Guildford Borough Council
Air Quality Action Plan – Compton Village

In fulfilment of Part IV of the
Environment Act 1995
Local Air Quality Management

April 2019

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Report Reference number	Compton AQAP 2019
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Executive Summary

This Air Quality Action Plan (AQAP) has been produced as part of our statutory duties required by the Local Air Quality Management framework. It outlines the action we will take to improve air quality within the Compton Air Quality Management Area (AQMA) in Guildford Borough Council between 2019 and 2020.

Air pollution is associated with a number of adverse health impacts. It is recognised as a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society: children and older people, and those with heart and lung conditions. There is also often a strong correlation with equalities issues, because areas with poor air quality are also often the less affluent areas[1,2].

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion[3]. Guildford Borough Council is committed to reducing the exposure of people in Compton village to poor air quality in order to improve health.

We have developed specific actions that can be considered under the topic of Transport planning and infrastructure.

Our priority is to reduce queueing in the village of Compton.

In this AQAP, we outline how we plan to effectively tackle air quality issues within our control. However, we recognise that there are a large number of air quality policy areas that are outside of our influence (such as vehicle emissions standards agreed in Europe), but for which we may have useful evidence, and so we will continue to work with regional and central government on policies and issues beyond Guildford Borough Council's direct influence.

Responsibilities and Commitment

This AQAP was prepared by Regulatory Services, Guildford Borough Council with the support and agreement of the following officers and departments:

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[1] Environmental equity, air quality, socioeconomic status and respiratory health, 2010
[2] Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006
[3] Defra. Abatement cost guidance for valuing changes in air quality, May 2013

Gary Durrant, Regulatory Services, Guildford Borough Council
Anjana Papnai, Regulatory Services, Guildford Borough Council
William Bryans, Strategic Transport, Surrey County Council
Bahram Assadi, Local Highway Services, Surrey County Council
Jessica Muirhead, Air Quality Consultant, AECOM

This AQAP has been approved by:

Justine Fuller, Regulatory Services Manager, Guildford Borough Council

This AQAP will be subject to an annual review, appraisal of progress and reporting to the relevant Council Committee. Progress each year will be reported in the Annual Status Reports (ASRs) produced by Guildford Borough Council as part of our statutory Local Air Quality Management duties.

If you have any comments on this AQAP please send them to Gary Durrant, Team Leader, Environmental Protection, Regulatory Services, Guildford Borough Council, Millmead House, Guildford, Surrey

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1. Introduction

This report outlines the actions that Guildford Borough Council will deliver between 2019 - 2020 in order to reduce concentrations of air pollutants and exposure to air pollution; thereby positively impacting on the health and quality of life of residents and visitors within the Compton Air Quality Management Area (AQMA).

It has been developed in recognition of the legal requirement on the local authority to work towards Air Quality Strategy (AQS) objectives under Part IV of the Environment Act 1995 and relevant regulations made under that part and to meet the requirements of the Local Air Quality Management (LAQM) statutory process.

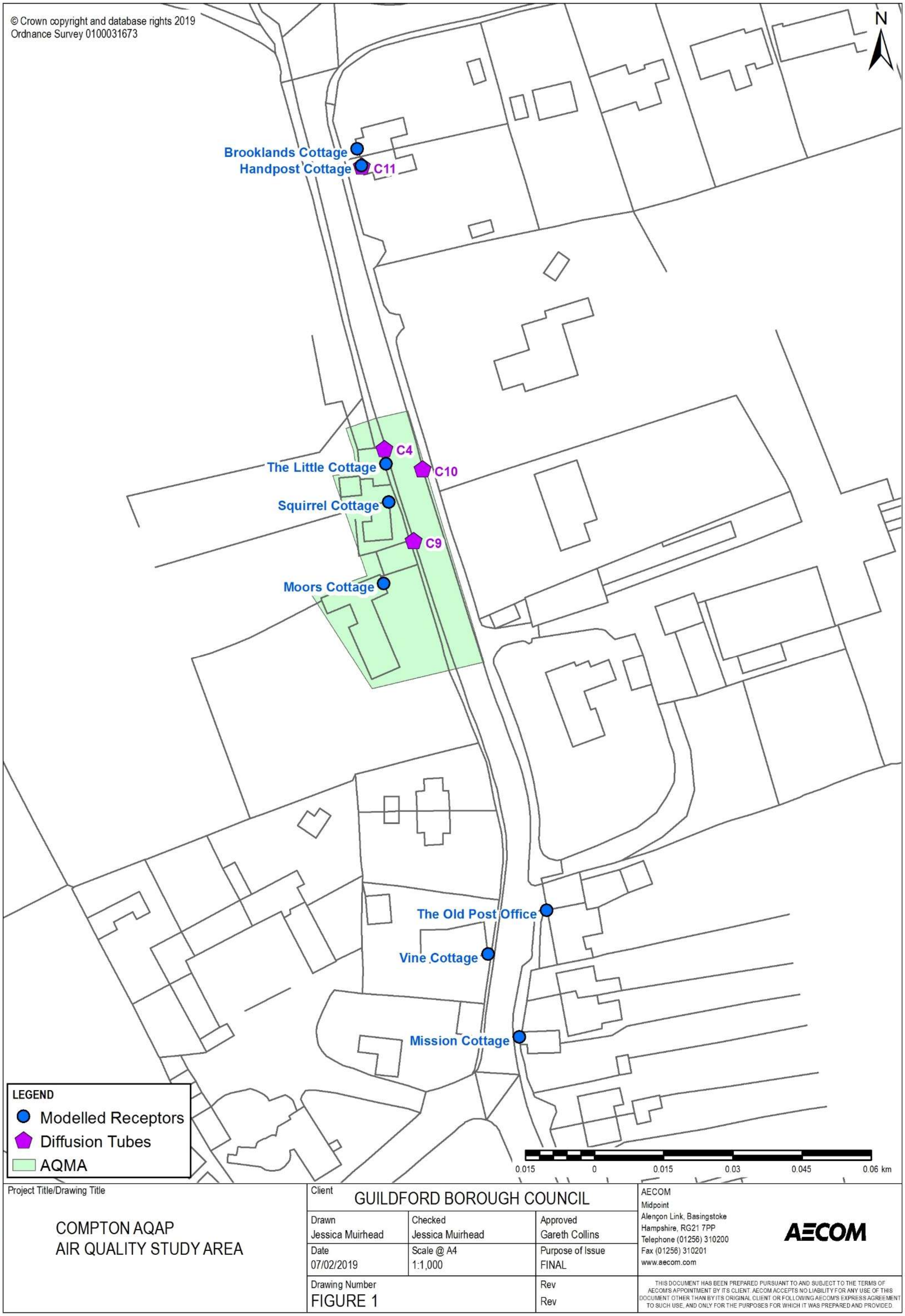
This Plan will be reviewed every five years at the latest and progress on measures set out within this Plan will be reported on annually within Guildford Borough Council's air quality ASR.

This AQAP is the second Action Plan prepared for Compton. The first was prepared in 2017 by Amec Foster Wheeler (Ref - 1). Guildford Borough Council subsequently consulted on the proposed actions in the 2017 report. Consultation responses for this plan are set out in Appendix A: Response to Consultation.

2. Summary of Current Air Quality in Compton

Please refer to the latest ASR from Guildford Borough Council (Ref - 2) for more detailed information on current air quality within the Borough.

With specific regard to the Compton village AQMA, diffusion tube monitoring has been undertaken for nitrogen dioxide (NO_2) along B3000, The Street, since 2014. Following measurements of concentrations of NO_2 exceeding the annual mean objective as specified in the Air Quality (England) Regulations 2000, an AQMA was declared for a small area encompassing 3 properties, situated along B3000, The Street, Compton, which came into effect on 1st February 2018. Figure 1 shows the AQMA, current diffusion tube monitoring locations and the locations modelled in the work set out in Appendix E.



