

Chapter 1: Strategic Case

Bradford Clean Air Plan



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Section 1: Foreword

1. Due to air quality forecasts for nitrogen dioxide (NO₂) levels in the district, Bradford Council has received Ministerial Direction to produce a business case for a Clean Air Plan (CAP) to achieve NO₂ compliance with legal levels in the shortest possible timeframe.
2. The Council will introduce a 'C' Classification Charging Clean Air Zone (CAZ) in January 2022, affecting non-compliant buses, coaches, taxis, HGVs and LGVs, with additional taxi and private hire measures that go beyond the national framework.
3. The CAP also seeks to improve the health and well-being of our diverse population and support our Climate Emergency Agenda.
4. The development of the CAP incorporates local data and close liaison with the Government's Joint Air Quality Unit (JAQU), including consideration of the Covid-19 pandemic.
5. This Strategic Case forms part of the Clean Air Plan Full Business Case

Section 2: Introduction

Strategic Aims

6. Bradford Council has developed a Clean Air Plan (CAP) with the critical success factor of achieving compliance with the EU Limit Value for Nitrogen Dioxide (NO₂) in the shortest possible timeframe, in line with Ministerial Direction. This is the first spending objective of the CAP.
7. The CAP demonstrates value for money to the Treasury in delivering our success factors. Additional success factors and spending objectives are:
 - to improve the health of residents of Bradford;
 - to support the Council's Climate Emergency agenda; and
 - to ensure that local businesses and disadvantaged groups are not adversely affected and are supported, where appropriate, to make the changes we need to improve local air quality for everyone.
8. Our ambitions go beyond achieving compliance with legal limits for air quality in Bradford. We recognise that continuing improvements in fine particulate levels will improve health outcomes across the district and further action will be required to achieve our ambitions of a net zero transport system by 2038.

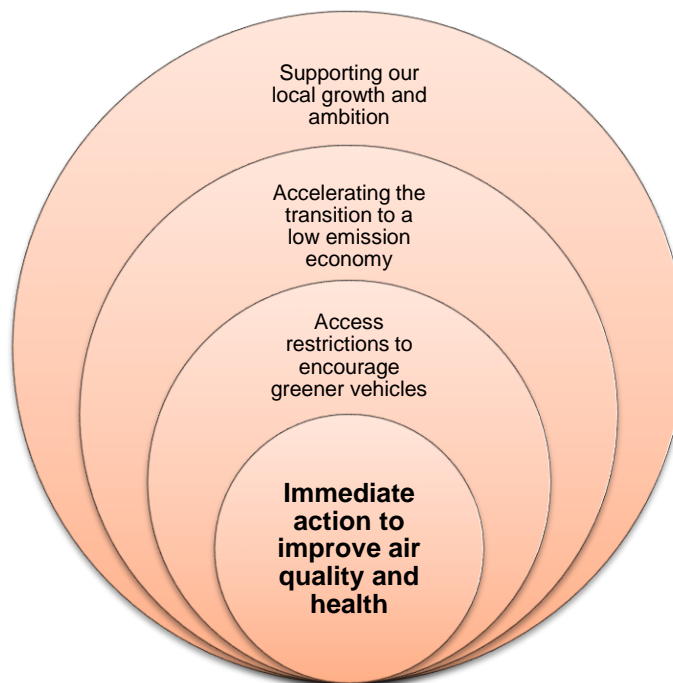


Figure 1: Core Strategic Aims of the Clean Air Plan

9. The CAP has been developed in line with the National Clean Air Zone Framework¹ and includes the following strategic aims:
- **Supporting our local growth and ambition** - The CAP is strategically aligned with our policies and strategies to fulfil our ambition of a community that has access to new fuels and technologies and modes of transport that will allow sustainable growth. The CAP includes measures that align with our strategic economic, health & well-being, procurement, land-use planning and transport & travel plans, including the Bradford & West Yorkshire Low Emission Strategies and our Transforming Cities Fund (TCF) Programme.
 - **Accelerating the transition to a low emission economy** - The CAP includes measures that allow our communities to experience low and ultra-low emission technologies while encouraging our ultra-low emission technology businesses to flourish and support our Climate Emergency agenda.
 - **Access restrictions to encourage cleaner vehicles** - We will implement a charging Clean Air Zone (CAZ) that will discourage the most polluting vehicles, including buses, coaches, taxis, heavy goods vehicles (HGV) and light goods vehicles (LGV) from entering the Bradford Clean Air Zone (CAZ), while encouraging the take up of electric vehicles, including buses, taxis and LGV.
 - **Immediate action to improve air quality and health** - CAP measures will be introduced from the beginning of 2021 and the charging CAZ will be implemented by January 2nd, 2022. A unique health impact assessment (HIA) will be carried out by Born in Bradford (BiB) and academic institutions to assess the benefits of the CAP.

National Overview

10. The UK has in place legislation passed down from the European Union to ensure that certain standards of air quality are met, by setting Limit Values on the concentrations of specific air pollutants. In common with many EU member states, the EU limit value for annual mean nitrogen dioxide (NO₂) is breached in the UK and there are on-going breaches of the NO₂ limit value in the Bradford District. The UK government is taking steps to remedy this breach in as short a time as possible with the aim of reducing the harmful impacts on public health. Within this objective, the government published a UK Air Quality Plan² and a Clean Air Zone Framework¹. The Clean Air Zone Framework provides the expected approach for local authorities when implementing and operating a Clean Air Zone (CAZ).
11. Air pollution is a national public health priority. Of all environmental factors, it has the largest impact on health in the UK attributable to over 40,000 deaths nationally and has health effects across the life course; from the underdevelopment of the unborn baby through to dementia in the later years of life. The strongest evidence of health impact is

¹ [Government's Clean Air Zone Framework \(February 2020\)](#)

² [Air Quality Plan for Nitrogen Dioxide in the UK \(2017\)](#)

worsening symptoms of respiratory diseases and cardio-vascular disease and cancer causation. Furthermore, the health impact is greatest for those at higher risk; people living in areas of highest deprivation are more likely to suffer these health problems than people living in more affluent areas. These issues are covered extensively in Section 8 – Assessment of Health Impacts of the Clean Air Plan.

National Clean Air Zone Framework

12. The Government has set out a plan for 'Improving air quality: national plans for tackling nitrogen dioxide in our towns and cities'. The plan sets out an approach for meeting these goals by implementing a programme of Clean Air Zones in line with a national Clean Air Zone Framework.
13. The plans highlight towns and cities where the Governments Pollution Climate Mapping (PCM) model predicts that the EU Limit for NO₂ (annual average) will be exceeded in 2020. The PCM model predicts that areas in the vicinity of Canal Road and parts of the Outer Ring Road will exceed the EU Limit Value beyond 2020.
14. The CAZ Framework outlines options for 'non-charging CAZ' (where vehicle emission standards are achieved through non-charging measures) and 'charging CAZ' where non-compliant vehicles will be required to pay a charge to enter the CAZ. Certain exemptions may be granted for specialist and emergency vehicles and possibly for residents affected by poor air quality and living within a CAZ.

Clean Air Zones fall into four classes shown in Table 1. The emission standards for each vehicle type to be compliant in a CAZ is shown in

15. Table 2.

Table 1: Clean Air Zone Classes

Clean Air Zone class	Vehicles included
A	Buses, coaches and taxis (including private hire)
B	Buses, coaches, taxis and heavy goods vehicles (HGVs)
C	Buses, coaches, taxis, HGVs and light goods vehicles (LGVs)
D	Buses, coaches, taxis, HGVs, LGVs and cars

Table 2: Clean Air Zone emission standards for vehicle types

Vehicle Type	Tax Classification	Compliant Emission Standard
Bus	M₃ (GVW over 5000 kg and more than 8 seats in addition to the driver)	Euro VI
Coach		
HGV	N ₂ (GVW over 3500 kg) N ₃ (GVW over 5000kg)	Euro VI
Van	N ₁ (GVW not exceeding 3500 kg))	Euro 6 (diesel) Euro 4 (petrol)
Minibus	M ₂ (GVW not exceeding 5000 kg, and more than 8 seats in addition to the driver)	Euro 6 (diesel) Euro 4 (petrol)
Cars, taxis and private hire	Passenger vehicle with up to 8 seats in addition to the driver	Euro 6 (diesel) Euro 4 (petrol)
Motorcycles and mopeds (optional)		Euro 3
<i>Ultra-low emission vehicles with significant zero emission range will never be charged for entering or moving through a Clean Air Zone</i>		

16. As a minimum any Clean Air Zone is expected to:

- be in response to a clearly defined air quality problem, seek to address and continually improve it, and ensure this is understood locally;
- have signs in place along major access routes to clearly delineate the zone;
- be identified in local strategies including (but not limited to) local land use plans and policies and local transport plans at the earliest opportunity to ensure consistency with local ambition;
- provide active support for ultra-low emission vehicle (ULEV) take up through facilitating their use;
- include a programme of awareness raising and data sharing;
- include local authorities taking a lead in terms of their own and contractor vehicle operations and procurement in line with this framework;
- ensure bus, taxi and private hire vehicle emission standards (where they do not already) are improved to meet Clean Air Zone standards using licensing, franchising or partnership approaches as appropriate; and
- support healthy, active travel.

17. Additionally, CAZ authorities are expected to be:

- working with SMEs and other businesses to help them understand their options for adapting to a Clean Air Zone, and the support available to them.

- engaging business participation in environmental sustainability and training programmes, for example to improve driver behaviour, and campaigns to raise employee awareness.
- working with local employers to increase awareness in their staff about local public transport choices and alternatives, and initiatives such as car clubs and car sharing.
- encouraging businesses to commit to use only their cleanest vehicles in a Clean Air Zone.
- encouraging businesses to commit, when buying new vehicles, to purchase those in line with or higher than Clean Air Zone standards.
- encouraging businesses to adopt approaches to operations that can support a Clean Air Zone.
- encouraging large taxi or private hire users, such as universities and hospitals, to require ultra-low emission vehicles within their contracts and promote travel planning to minimise use.
- developing delivery service plans with local businesses.

