City of BRADFORD METROPOLITAN DISTRICT COUNCIL

2017 Air Quality Annual Status Report (ASR)

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

February 2018

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Executive Summary: Air Quality in Our Area

Air Quality in Bradford

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

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion[3].

The air pollutants of concern in Bradford are nitrogen dioxide (NO_2) and particulate matter (PM). A significant source of these pollutants is traffic but industry, heat and power generation, domestic sources and natural activities also contribute.

Bradford has areas of high levels of deprivation and significant levels of health inequality. 27% of the Bradford district population live in areas classed as the 10% most deprived in England[4]. There are above average numbers of deaths from smoking, cancer, heart disease, strokes and it is estimated that emissions of man-made fine particles, $PM_{2.5,}$ cause 4.2% of total mortality, representing 2,300 years of life lost due to particulate pollution in Bradford[5]. Improving public health outcomes and reducing deprivation are significant challenges for City of Bradford MDC.

Poor air quality is closely linked to poor health, and frequently identified in the most deprived wards of the city. City of Bradford MDC fully recognises that improving local air quality is essential to attain better health outcomes for all. This is particularly important for the above national average numbers of young people in the district (22% of the total population) whom are particularly

[1] Environmental equity, air quality, socioeconomic status and respiratory health, 2010
[2] Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006
[3] Defra. Abatement cost guidance for valuing changes in air quality, May 2013
[4] https://ubd.bradford.gov.uk/media/1289/poverty-and-deprivation-ubd-20170206.pdf
[5] https://fingertips.phe.org.uk/search/particulate#page/0/gid/1/pat/6/par/E12000003/ati/102/are/E08000032

sensitive to the effects of poor air quality. They may experience life long impacts resulting from pollutant exposure in their early years.

Significant key challenges to improving air quality in Bradford are:

- Failure of manufacturers to reduce vehicle emissions as quickly as was previously anticipated. This is considered to be a direct result of inadequate emission control tests for new vehicles and the use of emission test defeat strategies by a number of vehicle manufacturers. Consequently 'on the road emissions' of NO_x from many modern vehicles, particularly Euro 5 diesel cars, are much higher than consumers have been led to believe.
- The increased uptake of diesel vehicles in the general vehicle fleet, driven by previous central government taxation polices designed to encourage their Purchase.
- Development related "emissions creep", arising from additional vehicle trips linked to development in the city and additional associated combustion sources such as heating and industry.
- Bradford has seen an increase in non-transport sources from domestic wood burning, biomass and local electricity generation (CHP and STOR).

For some pollutants the government has set health based objective levels which Local Authorities must comply with. Where these objectives are not met, Local Authorities must declare **Air Quality Management Areas (AQMAs)** and draw up **Air Quality Action Plans (AQAPs)** to improve air quality.

Bradford has a number of locations which have already been declared as AQMAs and a number of other locations where air quality is currently of concern (Figure 1).

Air Quality Management Areas in Bradford

Bradford has declared four Air Quality Management Areas (AQMAs). These are located close to the city centre at Manningham Lane, Thornton Road,

Mayo Avenue / Manchester Road and Shipley Airedale Road. The AQMAs were declared for exceedances of both the annual and hourly objectives for nitrogen dioxide. The detailed boundaries of the current AQMAs are shown in Figure 2.

This report presents air quality data for Bradford for the 2016 calendar year.

During 2016 the annual average NO_2 objective continued to be breached in the AQMAs located at Mayo Avenue, Manningham Lane and Shipley Airedale Road.

The annual average objective was not exceeded at Thornton Road during 2016. The last recorded breach of the annual average objective on Thornton Road occurred in 2014.

The hourly NO_2 objective was not exceeded at any of the AQMAs during 2016.

Figure 1: Current AQMAs and additional areas of air quality concern in Bradford

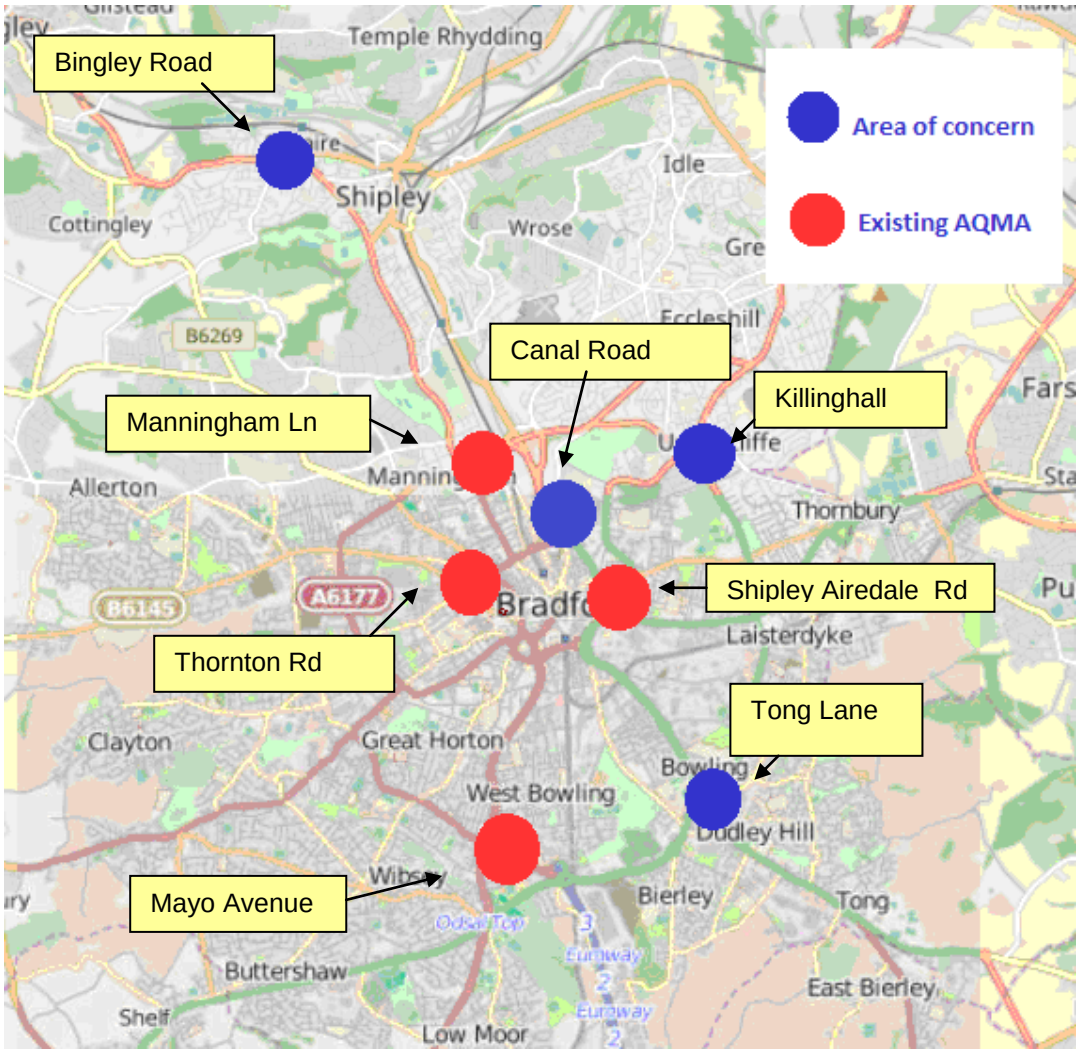
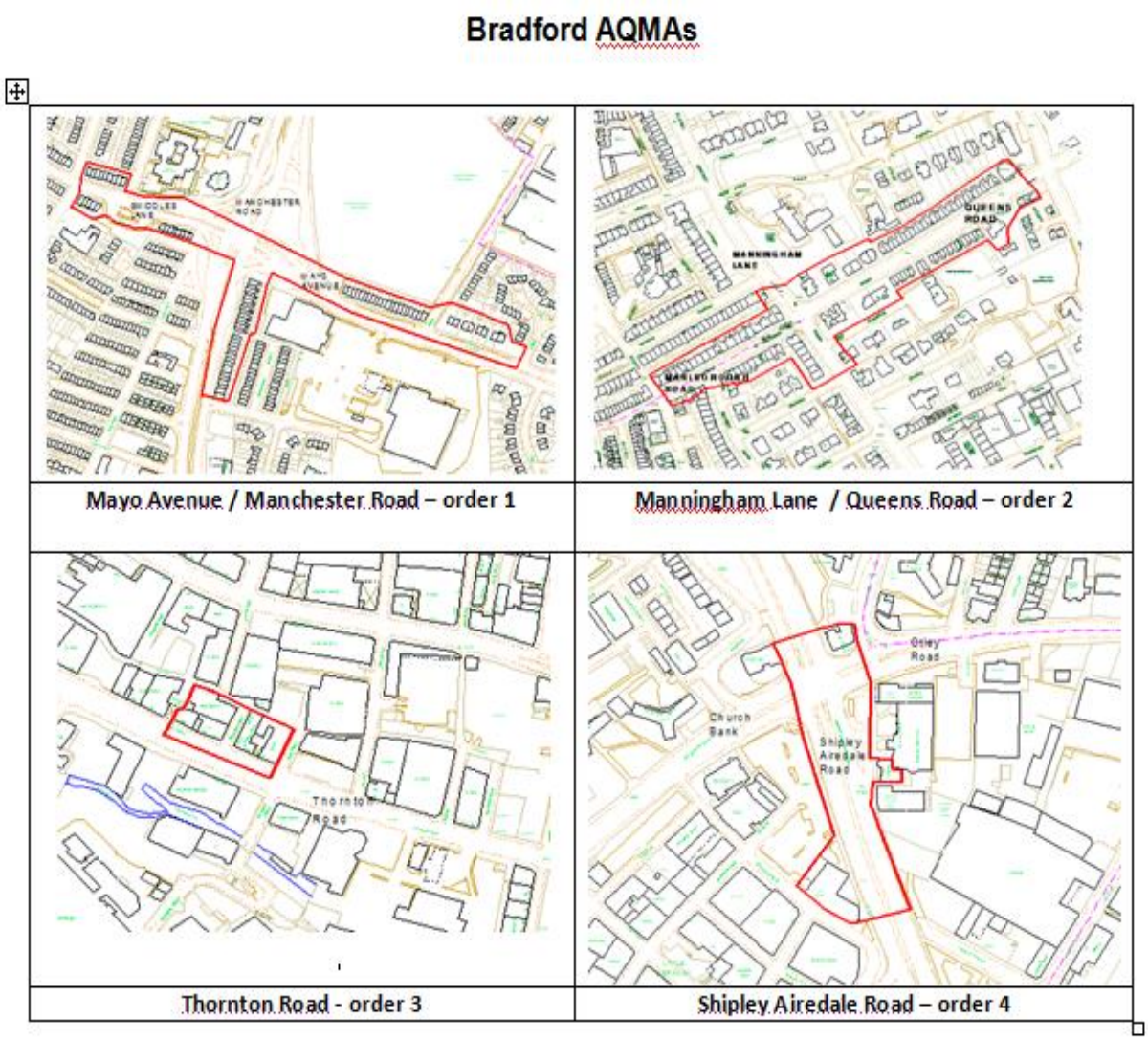


Figure 2: Bradford AQMA boundaries



Air quality trends in the AQMAs

The annual average NO_2 concentration recorded at Shipley Airedale Road in 2016 was 52µg/m^3. This was slightly higher than the value of 48µg/m^3 recorded in 2015 but is the same as levels recorded in 2012 and 2013. Some year to year fluctuation in air pollution concentrations at a particular location is expected due to the influence of weather conditions. A more effective understanding of long term trends in air quality can be obtained the examination of data from the past 5 years.

The average concentration of NO_2 measured at Shipley Airedale Road over the last 5 years is 52µg/m^3 indicating that the concentration of nitrogen dioxide in this area has stabilised, but is not showing any sign of significant improvement. This concentration of nitrogen dioxide is still well in excess of the 40ug/m^3 objective level, so further action is required to improve air quality in this area.

At Mayo Avenue the annual average nitrogen dioxide concentration recorded in 2016 was 46µg/m^3. This was slightly higher than the value of 42µg/m^3 recorded in 2014 and 2015, but is significantly lower than the values recorded prior to that. The average concentration of NO_2 measured at this site over the last 5 years was 56µg/m^3. There is some indication that air quality in the Mayo Avenue area has improved in the past 5 years, but it is too early to confirm if this is the start of a sustained downward trend.

At Thornton Road there was a further reduction in the annual average nitrogen dioxide concentration compared with the previous four years. The annual average concentration recorded in 2016 was 31µg/m^3 compared with a five year average of 45.6µg/m^3. If concentrations of nitrogen dioxide at Thornton Road continue to remain well below the annual average objective level it may be possible to consider revocation of the Thornton Road AQMA. Additional diffusion tube monitoring has recently been deployed in the Thornton Road area to ensure the reductions in nitrogen dioxide concentration are reflected elsewhere in the locality.

The annual average concentration of nitrogen dioxide measured at Manningham Lane in 2016 was 41µg/m^3. This was very similar to the 2015 value of 42µg/m^3. Due to historical problems with the analyser at this site there is insufficient reliable long term data to enable any conclusion about the longer term air quality trend at this particular location. Diffusion tube monitoring in the area suggests that some exceedances of the annual average NO_2 objective are still regularly arising at relevant locations in this vicinity.

Additional areas of air quality concern in Bradford

Since the declaration of the current AQMAs, City of Bradford MDC has identified three additional areas of the city where elevated NO_2 concentrations have been recorded (Bradford USA report 2015). These are located at:

- Saltaire Road / Bingley[6] Road junction
- Rook Lane / Rooley Lane / Tong Street area
- Harrogate Road / Killinghall Road/ Dudley Hill Road crossroads

The monitoring results obtained in 2016 indicate that the annual average NO_2 objective continues to be exceeded at two relevant locations on Bingley Road and at one location on Tong Street. The results for the Harrogate Road /Killinghall Road junction indicate that concentrations at relevant receptor points are currently borderline with the annual average NO_2 objective. Further information about current air quality and action to be taken in each of these areas can be found in section 3 of this report.

The 2016 monitoring data has also indicated elevated concentrations of nitrogen dioxide at two additional locations:

- Canal Road
- Greengates crossroads.

The monitoring location DT73 on Canal Road was established in late 2015 to measure baseline concentrations of nitrogen dioxide prior to the implementation of a development masterplan in this area. The delivery of the masterplan is expected to result in the development of over 1000 new homes, a primary school, healthcare centre, supermarket and car showroom by 2034. The council is also currently considering a further application for around 750 new homes on the nearby Bolton Woods Quarry site. Canal Road has been identified by DEFRA as having possible exceedances of the EU limit value for nitrogen dioxide. Currently there are no relevant locations on the stretch of Canal Road where the 2016 monitoring took place. Additional diffusion tubes

[6] This location has been described in previous reports as Bradford Road but is actually on Bingley Road close to where it meets Bradford Road

have now been deployed into nearby residential areas and will be reported in the ASR 2018.

Monitoring around Greengates crossroads was established in March 2016 to support a City of Bradford MDC planning application for a junction improvement plan aiming to reduce congestion in the area. If approved, this work is expected to improve air quality in this area.

In response to these latest monitoring results the City of Bradford MDC now intends to:

- Progress the declaration of a further AQMA on Bingley Road as soon as practicably possible . An update on progress will be provided in Bradford's ASR 2018.
- Further review the concentration at monitoring location DT64 Tong Street in the 2018 ASR to determine if the declaration of an AQMA is necessary.
- Continue to monitor and report on nitrogen dioxide concentrations in the Harrogate Road / Killinghall/ Dudley Hill area until such time as the City of Bradford MDC is satisfied that there is no risk of the air quality objectives being breached in this area.
- Further assess air quality in the vicinity of existing residential properties in the Canal Road / Valley Road area.
- Review the progress of the proposed junction improvement works at Greengates crossroads in the 2018 ASR report and continue monitoring air quality in the area until such time City of Bradford MDC is satisfied that there is no further risk of air quality objectives being exceeded.

Actions to Improve Air Quality in Bradford

The measures being taken by the City of Bradford MDC to improve air quality are detailed in the following documents:

- Air Quality Action Plan (2009)
- Air Quality Strategy (2011)
- Bradford Low Emission Strategy (2013)
- West Yorkshire Low Emission Strategy (WYLES) [7]

The documents can be viewed at:

https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/.

The approaches employed to improve air quality in Bradford are;

a) **Trip reduction** – measures which reduce the overall numbers of journeys taken in motor vehicles across the district. This includes investment in sustainable transport measures, enabling more people to walk, cycle or use public transport. It also incorporates measures that encourage people to share vehicles (such as car share schemes and car clubs) and measures that encourage working or studying from home.

b) **Emission reduction measures** – these are measures to reduce the total emissions from individual vehicles. This can be achieved by fitting emission abatement equipment to existing vehicles, replacing older vehicles with newer ones or by completely changing the technology and fuels used. For example, ultra low emission vehicles fuelled by electric or gas are much cleaner than those that use diesel. Procuring low emission goods and services is a significant element of this strategy

c) **Planning measures** - these are measures designed to reduce the emission impact of future developments in Bradford, primarily in terms of traffic pollution, but also incorporating heating and other combustion

[7] This report covers the actions undertaken during the calendar year 2015 to improve air quality in Bradford. During this period the West Yorkshire Low Emission Strategy (WYLES) was in draft format but has since been completed and was fully adopted in Bradford in December 2016 and all other West Yorkshire Councils. The link provided is to the final version of the document, not the draft version available in 2015.

sources, dust generation and industrial processes. The aim is to keep any additional trips to a minimum and ensure that the planning approval process assists in the delivery of the infrastructure needed to support the future use of sustainable transport or ultra low emission vehicles. For example, a developer may be required to provide a new cycle lane and / or electric vehicle recharging points for a new development.

d) **Education and research** - measures that help people to understand the sources of pollutants, how they impact on their health and how emissions and exposure to air pollutants can be reduced or avoided.

The policy document facilitating air quality improvement and associated emission reductions in Bradford during 2016 was the **Bradford Low Emission Strategy (LES)** that was adopted in 2013. The document places low emission measures and the need to improve air quality at the heart of local decision making processes, driving air quality improvement and attracting inward investment for sustainable transport and low emission technology projects. Progress on delivery of the Bradford LES is reported to the Health and Well Being board, ensuring achievement of the best possible air quality and health outcomes for the whole of the Bradford population is a key objective, not solely compliance with air quality objectives. Table 1 summarises air quality improvement measures in Bradford.

Some of the air quality improvement measures undertaken in Bradford during 2016 were also driven by the development of the West Yorkshire Low Emission Strategy (WYLES). This document was fully adopted in Bradford (December 2016) and is now being delivered across the West Yorkshire region. The document can be viewed in full at https://www.bradford.gov.uk/media/3590/west-yorkshire-low-emissions-strategy.pdf

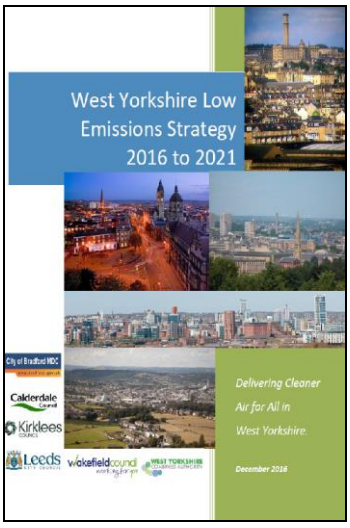


Table 1: Bradford Air Quality Improvement Measures

Strategy / Policy Area	Measures undertaken up to and including 2016	Planned progress for 2017
Bradford Low Emission Strategy (LES)	An over-arching City of Bradford MDC internal strategy to improve air quality through integrated policy development focusing on measures to reduce vehicle emissions. Adopted by Full Council, 5th November 2013. During 2016 a full review and update of the Bradford LES was commenced building on the measures outlined below and incorporating additional measures to bring it in line with the recently adopted regional West Yorkshire Low Emission Strategy (WYLES).	The updated Bradford LES is planned for publishing in 2017.
West Yorkshire Low Emission Strategy	Bradford MDC has secured funding for, and co-ordinated the development of, the West Yorkshire Low Emission Strategy (WYLES) in partnership with all the West Yorkshire Councils, West Yorkshire Combined Authority (WYCA) and PHE. This is an over-arching county wide strategy to improve air quality in the West Yorkshire region through integrated policy development. The WYLES was formally adopted by City of Bradford MDC in December 2016 and includes the following measures for County-wide implementation: • Bus emission standards, recognising urban hotspots • Extrapolation of the Bradford Leeds LEZ Study county-wide using CAZ standard data • Raising public health awareness of emissions and impact on health • West Yorkshire Electric Vehicle Strategy • Emission standards for taxis and promotion of ultra-low emission vehicles • CAZ to be introduced where necessary • Consistent mitigation measures to be applied through the planning process • Consistent procedures to consider vehicle emissions through Social Value public sector	Review and updating of local policies and procedures to reflect the WYLES requirements. Commence local implementation of WYLES measures. Further update on adoption and progress with WYLES measures to be provided in 2018 ASR report. Ongoing liaison with local bus companies to facilitate delivery of minimum Euro IV plus retrofit on all major routes in Bradford by 2018 with higher standards beyond.

	procurement • Eco Stars Scheme for Council Fleets, bus operators and freight companies[8]	
Environmental Health & Public Health	In 2015 the results of an innovative Low Emission Zone (LEZ) feasibility study were reported to Bradford Council Elected Members (as previously reported in the ASR 2016) and a decision was taken to investigate the feasibility of implementing a LEZ in Bradford. In October 2016 DEFRA published draft proposals for the introduction of Clean Air Zones (CAZs) in England. This followed consultation on a new draft national air quality plan for nitrogen dioxide (September 2015). Bradford was not highlighted in either of these initial documents as requiring a charging CAZ. During 2016 a successful high court case was launched by Client Earth against DEFRA challenging the scope and effectiveness of the national plan and calling for more cities to be required to have CAZs. As a result of this ongoing legal case it was decided to delay any further progress on the introduction of a LEZ in Bradford until the final versions of the new national air quality action plan and CAZ framework were available. Towards the end of 2016 all indications were that Bradford would be mandated to have a CAZ. Public Health research projects undertaken in collaboration with environmental epidemiologists and health researchers at Born In Bradford were completed. These covered: • school travel (including development of toolkit) • assessment of exposure of school children to air pollution as part of Born in Bradford 'Better Start Project' Project The project is now entering the second phase which will consider 'What factors help or hinder adoption of policies to improve air quality?'	Review final versions of the new national AQAP for nitrogen dioxide and CAZ framework and consider how these should be applied to Bradford. An update on how Bradford intends to proceed in relation to LEZ / CAZ proposals will be provided in the 2018 ASR report. The second phase research has received ethical approval from the University of Leeds and the data collection will commence during 2017. Aimed at researching the barriers to low emission policy making, it will gather questionnaires, interviews and experiences of tackling air quality through leadership and decision making. It will involve 15-20 participants at senior level and elected members.
Highways Management &	£400k secured through Clean Vehicle Technology Fund (CVTF, DfT, 2014/15) to retrofit 26 Euro III commercial, diesel buses with selective catalytic reduction and	New Low Moor railway station to open spring 2017

