Bath Clean Air Zone

Interim Monitoring Report
January to June 2023

Bath & North East Somerset Council

Improving People's Lives

CONTENTS

SUPPLIED AS ATTACHMENTS:

Acronyms and Abbreviations

ANPR	Automatic Number Plate Recognition
AQMA	Air Quality Management Area
AQO	Air Quality Objective
ASR	Annual Status Report
ATC	Automatic Traffic Counter
AURN	Automatic Urban and Rural Network
BID	Business Improvement District
B&NES	Bath and North East Somerset Council
CAF	Clean Air Fund
CAP	Clean Air Plan
CAZ	Clean Air Zone
CSF	Critical Success Factor
CVRAS	Clean Vehicle Retrofit Accreditation Scheme
DEFRA	Department for the Environment, Food and Rural Affairs
DfT	Department for Transport
DVLA	Driver and Vehicle Licensing Authority
EU	European Union
FBC	Full Business Case
HGV	Heavy Goods Vehicle
JAQU	Joint Air Quality Unit
LAQM	Local Air Quality Management
LEP	Local Enterprise Partnership
LEV	Low Emissions Vehicle
LGV	Light Goods Vehicle
MTC	Manual Classified Counts
NO	Nitrogen Oxide
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
OS	Ordnance Survey
PCM	Pollution Climate Mapping
PCN	Penalty Charge Notice
PHGV	Private Heavy Goods Vehicle
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter with particles less than 2.5 micrometers diameter
PM_{10}	Particulate Matter with particles less than 10 micrometers diameter
PRMS	Public Realm and Movement Strategy
TEA	Triethanolamine
TG	Technical Guidance
TMP	Traffic Management Plan
UK	United Kingdom
ULEV	Ultra-Low Emissions vehicle
UTC	Urban Traffic Control
UTMC	Urban Traffic Management and Control
VAT	Value Added Tax
WHO	World Health Organisation

Executive summary

In 2017, the Government directed Bath & North East Somerset (B&NES) Council to reduce nitrogen dioxide (NO_2) pollution in Bath to within the annual average limit of 40 micrograms per cubic metre ($\mu g/m^3$) in the shortest possible time, and by the end of 2021 at the latest.

This type of pollution is chiefly caused by road traffic, and extensive technical work showed that a charging clean air zone would be the only way to achieve success in the time frame. Clean air zones work by deterring certain higher emission vehicles from entering areas of high pollution by levying a daily charge on the driver, encouraging a more rapid replacement of polluting vehicles for cleaner, compliant ones than would otherwise naturally occur.

On 15 March 2021, the Council introduced a charging Class C Clean Air Zone (CAZ) in Bath's city centre to drive down NO_2 pollution at several locations which regularly exceed these NO_2 limits, in particular risking children's health and the health of our most vulnerable residents. In a Class C CAZ, private cars and motorbikes are not charged, regardless of emissions.

In Bath, significant financial support has been made available to individuals and businesses to replace non-compliant, chargeable vehicles regularly driving in the zone, and 900 polluting vehicles have already been replaced using government funds. More information on how the CAZ works can be found in 'How to use this report'.

Aims and limitations of this report

This report provides an update and indicative view of the CAZ's performance during the first 6 months of 2023 (January to June). It looks at impacts on air quality, traffic flow and vehicle compliance. It does not report comprehensively on all aspects of the zone, nor does it draw any conclusions about success with the Government's directive, all of which is included in the Clean Air Zone Annual Report, available here.

Due to Covid-19 having an unprecedented impact on travel behaviour in 2020, baseline data from the last representative year (which could be any year from 2017-2019) has been used to measure the impact and effectiveness of the zone. Due to seasonal effects, we also compare against similar seasons in this interim report, in this case the January to June time period of each year.

You can find out more about how we measure and present the data in the section ‘How to use this report’; and there is a more detailed explanation of how we monitor at the end of the report in the ‘Monitoring explained’ section.

Key findings

All the figures in this report are interim averages calculated from the first 6 months’ worth of data, from January to June. Data used for considering the success of the CAZ is derived from annual averages, calculated from twelve months of data. To account for the effects of seasonality on air quality, the baseline year is the same period in 2019 (January to June).

- Provisional air quality, traffic, and vehicle compliance data indicates that Bath’s Clean Air Zone is continuing to have the intended effect of improving fleet compliance, changing behaviours, and improving the city’s air quality in general.

- Our primary focus now is monitoring the traffic and air quality in locations with NO_2 concentrations close to the objective value.

- It is important to remember these results are for 6 months only and so do not determine whether the scheme is successful as this is based on an annual mean figure. Some of the interim averages include periods where one or more months of data is missing, which can skew the average. The full data is presented in the appendix to this report.

2023 Interim air quality results from within the CAZ (CAZ_Only):

- ‘CAZ_Only’ refers to those sites which are within the Clean Air Zone.

- Average nitrogen dioxide (NO_2) concentrations within the CAZ **are 25 per cent lower** than the same period in 2019 (January to June), representing an average **reduction of 9.3 µg/m^3**. This is the average reading from a total of 26 monitoring sites within the CAZ that recorded full interim data from January to June in both 2019 and 2023.

- In the 2023 interim period, **8 sites** within the CAZ **recorded greater than 40 µg/m^3.** This is a reduction of 4 sites when compared with the same period in 2019 and represents a decrease in the number of sites exceeding 40 µg/m^3 from 26% in 2019 to 12% in 2023. It must be noted that these concentrations are raw and indicative and can therefore not be compared to an annual average which accounts for the impacts of seasonality and temporary events such as key road closures.

- In the 2023 interim period, **9 sites** within the CAZ recorded concentrations **greater than 36 µg/m^3 but at or less than 40 µg/m^3**. This is an increase of 2 sites when compared with January to June 2019, however, represents a decrease in the proportion of sites from 15% in 2019 to 13% in 2023. The increase of sites between 36 and 40 µg/m^3 is likely due to sites over 40 µg/m^3 decreasing below the 40 µg/m^3 mark.

- **Two sites** recorded an interim average NO_2 concentration that had marginally increased when compared to the same time period in 2019, these sites are Marlborough Buildings which saw a minor elevation from 16.3 µg/m^3 to 17.1 µg/m^3 and Monmouth Place from 25.5 µg/m^3 to 26.3 µg/m^3. Both remain significantly below the national objective of 40 µg/m^3. It must be noted that the baseline concentration at both locations has experienced data loss. Additionally, whilst both sites have increased by 0.8 µg/m^3 when compared to 2019 (January to June), the figures are only indicative and are not representative of concentrations across the whole year.

2023 Interim air quality results from within the wider Bath urban area (CAZ_Boundary):

- 'CAZ_Boundary' refers to those sites which are outside of the CAZ boundary but are within the urban area of Bath including Batheaston and Bathampton.

- Average 2023 nitrogen dioxide (NO_2) concentrations for the 2023 interim period within the CAZ_Boundary are **24 per cent lower** than in 2019, representing a **reduction of 6.8 µg/m^3**. This is the average reading from a total of 31 monitoring sites that recorded data in both the 2019 and 2023 interim period, with full interim data from each site included in the analysis. This demonstrates that air quality is consistently improving across the district.

- In the 2023 interim, **no sites** within the CAZ_Boundary **recorded greater than 40 µg/m^3.** This is a reduction of 4 sites when compared with 2019 (January to June) and represents a decrease in the number of sites exceeding 40 µg/m^3 from 8% in 2019 to 0% in during the 2023 interim period.

- **No sites** were found to have increased in NO_2 concentration within the CAZ_Boundary when compared to 2019 during the same interim period.

2023 Interim air quality results from within the wider district (Wider_B&NES):

- 'Wider_B&NES' refers to those sites that are outside of the Bath, Batheaston and Bathampton urban areas, but are within the rural and district-wide urban areas in Bath and North East Somerset.

- Average 2023 nitrogen dioxide (NO_2) concentrations for the 2023 interim period within the wider region of B&NES (Wider_B&NES) are **22 per cent lower** than in the same 2019 period, representing a **reduction of 8.2 µg/m^3**. This is the average reading from a total of 14 monitoring sites that recorded data in both the 2019 and 2023 interim period, with full interim data from each site included in the analysis. This demonstrates that air quality is consistently improving across the district.

2023 Interim traffic flow figures:

- Despite Cleveland Bridge fully reopening (although subject to an 18-tonne weight restriction) in 2022 Q4, it is likely that traffic flows have continued to recover throughout this interim period. Additionally, due to further roadworks around Queen Square it is likely that traffic flows are still not representative during the reporting period, particularly within the CAZ.

- Nationally, average traffic volumes returned to around pre-pandemic levels and usage of LGVs and HGVs on the network are now exceeding pre-pandemic levels[1].

- Average traffic flows in the urban areas outside the zone's boundary, which include Batheaston and Bathampton, were **8% lower** than the baseline.

- Average traffic flows across the Wider B&NES region were **9% lower** than the baseline.

2023 Interim vehicle compliance and financial assistance scheme (FAS) figures:

- Compliance rates across all vehicle types continued to rise in the 2023 interim period when compared to the launch week of the CAZ in March 2021.

- Taxi/PHV compliance rose from 67% during the launch week to **an average of 95% by the end of June 2023**. An average of 499 individual taxis/PHVs were recorded in the CAZ each day during the interim period.

- Out of a total fleet of 226 scheduled buses, 88 were non-compliant when the bus retrofit programme started. By the end of June 2022, **the full fleet had been successfully retrofitted to meet CAZ emission standards** with financial support

[1] Department for Transport, 2024. Daily Domestic Transport Use by Mode. Available at: https://www.gov.uk/government/statistics/transport-use-during-the-coronavirus-covid-19-pandemic

from the government. An average of 156 unique buses/coaches were recorded in the CAZ each day during the interim period.

- HGV compliance for vehicles weighing greater than 3.5T but less than 12T rose from 86% during the launch week to **an average of 95% in 2023 (January to June)**. An average of 117 vehicles were recorded in the CAZ each day during the interim period.

- HGV compliance for vehicles weighing greater than 12T rose from 93% during the launch week to **an average of 97% in the 2023 interim period**. An average of 290 vehicles were recorded in the CAZ each day between January and June.

- Van/LGV compliance rose from 63% during the launch week to **an average of 85% in the 2023 interim period.** An average of 3103 individual vans/LGVs were recorded in the CAZ each day between January and June.

- Most vehicles recorded in the zone are private cars, with an average of **33,185 unique** private cars seen in the zone each day during the 2023 interim period (excluding taxis and private hire vehicles). This equates to at least 89% of all vehicles in the CAZ during this timeframe (January-June). **Private cars are not charged.**

- An average of **502 non-compliant** vehicles were seen in the zone each day during the 2023 interim period, compared to 1742 during the launch week of the CAZ in March 2021, a 71% decrease.

- The percentage of **chargeable non-compliant** vehicles (as a percentage of all overall traffic) entering the zone each week reduced from 5.7% in the launch week to an average of **1.18%** between January and June 2023.

- Minibus compliance varied considerably as there were only around 31 minibuses recorded in the CAZ each day during the 2023 interim period. The average minibus compliance was around **81%** during this time (January-June).

- The Council's financial assistance scheme (FAS) offered local businesses and individual grants and interest free loans to replace and upgrade non-compliant vehicles regularly driving in the zone.

- Owners of **over 1,500 vehicles applied for financial support** to upgrade or retrofit their vehicle.

- By the end of the scheme's deadline, owners' of **1560 vehicles** had passed the Council's **eligibility checks** to apply for funding to upgrade or retrofit their non-compliant vehicles via the Council's approved finance partners.

- By the end of the interim period, **943 vehicles** have already been **replaced** with cleaner, compliant ones, with more to be replaced in the coming months. As a result, the number of chargeable, non-compliant vehicles seen in the zone has fallen.

- The Council's FAS supported the **upgrade of 22 non-scheduled buses/coaches** from higher emission to cleaner, compliant ones by December 2022.

