THIRD WAVE LOCAL AUTHORITIES – TARGETED FEASIBILITY STUDY TO DELIVER NITROGEN DIOXIDE CONCENTRATION COMPLIANCE IN THE SHORTEST POSSIBLE TIME

Local authorities covered	Ashfield District Council

Further information on the content of each section is set out in the guidance.

Part 1: Understanding the problem

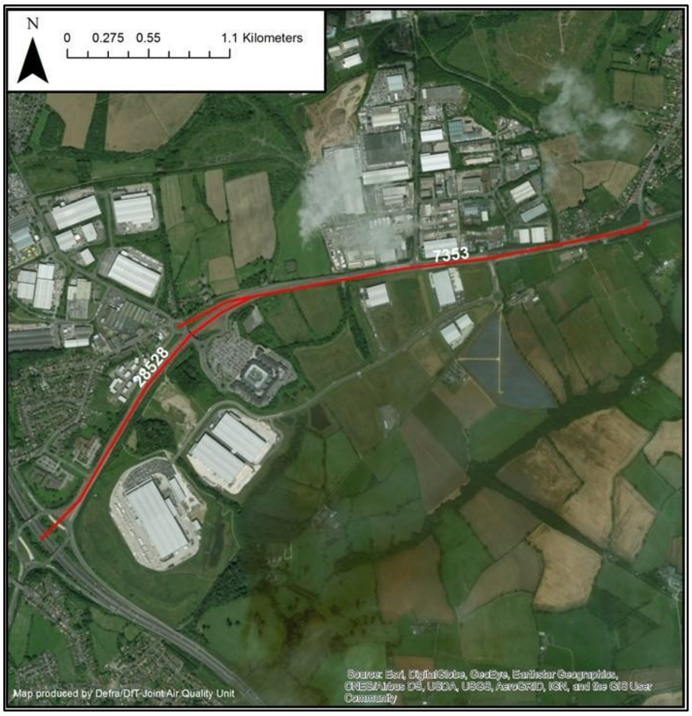
Introduction

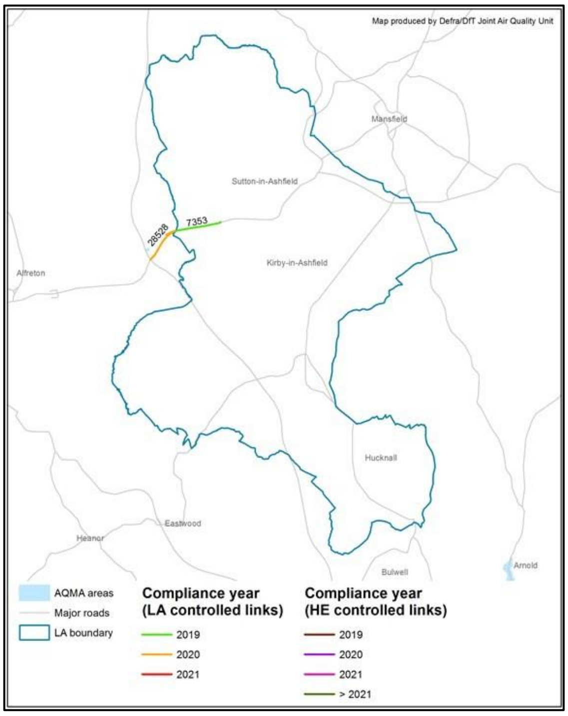
Ashfield District Council (the Council, ADC) has one road link (census ID: 7353) projected to have an exceedance of the annual mean NO_2 Air Quality Standard of 40µg/m^3. The road link under consideration is the stretch of the A38 that runs from the junction with the B6023 Alfreton Road, Sutton in Ashfield, to where the A38 meets the district boundary that is shared with Bolsover District Council (BDC). The Ashfield stretch of the A38 is managed by Nottinghamshire County Council (NCC), with the BDC section managed by the Derbyshire County Council's Highways Team. The projected exceedance within ADC continues from the B6023 junction of the A38, across the district boundary with Bolsover until it reaches Junction 28 of the M1.

Ashfield District Council are required to undertake a targeted Feasibility study on the A38 relating to one road link (census ID 7353), which is adjoined to the BDC road link (census ID 28528). Any actions from the targeted feasibility study will affect the traffic in both Council areas and therefore the Councils will work together when undertaking the feasibility study.

Figure 1 details the A38 PCM exceedance stretch. This targeted feasibility study aims to characterise the air quality issue and identify measures which could reduce the concentration of NO_2 on the A38 PCM exceedance stretch as quickly as possible, with the principal objective of bringing forward compliance in the shortest possible time.

Figure 1 – JAQU Maps detailing Predicted PCM Exceedance Location in ADC area.





PCM Findings

The results from the PCM show that the road link is projected to have the following annual mean NO_2 concentrations, with compliance with the annual mean Air Quality Standard of 40µg/m^3 achieved two years earlier than the Defra advised target date.

- 44µg/m^3 in 2017;
- 42µg/m^3 in 2018;

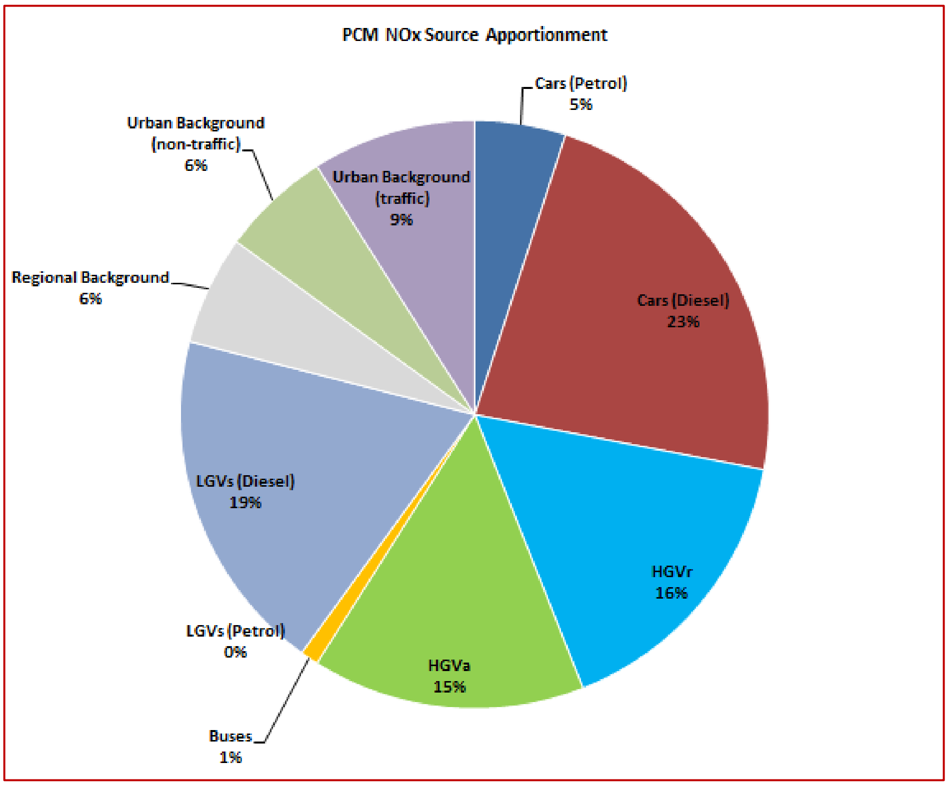
- 39.7μg/m^3 in 2019;
- 37μg/m^3 in 2020;
- 35μg/m^3 in 2021.

Compliance could therefore be realised if NO_2 concentrations are reduced by at least 2μg/m^3 in 2018, with a below exceedance level in 2019.

The PCM data shows that in 2015, the source contributors to total NO_X concentration on this road link were as illustrated in

Figure *2*.

Figure 2 – PCM based Total NO_x Emissions Source Apportionment (2015)



The PCM based NO_x source apportionment would suggest that 12% of the total NO_x emissions is attributable to regional and urban background sources (including traffic), whilst the remaining 88% is associated with local road traffic sources. Of this 88%, HGVs have been identified to be the principal source, contributing 31% of the total NO_x. Diesel cars are also observed to contribute a sizable proportion at 23%, petrol cars comparatively contribute significantly less at only 5%. Diesel LGVs contribute 19% of the total. Buses are predicted to contribute 1% of the total NO_x emissions.

The PCM utilises traffic data from the DfT traffic counts to define the corresponding vehicle emissions for input on each modelled road link. For PCM Census ID 7353, the traffic data from corresponding DfT count point (ID 7353 - E 446703, N 357321) has been applied. The DfT traffic data for the year 2015 was based upon an estimate calculated using the 2014 manual count, whereby trained enumerators count traffic by vehicle type over a 12 hour period. This raw data is then combined with information from a network of Automatic Traffic Counts (ATCs) to calculate a series of annual average daily flows (AADF) with associated fleet composition.

Figure 3 shows the traffic composition at DfT count point ID 7353 for the 2015 year, for which a total AADF of 43,528 was recorded with a HGV proportion of 7.6%, whilst the general AADF trend at this location since the year 2000 is provided in Figure 4. In addition to showing the AADF trend for count point ID 7353, count point ID 28528 in neighbouring Bolsover District Council is also shown in Figure 4. It can be seen that since 2000 there has been a general trend of traffic numbers increasing each year at both count points.

Figure 3 – Fleet Composition on the A38 as defined on DfT Count Point ID 7353 (2015)

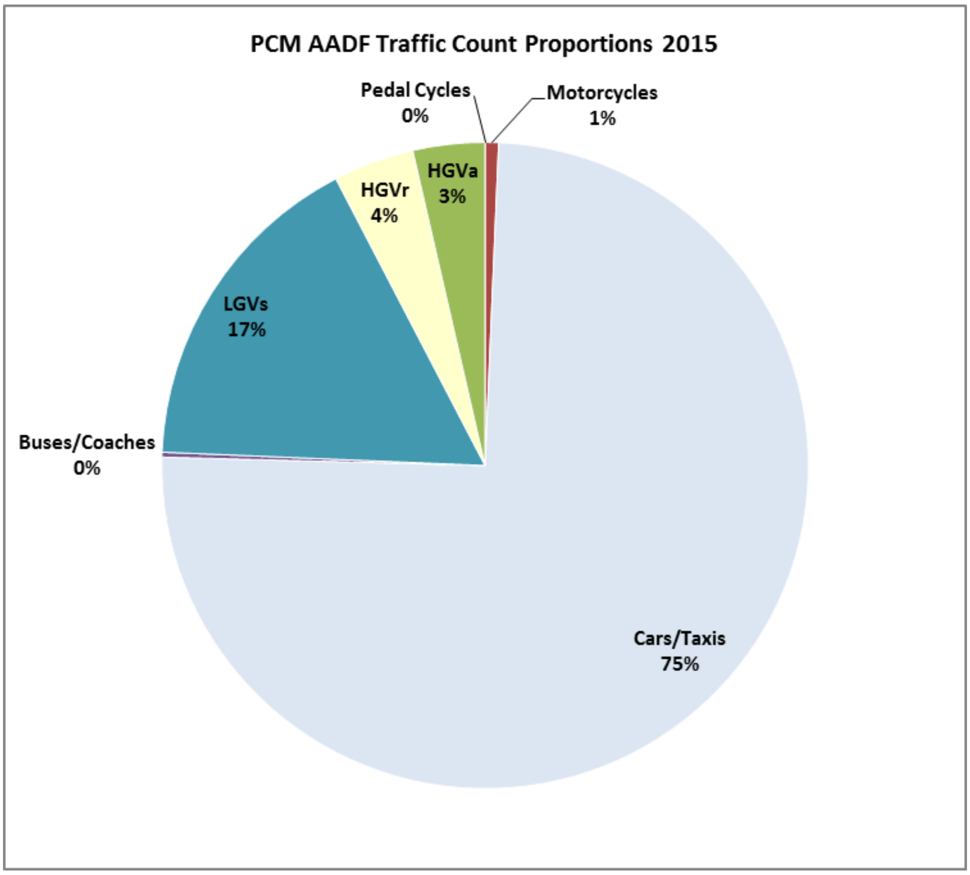
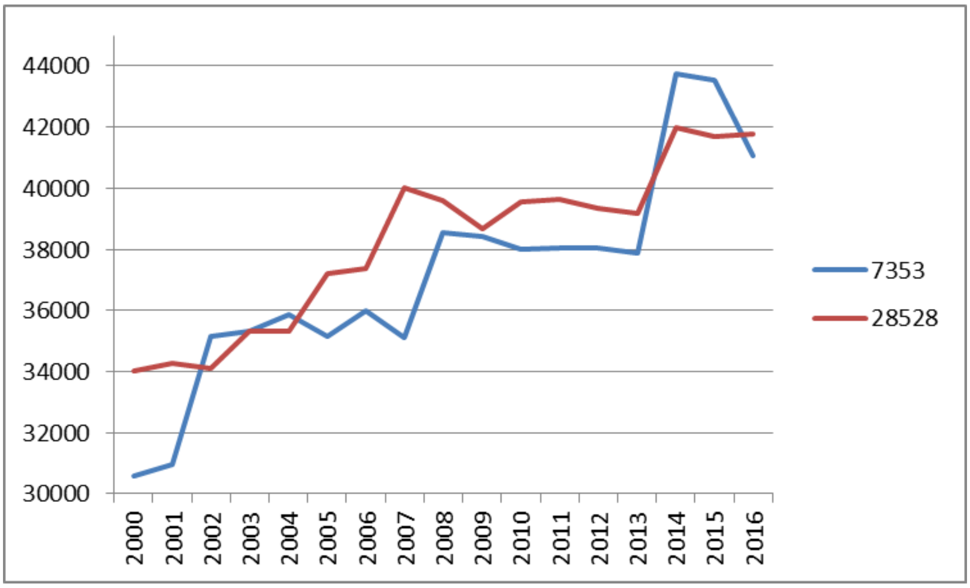


Figure 4 – AADF Trend since the year 2000 on the A38 as defined on DfT Count Point ID 28528 and 7353



Local Information

Local Context

The A38 is a dual carriageway which links the M1 motorway to Sutton-in-Ashfield and then on to Mansfield. The portion of the A38 to be considered in the study would be characterised as rural although some of the land close to the road is undergoing redevelopment as either large scale light industrial units or large scale commercial and leisure facilities.

