

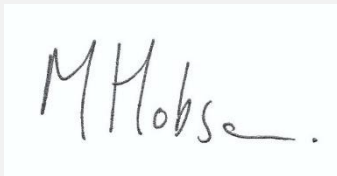
The background of the entire page is a photograph of a busy urban street. In the foreground, there is a line of vehicles, including several white delivery vans and a dark SUV, stopped at a traffic light. The road has white markings, including a "BUS LANE" and "AHEAD ONLY" sign. In the background, there are tall buildings and trees with autumn-colored leaves. The overall lighting is warm, suggesting late afternoon or early morning.

**Air Quality Assessment for
the proposed KFC restaurant
and drive thru at Altrincham
Rd, Baguley**

**Report to Soul Foods Group / KFC
UK**

January 2022

Title	Air Quality Assessment for the proposed KFC restaurant and drive thru at Altrincham Rd, Baguley
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1 Introduction

Aether has been commissioned by Soul Foods Group to undertake an air quality assessment for the proposed development in the existing Tesco Extra car park at Altrincham Road, Baguley. The development will consist of a KFC drive through and restaurant with 29 associated parking spaces. Although the proposed development includes parking, because the existing use is a Tesco Extra car park, the development is estimated to reduce the total number of car parking spaces on the site by 71. However, the Transport Assessment estimates that traffic flows will increase because of the development.

The development falls within Manchester City Council, which suffers from elevated levels of air pollution, primarily due to high levels of traffic. It is therefore important to assess whether there will be an exceedance of the air quality objectives for particulate matter (PM₁₀) or nitrogen dioxide (NO₂) at the proposed site and at nearby residential locations and then advise whether any action is required to reduce customers' and resident's exposure to air pollution. The assessment utilises ADMS-Roads, a comprehensive dispersion modelling tool for investigating air pollution problems due to small networks of roads and industrial sources.

The expected completion date of the proposed development is 2022. The assessment has therefore been completed for 2023, the expected first full year of operation.

1.1 The Location of the Development

The proposed development is located adjacent to Altrincham Road, a busy arterial road with relatively high traffic volumes. (Figure 1).

Figure 1: Location of the development site



1.2 Assessment Criteria

A summary of the air quality objectives relevant to the development site, as set out in the UK Air Quality Strategy¹, is presented in **Table 1** below.

Table 1: UK Air Quality Objectives for NO₂ and PM₁₀

Pollutant	Concentration	Measured as
Nitrogen Dioxide (NO ₂)	40 µg/m ³	Annual mean
	200 µg/m ³	Hourly mean not to be exceeded more than 18 times per year (99.8th percentile)
Particulate Matter (PM ₁₀)	40 µg/m ³	Annual mean
	50 µg/m ³	24 hour mean not to be exceeded more than 35 times a year (90.4th percentile)

The oxides of nitrogen (NO_x) comprise principally of nitric oxide (NO) and nitrogen dioxide (NO₂). NO₂ is a reddish brown gas (at sufficiently high concentrations) and occurs as a result of the oxidation of NO, which in turn originates from the combination of atmospheric nitrogen and oxygen during combustion processes. NO₂ can also form in the atmosphere due to a chemical reaction between NO and ozone (O₃). Health based standards for NO_x generally relate to NO₂, where acute and long-term exposure may adversely affect the respiratory system.

Particulate matter is a term used to describe all suspended solid matter, sometimes referred to as Total Suspended Particulate matter (TSP). Sources of particles in the air include road transport, power stations, quarrying, mining and agriculture. Chemical processes in the atmosphere can also lead to the formation of particles. Particulate matter with an aerodynamic diameter of less than 10 µm is the subject of health concerns because of its ability to penetrate deep within the lungs and is known in its abbreviated form as PM₁₀.

A growing body of research has also pointed towards the smaller particles as a metric more closely associated with adverse health impacts. In particular, particulate matter with an aerodynamic diameter of less than 2.5 micrometres, known as PM_{2.5}. Local Authorities in England have a flexible role² in working towards reducing emissions and concentrations of PM_{2.5} as there is no specific objective for them. However, there is a UK (excluding Scotland) annual mean objective of 25 µg/m³.

Further information on the health effects of air pollution can be found in the reports produced by the Committee on the Medical Effects of Air Pollutants³.

As defined by the regulations, the air quality objectives for the protection of human health are applicable:

- Outside of buildings or other natural or man-made structures above or below ground

¹ The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007), Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland. https://uk-air.defra.gov.uk/assets/documents/Air_Quality_Objectives_Update.pdf

² LAQM TG16 – paragraph 1.09

³ <https://www.gov.uk/government/collections/comeap-reports>

- Where members of the public are regularly present.

Using these definitions, the annual mean objectives will apply at locations where members of the public might be regularly exposed such as building façades of residential properties, schools and hospitals and will not apply at the building façades of offices or other places of work, where members of the public do not have regular access. The 24 hour objective will apply at all locations where the annual mean objective would apply together with hotels. Therefore, in this assessment the annual mean and 24 hour mean objectives do not apply at the development site but will apply at nearby residential locations. The hourly objective will apply at all locations where members of the public could reasonably be expected to spend that amount of time. Therefore, in this assessment the hourly objective will apply at the development site and at nearby residential locations.

1.3 Local Air Quality Management

Local authorities are required to periodically review and assess the current and future quality of air in their areas. Where it is determined that an air quality objective is not likely to be met, the authority must designate an Air Quality Management Area (AQMA) and produce an Air Quality Action Plan (AQAP).

