Air Quality Assessment Update - 2024

Arundel Street

Sir Robert McAlpine

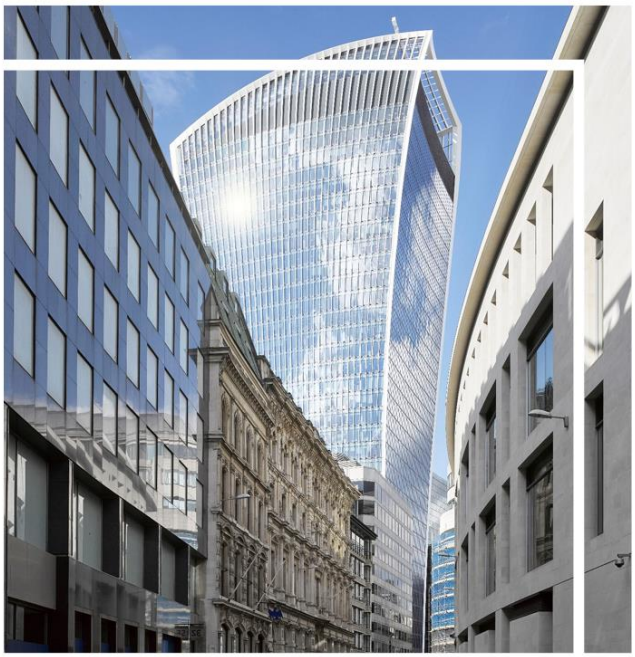
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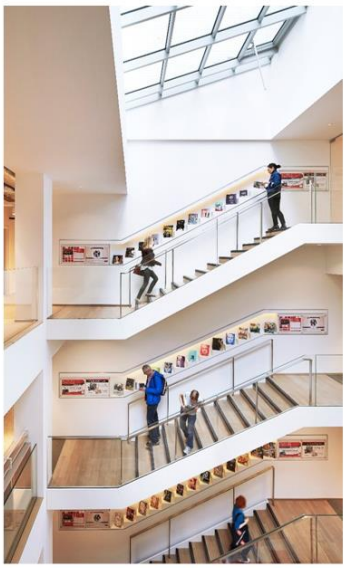
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1. Introduction

Hilson Moran has been commissioned by Sir Robert McAlpine to provide an updated dispersion model for the Proposed Development at Arundel Street to assess the likely significant effects of the Proposed Development with respect to Air Quality.

The Proposed Development is located in the administrative boundary of Manchester City Council and uses the most relevant baseline data from both Manchester City Council and Salford City Council for modelling purposes. The updated model uses baseline data from 2023 and assumes an opening year of 2029.

The previous modelling which was undertaken in 2019 has been updated and the findings presented in this report. The purpose of the update was to capture design changes and revisions to the scheme which have the potential to effect Air Quality, but also ensure the latest Defra toolkits and air quality modelling software was used.

1. Operational Phase

1.1.1. Road Traffic Emissions

Impacts on ambient concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been considered in the road traffic assessment as these are the main pollutants emitted by vehicles.

A detailed assessment of the potential impacts of development-generated road traffic on the local air quality was initially undertaken using the dispersion model ADMS-Roads, model Version 4.1.1.0 (release date 18/01/2018).

The updated modelling has been undertaken using the air dispersion model ADMS-Urban, Version 5.0.1 (release date 22nd January 2022). This model uses detailed road traffic information, surface roughness, and local meteorological information to predict the impact on pollutant concentrations at specific receptor points. Table 1 summarises the air quality modelling parameters for road traffic.

Following consultation with the project Transport Consultant at Curtins, it has been established that the traffic data initially provided will remain unchanged for the new model. As the previous traffic data was provided for 2017 and 2024, we have used a Tempro factor to grow the traffic to the years we will be modelling which are set out below:

- 2017-2023 – 1.1207
- 2024-2029 – 1.0679

Table 1 ADMS Modelling Parameters

Parameter	Local Area	Met. Measurement Site
Latitude	53.8	53.8
Surface Roughness	1	0.5
Monin-Obukhov Length (m)	30	30

The ADMS model uses meteorological data including wind speed and direction to determine how pollution is transported and diluted with distance from the source. For this assessment, meteorological data from Manchester 2019 (for all modelled scenarios) has been used as this site is considered representative of the Application Site.

For the assessment three scenarios have been modelled:

- 2023 – Baseline & Model Verification;
- 2029 – Without Development + Committed Developments; and
- 2029 – With Development + Committed Developments.

Vehicle Emission Factors

Vehicle emission factors for input into ADMS-Roads have been calculated using the Emission Factor Toolkit (EFT) version 12.0.1 (published December 2023), available on the

Defra website[1]. The EFT allows for the calculation of emission factors arising from road traffic for all years between 2018 and 2030. For the predictions of future year emissions, the toolkit takes into account factors such as anticipated advances in vehicle technology and changes in fleet composition, such that vehicle emissions are assumed to reduce over time. There is good evidence from real-world testing of EURO 6 (VI) compliant vehicles of substantial improvements in vehicle emissions compared to earlier EURO categories, in particular with respect to NO_X emissions.