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Ordnance Survey 0100031673
N
Brooklands Cottage
Handpost Cottage
C11
C4
The Little Cottage
C10
Squirrel Cottage
C9
Moors Cottage
The Old Post Office
Vine Cottage
Mission Cottage
LEGEND
Modelled Receptors
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COMPTON AQAP
AIR QUALITY STUDY AREA
Client
GUILDFORD BOROUGH COUNCIL
Drawn
Jessica Muirhead
Checked
Jessica Muirhead
Approved
Gareth Collins
Date
07/02/2019
Scale @ A4
1:1,000
Purpose of Issue
FINAL
Drawing Number
FIGURE 1
Rev
Rev
AECOM
Midpoint
Alençon Link, Basingstoke
Hampshire, RG21 7PP
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3. Guildford Borough Council's Air Quality Priorities

Public Health Context

Public Health England's Public Health Outcomes Framework identifies mortality attributable to air quality as an indicator for Public Health. This indicator addresses the fraction of mortality attributable to particulate air pollution ($PM_{2.5}$), a value for which is presented for each local authority. In Guildford Borough Council, this fraction has been calculated at 5.5%, which lies above the national average of 5.3%.

Local air quality presents a significant concern for public health, and as such local authorities are now required to promote inter-departmental links (e.g. with departments such as public health, environmental protection, and transport) to increase awareness of the effects of local air quality on public health, in addition to encouraging local action. Within Guildford, projects such as the 'Town Centre Transport Package' and 'Guildford Car Club' are being delivered to reduce the impact of transport on local air quality.

NO_2 emission initiatives implemented to target road transport emissions may simultaneously aid in addressing emissions of $PM_{2.5}$. This may subsequently contribute to improving Guildford Borough Council's mortality fraction attributable to particulate air pollution.

Planning and Policy Context

The Surrey Transport Plan (Ref - 3) outlines several objectives with regard to their Air Quality Strategy. The aim behind these objectives is to improve air quality in AQMAs to such an extent that active management in these areas need not be required, and that the AQMA itself can be undeclared.

The Guildford Borough Council Local Plan (Ref - 4) addresses the need to improve local air quality within the Borough. Many policies emphasise the importance of promoting the use of public transport, in addition to proposing improvements in existing walking and cycling infrastructure. There is also mention of the requirement for any further infrastructure development to enhance, rather than have a detrimental effect on, air quality within the Borough.

Guildford Borough Transport Strategy (Ref - 5) outlines anticipated improvements in transport infrastructure, one of which details the development of additional rail stations within the Borough, and 'Hotspots' improvements to aid congestion on the local road network.

Source Apportionment

The AQAP measures presented in this report are intended to be targeted towards the predominant sources of emissions within Compton Village AQMA.

A source apportionment exercise was carried out by AECOM in 2018 based on data collected by an Automatic Number Plate Recognition (ANPR) camera survey. This provided detailed information regarding vehicle type, age and Euro emission standard. Appendix C: ANPR Vehicle AnalysisAppendix C sets out the details of the ANPR survey, data and the breakdown of the fleet travelling through Compton.

In summary the results from the survey showed that:

- Traffic flowing through the AQMA is predominantly comprised of cars and Light Goods Vehicles (LGVs);
- The majority of NO_x emissions can be attributed to diesel cars and diesel LGVs;
- Diesel engines are responsible for over 90% of NO_x emissions.
- The vehicle fleet travelling through Compton is generally older than the default fleet assumed for 2018 in the UK.

Required Reduction in NO_x Emissions

A summary of recent measured annual mean NO_2 concentrations at diffusion tube sites within the Compton Village AQMA are given in Table 1 (Guildford Borough Council, 2018). The monitoring data shows that the annual mean objective has been exceeded at sites C4 and C9 over the last five and three years, respectively. Concentrations at these two sites are declining but are still not below the objective level. Concentrations at sites C10 and C11 are below the objective levels.

Table 1 – Monitored Annual Mean NO_2 concentrations

Site ID	Site Name	Site Type	NO_2 Annual Mean ($\mu g/m^3$)				
			2014	2015	2016	2017	2018
C4	Little Cottage	Kerbside	67	53	50	40	46.0
C9	Moors Cottage	Kerbside	-	-	50	42	44.3
C10	Opp. Little Cottage	Kerbside	-	-	39	31	30.7
C11	Handpost Cottage	Kerbside	-	-	-	-	32.2

The most recent data for 2018 shows that the annual mean NO_2 concentration at sites C4 and C9 in the AQMA are 46.0 and 44.3 $\mu g/m^3$, respectively. Therefore a reduction in NO_x emissions is required to achieve the annual mean objective value of 40 $\mu g/m^3$.

The required reduction in NO_x emissions has been calculated in line with Technical Guidance LAQM.TG16 (Ref - 6) Chapter 7 (Box 7.6) using Defra's NO_x to NO_2 calculator as outlined in Appendix D.

Within the AQMA, the worst-case monitored NO_2 concentration in 2018 is 46 $\mu g/m^3$ (at site C4). Based on the NO_x to NO_2 calculator this equates to a road NOx concentration of 71.8 $\mu g/m^3$. To meet the NO_2 objective value of 40 $\mu g/m^3$, a road NOx concentration of 57.3 $\mu g/m^3$ is required. This means that a required NO_x emissions reduction of 14.5 $\mu g/m^3$, i.e. 20.2% is required to meet the objective value at this site.

Reducing emissions is only the first strand of the Air Quality Action Plan. The second strand is to ensure that emissions remain at levels below the objective values (Section 3.2 Planning and Policy) and the third is improve public health by taking action to keep air pollution levels as low as they can possibly be (Section 3.1 Public Health Context).

Key Priorities

Based on the evidence on the key sources, the priorities for the action plan are to consider traffic management measures to reduce emissions within The Street, including:

- Reduction of queuing and congestion;

- Measures to target diesel vehicles

Measures to consider these priorities have previously been considered as part of the 2017 action plan. A number of additional measures have been considered for this updated plan.

4. Development and Implementation of Guildford Borough Council AQAP

Consultation and Stakeholder Engagement

In developing / updating this AQAP, we have worked with other local authorities, agencies, businesses and the local community to improve local air quality. Schedule 11 of the Environment Act 1995 requires local authorities to consult the bodies listed in Table 2. In addition, we have undertaken stakeholder engagement on the 2017 AQAP.

Five options were modelled in the 2017 AQAP, and the report indicated that Option 4 (Options 1 and 2 combined) was likely to deliver the largest reduction in the NO_2 concentration in the AQMA. The options were as follows:

- Option 1: Banning heavy goods vehicles (HGVs) from travelling through the declared AQMA;
- Option 2: Introduction of a 20mph zone along The Street, Compton;
- Option 3: Introduction of traffic signals along The Street in order to relieve congestion in the AQMA area;
- Option 4: Combined; Option 1 (Banning HGVs travelling through the declared AQMA); and Option 2 (Introduction of a 20mph zone along The Street, Compton); and
- Option 5: Combined; Option 1 (Banning HGVs travel through the declared AQMA) and Option 3 (Introduction of traffic signals along The Street in order to relieve congestion in the AQMA).

The consultation on the 2017 AQAP started on 22nd February 2018 and was open to receive comments until 13th April 2018. Statutory and non-statutory consultees were contacted by post or email. The consultation was also published on our website. We received 9 responses to the consultation (24% response). The responses to the public consultation and stakeholder engagement have been summarised in Appendix A.