The Greater Manchester Combined Authority (GMCA) has declared an AQMA covering the 10 districts of greater Manchester including the busiest arterial roads through the city⁴. This was declared in 2016 due to exceedances of the annual mean NO₂ objective. The proposed development is in the AQMA. An AQAP was published in 2016 and covers the period out to 2021 and states that "Greater Manchester local authorities will adopt the most recent IAQM/EPUK guidance for air quality assessment as current best practice, to help ensure that planning applications consider potential local air quality impacts and opportunities to improve air quality are realised."⁵. In addition, many other actions are identified to improve air quality in the region.

1.4 The ADMS-Roads Method

Local air quality has been assessed using ADMS-Roads, a comprehensive dispersion model that can be used to predict concentrations of pollutants in the vicinity of roads and small industrial sources. The model has been used for many years in support of planning applications for new commercial developments.

ADMS-Roads is able to provide an estimate of air quality both before and after development, taking into account important input data such as background pollutant concentrations, meteorological data, traffic flows and on-site energy generation (if applicable). The model output can be verified against local monitoring data to increase the accuracy of the predicted pollutant concentrations and this approach has been followed in this assessment.

The use of dispersion modelling enables estimates of concentrations to be made at varying heights. As a result, suggestions for appropriate mitigation measures can be made where necessary, taking into consideration the identification of worst-case locations.

⁴ https://uk-air.defra.gov.uk/aqma/details?aqma_ref=3367

⁵ https://www.manchester.gov.uk/downloads/download/4166/air_quality_reports

The most recent version of ADMS-Roads (v5) was issued in April 2020 and requires the following information to assess the impact at sensitive receptor locations:

- **Setup:** General site details and modelling options to be used
- **Source:** Source dimensions and locations, release conditions, emissions
- **Meteorology:** hourly meteorological data
- **Background:** Background concentration data
- **Grids:** Type and size of grid for output
- **Output:** Output required and sources/groups to include in the calculations.

2 Methodology

2.1 Local Pollutant Concentrations

It is good practice to include up-to-date local background pollutant concentrations in the assessment model, and also to verify modelled outputs against local monitoring data where available. This section provides an overview of the local data available for use in the assessment.

2.1.1 Local monitoring data

Manchester City Council has three automatic monitoring sites which measure nitrogen dioxide (NO₂) and particulate matter (PM₁₀). Unfortunately, all of these automatic monitoring sites are located more than 5km from the development site and are therefore unlikely to be representative. NO₂ concentrations are also measured passively at diffusion tube sites across the Borough. Details of the passive monitoring sites closest to the development site are given in **Table 2**. As shown below, unfortunately none of these are located within close proximity of the site either.

Monitoring results have been taken from the Council's 2019 Air Quality Annual Status Report (ASR)⁶.

Table 2: Monitoring sites closest to the KFC development site

Site Name	Site Type	Pollutant	Grid Reference	Distance to Kerb (m)	Approx. Distance to development site (m)
MA93NO	R	NO ₂	382419, 390010	3	2,320
MA94NO	R	NO ₂	382072, 388388	6	2,080
TR22NO	K	NO ₂	377061, 390086	1	3,240
TR18NO	UB	NO ₂	378822, 389010	15	1,420
MA8ANO	UB	NO ₂	381384, 387484	1.5	2,170
TR5NO	UB	NO ₂	379052, 392043	5	2,970

Note: R = roadside, K=kerbside, UB=urban background

The diffusion tubes were analysed by Staffordshire Scientific Services, who participate in the Proficiency scheme⁷. Whilst diffusion tubes provide an indicative estimate of pollutant concentrations, they tend to under or over read. The data is therefore

⁶ https://www.manchester.gov.uk/downloads/download/4166/air_quality_reports

⁷ This is a national QA/QC scheme.

corrected using a bias adjustment factor. There are two types of bias adjustment factor – local and national. The local factor is derived from co-locating diffusion tubes (usually in triplicate) with automatic monitors, whereas the national factor is obtained from the average bias from all local authorities using the same laboratory. Manchester City Council has applied a national bias adjustment factor of 0.85 to their 2019 diffusion tube results.

Monitoring results are presented in **Table 3**. The data shows that the annual mean NO₂ objective was exceeded once in 2019 at one of the monitoring sites, MA93NO. Diffusion tubes do not provide information on hourly exceedances, but research⁸ identified a relationship between the annual and 1 hour mean objective, such that exceedances of the latter were considered unlikely where the annual mean was below 60 µg/m³. Therefore, no exceedances of the hourly mean objectives are expected at the diffusion tube monitoring sites in the years shown.

Table 3: Monitoring results for sites close to the proposed development site, 2017-2019

Objective	Site Name	2017	2018	2019
Annual mean NO ₂ (µg/m ³)	MA93NO	NA	NA	42.9
	MA94NO	NA	NA	32.1
	TR22NO	32.1	33.7	35.3
	TR18NO	24.1	24	24.3
	MA8ANO	18.1	17.3	18
	TR5NO	29.2	26.6	28

Values exceeding the 40 µg/m³ annual mean objective are shown in bold, NA – data unavailable.