How to use this report

This report provides an update and indicative view of the CAZ's performance during January to June 2023 (interim period). The main areas we discuss are:

- air quality data
- traffic flow data
- and fleet compliance data

This report does not attempt to establish whether compliance (now termed 'success') with the Government's direction has been met. Neither is it a comprehensive report on all aspects of the Clean Air Zone, including its mitigation measures or data relating to CAZ operations or income (such as proceeds from daily charges and penalty notices etc).

Further information is included in the 2022 Clean Air Zone Annual Report, and/or in other previous quarterly reports in 2022.

Timescales and baseline data

To determine the effectiveness of the CAZ, we compare the latest data collected since the start of the CAZ with baseline data from similar periods before its launch.

And because we need to consider seasonal effects on both air quality and traffic flows, we compare like-for-like data from previous years. Previous years have been split into quarterly reports of 3 months such as January to March. We are now moving to a 6 monthly interim report spanning January to June.

The primary focus of this report is January to June 2023. Given the unprecedented conditions brought about by the Covid-19 pandemic in 2020 (including significant changes in transport and travel behaviour), we have discounted 2020 figures for comparative purposes, unless otherwise stated in the report.

When reading the report please note the following:

- All 2023 air quality data is provisional.

- Air pollution is affected by the seasons, therefore baseline air quality data for this report is from January to June 2019.
- We use data from 2017/18 for comparing traffic flows, because the Council has insufficient data for some periods including 2019.
- Traffic flows also vary according to the seasons, so we compare current traffic flow data from with data from January to June 2017/18.
- We also compare data from March 2021 (the launch of the zone) until the end of June 2023 (the end of the reporting period). However, the CAZ Annual Performance Report, looks at the annual trends from 2022 in greater detail.
- We also look at longer-term trends from 2017 to end of June 2023.

Climate summary January to June 2023

Air pollution is affected by meteorological conditions. This is a brief roundup of the monthly climate for this interim period, as described from the Met Office.

January and February were milder and dryer than average, whilst February had a harsh snap of colder weather towards the end of the month. The spring months brought unsettled weather with more than double the average rainfall in the south but with some short-lived warm spells during May. However, June provided warmer and more settled weather compared to previous months.

Most (approximately 80%) NO_2 arising from vehicles occurs as a result of chemical reactions of the nitric oxide (NO) directly emitted. Meteorological conditions are a significant factor in the resulting measured concentrations. Atmospheric NO_2 levels are usually higher in winter due to the cooler temperatures of vehicle catalysts, significantly compromising the reduction of NOx from emissions. Heatwaves also increase levels of NO_2. Long periods of unusual weather can result in annual measured concentrations becoming an outlier in a long-term trend.

Air quality data in this report has not been adjusted to take account of weather conditions – a process known as de-weathering. This process is used to remove the impact of weather variations from trends in annual data so that we can see the impact of other measures such as the implementation of the CAZ or a lockdown. Find more climatic information at:
https://www.metoffice.gov.uk/research/climate/maps-and-data/summaries/index

Covid-19 and air quality

- Multiple lockdowns in response to the Covid-19 pandemic had a significant effect on transport and travel behaviour, locally and nationally, which is why we've discounted 2020 data (unless otherwise stated).

- National traffic volumes have returned to pre-pandemic levels and in the case of LGVs and HGVs, pre-pandemic levels are being exceeded.
- Covid-19 is still influencing how people behave. There are lower rates of public transport use and higher rates of home-working and commuting by car.

World Health Organisation air quality targets update

The World Health Organisation (WHO) sets air quality guidelines. These guidelines are for use as an evidence-informed reference tool to help decision-makers in setting legally binding standards and goals for air quality management at national and local levels. The guidelines were updated in 2021 to reduce the limits for some measures in response to emerging evidence of the health impacts of these pollutants. Those pollutants with reduced limits include NO_2 and $PM_{2.5}$. The new ambitious targets are much lower than the currently mandated objective threshold limits.

Bath and North East Somerset continues to work towards the current UK air quality objectives with the ambition to introduce a localised target to ensure momentum on air quality improvements is maintained.

Further information

- You'll find more information on how we've measured and compared data in each individual section.
- As part of our obligations under the Local Air Quality Management (LAQM) legislation (part IV of Environment Act 1995) we issue an Annual Status Report (ASR) alongside this report. This sets out and comments on air quality data annually across the wider authority. These can be viewed online at: https://www.bathnes.gov.uk/services/environment/pollution/air-quality/reports
- You can also view an interactive map of historical NO_2 data collected from monitoring locations across the authority area, at: https://www.bathnes.gov.uk/services/environment/pollution-noise-nuisance/air-quality/air-quality-data-long-term
- The Clean Air Zone Annual Performance Report, published in June 2022, focuses on achieving success with the government's directive. It also focuses on a wide range of factors as set out in the Monitoring and Evaluation Plan in the Full Business Case for Bath's Clean Air Zone. A copy of which can be viewed at: https://beta.bathnes.gov.uk/sites/default/files/2020-10/appendix_r_674726.br_.042.fbc-26_monitoring_and_evaluation_plan.pdf
- The end of this report includes a 'Monitoring Explained' section, to aid understanding of the processes used to gather data for this report.

Background information

This section provides information on why we need a CAZ in Bath, the type of air pollution that we're trying to tackle, and how we decided on a Class C charging CAZ. Further information can be found in the Full Business Case at: www.bathnes.gov.uk/BathCAZ.

Air pollution

Air pollution is the leading environmental health risk to the UK public, with an estimated 28,000 to 36,000 deaths annually attributed to it in the UK alone[2].

Long-term exposure to air pollution is linked to premature death associated with lung, heart and circulatory conditions, while short-term exposure exacerbates asthma and increases hospital admissions.

There is evidence to suggest that despite strengthening environmental policies, the poorest in our society are being unfairly exposed to worse air pollution without seeing improvements[3]. Clean air is important for everyone and will alleviate stress on our health system, improve people's lives and make our society more equitable.

Types and causes of air pollution

There are different causes and sources of air pollution. Historically, combustion of fossil fuels for energy, such as coal, produced smoke and sulphur dioxide (SO_2). Now road traffic is chiefly responsible for the poor air quality in the UK contributing to nitrogen dioxide (NO_2) pollution and particulate matter (PM) pollution.

Particulate matter pollution, referred to as PM_{10} or $PM_{2.5}$, is made up of tiny bits of material from all sorts of places including smoke from fires, exhaust fumes, smoking or the dust from brake pads on vehicles. These particles are too small to see, and we can breathe them in without noticing.

Nitrogen dioxide (NO_2) comes from burning fuels or other materials, so levels are especially high around roads. But they are also produced from home gas boilers, bonfires, and other sources as well. You cannot see or smell nitrogen oxides, but they mix with the air we breathe and are absorbed into our bodies. Vehicle exhaust

[2] Public Health England. Review of interventions to improve outdoor air quality and public health, 2019 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/938623/Review_of_interventions_to_improve_air_quality_March-2019-2018572.pdf

[3] Air Quality Management Resource Centre, UWE. Emissions vs exposure: Increasing injustice from road traffic-related air pollution in the United Kingdom, 2019 https://www.sciencedirect.com/science/article/pii/S1361920919300392

emissions contribute 35 per cent of all UK nitrogen oxide emissions (NO_x) which is the single greatest source[4].

How does air pollution affect our health?

Air pollution particles and gases enter our bodies and can damage our cells in different ways. They usually get into our lungs first and can then move into our bloodstream to reach organs such as our heart and brain.

Any amount of pollution can be damaging to our health, but the more that you are exposed to, the bigger the risk and the larger the effect on you and your family. Some people are more vulnerable to the impacts of air pollution than others. Those more at risk from the negative effects of air pollution include children, pregnant and older people; people with lung conditions such as asthma, chronic obstructive pulmonary disease (COPD) and lung cancer. People with heart conditions such as coronary artery disease, heart failure and high blood pressure are also at risk.

Air pollution in Bath

In Bath, annual average nitrogen dioxide (NO_2) levels have exceeded the legal limit of 40 µg/m^3 at several locations within the city, chiefly caused by vehicle emissions.

The problem is exacerbated by Bath's topography. The city sits in the bottom of a valley surrounded by hills, and its central roads are flanked by tall buildings, which means that in certain conditions, vehicle emissions can get trapped in the atmosphere causing high levels of NO_2 in certain locations.

Particulate matter in Bath was not found to exceed legal limits for either PM_{10} (particulate matter less than 10 micrometers in diameter) or $PM_{2.5}$ (particulate matter less than 2.5 micrometers in diameter), except at times when there were meteorological or other events that caused spikes in these pollutants, nationally. There has been a downward trend in levels of PM in Bath since 2017.

Health impacts in Bath of NO_2 pollution

- NO_2 contributes to as many as 36,000 early deaths in the UK each year[5]

[4]DEFRA. Air quality: explaining air pollution – at a glance, 2019. https://www.gov.uk/government/publications/air-quality-explaining-air-pollution/air-quality-explaining-air-pollution-at-a-glance

[5] Public Health England. Improving outdoor air quality and health: review of interventions, 2019. https://www.gov.uk/government/publications/improving-outdoor-air-quality-and-health-review-of-interventions

- It irritates and inflames the lining of airways – which can worsen asthma and make breathing difficult among those with lung disease (such as bronchitis and emphysema). In Bath, around 12,000 people suffer from asthma[6]
- Research shows that high levels of NO_2 can affect children's lung development and that children who grow up in highly polluted areas are more likely to develop asthma[5]

How we monitor air quality

B&NES has been monitoring air pollution for many years, reviewing the monitoring sites regularly, more recently to ensure coverage of key CAZ locations and potential diversion routes around the zone. Three pollutants are measured around the district: NO_2, PM_{10} and $PM_{2.5}$.

There are currently over 150 locations where NO_2 is measured, including 48 key sites with higher levels of pollution where three diffusion tubes are located at each location to improve data confidence.

To read more about how air quality is measured and analysed in relation to the effectiveness of Bath's CAZ, see the 'Impacts of the CAZ on Air Quality section'.

More information about air quality across B&NES go to:
https://www.bathnes.gov.uk/services/environment/pollution/air-quality

Why we need a charging CAZ

In 2017, following a successful ruling by the Supreme Court in a case brought against the government by Client Earth, the government directed Bath and North East Somerset (B&NES) Council to reduce the annual average NO_2 levels in Bath to within legal limits in 'the shortest possible time' and 'by the end of 2021 at the latest'.

Since 2017, we have done significant technical work to understand what's required to comply with air quality limits, establishing that a charging clean air zone would be the only measure capable of delivering the necessary air quality improvements by the end of 2021. A CAZ works by deterring higher emission vehicles from driving in the most polluted areas of the city by levying a daily user charge, encouraging a more rapid replacement of polluting vehicles for cleaner, compliant ones than would otherwise naturally occur. Birmingham, Portsmouth, Bradford, Bristol, Sheffield, Newcastle and Gateshead have also introduced charging Clean Air Zones.

[6] Bath and North East Somerset Council. Clean Air 4 Bathnes. https://www.bathnes.gov.uk/bath-breathes-2021-overview/background

Other than meeting these objectives, the CAZ is seen in the context of the Council's wider commitment towards improving public health and the natural environment. In March 2019 the Council declared a Climate Emergency, resolving to provide the leadership in making the Council area carbon neutral by 2030[7]. And in July 2020, the Council declared an Ecological Emergency, resolving to work with local and national partners to resist the destruction of natural habitats through planning policy and development management.

The government has provided all the funds required for us to prepare and implement the CAZ. Work is overseen by the government's Joint Air Quality Unit (JAQU) and subject matter experts are also independently verifying the work being done.

How we decided on a class C charging CAZ

The options for Bath to achieve success were a Class D charging clean air zone, charging all higher emission vehicles including cars and motorbikes or a Class C charging Clean air zone, charging all higher emission vehicles except private cars and motorbikes but including some additional traffic management.