Ministerial Direction

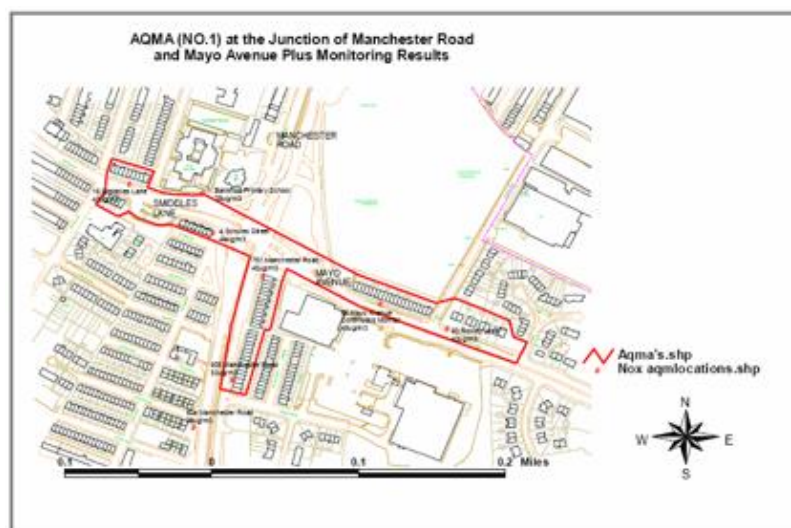
18. The Government first advised the Council for the need to tackle roadside NO₂ concentrations at the beginning of 2017, however, the Council were then informed by the Government in July 2017 that further action wouldn't be supported. Following subsequent High Court rulings, the Council received Ministerial Direction in 2018 to produce a Clean Air Plan to achieve compliance with the EU Limit Value for Nitrogen Dioxide in the shortest possible timeframe. As such, Bradford forms part of a 3rd wave of directed local authorities developing plans to improve air quality.

Section 3: Local Overview

19. Bradford is the sixth largest metropolitan district in the UK by population and is the fastest growing city outside London with a population of >530,000. The Bradford population is diverse with over 85 languages spoken. It has a multi-ethnic population with 67% identifying as White British and 20% as Pakistani in the last census³. It is a deprived city, with 40% of Bradford residents living in areas that rank in the most deprived quintile (20%) of local areas in England⁴. Bradford is also one of the youngest cities in the UK with around a quarter of the population under 16.
20. In the 2019 edition of the English Indices of Deprivation Bradford District is ranked 5th most income deprived and 6th most employment deprived local authority in England.

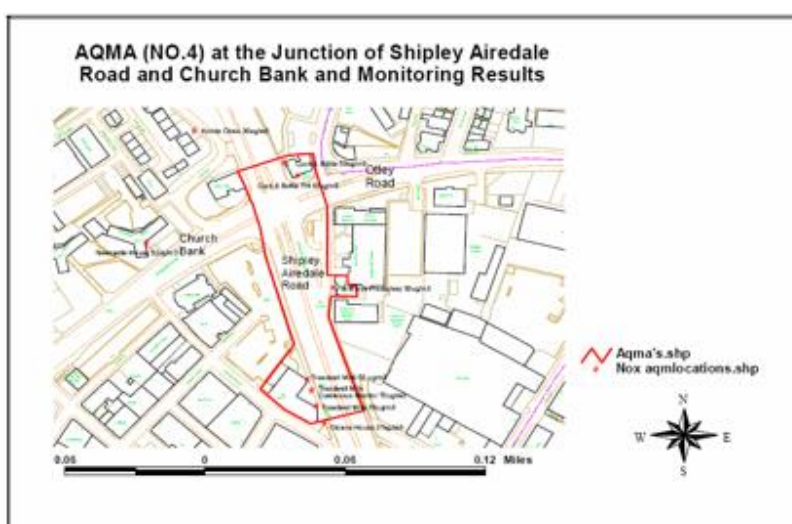
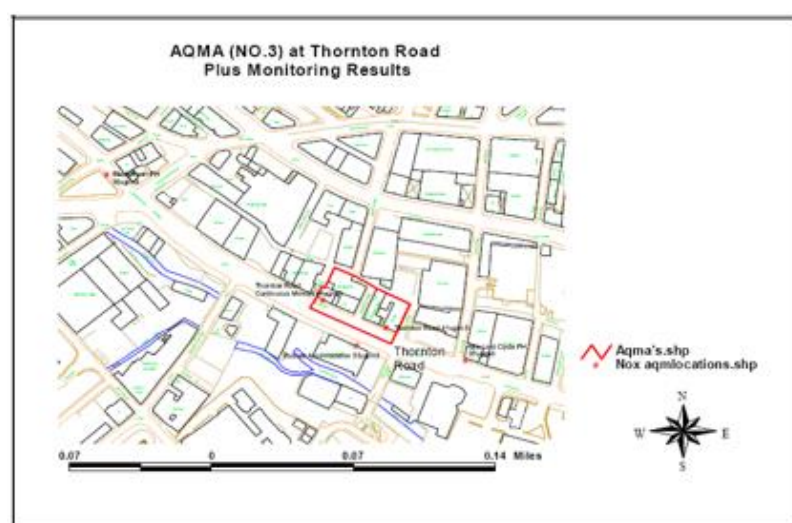
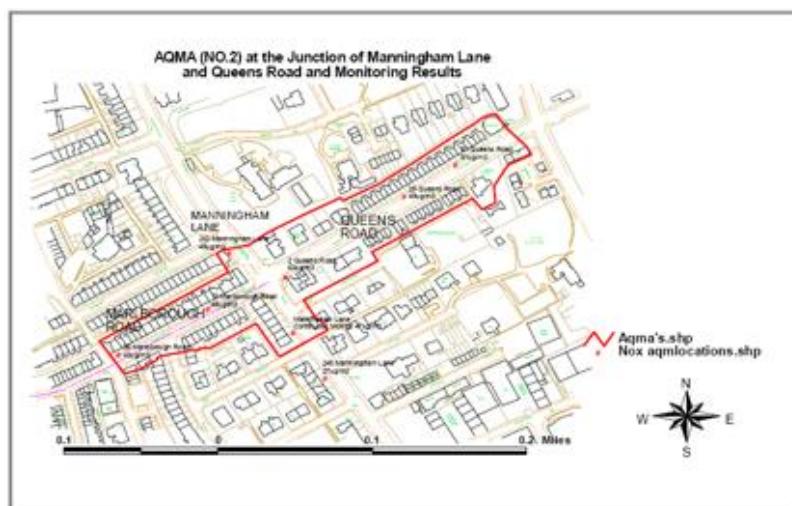
Bradford Air Quality

21. Bradford Council has designated four Air Quality Management Areas (AQMA) in the district due to elevated levels of nitrogen dioxide (NO₂ annual average) that breach the EU Limit Value. The AQMA were designated for key locations on Manchester Road/Mayo Avenue, Manningham Lane, Thornton Road and Shipley Airedale Road. The most significant cause of elevated levels in the AQMA was road transport emissions and that in 2009 it was projected that all AQMA would achieve compliance with the EU Limit Value by 2015 due to natural vehicle upgrades. However, the proliferation of diesel cars and the underestimation of their emissions has contributed significantly to the continuation of elevated levels of NO₂ in the district. The AQMA maps (including NO₂ monitoring data for 2008) are shown below:



³ [Office of National Statistics. 2011 Census. Secondary 2011 Census 2011](#)

⁴ [Ministry of Housing CALG. English Indices of Deprivation 2015 - LSOA Level. Secondary English Indices of Deprivation 2015 - LSOA Level 2015.](#)



Bradford Health

22. Fingertips data indicate that in 2017 in Bradford 4.3% of mortality is attributed to particulate pollution (this is equivalent to over 200 deaths every year). Bradford also has high levels of

underlying ill health which make us more vulnerable to the effects of air pollution, e.g. higher than average mortality from cardiovascular disease under 75 years (102.2 per 100,000), low birth weight babies (3.6%)⁵. Bradford also has markedly higher than average prevalence of respiratory disease;

Table 3: Under 75 Mortality Rate from all respiratory disease

Year	Bradford		Y&H	England
	Number	Rate per 100,000	Rate per 100,000	Rate per 100,000
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
2015-17	612	53.9	39.7	34.3
2016-17	591	50.7	41.2	34.7

23. The rate of admissions for asthma in Bradford is also particularly high compared with England. Similarly, the rate of COPD admissions is far higher than the national average of 2 at 2.6 per 1,000. These figures give an indication of the scale of the 'at-risk' population that have potential to be more adversely affected by poor air quality, and conversely indicates a higher number of people who would be positively affected by improved air quality than the general UK population.

Table 4: Emergency hospital admissions for asthma in 0-19 year-olds

Year	Bradford		Y&H	England
	Number	Rate per 1,000	Rate per 1,000	Rate per 1,000
2012-13	324	2.2	2.1	2.2
2013-14	313	2.2	2.0	2.0
2014-15	420	2.9	2.1	2.2
2015-16	356	2.4	1.7	2.0
2016-17	397	2.7	1.8	2.0
2017-18	385	2.6	1.7	1.9
2018-19	415	2.8	1.6	1.8

⁵ [Public Health England. Local Authority Health Profiles, Secondary Local Authority Health Profiles 2019](#)

24. 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) who are particularly sensitive to the effects of poor air quality. They may experience life-long impacts resulting from pollutant exposure in their early years.

Born in Bradford (BiB)

25. In Bradford there is greater understanding of the impact of air quality on the health of the population because we have Born in Bradford (BiB). BiB is a longitudinal birth cohort study following the lives of 13,500 children and their families who were born in the city between 2007-2011 (www.borninbradford.nhs.uk). Its aim is to explore what keeps some families healthy and why others fall ill. BiB has been at the forefront of international cutting edge research exploring the impacts of air quality on health outcomes such as ESCAPE (2008-2012: European Study of Cohorts for Air Pollution Effects⁶) and HELIX (2013-2017: Human Early Life Exposome⁷).



26. The Council are partners to many of the projects and provide some of the data and expertise required for the research.
27. Key air quality research findings from BiB;
- Pooling data from over 74,000 mothers across 14 European cohorts including BiB research has demonstrated that a 10ug/m³ increase in NO₂ is associated with a 9% increase in the odds of low birthweight while a 5ug/m³ increase in PM_{2.5} is associated with an 18% increase in odds of low birth weight⁸.
 - Bradford has high levels of childhood asthma; 22% of children have a recorded wheezing disorder⁹. Researchers have estimated that 38% of all annual childhood asthma cases may be due to negative health effects of nitrogen oxide or nitrogen dioxide.

