Brighton & Hove City Council

Detailed Air Quality Assessment 2020

Executive Summary

Where air quality standards for the protection of human health are not met the Local Authority has a statutory duty under the Environment Act 1995 to declare one or more Air Quality Management Areas (AQMA). The order triggers the requirement for an Air Quality Action Plan (AQAP) to be completed within a year of the AQMA declarations.

In 2013 Brighton and Hove City Council (BHCC unitary authority) declared two Air Quality Management Areas (AQMAs) for none compliance with nitrogen dioxide (English annual and hourly legal limits). AQMA 1 included the City Centre, parts of Hove and South Portslade. AQMA 2 covers Rottingdean High Street and the junction with the A259. This report sets out technical justifications for amendments to the 2013 AQMAs orders.

The AQMA review and associated air quality assessment will help guide options for the Ultralow Emission Zone and potential vehicle restrictions scheduled to be considered by ETS committee.

It is a timely review of the Cities air quality following committee consideration of the Air Quality Action Plan (AQAP) in 2015. In addition to the requirement for annual reports Defra's guidance suggests five year reviews of local air quality to determine if the extant AQAP and AQMA are still relevant. This report sets out an updated environmental model verified with evidence collected since the last AQMA declaration. The latest annual monitoring is set out in the City Council's 2020 Annual Status Report on air quality.

Recommendations to the Council's Transport, Environment Committee (ETS September 2020) is for six AQMAs covering a reduced part of the area previously declared. The remaining areas are priority for emission reduction and local air quality improvement.

Over a number of years roadside monitoring (up to January 2020) has sustained compliance with the nitrogen dioxide air quality standards in the following areas:

- Old Town - East Street and Pool Valley
- St James Street and Old Steine
- Kingsway and the coastal end of West Street
- Middle Section of Trafalgar Street North Laine
- Preston Road and Beaconsfield Road north of Preston Circus
- Boundary Road – Station Road, Portslade
- Church Road, Hove near Sackville Road

The Further Assessment concludes that AQMA 1 can be reduced in size. The proposed 2020 AQMA areas are as follows:

- AQMA 1 City Centre
- AQMA 2 Rottingdean High Street
- AQMA 3 SW Portslade including haulage route
- AQMA 4 Sackville Road – Old Shoreham Road Junction
- AQMA 5 South Street – Preston Road
- AQMA 6 Eastern Road outside the Hospital

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Glossary Used in LAQM Reports

Abbreviation	Description
ADMS-Urban	Atmospheric Dispersion Model System
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 standars. AQMAs are declared for specific pollutants and standards.
ASR	Air Quality Annual Status Report
ATC	Automatic Traffic Counter
AURN	Automatic Urban Rural air Monitoring Network (UK)
CAZ	Clean Air Zone
COMEAP	Committee on the Medical Effects of Air Pollutants
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EFT	Emission Factor Toolkit
EMIT	Atmospheric Emissions Inventory Toolkit
HGV	Heavy Goods Vehicle
LAQM	Local Air Quality Management
LAQM (TG)16	LAQM Technical Guidance 2016

LAQM (PG)16	LAQM Policy Guidance 2016
LGV	Light Goods Vehicle
NRMM	Non Road Mobile Machinery
NAEI	National Atmospheric Emissions Inventory
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen usually an emission rather than an outdoor concentration
PHE	Public Health England
PHOF	Public Health Outcomes Framework
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SCA	Smoke Control Zone
SO_2	Sulphur Dioxide
ULEZ	Ultralow Emissions Zone
$\mu g/m^3$	Micrograms per cubic meter a concentration in air

1 Introduction

1.1 *Purpose of the this Report*

This report supports Local Air Quality Management statutory duties set out in **Part IV of the Environment Act 1995.** The process follows DEFRA's guidance[1]. The report provides evidence and technical justification for proposed AQMA boundaries for consideration by Environment, Transport and Sustainability (ETS) committee September, 2020.

This Detailed Assessment identifies parts of AQMA 1 (2013) that have shown sustained evidence of compliance with nitrogen dioxide standards. It recommends streets and transport corridors that should remain in the AQMA distinguishing these from areas that can be revoked. A high resolution pollution map distinguishing priority areas for air quality improvement. Action to tackle confined emissions will benefit wider air quality.

Throughout Brighton & Hove PM_{10} (**Particulate Matter** less than ten microns) levels meet English standards over the past decade, therefore there is no statutory duty requiring the Local Authority to declare an AQMA for PM_{10}. Using the same modelling methods a short presentation focusing on $PM_{2.5}$ (Particulate Matter less than 2.5 microns) will follow this report. Changes to particulate legislation are anticipated with the government's Environment Bill. New government guidance can help the City Council consider the applicability of the **Clean Air Acts** and the potential benefits and practicalities of Smoke Control Zones.

1.2 *Climate Change and Local Air Quality*

Reducing combustion of fossil fuels is vital to work towards carbon neutrality and healthier air quality. That said there are distinctions. Modern efficient combustion requires less fuel and emits less smoke and carbon. However the hot burn emits oxides of nitrogen. This goes on to form nitrogen dioxide (NO_2) that is prejudicial

[1]Department for Environment Food and Rural Affairs Policy and Technical Guidance: https://laqm.defra.gov.uk/documents/LAQM-PG16-April-16-v1.pdf and https://laqm.defra.gov.uk/documents/LAQM-TG16-February-18-v1.pdf

to human health when inhaled. NO_2 is not a greenhouse gas contributing to climate change.

Considering the energy required to scrub sulphur out of crude oil the well to wheel CO_2 output of diesel cars is similar to petrol ones. Older diesel vehicles are the main reason for NO_2 above health protection standards in towns and cities.

Natural gas combustion hardly releases any particles, but efficient boilers do emit oxides of nitrogen. As a fossil fuel, natural gas combustion has a carbon footprint more than the burning of waste and wood (but less than diesel, oil and coal).

Renewable Heat can potentially save burning fossil fuels however wood burning can emit smoke, detrimental for local air quality.

Travelling further to avoid congestion may benefit the urban realm and local air quality, but runs the risk of increased fuel demand and CO_2 emissions.

Active travel has the advantage of avoiding emissions for more than one reason.

1.3 *Brighton and Hove City Council*

All the proposed amendments to AQMAs are within Brighton and Hove City Council (BHCC); the majority constituent of the Brighton-Worthing-Littlehampton agglomeration. Pre-2021 census estimates of the City's population are between 290,000 and 300,000. The population density for BHCC's urban planning authority (not including the South Downs National Park) is approaching 6,000 people per km^2. This is one of the highest in England outside of London. The city has elven million visitors per year. Investment to reduce pollution will have the greatest benefit on health where the population density is highest.

1.3.1 Existing AQMAs

Brighton and Hove's AQMAs were declared for none compliance with nitrogen dioxide standards in 2013. These areas are set out in appendix 1 accompanying the September committee report.

1.4 *Nitrogen Dioxide*

Nitrogen dioxide is a toxic respiratory irritant associated with both short-term and long term effects on human health[2]. Repetitive childhood exposure can inhibit lung tissue growth and repair increasing the risk of reduced lung capacity and poor respiratory health later in life[3]. Research evidence suggests chronic exposure can make the respiratory tract more susceptible to infections[4] such as asthma[5]. Nitrogen dioxide could also influence cognitive development[6]. Young children (including neonatal)[7] and older people with existing respiratory illnesses are more likely to be vulnerable to repeated inhalation of nitrogen dioxide. Nitrogen Dioxide (NO_2) and nitric oxide (NO) are both oxides of nitrogen (NO_x). In the atmosphere NOx leads to the formation of ground level ozone and nitrate particles. Airborne pollution mixtures in the particulate and gas phases influence health and wellbeing.

