Appendix 8.5: Modelling Parameters

APPENDIX 8.5 – MODELLING PARAMETERS

Air Quality Model

As set out in Chapter 8, air pollutant concentrations at specified receptor locations (as set out in Appendix 8.8) were calculated using the latest version of ADMS-Roads (model) (v.5.0.1.3). The model calculates pollution concentrations and deposition over a specified area and / or at a specified location, based upon the following input information:

- Source parameters: e.g. highway width, average speed of vehicles, the number of vehicles per hour and the diurnal traffic profile;
- Meteorological parameters: e.g. wind speed, direction, precipitation, temperature and atmospheric stability; and
- Topographical factors: e.g. ground levels, gradients, buildings and surface roughness.

Junctions have been modelled in line with TG22, which states:

> *"For junctions, common sense, driving experience and local knowledge are helpful to estimate speeds. For example, for a section of road leading up to traffic lights, the aim should be to estimate average speeds over a 50 m section of road:*
>
> *Traffic pulling away from the lights, e.g. 40-50 kph;*
>
> *Traffic approaching the lights when green, e.g. 20-50 kph; and*
>
> *Traffic on the carriageway approaching the lights when red, e.g. 5-20 kph, depending on the time of day and how congested the junction is.*
>
> *It is considered that the combined effect of these three conditions is likely in most instances to be a two-way average speed for all vehicles of 20 to 40 kph. Speeds in similar ranges would also apply at roundabouts, although on sections of large roundabouts, speeds may well average between 40-50 kph."*

The modelled highway network for all scenarios, including the modelled speeds, is illustrated in Figures 8.5.1 to Figure 8.5.8. To note, where roads are marked as having a road speed of 113 kph, in line with National Speed Limits, HGVs were modelled at 96 kph.

Figure 8.5.1: Modelled Highway Network (area immediately surrounding the site, Nailstone and Ibstock)

