Worcestershire Regulatory Services
Supporting and protecting you

Worcester CITY COUNCIL

2023 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the Environment Act 1995 Local Air Quality Management, as amended by the Environment Act 2021

Date: June, 2023

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Executive Summary: Air Quality in Our Area

Air Quality in Worcester City

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

The mortality burden of air pollution within the UK is equivalent to 29,000 to 43,000 deaths at typical ages[3], with a total estimated healthcare cost to the NHS and social care of £157 million in 2017[4].

Worcestershire Regulatory Services (WRS) is a shared service formed from the Environmental Health and Licensing departments of the six Worcestershire District Councils. Responsibility for managing (monitoring and reporting of) local air quality transferred from the partnership councils to WRS in April 2011.

Three Air Quality Management Areas (AQMA) were declared by Worcester City Council in 2009 for exceedances of the annual average objective for nitrogen dioxide (NO_2):

- Dolday/Bridge Street AQMA declared 1st March 2009;
- Lowesmoor/Rainbow Hill AQMA declared 1st March 2009; and
- Newtown Road AQMA declared 1st March 2009.

The Newtown Road AQMA was revoked by the council on 30th July 2014.

A further AQMA was declared by the council for the St Johns area of Worcester for exceedance of the annual mean objective for NO_2 on 26th September 2014.

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[1] Public Health England. Air Quality: A Briefing for Directors of Public Health, 2017

[2] Defra. Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006

[3] Defra. Air quality appraisal: damage cost guidance, January 2023

[4] Public Health England. Estimation of costs to the NHS and social care due to the health impacts of air pollution: summary report, May 2018

In 2017, a detailed assessment was undertaken of an area within London Road and Sidbury by Air Quality Consultants (AQC) on behalf of Worcester City Council. The AQC report concluded that an area at the western end of London Road should be declared as an AQMA.

Additionally, long term trend measurements and automatic analyser results up to 2018 within Foregate Street, The Butts and The Tything, Worcester indicated that requirement for a new AQMA declaration of this combined study area would likely be confirmed by detailed assessment.

On 11th June 2019 Worcester City Council formally declared the Worcester City AQMA (Worcester City (Political Boundary)) which encompasses the whole district area as an AQMA, for likely breach of the nitrogen dioxide annual mean.

Additionally, Worcester City Council AQMAs Variation Order 2019 consolidates the existing 2009 and 2014 AQMAs, as detailed above, into the Worcester City AQMA (Worcester City (Political Boundary)) as of 11th June 2019.

Details of declaration and plans of the AQMAs can be found on the following pages of WRS website: Air Quality Management Area Declarations | Worcestershire Regulatory Services (worcsregservices.gov.uk)

Areas of poor air quality within Worcester typically coincide with the strategic road network in and around the city centre in proximity with sensitive residential receptors. These generally relate to The Butts / All Saints Road / Bridge Street strategic road one way system, The Tything (A38) to The Foregate Street corridor, Lowesmoor / Rainbow Hill / Astwood Road (B4850) corridor, St Johns Bull Ring (A44) and London Road (A44).

Like many parts of the UK, poor air quality in Worcester City is linked to areas with high volumes of traffic, congestion and ‘street canyon’ landscapes (where height of the building is greater than width of road). Worcestershire County Council has responsibility for strategic transport issues in the county and published the fourth Local Transport Plan (LTP4) in 2017.

Pre-pandemic WRS has enjoyed a good working relationship with the County Council’s Strategic Transport Team and developed closer working ties with Public Health, Planning and Sustainability colleagues within the County and District Councils. Unfortunately, the COVID-19 pandemic, led to the suspension of existing action groups in 2020 and delayed air quality improvement projects. Additionally, there have been significant personnel turnover within the WRS, County and District Council teams in the interim period.

As we have emerged from the pandemic during 2022-23, WRS are seeking to re-engage with those teams and new colleagues from the different disciplines that have a role in improving air quality.

All bar one diffusion tube monitoring stations in the Worcester City area saw an increase in annual mean NO_2 concentrations between 2021 and 2022. Monitoring data from 2021 does not represent a standard year with the continuation of the COVID-19 pandemic, associated lockdowns and restrictions affecting travel patterns and behaviours. As such, monitoring data shows an overall increase of 3.71 $\mu g/m^3$ (11%) in average recorded annual mean NO_2 concentrations across the Worcester City area between 2021 and 2022 (27.5 $\mu g/m^3$ in 2021 and 31.21 $\mu g/m^3$ in 2022). This is likely to have been caused by the increase in traffic between the two periods following the cessation of all COVID-19 regulations and restrictions in March 2022.

At this time, it is unclear if some enforced behaviours during the pandemic that led to a decrease in the number of journeys made, such as virtual meetings replacing face to face and an increase in working from home, will continue to have the beneficial impact on reducing concentrations of NO_2 in future years after 2022.

In comparing measured concentrations with pre-pandemic levels, 2018 recorded data averaged concentrations of 7.15 $\mu g/m^3$ and 19% higher than 2022 data across Worcester City.

In 2022, the highest concentration of NO_2 recorded across Worcester City was 43.91 $\mu g/m^3$ at But2 (located in The Butts). This location has recorded the highest concentration across the city for the last 5 years with a measured concentration of 39.1 $\mu g/m^3$ in 2021 and 52.43 $\mu g/m^3$ in 2018.

One other diffusion tube monitoring location recorded an exceedance of the AQS objective for annual average NO_2, 41.51 $\mu g/m^3$ at location Ast3, through this is reduced to 30.9 $\mu g/m^3$ when calculating back to the nearest relevant receptor.

A further 7 diffusion tube monitoring location recorded concentrations within -10% of the AQS objective for annual average NO_2, though only 3 locations (BrS2, Bkc and GS) record concentrations above 36 $\mu g/m^3$ when calculating back to the nearest relevant receptor. All concentrations are shown in Table B.1.

Given the trends recorded in 2022 no amendments to the Worcester City AQMA are proposed at this time.

No annual means greater than 60 ug/m^3 have been recorded indicating that it is very unlikely that there have been any exceedances of the 1-hour mean objective for NO_2 at any diffusion tube monitoring sites.

Actions to Improve Air Quality

Whilst air quality has improved significantly in recent decades, there are some areas where local action is needed to protect people and the environment from the effects of air pollution.

The Environmental Improvement Plan[5] sets out actions that will drive continued improvements to air quality and to meet the new national interim and long-term $PM_{2.5}$ targets. The National Air Quality Strategy, published in April 2023, will provide more information on local authorities' responsibilities to work towards these new targets and reduce $PM_{2.5}$ in their areas. The Road to Zero[6] details the approach to reduce exhaust emissions from road transport through a number of mechanisms; this is extremely important given that the majority of Air Quality Management Areas (AQMAs) are designated due to elevated concentrations heavily influenced by transport emissions.

In 2013, WRS produced a countywide Air Quality Action Plan (AQAP) for Worcestershire which was adopted by Worcester City Council. WRS have produced two updates to the AQAP, the latest in September 2016. For details of all measures completed, in progress or planned, please refer to the 'Air Quality Action Plan Progress Report for Worcestershire April 2015-2016'. A copy of this, the previous update, and the AQAP, is available to view or download at: Worcester City Council | Worcestershire Regulatory Services (worcsregservices.gov.uk)

Partnership Working

Worcestershire County Council has responsibility for strategic transport issues in the county and published the fourth Local Transport Plan. Pre-pandemic WRS has enjoyed a good working relationship with the County Council's Strategic Transport Team and

[5] Defra. Environmental Improvement Plan 2023, January 2023

[6] DfT. The Road to Zero: Next steps towards cleaner road transport and delivering our Industrial Strategy, July 2018

developed closer working ties with Public Health, Planning and Sustainability colleagues within the County and District Councils. Unfortunately, the COVID-19 pandemic, led to the suspension of existing action groups in 2020 and delayed air quality improvement projects. Additionally, there have been significant personnel turnover within the WRS, County and District Council teams in the interim period.

As we have emerged from the pandemic during 2022-23, WRS are seeking to re-engage with those teams and new colleagues from the different disciplines that have a role in improving air quality.

Key developments in 2022 are:

1. Worcester City Council completed a Source Apportionment Assessment[7] in 2022 of background and local sources to inform the development of an Air Quality Action Plan. The assessment has been carried out for a number of areas of concern within the city; the Tything, Foregate Street, the Butts, the Cross, Bridge Street, All Saints Road, and Lowesmoor. Further information is provided below and in Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC, and a copy of the full document is provided within Appendix F: Source Apportionment Assessment 2022.
2. Formation of a new Air Quality Action Plan Steering Group to develop and produce a new countywide air quality action plan and strategy, this is discussed more detail below.
3. In September 2022 WRS submitted, and have been successful in, a bid for funding from Defra's Air Quality Grant to expand the real time monitoring network across Worcestershire. Further information is provided below.
4. A public consultation to assist with development of a Transport Strategy for the city centre was completed in 2022. The Worcester City Centre Transport Strategy is being developed to address transport issues including air quality. Worcester City Council have commissioned specialist transport consultants SYSTRA to develop the strategy and are collaborating with Worcestershire County Council to progress the plan in 2022-23. Further information is provided below.

[7] Worcestershire Regulatory Services 'Worcester City Source Apportionment Assessment' (April 2022)

5. Southern Link Road A4440 improvements have been completed and the link road reopened in Autumn 2022. Improvements are anticipated to provide an increase in journey time reliability and reduction in congestion on this major route linking Worcester to the strategic road network. Further information is provided below.

Source Apportionment Assessment 2022

Following declaration of the Worcester City AQMA in June 2019, the Council undertook a Source Apportionment Assessment of background and local sources to inform the development of an Air Quality Action Plan. A copy of the full document is provided within Appendix F: Source Apportionment Assessment 2022. Required traffic surveys began in early 2020 but were suspended due to the outbreak of the Covid-19 pandemic which had significant impacts on traffic movements and behaviour. The level of traffic flow was deemed to have returned to sufficient levels to resume outstanding traffic surveys towards the end of 2021.

Source apportionment studies have been carried out for a number of areas of concern within the city; the Tything, Foregate Street, the Butts, the Cross, Bridge Street, All Saints Road, and Lowesmoor. Additionally, source apportionment previously undertaken for St Johns and London Road in 2017 was included within the assessment.

The outcome of the source apportionment exercise shows that background concentrations contributes a significant proportion of the overall concentration of NO_2 measured within each of the study areas varying from 25.97% to 39.27%. Cars were shown to comprise the largest proportion of traffic volume with between 65.74% and 82.54% contributing to between 18.91% and 49.87% of vehicle source emissions. Buses comprise a much smaller proportion of the traffic volume ranging between 1.19% and 10.47% but contributing much larger proportions of vehicle emissions of between 13.7% and 58.19%.

The assessment concluded targeting individual types of vehicles in isolation within most areas of concern is unlikely to lead to the annual mean objective being achieved unless the reductions are very large.

For the majority of study areas it is likely that a reduction across all vehicle types, or combination of several categories, would be required to achieve the objective. The data indicates that a maximum reduction in NO_2 of 37.7% would be required to achieve the annual average of nitrogen dioxide objective within all areas. A maximum reduction of 43%

would be necessary across all vehicle types to achieve results 5% below the objective, and 48.1% to achieve 10% below the objective.

Air Quality Actions Plan and Air Quality Strategy

A new Air Quality Action Plan is required for Worcestershire in accordance with the Environment Act 2021 and revised guidance published in Aug 2022 (LAQM.TG22 and PG22). The COVID19 pandemic, unfortunately, led to the suspension of previous district AQAP working groups and public health action group's programmes in 2020. In September 2022, WRS began discussions with Worcestershire County Council colleagues with a view to forming a new Steering Group and producing a new plan of actions to improve air quality across the County, to comply with recent legislative changes.

The group membership has expanded considerably at the beginning of 2023 and is currently progressing a programme of works, outlined below, which will be reported on in the next ASR (2024).

The group currently comprises officers from the County and District authorities from public health, air quality, strategic planning, sustainability, highways and transport disciplines, and also representatives from the NHS.

The Action Plan will incorporate an improving Air Quality Strategy applicable across the County including districts councils that currently have no AQMAs in accordance with legislation and guidance.

The first step in action planning is to determine the contribution of sources of air pollution (source apportionment) to inform future actions. Up to date source apportionment has been completed for Worcester City, but further work is required for some parts of the County.

The initial Steering Group work is focussed on actions informed by the available source apportionment work in addition to countywide actions applicable to all districts.

The timeline for the various stages and delivery of the Air Quality Strategy and Action Plan is set out below.

Timeline	Phase
Feb – Dec 2023	Identification of potential overarching Worcestershire County Council actions and Worcester City Council Specific actions, feasibility filter of measures, cost benefit analysis, determination of impact, timelines and funding sources, drafting of countywide action plan
Jan – Mar 2024	Submission of Draft for review by Senior Management Team and approval by Political Committees at Worcester City Council and Worcestershire County Council and revisions
March 2024	Submission of Draft countywide AQAP inc. local AQ strategy and Worcester City Council specific actions to DEFRA
April- June 2024	3 month Public Consultation on Draft countywide AQAP following revisions
July - Sept 2024	Revisions and finalisation of countywide AQAP inc. local AQ strategy and Worcester City Council specific actions
	Consideration for revocation of AQMAs and source apportionment work for other AQMAs in 1) Bromsgrove DC 2) Wyre Forest DC 3) Wychavon DC
Sept – Oct 2024	Submission of Finalised AQAP for review by Senior Management Team and approval by Political Committees at Worcester City Council and Worcestershire County Council and revisions
Sept 2024 - Mar 2025	AQAPSG work on Bromsgrove DC and Wyre Forest DC specific actions (if required), refresh SG membership with relevant stakeholders. Identification of district specific actions, feasibility filter of measures, cost benefit analysis, determination of impact, timelines and funding sources, and draft update to AQAP. Consultation on additional chapters/amendments
Nov 2024	Publication of Finalised countywide AQAP inc. local AQ strategy & Worcester City chapter and submission to DEFRA
Mar - May 2025	Annual review for any amendments requiring further work.

Real-time Air Quality Monitoring Project

In September 2022 officers from WRS submitted an application to Defra's Air Quality Grant Scheme 2022/23. The scope of the bid was to establish an enhanced real-time air quality monitoring network across the main areas of air quality concern in Worcestershire for purposes of informing the public and vulnerable groups of the status of air pollution. The scheme would see the installation of approximately 24 'low-cost Air Quality Monitors' across the county which measure NO_2, PM_{10}, and $PM_{2.5}$. This will provide important data in respect of particulate matter for which monitoring across the county has been limited previously. The results of monitoring would then be used to inform decision making and requirements for further action as necessary. Realtime information will enable a better understanding of air quality in the district and help quantify the impacts from road traffic and other sources, such as solid fuel burning, agriculture and industry. The system will also provide an alert in the event of poor air quality so that vulnerable groups can be informed and limit exposure.

In February 2023 Defra announced that the WRS bid had been successful and the requested £248,400 was awarded. An additional 10% of funds will also be provided by

each district council in Worcestershire, as per the match-funding requirement of the scheme, which equates to £27,600. Giving a grand total of £276,000 for the project.

At the time of writing the project is at the procurement stage, with the tender specification close to completion. Once a successful supplier has been appointed, exact monitoring locations will be agreed, and equipment installed. This is anticipated to be in the latter stages of 2023.

Approximately ten of the monitors are to be deployed within the Worcester City Council area. Locations are currently to be confirmed but are expected to represent worst case conditions in relation to road traffic and impacts from agriculture and solid fuel burning.

Worcester City Council actions

Worcester City Council have implemented or taken forward a number of actions and plans that will benefit air quality within the district:

- Worcester City Council have commissioned consultants SYSTRA to develop the Worcester City Centre Transport Strategy to address issues such as accessibility for all modes traffic congestion, air quality, parking provision and public realm enhancements. A public consultation was undertaken in 2022 and development of the strategy is being progressed in collaboration with Worcestershire County Council in 2022-23. Further information is available here: Help shape Worcester's new transport strategy - Worcester City Council
- Worcester City Council will be investing £200K in 2023 to install EV charge points at more locations, including 10 dual chargers within King Street and Tallow Hill car parks. Further information is available here: More electric vehicle charging points proposed for Worcester - Worcester City Council
- Developing an Active Travel Action Plan in 2023 to encourage more active travel from council employees and general public. More information is available via Plan to boost walking and cycling in Worcester - Worcester City Council
- Funding for a bike share scheme in Worcester City has been secured as part of the Council's Town Fund bid, with a total of £700,000 being allocated. Procurement to appoint an operator to run the scheme has started and the contract should be awarded by end of 2023, with the mobilisation period then running through until the launch of the scheme in late spring 2024.

- In December 2022, Worcester City Council changed the fee for fully electric taxi's and private hire vehicles to incentivise take up of low emission vehicles within the local taxi fleet. The first 10 licences issued to electric vehicles each year for the next 3 years are free.

Worcestershire County Council actions

Worcestershire County Council have implemented or taken forward a number of actions and plans that will benefit air quality within Worcester City:

- Southern Link Road A4440 improvements – Work to complete dualling of carriageway between the Ketch and Powick roundabouts, capacity improvements to those junctions, an additional bridge over River Severn, and new foot/cycle bridges has been completed and link road reopened in Autumn 2022. Increase in journey time reliability and reduction in congestion on the major route linking Worcester to the strategic road network and to south Worcestershire and Herefordshire is expected. Further information is available via the following link: - The A4440 Worcester Southern Link Road Improvements | Worcestershire County Council
- A new walking and cycling bridge across the River Severn in Worcester from Gheluvelt Park to the Kepax site in St John's is in construction in 2023 and due for completion in late 2024. Further information is available here: Kepax walking and cycling bridge | Worcestershire County Council
- Improvements to the canal towpath surfacing as an active travel route are being delivered through Towns Fund and Active Travel England Funding
- New active travel routes are being delivered through the Towns Fund, during 2023. Routes are being developed to provide links through Ronkswood and Diglis to St Peters.
- Shrub Hill rail station regeneration masterplan is in development which will assist with enhanced rail services calling at the station including off peak trains to Birmingham, and hourly regional service to Bristol.
- Worcester Local Cycling and Walking Infrastructure Plan (LCWIP) funded by Active Travel England, due to complete by late 2024.
- Worcestershire County Council are collaborating with the districts in review of the South Worcestershire Development Plan, which includes detailed policy to address the impact of air pollution from new development including prioritisation of active

travel and corridor improvements. The plan is due to be submitted to the Secretary of State for DLUHC in summer 2023.

- Worcestershire County Council is working in partnership with Worcester City Council to deliver a programme of public realm improvements across the northern end of the city centre over a series of phases to be completed in 2024, funded through the Future High Street Fund. More information here: Worcester City future High Street improvements | Worcestershire County Council

Worcester City Council expects the following measures to be completed over the course of the next reporting year:

- Implementation of an enhanced monitoring network across the County to provide real time data on a range of air pollutants to go live at beginning of 2024.
- Appointment of an operator of a bike share scheme in Worcester City

Conclusions and Priorities

The Worcester City AQMA (Worcester City (Political Boundary)) encompasses the whole district area as an AQMA, for likely breach of the nitrogen dioxide annual mean.

Monitoring results in Worcester City demonstrate an increase in NO_2 concentrations at all diffusion tube monitoring locations, with one exception, in 2022 compared to 2021; this is consistent with trends across Worcestershire. This is likely to have been caused by the increase in traffic following the cessation of COVID-19 regulations in 2022.

Measured concentrations at diffusion tube locations in 2022 are on average 7.15 µg/m^3 and 19% lower than pre-pandemic recorded data in 2018 across Worcester City.

Exceedances of the annual mean objective for NO_2 were measured at 2 locations within Worcester City in 2022.

In 2022, the highest concentration of NO_2 recorded across Worcester City was 43.91 µg/m^3 at But2 (located in The Butts). This location has recorded the highest concentration across the city for the last 5 years with a measured concentration of 39.1 µg/m^3 in 2021 and 52.43 µg/m^3 in 2018.

One other diffusion tube monitoring location recorded an exceedance and a further 7 diffusion tube monitoring location recorded concentrations within -10% of the of the AQS

objective for annual average NO_2, though only 3 of these locations record concentrations above 36 µg/m^3 when calculating back to the nearest relevant receptor.

At this time, it is unclear if some enforced behaviours during the pandemic decreasing the number of journeys made, such as virtual meetings replacing face to face and an increase in working from home, will continue to have the beneficial impact on reducing concentrations of NO_2 in future years after 2022.

Given the trends recorded in 2022 no amendments to the Worcester City AQMA are proposed at this time.

Worcester City Council have not identified any new sources impacting air quality in 2022. A number of applications for new developments have been received and a number of new developments are under construction. The proposals have been assessed as part of the planning process and are not expected to have a significant impact on local air quality when they are operational.

Worcester City Council's priorities for the coming year are:

- Installation of 10 realtime Air Quality Analysers in the district monitoring NO_2 and particulate matter as part of the Defra funded enhanced monitoring project to inform future decisions and actions, and provide an alert system for vulnerable individuals.
- Work will continue with development of a countywide Air Quality Strategy and Action Plan including a chapter focussed on Worcester City specific actions. Publication of the draft document is anticipated in Spring 2024 with a finalised version later next year following the necessary consultation process. This is to remain a 'live' document that can be added to and revised on a regular basis as planned actions evolve.
- Developing closer working ties with Public Health colleagues on variety of work streams: AQAP progression, campaigns such as Clean Air Day 2023 and establishing an alert system for vulnerable groups linked to the real time monitoring network.
- Progressing the development of the Worcester City Centre Transport Strategy in collaboration with Worcestershire County Council. Elements of the transport strategy that have a beneficial impact on air quality will be incorporated within the development of the AQAP.

- Developing an Active Travel Action Plan to encourage more active travel from council employees and the general public.
- Progressing installation of additional EV charge points within King Street and Tallow Hill car parks.
- Appointing an operator of a bike share scheme in Worcester City to be launched in spring 2024.
- Continue monitoring of air pollutants at key locations across the district.
- Ensure proportionate mitigation measures are included within new developments where air quality is a relevant concern.

Local Engagement and How to get Involved

There are a number of ways members of the public can help to improve local air quality:

- **Walk or cycle, leave your car at home:** Leaving your car at home and walking or cycling instead will benefit in three ways - increased exercise, reduced pollution exposure and will reduce individual's pollution emissions;
- **Turn off your engine when stationary or parked,** don't 'idle', particularly outside sensitive receptors such as schools, hospitals, care homes and residential properties;
- General travel planning advice is available on Worcestershire County Council's website (including walking, cycling, bus maps and timetables, community transport and travel to school).
- **Hold meetings by Conference Call** by phone or video conference via Teams, Zoom, Skype or Facetime rather than driving to meetings. This reduces fuel and other travel costs, vehicle maintenance and hire cost, increases productivity through reduction in hours lost through unnecessary travel;
- Facilitate **Flexible Working Arrangements** for non-front-line staff to **work remotely from home** or nearer home facilities for one or more days a week thus removing or reducing any journey to work. This reduces congestion which has beneficial impacts for delivery times, reduced business costs and thus economic benefits. Additionally, provides social benefits through improved work life balance for employees, reduces local air quality and reduced emergency vehicle response times.

- **Switch Fleet to Low Emission Vehicles**: The government is currently providing grants for up to 75% of Electric Vehicle (EV) charging points, up to 40 charge points:

  Workplace Charging Scheme: guidance for applicants - GOV.UK (www.gov.uk)

- If you have to drive follow fuel efficient driving advice, often known as '**Smarter Driving Tips'**, to save on fuel and reduce your emissions. A number of websites promote such advice including:

  http://www.theaa.com/driving-advice/fuels-environment/drive-smart

  Maximise fuel economy through efficient driving - Energy Saving Trust

  How to save fuel - the ultimate guide | RAC Drive

- **Reduce air pollution from open fires and wood-burning stoves**: Advice is available from Defra on choosing the right stove, using the right fuels and maintenance, enabling householders to reduce the impact on their health and air quality from open fires and wood burning stoves. Further information is available on the Smokeless Zones and Public Advice pages on WRS website.

Air pollution can affect all of us over our lifetime however certain groups will be more sensitive to the effects of air pollution. Vulnerable groups include adults and children with lung or heart conditions such as asthma, chronic bronchitis, emphysema and chronic obstructive lung disease (COPD)[8,9]. Senior citizens are more likely to be affected by respiratory diseases and children are more likely to be affected by air pollution due to relatively higher breathing and metabolic rates as well as a developing lung and immune system.

Vulnerable individuals and groups can keep informed of:

- Current levels and forecasts of air pollution from Defra at:

  https://uk-air.defra.gov.uk/.

[8] http://www.breathelondon.org/

[9] https://www.londonair.org.uk/LondonAir/guide/MyActionsForMe.aspx

- If you are sensitive to the effects of air pollution, it may be appropriate to limit the length of time spent in areas of local poor air quality – see advice from Defra at https://uk-air.defra.gov.uk/air-pollution/daqi

- If you are on social media, sign up to the WRS Twitter feed. WRS tweet when pollution is forecast by Defra to be moderate to very high.

Further information for the general public on reducing your family's exposure to poor air quality in Worcestershire and how individuals, business and schools can assist with reducing their impact on local air quality is available at Protecting Me and Others from Air Pollution | Worcestershire Regulatory Services (worcsregservices.gov.uk) .

Local Responsibilities and Commitment

This ASR was prepared by the Worcestershire Regulatory Services for Worcester City Council with the support and agreement of the following officers and departments:

Worcestershire Regulatory Services

Worcester City Council

Worcestershire County Council Highways Department

This ASR has been signed off by a Director of Public Health with the following comments:

We welcome the submission of these reports, continued focus on improving air quality, and installation of new real time air quality monitors which will provide 'information for action' across the system. We recommend inclusion in future reports to recognise ageing population and increasing long term conditions sensitive to poor air quality.

If you have any comments on this ASR, please send them to:

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1 Local Air Quality Management

This report provides an overview of air quality in Worcester City during 2022. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995), as amended by the Environment Act (2021), and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in order to achieve and maintain the objectives and the dates by which each measure will be carried out. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by Worcester City Council to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England are presented in Table E.1.

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority should prepare an Air Quality Action Plan (AQAP) within 18 months. The AQAP should specify how air quality targets will be achieved and maintained and provide dates by which measures will be carried out.

A summary of AQMAs declared by Worcester City Council can be found in Table 2.1. The table presents a description of the AQMA that is currently designated within Worcester City. Appendix D: Map(s) of Monitoring Locations and AQMAs provides a map of the AQMA and also the air quality monitoring locations in relation to the AQMA. The air quality objectives pertinent to the current AQMA designation is the NO_2 annual mean concentration.

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance: Declaration	Level of Exceedance: Current Year	Number of Years Compliant with Air Quality Objective	Name and Date of AQAP Publication	Web Link to AQAP
Worcester City AQMA (Political Boundary)	11.06.2019	NO_2 Annual Mean	AQMA encompasses whole district within political boundary of Worcester City.	NO	55	43.9	Not compliant	Citywide AQMA Action Plan in progress - delayed due to Covid-19	Not yet published

☒ **Worcester City Council confirm the information on UK-Air regarding their AQMA(s) is up to date.**

☒ **Worcester City Council confirm that all current AQAPs have been submitted to Defra.**

2.2 Progress and Impact of Measures to address Air Quality in Worcester City

Defra's appraisal of last year's ASR concluded:

1. The Council have presented NO_2 trends for monitoring locations. This is extremely useful as it allows the reader to easily understand trends relating to NO_2 within the borough. This approach to data/trend presentation is encouraged for future reports.
2. In Figure A.1 in the graph titled 'Trends in Annual Mean NO_2 Concentrations in Worcester City Council (2017-2021)', there are too many monitoring results shown on this graph which makes it quite hard to read. For future reports, this many monitoring results should be spread over multiple graphs to make the graphs easier to read and interpret for the reader.
3. The figures in Appendix D should not include AQMA's that have been revoked and no longer in effect.
4. There should be some text explaining the justification of using the chosen bias adjustment factor.
5. Evidence of progress against the action plan measures during the current reporting year, and the priorities and proposed actions for the next reporting year need to be made clearer so that it is easier for the reader to see what progress is being made against the action plan measure, and what the priorities are for the council in the next reporting year.
6. A priority for the council in the next reporting year should be to continue with the development of an AQAP and to get it published for public consultation as soon as possible.
7. Make sure that the details of the AQMA match up with the details of the AQMA that are captured in the portal. In table 2.1, the AQMA was said to be declared in August 2019 whereas in the portal, the AQMA was said to be declared in June 2019.

WRS note the comments above.

In 2013, WRS produced a countywide Air Quality Action Plan (AQAP) for Worcestershire which was adopted by Worcester City Council. WRS have produced two updates to the AQAP, the latest in September 2016. For details of all measures completed, in progress or planned, please refer to the 'Air Quality Action Plan Progress Report for Worcestershire April 2015-2016'. A copy of this, the previous update, and the AQAP, is available to view

or download at: Worcester City Council | Worcestershire Regulatory Services (worcsregservices.gov.uk)

Worcester City Council has taken forward a number of direct measures during the current reporting year of 2022 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. 30 measures are included within Table 2.2, with the type of measure and the progress Worcester City Council and partners have made to date and updates in 2022 presented. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within Table 2.2.

Key developments in 2022 are:

1. Worcester City Council completed a Source Apportionment Assessment[10] in 2022 of background and local sources to inform the development of an Air Quality Action Plan. A summary is provided below, further information is provided in Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC and a copy of the full document is provided within Appendix F: Source Apportionment Assessment 2022.
2. Formation of a new Air Quality Action Plan Steering Group to develop and produce a new countywide air quality action plan and strategy, this is discussed in more detail below.
3. In September 2022 WRS submitted, and have been successful in, a bid for funding from Defra's Air Quality Grant to expand the real time monitoring network across Worcestershire. Further information is provided below.
4. A public consultation to assist with development of a Transport Strategy for the city centre was completed in 2022. The Worcester City Centre Transport Strategy is being developed to address transport issues including air quality. Worcester City Council have commissioned specialist transport consultants SYSTRA to develop the strategy and are collaborating with Worcestershire County Council to progress the plan in 2022-23. Further information is provided below.
5. Southern Link Road A4440 improvements have been completed and the link road reopened in Autumn 2022. Improvements anticipated to provide an increase in

[10] Worcestershire Regulatory Services 'Worcester City Source Apportionment Assessment' (April 2022)

journey time reliability and reduction in congestion on this major route linking Worcester to the strategic road network. Further information is provided below.

Source Apportionment Assessment 2022

Following declaration of the Worcester City AQMA in June 2019, the Council undertook a Source Apportionment Assessment of background and local sources to inform the development of an Air Quality Action Plan. A copy of the full document is provided within Appendix F: Source Apportionment Assessment 2022. Required traffic surveys were commissioned and began in early 2020 but were suspended due to the outbreak of the Covid-19 pandemic which had significant impacts on traffic movements and behaviour. The level of traffic flow was deemed to have returned to sufficient levels to resume outstanding traffic surveys towards the end of 2021.

Source apportionment studies have been carried out for a number of areas of concern within the city; the Tything, Foregate Street, the Butts, the Cross, Bridge Street, All Saints Road, and Lowesmoor. Additionally, source apportionment previously undertaken for St Johns and London Road in 2017 was included within the assessment.

The outcome of the source apportionment exercise shows that background concentration contributes a significant proportion of the overall concentration of NO_2 measured within each of the study areas varying from 25.97% to 39.27%. Cars were shown to comprise the largest proportion of traffic volume with between 65.74% and 82.54% contributing to between 18.91% and 49.87% of vehicle source emissions. Buses comprise a much smaller proportion of the traffic volume ranging between 1.19% and 10.47% but contributing much larger proportions of vehicle emissions of between 13.7% and 58.19%.

The assessment concluded targeting individual types of vehicles in isolation within most areas of concern is unlikely to lead to the annual mean objective being achieved unless the reductions are very large. For example, reductions of 50% or greater in the emissions from cars would be required within 5 of the areas, with a 100% reduction not being sufficient to achieve compliance within 2 of the locations. In those two locations a 60 to 70% reduction in the number of buses would be necessary to attain the objective.

For the majority of the locations, it is likely that a reduction across all vehicle types, or combination of several categories, would be required to achieve the objective. The data indicates that a maximum reduction in NO_2 of 37.7% would be required to achieve the objective within all areas. A maximum reduction of 43% would be necessary across all

vehicle types to achieve results 5% below the objective, and 48.1% to achieve 10% below the objective.

Air Quality Actions Plan and Air Quality Strategy

A new Air Quality Action Plan is required for Worcestershire in accordance with the Environment Act 2021 and revised guidance published in Aug 2022 (LAQM.TG22 and PG22). The COVID19 pandemic, unfortunately, led to the suspension of previous district AQAP working groups and public health action group's programmes in 2020. In September 2022, WRS began discussions with Worcestershire County Council colleagues with a view to forming a new Steering Group and producing a new plan of actions to improve air quality across the County, to comply with recent legislative changes.

The group membership has expanded considerably at the beginning of 2023 and is currently progressing a programme of works, outlined below, which will be reported on in the next ASR (2024).

The group currently comprises officers from the County and District authorities from public health, air quality, strategic planning, sustainability, highways and transport disciplines, and also representatives from the NHS and the University of Worcester.

The Action Plan will incorporate an improving Air Quality Strategy applicable across the County including districts councils that currently have no AQMAs in accordance with legislation and guidance.

The first step in action planning is to determine the contribution of sources of air pollution (source apportionment) to inform future actions. Up to date source apportionment has been completed for some parts of the County, but further work is required.

The initial Steering Group work is focussed on actions informed by the available source apportionment work in addition to countywide actions applicable to all districts.

The timeline for the various stages and delivery of the Air Quality Strategy and Action Plan is set out below.

Timeline	Phase
Feb – Dec 2023	Identification of potential overarching Worcestershire County Council actions and Worcester City Council Specific actions, feasibility filter of measures, cost benefit analysis, determination of impact, timelines and funding sources, drafting of countywide action plan
Jan – Mar 2024	Submission of Draft for review by Senior Management Team and approval by Political Committees at Worcester City Council and Worcestershire County Council and revisions
March 2024	Submission of Draft countywide AQAP inc. local AQ strategy and Worcester City Council specific actions to DEFRA
April- June 2024	3 month Public Consultation on Draft countywide AQAP following revisions
July - Sept 2024	Revisions and finalisation of countywide AQAP inc. local AQ strategy and Worcester City Council specific actions
	Consideration for revocation of AQMAs and source apportionment work for other AQMAs in 1) Bromsgrove DC 2) Wyre Forest DC 3) Wychavon DC
Sept – Oct 2024	Submission of Finalised AQAP for review by Senior Management Team and approval by Political Committees at Worcester City Council and Worcestershire County Council and revisions
Sept 2024 - Mar 2025	AQAPSG work on Bromsgrove DC and Wyre Forest DC specific actions (if required), refresh SG membership with relevant stakeholders. Identification of district specific actions, feasibility filter of measures, cost benefit analysis, determination of impact, timelines and funding sources, and draft update to AQAP. Consultation on additional chapters/amendments
Nov 2024	Publication of Finalised countywide AQAP inc. local AQ strategy & Worcester City chapter and submission to DEFRA
Mar - May 2025	Annual review for any amendments requiring further work.

Real-time Air Quality Monitoring Project

In September 2022 officers from WRS submitted an application to Defra's Air Quality Grant Scheme 2022/23. The scope of the bid was to establish an enhanced real-time air quality monitoring network across the main areas of air quality concern in Worcestershire for purposes of informing the public and vulnerable groups of the status of air pollution. The scheme would see the installation of approximately 24 'low-cost Air Quality Monitors' across the county which measure NO_2, PM_{10}, and $PM_{2.5}$. The results of monitoring would then be used to inform decision making and requirements for further action as necessary.

In February 2023 Defra announced that the WRS bid had been successful and the requested £248,400 was awarded. An additional 10% of funds will also be provided by each district council in Worcestershire, as per the match-funding requirement of the scheme, which equates to £27,600. Giving a grand total of £276,000 for the project.

At the time of writing the project is at the procurement stage, with the tender specification close to completion. Once a successful supplier has been appointed, exact monitoring

locations will be agreed, and equipment installed. This is anticipated to be in the latter stages of 2023.

Ten of the monitors are to be deployed within Worcester City area. Locations are currently to be confirmed but are expected to represent worst case conditions in relation to road traffic and impacts from agriculture and solid fuel burning.

Other Worcester City Council actions

Worcester City Council have implemented or taken forward a number of actions and plans that will benefit air quality within the district:

- Worcester City Council have commissioned consultants SYSTRA to develop the Worcester City Centre Transport Strategy to address issues such as accessibility for all modes traffic congestion, air quality, parking provision and public realm enhancements. A public consultation was undertaken in 2022 and development of the strategy is being progressed in collaboration with Worcestershire County Council in 2022-23. Further information is available here: Help shape Worcester's new transport strategy - Worcester City Council
- Worcester City Council will be investing £200K in 2023 to install EV charge points at more locations, including 10 dual chargers within King Street and Tallow Hill car parks. Further information is available here: More electric vehicle charging points proposed for Worcester - Worcester City Council
- Developing an Active Travel Action Plan in 2023 to encourage more active travel from council employees and general public. More information is available via Plan to boost walking and cycling in Worcester - Worcester City Council
- Funding for a bike share scheme in Worcester City has been secured as part of the Council's Town Fund bid, with a total of £700,000 being allocated. Procurement to appoint an operator to run the scheme has started and the contract should be awarded by end of 2023, with the mobilisation period then running through until the launch of the scheme in late spring 2024.
- In December 2022, Worcester City Council changed the fee for fully electric taxi's and private hire vehicles to incentivise take up of low emission vehicles within the local taxi fleet. The first 10 licences issued to electric vehicles each year for the next 3 years are free.

Worcestershire County Council actions

Worcestershire County Council have implemented or taken forward a number of actions and plans that will benefit air quality within Worcester City:

- Southern Link Road A4440 improvements – Work to complete dualling of carriageway between the Ketch and Powick roundabouts, capacity improvements to those junctions, an additional bridge over River Severn, and new foot/cycle bridges has been completed and link road reopened in Autumn 2022. Increase in journey time reliability and reduction in congestion on the major route linking Worcester to the strategic road network and to south Worcestershire and Herefordshire is expected. Further information is available via the following link: - The A4440 Worcester Southern Link Road Improvements | Worcestershire County Council
- A new walking and cycling bridge across the River Severn in Worcester from Gheluvelt Park to the Kepax site in St John's is in construction in 2023 and due for completion in late 2024. The scheme will link to existing cycle routes (park/racecourse/Waterworks Roads/ Severn Path), increase connectivity between east and west banks of the river and allows future expansion to walking and cycling routes. Further information is available here: Kepax walking and cycling bridge | Worcestershire County Council
- Improvements to the canal towpath surfacing as an active travel route are being delivered through Towns Fund and Active Travel England Funding
- New active travel routes are being delivered through the Towns Fund, during 2023. Routes are being developed to provide links through Ronkswood and Diglis to St Peters.
- Shrub Hill railway station regeneration masterplan is in development which will assist with enhanced rail services calling at the station including off peak trains to Birmingham, and hourly regional service to Bristol.
- Worcester Local Cycling and Walking Infrastructure Plan (LCWIP) funded by Active Travel England, due to complete by late 2024.
- Worcestershire County Council are collaborating with the districts in review of the South Worcestershire Development Plan, which includes detailed policy to address the impact of air pollution from new development including prioritisation of active travel and corridor improvements. The plan is due to be submitted to the Secretary of State for DLUHC in summer 2023.

- Worcestershire County Council is working in partnership with Worcester City Council to deliver a programme of public realm improvements across the northern end of the city centre over a series of phases to be completed in 2024, funded through the Future High Street Fund. More information here: Worcester City future High Street improvements | Worcestershire County Council

Worcester City Council expects the following measures to be completed over the course of the next reporting year:

- Implementation of an enhanced monitoring network across the County to provide real time data on a range of air pollutants to go live at beginning of 2024.
- Appointment of an operator of a bike share scheme in Worcester City

Worcester City Council's priorities for the coming year are:

- Installation of 10 real-time Air Quality sensors in the district monitoring NO_2 and particulate matter as part of the Defra funded enhanced monitoring project to inform future decisions and actions.
- Supporting the development of countywide Air Quality Action Plan and Air Quality Strategy including a chapter focussed on Worcester City specific actions.
- Developing closer working ties with Public Health colleagues on a variety of work streams: AQAP progression, campaigns such as Clean Air Day 2023 and establishing an alert system for vulnerable groups linked to the real time monitoring network.
- Progressing the development of the Worcester City Centre Transport Strategy in collaboration with Worcestershire County Council. Elements of the transport strategy that have a beneficial impact on air quality will be incorporated within the development of the AQAP.
- Developing an Active Travel Action Plan to encourage more active travel from council employees and the general public.
- Progressing installation of additional EV charge points within King Street and Tallow Hill car parks.
- Appointing an operator of a bike share scheme in Worcester City to be launched in spring 2024.
- Continue monitoring of air pollutants at key locations across the district.

- Ensure proportionate mitigation measures are included within new developments where air quality is a relevant concern.

The principal challenges and barriers to implementation that Worcester City Council anticipates facing are:

- Quantification of impact of potential AQAP measures to inform decision process; and
- Obtaining sufficient data to model impact of measures to inform decision process within timescales required to produce an effective action plan;
- Availability of funding for potential AQAP measures to improve air quality.

Whilst the measures stated above and in Table 2.2 will help to contribute towards compliance Worcester City Council anticipates that further additional measures not yet prescribed will be required in subsequent years to achieve compliance and enable the revocation of the Worcester City AQMA.

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
T&F 1	Consider AQ impacts in every Council Policy	Policy Guidance and Development Control	Other policy	2019	2019	Worcester City Council	Worcester City Council (Officer Resource)	No	Not Funded	< £10k	Completed	0	Implementation of Policy	Air quality is a consideration as part of policy and formal report writing.	Represents an ongoing process
T&F 2	Electric Vehicle Infrastructure in Residential Streets	Promoting Low Emission Transport	Procuring alternative refuelling infrastructure to promote Low Emission Vehicles, EV recharging, gas fuel recharging	2019	2026	Worcester City Council, Worcestershire County Council	Possible funding streams available	No	Partially Funded	£1 million - £10 million	Planning	0 - 8 %	Implementation of EV charging points in local residential areas, uptake of ULEV	EV Charging Strategy has been produced and approved by Environmental Committee June 2023	22% of residents have no access to off road parking. Significant funding required to provide all with access to EV charge points.
T&F 3	AQ in Car Parking (Masterplan) Proposals	Transport Planning and Infrastructure	Other	2019		Worcester City Council	Unknown at this time	No	Not Funded		Planning	Unknown	Design and location of multi storeys to replace multiple single level car parking and limit AQ impact e.g. promote ULEV	Worcester City Centre Transport Strategy in development. Public consultation completed in 2022	Long timeline of 20+ years for implementation of Masterplan strategy.
T&F 4	ULEV Pool Cars	Promoting Low Emission Transport	Other	2019		Worcester City Council	Not identified at this time	No	Not Funded		Planning	<0.2 µg/m3	Purchase and use of vehicles for staff journeys	Initial study prior to COVID-19 indicated relatively low business mileage for officers and working practices changed significantly during COVID. Number of EV vehicles within fleet has increased and trials continue on larger vehicles. Active Travel Plan in development	Assessed to be low demand.
T&F 5	Emissions Standard for Licensed Taxis	Promoting Low Emission Transport	Taxi Licensing Conditions	2019	2023	Worcester City Council, Worcestershire Regulatory Services	Not identified at this time	No	Not Funded		Implementation	0 - 9 %	Introduction o emission standard, uptake of ULEV	Fees changed to incentivise take up of low emission vehicles. The first 10 licences issued to electric vehicles each year for the next 3 years are free from Dec 2022. Consideration being given to lowering age limits of vehicles to further incentivise trade to take up LEV, in June 2023.	