⁶ Eeftens M, Beelen R, de Hoogh K, et al. Development of Land Use Regression models for PM(2.5), PM(2.5) absorbance, PM(10) and PM(coarse) in 20 European study areas; results of the ESCAPE project. *Environmental science & technology* 2012;**46**(20):11195-205 doi: 10.1021/es301948k[published Online First: Epub Date].

⁷ Vrijheid M, Slama R, Robinson O, et al. The Human Early-Life Exposome (HELIX): Project Rationale and Design. *Environmental Health Perspectives* 2014;**122**(6):535-44 doi: 10.1289/ehp.1307204[published Online First: Epub Date].

⁸ Pedersen M, Giorgis-Allemand L, Bernard C, et al. Ambient air pollution and low birthweight: a European cohort study (ESCAPE). *The Lancet Respiratory Medicine* 2013;**1**(9):695-704 doi: 10.1016/S2213-2600(13)70192-9[published Online First: Epub Date]

⁹ Mebrahtu TF, Feltbower RG, Parslow RC. Incidence and Burden of Wheezing Disorders, Eczema, and Rhinitis in Children: findings from the Born in Bradford Cohort. *Paediatric and perinatal epidemiology* 2016;**30**(6):594-602 doi: 10.1111/ppe.12310[published Online First: Epub Date]

- A recent study found that 55% of the population in Bradford are exposed to levels of particulate matter greater than 10ug/m3 per year (greater than World Health Organisation Guidelines) and that this accounted for 17 deaths each year in the district. Lower social economic status groups and ethnically diverse populations were found to incur a greater burden of deaths than those who are more affluent and less ethnically diverse¹⁰.
- More recently the impact of air pollution on our DNA has been explored. Telomeres are 'buffers' at each end of our chromosomes; a shorter telomere length is associated with greater biological aging. Using data from Born in Bradford and 6 other birth cohorts across Europe, researchers found that greater exposure to air pollution during pregnancy was associated with shorter telomere length in children aged 8 years¹¹.

Bradford Climate Emergency

Becoming a Zero-Carbon City

28. Clean Air Zones improve the urban environment to support public health and the local economy, making cities more attractive places to live, work, do business and spend leisure time. They support cities to grow and transition to a low emission economy thus ensuring these benefits are sustainable for the long term.
29. Implementing a Clean Air Plan (CAP) in Bradford will accelerate the transition to a low emission economy by supporting the Council's ambitions to become a zero-carbon city by 2038 via the targeting of transport emissions. Significant progress is to be reported by 2030. It is well established that the climate breakdown is a significant problem for the world. In January 2019 Bradford Council acknowledged the need its play our part in tackling the climate agenda and declared a climate emergency¹². This was followed by West Yorkshire Combined Authority also prioritising this for the region and also declaring a climate emergency in June 2019.
30. Transport is the largest sector for UK greenhouse gas emissions (27%), of which road transport accounts for over 90%¹³.
31. The Council has produced its Climate Action Plan (2020/21) with a key aim to improve air quality and health and well-being of the district with the actions of the Climate Action Plan to align with the Clean Air Plan and CAZ development and introduction.

¹⁰ Mueller N, Rojas-Rueda D, Khreis H, et al. Socioeconomic inequalities in urban and transport planning related exposures and mortality: A health impact assessment study for Bradford, UK. *Environment international* 2018; **121**(Pt 1):931-41 doi: 10.1016/j.envint.2018.10.017[published Online First: Epub Date]

¹¹ Clemente DBP, Vrijheid M, Martens DS, et al. Prenatal and Childhood Traffic-Related Air Pollution Exposure and Telomere Length in European Children: The HELIX Project. *Environmental Health Perspectives* 2019; **127**(8):087001 doi: doi:10.1289/EHP4148[published Online First: Epub Date]

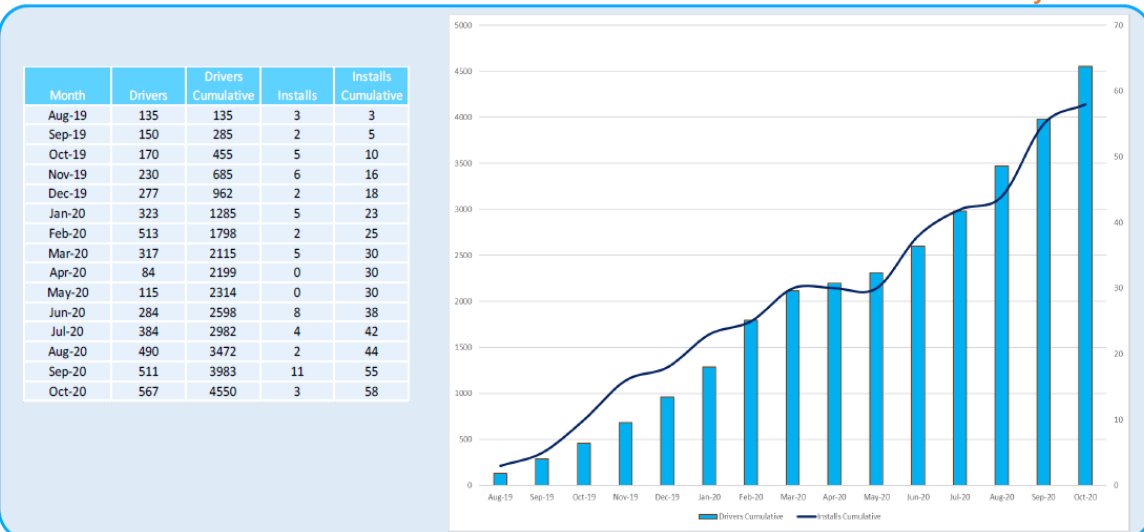
¹² [Bradford Council's Climate Emergency & Green Economy Response](#)

¹³ [BEIS \(2018\) Final UK Greenhouse Gas Emissions National Statistics 1990-2016](#)

32. As part of this joint activity the Council is developing an Advanced Fuel Centre (AFC) in partnership with Northern Gas Networks to supply compressed biomethane for heavy duty vehicle operators, including the Council, allowing cost-effective solutions for hauliers and bus operators to achieve CAZ standard compliance and an 85% reduction in greenhouse gas (GHG) emissions. Up to 20% hydrogen will be integrated into the fuel supply from 2028, reducing the GHG footprint even further. The AFC will also provide the opportunity to provide dedicated hydrogen fuelling facilities going forward as the AFC is expanded. The Council has also committed to replace all 222 light commercial fleet vehicles with electric vehicles by 2023/24, with transition starting in 2021.
33. The Council has introduced 20 rapid charging points across the District as part of the West Yorkshire Ultra-Low Emission Taxi Scheme Network. This scheme will see 88 rapid charging points installed across West Yorkshire. Charging is free at these points until October 2021 for both taxi drivers and the public with greatest use across West Yorkshire seen in Bradford¹⁴. Table 5 shows the number of charging units installed by October 2020, with the cumulative numbers of drivers accessing these points. The most popular site in West Yorkshire is Vicar Lane, Bradford.
34. There are an additional 13 rapid chargers in the District, operated commercially, plus 10 fast chargers installed in Council owned car parks.
35. The Council is also transitioning around 20,000 streetlights to LED and as part of this scheme, light posts will be brought to the front of pavements and charging points installed. This will widen the appeal of electric vehicles to residents of the District who live in terraces without dedicated parking.

¹⁴ [Electrical Vehicle Charging Points in Bradford](#)

Table 5: West Yorkshire Ultra-Low Emission Taxi Scheme Network Installations and use by all drivers



Bradford Transport System

36. There are over 1,900km of roads in Bradford District and the highway network in the major urban settlement of Bradford City is characterised by a radial pattern of routes leading to the city centre, with an outer ring road (A6177) and a ‘quasi inner ring road’ comprising mainly the A650. The main routes to the north of the district provide connections to Airedale and Wharfedale, and there is also an important network of routes serving Keighley and smaller settlements to the west of the district.

Bradford is connected to the national motorway network via the M606 motorway (‘Bradford Spur motorway’), which links to the M1 motorway via Junction 26 of the M62 motorway. The Leeds-Bradford Airport (LBA) is located in Yeadon, less than 10 miles from Bradford City, and can be accessed via the A658. LBA serves the metropolitan



areas of Leeds and Bradford as well as the wider Yorkshire region, and operates daily flights to several domestic and European destinations.

37. Bradford is served by an extensive public transport network comprising a bus network with several interconnected bus routes and a rail network incorporating the Airedale Line and Calderdale Line. The bus network includes two bus interchanges in Bradford City Centre and Shipley as well as a bus station in Keighley. The bus network provides connections within and between settlements across the district as well as direct links to Leeds, Halifax, Wakefield and other adjoining towns. The rail network has two terminus stations; Bradford Forster Square and Bradford Interchange. The rail network provides connections to several settlements across the district as well as major cities and towns in the North of England, including Leeds, Manchester, Halifax and Huddersfield.
38. Most local buses are run on a commercial basis with some running on tender from Metro (West Yorkshire Combined Authority). Rail services are at present provided by Northern and LNER, both under Government control delegated to the DfT Operator of Last Resort. Grand Central also run rail services to London on a commercial, open access basis. Metro also supports other organisations to promote cycling, car clubs, car share schemes, walking, and other initiatives aimed at encouraging sustainable travel choices and modal shift (travel planning). A number of private operators, including National Express and StageCoach (Megabus), provide long distance intercity coach services between Bradford and major urban areas in the UK and Europe. Bradford is also served by private car hires, licensed taxis and ride share companies such as Uber.
39. Bradford Council is currently developing a district-wide transport strategy that will set out its vision, objectives and high-level plan of action to deliver an enabling and resilient transportation system to support its goal of an inclusive and economically prosperous place where people want to live, work, study, visit and invest. The strategy will focus on addressing current challenges, but also take into account emerging realities and opportunities that will be created by socio-political changes and technological innovations which continue to shape how people live, communicate, work, study and socialise.
40. The vision and strategic priorities in the emerging strategy will align with wider socio-economic aspirations of its stakeholders and communities, as set out in the *Local Plan for the Bradford District (Adopted Core Strategy 2017)*¹⁵, *An Economic Strategy for Bradford District 2018-2030*¹⁶, *Bradford Low Emission Strategy*¹⁷ and *Bradford District Cycle Strategy 2016-2026*¹⁸. The transport strategy will complement the visions and aspirations of strategic partners, including the Bradford Economic Partnership, West Yorkshire

¹⁵ [Local Plan for the Bradford District \(Adopted Core Strategy 2017\)](#)

¹⁶ [An Economic Strategy for Bradford District 2018-2030](#)

¹⁷ [Bradford Low Emission Strategy](#)

¹⁸ [Bradford District Cycle Strategy 2016-2026](#)

Combined Authority, Leeds City Region Enterprise Partnership, The Northern Powerhouse, Transport for the North and Department for Transport.