The Ashfield stretch of the A38 comprises a number of industrial estates such as Castlewood Business Park to the south of the A38 (located in ADC and BDC) and South Fulwood Industrial Estate to the North of the A38 (located in Ashfield District Council). Large distribution centres, including the Co-op distribution centre and the designer outlet retail park, also reside along the A38 (in BDC). This land use provides evidence towards the large source apportionment of HGV and LGVs. This stretch of the A38 is also a corridor for accessing the M1, therefore commuting by car is reported as the largest source of NO_2 emissions. Furthermore, there are two bus services travelling along the ADC section of the A38, operated by Trentbarton and G J Holmes, which are largely consistent of Euro 5 or older diesel vehicles. This provides a development opportunity for the measures that may be developed by ADC.

The East Midlands Designer Outlet is a leisure and retail facility located to the south of the A38 in the BDC area. In addition to this, an application has recently been submitted for a large mixed-use development located at Cartwright Lane, South Normanton. The proposed development will form part of a ‘hybrid’ planning application, seeking full planning permission for retail and hotel use at the site frontage and outline permission for employment use at the rear of the application site. The proposed development would include an access road to the nearby roundabout between Berristow Lane and Cartwright Lane. An air quality assessment has been undertaken in relation to the development which found air quality impacts to be negligible. However BDC have now indicated further air quality studies are required as the assessment did not satisfactorily consider the impacts on the A38 (The application has now been withdrawn).

Local Monitoring

Ashfield has no historical monitoring data for the census ID 7353 stretch of the A38 Corridor, therefore upon learning of the exceedance based on the PCM model, ADC deployed a set of triplicate diffusion tubes at a location very close to the reference point highlighted by Defra as the point of highest exceedance (census ID 7353). The ADC diffusion tubes were deployed on 30th January 2018, with the intention that this data can be used in the long term for verification of the PCM model. Figure 5 illustrates diffusion tube monitoring undertaken by both BDC (Tubes 50, 51, 52 & 22) and ADC (Triplicate site 2018 ADC) that is within or close to the relevant exceedance area. ADC does not presently have any long term monitoring sites located within the study area.

Figure 5 – Council Diffusion Tube Monitoring

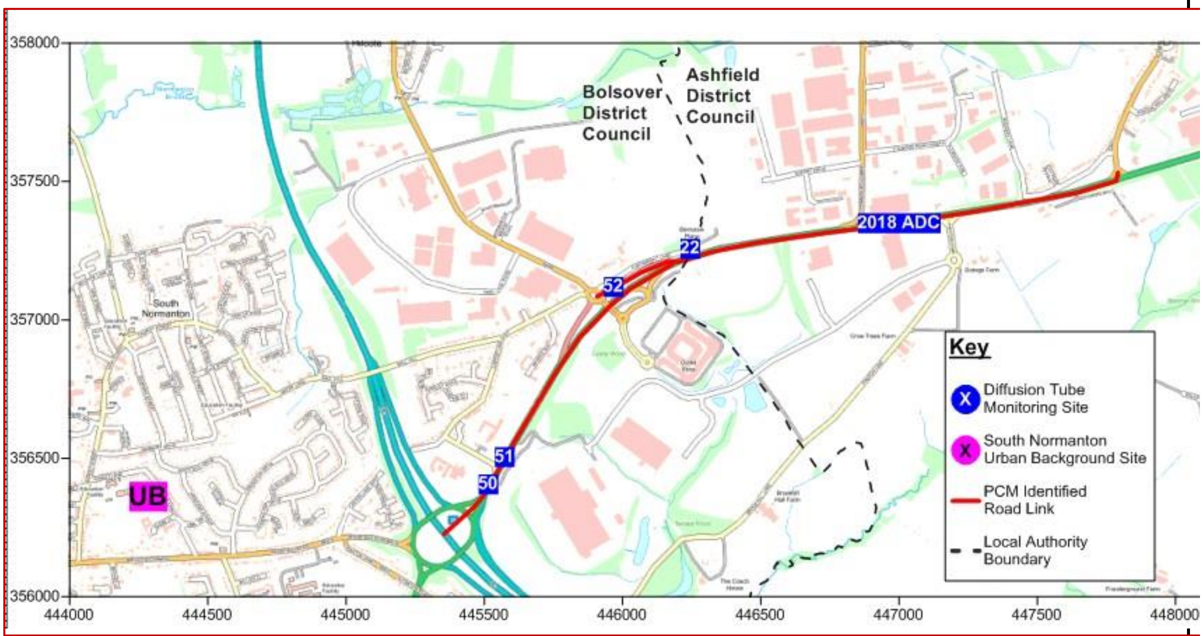


Table 1 provides some details of the monitoring undertaken in the study area.

Recorded NO_2 concentrations at BDC monitoring location 22 were observed to be well below the 40µg/m^3 annual mean for 2015, 2016 and 2017. This site is important to both Councils due to its close proximity to the council boundary. The monitored concentration at diffusion tube 22 is observed to be consistent across the three years not showing any upward or downward trend.

Table 1 – Council Monitoring Locations

ID	Receptor	X	Y	Distance from Receptor to A38 Carriageway (m)	Annual Mean NO_2 (µg/m^3)		
					2015	2016	2017
22	37 Berristow Place	446245	357257	10.4	26.3	26.4	26.0
50	Derbyshire Hotel	445515	356406		Bolsover Monitoring Commissioned in March 2018		
51	Premier Inn	445574	356504				
52	Slip Road	445968	357119				
2018 ADC	Fulwood Industrial Estate	447001	357349		Ashfield Monitoring Commissioned in January 2018		

The nearest AURN monitoring location is Chesterfield Roadside located approximately 17km to the north west. Although it may be possible to use this site for model verification this would not be the preferred approach due to the distance from the study area and the difference in context between the AURN site and the study location.

BDC previously operated an automatic analyser at an urban background location approximately 2 km to the west of the A38 study area. The analyser was decommissioned at the end of 2015. Table 2 below provides annual mean NO_2 data for the automatic analyser for year 2011 to 2015. The recorded annual mean NO_2 is observed to be well below 40 µg/m^3 air quality objective for all years between 2011 and 2015 and shows a generally decreasing trend. This data may be considered useful to provide a background NO_2 concentration for future dispersion modelling studies.

Table 2 – BDC Automatic Monitoring Location

ID	Receptor	X	Y	Annual Mean NO_2 (µg/m^3)				
				2011	2012	2013	2014	2015
South Normanton	Urban Background	444185	356361	20.2	21.8	21.3	18.7	16.4

ANPR Survey

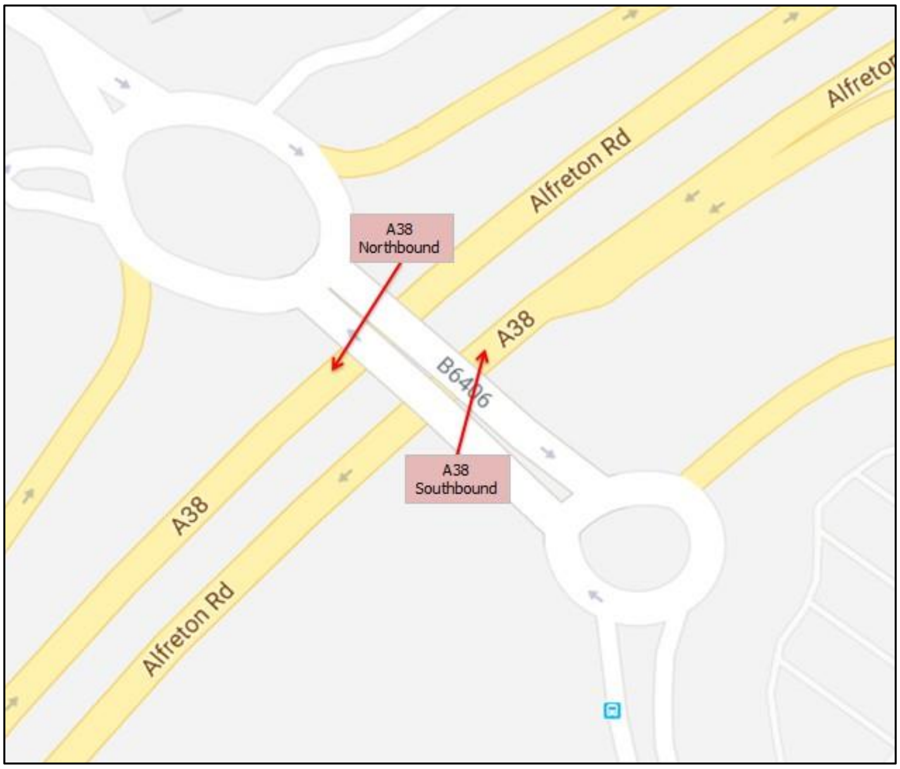
The Council, in partnership with BDC have undertaken an Automatic Number Plate Recognition (ANPR) survey which was carried out along the A38 PCM exceedance stretch. The survey comprised of a 72-hour period from Friday 15th June to Sunday 17th June inclusive. Data was collected in both directions (Northbound and Southbound) providing the petrol/diesel/electric split, fleet composition, Euro classification, traffic flows and diurnal profile of vehicles on the A38.

The additional local information was used to inform a local dispersion modelling exercise undertaken in ADMS-Roads, outputs from which will provide updated source apportionment results to be used to better direct possible measures. It is proposed that the model will be verified using monitoring data collected at diffusion tube 22 monitoring location, complimented if possible by further monitoring data from the Council.

The ANPR survey location is illustrated in

Figure 6.Two ANPR cameras were installed on the B6406 flyover passing over the A38. In addition, Manual Classified Count (MCC) cameras were also installed at the same direction to capture total traffic flow and to quantify the capture rate of the ANPR data.

Figure 6 – ANPR Survey Location



Total Traffic Flows

The 24-hour total AADF obtained for the 15th, 16th, and 17th of June 2018 were 19,189, 12,873 and 11,931 respectively for the northbound link, and 24,507, 18,255 and 15,593 respectively for the southbound link. For inclusion within the roads dispersion model, the data from the ANPR survey has been used specifically for the A38 northbound and southbound carriageways (either site of the sliproads leading up to/down from the B6406).

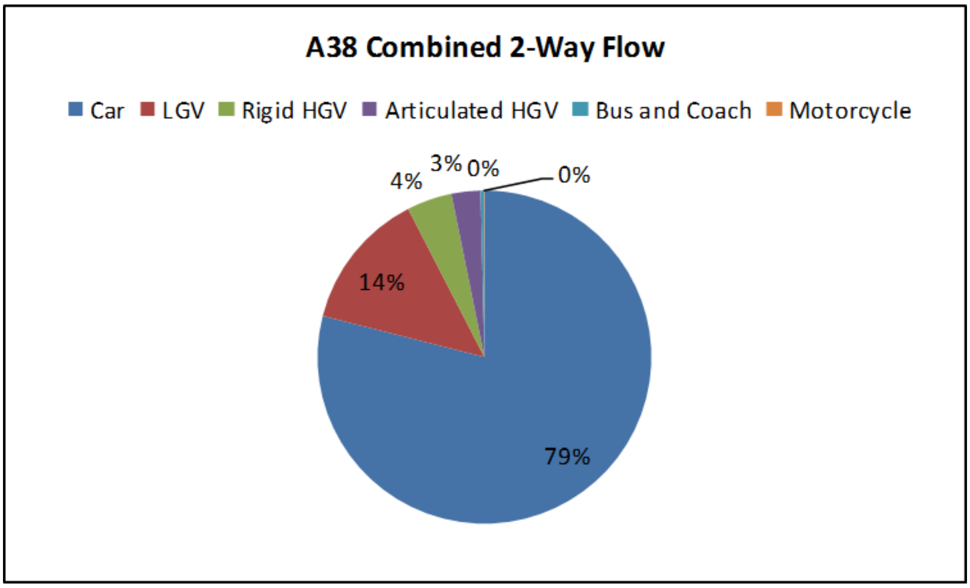
For the remainder of the A38 exceedance stretch DfT traffic count data has been used for the two PCM links (28528 and 7353) in conjunction with a diurnal profile and Euro Classifications calculated from combining the data from the northbound and southbound ANPR data.