Defra's EFT calculator has been used to calculate the emission factors for NO_x, PM_{10} and $PM_{2.5}$. Emission factors for 2023 have been used for the baseline and model verification scenario and emission factors for 2029 has been used for the future scenario.

Selection of Background Concentrations

The background concentrations of those pollutants included within the AQS and used within the air quality assessment have been mapped at a grid resolution of 1x1 km for the whole of the UK and are available on Defra's website. Estimated background concentrations are available for all years between 2018 and 2030 and the maps assume that background concentrations will reduce (i.e., improve) over time. This assumption is based upon improvements in emissions from various sources. In line with the findings (usually based on monitoring data) of local authorities, measured concentrations have not reduced as expected over time.

Model Verification

The ADMS-Urban dispersion model has been validated by the software developer and is considered to be fit for purpose, however local model validation, *i.e*. in the vicinity of the Proposed Development, has not been undertaken. Therefore, to validate the model and to determine how well the model is performing at a local level, comparing the modelling results with local monitoring data is undertaken. The verification process aims to minimise model uncertainty and error by adjusting the modelled results by a factor to offer greater confidence in the final results. This is undertaken in accordance with the methodology specified in Chapter 7, Section 4, of LAQM.TG22.

The adjustment factor calculated is 0.8. This indicated that the model was over-predicting. As the model was over-predicting, instead of applying this factor to adjust the modelled road-NO_X outputs, the outputs remained unadjusted and an adjustment factor of 1 was assumed.

No local monitoring data was available for PM_{10} and $PM_{2.5}$, therefore the adjustment factor calculated for NO_X has been applied to both the modelled PM_{10} and $PM_{2.5}$ concentrations prior to adding to the appropriate background concentration. This approach is in accordance with LAQM.TG22.

Point Source Emissions

Following consultation with the M&E Engineer and Energy Consultant it is understood that the provision of heating and hot water will be provided via an all-electric approach,

[1] Defra (2020) Defra Emission Factor Toolkit (v10.1) Available at https://laqm.defra.gov.uk/review-and-assessment/tools/emission-factors-toolkit.html. Accessed on 23/07/2024.

with air source heat pumps (ASHP). Therefore, a detailed assessment of any onsite combustion plant has been scoped out.

Impacts of Emissions from Road Traffic

ADMS-Urban provides modelled outputs for NO_x, PM_{10} and $PM_{2.5}$ for all receptors modelled. Total annual mean concentrations for NO_2 are calculated by taking the adjusted modelled NO_x output, using the Defra NO_x to NO_2 calculator and combining with the background concentration. The total pollutant concentrations are then compared to the relevant AQS objectives of 40µg/m^3.

To determine compliance with the 1-hour mean objective for NO_2 (200µg/m^3) the 99.79th percentile has been quantitatively assessed using ADMS-Urban.

Total annual mean concentrations for PM_{10} and $PM_{2.5}$ are calculated by adding the adjusted modelled outputs to the relevant background concentrations. The total pollutant concentrations are then compared to the relevant AQS objectives of 40 and 20µg/m^3, respectively.

The short term AQS objective for PM_{10} is 50µg/m^3, where no more than 35 exceedances are allowed per year. Guidance from Defra provides the following equation that relates the long term AQS objective to the short term AQS objective:

- No. 24-hour mean exceedances = -18.5 + 0.00145 x annual mean^3 + (206/annual mean).

This approach has been adopted for 24-hour mean PM_{10} for this assessment.

2. Modelled Results

2.1.1. Annual Mean NO_2 Concentrations

The objective for annual mean NO_2 concentrations is 40 µg/m^3.

'Without' and 'with' the Proposed Development operational, the annual mean NO_2 concentrations at all existing receptor locations were compliant with the AQS Objective. The highest predicted concentration with the Proposed Development operational is 30.9 µg/m^{3}at existing receptor E16a.

The greatest predicted change in annual mean NO_2 brought about by development generated road traffic is 0.3 µg/m^3 at various existing receptor locations E8. According to the EPUK/IAQM guidance, the impacts on annual mean NO_2 concentrations at all existing receptors were negligible.

With the Proposed Development operational, annual mean NO_2 concentrations at modelled proposed receptor locations below the AQS objective. The highest concentration is 28.3 µg/m^3 at ground floor level at receptor locations N12 and N16. Concentrations at all proposed receptor locations decreased from ground floor upwards.

On this basis, mitigation to protect future users of the Proposed Development from elevated annual mean NO_2 concentrations is not required.