We engaged extensively with the public throughout 2018/19 before reaching a decision on a Class C charging Clean Air Zone. The overwhelming opinion was that while we needed to tackle pollution, a class C charging CAZ would strike a better balance between tackling pollution and protecting central businesses and vulnerable residents that might be disproportionally affected by charging higher emission private cars.

Technical modelling suggested that we could achieve success with a Class C CAZ provided we also introduced additional traffic measures at Queen Square to address a particular NO_2 hotspot on Gay Street.

In addition, it was agreed that significant financial support would be given to local individuals and businesses to help them replace higher polluting vehicles regularly entering the zone with cleaner, compliant ones. This mitigation would reduce the impact of charges on affected businesses, and individuals, while also further reducing emissions to support better air quality.

The full business case for the CAZ was approved by central government in January 2020 and can be read here: https://beta.bathnes.gov.uk/policy-and-documents-library/baths-clean-air-zone

[7] Bath and North East Somerset Council. Climate Emergency, 2021 https://www.bathnes.gov.uk/climate-emergency

How Bath's CAZ works

As a Class C charging clean air zone, daily charges apply to the following higher emission vehicles driving in the zone that do not comply with Euro 6/VI (diesel), or Euro 4/IV (petrol) emissions standards:

- Taxis, private hire vehicles (PHVs), vans (including pick-ups and N1 campervans), minibuses, and light goods vehicles (LGVs) - £9 per day
- Buses, coaches and heavy goods vehicles (HGVs) - £100 per day
- A discounted charge of £9 per day is also available for private HGVs (PHGVs), such as larger motorhomes and horse transporters, once registered with the Council.

Cars and motorbikes (except for taxis and PHVs) are not charged in a Class C CAZ, regardless of their emissions standard. This includes campervans classed as M1 on their V5C.

Importantly, the Council is not keen to penalise motorists or make money from the zone. Its priority is to inform people about daily charges, deter polluting vehicles from entering the zone, and encourage those with chargeable, non-compliant vehicles regularly entering the zone to upgrade their vehicles, or consider alternative sustainable transport options.

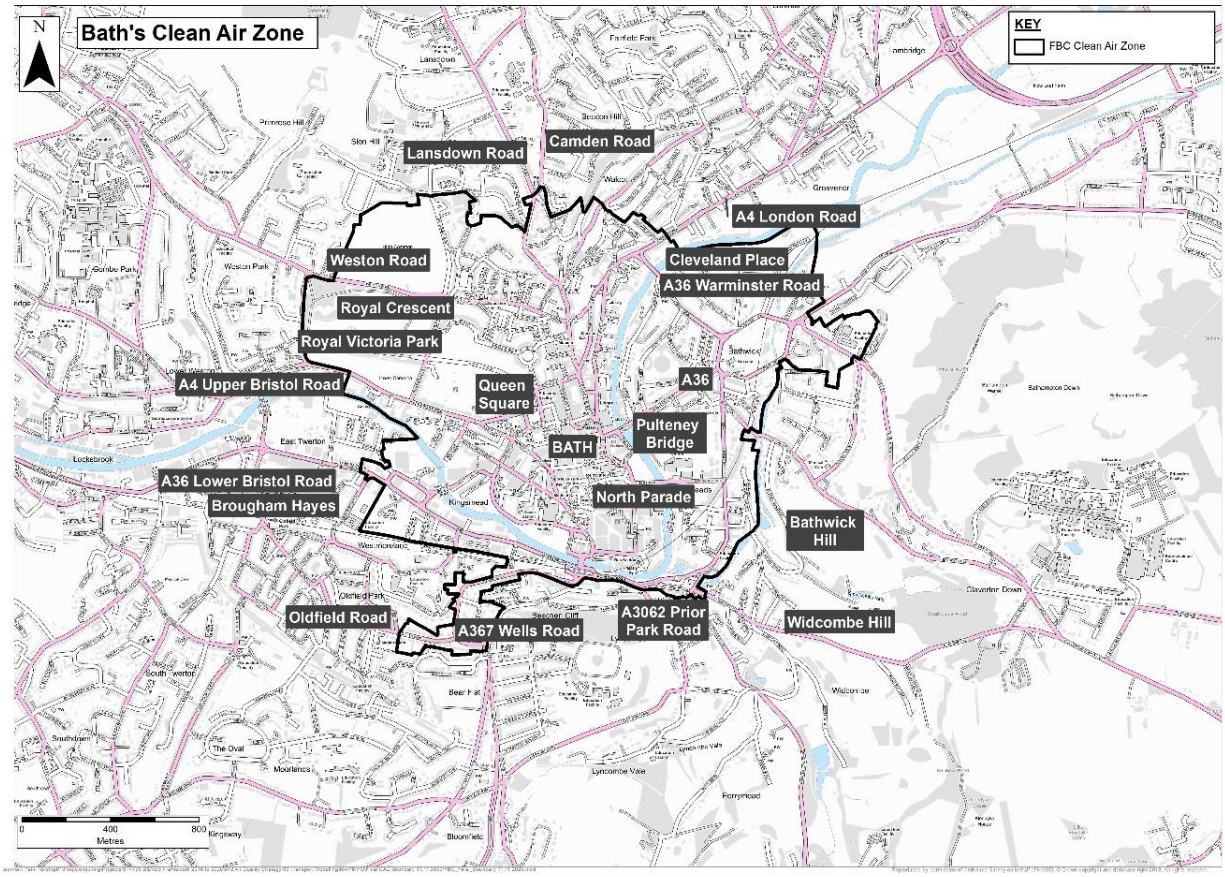
Revenue from daily charges and penalty charges is used to fund the operational costs of the scheme. Any surplus proceeds must be reinvested into sustainable transport and air quality projects.

Zone boundary

The zone covers the very centre of the city (see Figure 1), but its boundary is designed to ensure that annual average levels of NO_2 both inside and outside the zone were within acceptable legal limits by the end of 2021, as per the government's directive. An interactive map can be viewed online at: https://beta.bathnes.gov.uk/view-map-baths-clean-air-zone

The Clean Air Zone is as small as possible to minimise the social, economic and distributional impact of the scheme, whilst at the same time capturing as many non-compliant vehicle movements as possible in and around the city, with a view to ensuring that air quality limit values were met in the shortest possible time. See the 'Impact of the CAZ on Air Quality' section for a map showing where NO_2 monitoring sites are currently located across the city.

Figure 1- A map of the CAZ boundary.



Exemptions

National exemptions apply permanently for ultra-low emission vehicles, hybrid and alternatively fuelled vehicles, disabled passenger tax class vehicles, disabled tax class vehicles, military vehicles, historic vehicles, and vehicles with retrofit technology accredited by the Clean Vehicle Retrofit Accreditation Scheme (CVRAS).

Local exemptions applied temporarily from launch for two or four years (and for shorter periods) for certain vulnerable groups, and hard-to-replace vehicles. Exemptions were also introduced to encourage applications to the now closed financial assistance scheme to upgrade or replace non-compliant vehicles. Exemptions were developed in response to feedback from our public consultations and to mitigate the impact of charges on certain groups. For more information on local exemptions see www.bathnes.gov.uk/CAZexemptions

Schemes to support and encourage vehicle compliance

Alongside zone charges that deter the use of non-compliant vehicles in the zone and encourage owners to upgrade, the Council introduced two government-funded schemes that helped to mitigate the impact of charges on businesses/individuals regularly travelling in the zone, and further improve air quality:

- A financial assistance scheme for businesses and individuals regularly travelling in the zone to help replace or retrofit up to 1,500 polluting, chargeable vehicles with cleaner, compliant ones (via grants and or interest-free finance worth £9.4 million)
- A bus retrofit scheme to financially support local bus operators to retrofit the engines of all remaining non-compliant buses on scheduled routes in the city so that they meet the new emission standards i.e., are compliant with Euro 6 diesel standards (worth £1.7 million)

Both schemes are now closed. The Bus Retrofit Scheme is also complete, with all retrofits completed by June 2022.

Assessing the impacts of Bath's CAZ

The purpose of the CAZ was to reduce nitrogen dioxide (NO_2) pollution in Bath to within the annual average limit of 40 micrograms per cubic metre ($\mu g/m^3$) in the shortest possible time, and by the end of 2021 at the latest.

To show that we have achieved success, we are required to evidence that the annual average levels of NO_2 recorded at every monitoring site in Bath (both inside and outside of the zone) do not exceed 40 $\mu g/m^3$, based upon a full 12 months of data from each individual site. The results of which for 2022 are published within the Clean Air Zone Annual Report, available on our website.

It is also relevant to report on rates of vehicle compliance. There were initial concerns raised by the public as to how the zone might impact traffic flows, business and personal travel behaviour, and the local economy, and the report therefore considers data to measure any such impacts, to ascertain whether corrective action is required.

The Council is committed to monitoring and reporting on these measures at various intervals and the full list, including a reporting timeline is included in Appendix 1.

We have already introduced additional traffic and air quality monitoring in areas where the public has expressed concern about displacement effects. For more information see the Traffic Displacement Appendix (Appendix 2) supporting this report.

For more information on previous monitoring surveys that have taken place, see Appendix 2 of the CAZ Annual Report, available here: https://beta.bathnes.gov.uk/sites/default/files/Appendix%202%20Investigating%20traffic%20displacement%20concerns.pdf

The purpose of our previous quarterly reports and the interim reports moving forward is to provide an indicative view of the zone's performance, looking at three key measures outlined in Table 1: air quality data, traffic flow data and vehicle compliance data. This report also includes data on the financial assistance and bus retrofit schemes because of their influence on fleet compliance.

Secondary measures, as presented within the Monitoring and Evaluation Plan in the Full Business Case of Bath's Clean Air Zone, are reported on within the CAZ Annual Performance Report.

Table 1- Data collection and collation for Bath CAZ Interim reporting.

Measure	Data to be Used	Rationale for Inclusion	Data Collection Methods	Frequency of Data Collection
M1: Air quality data	NO_2 concentrations data collected at existing monitoring locations in Bath and wider B&NES	To understand changes in air quality data, particularly NO_2 concentrations.	Diffusion tubes and real time monitoring	Baseline (pre-scheme) then continuous monitoring (reported every 6 months).
M2: Traffic Flows	Traffic flows in and around the CAZ areas area collected to understand the changes in traffic flows as a result of the scheme.	To understand changes in traffic flows along key corridors and links on the highway network. This includes possible 'rat-run' routes which may have been created by the CAZ, so responding to consultation concerns by residents in specific areas.	Automatic Number Plate Recognition (ANPR) camera cordon and ancillary Manual Classified Counts (MTC) or Automatic Traffic Counts (ATC) on key roads or perceived 'rat-runs'	Baseline (pre-scheme) then continuous monitoring (reported every 6 months).
M3: Vehicular fleet information	Number of compliant/non-compliant vehicles travelling within Bath	To understand changes in the type of vehicles travelling in Bath.	ANPR cordon, cross-referencing with DVLA vehicle database	Baseline (pre-scheme) then continuous monitoring (reported every 6 months).

Impacts of the CAZ on air quality

The purpose of the CAZ is to reduce nitrogen dioxide (NO_2) pollution in Bath to within the annual average limit of 40 micrograms per cubic metre ($\mu g/m^3$) in the shortest possible time, and by the end of 2021 at the latest so as to fulfil the obligations set out within the ministerial direction known as the Environment Act 1995 Bath and North East Somerset Council Air Quality Direction 2019.

To show that we've met this requirement, we must evidence that the annual average levels of NO_2 recorded at every monitoring site in Bath (both inside and outside of the zone) does not exceed 40 $\mu g/m^3$ and demonstrate this can be maintained across consecutive years.

How we collect and measure air quality data

We have measured air quality in Bath and North East Somerset since the mid-1990s. Currently we measure nitrogen dioxide (NO_2) and Particulate Matter ($PM_{2.5}$ and PM_{10}) concentrations in two ways: automatic analysers and diffusion tubes.

