Appendix A7.1: Air Quality Dispersion Model Setup

1 Introduction

1.1 The ADMS-Roads model has been developed by Cambridge Environmental Research Consultants Ltd (CERC) and is a version of an atmospheric modelling system that focuses on road traffic as a source of pollutant emissions. Version 4.1.1 (January 2018) has been used for this study.

1.2 The modelling system takes into account the emissions produced by light duty and heavy duty vehicles (LDV and HDV respectively) travelling at a certain speed along a section of road over an average hour and predicts the dispersion of these emissions using appropriate historical meteorological data. The effect of meteorological conditions on dispersion is given a complex treatment within the model. The most significant factors are wind speed and direction, and the boundary layer height which is the calculated mixed depth of the lower atmosphere.

2 Assessment Scenarios

2.1 In order to quantify the air quality impact of the proposed scheme, the pollutant concentrations resulting from the emissions from existing road traffic on local roads have been compared to those resulting from predicted traffic emissions with the proposed scheme in place.

2.2 The following scenarios were modelled:

- 2018 base scenario (modelled as 2017) - existing situation;
- 2022 assessment year ‘do minimum’ - without the proposed scheme; and
- 2022 assessment year ‘do something’ – with the proposed scheme.

2.3 In addition to these, Design Year scenarios 15 years after opening (2037) were considered for regional emissions. The assessment covers different pollutants, as follows:

- Local air quality, focusing only on the pollutants NO_2 and PM_{10}; and
- Regional air quality, focusing on NOx, PM_{10} and CO_2 emissions.

3 Modelling Parameters

Road Parameters

3.1 ADMS-Roads Model requires lengths of road of equal width to be input into the model. Road alignment and width were determined using the Ordnance Survey Mastermap base mapping within ArcGIS.

Traffic Emissions

3.2 The traffic flow data for the model was prepared by Jacobs. Emission rates representing links in the traffic model were calculated based on the traffic flow, HDV composition, pivoted-speed and road type, based on the UK Emission Factor Toolkit v8.0.1 produced by Defra.

Meteorological Data

3.3 In order to assess the impact of the proposed scheme upon local air quality using a dispersion model, it is important to use representative meteorological data. In simple terms, meteorology is the next most significant factor in determining ambient pollutant levels, after emissions.

3.4 Meteorological data for the dispersion modelling assessment was taken from Inverness Airport which is considered to be the most representative source for the study area. The Windrose from Inverness Airport for 2017 is shown on Diagram 1: Inverness Airport Windrose for 2017.

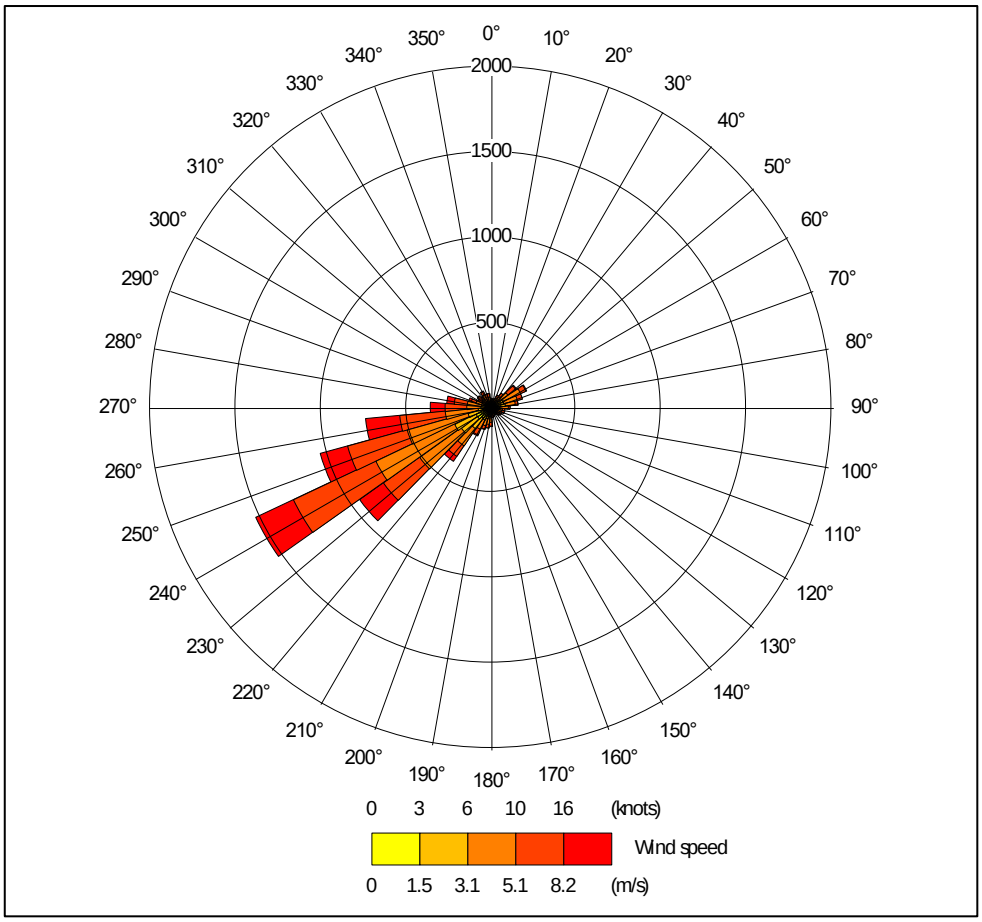

Diagram 1: Inverness Airport Windrose for 2017

Surface Roughness Length

3.5 The surface roughness length at the meteorological data site, where the wind speed measurements were taken, and those across the proposed scheme area, were both set to 0.3m, due to the area being predominantly rural.

Monin-Obukhov Length

3.6 ADMS-Roads Models use the Monin-Obukhov length as a parameter to describe the turbulent length scale which is dependent on meteorological conditions. A minimum length can be used to account for the urban heat island effect, whereby retained heat in cities causes convective turbulence, which prevents the formation of a very shallow boundary layer at night. A minimum Monin-Obukhov length of 10m was set.

Terrain

3.7 The terrain has an effect on the flow field in the air above it. It is recommended that the effect of terrain is incorporated into ADMS-Roads Model where gradients of greater than 10% exist within the modelled area, or a short way outside of it. These do not occur in the study area and it has not been necessary to include the effect of terrain in the assessment.

Street Canyons

3.8 'Street canyons' in air quality modelling are roads with continuous high buildings on either side. This arrangement tends to impede the dispersion of pollutants from the road, particularly when the wind is at right angles to it, since a vortex is created in the street canyon, retaining the pollution.

3.9 No road links in the study area were identified as being 'street canyons'. This feature was therefore not included within the modelling assessment.

Receptors

3.10 A total of 76 representative receptors were included in the assessment, including residential receptors, schools and education facilities, care homes and prisons. The building usage was identified using an Ordnance Survey Address Base Layer data within ArcGIS. The grid reference was adjusted to represent the worst-case façade of the property to highlight the spatial variability of predicted concentrations with or without the proposed scheme. These are outlined in Appendix 7.4 (Air Quality Receptor Results) and presented in Figure 7.2 to 7.5.