A66 Northern Trans-Pennine Project
TR010062

3.4 Environmental Statement Appendix 5.2 Air Quality Assessment Methodology

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3.4 ENVIRONMENTAL STATEMENT APPENDIX 5.2 AIR QUALITY ASSESSMENT METHODOLOGY

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5.2 Methodology

5.2.1 Construction phase dust assessment

5.2.1.1 The *Design Manual for Roads and Bridges LA 105 Air quality (DMRB LA 105)* (Highways England, 2019)[1] construction phase assessment for air quality requires the air quality assessor to identify key sensitive receptor locations that may require mitigation to reduce the effects of dust emissions and to propose methods of mitigation. These mitigation measures are set out in the draft Environmental Management Plan (EMP) for the project.

5.2.1.2 Dust emissions arising from construction and demolition activities are likely to be variable in nature and would depend on the type and extent of activity, soil type and moisture content, as well as road surface conditions and weather conditions.

5.2.1.3 Construction, demolition and earthwork activities from the scheme may all have an impact on local air quality. Trackout of material onto local roads where it can be re-suspended may also affect air quality. Trackout refers to the transport of dust and PM_{10} from construction areas onto the road network

5.2.1.4 As such, sensitive receptors located along the project that may be impacted during the construction phase have been identified (namely those located closest to the project and routes which would be affected by construction works, up to a maximum distance of 200m away).

5.2.2 Construction phase traffic assessment

5.2.2.1 Where construction activities are likely to last for more than two years and total flow changes of 1000 AADT or more, and/or HDV flow changes of 200 AADT or more as a result of on-site or off-site vehicle movements are anticipated, the impact of construction activities on vehicle movements should be assessed.

5.2.2.2 The emissions from site equipment have been scoped out of the assessment due to the temporary nature of the works and the minimal impact the site equipment would have on overall pollutant concentrations.

5.2.3 Local operational air quality assessment

Dispersion model and set up

5.2.3.1 The ADMS-Roads model (version 5.0.0.1) developed by Cambridge Environmental Research Consultants Ltd (CERC) has been used for this assessment. ADMS-Roads is a detailed atmospheric dispersion model, which focuses on road traffic as a source of pollutant emissions.

5.2.3.2 The model takes into account emissions from light and heavy-duty vehicles, travelling at specified speeds along a road ‘link’ over a period

[1] Highways England (2019) Design Manual for Roads and Bridges LA 105 Air Quality.

of one hour, and predicts the dispersion of these emissions using appropriate historical meteorological data.

Traffic emissions

5.2.3.3 Traffic data has been provided for the air quality assessment by the Arup transport team. Road traffic emissions have been calculated using the emission factors provided in the latest version (version 4.3) of the National Highways speed band emissions factors spreadsheet (National Highways, 2022)[2]. Using this methodology allows the effects of reducing or creating congestion to be more effectively assessed within the air quality study area.

5.2.3.4 ES Figure 5.1: Air Quality Study Area and Constraints (Application Document 3.3) shows the Transport Reliability Area (TRA) developed by the traffic team to allow project effects to be evaluated. The TRA is the area over which the greatest traffic model detail has been developed. A small number of roads that cross or are close to the TRA have also been included in the assessment.

5.2.3.5 Any potentially affected links beyond the TRA have not been explicitly modelled as there is less confidence in traffic flows on them. The air quality assessment has provided quantitative predictions in the immediate area around the project where the highest changes in traffic are expected, the maximum changes in concentration have been calculated and an evaluation of the significance of these changes has been provided (as detailed in the assessment of effects and significance of effects sections below).

5.2.3.6 Air quality monitoring undertaken by the local authorities shows the air quality in and around the project to be below the air quality objectives. In addition, guidance prepared by Defra and National Highways suggests there will be further improvements in air quality in future years. As the opening year of the project is 2029 and air quality is expected to have improved further between 2019 and the project opening year. Even if a notable deterioration in pollutant concentrations was achieved during the operational stage of the project, this would not be considered significant using National Highways' approach to the evaluation of significant effects (*DMRB LA 105*), as only changes in air quality above an air quality objective are considered to be potentially significant (see section 5.4.56 in A66 ES Chapter 5 Air Quality, Application Document 3.2).