1.4.1 Nitrogen Dioxide Standards

The air quality standards for the protection of human health applicable to Local Air Quality Management (LAQM) in England are set out in the Air Quality Regulations 2000 (SI 928), shown in Table 1.1.

[2] Nitrogen Dioxide: effect on mortality https://www.gov.uk/government/publications/nitrogen-dioxide-effects-on-mortality
[3] Effect of Long-Term Exposure to Traffic-Related Air Pollution on Lung Function in Children https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5446841/
[4] US EPA Health Effects of NO_2 https://www.epa.gov/no2-pollution/basic-information-about-no2#Effects
[5] The LANCET Planetary Health NO_2 increases the risk for childhood asthma https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(19)30059-2/fulltext
[6] Prenatal exposure to PM2.5 and NO_2 and infant cognitive development https://www.sciencedirect.com/science/article/abs/pii/S0013935119302063
[7] Gaseous Air Pollutants and Hospitalization for Respiratory Disease in the Neonatal Period https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1665436/

Table 1 Nitrogen Dioxide Air Quality Standard Included in Regulations for the purpose of LAQM in England

Pollutant	Air Quality Standard	
	Concentration	Averaging Period
Nitrogen dioxide NO_2	200 $\mu g/m^3$ not to be exceeded more than 18 times a year	1-hour mean
	40 $\mu g/m^3$	Annual mean

For nitrogen dioxide the English legal limit and World Health Organisation (WHO) guidelines are the same.

1.4.2 Discussion about Nitrogen Dioxide Standards

The number of hours people inhale airborne pollutants relates to dose and exposure and is significant when considering impacts on cardio-pulmonary health. The annual mean is a more stringent standard applicable at residential settings (relevant receptors) where adult or child dwelling time can be thousands of hours per year[8]. The NO_2 annual mean is the reason for the majority of the AQMA in Brighton & Hove.

The further assessment also assesses in comparison with the hourly concentration of NO_2 (the tally of higher pollution throughout the calendar year) protecting acute and chronic effects on human health. The hourly standard applies at locations where people spend half an hour for example shopping or meeting friends or waiting for transport. It does not include the central reservation of a main road where pollution can be high and the general public is not present. It is unlikely that the short term standard of 200 $\mu g/m^3$ will be exceeded where the annual mean is less than 60 $\mu g/m^3$. Parts of AQMA 1 at risk for exceeding the hourly standard include London Road and North Street. AQMA 1 is the only remaining area recommended for deceleration of both annual and hourly standards.

[8] >50% of a year = 4380 hours

2 Method

2.1 *Criteria for Determining the AQMA*

The AQMA is determined relative to the nitrogen dioxide air quality standard of 40µg/m^3 as an annual mean. To provide a margin of tolerance an extant AQMA can be revoked where relevant receptors meet the following criteria:

- -10% of the target level that is <36 µg/m^3 for at least three years
- -20% of the target level that is <32 µg/m^3 for at least two years
- Archive and recent monitoring indicated levels are <36 µg/m^3

The proposed AQMA boundaries have been digitized on a map. The AQMAs include sections where the verified model maps NO_2 at >36 µg/m^3 in 2019. Where possible the boundary follows premises edges and joins up ribbons and hotspots of pollution following road transport corridors, including junctions.

2.2 *Monitoring*

Details of the council's most recent monitoring are presented in the City Council's Annual Status Reports. Monitoring is carried out for the following reasons:

- Determine the area of exceedance of annual and hourly air quality standards
- Continue to track long term trends i.e. monitoring positions that started at least five years back or more than a decade ago in some cases
- Background records set back from road traffic emissions representative of pollution levels across the city region
- Checks before and after an intervention, development or transport scheme

The council monitors are presented in Appendix 6.1.

2.2.1 Evidence for nitrogen dioxide compliance

To help guide the proposed AQMA boundaries in accordance with the criteria set out in section 2.1, the following monitors in or close to the AQMA show nitrogen dioxide levels have sustained the required outdoor air quality standard to revoke part of the AQMA.

Table 2 Nitrogen Dioxide Levels Sustaining the Objective <36 µg/m^3

Façade Monitor	Street	2013	2014	2015	2016	2017	2018	2019
C01-14	East Street		31.2	29	Project monitors ceased when the objective is met			
C02-10	Pool Valley	35.6	35.4	31.7				
C02-08	Old Steine Reinstated		No Data				30.8	29
C03-96	St James's Street	39.9	36.3	33	35.3	34.1	35.5	29.3
C05-12	Pavilion Park (Background)	26.1	22.6	22.5	26.1	23.6	22	21
C29 -14	Kingsway		30.8	30.4	35	32.5	ceased	
W12-12	Church Road Hove	36.8	38.3	32.7	34.5	35.3	33	
W15-15	Boundary Road (Pub)			25.5			ceased	
W16-16	Boundary Road (Bakers)				28.5	29.6		
W18-10	Vale Park (Background)	23	20.1	21	19.8	22.3	20.2	18.4

Note: Background monitors, set back from roads and are outside the AQMA. They are included here for comparison. Monitoring continues at background and next to St James Street that has recorded local air quality since 1996.

2.2.2 Compliant Zones Meeting the Objective

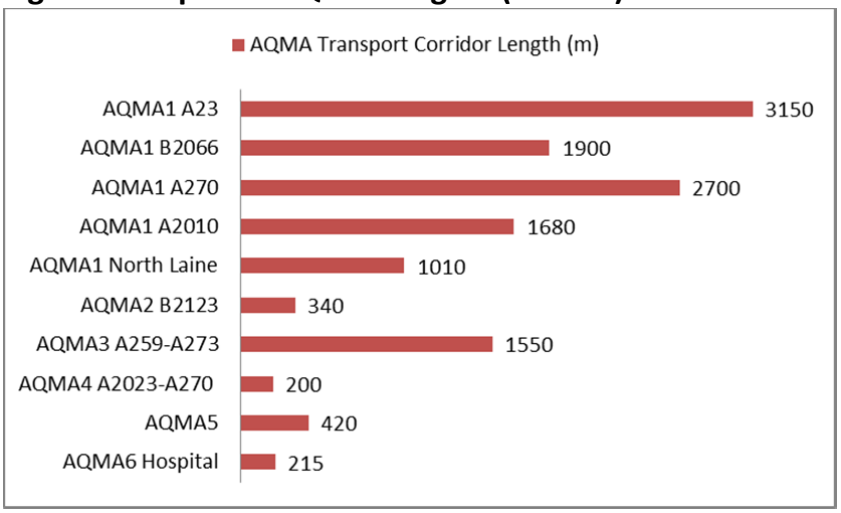
East Street is part of the **Old Town** where transport schemes have minimised the passing of road traffic. The area is compliant with all air quality standards. Monitoring in 2014/15 indicated compliant air quality in the vicinity of **Pool Valley**. A further step improvement is expected in the area when the National Express coach fleet achieves the euro-VI emissions standard, scheduled for 2020. Monitor C02-08 adjacent with **Old Steine** (east side) recorded 35 µg/m^3 in 2008. The Monitoring position was reinstated in 2018 and initially indicated a 13% improvement over the decade. This pattern is similar to the long term trend recorded on **St James's Street**.

