MEMO

TO	Jon Phillip	**FROM**	Amber Sunderland
DATE	**15 December 2021**	**CONFIDENTIALITY**	**Internal**
SUBJECT	**70053766 – The Groves, York**		

WSP has completed a preliminary investigation to show indicative changes in air pollutant concentrations of nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$) following implementation of a number of Experimental Traffic Regulation Orders (ETROs) within The Groves, York.

The ETRO's were introduced in September 2020 as part of a programme of measures to improve safety, air quality and pedestrian accessibility by implementing a Low Traffic Neighbourhood (LTN), re-routing traffic from predominantly residential areas to main roads (hereafter referred to as 'the scheme').

The scheme has the potential to generate air quality improvements and deteriorations in the wider area due to increased pedestrian and cycle access and the re-routing of traffic flows. The scheme also has the potential to impact the City of York Council's voluntary Clean Air Zone (CAZ)[1] through the reduction of concentrations at certain receptors due to the re-routing of traffic and bus routes.

The aim of this investigation is to assess the potential changes in air pollutant concentrations, and indicative magnitude thereof, resulting from changes in traffic flows near selected local residential and educational receptors as a result of the scheme. Outcomes of the investigation found that the scheme will lead to increases and decreases in ambient pollutant concentrations near selected receptors due to increasing and decreasing traffic flows associated with the scheme along the respective road network.

This memo provides a summary of the data used in the investigation, the assessment methodology and the indicative changes in ambient pollutant concentrations as a result of implementing the scheme.

It should be noted that this investigation does not serve as an air quality impact assessment for compliance purposes, rather it is aimed toward assessing the nature of changes in air quality following implementation of the scheme (i.e.: increasing or decreasing concentrations) for indicative purposes only.

DATA USED

Table 1 below lists the data sources and guidance documents followed for the purpose of investigating indicative changes in air quality following implementation of the scheme.

Table 1: Data used for dispersion modelling investigation

Data/Resource	Summary	Source/Reference
Department for Environment, Food and Rural Affairs (Defra) national background pollutant mapping data	Background 1km x 1km grid pollutant data obtained for the respective grid squares encompassing the study area	Annual mean data sourced from Defra: https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

[1] City of York Council [online] Accessed Air Quality Action Plan – City of York Council

Defra Local Air Quality Management (LAQM) tools	A suite of tools to enable collation of vehicle emissions inventory data, background pollutant mapping data adjustment, and conversion of nitrogen oxide (NO_X) to NO_2	All LAQM tools sourced from Defra: *https://laqm.defra.gov.uk/review-and-assessment/tools/tools.html*
Air Dispersion Modelling System for Roads (ADMS-Roads)	Dispersion model capable of predicting dispersion of vehicle emissions from the assessed road network and calculating pollutant concentrations at identified receptors	ADMS-Roads v5.0.0.1 developed by Cambridge Environmental Research Consultants (CERC) Ltd
Past and current year (2020 and 2021) Annual Average Weekday Traffic (AAWT) traffic data for all model scenarios	Traffic data provided in appropriate format to enable air pollutant emissions inventory (NO_X) databases to be generated prior to dispersion modelling	Data supplied by project transport consultant (WSP) based on Saturn modelling.
Meteorological data	Hourly sequential met data obtained for input to ADMS-Roads model.	Data from Linton-on-Ouse monitoring station for year 2021.
Local air quality management Technical Air Quality Guidance (LAQM.TG(16))	Guidance document, including information on dispersion modelling and model verification / adjustment	Defra (2018) *Local Air Quality Management Technical Guidance TG16*[2]
Land Use Planning & Development Control Guidance	Guidance provided by the Environmental Protection UK (EPUK)/Institute for Air Quality Management (IAQM) that includes air quality impact descriptor criteria	Document published by EPUK/IAQM (2017) *Land-Use Planning & Development Control: Planning for Air Quality*[3]
Design Manual for Roads and Bridges (DMRB) – Air Quality	DMRB guidance for assessing air quality impacts on sensitive human receptors and designated ecological sites	DMRB LA 105 Air Quality[4]

DISPERSION MODELLING

Model Domain

The study area included the Air Quality Management Area (AQMA), associated roads and selected sensitive receptors. (**Figure 1**). The affected road network is located within the City of York Council's AQMA Number 5, designated in 2018 for exceedances of NO_2.