2.1.2 Background mapped data

Background pollutant concentration maps are available from the Defra LAQM website⁹ and data has been extracted for the local vicinity of the proposed development for this assessment. These 2018 baseline, 1 kilometre grid resolution maps are derived from a complex modelling exercise that takes into account emissions inventories and measurements of ambient air pollution from both automated and non-automated sites. The projections in the 2018 LAQM background maps are based on assumptions which were current before the Covid-19 outbreak in the UK. In consequence these maps do not reflect short or longer term impacts on emissions in 2020 and beyond resulting from behavioural change during the national or local lockdowns.

The estimated mapped background NO_x, NO₂ and PM₁₀ concentrations around the development site are 23 µg/m³, 16.6 µg/m³ and 11.8 µg/m³ respectively in 2019 (the base year used in the study). For 2023 (the estimated first full year of occupation), the concentrations obtained for the same pollutants are 19.1 µg/m³, 14.1 µg/m³, and 11.2 µg/m³ respectively.

Due to the lack of a nearby urban background monitoring site (the closest one is located more than 1.4km away and is therefore unlikely to be representative), the 2019 mapped background concentrations have been used in this assessment. To provide a conservative estimate, the projected improvements in background air quality by 2023

⁸ As described in Box 5.2 of LAQM Technical Guidance (TG16).

⁹ <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html>

have not been used in the dispersion modelling. This is in line with best practice to apply worst-case assumptions.

2.2 Model input data

Hourly meteorological data from Manchester Airport for 2019 has been used in the model. The wind-rose diagram (Figure 2) presents this below.

Figure 2: Wind-rose diagram for Manchester Airport meteorological data, 2019

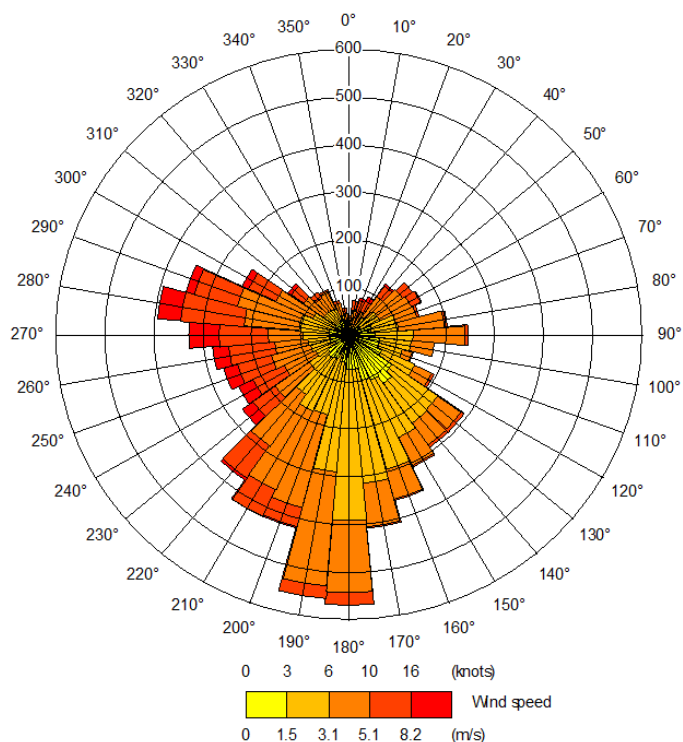
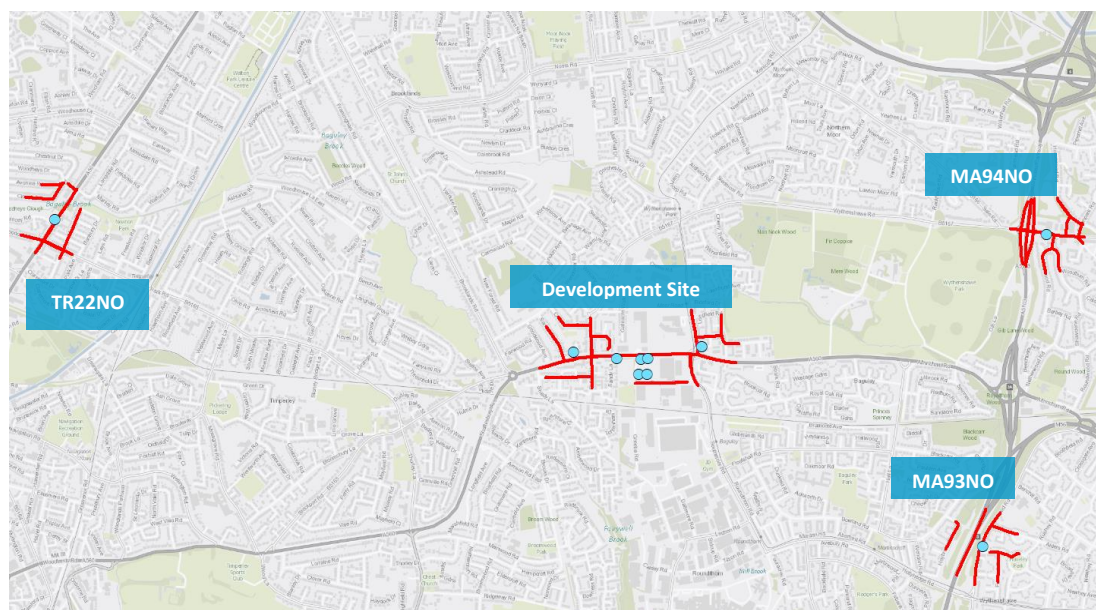


Figure 3: Road sources and receptors



Contains Ordnance Survey data © Crown copyright and database right [2021]

ArcMap software has been used to model the road source locations (red lines) that are within 200 metres of the receptor locations (blue circles). This data can then be automatically uploaded to ADMS-Roads. This generates an accurate representation of the surrounding area to be assessed in the model in terms of the length of roads and distances between sources and receptors. This is shown in **Figure 3** above. It is assumed that the contribution of other sources to NO₂ and PM₁₀ is included in the background concentrations.