5.2.3.7 Therefore, the exclusion of wider areas of potential traffic changes is considered appropriate for the Project.

Detailed model inputs

Minimum Monin-Obukhov length and surface roughness

5.2.3.8 The minimum Monin-Obukhov length describes the minimum stability of the atmosphere. For this model, a length of 10m was used representing the rural nature of the region.

[2] National Highways (2022) Speed band emission factors for use with DMRB (version 4.3) provided by email from National Highways.

5.2.3.9 The amount of mechanical turbulence (and hence, mixing) in the atmosphere is affected by the surface/ground over which the air is passing. Typical surface roughness values range from 1.5m (for cities, forests and industrial areas) to 0.0001m (for water or sandy deserts). In this assessment, a surface roughness of 0.3m was used, which represents the agricultural nature of the area.

Other model inputs

Table 1: ADMS-Roads Model Input Parameters

Model Parameter	Model Input
Terrain type	Flat terrain has been assumed across the model domain.
Receptor location	The coordinates of sensitive human receptor and designated sites have been determined in the GIS software and are based on OS grid references (in m). Human receptors have been modelled at a height (z) of 1.5m, whereas designated sites have been modelled at a height of 0m, i.e., ground level.
Emissions	NO_X and PM_{10} emissions have been modelled.
Emission factors	Taken from DMRB LA 105 based on speed bands.
Meteorological data	1 year (2019) hourly sequential data from the meteorological station at Warcop Range and RAF Leeming.
Emission profiles	Emissions have been calculated based on predicted traffic flows (AADT), including the proportion of light-duty and heavy-duty vehicles, as well as traffic flow conditions (speed bands) taken from the traffic data detailed in the Combined Modelling and Appraisal Report (ComMA Report) for the Project which will be published as part of the DCO (Application Document 3.8).
Receptors	Selected receptors.
Model output	Long-term annual mean NO_X concentrations (µg/m^3). Long-term annual mean PM_{10} concentrations (µg/m^3).

5.2.3.10 Defra Local Air Quality Management (LAQM) guidance and tools, such as the NO_X to NO_2 conversion approach and appropriate in square removed background maps, have also been used as required by *DMRB LA 105*.

Model verification

5.2.3.11 The model has been verified by comparing the baseline modelling predictions and baseline air quality monitoring data. Where systematic bias is clearly evident in the base year verification, an adjustment factor has been calculated (as set out in ES Appendix 5.4: Air Quality Assessment Results (Application Document 3.4)) and applied to bring modelled concentrations more into line with monitored concentrations.

5.2.3.12 A scheme specific baseline monitoring programme was undertaken as described in ES Appendix 5.3: Baseline Monitoring (Application Document 3.4) between November 2021 and February 2022. Following the conclusion of the programme in March 2022 and subsequent receipt of the monitoring data from the analyst, a separate verification exercise was undertaken to further consider the model performance using this

scheme specific data. This exercise concluded that the verification factor derived is in good agreement with that used in the assessment, identifying a similar trend, and therefore not materially affecting the conclusions of the assessment.

Meteorological data

5.2.3.13 ADMS-Roads uses hourly sequential meteorological data; including wind direction, wind speed, temperature, precipitation and cloud cover, to facilitate the prediction of pollution dispersion between the source and receptors.

5.2.3.14 Meteorological data have been obtained from the two meteorological stations, Warcop Range and Royal Air Force (RAF) Leeming, for 2019 which are representative of the prevailing conditions across the study area. This approach is consistent with the base/verification traffic year and has been used in the local air quality assessment. Warcop Range is the closest station to the Project and is located one mile (1.6km) north-east of the scheme and RAF Leeming is located over 11 miles (18km) south-east.

5.2.3.15 A wind rose, derived from the 2019 Warcop Range meteorological data, is presented in Plate 1: Wind Rose for Warcop Range, 2019 and shows that winds predominantly originate from the south-west and south-east, and also features a strong north-westerly component.

5.2.3.16 A wind rose derived from the 2019 RAF Leeming is presented Plate 2: Wind rose for RAF Leeming, 2019 and shows that winds predominantly originate from the south-east with some contributions from south-west.