[8] http://www.westyorks-ca.gov.uk/News/Articles/ECO-Stars/

Transport	particle traps (SCRT) in 2015 (in partnership with First Bus and Transdev)[9] Retrofitting of 165 Euro III school buses across West Yorkshire in partnership with West Yorkshire Combined Authority (WYCA) Using Clean Bus/Vehicle Technology Fund (DfT) completed in 2016[10] Partnership work with First Bus to encourage minimum Euro IV Standard for commercial buses from 2018 with further improved standards for 2020 and beyond commenced during 2016. First operate 86% of commercial bus routes In Bradford Real-world emissions testing of buses evidenced that retrofits achieved 95% reduction in NOx emissions Car club introduction in Bradford during 2015 (including an electric vehicle). Enterprise Car Club[11] £19 million Cycle Super-Highway (Bradford-Leeds) separated cycle lane opened in 2016 provided 14km of segregated cycle path. West Yorkshire's first new railway station in ten years opened at Apperley Bridge in Bradford in December 2015. Work on a new station at Low Moor took place during 2016.	Junction improvement works at Greengates to be progressed through planning system Public access rapid charger to be provided in Bradford city centre during 2017 (LTP funded) Produce Bradford Council Travel Plan[12]
Development Control	Co-ordination of policies to limit the impact of biomass CHP installations in the urban area Continued implementation of Bradford LES low emission planning policies to ensure emission mitigation measures are implemented at the design stage, including the consideration of damage costs for major schemes. Required measures include: • Plug-in vehicle recharging on all schemes where practical – by the end of 2016 in the region of 5,000 charging points had been secured on new development schemes (since policy adoption in 2013) • Low Emission Strategies/fleet emission standards on commercial schemes • Monitored travel plans on all qualifying schemes • Electric vehicle provision	Bradford LES planning guidance to be incorporated into West Yorkshire Low Emission Strategy (WYLES) – Air Quality & Emissions: Technical Planning Guidance. Ongoing routine review of planning applications and requests for LES planning measures Inclusion of low NO_x boiler requirement and the updating of commercial fleet standards and emission standards for NRMM (non-road mobile machinery) through development control in

[9] http://www.thetelegraphandargus.co.uk/news/11466565.Government_grant_allows_green_makeover_of_most_polluting_buses/
[10] http://www.westyorks-ca.gov.uk/News/Articles/AccessBuses-go-green/
[11] https://www.enterprisecarclub.co.uk
[12] http://intranet.bradford.gov.uk/docs/Documents/Corporate%20Travel%20Plan%202015.pdf#search=bradford%20travel%20plan

	• Cycle lanes and infrastructure for walking During 2016 a Defra grant bid to secure funding for 'try & buy' EV demonstration projects to compliment EV ready development sites was submitted but was unsuccessful.	Bradford LES update 2017
Bradford Council Fleet Management	Measures introduced / completed : • Whole life costs considered in vehicle purchasing • Hybrid electric cars, electric pool cars and vans incorporated into council fleet • Feasibility study of introducing gas/biomethane infrastructure for Refuse collection vehicles (RCV) fleet • Monthly fuel reports for client departments	Assessment of City of Bradford MDC fleet under Eco-stars fleet recognition scheme – Achieving a 4 star rating (with aim of achieving the top rating of 5 for the future) Continued aspiration to have 80% of City of Bradford MDC Euro VI/6 in 2020 This work was nationally recognised – Bradford are winners of the 2016 Fleet Heroes Air Quality award.
Procurement	Vehicle emission assessment matrix developed and incorporated into all relevant tender evaluations through Social Value procurement policy Vehicle emission standards accorded 5% of evaluation score for relevant contract awards	Ongoing application of vehicle emissions procurement standards in line WY procurement guidance
Taxi Licensing	Ultra-Low Emission Taxi Study as part of OLEV funded EST study across West Yorkshire undertaken in 2015 Measures include consideration of new West Yorkshire wide emission standards to be integrated into the taxi licensing system in accordance with the WYLES A successful regional bid for an Ultra Low Emission Vehicle taxi scheme was submitted during 2016.	The Ultra Low Emission Vehicle taxi scheme will be launched across West Yorkshire during 2017. It will include provision of 88 electric vehicle recharging points at railway stations and city centre locations across the region to support the uptake of EVs by the taxi trade. Scheme due for completion in 2021.
Freight & logistics	Measures to improve vehicle emissions include: • Introduction of Eco Stars fleet recognition scheme in West Yorkshire commenced during 2016 • Continued consideration of vehicle emissions through Social Value public procurement	Formal launch of Eco-stars fleet recognition scheme in Bradford planned for March 2017. Continued implementation of

	• Continued requirement for fleet standards on some new commercial development schemes	fleet procurement and low emission planning fleet requirements

Conclusions and Priorities

Bradford has taken a proactive and innovative approach to local air quality management. It was one of the first local authorities in the UK to adopt a Low Emission Strategy (in 2013). Bradford has well established low emission planning and procurement policies and has shared these with partners across the region. To this end Bradford secured funding, project managed and lead the development of the West Yorkshire Low Emission Strategy. There has been significant local investment in retrofitting of service and school buses, development of a cycle superhighway and the opening of new railway stations to reduce the impact of vehicle emissions. The Council also continues to reduce emissions from its own vehicle fleet and is encouraging private partners to match this through the West Yorkshire Eco-stars scheme and new initiatives to reduce taxi emissions.

Some areas of Bradford have experienced slight improvements in air quality in recent years and it may soon be possible to revoke the AQMA at Thornton Road. However, other areas of the city continue to show little or no improvement. During 2016 additional locations were identified where the annual average nitrogen dioxide objective is currently not being met and air quality improvement remains a key challenge for City of Bradford MDC.

Without further intervention at local level to reduce transport emissions, air quality in Bradford is unlikely to significantly improve over the next few years. In recognition, City of Bradford MDC has already invested in feasibility studies relating to the possible introduction of a Low Emission Zone (LEZ) both in Bradford/Leeds and the wider West Yorkshire area. These studies have indicated the potential for substantial health benefits amongst the Bradford population as a result of introducing LEZ type controls.

In December 2015 a new draft National Air Quality Action Plan was announced to establish mandatory Clean Air Zones (CAZs) in five English cities by 2020, including our neighbouring authority, Leeds. A draft CAZ framework was published in October 2016. Neither of these documents highlights Bradford as requiring a mandatory CAZ but they have been subject

to legal challenge and final versions of the documents will not be available until 2017. This may result in Bradford being required to implement a CAZ at a later date.

In the proposed update of the Bradford LES, the introduction of a voluntary Clean Air Zone (CAZ) in Bradford will be considered. This will incorporate the findings of the previous West Yorkshire Low Emission Zone (LEZ) feasibility study and the likely implications that the presence of a CAZ in neighbouring Leeds will have on future vehicle emission standards within Bradford. The West Yorkshire LEZ study concluded that considerable health benefits could be achieved by reducing emissions from diesel vehicles in Bradford and that tackling emissions from diesel buses should be a key priority of a future strategy. Currently all private cars fall outside the scope of any proposed CAZ controls in the UK.

Until a local decision is made on the implementation of a voluntary CAZ, the current programme of bus replacement and retrofits will be pursued. Bradford Council will also continue to work with local bus operators to achieve a voluntary minimum emission standard for the majority of buses that operate within the Bradford district (currently working towards a minimum Euro IV plus retrofit standard).

If Bradford is subsequently advised that it must implement a mandatory CAZ, the current approach to air quality improvement in Bradford (and the level of resource currently available for this work) would require full review. Any detailed CAZ proposals would then be subject to full public consultation.

During 2017 monitoring will continue within all Bradford's AQMAs and the other areas of concern highlighted within this report. An additional AQMA at Bingley Road will be declared as soon as possible.

Local Engagement and How to get Involved

In order to improve air quality in Bradford and reduce exposure to pollution, Bradford MDC advises residents to make simple changes to their everyday life;

- If able, reduce your vehicle use by walking and cycling for shorter journeys, highlighting the value for health and the environment.

Consider using the 'walk it' app (https://walkit.com/) which helps plan journeys in Bradford (and other cities). Try and pick routes which are not as heavily trafficked (e.g. through parks and lesser used streets) to reduce the amount of pollution exposure.

- Make the most of public transport as an alternative to using a car, this can save money and reduce impact on the environment. Check out the information on the Council website for local transport provision and see if it can help better plan journeys - https://www.bradford.gov.uk/transport-and-travel/public-transport/public-transport/
- If you have children who are travelling to school consider the advice on the Council website to help make this journey more sustainable and improve their health ; https://www.bradford.gov.uk/education-and-skills/travel-assistance/sustainable-travel-to-school/
- Think about how homes are heated and to ensure compliance with the legal requirements for smokeless zones. Residents are advised that if they fail to comply they could risk a fine of up to £1,000 per offence https://www.google.co.uk/#q=defra+smoke+control+areas)
- If you live in an urban area, consider buying a 'low nitrogen oxide' boiler the next time it requires replacement.
- If you own a vehicle which is regularly driven in urban areas, think about the impact on the environment when the time comes to replace it. Low emission vehicles (tax band A and B) are usually better environmental options for urban driving and even older petrol vehicles are less polluting in most cases than diesel vehicles. Consider low emission alternatives, such as hybrids and electric vehicles, although the initial purchase price may seem high in the longer term they may prove more cost effective through reduced fuel and tax costs. Government grants are available to help with the purchase of some low emission vehicles. https://www.gov.uk/plug-in-car-van-grants/eligibility

Whatever vehicle you drive the Council encourages drivers to try and follow the green driving tips below;

Green driving tips

- **Lift-Share**

  Check if it is possible to share your vehicle or take a lift to reduce the impact of journeys. Consider using the West Yorkshire lift share website to help with this; https://wy.liftshare.com/

- **Check your tyres**

  Under-inflated tyres mean an engine has to work harder and will produce more emissions.

- **Clear the clutter**

  Remove unnecessary clutter from your boot and reduce engine workload.

- **Stick to the speed limit**

  High speeds produce more emissions. At 70mph a driver could be using up to 15 per cent more fuel than at 50mph.

- **Slow down as you approach traffic jams**

  Stop-start traffic jams use more fuel. Slow down early and take your foot off the accelerator.

- **Don't over-rev**

  Changing up a gear early can reduce revs. For diesel cars change up when the rev counter reaches 2000rpm. For petrol cars, change up at 2500rpm.

- **Switch off your engine**

  If likely to be at a standstill for more than three minutes switch off your engine.

- **Close windows**

  Keeping windows closed at higher speeds will use less fuel.

- **Cut down on air-conditioning**

  Air-conditioning increases fuel consumption and produces more emissions.

If you would like to see more done to improve air quality in your area then you could contact the local Councillor or MP and tell them about your concerns or ideas.

To find out who your local Councillor or MP is and how to contact them;

https://bradford.moderngov.co.uk/mgMemberIndex.aspx?bcr=1

http://www.parliament.uk/mps-lords-and-offices/mps/

For more information on national campaigns to improve air quality and opportunities to undertake your own monitoring visit;

- https://www.foe.co.uk/page/air-pollution-campaign-clean-air
- http://www.clientearth.org/
- http://cleanair.london/

Daily national air quality updates, pollution forecasts and advice about how to protect yourself from the impacts of poor air quality can be found at:

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

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1 Local Air Quality Management

This report provides an overview of air quality in City of Bradford MDC during 2016. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act 1995 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 pursuit of the objectives. This Annual Status Report (ASR) is an annual requirement highlighting the strategies employed by City of Bradford MDC to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England can be found in Table E.1 in Appendix E.

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 must prepare an Air Quality Action Plan (AQAP) within 12-18 months setting out measures it intends to put in place in pursuit of compliance with the objectives.

A summary of the AQMAs declared by City of Bradford MDC can be found in Table 2.1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries, are available online at

https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/review-and-assessment-of-air-quality-in-the-bradford-metropolitan-district/

The results of the monitoring undertaken in 2016 indicate that a new AQMA is required on Bingley Road (see section 3).

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	City / Town	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance (maximum monitored/modelled concentration at a location of relevant exposure)		Action Plan (inc. date of publication)
						At Declaration	Now	
Mayo Avenue / Manchester Road (order 1)	2006	NO2 Annual Mean	Bradford	Several areas of terrace housing located adjacent to the junction of Mayo Avenue and Manchester Road	NO	57	42	Bradford Air Quality Action Plan (2009), Bradford Low Emission Strategy (2013), West Yorkshire Low Emission Strategy (2016) https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/
Manningham Lane / Queen's Road (order 2)	2006	NO2 Annual Mean	Bradford	Mixed housing (predominately terraced) adjacent to juntion of Manningham Lane and Queen's Road	NO	33	36	Bradford Air Quality Action Plan (2009), Bradford Low Emission Strategy (2013), West Yorkshire Low Emission Strategy (2016) https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/
Thornton Road (order 3)	2006	NO2 Annual Mean	Bradford	Small area of mainly student housing located adjacent to Thornton Road	NO	35	31	Bradford Air Quality Action Plan (2009), Bradford Low Emission Strategy (2013), West Yorkshire Low Emission Strategy (2016) https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district
Shipley Airedale Road (order 4)	2006	NO2 Annual Mean	Bradford	Small amount of housing (mainly apartments in former Mill building) located adjacent to Shipley Airedale Road	NO	68	48	Bradford Air Quality Action Plan (2009), Bradford Low Emission Strategy (2013), West Yorkshire Low Emission Strategy (2016) https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/

Mayo Avenue / Manchester Road (order 1)	2006	NO2 1 Hour Mean	Bradford	Several areas of Terrace housing located adjacent to the junction of Mayo Avenue and Manchester Road	NO	Unknown (declaration based on diffusion tube data)	No exceedance of hourly objective (2 hours over 200ug/m^3 in 2016)	Bradford Air Quality Action Plan (2009), Bradford Low Emission Strategy (2013), West Yorkshire Low Emission Strategy (2016) https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/
Manningham Lane / Queen's Road (order 2)	2006	NO2 1 Hour Mean	Bradford	Mixed housing (predominately terraced) adjacent to juntion of Manningham Lane and Queen's Road	NO	Unknown (declaration based on diffusion tube data)	No exceedance of hourly objective (0 hours over 200ug/m3 in 2016)	Bradford Air Quality Action Plan (2009), Bradford Low Emission Strategy (2013), West Yorkshire Low Emission Strategy (2016) https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/
Thornton Road (order 3)	2006	NO2 1 Hour Mean	Bradford	Small area of mainly student housing located adjacent to Thornton Road	NO	Unknown (declaration based on diffusion tube data)	No exceedance of hourly objective (0 hours over 200ug/m3 in 2016)	Bradford Air Quality Action Plan (2009), Bradford Low Emission Strategy (2013), West Yorkshire Low Emission Strategy (2016) https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/
Shipley Airedale Road (order 4)	2006	NO2 1 Hour Mean	Bradford	Small amount of housing (mainly apartments in former Mill building) located adjacent to Shipley Airedale Road	NO	Unknown (declaration based on diffusion tube data)	No exceedance of hourly objective (0 hours over 200ug/m3 in 2016)	Bradford Air Quality Action Plan (2009), Bradford Low Emission Strategy (2013), West Yorkshire Low Emission Strategy (2016) https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/

2.2 Progress and Impact of Measures to address Air Quality in Bradford

Defra's appraisal of last year's 2016 ASR concluded that the report was well structured, detailed, and provided the information specified in the guidance. The conclusions reached for all the pollutants were accepted. It was recognised that the Council has actively pursued a wide ranging programme of policies and strategies designed to support the development of measures to promote transport focussed emissions reductions and alternatives to the use of private vehicles, but noted there was still further work to do, particularly in the vicinity of a number of busy road junctions around the city, where additional areas of exceedance continue to be identified.

The main recommendations were that:

1. The Council should progress further assessments in the areas of exceedance outside the current AQMAs and review the monitoring strategy in locations where the AQMA status is uncertain.

2. It would be beneficial to review the level of further emissions reductions required at hotspot locations to achieve the air quality objectives, in order to inform the development of the measures within the AQAP.

3. Measures in the action plan should be reconsidered to prioritise those that can significantly impact on reducing pollution below objective levels, based on a clear understanding of current and future transport management within the city, with a consideration of what further measures may be possible to address the continuing exceedances. The ongoing discussions with regard to a Clean Air Zone were noted.

4. Monitoring locations should be clearly identified in relation to the individual AQMAs, in maps and tables, to assist in interpreting the results.

5. The designation of the AQMAs in relation to whether they are only designated for exceedance of the annual mean or both the annual and hourly mean objectives for nitrogen dioxide required clarification.

In this 2017 ASR report these issues have been addressed as follows:

Action in relation to recommendation 1

A further review of monitoring data and the positioning of relevant receptors in each of the additional areas of concern has been undertaken and is included in this report (section 3). This has concluded that only the exceedances of the nitrogen dioxide objective at Bingley Road require an AQMA declaration at this time. Further diffusion tube monitoring has been established around some of the existing AQMAs to confirm the extent of these exceedances and the results of this additional monitoring will be reported in the 2018 ASR.

Action in relation to recommendations 2 and 3

In the 2015 Low Emission Zone feasibility Study[13] (page 11) the required reductions in tons of NOx were calculated for a number of exceedance areas as follows;

(excerpt from the LEZ feasibility study below)

[13] https://www.bradford.gov.uk/media/1384/reportofthelezfeasibilitystudy.pdf

Table 14: Projected nitrogen dioxide concentrations at Bradford diffusion tube sites and required reduction in emissions to meet the EU limit value

Name	Projected concentration, µg m			Required emission reduction,% of base		Required emission reduction from baseline, tonnes	
	2012 base	2016 base	2021 base	2016	2021	2016	2021
Manningham Lane	79	72.7	55.9	63	41	107	44
St Mary's Presbytery	62	55.0	43.2	46	14	78	14
East Parade Apartments	38	32.6	26.2				
102 Thornton Road	41	34.9	28.6				
Mayo Avenue Unit	49	43.1	33.1	12		20	
Treadwell Mills	75	68.5	53.0	61	38	104	40
Central House	34	29.0	23.7				
Cock And Bottle Public House	61	54.5	42.2	42	9	72	9

The conclusions were that even with the emission reduction scenarios outlined within the feasibility study, the required reductions would be challenging to meet (see page 11 – Bradford LEZ feasibility study).

A further assessment of emission reduction requirements at all hotspot locations has not yet been completed as the Council has been waiting for a decision on whether a mandatory CAZ which would form the basis of any future AQAP for the city. The proposed way forward with this is as follows:

- **Thornton Road AQMA** - air quality at this location appears to have considerable improved in recent years and additional diffusion tube monitoring has now been deployed to confirm this. An air quality modelling study was recently undertaken for this area as an element of an exposure assessment supporting a residential development proposal (planning application 16/09263/MAF). This concluded that current air quality within the Thornton Road AQMA is within the air quality objective levels and is predicted to remain so for the foreseeable future. Monitoring data for the Thornton Road AQMA will be reviewed again in the 2018 ASR with a view to a probable recommendation of revocation. A detailed assessment of emission reduction requirements is not considered necessary for this location and it is unlikely to require any specific additions to the current AQAP.

- **Manningham Lane / Mayo Avenue and Shipley Airedale Road AQMAs –** There is no sign of long term air quality improvement at either of these locations. It is recognised that the Bradford Air Quality Action plan requires further review to ensure the current measures are the most appropriate for these areas. As detailed above City of Bradford MDC is still awaiting a decision on implementation of a mandatory CAZ as this would impact significantly on these locations. Once there is clarity on the national position, City of Bradford MDC will commence a review of the current AQAP, including consideration of whether a mandatory or voluntary CAZ is appropriate. This will include a full review of the emission reduction requirements in each of these areas and the consideration of other schemes that may be able to deliver similar levels of improvement. A further update on City of Bradford's longer term AQAP development work will be provided in the 2018 ASR.
- The planned AQMA declaration on Bingley Road will require an assessment of the emission reductions required in this area. It should be noted that there has been a significant junction improvement scheme implemented at this location within the last four years (replacement of a roundabout with a junction). It is unlikely that there will be an additional traffic management solution to this particular problem which is created by the volume of traffic on this busy residential road. Any further action planning measures will most likely require improved access to more sustainable transport options and address emissions from individual vehicles.
- Current monitoring data for the Killinghall / Harrogate Road junction and the Tong Street / Rooley Lane area is indicating that air quality is borderline with the annual average air quality objective for nitrogen dioxide and may not require AQMA declaration. Monitoring will be continued for a further year and if

it becomes necessary to declare AQMAs emission reduction requirements will then be assessed at that point.

- A junction improvement scheme for the Greengates crossroads is currently in preparation. This will include a full air quality impact assessment supported by local monitoring data (monitoring commenced March 2016). An update on the progress of this scheme and expected outcomes for air quality concentration will be detailed in the 2018 ASR. Detailed assessment of emission reduction needs is not considered appropriate at this time, but will be progressed if the junction improvement scheme is not considered to offer enough sufficient air quality improvement or fails to obtain planning permission.

Action in relation to recommendations 4

- Improved maps of the AQMAS and associated monitoring locations have been provided at Appendix D

Action in relation to recommendations 5

- This report clearly states the basis of the AQMA declarations that were made (annual and hourly NO_2 objectives)

City of Bradford MDC has taken forward a number of direct measures during the current 2016 reporting year in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2 and summarised in table 1 of the Executive Summary.