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
T&F 6	Low Emission Strategy	Policy Guidance and Development Control	Low Emissions Strategy	2019		Worcester City Council, Worcestershire Regulatory Services	Officer Time	No	Not Funded	< £10k	Aborted	0	Completion of LES	Working group on LES and WCC AQAP suspended in 2020 due to COVID19 pandemic. Since superseded by work on new countywide AQAP which will likely incorporate LES actions. Some elements incorporated into Council's Environmental Sustainability Strategy 2020-2030 and other policies such as SWDP Air Quality SPD.	Work on LES suspended in 2020, as was WCC/WRS AQAP working group, due to COVID19 pandemic. Since superseded by requirement for countywide AQAP in 2022-23. https://www.worcester.gov.uk/climate-emergency/reducing-carbon-emissions
NAWC1	Develop and implement Worcester City Centre Masterplan	Traffic Management	UTC. Congestion management, traffic reduction	2019	2032	Worcester City Council and others for the various measures	TBC as various measures progress	No	Not Funded	> £10 million	Planning	Not quantifiable at this time	Masterplan - potentially reduced vehicle movements in some key areas through car parking provision strategy (e.g. uptake of EV), realm enhancements supporting walking and cycling.	Masterplan adopted 16th July 2019. Plan to be implemented over the next 20+ years.	Long time to implementation. Pre COVID-19 plans subjected to delay.
5.1.1	Major signalling infrastructure update at St Johns, St Clements, Croft Road, Dolday, Sidbury, Commandery Road and London Road	Traffic Management	UTC. Congestion management, traffic reduction	2013	2022	National Productivity Investment Fund	National Productivity Investment Fund	No	Funded		Completed	Reduces Emissions - not quantified at this time	Improve network efficiency and accessibility for all modes of transport	Completed	
5.1.1/DD3	Alteration to phasing of traffic light systems / Junction review (Dolday)	Traffic Management	Strategic highway improvements, reprioritising road space away from cars, including access management, selective vehicle priority, bus priority, high vehicle occupancy lane	2013	2015	Worcestershire County Council	National Productivity Investment Fund	No	Funded		Completed	1.2 - 6.8% (Dolday)	Improved Traffic Flow	Completed	

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
5.1.1 / LRH7	Alteration to traffic light phasing - Lowesmoor improvement scheme. Renewed enforcement of an existing TRO restricting all vehicles, with the exception of buses at certain times of day	Traffic Management	Strategic highway improvements and congestion reduction	2013	2015	Worcestershire County Council	Worcestershire County Council	No	Not Funded		Implementation	5 - 10 %	Improved flow of traffic through Lowesmoor. Reduced congestion. Reduced volume of traffic	Implemented January 2015. Enforcement cameras added at a later date.	
5.1.4	Variable Message Systems	Traffic Management	Other	2013	2016	Worcestershire County Council	DfT	No	Funded		Completed	Reduces Emissions - not quantified at this time	Decrease in traffic movements through AQMA	VMS around City completed 2016	
5.1.5 /LRH5	Loading and unloading restrictions during peak traffic times (Lowesmoor / Rainbow Hill)	Traffic Management	Workplace parking levy, parking enforcement on highway	2013	2020	Worcester City Council	Worcester City Council	No	Funded		Completed	Reduces Emissions - Not quantified at this time	Reduced incidence of loading and unloading during peak times	TRO implemented and updated. Bus Lane Enforcement MTE cameras installed	
5.1.7	Signage to avoid AQMA	Traffic Management	Other	2013	2016	Worcestershire County Council	DfT	No	Funded		Completed	Reduces Emissions - not quantified at this time	Decrease in number of strategic journeys through AQMA	VMS around City completed 2016	Additional measures being considered as part of the Worcester City Centre Traffic Strategy
5.1.13	Alteration to Parking Provision	Traffic Management	UTC. Congestion management, traffic reduction	2013		Worcester City Council, Worcestershire County Council	Not identified at this time	No	Not Funded	£1 million - £10 million	Planning	Reduces emissions - not quantified at this time	Reduced traffic movements and congestion in inner city	City Masterplan (adopted 2019) proposals to consolidate existing multiple single level surface car parking into fewer multi story car parks at strategic points - see T&F3 for further info.	Masterplan long lifetime of 20+ years. Congestion may increase in interim period between sale of existing car park land and implementation of replacement multi storey car parks
5.2.1	Bus Quality Partnership	Promoting Low Emission Transport	Public vehicle procurement – prioritising uptake of Low Emission Vehicles	2013		Worcester City Council, Worcestershire County Council, local bus companies	Unknown at this time	No	Not Funded		Planning	0 to 23 %	Replacement of lower Euro standard buses on key city centre routes	Meetings with First Bus group July 2018. Bus fleet has been updated in interim period.	Worcester is non profitable area for bus companies proving barrier to LEV investment locally. Requires LA subsidisation and/or enforcement.
5.2.2	Freight Quality Partnership	Traffic Management	UTC. Congestion management, traffic reduction	2013	2018	WCC	WCC	No	Partially Funded	£50k - £100k	Completed	Unknown	Fewer HGVs travelling through AQMA	On-going duty under Traffic Management	Worcester City Centre Transport Strategy in development. Public consultation completed in 2022

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
5.2.4	Railway Enhancements - new Worcestershire Parkway Station	Transport Planning and Infrastructure	Public transport improvements interchanges stations and services	2013	2020	Worcestershire Council Council, Worcestershire Local Enterprise Partnership	DfT, Worcestershire Local Enterprise Partnership	No	Funded		Completed	Reduces Emissions - Not quantified at this time	Reduce commuter traffic, destined for city central stations at Shrub Hill and Foregate Street	Works completed in 2019 and the new station opened on 23rd February 2020, 3 weeks prior to the first lockdown. Initial indications were of high use in excess of the business plan, with the car park 75% full and strong ticket sales. Station is at the heart of the emerging proposals for Worcestershire Parkway Strategic Growth area arising from the review of SWDP.	Rail use has recovered nationally following to the COVID-19 pandemic, though longer term trends are still to emerge
5.2.5	Greening Council Fleets	Promoting Low Emission Transport	Procuring alternative refuelling infrastructure to promote Low Emission Vehicles, EV recharging, gas fuel recharging	2013		Worcester City Council, Worcestershire County Council	Not identified at this time	No	Not Funded	£100k - £500k	Planning	Reduces Emissions - Not quantified at this time	Increase in number of Council fleet and contractors' vehicles of higher Euro Standard or ULEV	T&F4 recommendation procurement ULEV pool cars 2019	Initial study prior to COVID-19 indicated relatively low business mileage for officers and working practices changed significantly during COVID. Number of EV vehicles within fleet has increased and trials continue on larger vehicles. Active Travel Plan in development
5.2.10	Installing electric vehicle charging points	Promoting Low Emission Transport	Procuring alternative refuelling infrastructure to promote Low Emission Vehicles, EV recharging, gas fuel recharging	2013		Worcester City Council, Worcestershire County Council	Developers as part of planning and variable funding streams for other schemes	No	Partially Funded	£100k - £500k	Implementation	0 to 37%	Increase in availability of EV charging points and corresponding increase in uptake of electric vehicles	Worcester City Council investing £200K in 2023 to install EV charge points at more locations, including 10 dual chargers within King Street and Tallow Hill car parks funded by £55k from WCC budget and £68,560 from OZEV.	
5.3.1	Travel Planning	Promoting travel alternatives	Personalised travel planning	2013	2019	Worcestershire County Council	Worcestershire County Council	No	Not Funded		Completed	Unknown	Increased uptake of alternative modes of transport	Worcs County Council offer online travel planning tool Modeshift STARS for business Travel Plans only.	Businesses can register at www.modehiftstars.org
5.3.2	Car Sharing	Alternatives to private vehicle use	Car & lift sharing schemes	2013	2015	Worcestershire County Council	Worcestershire County Council	No	Funded	£10k - 50k	Completed	<1%	Increase in number of people car sharing	Liftshare website scheme launched Autumn 2015.	Following an initial surge in interest from public, use of service has slowed down and has been folded.
5.3.4	Promote flexible working arrangements	Promoting travel alternatives	Encourage / facilitate home-working	2013		Worcester City Council, Worcestershire County Council	Various	No	Not Funded	£50k - £100k	Implementation	Unknown	Increase in number of people able to work from home	County Council have pushed for maximum coverage of fibre optic broadband. Ongoing - 9% coverage as of December 2019.	Traffic levels at 98% of pre pandemic levels at end of 2022, potentially people continuing to WFH post pandemic.

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
5.4.1	Smarter Driving Tips	Public Information	Via the internet	2013	2017	WRS & WCC	Officer time (WRS)	No	Not Funded	£10k - 50k	Completed	<0.2 µg/m3	Increase in website hits	Advice page created for all groups affected by and impacting air quality and shared with County Public Health.	Created Mar 2017, Updated March 2019
5.4.2	Provide link to real time air quality information	Public Information	Via the internet	2022	2024	WRS WCC PHE	Officer time (WRS)	YES	Funded	£100k - £500k	Planning	0	Increase in WRS website hits	Funding secured from Defra AQ Grant and WCC match contribution for 10 low cost sensors in Worcester for 3 years. Link to live feed of monitoring on website	
5.4.4	Make air quality information more available and accessible	Public Information	Via the internet	2013	2017	WRS	Officer time (WRS)	No	Not Funded	£10k - 50k	Completed	0	Website hits and enquiries for information	All existing LAQM reports and details of AQMAs are available to public on WRS website. WRS use Twitter account to release information.	Ongoing and updated regularly
5.4.5	Raise the profile and increase awareness of air quality within the region	Other	Other	2013	2020	WRS CEEPG MJAC DEFRA	Officer time (WRS)	No	Not Funded	£10k - 50k	Completed	0	Improved cross boundary knowledge sharing between local authorities in West Midlands	WRS held position of Air Quality technical coordinator for MJAC, member of CEEPG and member of Defra LAQM Team Local Authority Advisory Group both formed in 2017.	Local groups suspended in or folded by 2020.
5.5.1	Produce Air Quality Supplementary Planning Document	Policy Guidance and Development Control	Air quality planning and policy guidance	2013	2022	Worcestershire County Council Strategic Planner, WRS and South Worcestershire Councils	Worcestershire County Council Strategic Planner, WRS and South Worcestershire Councils (Resources)	No	Funded		Implementation	Reduces emissions from new developments	Formal adoption and utilised by Worcester City Council planning authority	WRS 'Technical Guidance Note for Planning' updated Nov 2022. AQ SPD for SWDP in development.	SPD work awaiting outcome of South Worcestershire Development Plan review due 2023 (delayed due to COVID-19 impacts)
5.6.3	Air Quality Networks	Policy Guidance and Development Control	Regional Groups Co-ordinating programmes to develop Area wide Strategies to reduce emissions and improve air quality	2013		WRS CEEPG DEFRA	Officer time (WRS)	No	Not Funded	< £10k	Aborted	0	Improved cross boundary working between local authorities in West Midlands	Pre pandemic formed groups suspended in 2020.	Differing AQ issues, priorities, and resources in regional authorities.
5.6.8	Forge closer links with local health agencies	Other	Other	2013		WRS WCC PHE	DoPH, Officer time (WRS)	No	Not Funded	< £10k	Implementation	0	Increase participation of Public Health in Worcestershire Air Quality issues and action groups	County Air Quality Partnership set up May 2019 by DoPH supported by WRS	Local group suspended in 2020. Re-engagement between WRS and PH on 2023

2.3 $PM_{2.5}$ – Local Authority Approach to Reducing Emissions and/or Concentrations

As detailed in Policy Guidance LAQM.PG22 (Chapter 8), local authorities are expected to work towards reducing emissions and/or concentrations of $PM_{2.5}$ (particulate matter with an aerodynamic diameter of 2.5µm or less). There is clear evidence that $PM_{2.5}$ has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

There are currently no automatic $PM_{2.5}$ monitoring stations in Worcestershire that are recognised by Defra for measuring against ambient air quality directives. The nearest AURN $PM_{2.5}$ monitoring station is the Birmingham Ladywood site approximately 46 kilometres to the north-east of Worcester City. However, WRS have assisted the Defra AURN expansion project team with potential locations for two $PM_{2.5}$ monitors in Worcestershire, including within Worcester City, and it is hoped these will be in place within the next 6 to 12 months.

Following success of bid for funding from the Defra Air Quality Grant 2022/23, WRS are progressing implementation of up to 10 low-cost Air Quality Monitors in Worcester City. It is anticipated the sensors will be in place within the next 12 months.

WRS has reviewed the DEFRA national background maps to determine projected $PM_{2.5}$ concentrations across Worcester City area for the 2022 calendar year. The annual average total $PM_{2.5}$ at 32 locations (centre points of 1km x 1km grids) across Worcester City is 8.22 $\mu g/m^3$, with a minimum concentration of 7.71 $\mu g/m^3$ and a maximum concentration of 9.28 $\mu g/m^3$.

This indicates that $PM_{2.5}$ concentrations within the Worcester City are generally below the annual average limit value for $PM_{2.5}$ target of 10$\mu g/m^3$ to be met across England by 2040.

WRS has reviewed the fraction of mortality attributable to particulate air pollution (indicator D01) as published by Public Health England as part of the Public Health Outcomes Framework[11]. The fraction of mortality attributable to particulate emissions in Worcester City in 2021 (the most recent year available) was 5.2% WCC. This falls below the national figure

[11] Public Health Outcomes Framework - OHID (phe.org.uk)

for England (5.5% in 2021) and below the figure for the West Midlands region (5.5% in 2021). Recent trend data is not available for the district due to a lack of data points with valid values.

More information on the Public Health Outcomes Frameworks that examines indicators that help us understand trends in public health can be found at: Public Health Outcomes Framework - PHE

The whole district area of Worcester City Council is a Smoke Control Area. More information, maps and guides on the type of fuels that can be used can be found at:

Smoke Control Areas | Worcestershire Regulatory Services (worcsregservices.gov.uk)

WRS hold 6 records of complaints of nuisance from smoke attributable to wood burning stoves in residential developments in Worcester City in 2022. All complaints were unsubstantiated, and no further action has been taken.

In light of the above no additional actions are currently planned by Worcester City in relation to the reduction of $PM_{2.5}$ levels. However, it is anticipated that any actions taken to improve NO_2 levels across the District as part of the revised future countywide AQAP will likely result in a linked improvement in $PM_{2.5}$ levels. Additionally, the new countywide AQAP will include the local air quality strategy for all Worcestershire districts and have due regard for the new responsibilities on local authority for $PM_{2.5}$ outlined within the revised national Air Quality Strategy (28 April 2023) published at the time of producing this report.

3 Air Quality Monitoring Data and Comparison with Air Quality Objectives and National Compliance

This section sets out the monitoring undertaken within 2022 by Worcester City Council and how it compares with the relevant air quality objectives. In addition, monitoring results are presented for a five-year period between 2018 and 2022 to allow monitoring trends to be identified and discussed. Trend graphs are provided in the appendices below, Appendix A: Monitoring Results.

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Worcester City Council did not undertake any automatic monitoring during 2022.

3.1.2 Non-Automatic Monitoring Sites

Worcester City Council undertook non-automatic (i.e. passive) monitoring of NO_2 at 37 sites during 2022. Table A.1 in Appendix A presents the details of the non-automatic sites.

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on Quality Assurance/Quality Control (QA/QC) for the diffusion tubes, including bias adjustments and any other adjustments applied (e.g. annualisation and/or distance correction), are included in Appendix C.

3.2 Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias, annualisation (where the annual mean data capture is below 75% and greater than 25%), and distance correction. Further details on adjustments are provided in Appendix C.

3.2.1 Nitrogen Dioxide (NO_2)

Table A.2 in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past five years with the air quality objective of 40µg/m^3. Note that the concentration data presented represents the concentration at the location of the

monitoring site, following the application of bias adjustment and annualisation, as required (i.e. the values are exclusive of any consideration to fall-off with distance adjustment).

For diffusion tubes, the full 2022 dataset of monthly mean values is provided in Appendix B. Note that the concentration data presented in Table B.1 includes distance corrected values, only where relevant.

There have been no changes to the monitoring network across Worcester City during 2022.

Monitoring data from 2021 does not represent a standard year with the continuation of the COVID-19 pandemic, associated lockdowns and restrictions affecting travel patterns and behaviours. As such, monitoring data shows an overall increase in average recorded annual mean NO_2 concentrations of 3.72 µg/m^3 (11%) between 2021 (27.5 µg/m^3) and 2022 (31.21 µg/m^3) across the Worcester City area. All bar one diffusion tube monitoring stations in the Worcester City area saw an increase in annual mean NO_2 concentrations between 2021 and 2022. This is likely to have been caused by the increase in traffic between the two periods following the cessation of all COVID-19 regulations and restrictions in March 2022. Interim traffic data from County Council indicates traffic increased by approximately 9 - 14% between 2021 – 2022 and has returned to 98% of pre-pandemic levels across the County by the beginning of 2023.

At this time, it is unclear if some enforced behaviours during the pandemic that led to a decrease in the number of journeys made, such as virtual meetings replacing face to face and an increase in working from home, will continue to have the beneficial impact on reducing concentrations of NO_2 in future years after 2022.

Measured concentrations in 2022 are generally in line with 2019 data, on average -0.04 µg/m^3 and -0.39% below 2019 records. However, 2019 measurements were subject to application of particularly low bias adjustment factor and not considered indicative of local trends. In comparing 2022 measured concentrations with pre-pandemic levels it is considered appropriate to compare with 2018 recorded data which averages concentrations of 7.15 µg/m^3 and 19% higher than 2022 data across Worcester City.

In 2022, the highest concentration of NO_2 recorded across Worcester City was 43.91 µg/m^3 at But2 (located in The Butts). This location has recorded the highest concentration across the city for the last 5 years with a measured concentration of 39.1 µg/m^3 in 2021 and 52.43 µg/m^3 in 2018.

One other diffusion tube monitoring location recorded an exceedance of the AQS objective for annual average NO_2, 41.51 µg/m^3 at location Ast3, through this is reduced to 30.9 µg/m^3 when calculating back to the nearest relevant receptor.

A further 7 diffusion tube monitoring location recorded concentrations within -10% of the AQS objective for annual average NO_2, though only 3 locations (BrS2, Bkc and GS) record concentrations above 36 µg/m^3 when calculating back to the nearest relevant receptor. All concentrations are shown in Table B.1.

Given the trends recorded in 2022 no amendments to the Worcester City AQMA are proposed at this time.

No annual means greater than 60 µg/m^3 have been recorded indicating that it is very unlikely that there have been any exceedances of the 1-hour mean objective for NO_2 at any diffusion tube monitoring sites.

3.2.2 Particulate Matter (PM_{10})

Worcester City Council did not undertake PM_{10} monitoring in 2022.

3.2.3 Particulate Matter ($PM_{2.5}$)

Worcester City Council did not undertake $PM_{2.5}$ monitoring in 2022.

3.2.4 Sulphur Dioxide (SO_2)

Worcester City Council does not undertake SO_2 monitoring.

Appendix A: Monitoring Results

Table A.1 – Details of Non-Automatic Monitoring Sites

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
But1	Magdala Court, The Butts, WR1 3PB	Roadside	384776	255107	NO_2	Worcester City AQMA	0.0	1.2	No	2.5
But2	Magdala Court, The Butts, WR1 3PB	Roadside	384724	255086	NO_2	Worcester City AQMA	0.0	1.7	No	2.4
Dd1	Ambirak, Dolday 1 (opp Bus Station), WR1 3PL	Roadside	384652	254986	NO_2	Worcester City AQMA	N/A	2.2	No	2.2
DDASH	All Saints House, WR1 3NX	Roadside	384682	254924	NO_2	Worcester City AQMA	2.0	2.3	No	2.1
BrS	Bridge Street, John Gwen House, WR1 3NJ	Kerbside	384666	254818	NO_2	Worcester City AQMA	2.0	0.7	No	2.2
BRS2	Bridge Street, WR1 3NJ	Roadside	384695	254840	NO_2	Worcester City AQMA	1.0	2.0	No	2.1
Tyn3	No. 26 Upper Tything, WR1 1HT	Roadside	384679	255998	NO_2	Worcester City AQMA	0.1	2.0	No	2.2
Tyn2	Lamp & Flag PH Upper Tything (LP) 934, WR1 1JL	Roadside	384767	255606	NO_2	Worcester City AQMA	2.6	2.3	No	2.2
Tyn	925 - HAMMERCHILDS, Upper Tything, WR1 1JT	Roadside	384833	255461	NO_2	Worcester City AQMA	2.1	1.6	No	2.2

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
Fos2	Hewitt Recruitment, 35 Foregate Street, WR1 1EE	Roadside	384866	255367	NO_2	Worcester City AQMA	3.5	3.2	No	2.1
Fos3	Café Mela, 22 Foregate Street, WR1 1DN	Roadside	384899	255329	NO_2	Worcester City AQMA	2.4	2.2	No	2.5
Fos	Foregate Street junction with Shaw Street, WR1 1EB	Kerbside	384941	255140	NO_2	Worcester City AQMA	1.9	1.0	No	2.5
Crs1	29 The Cross, WR1 3PZ	Roadside	384967	255012	NO_2	Worcester City AQMA	3.6	3.4	No	2.2
Swth1	St. Swithin's Street, WR1 3PR	Roadside	385013	254987	NO_2	Worcester City AQMA	2.5	2.1	No	2.2
Lwm2	Lowesmoor 2 (City Walls Road end), WR1 2SG	Roadside	385164	255134	NO_2	Worcester City AQMA	2.1	1.9	No	2.5
Lwm1	Lowesmoor 1 Rainbow Hill End, WR1 2SE	Roadside	385268	255191	NO_2	Worcester City AQMA	1.7	1.4	No	2.6
Stj1	1A St. Johns, WR2 4EY	Roadside	384137	254510	NO_2	Worcester City AQMA	3.1	2.7	No	2.0
Brm2	10 Bromyard Road, WR2 5BS	Roadside	383967	254481	NO_2	Worcester City AQMA	0.0	8.8	No	1.9
KCP	King Charles Place, WR2 5AJ	Roadside	384016	254399	NO_2	Worcester City AQMA	2.6	2.2	No	2.1
Stj2	The Fortune House, 65 St. Johns, WR2 5AG	Roadside	384013	254356	NO_2	Worcester City AQMA	2.7	2.2	No	2.0
Stj3	The Bell, 35 St. Johns, WR2 5AG	Roadside	384046	254424	NO_2	Worcester City AQMA	2.6	2.1	No	2.0

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) [1]	Distance to kerb of nearest road (m) [2]	Tube Co-located with a Continuous Analyser?	Tube Height (m)
McI	McIntyre Road, WR2 5LQ	Suburban	383454	254606	NO_2	Worcester City AQMA	4.5	1.2	No	2.3
AST4	246 Astwood Road, WR3 8HD	Roadside	386097	256565	NO_2	Worcester City AQMA	0.0	9.9	No	2.0
AST1b	LP5129 170/172 Astwood Road, WR3 8HA	Roadside	386022	256401	NO_2	Worcester City AQMA	5.5	3.5	No	2.1
Ast3	Astwood Road 3 Rainbow Hill, WR3 8NL	Roadside	385764	255968	NO_2	Worcester City AQMA	6.6	1.7	No	2.3
OAK	22 Oaklands, WR5 1SL	Roadside	387810	254993	NO_2	Worcester City AQMA	0.0	7.0	No	1.9
LRW	London Road Waitrose, WR5 2JN	Kerbside	386654	253761	NO_2	Worcester City AQMA	4.0	0.5	No	1.9
LR1	London Road Bargain Booze LP 6569, WR5 2DY	Roadside	385636	254158	NO_2	Worcester City AQMA	2.9	1.6	No	2.1
LR2	London Road Royal Court LP 6561, WR5 2DL	Roadside	385428	254238	NO_2	Worcester City AQMA	3.0	1.5	No	2.2
LR3	London Road Commandery Road Junction, WR5 2DL	Roadside	385357	254272	NO_2	Worcester City AQMA	0.5	1.8	No	2.3
LR5	London Road Bus stop SL6554 opp Bath Road, WR5 2DH	Roadside	385325	254329	NO_2	Worcester City AQMA	0.3	1.5	No	2.2
LR4	London Road SL6565 adj No 61, WR5 2DS	Roadside	385525	254219	NO_2	Worcester City AQMA	3.1	1.9	No	2.1
SIDFG	Sidbury Street o/s Fisher German	Roadside	385146	254474	NO_2	Worcester City AQMA	6.2	2.3	No	2.2

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
	Estate Agents, WR1 2LS									
BG2	Near 17 Broomhall Green, Broomhall, WR5 2PG	Roadside	386165	252146	NO_2	Worcester City AQMA	5.3	5.1	No	2.3
RH	Nursery Rainbow Hill LP5196, WR3 8LX	Roadside	385420	255413	NO_2	Worcester City AQMA	7.8	1.5	No	2.4
Bkc	Berkeley Court, Foregate Street, Worcester, WR1 3QF	Roadside	384948	255111	NO_2	Worcester City AQMA	0.2	4.1	No	2.5
GS	54 George Street Worcester WR1 2DY	Roadside	385358	254969	NO_2	Worcester City AQMA	0.0	2.0	No	2.3

Notes:

(1) 0m if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property).

(2) N/A if not applicable.

Table A.2 – Annual Mean NO_2 Monitoring Results: Non-Automatic Monitoring (µg/m^3)

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
But1	384776	255107	Roadside	100.0	100.0	**44.4**	33.5	27.3	31.0	35.7
But2	384724	255086	Roadside	100.0	100.0	**52.4**	**42.1**	35.9	39.1	**43.9**
Dd1	384652	254986	Roadside	100.0	100.0	37.2	29.7	23.2	25.3	29.9
DDASH	384682	254924	Roadside	92.3	92.3	**43.8**	36.8	29.0	30.5	35.9
BrS	384666	254818	Kerbside	82.7	82.7	**42.3**	31.0	24.9	29.4	31.7
BRS2	384695	254840	Roadside	100.0	100.0	**47.7**	38.6	35.6	33.8	39.1
Tyn3	384679	255998	Roadside	100.0	100.0	37.9	29.5	23.4	26.2	31.0
Tyn2	384767	255606	Roadside	100.0	100.0	**47.8**	39.9	31.3	34.6	38.8
Tyn	384833	255461	Roadside	92.3	92.3	**47.2**	**41.8**	31.1	34.3	38.7
Fos2	384866	255367	Roadside	82.7	82.7	35.8	30.7	22.8	25.6	30.0
Fos3	384899	255329	Roadside	100.0	100.0	32.9	27.6	21.3	24.3	29.4
Fos	384941	255140	Kerbside	100.0	100.0	**48.5**	37.3	27.5	33.1	37.6
Crs1	384967	255012	Roadside	82.7	82.7	36.8	29.1	22.0	22.9	26.2

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2022 (%) [2]	2018	2019	2020	2021	2022
Swth1	385013	254987	Roadside	100.0	100.0	30.0	23.4	17.8	19.0	21.5
Lwm2	385164	255134	Roadside	100.0	100.0	35.9	29.5	23.1	24.5	29.2
Lwm1	385268	255191	Roadside	100.0	100.0	**41.2**	33.9	31.8	31.6	36.2
Stj1	384137	254510	Roadside	90.4	90.4	**42.7**	36.0	22.7	28.0	34.6
Brm2	383967	254481	Roadside	90.4	90.4	32.4	27.8	19.1	22.0	24.9
KCP	384016	254399	Roadside	80.8	80.8	33.3	27.9	22.0	24.5	28.1
Stj2	384013	254356	Roadside	90.4	90.4	30.3	23.5	17.5	21.1	24.8
Stj3	384046	254424	Roadside	82.7	82.7	34.3	27.9	19.9	25.0	29.2
Mcl	383454	254606	Suburban	90.4	90.4	14.3	11.9	10.1	12.7	10.9
AST4	386097	256565	Roadside	90.4	90.4	25.3	21.6	16.9	19.8	21.3
AST1b	386022	256401	Roadside	90.4	90.4	34.2	28.9	23.9	27.2	29.7
Ast3	385764	255968	Roadside	82.7	82.7	**50.6**	**40.0**	31.3	38.1	**41.5**
OAK	387810	254993	Roadside	90.4	90.4	19.0	16.7	13.1	13.1	15.6
LRW	386654	253761	Kerbside	90.4	90.4	**45.2**	35.7	25.0	30.4	34.5

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
LR1	385636	254158	Roadside	100.0	100.0	35.5	29.3	22.8	25.1	27.4
LR2	385428	254238	Roadside	92.3	92.3	39.8	34.5	25.1	32.3	32.5
LR3	385357	254272	Roadside	90.4	90.4	**42.3**	33.7	26.5	31.0	34.0
LR5	385325	254329	Roadside	92.3	92.3	**44.1**	35.0	27.5	30.5	33.2
LR4	385525	254219	Roadside	100.0	100.0	38.4	29.7	24.7	27.8	32.4
SIDFG	385146	254474	Roadside	100.0	100.0	**41.9**	34.3	25.9	29.7	35.6
BG2	386165	252146	Roadside	90.4	90.4	27.4	22.8	16.8	20.7	22.3
RH	385420	255413	Roadside	92.3	92.3	34.3	30.1	21.6	27.8	30.5
Bkc	384948	255111	Roadside	100.0	100.0	**46.9**	38.4	29.4	32.9	38.8
GS	385358	254969	Roadside	92.3	92.3		36.3	29.4	32.5	38.3

☐ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG22.**

☒ **Diffusion tube data has been bias adjusted.**

☒ **Reported concentrations are those at the location of the monitoring site (bias adjusted and annualised, as required), i.e. prior to any fall-off with distance correction.**

Notes:

The annual mean concentrations are presented as µg/m^3.

Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.

NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined**.

Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per LAQM.TG22 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Concentrations are those at the location of monitoring and not those following any fall-off with distance adjustment.

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

Figure A.1 – Trends in Annual Mean NO_2 Concentrations in Worcester City

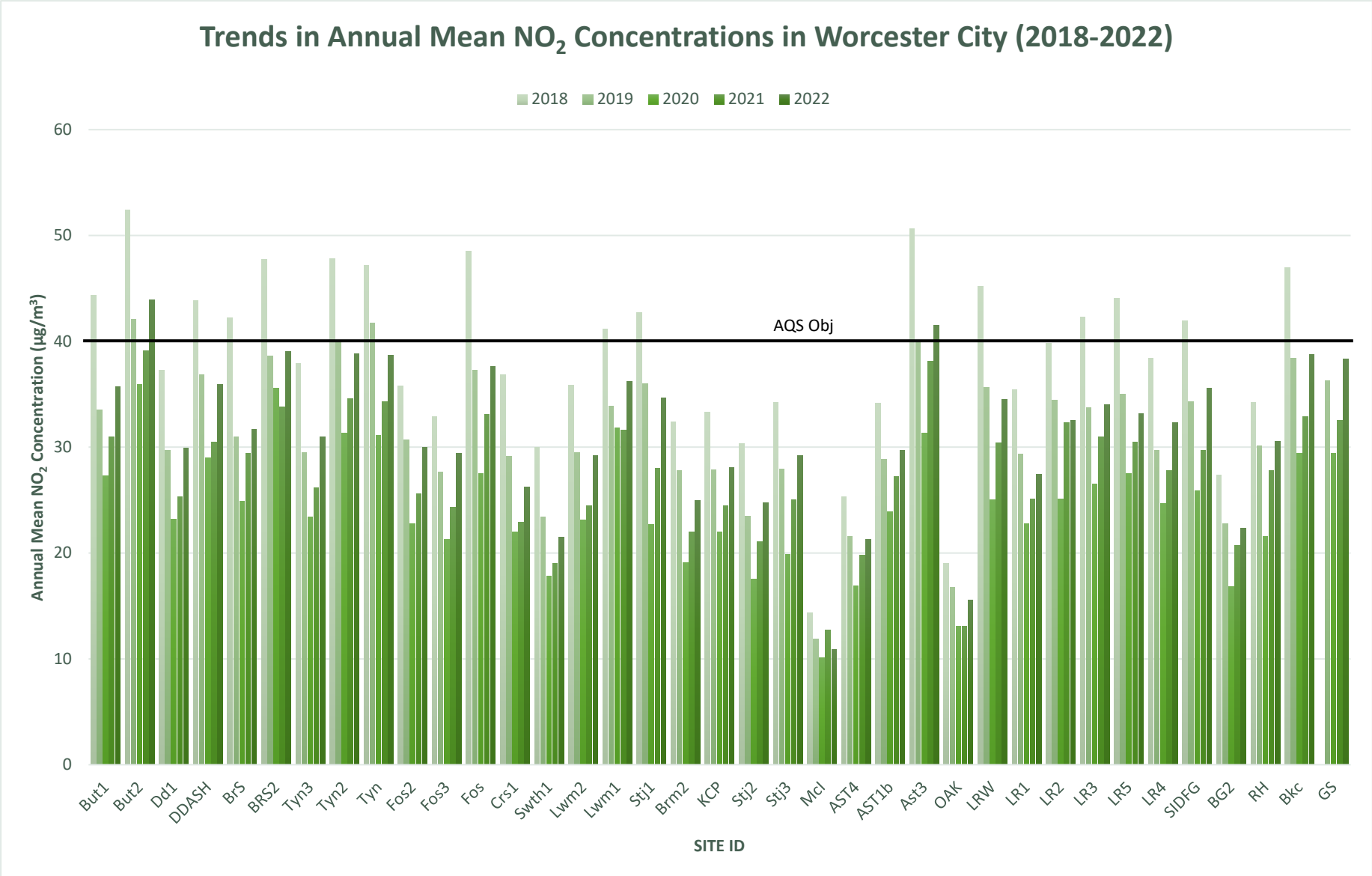


Figure A.2 – Trends in Annual Mean NO_2 Concentrations in Dolday and The Butts

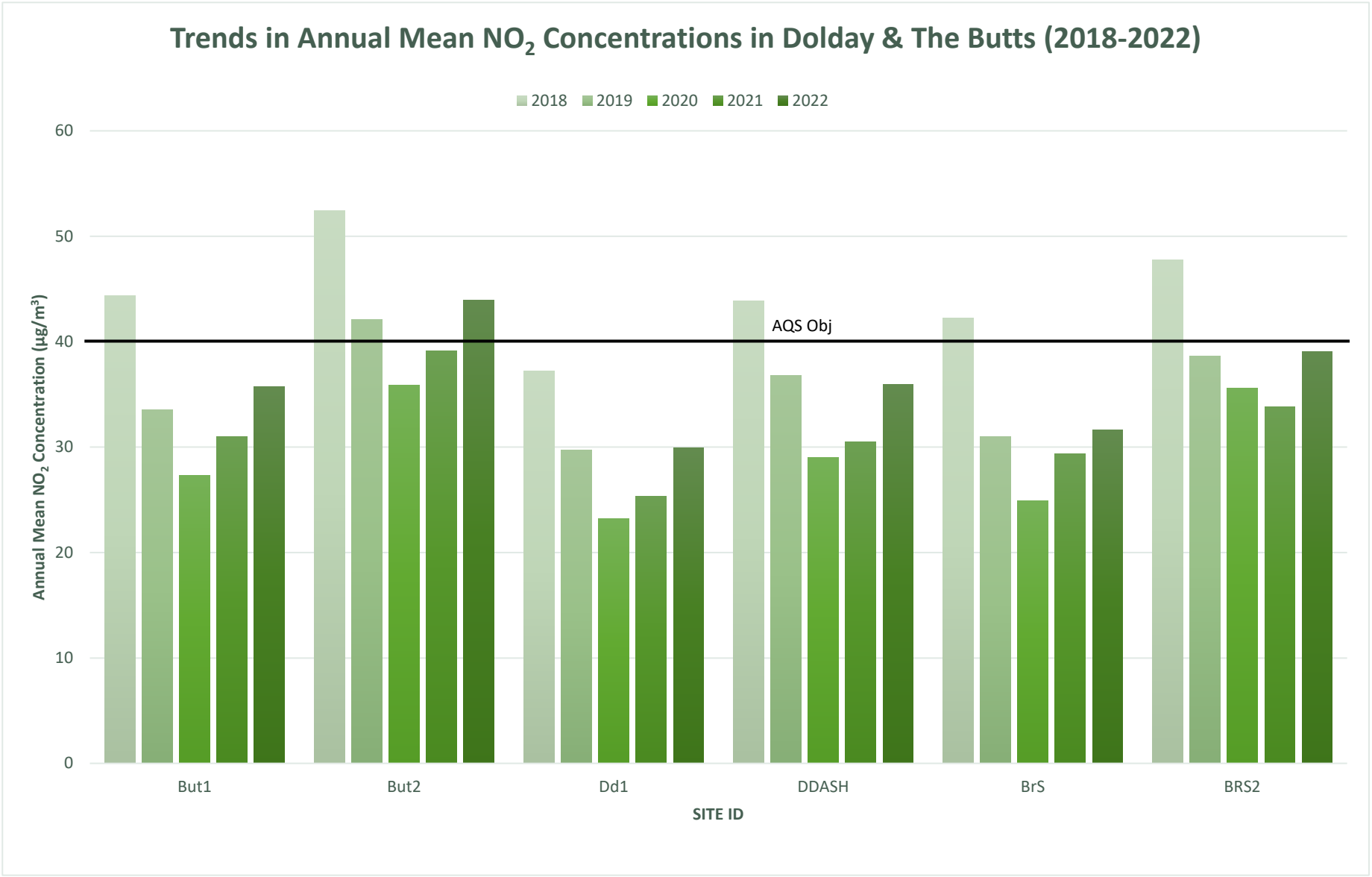


Figure A.3 – Trends in Annual Mean NO_2 Concentrations in The Tything, Foregate Street & The Foregate

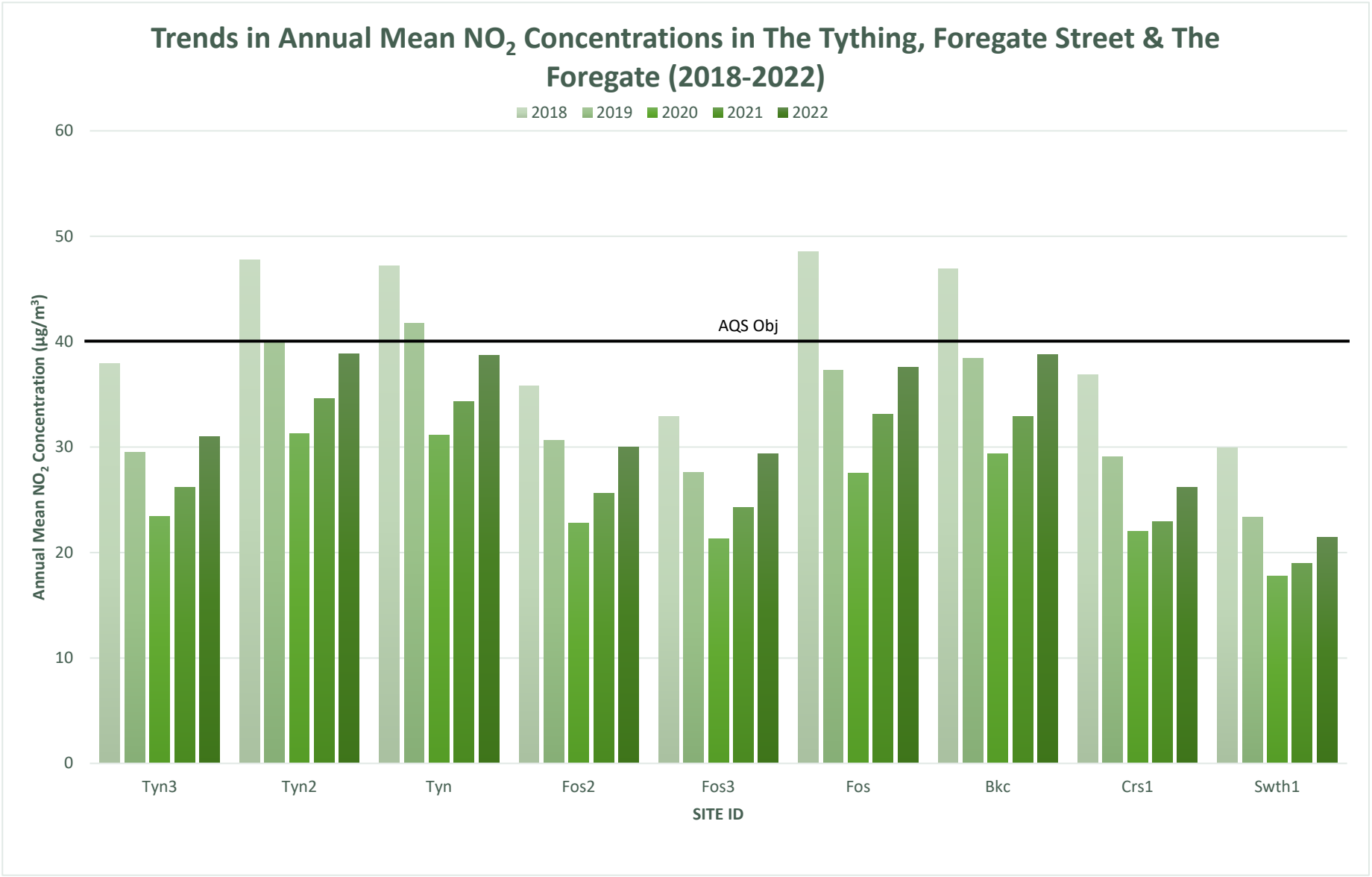


Figure A.4 – Trends in Annual Mean NO_2 Concentrations in Lowesmoor, Astwood Road and Tallow Hill

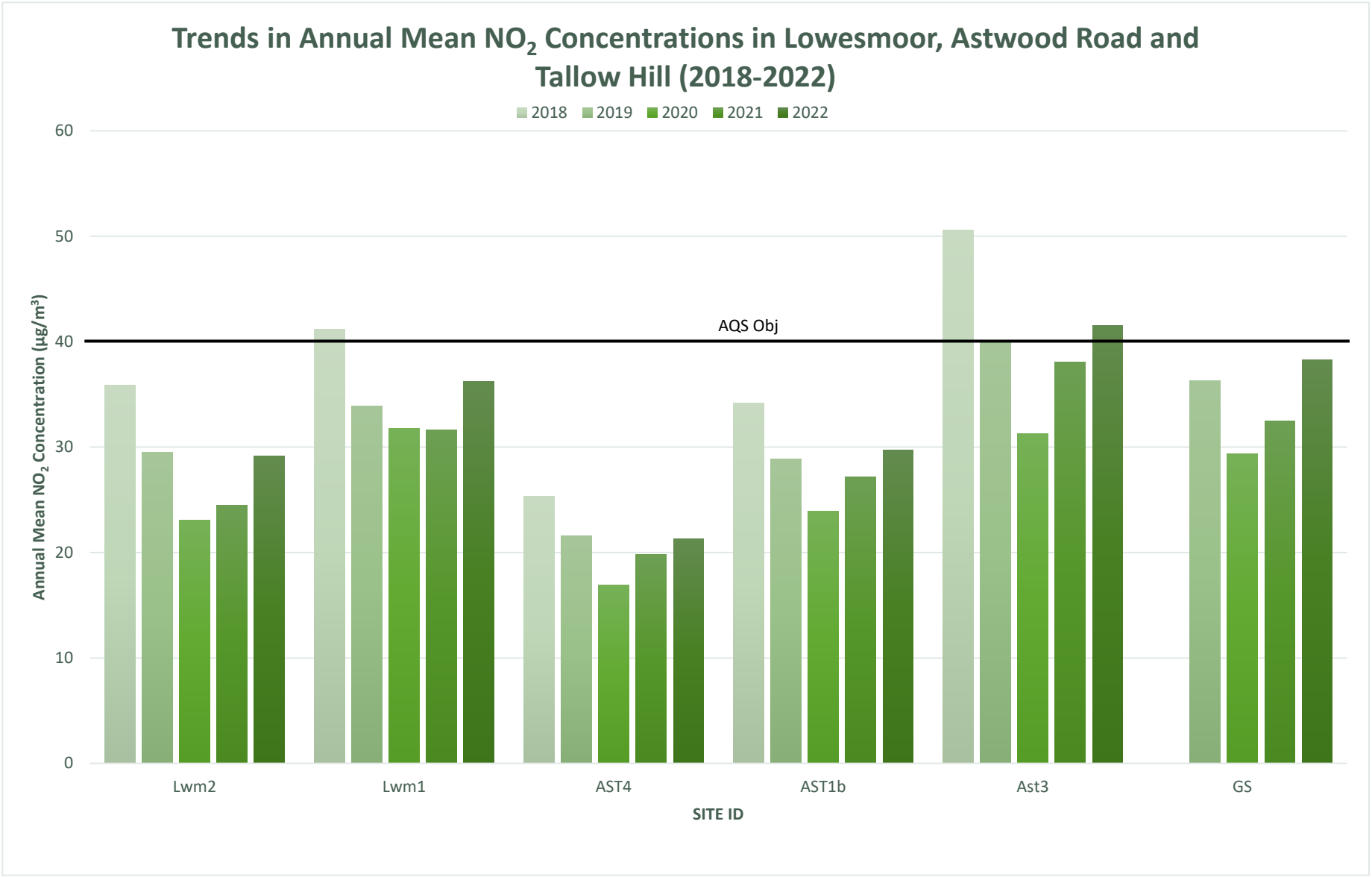


Figure A.5 – Trends in Annual Mean NO_2 Concentrations in St. Johns

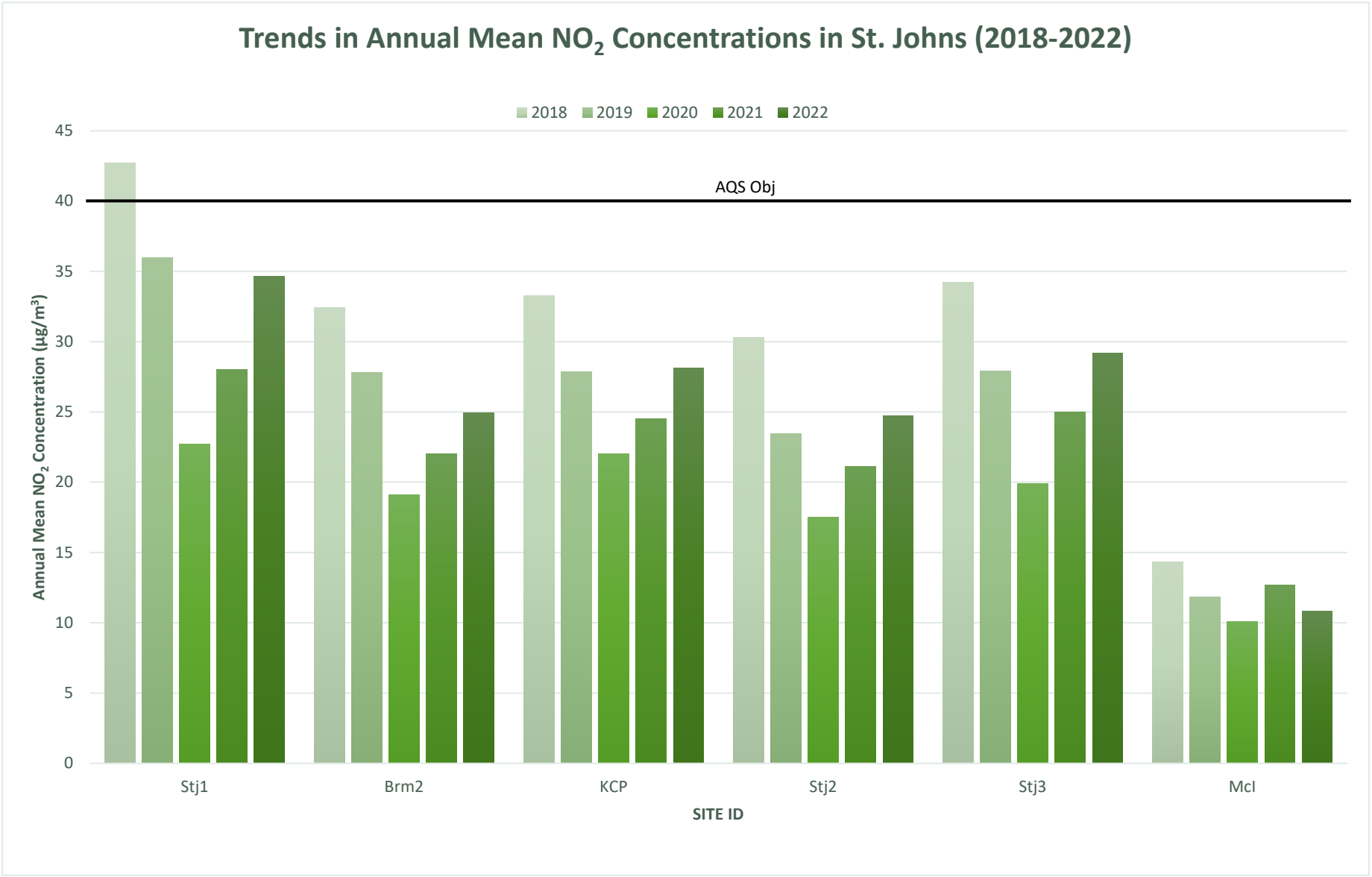


Figure A.6 – Trends in Annual Mean NO_2 Concentrations in London Road and Sidbury