Monitor C29-14 on the facade of **Kingsway** (west of Middle Street) recorded four years of compliant NO_2 2014-2017. Evidence shows a decrease in traffic along the A259 with an increase in cycling along the sea front over the same period.
By 2012 the majority of **Church Road Hove** had proven to be compliant with air quality standards. At that time the section between Sackville Road and the library, enclosed by buildings required further improvement. Sustained compliance (over four years) has been recorded by monitor W12-12 since the AQMA was last declared.
In 2009 35 µg/m^3 was recorded next to **Boundary-Station Road in Portslade**. Advisory *Cut engine cut pollution* signs are fixed in the area and more were added this year. The level crossing plays a part in congestion and the test was to measure significance in terms of long term air quality. Westerly winds can be strong along the railway and NO_2 was found to be compliant along Boundary-Station Road for three years: 2015-2017. The background monitor - W18-10 suggest a wider improvement across the Portslade area. Modelling shows NO_2 concentrations drop off within a few metres distance from the kerb of local trunk roads. It is advisable that planning does not permit housing adjacent to the A27/A23 risking the requirement for AQMAs in the future.

2.2.3 Reasons for Retaining parts of the AQMA

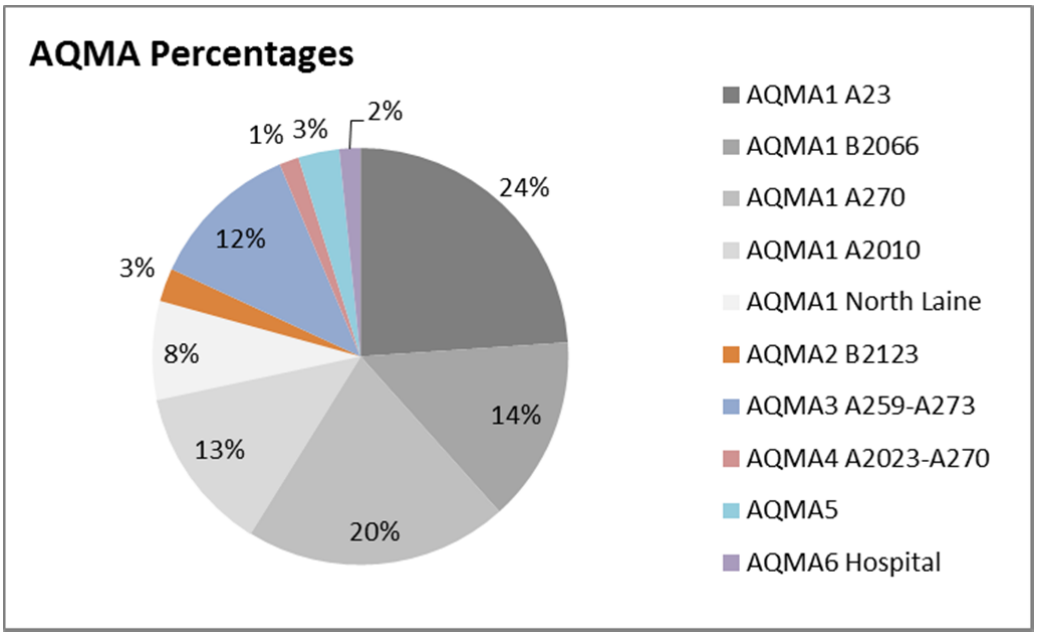
Error! Reference source not found. shows the road length of the proposed 2020 AQMAs. The total of 13 km compares to more than 20 km previously.

Figure 1 Proposed AQMA Lengths (metres)



Note the Transport Corridors comprising AQMA1 are joined as part of one City Centre Area

Figure 2 Relative Share of Total AQMA (13.2 km)



2.2.3.1AQMA 1City Centre

The majority (79%) of the proposed AQMA is along four main transport corridors connecting the City Centre; A23, B2133 (current ULEZ) A270 and A2010 and parts of North Laine including; Frederick Place and Church Road, Portland and Windsor Streets.

2.2.3.2AQMA 2 Rottingdean

No changes are proposed to the AQMA in Rottingdean. Monitoring started in 2009, with new positions added January 2020.

2.2.3.3AQMA 3 SW Portslade A259 and A293

The retained AQMA follows the A259 commuter route from West Sussex (Wellington Road) and the A293 haulage from the port via the Southern Cross Junction. Source apportionment is included in the Appendix.

2.2.3.4AQMA 4 Sackville Road - Old Shoreham Road

Monitors suggested NO_2 compliance in 2019. Further monitoring is recommended for 2021. Important for planning will be to insure developments adjacent to the junction do not further enclose the space and opportunities should be sort for setting back the building line.

2.2.3.5 AQMA 5 South Road – Preston Road

The area comprises two hotspots one on the corner of Millers Road and South Road and one north or Preston Drove adjacent with Preston Road on the west side. South Road is an important east-west road traffic link under the railway. Long term improvement has been recorded, this has not been sufficient to the revoke the AQMA at this stage.

2.2.3.6 AQMA 6 Eastern Road (Hospital)

The section selected for AQMA 6 is more enclosed than other parts of Eastern Road. The construction phases of the hospital have advanced, lower pollution was recorded 2019 and further monitoring is recommended for 2021.

2.3 *Modelling Approach*

This section sets out how emissions and local air quality have been assessed with a computer based model. Emissions sources are included for 131 km^2 across Greater Brighton that includes none transport sources and minor roads. 361 road links have been used to assess road traffic emissions and map NO_2 in order to determine the AQMA boundaries.

2.3.1 Emissions and Dispersion

The contribution from transport, commercial and domestic emission sources on nitrogen dioxide concentrations has been mapped throughout Brighton & Hove.

The Emissions Inventory Toolkit (EMIT)[9] has been used to calculate emission rates including year round contributions from; motorcycle, car, van, lorry and bus. Emissions are influenced by; the flow of traffic, road gradient, fuel type, vehicle weight and age. The government's emissions factor toolkit has been used to calculate road traffic emissions using the English urban 2019 fleet (outside of London). Local adjustments have been made for the local bus fleet that has phased out pre euro-V emissions standards on regular services, replacing with a higher percentage of euro-VI hybrids compared with the national average. Geo-referenced buses started to serve the city three-quarters of the way through 2019. For city centre road links 60% of cars counted are assumed to be diesels with an emission profile similar to a Hackney carriage taxi.

[9] Emissions Inventory Toolkit http://www.cerc.co.uk/environmental-software/EMIT-tool.html

Modern petrol emissions are mitigated with a three way catalyst. Modern diesel engines that have direct fuel injection depend on exhaust after treatment to control particulate and oxide of nitrogen emissions. Diesel particulate traps combine with selective catalytic reduction. The later requires optimal heat to be effective, so exhaust temperature is an important variable with emission rates.

ADMS-Urban[10] is the Atmospheric Dispersion Model System used by the City Council. ADMS is set up to model the dispersion of emissions in the environment and to map pollution concentrations citywide. The dispersion of emissions is influenced by; the width of the street, surface roughness of the land and meteorological conditions such as wind velocity and convective uplift.

Background pollutant levels present across the region also have an influence on pollution levels throughout the city. ADMS can be used to determine source apportionment i.e. the share of emission sources that contribute to outdoor pollution levels at locations where the public spends time breathing the air. The "other" category refers to commercial and domestic emissions such as gas boilers, fireplaces, None Road Mobile Machinery (NRMM), static diesel generators and a small contribution from local shipping and rail. The regional category includes emissions from outside the conurbation such as the M23/M25, Airports, regional Power Stations, London and International.

2.3.2 Model Year

2019 has been modelled to represent the latest situation, at the time of writing this is the last full calendar year that can be compared with annual and hourly air quality standards. Some of the changes that have happened since the final quarter of 2019 are discussed in the results section.

2.3.3 Traffic Data

Detailed traffic data has been obtained from automatic traffic counters.

Traffic emissions rates are based on annual average weekday or seven day traffic counts; whichever is greater. In most cases weekday traffic is higher, the

[10] ADMS-Urban http://www.cerc.co.uk/environmental-software/ADMS-Urban-model.html

exceptions being the A23 and B2166 (ULEZ) where Saturdays increase the daily average. The higher count of motorbikes (used for leisure) on Sundays has been included.

