Government Property Agency

AtkinsRéalis



MANCHESTER DIGITAL CAMPUS

Environmental Statement
Volume 4 - Appendix 7.1:
Air Quality Assessment

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Appendix 7.1. Air Quality Assessment

Air quality assessment methodology

Construction dust assessment

The IAQM Construction Dust Guidance presents a framework for undertaking risk assessment of construction dust emissions. It considers activities with dust raising potential to during demolition, earthworks, construction and trackout[1] activities. This method is deliberately conservative and further assessment is necessary for most developments. There are four key steps in the assessment process, as follows:

- **Step 1** (screening) - identification of the number of receptors within 250 metres of the boundary of the Site and / or within 50 metres of the route(s) used by construction vehicles on the public highway up to 250 metres from the Site entrance. Ecological receptors should also be identified within 50 metres of the Site and / or of the route(s) used by construction vehicles on the public highway up to 250 metres from the Site entrance. No further assessment is required if there are no receptors.
- **Step 2** - Assessment of the risk of dust effects by considering the area around the site in the context of potential dust impacts and distances to nearby receptors in relation to proposed demolition, earthworks, construction and trackout activities.
- **Step 2A** - Dust emission magnitude classes of 'large', 'medium' and 'small' are used to define the magnitude of dust emissions likely to arise from each activity, depending on the nature and scale of the construction (see Table 1.1)
- **Step 2B** - The sensitivity of the surrounding area is defined as 'high', 'medium' and 'low' for dust soiling effects, human health impacts, and ecological impacts separately, taking into account the sensitivity of nearby receptors (see Table 1.2), and the number and distance of sensitive receptors from dust generating activities, and other site-specific factors (defined in the IAQM's Construction Dust Guidance). In addition, for the effect on human health, background PM_{10} concentrations are taken into account. The definitions are provided in Tables 2, 3 and 4 of the IAQM Construction Dust Guidance.
- **Step 2C** - The potential dust emission magnitude (Step 2A) for each activity, and the sensitivity of the area (Step 2B) are combined to give the risk of dust impacts (see Table 1.3 to Table 1.5). Where there are low, medium or high risks of an impact, then site-specific mitigation will be required, proportionate to the level of risk.
- **Step 3** – Determination of the site-specific mitigation in terms of the identified risks including the reduction of emissions for non-road mobile machinery (NRMM) where applicable.
- **Step 4** – Assessment of the significance of the dust effects, after the application for the site-specific mitigation. Once mitigation has been applied, there should not be any significant adverse effects.

Table 1.1 - Examples of dust emission magnitude definitions

Magnitude	Demolition	Earthworks	Construction	Trackout
Large	Total building volume >75,000m^3	Total site area >110,000m^2	Total building volume >75,000m^3	>50 HDV outward movements per day

[1] The transport of dust and dirt from the construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. This arises when HDVs leave the construction/demolition site with dust materials, which may spill onto the road, and/or when HDVs transfer dust and dirt onto the road having travelled over muddy ground on site.

Magnitude	Demolition	Earthworks	Construction	Trackout
Medium	Total building volume between 12,000m^3 and 75,000m^3	Total site area between 18,000m^2 and 110,000m^2	Total building volume between 12,000m^3 and 75,000m^3	20 – 50 HDV outward movements per day
Small	Total building volume <12,000m^3	Total site area <18,000m^2	Total building volume <12,000m^3	<20 HDV outward movements per day

Table 1.2 - Examples of receptor sensitivity categories to effects during construction

Sensitivity	Dust Soiling Effects	Health Effects to PM_{10}	Ecological Effects
High	Dwellings, Museums, Medium and long-term car parks, Car showrooms	Residential properties, Hospitals, Schools, Residential care homes.	International or national designated site where the designated features may be affected by dust soiling.
Medium	Parks, Places of work.	Offices, Shops.	Location with an important plant species with unknown sensitivity to dust. National designated site with dust sensitive features.
Low	Playing fields, Farmland, Footpaths, Short term car parks, Roads.	Public Footpaths Playing fields, Parks, Shopping Streets.	A locally designated site with dust sensitive features.

Table 1.3 - Risk of dust impacts - demolition

Sensitivity of Area	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table 1.4 - Risk of dust impacts - earthworks and construction

Sensitivity of Area	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 1.5 - Risk of dust impacts - trackout

Sensitivity of Area	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Air dispersion modelling

Road traffic contributions to pollutant concentrations have been estimated using the dispersion model, ADMS Roads (v5.0.1.3) at selected existing sensitive and proposed future receptors to determine the impact of the Proposed Development on local air quality.