Seven sensitive receptor locations have been selected for the assessment. A, B, C and D are all on the perimeter of the proposed site. These sites have been chosen to reflect the extremities of the site and their proximity to road traffic sources. The architect's plans (**Figure 4**) show the development site in more detail with receptor locations highlighted (blue circles).

Four existing sensitive receptors have also been modelled:

- E1: a dwelling situated adjacent to Altrincham Road and 100m east of the development site
- E2: a doctor's surgery situated adjacent to Altrincham Road and under 350m from the development site
- E3: ground floor at the southwestern most corner of a dwelling at the junction of Altrincham Road with Moor Road
- E4: first floor at the southwestern most corner of a dwelling at the junction of Altrincham Road with Moor Road

These sites, shown in figure 5, represent existing receptor locations with likely worst-case exposure.

Figure 4: The location of the receptors at the development site used in the modelling

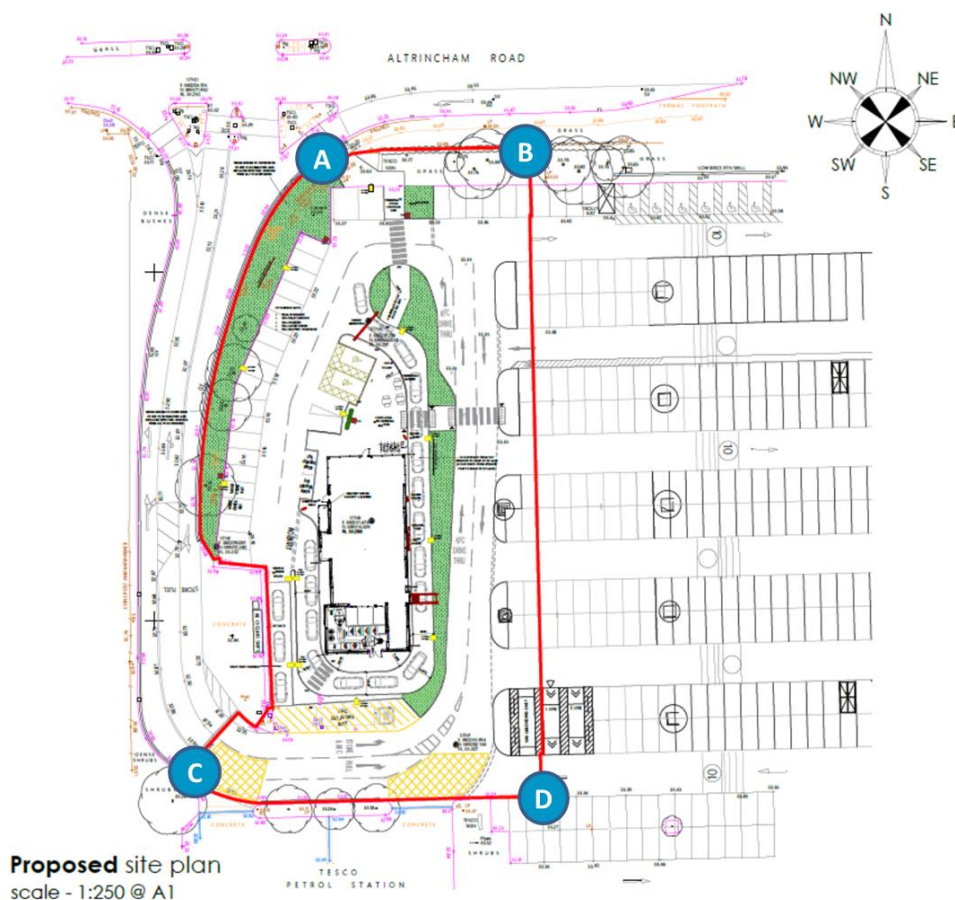
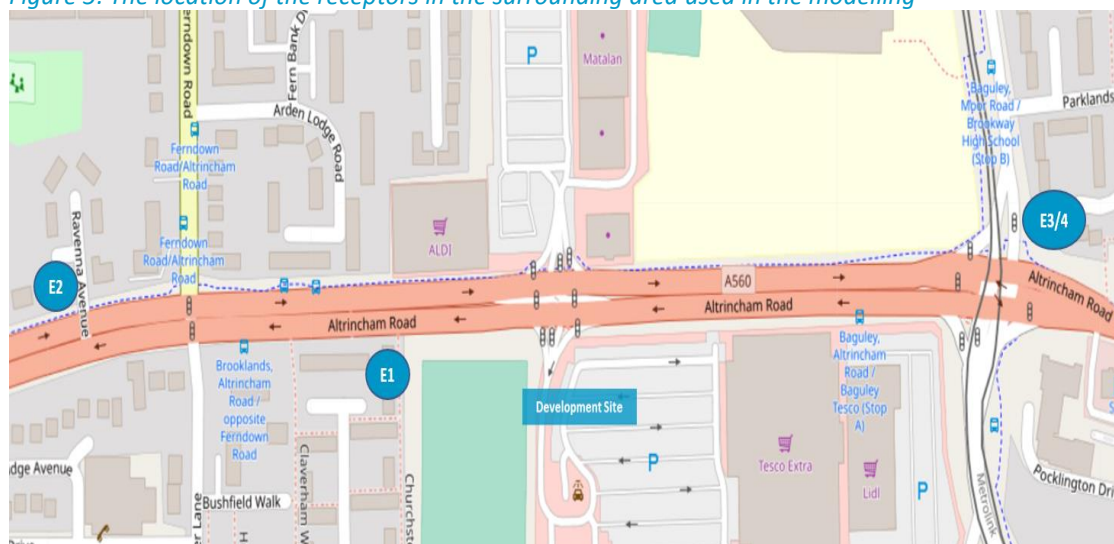