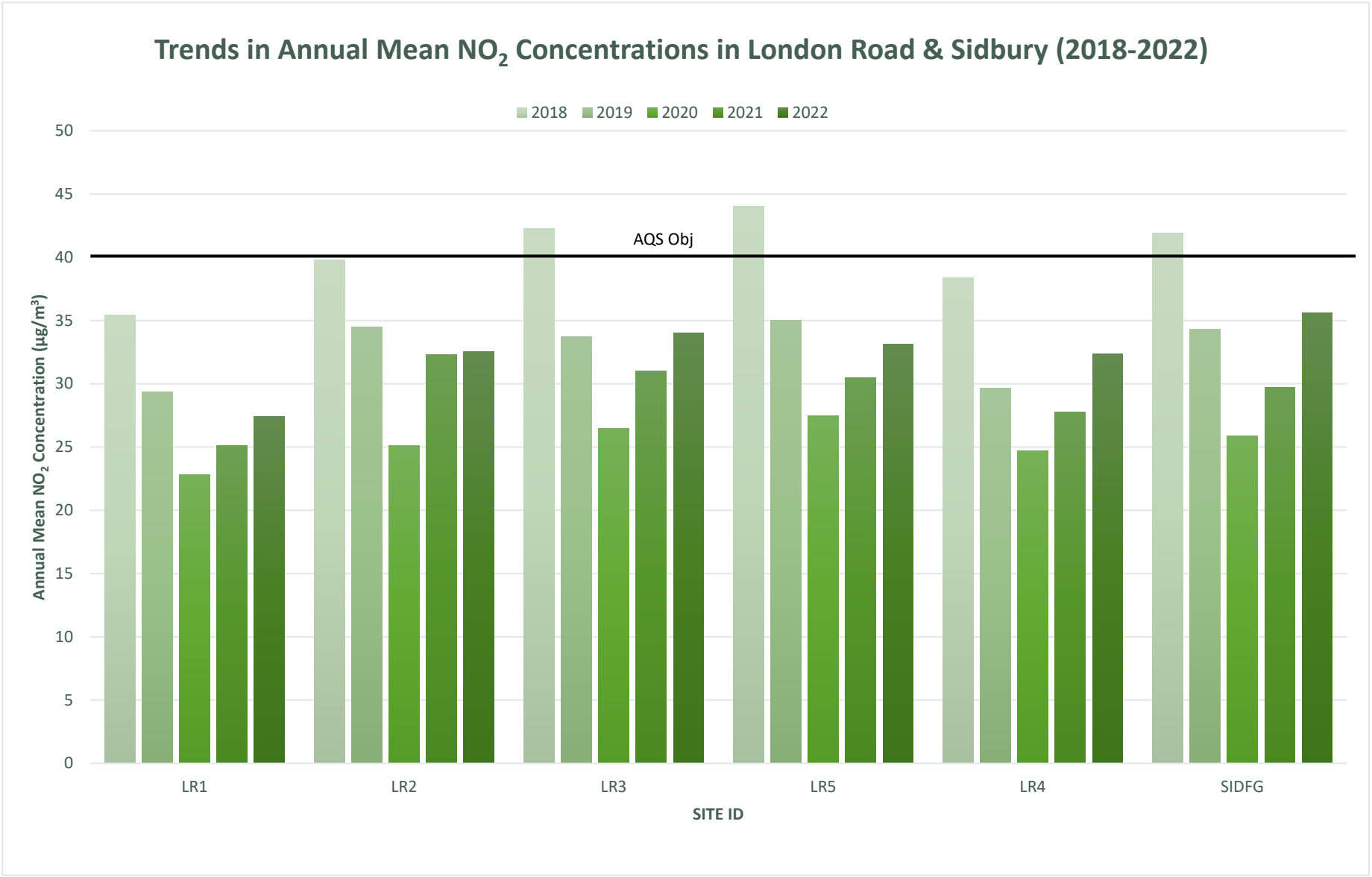
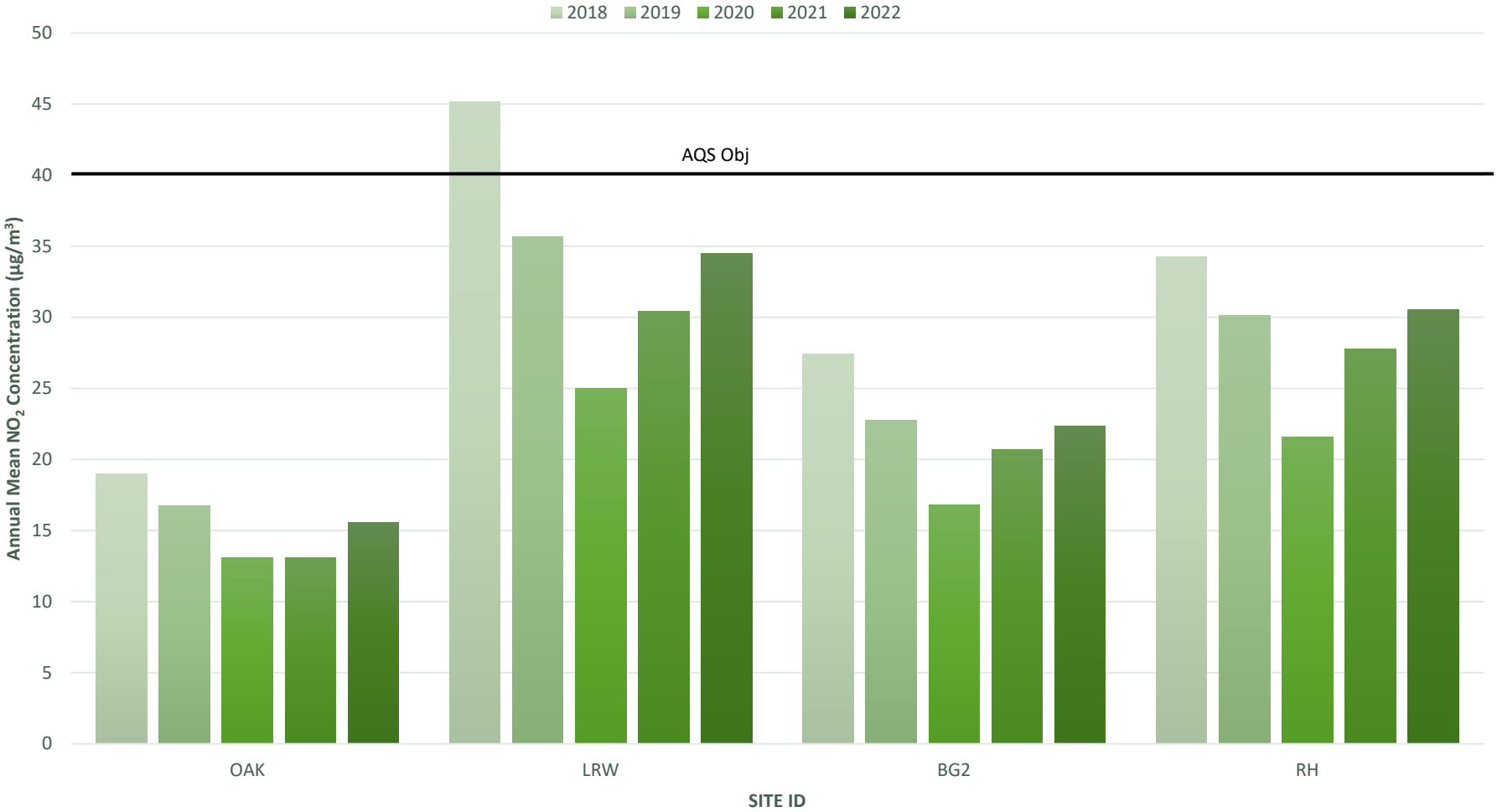


Figure A.7 – Trends in Annual Mean NO_2 Concentrations in Out of City Locations



Appendix B: Full Monthly Diffusion Tube Results for 2022

Table B.1 – NO_2 2022 Diffusion Tube Results ($\mu g/m^3$)

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.97)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
But1	384776	255107	44.5	28.4	45.9	36.9	33.9	28.7	36.2	40.8	38.1	32.9	34.3	41.2	36.8	35.7		
But2	384724	255086	59.0	29.9	48.6	39.5	38.1	40.7	44.6	48.6	51.4	46.2	48.8	47.9	45.3	**43.9**		
Dd1	384652	254986	36.2	21.8	40.0	33.4	25.8	23.5	28.3	39.9	31.5	28.0	29.0	32.9	30.8	29.9		
DDASH	384682	254924	43.1	31.8	39.0	33.6	34.3		35.8	34.6	34.8	40.1	40.5	40.1	37.0	35.9		
BrS	384666	254818	40.8	23.6	42.8		29.8	26.1	34.8		35.2	26.7	30.0	36.5	32.6	31.7		
BRS2	384695	254840	46.6	25.6	50.6	41.8	37.4	32.5	40.0	47.4	39.7	38.6	41.1	42.2	40.3	39.1	36.4	
Tyn3	384679	255998	40.9	21.2	46.4	29.7	23.3	21.6	26.2	33.8	34.5	31.1	33.7	41.2	32.0	31.0		
Tyn2	384767	255606	49.4	32.9	45.0	32.9	35.1	35.7	39.7	36.8	42.6	40.1	46.3	43.9	40.0	38.8	33.8	
Tyn	384833	255461	48.4	32.6		36.8	35.1	38.1	41.2	41.3	39.5	39.9	45.1	40.9	39.9	38.7	33.7	
Fos2	384866	255367	38.6	23.3	37.5	26.3		24.3	25.8	24.9		34.2	37.4	37.2	30.9	30.0		
Fos3	384899	255329	33.8	24.4	41.8	25.9	23.1	21.0	23.9	28.7	30.3	30.2	44.5	36.1	30.3	29.4		
Fos	384941	255140	48.2	31.2	48.9	39.5	34.9	28.4	37.2	44.2	42.3	32.5	35.8	42.2	38.8	37.6	32.0	
Crs1	384967	255012	37.0	23.4	28.5	25.1	22.1		24.6	25.7	26.6		24.2	32.9	27.0	26.2		
Swth1	385013	254987	30.5	18.6	30.9	22.4	16.0	14.7	17.8	23.8	22.6	19.0	21.6	27.8	22.1	21.5		
Lwm2	385164	255134	38.6	23.1	40.9	27.7	23.1	20.7	24.9	31.8	29.8	29.2	34.0	37.2	30.1	29.2		
Lwm1	385268	255191	52.4	33.2	38.8	37.5	31.5	30.1	33.5	37.0	35.0	35.9	39.4	43.6	37.3	36.2	32.1	
Stj1	384137	254510	38.8	37.0	39.0	34.5	38.8	33.3	31.7	32.2	32.6	34.6	40.5		35.7	34.6		
Brm2	383967	254481	37.3	27.7	32.8	22.1	23.4	19.9	20.0	17.9	22.4	25.0	34.4		25.7	24.9		
KCP	384016	254399	38.8	27.6	34.3	27.1	25.8	23.5	27.6	26.2	29.1		29.8		29.0	28.1		
Stj2	384013	254356	32.6	19.9	33.6	26.8	21.2	18.7	21.7	23.2	26.2	26.5	30.4		25.5	24.8		
Stj3	384046	254424	34.0	23.1	37.6	34.4	26.8	23.4		28.2	31.8	30.2	31.7		30.1	29.2		
Mcl	383454	254606	15.4	10.2	17.7	10.4	6.7	5.8	7.8	8.8	11.6	13.5	15.2		11.2	10.9		
AST4	386097	256565	27.3	19.8	27.2	21.1	20.0	15.9	18.7	20.3	23.1	22.5	25.4		21.9	21.3		
AST1b	386022	256401	39.5	27.1	36.0	32.2	26.1	23.3	24.9	30.0	32.3	29.9	35.6		30.6	29.7		
Ast3	385764	255968		37.3	46.0	45.8	42.6	36.8	43.1	42.5	47.5	44.0	42.5		42.8	**41.5**	30.9	
OAK	387810	254993	24.8	14.8	18.3	13.8	12.5	12.2	12.4	11.8	15.4	19.1	21.7		16.1	15.6		
LRW	386654	253761	44.0	26.4	42.0	34.0	34.1	30.3	34.7	36.0	40.6	34.0	34.7		35.5	34.5		

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.97)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
LR1	385636	254158	36.4	26.1	35.0	25.4	23.8	22.1	25.0	26.2	27.3	27.4	33.3	31.2	28.3	27.4		
LR2	385428	254238	39.6	31.6		29.3	29.3	29.5	31.2	30.8	35.9	39.8	36.4	35.6	33.5	32.5		
LR3	385357	254272	44.2	29.4	41.3	31.6	31.8	29.7	31.8	34.4	34.6	39.3	37.8		35.1	34.0		
LR5	385325	254329	40.2		40.5	33.8	27.8	25.4	31.3	37.7	35.3	26.7	36.6	40.7	34.2	33.2		
LR4	385525	254219	47.5	23.4	47.3	33.3	28.7	25.1	30.4	34.7	33.7	29.8	31.2	35.3	33.4	32.4		
SIDFG	385146	254474	45.1	32.3	43.0	34.6	31.3	31.6	35.0	38.0	37.9	33.7	37.0	40.9	36.7	35.6		
BG2	386165	252146	29.7	16.4	30.7	24.8	16.1	16.3	19.3	21.7	24.9	25.0	28.3		23.0	22.3		
RH	385420	255413	38.7	27.9	33.7	26.9	27.5	26.4	29.2	27.2		34.5	35.8	38.5	31.5	30.5		
Bkc	384948	255111	41.5	29.7	46.0	38.8	31.8	34.6	40.3	42.2	41.1	39.2	49.3	45.4	40.0	38.8	38.5	
GS	385358	254969	48.4	29.8	47.6	39.0	33.6	31.4	32.8		41.0	41.1	44.7	44.9	39.5	38.3		

☒ **All erroneous data has been removed from the NO_2 diffusion tube dataset presented in Table B.1.**

☐ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG22.**

☒ **Local bias adjustment factor used.**

☐ **National bias adjustment factor used.**

☒ **Where applicable, data has been distance corrected for relevant exposure in the final column.**

☒ **Worcester City Council confirm that all 2022 diffusion tube data has been uploaded to the Diffusion Tube Data Entry System.**

Notes:

Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.

NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined**.

See Appendix C for details on bias adjustment and annualisation.

Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC

New or Changed Sources Identified Within Worcester City During 2022

Worcester City Council has not identified any new sources impacting on air quality within the reporting year of 2022.

Details of significant developments under construction in 2022 are as follows:

Application Number	Location	Description of development under construction
P12G0199	Land adjacent to Sheriff Street, Worcester	Proposed urban renewal and regeneration scheme for mixed use development including 469 dwellings (214 dwellings under construction in Phase 1)
P17G0258	Crown Packaging Site, Perrywood Walk, Worcester	Demolition of all existing buildings and the erection of 215 dwellings (due to be completed in 2023)
P15C0371	The Ice House, Bromyard Road, Worcester	Conversion of the Former Ice Works and demolition of redundant ancillary buildings and erection of new build to comprise 54 dwellings. 33 dwellings Under Construction in Phase Two.
19/00851/FUL	JVM Casting site, Droitwich Road, Worcester	Demolition of part of an existing industrial building (Class B2) and erection of a retail foodstore (Class A1) with provision of associated car parking, access and landscaping, together with provision of car parking associated with the retained industrial use and new access. (due to be competed in 2023)

The proposals have been assessed as part of the planning process and are not expected to have a significant impact on local air quality when they are operational.

Applications for a number of new developments have been identified within Worcester City. The proposals have been assessed as part of the planning process and are not expected to have a significant impact on local air quality when they are operational.

Details of applications for significant developments received by Worcester City Council in 2022 are as follows:

Application Number	Location	Description of development
22/00656/FUL	2 Central Park, Great Western Avenue, Worcester, WR5 1DY	Back up (diesel) power generator

Additional Air Quality Works Undertaken by Worcester City Council During 2022

Worcester City Council completed a Source Apportionment Assessment[12] in 2022 of background and local sources to inform the development of an Air Quality Action Plan. A copy of the full document is provided within Appendix F: Source Apportionment Assessment 2022. The assessment has been undertaken using a simple spreadsheet approach following the process outlined in Technical Guidance (LAQM.TG16) and utilising Defra's Emissions Factor Toolkit (EfT) v11.0. Traffic surveys were commissioned and began in early 2020 but were suspended due to the outbreak of the Covid-19 pandemic which had severe impacts on traffic movements and behaviour. The level of traffic flow was deemed to have returned to sufficient levels to resume outstanding traffic surveys towards the end of 2021.

Source apportionment studies have been carried out for a number of areas of concern within the city; the Tything, Foregate Street, the Butts, the Cross, Bridge Street, All Saints Road, and Lowesmoor. Source apportionment was undertaken previously for St Johns and London Road in 2017. These reports have been reviewed and relevant data presented to feed into the assessment.

The outcome of the source apportionment exercise shows that background concentration contributes a significant proportion of the overall concentration of NO_2 measured within each of the study areas varying from 25.97% to 39.27%. Cars were shown to comprise the

[12] Worcestershire Regulatory Services 'Worcester City Source Apportionment Assessment' (April 2022)

largest proportion of traffic volume with between 65.74% and 82.54% contributing to between 18.91% and 49.87% of vehicle source emissions. Buses comprise a much smaller proportion of the traffic volume ranging between 1.19% and 10.47% but contributing much larger proportions of vehicle emissions of between 13.7% and 58.19%.

Targeting individual types of vehicles in isolation within most areas of concern is unlikely to lead to the annual mean objective being achieved unless the reductions are very large. For example, reductions of 50% or greater in the emissions from cars would be required within 5 of the areas, with a 100% reduction not being sufficient to achieve compliance within 2 of the locations. In those two locations a 60 to 70% reduction in the number of buses would be necessary to attain the objective.

For the majority of the locations it is likely that a reduction across all vehicle types, or combination of several categories, would be required to achieve the objective. The data indicates that a maximum reduction in NO_2 of 37.7% would be required to achieve the objective within all areas. A maximum reduction of 43% would be necessary across all vehicle types to achieve results 5% below the objective, and 48.1% to achieve 10% below the objective.

QA/QC of Diffusion Tube Monitoring

The following UKAS accredited company provided Worcester City Council with nitrogen dioxide diffusion tubes and analysis in 2022:

Gradko International Limited
St. Martins House
77 Wales Street
Winchester
SO23 0RH
diffusion@gradko.com

The 20% Triethanolamine (TEA) / De-ionised Water preparation method is used.

Gradko International Limited participate in the AIR NO_2 Proficiency Testing Scheme (AIR-PT).

All monitoring undertaken has been completed in accordance with the 2022 Diffusion Tube Monitoring Calendar, i.e. on or within ± 2 days of the specified date.

Diffusion Tube Annualisation

All diffusion tube monitoring locations within Worcester City recorded data capture of 75% therefore it was not required to annualise any monitoring data. In addition, any sites with a data capture below 25% do not require annualisation.

Diffusion Tube Bias Adjustment Factors

The diffusion tube data presented within the 2023 ASR have been corrected for bias using an adjustment factor. Bias represents the overall tendency of the diffusion tubes to under or over-read relative to the reference chemiluminescence analyser. LAQM.TG22 provides guidance with regard to the application of a bias adjustment factor to correct diffusion tube monitoring. Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data taken from NO_x/NO_2 continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

Worcester City Council have applied a local bias adjustment factor of 0.97 to the 2022 monitoring data. A summary of bias adjustment factors used by Worcester City Council over the past five years is presented in Table C.1.

WRS has determined the appropriate local bias adjustment factor utilising the Diffusion Tube Data Processing Tool v3.0. The site used was the colocation study at Wyre Forest House, Kidderminster. The local bias adjustment factor has been used as more conservative compared with the national bias adjustment factor (0.83, Defra published National Diffusion Tube Bias Adjustment Spreadsheet Version 03/23), following consultation with Defra LAQM helpdesk and technical guidance.

Table C.1 – Bias Adjustment Factor

Monitoring Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2022	Local	-	0.97
2021	National	03/21	0.84
2020	National	03/21	0.81
2019	National	03/20	0.78
2018	National	03/19	0.89

Table C.2 – Local Bias Adjustment Calculation

	Local Bias Adjustment Input 1	Local Bias Adjustment Input 2	Local Bias Adjustment Input 3	Local Bias Adjustment Input 4	Local Bias Adjustment Input 5
Periods used to calculate bias	11				
Bias Factor A	0.97 (0.92 - 1.04)				
Bias Factor B	3% (-4% - 9%)				
Diffusion Tube Mean (µg/m^3)	13.0				
Mean CV (Precision)	2.7%				
Automatic Mean (µg/m^3)	12.7				
Data Capture	100%				
Adjusted Tube Mean (µg/m^3)	13 (12 - 14)				

Notes:

A single local bias adjustment factor has been used to bias adjust the 2022 diffusion tube results.

NO_2 Fall-off with Distance from the Road

Wherever possible, monitoring locations are representative of exposure. However, where this is not possible, the NO_2 concentration at the nearest location relevant for exposure has been estimated using the Diffusion Tube Data Processing Tool/NO_2 fall-off with distance calculator available on the LAQM Support website. Where appropriate, non-automatic annual mean NO_2 concentrations corrected for distance are presented in Table B.1 and the calculation is shown below in Table C.4.

Table C.3 – NO_2 Fall off With Distance Calculations (concentrations presented in µg/m^3)

Site ID	Distance (m): Monitoring Site to Kerb	Distance (m): Receptor to Kerb	Monitored Concentration (Annualised and Bias Adjusted	Background Concentration	Concentration Predicted at Receptor	Comments
BRS2	2.0	3.0	39.1	11.2	*36.4*	*Predicted concentration at Receptor within 10% the AQS objective.*
Tyn2	2.3	4.9	38.8	11.7	33.8	

Site ID	Distance (m): Monitoring Site to Kerb	Distance (m): Receptor to Kerb	Monitored Concentration (Annualised and Bias Adjusted	Background Concentration	Concentration Predicted at Receptor	Comments
Tyn	1.6	3.7	38.7	11.7	33.7	
Fos	1.0	2.9	37.6	11.7	32.0	
Lwm1	1.4	3.1	36.2	12.03626	32.1	
Ast3	1.7	8.3	41.5	12.0	30.9	
Bkc	4.1	4.3	38.8	11.7	*38.5*	*Predicted concentration at Receptor within 10% the AQS objective.*

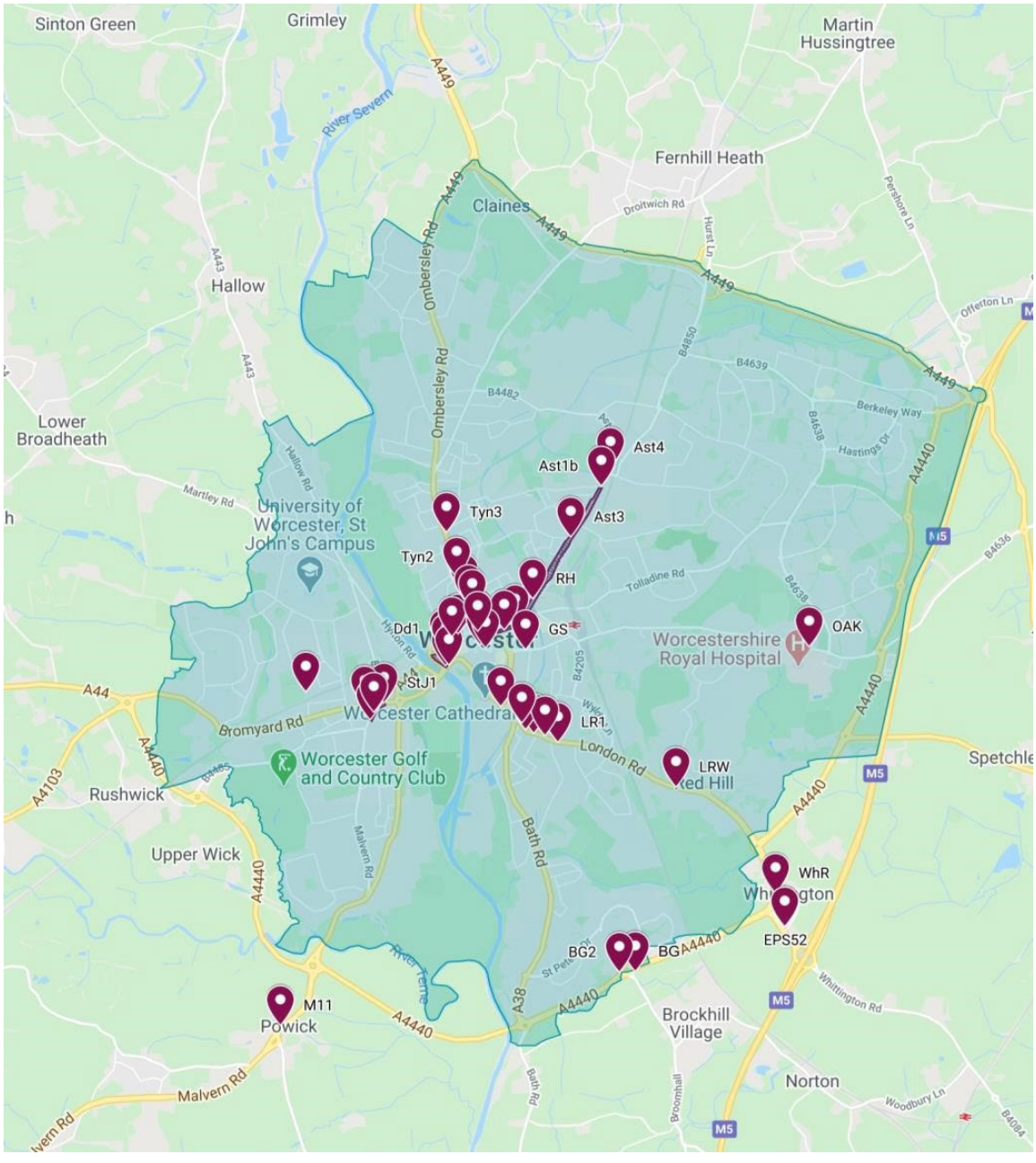
QA/QC of Automatic Monitoring

Worcester City Council did not undertake any automatic monitoring in 2022.

Appendix D: Map(s) of Monitoring Locations and AQMAs

Figure D.1 – Map of Non-Automatic Monitoring Site

Figure D.1 – Worcester City AQMA (Political Boundary) and Overview of Monitoring Locations