Section 4: Action for Change

Introduction

41. This section outlines the local, regional and national plans and strategies and evidence base that are the current drivers to improve air quality in Bradford. The relationships between the respective policies detailed in this section is illustrated in Figure 2.

Figure 2: Policy relationship hierarchy



Bradford Low Emission Strategies

42. As part of our plans to improve air quality we produced a Low Emission Strategy (LES) in 2013 which provided an innovative approach to reducing vehicle emissions. The LES 2013 included a programme of policy development, involving many Council Departments, leading to a series of measures that would help drive a reduction in vehicle emissions. This included:
- A low emission zone feasibility study in partnership with Leeds City Council, Bradford NHS and Public Health England (PHE)
 - An innovative health impact assessment (HIA) in partnership with Bradford Health Improvement Academy, Public Health England (PHE) and Leeds and York Universities, leading to the development of a national, free-to-use HIA toolkit. Outputs from the HIA showed significant health benefits from upgrading buses, reducing diesel car use and increasing ZEV / reducing car journeys – see Table 6.
 - Innovative planning and development control guidance, including the consideration of air quality mitigation at the design stage and off-set mitigation to support the implementation of the LES.
 - Requirements for electric vehicle charging on new development schemes, resulting in the provision of over 5,000 charging points to date.
 - Inclusion of vehicle emission considerations through Social Value procurement practices. Improvements in the emissions of the Bradford Council Fleet, including a Vehicle Advisory Group.
 - The Council Fleet were recognized by winning the Energy Savings Trust (EST) Air Quality Fleet Heroes Award 2016 and also given a 4 Star award through the West Yorkshire Eco-Stars Fleet Recognition Scheme.

- Feasibility study and plan for the migration of heavy-duty Council vehicles to run on natural gas and biomethane.
- Introduction of the Bradford Car Club with Enterprise, including electric cars.
- Installation of public electric charge points in the District.
- Reduction in the emissions of buses – working with First and Transdev to secure £400,000 of Government funding to upgrade 25 Euro III buses to a Euro VI Standard meaning all bus services operating in the Manningham AQMA are of the latest standard.
- West Yorkshire Low Emission Strategy (WYLES 2016-21)¹⁹

Table 6: Bradford/Leeds Low Emission Zone Feasibility Study: HIA (Bradford NHS/PHE 2015)

Cost per condition in (£) (in NHS cost and quality adjusted life years)	Bradford LEZ Modelled Scenario			
	All pre-euro 4 HGVs and buses upgraded to euro6 by 2016	All pre-euro 5 buses upgraded to euro 6 by 2021	Reduction in number of diesel cars from 50% to 20% (as in the year 2000)	10% reduction in number of car journeys by 2021
Health benefit across the Bradford population				
Deaths (PM_{2.5}) (£168,000)	2 (0-2.3)	3 (0.3-5)	3 (0.3-5)	3 (0.3-5)
Cardiopulmonary deaths (PM_{2.5}) (£168,000)	1 (0-2)	2 (1-3)	2 (1-3)	2 (1-3)
Coronary events (PM_{2.5}) (Bradford only) (£50,160)	24 (0-53)	45 (0-99)	45 (0-100)	45 (0-99)
Low birth weight babies <2500g (PM_{2.5}) (£2,325)	2 (1-4)	3 (1-6)	3 (1-6)	4 (1-7)
Pre-term births (PM_{2.5}) (£28,109)	0.4 (0.4-0.4)	0.7 (0.6-0.7)	0.7 (0.6-0.7)	0.7 (0.6-0.7)
Low birth weight babies <2500g (NO₂) (£2,325)	8 (0-17)	18 (0-38)	21 (0-45)	17 (0-36)
Childhood asthma development <18yrs (NO₂) (£17,016)*	82 (18-152)	181 (40-335)	212 (47-393)	173 (38-320)
Annual years of life gained for new-borns (all births combined)	42	64	6	76

¹⁹ [West Yorkshire Low Emission Strategy](#)

Cost per condition in (£) (in NHS cost and quality adjusted life years)	Bradford LEZ Modelled Scenario			
	All pre-euro 4 HGVs and buses upgraded to euro6 by 2016	All pre-euro 5 buses upgraded to euro 6 by 2021	Reduction in number of diesel cars from 50% to 20% (as in the year 2000)	10% reduction in number of car journeys by 2021
Health benefit across the Bradford population				
Annual Health Cost Saving	£1,574,334	£2,829,701	£2,836,676	£2,943,768
One-off Health Cost Saving –cases of childhood asthma*	£1,395,312	£3,079,896	£3,607,392	£2,943,768

- 43. The LES 2013 recognized the importance of working with all West Yorkshire Councils in a co-ordinated drive to improve road transport vehicle emissions across the region and included a commitment to lead the development of a West Yorkshire Low Emission Strategy (WYLES). The WYLES was produced in partnership with Leeds, Calderdale, Kirklees and Wakefield Councils, West Yorkshire Combined Authority (WYCA) and Public Health England (PHE) and was adopted by all West Yorkshire Councils in December 2016.
- 44. A key aspect of all our low emission strategy work has involved public health considerations, including the development of the Bradford Clean Air Plan. As part of the Clean Air Plan, Born in Bradford (BiB) will undertake a health impact assessment (HIA) with regional academic institutions to evaluate the benefits of our plan (see Section 7).

WYLES Objectives

- 45. The West Yorkshire local authorities (WYLA) and West Yorkshire Combined Authority (WYCA) have committed to work together to achieve the WYLES Objectives shown in Table 7.

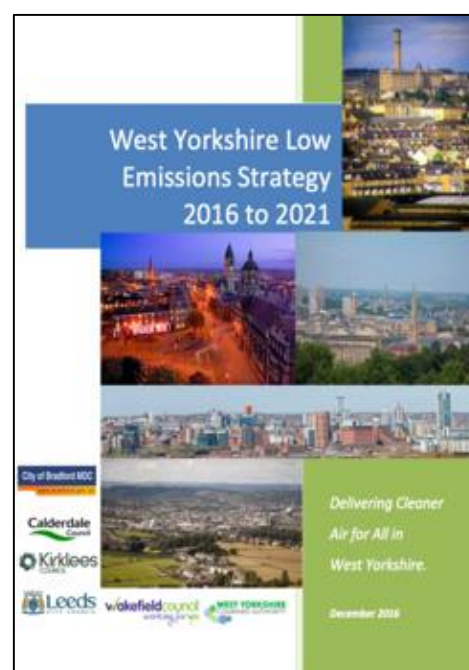


Table 7: Objectives of the West Yorkshire Low Emission Strategy 2016 to 2021

REF	OBJECTIVE
001	A Clean Air Zone will be introduced within the Leeds district, and elsewhere where necessary, to control emissions from the most polluting vehicles.
002	We will work with West Yorkshire bus operators to accelerate investment in newer buses, emission abatement technology and alternative fuels and technologies to reduce emissions through the implementation of the West Yorkshire Bus Strategy and Bus 18 Project.
003	We will accelerate the uptake of plug-in electric cars and vans through improved electric vehicle charging infrastructure and the implementation of an Electric Vehicle Strategy.
004	We will introduce the Eco Stars fleet recognition scheme to support businesses, bus operators and public sector fleet managers to reduce emissions from their fleet operations.
005	We will work with our partners to assess to develop infrastructure to support alternative fuels and technology for transport including, natural gas, bio-methane, LNG and hydrogen.
006	We will support the taxi industry to help the transition to low emission vehicles including demonstrating economic benefits; supporting funding bids and considering policy incentives to promote the uptake of ultra-low emission taxis.
007	We will use the West Yorkshire Transport Strategy and Leeds City Region Strategic Economic Plan to help deliver the WYLES objectives, including improved cycling and walking provision; better public transport; low emission energy production and use, and sustainable infrastructure to deliver “Good Growth”.
008	We will use the <i>West Yorkshire Air Quality and Planning Technical Guide</i> to deliver sustainable developments and deliver air quality improvements.
009	We will use our influence to promote low emission transport through the use of the <i>West Yorkshire Low Emission Procurement Guide</i> in the procurement of vehicles, goods and services and lead by example to reduce emissions from our own fleet operations.
010	We will continue to raise awareness of the impact of poor air quality with the public, policy makers and partners to improve air quality through changing behaviour, influencing policy, access funding and working together to deliver the objectives of this low emissions strategy.

WYLES Measures

46. The WYLES has resulted in the following policies, measures and achievements:

- Development of West Yorkshire Air Quality and Planning: Technical Planning Guidance²⁰
- Sets EV charging specification for new developments
- Public sector vehicle procurement guidance
- Forms part of the West Yorkshire Transport Strategy
- Introduction of a West Yorkshire Bus Emission Strategy
- Introduction of a West Yorkshire Electric Vehicle Strategy
- Commitment to upgrade the emissions of older buses as part of the Bus 18 Programme
- Successful in securing over a £1m in Government funding to upgrade the emissions of 165 school buses (MyBus)
- Successful in securing £422,000 in Government funding as part of a £895,000 programme to upgrade the emissions of 26 Access Buses
- Secured £1.9m in Government funding to install an extensive network of fast and rapid electric vehicle charging points to support the take up of ultra-low emission taxis across West Yorkshire
- Development of emission standards for taxis in West Yorkshire
- Successful in securing £4.1m in 2018 to retrofit 231 West Yorkshire buses, 62 in Bradford, to meet Euro VI emission standards – this work is currently ongoing and is forecast to remove 52 tonnes of nitrogen dioxide from the WY bus fleet, delivering £23.9m in health cost savings.