2.1.2. Hourly Mean NO_2 Concentrations

To determine compliance with the 1-hour mean objective for NO_2, detailed modelling has been undertaken to compare total concentrations against the relevant AQS objective – 200 µg/m^3.

With the Proposed Development operational, short-term NO_2 concentrations at all existing receptors are predicted to be below AQS objective. The highest predicted concentration with the Proposed Development operational is 70.5 µg/m^3 at E16b. The impacts of the Development on hourly mean NO_2 concentrations are negligible, therefore mitigation is not required.

All new Proposed receptors would experience concentrations below the short-term AQS objective, with the highest predicted concentration being 72.2 µg/m^3 at N16 GF. On this basis, mitigation to protect future users of the Proposed Development from elevated annual mean NO_2 concentrations is not required.

2.1.3. Annual Mean PM_{10} Concentrations

The objective for annual mean PM_{10} concentrations is 40 µg/m^3.

'Without' and 'with' the Proposed Development operational, the annual mean PM_{10} concentrations at all existing receptors are below the AQS Objective. The highest predicted concentration with the Proposed Development operational is 15.4 µg/m^3 at existing receptor E17a.

The greatest predicted change in annual mean PM_{10} brought about by development generated road traffic is 0.1 µg/m^3 at existing receptor E8a. According to the EPUK/IAQM guidance, the impacts on annual mean PM_{10} concentrations at existing receptors are negligible.

With the Proposed Development operational, annual mean PM_{10} concentrations at all modelled proposed receptors were below the AQS objective - the highest concentration is 14.9 µg/m^3 ground floor level at receptor location N12.

On this basis, mitigation to protect future users of the Proposed Development from elevated annual mean PM_{10} concentrations is not required.

2.1.4. Daily Mean PM_{10} Concentrations

The AQS objective for daily mean PM_{10} concentrations is 50 µg/m^3, to be exceeded no more than 35 times a year.

The assessment demonstrates that all existing receptors fall within the daily mean PM_{10} objective with a maximum of 17 day of exceedance predicted in both the 'without' and 'with' Development scenarios. Furthermore, there are no differences between the 'without' and 'with' development scenarios. As a result, the impacts on daily mean PM_{10} concentrations are negligible.

For daily mean PM_{10}, it is predicted that all new receptors would be well within the AQS objective, again with no predicted exceedances of the limit at a number of receptors.

2.1.5. Annual Mean $PM_{2.5}$ Concentrations

The objective for annual mean $PM_{2.5}$ concentrations is 20 µg/m^3.

'Without' and 'with' the Proposed Development operational, the annual mean $PM_{2.5}$ concentrations at all existing receptors are below the AQS Objective. The highest predicted concentration with the Proposed Development operational is 9.7 µg/m^3 at existing receptor E17a.

The are no predicted changes in annual mean $PM_{2.5}$ brought about by development generated road traffic. According to the EPUK/IAQM guidance, the impacts on annual mean $PM_{2.5}$ concentrations at existing receptors are negligible.

3. Summary

Hilson Moran has updated the Air Quality Assessment for the Proposed Development on Arundel Street to account for changes in air quality assessment methodology since the original and updated assessments were completed in 2017 and 2019, respectively.

A quantitative road traffic assessment has been updated using ADMS-Urban. The conclusions of the detailed dispersion modelling indicate:

- The impact on annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at all existing receptors modelled is negligible;
- All proposed receptors have predicted annual mean NO_2 concentrations below the AQS;
- All modelled receptors (existing and proposed) are predicted to have 1-hour mean NO_2 concentrations well below the AQS objective; and
- The annual mean concentrations of PM_{10} and $PM_{2.5}$ are below the AQS objective for all modelled receptors and within the objective for daily mean PM_{10}. The impacts are classified as negligible.

Based upon the above findings it is concluded that the findings as presented in the previous assessment remain unchanged (i.e., there are no exceedances identified) and site-specific mitigation to protect existing and future users of the Proposed Development from poor air quality is not required.