Traffic conditions

Traffic conditions vary throughout the course of a day and between weekdays and weekends, hence a 24-hour diurnal profile for both weekdays and weekends has been applied in the model to improve the estimation of vehicle emissions in each modelled hour. The ADMS-Roads model was set up with a daily average emission rate for each road link and a time varying emissions file based on an hourly traffic profile derived from the national road traffic distribution by time of the day and day of the week[2]. Further details of the traffic data and diurnal emission profile used are provided below.

Emission factors

Vehicle exhaust emissions of NO_X, PM_{10} and $PM_{2.5}$ for each road link, in each scenario, have been calculated using DEFRA's Emissions Factors Toolkit (EFT, version 12.1)[3] using traffic data provided by AtkinsRéalis Transportation. The emission calculations assumed a road type of "Urban (not London)" for all modelled roads.

Road canyons

The ADMS-Roads advanced street canyon module was used to provide an improved representation of the real-world conditions in the study area. Street canyons were applied to sections of A665 Great Ancoats Street between Oldham Street and Blossom Street and Angel Street between Rochdale Road and Naples Street.

Background concentrations

The output from the ADMS-Roads model provides the contribution from road traffic emissions to annual mean concentrations at discrete receptor points. These concentrations are combined with estimates of background concentrations, to account for other sources of air pollution, and derive total annual mean concentrations for comparison with air quality criteria. Total background concentrations were used in the assessment and were derived from DEFRA's background maps (2018 reference year)[4] for the year 2030. Sector removal was not undertaken as the extent of the traffic data did not cover all road links within 200 m of the receptors.

Background comparison

A comparison of DEFRA mapped background concentrations and LAQM monitoring reported at background sites was undertaken, to determine if the difference between the monitored and DEFRA mapped background concentrations is within 30% (which is considered the acceptable difference within the methodology used by DEFRA to derive the mapped background concentrations) as shown in Table 1.6. This indicates that the difference between the monitored and DEFRA mapped background concentrations are within 30% at the majority of the sites. Those sites where mapped concentrations underpredict monitored concentrations by more than 30% (MA77NO, MA78NO and MA79NO) are considered to be directly impacted by road or rail sources. The DEFRA mapped background have therefore been used unadjusted for results processing.

[2] DfT traffic counts: https://www.gov.uk/government/collections/road-traffic-statistics

[3] Emissions Factors Toolkit: https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/

[4] The latest available version at the time the modelling was undertaken in September / October 2024: 2018 Reference Year Background Maps - Defra, UK. https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

Table 1.6 - Comparison of annual mean NO_2 DEFRA mapped background and local monitoring background concentrations, 2022 (µg/m^3)

Monitoring site ID	X(m)	Y(m)	NO_2 DEFRA background concentration	NO_2 monitored concentration	(DEFRA background - monitored)/DEFRA background concentration %
MA8ANO	381398	387501	23.9	19.5	-22.3
MA26ANO	383973	398874	27.5	25.2	-9.0
MA59NO, MA60NO, MA61NO	384310	398337	25.3	26.3	3.6
MA72NO	384761	397384	26.3	24.7	-6.3
MA77NO	383576	397489	33.1	22.8	-45.1
MA78NO	386289	396828	27.2	16.8	-62.4
MA79NO	386875	395861	25.4	17.1	-48.5
MA81NO	386589	394083	18.8	15.9	-18.3
MA90BNO, MA91BNO, MA92BNO	384202	386121	15.2	14.0	-8.3
MA77NO is located at the roadside and within 10 m of the rail line. MA78NO is located at the roadside and 21 m from the rail line. MA79NO is within 2 m of the rail line.					

NOx to NO_2 conversion

To derive total NO_2 concentrations from modelled road NO_x concentrations, and allow comparison with the air quality criteria, the method described in DEFRA's LAQM.TG(22) has been applied. Total annual mean NO_2 concentrations were calculated from modelled road NO_x and background NO_2 concentrations, using the latest version of the 'NO_x to NO_2 conversion spreadsheet' (version 8.1, August 2020) available from the DEFRA website[5].

In addition to the modelled road NO_x and background NO_2 data, DEFRA's NO_x to NO_2 conversion spreadsheet requires a local authority area to be specified to determine regional oxidant concentrations, and a traffic mix to determine the proportion of primary NO_2. The local authority area selected in the conversion tool was "Manchester District" based on the location of the relevant receptors; the traffic mix selected was "All other urban UK traffic" for all modelled roads.