47. There has been considerable progress in targeting vehicle emission reductions since the launch of the LES 2013. It can also be seen that it has helped provide a platform for inward investment and funding opportunities to help secure continuing emission improvements.

Transforming Cities Fund

48. The Transforming Cities Fund (TCF) was announced in the Budget of November 2017 to “support intra-city transport, target projects to drive productivity by improving connectivity, reduce congestion and utilise new mobility services and technology”. Through TCF, the

²⁰ <https://www.bradford.gov.uk/media/3591/air-quality-and-emissions-planning-guide.pdf>

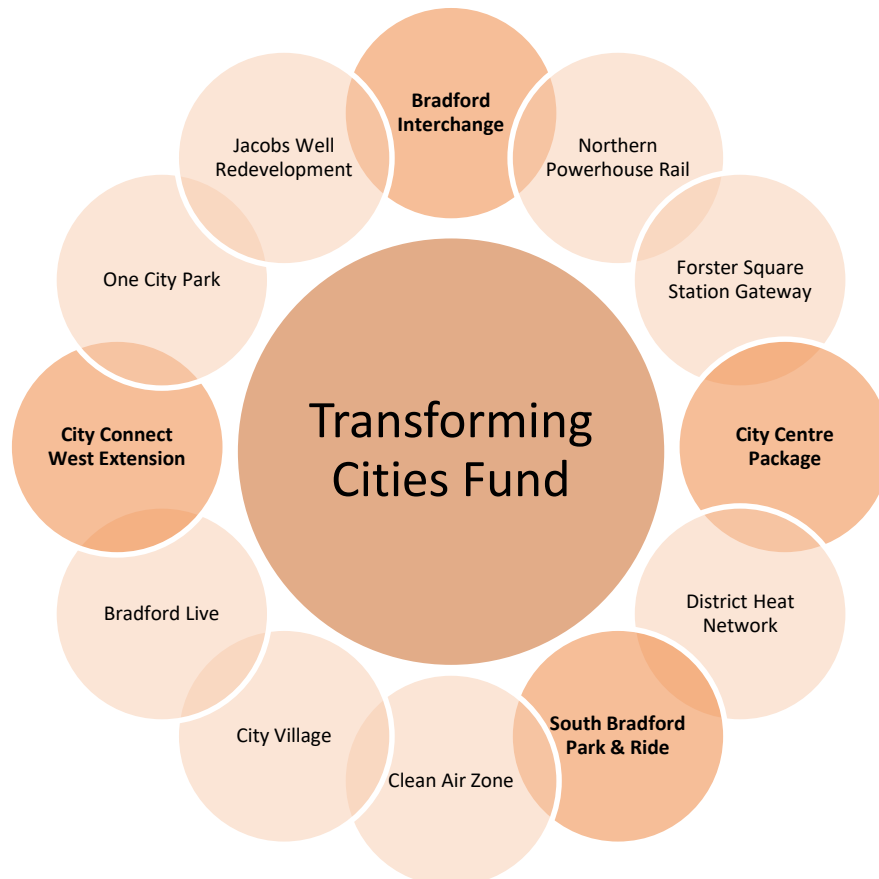
Department for Transport has made £1.28 billion of capital funding available for competitive bidding by non-mayoral combined authorities up to 2022-23. The Leeds City Region is one of the 12 non-mayoral areas to be successful in applying for TCF.

49. The Department for Transport is currently reviewing the ‘small bids’ and is anticipated to reach a decision over the next month. Development work on the remaining bids is now underway. Further details on TCF can be found on the following link - <https://westyorks-ca.gov.uk/transport/transforming-cities-fund/>
50. TCF bids that are relevant to Bradford include:
 - Redevelopment of the Bradford Interchange
 - Bus improvement corridors
 - Pedestrianisation of Bradford City Centre
 - Measures to support park and ride facilities
51. The CAP has taken into consideration the TCF bids and includes measures that can complement successful funding awards.

Transforming Cities Fund Inter-dependencies

52. Figure 3 below illustrates the inter-relationship between the Clean Air Plan objectives and the Council’s wider aspirations.

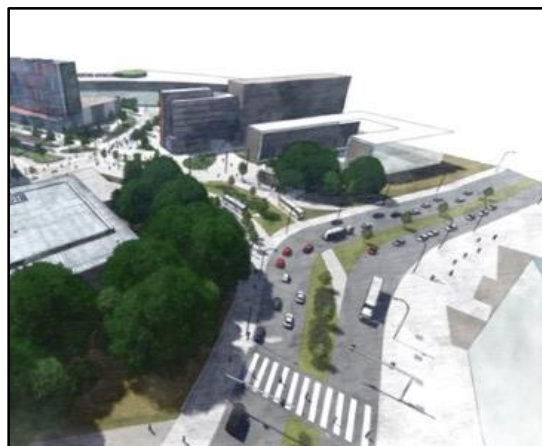
Figure 3: Transforming Cities Fund Inter-dependencies



Sustainable and Active Travel Measures in Bradford City Centre

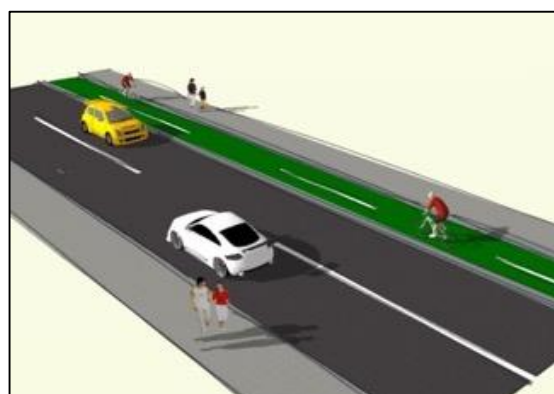
53. The City Centre package includes a range of intervention all designed to make the city centre environment of Bradford more appealing to pedestrians, including:

- Removal of Jacobs Well roundabout
- Pedestrianisation of Hall Ings, Bridge Street, Market Street and
- Realigning Princes Way and Manchester Road.
- Dedicated bus access from Nelson Street onto Princes Way.
- Reconfiguring bus stops in city centre core.
- Creating public transport corridor along Well Street and Vicar Lane



City Connect West Extension

- Extension of segregated City Connect route to the west of the city centre along Thornton Road.
- Connects to existing City Connect 1 (Bradford – Leeds) and City Connect 2 (Canal Road Corridor) and National Cycle Route 66.



Manchester Road Bus Expressway to South Bradford Park & Ride

- Complements the provision of a P&R facility (up to 1,000 car capacity) in South Bradford adjacent to Junction 2, M606.
- Supports 10-minute journey times from P&R to city centre
- Replaces the guided bus way on Manchester Road with 2-way bus expressway
- The ambition will be to provide an electric bus service



Advanced Fuel Centre

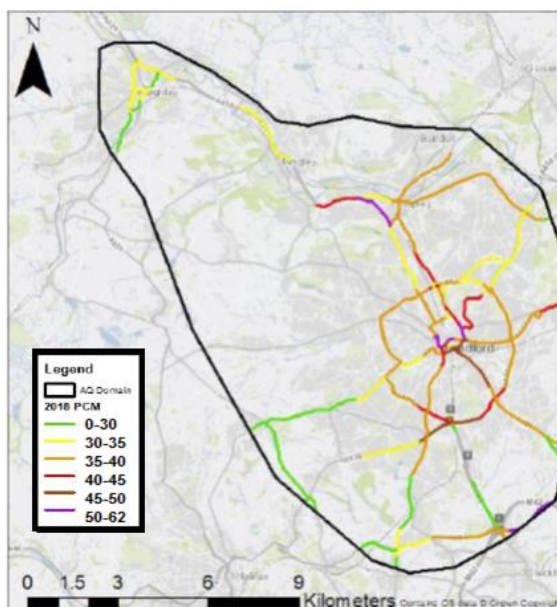
54. Bradford Council Executive approved the development of an Advanced Fuel Centre (AFC) for Bradford on the 7th July 2020. The AFC is a £6m project in partnership with Northern Gas Networks which includes £770,000 OfGem National Innovation Competition funding to access the high-pressure Local Transmission System (LTS) and provide compressed biomethane refuelling facilities for heavy duty vehicles at the Waste Recycling Facility on Bowling Back Lane.
55. The AFC will be operational in late 2021, allowing Council vehicles and 3rd party vehicles to access clean, low-cost fuels and achieve up to 84% greenhouse gas reductions. Up to 20% hydrogen will be integrated into the fuel from 2028 onwards. It is estimated that the Council Fleet will reduce CO₂e emissions by 12,000 tonnes over the first 7 years of operation. Heavy duty vehicle operators, including HGV and buses will be given access to the AFC.
56. The Council will consider the potential of using local organic waste to produce sustainable, vehicle grade biomethane for use at the AFC going forward.

Section 5: Clean Air Plan Assessments

57. Bradford Council submits an Air Quality Annual Status Report to Government each year. The Council currently undertakes an extensive programme of air quality monitoring, assessing levels of nitrogen dioxide (NO₂) and particulate matter (PM₁₀ & PM_{2.5}). NO₂ is measured by continuous, automatic analysers at seven strategic locations in the district and at many more sites using diffusion tubes. Our latest monitoring data can be found in the 2019 Annual Status Report²¹.
58. Our monitoring data confirms that there continues to be breaches of the EU Limit Value for NO₂ (annual average) at key locations in the district. The Government’s Air Quality Plan for nitrogen dioxide (NO₂) in the UK (2017)²² includes pollution climate mapping (PCM) modelling that confirmed that the following locations were at risk of exceedance in future years:
- Shipley Airedale Road
 - City Centre - Hall Ings
 - Outer Ring Road – Tong Street
 - Bingley Road, Saltaire
 - Saltaire Road, Shipley

The predicted baseline levels of NO₂ in the District in 2018, predicted by the PCM model are shown in Figure 4.