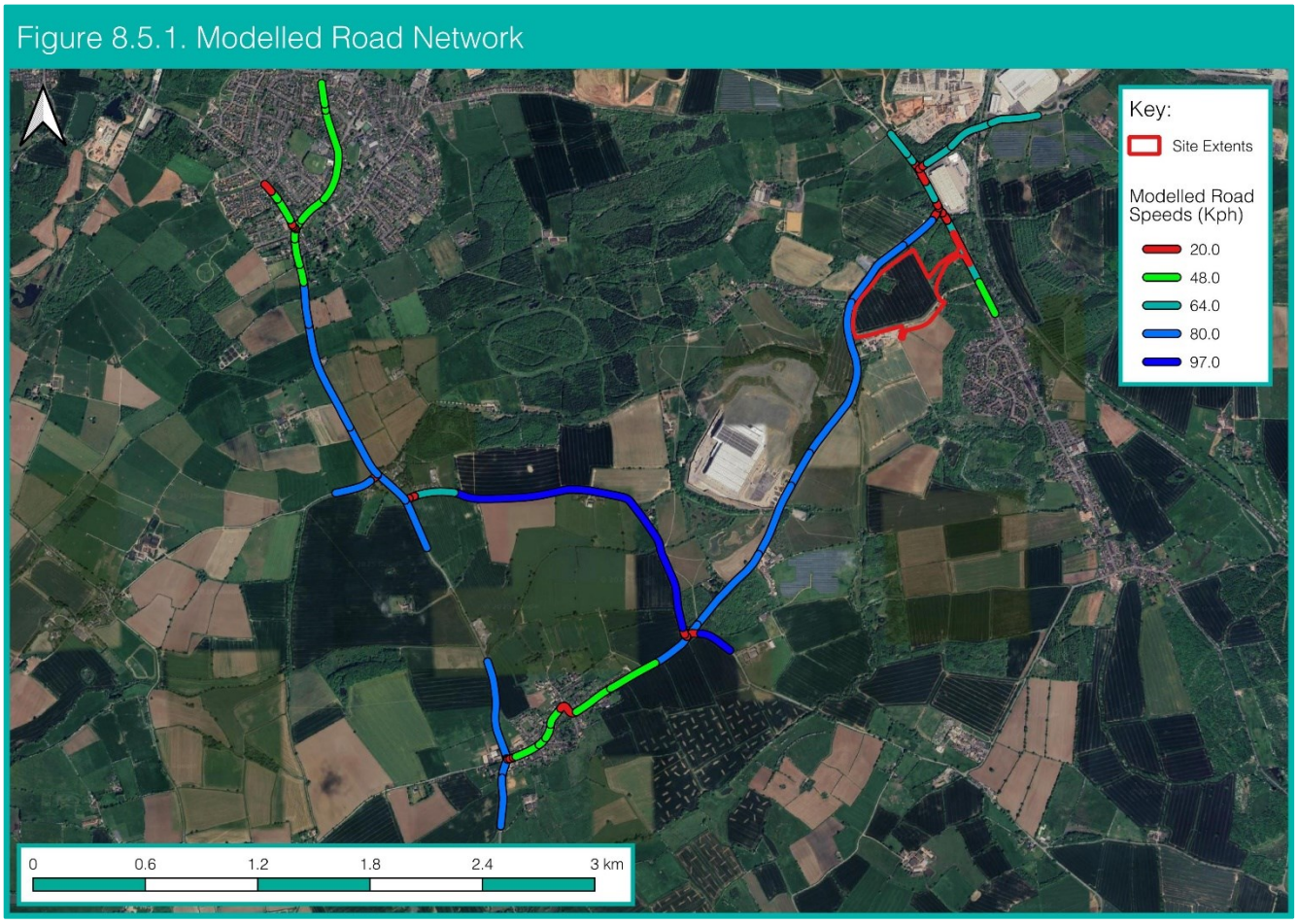


Figure 8.5.2: Modelled Highway Network (area northeast of the site)

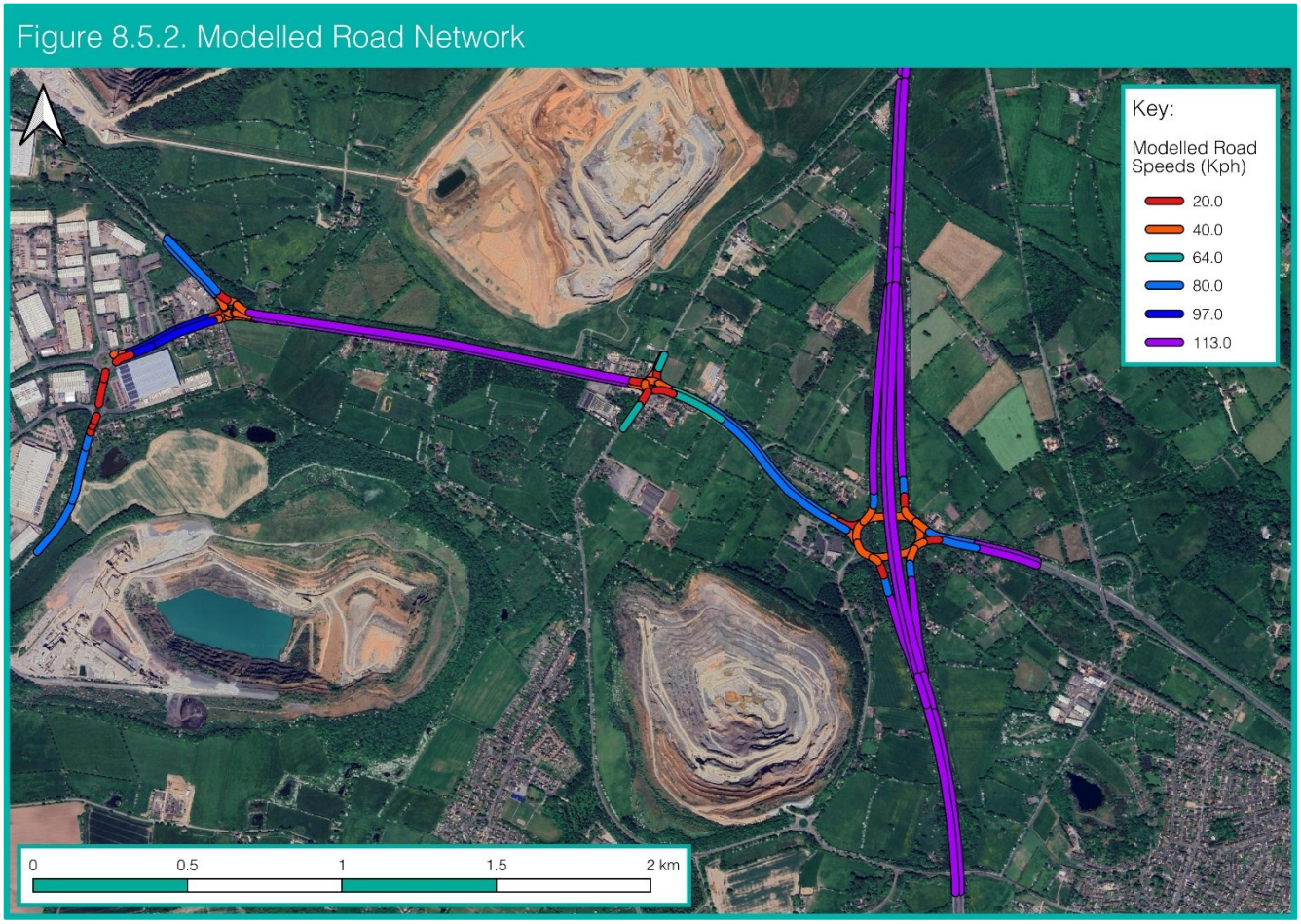


Figure 8.5.3: Modelled Highway Network (Coalville)