Table 2 - Consultees

	Consultee
1.	10 residential properties within the AQMA or adjoining area
2.	Surrey Highways
3.	Compton Parish Council
4.	Waverley Borough Council
5.	Puttenham Parish Council
6.	Shackleford Parish Council
7.	Artington Parish Council
8.	Guildford Borough Council – Economic development, Planning Policy, Major Projects, Parks and Leisure Service
9.	Highways England
10.	Surrey Public Health
11.	Local businesses
12.	Local Emergency Services

5. AQAP Measures

Based on the modelling conducted for the previous 2017 Action Plan and updated dispersion modelling work for this plan, the options to improve NO_2 concentrations in the Compton Village AQMA are limited to those to lower the speed limits and reduce queuing and congestion. Following discussions with Surrey County Council, no feasible mechanisms to reduce the number of diesel vehicles within this AQMA were identified, so these were not modelled.

As a result of the modelling (see Appendix C), only one measure was considered suitable for taking forward in the new Compton AQAP. Details of this measure are given in Table 3.

Future ASRs will provide regular annual updates on the implementation of this measure.

Table 3 – Air Quality Action Plan Measures

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
1	Banning of right hand turn into Down Lane	Traffic Management	Access Management	Guildford Borough Council (GBC)	2019	2020	Measured NO_2 concentrations in AQMA	1µg/m^3		2020	Modelling results show that this option has the most potential to improve NO_2 concentrations on The Street

Appendix A: Response to Consultation

Table A.1 - Summary of Responses to Consultation and Stakeholder Engagement on the AQAP

Consultee	Category	Response	GBC Observation
Compton Parish Council	Residents	1. Option 1 and 2 combined is supported 2. Do not agree that Option 3 is a viable option 3. Other measures - No space for cycle lane; Electric charging point will have minimal impact as the existing traffic is not locally generated 4. Other suggestions: a. Adding no right turn sign to Down Lane, to prevent queuing due to traffic waiting to turn right. b. Change signage on A3 to direct traffic to Godalming via Milford and. c. Average Speed cameras in AQMA; offered funding opportunity, annual contribution to the operational and maintenance d. Recommendation for modelling to consider increase in traffic through the AQMA due to new development and new road infrastructure. e. Requested confirmation that A3 as contributor to the air pollution in Compton is ruled out. f. Continue monitoring in Compton during April – August 2018 to assess changes in pollution level as a result of temporary road closure for bridge replacement work in New Pond Road.	1. Comment noted. 2. Comment noted. 3. Comment noted. 4. a. Considered for further assessment b. Considered for further assessment, to be discussed with Highways England. c. To be assessed further. d. Will have little control, to be discussed with Surrey Highways. e. Compton AQMA is due to a localized exceedance and is too far from the A3 to be significantly affected. f. Monitoring will continue.

Consultee	Category	Response	GBC Observation
Resident 1	Resident	1. Support Option 1 & 2 combined 2. In recent past, temporary traffic due to construction work in the AQMA has been counterproductive due to additional queuing and heavy acceleration by frustrated drivers 3. Provision of cycling lane might work as drivers will have to slow down to accommodate cyclists, however, road not wide enough. 4. EV charging points have benefits in long term but no immediate reductions likely 5. Support average speed cameras at least for 30mph if reduction to 20mph is not possible	1. Comment noted. 2. Comment noted. 3. Comment noted. 4. Comment noted. 5. Viability to be assessed further with Surrey Highways.
Resident 2	Resident	1. Support Option 1 & 2 combined	Comment noted.
Resident 3	Resident	2. Support Option 1 & 2 combined	Comment noted.
Surrey Public Health	Public Body	3. Supportive to the cycling lane infrastructure	Comment noted.
Resident 4	Resident	1. Support Option 1 & 2 combined 2. Do not support option 3, locating traffic light **3. Suggestions:** a. Removing national speed limit sign on the Street just past Down Lane, which makes drivers speed. b. Remove road sign for Godalming on A3 slip which leads through Compton.	1. Comment noted. 2. Comment noted. 3. a. Viability to be assessed further b. Viability to be assessed/discussed with Highways England.
Resident 5	Resident	1. Support Option 1, Ban on HGVs 2. 20mph speed restriction will only work if average speed cameras are deployed 3. Do not support Option 3 as it is likely to shift the AQMA elsewhere on The Street. 4. No right turn to Down Lane from The Street, B3000	1. Comment noted. 2. Comment noted. 3. Comment noted. 4. Viability to be assessed
Surrey Highways	Public Body	1. Recommend Option 1 to be discounted; B3000 is most suited route between A31/A3 for HGVs and	1. Further advice needed

Consultee	Category	Response	GBC Observation
		for businesses located on/off B3100; D96 Priorsfield Road / Hurtmore Road is unsuitable for HGVs; Alternative route via Guildford will be temporary diversion route during the Network Rail Bridge replacement work, however, in long run will shift the problem elsewhere as well as increase in overall emission level. 2. The 20mph is only a possibility for the northern part near Moors Cottage and need to be investigated further. For more rural section of the road, a poor compliance to 30mph shows that 20mph will not be a viable option 3. The police are not likely to provide any fixed camera enforcement as it is only for casualty reduction, not air quality. 4. Any 20mph limit has to comply with the SCC policy which is currently under review 5. Queried over how speed reduction will achieve emission reduction during the off-peak hours 6. Impact of pollutant emissions in diesel vehicles to be considered due to speed reduction 7. The stop-go traffic is primarily northbound; queried whether speed reduction necessary for south bound traffic which generally flows smoothly even during peak time. 8. Option 3: Traffic signal has to be associated with either a junction or other facilities such as pedestrian crossing. Otherwise drivers are likely to ignore them causing other impacts such as safety. 9. Other measures: Fencing or plantation for screening; 10. Queried over exact cause of stop-go traffic;	2. Moors cottage and adjoining area is in AQMA; Air quality is not an issue beyond the village 3. To be discussed 4. Check SCC policy. Further investigation needed; can two different speeds be applied to the same road. 5. Comment noted. 6. Comment noted. 7. Comment noted. 8. Comment noted. 9. Not enough space; visibility and road safety might become an issue; conservation area; 10. Comment noted. 11. Source apportionment to be queried further

Consultee	Category	Response	GBC Observation
		11. Is the intervention targeting the right vehicles as the maximum contributors are the diesel vehicles (53%)	
Resident 6	Resident	1. None of the option scenarios discussed achieve compliance at all the receptor locations except for one (R3) 2. The combined effect of NO_2 with other emissions (Particulate matter) is likely to have greater impact on health 3. Highly support the Option 1 – Ban on HGV, however by implementation of physically restricting features for HGVs 4. Highly agree with Option 2 – reduction in speed limit to 20mph 5. Option 3: Do not support traffic signal for northbound traffic, but similar benefit may be achieved by making this stretch of road only southbound 6. Other measures in AQAP (Cycle Lane and Electric vehicle charging point)- the contribution of location residents to the emission is very very small; with regards to comment in the report about insufficient space for cycle lane – There would be sufficient space for cycle lane in expense of car lane	1. Comment noted. 2. Comment noted. 3. Comment noted. 4. Comment noted. 5. Comment noted. 6. Comment noted.
Highways England	Public Body	Acknowledgement received, consultation deadline missed to respond	

Appendix B: Reasons for Not Pursuing Action Plan Measures

Table B.1 - Action Plan Measures Not Pursued and the Reasons for that Decision

Action category	Action description	Reason action is not being pursued (including Stakeholder views)
Freight and Delivery Management	Re-routing HGVs to avoid Compton	Not considered practicable due to length of alternative route. In addition the fleet analysis shows that HGVs are not the main source of emissions in the AQMA.
Traffic Management	Reduce speed to 20 mph.	Modelling shows that this would increase concentrations in the AQMA.
Vehicle Fleet Efficiency	Improving commercial fleet and providing driver education.	Not considered to provide a measurable improvement as the majority of emissions are not from commercial vehicles.