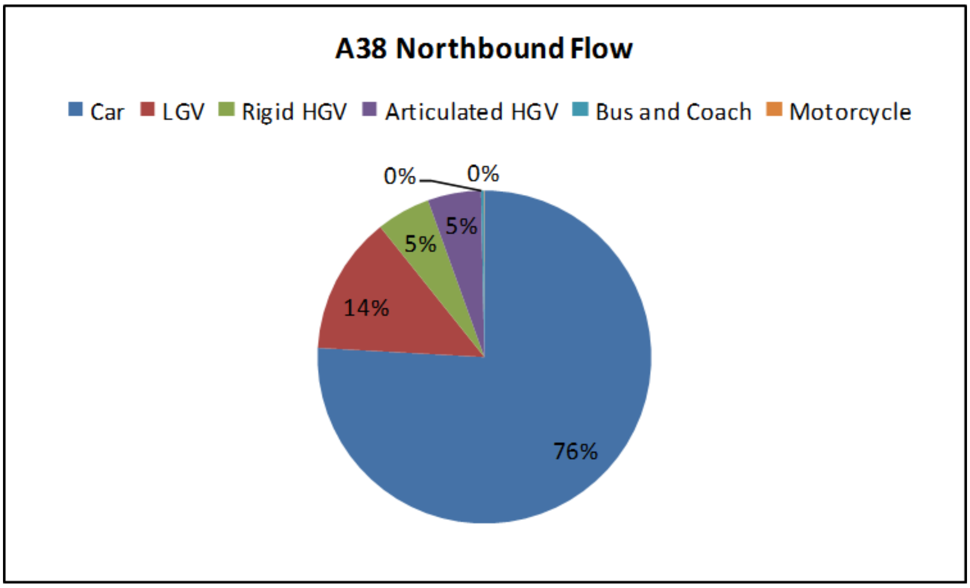
Fleet Composition

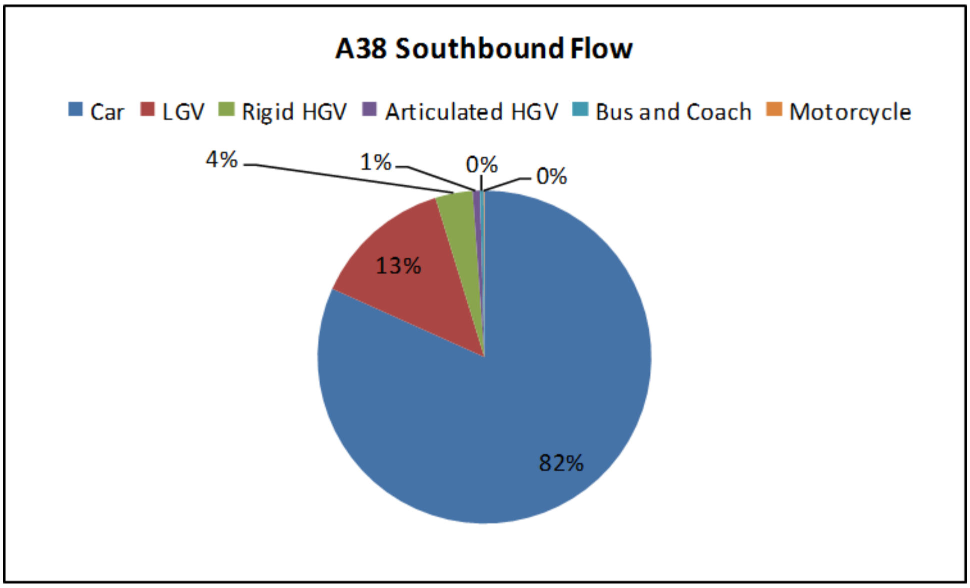
Figure 7 shows the fleet composition along the A38 at the survey location, fleet compositions are provided for the combined 2-way flow calculated from the ANPR survey in addition to the separate northbound and southbound flows. Cars were found to account for the highest % of the total fleet for each link, followed by LGVs and Rigid/Articulated HGVs. When comparing the northbound and southbound links the southbound link has 6% more Cars within the vehicle fleet and 4% less Articulated HGVs, this would suggest that more HGVs are travelling towards Sutton-in-Ashfield and Mansfield rather than in the reverse direction towards the M1.

The categories of Buses and Coaches and Motorcycles represent a negligible fraction of the total fleet.

Figure 7 – Fleet Composition







Petrol and Diesel Split

Figure 8,

Figure 9 and Figure 10 illustrates the Petrol and Diesel Splits for Cars and LGVs based upon the ANPR survey data. The survey results identified that car fleets for the northbound and southbound links are similar, and that all LGV vehicles were found to be diesel fuelled.

Figure 8 – Petrol Diesel Split for Cars and LGVs: A38 Combined

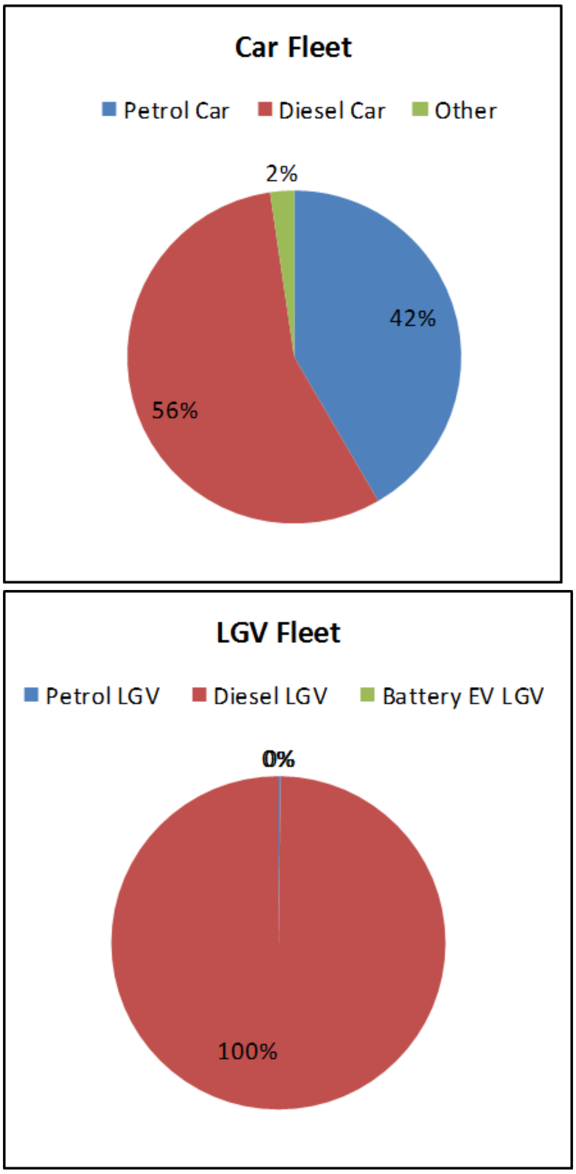
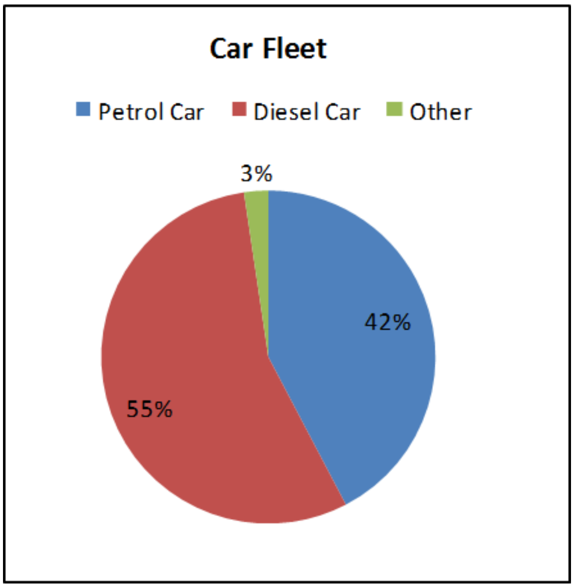


Figure 9 – Petrol Diesel Split for Cars and LGVs: Southbound Flow



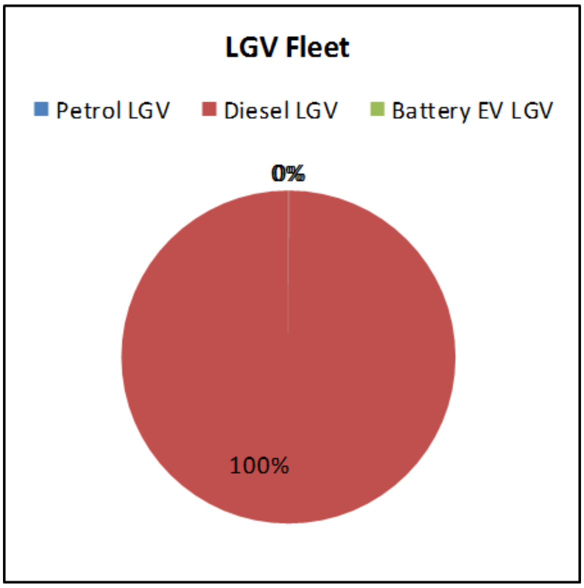
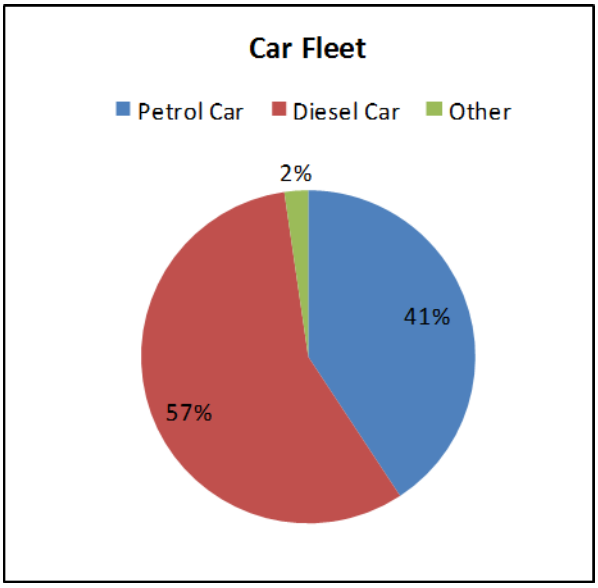
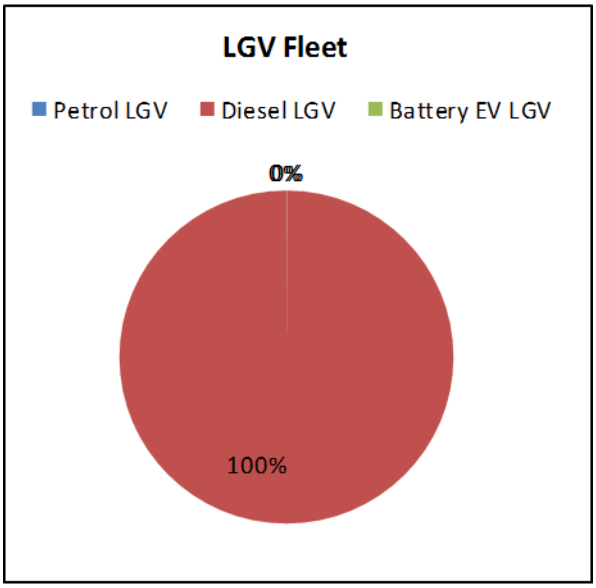


Figure 10 – Petrol Diesel Split for Cars and LGVs: Northbound Flow





Euro Composition

Figure **11**, Figure 12 and Figure 13 show the default national Euro proportions relative to the local Euro proportions derived from the ANPR survey data for the A38, for the Car fleet. The survey data show that Petrol and Diesel Cars are predominantly comprised of Euro 4, 5 and 6 class vehicles. The ANPR survey has presented a similar Euro Composition split to the national assumed fleet, with Euro 5 class for both Petrol Cars and Diesel Cars very similar.