[2] Department for Environment, Food and Rural Affairs (2018) 'Local Air Quality Management Technical Guidance' LAQM-TG16-February-18-v1.pdf (defra.gov.uk)

[3] EPUK/IAQM (2017) Land-Use Planning & Development Control: Planning for Air Quality

[4] Design Manual for Roads and Bridges. Volume 11, Section 3, Part 1, HA207/07 Air Quality (2007)

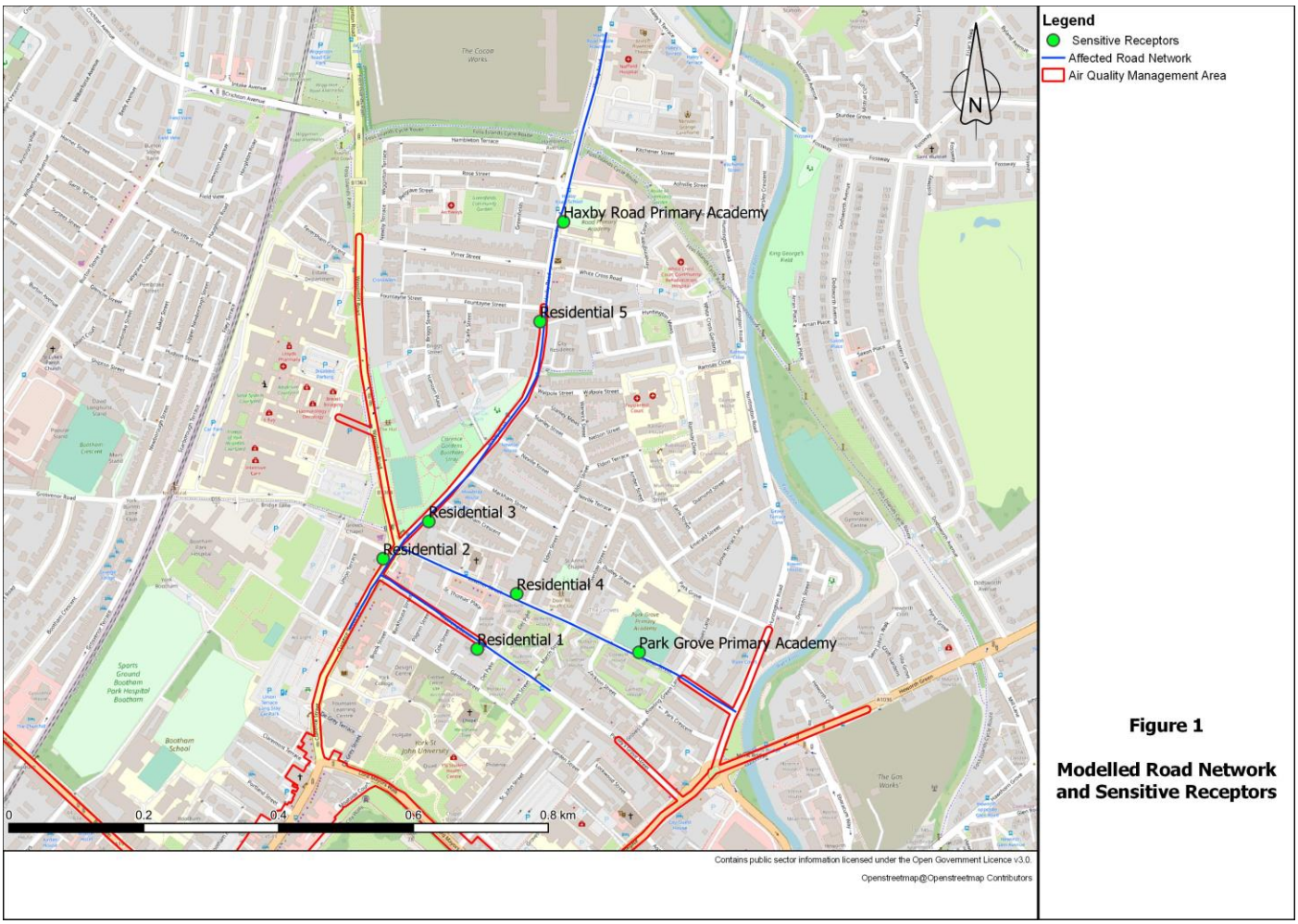

Figure 1: Modelled Road Network and Sensitive Receptors

Model Setup

The investigation focused on the year before implementation of the scheme 'Without Scheme 2020' and one year after the changes were implemented 'With Scheme 2021'. **Table 1** presents the roads selected for inclusion in the air dispersion model and the associated AAWT predictions for (Without Scheme 2020) and (With Scheme 2021) scenarios. Street Canyons were applied to all roads, with all associated discrete receptors positioned accordingly.

Table 2: Roads selected for air dispersion modelling

Road	Link ID	Without 2020 AAWT	With 2021 AAWT
Lowther Street	1_1	5759	556
Haxby Road (North)	1_3	12,312	13,819
Haxby Road (South)	1_4	10,243	13,839
Townend Street	1_5	3133	834

Vehicle Emissions Inventories

The traffic data were used to develop NO_X, PM_{10} and $PM_{2.5}$ emissions inventory databases for each scenario using the Defra Emissions Factors Toolkit (EFT) version 11.0. This accounts for traffic flow characteristics, including:

- Road type (e.g. urban, rural, motorway);
- Total vehicle flow by link (AADT);
- Percentage of Heavy-Duty Vehicles (HDVs) per link; and
- Average link speed (km/h).