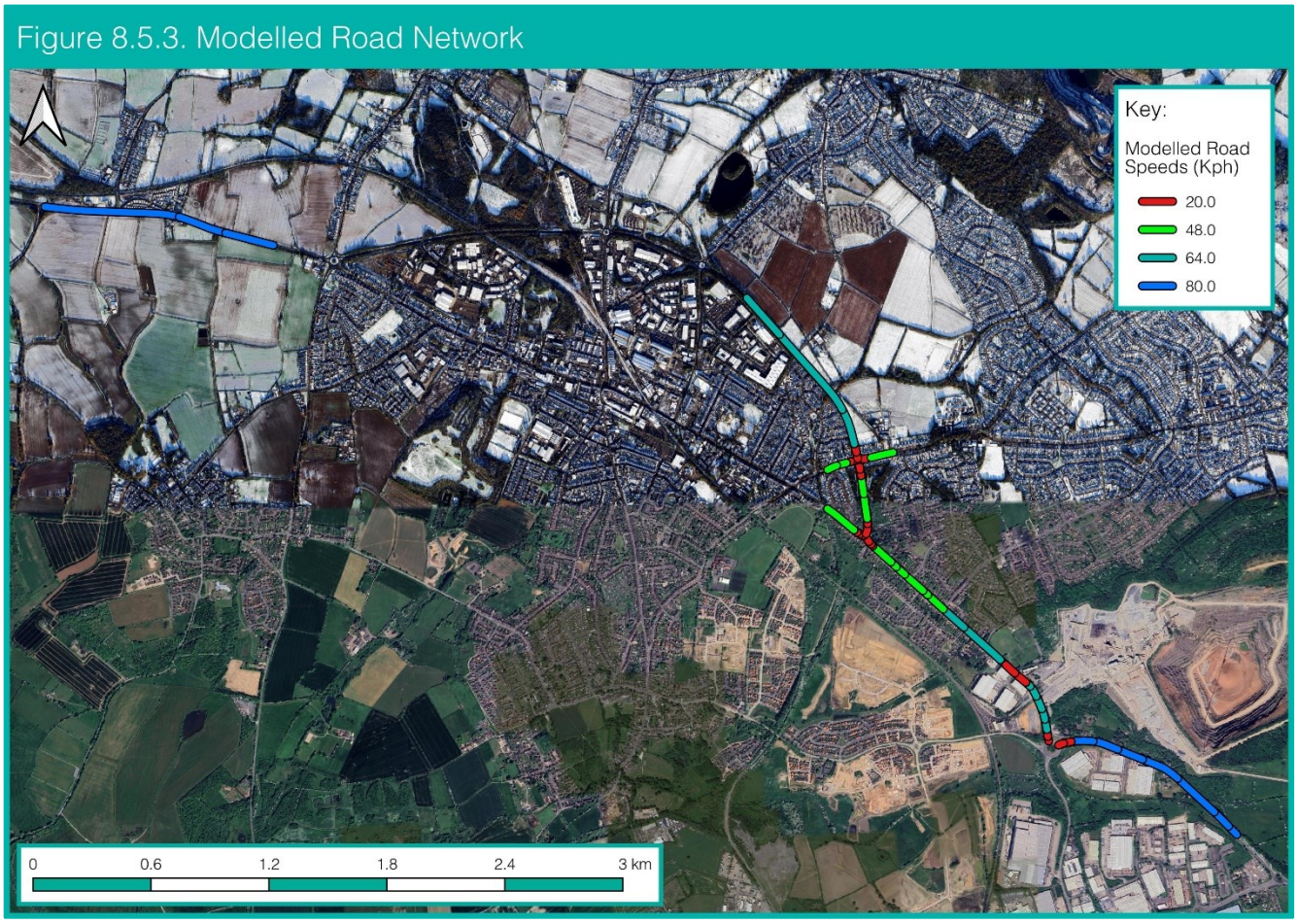


Figure 8.5.4: Modelled Highway Network (Ratby)