More detail on these measures can be found in the respective Action Plans which include:

- Air Quality Action Plan (2009)
- Air Quality Strategy (2011)
- Bradford Low Emission Strategy (2013)
- West Yorkshire Low Emission Strategy (WYLES)
- West Yorkshire Transport Plan (2011)
- West Yorkshire Combined Authority Draft Transport Strategy (2016)

Key completed measures are:

- Opening of £19 million Cycle Super-Highway (Bradford-Leeds) in 2016 providing 14km of segregated cycle path .
- £400k secured through Clean Vehicle Technology Fund (CVTF, DfT, 2014/15) to retrofit 26 Euro III commercial, diesel buses with selective catalytic reduction and particle traps (SCRT) in 2015 (in partnership with First Bus and Transdev)[14]
- Retrofitting of 165 Euro III school buses across West Yorkshire in partnership with West Yorkshire Combined Authority (WYCA) Using Clean Bus/Vehicle Technology Fund (DfT) completed in 2016
- Partnership work with First Bus to encourage minimum Euro IV Standard for commercial buses from 2018, with further improved standards for 2020 and beyond, commenced during 2016. First operate 86% of commercial bus routes in Bradford
- Enterprise car club introduction in Bradford during 2015 (including an electric vehicle).
- Opening of new railway station at Apperley Bridge in December 2015 and commencement of works on Low Moor station
- Set up of West Yorkshire Eco-stars scheme and recruitment of first members during 2016
- Adoption of the West Yorkshire Low Emission Strategy (December 2016)
- Continued implementation of low emission planning measures which have resulted in the conditioning of over 5000 EV charging points to date and ensured Construction Emission Management Plans (CEMPs) and low emission travel plans will be provided for a wide range of developments. A number of large scale developments have also been required to provide emission damage costs and bespoke emission mitigation measures.

[14] http://www.thetelegraphandargus.co.uk/news/11466565.Government_grant_allows_green_makeover_of_most_polluting_buses/

WYLES

The WYLES was formally adopted by City of Bradford MDC in December 2016 and includes the following measures for County-wide implementation:

- Bus emission standards, recognizing urban hotspots
- Extrapolation of the Bradford Leeds LEZ Study County-wide using CAZ standard data
- Public health awareness raising of emissions and impact on health
- West Yorkshire Electric Vehicle Strategy
- Emission standards for taxis and promotion of ultra-low emission vehicles
- CAZ to be introduced where necessary
- Consistent mitigation measures to be applied through the planning process
- Consistent procedures to consider vehicle emissions through Social Value public sector procurement
- Eco Stars Scheme for Council Fleets, bus operators and freight companies

City of Bradford MDC expects the following measures to be completed over the course of the next reporting year:

- Development of an updated Bradford LES (to reflect WYLES adopted December 2016) and ongoing implementation of WYLES measures in Bradford
- Opening of new railway station at Low Moor (expected Spring 2017)
- Official launch of West Yorkshire Eco-stars scheme
- Submission of planning permission for junction improvement works at Greengates junction and associated air quality impact assessment
- Continued implementation of fleet procurement and low emission planning fleet requirements
- Introduction of public rapid charger in Bradford City Centre
- Launch of Ultra Low Emission taxi scheme across West Yorkshire

- Commencement of Phase 2 of BiB research project 'What factors help or hinder adoption of policies to improve air quality?'
- Further consideration of the need for a CAZ in Bradford

City of Bradford's priorities for the coming year are:

- To continue to update the Bradford LES (and other local policies) in line with the WYLES
- To continue to implement the measures in the Bradford LES and WYLES (particularly low emission planning measures which have already secured planning consent for over 5000 EV charging points in the city and numerous other LES planning interventions relating to low emission fleets and low emission travel planning measures)
- To continue to negotiate and facilitate retrofit and upgrading of the Bradford bus fleet to meet a minimum Euro IV standard
- To open the new railway station at Low Moor
- To continue to reduce emissions from the council fleet and those of others via wider implementation of the Eco-stars fleet recognition scheme
- To implement further measures to promote the uptake of low emission taxis
- To declare an AQMA on Bingley Road and consider appropriate AQAP measures for this area based on an assessment on the level of emission reduction needed
- To review Bradford's current air quality management policies and commence update of Bradford's AQAP in line with DEFRAs final CAZ proposals
- To further progress the provision of a CNG refuelling station for the council fleet

The principal challenges and barriers to implementation that City of Bradford MDC anticipates facing are;

- limited funding and staffing resource to progress all areas of LES and AQAP delivery, alongside ongoing air quality monitoring, reporting and legislative requirements

- continued uncertainty about the degree of national support for the development of a CAZ in Bradford. It is unlikely that a charging CAZ for Bradford could be pursued without significant external funding for a feasibility study and the resulting ongoing project management costs.
- Potential negative emission impacts arising from the implementation of a mandatory charging CAZ in Leeds. There is a particular risk in relation to the emission standards of the Bradford bus fleet as bus operators reassign their fleets to meet regional emission requirements.
- Lack of public support for some air quality improvement measures – for example there are already objections arising to the proposed junction improvements at Greengates.
- The cumulative emission impacts of development planned for the area. Although Bradford has well established low emission planning policies, there is considerable development planned for the city and it is only possible to mitigate a small proportion of this emission growth. Preventing further emission growth is particularly challenging in areas eligible for regeneration funding and where the priority is to provide employment and housing.
- Lack of options for further junction improvements where significant works have already been undertaken but air quality problems persist (as in the Bingley Road area)
- The negative emission impact of increasing numbers of biomass boilers and STOR (Short Term Operating Reserve) plant within the urban environment that can singly offset any air quality gains made through transport improvement projects. These installations frequently do not require planning permission or are difficult to condition.
- Uncertainty about the future emission performance of vehicles. When on the road, modern diesel cars have been shown to emit far more nitrogen dioxide than expected due to the development of emission ‘defeat’ strategies by some vehicle manufacturers. The effectiveness of some vehicle retrofit technologies can also be limited during urban driving cycles. Whilst Euro VI HGVs and buses are currently thought to be delivering considerable reductions in emissions, the long term effectiveness of these vehicles as they

age is an unknown factor as Bradford considers its longer term air quality plans. The on road performance of Euro 6 cars is still subject to investigation but initial indications are that some models are not performing as well on the road as expected.

City of Bradford MDC anticipates that the measures stated above and in Table 2.2 will achieve compliance in the Thornton Road AQMA and that it may be possible to revoke this within the next couple of years.

Whilst the measures stated above and in Table 2.2 will help to contribute towards compliance, City of Bradford MDC anticipates that further additional measures not yet prescribed, will be required to achieve compliance and enable the revocation of the AQMAs at Mayo Avenue, Manningham Lane and Shipley Airedale Road.

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
1	Ongoing implementation and review of the Bradford LES	Policy Guidance and Development Control	Low Emissions Strategy	City of Bradford MDC	completed	Adopted Nov 2013, review ongoing	Update and review Bradford LES by end of 2017	Emissions from all existing and new sources to be reduced as far as possible using measures within Bradford LES	Good	Ongoing delivery and review	All the additional measures detailed below contribute to the delivery of the Bradford LES and are subject to ongoing review and development. The Bradford LES is currently being updated to incorporate WYLES measures and targets.
2	Adoption of West Yorkshire Low Emission Strategy	Policy Guidance and Development Control	Low Emissions Strategy	City of Bradford MDC in conjunction with other partners	completed	Adopted Dec 2016	Adoption of WYLES by City of Bradford MDC by end of 2016 - met	Emissions from all existing and new sources to be reduced as far as possible across West Yorkshire region using measures within the WYLES.	Good	Ongoing delivery and review	The development of the WYLES has been led by City of Bradford MDC. Many of the ideas and concepts within it have their origins within the Bradford LES.
3	Low emission planning guidance	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	City of Bradford MDC	completed	Adopted Nov 2103, review ongoing	Number of EV charging points delivered on new development	Emissions from all new developments to be reduced as far as practically possible and	LES planning guidance now routinely applied to all planning	Ongoing delivery and review	Since implementation the LES planning guidance has resulted in the conditioning of over 5000 EV

								opportunities for increased exposure to air pollution minimised.	applications		charging points on new developments and numerous other low emission fleet measures. The Bradford LES planning policy is currently being reviewed to align it with the WYLES planning guidance.
4	LEZ feasibility study	Promoting Low Emission Transport	Low Emission Zone (LEZ)	City of Bradford MDC in conjunction with other partners	completed	LEZ feasibility study completed and reported to members in 2015 with council decision to consider the feasibility of implementation in Bradford. Currently on hold pending outcome of discussions around CAZ.	No date set for implementation of LEZ or CAZ	The LEZ feasibility study indicated that an LEZ could reduce NOx emissions within the outer ring road by 195.6 tonnes	Awaiting steer from Members and Defra on next steps	ongoing	Bradford was identified in the new National Air Quality Action Plan as likely to require a mandatory CAZ in order to meet EU limit values for NO2. Discussions currently ongoing locally with Defra and neighbouring Leeds to determine if and how this should be progressed.
5	WYLES procurement guidance	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	City of Bradford MDC in conjunction with other partners	completed	Ongoing (2016-2021)	Low emission procurement contracts	Emissions in relation to all new procurement contracts to be reduced as far as practically possible. Operators to be rewarded for LEV practices.	LEV procurement policy 5% of award decision as part of procurement policy (social values)	ongoing	All procurement decisions (including delivery of goods and services) with a transport or heating impact to be considered in relation to the emissions matrix

6	Identifying barriers to walking to school	Promoting Travel Alternatives	School Travel Plans	City of Bradford MDC and Born in Bradford	completed	ongoing	Development of school travel plan toolkit by Dec 2017	Reduction in pollution in all areas, in particular around school gates and playgrounds	ongoing	Dec-17	This work is being completed in partnership with Born in Bradford and the Bradford Institute of Health Research (NHS). Phase 2 will commence in 2017.
7	Bus retrofit projects	Vehicle Fleet Efficiency	Vehicle Retrofitting programmes	City of Bradford MDC	completed	completed 2015	25 buses successfully retrofitted, 11 in the city centre and 14 on Manningham Lane	Real world (PEMS) emission testing of the buses showed retrofit acheived a 95% reduction in Nox emissions. Improvements in air quality in Manningham Lane.	completed	completed	This was possible due to a successful CVTF fund application worth £400,000. The application was supported by evidence from the LEZ study. Future projects will source alternative funding streams where available and operators will be encouraged to invest in their own fleets.
8	Car clubs	Alternatives to private vehicle use	Car Clubs	City of Bradford MDC	completed	scheme operational	Number of registered car club owners	Not quantified	scheme operational	completed	Further car clubs / car club vehicles will be introduced in the district as demand increases. Planning is being used as a measure to facilitate this, particularly on new housing schemes.

9	Cycle Super Highway	Transport Planning and Infrastructure	Cycle network	City of Bradford MDC	completed	opened June 2016	Not identified	Not quantified	scheme operational	completed	
10	Staff Travel Plan	Promoting Travel Alternatives	Workplace Travel Planning	City of Bradford MDC	completed - CHECK	ongoing	Not identified	Not quantified			Travel plan hierarchy promotes bus/rail and ULEV car club vehicles for business trips
11	Eco-stars Fleet Recognition Scheme	Vehicle Fleet Efficiency	Fleet efficiency and recognition schemes	WYLES steering group / City of Bradford MDC	ongoing	2016	Number of Bradford fleets joining the scheme	Not quantified	Scheme to launch early 2017.	ongoing	The introduction of the West Yorkshire ECO-stars scheme is a measure in the WYLES. Scheme is funded by West Yorkshire Combined Authority
12	CNG	Vehicle Fleet Efficiency	City CNG Station	City of Bradford MDC	ongoing	2013	CNG station build	77 tonnes NOx	Feasibility study completed. Vehicle trial completed	Ongoing	Good political support for project but no decision yet made due to funding uncertainties and practical considerations
13	Low emission procurement policies for City of Bradford MDC fleet	Promoting Low Emission Transport	Public Vehicle Procurement - Prioritising uptake of low emission vehicles	City of Bradford MDC	completed	ongoing	Implementation of WYLES procurement guidance	Not quantified	Reduction of 332t/CO2e 2014/15-2015/16. 7 electric vans and 2 electric pool cars with 3 additional charging stations	ongoing application and review of policy needed	Introduction of whole life costs into vehicle procurement considerations including air quality damage costs
14	Voluntary emission standards for buses	Promoting Low Emission Transport	Other	City of Bradford MDC / Bus operators	WYLES objective	By 2018	Euro IV plus retrofit by 2018	24.7 tonnes of Nox	Progressed through Bus 18 programme with operators	End of 2018	City of Bradford MDC and WYCA have entered into negotiations with local bus companies to try

											and achieve a minimum Euro IV emission standard for the majority of buses used in Bradford.
15	Delivery of new railway stations	Transport Planning and Infrastructure	Public transport improvements-interchanges stations and services	WYLES	Apperley Bridge completed , Low Moor in progress	Apperley Bridge completed , Low Moor in progress	Passenger numbers	Not quantified	Apperley Bridge open, Low Moor ongoing	Unknown	The new station at Apperley Bridge provides two trains per hour on the Leeds/ Foster Square / Keighley route. This will help to remove car trips from the main road network in Bradford and Leeds
16	Encouraging uptake of low emission taxis	Promoting Low Emission Transport	Taxi Licensing conditions	City of Bradford MDC	ongoing	In discussion	West Yorkshire Low Emission taxi licensing policy	Not quantified	Ultra low emission taxi study as part of OLEV funded EST study across West Yorkshire undertake in 2015	ongoing	OLEV study has provided detailed information about the current taxi fleet and identified where emission reduction opportunities exist. City of Bradford MDC is currently considering the feasibility of implementing various measures for reducing taxi emissions and how they might be funded
17	Public awareness	Public Information	Via other mechanisms	City of Bradford MDC / NHS	2015	2016	Number of signatories	N/A	ongoing	ongoing	Raising public awareness through the use of street infographics and air quality and health online

											petition in partnership with Doctors and academics at the University of Leeds
18	Health and air quality economics	Public Information	Via other mechanisms	City of Bradford MDC / NHS	2015	2016	Toolkit development and workshops to share with stakeholders	Policy influence	Uptake ongoing	ongoing	Development of CAPTOR toolkit and published papers to quantify the health impact of Low Emission Policy change in partnership with NHS and economics experts at University of York
19	Identifying barriers to Low Emission Policy change	Public Information	Via other mechanisms	City of Bradford MDC / NHS	2016	2017-18	Published papers	Policy influence	ongoing	2018	Project to identify the barriers to policy change
120	Public health reporting of Air Quality	Public Information	Via other mechanisms	City of Bradford MDC / NHS	2016	ongoing	Air quality in key council documents	Policy influence	ongoing	ongoing	Air quality in the JSNA, directors PH report, Health and Well Being Strategy and Transformation Plan. Raising the profile of air quality and reporting to the Health and Well Being Board.

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

As detailed in Policy Guidance LAQM.PG16 (Chapter 7), 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.

In Bradford, emissions of man-made fine particles $PM_{2.5}$ are estimated to cause 4.2% of total mortality, representing 2,300 years of life lost due to particulate pollution in Bradford[15]. Road transport emissions are the most significant source of fine particulates, leading to exceedances, but locally elevated concentrations can also arise from biomass combustion, heating, industry and wind blown dust. The World Health Organisation (WHO) classifies diesel exhaust emissions as carcinogenic.

No areas within the Bradford district are considered likely to exceed the EU Limit Value for $PM_{2.5}$ (annual average concentration of 25µg/m^3) but there are areas, near to major roads, experiencing concentrations of $PM_{2.5}$ which exceed the recommended World Health Organisation (WHO) Target Level of 10µg/m^3.

There are marked differences in people's health within the Bradford district indicating the existence of significant health inequalities. For example, people living in Wharfedale to the north of the district typically live five years longer than people living in Tong in the south. Similarly, when the Bradford district is compared to the rest of the UK, average life expectancy is reduced. In Bradford there are more deaths as a resulting from smoking, cancer, heart disease, and strokes, and higher rates of mortality in children, than in many other cities.

Under 75 mortality rate from all respiratory disease in Bradford;

Year	Bradford		Y&H	England
	Number	Rate per 100,000	Rate per 100,000	Rate per 100,000
2010-12	487	46.6	39.4	33.5
2011-13	517	48.9	39.3	33.2
2012-14	536	50.1	38.6	32.6
2013-15	556	50.9	38.4	33.1
2014-16	569	51.4	39.0	33.8

[15] https://fingertips.phe.org.uk/search/particulate#page/0/gid/1/pat/6/par/E12000003/ati/102/are/E08000032

Through research carried out by environmental epidemiologists at the Bradford Institute of Health Research (BIHR) many of these illnesses have been proven to have direct linkages to local air pollution exposure. The data demonstrates that Bradford has a higher rate of 'at risk' people whom will be more vulnerable to the ill-health effects associated with air pollution exposure.

Within the City of Bradford MDC, air quality and public health specialists work closely to deliver the key outcomes in the Bradford LES and the WYLES (as detailed in Tables 1 and 1.2). They are supported by colleagues from other Council Departments such as transport, planning, highways, fleet management and procurement.

Delivery of the LES and WYLES will result in reduced exposure to all types of air pollutants, including $PM_{2.5}$ so there is no current requirement for additional $PM_{2.5}$ reduction measures in Bradford. The LES and WYLES measures aimed at reducing emissions from diesel vehicles and biomass boilers will be the most effective ones to reducing $PM_{2.5}$ as these are the main sources of this pollutant in Bradford.

There is a strong emphasis on improving the understanding of how air pollution impacts on health, and consequently communicating this effectively to other professionals and members of the public.

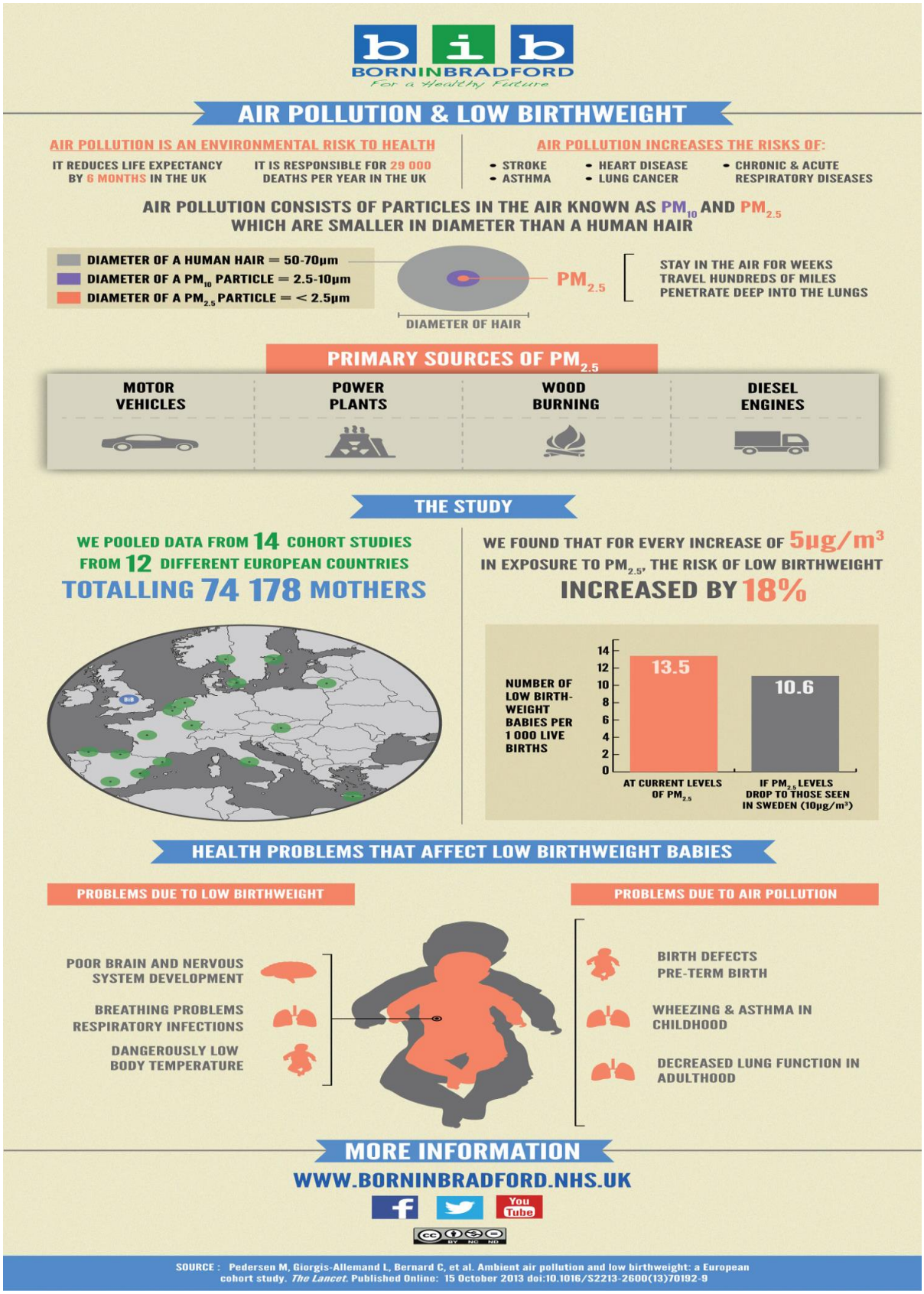
The Public Health Department has funded $PM_{2.5}$ monitoring at three of the existing air pollution stations (Bingley, Keighley and Shipley Airedale Road). The results from this monitoring are used to inform major research programmes (such as the 'Born in Bradford (BiB)' and 'Helix' project) and are being pro-actively communicated to the public using striking and informative infographics on our air pollution stations (developed in conjunction with Dr Catherine Stone at Leeds University) – see figure 3

Born in Bradford is one of the largest and most important medical research studies currently being undertaken in the UK. It is tracking the lives of 13,500 Bradford born babies (and their families) to ascertain more about the causes of childhood illness. The work has already identified a number of important linkages between air pollution exposure and health as detailed in the infographic below (figure 4).

Figure 3: Communication of air quality information

Infographics produced by Dr Catherine Stone, University of Leeds

Figure 4: Outcomes from BiB study



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

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

This section sets out what monitoring has taken place and how it compares with objectives.

City of Bradford MDC undertook automatic (continuous) monitoring at 7 sites during 2016. Table A.1 in Appendix A shows the details of the sites.

The monitoring equipment operated in Bradford is owned and operated by Bradford MDC. The Mayo Avenue automatic monitoring site was affiliated to the national AURN monitoring network during 2015. Results from this site can now be viewed at http://uk-air.defra.gov.uk/networks/network-info?view=aurn.

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

3.1.2 Non-Automatic Monitoring Sites

City of Bradford MDC undertook non- automatic (passive) monitoring of NO_2 at 42 sites during 2016. Table A.2 in Appendix A details these 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” and distance correction. Further details on adjustments are provided in Appendix C.