Date: 18.05.2022	**Copyright:** Map data @2020 Google United Kingdom

Figure D.2 – Former Dolday AQMA and The Butts

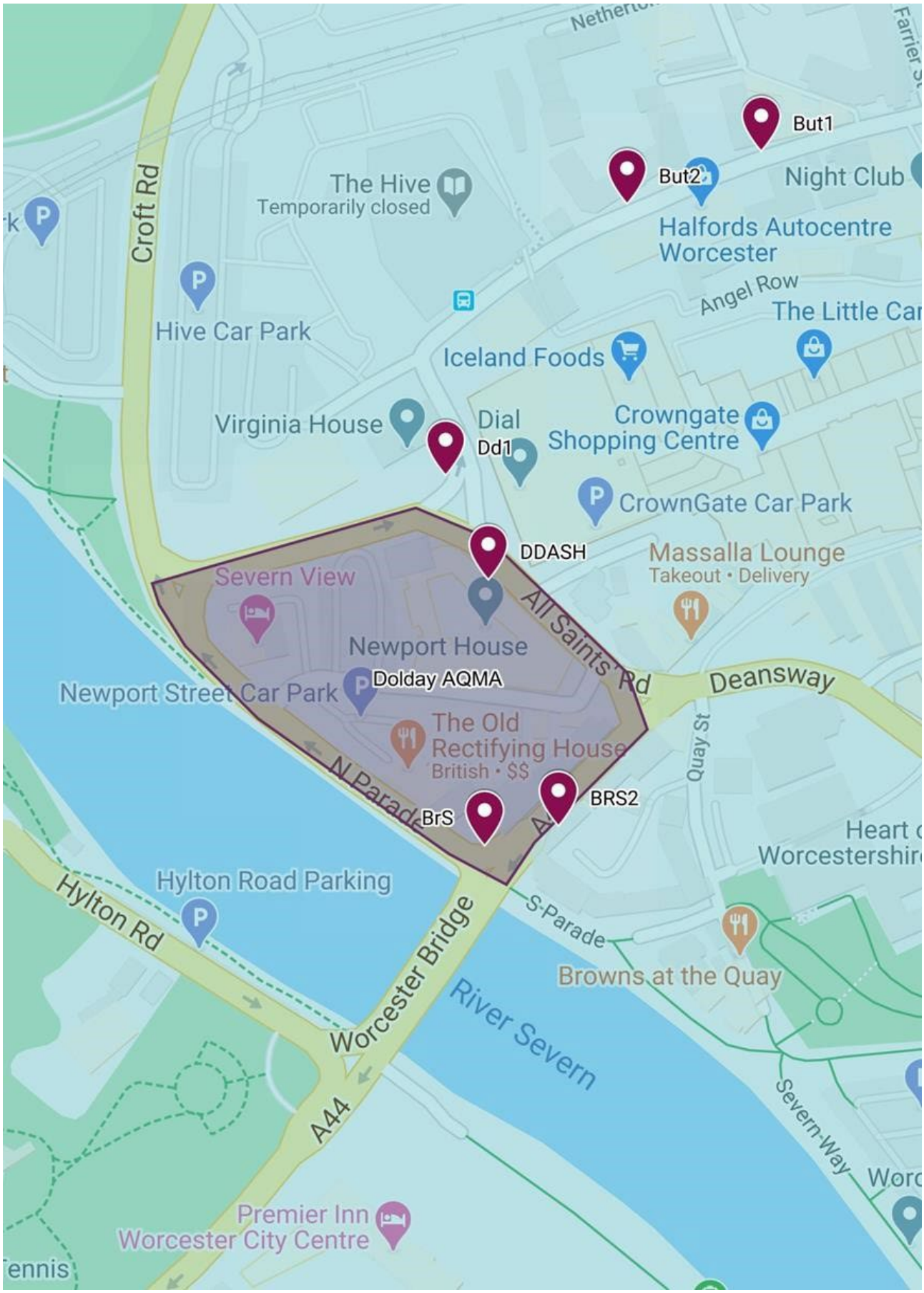


Figure D.3 – Foregate Street and The Tything

Figure D.4 – The Foregate Street to Saint Swithins Street

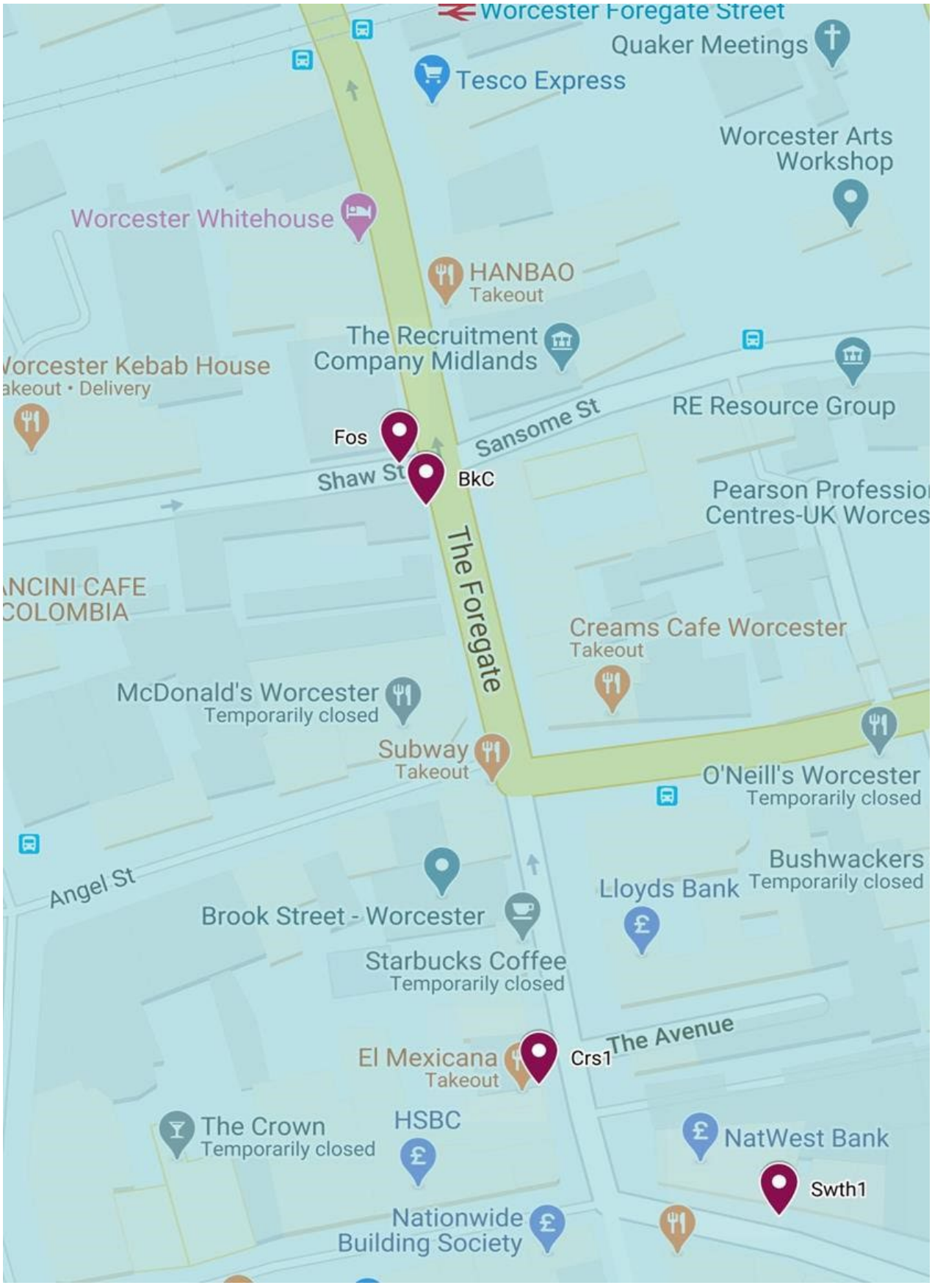


Figure D.5 – Former Lowesmoor-Astwood Road AQMA and Tallow Hill

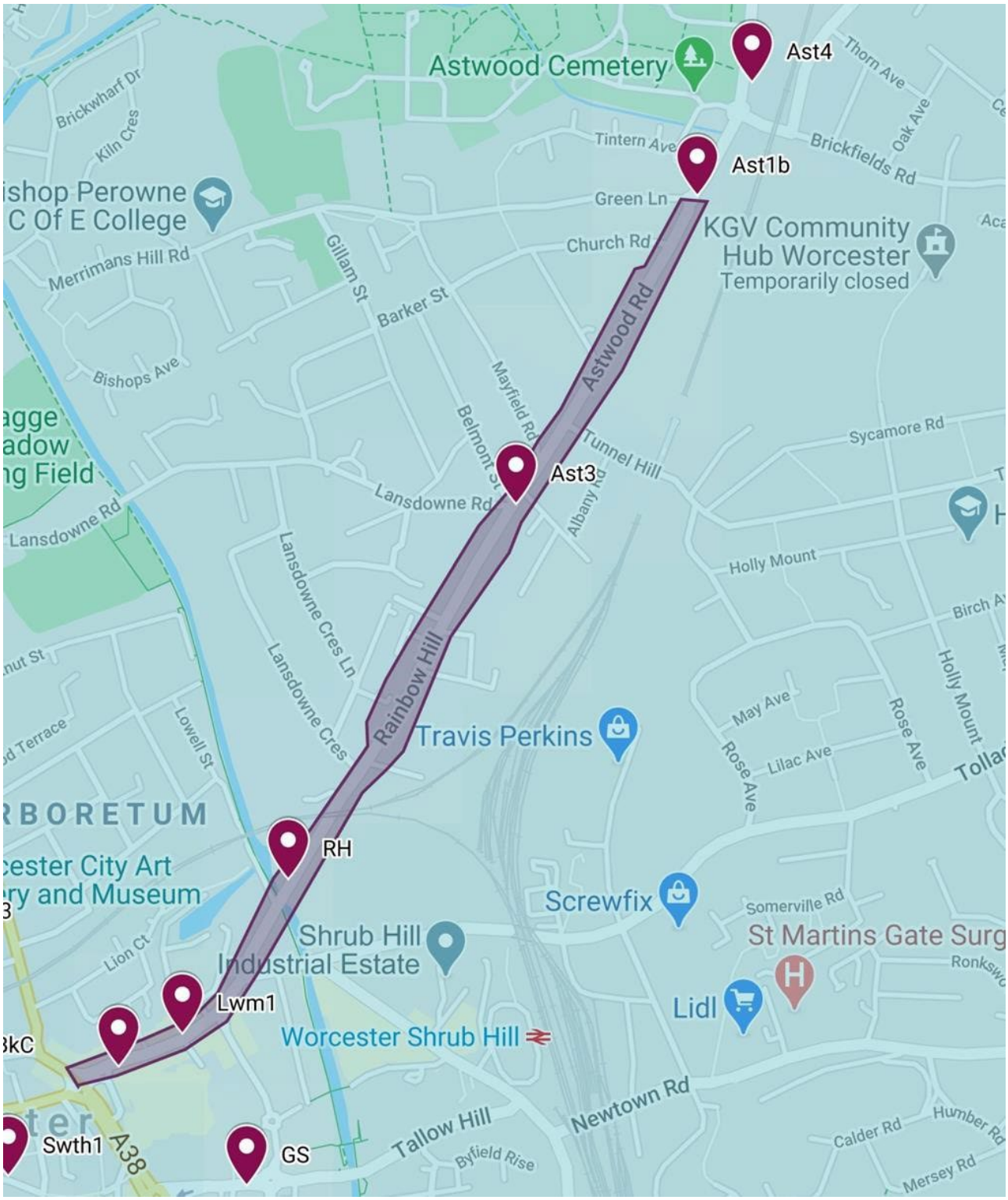


Figure D.6 – Henwick & St Johns

Figure D.7 – Former St. Johns AQMA

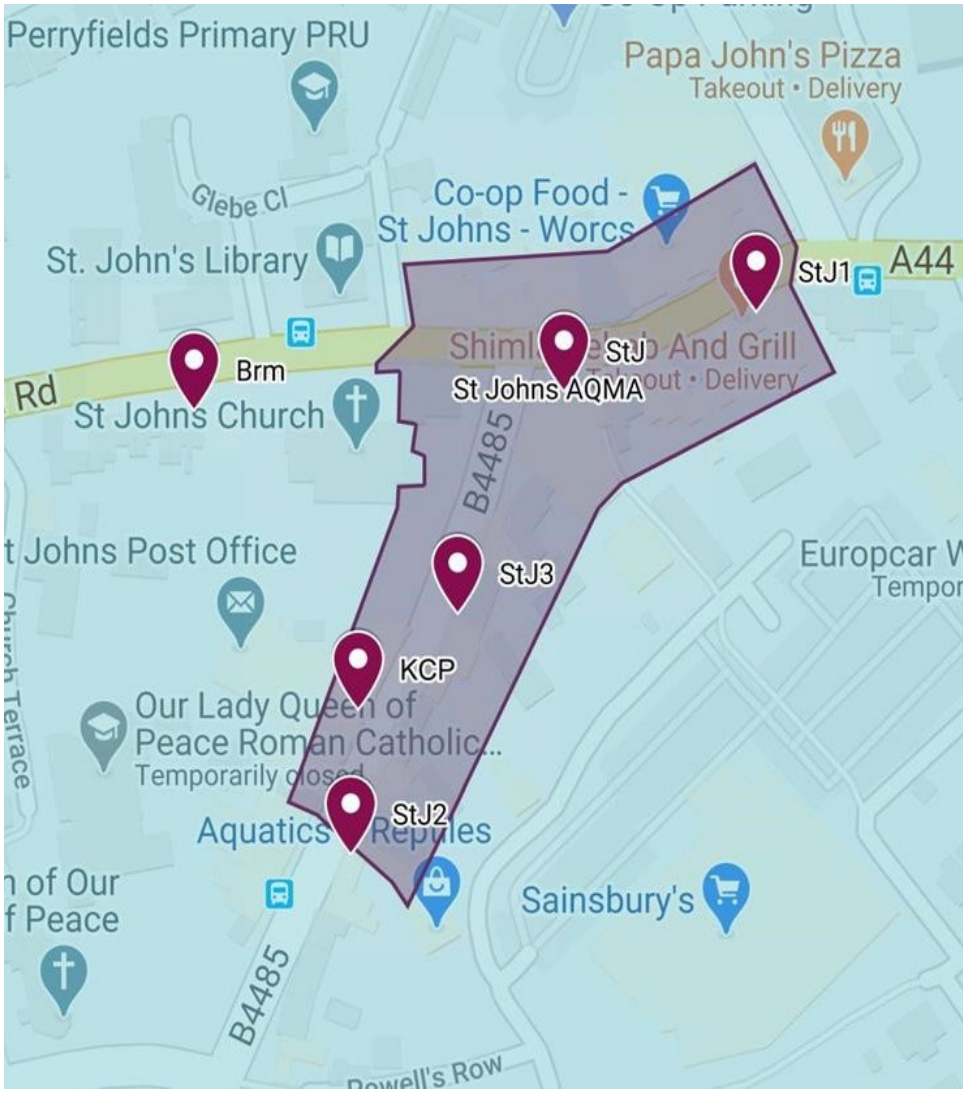


Figure D.8 – London Road and Sidbury

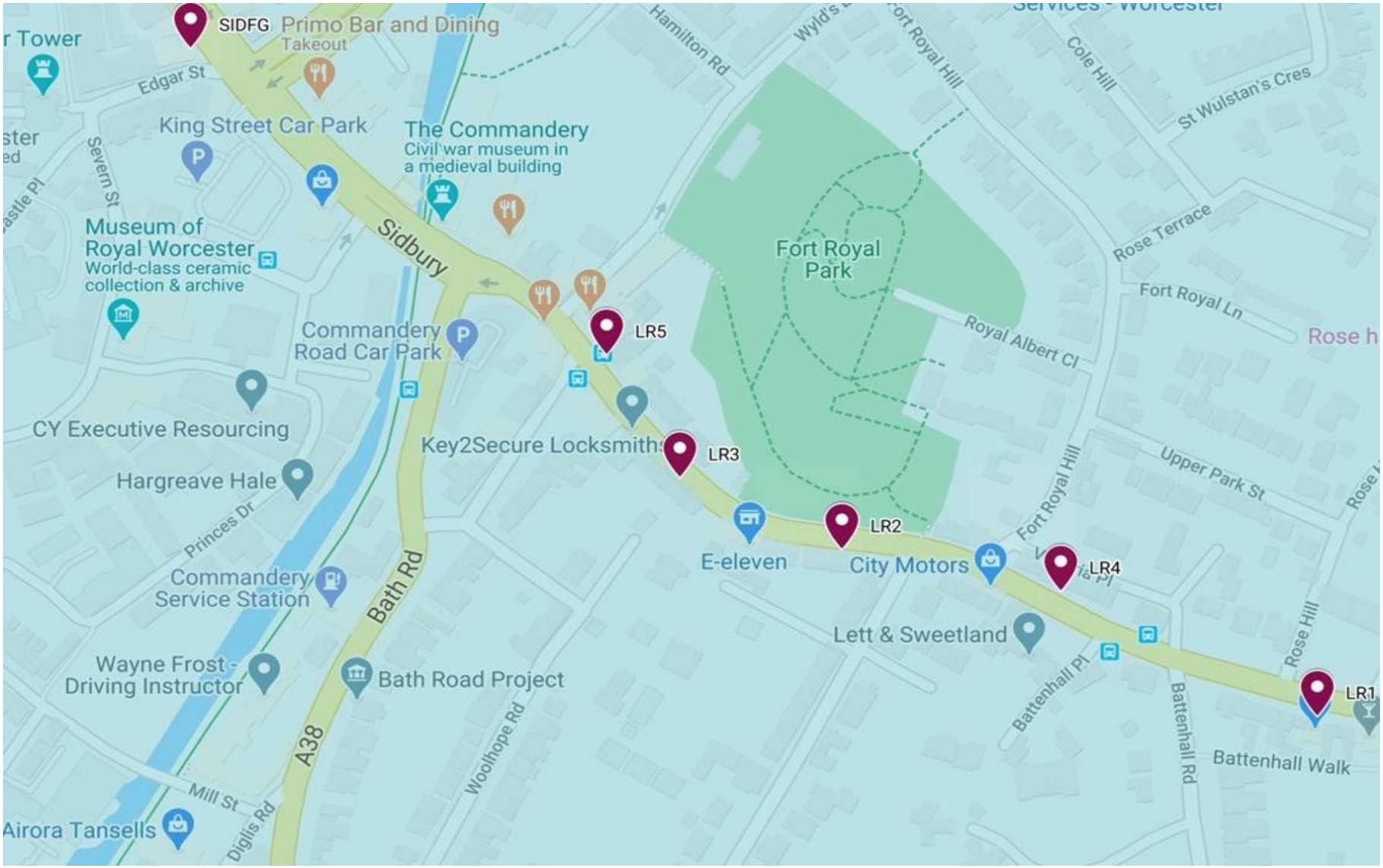


Figure D.9 – Ronkswood and Red Hill

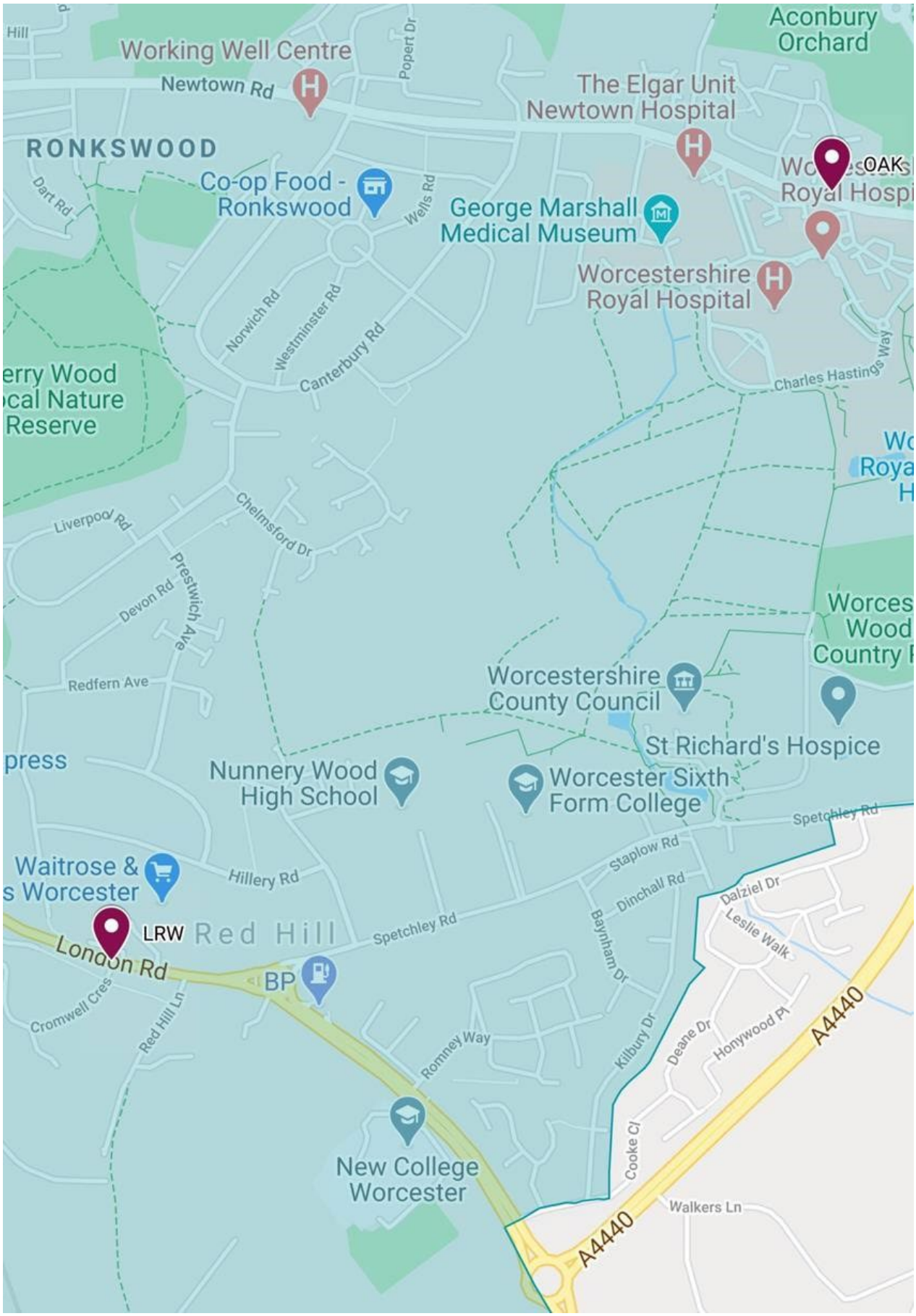
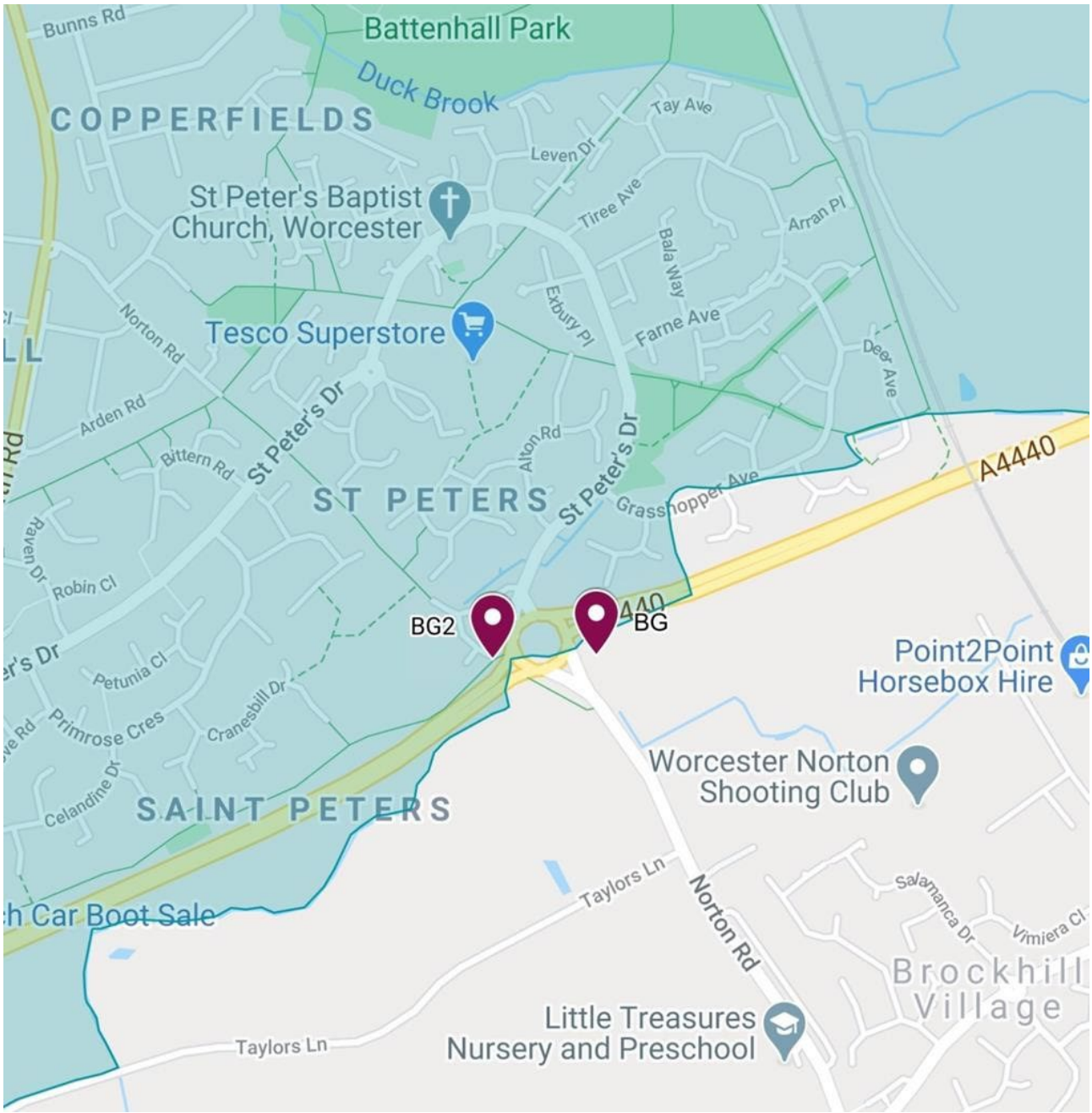


Figure D.10 – St. Peters



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England[13]

Pollutant	Air Quality Objective: Concentration	Air Quality Objective: Measured as
Nitrogen Dioxide (NO_2)	200µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
Nitrogen Dioxide (NO_2)	40µg/m^3	Annual mean
Particulate Matter (PM_{10})	50µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
Particulate Matter (PM_{10})	40µg/m^3	Annual mean
Sulphur Dioxide (SO_2)	350µg/m^3, not to be exceeded more than 24 times a year	1-hour mean
Sulphur Dioxide (SO_2)	125µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
Sulphur Dioxide (SO_2)	266µg/m^3, not to be exceeded more than 35 times a year	15-minute mean

[13] The units are in microgrammes of pollutant per cubic metre of air (µg/m^3).

Appendix F: Source Apportionment Assessment 2022

Worcester City Council

Worcester City
Source Apportionment Assessment 2022

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

April 2022

Local Authority Officer	Stephen Williams
Department	Land & Air Quality Team
Address	Wyre Forest House Finepoint Way Kidderminster Worcestershire DY11 7WF
Telephone	01905 822799
E-mail	wrsenquiries@worcsregservices.gov.uk
Report Reference number	WCC/WORC/SA/2022
Date	April 2022

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1.0 Introduction

This report fulfils the requirements of the Local Air Quality Management (LAQM) process as set out in Part IV of the Environment Act 1995, the Air Quality Strategy for England, Wales and Northern Ireland 2007 and the relevant Policy and Technical Guidance.

Policy Guidance (LAQM.PG16) requires a Local Authority to produce an Air Quality Action Plan (AQAP) following declaration of an Air Quality Management Area (AQMA). In order to develop an appropriate plan, it is necessary to identify the emission sources contributing to the exceedance of the Objective.

2.0 Air Quality Objectives

The air quality objectives set out in the Air Quality (England) Regulations 2000, as amended by the Air Quality (England) (Amendment) Regulations 2002, provide the statutory basis for the air quality objectives under LAQM in England. The relevant objectives for the propose of this assessment are set out in Table 1 below.

Table 1 Nitrogen Dioxide National Air Quality Objectives

Pollutant	Objective	Averaging Period	Obligation
Nitrogen Dioxide	200µg/m^3	1-hour mean	All local authorities
	not to be exceeded more than 18 times a year		
	40µg/m^3	Annual mean	All local authorities

3.0 Declaration

Three Air Quality Management Areas (AQMA) were declared by Worcester City Council in 2009 for exceedances of the annual average mean objective for nitrogen dioxide (NO_2):

- Dolday/Bridge Street AQMA declared 1st March 2009.
- Lowesmoor/Rainbow Hill AQMA declared 1st March 2009; and
- Newtown Road AQMA declared 1st March 2009.

The Newtown Road AQMA was revoked by the council on 30th July 2014.

A further AQMA was declared by the council for the St Johns area of Worcester for exceedance of the annual mean objective for NO2 on 26th September 2014.

In 2017, a detailed assessment was undertaken of an area within London Road and Sidbury by Air Quality Consultants (AQC) on behalf of Worcester City Council. The AQC report concluded that an area at the western end of London Road should be declared as an AQMA. A copy of AQC (July 2017) '*Detailed Assessment of Air Quality along London Road, Worcester'* (ref: J2829A/1/F1) can be made available on request.

Additionally, long term trend measurements and automatic analyser results up to 2018 within Foregate Street, The Butts and The Tything, Worcester indicated that requirement for a new AQMA declaration of this combined study area would likely be confirmed by detailed assessment.

On the 11th June 2019 Worcester City Council formally declared the Worcester City AQMA (Political Boundary of Worcester City) which encompasses the whole district area as an AQMA, for likely breach of the nitrogen dioxide annual mean.

Additionally, Worcester City Council AQMAs Variation Order 2019 consolidates the existing 2009 and 2014 AQMAs, as detailed above, into the Worcester City AQMA (Political Boundary of Worcester City) as of 11th June 2019.

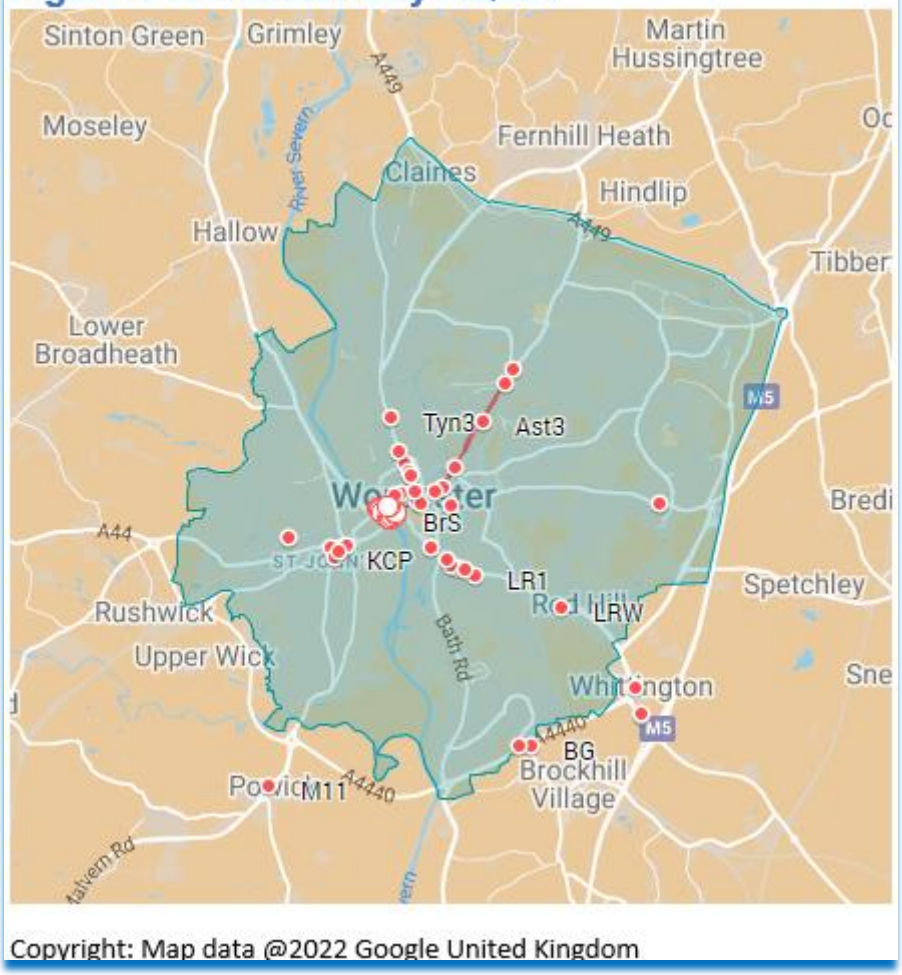
Details of declaration and plans of the AQMAs can be found on the following pages of WRS website: Air Quality Management Area Declarations | Worcestershire Regulatory Services (worcsregservices.gov.uk)

In 2013, WRS produced a countywide Air Quality Action Plan (AQAP) for Worcestershire which was adopted by Worcester City Council. WRS have produced two updates to the AQAP, the latest in September 2016. Following the identification of further areas of exceedance across Worcester City, and subsequent declaration of the Citywide AQMA, it is necessary to develop a new action plan relevant to these changes.

This report details the first steps in the process of developing a new Action Plan for improving nitrogen dioxide levels within the Worcester City AQMA. The report aims to identify and quantify the various emission sources which contribute to the exceedances occurring at different locations across the city.

Work previously commenced at the start of 2020 but was suspended due to the outbreak of the Covid-19 Pandemic which had severe impacts on traffic movements and behaviour. Traffic movements were deemed to have returned to normal at the tail end of 2021 when progress was resumed, and the outstanding traffic surveys carried out.

Figure 1 Worcester City AQMA



4.0 Methodology and Input Data

This source apportionment assessment has been undertaken generally following the process outlined in Technical Guidance (LAQM.TG16). LAQM.TG16 (paragraph 7.100) advises that "source apportionment may be undertaken using a simple spreadsheet approach. For example, where road traffic emissions are the principal concern, the percentage contribution to NOX emissions may be calculated using the appropriate emissions factors". This approach has been adopted for the Worcester City source apportionment assessment utilising Defra's Emissions Factor Toolkit (EfT) v11.0.

Copies of the Emission Factor Toolkit input and outputs are shown in Appendix B.

4.1 Emission Factor Toolkit

Source apportionment was undertaken using the most recent version of DEFRA's Emission Factor Toolkit (EfT v11.0).

4.2 Traffic Data

Traffic Count Data

WRS commissioned 12-hour road traffic counts to be undertaken by Worcestershire County Council at the locations within the Worcester City AQMA where exceedances have been recorded. The first traffic surveys were carried out in March 2020 for Foregate Street, The Butts and the Tything. Other traffic surveys were scheduled to take place but were cancelled due to the Covid-19 Pandemic and subsequent lockdowns which heavily reduced traffic flows. The outstanding surveys were conducted in November 2021 for All Saints Road, Bridge Street, Lowesmoor, and the Cross once traffic volumes were considered to have returned to pre-pandemic levels.

The traffic count data were scaled to 24hours using DfT Table TRA037. A separate figure was calculated to scale taxi journeys from available data to reflect the level of evening and weekend operation. The traffic data and scaling calculations are provided in Appendix B.

Speed Data

Speed data for the various routes within Worcester City were derived from basic speed surveys carried out by WRS in January and February 2020. The surveys were carried out

using Android App “Speedometer GPS” which uses the inbuilt GPS of the smart phone to monitor and record journey statistics, including speed. These data are then displayed on a Google base map. The data is stored and can be reviewed later however there is no function to export the data from the app and as such it is not possible to reproduce it in full as part of this report. A summary of the information gathered is provided in Appendix B.

4.3 Diffusion Tube Data

Worcester City Council monitors annual mean nitrogen dioxide concentrations using passive diffusion tubes with 37 locations currently located across the District. Various diffusion tube monitoring locations are present within the areas of concern located inside the citywide AQMA area. Plans showing the locations of diffusion tube monitoring locations in relation to the study areas are included in Section 6. Where two or more diffusion tubes were located within the same study area the location recording the highest NO_2 concentration has generally been utilised to represent worst case conditions. The most representative monitoring location has been used in each case to inform the study. Two locations within Foregate Street (Fos and Fos2) have been included to provide comparison as the location with the highest concentrations is located at the edge of the study area at a busy signal-controlled crossroads.

It was decided to use data from 2018 as this was considered the most representative of concentrations. 2017 and 2019 data were subject to a low bias adjustment factor leading to lower than expected results. 2020 and 2021 results were even more heavily reduced due to the impacts of the Corona Virus Pandemic and subsequent lockdowns. 2018 was therefore considered to be more appropriate year to use being in line with previous long-term trends.
LAQM.TG16 advises that as diffusion tubes are not the reference method, and passive diffusion typically results in a low accuracy, it is necessary to bias adjust the results based upon local or national collocation studies with chemiluminescent analysers. The bias - adjustment factor of 0.89 issued by Defra was utilised to adjust the 2018 data.

Table 2 Annual mean nitrogen dioxide concentrations measured at diffusion tube locations within the study areas (µg/m^3)

Site	Description	2018[abc]
Tyn	925 - Hammerchilds, The Tything, WR1 1JT	**47.21**
Fos	Foregate Street junction with Shaw Street, WR1 1EB	**48.51**
Fos2	Hewitt Recruitment, 35 Foregate Street, WR1 1EE	**35.81**
But2	Magdala Court, The Butts, WR1 3PB	**52.43**
BRS2	Bridge Street, WR1 3NJ	**47.7**
Bkc	Berkeley Court, Foregate Street, Worcester, WR1 3QF	**46.94**
DDASH	All Saints House, WR1 3NX	**43.8**
Lwm1	Lowesmoor, Rainbow Hill End, WR1 2SE	**41.2**
Objective	**40**	

[a] *bias-adjusted using 2018 defra national factor 0.89*
[b] *annualised in accordance with DEFRA TG16*
[c] *calculated back to relevant exposure in accordance with DEFRA TG16*

5.0 Background and Local Contributions

Technical guidance (LAQM.TG16) advises that determining *"…the apportionment for NO_2 is not straightforward due to the non-linear relationship between emissions of NO_2 and nitrous oxides (NO_X). This is additionally complicated by the different proportions of NO_2 in the NO_X emission for different sources, for example, petrol cars or diesel cars. The following advise therefore applies to NO_2 source apportionment:*

- *Background contributions: the national maps will give the total background NO_2 concentration. This should be apportioned to regional and local background using the ration of the background NO_X concentrations attributable to these two sources, which are also available in the national maps; and*

- *Local contributions: the local contribution to NO_2 is the difference between the total (measured or modelled) NO_2 and the total background NO_2. This is then apportioned to the local sources, for example, buses, HGVs, taxis, cars, using the relative contributions of these sources to the local NO_X concentration"*

Regional and total background concentrations of NO_X and NO_2 for 2018, available from the DEFRA website, have been used to calculate the contribution of local NO_2 for the relevant monitoring locations for each area recording the highest measured level of NO_2 following the procedure laid out in LAQM.TG16 Box 7.5. The local contribution has then been apportioned to each vehicle class according to the results of the EfT. Calculations are presented in Appendix C. The results are summarised in Tables 3 and 4 below.

Table 3 Measured NO_2 concentrations & contribution of each main source type

	Annual Mean Concentration (µg/m³)								
Site ID	Regional Background	Local Background	Cars	LGVs	Taxis	HGVs	Buses	MCs	Total
Tything (Tyn)	9.12	4.5	16.29	6.18	2.35	4.16	4.6	0.03	47.21
Foregate (Fos)	9.12	4.5	12.1	4.65	4.68	2.93	10.48	0.03	48.51
The Foregate (Fos2)	9.12	4.5	7.7	2.95	2.98	1.86	6.67	0.02	35.81
The Butts (But2)	9.12	4.5	8.52	3.65	2.43	2.06	22.13	0.02	52.43
Bridge Street (BRS2)	8.43	4.69	17.25	6.96	1.48	4.02	4.82	0.05	47.70
The Cross (Bkc)	9.12	4.5	7.69	3.13	4.26	2.2	16.02	0.04	46.94
All Saints Road (DDASH)	8.43	4.69	13.74	4.72	1.18	3.96	7.02	0.05	43.80
Lowesmoor (Lwm1)	10.07	4.21	5.09	2.91	2.02	1.21	15.67	0.01	41.20
	% Contribution to Total								
Site ID	Regional Background	Local Background	Cars	LGVs	Taxis	HGVs	Buses	MCs	Total
The Tything (Tyn)	19.32	9.53	34.51	13.09	4.98	8.82	9.75	0.07	100
Foregate (Fos)	18.82	9.29	24.95	9.58	9.64	6.03	21.6	0.06	100
Foregate Street (Fos2)	25.49	12.58	21.5	8.25	8.31	5.19	18.62	0.06	100
The Butts (But2)	17.39	8.58	16.25	6.96	4.63	3.92	42.21	0.04	100
Bridge Street (BRS2)	17.67	9.83	36.16	14.59	3.11	8.43	10.1	0.11	100
The Cross (Bkc)	19.4	9.58	16.39	6.66	9.07	4.69	34.12	0.09	100
All Saints Road (DDASH)	19.25	10.71	31.38	10.77	2.7	9.05	16.02	0.11	100
Lowesmoor (Lwm1)	24.44	10.22	12.35	7.06	4.91	2.94	38.04	0.03	100

Background split determined following technical guidance in Defra (Oct 2016) 'Background Concentration Maps User Guide':

(1) Regional background includes emissions from sources not in LA control e.g. Motorways outside of study area, Industrial sources, Domestic properties, Railways, Rural sources, Others

(2) Local background includes emissions from sources LA have some influence over e.g. Primary A roads, Minor Roads and Point sources in and outside of study area

Table 3 above demonstrates that the main contributors to emissions within the study areas are cars within the Tything, Foregate Street (Fos), Bridge Street, and All Saints Road. Buses are indicated to be the main contributor at the Butts, the Cross, and Lowesmoor. The

regional background is the highest source attributed at Foregate (Fos2), and second highest in six of the areas, and third at Foregate Street (Fos). Cars and regional background contributions are in the top three contributions for all 8 locations, with buses in 6 out of the 8 locations, and LGVs making up the remaining 2.

As the local authority is largely unable to influence regional background levels it is more useful to consider the source apportionment of the local traffic sources in isolation when developing actions for improving air quality. Table 4 below illustrates the local traffic contribution, excluding background concentrations, broken down into vehicle type.

Table 4 - Concentrations & percentage contribution of emissions to local traffic sources

Annual Mean Concentration (µg/m^3)										
Site ID	Cars			LGVs		Taxis	HGVs	Buses	MCs	Total
	Petrol	Diesel	Other	Petrol	Diesel					
Tything (Tyn)	2.15	14.07	0.07	0.03	6.15	2.35	4.16	4.6	0.03	33.59
Foregate (Fos)	1.58	10.51	0.02	0.01	4.64	4.68	2.92	10.49	0.03	34.88
Fos2	1.01	6.68	0.02	0	2.95	2.98	1.86	6.67	0.02	22.19
The Butts (But2)	1.07	7.43	0.02	0.02	3.64	2.43	2.05	22.13	0.02	38.81
Bridge Street (BRS2)	2.16	15	0.08	0.01	6.95	1.48	4.02	4.82	0.05	34.57
The Cross (Bkc)	0.93	6.71	0.03	0.01	3.12	4.26	2.2	16.03	0.03	33.32
All Saints Road (DDASH)	1.73	11.97	0.02	0.01	4.72	1.19	3.97	7.03	0.04	30.68
Lowesmoor (Lwm1)	0.64	4.43	0.02	0.01	2.92	2.02	1.21	15.66	0.01	26.92
% Contribution to Total										
Site ID	Cars			LGVs		Taxis	HGVs	Buses	Motorcycles	Total
	Petrol	Diesel	Other	Petrol	Diesel					
Tything (Tyn)	6.4	41.9	0.2	0.10	18.3	7	12.4	13.7	0.10	100
Foregate (Fos)	4.53	30.12	0.07	0.02	13.3	13.41	8.37	30.08	0.09	99.99
Fos2	4.53	30.12	0.07	0.02	13.3	13.41	8.37	30.08	0.09	99.99
The Butts (But2)	2.76	19.15	0.04	0.04	9.37	6.26	5.29	57.03	0.05	99.99

Bridge Street (BRS2)	6.26	43.38	0.24	0.03	20.09	4.29	11.63	13.93	0.15	100
The Cross (Bkc)	2.79	20.15	0.1	0.01	9.36	12.79	6.6	48.1	0.1	100
All Saints Road (DDASH)	5.64	39.03	0.07	0.02	15.38	3.87	12.94	22.9	0.15	100
Lowesmoor (Lwm1)	2.37	16.44	0.09	0.01	10.84	7.51	4.5	58.19	0.05	100

Highest Contribution*, *Second*, *Third*, *Fourth

Table 4 illustrates the contributors to emissions within the study areas with background concentrations removed shown as a percentage and as micrograms per cubic metre (µg/m^3) for the remaining roadside concentrations. To help identify and rank the concentrations the greatest values are shown in red, the second highest in yellow, the third in green and the fourth in blue. The highest contributors are diesel cars in 5 of the study areas and buses in the other 3. Again, six of the second highest contributors are shown to be diesel cars and buses with the remaining two being diesel LGVs. The third largest comprise buses, LGV diesels and taxis, with the fourth highest contributor comprising the remaining diesel LGVs, taxis and HGVs. For clarity, the rankings are shown in the table below.

Table 5 – Breakdown of top contributions to emissions in each area

Site ID	First Largest Contributor (% / µg/m^3)	Second	Third	Fourth
The Tything (Tyn)	**Diesel Cars (41.9% / 14.07µg/m^3)**	**Diesel LGVs (18.3% / 6.15µg/m^3)**	**Buses (13.7% / 4.6µg/m^3)**	**HGVs (12.4% / 4.16µg/m^3)**
Foregate Street (Fos)	**Diesel Cars (30.12% / 10.51µg/m^3)**	**Buses (30.08 / 10.49µg/m^3)**	**Taxis (13.41% / 4.68µg/m^3)**	**Diesel LGVs (13.3% / 4.64µg/m^3)**
Foregate Street (Fos2)	**Diesel Cars (30.12% / 6.68µg/m^3)**	**Buses (30.08% / 6.67µg/m^3)**	**Taxi (13.41% / 2.98µg/m^3)**	**Diesel LGVs (13.3% / 2.95µg/m^3)**
The Butts (But2)	**Buses (57.03% / 22.13µg/m^3)**	**Diesel Cars (19.15% / 7.43µg/m^3)**	**Diesel LGVs (9.37% / 3.64µg/m^3)**	**Taxis (6.26% / 2.43µg/m^3)**
Bridge Street (BRS2)	**Diesel Cars (43.38% / 15µg/m^3)**	**Diesel LGVs (20.09% / 6.95µg/m^3)**	**Buses (13.93% / 4.82µg/m^3)**	**HGVs (11.63% / 4.02µg/m^3)**
The Cross (Bkc)	**Buses (48.1% / 16.03µg/m^3)**	**Diesel Cars (20.15% / 6.71µg/m^3)**	**Taxis (12.79% / 4.26µg/m^3)**	**Diesel LGVs (9.36% / 3.12µg/m^3)**
All Saints Road (DDASH)	**Diesel Cars (39.03% / 11.97µg/m^3)**	**Buses (22.09% / 7.03µg/m^3)**	**Diesel LGVs (15.38% / 4.72µg/m^3)**	**HGVs (12.94% / 3.97µg/m^3)**
Lowesmoor (Lwm1)	**Buses (58.19% / 15.66µg/m^3)**	**Diesel Cars (16.44% / 4.43µg/m^3)**	**Diesel LGVs (10.84% / 2.92µg/m^3)**	**Taxis (7.51% / 2.02µg/m^3)**

6.0 Required Improvements

The degree of improvement required to achieve the annual mean objective for nitrogen dioxide (NO_2) is the difference between the highest measured or predicted concentration and the objective level (40µg/m^3). For example, the highest nitrogen dioxide concentration at a representative location in the Tything study area in 2018 is 47.21µg/m^3 at Tyn, requiring a reduction of 7.21µg/m^3 for the objective to be met.

However Technical Guidance (LAQM.TG16) advises that in terms of the reduction in emissions required it is more useful to consider nitrogen oxides (NOx). Therefore, the road NOx reduction required for compliance with the national air quality objectives in the Tything at Tyn has been calculated in accordance with LAQM.TG16 Box 7.6 utilising Defra's NOx to NO_2 Conversion Spreadsheet v5.1. Calculations are included in Appendix C.

It is generally accepted that the revocation of an AQMA is not appropriate unless measured concentrations are consistently below the objective to avoid 'bouncing' between revocation and re-declaration of borderline AQMAs. Therefore, the reduction in NO_X required to achieve targets at 5% and 10% below the objective have also been calculated. Achieving these levels would provide greater confidence to the local authority that emissions of NO_2 are unlikely to exceed the objective again. A summary of the required reductions in NO_X and NO_2 to achieve concentrations of 36µg/m^3, 38µg/m^3 and 40µg/m^3 at the relevant monitoring locations are presented in Table 6 below.

Table 6 Required reduction in annual mean concentration at monitoring locations

Required reduction in NO_X/NO_2 concentrations at monitoring locations				
	Required reduction to: -	**Required NO_X reduction (µg/m^3)**	**Required NO_X reduction (% of local sources)**	**Equivalent NO_2 reduction (µg/m^3)**
The Tything (Tyn)	**Objective 40µg/m^3**	19.40	26.54	8.91
	5% below obj. 38µg/m^3	23.93	32.74	10.99
	10% below obj. 36µg/m^3	28.38	38.82	13.04
Foregate Street (Fos)	**Objective 40µg/m^3**	22.61	29.63	10.34
	5% below obj. 38µg/m^3	27.14	35.57	12.41
	10% below obj. 36µg/m^3	31.59	41.4	14.44
Foregate Street (Fos2)	**Objective 40µg/m^3**	n/a	n/a	n/a
	5% below obj. 38µg/m^3	n/a	n/a	n/a
	10% below obj. 36µg/m^3	1.81	3.89	0.86
The Butts (But2)	**Objective 40µg/m^3**	32.5	37.7	14.63
	5% below obj. 38µg/m^3	37.03	42.96	16.67
	10% below obj. 36µg/m^3	41.48	48.12	18.68
Bridge Street (BRS2)	**Objective 40µg/m^3**	20.72	27.79	9.61
	5% below obj. 38µg/m^3	25.27	33.89	11.72
	10% below obj. 36µg/m^3	29.73	39.87	13.79

The Cross (Bkc)	**Objective 40µg/m^3**	17.63	24.66	8.22
	5% below obj. 38µg/m^3	22.18	31.03	10.34
	10% below obj. 36µg/m^3	26.64	37.27	12.42
All Saints Road (DDASH)	**Objective 40µg/m^3**	11.19	17.2	5.28
	5% below obj. 38µg/m^3	15.74	24.2	7.42
	10% below obj. 36µg/m^3	20.20	31.06	9.53
Lowesmoor (Lwm1)	**Objective 40µg/m^3**	2.9	5.11	1.38
	5% below obj. 38µg/m^3	7.45	13.13	3.53
	10% below obj. 36µg/m^3	11.91	20.99	5.65

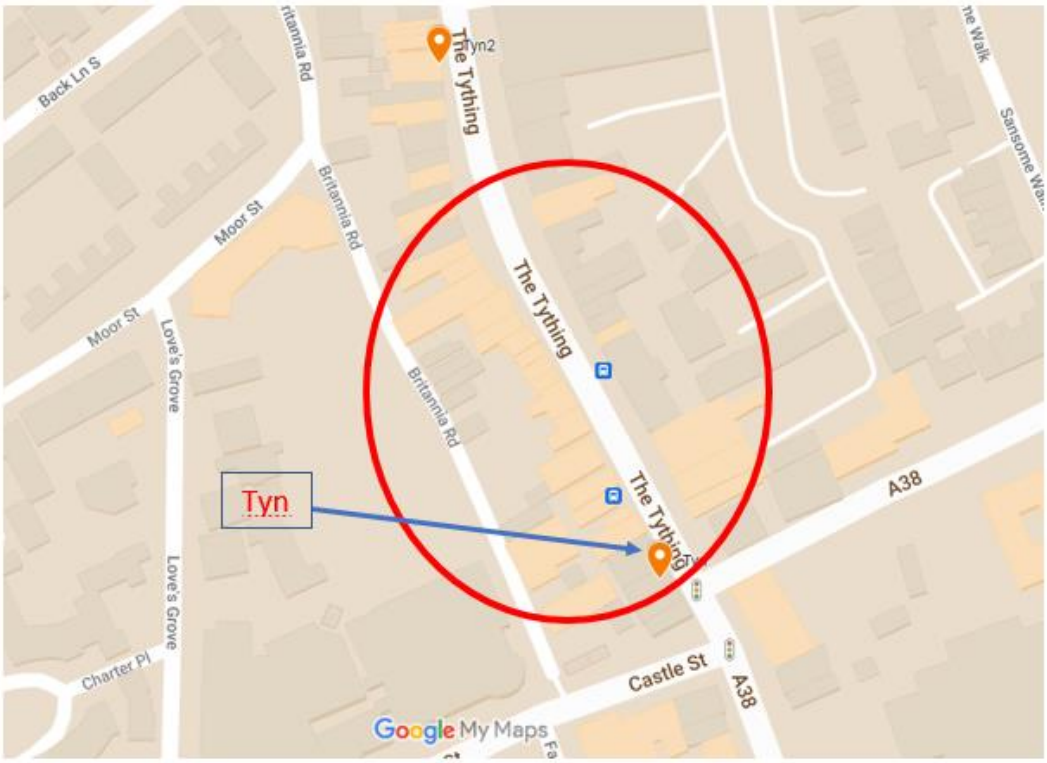
Table 6 indicates that the largest reduction of 37.7% in emissions, or 14.63µg/m^3, is required within the Butts study area (But2) to reduce level of NO_2 to the objective. The smallest reduction of 5.11%, or 1.38µg/m^3, is required at Lowesmoor (Lwm1). All other areas fall within that range bracket with the exception of Fos2 that already measures within the objective and therefore no reduction is required (although a 0.86 µg/m^3 decrease is required to be 10% below).

This report does not focus on how required reductions might be achieved. However, in order to inform the focus of potential measures for consideration as part of Action Plan development the information below demonstrates the reduction in emissions that could be expected to be achieved in each of the study areas, assuming stepped nominal emission reductions for each main vehicle category.

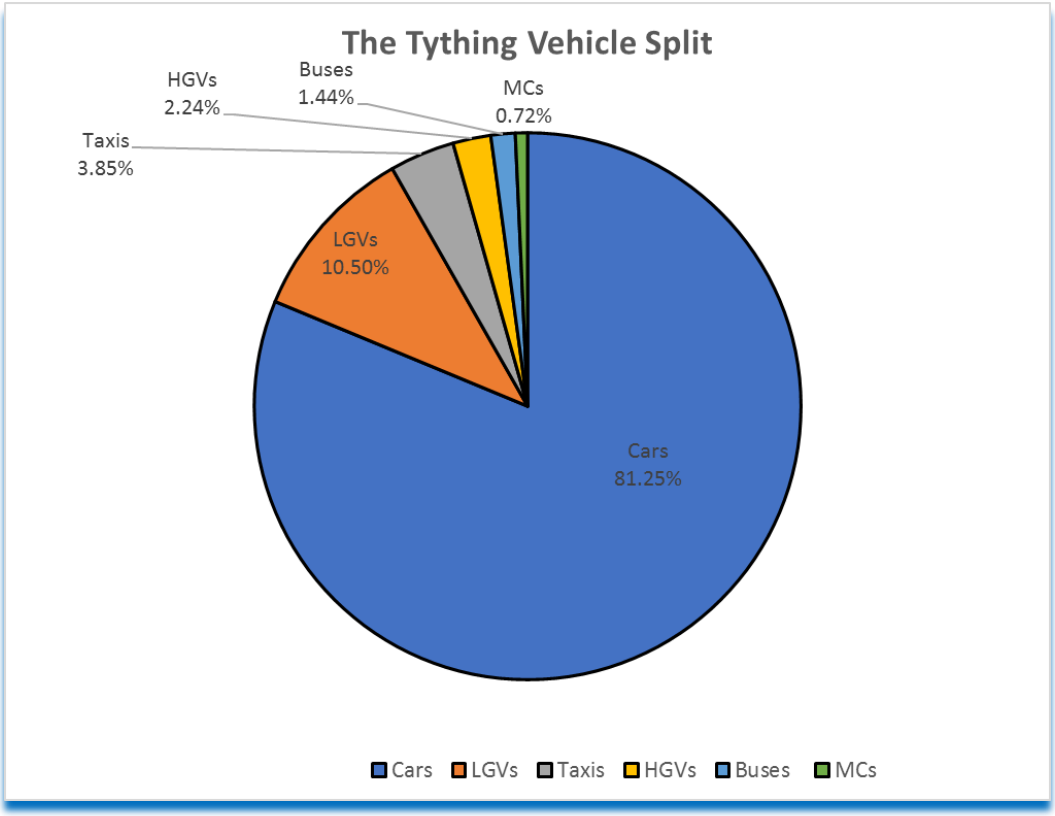
6.1 The Tything (Tyn)

The traffic data survey was undertaken along the Tything, north of St Mary's Street, taking account of north and south bound traffic on the 3rd March 2020. The plan below shows the study area and location of monitoring point Tyn.

Figure 2.1 The Tything (Tyn) Study Area



The traffic survey identified the following proportion of vehicles.



The emissions output based on traffic composition were then calculated and can be seen on the chart below..

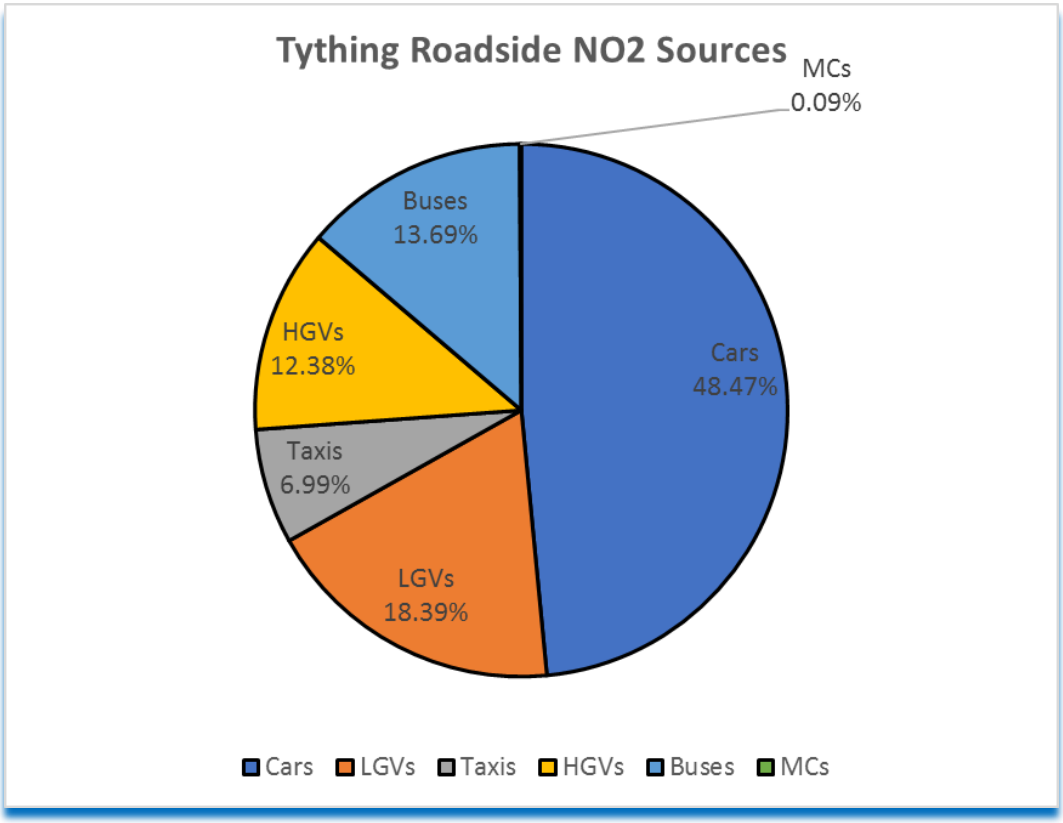


Table 6.1 Required reduction in annual mean concentration at Tyn

Tything Reduction in Emissions (µg/m3)											
Vehicle Type	Total Emissions	10% reduction	20% reduction	30% reduction	40% reduction	50% reduction	60% reduction	70% reduction	80% reduction	90% reduction	100% reduction
Cars	16.29	1.629	3.258	4.887	6.516	8.145	9.774	11.403	13.032	14.661	16.29
Taxis	2.35	0.235	0.47	0.705	0.94	1.175	1.41	1.645	1.88	2.115	2.35
LGVs	6.18	0.618	1.236	1.854	2.472	3.09	3.708	4.326	4.944	5.562	6.18
HGVs	4.16	0.416	0.832	1.248	1.664	2.08	2.496	2.912	3.328	3.744	4.16
Buses	4.6	0.46	0.92	1.38	1.84	2.3	2.76	3.22	3.68	4.14	4.6
MC	0.03	0.003	0.006	0.009	0.012	0.015	0.018	0.021	0.024	0.027	0.03
Total Vehicles	33.61	3.388	6.776	10.164	13.552	16.94	20.328	23.716	27.104	30.492	33.61

**reductions that would achieve the national objective of 40µg/m^3*
***reductions that would achieve 5% below the objective (38µg/m^3)*
****reductions that would achieve 10% below the objective (36µg/m^3)*

As indicated in table 6 previously a reduction of 8.91µg/m^3 or more would be required to meet the national objective, 10.99µg/m^3 for 5% below the objective, and 13.04µg/m^3 for 10% below.