Figure 4: NO₂ levels in the District predicted for 2018 by the Government PCM Model

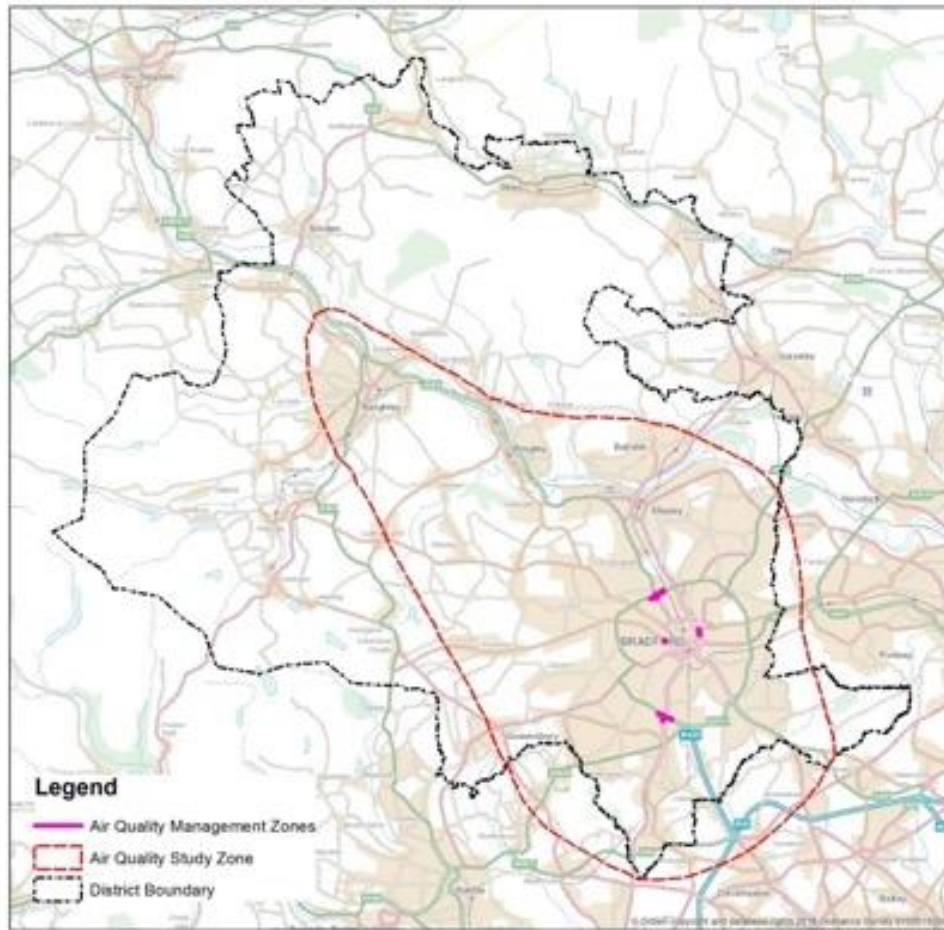


²¹ [2019 Air Quality Annual Status Report \(ASR\)](#)

²² [Air Quality Plan for Nitrogen Dioxide in the UK, 2017](#)

59. Further modelling has been carried out as part of the CAP assessment across a wide study area – see Figure 5.

Figure 5: Study Area for the development of the Bradford Clean Air Plan



60. Assessments have looked at baseline line concentrations in 2018 and in 2022 which is the year that the Government has required for compliance across the district. Figure 6 shows some of our baseline modelling for the City Centre in 2018 (with areas shown in red exceeding the Limit Value)
61. Table 8 also shows the predicted baseline levels at our key locations in 2022. This data confirmed that a Clean Air Zone (CAZ) or measures that are equally effective will be required to achieve compliance in 2022.

Table 8: Modelled outputs for 2018/22 baseline at key locations (NO₂ µg/m³)

	Saltaire	ShIPLEY Airedale Road	Godwin Street
2018	60	51	48
2022	46	48	37

Figure 6: Baseline concentrations of NO₂ in the City Centre (2018)



62. Our modelling shows that transport emissions are responsible for ~80% of the total nitrogen dioxides at roadside sites in Bradford where exceedances of the Limit Value are occurring, of which over 30% is attributable to diesel cars. Bus contributions vary widely (0-40%) depending on routes. Heavy goods vehicles are responsible for a further ~8% with the remainder being attributed to light goods vehicles, petrol cars, buses, and background traffic. The urban background from non-traffic sources is attributed to domestic and commercial heating, industry and other long-range sources such as power stations. The source apportionment varies from link to link depending on frequency of different vehicle types.
63. Figures 7-10 show the source apportionment projections for Shipley Airedale Road and Bingley Road, Saltaire in 2022, with and without the proposed CAZ scheme. It can be clearly seen that even with the CAZ scheme diesel cars remain the most significant contribution to NO₂ level from road transport.

