Sheffield & Rotherham Clean Air Plan Full Business Case Transport Modelling Methodology Report (T3)

April 2022

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Revision History	
Version	**Nature of Revision**
V1_FBC	Draft for FBC
FBC Final	Final formatted version for FBC submission

Contents

Section 1 Introduction

1.1 Context

1.1.1 In 2017, the UK government named Sheffield and Rotherham as one of 29 areas in England which contained locations where the annual average concentrations of Nitrogen Dioxide (NO_2) exceeded statutory limits and was projected to continue to do so beyond a 3-4 year horizon.

1.1.2 The two councils have therefore been developing a strategy which will help ensure that the two areas will become compliant with this statutory limit 'in the shortest possible time'.

1.2 Overview of this Document

1.2.1 This document is the Transport Model Methodology Report (T3), which explains how the Transport Model has been used to assess the Sheffield and Rotherham CAZ options that have been considered, and in particular for this version how the modelling developed for the Full Business Case (FBC) of the Preferred Option. This report includes a description of:

- The approach taken to forecast traffic in 2022, including the demand growth assumptions used in the forecast, as well as the results of any reviews of local schemes/development plans that have been conducted, including an uncertainty log which provides a clear description of the planning status of local developments;
- How uncertainty was managed in the forecasting, including demand suppression and mode shift;
- How the transport modelling outputs fed into the air quality modelling; and
- How the distribution of Euro standards within the fleet were forecast.

1.2.2 This report is part of the Full Business Case (FBC) technical report pack and should be read alongside documents T1, T2 and T4.

1.3 Model Background and Vision

1.3.1 Several alternative strategic transport modelling options were considered by Sheffield City Council (SCC) and Rotherham Metropolitan Borough Council (RMBC) in advance of undertaking the modelling work to support the CAZ. The aim was to identify an approach which could deliver the required evidence base that would be as robust as possible, without jeopardising our ability to deliver the study within challenging timescales.

1.3.2 At the Outline Business Case stage the Sheffield and Rotherham Transport Model (SRTM3B) was used as it was the best model available at that time. However for the FBC it was decided to use the newly available **Sheffield City Region Transport Model (SCRTM1)** to undertake the CAZ modelling work as it represented a more up to date modelling framework for the assessment

1.4 Structure of this Document

1.4.1 The remainder of this document is structured as follows:

- Section 2 details the forecasting approach which has been undertaken in the traffic model including the management of uncertainty;
- Section 3 details the link to the Air Quality Model; and

- Section 4 details how the fleet has been forecast.

Section 2 Forecasting Approach

2.1 Introduction

2.1.1 This section describes how future year forecasting has been undertaken using the SCRTM1 model. The standard forecasting procedures are the same as those developed for use with SRTM3B, wherein an interpolation takes place between the base year and future year to produce results for the forecast year.

2.1.2 At OBC stage the modelling considered a 2021 forecast year for the CAZ, but due to the impact of COVID and associated delays the model year was shifted to 2022 as the likely year in which compliance could be achieved and during which go-live was likely. The standard forecast years within the SCRTM1 model are however, 2024 and 2034 based on the input uncertainty log data. To obtain the CAZ forecast year of 2022 linear interpolation has been undertaken using the modelled outputs from the 2016 Base year and the 2024 forecast (in which both include the 2022 forecast year transport schemes to ensure the interpolation gives the 'correct' result). For the modelling the 2016 base year has been used as a pseudo-2017 year to match the base year of the modelling at OBC stage (and the Base Year for the Air Quality Model), and the demand has been updated to match. From this point on the Base Year is referred to as 2017.

2.1.3 The remainder of this section describes how the 2024 model forecast year was created for the CAZ work. It does not consider the 2034 forecast year as this will not be used for the CAZ study.

2.2 Approach to Using the Uncertainty Logs

Supply Side

2.2.1 The Baseline scenario forecasts made use of the scheme information provided in the Uncertainty Logs as provided by SCC, RMBC and HE (supplied November 2017). In summary, the information contained in the Uncertainty Logs was incorporated into the Baseline models as follows:

- Only Major/Significant highway improvement schemes modelled;
- Major Public Transport schemes modelled (eg. BRT North, Tram-train, additional Supertram vehicles);
- Category 1 & 2 Schemes (as defined by DFT as near certain – TAG Unit M4) from the 2024 Sheffield and Rotherham Uncertainty Logs were coded in Baseline Scenario;
- Major committed schemes on the Strategic Road Network (SRN) within the modelled area were coded in 2024 Baseline Scenario; and
- Update of values of time, vehicle operating costs, and PT fares to future year values

2.2.2 Category 3 & 4 (with are hypothetical) Supply Side Schemes from the 2024 Sheffield and Rotherham Uncertainty Logs are not included in these Baseline forecasts.

Demand Side

2.2.3 The principle behind the Baseline assumptions is to include all development sites within the model boundary covering the Sheffield and Rotherham districts that already have planning permission and are considered "near certain" or "more than likely" to be in place by 2024. This information was obtained from uncertainty logs provided by Sheffield City Council and Rotherham Metropolitan Borough Council for use in SCRTM1.

2.2.4 This uncertainty log data is passed through the C-TRIP End process and is controlled to match forecast growth from the National Trip End Model Version 7.2 (via the TEMPRO program) for cars and forecasts from the National Transport Model for goods vehicles.

2.2.5 The CTripEnd is a trip-end model, based on version 7.2 of DfT's National Trip-End Model (NTEM7.2), that makes use of: i) land-use planning data at an MSOA level, ii) NTS trip rates by area type, iii) the NTEM72 model structure and segmentation into population, employment and car ownership categories and produces production-attraction (PA) trip end estimates at an average weekday, zonal level by mode, time period and purpose of travel.

2.2.6 In the context of the SCRTM1, the SCR CTripEnd Model was adapted to use the FLUTE zoning system instead and was sequentially converted to the SCR zoning system. Trip ends were calculated at both a Production-Attraction (PA) and Origin-Destination (OD) level by SCR zone, trip purpose (HBW, HBEB, HBO, NHBEB, NHBO), time period and direction of travel for OD home based trips (Outbound or "From Home"/ Inbound or "To Home"). Trip ends were derived for car and public transport (in people) at an all-day level.

2.2.7 The trip-end estimates produced, having taken into consideration the land use (housing and employment) developments and socio-demographic / socio-economic characteristics (household types, level of car ownership) that are specific to Sheffield City Region, are considered to be more accurate and reliable for the fully modelled, internal area compared to the respective NTEM72 trip ends based solely on Census 2011 employment and population data.

2.2.8 This approach enables us to account for differential growth between zones resulting from the location of individual developments whilst maintaining consistency with the overall expectations of population and economic growth in the area.

2.2.9 The cut-off decisions made as to which developments contained in the Uncertainty Log should be explicitly modelled were a little different for the forecast years from those made in updating the base models. As there were many small sites in the Uncertainty Log, a low cut-off had to be set to model the impact of the many small sites. The cut-off was therefore only applied to residential developments and set to 20 dwellings, which is equivalent to approximately 70 daily arrivals. The cut-off removed 1100 dwellings, or 2.5% of all dwellings in the Uncertainty Log

2.3 Forecast Year Baseline Transport Networks

2.3.1 Modelled changes to the Strategic Road Network and key changes to the local road network between the Base Year and the Forecast Modelled Year (2022) are summarised in Table 1 below.