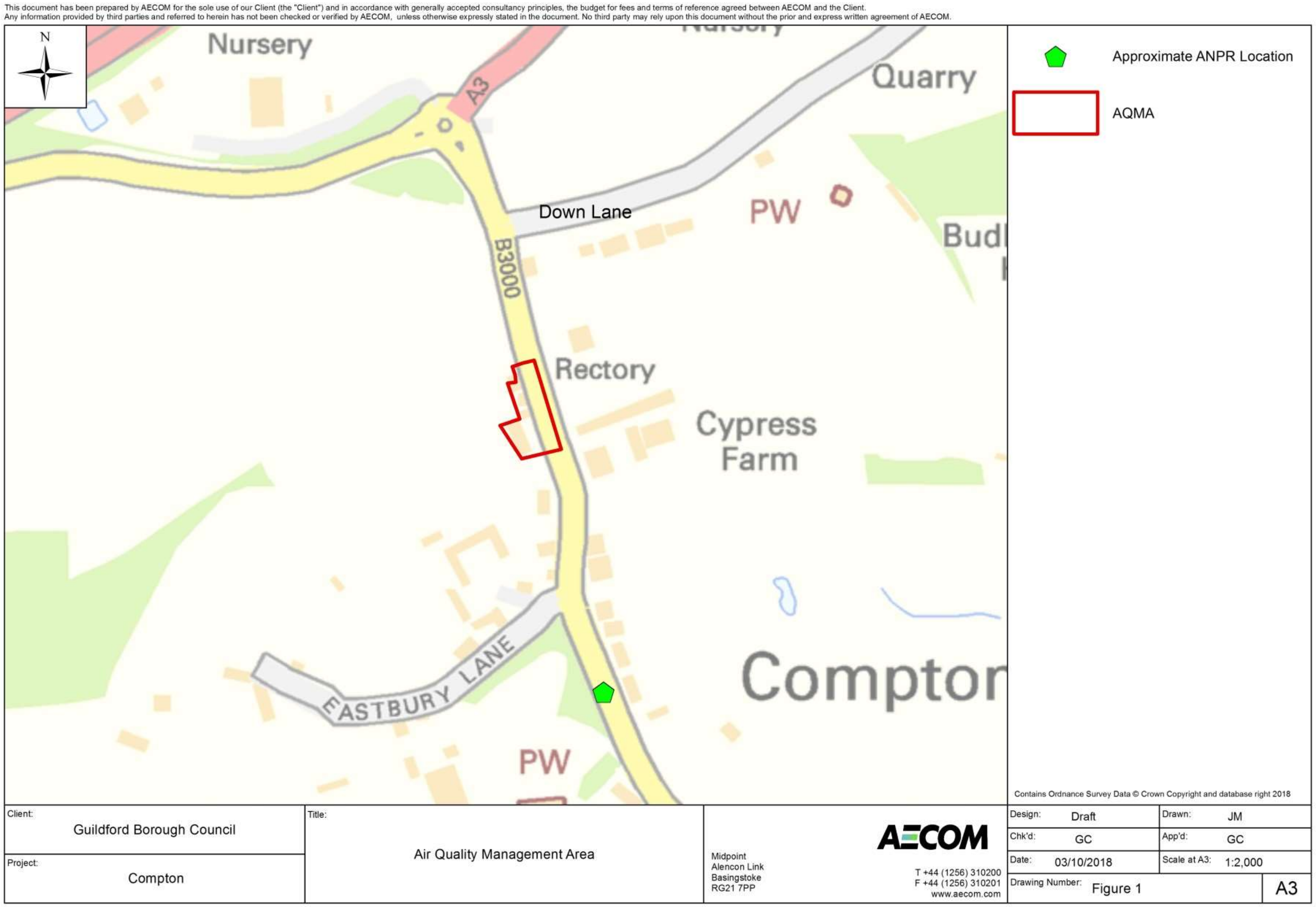
Appendix C: ANPR Vehicle Analysis

C1. Introduction

To provide more in-depth information about the traffic travelling along The Street, Compton, GBC requested for AECOM to organise a 24 hour Automatic Number Plate Recognition (ANPR) camera survey. This was undertaken by National Data Collection (NDC) on Tuesday 17th July 2018. Data from the DVLA about the make and model of the car was extracted for every fifth vehicle. This data was used to establish the fleet make-up in terms of vehicle types and Euro categories.

Figure C.1 shows the Compton AQMA and approximate ANPR locations.

Figure C.1 - Compton Air Quality Management Area



C2. Analysis

Total traffic flow on the survey data was recorded as 6,446 Northbound and 7,614 Southbound, so a total flow of 14,060 in 24 hours. The results provided by the DVLA were analysed to show the diurnal flow profile by vehicle type. Vehicle type is classified using the definitions from the COBA Manual[4], as shown in Figure C.2.

Figure C.2 - Vehicle Classification from COBA

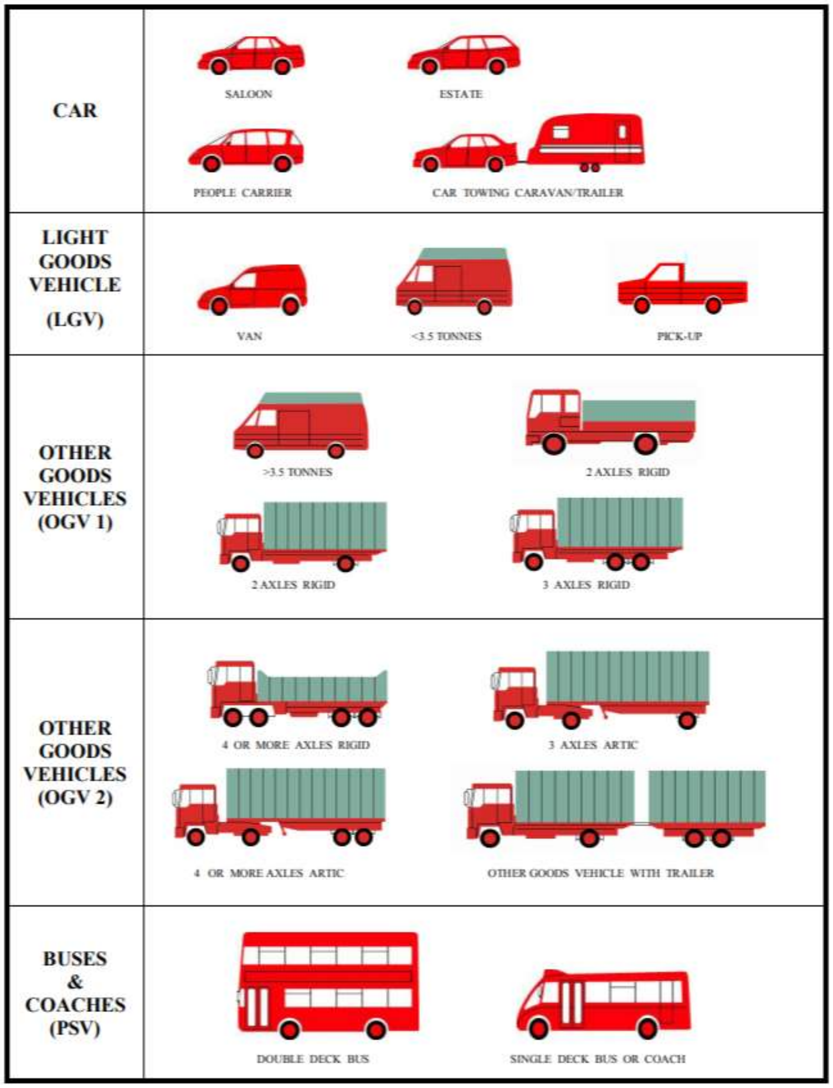


Figure C.3 shows the Northbound flow profile and Figure C.4 shows the Southbound profile for the day of the survey. Please note that totals on Figure C.3 and Figure C.4

[4] COBA Manual 2017, TAME Software: https://www.tamesoftware.co.uk/manuals/COBA_MANUAL/COBA2017%20Part%204%20(July%202017).pdf

are approximately one fifth of the total as only one in five number plates were extracted from the DVLA database.