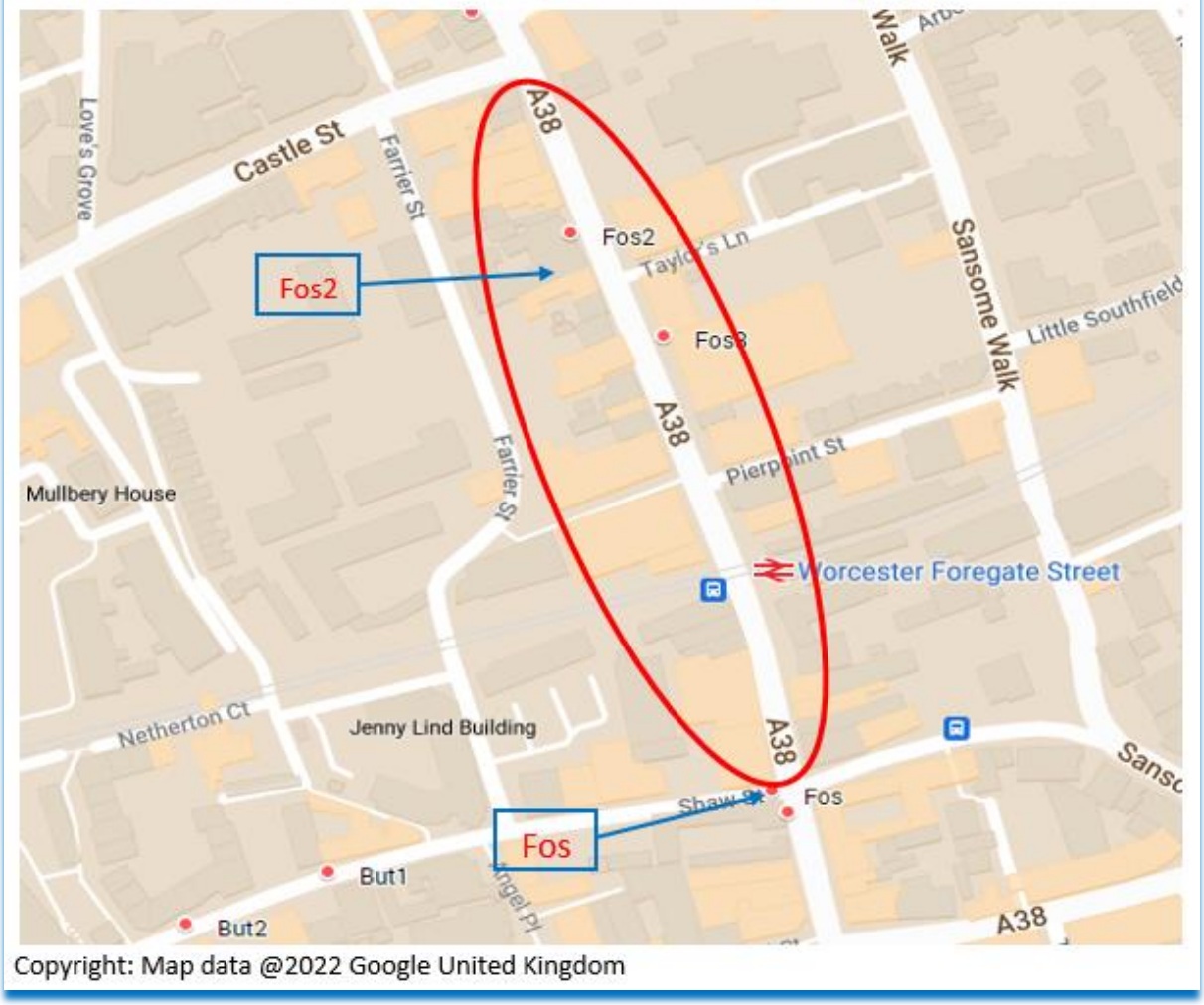
Table 6.1 demonstrates that to achieve the NO_2 results highlighted above reductions targeting individual types of vehicle in isolation within the Tything would not lead to the annual mean objective being achieved. Cars would be an exception to this but would require a very large reduction of 60% or more to fall below the objective.

Actions to improve emissions are likely needed to target more than one type of vehicle to achieve the desired reduction. Table 6.1 demonstrates that a reduction of 30% or more is required across all vehicle types to meet the objective.

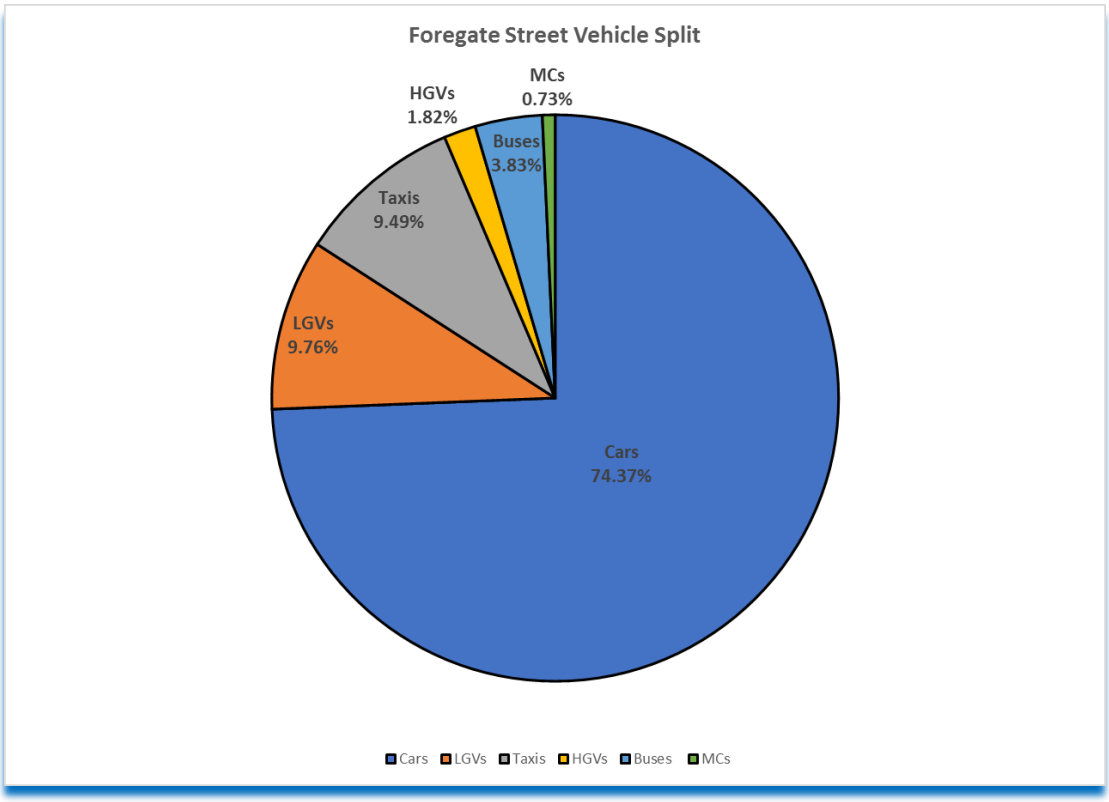
6.2 Foregate Street (Fos)

The traffic data survey was undertaken along Foregate Street, between Shaw Street and Castle Street, observing north and south bound traffic on the 10th March 2020. The plan below shows the study area and location of monitoring points Fos and Fos 2. Location Fos3 was not utilised as recorded concentrations are much lower.

Figure 2.2 The Foregate Street (Fos & Fos2) Study Area



The traffic survey showed the following proportion of vehicles within Foregate Street.



The emissions output based on traffic composition show the following roadside contributions.

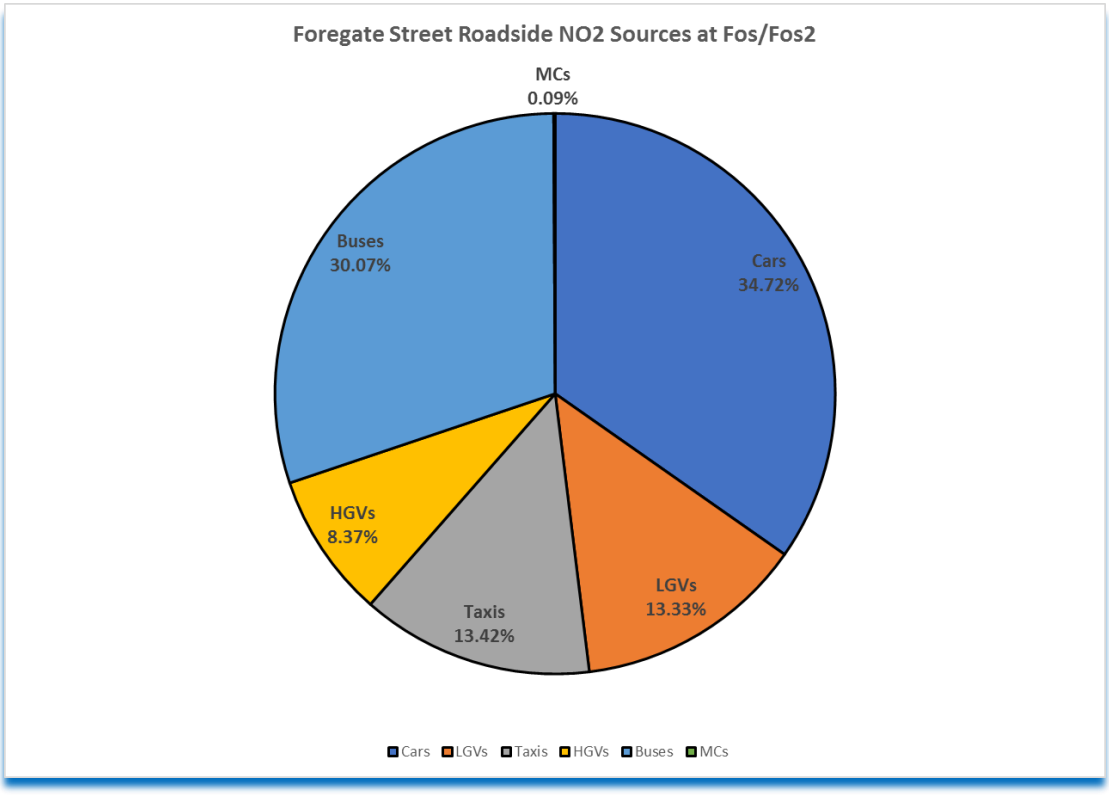


Table 6.2 Required reduction in annual mean concentration at Fos

Foregate (Fos) Reduction in Emissions (µg/m3)											
Vehicle Type	Total Emissions	10% reduction	20% reduction	30% reduction	40% reduction	50% reduction	60% reduction	70% reduction	80% reduction	90% reduction	100% reduction
Cars	12.11	1.211	2.422	3.633	4.844	6.055	7.266	8.477	9.688	10.899	12.11
Taxis	4.68	0.468	0.936	1.404	1.872	2.34	2.808	3.276	3.744	4.212	4.68
LGVs	4.65	0.465	0.93	1.395	1.86	2.325	2.79	3.255	3.72	4.185	4.65
HGVs	2.92	0.292	0.584	0.876	1.168	1.46	1.752	2.044	2.336	2.628	2.92
Buses	10.49	1.049	2.098	3.147	4.196	5.245	6.294	7.343	8.392	9.441	10.49
MC	0.03	0.003	0.006	0.009	0.012	0.015	0.018	0.021	0.024	0.027	0.03
Total Vehicles	34.88	3.488	6.976	10.464	13.952	17.44	20.928	24.416	27.904	31.392	34.88

**reductions that would achieve the national objective of 40µg/m^3*
***reductions that would achieve 5% below the objective (38µg/m^3)*
****reductions that would achieve 10% below the objective (36µg/m^3)*

As indicated in table 6 previously a reduction of 10.34µg/m^3 or more would be required to meet the national objective, 12.41µg/m^3 for 5% below the objective, and 14.44µg/m^3 for 10% below, based on concentrations recorded at monitoring location Fos.

Table 6.2 indicates that to achieve the NO_2 results highlighted above reductions targeting individual types of vehicle in isolation generally would not lead to the annual mean objective being achieved. The data indicates that a 90% or more reduction in the number of cars or 100% reduction in buses would be required to achieve the objective.

Actions to improve emissions are likely needed to target more than one vehicle type to achieve the desired reduction. Table 6.2 demonstrates that a reduction of 30% or more is required across all vehicle types to meet the objective, a 40% reduction would achieve concentrations 5% below the objective, and a 50% or more reduction would be necessary to achieve 10% below the objective.

The required reduction data has not been provided for location Fos2 as concentrations have been recorded below the objective.

6.3 The Butts (But2)

The traffic data survey was undertaken along the Butts with the traffic flowing east bound on the 12th March 2020. The plan below shows the study area and location of monitoring point But2. But2 was used instead of But1 due to the slightly higher concentrations being recorded at this location.

Figure 2.3 The Butts (But2) Study Area

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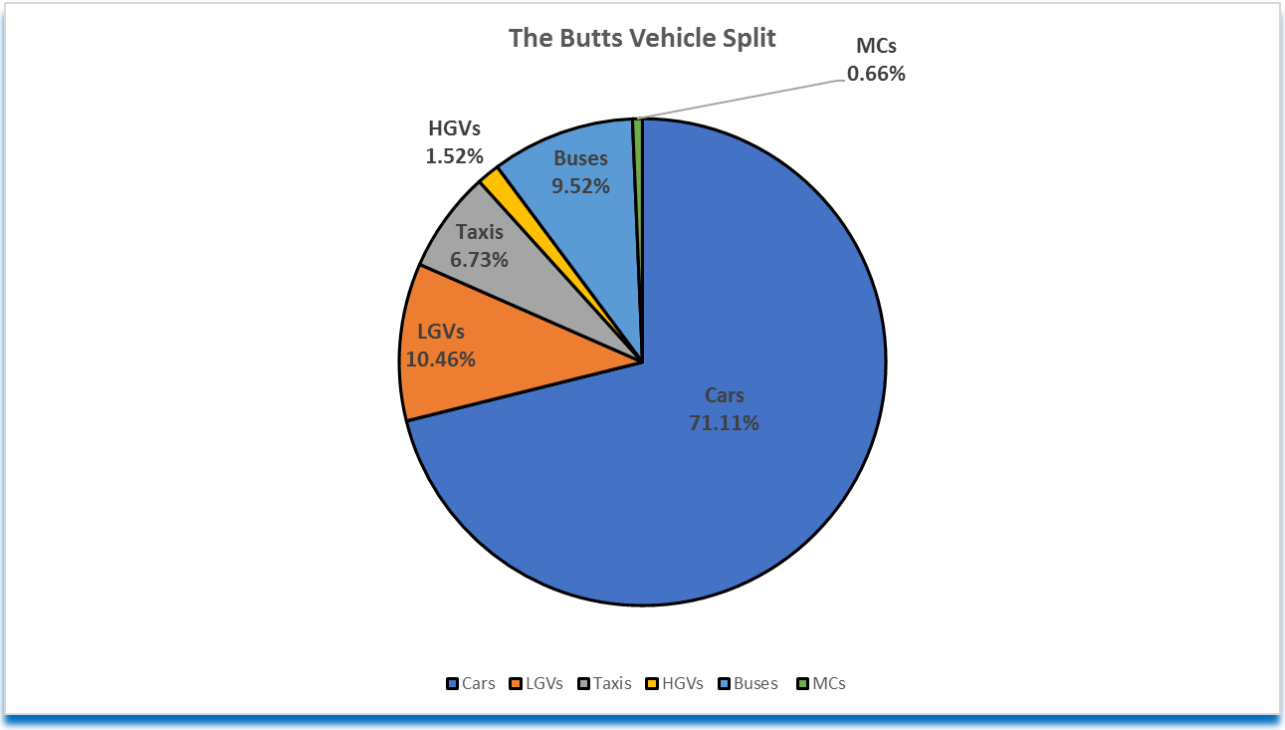
The traffic survey showed the following proportion of vehicles within the Butts.



The emissions output based on traffic composition show the following roadside contributions.

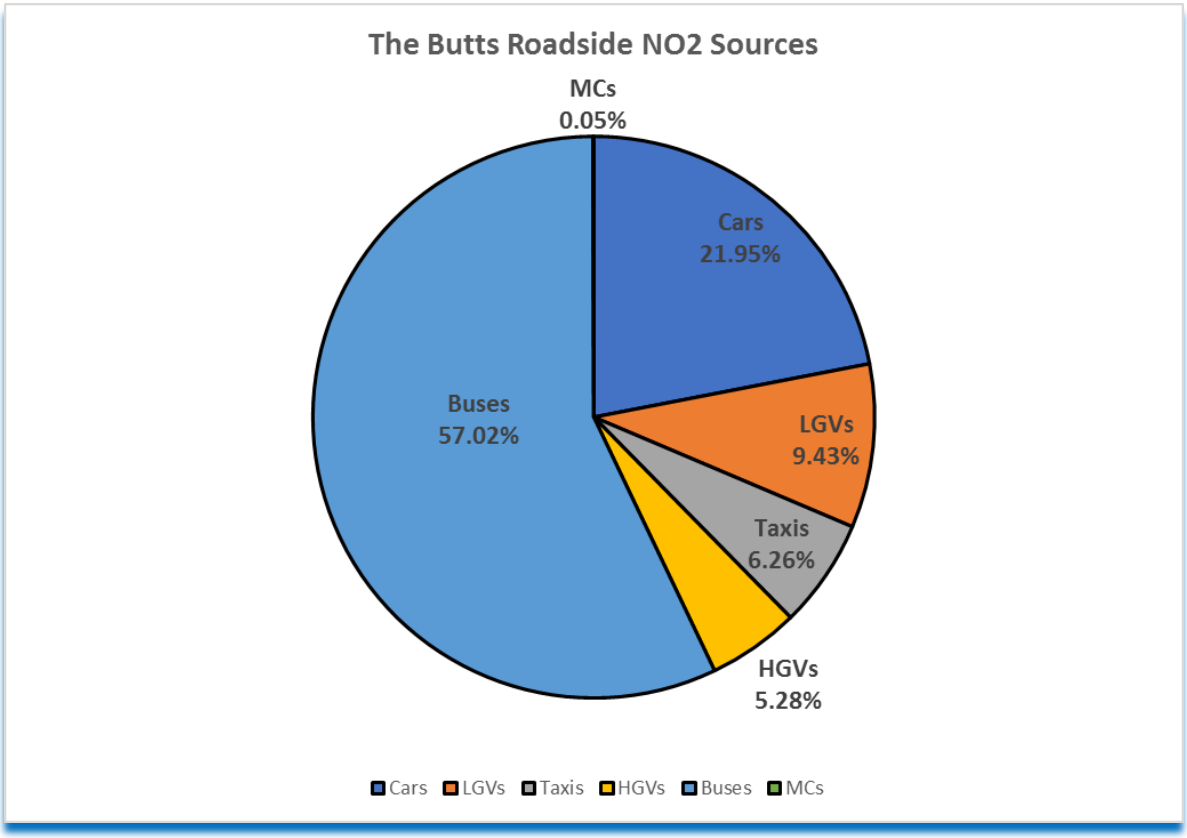


Table 6.3 Required reduction in annual mean concentration at But2

The Butts (But2) Reduction in Emissions (µg/m3)											
Vehicle Type	Total Emissions	10% reduction	20% reduction	30% reduction	40% reduction	50% reduction	60% reduction	70% reduction	80% reduction	90% reduction	100% reduction
Cars	8.52	0.852	1.704	2.556	3.408	4.26	5.112	5.964	6.816	7.668	8.52
Taxis	2.43	0.243	0.486	0.729	0.972	1.215	1.458	1.701	1.944	2.187	2.43
LGVs	3.66	0.366	0.732	1.098	1.464	1.83	2.196	2.562	2.928	3.294	3.66
HGVs	2.05	0.205	0.41	0.615	0.82	1.025	1.23	1.435	1.64	1.845	2.05
Buses	22.13	2.213	4.426	6.639	8.852	11.065	13.278	**15.491**	**17.704**	**19.917**	**22.13**
MC	0.02	0.002	0.004	0.006	0.008	0.01	0.012	0.014	0.016	0.018	0.02
Total Vehicles	38.81	3.881	7.762	11.643	**15.524**	**19.405**	**23.286**	**27.167**	**31.048**	**34.929**	**38.81**

**reductions that would achieve the national objective of 40µg/m^3*
***reductions that would achieve 5% below the objective (38µg/m^3)*
****reductions that would achieve 10% below the objective (36µg/m^3)*

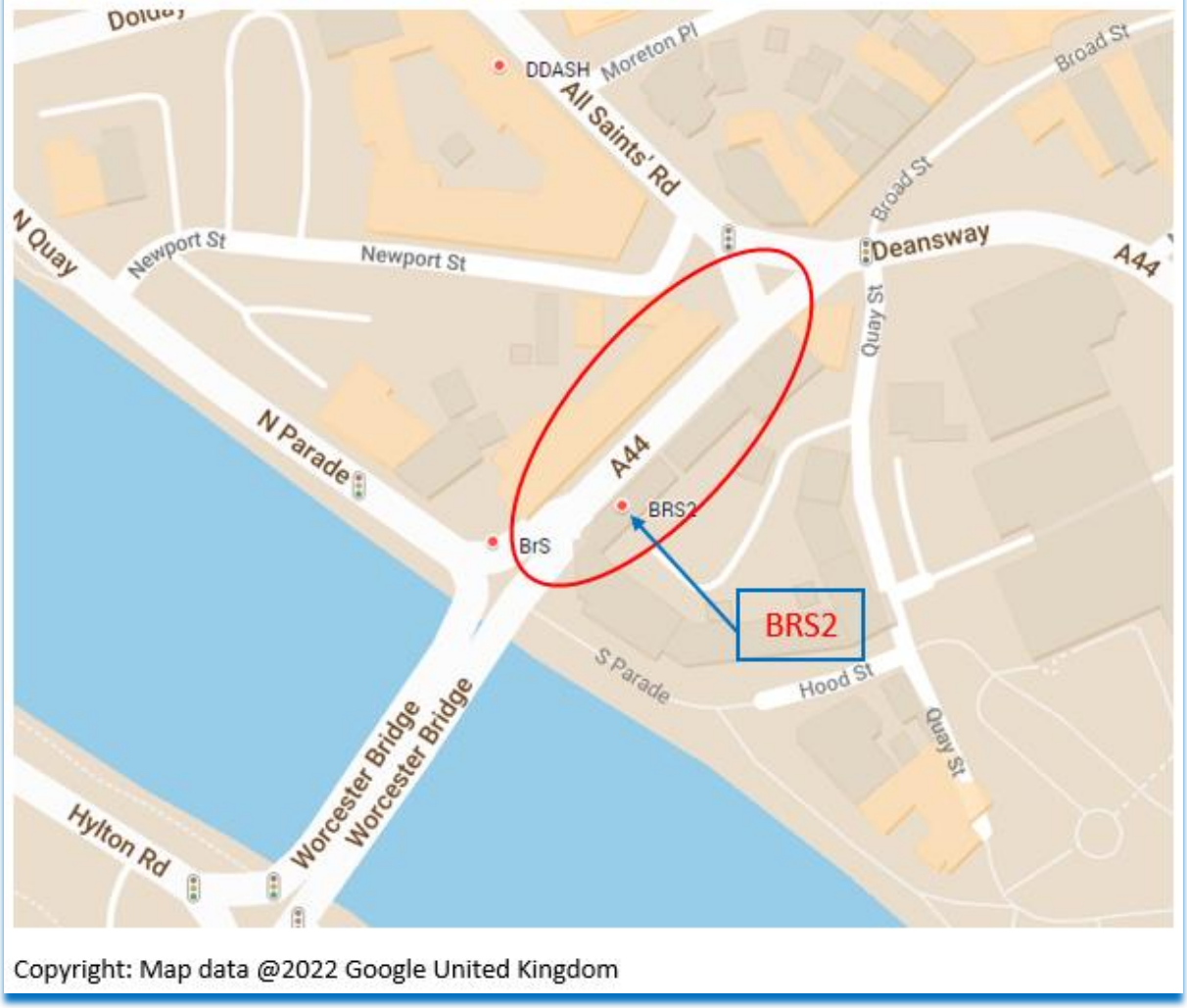
As indicated in table 6 previously a reduction of 14.63µg/m^3 would be required to meet the national objective, 16.67µg/m^3 for 5% below the objective, and 18.68µg/m^3 for 10% below, based on concentrations recorded at monitoring location But2.

Table 6.3 above demonstrates that it would require a large reduction of 70% or more in bus emissions to meet the annual mean objective. Actions to improve emissions are therefore likely needed to target more than one vehicle type to achieve the desired reduction. A reduction of 40% or more is required across all vehicle types to meet the objective, a 50% reduction would achieve concentrations 10% below the objective.

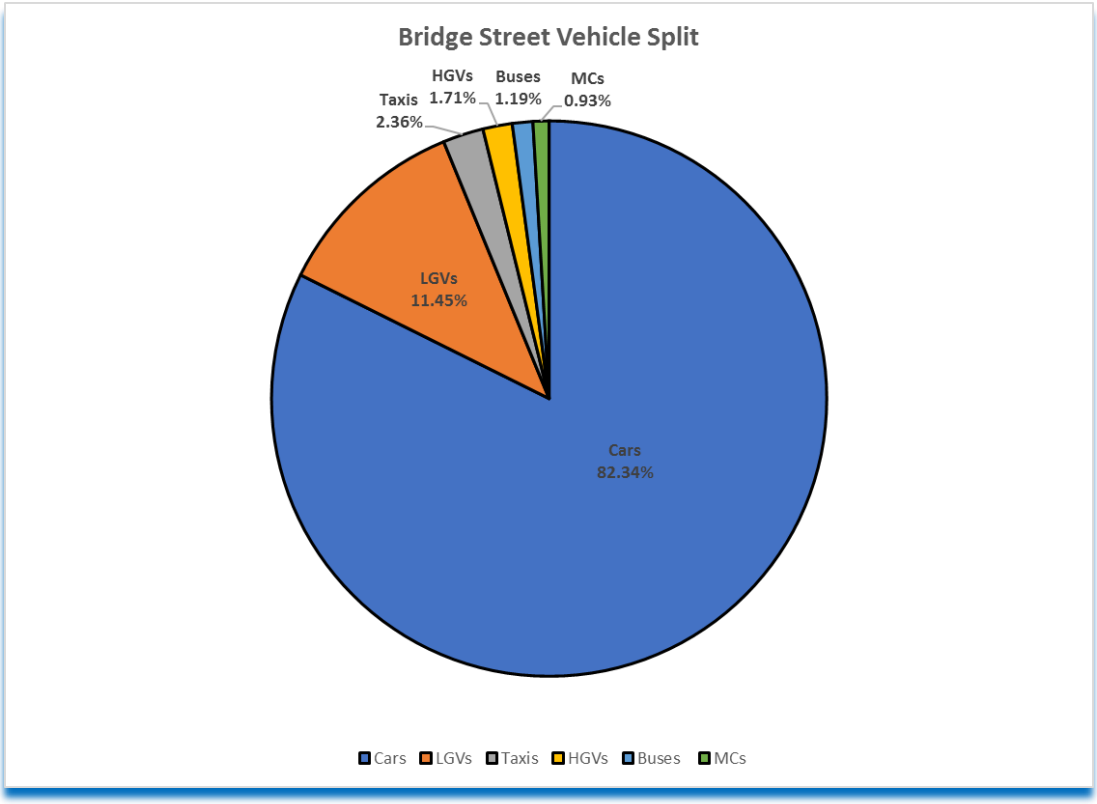
6.4 Bridge Street (BRS2)

The traffic data survey was undertaken along Bridge Street on the 11th November 2021 observing traffic travelling southbound along the one-way section of road. The plan below shows the study area and location of monitoring point BRS2.

Figure 2.4 Bridge Street (BRS2) Study Area



The traffic survey showed the following split of vehicles within Bridge Street.



The emissions output based on traffic composition show the following roadside contributions.

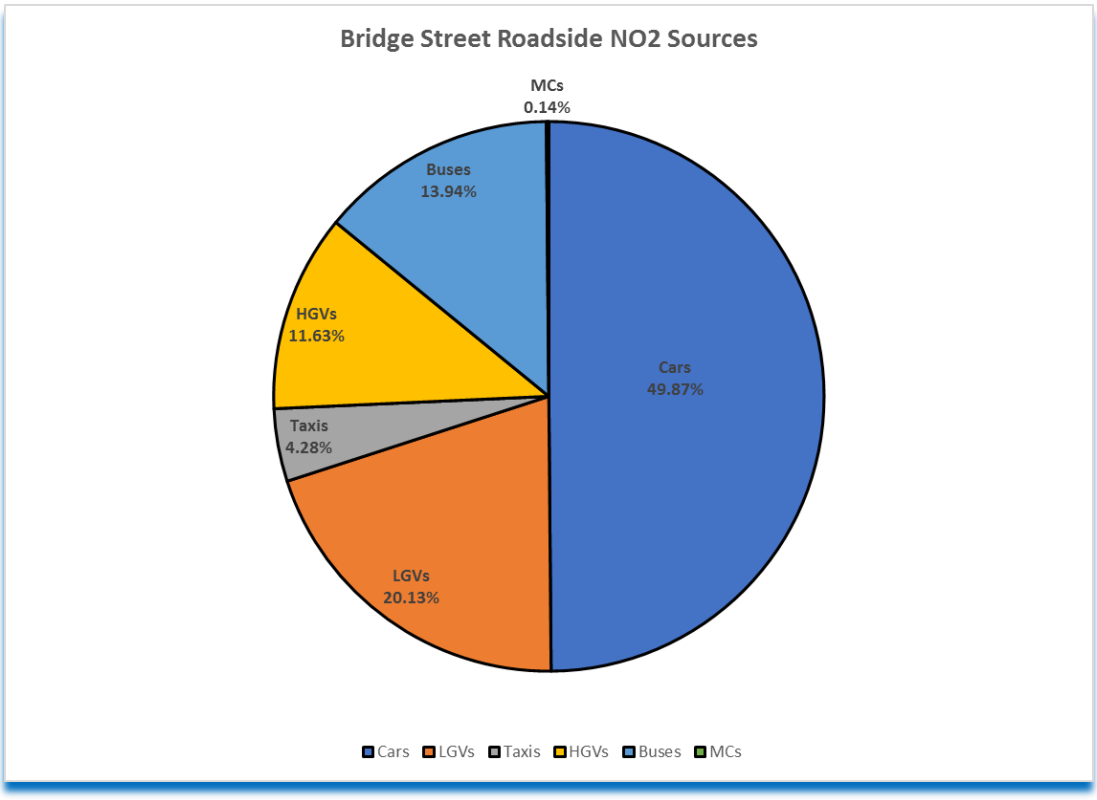


Table 6.4 Required reduction in annual mean concentration at BRS2

Bridge Street (BRS2) Reduction in Emissions (µg/m3)											
Vehicle Type	Total Emissions	10% reduction	20% reduction	30% reduction	40% reduction	50% reduction	60% reduction	70% reduction	80% reduction	90% reduction	100% reduction
Cars	17.24	1.724	3.448	5.172	6.896	8.62	**10.344**	**12.068**	**13.792**	**15.516**	**17.24**
Taxis	1.48	0.148	0.296	0.444	0.592	0.74	0.888	1.036	1.184	1.332	1.48
LGVs	6.96	0.696	1.392	2.088	2.784	3.48	4.176	4.872	5.568	6.264	6.96
HGVs	4.02	0.402	0.804	1.206	1.608	2.01	2.412	2.814	3.216	3.618	4.02
Buses	4.82	0.482	0.964	1.446	1.928	2.41	2.892	3.374	3.856	4.338	4.82
MC	0.05	0.005	0.01	0.015	0.02	0.025	0.03	0.035	0.04	0.045	0.05
Total Vehicles	34.57	3.457	6.914	**10.371**	**13.828**	**17.285**	**20.742**	**24.199**	**27.656**	**31.113**	**34.57**

**reductions that would achieve the national objective of 40µg/m^3*
***reductions that would achieve 5% below the objective (38µg/m^3)*
****reductions that would achieve 10% below the objective (36µg/m^3)*

Table 6 previously highlighted that a reduction of 9.61µg/m^3 would be required to meet the national objective, 11.72µg/m^3 for 5% below the objective, and 13.79µg/m^3 for 10% below, based on concentrations monitored at location BRS2.

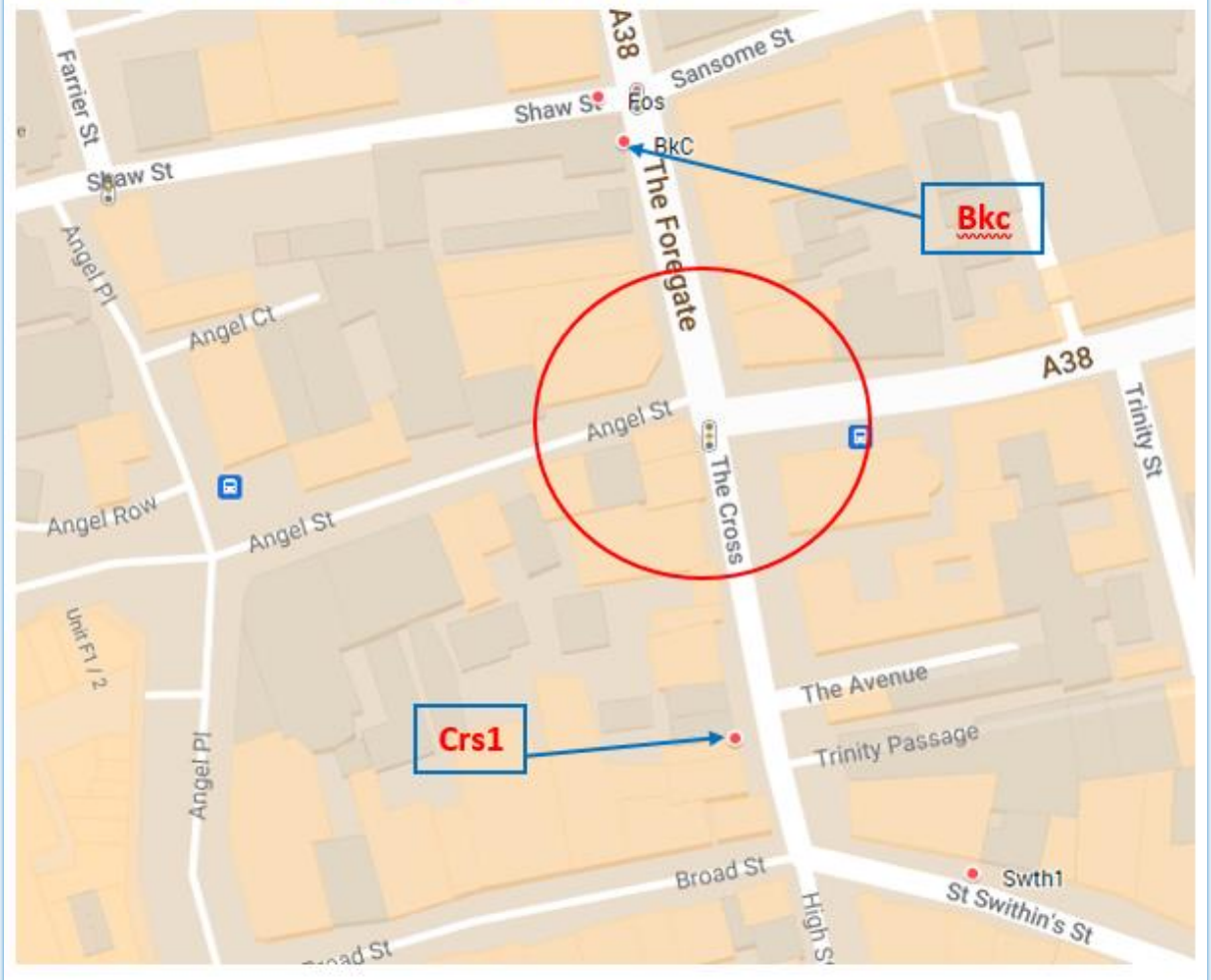
Table 6.4 indicates that to achieve the NO_2 results highlighted above reductions targeting individual types of vehicle in isolation generally would not lead to the annual mean objective being achieved. The data indicates that a 60% or more reduction in the number of cars would be required to meet the objective.

Actions to improve emissions are therefore likely needed to target more than one vehicle type to achieve the desired reduction. Table 6.4 demonstrates that a reduction of 30% or more is required across all vehicle types to meet the objective, a 40% or greater reduction would achieve concentrations 10% below the objective.

6.5 The Cross (Bkc)

The traffic data survey was undertaken at the Cross on the 11th November 2021 observing traffic utilising the crossroads, consisting of The Foregate, St Nicholas Street, The Cross and Angel Street. Figure 2.5 below shows the study area and location of monitoring points Bkc and Crs1. Monitoring location Bkc was utilised within the study as it is located slightly closer to the crossroads than Crs and has recorded higher concentrations of NO_2. Given these factors Bkc was considered the most representative monitoring location.

Figure 2.5 The Cross (Bkc) Study Area



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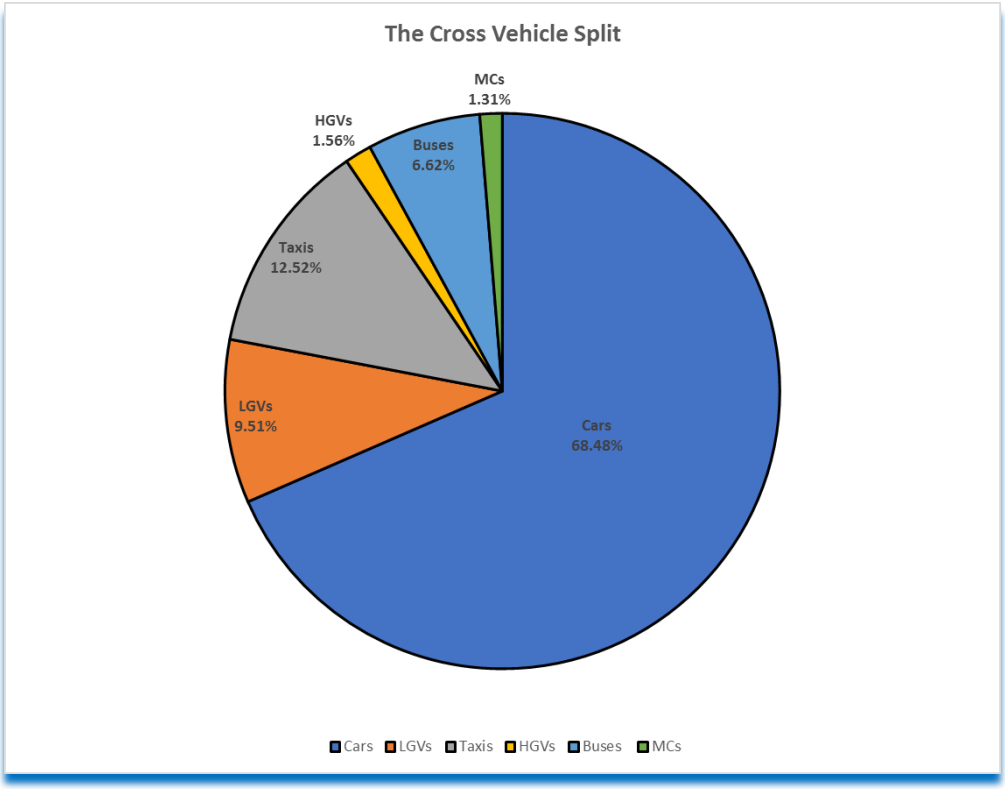
The traffic survey showed the following proportion of vehicles within the Cross.



The emissions output based on traffic composition show the following roadside contributions.