Table 1. List of Schemes included in the Baseline Test

Scheme ID	Description
S010	A61 inbound at Heeley Bottom - significant widening to provide bus lane

S011	Greenhill Parkway/Greenhill Ave, signalise junction
S012	Meadowhead roundabout - extra lane arising from development
S026	Barnsley Road (Norwood road - Toll Bar) road widening to provide bus lane
S033	Blackstock Road / Gleadless Road - bus lane + junction imp.
S041	Broad Lane / Rockingham St junction - signalisation
S043	SRQ traffic management changes
S056	Castlegate downgraded through G2G2
S080	new signalised all-movements junction
S107	SCRIF Bridgehouses
S108	IKEA junction improvements between A6178 / A6102 and Tinsley Roundabout, plus Meadowhall Roundabout.
TCF9	Cross city bus (Bus Gates on Furnival Gate and Arundel Gate are not included in the Baseline)
TCF15	Sheffield to Burngreave via Kelham Island - Housing zone north Scheme – Have only included Alma street Closure
TCF18 & 19	Parkgate Link Road scheme (TCF)
College Road Roundabout	Road widening into the roundabout
B6089 Main Street/Coach Road/Potter Hill, Greasborough;	To remove the eastern island on Main Street whilst retaining traffic signal control
A630 Sheffield Parkway improvement	Widening to 3 lanes from 2 between M1 Junction 33 and Catcliffe.
BRT North	New link road from Meadowhall to A6178 Sheffield Road and signalisation of junctions.
Sheffield Retail Quarter	Development-related changes to road layout in Sheffield city centre
Bridgehouse Junction	Improvements to junction lay out
Waverley	Signalisation of two roundabouts and reinstating Highfield Lane Orgreave Road.
SAV Tram-Train	Tram-Train connection Sheffield city centre, Meadowhall, Rotherham Central and Parkgate.
M1 J31-J32 Extra Lane	Widening from three to four lanes.
M1 J28-31 Managed Motorways	Hard shoulder permanently converted to an extra lane and variable speed limits.
M1 J32-J35a Managed Motorways	Hard shoulder permanently converted to an extra lane and variable speed limits.

2.3.2 In addition to the schemes listed above The Pence Per Minute (PPM) and Pence Per Kilometre (PPK) factors included in the model for forecasting are taken directly from TAG Databook v28 (which is also used for the Base Year values).

2.4 Forecast Year Baseline Development Assumptions

2.4.1 The baseline scenario includes all developments identified in the Uncertainty Log as either Category 1 or 2 – “near certain” or “more than likely”.

Table 2. Baseline Scenario – New Actual Residential and Commercial Development in 2024		
District	**New residential (Dwellings)**	**New Job**
Rotherham	3,023	567
Sheffield	11,199	27,966

2.4.2 **Error! Reference source not found.** shows the total level of residential and commercial developments modelled explicitly in the 2024 Baseline forecasts (relative to the 2017 base model) for the Rotherham and Sheffield districts.

Table 3. 12-hour Trip Ends by Land Use Type	
Lane Use Type	**2024 12H Arrivals**
A1 Shops	95,735
B1 Business	15,257
B2 General Industry	3,306
C3 Dwelling Houses	81,741

2.4.3 The total scale of the development in units of 12-hour arrivals included in the Baseline Scenario for the 2024 forecast year is summarised in Table 3 and Figure 1 below.

Table 4. Development Trips by Mode and Time Period			
Period	**2024 Car**	**2024 PT**	**2024 Walk / Cycle**
Total	115,295,068	18,102,448	40,610,115

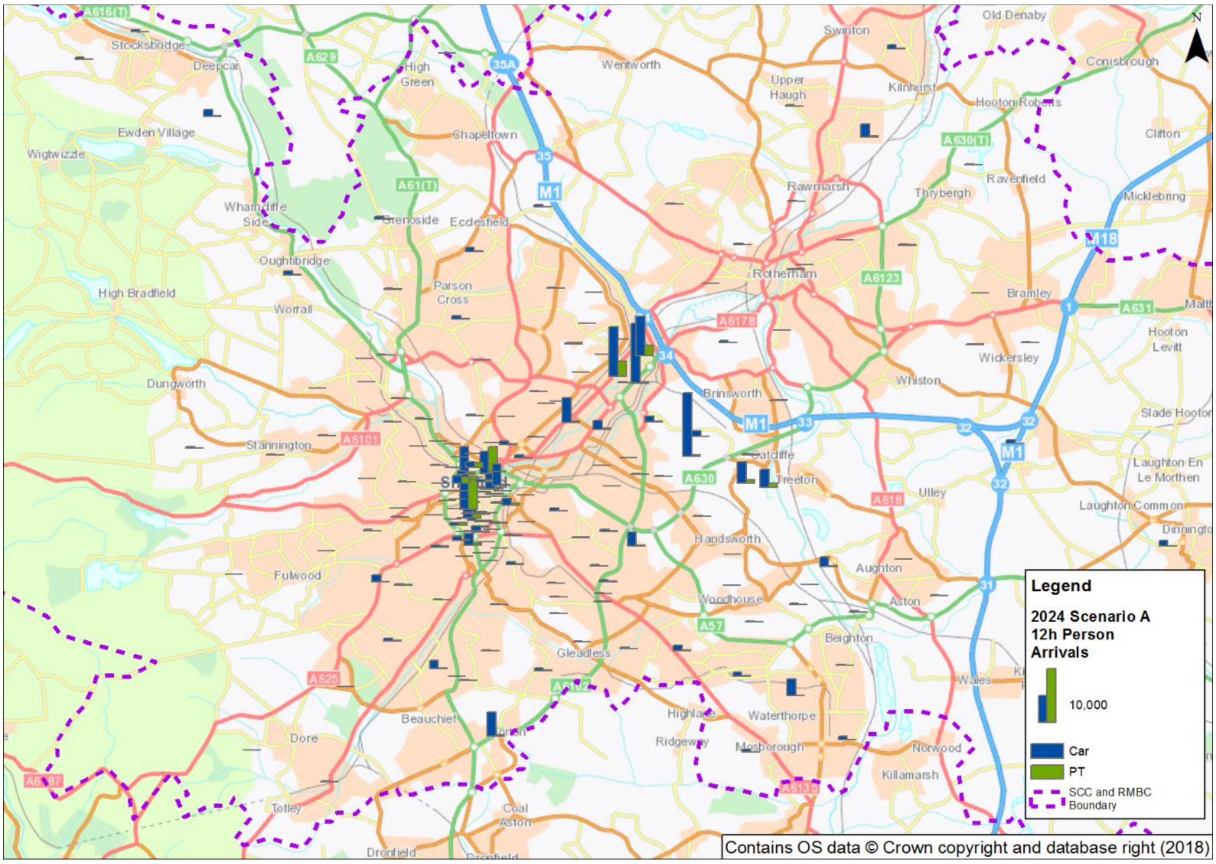

Figure 1. 12-hour Car and PT person trip end arrivals for development in 2024 Baseline Scenario

2.5 Model Interpolation

2.5.1 The transport model has been run for the years 2016 and 2024 as these are the standard modelled years available in the off-the-shelf SCRTM1 release. The 2016 run for CAZ purposes actually reflects the 2017 situation, ie the Base Year for the Clean feasibility study, and has bene update with 2017 matrices and parameters. The model results are then interpolated for the 2022 scenario.

2.5.2 This approach was carried over from the OBC stage and helped reduce creating significant additional model years for the transport model. There are no significant step changes in developments as discussed in Section 2.7 and therefore on the demand side the interpolation process will give a robust answer. Interpolating between highway schemes was identified as a weakness in the OBC approach (although there are no major step change schemes in the pipeline), so an approach was adopted for FBC where all 2022 Baseline schemes would be included in both the 2017 and the 2024 runs.

2.6 Uncertainty Log

2.6.1 The version of the SCRTM1 uncertainty log used in the Sheffield Clean Air Plan work is summarized in Appendix A of the SCRTM1 Forecasting Report. This report is included as Supporting Document SD02 to this report.