3.2.1 Nitrogen Dioxide (NO_2)

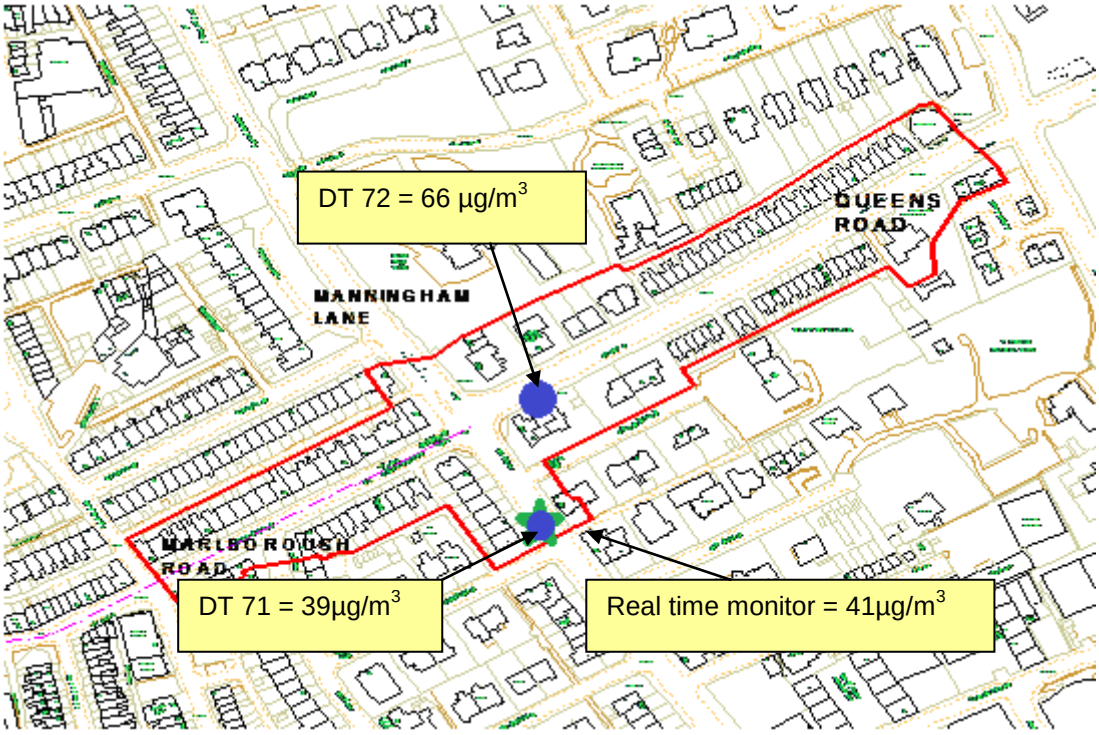
Table A.3 in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

For diffusion tubes, the full 2016 dataset of monthly mean values is provided in Appendix B.

Table A.4 in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for the past 5 years with the air quality objective of 200µg/m^3, not to be exceeded more than 18 times per year.

Bradford currently has 4 AQMAs located at Manningham Lane, Mayo Avenue, Thornton Road and Shipley Airedale Road. The outcomes for each of these AQMAs for the 2016 monitoring period are as follows:

Manningham Lane AQMA (2016)



At Manningham Lane the real time analyser and the co-located diffusion tube (DT71) indicated a roadside concentration of nitrogen dioxide between 39 to 41 µg/m^3 during 2016. The relevant receptor point to the real time monitoring site and the co-located diffusion tube DT71 is the nearest house façade located approximately 4m back from the monitoring position. When corrected for distance

the results for both locations fall below the 40 µg/m^3 objective level to 36µg/m^3 (real time site) and 35 µg/m^3. The other tube located within this AQMA (DT72) recorded a concentration of 66 µg/m^3 during 2016. This tube is located at a relevant location (post directly in line with front façade of the nearest residential property) and does not require distance correction. At this particular location both the annual and hourly objectives for nitrogen dioxide may still be exceeded.

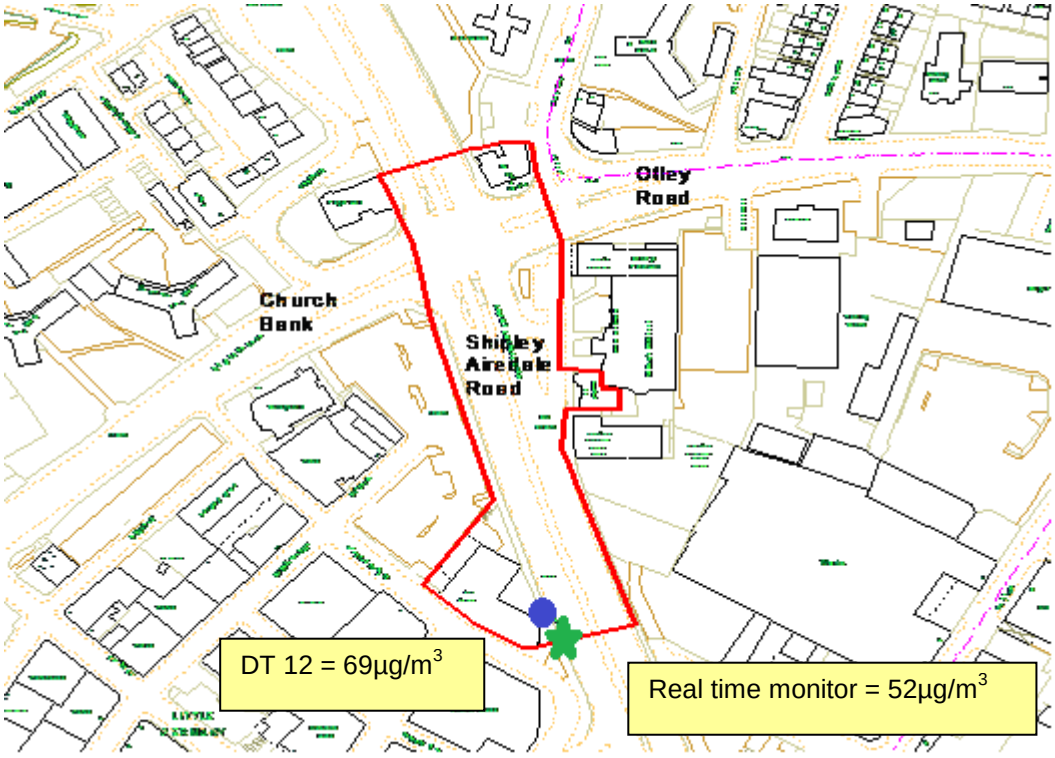
In the past there have been technical issues with the real time analyser at Manningham Lane and limited collection of diffusion tube data. Results for the last 5 years are summarised below (results for monitoring location and bias corrected). There is little evidence of any major improvement in air quality within this AQMA during this period.

Manningham Lane 5 year data

	2012	2013	2014	2015	2016
DT71	-	-	-	40	39
DT72	79	-	-	60	66
Manningham Lane real time site	-	-	35	42	41

On the basis of these results the AQMA declaration at Manningham Lane is still considered relevant and will remain in place subject to further review in the 2018 ASR.

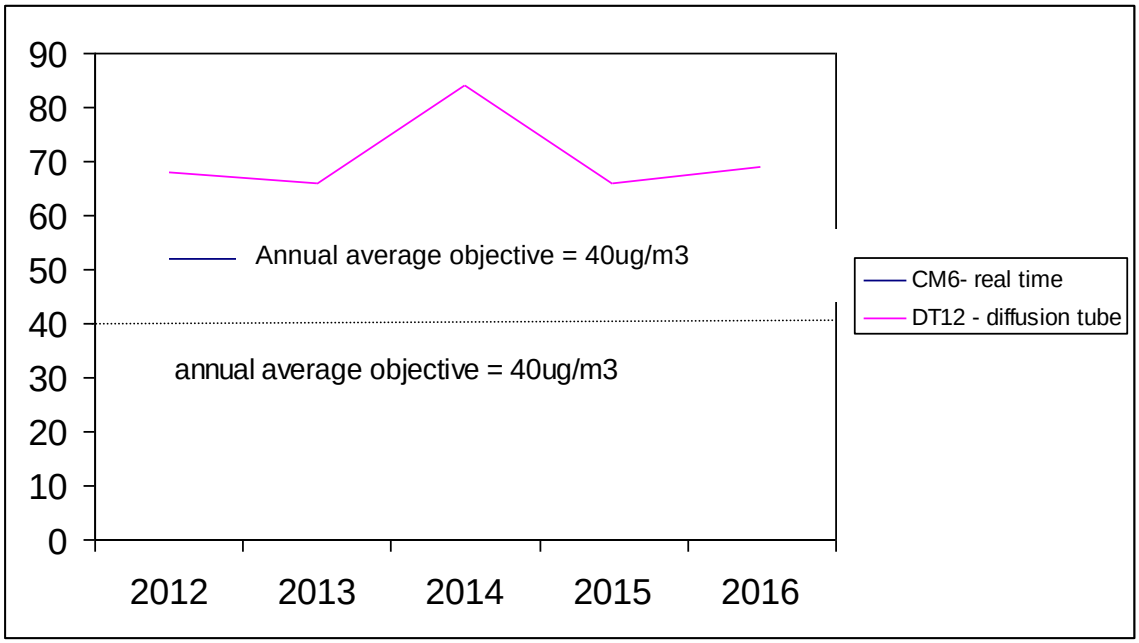
Shipley Airedale Road AQMA (2016)



Both the Shipley Airedale Road monitoring sites recorded concentrations well above the annual average objective for nitrogen dioxide in 2016. When corrected for distance to the nearest relevant receptor the results are still well above the objective (DT12 = 62 µg/m^3 and real time site = 48 µg/m^3). This indicates that the annual average objective (and potentially the hourly objective) may still be breached at some locations within this AQMA.

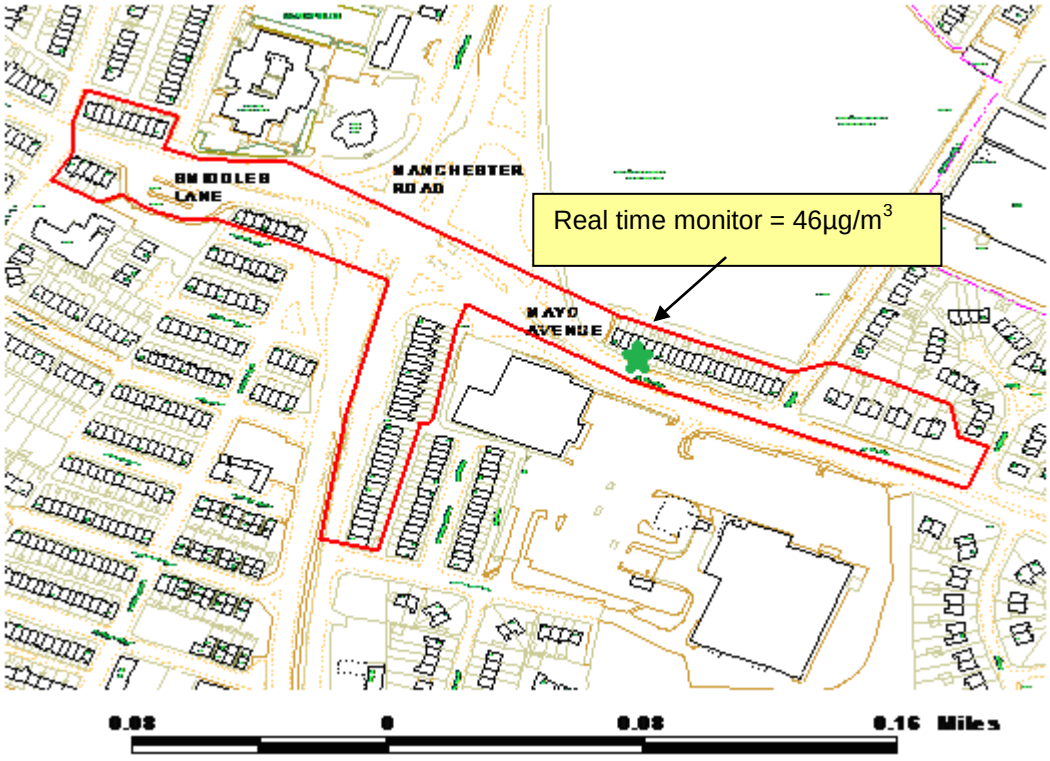
The graph below details the 5 year trend for the monitoring sites in the Shipley Airedale Road AQMA.

Shipley Airedale Road 5 year data



On the basis of these results the AQMA declaration at Shipley Airedale Road is still considered relevant and will remain in place subject to further review in the 2018 ASR.

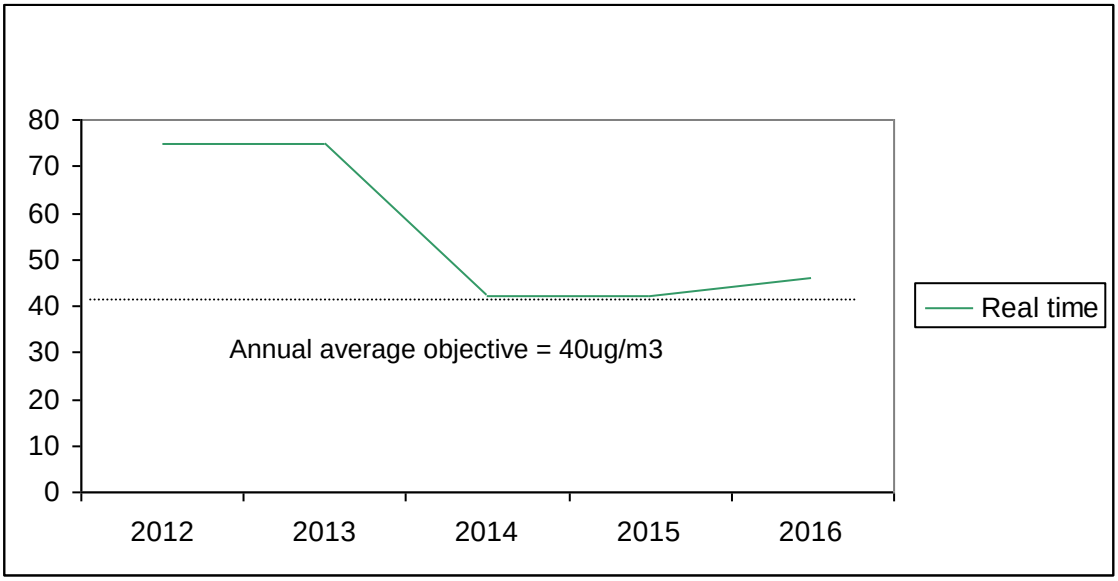
Mayo Avenue AQMA (2016)



During 2016 the only monitoring undertaken in the Mayo Avenue AQMA was at the real time monitoring site. This recorded an annual average roadside concentration of 46µg/m^3 and a distance corrected concentration at the nearest relevant receptor of 42µg/m^3. There were no recorded breaches of the hourly objective. To further consider the extent of the air quality exceedance in this area four additional diffusion tube monitoring locations have recently been established on Mayo Avenue (2 sites), Manchester Road and Smiddles Lane (outside Bankfoot School). Results for these sites will be considered in the 2018 ASR.

Mayo Avenue 5 year data

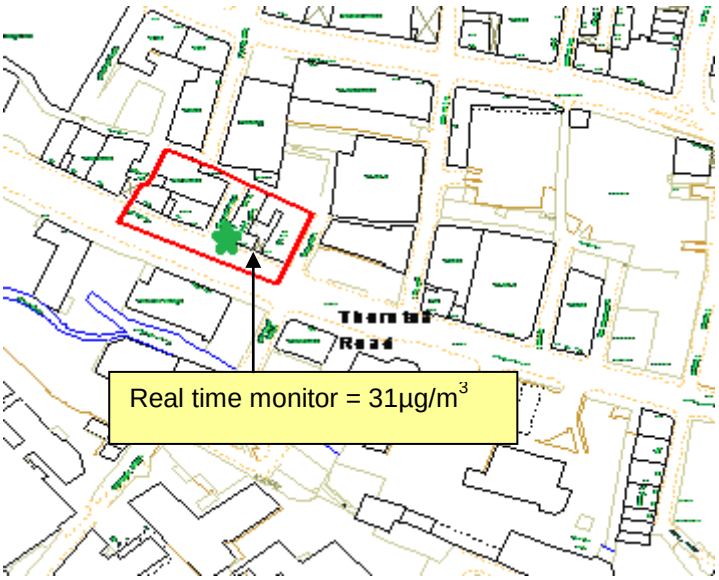
The graph below shows the 5 year trend for the monitoring site at Mayo Avenue



The 5 year trend details a marked reduction in annual average concentration since 2014. There is no obvious reason for this but it is most likely due to a combination of improved data management and reduced vehicle emissions on this very busy road which carries a large amount of HGV traffic. The Mayo Avenue station was affiliated to the national monitoring network in 2015. As detailed above, monitoring in this area has recently been increased to provide a better understanding of air quality within this AQMA.

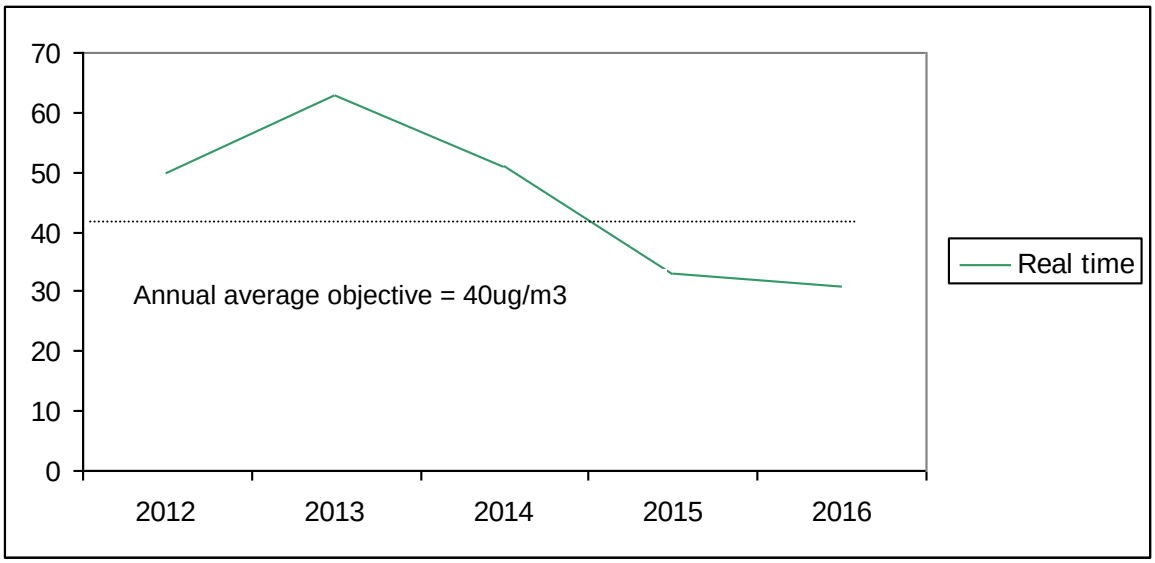
On the basis of these results the AQMA declaration at Mayo Avenue is still considered relevant and will remain in place subject to further review in the 2018 ASR.

Thornton Road AQMA (2016)



During 2016 the only monitoring undertaken in the Thornton Road AQMA was at the real time monitoring site. This recorded an annual average roadside concentration of 31µg/m^3. There were no exceedances of the hourly objective. The site is located immediately adjacent to an office building, but there are other buildings in a similar position on this stretch of road which have residential use. The results from the Thornton Road real time monitoring site have not been corrected for distance as they are considered representative of exposure at some residential properties in this AQMA. To provide a better understanding of air quality in this area, three additional diffusion tube monitoring locations have recently been established. These include locations adjacent to student accommodation. Results for these sites will be considered in the 2018 ASR.

Thornton Road 5 year data



Similar to the Mayo Aveue AQMA, Thornton Road also shows a marked reduction in the annual average nitrogen dioxide concentration since 2014. Again there is no obvious reason for this and it is most likely to be a combination of improved data management and improved vehicle emissions. The Thornton Road real time monitoring site remains fully within local authority control.

In addition to local authority monitoring a full exposure impact assessment was recently submitted for a proposed housing development immediately adjacent to this AQMA. This included detailed modelling of current and future air quality. The results of this exposure assessment corresponded closely with the results of the most recent monitoring in the area and suggested that air quality is no longer of concern in this area. For more information see planning application 16/0923/MAF on the council's on-line planning tool available at:
https://planning.bradford.gov.uk/online-applications/
The application was approved without the need for any air quality exposure mitigation measures.

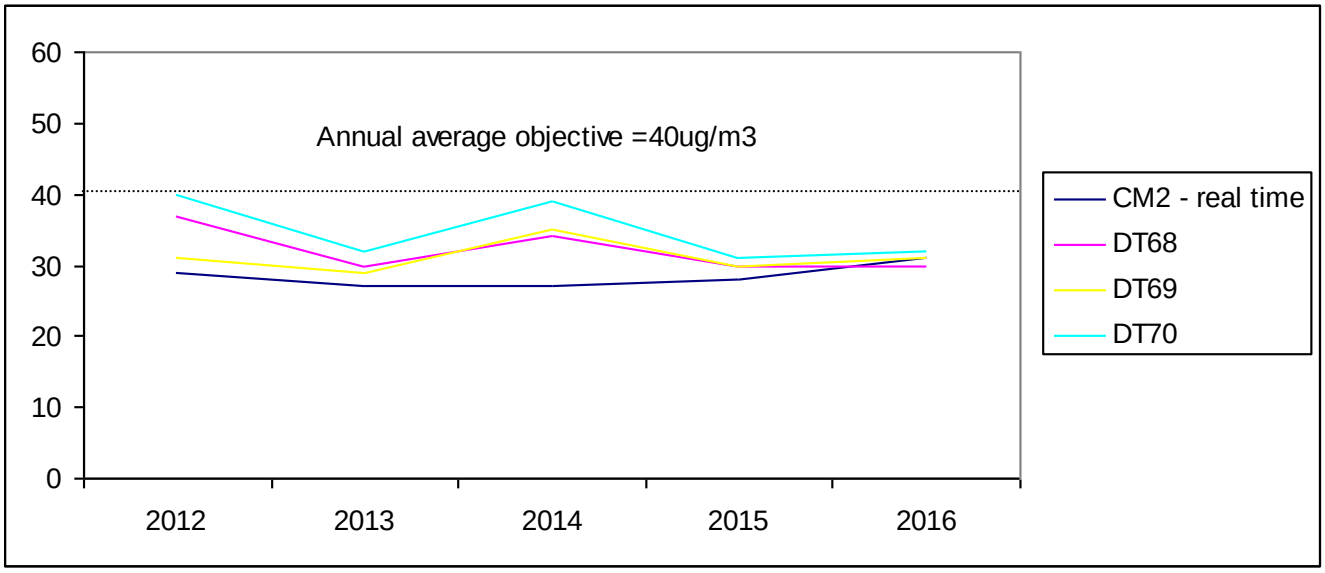
Based on the current evidence it may be possible to revoke this AQMA. It is proposed to maintain the AQMA declaration in place until the 2018 ASR report has been completed and the results of the extended monitoring are known.