Meteorological data

Hourly sequential meteorological data have been taken from the nearest suitable meteorological station, in this case Manchester Airport for the year 2022. The weather station is located approximately 14 km south of the Proposed Development and is considered to represent conditions in the study area given the absence of major topographical features between the two locations. The basic data include date, hour, direction that the wind is blowing from, wind

[5] The latest available version at the time the modelling was undertaken in September / October 2024: NOx to NO_2 calculator: https://laqm.defra.gov.uk/air-quality/air-quality-assessment/nox-to-no2-calculator/

speed, how many eighths (‘oktas’) of the sky are covered by cloud, and surface air temperature. A wind rise for the year 2022 is presented in Figure 1, which indicates that the prevailing wind is from the south and west.

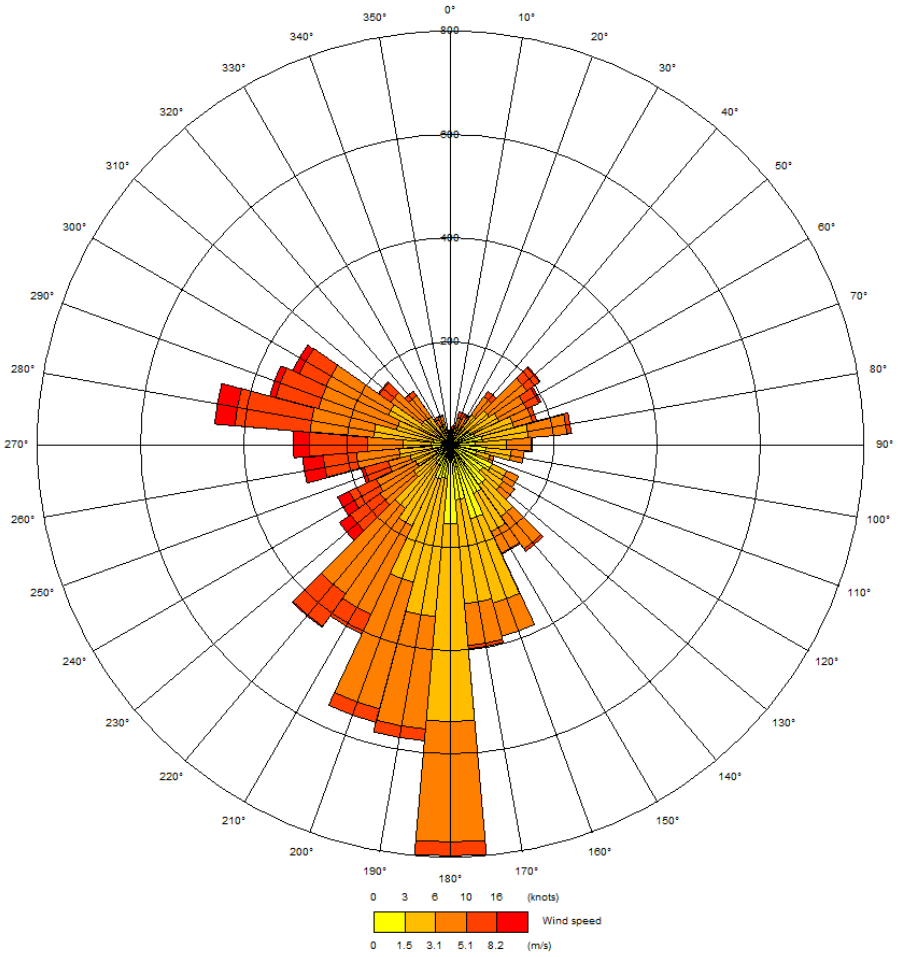


Figure 1 - Windrose Manchester Airport 2022

Receptors

Changes in air quality as a result of the Proposed Development were modelled at 24 locations representative of human health receptors (e.g. existing residential properties and future residential developments). The selected receptors are listed in Table 1.9.

Human health receptors were positioned at the façades of buildings in order to provide an estimate of the highest pollutant concentrations likely to affect each property. The height of each residential receptor was set at 1.5 m above ground level for ground floor properties and 4.5m above the first-floor level to represent breathing height at ground floor and first floor.

Model inputs and assumptions

The air dispersion modelling is based on the following key inputs, assumptions and uncertainty:

- OpenStreetMap mapping has been used to define the modelled road geometry and receptor locations.
- Road widths have been manually determined from aerial photography using Google Earth Pro data.
- Surface roughness has been defined as 1.5 metre for the study area and 0.3 metre for the meteorological site. The surface roughness value of 1.5 for the study is representative of large urban area and the surface

roughness of and 0.3 (agricultural max) for the meteorological site which is representative of the grassland areas surrounding the meteorological site.