Automatic analysers measure NO_2 and PM in four permanent roadside locations in Bath. They take hourly readings of air pollution concentrations and provide more accurate readings than diffusion tubes. One of these monitoring stations is linked to the UK Automatic Urban and Rural Network (AURN) which provides national coverage of a range of pollutants.

Diffusion tubes are light, mobile and can be placed in many locations around the area, usually 1 to 15 metres from the road or at the kerbside (less than 1 metre from the road) and around 2-3 metres above ground level. The ambient air reacts with a chemical reagent in the tube so that NO_2 concentrations can be measured. The tubes are exposed to the air for one month before they are collected and sent to a laboratory for analysis. There are currently over 150 diffusion tube locations across Bath & North East Somerset.

In recent years, average annual levels of particulate matter pollution in Bath have not exceeded the legal limit which is 40 $\mu g/m^3$ for PM_{10} and 20 $\mu g/m^3$ for $PM_{2.5}$, except at times when there were meteorological or other events that caused spikes in these pollutants, nationally. Whilst we continue to measure it, PM data will not form part of these interim or annual reports.

Comparing air quality data inside and outside of the zone

The Council has committed to assessing whether the introduction of the CAZ would lead to displacement impacts in areas outside of the zone's boundary.

To establish the impact of the zone on air quality in surrounding areas, and trends inside and outside of the zone, we present air quality data for the following areas:

- The Clean Air Zone (sites within the CAZ boundary which are referred to as 'CAZ_Only')
- The boundary area (sites outside the CAZ boundary but within the urban area of Bath including Batheaston and Bathampton, which are referred to as 'CAZ_Boundary')
- The wider area (sites outside of the Bath, Batheaston and Bathampton urban areas, but within the rural areas and district-wide urban areas in Bath & North East Somerset, which are referred to as 'Wider_B&NES')

Air quality monitoring locations

Figure 2 and 3 details the placement of diffusion tube monitoring sites within and outside the CAZ respectively.

Figure 2- A map showing the Clean Air Zone and the automatic analyser (squares) and diffusion tube (triangles) locations in Bath © Crown Copyright 2021. License number 100023334.

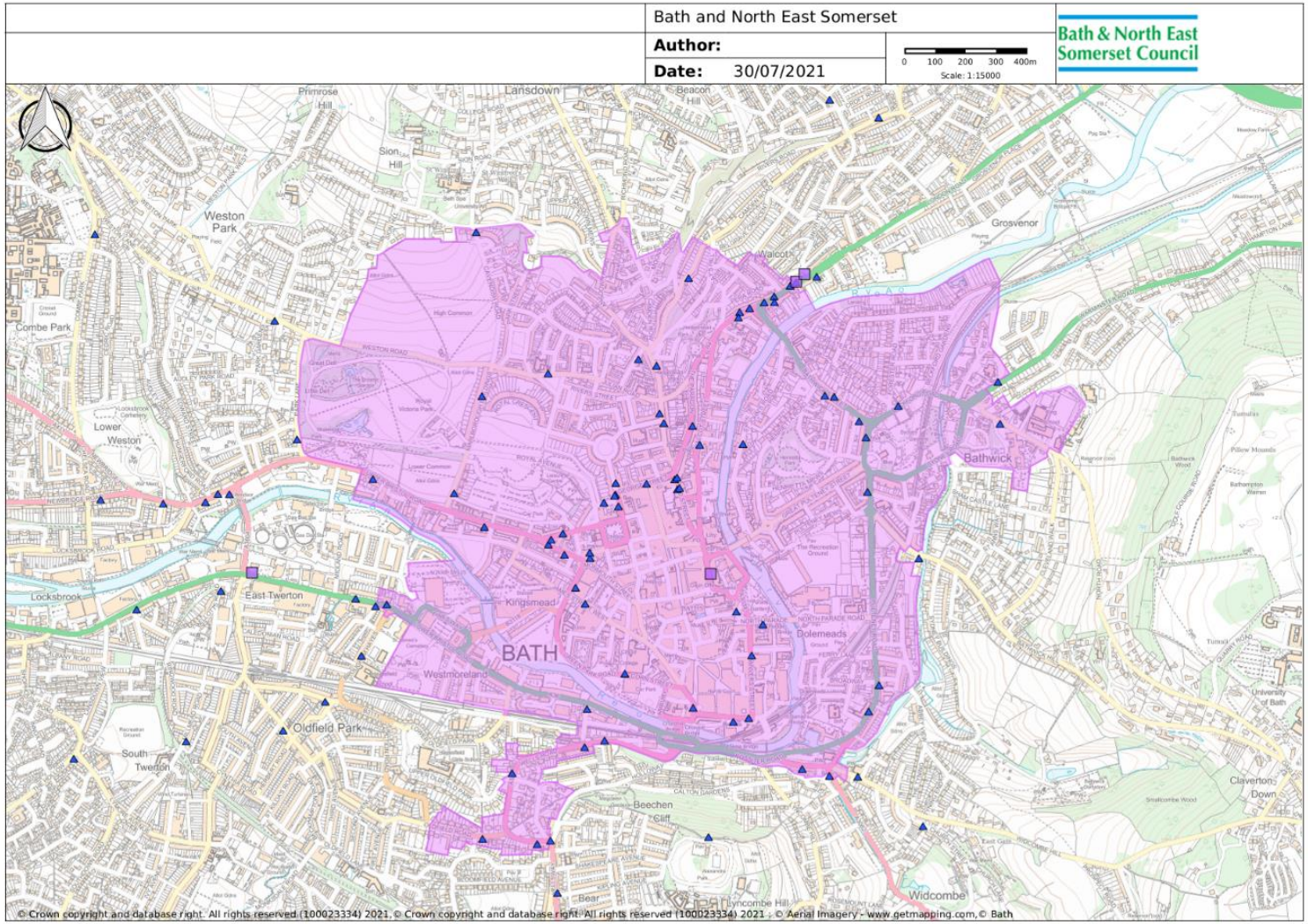
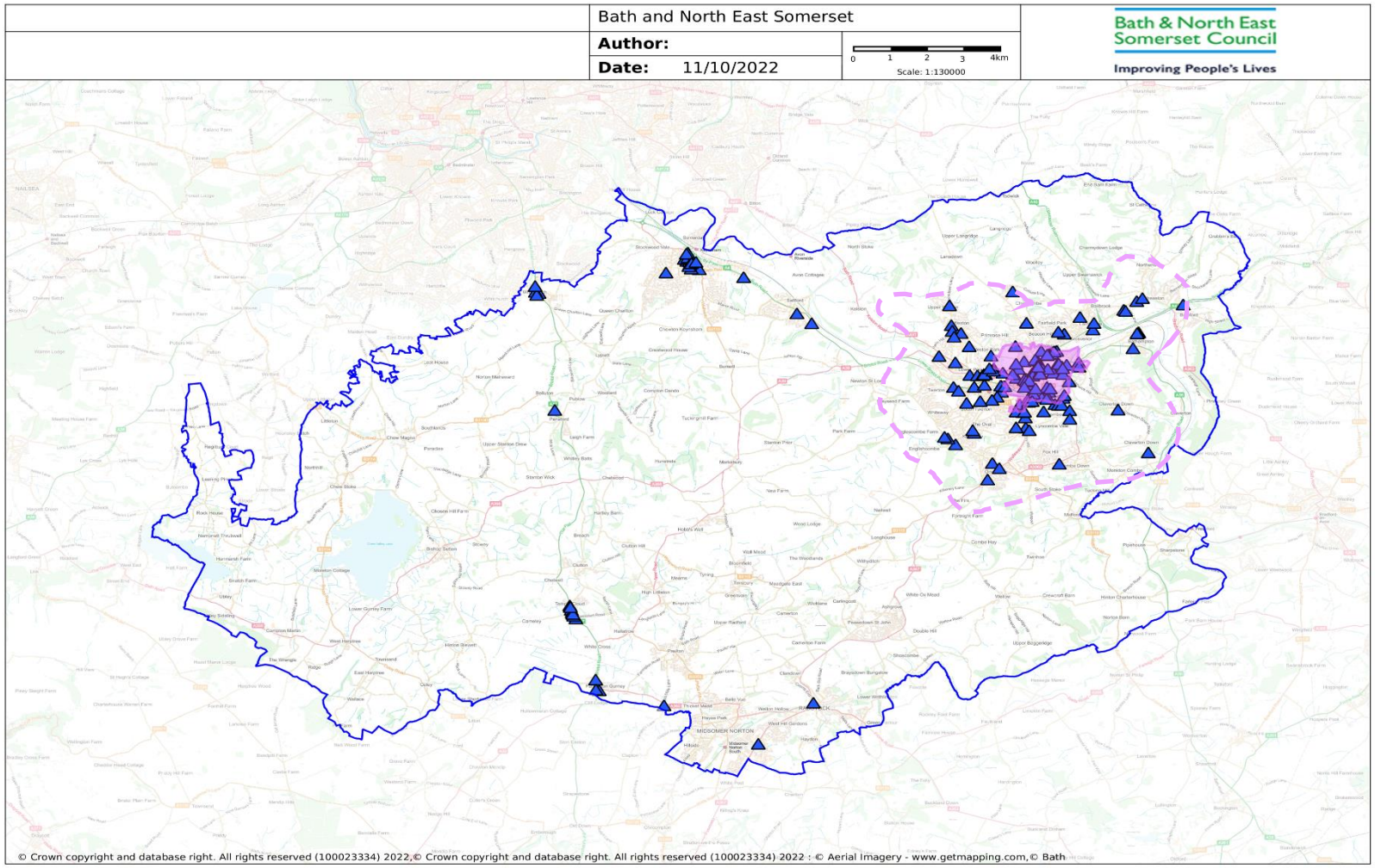


Figure 3 - A map showing current diffusion tube locations in three site groupings: The wider area of Bath and North East Somerset (the blue line; Wider_B&NES), the wider Bath urban area outside of the CAZ (the dotted pink line; CAZ_Boundary) and in the CAZ (the pink area; CAZ_Only). © Crown Copyright 2021. License number 100023334.



Numbers of diffusion tube sites in each location

Table 2 shows the growing number of diffusion tube air quality monitoring sites across the authority area. Additional sites were chosen based on the air pollution dispersion model developed for the CAZ Full Business Case, enabling us to check the impact of the clean air zone against what was modelled.

Triplicate sites are where three diffusion tubes are co-located at one monitoring site to improve accuracy. These are located where annual NO_2 concentrations are predicted to be greater than 34 µg/m^3. The NO_2 concentration from each triplicate diffusion tube is averaged to produce one result for the site, so triplicate measurements are only counted once for analysis.

Most of the air quality data shown in this report comes from averaging monthly diffusion tube results. We also report data from four automatic analysers located in Bath.