Figure 5: The location of the receptors in the surrounding area used in the modelling



2.3 Traffic data

Average annual daily traffic (AADT) count data for 2019 (the selected baseline year) has been obtained for Altrincham Rd, Princess parkway, Greenwood Rd, Heyes Lane, Brooklands Rd, Greenpark Rd, M56, Washway Rd, A56, Banbury Drive, Wythenshawe

Rd, Floatshall Rd and Palatine Road from Department for Transport (DfT) Traffic Counts¹⁰, which provides data for major roads. In the absence of any other data being available for the minor roads, estimates are based upon AADT values for local roads which are comparable in traffic volume and mixture. Therefore there will be uncertainty in the model input. All roads within 200 metres of the modelled receptors have been included in the assessment. The values are shown in Appendix B.

For the purpose of this assessment, the RTF model has been utilised to project traffic growth. It has been assumed that traffic on local roads will increase by 4.6 % between 2019 and 2023.

Consultation with transport planners at Mode Transport Planning¹¹ concludes that the development will result in a maximum of 294 additional daily vehicular trips, with 0.2% of these additional vehicular trips being Heavy Duty Vehicles (HDVs). The resulting estimated increase in daily car trips has been taken into account in the assessment for roads with direct access to the site with development in 2023. Results (**Section 3** of this report) therefore refer to concentrations modelled in 2023 both without and with the proposed development.

Average speeds of 29.6, 29, 62.3, 24.9 and 29.1 kph have been assumed for Altrincham Road, Princess Parkway, M56, A56 and Banbury Drive respectively. These speeds are the average traffic speeds for these roads in 2019¹². In the absence of any other data being available for other modelled roads, average speeds have been assumed to be equal to the average speed in Manchester in DfT's table CGN0501b in the same data set, equal to 24.5 kph.

2.3.1 Queuing Traffic

Special consideration has been given to notable junctions modelled in this assessment. CERC note 60¹³ has been used for estimating emissions from queuing traffic. This defines a representative AADT for queuing traffic to be 30,000 at 5 kph, assuming an average vehicle length of 4 m. These figures, along with the traffic composition of the corresponding roads were then input into the Emission Factor Toolkit (EFT)¹⁴ to calculate emission rates. The emission rates were then used within the dispersion model as separate road sources of pre-defined length, representing each queue with time-varying emission profiles applied to represent busy periods. Traffic queues have been modelled along parts of Altrincham Road, Southmoor Road, Moor Road, Park Road, Homewood Road, Palatine Road, Ferndown Road, Princess Parkway and Manchester Road. Consideration has also been given to a bus stop located on Palatine Road, adjacent to monitoring site MA94NO. This has been modelled on ADMS by a road link of width 4 m with a vehicle speed of 5 kph, to try to take account of the emissions produced due to buses idling at the bus stop. DfT count site data along this road suggests that the traffic volumes of buses will have an AADT of 421¹⁵, with the link modelled as 100% HDV traffic.

¹⁰ <http://www.dft.gov.uk/traffic-counts>

¹¹ Personal communication with Claire Stapenhill at Mode Transport Planning on the 7th December 2021

¹² Department for Transport statistics, Table CGN0501c

¹³ Cambridge Environmental Research Consultants Ltd, Modelling Queuing Traffic – note 60, 20th August 2004

¹⁴ Latest version v11, <https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/>

¹⁵ <https://roadtraffic.dft.gov.uk/manualcountpoints/944408>

2.4 Conversion of NO_x to NO₂

Evidence shows that the proportion of primary NO₂ in vehicle exhaust has increased¹⁶. This means that the relationship between NO_x and NO₂ at the roadside has changed from that currently used in the ADMS model. A NO_x to NO₂ calculator (Published in August 2020)¹⁷ has therefore been developed and has been used in conjunction with the ADMS model to obtain a more accurate picture of NO₂ concentrations.

2.5 Model Verification

Model verification refers to checks that are carried out on model performance at a local level. This involves the comparison of predicted versus measured concentrations. Where there is a disparity, the first step is to check the input data and the model parameters in order to minimise the errors. If required, the second step will be to determine an appropriate adjustment factor that can be applied.

In the case of NO₂, the model should be verified for NO_x as the initial step and should be carried out separately for the background contribution and the source (i.e. road traffic). Once the NO_x has been verified and adjusted as necessary, a final check should be made against the measured NO₂ concentration.

For this project, modelled annual mean road-NO_x estimates have been verified against the concentrations measured at three diffusion tube sites, MA93NO, MA94NO, and TR22NO (see **Appendix A**). These sites were selected because they represent the monitoring sites closest to the proposed development for which traffic data was available. However, it is worth noting that none of these sites lie in close proximity to the development site and therefore there will be uncertainty in the modelled results.