Figure 11 – Euro Proportions for Diesel and Petrol Cars: A38 Combined

Petrol Car	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro 1	-	
2Euro 1	-	
3Euro 2	0.01	
4Euro 3	0.11	
5Euro 4	0.23	
6Euro 5	0.34	
7Euro 6	0.20	
7Euro 6c	0.12	

Diesel Car	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro 1	-	
2Euro 1	-	
3Euro 2	0.00	
4Euro 3	0.06	
5Euro 4	0.19	
6Euro 5	0.40	
7Euro 6	0.22	
7Euro 6c	0.13	
7Euro 6d	0.00	

Figure 12 – Euro Proportions for Diesel and Petrol Cars: A38 Southbound

Petrol Car	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro 1	-	
2Euro 1	-	
3Euro 2	0.01	
4Euro 3	0.11	
5Euro 4	0.23	
6Euro 5	0.34	
7Euro 6	0.20	
7Euro 6c	0.12	

Diesel Car	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro 1	-	
2Euro 1	-	
3Euro 2	0.00	
4Euro 3	0.06	
5Euro 4	0.19	
6Euro 5	0.40	
7Euro 6	0.22	
7Euro 6c	0.13	
7Euro 6d	0.00	

Figure 13 – Euro Proportions for Diesel and Petrol Cars: A38 Northbound

Petrol Car	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro 1	-	
2Euro 1	-	
3Euro 2	0.01	
4Euro 3	0.11	
5Euro 4	0.23	
6Euro 5	0.34	
7Euro 6	0.20	
7Euro 6c	0.12	

Diesel Car	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro 1	-	
2Euro 1	-	
3Euro 2	0.00	
4Euro 3	0.06	
5Euro 4	0.19	
6Euro 5	0.40	
7Euro 6	0.22	
7Euro 6c	0.13	
7Euro 6d	0.00	

Figure 14, Figure 15 and Figure 16 show the default national Euro proportions relative to the local Euro proportions derived from the ANPR survey data for the A38, for the LGV fleet. The survey data show that Petrol LGVs Euro proportions are less varied when compared to the national assumed fleet. The Euro proportions for Diesel LGVs from the survey show a high Euro 5 contribution than, but a lower Euro 6 contribution when compared to the national assumed fleet.

Figure 14 – Euro Proportions for Diesel and Petrol LGVs: A38 Combined

Petrol LGV	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro 1	-	
2Euro 1	0.00	
3Euro 2	0.03	
4Euro 3	0.11	
5Euro 4	0.20	
6Euro 5	0.34	
7Euro 6	0.32	
7Euro 6c	-	

Diesel LGV	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro 1	-	
2Euro 1	0.00	
3Euro 2	0.01	
4Euro 3	0.05	
5Euro 4	0.20	
6Euro 5	0.41	
7Euro 6	0.33	
7Euro 6c	-	
7Euro 6d	-	

Figure 15 – Euro Proportions for Diesel and Petrol Cars: A38 Southbound

Petrol LGV	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro 1	-	
2Euro 1	0.00	
3Euro 2	0.03	
4Euro 3	0.11	
5Euro 4	0.20	
6Euro 5	0.34	
7Euro 6	0.32	
7Euro 6c	-	

Diesel LGV	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro 1	-	
2Euro 1	0.00	
3Euro 2	0.01	
4Euro 3	0.05	
5Euro 4	0.20	
6Euro 5	0.41	
7Euro 6	0.33	
7Euro 6c	-	
7Euro 6d	-	

Figure 16 – Euro Proportions for Diesel and Petrol Cars: A38 Northbound

Petrol LGV	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro 1	-	
2Euro 1	0.00	
3Euro 2	0.03	
4Euro 3	0.11	
5Euro 4	0.20	
6Euro 5	0.34	
7Euro 6	0.32	
7Euro 6c	-	

Diesel LGV	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro 1	-	
2Euro 1	0.00	
3Euro 2	0.01	
4Euro 3	0.05	
5Euro 4	0.20	
6Euro 5	0.41	
7Euro 6	0.33	
7Euro 6c	-	
7Euro 6d	-	

Figure 17, Figure 18 and

Figure **19** show the default national Euro proportions relative to the local Euro proportions derived from the ANPR survey data for the A38, for the HGV fleet. The survey data show that for both Rigid and Articulated HGVs, the Euro 4 and Euro 5 proportions are higher, and the Euro 6 proportions are lower for the survey when compared to the national assumed fleet.

Figure 17 – Euro Proportions for Rigid and Articulated HGVs: A38 Combined

Rigid HGV	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro I	-	
2Euro I	-	
3Euro II	0.01	
4Euro III	0.09	
5Euro IV	0.08	
6Euro V_EGR	0.07	
7Euro V_SCR	0.20	
8Euro VI	0.55	
9Euro II SCRRF	-	
10Euro III SCRRF	-	
11Euro IV SCRRF	-	
12Euro V EGR + SCRRF	-	

Note: No emissions factors available for HGV SCRRF (Retrofits) therefore standard Euro class emissions factors will be assumed c

Artic HGV	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro I	-	
2Euro I	-	
3Euro II	0.00	
4Euro III	0.02	
5Euro IV	0.03	
6Euro V_EGR	0.06	
7Euro V_SCR	0.18	
8Euro VI	0.72	
9Euro II SCRRF	-	
10Euro III SCRRF	-	
11Euro IV SCRRF	-	
12Euro V EGR + SCRRF	-	

Figure 18 – Euro Proportions for Rigid and Articulated HGVs: A38 Southbound

Rigid HGV	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro I	-	
2Euro I	-	
3Euro II	0.01	
4Euro III	0.09	
5Euro IV	0.08	
6Euro V_EGR	0.07	
7Euro V_SCR	0.20	
8Euro VI	0.55	
9Euro II SCRRF	-	
10Euro III SCRRF	-	
11Euro IV SCRRF	-	
12Euro V EGR + SCRRF	-	

Note: No emissions factors available for HGV SCRRF (Retrofits) therefore standard Euro class emissions factors will be assumed c

Artic HGV	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro I	-	
2Euro I	-	
3Euro II	0.00	
4Euro III	0.02	
5Euro IV	0.03	
6Euro V_EGR	0.06	
7Euro V_SCR	0.18	
8Euro VI	0.72	
9Euro II SCRRF	-	
10Euro III SCRRF	-	
11Euro IV SCRRF	-	
12Euro V EGR + SCRRF	-	

Figure 19 – Euro Proportions for Rigid and Articulated HGVs: A38 Northbound

Rigid HGV	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro I	-	
2Euro I	-	
3Euro II	0.01	
4Euro III	0.09	
5Euro IV	0.08	
6Euro V_EGR	0.07	
7Euro V_SCR	0.20	
8Euro VI	0.55	
9Euro II SCRRF	-	
10Euro III SCRRF	-	
11Euro IV SCRRF	-	
12Euro V EGR + SCRRF	-	

Note: No emissions factors available for HGV SCRRF (Retrofits) therefore standard Euro class emissions factors will be assumed c

Artic HGV	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro I	-	
2Euro I	-	
3Euro II	0.00	
4Euro III	0.02	
5Euro IV	0.03	
6Euro V_EGR	0.06	
7Euro V_SCR	0.18	
8Euro VI	0.72	
9Euro II SCRRF	-	
10Euro III SCRRF	-	
11Euro IV SCRRF	-	
12Euro V EGR + SCRRF	-	

Figure 20,

Figure **21** and Figure 22 show the default national Euro proportions relative to the local Euro proportions derived from the ANPR survey data for the A38, for the Bus and Coach fleet. The survey data show that for Bus and Coaches, the Euro 4 proportions are far higher, and the Euro 5 and Euro 6 proportions are lower for the survey when compared to the national assumed fleet.

Figure 20 – Euro Proportions for Buses and Coaches: A38 Combined

Buses	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro I	-	
2Euro I	-	
3Euro II	0.03	
4Euro III	0.13	
5Euro IV	0.10	
6Euro V_EGR	0.08	
7Euro V_SCR	0.25	
8Euro VI	0.40	
9Euro II SCRRF	-	
10Euro III SCRRF	-	
11Euro IV SCRRF	-	
12Euro V EGR + SCRRF	-	

Note: Emissions factors (scaled) are available for Bus SCRRF (Retrofits) therefore user defined fleet may be used

Coaches	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro I	-	
2Euro I	-	
3Euro II	0.03	
4Euro III	0.13	
5Euro IV	0.10	
6Euro V_EGR	0.08	
7Euro V_SCR	0.25	
8Euro VI	0.40	
9Euro II SCRRF	-	
10Euro III SCRRF	-	
11Euro IV SCRRF	-	
12Euro V EGR + SCRRF	-	

Figure 21 – Euro Proportions for Buses and Coaches: A38 Southbound

Buses	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro I	-	
2Euro I	-	
3Euro II	0.03	
4Euro III	0.13	
5Euro IV	0.10	
6Euro V_EGR	0.08	
7Euro V_SCR	0.25	
8Euro VI	0.40	
9Euro II SCRRF	-	
10Euro III SCRRF	-	
11Euro IV SCRRF	-	
12Euro V EGR + SCRRF	-	

Note: Emissions factors (scaled) are available for Bus SCRRF (Retrofits) therefore user defined fleet may be used

Coaches	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro I	-	
2Euro I	-	
3Euro II	0.03	
4Euro III	0.13	
5Euro IV	0.10	
6Euro V_EGR	0.08	
7Euro V_SCR	0.25	
8Euro VI	0.40	
9Euro II SCRRF	-	
10Euro III SCRRF	-	
11Euro IV SCRRF	-	
12Euro V EGR + SCRRF	-	

Figure 22 – Euro Proportions for Buses and Coaches: A38 Northbound

Buses	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro I	-	
2Euro I	-	
3Euro II	0.03	
4Euro III	0.13	
5Euro IV	0.10	
6Euro V_EGR	0.08	
7Euro V_SCR	0.25	
8Euro VI	0.40	
9Euro II SCRRF	-	
10Euro III SCRRF	-	
11Euro IV SCRRF	-	
12Euro V EGR + SCRRF	-	

Note: Emissions factors (scaled) are available for Bus SCRRF (Retrofits) therefore user defined fleet may be used

Coaches	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro I	-	
2Euro I	-	
3Euro II	0.03	
4Euro III	0.13	
5Euro IV	0.10	
6Euro V_EGR	0.08	
7Euro V_SCR	0.25	
8Euro VI	0.40	
9Euro II SCRRF	-	
10Euro III SCRRF	-	
11Euro IV SCRRF	-	
12Euro V EGR + SCRRF	-	

Figure **23**, Figure 24 and Figure 25 show the default national Euro proportions relative to the local Euro proportions derived from the ANPR survey data for the A38, for the Full Hybrid fleet. The survey data show that for Full Hybrid Petrol and Diesel Cars, the majority of the vehicles were Euro 5 and Euro 6.

Figure 23 – Euro Proportions for Full Hybrid Petrol and Diesel Cars: A38 Combined

Default distribution based on petrol cars | *Default distribution based on petrol cars*

Full Hybrid Petrol Car	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro 1	-	
4Euro 3	0.00	
5Euro 4	0.09	
6Euro 5	0.29	
7Euro 6	0.32	
7Euro 6c	0.30	

Full Diesel Hybrid Car	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
6Euro 5	0.13	
7Euro 6	0.37	
7Euro 6c	0.49	
7Euro 6d	-	

Figure 24 – Euro Proportions for Full Hybrid Petrol and Diesel Cars: A38 Combined

Full Hybrid Petrol Car	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro 1	-	
4Euro 3	0.00	
5Euro 4	0.09	
6Euro 5	0.29	
7Euro 6	0.32	
7Euro 6c	0.30	

Full Diesel Hybrid Car	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
6Euro 5	0.13	
7Euro 6	0.37	
7Euro 6c	0.49	
7Euro 6d	-	

Figure 25 – Euro Proportions for Full Hybrid Petrol and Diesel Cars: A38 Combined

Full Hybrid Petrol Car	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
1Pre-Euro 1	-	
4Euro 3	0.00	
5Euro 4	0.09	
6Euro 5	0.29	
7Euro 6	0.32	
7Euro 6c	0.30	

Full Diesel Hybrid Car	Default Euro Proportions 2017 - England (not London)	User Euro Proportions 2017 - England (not London)
6Euro 5	0.13	
7Euro 6	0.37	
7Euro 6c	0.49	
7Euro 6d	-	

Diurnal Profiles

Figure 26, Figure 27 and

Figure 28 illustrate the diurnal profiles for the A38 from the ANPR survey completed, changes in traffic flows at each hour throughout the day on 15th (Friday), 16th (Saturday), and 17th (Sunday) June 2018 have been plotted. The a.m. and p.m. peaks, inter-peak and off-peak periods are clearly visible on the Friday, whilst the profile on the Saturday and Sunday show a characteristic single peak later in the day (with the Sunday exhibiting a lower flow than the Saturday).