Measuring air quality to take account of seasonal effects

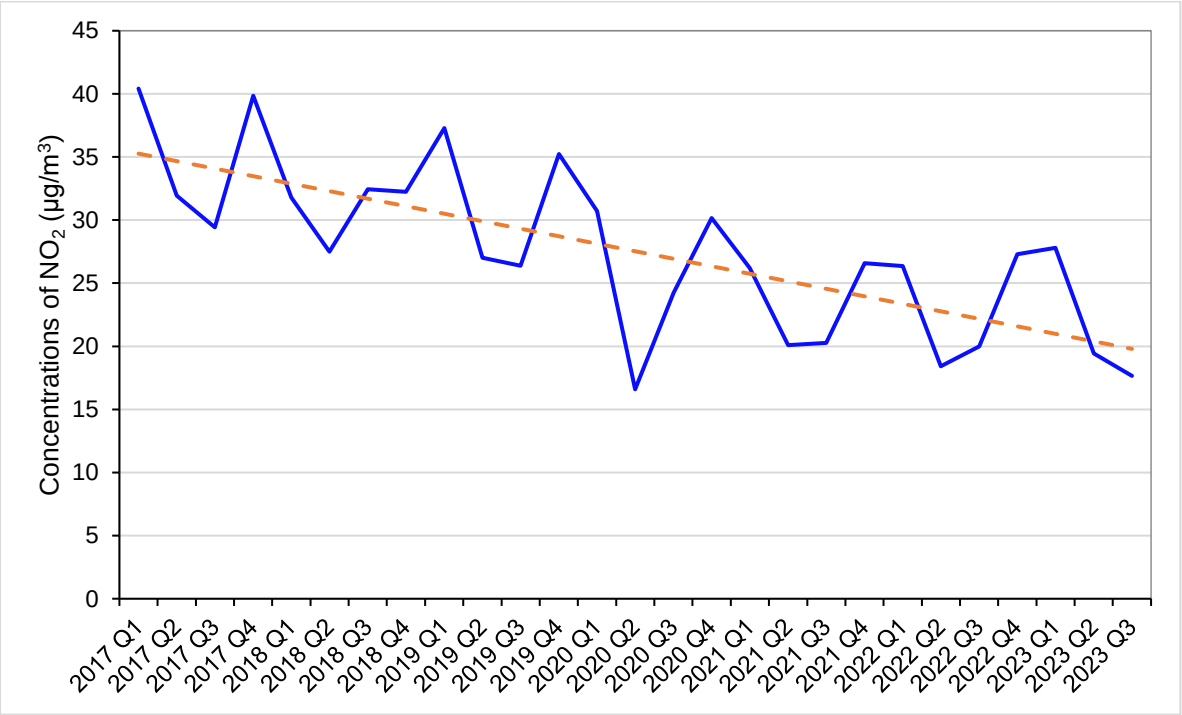
Annual average concentrations are useful because they account for varying seasonal cycles of pollutants such as:

- Meteorological conditions, for example wind, precipitation, and temperature
- And to a lesser degree, human sources of air pollution, for example increased energy generation for heating in winter or increased agricultural activities in spring.

Figure 4, seen below, shows interim averages of NO_2 concentrations at Widcombe High Street from 2017 to 2023. This site has been chosen as it is a long-term site with a high data capture that clearly presents the effects of seasonality.

As seen in Figure 4, concentrations of nitrogen dioxide are higher within the winter months, although the graph is showing an overall downward trend since 2017 at Widcombe High Street, NO_2 concentrations are higher within the first months of the year of each year.

Figure 4- Quarterly average NO_2 concentrations at Widcombe High Street since 2017.



Increased winter NO_2 concentrations are primarily due to:

- Lower vehicle catalyst temperatures meaning exhaust emissions abatement technology is less effective.
- Increased emissions from domestic sources, such as gas flues.
- The fact that NO_2 is retained in colder air for longer than warmer air.

Therefore, to account for seasonality within these reports we compare air quality data against similar time periods, for example comparing data for the first 6 months (January to June) of 2023 with the first 6 months (January to June) of 2019. Further information on air quality monitoring can be found in the ‘Monitoring Explained’ section at the end of this report.

Interim air quality results, January to June 2023

To identify emerging trends, we present provisional NO_2 data for the six months of January to June 2023. We compare it with baseline data from the interim period of 2019 and to previous years' data to account for seasonal differences and to show the impact of the zone's launch on air quality so far. The 2020 interim data has been discounted as a baseline because of Covid-19's unprecedented effect on traffic and travel behaviour.

All other areas across the city, that are not outlined in Table 3 to 5, have interim average levels of nitrogen dioxide below 36 µg/m^3 or have falling levels of NO_2 and are therefore excluded from the tables. The full monthly diffusion tube results can be found in the appendix to this report.

Tables included in this section:

- Table 3: Sites within the CAZ and Bath's wider urban area that recorded an NO_2 concentration greater than 40 µg/m^3 in the 2023 interim period.
- Table 4: The diffusion tube locations where the interim average exceeded 36 µg/m^3 but remained at or less than 40 µg/m^3, within the CAZ_Only and CAZ_Boundary site groupings.
- Table 5: The diffusion tube locations where the 2023 interim average NO_2 concentrations increased when compared to the 2019 interim average.
- Table 6: The number of sites, that when averaged during the interim period, provisionally recorded NO_2 concentrations greater than 40 µg/m^3 and 36 µg/m^3.

Table 3- Sites within the CAZ and Bath's wider urban area that recorded an NO_2 concentration greater than 40 µg/m^3 in the 2023 interim period, within the CAZ_Only and CAZ_Boundary site groupings. TA= triplicate average site. A 6-month period with at least one month of data missing are highlighted orange. Data may be missing for multiple reasons including damaged diffusion tubes or those recording invalid results.

Site ID	Site	Site Grouping	2019 Interim NO_2 concentration (µg/m^3)	2023 Interim NO_2 concentration (µg/m^3)	Change	Missing data?	Reason missing
DT020 (TA)	Wells Road	CAZ_Only	47.8	46.1	-1.7		
DT042	Dorchester Street	CAZ_Only	56.2	42.4	-13.8	June and July 2019	Missing tubes
DT198 (TA)	Walcot Parade	CAZ_Only	58.1	43.2	-14.9		
DT222 (TA)	Anglo Terrace Façade	CAZ_Only	N/A	43.5	N/A	2019 baseline	Installed in August 2019
DT224 (TA)	Walcot Parade 2	CAZ_Only	N/A	49.0	N/A	2019 baseline	Installed in August 2019
DT237	Broad Street 2	CAZ_Only	N/A	40.6	N/A	2019 baseline	Installed in August 2019
DT304	Walcot Parade 4	CAZ_Only	N/A	45.5	N/A	2019 baseline	Installed in August 2022
DT305	Wells Road 5	CAZ_Only	N/A	42.5	N/A	2019 baseline	Installed in August 2022

Table 4- NO_2 concentrations where the interim average exceeded 36 µg/m^3 but remained less than 40 µg/m^3, within the CAZ_Only and CAZ_Boundary site groupings. TA= triplicate average site. An interim period with at least one month of data missing is highlighted orange. Data may be missing for multiple reasons including diffusion tubes going missing or invalid results.

Site ID	Site	Site Grouping	2019 Interim NO_2 concentration (µg/m^3)	2023 Interim NO_2 concentration (µg/m^3)	Change	Missing data?	Reason missing
DT043	St. James Parade	CAZ_Only	42.6	37.8	-4.8		
DT060	Victoria Buildings	CAZ_Only	51.2	38.7	-12.5		
DT090 (TA)	Anglo Terrace	CAZ_Only	58.0	38.9	-19.1		
DT227 (TA)	Wells Road 3	CAZ_Only	N/A	36.5	N/A	2019 baseline	Installed in August 2019
DT230 (TA)	Upper Bristol Road 4	CAZ_Boundary	N/A	39.5	N/A	2019 baseline	Installed in August 2019
DT234 (TA)	Gay Street 2	CAZ_Only	N/A	36.0	N/A	2019 baseline	Installed in August 2019
DT235 (TA)	Wells Road 4	CAZ_Only	N/A	39.9	N/A	2019 baseline	Installed in August 2019
DT238 (TA)	Broad Street 3	CAZ_Only	N/A	38.0	N/A	2019 baseline	Installed in August 2019
DT239 (TA)	Broad Street 4	CAZ_Only	N/A	37.7	N/A	2019 baseline	Installed in August 2019
DT246 (TA)	Dorchester Street 2	CAZ_Only	N/A	39.2	N/A	2019 baseline, May, and June 2023	Installed in August 2019 and missing tubes in May and June 2023

Table 5- NO_2 concentrations at locations where the Interim average increased in 2023 when compared to the 2019 interim period, within the CAZ_Only and CAZ_Boundary site groupings. TA= triplicate average site. Interims with at least one month of missing data are highlighted orange. Data may be missing for multiple reasons including diffusion tubes going missing or invalid results.

Site ID	Site	Site Grouping	2019 Interim NO_2 concentration ($\mu g/m^3$)	2023 Interim NO_2 concentration ($\mu g/m^3$)	Change	Missing data?	Reason missing
DT214 (TA)	Marlborough Buildings	CAZ_Only	16.3	17.1	0.8	January-March 2019 and June 2019	Tube installed in April 2019 and missing tube
DT216 (TA)	Monmouth Place	CAZ_Only	25.5	26.3	0.8	January-March 2019	Tube installed in 2019

Table 6- The total number of sites at locations in the clean air zone and outside the boundary but within urban areas of Bath, which recorded greater than 40 $\mu g/m^3$ and 36 $\mu g/m^3$ NO_2 concentrations during 2019 and 2023 interim period. The total number of sites reporting during each period is shown along with the proportion of sites recording greater than 40 $\mu g/m^3$ and 36 $\mu g/m^3$ because the total number of sites is variable. Note that sites which recorded above 40 $\mu g/m^3$ will also have recorded above 36 $\mu g/m^3$. Some sites reported here do not have full interim data available and are missing one or more month's data.

CAZ_Only and CAZ_Boundary	No. sites >40 $\mu g/m^3$ average	Proportion sites >40 $\mu g/m^3$ (%)	No. sites >36 $\mu g/m^3$	Proportion sites >36 $\mu g/m^3$ (%)
2019	16	34	26	55
2023	8	12	18	27
Change	-8	-22	-8	-28

N.B. It should be noted that new sites were added for a variety of reasons including in response to requests and to verify model predictions. This table considers all sites reporting during the interim period, regardless of how many months are missing. Any numerical discrepancies are due to rounding.

Comments and key findings:

- To identify emerging trends, we compare provisional NO_2 data for the months January to June baseline data from the interim period in 2019. This accounts for seasonality as there is a clear increasing trend in NO_2 concentrations during this this part of the year.

- This data for the interim has been averaged across every site reporting for the time period, in the site groupings. Some of the results included did not record full data, as one or more months may be missing.

- Missing or invalid data can lead to misleading results, for example, skewing an average. We have omitted results from our analysis if there is missing data because losing more than one month's information from a 6-month period means more than 20% of the data is missing.

- Multiple monitoring locations have been added since the 2019 interim period across B&NES. See Table 2 for details. Sites were added for a range of reasons including in response to public requests as well as verifying model predictions for the CAZ, therefore, there are more sites in June 2023 than in 2019.

- **2 sites** recorded an interim average NO_2 concentration that had increased when compared to 2019, these sites are Marlborough Buildings and Monmouth Place. These figures are only indicative and are not representative of concentrations across the whole year.

- It should also be noted that the 2 sites that increased within the interim period compared to 2019 only increased by 0.8 $\mu g/m^3$ to values that are still well below 40 $\mu g/m^3$ and therefore are not currently of concern (see Table 5). Monitoring will continue at both sites.

- In the 2023 interim period, **8 sites** within the CAZ (CAZ_Only) **recorded greater than 40 $\mu g/m^3$.** This is a reduction of 4 sites when compared with 2019 and represents a decrease in the number of sites exceeding 40 $\mu g/m^3$ from 26% in 2019 to 12% in the 2023 interim.

- In the 2023 interim period, **0 sites** within the wider Bath urban area (CAZ_Boundary) **recorded greater than 40 $\mu g/m^3$.** This is a reduction of 4

sites when compared with 2019 and represents a decrease in the number of sites exceeding 40 µg/m^3 from 8% in 2019 to 0% in the 2023 interim period.

- In the 2023 interim period, **9 sites** within the CAZ **recorded concentrations greater than 36 µg/m^3 but at or less than 40 µg/m^3**. This is an increase of two sites when compared to 2019, but, however, represents a smaller proportion of sites, decreasing from 15% to 13%.

- In the 2023 interim period, **1 site** within the wider Bath urban area (CAZ_Boundary) **recorded greater than 36 µg/m^3 but less than 40 µg/m^3.** This is a reduction of two sites when compared with 2019 and represents a decrease from 6% in 2019 to 2% in the 2023 interim period.

- It is anticipated that continued improvements in vehicle compliance rates will further improve NO_2 concentrations at our monitoring sites.

Trend analysis

Here we present trend analysis by comparing 2023 interim data to the 2019 interim baseline. For analysing interim data, we discount any sites where one or more months' data is missing from the interim, from the analysis. Since an interim comprises six months, and NO_2 concentrations vary seasonally, including an interim average concentration for analysis with one or more months missing, would skew the results. Therefore, when analysing data, we only consider an interim with at least five months full data.