2.6.2 The key question is around whether there are any step changes in developments within the assessment period and therefore could be a problem for the interpolation approach described in the previous section.

2.6.3 The following chart shows the build out of dwellings in Rotherham and Sheffield comparing the interpolation approach with the year on year data in the uncertainty log. It is clear that the profile of development is steady and that in undertaking linear interpolation we are not missing a vital step-change.

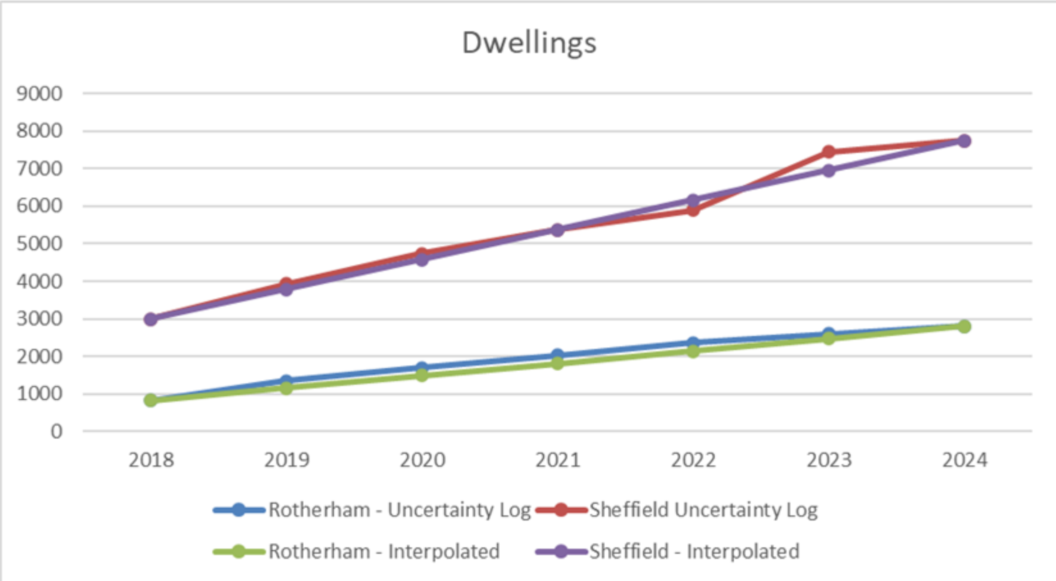

Figure 2. Dwellings: Uncertainty log versus linear interpolation (Sheffield and Rotherham)

2.6.4 The following chart shows this restricted to Sheffield City Centre and it is clear that there is no bias introduced in this key location either.

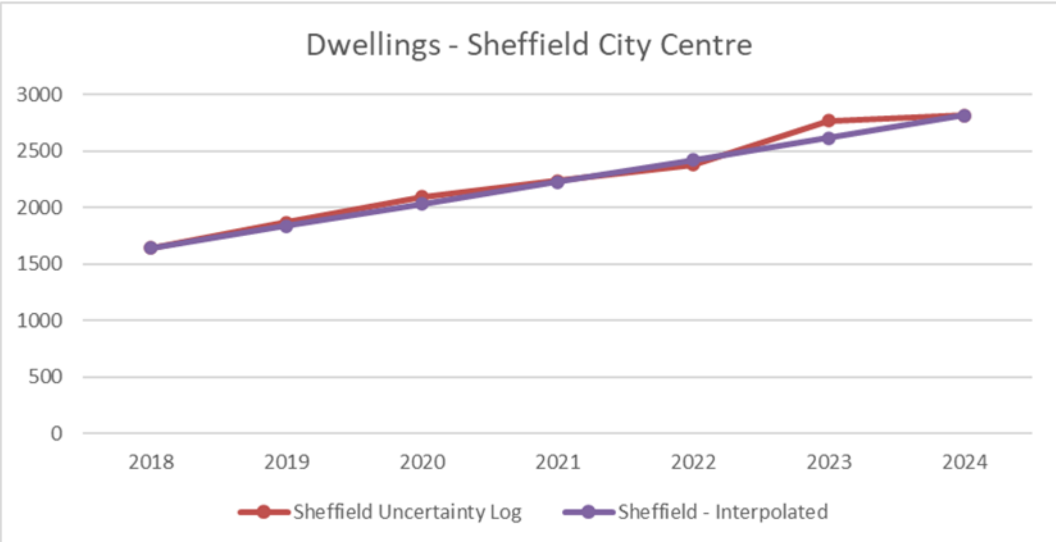

Figure 3. Dwellings: Uncertainty log versus linear interpolation (Sheffield City Centre)

2.6.5 The following chart shows the differences between the uncertainty log and the linear interpolation approach when considering Jobs in Sheffield City Centre. It is clear that in 2022 the interpolation approach delivers less jobs than the uncertainty log suggested would be delivered by then. However, the majority of the shortfall are associated with Heart of the City Development[1] which in the uncertainty log was expected to be fully online by 2020 (hence the large jump), but in reality, completion is now not expected until

[1] https://heartofsheffield.co.uk/community

mid-2023. Therefore, the interpolated approach is probably a better reflection of what will be on the ground in 2022.

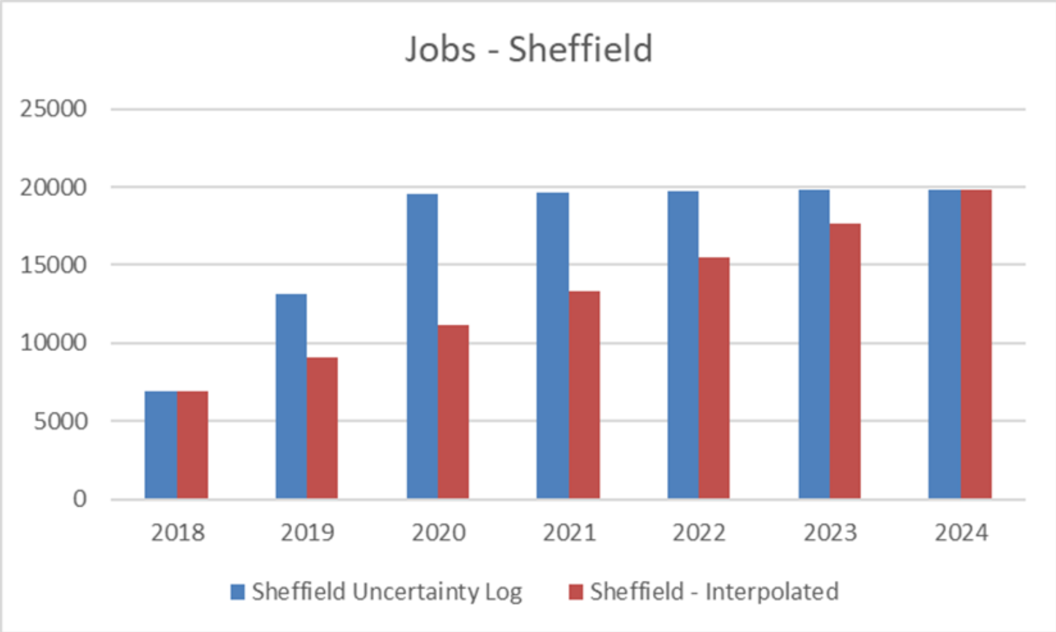

Figure 4. Jobs: Uncertainty log versus linear interpolation (Sheffield City Centre)

2.6.6 For jobs outside the City Centre in Sheffield the interpolated approach matches very closely with the uncertainty log. And in Rotherham the uncertainty log has no job changes coming online before 2024.