Appendix 1 – Traffic Data

ID	Width	Speed	2023 Baseline					2029 Baseline (Without Development_					2029 Baseline + Construction Traffic				
			AADT	AAHT	HGV %	HGV AADT	HGV AAHT	AADT	AAHT	HGV %	HGV AADT	HGV AAHT	AADT	AAHT	HGV %	HGV AADT	HGV AAHT
1	7	16	110	5	0.00%	0	0	133	6	0.00%	0	0	0	0	0.00%	0	0
2	6.2	16	1555	65	2.38%	41	2	1888	79	2.38%	45	2	2235	93	2.00%	45	2
3	6.6	16	3556	148	2.25%	90	4	3797	158	2.25%	97	4	4630	193	2.10%	97	4
4	6.6	32	3556	148	2.25%	90	4	3797	158	2.25%	97	4	4630	193	2.10%	97	4
5	6.6	16	3556	148	2.25%	90	4	3797	158	2.25%	97	4	4630	193	2.10%	97	4
6	13	16	28365	1182	6.26%	1989	83	32528	1355	6.26%	2035	85	32714	1363	6.20%	2035	85
7	22	16	28365	1182	6.26%	1989	83	32528	1355	6.26%	2035	85	32714	1363	6.20%	2035	85
8	22	16	28934	1206	2.98%	967	40	35142	1464	2.98%	1051	44	35192	1466	3.00%	1051	44
9	22	37	28934	1206	2.98%	967	40	35142	1464	2.98%	1051	44	35192	1466	3.00%	1051	44
10	9.5	48	8777	366	3.35%	329	14	10658	444	3.35%	358	15	10667	444	3.40%	358	15
11	15	16	8777	366	3.35%	329	14	10658	444	3.35%	358	15	10667	444	3.40%	358	15
12	8	16	3948	164	1.71%	75	3	4793	200	1.71%	82	3	5073	211	1.60%	82	3
13	20	30	19851	827	3.55%	789	33	22765	949	3.55%	807	34	22824	951	3.50%	807	34
14	20	16	19851	827	3.55%	789	33	22765	949	3.55%	807	34	22824	951	3.50%	807	34
15	10	16	13879	578	5.80%	902	38	15916	663	5.80%	923	38	16102	671	5.70%	923	38
16	16.7	16	14152	590	3.53%	560	23	16229	676	3.53%	573	24	16252	677	3.50%	573	24
17	16.7	34	14152	590	3.53%	560	23	16229	676	3.53%	573	24	16252	677	3.50%	573	24

18	28	54	61249	2552	6.99%	4797	200	70239	2927	6.99%	4909	205	70286	2929	7.00%	4909	205
19	34	54	61249	2552	6.99%	4797	200	70239	2927	6.99%	4909	205	70286	2929	7.00%	4909	205
20	34	16	39192	1633	3.80%	1671	70	0	0	3.80%	0	0	0	0	0.00%	0	0
21	20.2	64	39192	1633	3.80%	1671	70	0	0	3.80%	0	0	0	0	0.00%	0	0
22	37.4	54	63829	2660	6.45%	4612	192	73197	3050	6.45%	4720	197	73277	3053	4.40%	4720	197
23	19	16	28365	1182	6.26%	1989	83	32528	1355	6.26%	2035	85	32714	1363	6.20%	2035	85
24	11	16	28365	1182	6.26%	1989	83	32528	1355	6.26%	2035	85	32714	1363	6.20%	2035	85
25	15	37	28365	1182	6.26%	1989	83	32528	1355	6.26%	2035	85	32714	1363	6.20%	2035	85

Appendix 2 – Modelled Receptors

Receptor ID	X	Y	2023			2029		
			NO_2 (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)	NO_2 (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
DT1	382449	397736	19.1	12.5	8.1	15.9	12.3	7.9
E1a	382796.7	397422.9	19.1	12.5	8.1	15.9	12.3	7.9
E1b	382796.7	397422.9	19.1	12.5	8.1	15.9	12.3	7.9
E2	382779.6	397386.4	19.1	12.5	8.1	15.9	12.3	7.9
E3a	382795.7	397342.6	19.1	12.5	8.1	15.9	12.3	7.9
E3b	382795.7	397342.6	19.1	12.5	8.1	15.9	12.3	7.9
E4a	382812.2	397313.4	19.1	12.5	8.1	15.9	12.3	7.9
E4b	382812.2	397313.4	19.1	12.5	8.1	15.9	12.3	7.9
E5	382909.3	397309.1	19.1	12.5	8.1	15.9	12.3	7.9
E6	382848.2	397241.9	19.1	12.5	8.1	15.9	12.3	7.9
E7a	382613.1	397202.8	19.1	12.5	8.1	15.9	12.3	7.9
E7b	382613.1	397202.8	19.1	12.5	8.1	15.9	12.3	7.9
E8a	382526.1	397126.2	19.1	12.5	8.1	15.9	12.3	7.9
E8b	382526.1	397126.2	19.1	12.5	8.1	15.9	12.3	7.9
E8c	382526.1	397126.2	19.1	12.5	8.1	15.9	12.3	7.9
E9	382515.1	397034.1	19.1	12.5	8.1	15.9	12.3	7.9
E10	382655.3	397100.6	19.1	12.5	8.1	15.9	12.3	7.9
E11	382907.9	397215.9	19.1	12.5	8.1	15.9	12.3	7.9
E12a	382959.2	397204.2	19.1	12.5	8.1	15.9	12.3	7.9
E12b	382959.2	397204.2	19.1	12.5	8.1	15.9	12.3	7.9
E12c	382959.2	397204.2	19.1	12.5	8.1	15.9	12.3	7.9
E13	382946.6	397097.4	19.1	12.5	8.1	15.9	12.3	7.9
E14a	382984.2	397122.5	19.1	12.5	8.1	15.9	12.3	7.9
E14b	382984.2	397122.5	19.1	12.5	8.1	15.9	12.3	7.9
E14c	382984.2	397122.5	19.1	12.5	8.1	15.9	12.3	7.9
E15	383086.1	397162.9	22.1	12.8	8.2	18.7	12.5	8.0