The adjustment factor determined for annual mean NO_x concentrations was also applied to the modelled annual mean PM₁₀ concentrations. This was done as no PM₁₀ monitoring data that is representative of the development site is available, and this approach was considered more appropriate than not applying any adjustment¹⁸.

3 Results

3.1 Results of the Dispersion Modelling

Table 4 below provides the estimated pollutant concentrations in the development year (2023) without¹⁹ and with the development. Given the inherent uncertainties in the modelling, background pollutant concentrations and vehicle fleet emission factors have been maintained at 2019 levels in the development year scenarios to provide a conservative estimate. Traffic growth has been predicted using the RTF calculator.

¹⁶ <http://uk-air.defra.gov.uk/assets/documents/reports/ageg/primary-no-trends.pdf>

¹⁷ <https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOXNO2calc>

¹⁸ Paragraph 7.529 of LAQM TG(16)

¹⁹ 'With' development includes the impact of the additional traffic that will be generated with the development.

Table 4: Estimated pollutant concentrations in 2023 without and with the development ($\mu\text{g}/\text{m}^3$)

Receptor type	Floor level	Receptor	Annual mean NO ₂ concentration ($\mu\text{g}/\text{m}^3$)		Annual mean PM ₁₀ concentration ($\mu\text{g}/\text{m}^3$)		NO ₂ Change	PM ₁₀ change
			Without development	With development	Without development	With development		
Development Site Receptors	Ground	A	26.4	26.4	12.7	12.7	<0.1	<0.1
		B	26.7	26.8	12.9	12.9	<0.1	<0.1
		C	25.1	25.1	12.2	12.2	<0.1	<0.1
		D	25.2	25.2	12.2	12.2	<0.1	<0.1
Nearby Sensitive Receptors	Ground	E1	27.8	27.8	13.3	13.3	<0.1	<0.1
		E2	27.7	27.8	13.3	13.3	<0.1	<0.1
		E3	30.0	30.0	14.0	14.0	<0.1	<0.1
	First	E4	28.6	28.6	13.5	13.5	<0.1	<0.1

Note: The changes in NO₂ and PM₁₀ presented may not exactly equal the difference in the constituent parts shown due to rounding.

Nitrogen dioxide

In the without development scenario, the model predicts annual mean NO₂ concentrations to be 34% below the annual mean objective at all locations. It is worth noting however that the annual mean objective will not apply at the development site, but will occur at nearby residential locations. The worst-case location is identified as E3, at ground level at the junction of Altrincham Road, Southmoor Rd and Moor Road, where roadside concentrations will be maximised.

The estimated annual mean NO₂ concentrations at the development site are reasonable when compared to the data collected at the monitoring sites. For example, the monitoring site TR22NO which, like the development site, is situated on a busy A road has recorded higher NO₂ concentrations than at the development site. This is expected though as monitoring site TR22NO is located on an A road with a slightly higher AADT than the A road adjacent to the development site and it is also located only 1m from the kerb whereas the receptors placed at the development site are set further back.

The Guidance states that authorities may assume exceedances of the hourly mean objective are only likely to occur where annual mean concentrations are 60 µg/m³ or above. Therefore, it is considered highly unlikely that this objective will be exceeded at any of the receptors.

The model has also been run for a with development scenario taking into account predicted increases to traffic levels due to the development. The results indicate that annual mean NO₂ concentrations would increase by less than 0.1 µg/m³ at worst-case locations.

Particulate matter

The model estimates no exceedance against the annual mean PM₁₀ objective. Potential exceedances of the daily mean PM₁₀ objective can be estimated based on the annual mean²⁰, such that:

$$\begin{aligned} \text{No. 24 – hour mean exceedances} \\ = -18.5 + 0.00145 \times \text{Annual Mean}^3 + \left(\frac{206}{\text{Annual Mean}} \right) \end{aligned}$$

On this basis, it is estimated that in 2023 there will be no exceedances of the daily mean PM₁₀ limit value, regardless of whether the development takes place or not. Therefore, the daily mean PM₁₀ objective would be met.

For estimating PM_{2.5} concentrations, where no appropriate sites measuring both PM₁₀ and PM_{2.5} are available, then a nationally derived correction ratio of 0.7 can be used²¹. If this factor is used, then all locations in the modelling meet the UK annual mean PM_{2.5} limit value of 25 µg/m³.

3.2 Significance

Professional judgement is an important part of the assessment of significance. However, there are various documents available that attempt to qualitatively or quantitatively provide ways of assessing the significance of a development on air quality. The most commonly applied is Environmental Protection UK's Air Quality Guidance Document²²

²⁰ Paragraph 7.92 of LAQM TG(16)

²¹ LAQM: TG16, paragraph 7.109

²² <http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf>

which outlines how impacts may be assessed quantitatively. The assessment is made up of two steps – firstly to assess the magnitude of change in concentration (e.g. between with and without development) relative to the objective level, and secondly the percentage above/below the objective based upon the total modelled concentration at a given location or receptor. By combining these two values, you can obtain the impact descriptor. This method is presented in **Table 5** below.

Table 5: Significance of change description

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75 % or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94 % of AQAL	Negligible	Slight	Moderate	Moderate
95-102 % of AQAL	Slight	Moderate	Moderate	Substantial
103-109 % of AQAL	Moderate	Moderate	Substantial	Substantial
110 % or more of AQAL	Moderate	Substantial	Substantial	Substantial

In addition to the criteria provided above, the Guidance document states that the table is intended to be used by rounding the change in percentage pollutant concentrations to whole numbers. Changes of 0 % i.e. less than 0.5 % are described as negligible.