Trends in background air quality in Bradford

Background air pollution levels were measured at Keighley and Bingley during 2016. Background levels of NO_2 at these sites have generally remained stable over the previous 5 years with no emerging evidence of a long term upward or downward trend. There was no recorded exceedance of the hourly nitrogen dioxide objective at ether background site during 2016.

The Keighley monitoring site is representative of an urban centre being located about 5m back from the nearest road in the centre of Keighley. There are three diffusion tubes co-located with the inlet at the site. The annual average concentration measured at the Keighley real time site during 2016 was 31µg/m^3. The tube results correlated well with this.

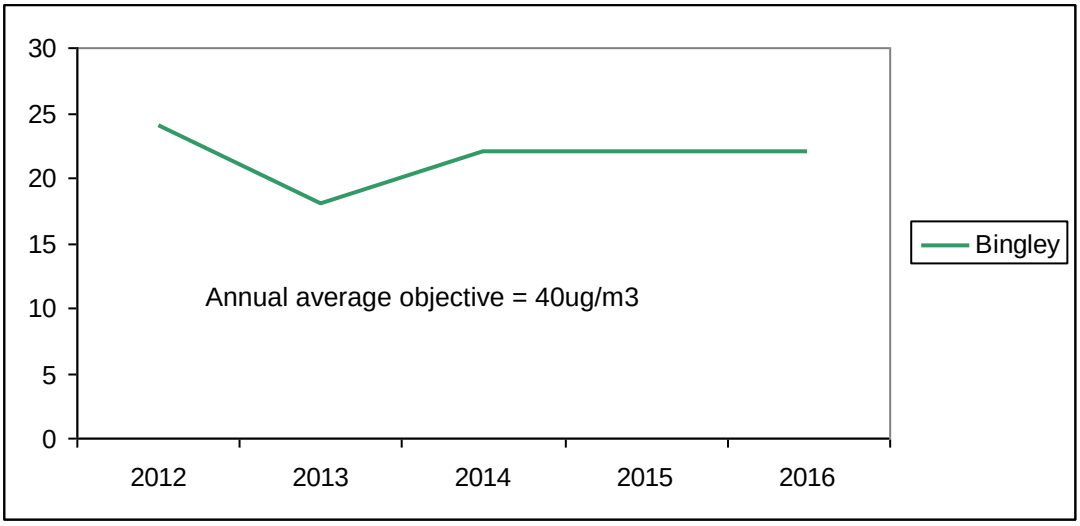
Keighley 5 year data



The annual average concentration of nitrogen dioxide measured at the real time site in Keighley has remained stable over the past 5 years at around 28 to 30 µg/m^3. There has been more variance in the diffusion tube results, but this is expected due to the limitations of this monitoring method. All the tube results shown in the graph above have been bias corrected based on national bias factors.

The Bingley site is more representative of an urban background location. Monitoring ceased at this site in June 2016 to relocate the analyser to Tong Street. The annual average concentration for the Bingley site measured in 2016 has been annualised to enable a comparison with data from previous years. The results are shown in the graph below.

Bingley 5 year data



In recent years the annual average nitrogen dioxide concentration at Bingley has stabilised at around 22 µg/m^3. This urban background concentration has been used in all the distance correction calculations carried out within this report.

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Compliance with NO_2 hourly objective (diffusion tubes)

The diffusion tube monitoring undertaken in 2016 identified two sites (DT12 and DT72) as having an annual average concentration >60 µg/m^3 at a relevant receptor point. An annual average concentration of >60 µg/m^3 measured using a diffusion tube can be indicative of a location where the hourly objective may be exceeded.

Sites DT12 (Shipley Airedale Road) and site DT72 (Queen's Road) are located within exisiting AQMAs and have already been discussed in detail.

Compliance with annual average NO2 objective (diffusion tubes)

The diffusion tube monitoring undertaken in 2016 identified the following sites as having exceedance of the 40 µg/m^3 annual average objective at relevant receptor points (based on distance corrected results shown in table B.1). The tubes showing concentrations in excess of 60 µg/m^3 (discussed above) have been excluded from this list.

- DT31 – Bingley Road
- DT50 – Bingley Road
- DT64 – Tong Street
- DT93 – New Line

The following tubes were approaching the 40 annual average objective (>39 µg/m^3).

- DT42 – Killinghall Road (39.5 µg/m^3)
- DT5 – Harrogate Road (39 µg/m^3)

Tubes, DT31, DT50 , DT64, DT42 and DT5 are in areas identified in the ASR 2015 as requiring further investigation. Further information about these areas can be found below.

Tube DT93 is located at the New Line junction, where planning permission for a detailed junction improvement scheme is currently being sought. The air quality

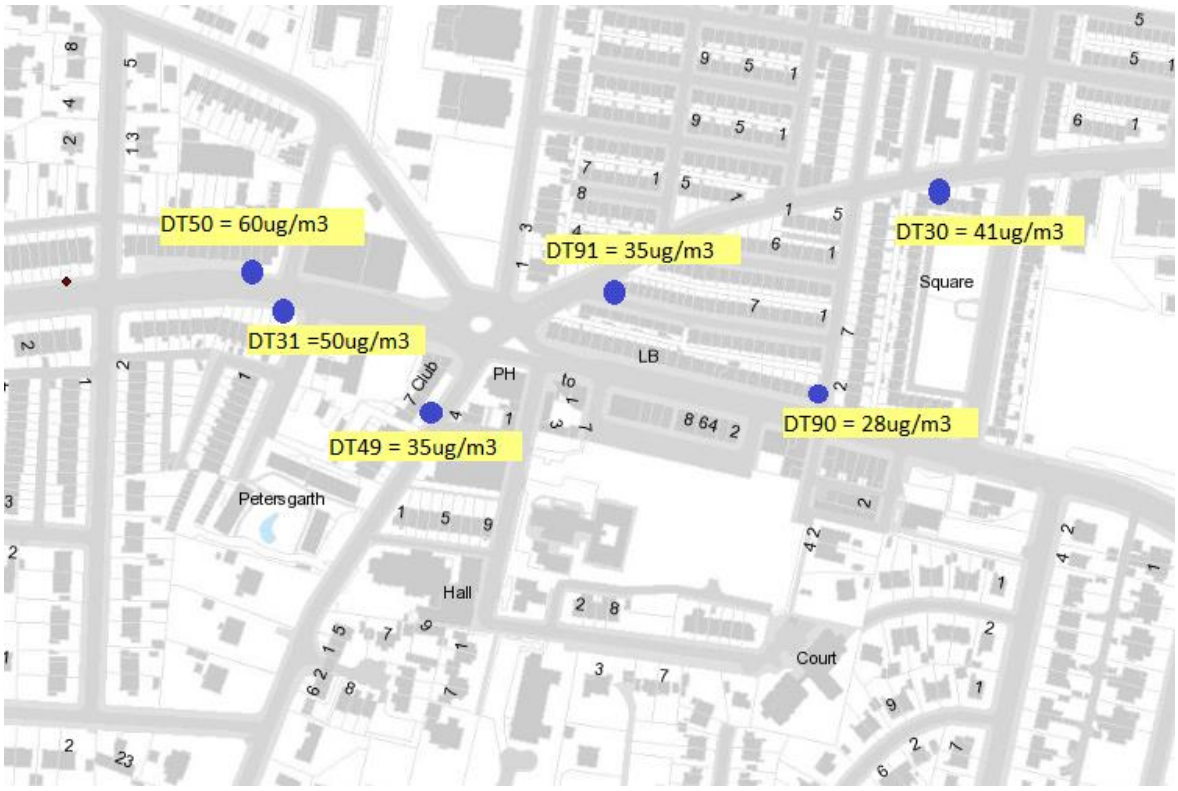
assessment prepared to support this planning application suggests that the proposals should help to improve air quality at this receptor points (see planning application 17/00916/FUL at https://planning.bradford.gov.uk/online-applications/). A full update on the progress of the planning application will be provided in the 2018 ASR. No further action is proposed at this location until the outcome of the planning decision is known. Monitoring continues in the area.

Update on other areas of air quality concern

The 2015 USA reports three areas of the city identified as requiring further investigation prior to possible AQMA declarations. These were:

- Saltaire Road / Bingley Road junction
- Rook Lane / Rooley Lane / Tong Street area
- Harrogate Road / Killinghall Road/ Dudley Hill Road crossroads

Current situation Saltaire Road / Bingley Road junction



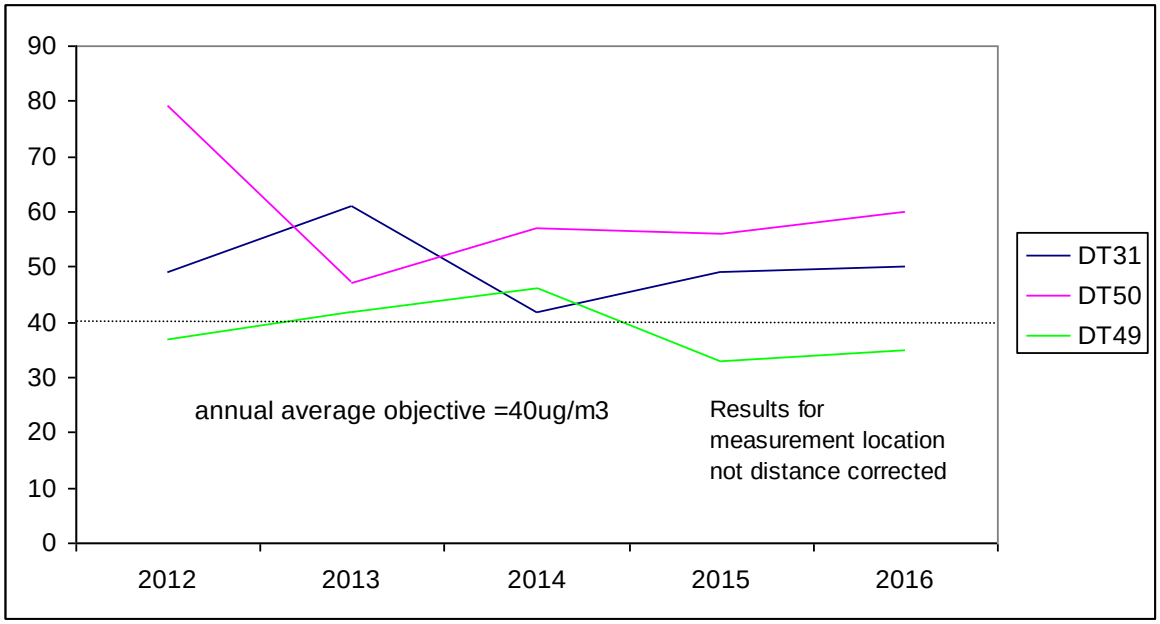
During 2016 diffusion tube monitoring was undertaken at 6 locations in this area. The distance corrected results for each are shown below. It should be noted that for the purpose of this report the distance of the measurement sites to the nearest relevant receptors and the roadside have been fully reviewed: The distances used in this report represent the best available estimate of the measurement point to the flow of traffic and the facades of relevant buildings. Previous reports only considered measurements to kerbside and in some instances the edge of gardens rather than building facades. As the annual average objective is now the main objective of concern, building facades rather than gardens, are now considered the most appropriate point for exposure considerations.

Site number	Location	Assumed distance from traffic flow (m)	Assumed distance from nearest receptor point (m)	Have distance parameters changed since previous reports?	Bias and distance corrected concentration 2016 (µg/m^3)
DT31[16]	Post outside 80 Bingley Road	1.5	4.0 (house façade)	Receptor point previously in front garden at 2m back from tube. Road previously assumed to be 1.2m away.	42
DT50	Post outside 203 Bingley Road	2	2.5	Receptor point previously assumed to be at 2m	53
DT30	Saltaire Road	2	2.0	Receptor point previously assumed to be	38

[16] This tube was reported as DT32 in the 2015 USA report

				at 1.2m	
DT49	Moorhead Lane	4	1.5	No	31
DT90	George Street	1	1	New site	28
DT91	Dove Street	1.5	1.5	New site	35

Trends around Bingley Road

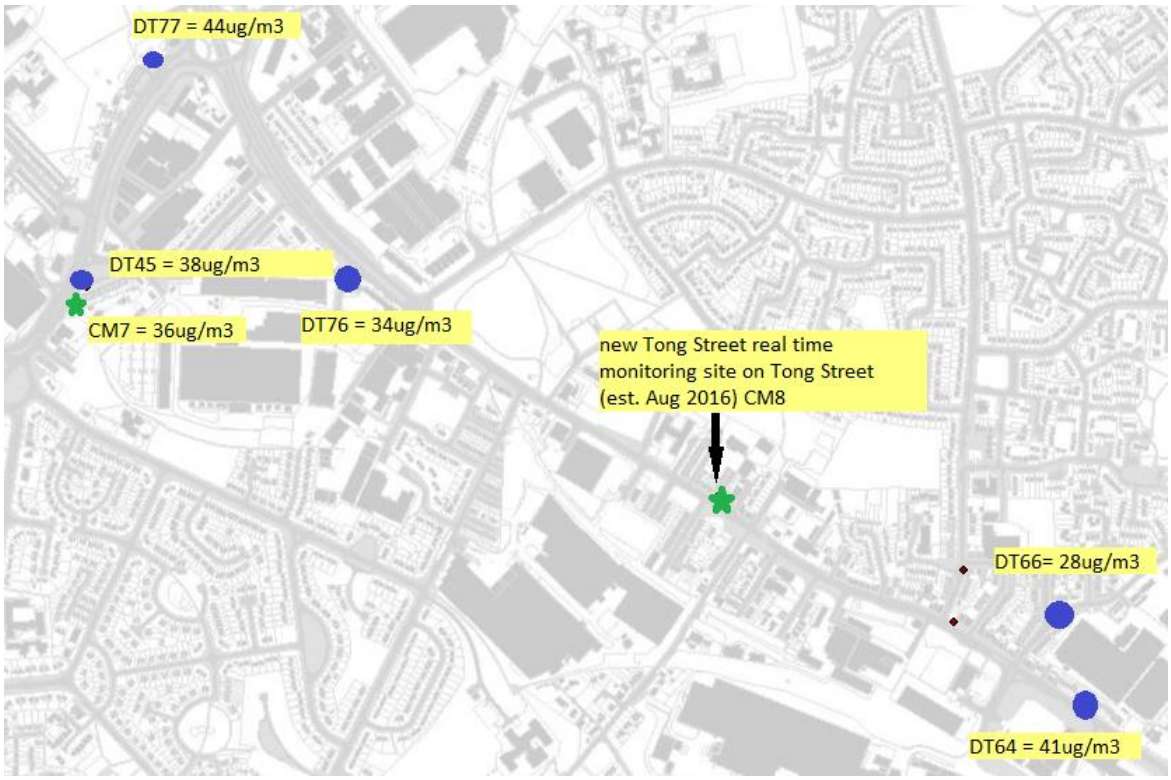


The graph above shows the bias corrected measured value at three long term monitoring sites closest to Bingley Road (with no distance correction applied). This indicates that over a 5 year period the nitrogen dioxide concentration on Bingley Road (tubes DT31 and DT50) has not improved significantly and in recent years appears to have increased, particularly since 2014. This coincides with the junction improvement work at this location which may have impacted on the queue locations and requires further investigation. In contrast tube DT49 on Moorhead Lane shows a marked reduction in nitrogen dioxide concentration since 2014 and this may also be as a result of the junction works.

If the current trends continue then it is likely that the 2017 monitoring period will also indicate a breach of the nitrogen dioxide annual average objective on Bingley Road. Bradford MDC will now take steps towards implementing an AQMA in this

area. An investigation will also be undertaken into the possibility of altering traffic light timings to reduce queuing times. A further update on this area will be provided in the 2018 ASR report.

Current situation Rook Lane / Rooley Lane /Tong Street area



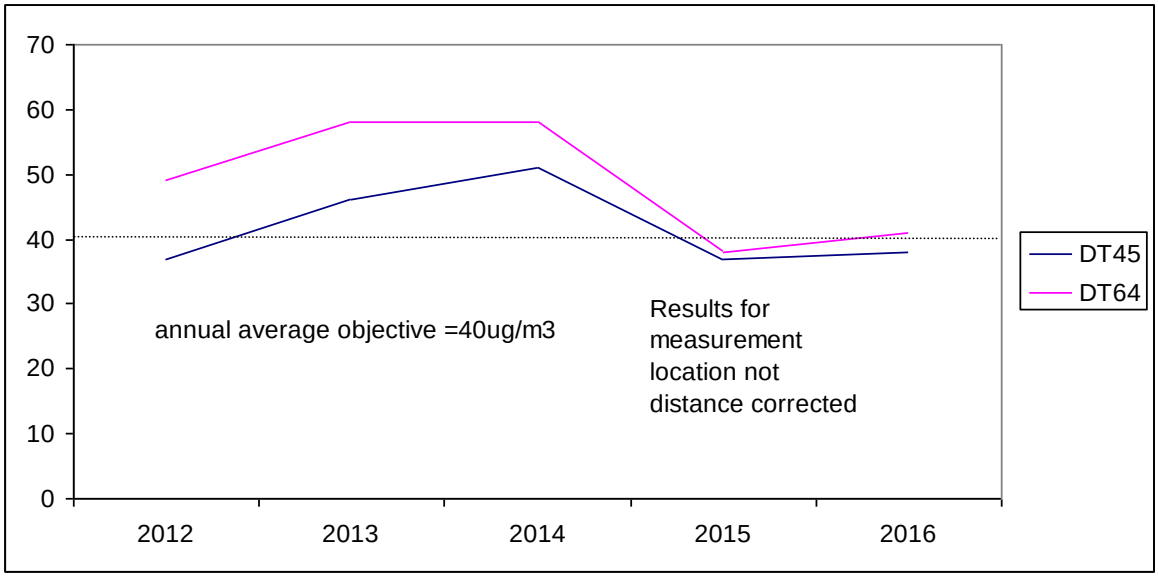
The 2016 ASR report identified elevated concentrations of nitrogen dioxide in this area. During 2016 monitoring continued at the 5 diffusion tube locations previously reported, and at two additional locations on Tong Street. Monitoring also continued at the Rooley Lane / Rook Lane real time monitoring site (CM7). The distance corrected results for each of these sites are shown below. It should be noted that for the purpose of this report the distance of the measurement sites to the nearest relevant receptors and the roadside have been fully reviewed: The distances used in this report represent the best available estimate of the measurement point to the flow of traffic and the facades of relevant buildings. Previous reports only considered measurements to kerbside and in some instances the edge of gardens rather than building facades. As the annual average objective is now the main objective of concern, building facades, rather than gardens, are now considered the most appropriate point for exposure considerations.

Site number	Location	Assumed distance from traffic flow (m)	Assumed distance from nearest receptor point (m)	Have distance parameters changed since previous reports?	Bias and distance corrected concentration 2016 ($\mu g/m^3$)
DT45	Rook Lane	1.5	0	No change as this site is not suitable for use with distance calculator	38
DT76	Rook Lane	0.5	3.5	Distance to road reduced from 1m to 0.5m Distance to house reduced from 4m to 3.5m	36
DT77	Rooley Lane	0.5	4.0	Distance to road reduced from 1m to 0.5m, now distance corrected to houses façade at 4m.	37
DT88	Tong Street	2.0	0	New site	34
DT89	Tong Street	3.0	3.0	New site	33
DT66	Holme Lane	3.0	1.0	Distance to receptor changed from garden (1.0m) to nearest house faced in line with tube (3m)	26
DT64	Tong Street	1.5	0	No change	**41**

CM7	Rook Lane	1.5	1.0	Yes – nearest receptor point changed to reflect gable end of nearest house (previous receptor point set at 4m)	34

These latest results show there was no widespread exceedance of the annual average nitrogen dioxide objective in this area during 2016. The only slight exceedance occurred at site DT64 which is immediately adjacent to a residential property.

Trends around Tong Street / Rooley Lane /Rook Lane



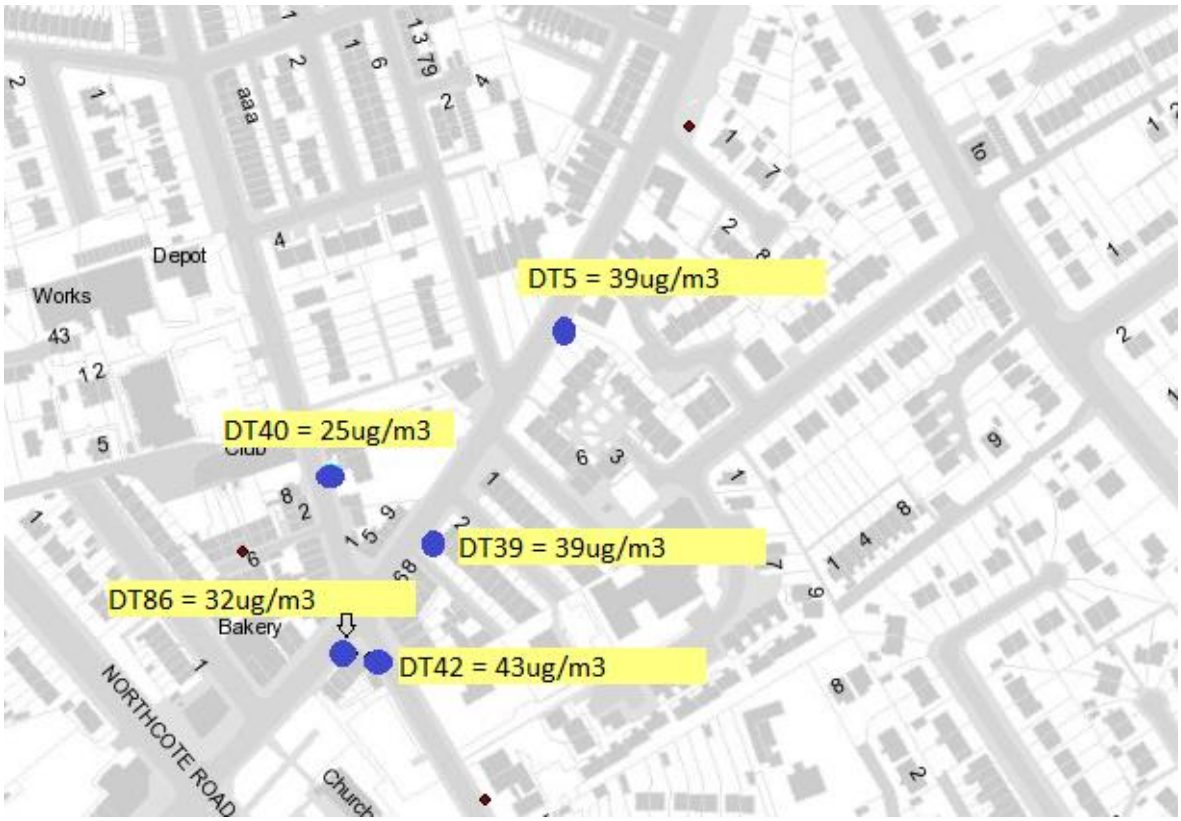
The above graph shows the bias corrected measured value at two long term monitoring sites on Tong Street (DT64) and Rook Lane (DT45). The trend at both sites is very similar showing an increase between 2012 and 2014, followed by a decrease from 2015 onwards back towards the 2012 levels. Levels in 2016 at both these sites were slightly higher than the corresponding value for 2015 resulting in the longer term trend being difficult to predict.