Receptor ID	X	Y	2023			2029		
			NO_2 (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)	NO_2 (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
E16a	382970.2	397347.5	19.1	12.5	8.1	15.9	12.3	7.9
E16b	382970.2	397347.5	19.1	12.5	8.1	15.9	12.3	7.9
E16c	382970.2	397347.5	19.1	12.5	8.1	15.9	12.3	7.9
E17a	382864.1	397440.5	19.1	12.5	8.1	15.9	12.3	7.9
E17b	382864.1	397440.5	19.1	12.5	8.1	15.9	12.3	7.9

Appendix 3 – Model Verification

The comparison of modelled concentrations with local monitored concentrations is a process termed 'verification'. Model verification investigates the discrepancies between modelled and measured concentrations. Discrepancies occur due to model uncertainties, such as:

- Estimates of background pollutant concentrations;
- Meteorological data uncertainties;
- Traffic data uncertainties;
- Model input parameters; and
- Overall limitations of the dispersion model.

NO_2 is produced in the atmosphere by the reaction of nitric oxide (NO) with ozone. Therefore model verification for nitrogen oxides (NO_X = NO + NO_2) the primary pollutant is appropriate. This has been undertaken in accordance Chapter 7 of LAQM.TG(22).

The model has been run to predict the 2023 annual mean road-NO_X contribution at the monitoring locations given below. The model outputs of road-NO_X for each location have been compared with the 2022 'measured' road-NO_X, which was determined utilising the NO_X from NO_2 calculator and the NO_2 concentration data from LBC monitoring.

Details of the data used in the verification process is in the table and figure below.

ID	2023 Monitored Total NO_2 ($\mu g/m^3$)	2023 Background NO_2 ($\mu g/m^3$)	2023 Monitored Road Contribution NO_X ($\mu g/m^3$)	2023 Modelled Road Contribution NO_X ($\mu g/m^3$)	Ratio of monitored NO_X road contribution/modelled road contribution NO_X
SA60NO: Regent Road	32.1	19.1	22.27	29.09	0.77

The adjustment factor calculated is 0.8. This indicated that the model was over-predicting. As the model was over-predicting, instead of applying this factor to adjust the modelled road-NO*X* outputs, the outputs remained unadjusted and an adjustment factor of 1 was assumed.

For PM_{10} and $PM_{2.5}$ there are no relevant local monitoring data against which the model could be verified. Consequently, the verification factors determined above for adjusting the road-NO_X contribution has been applied to the predicted road-PM_{10} and road-$PM_{2.5}$ contributions, consistent with guidance set out in LAQM.TG(22).

Appendix 4 – Dispersion Modelling Results

Operational Traffic (2029): Annual Mean NO_2 Results

Receptor ID	2029 Future Base (µg/m³)	2029 Operational (µg/m³)	Change (µg/m³)	Impact/ Exceed
DT1	16.6	16.6	0.0	Negligible
E1a	16.6	20.9	0.0	Negligible
E1b	20.8	18.4	0.1	Negligible
E2	18.3	19.9	0.0	Negligible
E3a	19.9	20.3	0.1	Negligible
E3b	20.2	17.5	0.1	Negligible
E4a	17.5	20.9	0.0	Negligible
E4b	20.8	17.6	0.1	Negligible
E5	17.6	27.7	0.0	Negligible
E6	27.6	26.9	0.1	Negligible
E7a	26.8	20.5	0.1	Negligible
E7b	20.3	18.6	0.2	Negligible
E8a	18.5	22.1	0.0	Negligible
E8b	21.8	19.3	0.3	Negligible
E8c	19.2	17.4	0.1	Negligible
E9	17.4	23.6	0.0	Negligible
E10	23.5	22.8	0.1	Negligible
E11	22.7	22.4	0.1	Negligible
E12a	22.4	22.5	0.0	Negligible
E12b	22.5	17.4	0.0	Negligible
E12c	17.3	16.2	0.0	Negligible
E13	16.2	21.3	0.0	Negligible
E14a	21.2	20.6	0.0	Negligible
E14b	20.6	16.9	0.0	Negligible
E14c	16.9	16.2	0.0	Negligible
E15	16.2	23.0	0.0	Negligible
E16a	23.0	30.9	0.0	Negligible
E16b	30.8	20.1	0.1	Negligible
E16c	20.1	16.9	0.0	Negligible