The traffic flows between the AM peak and PM peak (commonly known as the inter-peak period) were relatively high in this survey, which is unexpected given that the road is heavily used by commuter traffic.

Figure C.3 - Northbound Diurnal Flow Profile

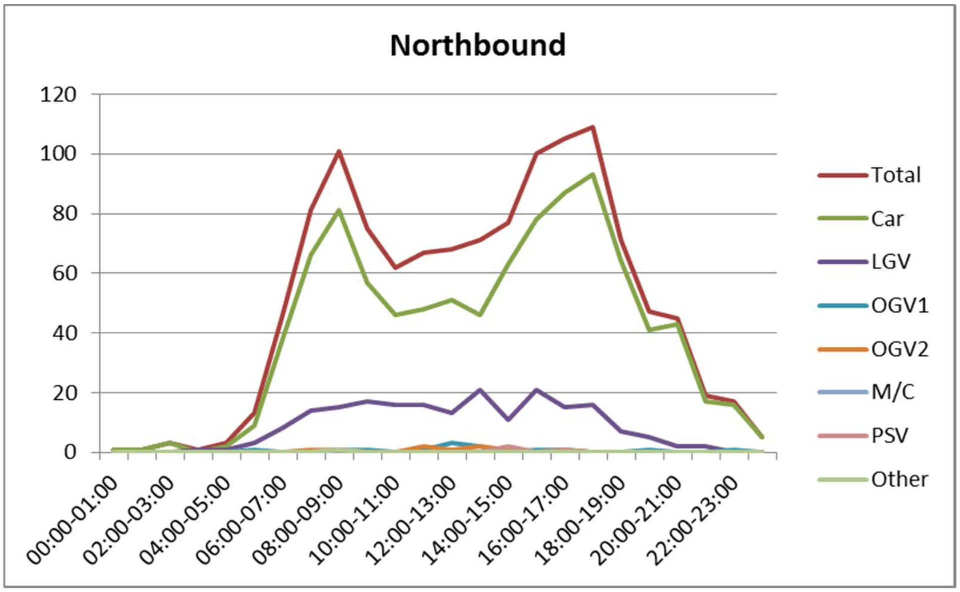
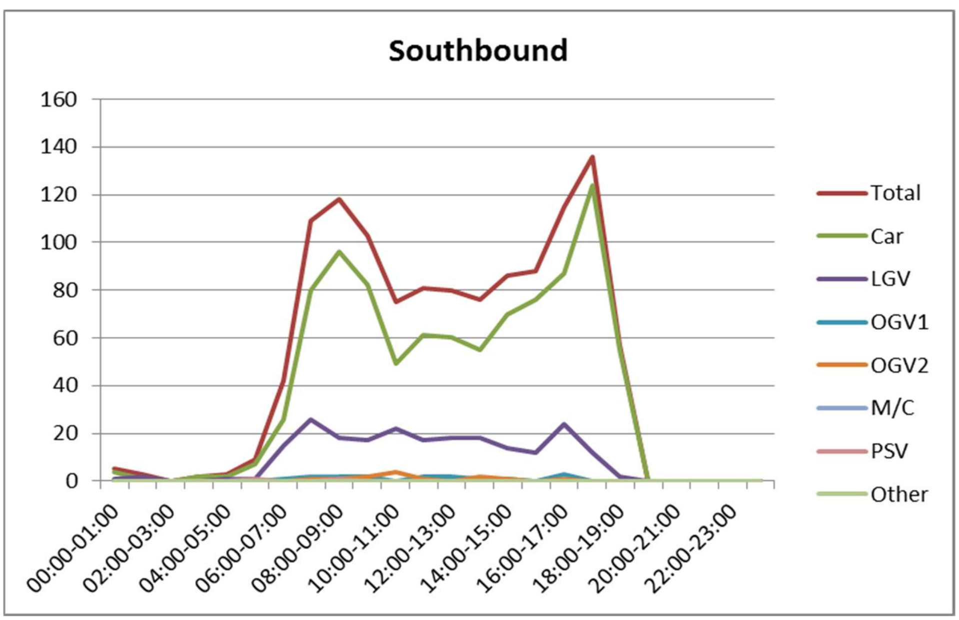
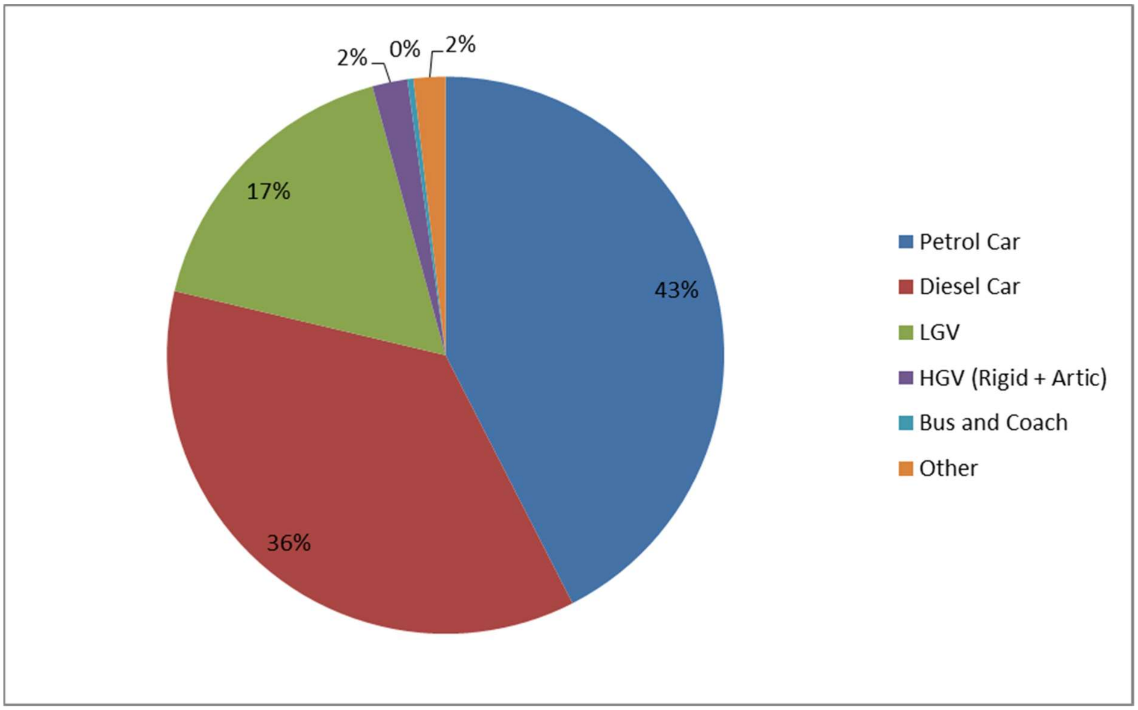


Figure C.4 - Southbound Diurnal Flow Profile



The vehicle fleet breakdown by a more detailed vehicle type was calculated, and is shown in Figure C.5. The majority of the vehicles were found to be cars (79%), with 17% light goods vehicles (LGV) and 2% heavy goods vehicles (HGV).