Figure 7: Baseline source apportionment at Shipley Airedale Road in 2022

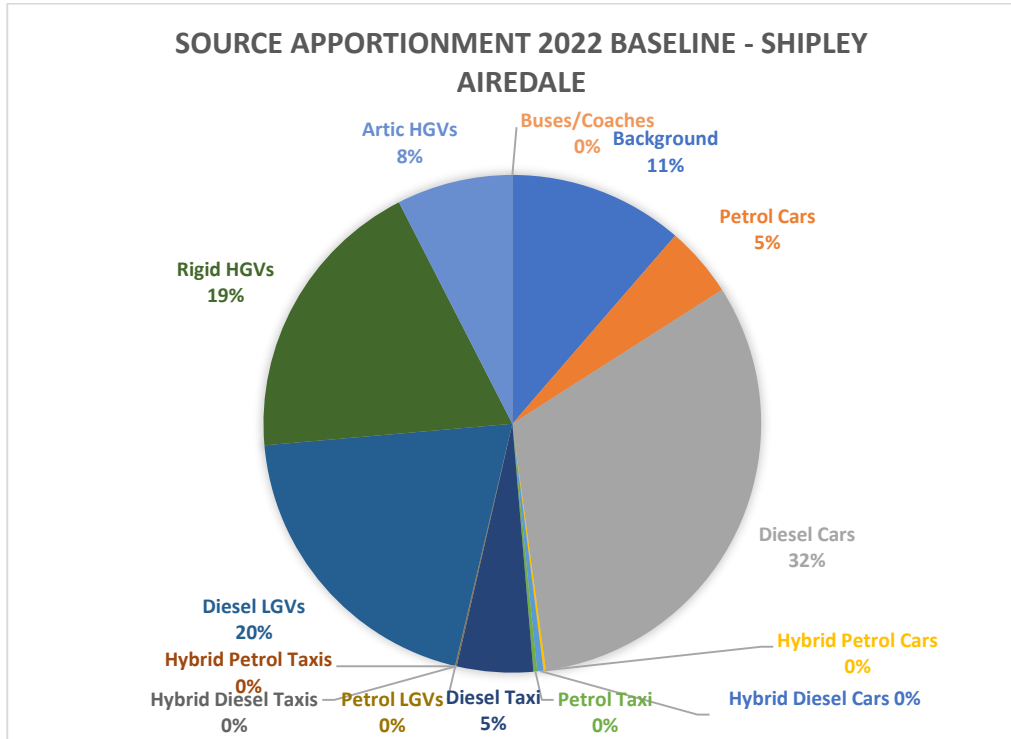


Figure 8: Source apportionment at Shipley Airedale Road in 2022 with CAZ C+

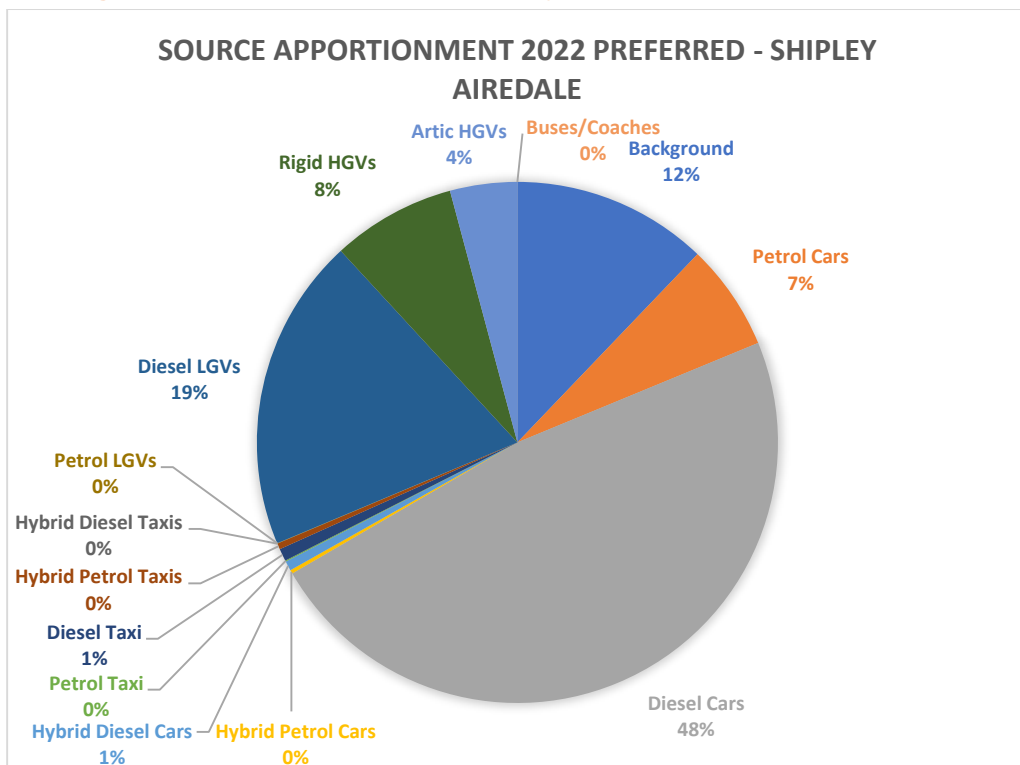


Figure 9: Baseline source apportionment at Bingley Road, Saltaire in 2022

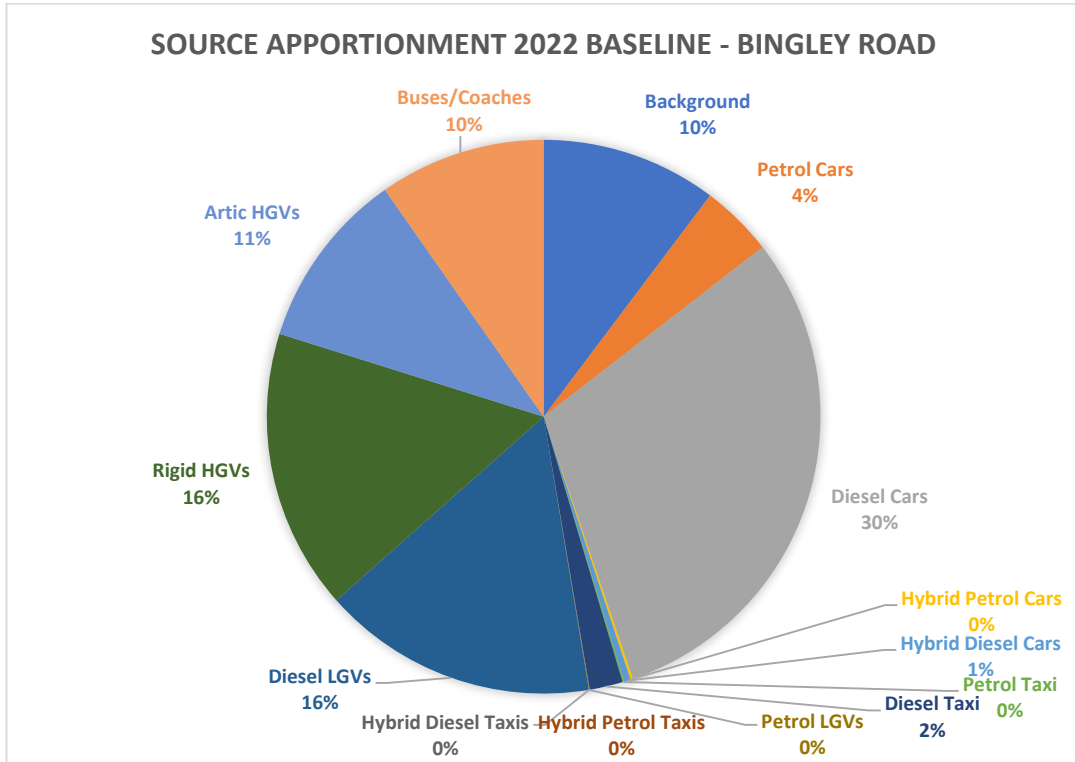
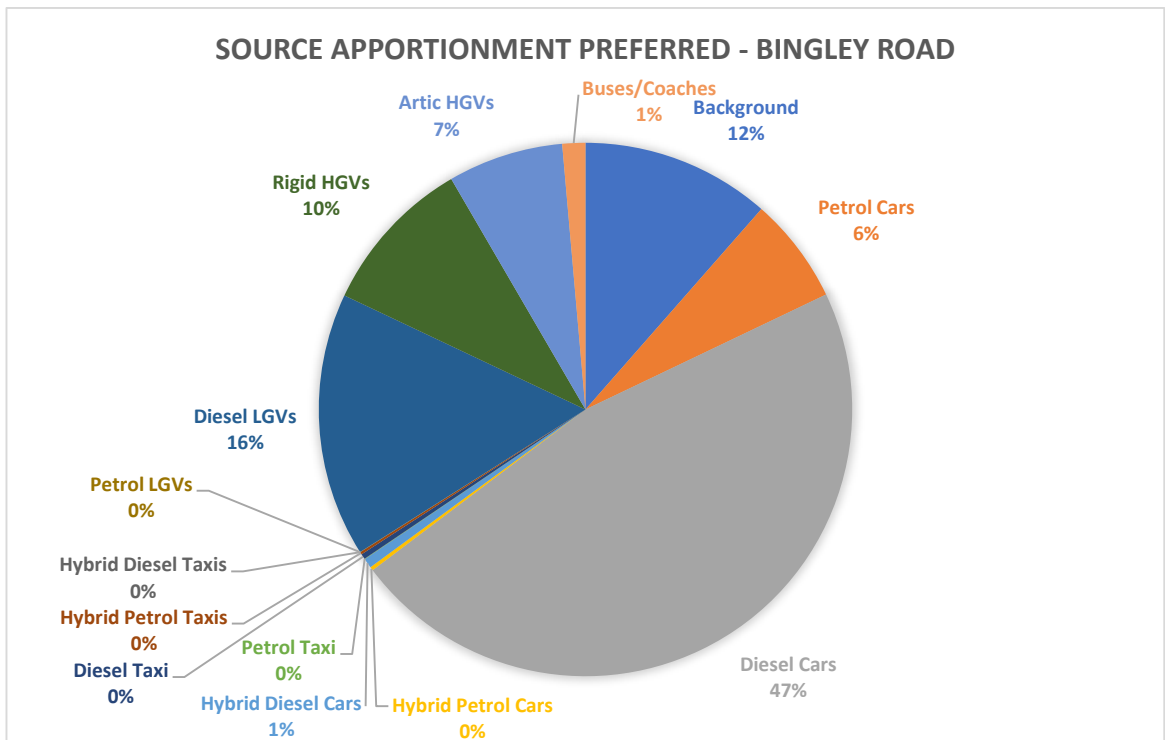
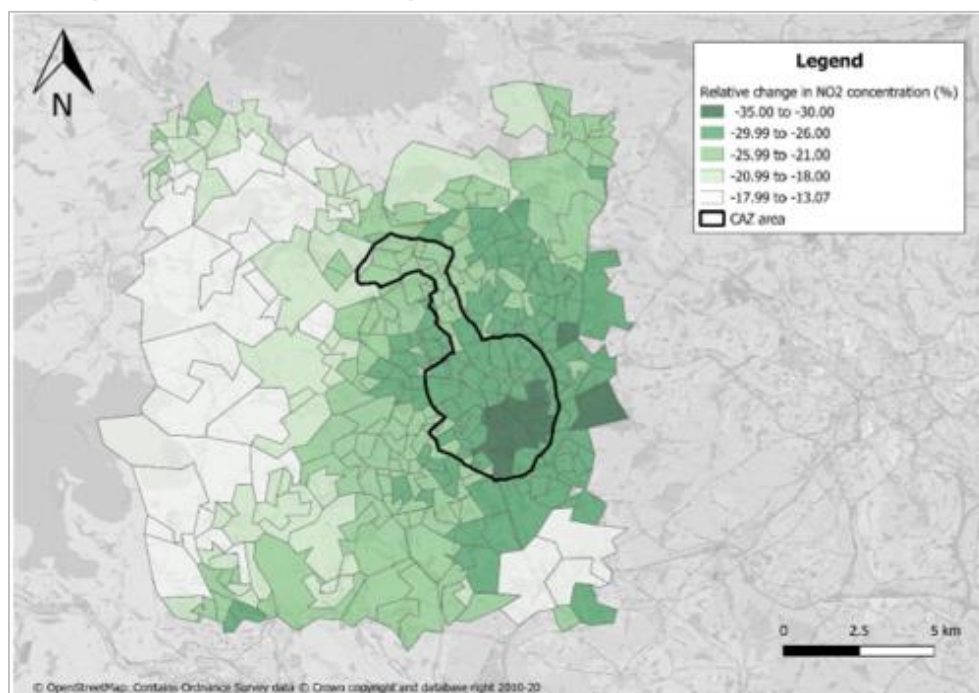


Figure 10: Baseline source apportionment at Bingley Road, Saltaire in 2022 with CAZ C+



64. Figure 11 shows the % reduction in NO2 concentrations in the CAZ area and across the district that will be achieved by the selected option – CAZ C Plus. There are no areas of the district predicted to suffer a deterioration in air quality as a result of implementing the CAZ.

Figure 11: Predicted percentage reduction in NO2 across the district in 2022



Clean Air Zone

65. The Council's option to improve air quality in the shortest possible timeframe is a Clean Air Zone C Plus which will include the following vehicles and daily charges for non-compliant vehicles entering the Zone:
- Buses - **£50**
 - Coach - **£50**
 - Heavy goods vehicle (HGV) - **£50**
 - Light goods vehicle (LGV) – **£9**
 - Minibus - **£9**
 - Taxis - **£12.50**
66. The CAZ compliant emission standards for all these vehicles are detailed in the National Clean Air Zone Framework – see Table 1, except for private hire vehicles (PHV). CAZ compliant standards for PHV are required to go beyond the National Clean Air Zone Framework. PHV standards are a tipping measure that ensure compliance with legal limits as part of the CAZ C implementation. These standards are described as plus measures.
67. All Hackney Carriages will be required to meet Euro 6 Standard as a minimum, including Bradford WAV PHV and out of district Hackney Carriages.
68. Non-WAV PHV will need to meet Euro 5 petrol hybrid Standard as a minimum

69. All Bradford Council licensed Hackney Carriages and PHV will be encouraged to upgrade to a zero-emission vehicle with a target of 25% across the licensed fleet. This incentivised transition also forms part of our CAZ+ measures.
70. The Council proposes to update taxi licensing standards to reflect CAZ requirements, including increasing the licensing life of CAZ compliant taxis to support upgrading.
71. There will be exemptions to charges for emergency vehicles, military vehicles and other vehicle types specified by the Government. At a local level, exemptions will be provided for charities, state schools and small & medium enterprises (SME) pertinent to the CAZ and those outside entering infrequently.
72. Grant funding will be made available to affected vehicle operators to assist with upgrade costs to comply with the CAZ standard.
73. The CAZ will be enforced by an automatic number plate (ANPR) camera network. Vehicle operators will be able to check whether their vehicle is compliant and pay the charge, if not, on the Government's CAZ Vehicle Checker & Payment Portal - <https://www.gov.uk/check-clean-air-zone-charge>

Section 6: Clean Air Plan Stakeholder Engagement

74. Stakeholder engagement and effective communications have formed a central theme in developing the CAP and will continue to play an important part of our delivery plans. *The Clean Air Plan: Stakeholder Engagement and Communications Strategy (2020)* can be found in [Appendix 4](#).
75. The Council carried out a public engagement survey in July/August 2019 to help inform the development of the CAP and undertook full public consultation on the CAP Outline Business Case (OBC) Preferred Option from 18th February to 8th April 2020. The consultation included engagement sessions in Bradford, Keighley, Shipley and Ilkley with representation from the taxi trade at most events. The responses have informed the CAP development and economic assessments for the Final Business Case. The number of responses is shown in Table 9.