E17a	16.9	30.5	0.0	Negligible
E17b	30.4	19.8	0.0	Negligible
N_1_GF	-	26.0	-	Negligible
N_2_GF	-	24.8	-	Negligible
N_3_GF	-	24.8	-	Negligible
N_4_GF	-	24.1	-	Negligible
N_5_GF	-	23.1	-	Negligible
N_6_GF	-	22.7	-	Negligible
N_7_GF	-	22.2	-	Negligible
N_8_GF	-	22.0	-	Negligible
N_9_GF	-	21.7	-	Negligible
N_10_GF	-	21.5	-	Negligible
N_11_GF	-	23.0	-	Negligible
N_12_GF	-	28.3	-	Negligible
N_13_GF	-	27.4	-	Negligible
N_14_GF	-	26.5	-	Negligible
N_15_GF	-	27.9	-	Negligible
N_16_GF	-	28.3	-	Negligible
N_17_GF	-	23.5	-	Negligible
N_18_GF	-	23.1	-	Negligible
N_19_GF	-	22.2	-	Negligible
N_20_GF	-	21.8	-	Negligible
N_21_GF	-	21.8	-	Negligible
N_22_GF	-	21.8	-	Negligible
N_23_GF	-	21.8	-	Negligible

Operational Traffic (2029): Hourly Mean NO_2 Results

Receptor ID	2029 Future Base (µg/m³)	2029 Operational (µg/m³)	Change (µg/m³)	Impact/ Exceed
DT1	37.8	37.8	0.0	Negligible
E1a	52.0	52.1	0.1	Negligible
E1b	43.8	43.9	0.1	Negligible
E2	49.2	49.4	0.1	Negligible

E3a	50.1	50.4	0.2	Negligible
E3b	40.9	40.9	0.0	Negligible
E4a	51.5	51.9	0.4	Negligible
E4b	41.1	41.1	0.0	Negligible
E5	72.2	72.3	0.1	Negligible
E6	64.4	64.7	0.3	Negligible
E7a	44.9	45.3	0.4	Negligible
E7b	41.7	41.9	0.2	Negligible
E8a	47.8	48.4	0.6	Negligible
E8b	42.4	42.6	0.2	Negligible
E8c	39.2	39.3	0.1	Negligible
E9	64.6	64.8	0.3	Negligible
E10	60.7	60.9	0.3	Negligible
E11	64.9	65.0	0.1	Negligible
E12a	61.8	61.9	0.1	Negligible
E12b	41.7	41.8	0.0	Negligible
E12c	34.7	34.7	0.0	Negligible
E13	54.0	54.0	0.0	Negligible
E14a	55.6	55.7	0.0	Negligible
E14b	41.6	41.6	0.0	Negligible
E14c	34.5	34.5	0.0	Negligible
E15	64.4	64.5	0.1	Negligible
E16a	70.4	70.5	0.1	Negligible
E16b	47.3	47.4	0.0	Negligible
E16c	36.9	36.9	0.0	Negligible
E17a	64.9	65.0	0.1	Negligible
E17b	47.2	47.3	0.1	Negligible
N_1_GF	-	66.7	-	Negligible
N_2_GF	-	63.2	-	Negligible
N_3_GF	-	62.6	-	Negligible
N_4_GF	-	57.4	-	Negligible
N_5_GF	-	55.3	-	Negligible
N_6_GF	-	54.6	-	Negligible

N_7_GF	-	53.2	-	Negligible
N_8_GF	-	52.5	-	Negligible
N_9_GF	-	52.1	-	Negligible
N_10_GF	-	54.7	-	Negligible
N_11_GF	-	59.5	-	Negligible
N_12_GF	-	72.6	-	Negligible
N_13_GF	-	70.4	-	Negligible
N_14_GF	-	68.6	-	Negligible
N_15_GF	-	71.7	-	Negligible
N_16_GF	-	72.2	-	Negligible
N_17_GF	-	60.8	-	Negligible
N_18_GF	-	59.7	-	Negligible
N_19_GF	-	57.0	-	Negligible
N_20_GF	-	55.4	-	Negligible
N_21_GF	-	55.4	-	Negligible
N_22_GF	-	55.4	-	Negligible
N_23_GF	-	55.4	-	Negligible

Operational Traffic (2029): Annual Mean PM_{10} Results

Receptor ID	2029 Future Base (µg/m³)	2029 Operational (µg/m³)	Change (µg/m³)	Impact/ Exceed
DT1	12.4	12.4	0.0	Negligible
E1a	13.2	13.2	0.0	Negligible
E1b	12.7	12.7	0.0	Negligible
E2	13.0	13.0	0.0	Negligible
E3a	13.0	13.1	0.0	Negligible
E3b	12.6	12.6	0.0	Negligible
E4a	13.1	13.2	0.0	Negligible
E4b	12.6	12.6	0.0	Negligible
E5	14.3	14.3	0.0	Negligible
E6	14.3	14.3	0.0	Negligible
E7a	13.0	13.1	0.0	Negligible
E7b	12.7	12.7	0.0	Negligible