As levels in this area are currently below the objective level (with the exception of DT64 on Tong Street) , and there appears to have been some improvement in concentrations in recent years, it is proposed to continue monitoring in this area for another year and to review the situation in the 2018 ASR report. Additional real

time data for the new Tong Street real time monitoring site will also then be available.

In the intervening period City of Bradford MDC will begin to investigate the most appropriate options for improving air quality at location DT64, a possible resultion being changes to traffic signalling times or similar.

Current situation Harrogate Road / Killinghall junction



In recent years there have been a number of monitored exceedances of the annual average nitrogen dioxide objective at sites around the Harrogate Road / Killinghall Road junction. During 2016 further diffusion tube monitoring was undertaken at 5 locations in this area, including at a new site DT86 on Otley Road.

The 2016 distance corrected results for each of these sites are shown below. It should be noted that for the purpose of this report the distance of the measurement sites to the nearest relevant receptors and the roadside have been fully reviewed: The distances used in this report represent the best available estimate of the measurement point to the flow of traffic and the facades of relevant

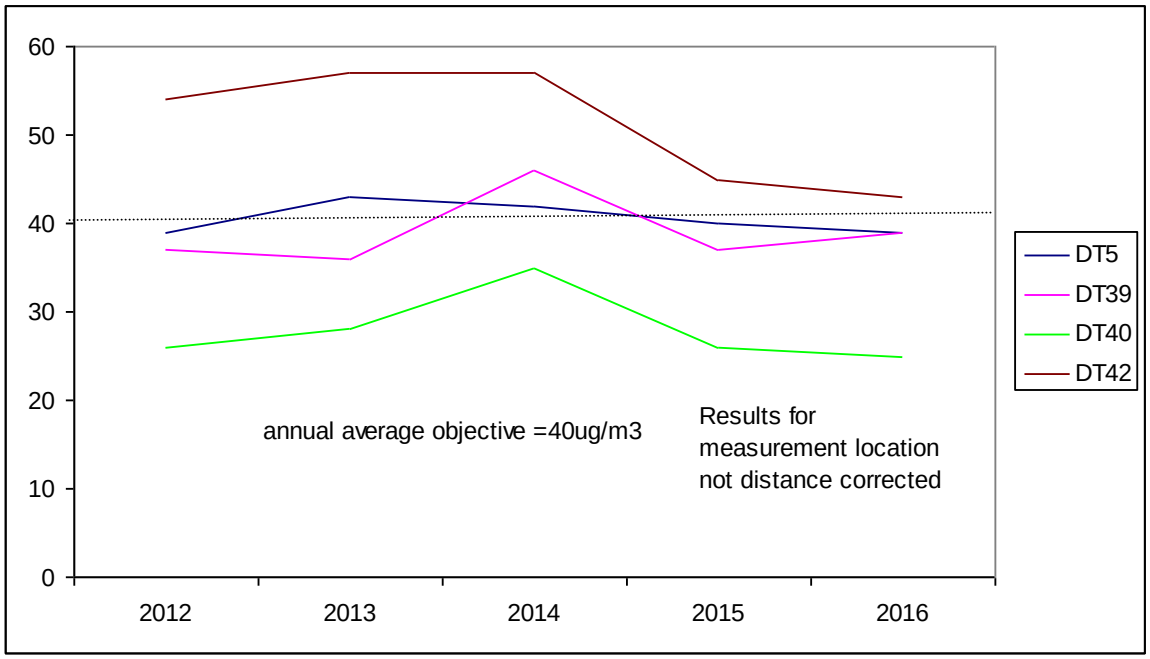
buildings. Previous reports only considered measurements to kerbside and in some instances the edge of gardens rather than building facades. As the annual average objective is now the main objective of concern, building facades rather than gardens are now considered the most appropriate point for exposure considerations.

Site number	Location	Assumed distance from traffic flow (m)	Assumed distance from nearest receptor point (m)	Have distance parameters changed since previous reports?	Bias and distance corrected concentration 2016 ($\mu g/m^3$)
DT5	Harrogate Road	1.0	0	The distance to road has been updated from <0.5 to 1.0m. The assumed distance to receptor has been reduced from 1m to 0m.	**39**
DT39	Harrogate Road	2	2	Both the distance to the road and distance to receptor figures have been increased from 1m to 2m	36
DT40	Dudley Hill Road	1.5	0	Distance to receptor has been reduced from 1m to 0m. Distance to road has been increased from	25

				1m to 1.5m	
DT42	Killinghall Road	1	1.3	Distance to nearest receptor has been reduced from 2m to 1.3m	**39.5**
DT86	Otley Road	0.3	2	New site	32

The distance corrected result for results for D42 (Killinghall) was 39.5 µg/m^3 which is very close to the 40 µg/m^3 annual average air quality objective for nitrogen dioxide. This tube is located at ground floor level and the relevant receptor point is an upstairs flat with only one very small window on the Killinghall Road façade. This does not appear to serve a habitable room. Tube DT5 was also approaching the objective level and has a relevant receptor point at ground floor level. All other sites in the vicinity were well within the objective level during 2016.

Trends around Harrogate Road / Killinghall Road junction



The above graph above shows the bias corrected measured value at the four long term monitoring sites in this area (with no distance correction applied). This indicates that over a 5 year period the nitrogen dioxide concentration at the Killinghall Road site (DT42) has fallen considerably, but there has been little change in the concentrations recorded on Harrogate Road (DT5 and DT39). If this trend continues then it is likely that the 2017 monitoring period will detail further improvement on Killinghall Road but little improvement on Harrogate Road.

As there is still some uncertainty about long term compliance with the annual average objective for nitrogen dioxide at the Harrogate Road / Killinghall junction it is proposed to continue monitoring for a further year and undertake a further review of the data before progressing towards any AQMA declaration. Further monitoring will be established on Killinghall Road and Harrogate Road to assess how concentrations change further away from the junction.

Emerging areas of concern

Canal Road

In response to planning applications in the area, diffusion tube monitoring sites were established in the Canal Road area of the city during 2016. The initial results from one of these sites DT73 indicates that the annual average NO_2 objective is already being breached in this area. This is currently not a relevant location so does not require an AQMA declaration. Further monitoring is to be established along this corridor to measure the extent of the exceedance area and this will include sites close to existing relevant locations.

The national PCM air pollution model operated on behalf of DEFRA, to identify potential exceedance of EU limit values, also indicates elevated concentrations of NO_2 around the Canal Road area. Any ongoing breaches of the 40µg/m^3 in this area would be of national concern and may result in DEFRA requiring the council to take action at a local level, either now, or in the future, to address any breach of EU limit values. For further information on this see https://uk-air.defra.gov.uk/research/air-quality-modelling?view=modelling

A further update on air quality in the Canal Road area and the status of the planning applications in the areas will be provided in the 2018 ASR report.

Greengates junction

Elevated concentrations of nitrogen dioxide have also been observed around the Greengates junction during 2016 following the installation of monitoring to support a planning application for a major junction improvement scheme. The scheme has been subject to a detailed independent air quality impact assessment study using both the measured air quality data and detailed air pollution modelling. The results of this assessment indicate that if the junction improvements are approved and implemented the current air quality issues in this area should be fully alleviated by 2019. Further information on the proposed scheme and the supporting air quality work can be found at https://planning.bradford.gov.uk/online-applications/. Planning application reference 17/00916/FUL. The progress of the planning application and results from the ongoing monitoring in the area will be further reviewed in the 2018 ASR report.

3.2.2 Particulate Matter (PM_{10})

Table A.5 in Appendix A compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

Table A.6 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past 5 years with the air quality objective of 50µg/m^3, not to be exceeded more than 35 times per year.

During the 2016 period there were no exceedances of the objectives for PM_{10} in Bradford.

Compliance with annual average objective

Table A.5 in Appendix A compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the previous 5 years with the air quality objective of 40µg/m^3.

There were no exceedances of the annual average air quality objective for PM_{10} recorded at any of the continuous monitoring sites in Bradford during 2016.

The background levels of PM_{10} recorded at Bingley and Keighley were similar to the range of values as those recorded over the previous 5 years, but at both sites concentrations were slightly higher than in the previous two years. Some slight annual variation in concentration is expected due to the influence of weather conditions, but there is currently no evidence of any long term change in background concentrations of PM_{10} within the Bradford district.

Long term trend data for the roadside PM_{10} site is not available due to a break in PM_{10} monitoring between 2013 and late 2015. This was to allow levels of $PM_{2.5}$ to be assessed at the same site. In 2012 the annual average PM_{10} concentration at Shipley Airedale Road was recorded as 30µg/m^3. The 2016 data indicates this has fallen considerably to 21µg/m^3. This level of improvement can most probably be attributed to the significant reduction in emissions of PM10 from vehicles due to improved vehicle exhaust technology, mainly the increased uptake of particulate

traps on diesel vehicles. Emission abatement technology has been more successful at reducing particulate emissions than oxides of nitrogen.

Compliance with daily mean objective

Table A.6 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the previous 5 years with the air quality objective of 50µg/m^3, which is not to be exceeded more than 35 times per year.

At Bingley there were no exceedances of the 50µg/m^3 daily mean objective during 2016.

At Keighley a level of 50µg/m^3 was only observed on 1 day. These were:

- 52.9 µg/m^3 recorded on 6th December 2016

At the Shipley Airedale Road site there were eight days during 2016 when the 24 hour mean value exceeded 50µg/m^3. These were:

- 57.2 µg/m^3 recorded on 20th January 2016
- 67.7 µg/m^3 recorded on 11th March 2016
- 64.0 µg/m^3 recorded on 13th March 2016
- 50.2 µg/m^3 recorded on 15th September 2016
- 59.6 µg/m^3 recorded on 26th November 2016
- 52.2 µg/m^3 recorded on 5th December 2016
- 69.7 µg/m^3 recorded on 6th December 2016

35 exceedances of the 50µg/m^3 objective are allowed at any one site per annum, therefore the 24 hour daily mean objective was complied with in Bradford during 2016.

The PM_{10} analyser at Bingley has recently been moved to a roadside location on Tong Street but PM10 monitoring will continue at the Keighley and Shipley Airedale Road sites during 2017.

3.2.3 Particulate Matter ($PM_{2.5}$)

Table A.7 in Appendix A presents the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the previous 5 years.

The levels of $PM_{2.5}$ measured in Bradford during 2016 were all below the current EU annual average limit value of 25 µg/m^3 and very similar to those recorded in 2015.

$PM_{2.5}$ monitoring is continuing at Keighley and Shipley Airedale Road but the Bingley PM2.5 monitor has been relocated to a roadside location in Tong Street to provide information about roadside $PM_{2.5}$ levels in that locality.

3.2.4 Sulphur Dioxide (SO_2)

There is no ratified SO_2 monitoring data available for Bradford for 2016. SO_2 monitoring undertaken previously in Bradford recorded levels well below the national air quality objective levels and there are no reasons to suggest that this position will have changed.

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
CM1	Bingley	Urban Background	410881	438942	NO_2; PM_{10}	NO	Chemiluminescent; FDMS	n/a	5	2.7
CM2	Keighley	Urban Centre	406057	441271	NO2; PM_{10}	NO	Chemiluminescent	n/a	5	2.7
CM3	Manningham Lane	Roadside	415582	434457	NO2	YES	Chemiluminescent	4	1.5	1.5
CM4	Manchester Road / Mayo Avenue	Roadside	415933	430569	NO2	YES	Chemiluminescent	2	2	1.5
CM5	Thornton Road	Roadside	415887	433047	NO2	YES	Chemiluminescent	0	2	1.5
CM6	Shipley Airedale Road	Roadside	416974	433245	NO2; PM10	YES	Chemiluminescent	2	2	2.7
CM7	Rook Lane	Roadside	417860	430705	NO2	YES	Chemiluminescent	1	1.5	2.7

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 – Details of Non-Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
DT5	Harrogate Road	Kerbside	417982	434886	NO_2	NO	0	1	NO	2.5 - 2.6
DT39	Harrogate Road	Kerbside	417927	434799	NO_2	NO	2	2	NO	2.5 - 2.6
DT40	Dudley Hill Road	Kerbside	417886	434827	NO2	NO	0	1.5	NO	2.5-2.6
DT42	Killinghall	Roadside	417902	434751	NO2	NO	1.3	1	NO	2.5 - 2.6
DT12	Treadwell Mills	Roadside	416967	433268	NO2	YES	1	1.5	NO	2.5 - 2.6
DT45	Rook Lane	Roadside	417877	430717	NO2	NO	0	1.5	NO	2.5 - 2.6
DT30	Saltaire Road	Roadside	413861	437772	NO2	NO	2	2	NO	2.5 - 2.6
DT31	80 Bingley Road	Roadside	413527	437713	NO2	NO	4	1.5	NO	2.5 - 2.6
DT49	Moorhead Lane	Roadside	413604	437658	NO2	NO	4	1.5	NO	2.5 - 2.6
DT50	203 Bingley Road	Roadside	413510	437732	NO2	NO	2.5	2	NO	2.5 - 2.6
DT68	Keighley AQ	Urban Centre	406060	441274	NO2	NO	n/a	5	YES	3
DT69	Keighley AQ	Urban Centre	406060	441274	NO2	NO	n/a	5	YES	3
DT70	Keighley AQ	Urban Centre	406060	441274	NO2	NO	n/a	5	YES	3
DT64	Tong Street	Roadside	419379	430091	NO2	NO	0	1.5	NO	2.5 - 2.6
DT66	Holme Lane	Kerbside	419341	430225	NO2	NO	3	1	NO	2.5 - 2.6

DT19	Cock and Bottle	Kerbside	416950	433436	NO2	YES	n/a	<0.5	NO	2.5 - 2.6
DT21	Prospect Street	Suburban	404719	440613	NO2	NO	0	>5	NO	2.5 - 2.6
DT71	Manningham Ln AQ	Roadside	415585	434455	NO2	YES	4	1.5	YES	2.5 - 2.6
DT72	Queen's Road	Kerbside	415573	434521	NO2	YES	0	2	NO	2.5 - 2.6
DT73	Canal Road	Roadside	415448	435812	NO2	NO	n/a	1	NO	2.5 - 2.6
DT74	Gaitsby Lane	Kerbside	415549	435918	NO2	NO	n/a	<0.5	NO	2.5 - 2.6
DT75	Laisteridge Lane	Kerbside	415504	432347	NO2	NO	8	1	NO	2.5 - 2.6
DT76	Rook Lane	Kerbside	418268	430732	NO2	NO	3.5	0.5	NO	2.5 - 2.6
DT77	Rooley Lane	Kerbside	417982	431058	NO2	NO	4	0.5	NO	2.5 - 2.6
DT78	Aireworth Road	Kerbside	407380	441811	NO2	NO	3	1	NO	2.5 - 2.6
DT79	Centenary Sq	Urban Background	416282	432966	NO2	NO	0	70	NO	2.5 - 2.6
DT80	City Exchange	Kerbside	416388	432817	NO2	NO	1	1	NO	2.5 - 2.6
DT81	Interchange	Kerbside	416413	432674	NO2	NO	1	1	NO	2.5 - 2.6
DT82	Sharpe St	Kerbside	416288	432652	NO2	NO	30	0	NO	2.5 - 2.6
DT83	Sharpe St	Kerbside	416154	432638	NO2	NO	25	0	NO	2.5 - 2.6
DT 84	Wilton St	Kerbside	416054	432675	NO2	NO	5	<1	NO	2.5 - 2.6
DT85	Ice rink	Kerbside	416092	432676	NO2	NO	6	<1	NO	2.5 - 2.6
DT86	Otley Road	Roadside	417894	434753	NO2	NO	0	2	NO	2.5 - 2.6
DT88	Tong Street	Roadside	418829	430399	NO2	NO	0	2	NO	2.5 - 2.6
DT89	Tong Street	Roadside	419188	430213	NO2	NO	3	3	NO	2.5 - 2.6
DT90	George St	Roadside	413807	437664	NO2	NO	0	1	NO	2.5 - 2.6
DT91	Dove St	Roadside	413697	437723	NO2	NO	0	1.5	NO	2.5 - 2.6
DT92	Harrogate Road	Roadside	418033	434970	NO2	NO	0.3	1.5	NO	2.5 - 2.6
DT93	New Line	Roadside	419003	437308	NO2	NO	0	1	NO	2.5 - 2.6

DT94	Stockhill Road	Roadside	419103	437337	NO2	NO	2.5	3.5	NO	2.5 - 2.6
DT95	Harrogate Road	Roadside	419111	437322	NO2	NO	n/a	1	NO	2.5 - 2.6
DT96	New Line	Roadside	419152	437209	NO2	NO	7	1	NO	2.5 - 2.6

Notes:

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

(2) N/A if not applicable.

Table A.3 – Annual Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid data for monitoring period (%) (1)	Valid data capture 2016 (%) (2)	Annual mean nitrogen dioxide concentration (µg/m^3) (3)				
					2012	2013	2014	2015	2016
CM1	Urban Background	Automatic	95%	42%	24	18	22	22	22
CM2	Urban Centre	Automatic		94%	29	27	27	28	31
CM3	Roadside	Automatic		77.0%	no data	no data	35	**42**	41
CM4	Roadside	Automatic		98%	**75**	**75**	**42**	**42**	**46**
CM5	Roadside	Automatic		86%	**50**	**63**	**51**	33	31
CM6	Roadside	Automatic		92%	**52**	**52**	**54**	**48**	**52**
CM7	Roadside	Automatic		87%	no data	no data	**57**	34	36
DT5	Kerbside	Diffusion Tube		100.0%	39	**43**	**42**	**40**	39
DT39	Kerbside	Diffusion Tube		91.6%	37	36	**46**	37	39
DT40	Kerbside	Diffusion Tube		91.6%	26	28	35	26	25
DT42	Roadside	Diffusion Tube		100.00%	**54**	**57**	**57**	**45**	**43**
DT12	Roadside	Diffusion Tube		100.00%	**68**	**66**	**84**	**66**	**69**
DT45	Roadside	Diffusion Tube		100.00%	37	**46**	**51**	37	38
DT30	Roadside	Diffusion Tube		91.60%	**45**	no data	**49**	39	**41**
DT31	Roadside	Diffusion Tube		100.00%	**49**	**61**	**42**	**49**	**50**
DT49	Roadside	Diffusion Tube		100.00%	37	**42**	**46**	33	35
DT50	Roadside	Diffusion Tube		100.00%	**79**	**47**	**57**	**56**	**60**

DT68	Urban Centre	Diffusion Tube		100.00%	37	30	34	30	30
DT69	Urban Centre	Diffusion Tube		100.00%	31	29	35	30	31
DT70	Urban Centre	Diffusion Tube		100.00%	**40**	32	39	31	32
DT64	Roadside	Diffusion Tube		91.60%	**49**	**58**	**58**	38	**41**
DT66	Kerbside	Diffusion Tube		100.00%	36	34	39	32	28
DT19	Kerbside	Diffusion Tube		100.00%	**110**	**66**	**74**	**53**	**58**
DT21	Suburban	Diffusion Tube		100.00%	24	29	21	17	12
DT71	Roadside	Diffusion Tube		100.00%	**no data**	**no data**	**no data**	**40**	39
DT72	Kerbside	Diffusion Tube		100.00%	**79**	**no data**	**no data**	**60**	**66**
DT73	Roadside	Diffusion Tube		91.60%	**no data**	**no data**	**no data**	**51**	**51**
DT74	Kerbside	Diffusion Tube		100.00%	**no data**	**no data**	**no data**	25	22
DT75	Kerbside	Diffusion Tube		100.00%	**no data**	**no data**	**no data**	28	28
DT76	Kerbside	Diffusion Tube		100.00%	**no data**	**no data**	**no data**	**41**	34
DT77	Kerbside	Diffusion Tube		100.00%	**no data**	**no data**	**no data**	**51**	**44**
DT78	Kerbside	Diffusion Tube		75%	**no data**	**no data**	**no data**	27	23
DT79	Urban Background	Diffusion Tube		91.60%	**no data**	**no data**	**no data**	33	29
DT80	Kerbside	Diffusion Tube		100%	**no data**	**no data**	**no data**	34	33
DT81	Kerbside	Diffusion Tube		83.30%	**no data**	**no data**	**no data**	36	34
DT82	Kerbside	Diffusion Tube		91.60%	**no data**	**no data**	**no data**	37	34
DT83	Kerbside	Diffusion Tube		91.60%	**no data**	**no data**	**no data**	29	28
DT84	Kerbside	Diffusion Tube		91.60%	**no data**	**no data**	**no data**	32	32
DT85	Kerbside	Diffusion Tube		58%	**no data**	**no data**	**no data**	31	32
DT86	Roadside	Diffusion Tube	82%	75%	**no data**	**no data**	**no data**	**no data**	32
DT88	Roadside	Diffusion Tube	100%	91.60%	**no data**	**no data**	**no data**	**no data**	35
DT89	Roadside	Diffusion Tube	100%	91.60%	**no data**	**no data**	**no data**	**no data**	36

DT90	Roadside	Diffusion Tube	100%	91.60%	**no data**	**no data**	**no data**	**no data**	28
DT91	Roadside	Diffusion Tube	91%	83.30%	**no data**	**no data**	**no data**	**no data**	35
DT92	Roadside	Diffusion Tube	100%	83.30%	**no data**	**no data**	**no data**	**no data**	38
DT93	Roadside	Diffusion Tube	100%	83.30%	**no data**	**no data**	**no data**	**no data**	**40**
DT94	Roadside	Diffusion Tube	80%	66.60%	**no data**	**no data**	**no data**	**no data**	27
DT95	Roadside	Diffusion Tube	100%	83.30%	**no data**	**no data**	**no data**	**no data**	**51**
DT96	Roadside	Diffusion Tube	70%	58.30%	**no data**	**no data**	**no data**	**no data**	38

Diffusion tube data has been bias corrected - YES

Annualisation has been conducted where data capture is <75% - YES

If applicable, all data has been distance corrected for relevant exposure – NO (see table B.1 for distance corrected 2016 results)

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.**

(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%).