2.6.7 The maps below show the key development sites in Rotherham and Sheffield between the model Base Year and the 2022 year of expected compliance. The charts show the situation as described by the uncertainty log around housing and jobs in Sheffield and housing in Rotherham. In Rotherham there are no significant changes in jobs expected to come online (according to the uncertainty log) by 2024. *Note: the two zones in central Sheffield with 7000 jobs in each represent the Heart of the City development which is only partially online in the interpolated approach as discussed above.*

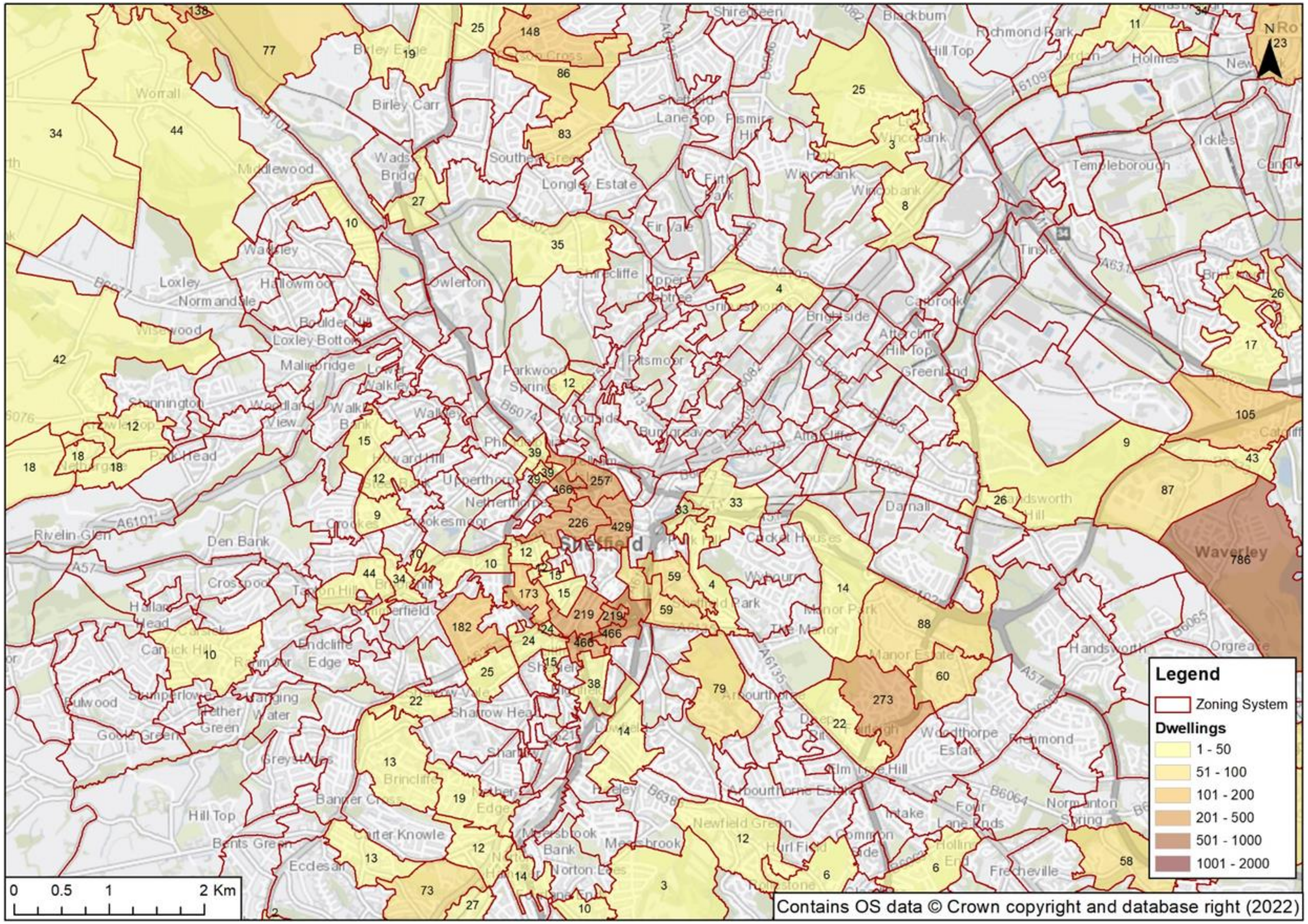

Figure 5. Housing Development by Size in Sheffield (Base Year to 2022)

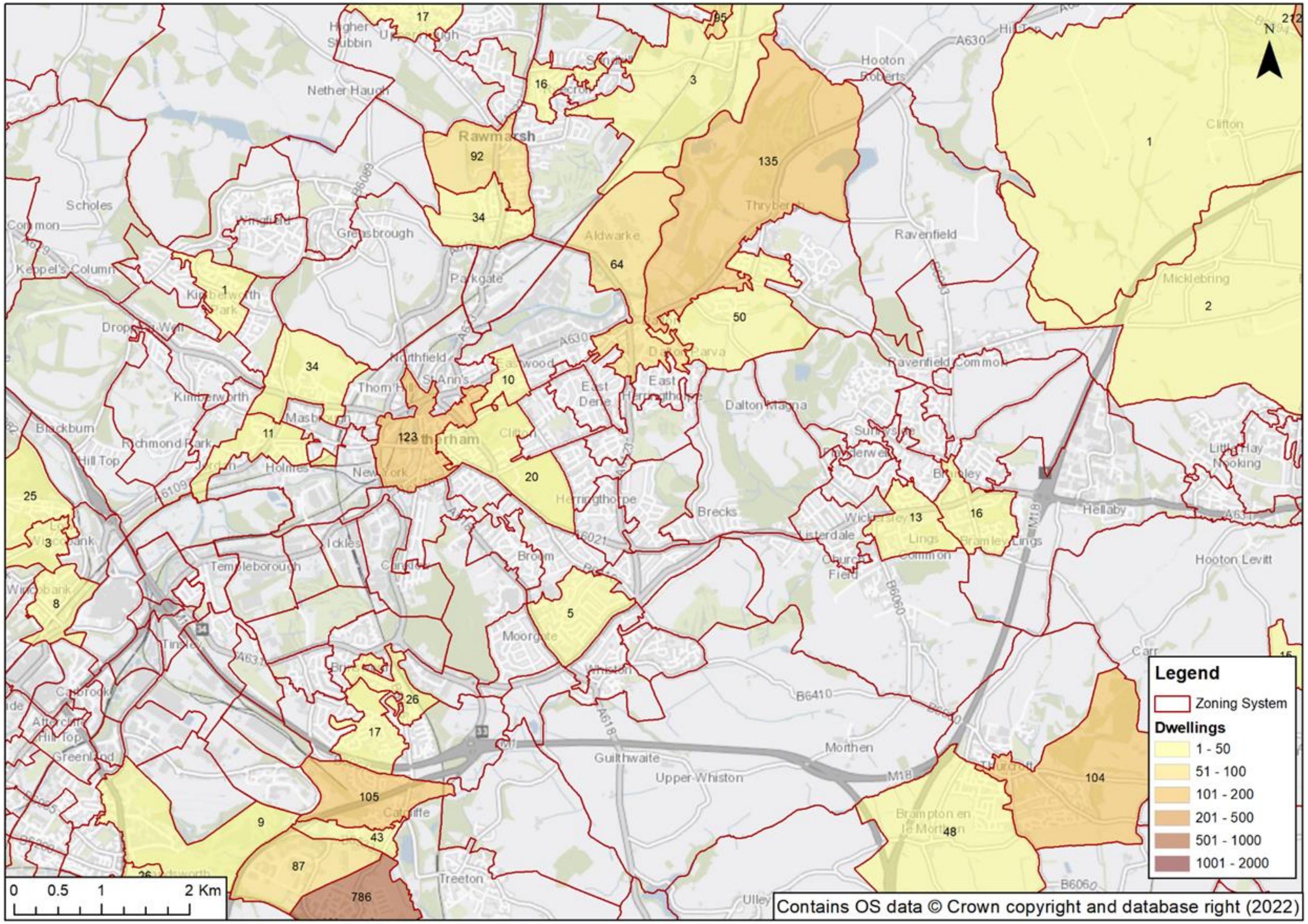

Figure 6. Housing Development by Size in Rotherham (Base Year to 2022)