Figure C.5 - Fleet Breakdown by Vehicle Type



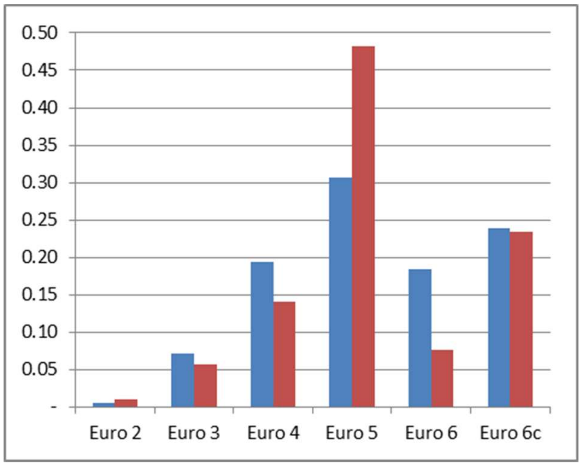
In addition to the fleet breakdown by type of vehicle, reference to the DVLA database enabled the proportion of each Euro emission type to be calculated.

The proportion of vehicles of each Euro emission type has been compared to the default for England for 2018 in Figure C.6. The fleet travelling through Compton is on the whole, slightly older than that for England. For cars and LGVs, the most common category is Euro 5, which is the same for the whole of England.

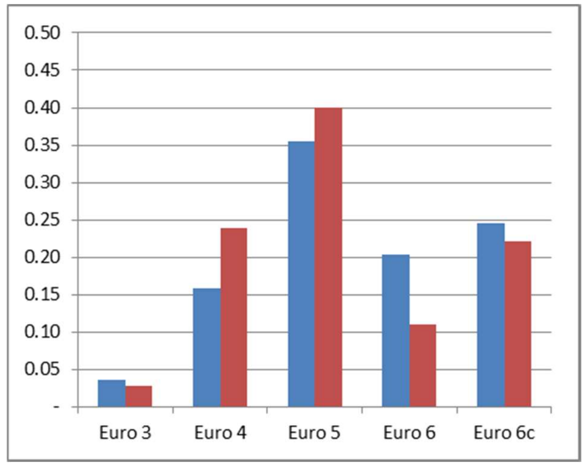
The bespoke Euro category profile was entered into the most recent Emission Factors Toolkit (EFT) spreadsheet, along with the fleet breakdown so that a source apportionment could be undertaken. The EFT was run at a variety of speeds as the ANPR survey did not measure speed.

Figure C.7 shows the results of the source apportionment exercise. The largest contributor to NOx emissions in Compton at all speeds is diesel cars, and along with diesel LGVs account for at least 80% of NOx emissions. Rigid HGVs contribute approximately 12% of NOx emissions at 10 km/h, but reduce at higher speeds as mitigation technology fitted to these vehicles works more efficiently. Articulated HGVs display a similar trend, but with a lower percentage of the NOx emissions due to the lower vehicle numbers.

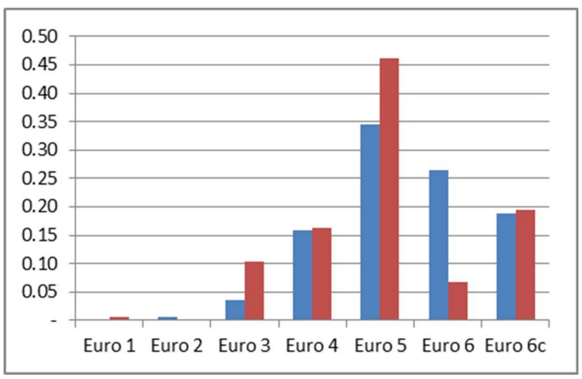
Figure C.6 - Euro Proportions of Different Vehicle Types



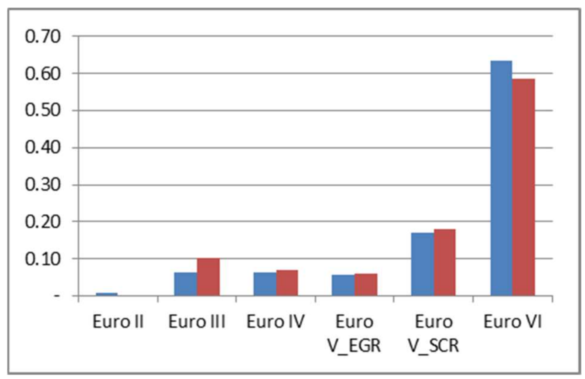
Petrol Car Euro Proportions



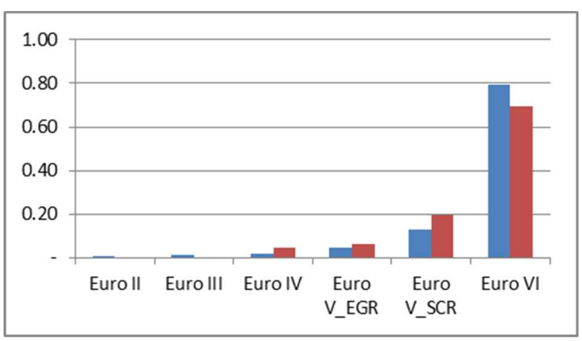
Diesel Car Euro Proportions



Diesel LGV Euro Proportions

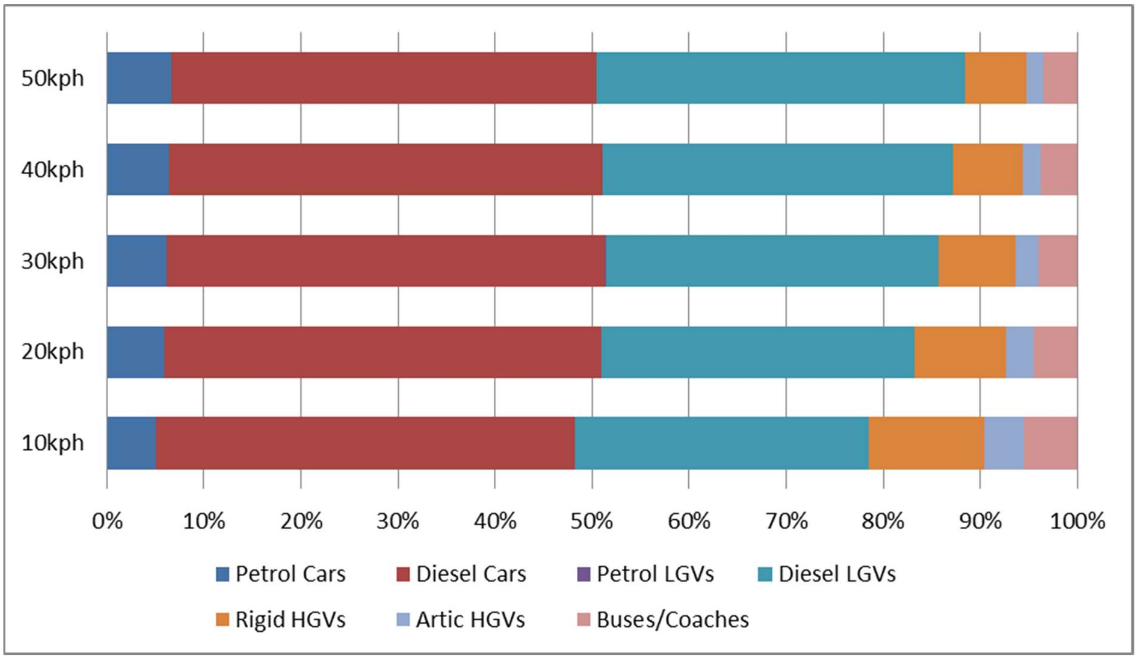


RiRigid HGV Euro Proportions



Articulated HGV Euro Proportions

Figure C.7 - Source Apportionment of Emissions for Different Speeds



C3. Conclusion

The results from the ANPR camera survey suggest that The Street is busier in the inter-peak period than expected, although there are noticeable AM and PM peaks. Diesel cars are the highest contributor to NOx emissions in Compton and all diesel vehicles are responsible for over 90% of emissions.