The emissions database outputs for each respective scenario provided road link-specific pollutant emission rates (g/km/s), which were input to the ADMS-Roads model to enable prediction of road-NO_X concentrations at identified sensitive receptor locations.

Model Verification

Verification of the ADMS-Roads model outputs was not completed due to insufficient traffic data for 2019. The year 2019 is considered the last suitable model verification year, prior to COVID-19 social restrictions which impacted traffic flows. However, given that the air quality investigation is intended to provide an indication of the impact of the scheme and not an assessment of compliance, model verification was not considered necessary to meet the requirements of the study.

LIMITATIONS

The limitations of the study are listed below.

- The traffic data collected in 2020 may have been impacted by changes in behaviour due to the restrictions in travel placed during the COVID-19 pandemic. Therefore, these data are likely to be unrepresentative of traffic flows collected in a normal year.
- A formal model verification study was unable to be undertaken as monitoring data in 2020 may have been impacted by the changes in traffic flows during the COVID-19 pandemic, reducing confidence in the accuracy of the predicted concentrations at receptors, but not the resultant percentage changes in concentrations due changes in traffic flows associated with the scheme.
- AADT flows were not provided as a full year of traffic data was not available. The AAWT flows provided were used to undertake the comparison and have been assumed representative of the changes in traffic flows from the scheme, as advised by the project transport consultant (WSP).
- Meteorological data obtained from Linton-on-Ouse station was assumed representative of site conditions as no site-specific data is available.
- The traffic model data used within the dispersion model does not consider the modal shift to public and active transport modes that will be driven as part of the scheme, nor any mitigation measures proposed such as improved signing and traffic re-routing to reduce queuing and congestion at junctions.
- There are uncertainties associated with both measured and predicted concentrations. The model (ADMS-Roads) used in this assessment relies on input data (including predicted traffic flows), which are subject to uncertainty. The model itself simplifies complex physical systems into a range of algorithms. In addition, local micro-climatic conditions may affect the concentrations of pollutants that the ADMS-Roads model will not consider.

RESULTS

Model predicted annual mean NO_2 concentrations at selected sensitive receptors for the Without Scheme 2020 and With Scheme 2021 scenarios are provided in **Table 3**. The highest predicted concentration for the Without Scheme 2020 is 19.3 µg/m^3 at Residential 3 located on Haxby Road, north of the scheme. However, local air quality at Residential 3 is predicted to experience the lowest deterioration (i.e. increase in concentrations) of 1.6 %, increasing annual mean NO_2 to 19.6 µg/m^3 in the With Scheme 2021 scenario. The maximum deterioration is observed at Haxby Road Primary Academy, which is predicted to experience a 3.3 % increase in annual mean NO_2 from 18.0 µg/m^3 in the Without Scheme 2020 scenario, to 18.3 µg/m^3 in the With Scheme 2021 scenario. Similarly, increased NO_2 concentrations are also observed at Residential 2 (2.9 %) and Residential 5 (2.3 %) due to increased traffic flow along Haxby Road. The

maximum improvement (i.e.: decrease in concentrations) is observed at Park Grove Primary Academy, with an 11.9 % reduction in annual mean NO_2 from 16.0 µg/m^3 in the Without Scheme 2020 scenario to 14.1 µg/m^3 in the With Scheme 2021 scenario. Other receptors predicted to experience improvements in local air quality are Residential 1 (Lowther Street) and Residential 4 (Townsend Street), showing percentage changes of -3.4 % and -9.6 %, respectively, following implementation of the scheme.

The NO_2 results show that the magnitude of change toward air quality improvement tends to be greater than the magnitude of change toward air quality deterioration as a result of the scheme.

*Table 3: Impact of change in NO_2 Concentration on local sensitive receptors**

Receptor	Without (µg/m^3)	With (µg/m^3)	Change(%)
Haxby Road Primary Academy	18.0	18.6	3.3
Park Grove Primary Academy	16.0	14.1	-11.9
Residential 1	14.6	14.1	-3.4
Residential 2	17.1	17.6	2.9
Residential 3	19.3	19.6	1.6
Residential 4	15.7	14.2	-9.6
Residential 5	17.1	17.5	2.3