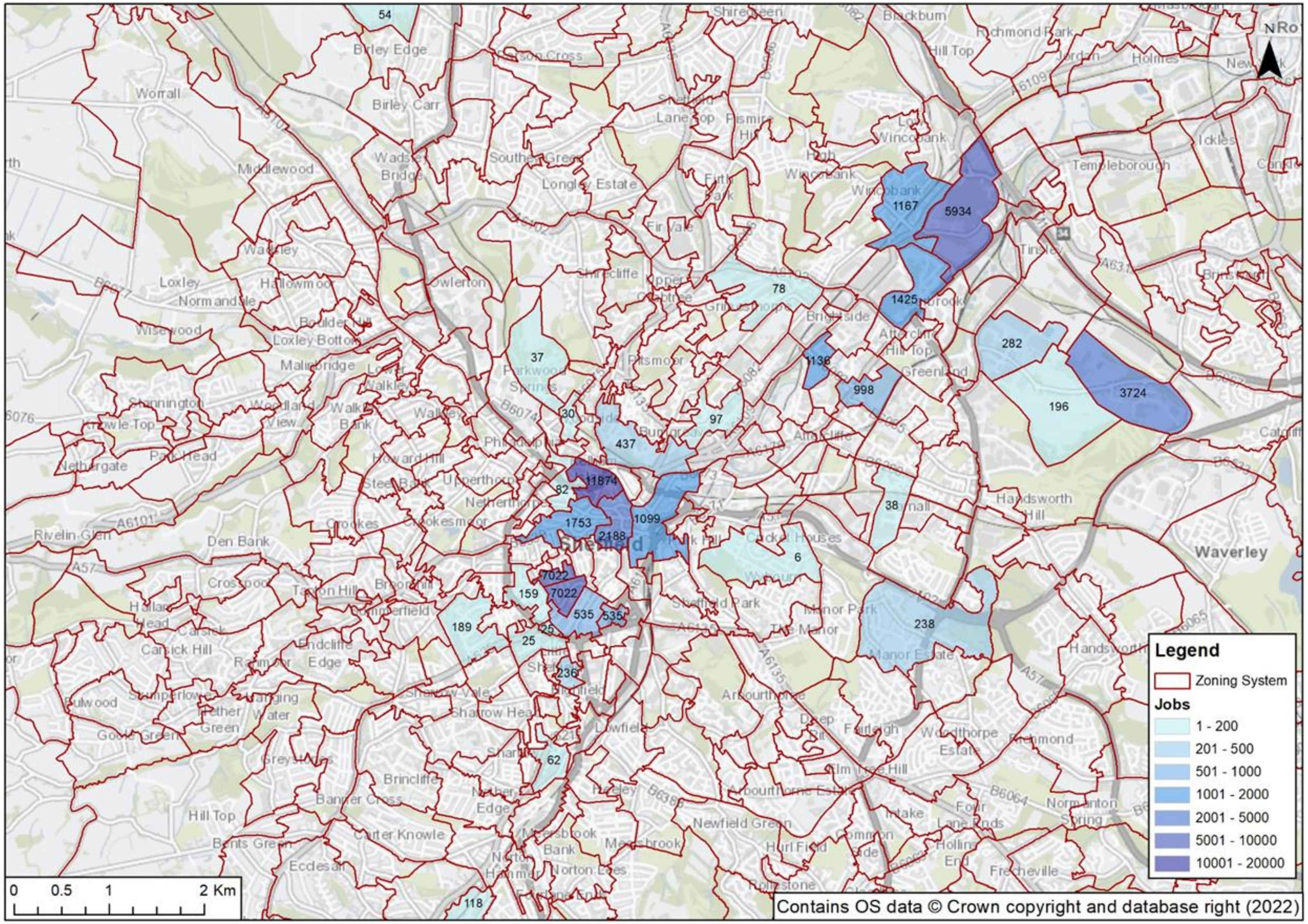

Figure 7. Job Changes in Sheffield (Base Year to 2022)

Section 3 Link to the Air Quality Modelling

3.1 Introduction

3.1.1 This section details how the transport model links to the air quality modelling, via SYSTRA's ENEVAL environmental appraisal software. Further details of ENEVAL's functionality can be found in Supporting Document **SD01** (ENEVAL User Manual). [*Note: the specifications in this user manual (para 2.2.2 relate to ENEVAL 10, the data included in the software has been updated in ENEVAL 11 to be consistent with EFT 9.1b, but no new user manual was created for this as the functionality is unchanged]*

3.1.2 ENEVAL version 11 is consistent with the version of the DEFRA Emissions Factor Toolkit (EFT v9.1b) that was supplied to local authorities for use in the CAZ modelling. The programme is based on the same data sources as the EFT and COPERT, and is a C# compiled executable which links to a SQL database. It calculates both link and junction emissions. The latter being done by calculating queue length at junctions and applying the same formulae at the lowest speed for which they hold.

3.1.3 ENEVAL also includes additional functionality with respect to the modelling of emissions at junctions and provides more flexibility and functionality to support the appraisal of a wide range of input fleet assumptions.

3.1.4 The ENEVAL software imports traffic directly from the model (in the form of user class inputs) and converts these first into fuel types by road type and then disaggregates to the more-detailed fleet type (Euro Class and Vehicle Size).

3.1.5 The programme then calculates the emissions (including NOX, PM10, HC and CO2) and the fraction of the NOX which is primary NO2 (f-NO2) for each link in the traffic model and the emissions at each modelled junction and stores these outputs in a table in the SQL database.

3.1.6 The fNO2 values are taken from The National Atmospheric Emissions Inventory (NAEI) and their Primary NO_2 Emission factors for road transport. The values provided by vehicle type, fuel type and Euro standard. These are linked to the fleet types in ENEVAL which has the corresponding information about vehicle type, fuel type and Euro standard. The process of calculating the f-NO_2 value starts by selecting the links that are closest to each location so that there are maximum two links per location as the traffic is usually bi-directional. At these locations, the tail-pipe NO_x emissions already calculated in ENEVAL by vehicle type are extracted and annualised with the factors used to provide annual NOx emissions which are derived from DfT counts. Once NOx by fleet type and location has been calculated, the f-NO_2 values are joined and a single fNO2 value by location can be calculated by weighting the f-NO_2 values by the NOx emissions for each fleet type.

3.1.7 The outputs from the ENEVAL process are then input into the South Yorkshire Airviro model, which undertakes the air quality dispersal modelling. More details on this can be found in the AQ2 Air Quality Modelling Methodology Report.

3.2 Traffic Disaggregation in SCRTM1

3.2.1 The SCRTM1 SATURN assignment models contain 6 user classes and one preload, which are:

- Three Car User Classes (Business, Commute, Other);
- LGV;

- MGV;
- HGV; and
- Bus Preloads.

3.2.2 Traffic flows for these user classes are output to a text file along with link lengths and average speeds (including average junction delay) for each time period in the correct format for input into ENEVAL.