(3) Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Table A.4 – 1-Hour Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
					2012	2013	2014	2015	2016
CM1	Urban Background	automatic	95%	42%	**44**	0	0	0	0 (81.2)
CM2	Urban Centre	automatic		94%	0	0	0	0	0
CM3	Roadside	automatic		77%	no result	no result	0(116)	0	0 (114.3)
CM4	Roadside	automatic		98%	**43**(182**)**	**84**(193)	**34**	0	2
CM5	Roadside	chemiluminescence		86%	0	0	**141**(306)	0	0
CM6	Roadside	automatic		92%	1	0	**0**(135)	0	0
CM7	Roadside	automatic		87%	no result	no result	**106** (293)	0	0

Notes:

Exceedances of the NO_2 1-hour mean objective (200µg/m^3 not to be exceeded more than 18 times/year) are shown in **bold.**

(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%).

(3) If the period of valid data is less than 85%, the 99.8th percentile of 1-hour means is provided in brackets.

Table A.5 – Annual Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	PM_{10} Annual Mean Concentration ($\mu g/m^3$) (3)				
				2012	2013	2014	2015	2016
CM1	Urban Background	87.5	15.3	15	15.4	13.3	12.6	15.1
CM2	Urban Centre Roadside		90.2	17.3	16.6	12.4	14	15.5
CM6			85.5	30	n/a	n/a	n/a	21.2

Annualisation has been conducted where data capture is <75% - YES

Notes:

Exceedances of the PM_{10} annual mean objective of 40$\mu g/m^3$ are shown in **bold.**

(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%).

(3) All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Table A.6 – 24-Hour Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)				
				2012	2013	2014	2015	2016
CM1	Urban Background	87.5	15.3	3(28.9)	3(25.4)	1(24.4)	1(22.9)	0 (31.7)
CM2	Urban Centre		90.2	7(30.6)	2(25.2)	3(23.3)	1	1
CM6	Roadside		85.5	n/a	n/a	n/a	2	8

Notes:

Exceedances of the PM_{10} 24-hour mean objective (50µg/m^3 not to be exceeded more than 35 times/year) are shown in **bold.**

(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%).

(3) If the period of valid data is less than 85%, the 90.4th percentile of 24-hour means is provided in brackets.

Table A.7 – $PM_{2.5}$ Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	$PM_{2.5}$ Annual Mean Concentration ($\mu g/m^3$) (3)				
				2012	2013	2014	2015	2016
CM1	Urban Background	87.5	15.3	n/a	n/a	n/a	9.3	9.9
CM2	Urban Centre		90.2	n/a	n/a	n/a	9.5	9.3
CM6	Roadside		86.3	n/a	10.4	11	13.1	13.0

Annualisation has been conducted where data capture is <75% - YES

Notes:

(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%).

(3) All means have been “annualised” as per Boxes 7.9 and 7.10 in LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Appendix B: Full Monthly Diffusion Tube Results for 2016

Table B.1 – NO_2 Monthly Diffusion Tube Results - 2016

Site ID	NO_2 Mean Concentrations ($\mu g/m^3$)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (factor 0.75) and annualised	Distance Corrected to Nearest Exposure ([2])
DT5	65.0	63.0	52.0	56.0	45.0	42.0	42.0	34.0	43.0	49.0	68.0	67.0	52.2	39	39
DT39	56.0	55.0	47.0	46.0	no data	45.0	39.0	35.0	49.0	59.0	83.0	58.0	52.0	39	36.2
DT40	40	41	30	30	27	28	22	27	22	no data	55	44	33.3	25	25.0
DT42	63	68	59	57	51	57	48	52	56	23	90	68	57.7	**43**	39.5
DT12	80	88	123	89	83	79	60	73	99	81	140	110	92.1	**69**	**63.7**
DT45	61	57	53	45	41	40	36	41	43	55	74	61	50.6	38	38.0
DT30	63	63	61	52	55	47	44	38	50	no data	69	65	55.2	**41**	37.9
DT31	69	81	81	69	55	56	56	35	59	80	98	57	66.3	**50**	**42.0**
DT49	48	52	42	48	48	37	35	32	38	50	79	54	46.9	35	31.3
DT50	85	86	67	89	77	64	72	65	71	77	122	92	80.6	**60**	**52.8**
DT68	50	48	41	38	32	30	34	30	33	41	55	48	40.0	30	**n/a**
DT69	51	45	43	42	33	31	32	34	33	39	52	54	40.8	31	**n/a**
DT70	51	46	39	39	38	32	31	31	25	41	82	52	42.3	32	**n/a**
DT64	44	62	54	57	56	47	45	43	45	no data	79	62	54.0	**41**	**41.0**

DT66	50	48	36	33	26	22	28	31	29	34	63	50	37.5	28	26.3
DT19	81	85	79	82	72	69	64	52	67	79	114	83	77.3	**58**	**n/a**
DT21	24	21	16	14	12	9	10	11	13	14	34	21	16.6	12	**n/a**
DT71	64	55	57	54	46	50	48	43	39	48	70	52	52.2	39	35.3
DT72	84	88	84	90	96	74	65	71	74	101	133	88	87.3	**66**	**66.0**
DT73	81	81	72	no data	76	52	45	49	52	75	95	77	68.6	**51**	**n/a**
DT74	35	40	30	23	22	17	20	20	22	31	51	41	29.3	22	**n/a**
DT75	47	51	6	32	32	28	25	27	29	61	63	45	37.2	28	25.3
DT76	52	56	41	45	47	32	27	30	39	49	75	52	45.4	34	29.6
DT77	66	70	52	61	47	45	40	38	57	68	89	66	58.3	**44**	35.5
DT78	46	40	27	23	23	20	no data	18	no data	28	no data	46	30.1	23	22.7
DT79	48	44	no data	34	34	23	27	28	30	41	57	55	38.3	29	**n/a**
DT80	48	50	51	50	44	32	32	36	37	51	56	40	43.9	33	**n/a**
DT81	46	56	45	54	46	35	33	47	36	no data	no data	60	45.8	34	**n/a**
DT82	58	50	46	43	74	30	15	34	42	51	no data	61	45.8	34	**n/a**
DT83	39	40	38	38	38	35	25	29	33	39	no data	51	36.8	28	**n/a**
DT84	49	55	49	47	42	25	29	32	35	54	no data	57	43.1	32	27.8
DT85	48	no data	no data	51	44	31	26	32	no data	no data	no data	53	40.7	32	27.5
DT86	no data	54	42	no data	26	37	no data	29	42	46	66	45	43.0	32	32.0
DT88	no data	58	49	40	40	40	35	38	39	47	73	54	46.6	35	35.0
DT89	no data	57	43	44	33	35	40	42	41	41	81	64	47.4	36	33.5
DT90	no data	44	38	34	26	24	25	30	30	34	65	67	37.9	28	28.0
DT91	no data	no data	52	52	44	36	44	23	44	53	76	46	47.0	35	35.0
DT92	no data	no data	49	54	57	42	38	38	41	49	82	61	51.1	38	37.2
DT93	no data	no data	48	55	56	53	40	41	48	52	84	61	53.8	**40**	**n/a**

DT94	no data	no data	36	no data	no data	21	26	25	27	35	71	56	37.1	27	26.3
DT95	no data	no data	65	67	76	56	58	61	66	73	82	77	68.1	**51**	**n/a**
DT96	no data	no data	44	48	no data	no data	no data	47	44	49	68	63	51.9	38	31.3

Local bias adjustment factor used - NO
National bias adjustment factor used – YES
Annualisation has been conducted where data capture is <75% - YES
Assumed background concentration for distance correction calculations = 22µg/m^3

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.**
(1) See Appendix C for details on bias adjustment and annualisation.
(2) Distance corrected to nearest relevant public exposure.

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

C 1.0 Diffusion tube preparation

All diffusion tubes used in conjunction with this report were prepared by West Yorkshire Analytical services using 50% TEA in acetone.

WYAS participate in the Inter-laboratory comparison scheme AIR PT. This is an independent analytical proficiency-testing (PT) scheme, operated by LGC Standards and supported by the Health and Safety Laboratory (HSL). AIR PT is a new scheme, started in April 2014, which combines two long running PT schemes: LGC Standards STACKS PT scheme and HSL WASP PT scheme. AIR PT offers a number of test samples designed to test the proficiency of laboratories undertaking analysis of chemical pollutants in ambient indoor, stack and workplace air. One such sample is the AIR NO2 test sample type that is distributed to participants in a quarterly basis. The results of this scheme are published annually.

The AIR PT NO2 diffusion tube results for WYAS for the period covered by this progress report are shown in Table C.1

Table C.1 AIR PT NO2 diffusion tube results for WYAS (2016

AIR round	Result for WYAS
January – February 2016	75%
April – May 2016	100%
July – August 2016	No result
September– October 2016	50%

The average WASP result for the 2015 period was 75%.

C 2.0 Nitrogen Dioxide Bias Factors

Local nitrogen dioxide diffusion tube bias factors are not available from the Bradford district monitoring network. The NO_2 tube results reported within this report have been corrected for bias using the factors provided on the LAQM support website (DEFRA spreadsheet version 09/17. These factors are derived from co-location studies in other areas using WYAS tubes.

The bias factor used in this report was **0.75**

C 3.0 PM Monitoring Adjustment

The PM_{10} and $PM_{2.5}$ data within this report was collected using PM_{10}/ $PM_{2.5}$ FDMS measurement systems. It has been subject to ratification and verification checks, but has not been corrected for volatility as this is not necessary for FDMS measurements.

C 4.0 QA/QC of Automatic Monitoring

The City of Bradford Metropolitan District Council's air quality analysers are type approved as recommended in LAQM.TG1 (00) *Review and Assessment: Monitoring air quality* and LAQM.TG4 (00) *Review and assessment: Pollutant specific guidance.*

The Council's own automatic network is operated by council officers trained by the instrument supplier. Signal Group provide routine maintenance and emergency repair services. All the real time data provided in this report is from council operated analysers with the exception of the Mayo Avenue site (CM4) which is affiliated to the AURN network and operated by DEFRA.

Bradford MDC air quality staff undertake Local Site operator duties at the Mayo Avenue monitoring station on behalf of DEFRA. Annual auditing of this site and data management is managed by DEFRA using their own contractors. Data management of all the other Bradford sites is undertaken in house by City of Bradford MDC AQ staff.

The City of Bradford MDC monitoring sites have a programme of routine operational checks and programmed fortnightly site visits which include:

- Daily checks on data transfer, telephone lines and analyser operation (by Signal Group).

- Weekly download of raw data (by Signal Group)
- Prompt fault reporting and carrying out of repairs under a service agreement with the equipment supplier (Signal Group).
- Fortnightly manual calibration checks, site inspections of equipment status, site safety and security (by Bradford MDC staff).
- Programmed six-monthly servicing and calibration by equipment suppliers under service agreement (Signal Group)

Maintenance systems

The Council's monitoring network of automatic continuous monitors is maintained in accordance with a schedule which is essentially similar to that employed for the AURN and affiliated sites. All analysers are maintained and serviced according to manufacturers specifications and have a six-monthly service and recalibration by Signal Ambitech, the suppliers of the equipment. The servicing, calibration, and repair documentation is kept in a central record. Routine maintenance is carried out at the two-weekly calibration site visit, and any faults are recorded with the calibration log for the visit. These records are kept on site and centrally at the Environmental Health Services Scientific and Technical Services Team office.

Calibration Routines

A zero and span calibration check is performed every two weeks during the site inspection visit. The methodology used is essentially that found in the AURN Local Site Operators Manual issued by NETCEN, and the manufacturer's instruction manual.

The basic steps are:

- Pre-calibration check of the general site condition and status of the analyser, before the zero and span checks are performed.
- Zero check to verify the performance of the analyser in the absence of the gas being monitored.
- Span check to verify the response of the analyser to gas of a known concentration.
- Post calibration check of the general site condition and status of the analyser on completion of all calibration routines.

A record of each analyser zero and span check is fully documented and a record kept on site and also centrally.

Calibration Gas Standards

The gases used for onsite span calibration checks are supplied by Air Liquide Ltd and are traceable via European Accreditation DIN EN 45001 and DIN EN ISO 900. The tolerance of the nitrogen dioxide and nitric oxide in air mixes is typically ±5%, and for a sulphur dioxide in air mix, it is typically ±5%.

Zero air is generated internally in the Ambirak, and the scrubbers are changed when necessary in accordance with manufacturer's recommendations and the NETCEN LSO Site Manual for the Ambirak.

Data scaling, validation and ratification

Unscaled data is gathered every hour by an Ambidesk system located in the Scientific and Technical Services Team office. Scaling factors are applied automatically by the Ambidesk software using factors derived during the fortnightly calibration check and the daily automatic internal calibration checks at the Ambirak.

A daily report is generated to enable unusual readings to be identified. Monthly reports are produced for further checks on data capture rates, and any other unusual variations in measured scaled data. The original raw unscaled data is retained on disk at the Ambirak in the event of anomalous scaled data events.

All scaled hourly results downloaded from the Ambirak system are subject to detailed checking by an air quality officer at Bradford MDC on an annual basis as part of the ASR reporting.

Where unusual or unexpected results are obtained from an individual site, comparisons are undertaken with data from other monitoring locations inside and outside the Bradford district and the past history of the analyser in terms of reliability and recent breakdowns is taken into consideration. Any data considered to be unrepresentative of actual ambient conditions is removed from the data set prior to preparation of summary reports. A full record is kept of any adjustments to data on an hour by hour basis.

Short-term to Long-term Data Adjustment

Short to long term data adjustment has been undertaken for diffusion tube data (where applicable) and annual average PM_{10} and PM2.5 data from Bingley for the purpose of this report. These are detailed below.

C 4.1 Annualisation of PM_{10} data for Bingley

The PM_{10} data reported for Bingley covers the period 7th April 2016 to 9th June 2016. The data has therefore been annualised using AURN data from the Leeds City Centre and Salford Eccles sites which both had good data capture during this period. The Keighley site could not be used for the annualisation calculation as there was a significant amount of missing data during the period of interest.

An annualisation factor of 0.94 has been used to annualise the Bingley PM_{10} data as detailed in Table C.1 below

Table C.4.1 Annualisation factor for Shipley Airedale Road PM_{10} data

Site	Annual Mean 2016 A_m	Period Mean Pm (21st August to 31st December)	Ratio (Am/Pm)
Salford Eccles	17.34	18.55	0.934
Leeds City Centre	16.91	17.69	0.945
Average ratio			**0.94**

C 4.2 Annualisation of NO_2 diffusion tube data

Where diffusion tube monitoring is only undertaken for part of a year and/or where annual data capture is less than 75%, the annual averages require annualisation to take account of any seasonal variation in concentration.

The diffusion tube measurements undertaken in Bradford during 2016 have been annualised using NO_2 data from the Keighley. The calculations are detailed below.

Table C.4.2 Diffusion tube annualisation calculations

DT85

Month	Keighley Real Time mean	DT85	Keighley when DT85 present	
5/1/16 (noon) to 2/2/2016 (noon)	33	48.00		33.00
2/2/2016 (13:00) to 3/3/2016(noon)	29			
3/3/2016(13.00) to 11/4/2016 (noon)	29			
11/4/2016 13:00 to 3/5/2016 noon	27	51		27
3/5/2016 13:00 to 1/6/2016 15:00	29	44		29
1/6/2016 16:00 to 6/7/2016 14:00	31	31		31
6/7/2016 15:00 to 2/8/2016 11:00	27	26		27
2/8/2016 noon to 1/9/2016 11:00	27	32		27
1/9/2016 noon to 5/10/2016 11:00	31			
5/10/2016 noon to 8/11/2016 11:00	37			
8/11/2016 noon to 6/12/2016 noon	36			
6/12/2016 13:00 to 30/12/2016 2:00	33	53.00		33.00
Average	30.86	40.71		29.57
Annualisation Factor				**1.043519**
Annualised value				40.71*1.0435 **= 42.5**
Bias corrected annualised value				42.2*0.75 = **32ug/m^3**

DT94

Month	Keighley Real Time mean	DT94	Keighley when DT94 present	
Jan-17	33			
Feb-17	29			
9/3/2016 10:00 to 11/4/2016 15:00	29	36		29
11/4/2016 16:00 to 3/5/2016 16:00	28			
3/5/2016 17:00 to 1/6/2016 14:00	29			
1/6/2016 15:00 to 5/7/2016 15:00	31	21		31
5/7/2016 16:00 to 2/8/2016 14:00	27	26		27
2/8/2016 15:00 to 1/9/2016 15:00	27	25		27
1/9/2016 16:00 to 5/10/2016 15:00	31	27		31
5/10/2016 16:00 to 7/11/2016 15:00	37	35		37
7/11/2016 16:00 to 5/12/2016 14:00	35	71		35
5/12/2016 14:00 to 30/12/2016 2:00	34	56.00		34
Average	30.83	37.13	31.38	
Annualisation Factor				**0.982736**
Annualised value				37.13*0.9827 = **36.5**
Bias corrected annualised value				36.5*0.75 **= 27ug/m^3**

DT96

Month	Keighley Real Time mean	DT96	Keighley when DT96 present	
Jan-17	33			
Feb-17	29			
9/3/2016 10:00 to 11/4/2016 15:00	29	44		29
11/4/2016 16:00 to 3/5/2016 16:00	28	48		28
3/5/2016 17:00 to 1/6/2016 14:00	29			
1/6/2016 15:00 to 5/7/2016 15:00	31			
5/7/2016 16:00 to 2/8/2016 14:00	27			
2/8/2016 15:00 to 1/9/2016 15:00	27	47		27
1/9/2016 16:00 to 5/10/2016 15:00	31	44		31
5/10/2016 16:00 to 7/11/2016 15:00	37	49		37
7/11/2016 16:00 to 5/12/2016 14:00	35	68		35
5/12/2016 14:00 to 30/12/2016 2:00	34	63.00		34
Average	30.83	51.86	31.57	
Annualisation Factor				**0.976621**
Annualised value				51.86*0.976 **= 50.62**
Bias corrected annualised value				50.62*0.75 **= <u>38ug/m3</u>**

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

The maps below show the location of all the Bradford diffusion tube monitoring sites.

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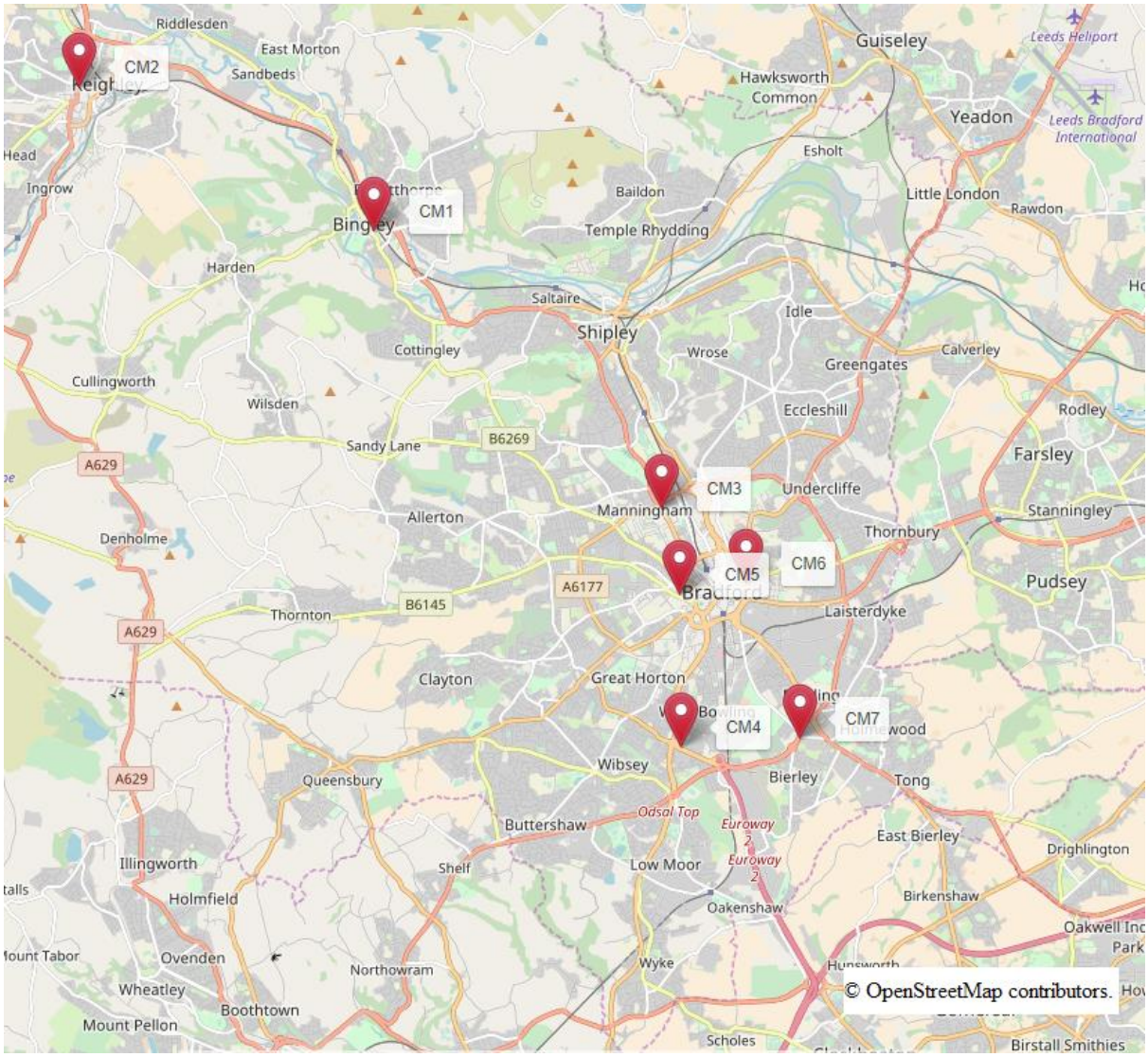
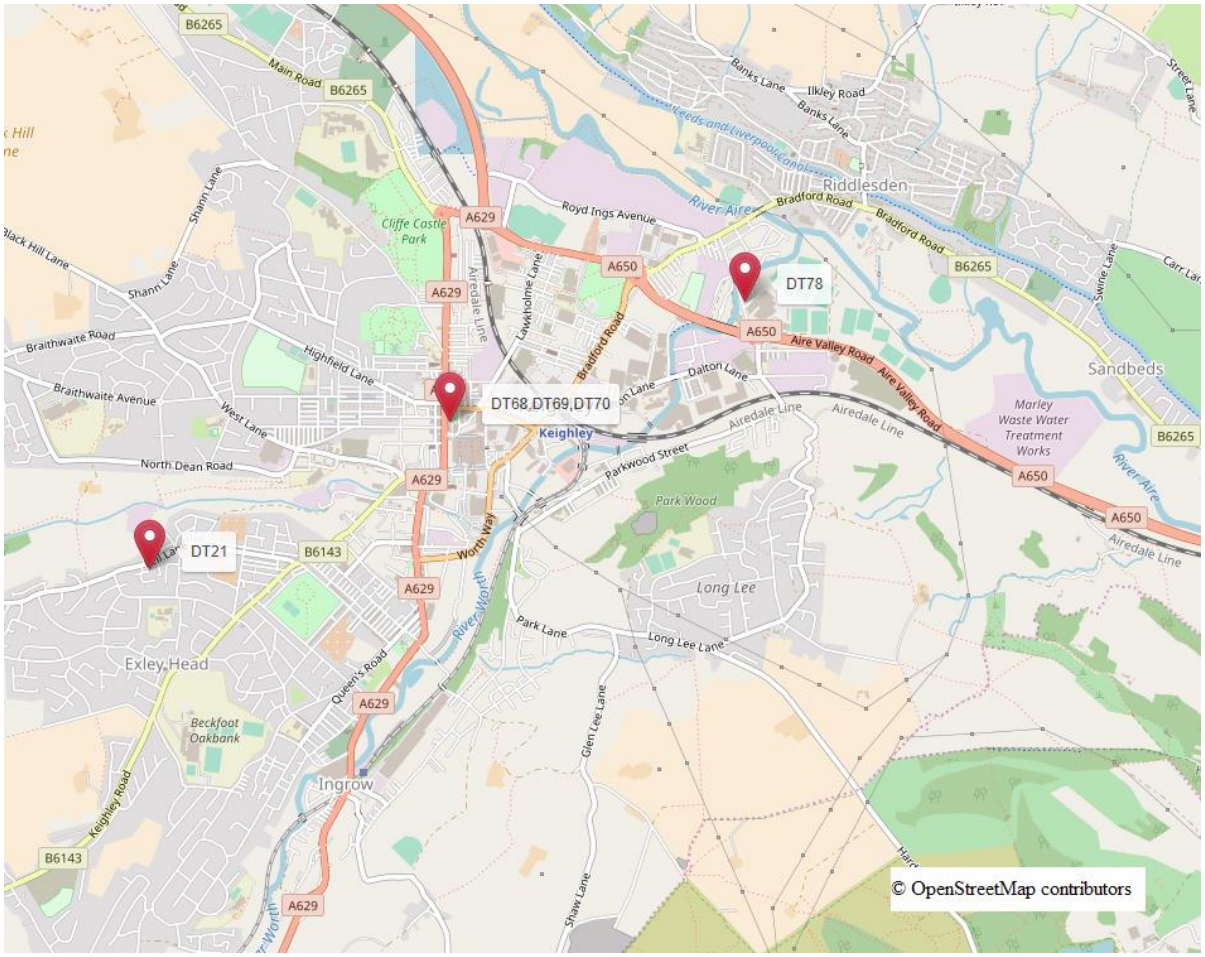
Map 1: Bradford real time monitoring sites