E8a	13.2	13.3	0.1	Negligible
E8b	12.8	12.8	0.0	Negligible
E8c	12.5	12.5	0.0	Negligible
E9	13.3	13.3	0.0	Negligible
E10	13.5	13.5	0.0	Negligible
E11	13.4	13.4	0.0	Negligible
E12a	13.4	13.4	0.0	Negligible
E12b	12.5	12.5	0.0	Negligible
E12c	12.3	12.3	0.0	Negligible
E13	13.3	13.3	0.0	Negligible
E14a	13.1	13.1	0.0	Negligible
E14b	12.5	12.5	0.0	Negligible
E14c	12.3	12.3	0.0	Negligible
E15	13.3	13.3	0.0	Negligible
E16a	15.0	15.0	0.0	Negligible
E16b	13.0	13.0	0.0	Negligible
E16c	12.4	12.5	0.0	Negligible
E17a	15.4	15.4	0.0	Negligible
E17b	13.0	13.0	0.0	Negligible
N_1_GF	-	14.2	-	Negligible
N_2_GF	-	13.9	-	Negligible
N_3_GF	-	13.9	-	Negligible
N_4_GF	-	13.7	-	Negligible
N_5_GF	-	13.5	-	Negligible
N_6_GF	-	13.5	-	Negligible
N_7_GF	-	13.4	-	Negligible
N_8_GF	-	13.4	-	Negligible
N_9_GF	-	13.3	-	Negligible
N_10_GF	-	13.3	-	Negligible
N_11_GF	-	13.7	-	Negligible
N_12_GF	-	14.9	-	Negligible
N_13_GF	-	14.6	-	Negligible
N_14_GF	-	14.4	-	Negligible

N_15_GF	-	14.7	-	Negligible
N_16_GF	-	14.6	-	Negligible
N_17_GF	-	13.7	-	Negligible
N_18_GF	-	13.6	-	Negligible
N_19_GF	-	13.5	-	Negligible
N_20_GF	-	13.4	-	Negligible
N_21_GF	-	13.4	-	Negligible
N_22_GF	-	13.4	-	Negligible
N_23_GF	-	13.4	-	Negligible

Operational Traffic (2029): Daily Mean PM_{10} Results

Receptor ID	2029 Future Base (Days exceeding the 24-hour AQS)	2029 Operational (Days exceeding the 24-hour AQS)	Change (µg/m^3)	Impact/ Exceed
DT1	1	1	0	Negligible
E1a	0	0	0	Negligible
E1b	1	1	0	Negligible
E2	1	1	0	Negligible
E3a	1	1	0	Negligible
E3b	1	1	0	Negligible
E4a	0	0	0	Negligible
E4b	1	1	0	Negligible
E5	0	0	0	Negligible
E6	0	0	0	Negligible
E7a	0	1	1	Negligible
E7b	1	1	0	Negligible
E8a	0	0	0	Negligible
E8b	1	1	0	Negligible
E8c	1	1	0	Negligible
E9	0	0	0	Negligible
E10	0	0	0	Negligible
E11	0	0	0	Negligible
E12a	0	0	0	Negligible

E12b	1	1	0	Negligible
E12c	1	1	0	Negligible
E13	0	0	0	Negligible
E14a	0	0	0	Negligible
E14b	1	1	0	Negligible
E14c	1	1	0	Negligible
E15	0	0	0	Negligible
E16a	0	0	0	Negligible
E16b	1	1	0	Negligible
E16c	1	1	0	Negligible
E17a	0	0	0	Negligible
E17b	1	1	0	Negligible
N_1_GF	-	0	-	Negligible
N_2_GF	-	0	-	Negligible
N_3_GF	-	0	-	Negligible
N_4_GF	-	0	-	Negligible
N_5_GF	-	0	-	Negligible
N_6_GF	-	0	-	Negligible
N_7_GF	-	0	-	Negligible
N_8_GF	-	0	-	Negligible
N_9_GF	-	0	-	Negligible
N_10_GF	-	0	-	Negligible
N_11_GF	-	0	-	Negligible
N_12_GF	-	0	-	Negligible
N_13_GF	-	0	-	Negligible
N_14_GF	-	0	-	Negligible
N_15_GF	-	0	-	Negligible
N_16_GF	-	0	-	Negligible
N_17_GF	-	0	-	Negligible
N_18_GF	-	0	-	Negligible
N_19_GF	-	0	-	Negligible
N_20_GF	-	0	-	Negligible
N_21_GF	-	0	-	Negligible