- Model default values have been used for surface albedo and Priestly-Taylor parameter[6]. The Monin-Obukhov length for the dispersion site and the meteorological site were both set at 30 metres to represent cities and large towns[7]. The meteorological site is at the edge of an urban area and as such a value of 30 metres is considered appropriate.
- A generic diurnal profile was used, based on 2022 traffic statistics (Great Britain) for traffic distribution on all roads by time of day and day of the week, for selected vehicle types.
- Uncertainty associated with input data (traffic data, emissions data).
- Simplifications in model algorithms and empirical relationships that are used to simulate complex physical and chemical processes in the atmosphere.
- Uncertainty associated with vehicle emissions data has been minimised by using the current version of the ADMS-Roads modelling software (version 5.0.1.3) and DEFRA vehicle emissions factors spreadsheet (EFT v12.1).
- Uncertainty associated with model algorithms and empirical relationships have been minimised by using algorithms and relationships within a dispersion model (ADMS-Roads) that has been independently validated and judged as fit for purpose.
- A full year of hourly sequential meteorological data has been used to estimate future concentrations; this was provided by an approved supplier and has been subject to robust quality checks. The key limiting assumption is that conditions in the future will be the same as in the past; however, in reality, no two years will be the same.
- The modelling used relevant supporting tools and datasets from DEFRA, as were current at the time modelling was undertaken in September / October 2024. The assessment has not been updated for more recent updates to these resources published in November 2024. Considering the findings of the assessment, use of updated resources would be unlikely to make a material difference to assessment findings.

Traffic data and diurnal profile

Table 1.7 - 2030 road traffic data

Road Name	Without the Proposed Development total AADT	With the Proposed Development total AADT	HGV%	Speed (kph)	Change (AADT)
A62 Oldham Road NB (north of Adlington Street)	7887	7963	5.1	48.3	76
A62 Oldham Road NB (south of Adlington Street)	4372	4399	5.1	48.3	27
A62 Oldham Road SB (north of Adlington Street)	9478	9602	5.1	48.3	124
A62 Oldham Road SB (south of Adlington Street)	17896	18116	5.1	48.3	221
A664 Angel Street EB only	12438	12567	5.1	48.3	129

[6] Model default surface albedo = 0.23 (not snow covered); model default Priestly-Taylor parameter = 1 (moist grassland).

[7] Model default minimum Monin-Obukhov length is calculated by the model based on surface roughness; the Monin-Obukhov length is a parameter that limits occasions of very stable conditions with minimal thermal turbulence.

Road Name	Without the Proposed Development total AADT	With the Proposed Development total AADT	HGV%	Speed (kph)	Change (AADT)
A664 Corporation Street (north of Ring Road junction, NB only)	12215	12354	5.1	48.3	140
A664 Rochdale Road NB (north of Angel Street)	4562	4596	5.1	48.3	34
A664 Rochdale Road NB (south of Angel Street)	5359	5391	5.1	48.3	33
A664 Rochdale Road SB (north of Angel Street)	6892	6943	5.1	48.3	50
A664 Rochdale Road SB (south of Angel Street)	6200	6198	5.1	48.3	-2
A665 Adlington Street EB only	13253	13416	5.1	48.3	164
A665 Adlington Street EB only (at junction)	13253	13416	5.1	32.2	164
A665 Cheetham Hill Road (between Trinity Way and Corporation Road) (at junction)	27812	27972	5.1	32.2	160
A665 Cheetham Hill Road (between Trinity Way and Corporation Road)	27812	27972	5.1	48.3	160
A665 Cheetham Hill Road (north of Trinity Way) SP	12287	12300	5.1	32.2	12
A665 Cheetham Hill Road (north of Trinity Way)	12287	12300	5.1	48.3	12
A665 Great Ancoats Street eastbound (EB) (between Newton Street and Laystall Street)	11319	11578	5.1	48.3	259
A665 Great Ancoats Street EB (between Ducie Street and Store Street)	12386	12716	5.1	48.3	330
A665 Great Ancoats Street EB (between Laystall Street and Ducie Street)	17471	17829	5.1	48.3	359
A665 Great Ancoats Street EB (between Oldham Street and Lever Street)	11776	11997	5.1	48.3	221
A665 Great Ancoats Street EB (between Lever Street and Newton Street)	12443	12655	5.1	48.3	212