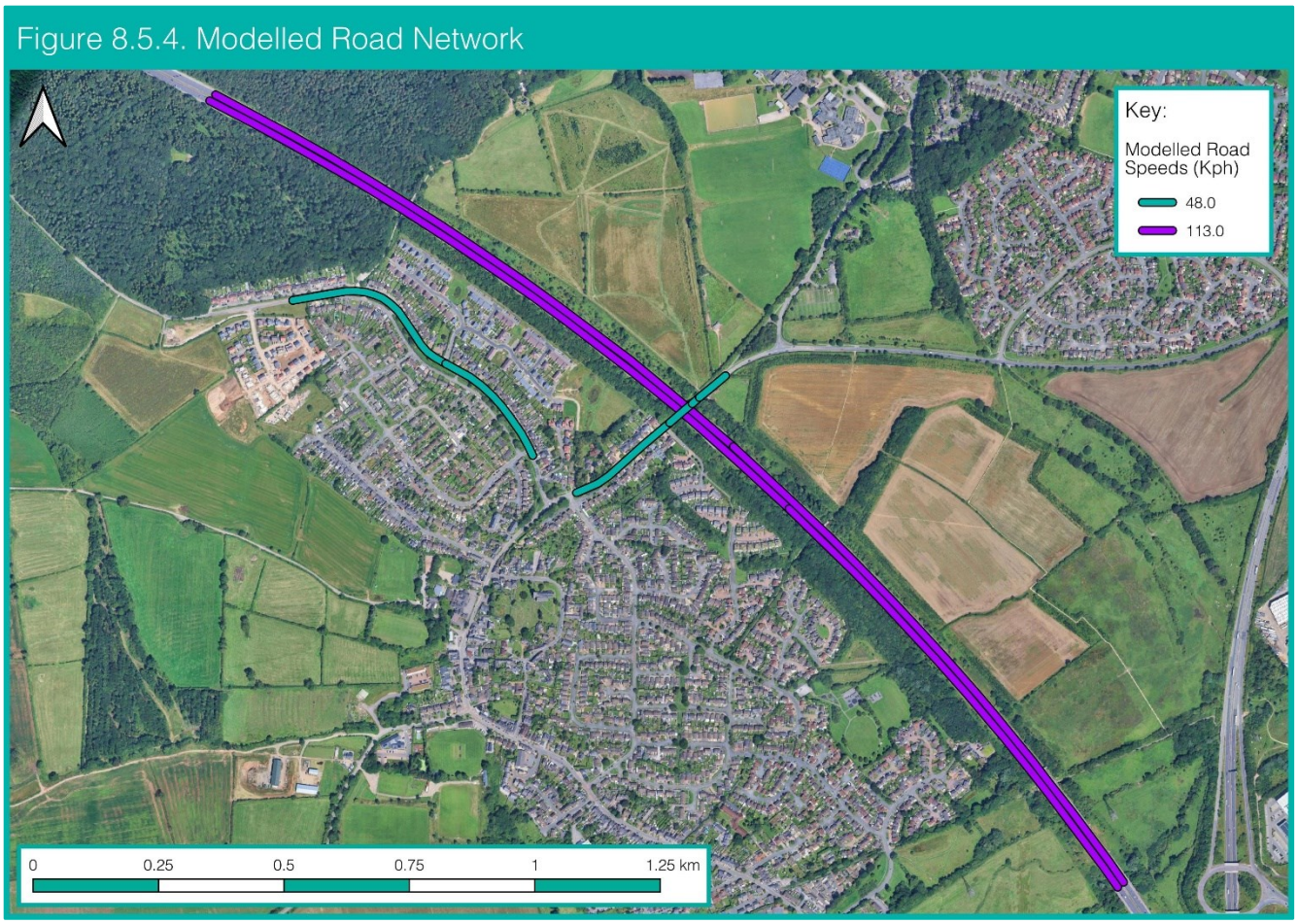


Figure 8.5.5: Modelled Highway Network (Kirby Muxloe)