Figure 26 – Diurnal Traffic Flows: A38 Combined

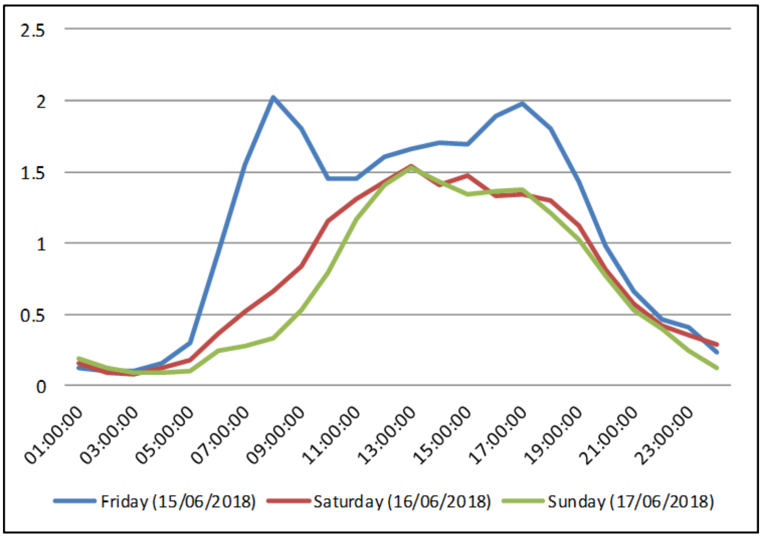


Figure 27 – Diurnal Traffic Flows: A38 Southbound

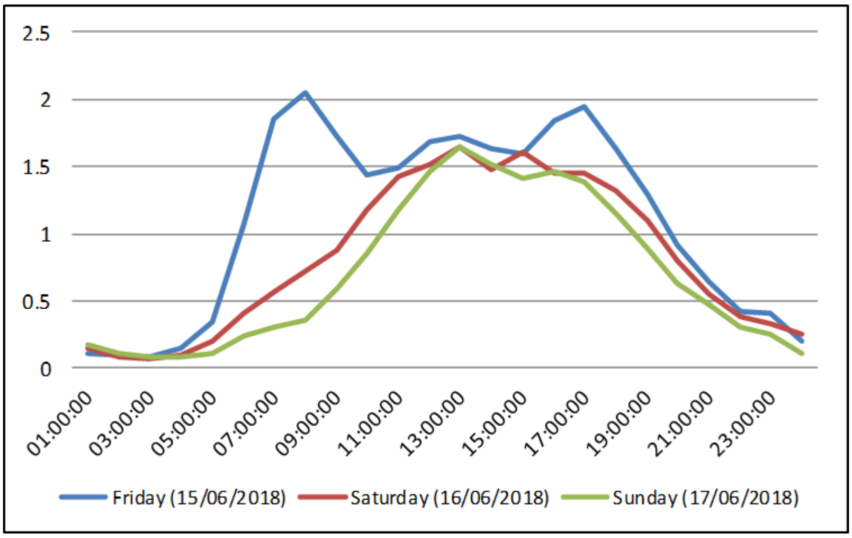
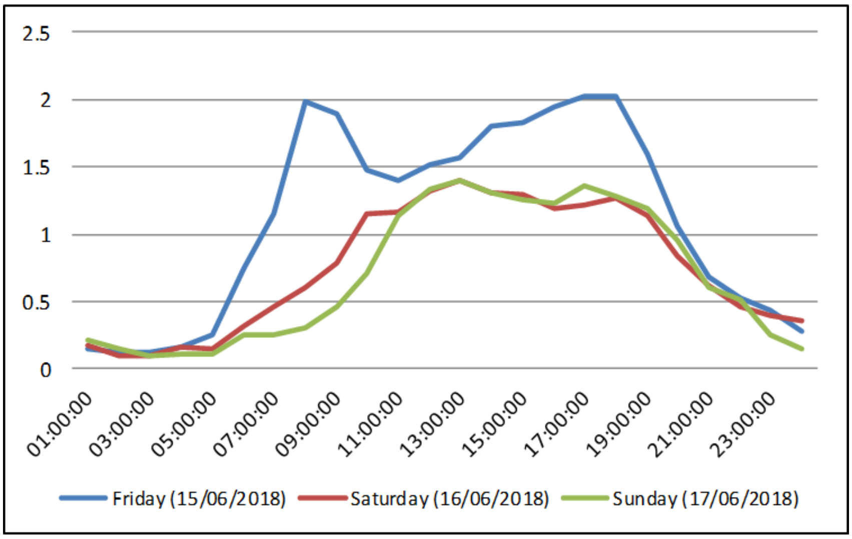


Figure 28 – Diurnal Traffic Flows: A38 Northbound



Local Dispersion Modelling

A local dispersion modelling study was undertaken to assess annual mean NO_2 concentrations across the A38 PCM exceedance stretch, with 2017 taken to be the baseline year. The ADMS-Roads model (version 4.1.1) and the Emissions Factors Toolkit (EFT version 8.0.1.a) were used for the purposes of the study, with traffic data used as input to the model derived from a combination of available sources, including:

- 2017 DfT traffic count data (AADF and fleet composition);
- June 2018 ANPR survey data (AADF, fleet composition, Euro composition and diurnal profile); and
- 2018 speed data from a Bluetooth journey time survey completed on the A38 between the 26th of June and the 5th of July.

Meteorological data from a representative station is required by the dispersion model. 2017 meteorological data from the Nottingham/Watnall weather station, approximately 30km northwest from the PCM exceedance stretch, has been used in this assessment.

Annual mean NO_2 concentrations were predicted for the 2017 baseline scenario at receptors plotted 4m from the kerb of the A38 PCM exceedance stretch (246 receptors to facilitate direct comparison against the PCM model predictions - referred to as ‘PCM receptors’). All PCM receptors were included at a height of 2m. Details of the discrete receptors, traffic data, background concentrations, meteorological data and the verification process can be found in Annex 1.

Results

PCM Receptors

Full results for PCM receptors can be found in Annex 2. 246 PCM receptors were modelled along the A38 PCM exceedance stretch, 155 receptors were located within BDC and 91 were located within ADC. The maximum annual mean NO_2 concentration at a discrete receptor along the A38 PCM exceedance stretch within ADC was predicted to be 38.4μg/m^3 at PCM receptor R71. This is below the annual mean EU limit value of 40μg/m^3, suggesting that compliance along Census ID 7353 has already been achieved by 2017.

Source Apportionment

To help inform the development of measures listed in Part 2 of the Targeted Feasibility Study, source apportionment for the entire A38 link for the different road traffic categories has been undertaken. Table 3 and 29show results for the source apportionment exercise based on the modelled discrete receptors for the modelled baseline year of 2017.

Source apportionment results have been calculated for two different selections of the modelled receptors:

1. Average across all modelled receptors – This provides an average at all modelled receptors and so is useful when considering possible measure to test and adopt. It will however understate road NO_x concentrations in problem areas; and
2. At the receptor with maximum road NO_x Concentration - Provides the NO_x source apportionment at the receptor with the highest predicted road NO_x concentration. This is likely to be in the area of most concern and so a good place to test and adopt measure. Any gains predicted by measures are however likely to be greatest at this location and so would not represent gains across the whole modelled area.

An average is usually also provided across all receptors with an NO_2 concentration greater than 40μg/m^3. Due to all predicted exceedances in 2017 being recorded within BDC (Census ID 28528) these averages have not been presented.

When considering the average NO_x concentration across all modelled receptors, road traffic accounts for 42.1μg/m^3 (60.4%) of 69.7μg/m^3. Of this 42.1μg/m^3, Cars account for the most (25.5%) of any of the vehicle types. LGVs and HGVs also account for a relatively high proportion of the overall predicted NO_x concentration at 16.5% and 17.7%.

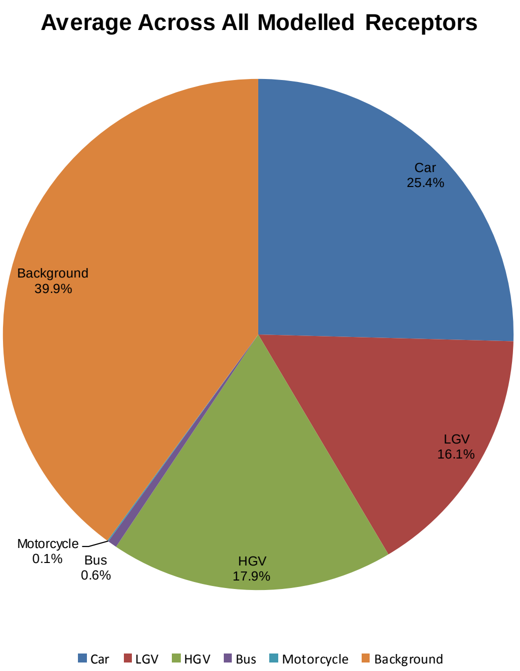
At the receptor within ADC with the maximum road NO_x concentration (Receptor 71), road traffic accounts for 50.1μg/m^3 (68.2%) of 73.5μg/m^3. Of this 73.5μg/m^3, cars account for the most (20.1%) of any of the vehicle types. HGVs are the second highest contributor to the overall predicted NO_x concentration at 18.2μg/m³ of NO_x representing 24.7% of the overall predicted NO_x concentration.

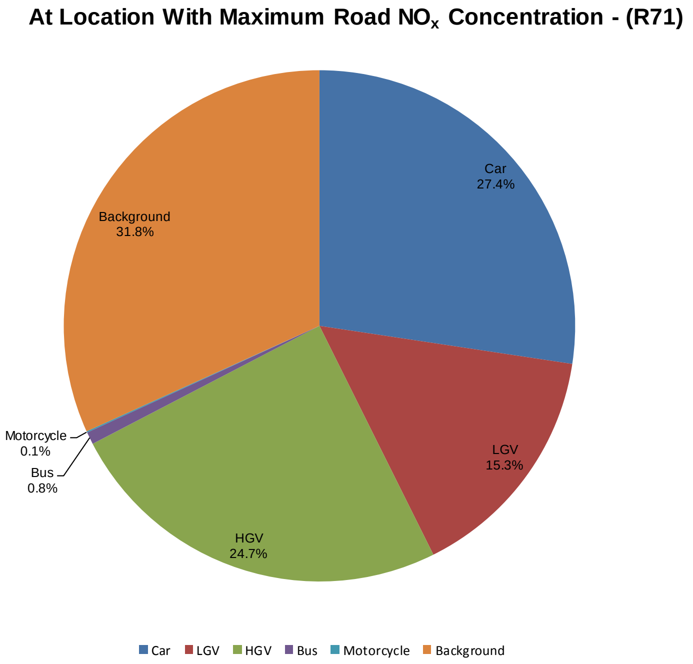
Figure 7 shows that HGVs make up a small proportion of the fleet on the A38 exceedance stretch, compared to the total number of cars a small number of HGVs travelling on the link are shown to contribute to a significant amount of the total NO_x concentration.

Table 3 – Source Apportionment Results

Results	All Vehicles	Car	LGV	HGV	Bus	Motorcycle	Background
Average Across All Modelled Receptors							
NO_x Concentration (μg/m³)	41.5	17.6	11.1	12.4	0.4	0.0	27.6
Percentage of Total NO_x	60.1	25.4	16.1	17.9	0.6	0.1	39.9
Percentage Contribution to Road NO_x	100.0	42.3	26.7	29.8 %	1.0	0.1	-
At ADC Location With Maximum Road NO_x Concentration (Receptor R71)							
NO_x Concentration (μg/m³)	50.1	20.1	11.2	18.2	0.6	0.1	23.3
Percentage of Total NO_x	68.2	27.4	15.3	24.7	0.8	0.1	31.8
Percentage Contribution to Road NO_x	100.0	40.1	22.4	36.2	1.1	0.1	-

Figure 29 – Pie Charts Showing Source Apportionment Results





Local Dispersion Modelling Results - Summary

The discrete receptor modelled concentrations suggest that within ADC there are no exceedances of the EU limit value along the A38 PCM exceedance stretch at any receptor locations.

In comparison with the PCM modelled results, the local dispersion modelling results suggest there is a discrepancy with regards to the annual mean NO_2 concentrations predicted along the PCM exceedance stretch, with the PCM model predicting 44µg/m^3 along the A38 PCM exceedance stretch in 2017 (Census ID 7353).

The reason for the difference between the PCM national model predictions and those obtained from the local dispersion model is likely include the following:

- Improved resolution of local data model inputs to the local dispersion model, i.e. traffic flows, fleet composition, Euro composition, average vehicle speeds, queuing parameters and road geometry. This will reduce the number of assumptions that are otherwise adopted in the PCM national modelling.