Road Name	Without the Proposed Development total AADT	With the Proposed Development total AADT	HGV%	Speed (kph)	Change (AADT)
A665 Great Ancoats Street EB (between Pollard Street and Adair Street)	14642	15001	5.1	48.3	360
A665 Great Ancoats Street EB (between Store Street and Pollard Street)	8209	8582	5.1	48.3	373
A665 Great Ancoats Street EB (east of Adair Street)	11906	12316	5.1	48.3	410
A665 Great Ancoats Street WB (between Ducie Street and Store Street)	11737	11906	5.1	48.3	170
A665 Great Ancoats Street WB (between Laystall Street and Ducie Street)	12033	12119	5.1	48.3	86
A665 Great Ancoats Street WB (between Lever Street and Newton Street)	12475	12590	5.1	48.3	114
A665 Great Ancoats Street WB (between Newton Street and Laystall Street)	13369	13500	5.1	48.3	132
A665 Great Ancoats Street WB (between Oldham Road and Lever Street)	15145	15227	5.1	48.3	82
A665 Great Ancoats Street WB (between Pollard Street and Adair Street)	13655	13876	5.1	48.3	221
A665 Great Ancoats Street WB (between Store Street and Pollard Street)	12497	12675	5.1	48.3	178
A665 Great Ancoats Street WB (east of Adair Street)	16013	16476	5.1	48.3	463
A665 Great Ancoats Street westbound (WB) (between Store Street and Pollard Street)	12497	12675	5.1	48.3	178
A665 Miller Street WB only (between Rochdale Road and Corporation Street)	14778	14844	5.1	48.3	66
A665 Miller Street westbound only (between Rochdale Road and Corporation Street)	14778	14844	5.1	32.2	66

Road Name	Without the Proposed Development total AADT	With the Proposed Development total AADT	HGV%	Speed (kph)	Change (AADT)
A665 Swan Street WB only (between Oldham Road and Rochdale Road)	13783	13854	5.1	48.3	71
Adair Street	7279	7578	2.8	48.3	299
Adair Street (at junction)	7279	7578	2.8	32.2	299
Blossom Street SB only	1248	1298	2.8	32.2	50
Blossom Street SB only SP	1248	1298	2.8	32.2	50
Corporation Street (south of Ring Road)	5415	5490	5.1	32.2	75
Corporation Street NB (south of Ring Road)	2360	2427	5.1	32.2	66
Corporation Street SB (south of Ring Road)	3054	3063	5.1	32.2	9
Former Retail Park access	25	422	2.8	48.3	397
George Leigh Street NB only	627	669	2.8	32.2	43
Laystall Street NB only	3100	3161	2.8	32.2	61
Lever Street NB only	3637	3637	2.8	32.2	0
Newton Street	6415	6491	2.8	32.2	75
Old Mill Street	5474	5511	2.8	32.2	37
Old Mill Street NB (at junction)	4874	4906	2.8	32.2	31
Old Mill Street SB	600	605	2.8	32.2	5
Oldham Street	1846	1846	5.1	32.2	0
Pollard Street	6422	6441	5.1	48.3	20
Pollard Street (at junction)	6422	6441	5.1	32.2	20
Rochdale Road (south of Ring Road) ('Shudehill')	9463	9470	5.1	32.2	7
Rochdale Road NB (south of Ring Road) ('Shudehill')	5015	5022	5.1	32.2	7
Rochdale Road SB (south of Ring Road) ('Shudehill')	4448	4448	5.1	32.2	0
Store Street	6750	6869	5.1	32.2	119
Trinity Way EB	11722	11798	5.1	48.3	76
Trinity Way EB (at junction)	11722	11798	5.1	32.2	76
Trinity Way WB	2704	2704	5.1	48.3	0
Speed limit of 20 or 30 mph provided by AtkinsRéalis Transportation team, as relevant was applied to traffic flows on the modelled road links. At junction speeds reduced to 20mph					

Road Name	Without the Proposed Development total AADT	With the Proposed Development total AADT	HGV%	Speed (kph)	Change (AADT)
Bold indicates links exceeding the IAQM Planning Guidance traffic scoping criteria.					

Table 1.8 - Modelled diurnal emissions profile 2022

Hour	Weekday	Saturday	Sunday
1	0.19	0.24	0.21
2	0.15	0.18	0.15
3	0.15	0.16	0.11
4	0.18	0.16	0.10
5	0.28	0.18	0.11
6	0.59	0.27	0.16
7	1.19	0.43	0.23
8	1.86	0.65	0.35
9	2.02	0.91	0.50
10	1.76	1.16	0.78
11	1.70	1.35	1.06
12	1.74	1.43	1.22
13	1.75	1.43	1.29
14	1.77	1.35	1.24
15	1.85	1.26	1.19
16	1.96	1.19	1.16
17	1.96	1.15	1.12
18	1.76	1.08	1.01
19	1.34	0.92	0.88
20	0.96	0.71	0.73
21	0.68	0.52	0.56
22	0.51	0.41	0.41
23	0.39	0.35	0.29
24	0.28	0.28	0.20