3.2.3 An update was incorporated into the SCRTM1 model to enable differential affects to be tested between CAZ-Compliant and Non-Compliant vehicles in the assignment models. This was undertaken by expanding the user classes from 7 to 14 in the assignment model, where 1 to 6 are the CAZ-compliant vehicle types for Car Business, Car Commute, Car Other, LGV and MGV and HGV and 7-12 are the non-compliant equivalents. The other two user classes are the compliant and non-compliant buses.

3.2.4 The setup of the assignment model is otherwise the same as in the core SCRTM1 model with each non-compliant user class having the same parameters as it's CAZ-compliant equivalent.

3.2.5 The VDM model was updated to work with a CAZ cordon. It does not distinguish between compliant and non-compliant cars, as the costs (and hence mode split responses) will differ between these two sub-groups of motorists. Post VDM run, the highway model is passed through an assignment that splits each of the 10 user classes into compliant and non-compliant modes, For trips with non-compliant vehicles to/from/within the cordon, the charge is applied in the ENEVAL model, thus overwriting any costs read from the VDM run.

3.2.6 The matrices for assignment in forecasting are split using a combination of ANPR data from 2019 combined with forecast data from the EFT and the local car fleet forecasting model (see more details in Section 4). The former allowed the compliant / non-compliant splits to be determined at four different key geographic areas (Sheffield, Rotherham, Parkway and the M1 Motorway) in the base year.

3.2.7 The table below also show the compliant split proportions including for bus, coach, 'black cabs' and car-based Private Hire Vehicles (PHV), which are included in the post-traffic assignment model ENEVAL inputs as preloads in the Baseline scenario (see following section).

Table 5. 2022 Baseline-Compliant Splits

Vehicle	Compliant Splits
Car	83.1%
LGV	61.6%
MGV	76.9%
HGV	92.7%
Black Cab	21.0%
PHV	65.7%

Bus	79.3%

3.3 Post-processing – Taxis

3.3.1 Within ENEVAL there are default Taxi splits based on the non-London road types within EFT. However, for Sheffield we know from the ANPR data the numbers of black cabs and private hire vehicles (PHV's) at each of the camera sites (Rotherham sites values were retained from OBC modelling as no new ANPR surveys undertaken). So rather than allow ENEVAL to split these based on default splits a process has been created to add these into the ENEVAL input file as a separate user class.

3.3.2 The taxis in SCRTM1 are included as a fixed percentage of the car user class. So, the process involves using proportions from the ANPR data for black cabs and PHV's separately based on the links geographical location and adding these in as 2 new preload fields. The two tables below, Table 6 and Table 7 respectively, below show proportions of black cabs and PHV's grouped into different geographies.

Table 6. Black Cabs as a Proportion of Total Car Vehicle Flows

Data Source	Morning Peak	Inter-Peak	Evening Peak	Off Peak
Sheffield Suburban	0.6%	0.8%	0.8%	2.2%
Sheffield Central	1.4%	1.9%	2.3%	4.4%
Rotherham	0.3%	0.8%	0.6%	0.8%
Motorway	0.1%	0.2%	0.2%	0.4%
Parkway	0.1%	0.1%	0.2%	0.3%
Buffer Network	0.7%	1.0%	1.0%	2.3%
External	0.7%	1.0%	1.0%	2.3%

Table 7. PHV as a Proportion of Total Car Vehicle Flows

Data Source	Morning Peak	Inter-Peak	Evening Peak	Off Peak
Sheffield Suburban	1.7%	2.2%	1.4%	3.4%
Sheffield Central	2.5%	3.5%	2.2%	4.8%
Rotherham	3.2%	3.9%	2.9%	4.8%
Motorway	0.8%	0.9%	0.7%	1.4%
Parkway	0.5%	0.6%	0.4%	0.9%
Buffer Network	2.0%	2.6%	1.7%	3.6%
External	2.0%	2.6%	1.7%	3.6%

3.3.3 As there is no data to split taxi travel by purpose. The three car purposes are combined before the black cab and PHV extraction factors are applied. Once these have been abstracted the remaining car flows are re-split into the three purposes based on the initial proportional splits.

3.3.4 In forecasting, the absolute taxi values are kept constant and subtracted from the car flows on that link. For the very unlikely event that this makes a link have zero flow a check has been included to set the car value for that link to zero.

3.4 Post-processing – HGV's

3.4.1 From a combination of the ANPR data and the DFT rolling count data we know the proportion of rigid and articulated HGV at certain key points on the Sheffield and Rotherham road network. So, as with taxi rather than allowing ENEVAL to apply the default splits (based on those in EFT), we will separate out the HGV user class into two before it is put into ENEVAL.

3.4.2 Before any splitting between rigid and articulated HGVs takes place, coaches are extracted from the HGV user class. A general proportion of 6.1% of HGVs were considered coaches, a proportion is based on the DFT rolling count data.

3.4.3 The different geographies are as follows:

- Motorways: 30% Rigid/70% Artic;
- The A57 east of the M1: 40% Rigid/60% Artic;
- The A616: 45% Rigid/55% Artic;
- The A57 between M1 and the A630: 65% Rigid/35% Artic;
- All other roads in Rotherham: 70% Rigid/30% Artic;
- Any route which crosses the Sheffield/Rotherham boundary: 75% Rigid/25% Artic; and
- All other roads in Sheffield: 80% Rigid/20% Artic.

3.4.4 Each link in the model is given a flag as to which of these geographies it is in and when the ENEVAL input file is being constructed the post-SCRTM1 process applies the relevant split for that link.

3.4.5 In total the ENEVAL input file therefore contains 10 vehicle type flows (each split by compliant and non-compliant), which are:

- Car Business;
- Car Commute;
- Car Other;
- LGV;
- Rigid HGV;
- Articulated HGV;
- Black Cab;
- PHV;
- Bus; and
- Coaches

3.5 ENEVAL in Operation

3.5.1 The version of ENEVAL used with SCRTM1 has been updated to be specific to Sheffield and Rotherham, in particular by incorporating fuel, engine size and euro composition splits which are specific to the area from the 2019 ANPR data, rather than the default non-London proportions from the EFT.

3.5.2 In operation ENEVAL spreadsheet undertakes the following steps:

1) Splits the user classes into fuel types based on data from the ANPR analysis;
2) Further splits the vehicle types by vehicle size and euro class (these splits are also based on the Sheffield and Rotherham ANPR data);
3) Undertakes emissions calculations on each link using link speed (excluding junction delay) and link distances (excluding junction queue lengths);
4) Applies fuel and mileage scaling factors, which take into account changing efficiency in fuel over time and reduced efficiency of vehicles as they become older;
5) Undertakes Junction Based emissions calculations (using the queue length as the distance over which the emissions are produced); and
6) Outputs the data to a SQL database.

3.5.3 Use of ENEVAL tool provides an automated and detailed method of transferring the data from model to AQ models. As ENEVAL is run on the linearly interpolated model results representing 2022 (in general, except where sensitivity tests dictate a different modelled year). As a result of this the following needs to be noted:

- The SCRTM1 Base Year is actually 2016, but this has been run with 2017 matrices to reflect the single year growth;
- The use of linear growth given the delivery of new developments and actual traffic trends could miss key development milestone jumps. However as per the discussion in section 2.6 the interpolated growth matches well with the uncertainty log (as in a constant profile), so in this instance this is not expected to cause any issues; and
- Traffic speeds at any pinch points could be different within 2022 compared to 2017 and 2024. However, it is likely that pinch points will change in a given year anyway as schemes and roadworks for example come on and offline. We believe the interpolated speeds at these locations is just as robust therefore as if we had specifically modelled 2022.

3.6 ENEVAL Outputs

3.6.1 The ENEVAL outputs which are stored in SQL are also linked to output mapping processes. Figure 8 below shows the initial ENEVAL run using SCRTM1 outputs and shows NO_x emissions (as an example) on each link in the modelled area. Similar maps, difference plots and grid-based maps can be produced for each of the modelled scenarios as required.

