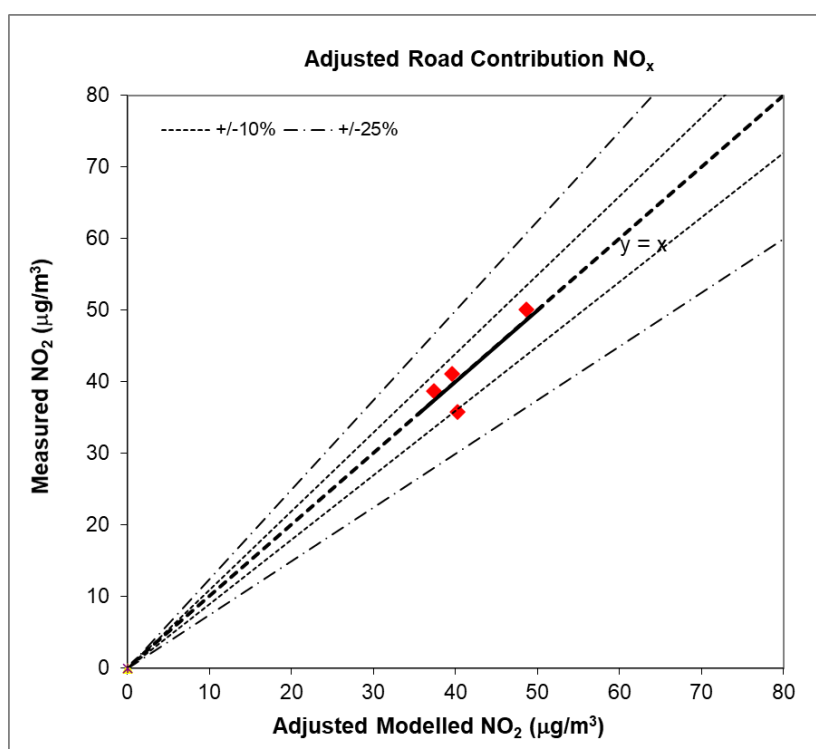


Figure 1.4 – Comparison of Measured NO₂ with Fully Adjusted Modelled NO₂ Concentrations

Particulates (PM₁₀ and PM_{2.5})

- 1.19. No suitable particulate monitoring is available in proximity to the site and the affected road network. Consequently, following LATG16 guidance, the NO₂ adjustment factors have been applied to the predicted particulate concentrations.

Modelled Results

- 1.20. Pollution concentrations for Scenario 3 are presented in Table 1.16.

Scenario 3: Future Baseline 2024 + Proposed D1 Development				
Receptor	Type	NO ₂ Result (µg/m³)	PM ₁₀ Result (µg/m³)	PM _{2.5} Result (µg/m³)
R1	Residential	19.6	15.0	9.9
R2	Residential	21.1	15.3	10.0
R3	School	19.1	14.9	9.8
R4	School	23.9	15.9	10.4
R5	Residential	20.5	15.0	9.9
R6	Residential	21.4	15.2	10.0
R7	Hospital	22.0	15.6	10.2
R8	Hospital	21.8	15.5	10.2
R9	Residential	22.5	15.7	10.3
R10	Residential	25.7	16.4	10.7
R11	Residential	26.3	16.5	10.7

Scenario 3: Future Baseline 2024 + Proposed D1 Development				
Receptor	Type	NO ₂ Result (µg/m ³)	PM ₁₀ Result (µg/m ³)	PM _{2.5} Result (µg/m ³)
R12	School	30.8	17.4	11.3
R13	Residential	29.0	16.8	11.0
R14	School	35.0	19.3	12.3
R15	Residential	31.9	18.3	11.8
R16	Residential	28.1	17.2	11.2
R17	Residential	28.5	17.1	11.1
R18	Residential	34.9	18.7	12.0
R19	Residential	28.6	16.9	11.0
R20	Residential	28.0	16.8	10.9
R21	Residential	35.6	18.9	12.1
R22	Residential	32.8	18.6	11.9
R23	Residential	25.7	16.6	10.8
R24	School	24.1	16.0	10.5
R25	School	22.7	15.8	10.3
R26	Residential	22.8	15.7	10.3
R27	Residential	25.7	16.5	10.7
Objective		40		