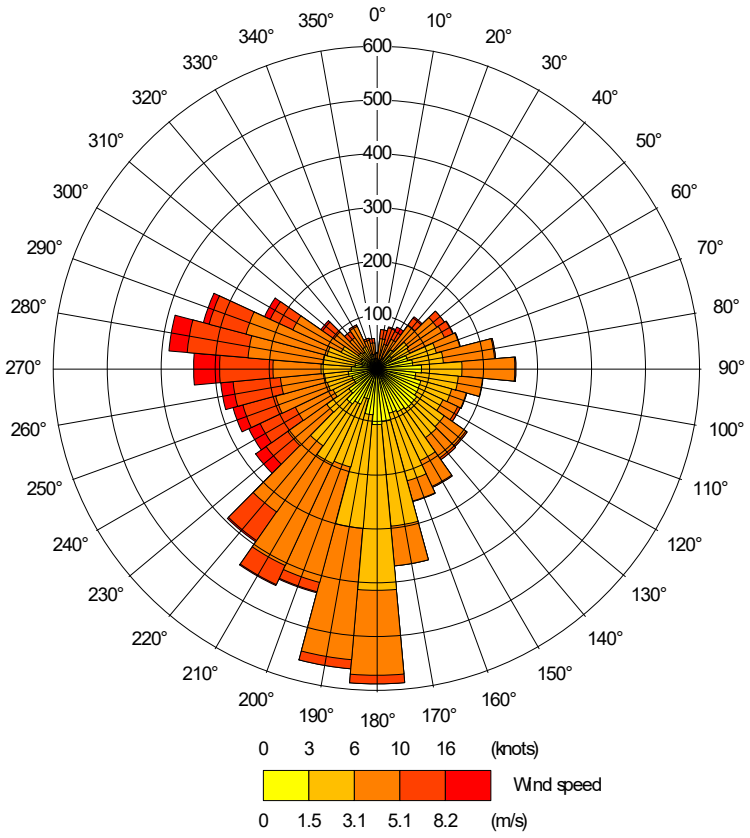
N_22_GF	-	0	-	Negligible
N_23_GF	-	0	-	Negligible

Operational Traffic (2029): Annual Mean $PM_{2.5}$ Results

Receptor ID	2029 Future Base (µg/m³)	2029 Operational (µg/m³)	Change (µg/m³)	Impact/ Exceed
DT1	8.0	8.0	0.0	Negligible
E1a	8.5	8.5	0.0	Negligible
E1b	8.2	8.2	0.0	Negligible
E2	8.3	8.3	0.0	Negligible
E3a	8.4	8.4	0.0	Negligible
E3b	8.1	8.1	0.0	Negligible
E4a	8.4	8.4	0.0	Negligible
E4b	8.1	8.1	0.0	Negligible
E5	9.1	9.1	0.0	Negligible
E6	9.1	9.1	0.0	Negligible
E7a	8.4	8.4	0.0	Negligible
E7b	8.2	8.2	0.0	Negligible
E8a	8.5	8.5	0.0	Negligible
E8b	8.2	8.2	0.0	Negligible
E8c	8.0	8.0	0.0	Negligible
E9	8.5	8.6	0.0	Negligible
E10	8.6	8.6	0.0	Negligible
E11	8.6	8.6	0.0	Negligible
E12a	8.6	8.6	0.0	Negligible
E12b	8.1	8.1	0.0	Negligible
E12c	7.9	7.9	0.0	Negligible
E13	8.5	8.5	0.0	Negligible
E14a	8.4	8.4	0.0	Negligible
E14b	8.0	8.0	0.0	Negligible
E14c	7.9	7.9	0.0	Negligible
E15	8.5	8.5	0.0	Negligible
E16a	9.5	9.5	0.0	Negligible

E16b	8.3	8.3	0.0	Negligible
E16c	8.0	8.0	0.0	Negligible
E17a	9.7	9.7	0.0	Negligible
E17b	8.3	8.3	0.0	Negligible
N_1_GF	-	9.0	-	Negligible
N_2_GF	-	8.9	-	Negligible
N_3_GF	-	8.9	-	Negligible
N_4_GF	-	8.8	-	Negligible
N_5_GF	-	8.7	-	Negligible
N_6_GF	-	8.6	-	Negligible
N_7_GF	-	8.6	-	Negligible
N_8_GF	-	8.5	-	Negligible
N_9_GF	-	8.5	-	Negligible
N_10_GF	-	8.5	-	Negligible
N_11_GF	-	8.7	-	Negligible
N_12_GF	-	9.4	-	Negligible
N_13_GF	-	9.3	-	Negligible
N_14_GF	-	9.1	-	Negligible
N_15_GF	-	9.3	-	Negligible
N_16_GF	-	9.3	-	Negligible
N_17_GF	-	8.7	-	Negligible
N_18_GF	-	8.7	-	Negligible
N_19_GF	-	8.6	-	Negligible
N_20_GF	-	8.5	-	Negligible
N_21_GF	-	8.5	-	Negligible
N_22_GF	-	8.5	-	Negligible
N_23_GF	-	8.5	-	Negligible

Appendix 5 – Wind Rose Manchester Airport 2019



Hilson Moran

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