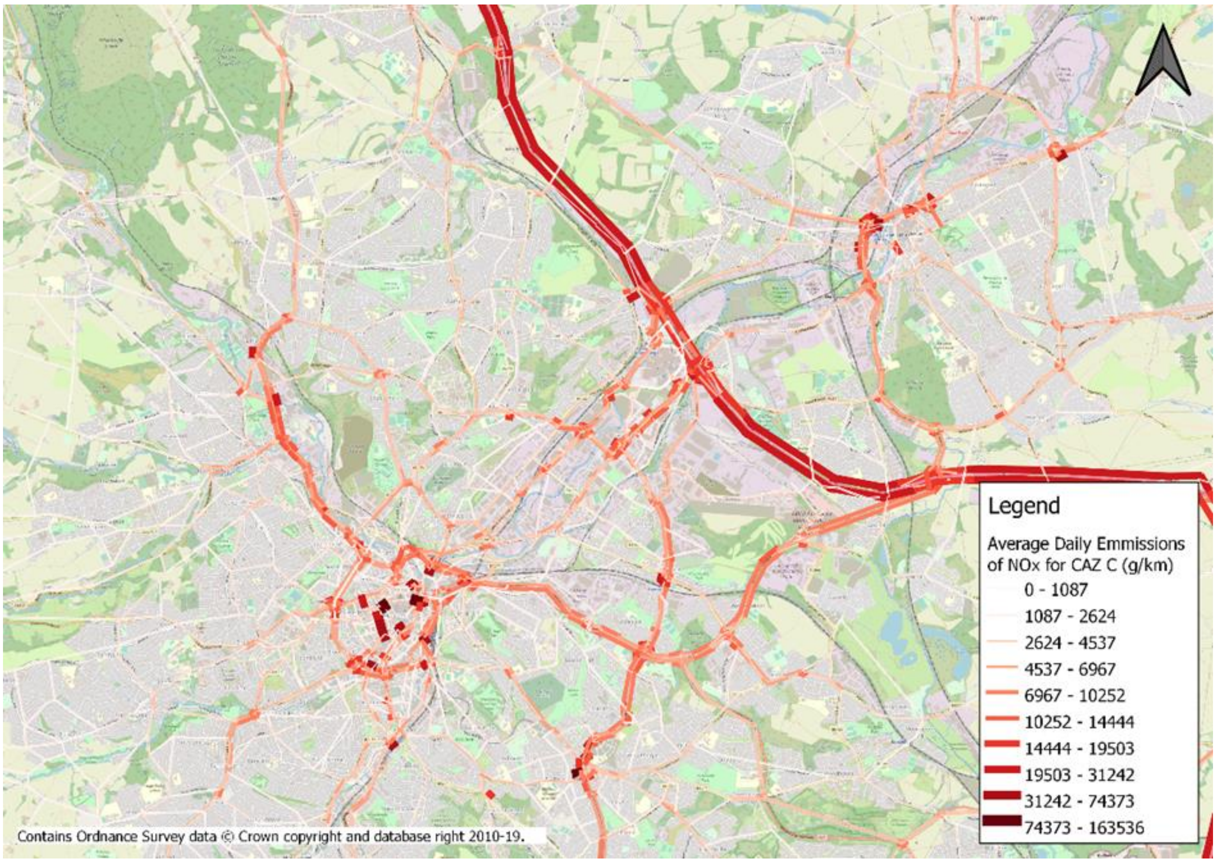

Figure 8. 24hr NO_x emissions from initial SCRTM1 ENEVAL run

3.6.2 The outputs from the ENEVAL process then feed into the f-NO_2 tool and the Airviro Air Quality Model (which is where the air quality dispersion modelling is done).

Section 4 Forecasting Fleet Changes

4.1 Overview

4.1.1 The This section of the report explains how we have predicted the future-year Baseline and Preferred Option fleet composition.

4.1.2 The Baseline fleet composition was developed by interrogating the 2019-ANPR site data and applied to the model flows via the fleet-splitting table used as input to the ENEVAL[2] software, which is consistent with version (9.1b)) of Defra's Emissions Factor Toolkit.

4.1.3 The fleet forecasting has been undertaken line with the latest version of EFT, but with a base-year fleet calibrated using local ANPR data and additional consideration of the recent trends in diesel car sales, using a bespoke fleet forecasting model for private cars and using the fleet by year tables in the EFT for other vehicle types.

4.1.4 Where old fleet types leave the overall fleet proportion and new types enter the fleet in EFT, we have included these in our forecasting process to come on line within the same timescales. The changing profile of vehicle/engine sizes in the fleet is also taken into consideration, using the proportional changes from EFT and applying them to the on-street traffic-based fleet profile that was observed in Sheffield and Rotherham in 2019.

4.1.5 SYSTRA's private car fleet forecasting model allows us to forecast in detail the local changes in the car fleet between 2019 and 2022 (and beyond). In particular, it allows the recent rapid changes in the proportions of petrol, diesel, hybrid and battery electric vehicles in new car sales to be incorporated within our fleet and emissions modelling. In addition it allows for more finesse in the modelling of the local conditions than is available in the EFT.

4.1.6 Additional detail on the car fleet model can be found in the supporting document to this report – SD03 SYSTRA's Car Fleet Model and additional details of the fleet forecasting process can be found in the **T4 Local Plan Transport Model Forecasting Report**.

4.1.7 The following charts show the resultant forecasts by the car fleet model and compare to other possible forecasting scenarios, each chart shows:

a) The ANPR data from 2019;
b) The EFT default value in 2019;
c) The actual modelled fleet "2022 Modelled Fleet" from using the fleet model;
d) The fleet as it would have been if we had applied EFT growth to the 2019 ANPR data, "EFT Modelled 2022";and
e) What the standard EFT fleet prediction is, "EFT 2022"

[2] SYSTRA's Environmental Appraisal module applied to the outputs of SRTM3B.

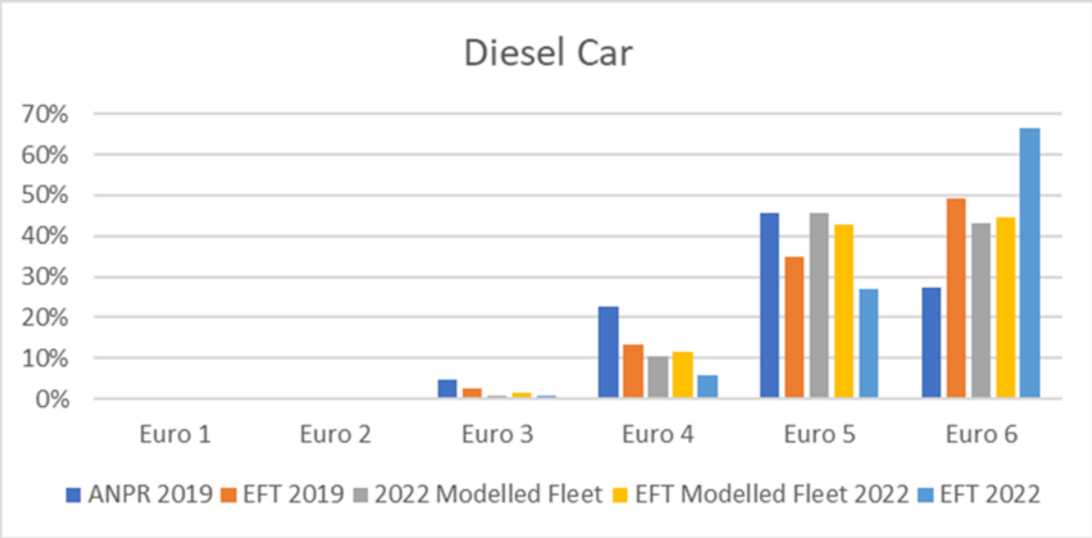

Figure 9. Diesel Car Forecasts (including alternative methods)