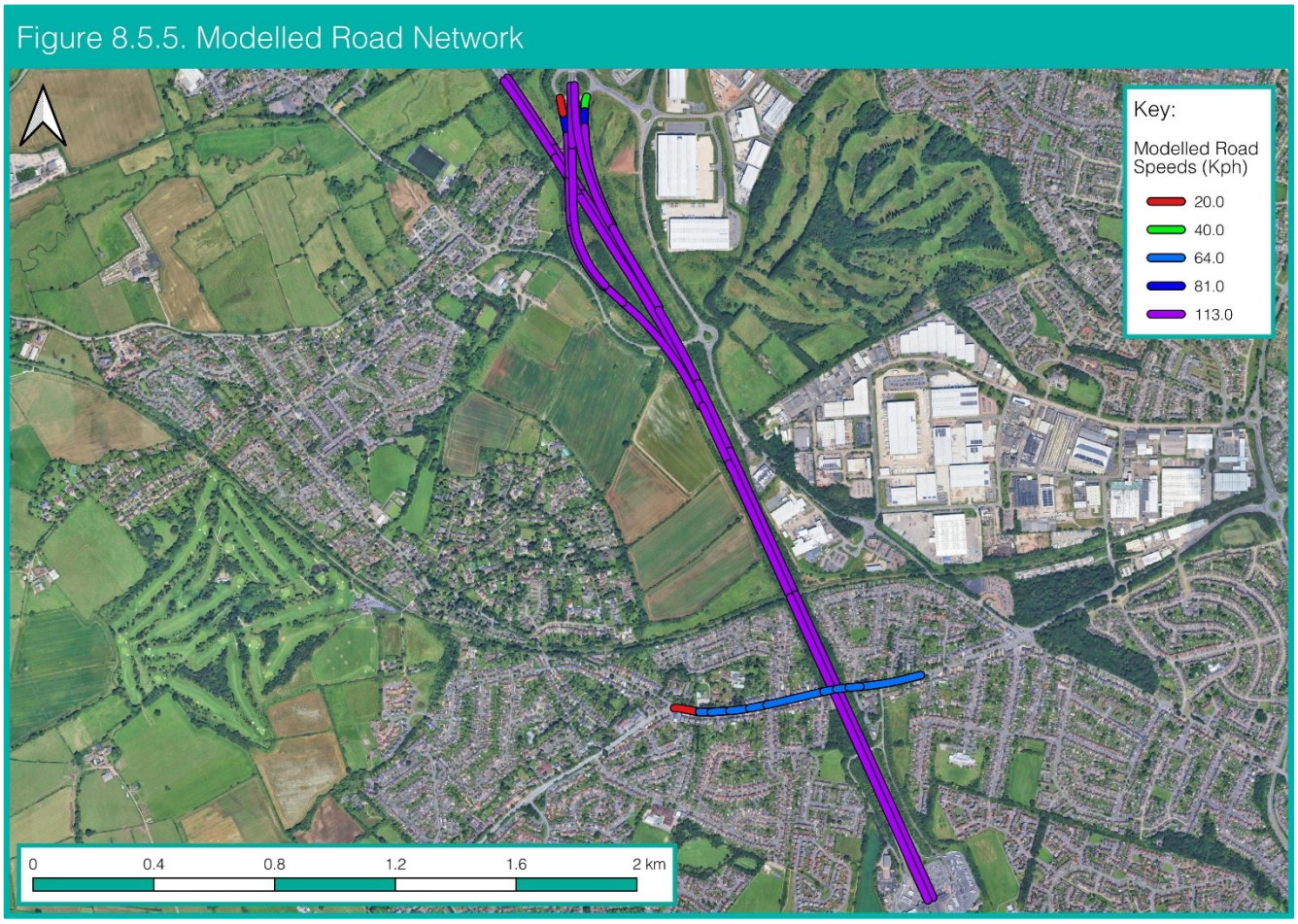


Figure 8.5.6: Modelled Highway Network (Narborough)