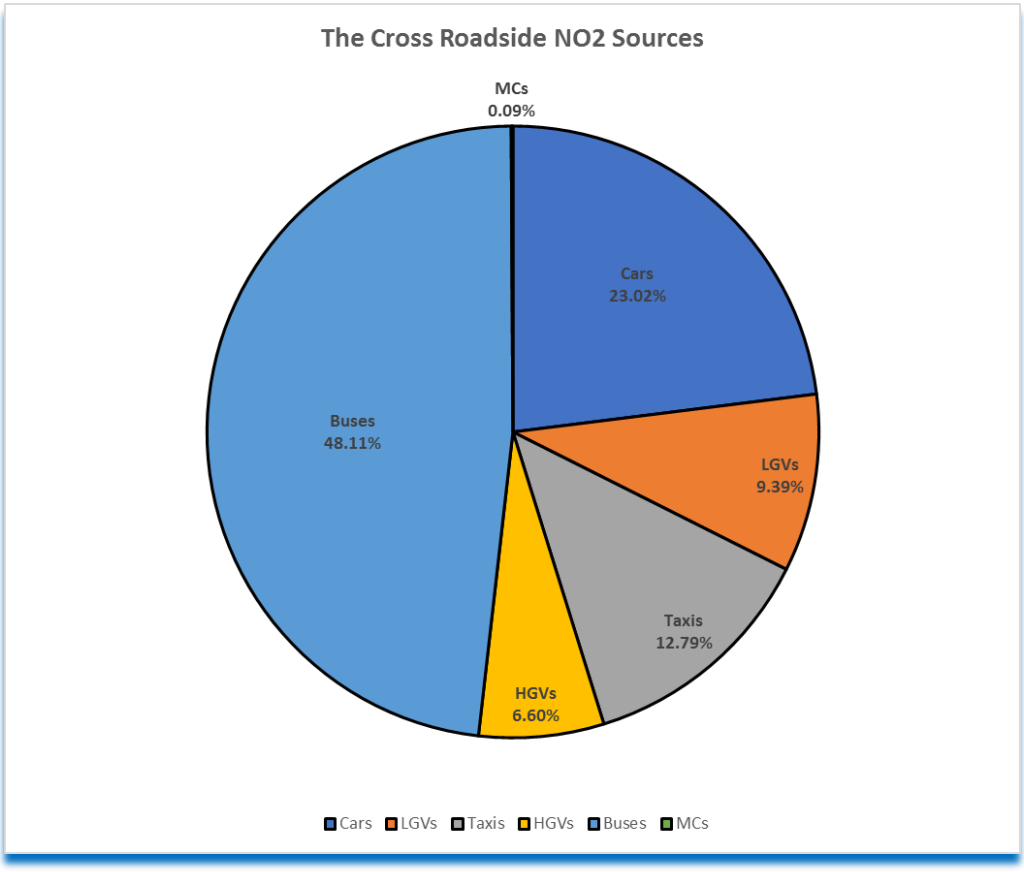


Table 6.5 Required reduction in annual mean concentration at Bkc

The Cross (Bkc) Reduction in Emissions (µg/m3)											
Vehicle Type	Total Emissions	10% reduction	20% reduction	30% reduction	40% reduction	50% reduction	60% reduction	70% reduction	80% reduction	90% reduction	100% reduction
Cars	7.67	0.767	1.534	2.301	3.068	3.835	4.602	5.369	6.136	6.903	7.67
Taxis	4.26	0.426	0.852	1.278	1.704	2.13	2.556	2.982	3.408	3.834	4.26
LGVs	3.13	0.313	0.626	0.939	1.252	1.565	1.878	2.191	2.504	2.817	3.13
HGVs	2.2	0.22	0.44	0.66	0.88	1.1	1.32	1.54	1.76	1.98	2.2
Buses	16.03	1.603	3.206	4.809	6.412	8.015	**9.618**	**11.221**	**12.824**	**14.427**	**16.03**
MC	0.03	0.003	0.006	0.009	0.012	0.015	0.018	0.021	0.024	0.027	0.03
Total Vehicles	33.32	3.332	6.664	**9.996**	**13.328**	**16.66**	**19.992**	**23.324**	**26.656**	**29.988**	**33.32**

**reductions that would achieve the national objective of 40µg/m^3*
***reductions that would achieve 5% below the objective (38µg/m^3)*
****reductions that would achieve 10% below the objective (36µg/m^3)*

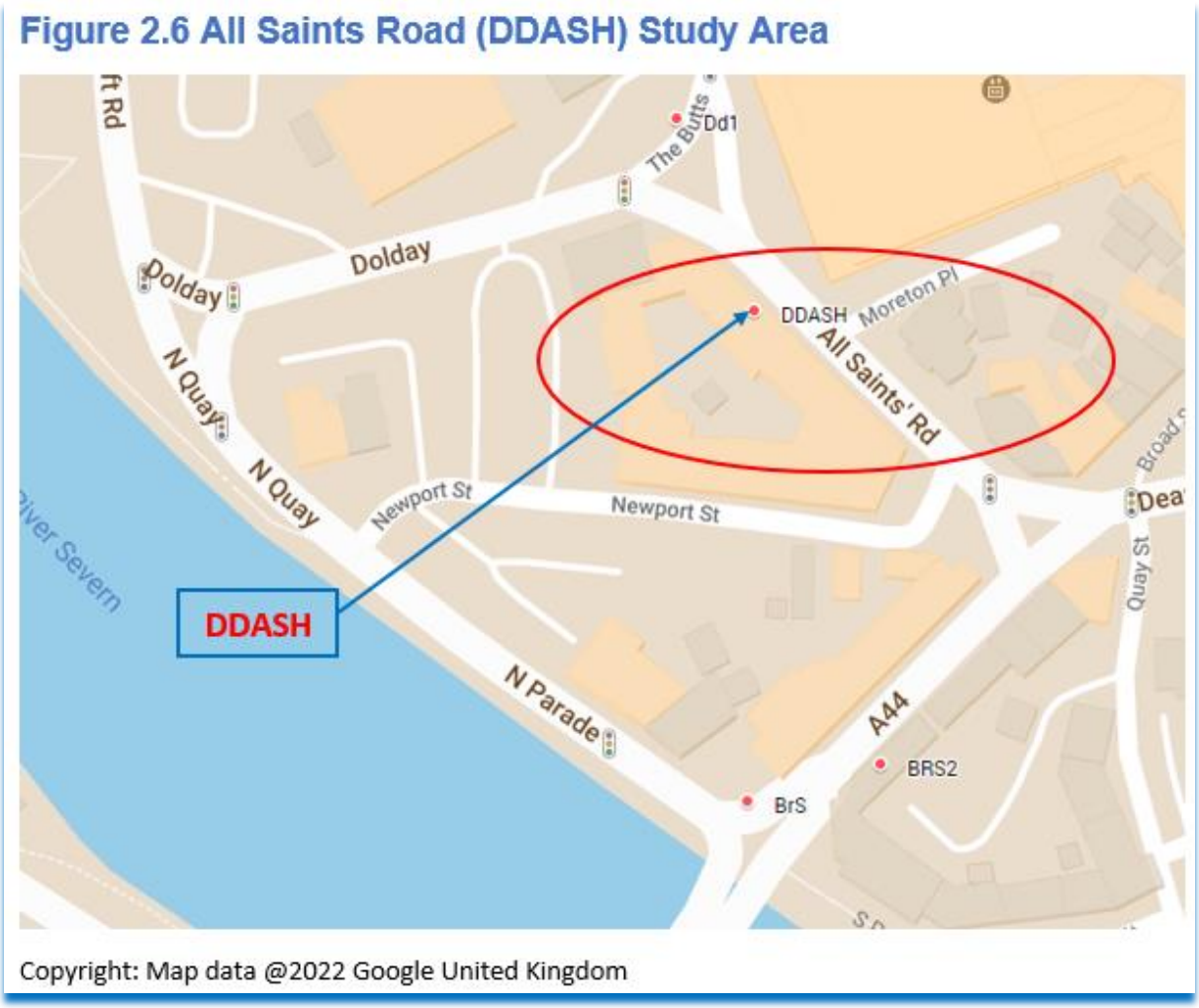
As indicated in table 6 previously a reduction of 8.22µg/m^3 would be required to meet the national objective, 10.34µg/m^3 for 5% below the objective, and 12.42µg/m^3 to achieve 10% below, based on concentrations recorded at monitoring location Bkc.

Table 6.5 above indicates that a reduction in bus emissions of 60% or more would be needed to meet the annual mean objective. Actions to improve emissions are therefore likely needed to target more than one vehicle type to achieve the desired reduction. A reduction of 30% is required across all vehicle types to meet the objective, a 40% or greater reduction would achieve concentrations 10% below the objective.

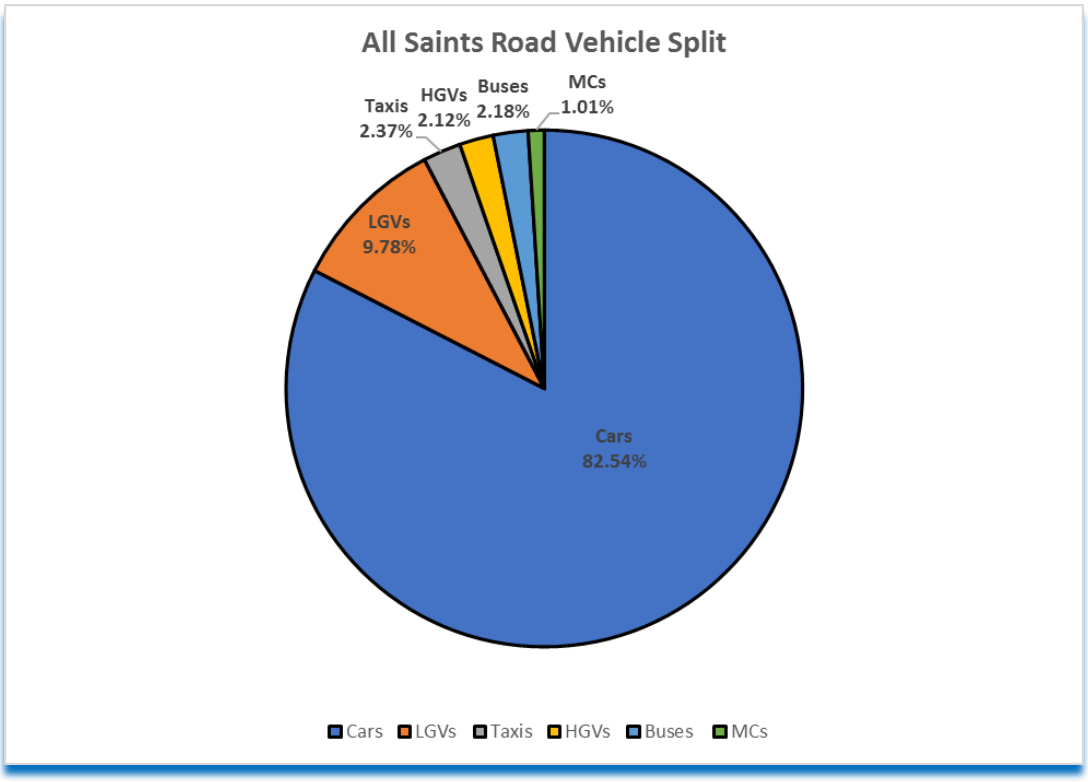
6.6 All Saints Road (DDASH)

The traffic data survey was undertaken along the one-way All Saints Road on the 11th November 2021. Figure 2.6 below shows the study area and location of monitoring point DDASH.

Figure 2.6 All Saints Road (DDASH) Study Area



The traffic survey showed the following proportion of vehicles on All Saints Road.



The emissions output based on traffic composition show the following roadside contributions.

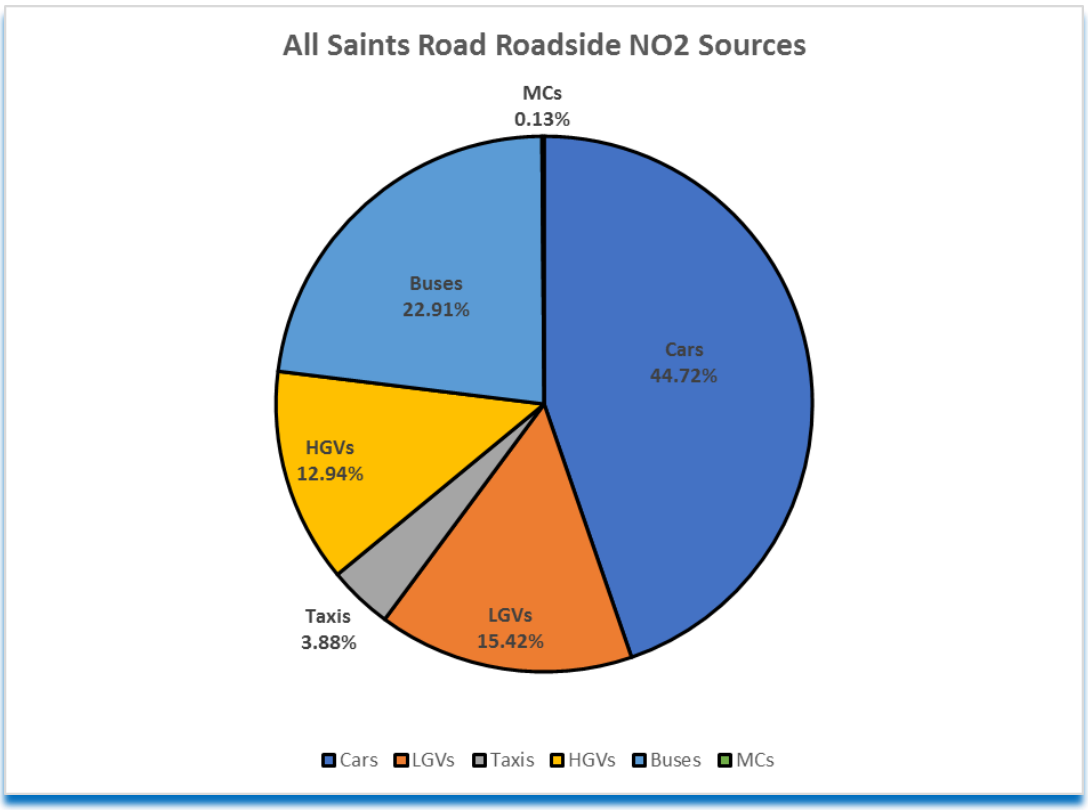


Table 6.6 Required reduction in annual mean concentration at DDASH

All Saints Road (DDASH) Reduction in Emissions (µg/m3)											
Vehicle Type	Total Emissions	10% reduction	20% reduction	30% reduction	40% reduction	50% reduction	60% reduction	70% reduction	80% reduction	90% reduction	100% reduction
Cars	13.72	1.372	2.744	4.116	**5.488**	**6.86**	**8.232**	**9.604**	**10.976**	**12.348**	**13.72**
Taxis	1.19	0.119	0.238	0.357	0.476	0.595	0.714	0.833	0.952	1.071	1.19
LGVs	4.73	0.473	0.946	1.419	1.892	2.365	2.838	3.311	3.784	4.257	4.73
HGVs	3.97	0.397	0.794	1.191	1.588	1.985	2.382	2.779	3.176	3.573	3.97
Buses	7.03	0.703	1.406	2.109	2.812	3.515	4.218	4.921	**5.624**	**6.327**	**7.03**
MC	0.04	0.004	0.008	0.012	0.016	0.02	0.024	0.028	0.032	0.036	0.04
Total Vehicles	30.68	3.068	**6.136**	**9.204**	**12.272**	**15.34**	**18.408**	**21.476**	**24.544**	**27.612**	**30.68**

**reductions that would achieve the national objective of 40µg/m^3*
***reductions that would achieve 5% below the objective (38µg/m^3)*
****reductions that would achieve 10% below the objective (36µg/m^3)*

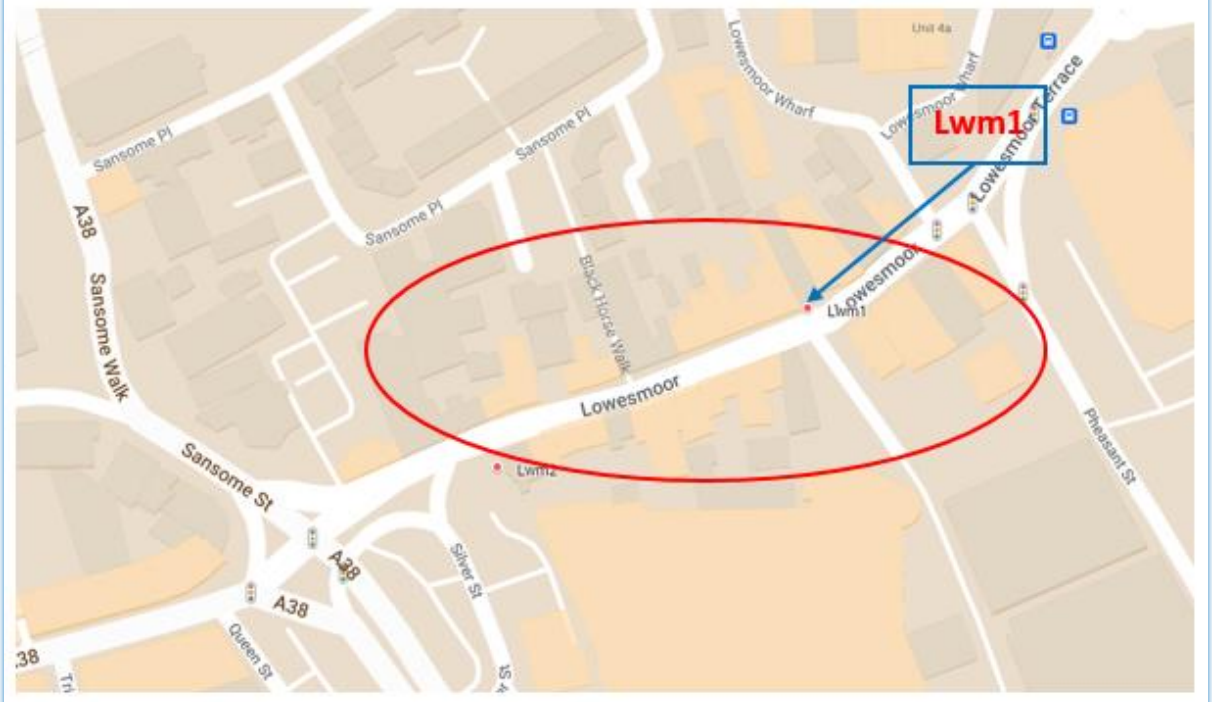
As previously highlighted a reduction of 5.28µg/m^3 or more would be required to meet the national objective, 7.42µg/m^3 for 5% below the objective, and 9.53µg/m^3 for 10% below, based on concentrations monitored at location DDASH..

Table 6.6 above indicates that a 40% or more reduction in the number of cars or 80% reduction in buses would be required to achieve the objective. A 20% reduction across all vehicle types is needed to meet the objective, a 30% reduction would achieve concentrations 5% below the objective, and a 40% or more reduction would be necessary to reach 10% below the objective. Unlike many of the study areas the data from All Saints Road indicates that the required reductions could be achieved by targeting various combinations of two or more categories.

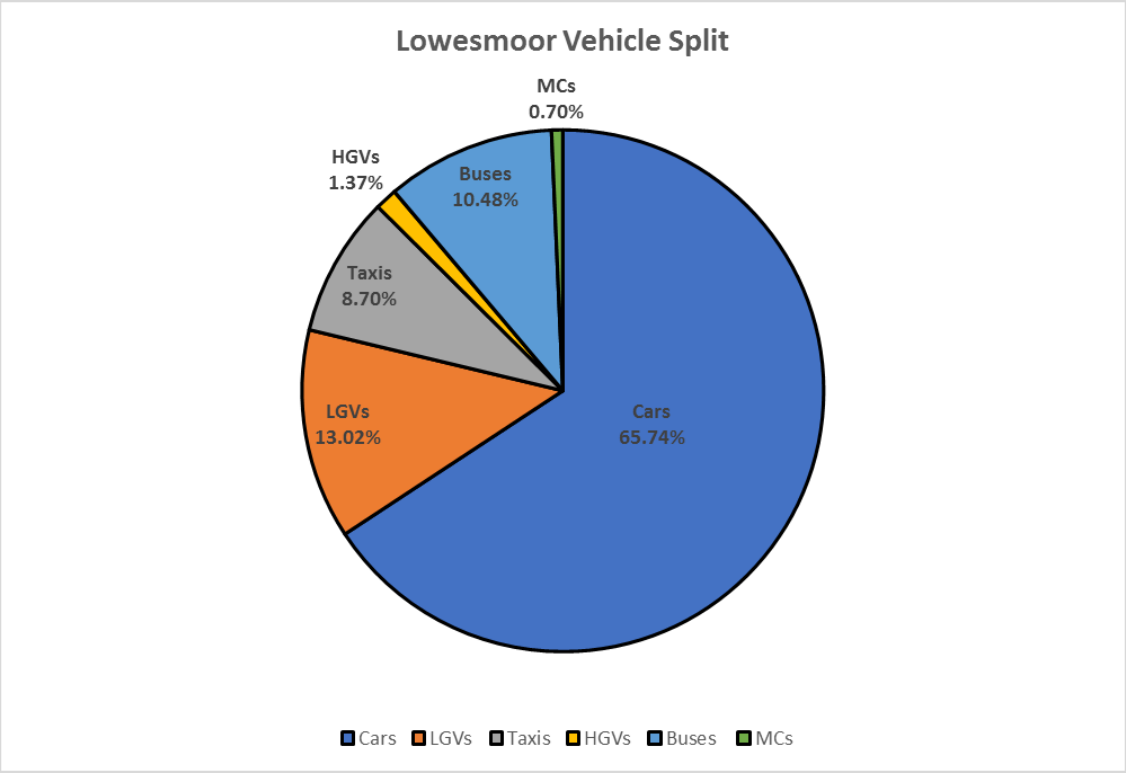
6.7 Lowesmoor (Lwm1)

The traffic data survey was undertaken within Lowesmoor on the 11th November 2021 observing traffic travelling westbound and eastbound. Figure 2.7 below shows the study area and location of monitoring point Lwm1. Monitoring location Lwm1 was utilised within the study as the recorded concentrations have been consistently higher than Lwm2 and therefore is the most representative monitoring location.

Figure 2.7 Lowesmoor (Lwm1) Study Area



The traffic survey showed the following proportion of vehicles in Lowesmoor.



The emissions output based on traffic composition show the following roadside contributions.

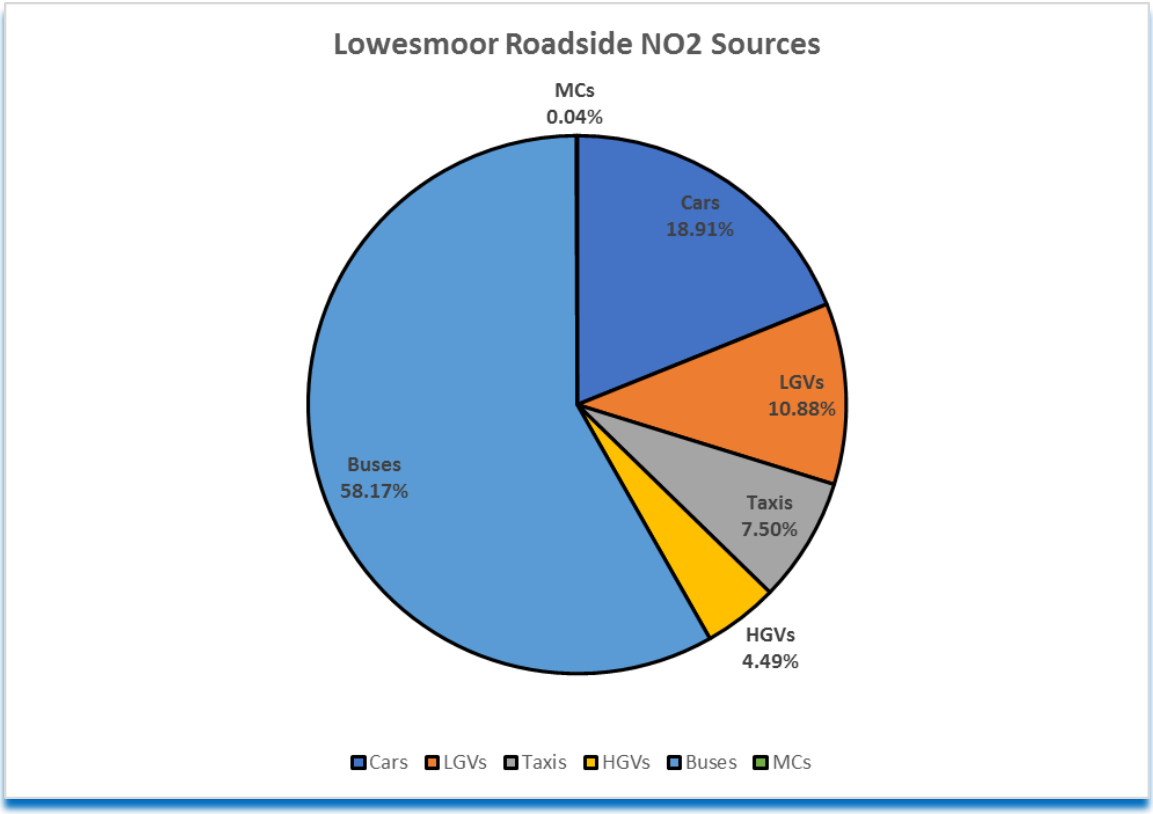


Table 6.7 Required reduction in annual mean concentration at Lwm1

Lowesmoor (Lwm1) Reduction in Emissions (µg/m3)											
Vehicle Type	Total Emissions	10% reduction	20% reduction	30% reduction	40% reduction	50% reduction	60% reduction	70% reduction	80% reduction	90% reduction	100% reduction
Cars	5.09	0.509	1.018	**1.527**	**2.036**	**2.545**	**3.054**	**3.563**	**4.072**	**4.581**	**5.09**
Taxis	2.02	0.202	0.404	0.606	0.808	1.01	1.212	**1.414**	**1.616**	**1.818**	**2.02**
LGVs	2.93	0.293	0.586	0.879	1.172	**1.465**	**1.758**	**2.051**	**2.344**	**2.637**	**2.93**
HGVs	1.21	0.121	0.242	0.363	0.484	0.605	0.726	0.847	0.968	1.089	1.21
Buses	15.66	**1.566**	**3.132**	**4.698**	**6.264**	**7.83**	**9.396**	**10.962**	**12.528**	**14.094**	**15.66**
MC	0.01	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.01
Total Vehicles	26.92	**2.692**	**5.384**	**8.076**	**10.768**	**13.46**	**16.152**	**18.844**	**21.536**	**24.228**	**26.92**

**reductions that would achieve the national objective of 40µg/m^3*
***reductions that would achieve 5% below the objective (38µg/m^3)*
****reductions that would achieve 10% below the objective (36µg/m^3)*

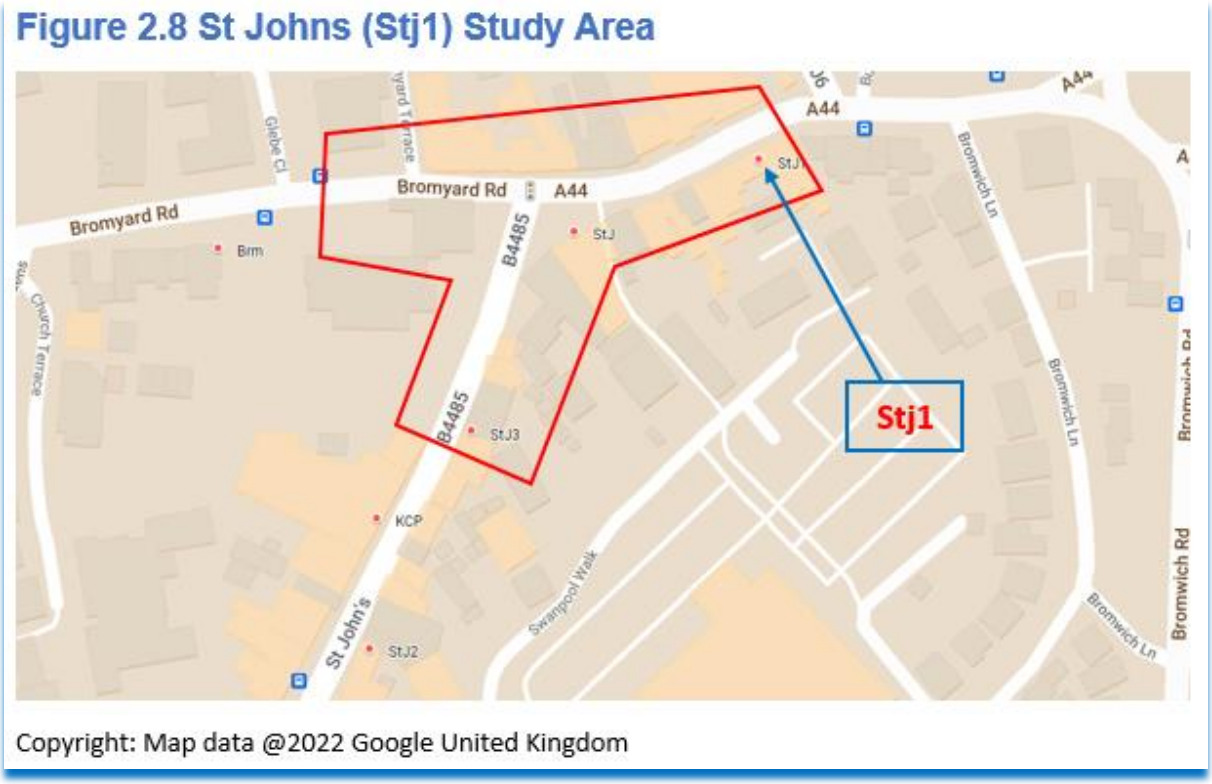
As previously highlighted in Table 6 a reduction of 1.38µg/m^3 or more would be required to meet the national objective, 3.53µg/m^3 for 5% below the objective, and 5.65µg/m^3 for 10% below, based on concentrations monitored at location Lwm1.

Table 6.7 above indicates that a 10% or more reduction in bus emissions, 30% or more reduction in cars, or a 50% reduction in LGVs would satisfy the objective. A 10% reduction across all vehicle types would meet the objective, a 20% reduction would achieve concentrations 5% below the objective, and a 30% or more reduction would achieve 10% below the objective. Unlike many of the other study areas the reduction required to meet the target in Lowesmoor is relatively small and therefore could be achieved by various combinations of categories or the individual vehicle types mentioned previously.

6.8 St Johns (Stj1)

A source apportionment exercise was undertaken by WRS in 2017 and has not been repeated as part of the more recent studies. The study site including monitoring locations is shown on the plan below.

Figure 2.8 St Johns (Stj1) Study Area



The nominal reductions per vehicle type for emissions at the most representative monitoring location Stj1, are shown in table 6.8 below.

Table 6.8 Required reduction in annual mean concentration at Stj1

St Johns (Stj1) Reduction in Emissions (µg/m3)											
Vehicle Type	Total Emissions	10% reduction	20% reduction	30% reduction	40% reduction	50% reduction	60% reduction	70% reduction	80% reduction	90% reduction	100% reduction
Cars	11.6	1.16	2.32	3.48	4.64	5.8	6.96	8.12	9.28	10.44	11.6
LGVs	3.3	0.33	0.66	0.99	1.32	1.65	1.98	2.31	2.64	2.97	3.3
HGVs	3.1	0.31	0.62	0.93	1.24	1.55	1.86	2.17	2.48	2.79	3.1
Buses	10.3	1.03	2.06	3.09	4.12	5.15	6.18	7.21	8.24	9.27	10.3
Total Vehicles	28.3	2.83	5.66	8.49	11.32	14.15	16.98	19.81	22.64	25.47	28.3

**reductions that would achieve the national objective of 40µg/m^3*
***reductions that would achieve 5% below the objective (38µg/m^3)*
****reductions that would achieve 10% below the objective (36µg/m^3)*

The source apportionment study indicates that a reduction of 4.76µg/m^3 or more would be required to meet the national objective, 6.95µg/m^3 for 5% below the objective, and

9.09µg/m^3 for 10% below, based on concentrations monitored at location Stj1. Outside of regional and local background concentrations, the largest roadside vehicle contributions to emissions were identified as cars (40.92%) and buses (36.36%).

Table 6.8 above indicates that a 50% or more reduction in cars or buses would satisfy the objective. A 20% reduction across all vehicle types would meet the objective, a 30% reduction would achieve concentrations 5% below the objective, and a 40% or more reduction would achieve 10% below the objective. It should be noted that taxis were not differentiated as part of the traffic survey

The report summarised: - *"Targeting individual types of vehicles on these local roads in isolation would not lead to the annual mean objective being achieved unless the reductions are very large (between 40 and 50%). However, a reduction in total vehicle emissions of around 20% or targeting a combination of 30% cars and buses would be potentially effective measures for achieving the objective. Greater reductions will be required to achieve more sustainable targets of 5 or 10% below the objective".*

A full version of the report can be accessed on the WRS website via the following link: -

source-apportionment-for-st-johns-worcester-aqma-final.pdf (worcsregservices.gov.uk)

6.9 London Road

A source apportionment exercise was undertaken on behalf of WRS in 2017 during a detailed assessment for London Road by Air Quality Consultants (*Detailed Assessment of Air Quality along London Road, Worcester for Worcester City Council* – July 2017). This has not been repeated as part of the more recent studies.

As the study was undertaken as part of a detailed assessment it included air quality modelling at numerous sensitive receptors along the road corridor. The highest predicted concentration was recorded at R12 (5 London Road) and therefore this location was used for calculating required emissions reductions for source apportionment. The modelled receptors from the study are shown on the plan below in Figure 2.9: -

Figure 2.9 London Road Study Area (from 2017 AQC Report)

Figure 2: Receptor Locations

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The nominal reductions per vehicle type for emissions at the modelled location R12, as calculated from the report, are shown in table 6.9 below.

Table 6.9 Required reduction in annual mean concentration at R12

London Road (R12) Reduction in Emissions (µg/m3)											
Vehicle Type	Total Emissions	10% reduction	20% reduction	30% reduction	40% reduction	50% reduction	60% reduction	70% reduction	80% reduction	90% reduction	100% reduction
Cars	13.41	1.341	2.682	4.023	5.364	6.705	8.046	9.387	10.728	12.069	13.41
LGVs	5.14	0.514	1.028	1.542	2.056	2.57	3.084	3.598	4.112	4.626	5.14
HGVs	8.78	0.878	1.756	2.634	3.512	4.39	5.268	6.146	7.024	7.902	8.78
Buses	1.31	0.131	0.262	0.393	0.524	0.655	0.786	0.917	1.048	1.179	1.31
MC	0.03	0.003	0.006	0.009	0.012	0.015	0.018	0.021	0.024	0.027	0.03
Total Vehicles	28.67	2.867	5.734	8.601	11.468	14.335	17.202	20.069	22.936	25.803	28.67

**reductions that would achieve the national objective of 40µg/m^3*
***reductions that would achieve 5% below the objective (38µg/m^3)*
****reductions that would achieve 10% below the objective (36µg/m^3)*

The source apportionment study carried out as part of the 2017 detailed assessment indicates that a reduction of 8.056µg/m^3 or more would be required to meet the national objective. Calculations for further reductions were not included in the report but would be approximately 10.137µg/m^3 to achieve 5% below the objective, and 12.182µg/m^3 for 10% below, based on modelled concentrations at location R12.

Outside of regional and local background concentrations (which would make up 39.27% of all contributions if included), the largest roadside vehicle contributions to emissions were identified as cars (46.77%), HGVs (30.62%), and LGVs (17.93%).

Table 6.9 above indicates that it would require at least a 70% reduction in emissions from cars or 100% removal of HGVs to satisfy the objective. A 30% reduction across all vehicle types would meet the objective, a 40% reduction would achieve concentrations 5% below the objective, and a 50% or more reduction would be necessary to achieve 10% below the objective.

The report summarises with the following: -

"Source apportionment of the local traffic emissions has been undertaken. This shows that, in the majority of cases, local background concentrations contribute the largest proportion to the overall concentration, followed by emissions from cars on the local roads. In a number of cases, emissions from regional background and HGVs also contribute a significant proportion to the overall concentration.

A reduction in traffic emissions along predominantly London Road would result in a decrease in the concentrations of nitrogen dioxide. Reductions in vehicle emissions from local traffic of up to 28.1% would be required to achieve the annual mean nitrogen dioxide objective where the highest concentrations are predicted to occur" (Detailed Assessment of Air Quality along London Road, Worcester for Worcester City Council – Air Quality Consultants – July 2017 (pg.20).

6.10 Overview of all Locations

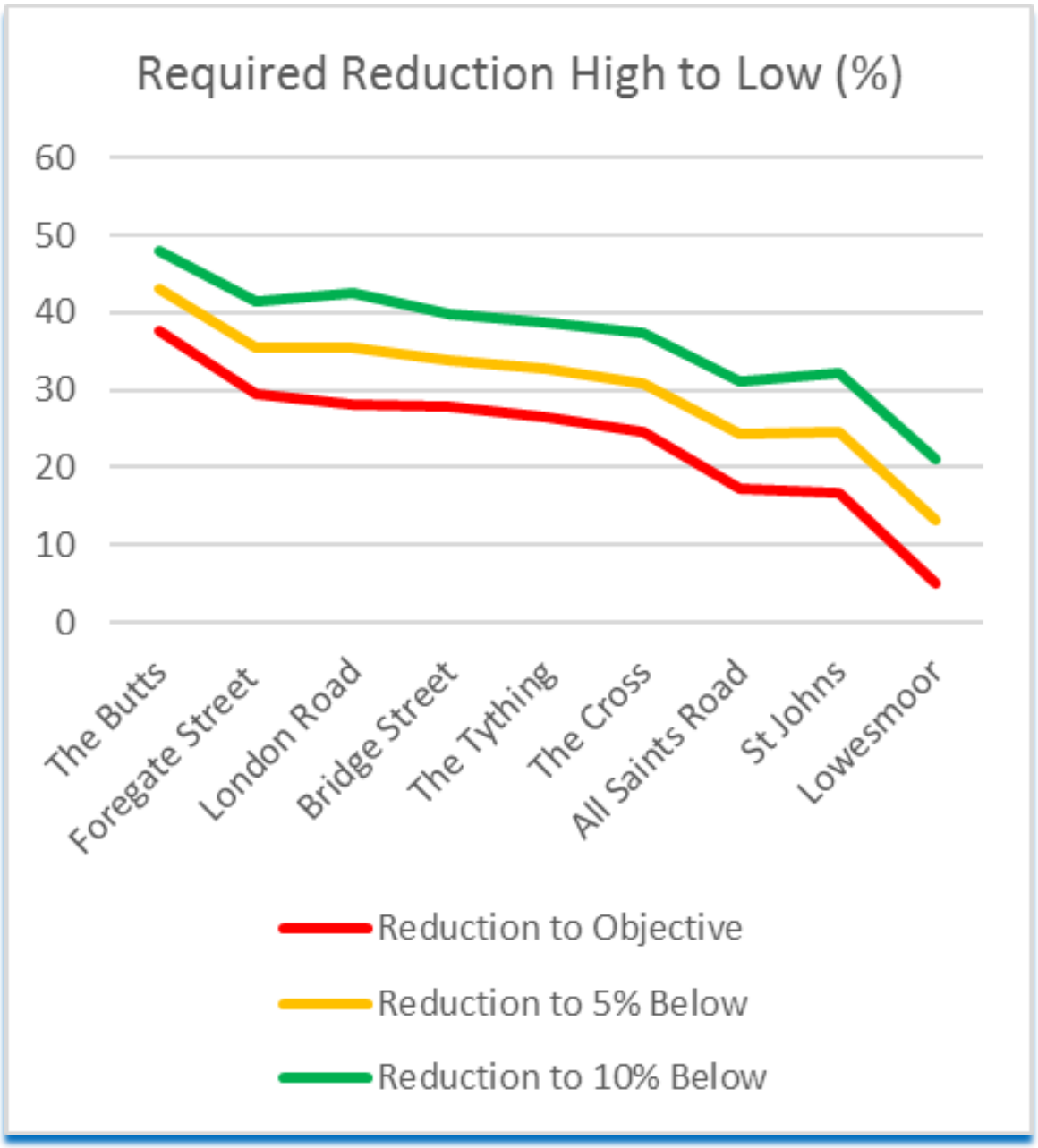
The source apportionment study undertaken is comprised of a number of separate areas or sections of the road network where exceedances of the annual mean objective for nitrogen dioxide has been identified via the monitoring network. Source apportionment for two of the areas, London Road and St Johns, was carried out separately in 2017 prior to the declaration of the citywide AQMA as each represented an area of concern at that time. Since then other areas of concern (the Tything, Foregate Street, the Butts, the Cross, Bridge Street, All Saints Road, and Lowesmoor) have presented themselves and have been looked at in detail above. Each study area is subject to different conditions and usage and therefore the outcomes vary between the locations as would be expected although there are similarities in some areas. To try and provide more of an overview and understand commonality between the areas, Table 6.10 below, presents the summary of findings.

Table 6.10 Comparison of Emissions Reductions at All Locations

Location	Emission Reduction Required to Meet Objective	All Vehicle Reduction to Meet Objective (%)	Reduction for 5% b/l objective (%)	Reduction for 10% b/l objective (%)	Highest Roadside Contributor	2nd Roadside Contributor	3rd Roadside Contributor	4th Roadside Contributor	Single Vehicle Reduction to Achieve Objective
The Tything	8.91	26.5	32.7	38.8	Diesel Cars 41.9%	Diesel LGVs 18.3%	Buses 13.7%	HGVs 12.4%	Cars 60%
Foregate Street	10.34	29.6	35.6	41.4	Diesel Cars 30.12%	Buses 30.08%	Taxis 13.41%	Diesel LGVs 13.3%	Cars 90% / Buses 100%
The Butts	14.63	37.7	43	48.1	Buses 57.03%	Diesel Cars 19.15%	Diesel LGVs 9.37%	Taxis 6.26%	Buses 70%
Bridge Street	9.61	27.8	33.9	39.9	Diesel Cars 43.38%	Diesel LGVs 20.09%	Buses 13.93%	HGVs 11.63%	Cars 60%
The Cross	8.22	24.7	31	37.3	Buses 48.1%	Diesel Cars 20.15%	Taxis 12.79%	Diesel LGVs 9.36%	Buses 60%
All Saints Road	5.28	17.2	24.2	31.1	Diesel Cars 39.03%	Buses 22.09%	Diesel LGVs 15.38%	HGVs 12.94%	Cars 40% / Buses 80%
Lowesmoor	1.38	5.1	13.1	21	Buses 58.19%	Diesel Cars 16.44%	Diesel LGVs 10.84%	Taxis 7.51%	Buses 10% / Cars 30% / LGVs 50% / Taxis 70%
St Johns	4.76	16.8	24.6	32.1	Buses 36.36%	Diesel Cars 35.16%	Diesel LGVs 11.41%	HGVs 11.08%	Cars 50% / Buses 50%
London Road	8.06	28.1	35.4	42.5	Cars - 46.77%	HGVs- 30.62%	LGVs - 17.93%	Buses - 4.57%	Cars 70% / HGVs 100%

The required reductions to meet the objective, and to achieve 5% and 10% below the objective, are presented in the graph below from highest to lowest.

Figure 3.0 Reductions Required at Each Location



When comparing the equivalent NO_2 reduction required, demonstrated in Tables 6 to 6.10, the results highlight that targeting individual categories of vehicle in isolation would not lead to the annual mean objective being achieved within most of the areas of concern unless the reductions were very large. The exception to this is within Lowesmoor where the required reduction is relatively small and therefore could be achieved by reducing emissions across all vehicle categories, or numbers of one type of vehicle, to the desired level.

In reality, in most cases, actions to improve emissions are likely to have to target more than one type of vehicle. Table 6.10 illustrates that:

- The required reduction across all vehicle types varies between the lowest of 5.1% at Lowesmoor and a highest of 37.7% at the Butts to achieve the objective. A 16.8% to 29.6% reduction is required at all other areas.
- A 13.1% to 43% reduction across all vehicle types is required to achieve concentrations 5% below the objective.
- A 21% to 48.1% reduction across all vehicle types is required to achieve concentrations 10% below the objective.
- Reducing emissions from cars and buses by 25% in St Johns, 30% in All Saints Road, 40% at the Cross, and 50% at the Butts and Foregate Street would potentially be effective measures for achieving the objective.
- Reducing emissions from cars and LGVs by 40% within the Tything and Bridge Street would potentially be an effective measure for achieving the objective.
- Reducing emissions from cars and HGVs by 40% within the London Road would potentially be an effective measure for achieving the objective.
- Reducing emissions from buses by 10% or cars and LGVs by 20% within Lowesmoor would potentially be effective measures for achieving the objective.

7.0 Summary and Conclusions

Worcester City Council consolidated a number of existing AQMAs by declaration of the Worcester City AQMA (Political Boundary of Worcester City) on the 11th June 2019 for likely breach of the nitrogen dioxide annual mean. The AQMA encompasses the boundary of the district.

Source apportionment of background and local sources has been undertaken to inform the development of an Air Quality Action Plan. The source apportionment exercise has been undertaken following guidance set out out in LAQM Technical Guidance 16.

Work previously commenced at the start of 2020 but was suspended due to the outbreak of the Covid-19 Pandemic which had severe impacts on traffic movements and behaviour. The level of traffic flow was deemed to have returned to normal, or as near as could be expected, towards the end of 2021 and therefore progress was resumed, and the outstanding traffic surveys carried out.

Source apportionment studies have been carried out for a number of areas of concern within the city; the Tything, Foregate Street, the Butts, the Cross, Bridge Street, All Saints Road, and Lowesmoor. Source apportionment was undertaken previously for St Johns and London Road in 2017. These reports have been reviewed and relevant data presented to feed into this study. Section 6 of this report provides a review in relation to each specific area of concern.

The outcome of the source apportionment exercise shows that background concentration contributes a significant proportion of the overall concentration of NO_2 measured within each of the study areas varying from 25.97% to 39.27%. Cars were shown to comprise the largest proportion of traffic volume with between 65.74% and 82.54% contributing to between 18.91% and 49.87% of vehicle source emissions. Buses comprise a much smaller proportion of the traffic volume ranging between 1.19% and 10.47% but contributing much larger proportions of vehicle emissions of between 13.7% and 58.19%.

Targeting individual types of vehicles in isolation within most areas of concern is unlikely to lead to the annual mean objective being achieved unless the reductions are very large. For example, reductions of 50% or greater in the emissions from cars would be required within 5

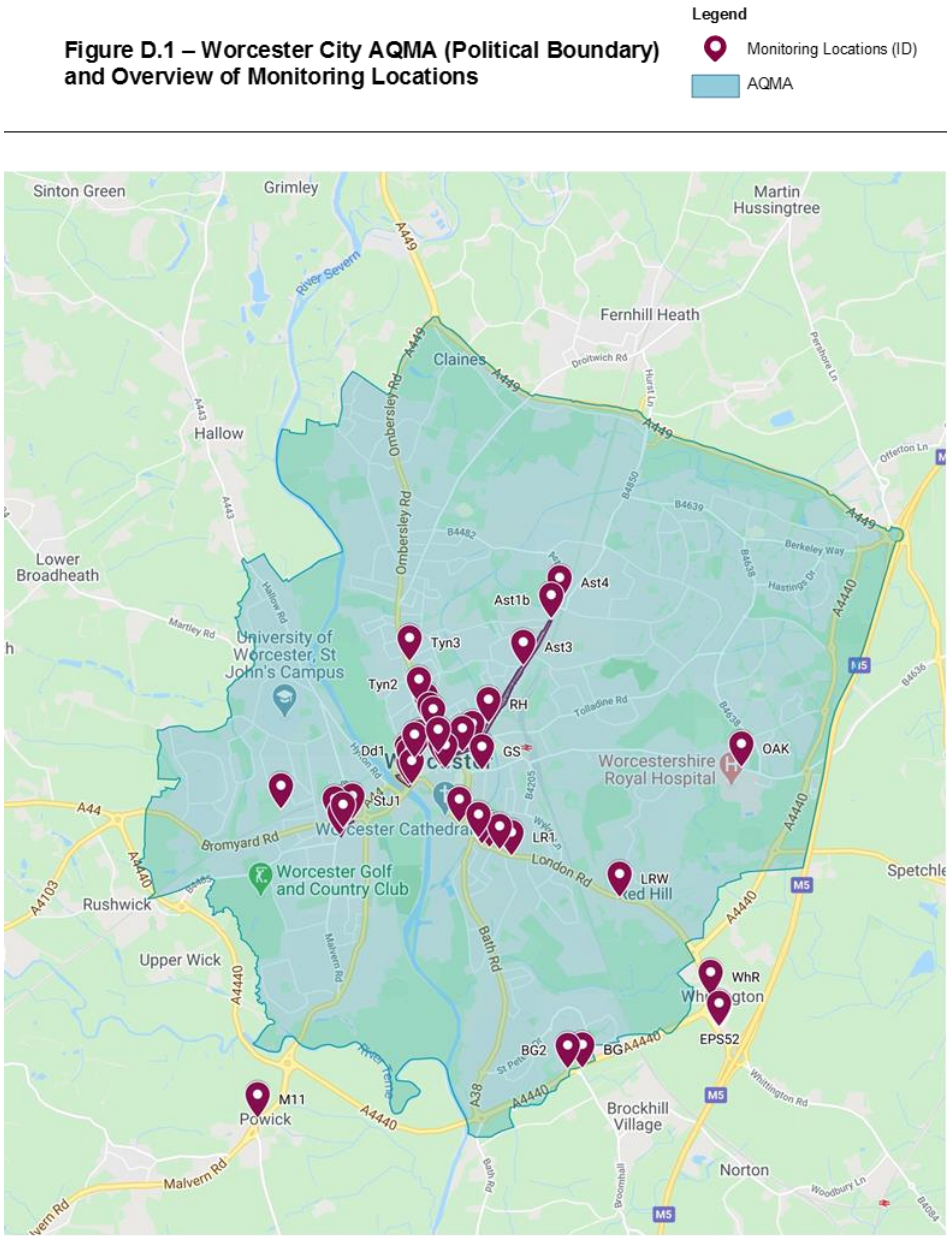
of the areas, with a 100% reduction not being sufficient to achieve compliance within 2 of the locations. In those two locations a 60 to 70% reduction in the number of buses would be necessary to attain the objective. Lowesmoor is an exception where relatively small reductions across one or more vehicle types could see concentrations of NO_2 fall to within the desired levels.