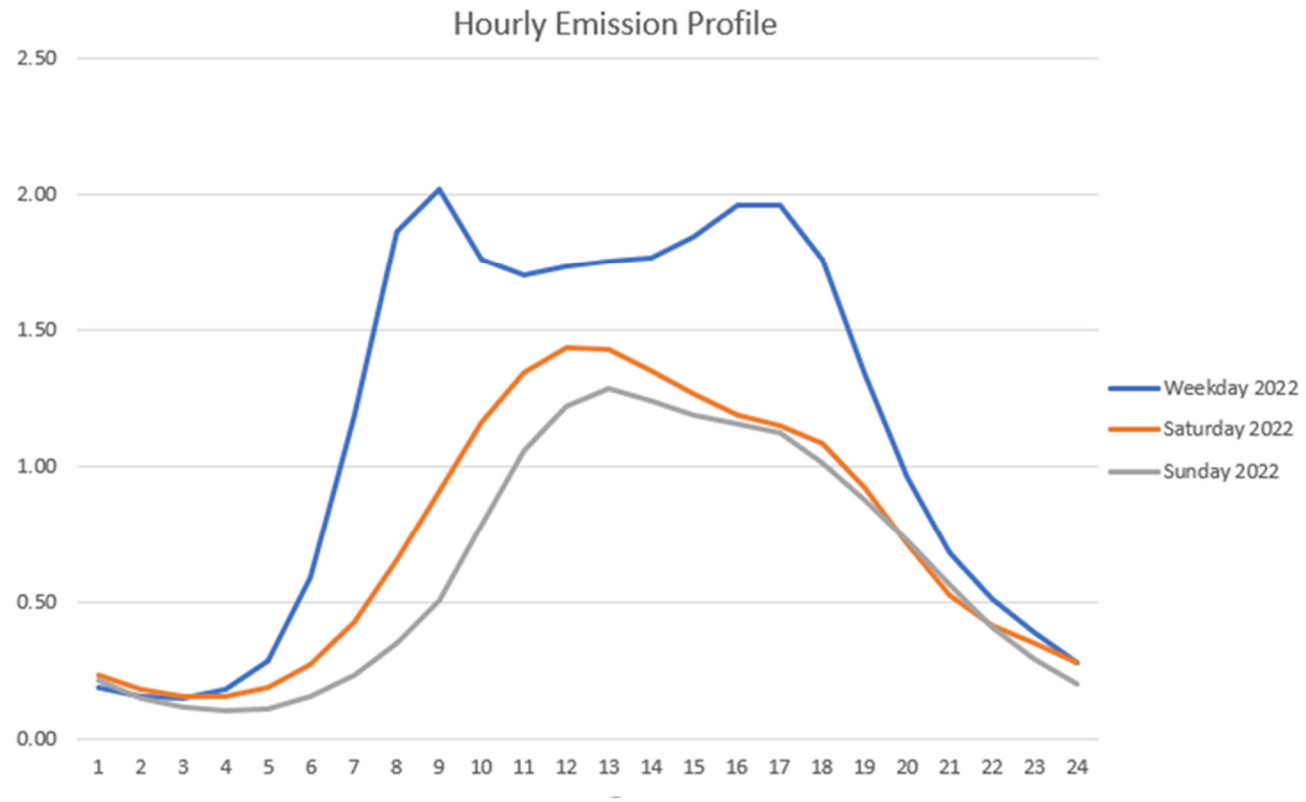


Figure 2 - Modelled diurnal traffic profiles

Modelled receptors

Table 1.9 - Modelled receptors

Receptor	X	Y	Name	Height (m)
R1	385281	398128	Residential Property, Great Ancoats Street	1.5
R2	385227	398180	Residential Property, Great Ancoats Street	1.5
R3	385222	398260	Residential Property, Old Mill Street	4.5
R4	384916	398420	Residential Property, Great Ancoats Street	1.5
R5	384794	398553	Residential Property, Oxid House, Newton Street	4.5
R6	384768	398618	Residential Property, Great Ancoats Street	4.5
R7	384130	399083	Residential Property, Cheetham Hill Road	4.5
R8	384567	398973	Residential Property, Rochdale Road	4.5
R9	384823	398613	Residential Property, Blossom Street	5
R10	385306	398326	Residential Property, Old Mill Street	1.5
R11	385497	398212	Residential Property, Pollard Street	4.5
R12	384706	398787	Residential Property, Addington Street	4.5
R13	384979	398415	New Receptor at the Proposed Development Site	1.5