Table 3 2019 Automatic Traffic Counts

ATC Number	Name	Motorbike	Car	LGV	HGV	Bus
5	Old Shoreham Road	231	22416	1441	848	296
22	Wellington Road	191	18166	1367	934	380
23	Marine Drive Roedean	571	20383	2532	314	591
74	New England Road	327	14472	1422	300	38
97	Telscombe Cliffs	162	20468	1508	275	423
300	Hollingdean Road	264	13304	957	255	38
301	Lewes Road near Hartington Road	345	13335	971	702	800
302	North Street	229	3334	580	405	2779
303	London Road north of Cheapside	565	6381	681	710	896
304	Frederick Place	226	3504	247	142	4
305	Queens Road South of Station	174	4522	1469	242	408
509	London Road North of Preston Drove	177	21464	1593	591	343
606	King George VI Avenue west of Dyke Rd	100	20439	1383	422	59
607	Dyke Road Avenue Hill top	112	22289	1850	331	26
608	London Road South of A23T/A27T	221	22165	872	551	59
614	Marine Drive near Chailey Avenue	189	23713	1684	308	527
618	Chailey Avenue	133	1924	45	6	0
800	Kings Road	1020	27145	1926	696	85
802	Western Road near Sillwood Road	301	5347	398	400	1154
809	Preston Road north of Preston Circus	436	11065	831	508	249
810	Beaconsfield Road	279	12758	978	522	243
813	Lewes Road Coombe Terrace	231	22416	1441	848	296

Where ATCs are not available DfT traffic counts or archives have been used.

After a long term trend for increases in traffic since the 1950s some local road counters indicate that total traffic and car numbers have peaked. Local Authority

fuel consumption statistics, point to a decline in private vehicle fuel burn since 2008[Error! Bookmark not defined.]. That said cars have a higher share of transport around the urban fringe and staycation traffic continues to add vehicles to the A23 Fridays and Saturdays. In recent years (before and since Covid-19) there has been an increase in van and scooter movements, food and internet deliveries.

2.3.4 Road Width

Road width can be a significant variable for localised air quality. Where engines launch or idle in a confined space pollutants become more concentrated compared with the surrounding environment. In order to represent the influence of building road enclosure on the dispersion of vehicle emissions some road links in ADMS-urban have been characterised as street canyons.

2.3.5 Commercial and Domestic Emissions

Brighton and Hove does not have large combustion industry with chimney stacks emitting pollutants. Citywide domestic and commercial sources such as gas boilers for heating have been included as area emissions sources in the ADMS-urban model. The model also includes construction, shipping and rail emissions.

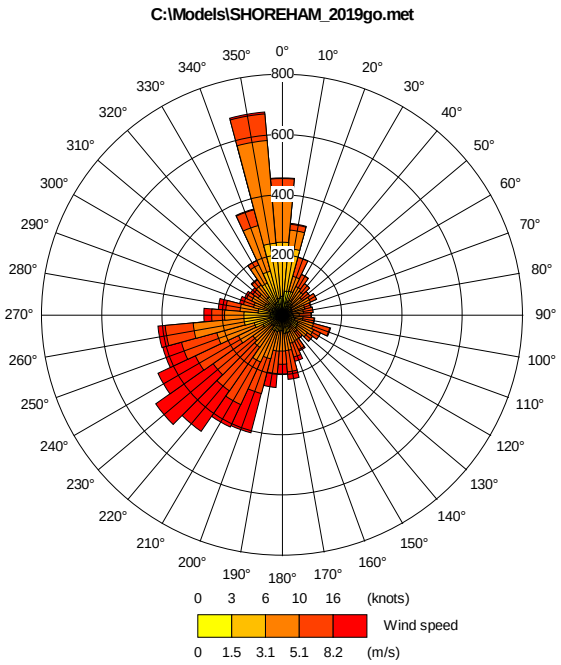
2.3.6 Background Levels of Pollution

Regional background concentrations in the model derive from the Automatic Urban Rural Network (AURN) continuous analyser at Lullington Health in a South Downs setting. This is the minimum pollution level (NO_2 annually 7 or 8 $\mu g/m^3$) that is likely to happen anywhere in Brighton & Hove.

2.3.7 Meteorological Data

Hourly sequential meteorological data from Shoreham-by-Sea for 2019 has been used to assess dispersion of emissions. The wind rose pattern for the year is shown in

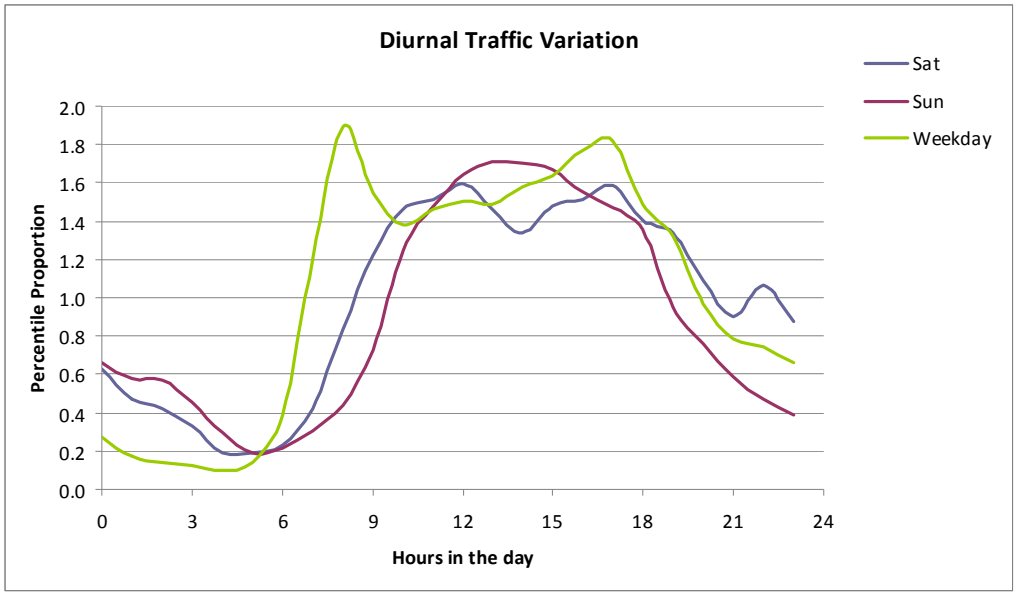
Figure 3 Shoreham-by-Sea Airfield Windrose 2019



2.3.8 Time Varying Emissions

The model acknowledges that road traffic emissions are not equal over a 24-hour weekday, Saturday and Sunday. For example daily traffic variations in Brighton are presented in Figure 4.

Figure 4 Twenty-Four hour Traffic Variability A259 Brighton



Bus, taxi and delivery emissions occur night and early morning and this is likely to be less favourable for dispersion. During the night (and mid-winter) atmospheric conditions are stable (not convective), parcels of air lack vertical uplift and inversions can trap ground level emission sources like fog. In contrast coastal breezes have more influence on air movement in the spring and summer.

2.3.9 Sunlight and Chemistry

The Sussex Coast often receives more sun than other parts of the UK. Hours of cloud cover are included as a variable in the air quality assessment. The azimuth of the sun relates to Brighton's latitude of 50.8 °N. The sun creates temperature gradients between land and sea, the ground and altitude. This helps with atmospheric mixing, dilution and dispersion. Photochemical reactions occur in the presence of sunlight.

The chemical reaction scheme within the ADMS-urban model has been used to calculate the chemical reactions in the atmosphere between nitric oxide (NO), nitrogen dioxide (NO_2), ozone (O_3). The atmospheric reactions influence how NO emissions covert to harmful NO_2.