C4. Additional Work

Discussions with Surrey County Highways have shown that there are no feasible mechanisms for reducing the number of diesel cars and LGVs. However, due to the localised nature of the AQMA, it is anticipated that reducing the queuing within the AQMA could reduce emissions enough to reduce the concentration of NO_2.

Anecdotal evidence from the local residents suggests that queues form during peak times because of cars trying to turn right into Down Lane. A queue survey was commissioned, and the results from the fleet characterisation exercise and the queue survey have been used to model NO_2 concentrations. Measures including how the air quality would be affected by banning right-turns into Down Lane, and forcing vehicles to carry on and go around the roundabout and turn left into Down Lane were modelled.

Appendix D: Reduction in road NOx emission calculation

The following is provided as an example of how to calculate the reduction in road NO_x emission required to meet the 40 µg/m^3 annual mean objective for NO_2. The measured or modelled NO_2 at the worst-case relevant exposure location is 46 µg/m^3. It is based on the required reduction in the road NO_x concentration at the worst-case relevant exposure location.

Step 1: Use the NO_x to NO_2 calculator (see para 7.86 of Technical Guidance LAQM.TG16[5]) to obtain the NO_x concentration that equates to the 46 µg/m^3 NO_2, which is 71.84 µg/m^3.

Step 2: Obtain the local background concentrations of NO_2 for the year of interest. This is 12.28 µg/m^3, from the background maps (see para 7.68 Technical Guidance LAQM.TG16).

Step 3: Calculate the road NO_x concentration required to give a total NO_2 concentration of 40 µg/m^3 i.e. the annual mean objective (road NO_x-required). This can be done using the NO_2 from NO_x calculator by entering a total NO_2 concentration of 40 µg/m^3 along with the local background NO_2 concentrations. The calculator gives the road NO_x-required concentration which is 57.3 µg/m^3.

Step 4: Calculate the road NO_x reduction to go from the road NO_x-current to the road NO_x-required. In this example the road NO_x reduction is 14.5 µg/m^3 (71.8 minus 57.3 µg/m^3), which represents a 20.2% reduction in road NO_x (14.5/71.8 as a percentage).

[5] https://laqm.defra.gov.uk/technical-guidance/

Appendix E: Dispersion Modelling of the AQMA

Introduction

The fleet determined in the ANPR analysis was used to calculate emissions for The Street and update previous dispersion modelling undertaken for Compton.

A queue survey was undertaken but was inconclusive about whether significant queuing occurred within the AQMA. Based on anecdotal evidence on queuing traffic and because the previous modelling considerably under-predicted concentrations, a decision was made to include a queue in the afternoon peak hour on weekdays on the northbound lane.

Modelling Methodology and Verification

The latest version of the Emissions Factor Toolkit (EFT) Spreadsheet v 8.0.1a was used to calculate the emissions for the model links. A street canyon was included in the vicinity of Little Cottage, as the proximity of the house to the road in combination with the barrier of trees opposite is likely to cause a canyon effect.

Detailed dispersion modelling was carried out using ADMS-Roads (version 4.1.1.0). The ADMS (Atmospheric Dispersion Modelling System) models are modern dispersion models with an extensive published track record of use in the UK for the assessment of local air quality effects, including model validation and verification studies.

Dispersion models require meteorological data in order to predict the dispersion of pollutants. Meteorological data from Heathrow Airport (2018) was used in the modelling.

The traffic count and fleet breakdown from the ANPR study was used. The bespoke fleet was used in the latest EFT to calculate emissions for the road links within the study area.

The dispersion model input data and model conditions are provided in Table D.1.

Table D.1 - ADMS Roads Model Conditions

Variables	ADMS Roads Model Input
Surface roughness at source	0.2 m
Minimum Monin-Obukhov length for stable conditions	10 m
Terrain types	Flat
Receptor locations	x, y coordinates determined by GIS, z=1.5m
Emissions	NO_x
Emission factors	EFT Version 8.0.1a emission factor dataset
Meteorological data	1 year (2018) hourly sequential data from Heathrow Airport meteorological station
Emission profiles	Yes – to turn on/off the queue
Receptors	Selected receptors only
Model output	Long-term annual mean NO_x concentrations

For road traffic emissions a 'NO_X to NO_2' conversion spreadsheet was made available by the Department for Environment, Food and Rural Affairs (Defra) as a tool to calculate the road NO_2 contribution from modelled road NO_X contributions. The tool comes in the form of a Microsoft Excel spreadsheet and uses Borough specific data to calculate annual mean concentrations of NO_2 from dispersion model output values of annual mean concentrations of NO_X. The most recent release of this tool (v6.1) was used to calculate the total NO_2 concentrations at receptors from the modelled road NO_X contribution and associated background concentration. Due to the location of the site, the 'All non-urban UK' traffic setting has been selected.

The latest diffusion tube monitoring for 2018 was used for verification. Of the five monitoring sites in Compton, C4, C9, C10 and C11 were considered suitable for model verification. C7 was not considered suitable for verification as it is on the side of Little Cottage within another canyon, which the model cannot accurately reflect.

The results of the monitoring were compared to modelled results for those locations, and a verification adjustment factor calculated in line with methods outlined in LAQM TG(16). Details of this comparison can be found in Table D.2.

Table D.2 - ADMS Roads Model Verification

Site ID	Measured Total NO_2 Concentration. ($\mu g/m^3$)	Measured Road NO_X Contribution ($\mu g/m^3$)	Modelled Road NO_X Contribution ($\mu g/m^3$)	Road NO_X Factor
C4	46.0	70.9	22.78	3.1
C9	44.3	66.7	23.71	1.5
C10	30.7	36.0	22.47	3.0
C11	32.2	39.2	13.85	2.8
			Overall Road NO_X Factor	**2.5**

Initially the modelled NO_x concentrations were adjusted by 2.5. However, this resulted in concentrations predicted at C4 to be lower than that monitored. As such it was decided that in order to produce conservative predictions of NO_2 concentrations, the factor of 3.1 derived from just tube C4 would be applied to all model results.

Modelling Scenarios

A number of scenarios have been assessed in the model as shown in Table D.3. The future projections for the fleet composition were based on the current fleet proportions factored forward using the EFT. The more conservative option of not converging with the national average fleet was selected, meaning that the projected fleet remains older on average than the national fleet.

Table D.3 - Modelling Scenarios

Ref	Description	Emission Year	Fleet	Queue?	Speed (mph)
S1	Existing Emissions	2018	ANPR-derived fleet	Yes	30
S2	2019 – no interventions	2019	ANPR- derived fleet projected using EFT	Yes	30
S3	2020 – no interventions	2020	ANPR- derived fleet projected using EFT	Yes	30
S3a	2021 – no interventions	2021	ANPR- derived fleet projected using EFT	Yes	30
S3b	2022 – no interventions	2022	ANPR- derived fleet projected using EFT	Yes	30
S4	2019 – 20 mph speed limit (resident suggestion)	2019	ANPR- derived fleet projected using EFT	Yes	20
S4a	2020 – 20 mph speed limit (resident suggestion)	2020	ANPR- derived fleet projected using EFT	Yes	20
S4b	2021 – 20 mph speed limit (resident suggestion)	2021	ANPR- derived fleet projected using EFT	Yes	20
S4c	2022 – 20 mph speed limit (resident suggestion)	2022	ANPR- derived fleet projected using EFT	Yes	20
S4d	2023 – 20 mph speed limit (resident suggestion)	2023	ANPR- derived fleet projected using EFT	Yes	20

S5	2019 – Right hand turn to Down Lane banned	2019	ANPR- derived fleet projected using EFT	No	30
S6	2020 – Right hand turn to Down Lane banned	2020	ANPR- derived fleet projected using EFT	No	30
S6a	2021 – Right hand turn to Down Lane banned	2021	ANPR- derived fleet projected using EFT	No	30

Scenarios 2 and 3 represent the current situation with the future fleet composition and emission factors. This includes a queue on the northbound lane for 1 hour in the afternoon peak. Scenario 4 is the same as Scenario 2 but with the speed limit lowered to 20 mph as suggested by a local resident. Scenarios 5 and 6 are where the right-hand turn to Down Lane is banned, and therefore no queue is present. Scenarios 3a, 3b, 4a, 4b, 4c, 4d and 6a are model runs of subsequent years of their respective scenarios to determine what year NO_2 concentrations will drop below 40 $\mu g/m^3$.