The long term average concentration at the E3 receptor (the worst case receptor in terms of modelled pollutant concentrations in the modelling) in the assessment year (2023) is 75% of the Air Quality Assessment Level (AQAL) and the change in concentration relative to the AQAL as a result of the proposed development at this location is 0.25%.

In applying these criteria, it can be concluded that the impact of the development on local annual mean NO₂ concentrations is likely to be ‘negligible’.

However, this is a fairly simplistic conclusion and other factors may also need to be considered in order to make transparent conclusions. Specific factors to consider may include:

1. Number of properties affected by the slight, moderate or major impacts and a judgement of the overall balance
2. Where new exposure is being introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective or limit value will be relevant
3. The magnitude of the changes and descriptions of the impacts at the receptors
4. Whether or not an exceedance of an objective or limit value is predicted to arise in the study area where none existed before or an exceedance area is substantially increased
5. Whether or not the study area exceeds an objective or limit value and this exceedance is removed or the exceedance area is reduced
6. Uncertainty, including the extent to which worst case assumptions have been made
7. The extent to which an objective or limit value is exceeded, for example an annual mean of 41 µg/m³ should attract less significance than an annual mean of 51 µg/m³.

In this case, none of the above criteria are of significance, suggesting that there will be no concerns in terms of exposure to harmful pollutant concentrations across the study area.

3.3 Mitigation Measures

Based on the ADMS results, there is no specific requirement for mitigation, as concentrations are estimated to meet all of the objective levels.

However, it is widely acknowledged that there is no safe level of exposure to air pollution²³ and the development is expected to have a 'slight' impact, and as such, the developer is encouraged to consider further mitigation measures to reduce emissions arising from the site. The National Planning Policy Framework²⁴, requires new developments to support sustainable travel and air quality improvements. A key theme of the NPPF is that developments "should ensure that appropriate opportunities to promote sustainable transport can be – or have been taken up". It states that developments should be located and designed where practical to:

- Give priority to pedestrian and cycle movements and have access to high quality public transport facilities. *As outlined in the Transport Assessment, the location of the application site is such that there is a well-established network of pedestrian and cycle routes along key highway links providing good connectivity to nearby bus and tram stops.*
- Incorporate facilities for charging plug-in and other ultra-low emission vehicles.
- A key tool to facilitate the above will be a Travel Plan. All developments which generate a significant amount of movement should be required to provide a Travel Plan. *A Framework Travel Plan has been produced.*

3.4 Mitigating the Impacts of the Construction Phase

Emissions and dust from the construction phase of a development can have a significant impact on local air quality. The Institute of Air Quality Management (IAQM) has produced a document titled 'Guidance on the assessment of dust from demolition and construction'²⁵ published in May 2015. This guidance contains a methodology for determining the significance of construction developments on local air quality using a simple four step process:

- STEP 1: Screen the requirement for a more detailed assessment
- STEP 2: Assess the risk of dust impacts
- STEP 3: Determine any required site-specific mitigation
- STEP 4: Define post mitigation effects and their significance.

The risk of dust emissions from a demolition/construction site causing loss of amenity and/or ecological impacts is related to a number of factors, including: the activities being undertaken; the duration of these activities; the size of the site; the mitigation measures implemented and meteorological conditions. In addition, the proximity of receptors to the site and the sensitivity of these receptors to dust, impacts the level of risk from dust emissions. Receptors include both 'human receptors' and 'ecological receptors'. The former refers to a location where a person or property may experience

²³ <https://www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution>

²⁴ <https://www.gov.uk/government/publications/national-planning-policy-framework--2> Published in July 2018

²⁵ <http://iaqm.co.uk/guidance/>

adverse effects for airborne dust or dust soiling, or exposure to PM₁₀, over a time period relevant to the air quality objectives (see **Table 1**). Ecological receptors are defined as any sensitive habitat affected by dust soiling, through both direct and indirect effects. Following assessment of the impacts of dust as a result of the development, a qualitative risk impact level can be assigned, ranging from 'negligible' to 'high risk'. Based on the designated risk impact level, the mitigation measures which are appropriate for all sites and are applicable specifically to demolition, earthworks, construction and trackout can be determined. Examples of the general measures include:

- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site
- Ensure all vehicles switch off engines when stationary – no idling vehicles
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable
- Ensure all loads entering and leaving the site are covered
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation

The use of the outlined IAQM methodology for assessing the impacts of dust from demolition/construction is considered to be current best practice. Therefore, it is recommended that the developer refers to the relevant IAQM documentation, to help reduce the impact of dust and vehicle exhaust emissions, and liaises with the Local Authority to come up with an acceptable dust management strategy.

4 Summary and Conclusions

An air quality assessment has been undertaken for a proposed commercial development at Altrincham Road. The Greater Manchester Combined Authority has declared one AQMA, due to the exceedance of the annual mean nitrogen dioxide (NO₂) objective. The proposed development falls within this AQMA.

A conservative approach with regards to expected improvements to air quality has been taken in that no improvement in the pollutant background concentrations or road transport emission factors has been assumed between the base year (2019) and the first year of occupation (2023). With expected improvements to the traffic fleet, improvements in pollutant concentrations may however materialise. This is in line with best practice to apply worst-case assumptions.