* The Air Quality Strategy (AQS)[5] objective for annual mean NO_2 is 40 ug/m^3

Model predicted annual mean PM_{10} concentrations at selected sensitive receptors for the Without Scheme 2020 and With Scheme 2021 scenarios are provided in **Table 4**. The highest predicted concentration for the Without Scheme 2020 is 13.3 µg/m^3 at Residential 3, which is predicted to experience a 0.8 % increase to 13.4 µg/m^3 in the With Scheme 2021 scenario. Similarly, increased NO_2 concentrations of 0.8 % are also observed at Haxby Road Primary Academy, Residential 2, Residential 3 and Residential 5 due to increased traffic flow along Haxby Road. Whilst the above are all representative of air quality deterioration, it is noted that the magnitude of these changes fall below 1 %. The largest magnitude of change is observed at Park Grove Primary Academy with a 3.1 % reduction in annual mean PM_{10} from 12.9 µg/m^3 in the Without Scheme 2020 scenario to 12.5 µg/m^3 in the With Scheme 2021 scenario. Other receptors that are predicted to experience air quality improvements include Residential 1 and Residential 4 (Lowther Street and Townsend Street, respectively) showing percentage changes of -0.8 % and -2.3 %, respectively. Therefore, the PM_{10} results show that the magnitude of change toward air quality improvement tends to be greater than the magnitude of change toward air quality deterioration as a result of the scheme.

*Table 4: Change in PM_{10} concentrations at local sensitive receptors**

Receptor	Without	With	Change (%)
Haxby Road Primary Academy	12.9	13.0	0.8
Park Grove Primary Academy	12.9	12.5	-3.1
Residential 1	12.6	12.5	-0.8

[5] Department for Environment, Food and Rural Affairs (Defra) and the Devolved Administrations (2007). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2)

Residential 2	13.0	13.1	0.8
Residential 3	13.3	13.4	0.8
Residential 4	12.8	12.5	-2.3
Residential 5	12.7	12.8	0.8

* The AQS objective[5] for annual mean PM_{10} concentrations is 40 ug/m^3

Model predicted annual mean $PM_{2.5}$ concentrations at selected sensitive receptors for the Without Scheme 2020 and With Scheme 2021 scenarios are provided in **Table 5**. The highest predicted concentration for the Without Scheme 2020 is 8.5 µg/m^3 at Residential 1. Residential 1 is predicted to experience the maximum improvement in local air quality, with a 5.9 % decrease in annual mean $PM_{2.5}$ to 8.0 µg/m^3 in the With Scheme 2021 scenario, due to a reduction in traffic flow along Townsend Road. Other receptors that show a reduction in annual mean $PM_{2.5}$ concentrations are Park Grove Primary Academy and Residential Receptor 4 (both located on Lowther Street) showing percentage changes of -2.4 % and -3.6 %, respectively. The maximum deterioration in local air quality is predicted to occur at Residential 3 (4.9%), with other deteriorations also observed at Haxby Road Primary Academy (1.2%), Residential 2 (1.2%) and Residential 5 (1.2%). Whilst deteriorations in air quality are observed following implementation of the scheme, these are relatively low, with the magnitude of change toward air quality improvements typically being greater than the magnitude of change towards air quality deterioration.

Table 5: Change in $PM_{2.5}$ concentration at local sensitive receptors

Receptor	Without	With	Change (%)
Haxby Road Primary Academy	8.3	8.4	1.2
Park Grove Primary Academy	8.2	8.0	-2.4
Residential 1	8.5	8.0	-5.9
Residential 2	8.2	8.3	1.2
Residential 3	8.1	8.5	4.9
Residential 4	8.3	8.0	-3.6
Residential 5	8.3	8.4	1.2

*The AQS objective[5] for annual mean $PM_{2.5}$ concentrations is 20 µg/m^3

SUMMARY

The aim of the study is to determine the indicative changes in air quality following implementation of the scheme in 2021. Based on the data available, our understanding of the scheme objectives, the limitations of the study, and the results presented above, the study has found that both air quality improvements and deteriorations are predicted at selected modelled receptors as a result of increasing and decreasing traffic flows associated with the scheme. This is aligned with expectations as the scheme has the potential to generate air quality improvements and deteriorations in the wider area due to increased pedestrian and cycle access and the re-routing of traffic flows.

Dispersion model predictions show that the increased traffic flows between 2020 (before the scheme) to 2021 (after the scheme) are likely to cause local air quality deterioration for residential and educational receptors located north and south of the scheme, along Haxby Road. However, local air quality

improvements are expected for residential and educational receptors located on Lowther Street and Townsend Road, due to traffic re-routing and reduced traffic flows in this area.

The highest adverse impact in NO_2 concentration (0.3µg/m^3 or 3.3%) is predicted at Haxby Road Primary Academy and the highest beneficial impact (1.9µg/m^3 or 11.9%) at Park Grove Primary Academy. This reflects the conclusion for all pollutant species which is that the magnitude of change in concentrations from 2020 to 2021 is typically greater for local air quality improvements, and lower for air quality deterioration following implementation of the scheme.