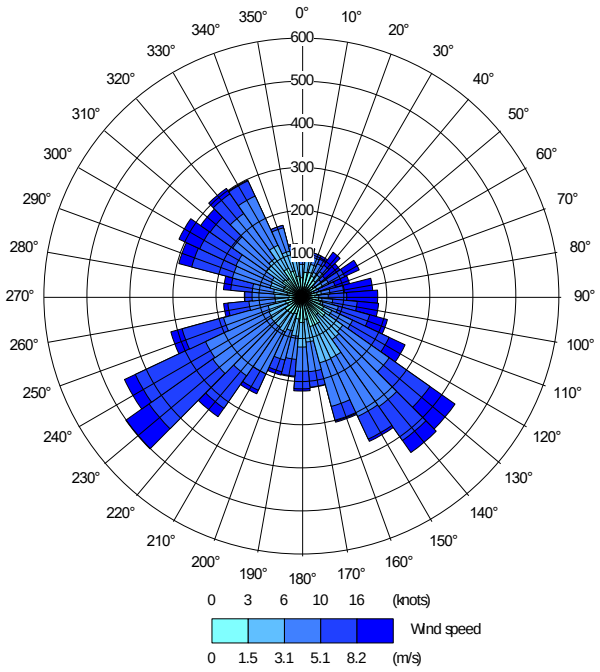

Plate 1: Wind Rose for Warcop Range, 2019

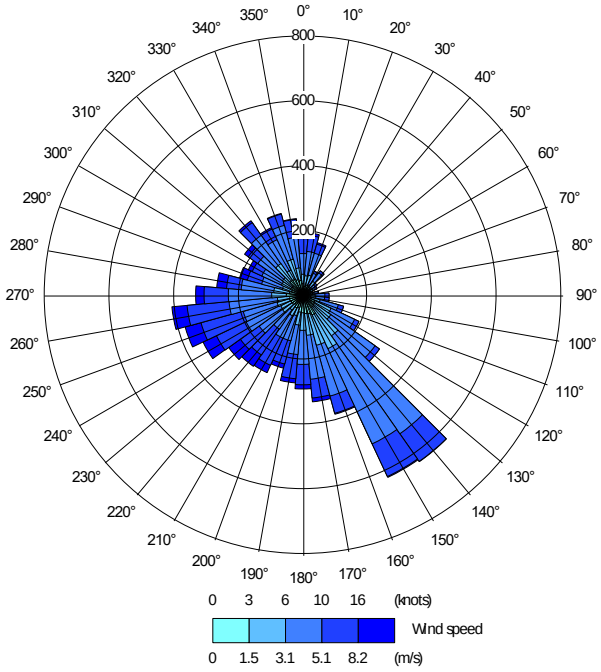

Plate 2: Wind rose for RAF Leeming, 2019

5.2.3.17 Most dispersion models used for modelling road traffic emissions do not use predict pollutant concentrations under calm winds conditions as dispersion is more difficult to calculate in these circumstances. ADMS-Roads treats calm wind conditions by setting the minimum wind speed to 0.75m/s. *LAQM TG.16* (Department for Environment Food and Rural Affairs, 2018)[3] guidance states that the meteorological data file is tested in a dispersion model and the relevant output log file checked to confirm the number of missing hours and calm hours that cannot be used by the dispersion model. This is important when considering predictions of high percentiles and the number of exceedances. The guidance recommends that meteorological data should only be used if the percentage of usable hours is greater than 75% and preferably greater than 90%.

5.2.3.18 The proportion of usable meteorological data from Warcop Range used in this assessment was 98% and for RAF Leeming it was 99%, both meet the requirement of the Defra guidance.

5.2.3.19 Helm Wind is a transient, local meteorological phenomena which is reported to occur under very specific conditions between the months of December and April. The use of observations from Warcop Range ensure this is 'local' wind is accounted for in the model.

[3] Department for Environment Food and Rural Affairs (2018) Part IV The Environment Act 1995 and Environment (Northern Ireland) Order 2002 Part III, Local Air Quality Management Technical Guidance LAQM.TG16, available at: https://laqm.defra.gov.uk/documents/LAQM-TG16-February-18-v1.pdf [Accessed December 2021].

Ammonia modelling

5.2.3.20 National Highways have developed a tool to account for the additional contribution of ammonia (NH_3) emissions from vehicles to deposited nitrogen[4]. This has been used in the assessment to determine the nitrogen deposition at designated ecological sites within 200m of the ARN.

[4] This draft tool has been provided by National Highways via email and is not publicly available yet.