For the majority of the locations it is likely that a reduction across all vehicle types, or combination of several categories, would be required to achieve the objective. The data indicates that a maximum reduction in NO_2 of 37.7% would be required to achieve the objective within all areas. A maximum reduction of 43% would be necessary across all vehicle types to achieve results 5% below the objective, and 48.1% to achieve 10% below the objective.

Appendix A – AQMA & diffusion tube location plans

Figure A1: Worcester City Wide AQMA plan

Figure D.1 – Worcester City AQMA (Political Boundary) and Overview of Monitoring Locations



Date: 21.05.2020	Copyright: Map data @2020 Google United Kingdom

Appendix B – EFT data inputs & outputs

Table B1: Traffic count data

worcestershire county council

Classification Count Sheet

Site Number. 2009500

Road No. A38 | Location. The Tything, Worcester | Day&Date. Tuesday, 3.3.2020 | Remarks. North of St. Marys St.

Hour Commencing		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Vehicles
Pedal	NB	0	6	9	3	3	7	3	7	6	10	15	19	14	0	0	0	**102**
Cycles	SB	0	27	35	12	11	10	7	8	7	8	13	13	12	0	0	0	**163**
	Both	0	33	44	15	14	17	10	15	13	18	28	32	26	0	0	0	**265**
Motor	To	0	5	5	3	3	3	10	9	4	3	8	5	3	0	0	0	**61**
Cycles	From	0	5	6	3	5	4	7	4	9	3	9	4	4	0	0	0	**63**
	Both	0	10	11	6	8	7	17	13	13	6	17	9	7	0	0	0	**124**
	To	0	678	618	494	444	435	522	563	656	640	700	639	694	0	0	0	**7083**
Cars	From	0	699	729	653	541	478	466	464	493	516	543	665	557	0	0	0	**6804**
	Both	0	1377	1347	1147	985	913	988	1027	1149	1156	1243	1304	1251	0	0	0	**13887**
	To	0	7	11	9	11	8	9	8	12	14	9	6	4	0	0	0	**108**
Buses	From	0	6	18	13	13	10	10	12	12	18	10	9	10	0	0	0	**141**
	Both	0	13	29	22	24	18	19	20	24	32	19	15	14	0	0	0	**249**
Light	To	0	99	86	78	84	90	86	88	95	108	76	56	49	0	0	0	**995**
Goods	From	0	102	82	61	43	76	69	76	78	67	64	45	56	0	0	0	**819**
Vehicles	Both	0	201	168	139	127	166	155	164	173	175	140	101	105	0	0	0	**1814**
Smaller	To	0	5	3	8	7	8	6	10	7	7	6	5	6	0	0	0	**78**
2-Axle	From	0	8	12	10	15	7	9	5	5	2	4	3	3	0	0	0	**83**
Lorries	Both	0	13	15	18	22	15	15	15	12	9	10	8	9	0	0	0	**161**
Bigger	To	0	7	5	8	5	4	5	4	7	4	2	2	1	0	0	0	**54**
2-Axle	From	0	7	9	7	4	5	4	3	4	2	2	2	1	0	0	0	**50**
Lorries	Both	0	14	14	15	9	9	9	7	11	6	4	4	2	0	0	0	**104**
3-Axle	To	0	2	2	2	5	3	2	2	3	2	1	2	0	0	0	0	**26**
Rigid/Artic	From	0	3	4	2	2	2	1	1	2	2	1	1	0	0	0	0	**21**
	Both	0	5	6	4	7	5	3	3	5	4	2	3	0	0	0	0	**47**
4 Axles or	To	0	4	5	4	5	6	3	5	3	2	1	0	0	0	0	0	**38**
more	From	0	4	2	5	5	2	3	2	6	3	2	1	2	0	0	0	**37**
Rigid/Artic	Both	0	8	7	9	10	8	6	7	9	5	3	1	2	0	0	0	**75**
	NB	**0**	**813**	**744**	**609**	**567**	**564**	**646**	**696**	**793**	**790**	**818**	**734**	**771**	**0**	**0**	**0**	**8545**
Totals	**SB**	**0**	**861**	**897**	**766**	**639**	**594**	**576**	**575**	**616**	**621**	**648**	**743**	**645**	**0**	**0**	**0**	**8181**
	Both	**0**	**1674**	**1641**	**1375**	**1206**	**1158**	**1222**	**1271**	**1409**	**1411**	**1466**	**1477**	**1416**	**0**	**0**	**0**	**16726**

worcestershire county council

Classification Count Sheet

Site Number. 2009500B

Road No. A38 | Location. The Tything, Worcester | Day&Date. Tuesday, 3.3.2020 | Remarks. North of St. Marys St.

Hour Commencing		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Vehicles
	NB	0	13	19	19	19	18	18	17	27	27	21	18	20	0	0	0	**236**
TAXIS	SB	0	14	12	19	22	18	14	13	25	22	12	11	17	0	0	0	**199**
	Both	0	27	31	38	41	36	32	30	52	49	33	29	37	0	0	0	**435**
	NB	**0**	**13**	**19**	**19**	**19**	**18**	**18**	**17**	**27**	**27**	**21**	**18**	**20**	**0**	**0**	**0**	236
Totals	**SB**	**0**	**14**	**12**	**19**	**22**	**18**	**14**	**13**	**25**	**22**	**12**	**11**	**17**	**0**	**0**	**0**	199
	Both	**0**	**27**	**31**	**38**	**41**	**36**	**32**	**30**	**52**	**49**	**33**	**29**	**37**	**0**	**0**	**0**	435

worcestershire county council

Classification Count Sheet

Site Number. 20090509

Road No. A38 | Location. Foregate Street, Worcester | Day&Date. Tuesday, 10.3.2020 | Remarks. (Shaw St. to Castle St.)

Hour Commencing		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Vehicles
Pedal	NB	0	10	12	5	7	16	9	9	9	12	12	28	10	0	0	0	**139**
Cycles	SB	0	14	18	9	5	11	6	5	9	6	4	1	2	0	0	0	**90**
	Both	0	24	30	14	12	27	15	14	18	18	16	29	12	0	0	0	**229**
Motor	To	0	2	2	2	4	2	1	5	3	3	5	4	5	0	0	0	**38**
Cycles	From	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Both	0	2	2	2	4	2	1	5	3	3	5	4	5	0	0	0	**38**
	To	0	255	303	247	252	260	248	286	354	371	377	471	378	0	0	0	**3802**
Cars	From	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Both	0	255	303	247	252	260	248	286	354	371	377	471	378	0	0	0	**3802**
	To	0	9	8	13	13	12	12	10	8	5	8	7	4	0	0	0	**109**
Buses	From	0	6	6	10	10	9	10	10	9	7	5	3	8	0	0	0	**93**
	Both	0	15	14	23	23	21	22	20	17	12	13	10	12	0	0	0	**202**
Light	To	0	46	40	49	47	46	41	44	45	48	46	36	26	0	0	0	**514**
Goods	From	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Vehicles	Both	0	46	40	49	47	46	41	44	45	48	46	36	26	0	0	0	**514**
Smaller	To	0	1	2	6	4	2	3	4	4	1	2	2	1	0	0	0	**32**
2-Axle	From	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Lorries	Both	0	1	2	6	4	2	3	4	4	1	2	2	1	0	0	0	**32**
Bigger	To	0	2	5	8	3	1	3	3	1	2	2	1	2	0	0	0	**33**
2-Axle	From	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Lorries	Both	0	2	5	8	3	1	3	3	1	2	2	1	2	0	0	0	**33**
3-Axle	To	0	5	3	2	1	3	2	2	3	1	2	0	0	0	0	0	**24**
Rigid/Artic	From	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Both	0	5	3	2	1	3	2	2	3	1	2	0	0	0	0	0	**24**
4 Axles or	To	0	1	1	2	0	1	0	1	0	0	1	0	0	0	0	0	**7**
more	From	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Rigid/Artic	Both	0	1	1	2	0	1	0	1	0	0	1	0	0	0	0	0	**7**
	NB	**0**	**331**	**376**	**334**	**331**	**343**	**319**	**364**	**427**	**443**	**455**	**549**	**426**	**0**	**0**	**0**	**4698**
Totals	**SB**	**0**	**20**	**24**	**19**	**15**	**20**	**16**	**15**	**18**	**13**	**9**	**4**	**10**	**0**	**0**	**0**	**183**
	Both	**0**	**351**	**400**	**353**	**346**	**363**	**335**	**379**	**445**	**456**	**464**	**553**	**436**	**0**	**0**	**0**	**4881**

worcestershire county council

Classification Count Sheet

Site Number. 20090509B

Road No. A38 | Location. Foregate Street, Worcester | Day&Date. Tuesday, 10.3.2020 | Remarks. Shaw St. to Castle St.

Hour Commencing		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Vehicles
	To	0	15	25	39	24	27	31	31	26	28	26	29	26	0	0	0	**327**
TAXIS	From	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Both	0	15	25	39	24	27	31	31	26	28	26	29	26	0	0	0	**327**
	NB	**0**	**15**	**25**	**39**	**24**	**27**	**31**	**31**	**26**	**28**	**26**	**29**	**26**	**0**	**0**	**0**	**327**
Totals	**SB**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	Both	**0**	**15**	**25**	**39**	**24**	**27**	**31**	**31**	**26**	**28**	**26**	**29**	**26**	**0**	**0**	**0**	**327**

worcestershire county council

Classification Count Sheet

Site Number. 20090503

Road No. | Location. The Butts, Worcester | Day&Date. Thursday, 12.3.2020 | Remarks. One way eastbound

Hour Commencing		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Vehicles
Pedal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Cycles	EB	0	9	5	6	3	1	2	4	0	0	0	1	3	0	0	0	**34**
	Both	0	9	5	6	3	1	2	4	0	0	0	1	3	0	0	0	**34**
Motor	To	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Cycles	From	0	6	2	2	3	6	3	3	2	1	4	3	4	0	0	0	**39**
	Both	0	6	2	2	3	6	3	3	2	1	4	3	4	0	0	0	**39**
	To	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Cars	From	0	402	410	331	283	275	280	353	306	309	434	376	347	0	0	0	**4106**
	Both	0	402	410	331	283	275	280	353	306	309	434	376	347	0	0	0	**4106**
	To	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Buses	From	0	32	45	41	53	50	46	51	49	44	60	46	45	0	0	0	**562**
	Both	0	32	45	41	53	50	46	51	49	44	60	46	45	0	0	0	**562**
Light	To	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Goods	From	0	71	54	49	49	47	48	50	57	55	63	42	32	0	0	0	**617**
Vehicles	Both	0	71	54	49	49	47	48	50	57	55	63	42	32	0	0	0	**617**
Smaller	To	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2-Axle	From	0	4	3	8	5	2	3	1	2	1	2	3	1	0	0	0	**35**
Lorries	Both	0	4	3	8	5	2	3	1	2	1	2	3	1	0	0	0	**35**
Bigger	To	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2-Axle	From	0	2	5	5	6	2	2	1	2	1	1	2	0	0	0	0	**29**
Lorries	Both	0	2	5	5	6	2	2	1	2	1	1	2	0	0	0	0	**29**
3-Axle	To	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Rigid/Artic	From	0	3	4	2	2	1	1	1	1	0	1	1	0	0	0	0	**17**
	Both	0	3	4	2	2	1	1	1	1	0	1	1	0	0	0	0	**17**
4 Axles or	To	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
more	From	0	0	2	2	1	1	0	0	1	1	0	0	0	0	0	0	**8**
Rigid/Artic	Both	0	0	2	2	1	1	0	0	1	1	0	0	0	0	0	0	**8**
	NB	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Totals	**SB**	**0**	**529**	**530**	**446**	**405**	**385**	**385**	**464**	**420**	**412**	**565**	**474**	**432**	**0**	**0**	**0**	**5447**
	Both	**0**	**529**	**530**	**446**	**405**	**385**	**385**	**464**	**420**	**412**	**565**	**474**	**432**	**0**	**0**	**0**	**5447**

worcestershire county council

Classification Count Sheet

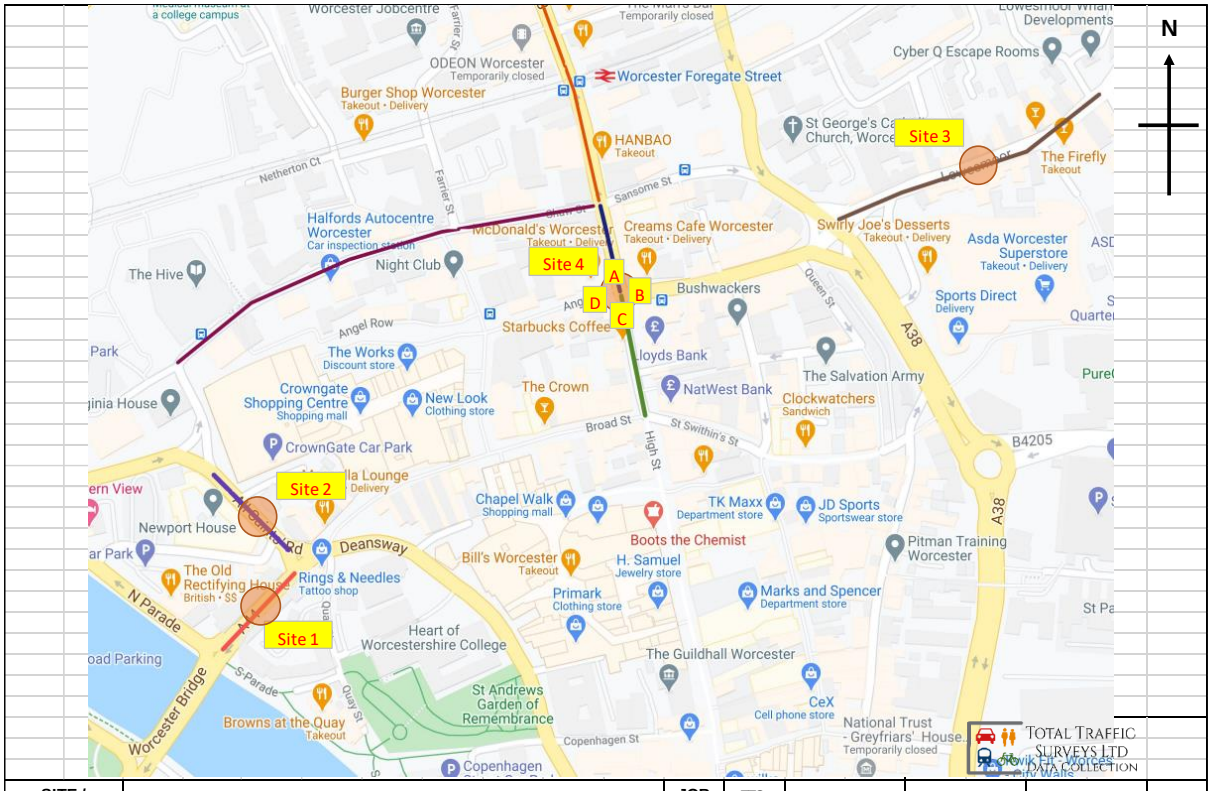
Site Number. 20090503B

Road No. | Location. The Butts, Worcester | Day&Date. Thursday, 12.3.2020 | Remarks. Taxis only

Hour Commencing		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Vehicles
	To	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Taxis	EB	0	12	23	36	18	24	19	16	17	27	24	16	28	0	0	0	**260**
	Both	0	12	23	36	18	24	19	16	17	27	24	16	28	0	0	0	**260**
	NB	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Totals	**SB**	**0**	**12**	**23**	**36**	**18**	**24**	**19**	**16**	**17**	**27**	**24**	**16**	**28**	**0**	**0**	**0**	**260**
	Both	**0**	**12**	**23**	**36**	**18**	**24**	**19**	**16**	**17**	**27**	**24**	**16**	**28**	**0**	**0**	**0**	**260**

TOTAL TRAFFIC SURVEYS LTD
DATA COLLECTION

Job Title:	Worcester Town Centre MCC's
Job Number:	TTS-1320-Nov
Client:	Worcestershire CC
Survey Date:	Thursday 11th November 2021
Survey Period:	0700-1900
Survey Type:	Manual Classified Counts
Comments:	There were no incidents likely to affect the outcome of the surveys. Weather - Dry



SITE / LOCATION:	Worcester Town Centre MCC's	**JOB NO:**	TTS-1320	**DWG NO:**	TTS-1320-001	**DRAWN:**	SES
SURVEY DATE:	Thursday 11th November 2021	**DWG TITLE:**	Location Plan and Observed Movements				
SURVEY TIMES:	0700-1900	**JOB TITLE:**	Worcester Town Centre MCC's				

TOTAL TRAFFIC SURVEYS LTD DATA COLLECTION

Job Title:	Worcester Town Centre MCC's
Job Number:	TTS-1320-Nov
Survey Date:	Thursday 11th November 2021
Survey Type:	Manual Classified Counts

Site: 1

Location: Bridge Street, Worcester

	Southbound - One way								
TIME	PC	M/C	Cars	Taxi	LGV	OGV1	OGV2	PSV	TOT
07:00	1	3	149	0	50	8	5	5	221
07:15	2	0	235	1	71	10	2	5	326
07:30	5	3	324	9	67	6	4	4	422
07:45	2	1	316	9	80	8	1	8	425
H/TOT	10	7	1024	19	268	32	12	22	1394
08:00	2	3	305	9	55	5	3	5	387
08:15	2	1	333	13	34	3	1	3	390
08:30	1	3	321	8	66	7	0	5	411
08:45	3	0	332	10	56	9	1	2	413
H/TOT	8	7	1291	40	211	24	5	15	1601
09:00	1	2	270	9	65	6	5	8	366
09:15	2	1	240	15	64	10	6	3	341
09:30	1	0	221	9	45	6	0	7	289
09:45	0	3	213	7	47	6	1	3	280
H/TOT	4	6	944	40	221	28	12	21	1276
10:00	1	1	199	4	37	5	4	5	256
10:15	0	3	252	6	47	11	2	3	324
10:30	0	7	246	9	50	5	1	9	327
10:45	1	2	248	7	31	4	3	5	301
H/TOT	2	13	945	26	165	25	10	22	1208
11:00	0	0	256	4	51	7	5	5	328
11:15	0	3	252	6	44	6	0	4	315
11:30	0	2	273	8	47	8	2	5	345
11:45	2	5	293	3	54	5	1	5	368
H/TOT	2	10	1074	21	196	26	8	19	1356
12:00	1	5	277	8	50	6	3	4	354
12:15	3	5	270	9	45	5	2	6	345
12:30	3	2	276	4	32	5	1	7	330
12:45	2	4	308	9	44	4	1	6	378
H/TOT	9	16	1131	30	171	20	7	23	1407
13:00	5	7	282	2	39	4	1	3	343
13:15	1	4	294	2	42	6	3	3	355
13:30	1	1	276	8	48	8	4	6	352
13:45	3	6	292	5	42	7	1	6	362
H/TOT	10	18	1144	17	171	25	9	18	1412
14:00	3	8	288	4	31	4	3	3	344
14:15	6	5	356	8	45	6	1	5	432
14:30	2	5	323	11	33	3	2	7	386
14:45	3	4	348	11	43	5	2	7	423
H/TOT	14	22	1315	34	152	18	8	22	1585
15:00	1	4	345	20	39	5	2	5	421
15:15	4	5	335	8	43	5	2	7	409
15:30	2	4	356	13	40	5	1	6	427
15:45	2	3	391	8	45	7	0	3	459
H/TOT	9	16	1427	49	167	22	5	21	1716
16:00	6	7	431	3	39	1	2	3	492
16:15	6	6	421	3	49	1	0	5	491
16:30	3	1	434	2	49	2	0	5	496
16:45	2	0	415	0	44	1	2	4	468
H/TOT	17	14	1701	8	181	5	4	17	1947
17:00	1	2	431	0	45	1	0	5	485
17:15	5	5	443	0	30	1	0	5	489
17:30	3	3	415	1	34	0	2	0	458
17:45	3	11	412	0	29	1	0	2	458
H/TOT	12	21	1701	1	138	3	2	12	1890
18:00	4	9	416	1	23	1	0	3	457
18:15	2	7	343	0	21	0	2	2	377
18:30	1	4	323	0	13	0	0	1	342
18:45	0	2	324	0	17	0	2	2	347
H/TOT	7	22	1406	1	74	1	4	8	1523
P/TOT	104	172	15103	286	2115	229	86	220	18315

TOTAL TRAFFIC SURVEYS LTD DATA COLLECTION

Job Title:	Worcester Town Centre MCC's
Job Number:	TTS-1320-Nov
Survey Date:	Thursday 11th November 2021
Survey Type:	Manual Classified Counts

Site: 2

Location: All Saints Road, Worcester

	Southbound - One way								
TIME	PC	M/C	Cars	Taxi	LGV	OGV1	OGV2	PSV	TOT
07:00	0	1	128	1	30	10	3	8	181
07:15	1	1	193	2	50	9	3	8	267
07:30	1	2	270	5	47	4	2	4	335
07:45	0	2	269	2	48	4	2	10	337
H/TOT	2	6	860	10	175	27	10	30	1120
08:00	1	1	288	3	35	2	3	6	339
08:15	1	3	273	6	35	4	0	8	330
08:30	1	2	237	8	39	7	0	7	301
08:45	0	4	229	11	37	8	1	9	299
H/TOT	3	10	1027	28	146	21	4	30	1269
09:00	2	1	240	8	36	8	5	7	307
09:15	1	0	204	11	32	8	3	8	267
09:30	0	2	186	7	34	6	2	7	244
09:45	1	0	198	8	35	6	1	7	256
H/TOT	4	3	828	34	137	28	11	29	1074
10:00	1	2	186	3	25	4	3	4	228
10:15	0	3	207	9	38	10	1	4	272
10:30	0	5	177	8	30	9	0	9	238
10:45	0	1	204	5	30	8	3	6	257
H/TOT	1	11	774	25	123	31	7	23	995
11:00	0	1	182	6	29	9	4	9	240
11:15	0	2	212	6	33	4	1	5	263
11:30	0	3	203	6	29	8	3	7	259
11:45	0	3	188	4	29	5	3	6	238
H/TOT	0	9	785	22	120	26	11	27	1000
12:00	1	3	213	8	28	6	3	5	267
12:15	3	2	219	8	27	7	2	9	277
12:30	0	4	237	6	15	4	1	9	276
12:45	1	6	246	6	29	2	3	7	300
H/TOT	5	15	915	28	99	19	9	30	1120
13:00	1	5	188	3	31	5	2	7	242
13:15	0	4	230	3	20	6	2	7	272
13:30	1	4	205	7	31	7	2	7	264
13:45	0	7	209	4	39	5	2	6	272
H/TOT	2	20	832	17	121	23	8	27	1050
14:00	1	6	220	5	30	7	2	4	275
14:15	0	4	244	6	21	6	1	10	292
14:30	0	2	249	4	25	1	4	8	293
14:45	0	5	262	5	30	3	11	5	321
H/TOT	1	17	975	20	106	17	18	27	1181
15:00	1	2	221	6	14	2	1	11	258
15:15	1	4	251	4	29	6	3	7	305
15:30	0	0	319	5	31	3	0	6	364
15:45	0	3	288	6	36	5	0	5	343
H/TOT	2	9	1079	21	110	16	4	29	1270
16:00	2	4	320	2	31	2	1	6	368
16:15	0	2	305	2	20	2	0	9	340
16:30	0	3	354	3	47	1	0	5	413
16:45	0	2	336	1	25	3	0	6	373
H/TOT	2	11	1315	8	123	8	1	26	1494
17:00	0	1	334	1	28	1	0	5	370
17:15	0	2	338	2	17	2	0	10	371
17:30	0	3	338	2	31	0	0	2	376
17:45	0	8	329	1	19	0	0	5	362
H/TOT	0	14	1339	6	95	3	0	22	1479
18:00	0	3	289	0	26	1	0	4	323
18:15	0	8	267	1	9	1	0	4	290
18:30	0	4	252	1	5	0	1	1	264
18:45	0	5	241	2	9	0	0	4	261
H/TOT	0	20	1049	4	49	2	1	13	1138
P/TOT	22	145	11778	223	1404	221	84	313	14190

TOTAL TRAFFIC SURVEYS LTD DATA COLLECTION

Job Title:	Worcester Town Centre MCC's
Job Number:	TTS-1320-Nov
Survey Date:	Thursday 11th November 2021
Survey Type:	Manual Classified Counts

Site: 3

Location: Lowesmoor, Worcester

	Eastbound									Westbound								
TIME	PC	M/C	Cars	Taxi	LGV	OGV1	OGV2	PSV	TOT	PC	M/C	Cars	Taxi	LGV	OGV1	OGV2	PSV	TOT
07:00	3	0	48	1	13	0	0	4	69	0	0	4	0	0	0	0	5	9
07:15	1	1	74	2	23	1	0	3	105	1	0	3	0	1	1	0	5	11
07:30	2	0	71	2	22	0	1	3	101	4	0	4	0	0	0	0	4	12
07:45	1	0	69	3	18	3	0	3	97	2	0	7	2	1	0	1	4	17
H/TOT	7	1	262	8	76	4	1	13	372	7	0	18	2	2	1	1	18	49
08:00	3	0	77	2	13	2	0	4	101	2	1	13	1	1	1	0	5	24
08:15	0	0	74	4	14	2	0	4	98	4	0	12	1	1	1	0	1	20
08:30	0	0	80	6	12	1	0	5	104	1	0	20	0	3	0	0	4	28
08:45	0	0	56	3	13	0	0	9	81	1	0	15	3	4	0	0	2	25
H/TOT	3	0	287	15	52	5	0	22	384	8	1	60	5	9	2	0	12	97
09:00	1	1	55	3	11	1	0	6	78	1	1	11	4	7	0	0	3	27
09:15	0	0	49	6	13	1	1	6	76	3	0	16	1	5	0	0	4	29
09:30	0	0	42	1	11	0	0	5	59	1	0	5	0	2	0	0	6	14
09:45	0	0	49	8	9	1	0	5	72	0	0	8	3	0	0	1	3	15
H/TOT	1	1	195	18	44	3	1	22	285	5	1	40	8	14	0	1	16	85
10:00	0	0	39	3	16	2	0	3	63	0	0	11	0	1	0	0	3	15
10:15	1	0	38	8	13	1	0	5	66	0	0	9	0	1	0	0	5	15
10:30	2	0	48	3	13	1	1	5	73	0	0	7	2	3	0	0	5	17
10:45	0	1	56	7	16	0	0	7	87	1	0	10	2	3	0	0	2	18
H/TOT	3	1	181	21	58	4	1	20	289	1	0	37	4	8	0	0	15	65
11:00	1	0	46	10	12	2	0	2	73	0	0	15	1	3	0	0	5	24
11:15	0	0	45	5	17	2	0	6	75	1	0	7	1	3	0	0	6	18
11:30	0	1	50	12	9	0	0	2	74	1	0	17	3	3	0	0	3	27
11:45	1	0	42	6	11	0	0	5	65	2	2	17	3	3	0	0	6	33
H/TOT	2	1	183	33	49	4	0	15	287	4	2	56	8	12	0	0	20	102
12:00	3	2	50	4	14	2	0	5	80	1	0	9	1	1	1	0	3	16
12:15	0	0	43	4	11	2	0	3	63	1	0	21	5	1	1	0	3	32
12:30	0	0	60	7	10	0	0	4	81	3	0	13	3	0	0	0	8	27
12:45	0	0	47	6	7	3	0	9	72	0	0	20	1	3	0	0	3	27
H/TOT	3	2	200	21	42	7	0	21	296	5	0	63	10	5	2	0	17	102
13:00	2	1	43	6	11	1	0	2	66	0	0	23	1	3	0	0	3	30
13:15	2	1	48	11	10	4	0	3	79	0	0	9	0	0	0	0	6	15
13:30	2	0	39	2	14	0	0	6	63	1	2	12	0	2	0	0	5	22
13:45	2	1	38	6	14	0	0	3	64	1	1	15	0	0	0	0	2	19
H/TOT	8	3	168	25	49	5	0	14	272	2	3	59	1	5	0	0	16	86
14:00	4	1	38	2	11	4	1	3	64	4	0	9	0	1	0	0	5	19
14:15	0	1	50	6	9	1	0	4	71	5	0	17	1	3	0	1	3	30
14:30	0	1	51	7	12	1	0	3	75	4	0	16	0	2	1	0	5	28
14:45	2	4	36	5	4	2	0	4	57	0	0	15	0	1	0	0	5	21
H/TOT	6	7	175	20	36	8	1	14	267	13	0	57	1	7	1	1	18	98
15:00	4	0	50	5	6	0	0	5	70	1	0	19	0	3	0	0	1	24
15:15	1	0	37	2	11	0	0	2	53	2	0	6	0	0	0	1	5	14
15:30	2	0	1	1	0	0	0	4	8	0	0	13	1	1	0	0	12	27
15:45	1	0	4	0	0	0	0	6	11	2	0	6	0	3	0	0	2	13
H/TOT	8	0	92	8	17	0	0	17	142	5	0	44	1	7	0	1	20	78
16:00	2	0	4	0	0	0	0	4	10	1	0	12	2	0	0	0	2	17
16:15	2	0	2	0	0	0	0	4	8	0	0	11	1	1	0	0	3	16
16:30	5	0	4	0	1	0	0	9	19	4	1	13	0	1	0	0	4	23
16:45	2	0	5	0	0	0	0	5	12	5	0	13	0	0	0	0	2	20
H/TOT	11	0	15	0	1	0	0	22	49	10	1	49	3	2	0	0	11	76
17:00	3	0	4	1	1	0	0	3	12	4	0	19	1	1	0	0	4	29
17:15	6	0	3	0	1	0	0	4	14	1	0	15	0	2	0	0	2	20
17:30	6	0	9	0	0	0	0	4	19	2	1	26	1	0	0	0	5	35
17:45	1	0	6	0	1	0	0	7	15	1	0	17	2	2	0	0	3	25
H/TOT	16	0	22	1	3	0	0	18	60	8	1	77	4	5	0	0	14	109
18:00	3	0	6	0	1	0	0	7	17	0	0	17	0	0	0	0	4	21
18:15	2	0	8	0	0	0	0	8	18	1	1	19	0	6	0	0	3	30
18:30	0	1	45	3	2	0	0	6	57	1	1	23	3	1	0	0	3	32
18:45	0	0	55	2	4	0	0	7	68	1	0	21	1	0	0	0	3	26
H/TOT	5	1	114	5	7	0	0	28	160	3	2	80	4	7	0	0	13	109
P/TOT	73	17	1894	175	434	40	4	226	2863	71	11	640	51	83	6	4	190	1056

TOTAL TRAFFIC SURVEYS LTD DATA COLLECTION

Job Title:	Worcester Town Centre MCC's
Job Number:	TTS-1320-Nov
Survey Date:	Thursday 11th November 2021
Survey Type:	Manual Classified Counts

Site: 4

Location: The Cross/The Foregate - 4 arm T/Signal Crossroads

	A - B									A - C								
TIME	PC	MC	Car	Taxi	LGV	OGV1	OGV2	PSV	TOT	PC	MC	Car	Taxi	LGV	OGV1	OGV2	PSV	TOT
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
07:45	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
H/TOT	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4
08:00	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3
08:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
08:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1
10:45	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
H/TOT	1	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	3
11:00	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
H/TOT	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
13:00	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
13:45	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
H/TOT	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
H/TOT	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3
15:00	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
H/TOT	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4
16:00	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
16:45	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
H/TOT	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	5
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4
17:30	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	5
18:00	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
H/TOT	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4
P/TOT	1	0	0	0	0	0	0	0	1	38	0	0	0	0	0	0	0	38

TOTAL TRAFFIC SURVEYS LTD DATA COLLECTION

Job Title:	Worcester Town Centre MCC's
Job Number:	TTS-1320-Nov
Survey Date:	Thursday 11th November 2021
Survey Type:	Manual Classified Counts

Site: 4

Location: The Cross/The Foregate - 4 arm T/Signal Crossroads

	A - D									A - A								
TIME	PC	MC	Car	Taxi	LGV	OGV1	OGV2	PSV	TOT	PC	MC	Car	Taxi	LGV	OGV1	OGV2	PSV	TOT
07:00	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	1	0	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0
08:00	1	0	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0
08:15	1	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
H/TOT	2	0	0	0	0	0	0	7	9	0	0	0	0	0	0	0	0	0
09:00	1	0	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0
09:15	1	0	0	0	0	0	0	3	4	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	1	1	0	3	5	0	0	0	0	0	0	0	0	0
09:45	1	0	0	0	2	0	0	0	3	0	0	0	0	0	0	0	0	0
H/TOT	3	0	0	0	3	1	0	8	15	0	0	0	0	0	0	0	0	0
10:00	0	0	1	0	1	0	0	3	5	0	0	0	0	0	0	0	0	0
10:15	0	0	0	2	1	0	0	3	6	0	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	0
10:45	1	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0
H/TOT	1	0	1	3	2	0	0	11	18	0	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	6	6	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0
11:45	0	0	0	2	0	0	0	2	4	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	2	0	0	0	12	14	0	0	0	0	0	0	0	0	0
12:00	0	0	1	0	0	0	0	4	5	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0
12:30	0	0	0	0	1	0	0	4	5	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0
H/TOT	0	0	1	0	1	0	0	13	15	0	0	0	0	0	0	0	0	0
13:00	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0
13:15	1	0	0	0	0	0	0	3	4	0	0	0	0	0	0	0	0	0
13:30	1	0	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0
13:45	0	0	0	1	0	0	0	2	3	0	0	0	0	0	0	0	0	0
H/TOT	2	0	0	1	0	0	0	10	13	0	0	0	0	0	0	0	0	0
14:00	1	0	0	0	0	0	0	5	6	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	1	0	3	4	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
H/TOT	1	0	0	0	0	1	0	12	14	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0
15:15	1	0	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
H/TOT	1	0	0	0	0	0	0	6	7	0	0	0	0	0	0	0	0	0
16:00	3	0	0	0	0	0	0	3	6	0	0	0	0	0	0	0	0	0
16:15	1	0	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0
16:30	2	0	0	0	0	0	0	2	4	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	6	0	0	0	0	0	0	7	13	0	0	0	0	0	0	0	0	0
17:00	1	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0
17:15	1	0	0	0	0	0	0	4	5	0	0	0	0	0	0	0	0	0
17:30	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0
H/TOT	4	0	0	0	0	0	0	7	11	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0
18:15	2	0	0	0	0	0	0	2	4	0	0	0	0	0	0	0	0	0
18:30	1	0	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0
18:45	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
H/TOT	4	0	0	0	0	0	0	6	10	0	0	0	0	0	0	0	0	0
P/TOT	25	0	2	6	6	2	0	101	142	0	0	0	0	0	0	0	0	0

TOTAL TRAFFIC SURVEYS LTD DATA COLLECTION

Job Title:	Worcester Town Centre MCC's
Job Number:	TTS-1320-Nov
Survey Date:	Thursday 11th November 2021
Survey Type:	Manual Classified Counts

Site: 4

Location: The Cross/The Foregate - 4 arm T/Signal Crossroads

	B - C									B - D								
TIME	PC	MC	Car	Taxi	LGV	OGV1	OGV2	PSV	TOT	PC	MC	Car	Taxi	LGV	OGV1	OGV2	PSV	TOT
07:00	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	12	14
07:15	0	0	0	0	0	0	0	0	0	1	0	0	1	2	0	0	13	17
07:30	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	6	9
07:45	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	7	9
H/TOT	0	0	0	0	0	0	0	0	0	2	0	2	4	2	1	0	38	49
08:00	0	0	0	0	0	0	0	0	0	2	0	1	0	0	1	0	7	11
08:15	0	0	0	0	0	0	0	0	0	3	0	0	1	1	0	1	4	10
08:30	0	0	0	0	0	0	0	0	0	1	0	2	2	0	0	0	9	14
08:45	0	0	0	0	0	0	0	0	0	0	0	1	3	0	1	0	8	13
H/TOT	0	0	0	0	0	0	0	0	0	6	0	4	6	1	2	1	28	48
09:00	0	0	0	0	0	0	0	0	0	0	0	1	4	1	0	0	11	17
09:15	0	0	0	0	0	0	0	0	0	2	0	0	4	0	0	0	9	15
09:30	0	0	0	0	0	0	0	0	0	1	0	2	5	0	0	0	6	14
09:45	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	6	7
H/TOT	0	0	0	0	0	0	0	0	0	3	0	3	14	1	0	0	32	53
10:00	1	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	3	5
10:15	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	7	10
10:30	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	7	9
10:45	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	6	7
H/TOT	1	0	0	0	0	0	0	0	1	0	0	0	7	0	1	0	23	31
11:00	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	5	9
11:15	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	7	11
11:30	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	4	7
11:45	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	9	12
H/TOT	0	0	0	0	0	0	0	0	0	1	0	1	10	2	0	0	25	39
12:00	0	0	0	0	0	0	0	0	0	1	0	1	2	0	0	0	4	8
12:15	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	5	8
12:30	0	0	0	0	0	0	0	0	0	2	0	0	5	1	0	0	11	19
12:45	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	6	9
H/TOT	0	0	0	0	0	0	0	0	0	3	0	3	10	2	0	0	26	44
13:00	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	2	5
13:15	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	8	10
13:30	0	0	0	0	0	0	0	0	0	1	0	1	6	0	0	0	5	13
13:45	0	0	0	0	0	0	0	0	0	1	0	0	4	0	0	0	5	10
H/TOT	0	0	0	0	0	0	0	0	0	3	0	1	14	0	0	0	20	38
14:00	0	0	0	0	0	0	0	0	0	2	0	0	2	1	0	0	6	11
14:15	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	4	5
14:30	0	0	0	0	0	0	0	0	0	3	0	0	2	0	0	0	6	11
14:45	0	0	0	0	0	0	0	0	0	0	0	2	3	0	0	0	7	12
H/TOT	0	0	0	0	0	0	0	0	0	6	0	2	7	1	0	0	23	39
15:00	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	3	5
15:15	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	0	6	10
15:30	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	14	20
15:45	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	6	9
H/TOT	0	0	0	0	0	0	0	0	0	2	0	0	13	0	0	0	29	44
16:00	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	5	7
16:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	6	7
16:30	0	0	0	0	0	0	0	0	0	3	0	0	4	0	0	0	9	16
16:45	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	5	8
H/TOT	0	0	0	0	0	0	0	0	0	5	0	1	7	0	0	0	25	38
17:00	0	0	0	0	0	0	0	0	0	3	0	1	3	0	0	0	4	11
17:15	0	0	0	0	0	0	0	0	0	1	0	2	3	0	0	0	5	11
17:30	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	7	11
17:45	0	0	0	0	0	0	0	0	0	1	0	2	2	0	0	0	6	11
H/TOT	0	0	0	0	0	0	0	0	0	5	0	7	10	0	0	0	22	44
18:00	0	0	0	0	0	0	0	0	0	2	0	3	3	0	0	0	5	13
18:15	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	3	5
18:30	0	0	0	0	0	0	0	0	0	1	0	5	3	0	0	0	6	15
18:45	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	3	6
H/TOT	0	0	0	0	0	0	0	0	0	5	0	10	7	0	0	0	17	39
P/TOT	1	0	0	0	0	0	0	0	1	41	0	34	109	9	4	1	308	506

TOTAL TRAFFIC SURVEYS LTD
DATA COLLECTION

Job Title:	Worcester Town Centre MCC's
Job Number:	TTS-1320-Nov
Survey Date:	Thursday 11th November 2021
Survey Type:	Manual Classified Counts

Site: 4

Location: The Cross/The Foregate - 4 arm T/Signal Crossroads

	B - A									B - B								
TIME	PC	MC	Car	Taxi	LGV	OGV1	OGV2	PSV	TOT	PC	MC	Car	Taxi	LGV	OGV1	OGV2	PSV	TOT
07:00	0	0	28	3	6	0	0	0	37	0	0	0	0	0	0	0	0	0
07:15	0	0	54	4	17	4	0	0	79	0	0	0	0	0	0	0	0	0
07:30	1	1	46	2	9	2	0	0	61	0	0	0	0	0	0	0	0	0
07:45	1	0	85	5	8	2	0	0	101	0	0	0	0	0	0	0	0	0
H/TOT	2	1	213	14	40	8	0	0	278	0	0	0	0	0	0	0	0	0
08:00	3	2	88	7	8	2	0	0	110	0	0	0	0	0	0	0	0	0
08:15	2	1	87	4	9	0	0	0	103	0	0	0	0	0	0	0	0	0
08:30	0	0	72	7	20	1	0	1	101	0	0	0	0	0	0	0	0	0
08:45	0	1	89	3	14	0	0	0	107	0	0	0	0	0	0	0	0	0
H/TOT	5	4	336	21	51	3	0	1	421	0	0	0	0	0	0	0	0	0
09:00	0	2	78	7	13	3	0	0	103	0	0	0	0	0	0	0	0	0
09:15	0	0	77	5	14	3	1	1	101	0	0	0	0	0	0	0	0	0
09:30	0	1	65	6	10	3	0	0	85	0	0	0	0	0	0	0	0	0
09:45	0	0	69	4	8	3	0	2	86	0	0	0	0	0	0	0	0	0
H/TOT	0	3	289	22	45	12	1	3	375	0	0	0	0	0	0	0	0	0
10:00	0	5	57	5	10	2	0	1	80	0	0	0	0	0	0	0	0	0
10:15	0	0	63	7	14	4	0	0	88	0	0	0	0	0	0	0	0	0
10:30	0	1	66	4	8	5	1	1	86	0	0	0	0	0	0	0	0	0
10:45	0	1	65	9	12	1	2	0	90	0	0	0	0	0	0	0	0	0
H/TOT	0	7	251	25	44	12	3	2	344	0	0	0	0	0	0	0	0	0
11:00	0	1	63	4	14	4	0	0	86	0	0	0	0	0	0	0	0	0
11:15	0	2	70	2	15	4	0	0	93	0	0	0	0	0	0	0	0	0
11:30	1	1	70	5	11	0	0	1	89	0	0	0	0	0	0	0	0	0
11:45	0	2	93	3	5	0	0	0	103	0	0	0	0	0	0	0	0	0
H/TOT	1	6	296	14	45	8	0	1	371	0	0	0	0	0	0	0	0	0
12:00	1	1	77	4	8	1	0	0	92	0	0	0	0	0	0	0	0	0
12:15	1	4	66	5	13	2	0	0	91	0	0	0	0	0	0	0	0	0
12:30	0	2	71	4	8	1	1	0	87	0	0	0	0	0	0	0	0	0
12:45	2	2	67	2	9	0	0	0	82	0	0	0	0	0	0	0	0	0
H/TOT	4	9	281	15	38	4	1	0	352	0	0	0	0	0	0	0	0	0
13:00	0	0	77	5	5	1	0	1	89	0	0	0	0	0	0	0	0	0
13:15	0	2	79	1	4	4	0	0	90	0	0	0	0	0	0	0	0	0
13:30	0	1	63	4	9	1	0	0	78	0	0	0	0	0	0	0	0	0
13:45	1	1	73	8	9	1	0	0	93	0	0	0	0	0	0	0	0	0
H/TOT	1	4	292	18	27	7	0	1	350	0	0	0	0	0	0	0	0	0
14:00	1	5	68	1	8	0	1	0	84	0	0	0	0	0	0	0	0	0
14:15	0	1	82	4	5	2	0	1	95	0	0	0	0	0	0	0	0	0
14:30	2	1	72	4	8	0	0	1	88	0	0	0	0	0	0	0	0	0
14:45	0	1	71	4	7	1	0	0	84	0	0	0	0	0	0	0	0	0
H/TOT	3	8	293	13	28	3	1	2	351	0	0	0	0	0	0	0	0	0
15:00	1	0	74	2	5	2	1	0	85	0	0	0	0	0	0	0	0	0
15:15	1	2	68	2	8	0	0	0	81	0	0	0	0	0	0	0	0	0
15:30	0	0	64	3	6	1	0	0	74	0	0	0	0	0	0	0	0	0
15:45	1	3	54	3	6	0	0	0	67	0	0	0	0	0	0	0	0	0
H/TOT	3	5	260	10	25	3	1	0	307	0	0	0	0	0	0	0	0	0
16:00	0	1	45	3	6	0	0	0	55	0	0	0	0	0	0	0	0	0
16:15	1	4	71	4	0	0	0	0	80	0	0	0	0	0	0	0	0	0
16:30	2	0	56	3	13	1	0	0	75	0	0	0	0	0	0	0	0	0
16:45	1	0	43	0	5	0	0	0	49	0	0	0	0	0	0	0	0	0
H/TOT	4	5	215	10	24	1	0	0	259	0	0	0	0	0	0	0	0	0
17:00	1	0	45	1	3	0	0	0	50	0	0	0	0	0	0	0	0	0
17:15	2	2	58	1	6	0	0	0	69	0	0	0	0	0	0	0	0	0
17:30	1	3	83	0	7	0	0	1	95	0	0	0	0	0	0	0	0	0
17:45	1	1	69	4	5	0	0	0	80	0	0	0	0	0	0	0	0	0
H/TOT	5	6	255	6	21	0	0	1	294	0	0	0	0	0	0	0	0	0
18:00	0	3	71	1	5	1	0	0	81	0	0	0	0	0	0	0	0	0
18:15	1	6	81	5	0	0	0	0	93	0	0	0	0	0	0	0	0	0
18:30	0	2	99	3	3	0	0	0	107	0	0	0	0	0	0	0	0	0
18:45	1	0	93	2	6	0	0	0	102	0	0	0	0	0	0	0	0	0
H/TOT	2	11	344	11	14	1	0	0	383	0	0	0	0	0	0	0	0	0
P/TOT	30	69	3325	179	402	62	7	11	4085	0	0	0	0	0	0	0	0	0