The Joint Air Quality Unit (JAQU) have validated the local dispersion modelling exercise and have concluded that it provides for an accurate reflection of the air quality along the A38 PCM exceedance stretch (Census ID 7353). The Council therefore consider that the findings from the local dispersion modelling exercise supersede the PCM model predictions, thereby providing for a revised baseline air quality position along Census ID 7353, i.e. the annual mean NO_2 concentration results from the local dispersion model replace the PCM model predictions.

On this basis, it is therefore concluded that no further consideration to possible measures to be implemented is required, with compliance against the annual mean EU limit value of 40μg/m^3 for NO_2 suitably demonstrated to have already been achieved by 2017 along the A38 PCM exceedance stretch (Census ID 7353).

Part 2: Developing a long list of measures for addressing the exceedances

This section should provide a long list of possible measures to be considered for each road link. Local authorities should consider the source apportionment set out in part 1.

Part 1 of the Targeted Feasibility Study concluded that there was no need to proceed with subsequent parts of the study, with compliance against the annual mean EU limit value of 40μg/m^3 for NO_2 suitably demonstrated to have already been achieved by 2017 along the A38 PCM exceedance stretch within ADC (Census ID 7353).

Part 3: Assessing deliverability/feasibility and delivering a short list

For each of the measures identified in part 2, local authorities should set out an assessment of deliverability including how long it would take to deliver each measure and whether it is practicably feasible to deliver. Based on this assessment of deliverability and feasibility, the local authority should develop a short list of measures to take forward to part 4 of the report.

Part 1 of the Targeted Feasibility Study concluded that there was no need to proceed with subsequent parts of the study, with compliance against the annual mean EU limit value of 40μg/m^3 for NO_2 suitably demonstrated to have already been achieved by 2017 along the A38 PCM exceedance stretch within ADC (Census ID 7353).

Part 4: Evidencing the short listed measures to identify options that could bring forward compliance

In this section, local authorities should set out the likely effectiveness of the shortlisted measures in bringing forward compliance. Local authorities should assess each option against the Primary Critical Success Factor.

Part 1 of the Targeted Feasibility Study concluded that there was no need to proceed with subsequent parts of the study, with compliance against the annual mean EU limit value of 40µg/m^3 for NO_2 suitably demonstrated to have already been achieved by 2017 along the A38 PCM exceedance stretch within ADC (Census ID 7353).

Part 5: Setting out a preferred option

In this section, local authorities should set out a summary of their preferred option to bringing forward compliance (where such measures exist). Where new measures have been identified that could bring forward compliance, local authorities should also assess a range of Secondary Critical Success Factors in order to identify the preferred option.

Ashfield District Council (the Council, ADC) has one road link (census ID: 7353) projected to have an exceedance of the annual mean NO_2 Air Quality Standard of 40µg/m^3. The road link under consideration is the stretch of the A38 that runs from the junction with the B6023 Alfreton Road, Sutton in Ashfield, to where the A38 meets the district boundary that is shared with Bolsover District Council (BDC). The Ashfield stretch of the A38 is managed by Nottinghamshire County Council (NCC), with the BDC section managed by the Derbyshire County Council's Highways Team. The projected exceedance within ADC continues from the B6023 junction of the A38, across the district boundary with Bolsover until it reaches Junction 28 of the M1.

In order to determine a more accurate local position on compliance with the annual mean NO_2 limit value, the Council undertook a local Automatic Number Plate Recognition (ANPR) survey and associated local dispersion modelling exercise, in order to provide an improved insight in to the air quality along the A38 PCM exceedance stretch.

The ADMS-Roads model (version 4.1.1) and the Emissions Factors Toolkit (EFT version 8.0.1.a) were used for the purposes of the dispersion modelling study, with traffic data used as input to the model derived from a combination of available sources. Further details of the model inputs and the model verification process can be found in Annex 1.

Annual mean NO_2 concentrations for PCM receptors can be found in Annex 2. Annual mean NO_2 concentrations were predicted at 246 PCM receptors across both BDC and ADC for a 2017 baseline scenario. The maximum annual mean NO_2 concentration at a PCM receptor along the A38 PCM exceedance stretch within ADC (Census ID 7353) was predicted to be 38.4µg/m^3 (PCM receptor R71).

At all receptor locations representative of relevant public access and therefore potential exposure, no exceedances of the annual mean EU limit value of 40µg/m^3 are predicted. This suggests that compliance along Census ID 7353 had already been achieved by 2017.

Therefore, in comparison with the PCM modelled results, the local dispersion modelling results suggest there is a discrepancy with regards to the annual mean NO_2 concentrations predicted along the PCM exceedance stretch, with the PCM model predicting 44μg/m^3 along the A38 PCM exceedance stretch in 2017 (Census ID 7353). The reason for the difference between the PCM national model predictions and those obtained from the local dispersion model is likely include the following:

i. Improved resolution of local data model inputs to the local dispersion model, i.e. traffic flows, fleet composition, Euro composition, average vehicle speeds, queuing parameters and road geometry. This will reduce the number of assumptions that are otherwise adopted in the PCM national modelling.

The Joint Air Quality Unit (JAQU) have validated the local dispersion modelling exercise and have concluded that it provides for an accurate reflection of the air quality along the A38 PCM exceedance stretch (Census ID 7353). The Council therefore consider that the findings from the local dispersion modelling exercise supersede the PCM model predictions, thereby providing for a revised baseline air quality position along Census ID 7353, i.e. the annual mean NO_2 concentration results from the local dispersion model replace the PCM model predictions.

On this basis, Part 1 of the Targeted Feasibility Study concluded that there was no need to proceed with subsequent parts of the study, with compliance against the annual mean EU limit value of 40μg/m^3 for NO_2 suitably demonstrated to have already been achieved by 2017 along the A38 PCM exceedance stretch (Census ID 7353).

Notwithstanding the above, due to the timings of reaching the above conclusion (i.e. through completion of the local ANPR survey and associated dispersion modelling exercise) relative to the need to progress the study, the Council had already prepared Parts 2 to 4. These were originally prepared relative to the PCM model baseline and were then only partially updated relative to the revised baseline position, i.e. that as determined from the local dispersion modelling exercise, which supersedes the PCM model predictions.

Conclusion

A local dispersion modelling study has demonstrated that compliance against the annual mean EU limit value of 40μg/m^3 for NO_2 had already been achieved by 2017 along the A38 PCM exceedance stretch (Census ID 7353). On this basis, it was concluded that no further consideration to possible measures to be implemented was required.

Notwithstanding the above, the Council remain committed to taking a proactive stance to ensuring positive improvements in air quality continue. This will be achieved with the help of the following ongoing actions:

i. **Road Junction Improvements** - Ashfield District Council working with Partners has taken the lead in commissioning a transport study for the

A38 Corridor working with Nottinghamshire County Council and Mansfield District Council. The aim of the study is to identify highway and transport infrastructure improvements to speed up journey times and prevent traffic idling along the A38 Corridor. The study is scheduled to start its assessment into the scale of the problem in spring 2018. Whilst this study was developed prior to Ministerial Direction regarding exceedances of air quality objectives this is an important measure aimed at ensuring that Ashfield District Council reduces the level of nitrogen dioxide emission in the shortest possible time and stays on schedule to be compliant by 2019. It targets all traffic emission sources highlighted in the sources apportionment projections.

ii. **Personal travel planning with households** – The County Council has secured Access Fund revenue funding from the DfT to deliver travel planning with households, jobseekers and school leavers in Mansfield during 2018/19 and 2019/20 to help promote walking, cycling, public transport and car sharing.

iii. **Cycle routes -** This section of the A38 already has a signed shared-use cycle route along the footway adjacent to the road

iv. **Integrated Transport Plan -** Facilities to help enable people to access jobs, services etc. on foot are developed and delivered by Nottinghamshire County Council.

v. **Promotion of walking and cycling** – The County Council produces a cycle route map and works in partnership with the districts to promote active travel (e.g. cycle training schemes, promotional events such as involvement in the Tour of Britain). Cycling and walking are also encouraged through the County Council's 'Wellbeing at Work' programme

vi. **Car/lift sharing schemes –** The County Council funds the countywide 'Nottinghamshire' lift share website to help facilitate car sharing in the county

vii. **Electric vehicle charge points –** the County Council is a partner in the Nottingham Go Ultra Low programme to encourage, and accelerate, the take-up of low emission vehicles. Work is currently underway to identify off-street car parks where these may be introduced (to deliver a public network of charge points). The programme also offers grants to workplaces to introduce charging infrastructure

viii. **Reduced speed limits –** the speed limit along this section of the A38 has been reduced to 50mph and average speed safety cameras have been introduced to help address road traffic collisions along the route.

ix. **The installation of CCTV** - Nottinghamshire County Council will be installing CCTV at 12 sets of traffic signals on the A38. The aim is to actively manage the traffic to ensure that journey times are more reliable and to minimise queues at traffic lights.

x. **East Midland Designer Outlet extension of the car park facilities -** A planning application has been submitted to ADC to extend the car parking facilities for the East Midlands Designer Outlet retail park which, if granted, will help to minimise standing traffic accessing the retail park.

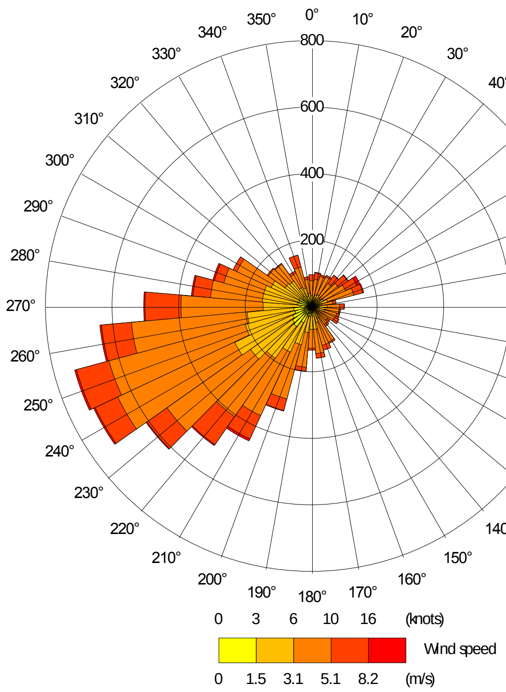
In addition to the above the Council will consider further measures that can be implemented, with a collaborative approach with the various stakeholders to be coordinated, in particular ensuring that a joined up approach with the other authorities across the north region is at the forefront of any further action.

Annex 1: Model Inputs – Additional Information

Meteorological Data

Meteorological data from a representative station is required by the dispersion model. 2017 meteorological data from the Nottingham/Watnall weather station, approximately 30km northwest from the PCM exceedance stretch, has been used in this assessment. A wind rose for the weather station for the year 2017 is shown in Figure A.1.

Figure A.1 – Wind Rose for Nottingham/Watnall Meteorological Data 2017



Most dispersion models do not use meteorological data if they relate to calm winds conditions, as dispersion of air pollutants is more difficult to calculate in these circumstances. ADMS-Roads treats calm wind conditions by setting the minimum wind speed to 0.75m/s. It is recommended in LAQM.TG(16) that the meteorological data file be tested within 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. LAQM.TG(16) recommends that meteorological data should have a percentage of usable hours greater than 85%. If the data capture is less than 85% short-term concentration predictions should be expressed as percentiles rather than as numbers of exceedances. 2017 meteorological data from Nottingham/Watnall includes 8478 lines of usable hourly data out of the total 8,760 for the year, i.e. 96.8% usable data. This is therefore suitable for the dispersion modelling exercise.

Traffic Inputs

The ADMS-Roads assessment incorporates numbers of road traffic vehicles, vehicle speeds on the local roads and the composition of the traffic fleet. The traffic data for this assessment has been derived from the Department for Transport (DFT) Traffic Counts website and an ANPR survey completed on the PCM exceedance stretch on the 15th, 16th and 17th of June 2018.

Traffic speeds were calculated from a Bluetooth journey time survey that is in operation on the PCM exceedance stretch and also based on speed limits across the road network. However, where appropriate, the speeds have been reduced to simulate queues at junctions, traffic lights and other locations where queues are known to be an issue. Traffic speeds have been assumed to be consistent across all the modelled scenarios.

The Emissions Factor Toolkit (EFT) version 8.0.1.a, made available through the Huddle portal has then been used to determine vehicle emission factors for input into the ADMS-Roads model; these are based upon the traffic data inputs.

Details of the traffic flows used in this assessment are provided in Table A.1 and Table A.2, and the modelled roads are presented in Figure A.2.

Background Monitoring Data

Defra maintains a nationwide model of existing and future background air quality concentrations at a 1km grid square resolution. The data sets include annual average concentration estimates for NO_x and NO_2 using a base year of 2015. The model used is semi-empirical in nature; it uses the National Atmospheric Emissions Inventory (NAEI) emissions to model-predict the concentrations of pollutants at the centroid of each 1km grid square, but then calibrates these concentrations in relation to actual monitoring data.