Receptor	X	Y	Name	Height (m)
R14	385069	398150	Residential Property, Store Street (New Development 126608_FO_2020)	1.5
R15	384875	398478	Residential Property, Great Ancoats Street (132489/FO/2021)	1.5
R16	385043	398326	Future Receptor (Hotel) Residence Inn, Great Ancoats Street (new hotel development 135662/FO/2022)	1.5
R17	385317	398094	Residential Property, Great Ancoats Street	1.5
R18	384221	399121	Residential Property, Corporation Street	1.5
R19	385255	397938	Future Receptor (Residential Property), Adair Street (new residential development 141176/JO/2024*)	1.5
R20	384479	398940	Residential Property, Angel Street	4.5
R21	385468	397995	Residential Property, Great Ancoats Street	4.5
R22	384089	399328	Residential Property, Cheetham Hill Road	4.5
R23	384976	398294	Future Receptor (Residential Property), Laystall Street (new residential development 128911/FO/2020)	1.5
R24	385349	398106	Ibis Hotel, Pollard Street	4.5
Note: R13, R16 and R24 are hotels where only the short-term AQS objectives apply. RFFPs have been included as receptors where they represent new 'worst case' exposure.				

This is taken from Manchester City Council Planning Portal (141176/JO/2024 | Variation to Planning Permission 121099/FO/2018 consisting of the re-wording of conditions 12 (Public Realm delivery) and 13 (Landscaping and Highways). | Rammon House 1 Portugal Street East Manchester M1 2WX)

Model verification

Model verification was undertaken considering monitoring sites within 200 m of the roads meeting the IAQM Planning Guidance traffic scoping. From the network of NO_2 diffusion tubes available from GMCA, only those within the operational phase assessment study area located at roadside and with sufficient data capture were considered suitable for the purpose of model verification.

The annual mean modelled NO_2 concentrations for the 2022 base year were verified by means of comparison against ratified monitoring data with reference to the methodology set out in DEFRA's LAQM.TG(22). An air quality model can be considered to perform reasonably well where 95% of modelled concentrations are within 25% of monitored concentrations in accordance with DEFRA's Technical Guidance LAQM.TG(22). The RMSE should ideally be within 10% of the relevant air quality criterion (less than 4 $\mu g/m^3$) but is acceptable where it is within 25% of the relevant air quality criterion (i.e. 10 $\mu g/m^3$). The Fractional Bias (FB) has an ideal value of 0 but is acceptable in the range between +2 and -2.

There is a total of 27 diffusion tube monitoring locations within the modelled area. fourteen of the monitoring sites were not considered suitable for model verification. These sites and reason for exclusion are provided in Table 1.10.

Table 1.10 – Monitoring sites excluded from verification

Site ID	Reason for exclusion
DT6	Same location as CAP12
CAP_MANC_013	Kerbside - within 1 m of kerb
CAP_MANC_015	Low data capture
CAP_MANC_051	Low data capture
CAP_MANC_052	Kerbside - within 1 m of kerb
CAP_MANC_064	Low data capture
CAP_MANC_076	Assumed kerbside (cannot locate on Google Maps), also appears to be within a construction site
CAP_MANC_078	Kerbside - within 1 m of kerb
CAP_MANC_079	Kerbside - within 1 m of kerb
CAP_MANC_136	Low data capture
CAP_MANC_137	Kerbside - within 1 m of kerb
CAP_MANC_141	Kerbside - within 1 m of kerb
CAP_MANC_142	Kerbside - within 1 m of kerb
CAP_MANC_144	Kerbside - within 1 m of kerb

First, the unadjusted modelled estimate of the total annual mean NO_2 concentrations have been compared against the monitored annual mean as shown in Table 1.11. For the unadjusted modelled estimates of NO_2 compared to monitored concentrations, the RMSE was 7.39 µg/m^3, which is below 25% of the AQS objective (10 µg/m^3). Overall, the unadjusted model tended to underestimate total concentrations of NO_2.

Table 1.11 - Comparison of unadjusted modelled and measured NO_2 concentrations (µg/m^3)

Site ID	X, Y	Measured NO_2	Modelled total NO_2	Modelled – measured difference	Ratio (modelled / measured)	% Difference
MA71NO	435635, 292283	34.4	26.0	-8.4	0.8	-24.4%
MA88NO	436394, 291987	35.7	32.5	-3.2	0.9	-9.0%
DT1	436525, 291869	26.4	23.1	-3.3	0.9	-12.5%
DT3	436606, 292206	27.2	24.8	-2.4	0.9	-8.7%
DT2	436693, 292267	26.5	24.9	-1.6	0.9	-6.2%
DT4	436693, 292267	26.4	24.1	-2.3	0.9	-8.7%
DT5	435818, 292278	28.7	26.3	-2.4	0.9	-8.4%
CAP_MANC_001	435756, 292314	50.9	35.3	-15.6	0.7	-30.7%
CAP_MANC_012	435953, 292114	38.5	32.3	-6.2	0.8	-16.2%
CAP_MANC_014	435953, 292114	43.0	32.2	-10.8	0.8	-25.0%
CAP_MANC_077	435896, 292206	32.2	29.0	-3.2	0.9	-10.0%