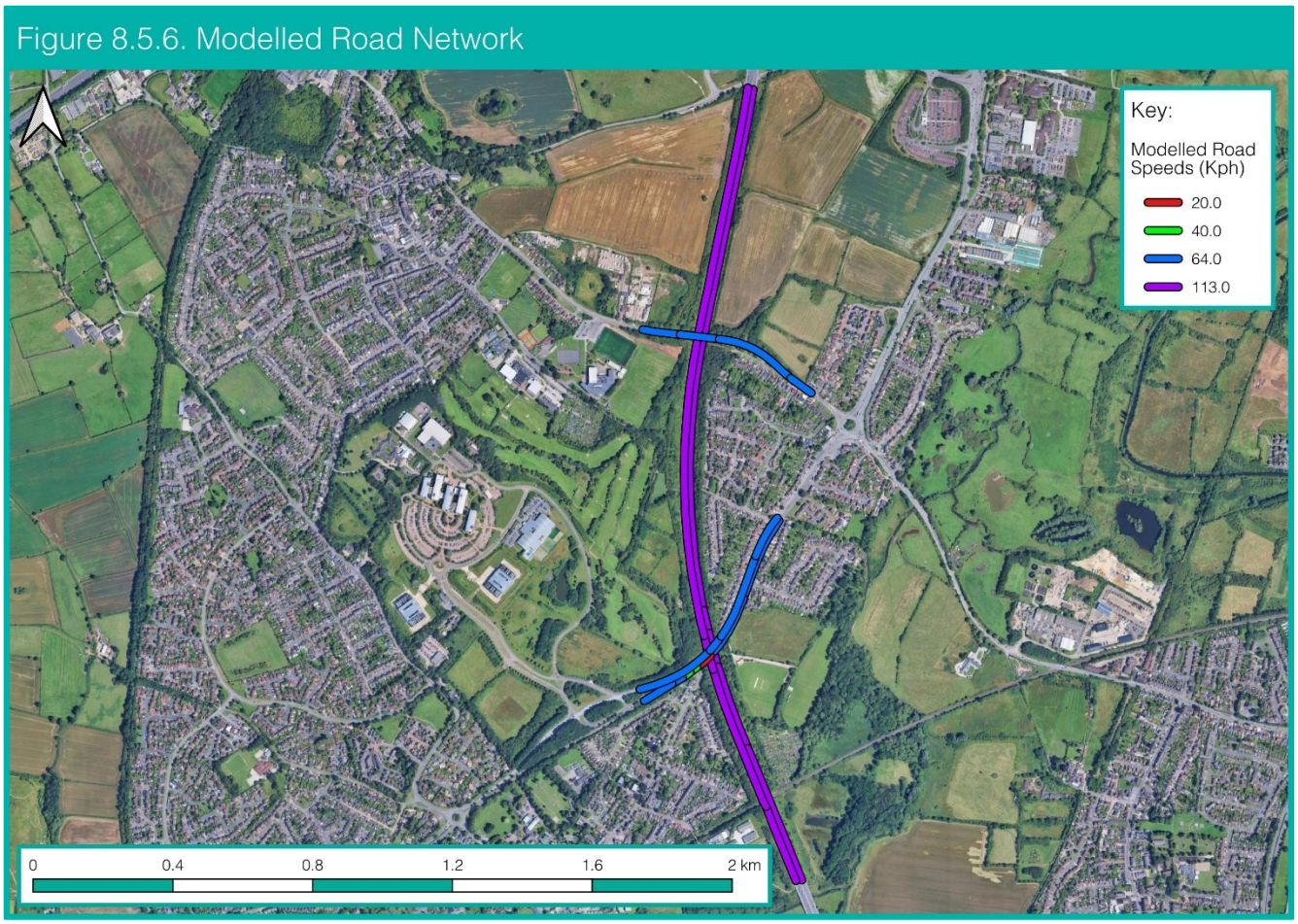


Figure 8.5.7: Modelled Highway Network (Copt Oak)

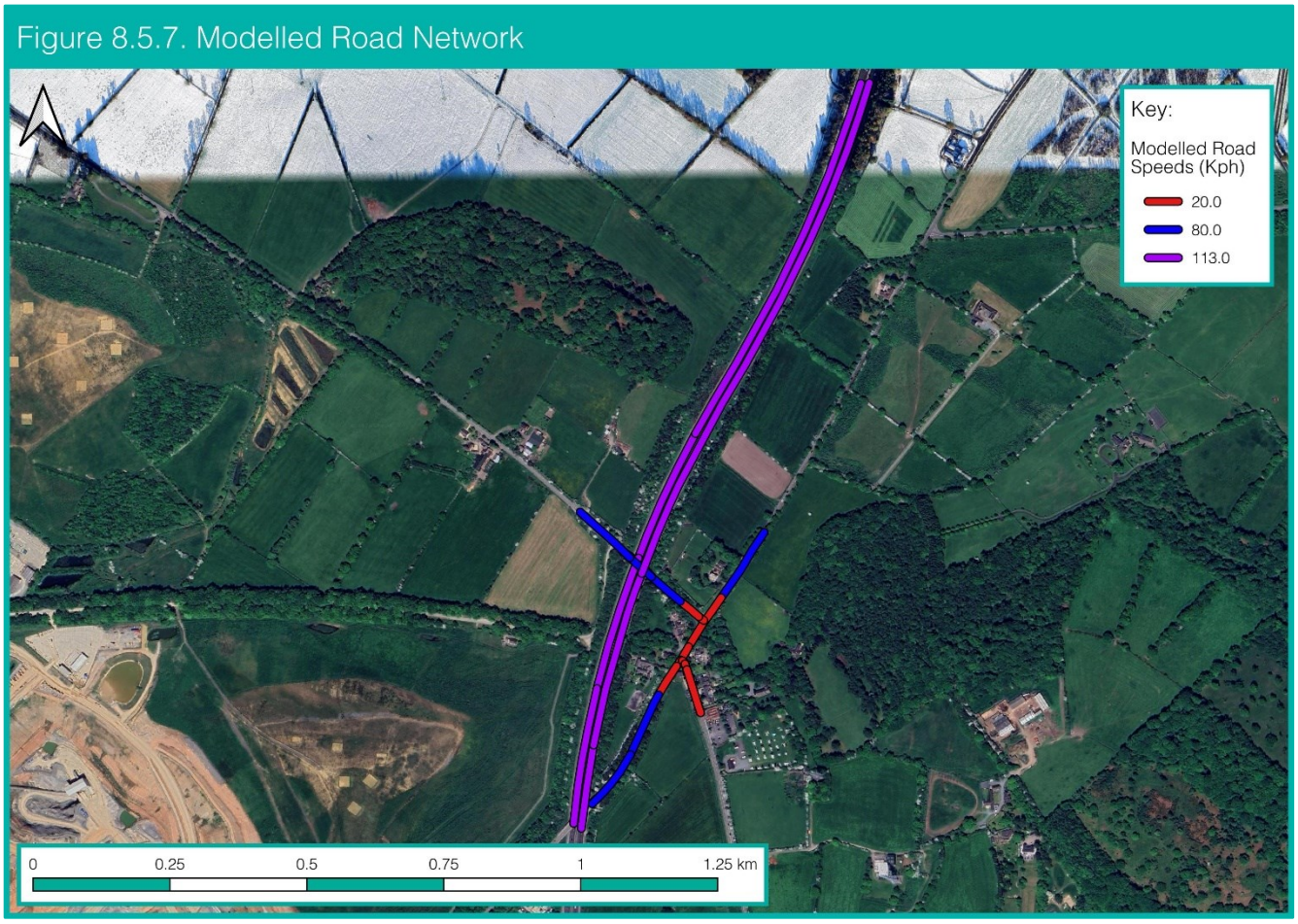
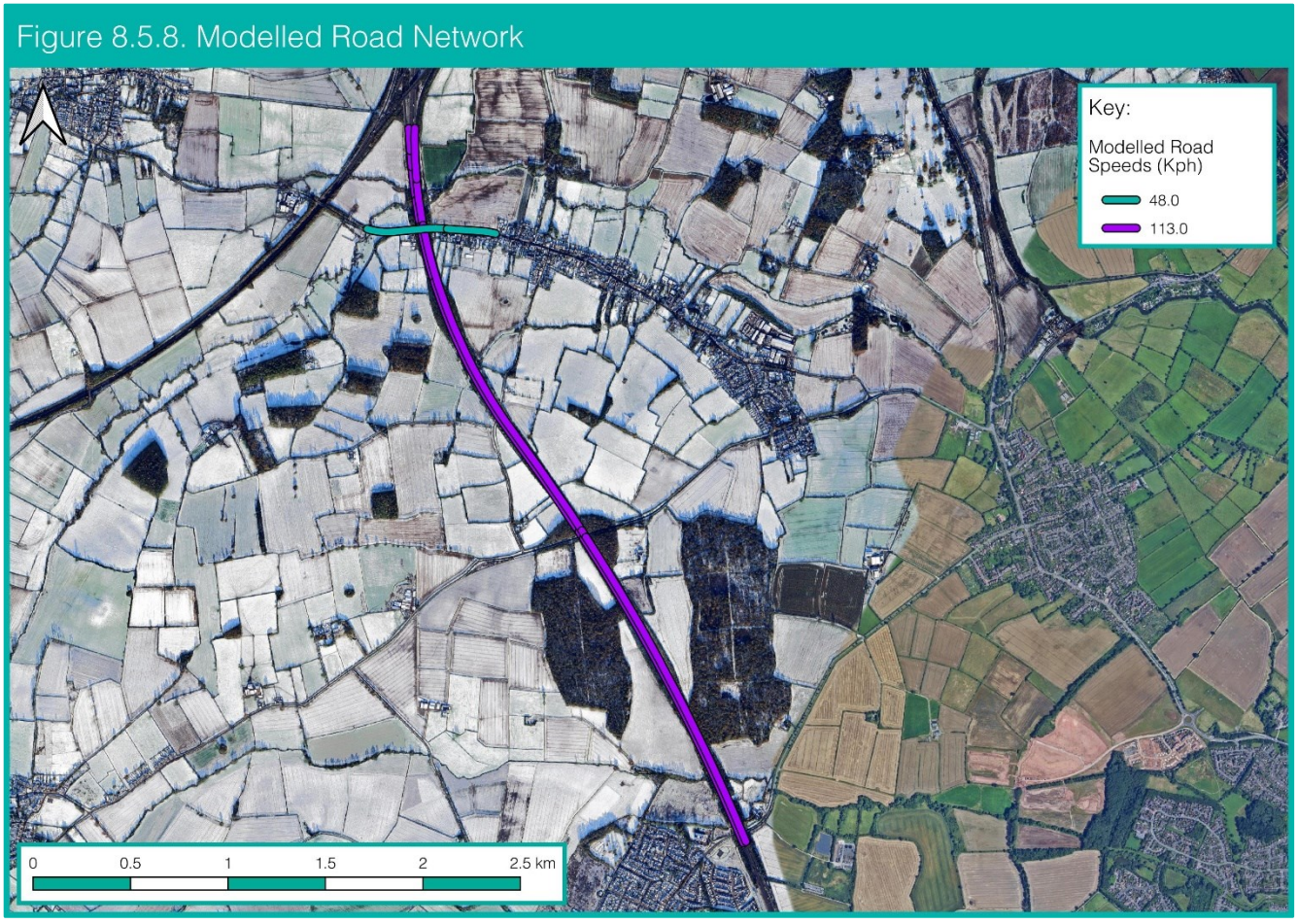