In this interim analysis we compare sites that have full interim data from both the baseline in 2019, and the current 2023 interim. This means that the data we are considering is like-for-like, comparable and robust.

Triplicate sites (where three diffusion tubes are co-located) are used to increase the accuracy of the data. Where these sites exist, the average from all three diffusion tubes is taken monthly and reported as one result.

We include the full interim diffusion tube data (regardless of if there are any months missing data for whatever reason), for all site groupings in both the 2019 and 2023 interim, in an appendix to this report.

Table 7- Interim average NO_2 concentrations in 2019 and 2023 in the three site groupings. The results only consider like-for-like data, meaning only diffusion tube sites which recorded at least 5 out of the 6 months of interim data in both 2019 and 2023 are included.

Interim Period	CAZ_Only NO_2	CAZ_Boundary NO_2	Wider_B&NES NO_2
2019	37.5	28.3	37.3
2023	28.3	21.5	29.1
Change 2019 – 2023 (µg/m^3)	-9.3	-6.8	-8.2
Change 2019– 2023 (per cent)	-25.0	-24.0	-22.0

Comments and key findings:

- For analysing interim data, we have discounted any sites where one or more months' data is missing from the interim, from the analysis.

- For our interim analysis we also only compare sites that have at least 80% of data from both the interim baseline, 2019, and this year, 2023. This means that the data we are considering is like-for-like, comparable and robust. Some sites are discounted due to not having full baseline (2019) or current (2023) data.

- Triplicate sites (where three diffusion tubes are co-located) are used to increase the accuracy of the data. Where these sites exist, the average from all three diffusion tubes is taken monthly and reported as one result.

- Average nitrogen dioxide (NO_2) concentrations within the CAZ are **25 per cent lower** than the same period in 2019, representing an **average reduction of 9.3 µg/m^3.** This is the average reading from the monitoring sites within the CAZ that recorded <80% of interim data from January to June in both 2019 and 2023.

- There was also an NO_2 reduction found in the Bath urban areas outside the zone's boundary, including Batheaston and Bathampton, averaging a **24 per cent reduction, or 6.8 µg/m^3 on average**, from the CAZ_Boundary monitoring sites that recorded >80% of data from January to June in both 2019 and 2023.

- There was also an NO_2 reduction found in the Wider_B&NES site grouping, averaging a **22 per cent reduction, or 8.2 µg/m^3** on average, from the Wider_B&NES monitoring sites that recorded <80% of interim data from January to June in both 2019 and 2023.

- Given that traffic levels have largely returned to those seen pre-pandemic and above, this reduction of NO_2 concentration in the Bath urban area is likely due to the natural replacement of older, more polluting vehicles with cleaner, compliant ones, boosted by the Council's financial assistance to local drivers to replace over 900 of non-compliant vehicles.

- A CAZ seeks to speed up the replacement of non-compliant vehicles so it is anticipated that we will see further air quality improvements once the effects of the pandemic on the demand and supply of compliant vehicles have diminished.

- Significant reductions in NO_2 seen in 2020 are likely because of Covid-19 restrictions reducing traffic flows. Due to the unprecedented nature of the pandemic, reduced traffic flows and improved air quality, we may expect to see NO_2 concentrations in 2023, exceed those of 2020.

Impacts of the CAZ on traffic flow

A Clean air zone is primarily designed to improve the compliance of vehicles driving in higher polluting areas, and not to influence traffic volumes i.e., it is aimed at reducing pollution, not congestion.

However, road traffic is the most significant cause of NO_2 pollution in Bath, so we monitor any changes in traffic flow in and around the zone and on the highway network around the city. This data helps us understand whether changes in traffic negatively impact air quality and/or road safety as a result of introducing the zone.

How we measure changes in traffic flow

We monitor where traffic is going and the volume of traffic on particular routes using manual classified counts (MTC), automated traffic counts (ATC) and automatic number plate recognition (ANPR) cameras.

To report on the CAZ, we focus on key roads inside and outside the Clean air zone and on connecting highways. Traffic flows are continually monitored at various locations across the city and, for the purpose of monitoring the impact of the CAZ, are reported in a 6-month interim period and annually.

To understand the impact of the zone on changes to traffic flows, we compare 2023 interim data with a similar time frame before the zone was introduced. Depending on the available data, this baseline data will be from 2017 or 2018. We have discounted data from 2020 due to the unprecedented impact on traffic and travel caused by the Covid-19 restrictions, and the Council has insufficient data for the year 2019. Sometimes there is no baseline data to draw on if the monitoring location is new or temporary.

It is important to remember that not all vehicles are chargeable, and most vehicles have no need to avoid the zone or seek alternative routes.

Online shopping and home-deliveries are increasing, which is leading to more commercial vehicles on the roads. The most recent national data shows light goods vehicles on average increased to 7.6% of their pre-pandemic levels whilst heavy goods vehicles increased to 1.0% and cars reduced by 7.2%, respectively[8].

[8] Department for Transport, 2024. Daily Domestic Transport Use by Mode. Available at: https://www.gov.uk/government/statistics/transport-use-during-the-coronavirus-covid-19-pandemic

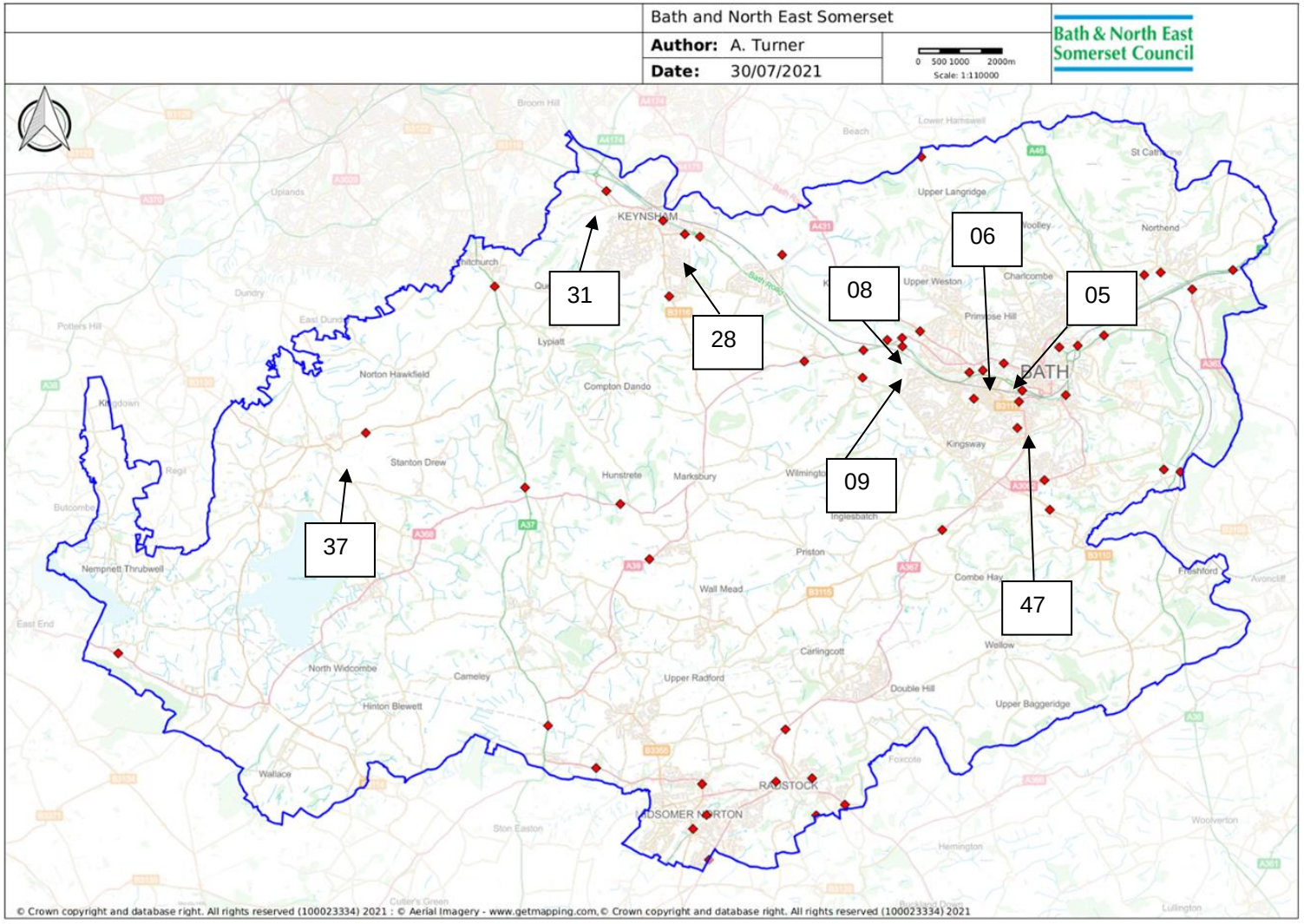
Figure 5 shows a map of the wider area, including the city of Bath, where automatic traffic counts (ATCs) are in place to analyse traffic flow. These are shown using a red diamond icon. A list of the locations used in the analysis can be found in Table 8, including the year the baseline data was recorded.
These permanent ATCs were selected as they were in use prior to the introduction of the CAZ and can therefore be used for comparison purposes.

Where possible we have used three sites from each site grouping to draw conclusions. Other monitoring methods such as temporary ANPR cameras will be used to monitor areas of perceived concern. Additionally, it must be noted that whilst there is sufficient data for analysis (with the exception of the CAZ), there are a few days missing in either our current or baseline year's interim period due to data loss, however, this is not considered to be significant for the purposes of analysis.

Table 8- ATC locations from Figure 5 (following page), along with their site category.

Site ID	Location	Site Category	Baseline data year
05	A4 Upper Bristol Road - W of Marlborough Lane	CAZ_Only	2017
47	A36 Lower Bristol Rd East of Westmoreland Rd	CAZ_Only	2016
06	A3064 Windsor Bridge, North of Stable Yard	CAZ_Boundary	2017
08	A4 Newbridge Road	CAZ_Boundary	2017
09	A36 Lower Bristol Road, East of Newbridge	CAZ_Boundary	2016
28	Bath Road, Keynsham	Wider_B&NES	2016
31	A4175 Durley Hill, West of Durley Lane	Wider_B&NES	2016
37	B3130 Chew Magna, East of Sandy Lane	Wider_B&NES	2017

Figure 5- ATC locations (red diamonds) used for traffic flow analysis. The number refers to the site ID which can be found in Table 8. © Crown Copyright 2021. License number 100023334.



Traffic flow data results

Interim traffic flow data is analysed here to identify short and long-term trends. This section outlines data from the selected ATCs and is used to identify trends in and around the CAZ.

Table 9- Two-way traffic flow data for ATCs by site grouping from the last year with representative data (2016, 2017 or 2018) and 2023. CAZ_Only last representative year was 2016/2017.

		7-Day Average		
Year	**Month**	**CAZ_Only***	**CAZ_Boundary**	**Wider_B&NES**
Baseline	January	15053	14313	11196
	February	15623	13701	11732
	March	15360	14332	11976
	April	16011	15137	12807
	May	15574	15203	12508
	June	16336	15454	12604
2023	January	10391	13349	10083
	February	14675	13742	10497
	March	14852	13620	10954
	April	15237	12664	10798
	May	13465	13656	12885
	June	10588	14275	11433

Table 10- Percentage change in average monthly traffic flows from 2017/18 to 2023. The bottom row shows the average change for the entire reported period (January to June), 2017/18 to 2023.

	7-Day Average		
	CAZ_Only*	**CAZ_Boundary**	**Wider_B&NES**
January	-31%	-7%	-10%
February	-6%	0%	-11%
March	-3%	-5%	-9%
April	-5%	-16%	-16%
May	-14%	-10%	3%
June	-35%	-8%	-9%
Baseline Interim- 2023 Interim average	-16%	-8%	-8%

Comments and key findings:

- Nationally, traffic levels have generally returned to pre-pandemic levels, marginally exceeding levels of the previous year by 2% (Department for Transport)[9].

