AQ1 - Air quality modelling tracking table

Date: February 2019

Ref	Requirement	Method Used
	<u>Air Quality model specification</u>	
	Model selection	
1.1.1	Details of air quality dispersion model to be used	RapidAir was used for the study- this is Ricardo's proprietary modelling system developed for urban air pollution assessment. The model is based on convolution of an emissions grid with dispersion kernels derived from the USEPA AERMOD model. The physical parameterisation (release height, initial plume depth and area source configuration) closely follows guidance provided by the USEPA in their statutory road transport dispersion modelling guidance. AERMOD provides the algorithms which govern the dispersion of the emissions and is an accepted international model for road traffic studies (it is one of only two mandated models in the US and is widely used overseas for this application). The combination of an internationally recognised model code and careful parameterisation matching international best practice makes RapidAir fit for purpose for this study. The model produces high resolution concentration fields at the city scale (1 to 3m scale) so is ideal for spatially detailed compliance modelling. Further details given in the needs assessment report. Further details can be found in section of the air quality modelling methodology report (AQ2).
1.1.2	Canyon effects included?	Yes. The model includes a canyon treatment based on the USEPA 'Stanford' model. The canyon model algorithms are essentially the same as those recommended by the European Environment Agency for modelling canyons in compliance assessment. Our model has terms to deal with canyon height, width, vehicle length, receptor height, emission strength, wind speed and direction (taken from the same met record as the main RapidAir model). Measured building height data is available. Building height data will be accessed from the OS MasterMap Topography Layer; coverage of which is available over most of the Derby conurbation. Further details given in section 3.2 and

		appendix 1 of AQ2 report. A map of canyons defined in the model is provided in section 4.2 of AQ2.
1.1.3	Gradient effects included?	Further to the update/clarification of the gradient method in TG16 we confirm that we have calculated a gradient adjustment to emission rates for pre Euro VI HGVs. To do this, we carried out a GIS gradient analysis of our modelling domain using publically available 1m resolution LIDAR DSM data to identify any road links with gradients greater than 2.5%. Gradient adjustment will then be applied to emission rates for each of the relevant pre Euro VI HGV vehicle categories on identified links.
	Air Quality model domain	
1.2.1	Please provide a map showing model domain in relation to exceedance locations identified in PCM model	Model domain is that covered by traffic model i.e. Derby City boundary full details, including a map, are provide in section 2 of AQ2
1.2.2	Locally identified exceedance locations included?	Yes (AQMAs and local diffusion tube monitoring all within domain)
1.2.3	Domain includes displacement routes?	Yes (all relevant routes from the traffic model)
	Air Quality model receptor locations	
1.3.1	Details of receptor grid size	Based on model capability of maximum of 1mx1m grid as described in section 3.2 and 3.3 of AQ2
1.3.2	Details of receptors at monitoring site locations	Diffusion tube locations - see section 2, Figure 6 in AQ 2.
1.3.3	Details of receptors at exceedance locations identified in PCM model (include distance from kerb and height above ground level)	Receptors based at 4m from kerb and 2m height in line with PCM. Also 25m from a major junction and representative of 100m of road in line with AQD requirements.

1.3.4	Details of receptors at locally identified exceedance locations, if any	Diffusion tube exceedance locations
1.3.5	Methods to be used to assign subset of receptors for AQD assessment requirements	Annex III of the AQD specifies that macroscale siting of sampling points should be representative of air quality for a street segment of no less than 100 m length at traffic-orientated sites. To provide results relevant to this requirement, for roadside locations where there is public access and the directive applies; road links with exceedances of the NO_2 annual mean objective stretching over link lengths of 100m or greater are presented as a separate GIS layer of model results. These were identified by extracting modelled NO_2 annual mean concentrations at buffers 4m from the edge of the carriageway as delineated in the OS Mastermap dataset. Annex III of the AQD also specifies that microscale sampling should be at least 25 m from the edge of major junctions. When reporting model results relevant to compliance with the AQD, locations up to 25m from the edge of major junctions in the model domain are therefore excluded. The results reported against each PCM link is then the highest concentration selected from the above dataset.
	<u>Base Year modelling</u>	
	General	
2.1.1	Base year to be used	The modelling base year is 2016; using the latest traffic and air quality measurement data. 2016 is the base year of the proposed transport model.
2.1.2	Details of Meteorological data to be used	We have used surface meteorological data from the Nottingham/Watanll surface observation site, this will be processed in house using our own meteorological data management system. Our RapidAir model also takes account of upper air data which is used to determine the strength of turbulent mixing in the lower atmosphere- we will derive this from the closest radiosonde site and process in the USEPA AERMET model. We will utilise data filling where necessary following USEPA