2.3.10 Local Surface Parameters

A factor that represents surface roughness is included in the model to take account of how air flows over different surfaces for example ice and grass provide less resistance to air flow compared with a city. Surface albedo varies with land type and is considered in the model and is defined as the ratio of reflective to shortwave incoming radiation. The Monin-Obukhov length is a factor used to account for the heat produced by urban areas. The selected values used by ADMS for represent the built environment.

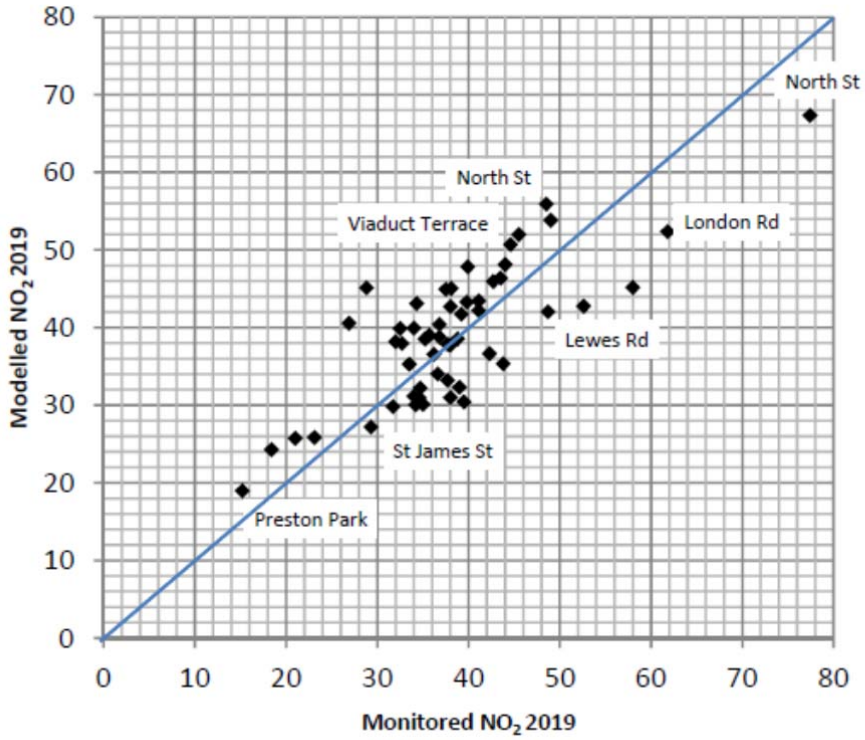
3 Results

3.1 *Model Results*

3.1.1 Model Verification

In order to verify model predictions results have been compared with 2019 monitoring data. Due to consideration of all parameters discussed in the previous chapter the model estimations shows good agreement with monitors as shown in Figure 5.

Figure 5 Model Predictions Vs Monitoring



Differences between modelled and monitored NO_2 can partly be accounted for by changes that have happened during the year. For example the Queens Road area shows a stepped improvement during 2019, changes to flow occurred along the A23 and construction reached a more advanced stage on Eastern Road. Adjustments are not required in accordance with the methods set out in LAQM Technical Guidance (TG 16). The reasonable agreement between monitoring

and modelling allows for a fair mapping of nitrogen dioxide throughout the city. This has helped to determine the AQMA boundaries and can guide options for the ULEZ and AQAP. Contour maps for nitrogen dioxide and source apportionment are set out in the appendix.

3.2 *Discussion of Results*

Nitrogen dioxide concentrations drop off with distance back from road sources. Street widths influence the dispersion and dilution of pollutants. Significant is the degree to which road traffic emissions are confined and the number of heavy and intermediate sized vehicles powered by diesel. The proposed AQMA boundaries mark out areas that are priority for emission reduction and local air quality improvement.

The most substantial step change in oxide of nitrogen emissions from heavy vehicles, has come with the euro-VI emissions standard[11].. Since euro-VI (2014) NOx emissions from newly registered trucks and buses show a marked improvement. Some Euro-6 diesel cars and vans registered 2014- 2016 continue to contribute to oxides of nitrogen in the city. The performance of exhaust mitigation is compromised without optimal temperatures for example on short journeys and with cold starts. Local urban driving includes a series of stops, launch and some standing hill starts.

The sale of diesel cars peaked around 2011 with a legacy since that time. Some modern diesel cars have achieved lower emissions. In most cases Real Drive Emissions (RDE) standards or true euro-6 diesel cars and vans have been differed[12] with market choice available 2021. At the same time there is a growing electric market for e-vehicles and e-bikes that have fewer moving parts are lower running costs.

[11] Trends in NO_x and NO_2 emissions and ambient measurements in the UK, March 2011
http://uk-air.defra.gov.uk/reports/cat05/1103041401_110303_Draft_NOx_NO2_trends_report.pdf
[12] Real Drive Emission Tests to achieve much closer to the euro-6 emissions standard
https://www.rac.co.uk/drive/advice/emissions/real-world-driving-emissions-tests/

4 Conclusions

The report sets out six AQMAs to retain with 79% of the road length in AQMA1- (City Centre) that includes Buckingham Place and Hollingdean Road. An effective action plan will need to consider funds for a variety of Transport and Planning measures. The Council will submit bids for grants when opportunities arise.

Local reports show poor air quality arises because of internal combustion engines in confined spaces. Important variables to consider are the uninterrupted flow of traffic, the count and age of diesel vehicles, road gradient the power of engines – driving style and the weight of vehicles. The dispersion of road traffic emissions will be influenced by building enclosure surrounding the street.

The outdoor pollutant concentration (μ/m^3 of air) that people inhale is a function of tail pipe emissions and ambient dispersion.

5 References

1. ***Nitrogen Dioxide: effect on mortality*** ***https://www.gov.uk/government/publications/nitrogen-dioxide-effects-on-mortality***

2. ***Effect of Long-Term Exposure to Traffic-Related Air Pollution on Lung Function in Children*** ***https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5446841/***

3. ***US EPA Health Effects of NO2*** ***https://www.epa.gov/no2-pollution/basic-information-about-no2#Effects***

4. ***The LANCET Planetary Health NO2 increases the risk for childhood asthma*** ***https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(19)30059-2/fulltext***

5. ***Prenatal exposure to PM2.5 and NO2 and infant cognitive development*** ***https://www.sciencedirect.com/science/article/abs/pii/S0013935119302063***

6. ***Gaseous Air Pollutants and Hospitalization for Respiratory Disease in the Neonatal Period*** ***https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1665436/***

7. ***>50% of a year = 4380 hours***

8. ***Emissions Inventory Toolkit*** ***http://www.cerc.co.uk/environmental-software/EMIT-tool.html***

9. ***ADMS-Urban*** ***http://www.cerc.co.uk/environmental-software/ADMS-Urban-model.html***