- *During 2023 new automatic traffic counters started recording after installation and extensive testing in the previous year (2022) at certain sites. The data from these new counters used during some of the months of the interim period are comparable to data from older counters. It may also be noted that the installation of this technology has been funded from grants received from central government and ensures that the Council has the most up to date monitoring methods as an authority, capable of monitoring the volume, classification, speed, and movement paths of active travel modes as well as different vehicle types.

- Traffic flows are monitored to understand any changes in the urban area of Bath outside the CAZ, and in the wider Council area, as presented in Figure 5 (a map of the ATC locations), Table 8 (a description of the ATC locations from which we analysed data), Table 9 (the data on vehicle numbers passing the selected ATCs: in the baseline period either 2017 or 2018 and the 2023 interim), and Table 10 (change in traffic flow between 2017/18 interims and the 2023 interim).

- General traffic flows (i.e., both compliant and non-compliant traffic) across an average seven-day week reduced by 16% inside the CAZ and 8% in the urban area of the city outside the CAZ. There was also an 8% reduction in traffic in the wider area, compared with the baseline.

- The data from the available permanent ATCs are, in general, showing that levels of traffic outside of the zone's boundary in Bath has not increased because of the zone, when compared to the baseline year.

- In addition, the closure of Cleveland Bridge significantly affected the levels and directions of traffic flow throughout the entire second half of 2021 and into much of 2022. Although the bridge was fully reopened throughout 2023 (subject to an 18-tonne restriction), traffic levels are still recovering.

[9] Department of Transport statistics from the Office for National Statistics. Economic activity and social change in the UK, real-time indicators, 2023 https://www.ons.gov.uk/economy/economicoutputandproductivity/output/bulletins/economicactivityandsocialchangeintheukrealtimeindicators/13july2023#transport

Areas of potential traffic displacement

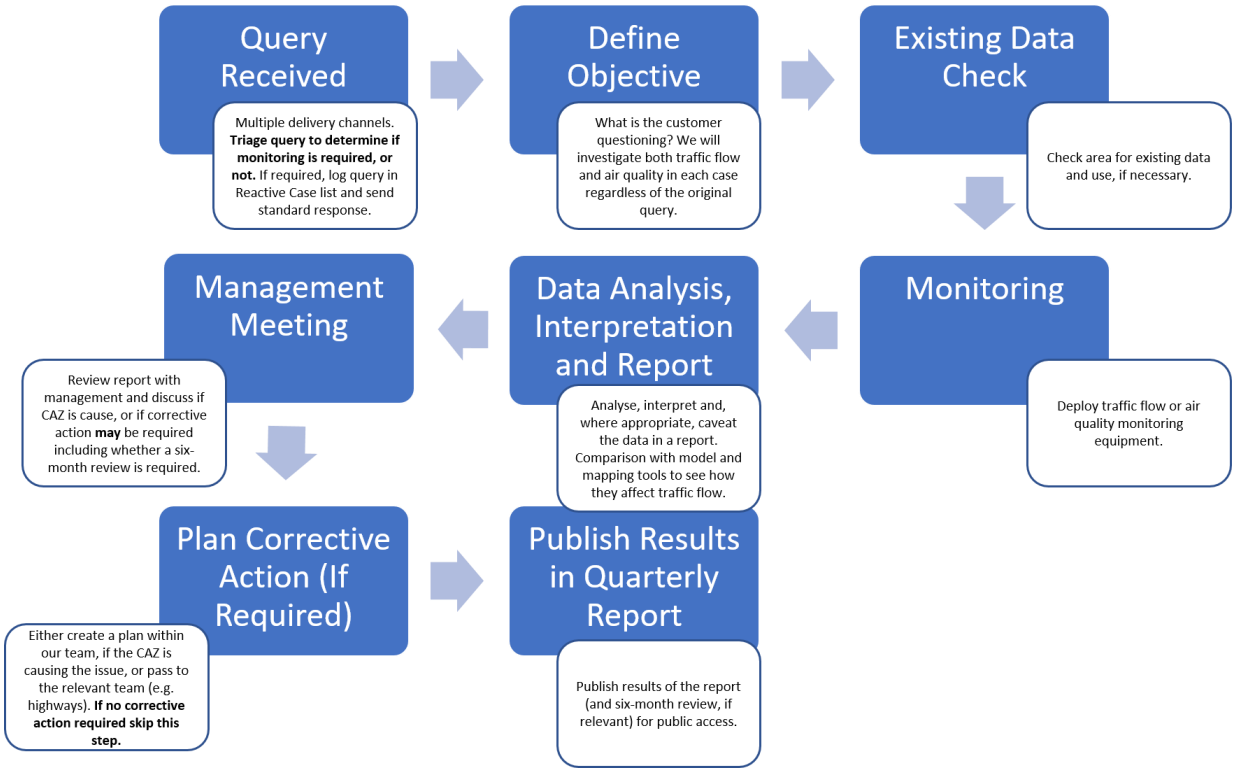
A key commitment of the Council during the business case development stage of the project was to monitor any concerns arising from the introduction of the CAZ. The purpose of the CAZ is to improve vehicle compliance rates whilst minimising the impact on normal traffic flows. Nationally, average traffic volumes returned to at least pre-pandemic levels and usage of LGVs and HGVs on the network are now exceeding pre-pandemic levels (Department for Transport).

We are actively investigating 10 locations where the public have expressed concern about a perceived increase in traffic in their communities since the launch of the CAZ. All locations logged and active are set out in Appendix 2 supporting this report. Information and analysis surrounding our previous monitoring surveys can be viewed here.

How we're investigating possible traffic displacement

From the launch of the CAZ in March 2021, comments from residents about potential CAZ-related impacts have been logged and investigated. Figure 6 shows the process we have put into place when following up these queries.

Figure 6 - A process map showing the details of the traffic displacement process followed when a query is received.



An updated traffic displacement appendix will be published alongside the 2023 Annual CAZ report in the summer, this ensures that the most up to date monitoring surveys can be included. Information and analysis surrounding our previous monitoring surveys can be viewed here.

The impact of the CAZ on fleet compliance

Vehicles contribute to approximately 80% of nitrogen oxide (NO_x) emissions in the vicinity of the main roads in Bath. Older vehicles generally emit more NO_x as recent technological advances in selective catalytic reduction has led to a lowering of NO_x emissions from vehicles, particularly those of a Euro 6 standard.

The purpose of the clean air zone is to speed up the natural replacement of older, more polluting vehicles with cleaner, compliant ones that meet the city's minimum emission standards. It does this by levying charges on owners of non-compliant vehicles that don't meet emission standards (i.e., pre-euro 6 diesel and pre-euro 4 petrol vehicles), so that they are incentivised to upgrade or replace their vehicle sooner than they might otherwise do (to avoid paying a daily charge).

In Bath, financial assistance was available to help support businesses and individuals who needed help to do this, mitigating the impact of charges. Improvements in Bath's fleet have been brought about in the following ways:

- Naturally as part of regular fleet upgrade programmes and because of pressure on manufacturers from government, environmental organisations, and the public to improve vehicle emissions.
- More recently and locally, as a specific reaction to the introduction to Bath's CAZ and other zones around the country e.g., drivers bringing forward plans to upgrade or replace older vehicles to avoid charges.
- And in response to direct Council and government-funded interventions to encourage upgrades, including a bus retrofit scheme and the financial assistance scheme which offered grants and / or interest-free finance to those regularly driving in the zone to replace non-compliant vehicles.

To understand whether the clean air zone is working to reduce emissions and air quality, we are monitoring rates of vehicle compliance in the zone.

How we measure fleet compliance in Bath

We measure changes in fleet composition using data gathered from 68 automatic number plate recognition (ANPR) cameras positioned around the perimeter of Bath's Clean Air Zone, and within the zone itself. Where traffic displacement concerns have been raised outside of the zone and we have determined that there is an increase in traffic flow, additional traffic and compliance monitoring is being undertaken using temporary ANPR cameras.

The camera captures individual number plates which are then cross referenced with a DVLA vehicle database to establish the number of vehicles in the zone on any given day, the type of vehicle captured in the zone e.g., bus, HGV, van etc., its age,

and the euro standard of the vehicle (if available). This enables us to understand the number of compliant vehicles seen in the zone (and in areas of potential traffic displacement) as a percentage of total vehicles driving in these areas each week.

To understand how fleet compliance in the zone has changed as a result of introduction of the CAZ, we are looking at weekly data from the cameras since the zone launched.

Vehicle compliance data for Bath CAZ

The following comments and findings refer to Figure 7 on the following page.

Comments and key findings:

- A vehicle is compliant when it meets the minimum emission standards for Bath's CAZ i.e., it's either Euro 6 diesel, Euro 4 plus petrol, hybrid, alternatively fuelled vehicles, or an electric vehicle.

- The percentage of chargeable non-compliant vehicles (as a percentage of all traffic) entering the zone each week reduced from 5.7% in the launch week, to an average of 1.18% between January and June 2023.

- An average of 502 non-compliant vehicles were seen in the zone each day, during the 2023 interim compared to 1742 during the launch week in March, a decrease of 71%.

- **Most vehicles recorded in the zone are private cars,** with an average of 33185 unique private cars seen in the zone each day during the 2023 interim. This equates to around 89% of all vehicles in the CAZ during the period.

- Bus/coach compliance rates **averaged at 98%** during the interim period, with an average of 156 individual vehicles seen per day. Due to changes in registration, certain compliant buses during the interim period have been flagged as non-compliant, bringing the compliance average down.

- HGV (>12 tonne) compliance rates **averaged at 96%** during the interim period, with an average of 290 individual vehicles seen per day.

- HGV (>3.5 tonne) compliance rates **averaged at 95%** during the interim period, with an average of 117 individual vehicles seen per day.

- Taxi/private hire vehicle compliance rates **averaged at 95%** during the interim period, with an average of 499 individual vehicles seen per day.