		guidance which sets out the preferred hierarchy of routines to account for gaps (persistence, interpolation, substitution).
	Traffic input data	
2.2.1	Source of traffic activity data	The key source of traffic data is the Derby Area Transport Model (DATM3) which represents transport networks and demand within the Derby Principal Urban Area (PUA) for Derby. Details of this are provided in the transport reports T1 to T5
2.2.2	Vehicle types explicitly included in air quality emissions and concentrations modelling	The core vehicle categories are cars, taxis, LGVs, rigid HGVs. Artic HGVs and buses. The standard Euro and technology categories will be used in line with COPERT 5. Details in section 4.3.2 of AQ2.
2.2.3	Details of representation of road locations (achieved through use of a georeferenced transport model or another approach?)	See Figure 3 in section 1.3 of AQ2 for map of transport model road network. All modelling links are snapped to the OS ITN road network for the best spatial representation.
2.2.4	Source of vehicle fleet composition information (local/EFT)	Detailed fleet composition data was derived from ANPR surveys conducted in 2016.
2.2.5	Source of vehicle speed information	Baseline average speed data was derived from Traffic Master journey time data (DfT)
	NOx/NO_2 emissions assumptions	
2.3.1	Source of emission factors for NOx	COPERT 5 data using our in-house emission calculation tool RapidEms which is fully compatible with COPERT 5.
2.3.2	Source of primary NO_2 emission fractions (f-NO_2)	Most recent NAEI spread sheet – See Section 4.3.3 in AQ2

2.3.3	Details of method used to calculate projections for f-NO_2	Most recent NAEI spread sheet - See Section 4.3.3 in AQ2
2.3.4	Details of methods to be used to calculate NO_2 concentrations from NOx concentrations	DEFRA NOx/NO_2 calculator – See section 4.3.3 in AQ2
	Non-road transport modelling	
2.4.1	Details of modelling for non-road transport sources	NAEI data and DEFRA Background maps for the 2016 base year. Two new developments covering and incinerators and aero-engine test bed, were modelled specifically for inclusion in 2020. See section 4.4 of AQ2 for further details.
	Measurement data for model calibration	
2.5.1	Details of the date, locations and type of monitoring data (automatic and/or diffusion tubes) used for the model calibration	Air quality monitoring data collected by Derby City Council across a network of 76 NO_2 diffusion tubes during 2016. See Figure 5 in AQ 2 for location and type of monitoring points.
	<u>Projections modelling</u>	
	Baseline projections modelling	
3.1.1	Years to be modelled (to include 2020; please include explanation for any additional years)	Key modelling years are 2016, as the model baseline, and 2020 as the target future year. In addition 2025 is being considered to model effects of major road network changes due to A38 grade separation scheme for the preferred option.
3.1.2	Details of method for projected vehicle fleet composition	For the future year 2020, the baseline 2016 ANPR fleet data is projected forward using our fleet projection tool. This uses trends from the NAEI to project forward from a local base year. See

		section 5.2 in AQ2.
3.1.3	Details of method for projected vehicle activity	Future vehicle activity will be estimated using the transport model
3.1.4	Impact of RDE included?	COPERT V now takes this into account
	With measures projections modelling	
3.2.1	Years to be modelled	2020 with interim years will be provided by interpolation.
3.2.2	Details of method for projected vehicle fleet composition	The fleet composition for the non-charging options uses baseline fleet in 2020 adjusted to reflect the measure assumptions. These assumptions are set out in section 2.2 of the Air Quality modelling report AQ3. For the Class D charging CAZ scheme the fleet composition is based in the split between compliant and non-compliant vehicles from the transport model, with the euro standard distribution assessed separately for complaint and non-compliant vehicles. See section 5.3 in AQ2 for further details.
3.2.3	Details of method for projected vehicle activity	Projected vehicle activity will be estimated using the traffic model. For the non-charging measures the baseline 2020 traffic model data is used but adjusted to reflect any measure related assumption. For the Class D charging CAZ scheme a new transport model run was used with the vehicle assignment split between complaint and non-complaint vehicles so that the behaviours of these groups are modelled separately. Further detail is provided in section 5.3 of AQ2