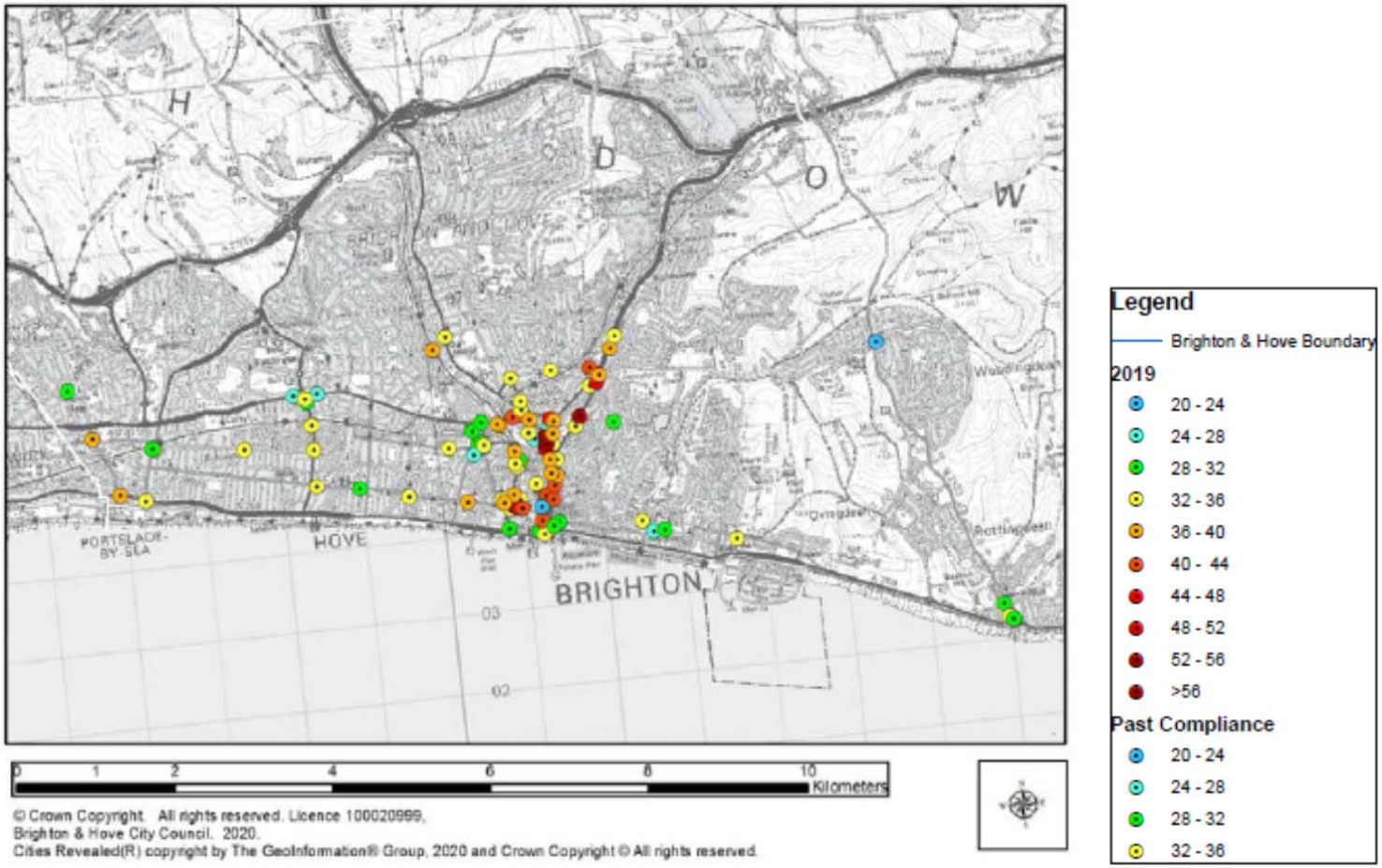
10. ***Trends in NOx and NO2 emissions and ambient measurements in the UK, Mach 2011***

11. ***http://uk-air.defra.gov.uk/reports/cat05/1103041401_110303_Draft_NOx_NO2_trends_report.pdf***

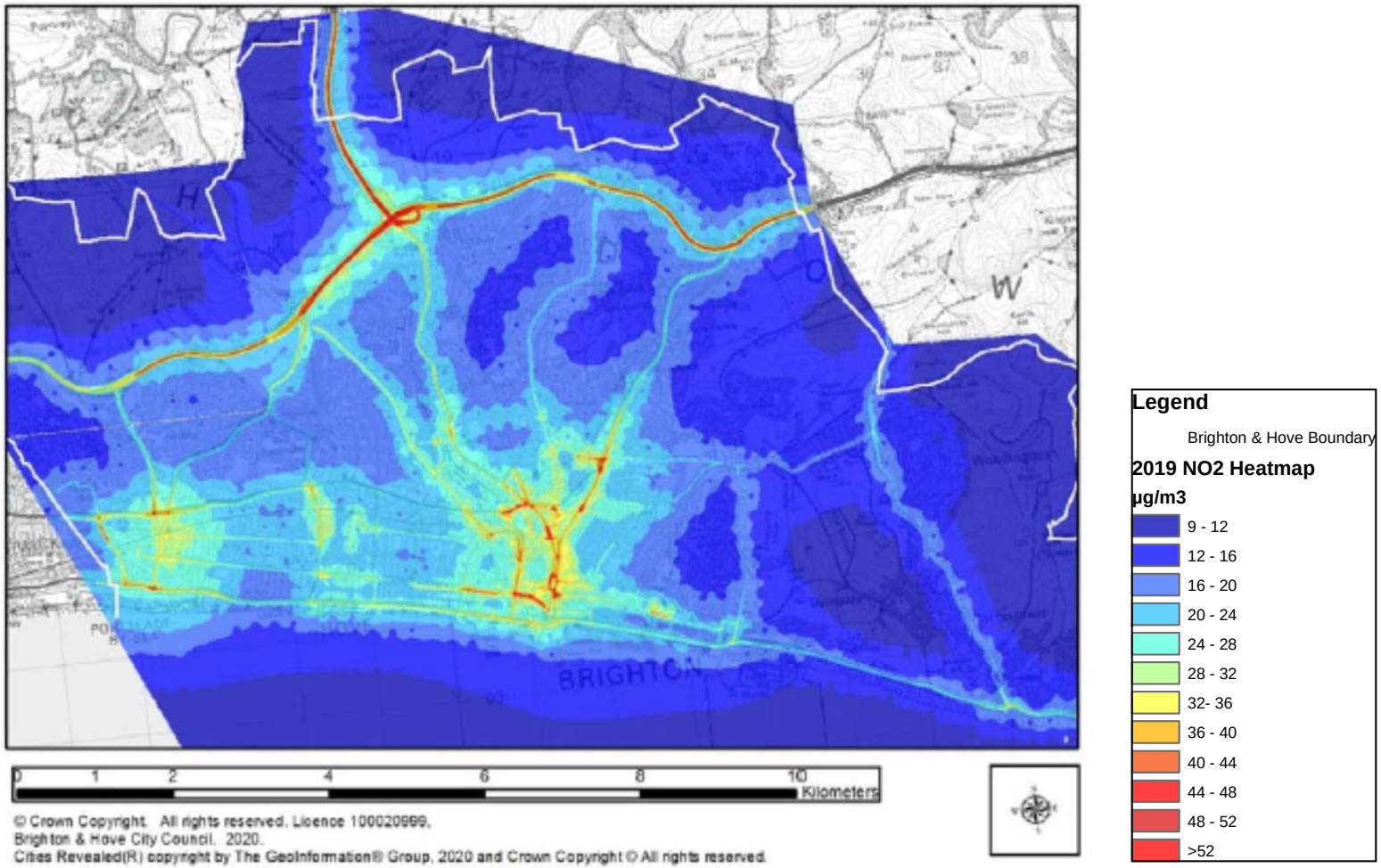
12. ***Real Drive Emission Tests to achieve much closer to the euro-6 emissions standard*** ***https://www.rac.co.uk/drive/advice/emissions/real-world-driving-emissions-tests/***