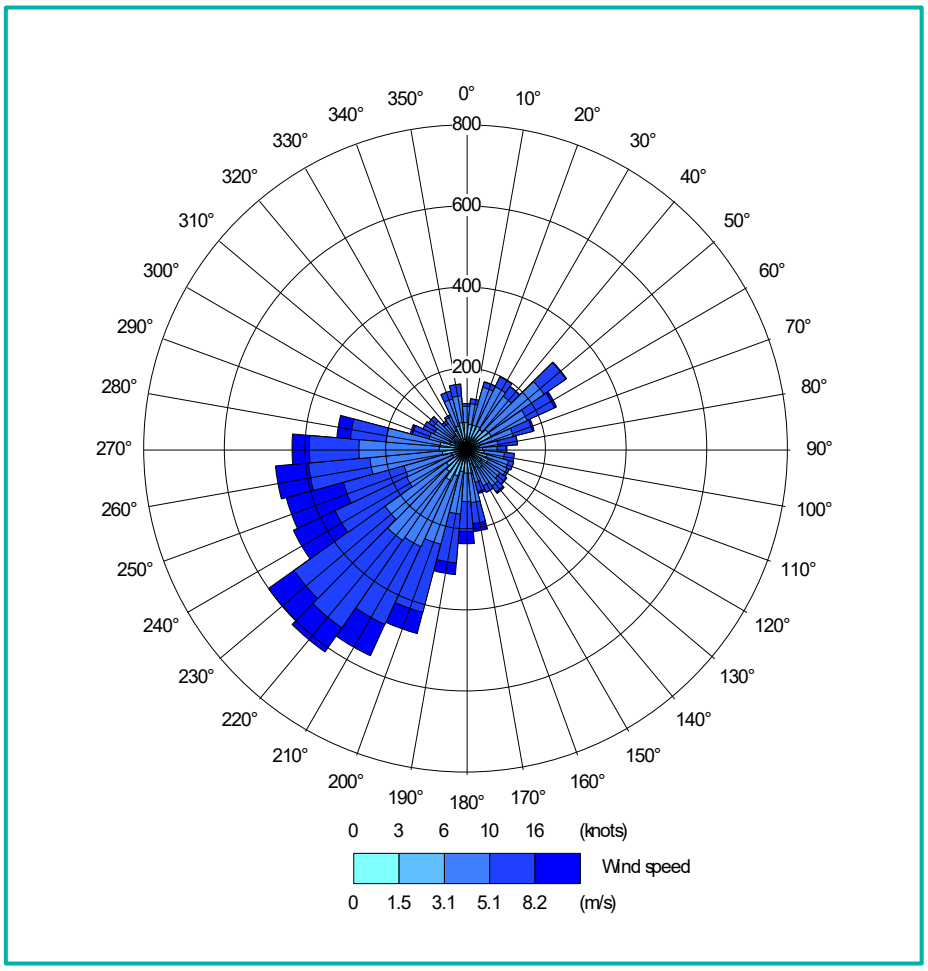
Figure 8.5.8: Modelled Highway Network (Long Whatton and Oakley Wood SSSI)