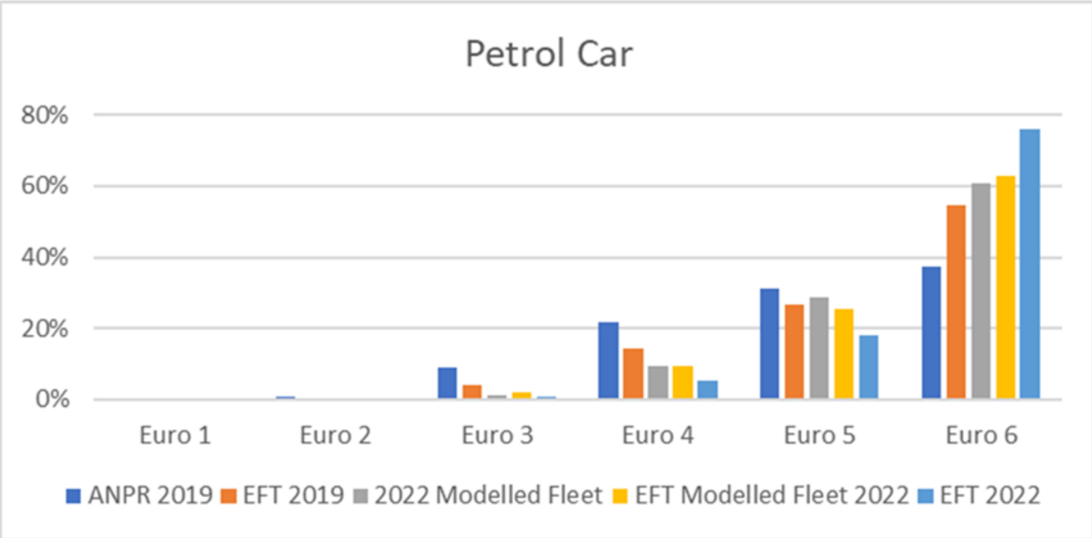

Figure 10. Petrol Car Forecasts (including alternative methods)

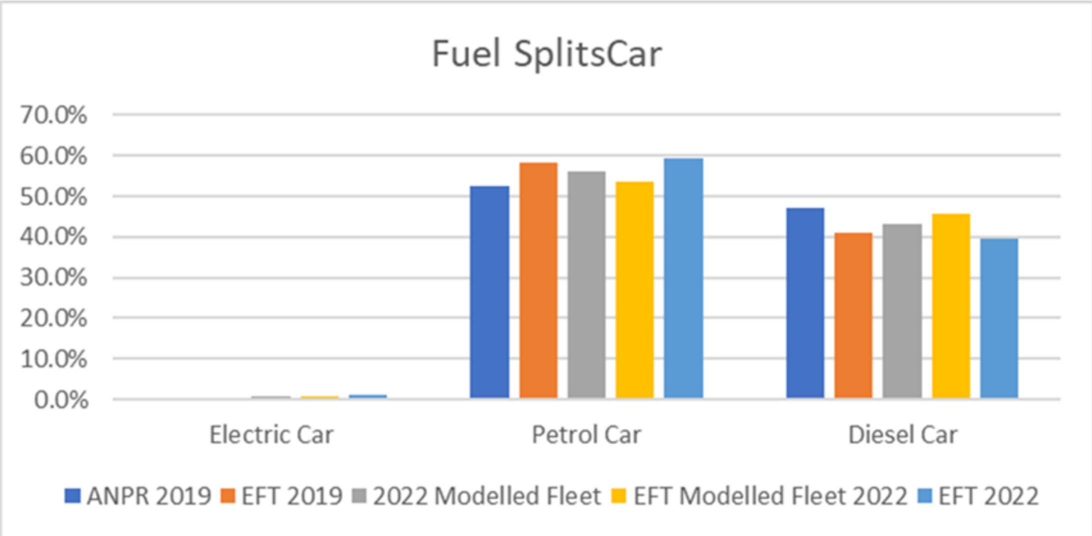

Figure 11. Car Fuel Split Forecasts (including alternative methods)

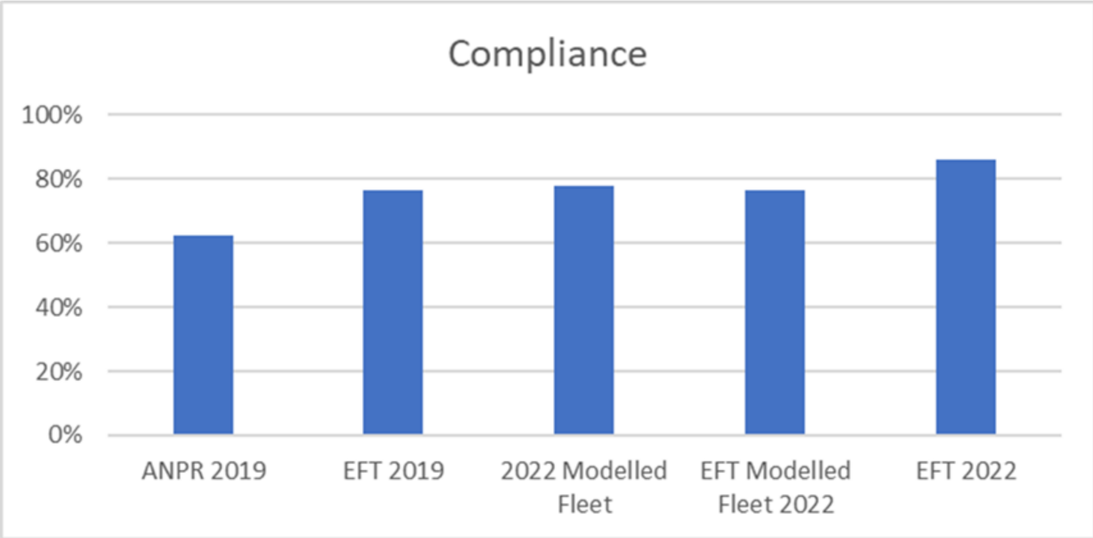

Figure 12. Car Compliance Forecasts (including alternative methods)

4.1.8 In addition to these charts, it should be noted that the change in car Euro classification over time very similar between the EFT and our fleet model. The biggest difference is at Euro 5 where the percentage difference is ~2%.

4.1.9 The following conclusions should be noted here:

- The compliance levels in 2022 are very similar (at 77%-79%) between the different approaches to fleet forecasting, but the SYSTRA fleet model enables us to capture the local nuances of the Sheffield and Rotherham car fleet churn;
- The forecast levels of BEVs are very similar in both approaches (0.71% of the car fleet in 2022 by the SYSTRA fleet model vs 0.65% in the EFT based approach); and
- The main difference between approaches is the change in the petrol / diesel split. The EFT-based %diesel now decreases slightly (by around 1.5%) from 2019 to 2022 (the previous EFT had predicted the %diesel to rise), but the rate of decrease is still lower than in the SYSTRA fleet model, which predicts a ~4% decline over these three years).
- In both approaches the diesel split reduces from 2019 to 2022 but in the fleet model it reduces faster. Under the EFT method diesel, as a proportion of the car fleet, reduces around 1.5% to 2022 but using the fleet model it reduces by ~4.1%. Note that the 2019 ANPR data suggests that diesel vehicles males up a smaller proportion of the local Sheffield & Rotherham car fleet than in the UK average figures.