6 Appendix

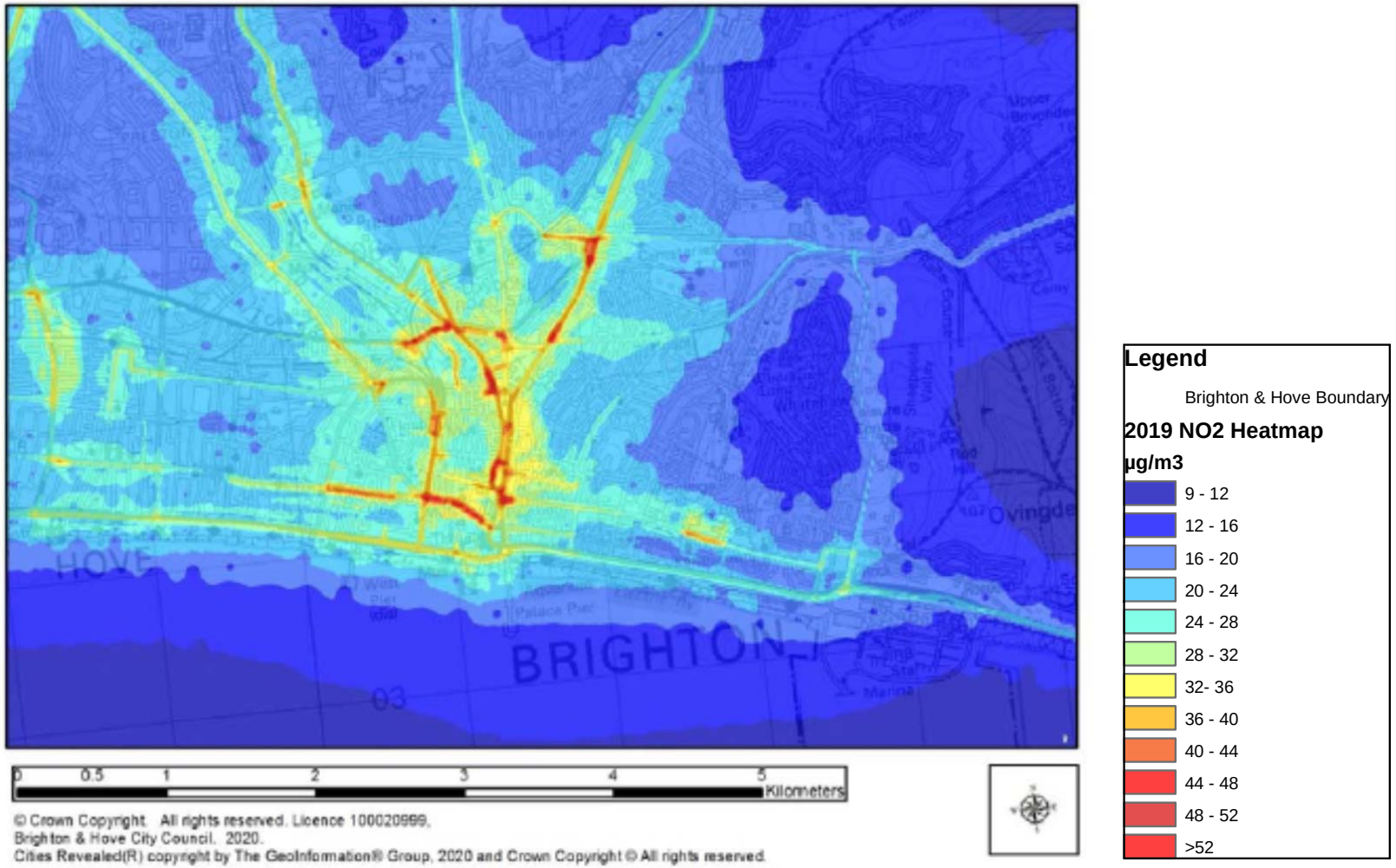
6.1 *Nitrogen Dioxide Monitoring Current and Archive*



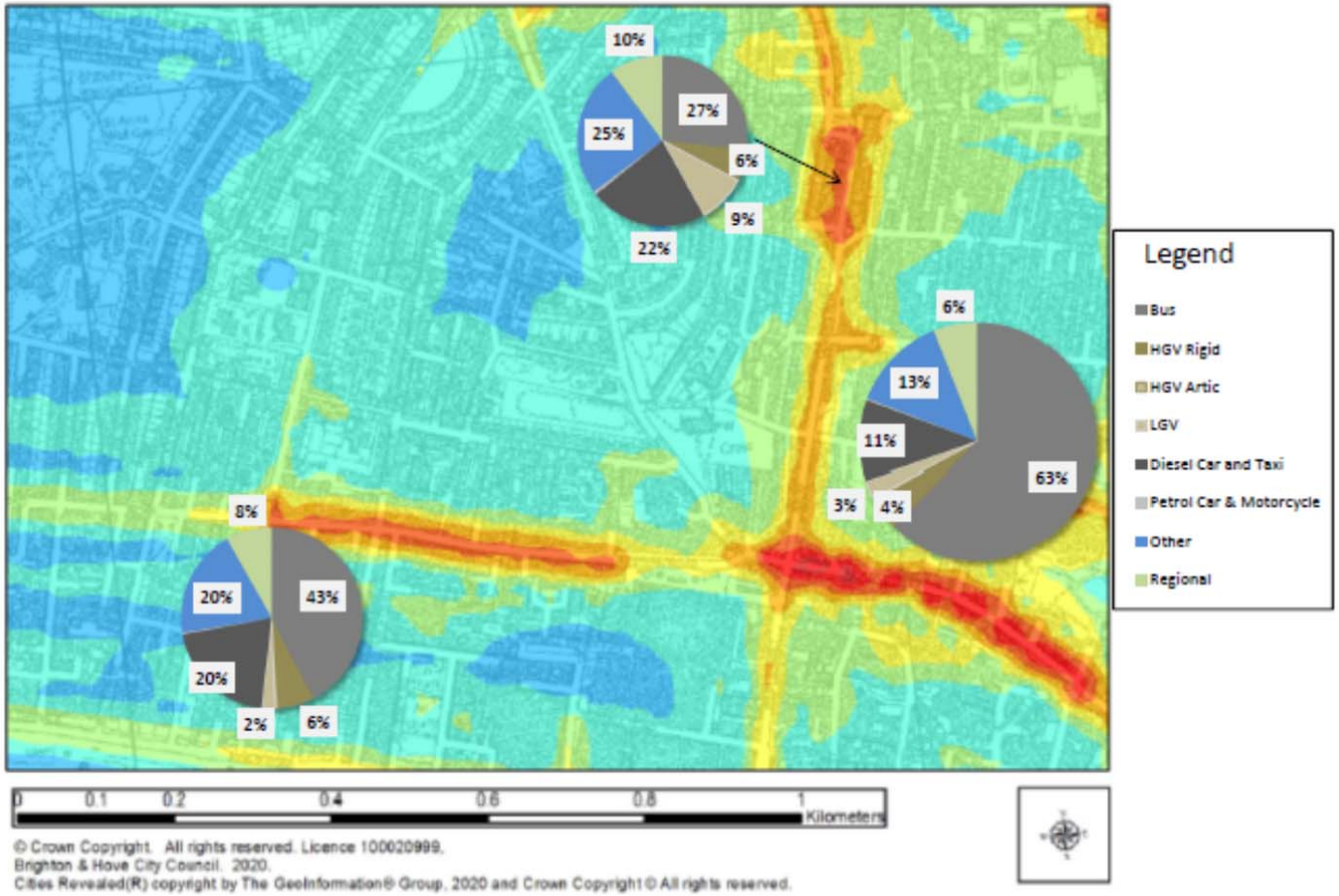
6.2 *Model Results Nitrogen Dioxide NO_2*