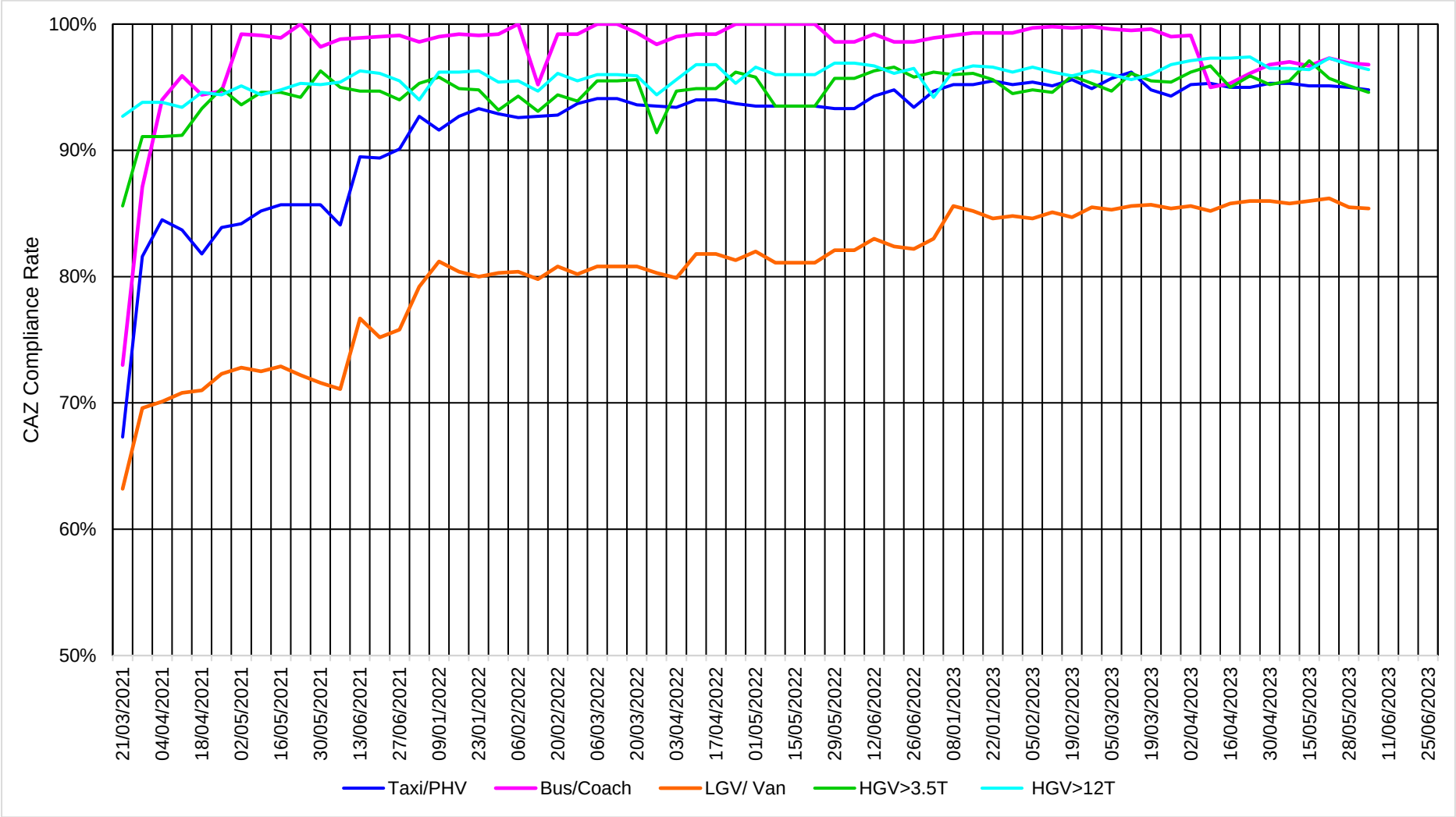
- Light goods vehicles/van compliance **averaged at 85%** during the interim period, with an average of 3,103 individual vehicles seen per day.

- Minibus compliance varied considerably as there were only around 31 minibuses recorded in the CAZ each day during the 2023 interim period. However, the average rate of compliance was **81%.**

- Rates of compliance are anticipated to continue to improve into 2024 particularly with respect to the supply of compliant LGVs which have been impacted most significantly by the pandemic.

- Compliance was supported through the government-funded FAS and bus retrofit schemes, in addition to drivers upgrading outside of these schemes.

Figure 7- Vehicle compliance rates within the CAZ as a 7-day moving average. Please note the y-axis compliance rate starts at 50%.



Bus retrofit upgrade programme

Traffic and air quality modelling prepared for the approved CAZ Final Business Case included the assumption that all scheduled public bus services would be compliant (Euro 6) standard by its launch. At the time, 87 out of a fleet of 226 scheduled buses operating in Bath were non-compliant.

To prepare for launch, the Council secured government funds to support bus operators to upgrade the remaining 87 buses with engine emissions abatement technology as certified by the Clean Vehicle Retrofit Accreditation Scheme (CVRAS).

In autumn 2020, agreements were finalised with six bus operators to commence installation of the retrofit technology as soon as possible. In addition, two buses not operating as a public-registered bus service (Wessex Water) were upgraded (replaced with new Euro 6 buses) and some coaches were retrofitted through the Council ’s financial assistance scheme.

Approximately £1.7 million was awarded as part of an implementation fund towards grants to operators to retrofit buses operating on public registered bus services.

Comments:

- By the end of June 2022, 100% (88) of non-compliant buses operating as public buses in central Bath were successfully retrofitted with emission abatement technology.

Financial support scheme uptake rates

To mitigate the impact of charges and further support air quality improvements, the Council has invested £9.4 million of government funds in a financial assistance scheme that offers grants and interest-free loans to businesses and individuals wishing to replace non-compliant, chargeable vehicles with cleaner, compliant ones.

Businesses and individuals could apply for funding to upgrade or retrofit vehicles if they passed a basic eligibility test, proving that they travel at least two days per week on average over a 60-day period. Those eligible could then apply for grants and/or interest loans via the Council's approved vehicle finance providers.

Table 11 below shows the number of vehicles that, by the end of June 2023, were eligible to be replaced and the number of vehicles replaced.

Table 11- The number of vehicles already replaced up to the end of June 2023.

Vehicle category	Number vehicles eligible for FAS funding to upgrade/ retrofit
M1 (taxis or private hire vehicles as private cars are compliant)	150
M2 (minibuses)	4
M3 (buses and coaches)	22
N1 (light goods vehicles i.e., vans)	1347
N2; N3 (heavy goods vehicles <12T; HGVs >12T)	38
Total	1560

*The two minibuses upgraded were LGVs and so included in those figures, below.

Comments and key findings:

- By the end of 2023 interim period, **1560** vehicles had passed basic eligibility tests, and **943** vehicles have already been replaced.

- HGVs already have a higher compliance rate across the UK and in Bath and were therefore not a priority for the financial assistance scheme. However, 38 HGVs regularly travelling into Bath have been approved for finance and **31** have been replaced.

- Owners whose vehicles passed eligibility tests could then approach the Council's approved list of finance providers to secure grants and interest free finance to replace their vehicles.

- Around 650 individuals and businesses were supported through the first stage of the scheme.

- At the end of December 2022, approx. £8 million had been spent upgrading and retrofitting vehicles via the financial assistance scheme (this includes the bus retrofit programme). Since then, a further £366k has been spent on this scheme.

- After the first phase of the FAS had closed, a small amount of residual funding has been prioritised to those with local exemptions which ended in March 2023, or to those who had previously expressed an interest in the scheme after it had launched. In total, by the end of March 2023, 1,560 vehicles had applied for either phase of the scheme, with **943** vehicles being replaced by the end of June 2023.

Conclusions

Nitrogen dioxide levels above the annual limit value of 40 µg/m^3 present a public health risk that's not acceptable to the council, or to central government. Any amount of pollution can be damaging to our health, but the more pollution you are exposed to, the greater the risk and larger the effect. Some people are more vulnerable to the impacts of air pollution than others. Those more at risk from air pollution include children, pregnant and older people; people with lung conditions such asthma, chronic obstructive pulmonary disease (COPD) and lung cancer. People with heart conditions such as coronary artery disease, heart failure and high blood pressure are also at risk.

The Council is committed to reporting on the impact of the CAZ on air quality, traffic flow and vehicle compliance on an annual and now 6 monthly periods (previously quarterly) so that we can monitor progress towards our target. This target is to reduce NO_2 concentrations to below the annual limit value of 40 µg/m^3 at all individual monitoring locations in Bath.

This report has set out related data and key findings from the 2023 interim period, and, as highlighted in our Executive Summary, the trends are encouraging. Air quality is improving across the entire district, despite traffic returning to around pre-pandemic levels.

Air quality

We are pleased to note that provisional average nitrogen dioxide (NO_2) concentrations within the CAZ for the 2023 interim are 25% lower than the same period in 2019, representing a reduction of 9.3 µg/m^3. There was an average reduction of 24% or 6.8 µg/m^3 in the CAZ_Boundary site grouping.

We also note that despite this general improvement, interim average concentrations of NO_2 at 8 monitoring sites within the CAZ still exceed 40 µg/m^3 and we will continue to monitor these sites closely. However, compared with baseline data for the same period 2019 (January to June), 4 fewer sites recorded NO_2 concentrations over 40 µg/m^3 and 1 more site recorded NO_2 concentrations over 36 µg/m^3 but less than 40 µg/m^3, which indicates progress towards our target.

Traffic flow

Nationally traffic flows have returned to pre-pandemic levels. Average traffic flows inside the CAZ were 8% lower than the baseline. Average traffic flows in the CAZ_Boundary and Wider_B&NES region were 8% lower than the baseline. These reflect roughly what we would expect for the interim period. Importantly, we note that

levels of traffic outside of the zone's boundary in Bath have not increased because of the zone, when compared with the baseline.

A key commitment of the Council is to monitor any concerns arising from the introduction of the CAZ, and while traffic flows have been substantially impacted and changed by the Covid-19 restrictions, we are investigating several locations where the public have expressed concerns over a perceived increase in traffic in their communities since its launch. These are outlined in Appendix 2, supporting this report.

Vehicle compliance

The aim of the zone is to improve the emission standards of vehicles driving in Bath. An average of 502 non-compliant vehicles were seen in the zone each day, during the 2023 interim compared to 1742 during the launch week in March. Additionally, the number of unique vehicles entering the zone during the 2023 interim was around 33,185 with the vast majority being private cars (88.8%).

95% of all taxis/private hire vehicles now entering the zone are compliant, compared with 67% prior to the zones launch. At the end of December 2022, 100% of non-compliant public buses on scheduled routes in Bath had been upgraded and are considered compliant.

To support the natural replacement of vehicles that happens as a result of a charging CAZ, the Council had, at the end of June 2023, supported the replacement of 943 vehicles. Additionally, after the first phase of the FAS had closed, a small amount of residual funding was prioritised to those with local exemptions which ended in March 2023, or those who had previously expressed an interest after the scheme had launched.

Next steps

We would like to thank the public and businesses for their commitment to supporting the Council to improve air quality in the city, especially those who have upgraded their vehicles. We continue to urge all residents to do their bit by walking, wheeling, cycling, or taking public transport, or ensuring their vehicles are compliant, wherever possible.

Monitoring Explained

Air Quality Monitoring Techniques

There are multiple methods whereby data on air quality is obtained.

Automatic Analyser

High-resolution measurements can be taken by automatic analysers that draw in ambient air. There are four of these instruments located within B&NES that are constantly monitoring air quality. The locations of the automatic analysers can be seen in Figure 2. One of the automatic analysers makes up part of the Automatic Urban and Rural Network (AURN) which feeds back to a national monitoring network. The data produced by these machines is compared with that of diffusion tubes to ensure accurate results.

Diffusion Tubes

Less expensive than automatic analysers, diffusion tubes can be located on existing street furniture. Due to the ease of deployment, hundreds of diffusion tubes can be located within a district building a picture of air pollution over a large area. Current locations of diffusion tubes can be seen in Figures 2 and 3. The tubes are exposed to ambient air for one month, before being sent to a laboratory for analysis. Data is then adjusted to consider laboratory or other inaccuracies before an annual mean is derived. Diffusion tubes are passive samplers and consist of a small plastic tube containing a chemical reagent called triethanolamine (TEA), in the case of NO_2 monitoring.

Traffic Monitoring Techniques

There are multiple methods whereby data on traffic flow and composition is obtained.

Automatic Number Plate Recognition (ANPR)

As part of the CAZ project, ANPR cameras were installed within and at entry/exit points to the zone. The cameras focus on the numberplates of vehicles and then the vehicle emissions information can be drawn from the DVLA database. Further useful data can be generated from matching entries into the system. For example, journey times through the CAZ.

Automatic Traffic Count (ATC)

Permanent Automatic Traffic Counters

As part of ongoing traffic monitoring, that was in place pre-CAZ, there are permanent ATCs at multiple locations in the district. Current locations of ATCs can be seen in Figure 5. These counters are built into the road and continuously monitor data on vehicle volume, speed, and classification.

Temporary Radar Automatic Traffic Counters

To quickly respond to potential traffic displacement issues, it is important to have monitoring equipment that is ready to deploy at short notice. Temporary radar ATCs can be fastened to existing street furniture and monitor vehicle volume and speed.

Video Survey Equipment

Much like Temporary radar ATCs, video survey cameras are easy to install on existing street furniture, at short notice. These cameras do not record vehicle speed but do record vehicle volume and classification, which can be useful in cases where it is important to know the type of vehicles using a route. These cameras can be used to assess how many vehicles enter/ exit junctions, which can be important.

Manual Traffic Counts

At times, manual traffic counts are superior to automatic equipment. Enumerators can be employed to manually count vehicles passing a specific point.