Modelling Results

Table D.4 shows the results of each modelling scenario. Exceedances of the annual mean air quality objective for NO_2 are shown in bold. The results show that under no intervention, exceedances of the NO_2 annual objective at The Little Cottage would persist up until 2022 (S3b). A reduction of the speed limit to 20 mph would cause an exceedance within the current AQMA, and in addition an exceedance outside the AQMA at Mission Cottage. Lastly banning right-hand turns onto Down Lane would decrease concentrations of NO_2 to below the annual objective in 2021 for The Little Cottage.

Table D.4 - Modelling Results

Receptor	NO₂ Concentration (µg/m³)					
	S1	S2	S3	S4	S5	S6
Brooklands Cottage	33.8	32.6	31.1	35.5	31.0	29.7
Handpost Cottage	33.8	32.6	31.1	35.5	31.0	29.7
The Little Cottage*	**46.7**	**44.8**	**42.6**	**49.2**	**42.5**	**40.4**
Squirrel Cottage*	34.3	33.0	31.5	36.0	31.4	30.0
Moors Cottage*	26.2	25.4	24.4	27.4	24.7	23.8
The Old Post Office	33.3	32.0	30.6	35.2	32.0	30.5
Vine Cottage	36.6	35.2	33.6	38.7	35.1	33.5
Mission Cottage	39.6	38.0	36.2	**41.9**	38.0	36.2
* Properties within the AQMA. **Bold** denotes exceedance of air quality objective.						

Receptor	NO₂ Concentration (µg/m³)						
	S3a	S3b	S4a	S4b	S4c	S4d	S6a
Brooklands Cottage	29.8	28.3	33.8	32.2	30.5	29.1	28.4
Handpost Cottage	29.8	28.3	33.8	32.2	30.5	29.1	28.4
The Little Cottage*	**40.5**	38.2	**46.6**	**44.3**	**41.6**	39.4	38.4
Squirrel Cottage*	30.1	28.6	34.3	32.7	30.9	29.4	28.7
Moors Cottage*	23.5	22.5	26.2	25.2	24.0	23.1	22.9
The Old Post Office	29.3	27.8	33.4	31.9	30.2	28.7	29.2
Vine Cottage	32.0	30.4	36.8	35.0	33.1	31.4	32.0
Mission Cottage	34.5	32.7	39.8	37.9	35.7	33.8	34.5
* Properties within the AQMA. **Bold** denotes exceedance of air quality objective.							

Table D.5 shows the change from the existing scenario at each modelled receptor. S4 (20 mph) increases concentrations from the existing scenario at all receptors. All other scenarios improve the NO_2 concentrations.

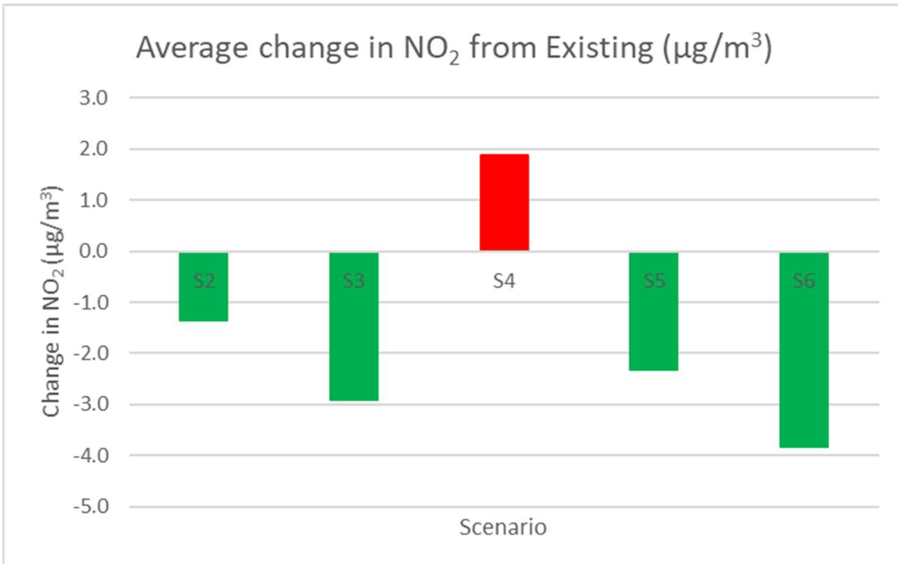
Figure D.1 shows the average change at all receptors.

Table D.5 - Change in NO_2 from Existing Scenario

Receptor	Existing	Change from Existing (µg/m³)				
	S1	S2	S3	S4	S5	S6
Brooklands Cottage	33.8	-1.3	-2.7	1.7	-2.8	-4.1
Handpost Cottage	33.8	-1.3	-2.7	1.7	-2.8	-4.1
The Little Cottage*	**46.7**	-1.9	-4.1	2.5	-4.2	-6.3
Squirrel Cottage*	34.3	-1.3	-2.8	1.7	-2.9	-4.3
Moors Cottage*	26.2	-0.9	-1.9	1.2	-1.5	-2.5
The Old Post Office	33.3	-1.3	-2.7	1.9	-1.3	-2.8
Vine Cottage	36.6	-1.4	-3.0	2.1	-1.5	-3.1

Receptor	Existing	Change from Existing (µg/m³)				
	S1	S2	S3	S4	S5	S6
Mission Cottage	39.6	-1.6	-3.4	2.3	-1.6	-3.4
Average change (µg/m³)		-1.4	-2.9	1.9	-2.3	-3.8
Average change in AQMA (µg/m³)		-1.4	-2.9	1.8	-2.9	-4.4

Figure D.1 – Change in NO_2 Concentration from Existing Scenario



Conclusions

The results of the modelling show that NO_2 concentrations fall below the objective of 40 µg/m³ at all locations in 2018 apart from Little Cottage where concentrations do not fall below the objective until 2022 (scenario 3b). Projection of the current fleet into the near-future (2019 - 2021) shows that concentrations should improve year on year as the fleet improves. A cautious approach was taken to the fleet projection to ensure that this is not an overly optimistic assessment.

The closure of the right-turn into Down Lane is anticipated to alleviate the peak hour queue that forms northbound. If the right-hand turn is closed there is potentially a reduction at Little Cottage of 8 µg/m³ by 2021 compared to the existing 2018 baseline.

Glossary of Terms

Abbreviation	Description
ADMS	Atmospheric Dispersion Modelling System
ANPR	Automatic Number Plate Recognition
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values’
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
AQS	Air Quality Strategy
ASR	Air quality Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
EFT	Emissions Factor Toolkit
EU	European Union
GBC	Guildford Borough Council
HGV	Heavy Goods Vehicle
LAQM	Local Air Quality Management
LGV	Lights Goods Vehicle
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides

References

Ref - 1 Guildford Borough Council (2017) Air Quality Action Plan for Compton, Amec Foster Wheeler, 2017

Ref - 2 Guildford Borough Council (2018), 2018 Air Quality Annual Status Report (ASR)

Ref - 3 Surrey County Council (2014) Surrey Transport Plan 3

Ref - 4 Guildford Borough Council (2003) Local Plan

Ref - 5 Guildford Borough Council (2017) Transport Strategy

Ref - 6 Department for Environment, Food and Rural Affairs (2016). Local Air Quality Management Technical Guidance (LAQM.TG16).

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