Meteorological Data

The meteorological data used within the model has been taken from East Midlands Airport for 2023, in line with the verification year. Where data was missing from East Midlands Airport, gaps were infilled from the next nearest meteorological station for the majority of the modelled road network, Coleshill. The wind rose is illustrated in Figure 8.5.9.

Figure 8.5.9: East Midlands Airport Meteorological Site Windrose



Diurnal Profile

A standard diurnal profile from the Department of Transport website has been utilised as part of the modelling process for an average 7-day week. The 2023 diurnal profile is illustrated in Figure 8.5.10.

Figure 8.5.10: 7-Day Diurnal Profile

Emission Factors

The model has been utilised to predict concentrations of NO_x, PM_{10}, and $PM_{2.5}$, based upon the vehicle flow, composition, and speed. Vehicles emit NO_x with different proportions of NO_2. Following release into the atmosphere, chemical reactions take place between nitric oxide (NO), NO_2 and Ozone (O_3). In this assessment, the modelling of NO_x emissions has taken place and the resulting NO_2 concentration has been calculated post modelling using the DEFRA NO_x to NO_2 Calculator (v9.1)[1].

Emission Factor Toolkit (EFT) (Version 12.1) released by DEFRA has been used to predict the traffic related emissions in 2023, 2024, 2026 and 2030. This is further set out in Chapter 7 as a potential limitation of the assessment.

It has been widely known for some time that NO_x/NO_2 levels historically have not reduced as quickly as anticipated, and this was identified by DEFRA in 2011. This was recently reiterated in an IAQM Interim Position Statement (v1.1)[2] released in July 2018 recognising that emissions from diesel vehicles have not declined as expected by DEFRA. This document has since been formally withdrawn, stating:

> *"There is a growing body of evidence to suggest that the latest COPERT vehicle emission factors, which feed into the EFT (v9 and onwards), reflect the real-world NOx emissions more accurately.*
>
> *It is judged that an exclusively vehicle emissions-based sensitivity test is no longer necessary.*
>
> *On this basis, the EFT may be used for future year modelling with greater confidence when considering the per vehicle emission, provided that the assessment is verified against measurements made in the year 2016 or later."*

Therefore, EFT v12.1 is acceptable for an assessment year of 2023, 2024, 2026 and 2030 and no sensitivity test has therefore been undertaken.

Verification Process

Whilst the ADMS-Roads model is widely accepted for its use in assessments of this nature, it is still important that a model verification process is undertaken to confirm that the model's performance is within an acceptable margin of error. The full verification process is set out in Appendix 8.7. Therefore, a comparison of modelled results with monitored results has been undertaken in line with TG22.

[1] Department for Environment, Food & Rural Affairs, No_x to NO_2 Calculator. Accessible at: https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html

[2] Institute of Air Quality Management, 2018. Dealing with Uncertainty in Vehicle No_x Emissions within Air Quality Assessments.

To note, TG22 states:

> *"Local authorities are reminded that any detailed dispersion modelling, should be compared against local monitoring data in order to provide confidence in the results and any decisions made based on the outcome of the modelling. However, this should be only possible if the measurements are of good quality, have been measured over a reasonable time period, and are representative of the receptor location assessed."*