TOTAL TRAFFIC SURVEYS LTD DATA COLLECTION

Job Title:	Worcester Town Centre MCC's
Job Number:	TTS-1320-Nov
Survey Date:	Thursday 11th November 2021
Survey Type:	Manual Classified Counts

Site: 4

Location: The Cross/The Foregate - 4 arm T/Signal Crossroads

	C - D									C - A								
TIME	PC	MC	Car	Taxi	LGV	OGV1	OGV2	PSV	TOT	PC	MC	Car	Taxi	LGV	OGV1	OGV2	PSV	TOT
07:00	0	0	0	1	0	0	0	0	1	3	0	3	0	2	3	0	0	11
07:15	0	0	0	0	0	1	0	0	1	0	0	4	2	8	1	0	0	15
07:30	0	0	0	0	1	0	0	0	1	2	0	9	4	4	1	0	0	20
07:45	0	0	0	0	0	0	0	0	0	1	0	9	2	6	1	0	0	19
H/TOT	0	0	0	1	1	1	0	0	3	6	0	25	8	20	6	0	0	65
08:00	0	0	0	0	0	0	0	0	0	1	0	6	2	1	0	0	0	10
08:15	1	0	0	0	0	0	0	0	1	3	0	7	4	4	2	0	0	20
08:30	0	0	0	0	0	1	0	0	1	1	0	6	2	7	0	0	0	16
08:45	0	0	0	0	0	0	0	0	0	0	0	5	3	7	1	0	0	16
H/TOT	1	0	0	0	0	1	0	0	2	5	0	24	11	19	3	0	0	62
09:00	0	0	0	0	0	0	0	0	0	0	0	23	8	9	1	0	0	41
09:15	0	0	0	0	0	0	0	0	0	1	0	18	6	4	1	0	0	30
09:30	0	0	0	0	0	0	0	0	0	0	1	21	6	10	0	0	0	38
09:45	0	0	0	0	0	0	0	0	0	0	0	16	4	12	1	0	0	33
H/TOT	0	0	0	0	0	0	0	0	0	1	1	78	24	35	3	0	0	142
10:00	0	0	0	0	0	0	0	0	0	1	0	24	6	4	3	0	0	38
10:15	0	0	0	0	0	0	0	0	0	0	2	18	5	1	0	0	0	26
10:30	0	0	0	0	0	0	0	0	0	0	0	19	5	9	1	0	0	34
10:45	0	0	0	0	0	0	0	0	0	2	0	32	6	7	0	0	0	47
H/TOT	0	0	0	0	0	0	0	0	0	3	2	93	22	21	4	0	0	145
11:00	0	0	0	0	0	0	0	0	0	0	0	18	9	2	0	0	0	29
11:15	0	0	0	0	0	0	0	0	0	0	0	28	6	2	0	0	0	36
11:30	0	0	0	0	0	0	0	0	0	0	0	21	9	4	1	0	0	35
11:45	0	0	0	0	0	0	0	0	0	1	1	23	8	4	1	0	0	38
H/TOT	0	0	0	0	0	0	0	0	0	1	1	90	32	12	2	0	0	138
12:00	1	0	0	0	0	0	0	0	1	1	0	28	1	3	0	0	0	33
12:15	0	0	0	0	0	0	0	0	0	1	0	18	5	2	0	0	0	26
12:30	0	0	0	0	0	0	0	0	0	0	0	18	10	5	0	0	0	33
12:45	1	0	0	0	0	0	0	0	1	1	1	19	5	4	1	0	0	31
H/TOT	2	0	0	0	0	0	0	0	2	3	1	83	21	14	1	0	0	123
13:00	0	0	0	0	0	0	0	0	0	0	0	21	4	3	0	0	0	28
13:15	0	0	0	0	0	0	0	0	0	0	1	26	7	3	0	0	0	37
13:30	1	0	0	0	0	0	0	0	1	0	1	16	8	1	2	0	0	28
13:45	0	0	0	0	0	0	0	0	0	0	0	20	6	4	0	0	0	30
H/TOT	1	0	0	0	0	0	0	0	1	0	2	83	25	11	2	0	0	123
14:00	0	0	0	0	0	0	0	0	0	1	0	17	6	2	0	0	0	26
14:15	0	0	0	0	0	0	0	0	0	2	1	19	6	6	0	0	0	34
14:30	0	0	0	0	0	0	0	0	0	1	1	18	9	2	0	0	0	31
14:45	2	0	0	0	0	0	0	0	2	1	0	15	3	2	0	0	0	21
H/TOT	2	0	0	0	0	0	0	0	2	5	2	69	24	12	0	0	0	112
15:00	0	0	0	0	0	0	0	0	0	3	1	15	4	2	0	0	0	25
15:15	0	0	0	0	0	0	0	0	0	1	0	23	5	1	0	0	0	30
15:30	0	0	1	0	0	0	0	0	1	2	0	17	4	2	0	0	0	25
15:45	0	0	0	0	1	0	0	0	1	0	1	12	4	3	0	0	0	20
H/TOT	0	0	1	0	1	0	0	0	2	6	2	67	17	8	0	0	0	100
16:00	1	0	0	1	0	0	0	0	2	0	0	11	7	2	0	0	0	20
16:15	0	0	0	0	0	0	0	0	0	4	0	15	4	3	0	0	0	26
16:30	1	0	0	0	0	0	0	0	1	2	0	14	1	7	0	0	0	24
16:45	0	0	0	1	0	0	0	0	1	1	0	13	5	0	0	0	0	19
H/TOT	2	0	0	2	0	0	0	0	4	7	0	53	17	12	0	0	0	89
17:00	0	0	0	1	1	0	0	0	2	1	0	16	1	2	0	0	0	20
17:15	0	0	0	0	0	0	0	0	0	5	0	18	2	2	0	0	0	27
17:30	0	0	0	1	1	0	0	0	2	1	0	19	2	4	0	0	0	26
17:45	0	0	0	1	1	0	0	0	2	2	0	15	1	1	0	0	0	19
H/TOT	0	0	0	3	3	0	0	0	6	9	0	68	6	9	0	0	0	92
18:00	1	0	0	0	0	0	0	0	1	2	0	14	4	2	0	0	0	22
18:15	0	0	0	0	0	0	0	0	0	1	0	12	4	2	0	0	0	19
18:30	1	0	0	0	0	0	0	0	1	2	1	27	4	2	0	0	0	36
18:45	0	1	0	0	0	0	0	0	1	2	1	20	2	3	0	0	0	28
H/TOT	2	1	0	0	0	0	0	0	3	7	2	73	14	9	0	0	0	105
P/TOT	10	1	1	6	5	2	0	0	25	53	13	806	221	182	21	0	0	1296

TOTAL TRAFFIC SURVEYS LTD DATA COLLECTION

Job Title:	Worcester Town Centre MCC's
Job Number:	TTS-1320-Nov
Survey Date:	Thursday 11th November 2021
Survey Type:	Manual Classified Counts

Site: 4

Location: The Cross/The Foregate - 4 arm T/Signal Crossroads

	C - B									C - C								
TIME	PC	MC	Car	Taxi	LGV	OGV1	OGV2	PSV	TOT	PC	MC	Car	Taxi	LGV	OGV1	OGV2	PSV	TOT
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:45	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
H/TOT	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P/TOT	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

TOTAL TRAFFIC SURVEYS LTD
DATA COLLECTION

Job Title:	Worcester Town Centre MCC's
Job Number:	TTS-1320-Nov
Survey Date:	Thursday 11th November 2021
Survey Type:	Manual Classified Counts

Site: 4

Location: The Cross/The Foregate - 4 arm T/Signal Crossroads

	D - A									D - B								
TIME	PC	MC	Car	Taxi	LGV	OGV1	OGV2	PSV	TOT	PC	MC	Car	Taxi	LGV	OGV1	OGV2	PSV	TOT
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:30	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1
14:45	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
H/TOT	1	0	1	0	0	0	0	0	2	1	0	0	0	0	0	0	0	1
15:00	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	1	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	2
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
P/TOT	2	0	1	0	0	0	0	0	3	5	0	0	0	0	0	0	0	5

TOTAL TRAFFIC SURVEYS LTD
DATA COLLECTION

Job Title:	Worcester Town Centre MCC's
Job Number:	TTS-1320-Nov
Survey Date:	Thursday 11th November 2021
Survey Type:	Manual Classified Counts

Site: 4

Location: The Cross/The Foregate - 4 arm T/Signal Crossroads

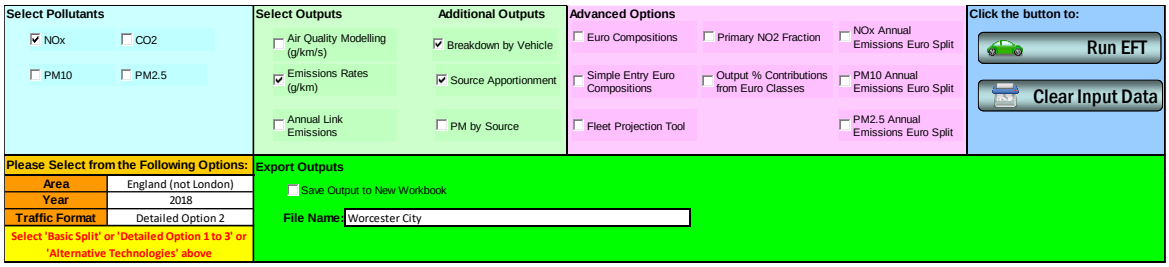
	D - C									D - D								
TIME	PC	MC	Car	Taxi	LGV	OGV1	OGV2	PSV	TOT	PC	MC	Car	Taxi	LGV	OGV1	OGV2	PSV	TOT
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P/TOT	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0

Site ID	MC	CARS	TAXIS	LGV	OGV1	OGV2	PSV	TOTAL
The Tything	124	13887	435	1814	265	122	249	16896
Scale Factor	1.23	1.23	2.3	1.23	1.23	1.23	1.23	
Total	153	17081	1001	2231	326	150	306	21248
Site ID	MC	CARS	TAXIS	LGV	OGV1	OGV2	PSV	TOTAL
Foregate Street	38	3802	327	514	65	31	202	4979
Scale Factor	1.23	1.23	2.3	1.23	1.23	1.23	1.23	
Total	47	4676	752	632	80	38	248	6474
Site ID	MC	CARS	TAXIS	LGV	OGV1	OGV2	PSV	TOTAL
Butts	39	4106	260	617	64	25	562	5673
Scale Factor	1.23	1.23	2.3	1.23	1.23	1.23	1.23	
Total	48	5050	598	759	79	31	691	7256
Site ID	MC	CARS	TAXIS	LGV	OGV1	OGV2	PSV	TOTAL
Bridge St	172	15103	286	2115	229	86	220	18211
Scale Factor	1.23	1.23	2.3	1.23	1.23	1.23	1.23	
Total	212	18577	658	2601	282	106	271	22706
Site ID	MC	CARS	TAXIS	LGV	OGV1	OGV2	PSV	TOTAL
All Saints Road	145	11778	223	1404	221	84	313	14168
Scale Factor	1.23	1.23	2.3	1.23	1.23	1.23	1.23	
Total	178	14487	513	1727	272	103	385	17665
Site ID	MC	CARS	TAXIS	LGV	OGV1	OGV2	PSV	TOTAL
Lowesmoor	28	2534	226	517	46	8	416	3775
Scale Factor	1.23	1.23	2.3	1.23	1.23	1.23	1.23	
Total	34	3117	520	636	57	10	512	4885
Site ID	MC	CARS	TAXIS	LGV	OGV1	OGV2	PSV	TOTAL
The Cross	83	4169	521	604	91	8	420	5896
Scale Factor	1.23	1.23	2.3	1.23	1.23	1.23	1.23	
Total	102	5128	1198	743	112	10	517	7810

Table B2: Traffic speed data

Location	Average Speed
Butts	10.29
Butts + Shaw Street	15.67
Cross	8.80
The Foregate	17.41
Foregate St	17.23
Tything N	19.24
Upper Tything N	19.57
Barborne Rd N	24.88
Barborne Rd S	29.95
Upper Tything S	31.22
Tything S	18.46
Barborne Rd N&S	27.41
Upper Tything N&S	25.40
Tything N&S	18.85
Average	**20.31**

Table B4: Emission Factor Toolkit v8.01 Input



SourceID	Road Type	Traffic Flow	% Car	% Taxi (black cab)	% LGV	% Rigid HGV
Bridge St	Urban (not London)	22707	82.34	2.36	11.46	1.24
All Saints Road	Urban (not London)	17665	82.54	2.37	9.78	1.54
Lowesmoor	Urban (not London)	4886	65.74	8.7	13.02	1.17
The Cross	Urban (not London)	15620	68.48	12.53	9.51	1.43
The Tything	Urban (not London)	21248	81.25	3.85	10.5	1.53
Foregate Street	Urban (not London)	6473	74.37	9.49	9.76	1.24
The Butts	Urban (not London)	7256	71.11	6.73	10.46	1.09

% Artic HGV	% Bus and Coach	% Motorcycle	Speed(kph)	No of Hours	Link Length (km)	% Gradient	Flow Direction	% Load
0.47	1.19	0.94	13	24				
0.58	2.18	1.01	13	24				
0.2	10.47	0.7	13	24				
0.13	6.61	1.31	10	24				
0.71	1.44	0.72	19	24				
0.59	3.82	0.73	17	24				
0.43	9.52	0.66	13	24				

Table B5: Emission Factor Toolkit v8.01 Output

Source Name	Pollutant Name	All Vehicles (g/km)	All LDVs (g/km)	All HDVs (g/km)	Petrol Cars (g/km)	Diesel Cars (g/km)	Taxis (g/km)	Petrol LGVs (g/km)	Diesel LGVs (g/km)
Bridge St	NOx	14,425.67511	10,737.10383	3,688.57128	903.33926	6,258.00224	619.04389	3.61483	2,897.99994
All Saints Road	NOx	12,522.89922	8,038.95112	4,483.94810	704.46329	4,880.26267	483.62825	2.39992	1,924.00631
Lowesmoor	NOx	6,538.06337	2,439.89869	4,098.16469	155.18989	1,075.09849	491.04624	0.88371	708.46507
The Cross	NOx	19,247.43933	8,722.23639	10,525.20294	537.25845	3,879.09080	2,460.78590	2.11535	1,800.22437
The Tything	NOx	12,151.10158	8,989.51148	3,161.59010	777.48545	5,090.53681	848.43855	2.97270	2,228.86474
Foregate Street	NOx	4,899.47427	3,018.04167	1,881.43260	221.72319	1,475.88773	656.57392	0.85264	650.68771
The Butts	NOx	9,017.14375	3,400.78731	5,616.35644	249.29193	1,727.00281	564.10768	1.05432	845.24567

Rigid HGVs (g/km)	Artic HGVs (g/km)	Buses/Coaches (g/km)	Motorcycles (g/km)	Full Hybrid Petrol Cars (g/km)	Plug-In Hybrid Petrol Cars (g/km)	Full Hybrid Diesel Cars (g/km)
1,238.07002	439.85659	1,989.70480	21.74110	10.88316	2.40317	20.07625
1,196.18437	422.27476	2,835.64632	18.17309	8.48716	1.87410	15.65633
251.36400	40.27513	3,766.88248	3.48374	1.86968	0.41285	3.44902
1,172.30206	104.25076	9,151.18845	22.33060	6.51113	1.43683	12.48296
1,059.41958	442.77205	1,641.95432	13.57481	9.27402	2.05077	16.31364
285.92426	124.09741	1,455.93003	4.34811	2.65274	0.58628	4.72934
347.76633	128.59356	5,086.46604	4.87792	3.00339	0.66320	5.54038

CNG Buses (g/km)	Biomethane Buses (g/km)	Biogas Buses (g/km)	Hybrid Buses (g/km)	FCEV Buses (g/km)	B100 Coaches (g/km)
0.33932	-	-	20.60055	-	-
0.48358	-	-	29.35906	-	-
0.64239	-	-	39.00068	-	-
1.29652	-	-	96.16516	-	-
0.38422	-	-	17.05993	-	-
0.31050	-	-	15.17040	-	-
0.86743	-	-	52.66308	-	-

All LDVs (%)	All HDVs (%)	Petrol Cars (%)	Diesel Cars (%)	Taxis (%)	Petrol LGVs (%)	Diesel LGVs (%)	Rigid HGVs (%)	Artic HGVs (%)	Buses/Coaches (%)	Motorcycles (%)	Full Hybrid Petrol Cars (%)	Plug-In Hybrid Petrol Cars (%)	Full Hybrid Diesel Cars (%)
74.4%	25.6%	6.3%	43.4%	4.3%	0.0%	20.1%	8.6%	3.0%	13.8%	0.2%	0.1%	0.0%	0.1%
64.2%	35.8%	5.6%	39.0%	3.9%	0.0%	15.4%	9.6%	3.4%	22.6%	0.1%	0.1%	0.0%	0.1%
37.3%	62.7%	2.4%	16.4%	7.5%	0.0%	10.8%	3.8%	0.6%	57.6%	0.1%	0.0%	0.0%	0.1%
45.3%	54.7%	2.8%	20.2%	12.8%	0.0%	9.4%	6.1%	0.5%	47.5%	0.1%	0.0%	0.0%	0.1%
74.0%	26.0%	6.4%	41.9%	7.0%	0.0%	18.3%	8.7%	3.6%	13.5%	0.1%	0.1%	0.0%	0.1%
61.6%	38.4%	4.5%	30.1%	13.4%	0.0%	13.3%	5.8%	2.5%	29.7%	0.1%	0.1%	0.0%	0.1%
37.7%	62.3%	2.8%	19.2%	6.3%	0.0%	9.4%	3.9%	1.4%	56.4%	0.1%	0.0%	0.0%	0.1%

CNG Buses (%)	Biomethane Buses (%)	Biogas Buses (%)	Hybrid Buses (%)	FCEV Buses (%)	B100 Coaches (%)
0.0%	-	-	0.1%	-	-
0.0%	-	-	0.2%	-	-
0.0%	-	-	0.6%	-	-
0.0%	-	-	0.5%	-	-
0.0%	-	-	0.1%	-	-
0.0%	-	-	0.3%	-	-
0.0%	-	-	0.6%	-	-

Appendix C – Source Apportionment calculations

Tables C1 to 8: The local contribution apportioned to vehicle class at each monitoring location (calculated in accordance with LAQM.TG16 Box 7.5)

Box 7.5 calculation – Tyn	Local Source (%)	NO_2 µg/m^3	Total (%)
T-NO_2 (Total (Monitored) nitrogen dioxide)		**47.21**	
TB-NO_2 (Total Background nitrogen dioxide[1])		13.62	
TB-NOx (Total Background nitrous oxides[1])		18.45	
RB-NOx (Regional Background nitrous oxides[1])		12.35	
Step 1: LB-NOx[2] = TB-NOx – RB-NOx		6.10	
Step2: RB-NO_2[3] = TB-NO_2 × (RB-NOx / TB-NOx)		**9.12**	19.32%
Step2: LB-NO_2[4] = TB-NO2 × (LB-NOx / TB-NOx)		**4.50**	9.53%
Step3: L-NO_2[5] = T-NO_2 – TB-NO_2		**33.59**	
Step4: % of vehicles from EfT			
Petrol Cars	6.39%	2.15	
Diesel Cars	41.89%	14.07	
Hybrid Cars	0.19%	0.07	
Total cars	**48.47%**	**16.29**	**34.51%**
Taxis	**6.99%**	**2.35**	**4.98%**
Petrol LGVs	0.10%	0.03	
Diesel LGVs	18.29%	6.15	
Total LGVs	**18.39%**	**6.18**	**13.09%**
HGVs	**12.38%**	**4.16**	**8.82%**
Buses/Coaches	**13.69%**	**4.60**	**9.75%**
Motorcycles	**0.09%**	**0.03**	**0.07%**
Total vehicles	**100%**	**33.59**	**100%**

1) Data from Defra 2018 Background Maps for model year of 2018 for relevant local coordinates
2) Local Background nitrous oxides
3) Regional Background nitrogen dioxide contribution
4) Local Background nitrogen dioxide contribution
5) Local sources nitrogen dioxide contribution

Box 7.5 calculation – Fos	Local Source (%)	NO_2 µg/m^3	Total %
T-NO_2 (Total (Monitored) nitrogen dioxide)		**48.51**	
TB-NO_2 (Total Background nitrogen dioxide[1])		13.62	
TB-NOx (Total Background nitrous oxides[1])		18.45	
RB-NOx (Regional Background nitrous oxides[1])		12.35	
Step 1: LB-NOx[2] = TB-NOx – RB-NOx		6.10	
Step2: RB-NO_2[3] = TB-NO_2 × (RB-NOx / TB-NOx)		**9.12**	18.82%
Step2: LB-NO_2[4] = TB-NO2 × (LB-NOx / TB-NOx)		**4.50**	9.29%
Step3: L-NO_2[5] = T-NO_2 – TB-NO_2		**34.89**	
Step4: % of vehicles from EfT			
Petrol Cars	4.53%	1.58	
Diesel Cars	30.12%	10.51	
Hybrid Cars	0.07%	0.02	
Total cars	**34.72%**	**12.11**	24.95%
Taxis	13.41%	**4.68**	9.64%
Petrol LGVs	0.02%	0.01	
Diesel LGVs	13.30%	4.64	
Total LGVs	**13.32%**	**4.65**	9.58%
HGVs	**8.37%**	**2.92**	6.03%
Buses/Coaches	**30.08%**	**10.49**	21.60%
Motorcycles	**0.09%**	**0.03**	0.06%
Total vehicles	**100%**	**34.88**	100%

1) Data from Defra 2018 Background Maps for model year of 2018 for relevant local coordinates
2) Local Background nitrous oxides
3) Regional Background nitrogen dioxide contribution
4) Local Background nitrogen dioxide contribution
5) Local sources nitrogen dioxide contribution

Box 7.5 calculation – Fos2	Local Source (%)	NO_2 µg/m^3	Total %
T-NO_2 (Total (Monitored) nitrogen dioxide)		**35.81**	
TB-NO_2 (Total Background nitrogen dioxide[1])		13.62	
TB-NOx (Total Background nitrous oxides[1])		18.45	
RB-NOx (Regional Background nitrous oxides[1])		12.35	
Step 1: LB-NOx[2] = TB-NOx – RB-NOx		6.10	
Step2: RB-NO_2[3] = TB-NO_2 × (RB-NOx / TB-NOx)		**9.12**	25.49%
Step2: LB-NO_2[4] = TB-NO2 × (LB-NOx / TB-NOx)		**4.50**	12.58%
Step3: L-NO_2[5] = T-NO_2 – TB-NO_2		**22.19**	
Step4: % of vehicles from EfT			
Petrol Cars	4.53%	1.01	
Diesel Cars	30.12%	6.68	
Hybrid Cars	0.07%	0.02	
Total cars	**34.72%**	**12.11**	21.50%
Taxis	13.41%	**2.98**	8.31%
Petrol LGVs	0.02%	0.00	
Diesel LGVs	13.30%	2.95	
Total LGVs	**13.32%**	**2.95**	8.25%
HGVs	**8.37%**	**1.86**	5.19%
Buses/Coaches	**30.08%**	**6.67**	18.62%
Motorcycles	**0.09%**	**0.02**	0.06%
Total vehicles	**100%**	**22.19**	100%

1) Data from Defra 2018 Background Maps for model year of 2018 for relevant local coordinates
2) Local Background nitrous oxides
3) Regional Background nitrogen dioxide contribution
4) Local Background nitrogen dioxide contribution
5) Local sources nitrogen dioxide contribution

Box 7.5 calculation – But2	Local Source (%)	NO_2 µg/m^3	Total %
T-NO_2 (Total (Monitored) nitrogen dioxide)		**52.43**	
TB-NO_2 (Total Background nitrogen dioxide[1])		13.62	
TB-NOx (Total Background nitrous oxides[1])		18.45	
RB-NOx (Regional Background nitrous oxides[1])		12.35	
Step 1: LB-NOx[2] = TB-NOx – RB-NOx		6.10	
Step2: RB-NO_2[3] = TB-NO_2 × (RB-NOx / TB-NOx)		**9.12**	17.39%
Step2: LB-NO_2[4] = TB-NO2 × (LB-NOx / TB-NOx)		**4.50**	8.58%
Step3: L-NO_2[5] = T-NO_2 – TB-NO_2		**38.81**	
Step4: % of vehicles from EfT			
Petrol Cars	2.76%	1.07	
Diesel Cars	19.15%	7.43	
Hybrid Cars	0.04%	0.02	
Total cars	**21.95%**	**8.52**	16.25%
Taxis	6.26%	**2.43**	4.63%
Petrol LGVs	0.04%	0.02	
Diesel LGVs	9.37%	3.64	
Total LGVs	**9.41%**	**3.66**	6.96%
HGVs	**5.29%**	**2.05**	3.92%
Buses/Coaches	**57.03%**	**22.13**	42.21%
Motorcycles	**0.05%**	**0.02**	0.04%
Total vehicles			
	100%	**38.81**	100%

1) Data from Defra 2018 Background Maps for model year of 2018 for relevant local coordinates
2) Local Background nitrous oxides
3) Regional Background nitrogen dioxide contribution
4) Local Background nitrogen dioxide contribution
5) Local sources nitrogen dioxide contribution

Box 7.5 calculation – BRS2	Local Source (%)	NO_2 µg/m^3	Total %
T-NO_2 (Total (Monitored) nitrogen dioxide)		**47.70**	
TB-NO_2 (Total Background nitrogen dioxide[1])		13.12	
TB-NOx (Total Background nitrous oxides[1])		17.65	
RB-Nox (Regional Background nitrous oxides[1])		11.34	
Step 1: LB-Nox[2] = TB-Nox – RB-Nox		6.31	
Step2: RB-NO_2[3] = TB-NO_2 × (RB-Nox / TB-Nox)		**8.43**	17.67%
Step2: LB-NO_2[4] = TB-NO2 × (LB-Nox / TB-Nox)		**4.69**	9.83%
Step3: L-NO_2[5] = T-NO_2 – TB-NO_2		**34.58**	
Step4: % of vehicles from EfT			
Petrol Cars	4.53%	2.16	
Diesel Cars	30.12%	15.00	
Hybrid Cars	0.07%	0.08	
Total cars	**34.72%**	**17.24**	36.16%
Taxis	13.41%	**1.48**	3.11%
Petrol LGVs	0.02%	0.01	
Diesel LGVs	13.30%	6.95	
Total LGVs	**13.32%**	**6.96**	14.59%
HGVs	**8.37%**	**4.02**	8.43%
Buses/Coaches	**30.08%**	**4.82**	10.10%
Motorcycles	**0.09%**	**0.05**	0.11%
Total vehicles	**100%**	**34.57**	100%

1) Data from Defra 2018 Background Maps for model year of 2018 for relevant local coordinates
2) Local Background nitrous oxides
3) Regional Background nitrogen dioxide contribution
4) Local Background nitrogen dioxide contribution
5) Local sources nitrogen dioxide contribution

Box 7.5 calculation – Bkc	Local Source (%)	NO_2 µg/m^3	Total %
T-NO_2 (Total (Monitored) nitrogen dioxide)		**46.94**	
TB-NO_2 (Total Background nitrogen dioxide[1])		13.62	
TB-NOx (Total Background nitrous oxides[1])		18.45	
RB-NOx (Regional Background nitrous oxides[1])		12.35	
Step 1: LB-NOx[2] = TB-NOx – RB-NOx		6.10	
Step2: RB-NO_2[3] = TB-NO_2 × (RB-NOx / TB-NOx)		**9.12**	19.40%
Step2: LB-NO_2[4] = TB-NO2 × (LB-NOx / TB-NOx)		**4.50**	9.58%
Step3: L-NO_2[5] = T-NO_2 – TB-NO_2		**33.32**	
Step4: % of vehicles from EfT			
Petrol Cars	2.79%	0.93	
Diesel Cars	20.15%	6.71	
Hybrid Cars	0.10%	0.03	
Total cars	**23.04%**	**7.67**	16.39%
Taxis	12.79%	**4.26**	9.07%
Petrol LGVs	0.01%	0.01	
Diesel LGVs	9.36%	3.12	
Total LGVs	**9.37%**	**3.13**	6.66%
HGVs	**6.60%**	**2.20**	4.69%
Buses/Coaches	**48.10%**	**16.03**	34.12%
Motorcycles	**0.10%**	**0.03**	0.09%
Total vehicles	**100%**	**33.32**	100%

1) Data from Defra 2018 Background Maps for model year of 2018 for relevant local coordinates
2) Local Background nitrous oxides
3) Regional Background nitrogen dioxide contribution
4) Local Background nitrogen dioxide contribution
5) Local sources nitrogen dioxide contribution

Box 7.5 calculation – DDASH	Local Source (%)	NO_2 µg/m^3	Total %
T-NO_2 (Total (Monitored) nitrogen dioxide)		**43.80**	
TB-NO_2 (Total Background nitrogen dioxide[1])		13.12	
TB-NOx (Total Background nitrous oxides[1])		17.65	
RB-NOx (Regional Background nitrous oxides[1])		11.34	
Step 1: LB-NOx[2] = TB-NOx – RB-NOx		6.31	
Step2: RB-NO_2[3] = TB-NO_2 × (RB-NOx / TB-NOx)		**8.43**	19.25%
Step2: LB-NO_2[4] = TB-NO2 × (LB-NOx / TB-NOx)		**4.69**	10.71%
Step3: L-NO_2[5] = T-NO_2 – TB-NO_2		**30.68**	
Step4: % of vehicles from EfT			
Petrol Cars	5.64%	1.73	
Diesel Cars	39.03%	11.97	
Hybrid Cars	0.07%	0.02	
Total cars	**44.74%**	**13.72**	31.38%
Taxis	3.87%	**1.19**	2.70%
Petrol LGVs	0.02%	0.01	
Diesel LGVs	15.38%	4.72	
Total LGVs	**15.40%**	**4.73**	10.77%
HGVs	**12.94%**	**3.97**	9.05%
Buses/Coaches	**22.90%**	**7.03**	16.02%
Motorcycles	**0.15%**	**0.04**	0.11%
Total vehicles	**100%**	**30.68**	100%

1) Data from Defra 2018 Background Maps for model year of 2018 for relevant local coordinates
2) Local Background nitrous oxides
3) Regional Background nitrogen dioxide contribution
4) Local Background nitrogen dioxide contribution
5) Local sources nitrogen dioxide contribution

Box 7.5 calculation – Lwm1	Local Source (%)	NO_2 µg/m^3	Total %
T-NO_2 (Total (Monitored) nitrogen dioxide)		**41.20**	
TB-NO_2 (Total Background nitrogen dioxide[1])		14.28	
TB-NOx (Total Background nitrous oxides[1])		19.51	
RB-NOx (Regional Background nitrous oxides[1])		13.76	
Step 1: LB-NOx[2] = TB-NOx – RB-NOx		5.75	
Step2: RB-NO_2[3] = TB-NO_2 × (RB-NOx / TB-NOx)		**10.07**	24.44%
Step2: LB-NO_2[4] = TB-NO2 × (LB-NOx / TB-NOx)		**4.21**	10.22%
Step3: L-NO_2[5] = T-NO_2 – TB-NO_2		**26.92**	
Step4: % of vehicles from EfT			
Petrol Cars	2.37%	0.64	
Diesel Cars	16.44%	4.43	
Hybrid Cars	0.09%	0.02	
Total cars	**18.90%**	**5.09**	12.35%
Taxis	7.51%	**2.02**	4.91%
Petrol LGVs	0.01%	0.01	
Diesel LGVs	10.84%	2.92	
Total LGVs	**10.85%**	**2.93**	7.06%
HGVs	**4.50%**	**1.21**	2.94%
Buses/Coaches	**58.19%**	**15.66**	38.04%
Motorcycles	**0.05%**	**0.01**	0.03%
Total vehicles	**100%**	**26.92**	100%

1) Data from Defra 2018 Background Maps for model year of 2018 for relevant local coordinates
2) Local Background nitrous oxides
3) Regional Background nitrogen dioxide contribution
4) Local Background nitrogen dioxide contribution
5) Local sources nitrogen dioxide contribution

Tables C9 to C16: Nitrous Oxides and Nitrogen Dioxide equivalent reduction required for monitoring locations (in accordance with LAQM.TG16 Box 7.6).

Box 7.6 Calculation – Tyn	NOx/NO_2 µg/m³	Reduction required (%)
Step 1 Total NOx	91.55	
Step 2 TB-NOx (Total Background nitrous oxides[1])	18.45	
Step 3 Local Sources NOx	73.10	
Step 4 Road NOx = 40 NO2 - TB-NO2	53.70	
Step 4 Road NOx = 38 NO2 - TB-NO2	49.17	
Step 4 Road NOx = 36 NO2 - TB-NO2	44.72	
Step 5 NOx equivalent for NO2 40µg/m³	19.40	26.5
Step 5 NOx equivalent for NO2 38µg/m³	23.93	32.7
Step 5 NOx equivalent for NO2 36µg/m³	28.38	38.8
Local NO2 reduction required for 40µg/m³	8.91	
Local NO2 reduction required for 38µg/m³	11.00	
Local NO2 reduction required for 36µg/m³	13.04	

1) Data from Defra 2018 Background Maps for model year of 2018 for relevant local coordinates

Box 7.6 Calculation – Fos	NOx/NO_2 µg/m³	Reduction required (%)
Step 1 Total NOx	94.76	
Step 2 TB-NOx (Total Background nitrous oxides[1])	18.45	
Step 3 Local Sources NOx	76.31	
Step 4 Road NOx = 40 NO2 - TB-NO2	53.70	
Step 4 Road NOx = 38 NO2 - TB-NO2	49.17	
Step 4 Road NOx = 36 NO2 - TB-NO2	44.72	
Step 5 NOx equivalent for NO2 40µg/m³	22.61	29.6
Step 5 NOx equivalent for NO2 38µg/m³	27.14	35.6
Step 5 NOx equivalent for NO2 36µg/m³	31.59	41.4
Local NO2 reduction required for 40µg/m³	10.34	
Local NO2 reduction required for 38µg/m³	12.41	
Local NO2 reduction required for 36µg/m³	14.44	

1) Data from Defra 2018 Background Maps for model year of 2018 for relevant local coordinates

Box 7.6 Calculation – Fos2	NOx/NO_2 µg/m^3	Reduction required (%)
Step 1 Total NOx	64.98	
Step 2 TB-NOx (Total Background nitrous oxides[1])	18.45	
Step 3 Local Sources NOx	46.53	
Step 4 Road NOx = 40 NO2 - TB-NO2	53.70	
Step 4 Road NOx = 38 NO2 - TB-NO2	49.17	
Step 4 Road NOx = 36 NO2 - TB-NO2	44.72	
Step 5 NOx equivalent for NO2 40µg/m^3	-	-
Step 5 NOx equivalent for NO2 38µg/m^3	-	-
Step 5 NOx equivalent for NO2 36µg/m^3	1.81	3.89
Local NO2 reduction required for 40µg/m^3	-	
Local NO2 reduction required for 38µg/m^3	-	
Local NO2 reduction required for 36µg/m^3	0.86	

1) Data from Defra 2018 Background Maps for model year of 2018 for relevant local coordinates

Box 7.6 Calculation – But2	NOx/NO_2 µg/m^3	Reduction required (%)
Step 1 Total NOx	104.65	
Step 2 TB-NOx (Total Background nitrous oxides[1])	18.45	
Step 3 Local Sources NOx	86.20	
Step 4 Road NOx = 40 NO2 - TB-NO2	53.70	
Step 4 Road NOx = 38 NO2 - TB-NO2	49.17	
Step 4 Road NOx = 36 NO2 - TB-NO2	44.72	
Step 5 NOx equivalent for NO2 40µg/m^3	32.50	37.7
Step 5 NOx equivalent for NO2 38µg/m^3	37.03	43
Step 5 NOx equivalent for NO2 36µg/m^3	41.48	48.1
Local NO2 reduction required for 40µg/m^3	14.63	
Local NO2 reduction required for 38µg/m^3	16.67	
Local NO2 reduction required for 36µg/m^3	18.68	

1) Data from Defra 2018 Background Maps for model year of 2018 for relevant local coordinates

Box 7.6 Calculation – BRS2	NOx/NO_2 µg/m^3	Reduction required (%)
Step 1 Total NOx	92.22	
Step 2 TB-NOx (Total Background nitrous oxides[1])	17.65	
Step 3 Local Sources NOx	74.57	
Step 4 Road NOx = 40 NO2 - TB-NO2	53.85	
Step 4 Road NOx = 38 NO2 - TB-NO2	49.30	
Step 4 Road NOx = 36 NO2 - TB-NO2	44.84	
Step 5 NOx equivalent for NO2 40µg/m^3	20.72	27.8
Step 5 NOx equivalent for NO2 38µg/m^3	25.27	33.9
Step 5 NOx equivalent for NO2 36µg/m^3	29.73	39.9
Local NO2 reduction required for 40µg/m^3	9.61	
Local NO2 reduction required for 38µg/m^3	11.72	
Local NO2 reduction required for 36µg/m^3	13.79	

1) Data from Defra 2018 Background Maps for model year of 2018 for relevant local coordinates

Box 7.6 Calculation – DDASH	NOx/NO_2 µg/m^3	Reduction required (%)
Step 1 Total NOx	82.69	
Step 2 TB-NOx (Total Background nitrous oxides[1])	17.65	
Step 3 Local Sources NOx	65.04	
Step 4 Road NOx = 40 NO2 - TB-NO2	53.85	
Step 4 Road NOx = 38 NO2 - TB-NO2	49.30	
Step 4 Road NOx = 36 NO2 - TB-NO2	44.84	
Step 5 NOx equivalent for NO2 40µg/m^3	11.19	17.2
Step 5 NOx equivalent for NO2 38µg/m^3	15.74	24.2
Step 5 NOx equivalent for NO2 36µg/m^3	20.20	31.1
Local NO2 reduction required for 40µg/m^3	5.28	
Local NO2 reduction required for 38µg/m^3	7.42	
Local NO2 reduction required for 36µg/m^3	9.53	

1) Data from Defra 2018 Background Maps for model year of 2018 for relevant local coordinates

Box 7.6 Calculation – Bkc	NOx/NO_2 µg/m³	Reduction required (%)
Step 1 Total NOx	89.93	
Step 2 TB-NOx (Total Background nitrous oxides[1])	18.45	
Step 3 Local Sources NOx	71.48	
Step 4 Road NOx = 40 NO2 - TB-NO2	53.85	
Step 4 Road NOx = 38 NO2 - TB-NO2	49.30	
Step 4 Road NOx = 36 NO2 - TB-NO2	44.84	
Step 5 NOx equivalent for NO2 40µg/m³	17.63	24.7
Step 5 NOx equivalent for NO2 38µg/m³	22.18	31
Step 5 NOx equivalent for NO2 36µg/m³	26.64	37.3
Local NO2 reduction required for 40µg/m³	8.22	
Local NO2 reduction required for 38µg/m³	10.34	
Local NO2 reduction required for 36µg/m³	12.42	

1) Data from Defra 2018 Background Maps for model year of 2018 for relevant local coordinates

Box 7.6 Calculation – Lwm1	NOx/NO_2 µg/m³	Reduction required (%)
Step 1 Total NOx	76.26	
Step 2 TB-NOx (Total Background nitrous oxides[1])	19.51	
Step 3 Local Sources NOx	56.75	
Step 4 Road NOx = 40 NO2 - TB-NO2	53.85	
Step 4 Road NOx = 38 NO2 - TB-NO2	49.30	
Step 4 Road NOx = 36 NO2 - TB-NO2	44.84	
Step 5 NOx equivalent for NO2 40µg/m³	2.90	5.1
Step 5 NOx equivalent for NO2 38µg/m³	7.45	13.1
Step 5 NOx equivalent for NO2 36µg/m³	11.91	21
Local NO2 reduction required for 40µg/m³	1.38	
Local NO2 reduction required for 38µg/m³	3.53	
Local NO2 reduction required for 36µg/m³	5.65	

1) Data from Defra 2018 Background Maps for model year of 2018 for relevant local coordinates

Table C 17: Defra's NOx to NO2 Conversion Spreadsheet v8.1 for calculations

Local Authority:	Worcester District			Year: Traffic Mix:	2018 All non-urban UK traffic	
Site ID	Diffusion tube NO_2, µg m^{-3}	Background µg m^{-3}		Road NO_x, µg m^{-3}	User defined local traffic mix fraction emitted as NO_2 (fNO_2)	Notes
	µg m^{-3}	NO_x	NO_2			
Tyn	47.21	18.45		73.1		
Fos	48.51	18.45		76.31		
Fos2	35.81	18.45		46.53		
But2	52.43	18.45		86.2		
BRS2	47.7	17.65		74.3		
Bkc	46.94	18.45		71.48		
DDASH	43.8	17.65		64.82		
Lwm1	41.2	19.51		56.56		
40	40		13.62	53.85		
38	38		13.62	49.3		
36	36		13.62	44.84		

References

1. Air Quality Consultants (July 2017) Detailed Assessment of Air Quality along London Road, Worcester for Worcester City Council
2. Defra (February 2018) Local Air Quality Management Technical Guidance LAQM.TG(16)
3. Defra (November 2021) Emissions Factor Toolkit v.11.0 User Guide
4. Defra (Oct 2016) Background Concentration Maps User Guide
5. Worcestershire Regulatory Services (2017) Worcester Road, St Johns Source Apportionment Report
6. Worcestershire Regulatory Services (2021) Air Quality Annual Status Report for Worcester City

Glossary of Terms

Abbreviation	Description
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'
AQAPSG	Air Quality Action Plan Steering Group
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
ASR	Annual Status Report
AURN	Automatic Urban and Rural Network (Defra) - UK's largest automatic monitoring network and is the main network used for compliance reporting against the Ambient Air Quality Directives (by Gov't)
Defra	Department for Environment, Food and Rural Affairs
DoPH	Director of Public Health
ICE	Internal Combustion Engine
LAQM	Local Air Quality Management
LCWIP	Local Cycling and Walking Infrastructure Plan
MCERTS	Monitoring Certification Scheme (Environment Agency) - certification of equipment that monitors pollution in the ambient air.
MJAC	Midland Joint Advisory Council
NHS	National Health Service
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
OZEV	Office of Zero Emission Vehicles
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide
SPD	Supplementary Planning Document
SWDP	South Worcestershire Development Plan
SYSTRA	A transport consulting and engineering firm, leading in transport infrastructure
TRO	Traffic Regulation Order

Abbreviation	Description
ULEV	Ultra Low Emission Vehicle
WRS	Worcestershire Regulatory Services

References

- DEFRA (2023) National Diffusion Tube Bias Adjustment Factor Spreadsheet v.03/23
- DEFRA (2018) Background Mapping for Local Authorities
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- Worcestershire Regulatory Services (2013) Air Quality Action Plan for Worcestershire
- Worcestershire Regulatory Services (2015) Air Quality Action Plan Progress Report for Worcestershire April 2013-April 2015
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