In order to avoid duplication of the road source contribution from Trunk A Roads in the modelling and assessment process, it is first necessary to remove these source sectors from the overall background concentration reported. Whilst relatively straightforward to make this adjustment for NO_x, the process is more complicated for NO_2 as the relationship between NO_2 and NO_x is not linear, therefore the NO_2 Adjustment for NO_x Sector Removal Tool has been used.

An urban background monitoring station used to be located within the grounds of Glebe Junior School, monitoring ceased at this location in 2016. In 2015 the annual mean NO_2 concentration observed at the Glebe Junior School monitor was 16.4µg/m^3. This is comparable to the Defra background map concentration of 14.5µg/m^3, which has been used within the verification process.

Table A.1 – Traffic Data used in the ADMS-Roads Assessment: 2017 DfT Data

Link Name	2017						Speed (kph)
	AADT	% Car	% LGV	% HGV	% Bus and Coach	% Motorcycle	
A38 PCM Exceedance Stretch: Link 7353	44,186	75.42	15.18	8.58	0.20	0.62	16 - 71
A38 PCM Exceedance Stretch: Link 28528	42,651	73.07	16.21	10.18	0.14	0.40	16 - 71

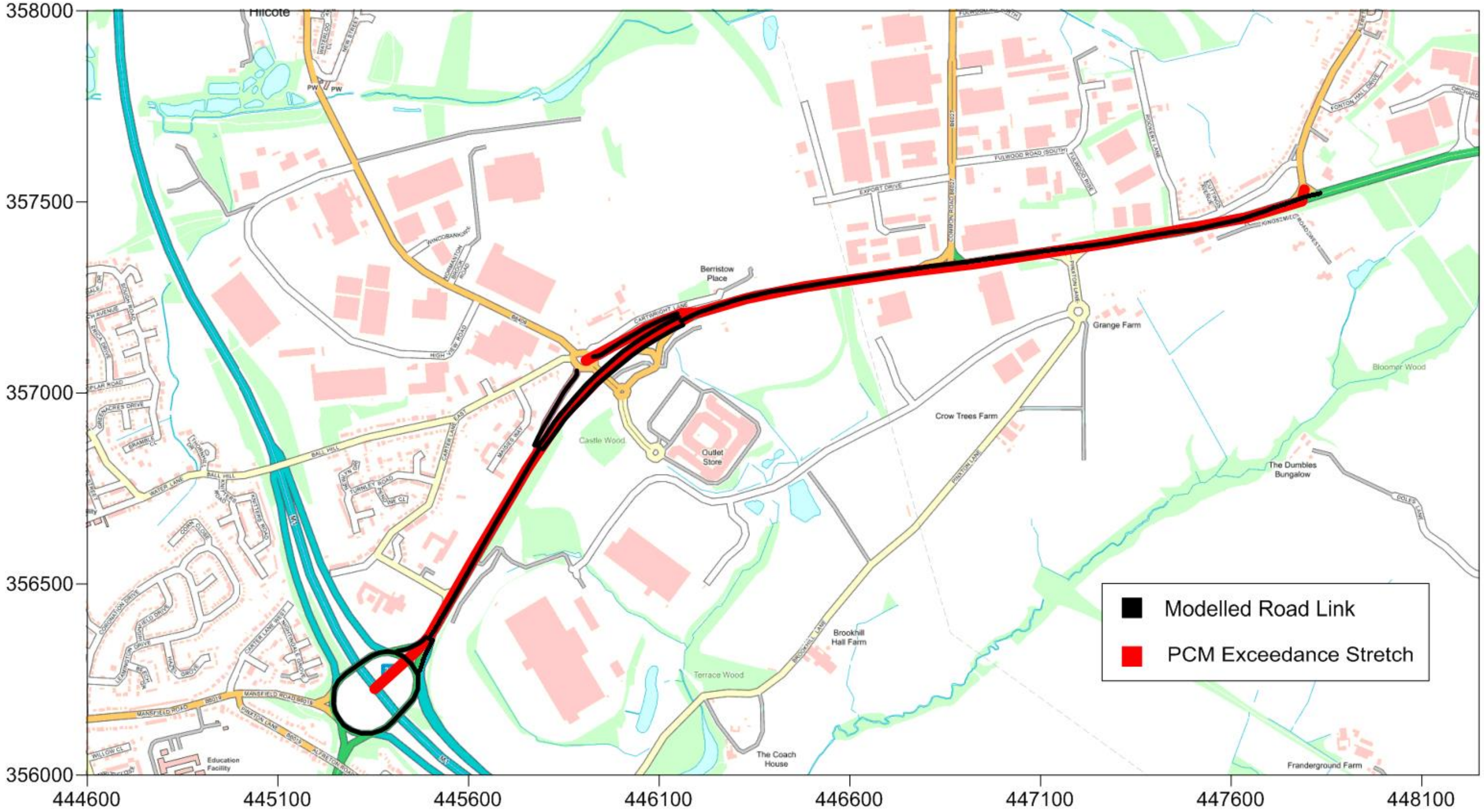
Note 1: Speeds have been reduced to simulate queues at junctions, traffic lights and other locations where queues are known to be an issue.
Note 2: A weighted average speed for the links has been calculated from the Bluetooth journey time survey completed.

Table A.2 – Traffic Data used in the ADMS-Roads Assessment: 2018 ANPR Survey Data

Link Name	2018											Speed (kph)
	AADT	% Petrol Car	% Diesel Car	% LGV	% Rigid HGV	% Artic HGV	% Bus and Coach	% Motorcycle	% Full Hybrid Petrol Car	% Full Hybrid Diesel Car	% Battery EV Cars	
A38 Southbound	22,340	34.59	45.22	13.53	3.61	0.71	0.34	0.09	1.71	0.08	0.13	69
A38 Northbound	17,250	30.90	43.23	13.40	5.23	5.16	0.28	0.06	1.56	0.06	0.12	71

Note 1: For all other vehicle contributions within the Alternative Technology option within the EFT, the percentage contribution is 0% - Taxi (black cab), Full Hybrid Petrol Car, FCEV Cars, E85 Bioethanol Cars, LPG Cars, Full Hybrid Petrol LGV, Plug-In Hybrid Petrol LGV, Battery EV LGV, FCEV LGV, E85 Bioethanol LGV, LPG LGV, B100 Rigid HGV, B100 Artic HGV, B100 Bus, CNG Bus, Biomethane Bus, Biogas Bus, Hybrid Bus, FCEV Bus and B100 Coach
Note 2: A weighted average speed for the links has been calculated from the Bluetooth journey time survey completed.

Figure A.2 – Modelled Roads



Modelled Receptors

The PCM receptors shown in Table A.3 have been located in line with JAQU and AQD guidance, 4m distance from each road link along the exceedance stretch, 25m from any major junction, representative of a 100m stretch of the exceedance link and were measured at a height of 2m. All modelled receptors are presented in Table A.3 and are presented in Figure A.3 and Figure A.4.

Table A.3 – PCM Receptors

Receptor ID	X	Y	Receptor ID	X	Y
R1 – ADC	446779	357345	**R33 – BDC**	446008	357148
R2 – ADC	446761	357341	**R34 – ADC**	447103	357351
R3 – ADC	446467	357291	**R35 – ADC**	446992	357334
R4 – ADC	446393	357281	**R36 – ADC**	446953	357329
R5 – BDC	445705	356751	**R37 – ADC**	446785	357308
R6 – BDC	445662	356679	**R38 – ADC**	446766	357307
R7 – BDC	445606	356580	**R39 – ADC**	446579	357280
R8 – BDC	445561	356500	**R40 – ADC**	446471	357262
R9 – BDC	445541	356466	**R41 – ADC**	446400	357251
R10 – BDC	445497	356389	**R42 – BDC**	445735	356734
R11 – BDC	445475	356359	**R43 – BDC**	445691	356662
R12 – BDC	445467	356353	**R44 – BDC**	445636	356563
R13 – ADC	446331	357269	**R45 – BDC**	445591	356484
R14 – BDC	446132	357175	**R46 – BDC**	445572	356448
R15 – BDC	446111	357163	**R47 – BDC**	445525	356369
R16 – BDC	446048	357125	**R48 – BDC**	445461	356331
R17 – BDC	446020	357106	**R49 – ADC**	446340	357235
R18 – BDC	445965	357060	**R50 – BDC**	446034	357089
R19 – BDC	445892	356989	**R51 – BDC**	445979	357044
R20 – BDC	445808	356912	**R52 – BDC**	445946	357016
R21 – BDC	445819	356929	**R53 – BDC**	445907	356975
R22 – BDC	445831	356945	**R54 – BDC**	445886	356953

Receptor ID	X	Y	Receptor ID	X	Y
R23 – BDC	445868	356990	**R55 – BDC**	445860	356924
R24 – BDC	445903	357028	**R56 – BDC**	445811	356857
R25 – BDC	445966	357087	**R57 – BDC**	445881	356978
R26 – BDC	446000	357117	**R58 – BDC**	445914	357016
R27 – BDC	446050	357151	**R59 – BDC**	445977	357074
R28 – BDC	446144	357215	**R60 – BDC**	446058	357136
R29 – BDC	446123	357207	**R61 – BDC**	446109	357167
R30 – BDC	446096	357195	**R62 – BDC**	446137	357182
R31 – BDC	446061	357179	**R63 – BDC**	446069	357165
R32 – BDC	446034	357163	**R64 – BDC**	446042	357149
R65 – BDC	446017	357135	**R106 – ADC**	446938	357367
R66 – BDC	445976	357109	**R107 – ADC**	446797	357348
R67 – BDC	445809	356917	**R108 – ADC**	446770	357344
R68 – BDC	445803	356845	**R109 – ADC**	446733	357336
R69 – ADC	446987	357373	**R110 – ADC**	446639	357320
R70 – ADC	446947	357369	**R111 – ADC**	446520	357301
R71 – ADC	446929	357366	**R112 – ADC**	446431	357286
R72 – ADC	446704	357332	**R113 – ADC**	446363	357274
R73 – ADC	446574	357310	**R114 – BDC**	445729	356792
R74 – BDC	445518	356429	**R115 – BDC**	445684	356715
R75 – BDC	445496	356387	**R116 – BDC**	445634	356629
R76 – BDC	445481	356366	**R117 – BDC**	445584	356540
R77 – BDC	445454	356347	**R118 – BDC**	445551	356483
R78 – ADC	446294	357260	**R119 – BDC**	445530	356448
R79 – BDC	446111	357163	**R120 – BDC**	445507	356408

Receptor ID	X	Y	Receptor ID	X	Y
R80 – BDC	445931	357031	**R121 – BDC**	445489	356377
R81 – BDC	445968	357123	**R122 – BDC**	445478	356362
R82 – BDC	445760	356851	**R123 – BDC**	445470	356356
R83 – BDC	445751	356834	**R124 – BDC**	445460	356350
R84 – BDC	446232	357244	**R125 – BDC**	445448	356344
R85 – BDC	446197	357233	**R126 – ADC**	446312	357265
R86 – BDC	446172	357223	**R127 – BDC**	446146	357182
R87 – ADC	446935	357326	**R128 – BDC**	446122	357169
R88 – ADC	446709	357298	**R129 – BDC**	446099	357157
R89 – BDC	445549	356410	**R130 – BDC**	446068	357138
R90 – BDC	445526	356371	**R131 – BDC**	446035	357116
R91 – BDC	445486	356346	**R132 – BDC**	445993	357083
R92 – BDC	445476	356339	**R133 – BDC**	445813	356920
R93 – ADC	446303	357225	**R134 – BDC**	445825	356937
R94 – BDC	446142	357157	**R135 – BDC**	445850	356967
R95 – BDC	445841	356897	**R136 – BDC**	445885	357009
R96 – BDC	445804	356847	**R137 – BDC**	445916	357041
R97 – BDC	446011	357103	**R138 – BDC**	445983	357101
R98 – BDC	445794	356830	**R139 – BDC**	446025	357134
R99 – BDC	445783	356814	**R140 – BDC**	446075	357166
R100 – ADC	446246	357202	**R141 – BDC**	446134	357211
R101 – BDC	446212	357189	**R142 – BDC**	446110	357201
R102 – BDC	446192	357179	**R143 – BDC**	446079	357187
R103 – BDC	446169	357165	**R144 – BDC**	446047	357171