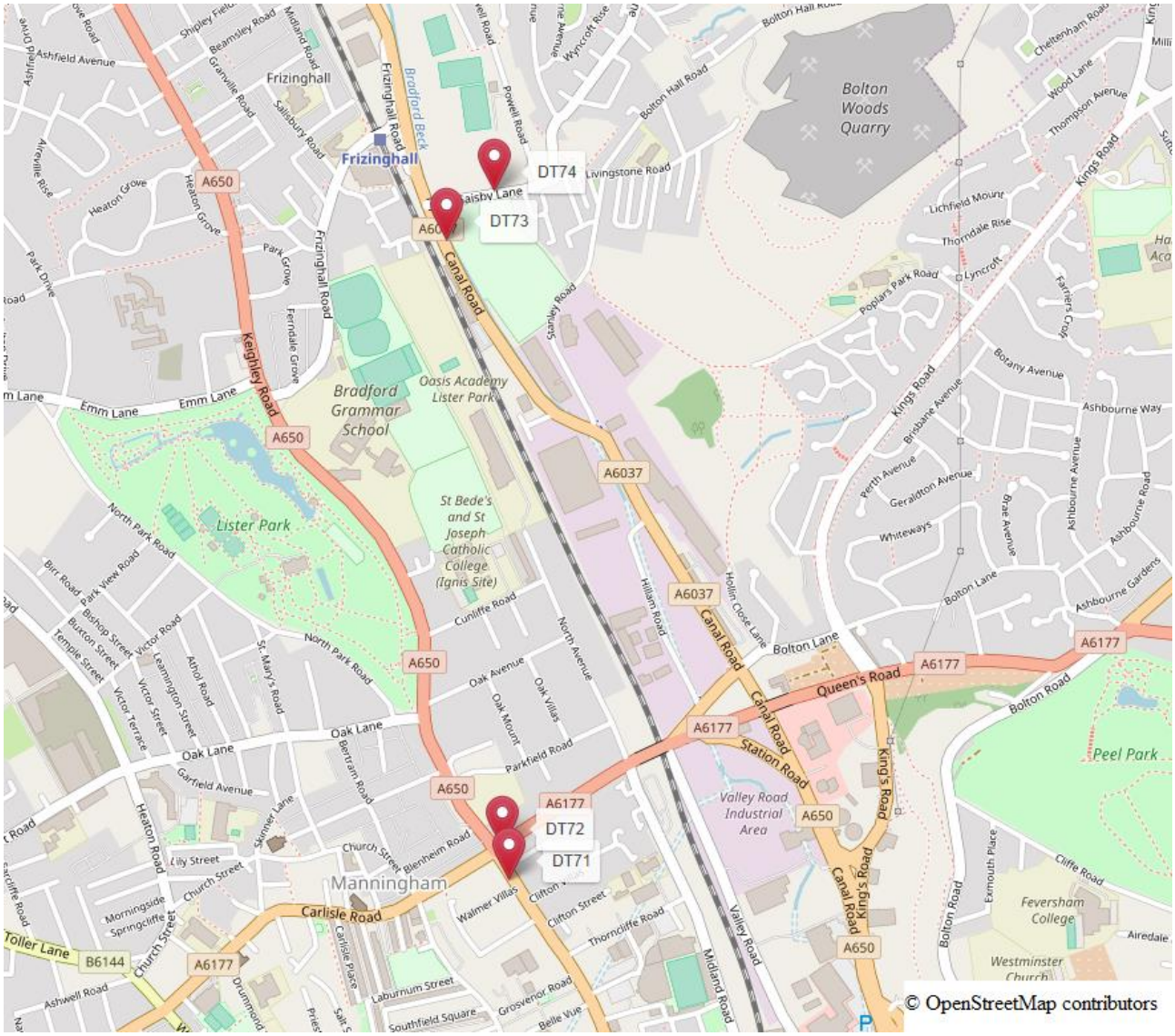


Map 2: Keighley diffusion tubes

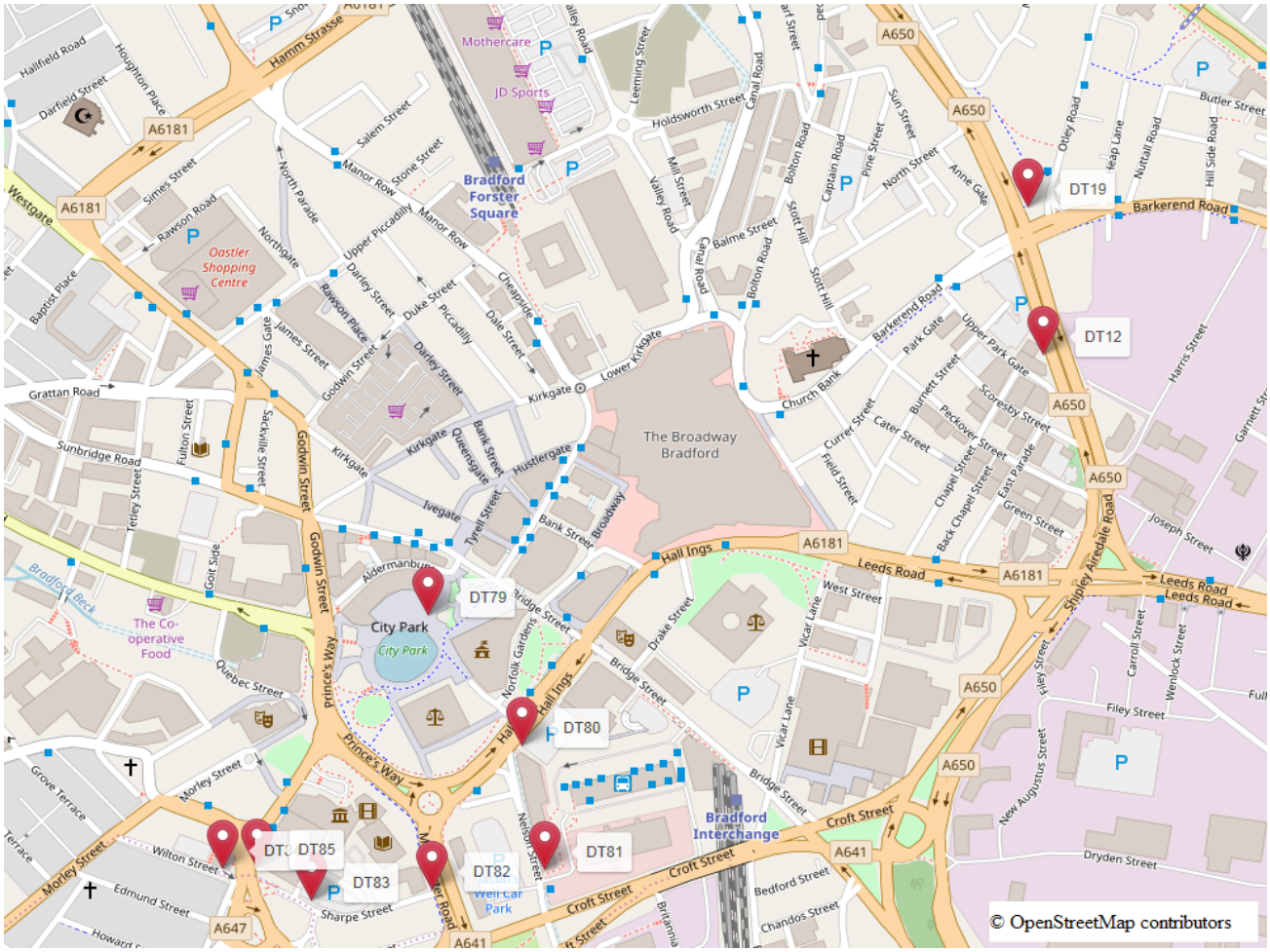


Map 2: Bingley Road diffusion tubes

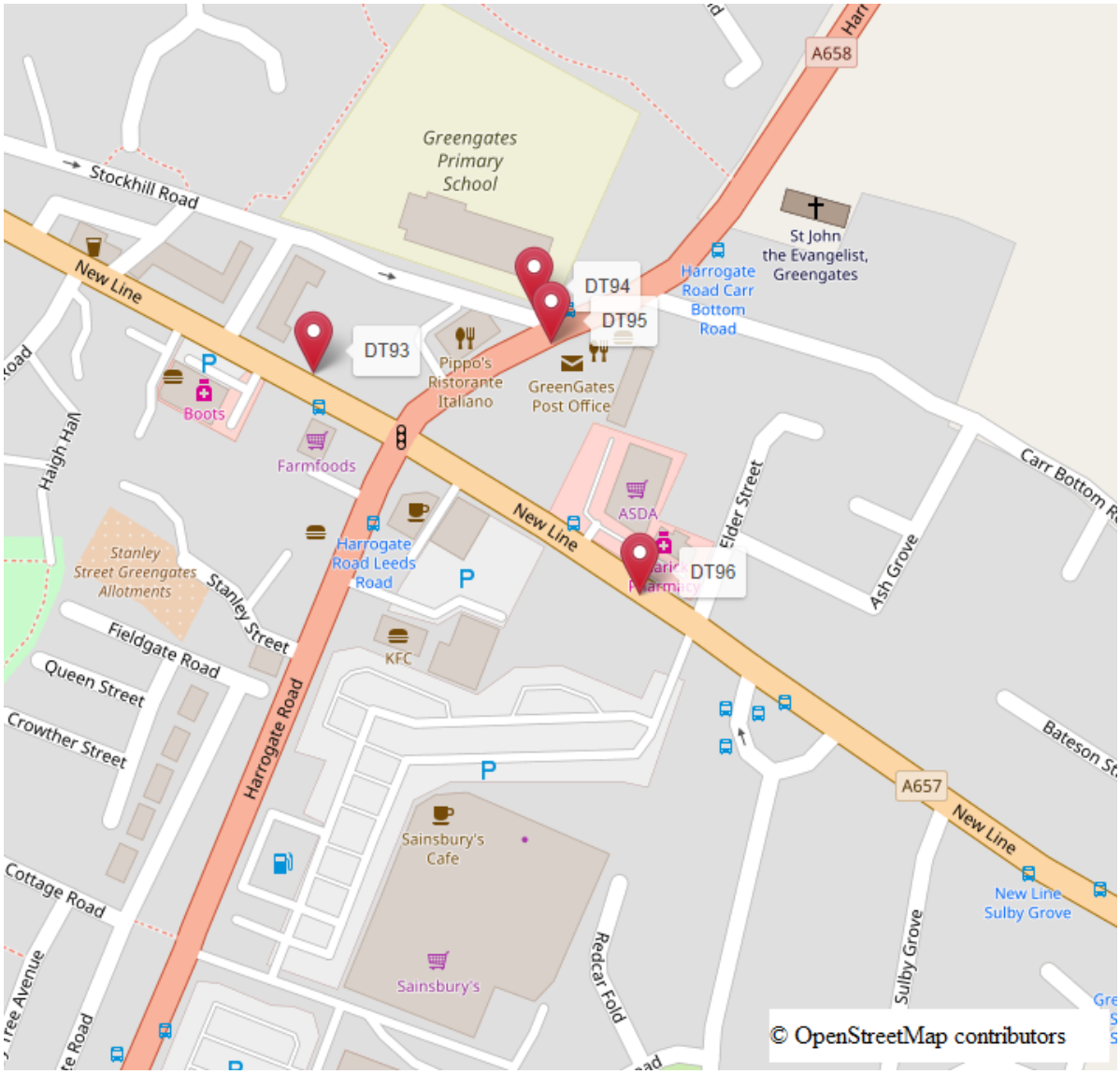
Map 4: Manningham Lane / Canal Road diffusion tubes



Map 5: City Centre diffusion tubes

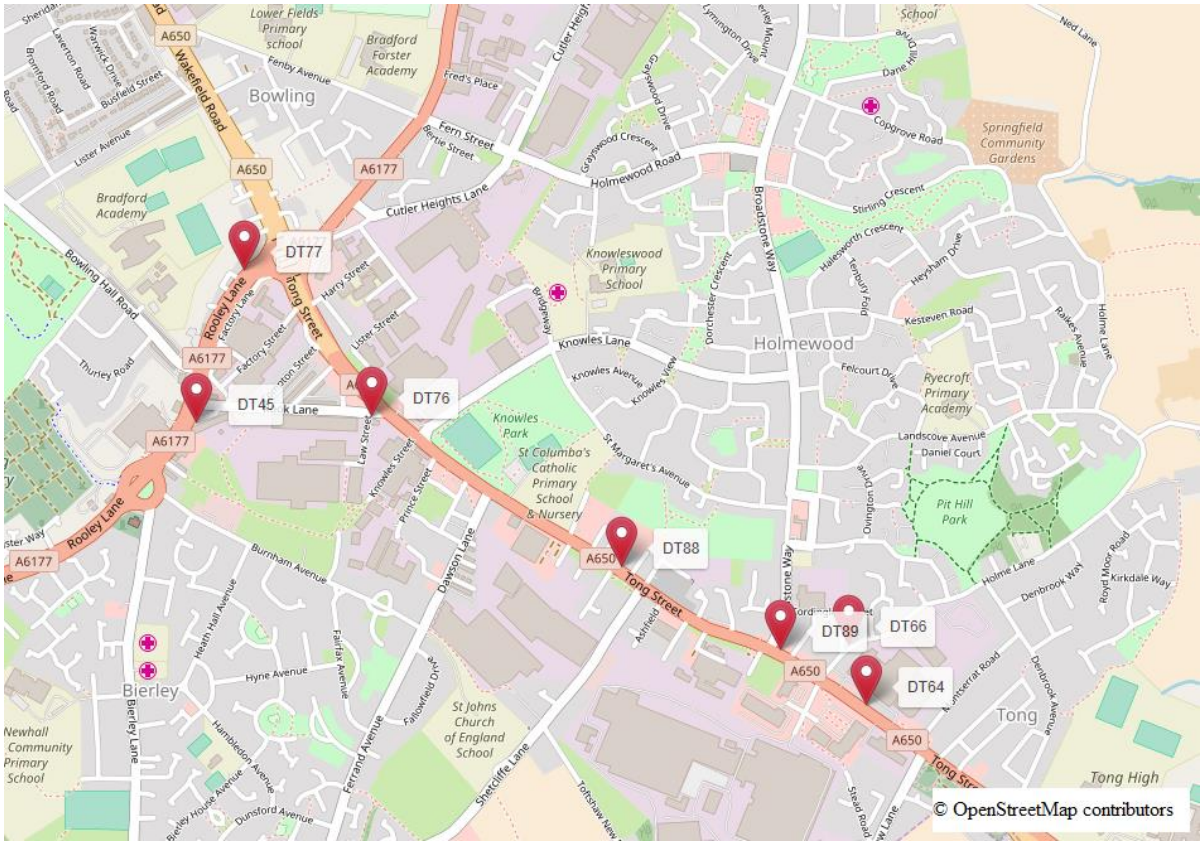


Map 6: Greengates junction diffusion tubes

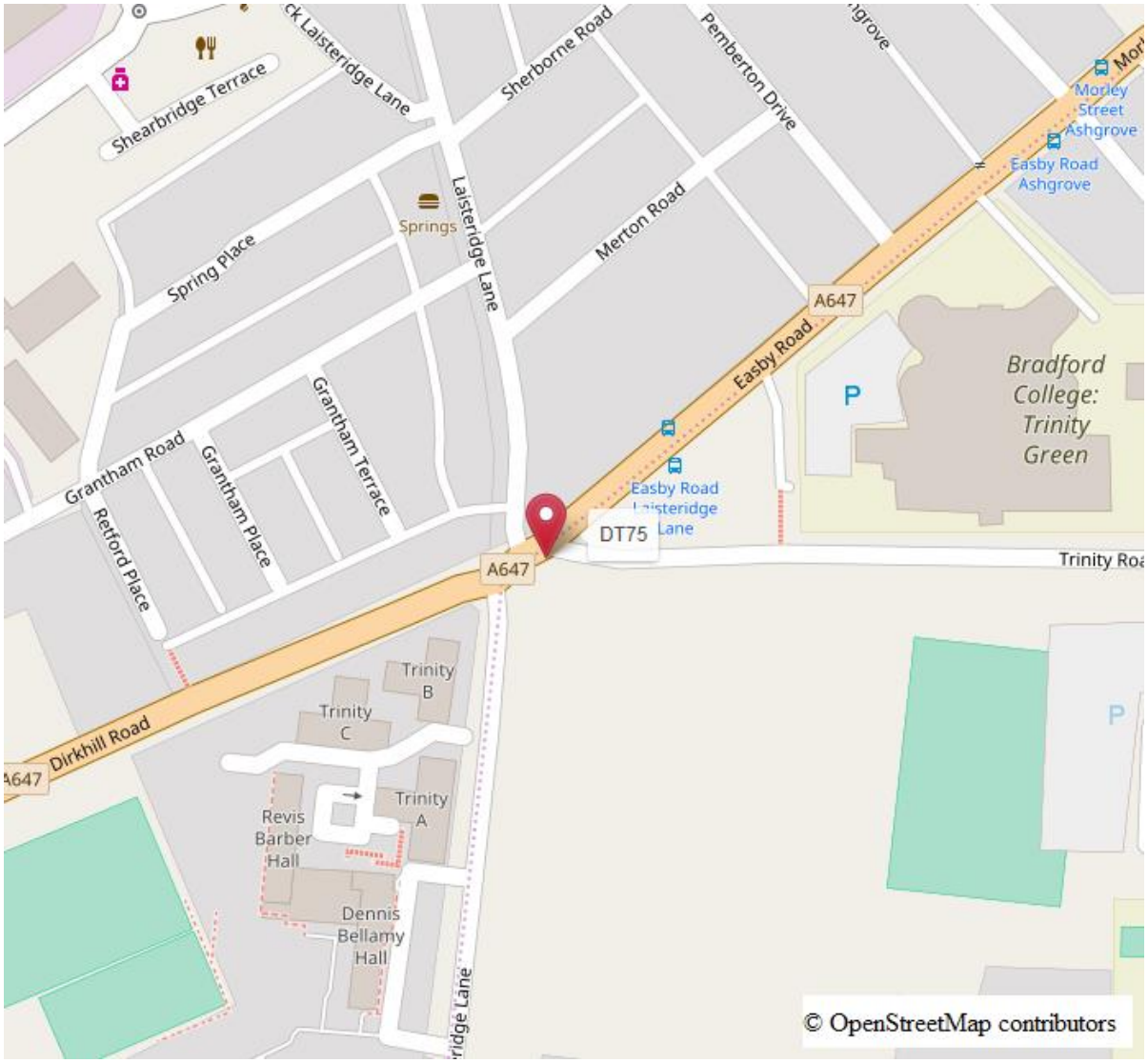


Map 7: Harrogate Road / Killinghall Road diffusion tubes

Map 8: Rooley Lane / Tong Street diffusion tubes



Map 9: Laisteridge Lane diffusion tube



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[17]	
	Concentration	Measured as
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	40 µg/m^3	Annual mean
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
	40 µg/m^3	Annual mean
Sulphur Dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean

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

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'
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	Air quality Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
EU	European Union
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide
MDC	Metropolitan District Council
EV	Electric Vehicle

References

West Yorkshire Low Emission Strategy

Bradford Low Emission Strategy