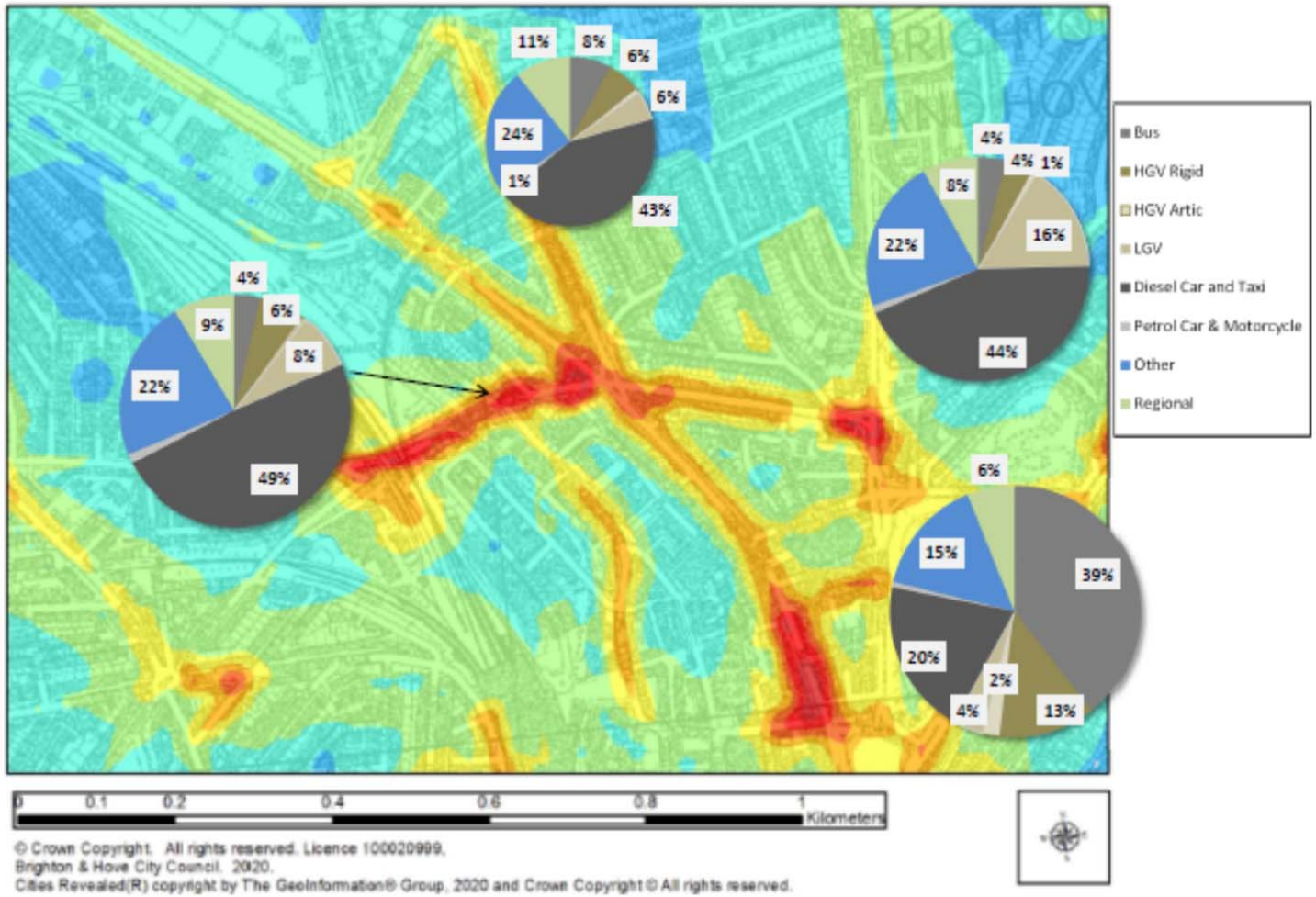
6.3 *Model Results City Centre NO_2*



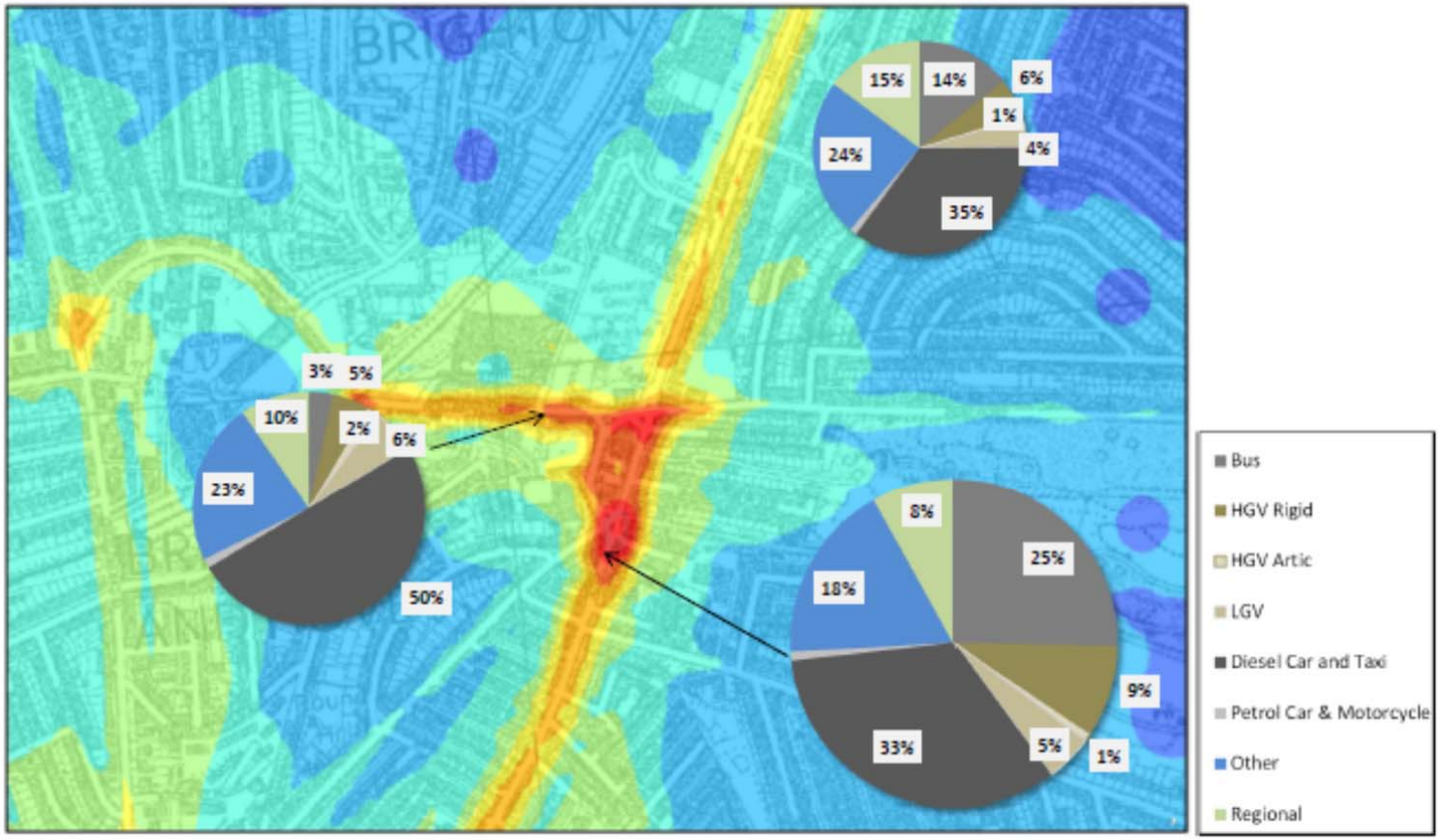
6.4 *2019 Source Apportionment NO_2 North Street – Western Road B2166 and Queens Road A2010*



6.5 *2019 Source Apportionment NO_2Arms leading to Preston Circus A270 and A23*



6.6 *Source Apportionment NO_2 Lewes Road A270 and Hollingdean Road*



6.7 *Source Apportionment NO_2 Portslade Wellington Road and Trafalgar Road A259 and A293*