Receptor ID	X	Y	Receptor ID	X	Y
R104 – ADC	447042	357381	**R145 – BDC**	446021	357155
R105 – ADC	446967	357371	**R146 – BDC**	445988	357135
R147 – BDC	445956	357115	**R188 – BDC**	445994	357088
R148 – BDC	445765	356858	**R189 – BDC**	446035	357120
R149 – BDC	445756	356842	**R190 – BDC**	446084	357151
R150 – ADC	446262	357253	**R191 – BDC**	446123	357174
R151 – BDC	446215	357239	**R192 – BDC**	446146	357186
R152 – BDC	446183	357228	**R193 – BDC**	446086	357173
R153 – BDC	446158	357218	**R194 – BDC**	446055	357157
R154 – ADC	447048	357343	**R195 – BDC**	446029	357142
R155 – ADC	446972	357332	**R196 – BDC**	445997	357122
R156 – ADC	446944	357328	**R197 – BDC**	445965	357102
R157 – ADC	446802	357310	**R198 – BDC**	445799	356899
R158 – ADC	446776	357306	**R199 – BDC**	445799	356837
R159 – ADC	446738	357303	**R200 – BDC**	445788	356822
R160 – ADC	446644	357290	**R201 – ADC**	446276	357212
R161 – ADC	446525	357271	**R202 – ADC**	446229	357195
R162 – ADC	446435	357256	**R203 – BDC**	446203	357184
R163 – ADC	446369	357244	**R204 – BDC**	446181	357172
R164 – BDC	445758	356775	**R205 – ADC**	447098	357389
R165 – BDC	445713	356698	**R206 – ADC**	447275	357409
R166 – BDC	445664	356613	**R207 – ADC**	447362	357424
R167 – BDC	445613	356524	**R208 – ADC**	447103	357351
R168 – BDC	445581	356466	**R209 – ADC**	447367	357391
R169 – BDC	445560	356429	**R210 – ADC**	447361	357424
R170 – BDC	445537	356391	**R211 – ADC**	447449	357438
R171 – BDC	445490	356351	**R212 – ADC**	447506	357445
R172 – BDC	445480	356342	**R213 – ADC**	447555	357456
R173 – BDC	445468	356335	**R214 – ADC**	447619	357470
R174 – BDC	445455	356328	**R215 – ADC**	447681	357490
R175 – ADC	446321	357230	**R216 – ADC**	447703	357499
R176 – BDC	**446155**	**357163**	**R217 – ADC**	447738	357509
R177 – BDC	**446079**	**357120**	**R218 – ADC**	447280	357376
R178 – BDC	**446047**	**357099**	**R219 – ADC**	447367	357392
R179 – BDC	**446006**	**357067**	**R220 – ADC**	447454	357406
R180 – BDC	**445926**	**356996**	**R221 – ADC**	447510	357412
R181 – BDC	**445896**	**356964**	**R222 – ADC**	447562	357424
R182 – BDC	**445872**	**356938**	**R223 – ADC**	447626	357438
R183 – BDC	**445850**	**356910**	**R224 – ADC**	447691	357459

Receptor ID	X	Y	Receptor ID	X	Y
R184 – BDC	**445826**	**356877**	**R225 – ADC**	447715	357468
R185 – BDC	**445807**	**356852**	**R226 – ADC**	447747	357479
R186 – BDC	**445898**	**356997**	**R227 – ADC**	447242	357404
R187 – BDC	**445927**	**357029**	**R228 – ADC**	447318	357416
R229 – ADC	447405	357431	**R238 – ADC**	447324	357384
R230 – ADC	447478	357442	**R239 – ADC**	447411	357399
R231 – ADC	447530	357450	**R240 – ADC**	447482	357409
R232 – ADC	447587	357463	**R241 – ADC**	447537	357418
R233 – ADC	447649	357480	**R242 – ADC**	447594	357431
R234 – ADC	447691	357495	**R243 – ADC**	447659	357449
R235 – ADC	447721	357504	**R244 – ADC**	447703	357464
R236 – ADC	447751	357514	**R245 – ADC**	447730	357473
R237 – ADC	447247	357371	**R246 – ADC**	447762	357484
Note 1 – All receptors modelled at a height of 2m BDC – Bolsover District Council ADC – Ashfield District Council					

Figure A.3 – Receptor Locations: North

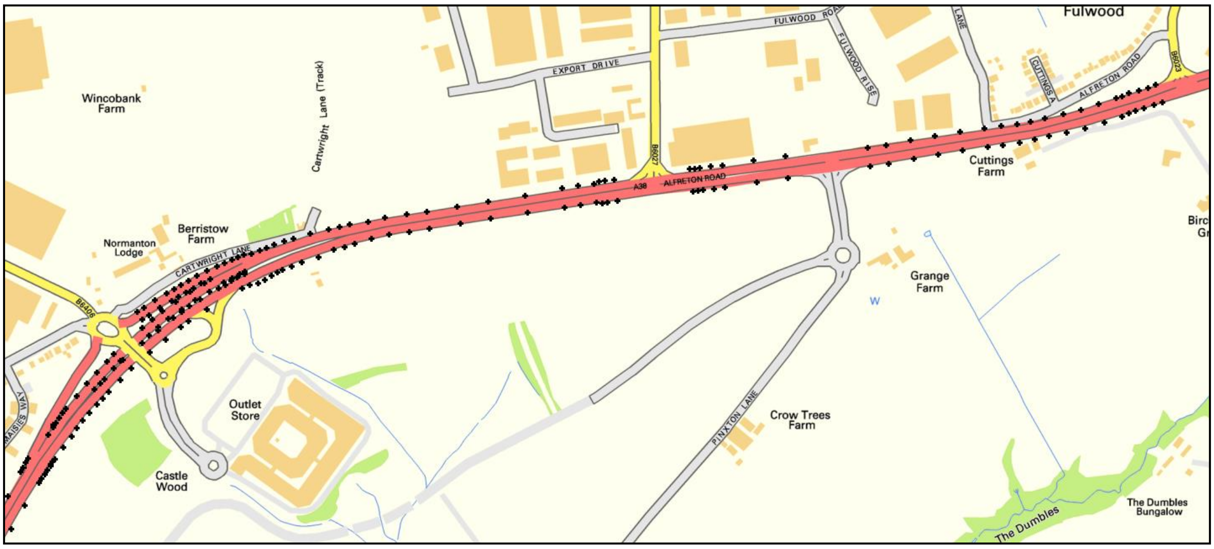
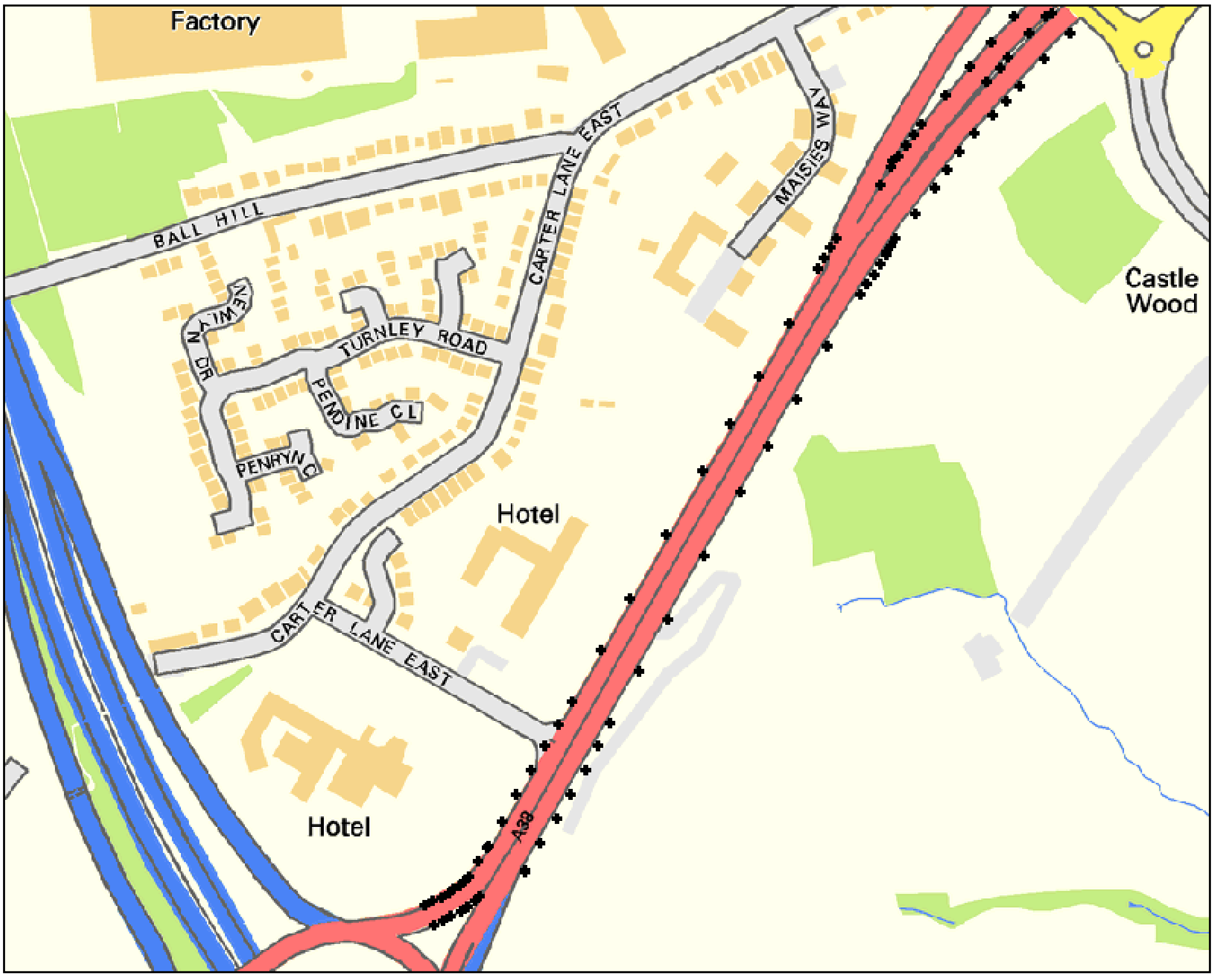


Figure A.4 – Receptor Locations: South


Factory
BALL HILL
CARTER LANE EAST
MAISIES WAY
NEWLYN DR
TURNLEY ROAD
PENDINE CL
PENRYN C
Hotel
CARTER LANE EAST
Hotel
A38
Castle Wood

Verification

For model verification, the diffusion tube data presented in Table A.4 has been used. The only monitoring location on the A38 exceedance stretch was DT22, therefore this has been the only monitoring location used within the verification.

The verification of the modelling output was performed in accordance with the guidance provided in Chapter 7 of LAQM.TG(16).

For the verification and adjustment of NO_x/NO_2, the annual mean concentration for DT22 in 2017 was used as presented in Table A.4.

Table A.4 below shows an initial comparison of the monitored and unverified modelled NO_2 result for the year 2017, in order to determine if verification and adjustment was required.

Table A.4 – Comparison on Unverified Modelled and Monitored NO_2 Concentrations

Site ID	Background NO_2 (µg/m^3)	Monitored total NO_2 (µg/m^3)	Unverified Modelled total NO_2 (µg/m^3)	% Difference (modelled vs. monitored)
DT22	14.5	26.0	21.1	-18.9

The model was under predicting at the monitoring location and no further improvement of the modelled results could be obtained on this occasion. Model adjustment was therefore carried out to allow for improvements in the results.

Model adjustment needs to be undertaken based on NO_x and not NO_2. NO_x concentrations were derived from the monitored NO_2 diffusion tube results used for verification. These calculations were undertaken using a spreadsheet tool available from the LAQM website. Table A.5 provides the relevant data required to calculate the model adjustment based on regression of the modelled and monitored road source contribution to NO_x.

Table A.5 – Data Required for Adjustment Factor Calculation

Site ID	Monitored total NO_2 (µg/m^3)	Monitored total NO_x (µg/m^3)	Background NO_2 (µg/m^3)	Background NO_x (µg/m^3)	Monitored road contribution NO_2 (total - background) (µg/m^3)	Monitored road contribution NO_x (total - background) (µg/m^3)	Modelled road contribution NO_x (excludes background) (µg/m^3)
DT22	26.0	45.6	14.5	23.3	11.5	22.3	12.5

As only a single verification point is present it is not possible to undertake linear regression. The ratio of the monitored road NO_x contribution to the modelled road NO_x contribution at DT22 is 1.789. Verification therefore gives an adjustment factor for the modelled results of 1.789.

Table A.6 below illustrates the adjusted modelled NO_2 concentrations plotted against monitored NO_2 concentrations. A verification factor of 1.789 was used to adjust the model results.

Table A.6 – Adjustment Factor and Comparison of Verified Results against Monitoring Results

Site ID	Ratio of monitored road contribution NO_x / modelled road contribution NO_x	Adjustment factor for modelled road contribution NO_x	Adjusted modelled road contribution NO_x (µg/m^3)	Adjusted modelled total NO_x (including background NO_x) (µg/m^3)	Modelled total NO_2 (based upon empirical NO_x / NO_2 relationship) (µg/m^3)	Monitored total NO_2 (µg/m^3)	% Difference (adjusted modelled NO_2 vs. monitored NO_2)
DT22	1.79	1.789	22.3	45.6	26.0	26.0	0.0

Annex 2: Model results – available on request