Site ID	X, Y	Measured NO_2	Modelled total NO_2	Modelled – measured difference	Ratio (modelled / measured)	% Difference
CAP_MANC_089	435556, 292383	31.2	27.8	-3.4	0.9	-10.9%
CAP_MANC_143	435051, 291594	43.2	29.8	-13.4	0.7	-31.0%

The second comparison of modelled estimates of road contributed annual mean NOx with the road NOx component derived from monitoring data is presented in Table 1.12. The measured road NOx component was estimated using Defra's NO_2 to NOx calculator (version 8.1, August 2020). Modelled road NOx concentrations can be adjusted by taking the slope of the linear regression line that has been forced through zero. The adjustment factor of 2.414 was derived from this comparison.

Table 1.12 - Comparison of unadjusted modelled and measured NO_X concentrations (µg/m^3)

Site ID	Modelled road NOx	Measured road NOx	Modelled - measured	Measured / modelled	Measured / modelled % difference
MA71NO	9.8	27.1	-17.3	2.8	-63.7%
MA88NO	12.4	19.1	-6.7	1.5	-34.9%
DT1	4.2	10.7	-6.5	2.5	-60.2%
DT3	7.6	12.3	-4.7	1.6	-38.0%
DT2	7.6	10.9	-3.3	1.4	-29.6%
DT4	6.2	10.7	-4.5	1.7	-42.2%
DT5	10.4	15.3	-4.9	1.5	-31.5%
CAP_MANC_001	18.2	53.5	-35.3	2.9	-66.0%
CAP_MANC_012	11.9	25.0	-13.1	2.1	-52.3%
CAP_MANC_014	11.8	34.9	-23.1	2.9	-66.0%
CAP_MANC_077	5.4	11.9	-6.5	2.2	-54.3%
CAP_MANC_089	3.0	9.7	-6.7	3.3	-69.5%
CAP_MANC_143	7.1	35.5	-28.4	5.0	-80.1%

The third comparison of the adjusted modelled estimates of total annual mean NO_2 with monitored concentrations is presented in Table 1.13. All the comparisons are within +/- 25% of the monitored values. The majority (8 of 13 sites) are within 10% of monitored concentrations. Overall, this suggests that the model is performing well at all locations in accordance with DEFRA Technical Guidance LAQM.TG(22).

The RMSE for the adjusted modelled NO_2 concentrations compared to monitored concentrations is 3.72µg/m^3 i.e. below the DEFRA's target value (4 µg/m^3). Adjustment has therefore improved model performance. Overall, the adjusted model has tended to slightly overestimate total concentrations of NO_2, as indicated by a fractional bias value of -0.006.

In absence of the continuous monitoring within the study area for PM_{10}, adjustment factor of 2.414 was applied on the basis of the NO_2 verification with reference to the methodology set out in DEFRA's LAQM.TG(22).

Table 1.13 - Comparison of adjusted modelled and measured NO_2 concentrations (µg/m^3)

Site ID	Measured NO_2	Modelled total NO_2	Modelled – measured difference (µg/m^3)	Ratio (modelled / measured)	% Difference
MA71NO	34.4	32.8	-1.6	1.0	-4.5%
MA88NO	35.7	40.8	5.1	1.1	14.1%
DT1	26.4	26.2	-0.2	1.0	-0.8%
DT3	27.2	30.2	3.0	1.1	11.1%
DT2	26.5	30.3	3.8	1.1	14.2%
DT4	26.4	28.5	2.1	1.1	8.0%
DT5	28.7	33.5	4.8	1.2	16.8%
CAP_MANC_001	50.9	46.9	-4.0	0.9	-7.9%
CAP_MANC_012	38.5	40.3	1.8	1.0	4.5%
CAP_MANC_014	43.0	40.1	-2.9	0.9	-6.6%
CAP_MANC_077	32.2	32.8	0.6	1.0	1.9%
CAP_MANC_089	31.2	29.9	-1.3	1.0	-4.1%
CAP_MANC_143	43.2	34.7	-8.5	0.8	-19.6%

Construction traffic data

Table 1.14 - Construction vehicle movements (AADT)

Vehicle type	Phase 1 enabling works	Phase 2 sub-structure	Phase 3 super-structure	Phase 4 façade and roof	Phase 5 internal fit-out	Phase 6 hard & soft landscaping	All phases
Duration	6 months	6 months	9 months	12 months	12 months	3 months	48 months
HDV	16	9	35	4	1	2	11
LDV (Vans)	22	22	103	24	0	9	31
Operatives and Visitors (Car)	58	98	132	129	110	2	104
Total LDV (Car & Van)	80	120	235	153	110	11	135

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