The ADMS-Roads dispersion model has been used to determine the impact of emissions from road traffic on sensitive receptors. Predicted concentrations have been compared with the air quality objectives. The results of the assessment indicate that annual mean NO₂ concentrations are below the objective in the 'without' development scenario at all receptors modelled. Concentrations of particulate matter (PM₁₀) are also predicted to be below the annual mean objective in the 'with' development scenario. Based on the evidence it is estimated that there will be no exceedances of either short term objective for NO₂ or PM₁₀. The 'with' development scenario predicts that the development will cause NO₂ and PM₁₀ concentrations to increase by <0.1µg/m³ as a result of the proposed development. Therefore, no mitigation is required as the air quality objectives are predicted to be met and the impact is negligible. Instead, other measures such as implementing a travel plan are being undertaken to reduce the emissions arising from

the development. In addition, the developer is encouraged to refer to the IAQM's 'Guidance on the assessment of dust from demolition and construction' to minimise the impact of the construction phase on local air quality.

Appendix A – Model Verification

In order to verify modelled pollutant concentrations generated in the assessment, the model has been run to predict the annual mean road-NO_x concentration during 2019 at the three diffusion tube sites described in **Table 2**.

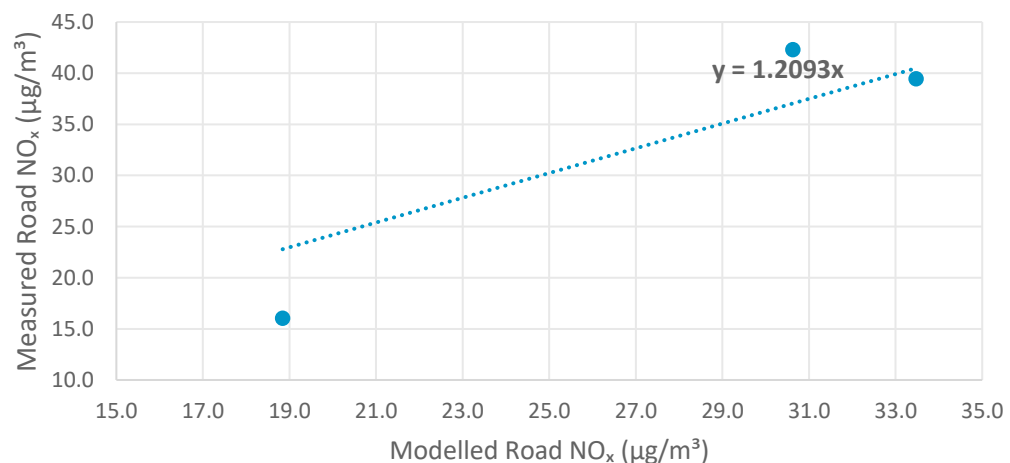
The model output of road-NO_x has been compared with the ‘measured’ road-NO_x. Measured NO_x for the monitoring sites was calculated using the NO_x to NO₂ calculator¹⁷.

A primary adjustment factor was determined to convert between the ‘measured’ road contribution and the model derived road contribution (**Figure A.1**). This factor was then applied to the modelled road-NO_x concentration for each receptor to provide adjusted modelled road-NO_x concentrations. Total NO₂ concentrations were then determined by combining the adjusted modelled road-NO_x concentrations with the 2019 background NO₂ concentration.

The results imply that the model was under-predicting the road-NO_x contribution. This is a common experience with ADMS and most other models.

The largest difference between measured and modelled emissions occurred at monitoring site MA93NO. This site was challenging to model due to the presence of a bus stop on the road adjacent to the modelling site. The site was also close to an elevated A road with associated slip roads, for which AADT values were hard to estimate. These factors will have increased uncertainty at site MA93NO.

Figure A.1: Comparison of Measured road-NO_x to unadjusted modelled road-NO_x concentrations



RMSE

The root mean square error (RMSE) is used to define the average error or uncertainty of the model. The following RMSE value has been calculated:

NO₂: 3.5

If the RMSE values are higher than ±25 % of the objective being assessed, it is recommended that the model inputs and verification should be revisited in order to make improvements. Ideally an RMSE within 10 % of the objective would be derived. In this case the model is being assessed against the annual mean objective, which is 40

$\mu\text{g}/\text{m}^3$ for NO_2 . An RMSE value of less than 10 % of the objective (less than $4 \mu\text{g}/\text{m}^3$) is obtained and therefore the model behaviour is acceptable.

Appendix B – Traffic Data

Table B.1: Traffic data for 2019 (and prediction for 2023 without development)

Development/ verification site	Road links	Annual Average Daily Traffic (AADT)	% Heavy Duty Vehicles (HDV)	Speed (kph)
Development site	Altrincham Rd	25,927 (27,122)	2.5	30
Verification sites	Princess parkway	122,887 (128,552)	3.9	29
	Greenwood Rd	8,887 (9,297)	1.8	24
Development site	Heyes Lane	4,181 (4,374)	0.3	24
	Brooklands Rd	16,698 (17,468)	0.6	24
Verification sites	Greenpark Rd	754 (789)	1.5	24
	M56	174,693 (182,746)	5.8	62
	Washway Rd, A56	30,659 (32,072)	3.3	25
	Banbury Drive	224 (234)	0.4	29
Development site	Wythenshawe Rd	8,173 (8,550)	1.0	24
Verification sites	Floatshall Rd	5,560 (5,816)	2.2	24
	Palatine Road	14,447 (15,113)	2.9	24

Note: With development results in an average daily traffic increase of 294 vehicles on all roads that have direct access to the site.



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