Table 9: Responses to Engagement & Public Consultation Exercises

ENGAGEMENT	PUBLIC RESPONSES	BUSINESS RESPONSES (incl Coaches)	TAXI RESPONSES (incl Operators)	TOTAL RESPONSES
CAP Development Engagement Survey	1,701	80	569	2,350
Preferred Option Consultation	805	88	744	1,637
TOTAL RESPONSES				3,987



- 76. The feedback from our preferred option consultation has been generally positive with good support for actions to improve air quality and introduce a CAZ, however, the consultation also identified the extent to which certain businesses, including taxis, would be adversely by our plans and a clear need for mitigation funding was identified.
- 77. The CAP consultation feedback summary can be found on the Breathe Better Bradford website - <https://www.bradford.gov.uk/breathe-better-bradford/clean-air-zone-consultation/clean-air-zone-consultation/>
- 78. The *CAP Consultation Feedback Reports* can be found in [Appendix 4](#).
- 79. The consultation also gave us useful insight into additional measures to the CAZ that would be supported by the public and businesses, including the Advanced Fuel Centre (AFC), Ultra-low Emission Buses, Electric Taxis and Park & Ride. These measures will be taken forward as part of the CAP Delivery Programme. Examples of consultation feedback are provided below.

Figure 12: Consultation Question (Public): Do you support the introduction of a CAZ C Plus?

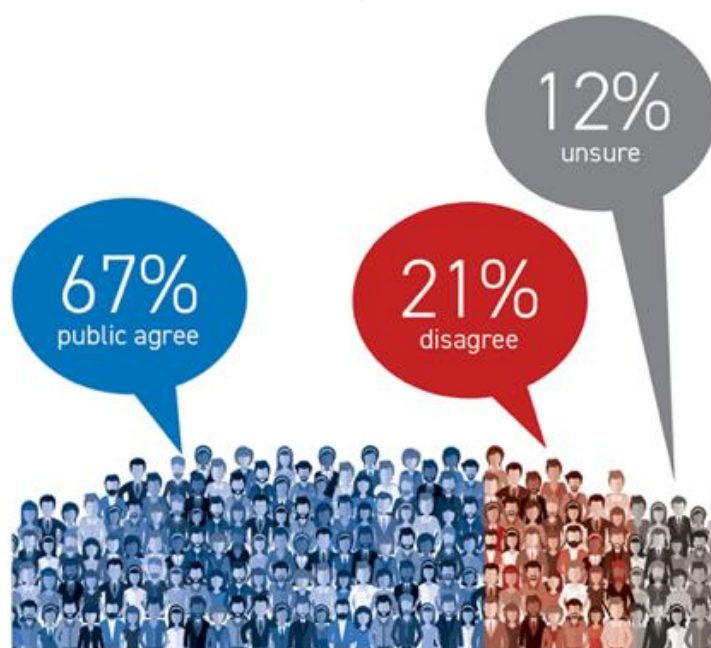
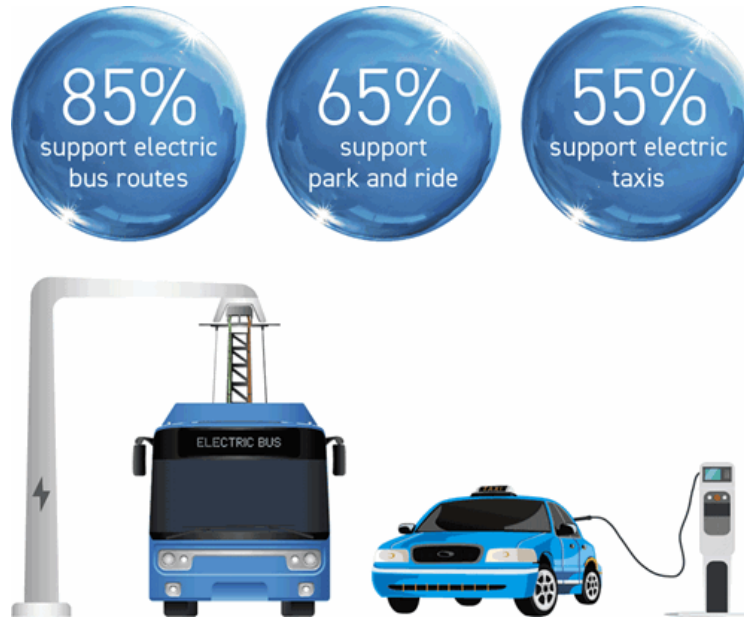
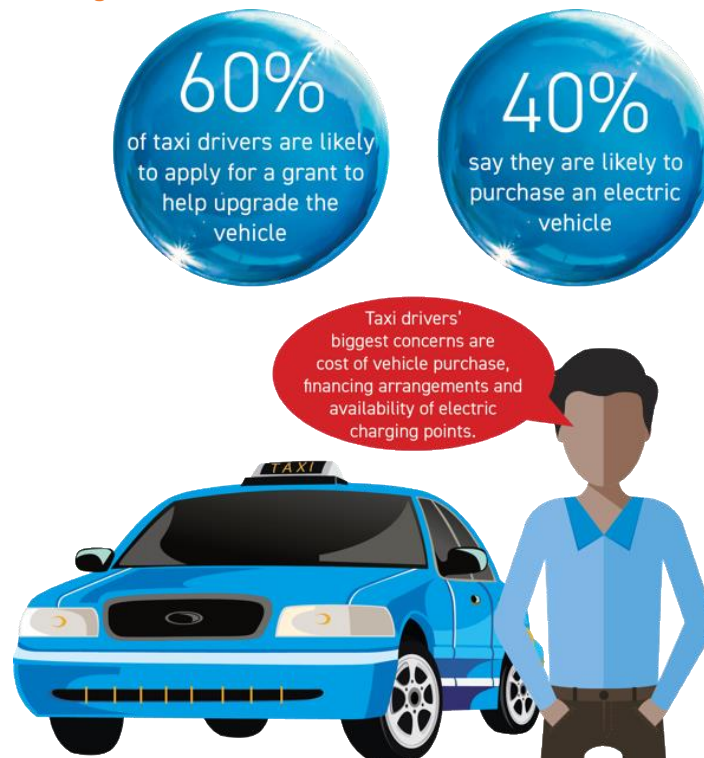


Figure 13: Do you support additional measures to the CAZ (public / business)



80. The Bradford taxi trade response rate to the consultation increased as the Covid-19 pandemic developed in March this year and since the Council has had to increase the licensing period for vehicles to account for the hardship experienced by the trade. The taxi consultation responses showed that up to 38% of the trade would either re-locate licensing or retire if the CAZ was introduced. Some taxi trade responses are shown below.

Figure 14: What do taxi drivers think about the CAZ

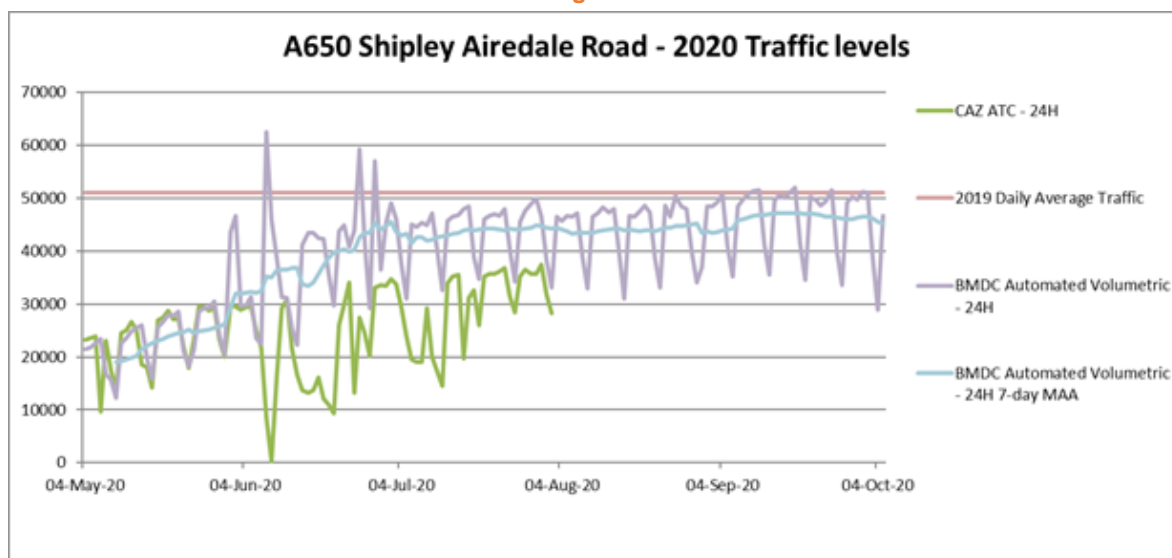


Section 7: Covid-19

81. The Covid-19 pandemic is having a significant economic and health impact on the population of Bradford, particularly among black and minority ethnic (BAME) residents, including taxi drivers.

At the start of the pandemic lockdown at the end of March 2020 the Council introduced traffic counting next to all 8 automatic air quality monitoring stations in the District. The traffic counts showed that traffic flows reduced to 50% of pre-lockdown levels but have since increased to nearly 100% of previous traffic volumes. Figure 15 shows traffic growth following the Covid-19 pandemic lockdown since the end of March at Shipley Airedale Road.

Figure 15: Traffic levels at Shipley Airedale Road from end of March 2020 pandemic lockdowns onwards through Tiered controls



82. The Council will continue to monitor air quality and traffic as part of the Clean Air Plan Monitoring & Evaluation Programme.

Section 8: Clean Air Plan – Assessment of Health Impacts

83. There aren't many evaluations of interventions such as CAZ on air quality or health outcomes. Their impact on relationships between acute pollution episodes and short-term health outcomes has not been explored and little is known about whether these interventions can generate lifetime health and health inequality impacts and cost-savings²³. In the majority of studies, modelled reductions in air quality (e.g. from projected vehicle emissions and air pollution dispersion models) are linked with assumed improvements in health^{23,24,25}. Results from these complex causal modelling chains are highly uncertain and do not account for important real-world factors. Other weaknesses include lack of statistical power, no prospective follow up with baseline health data and lack of controls²⁵.
84. A recently published Cochrane review²⁶ containing studies up until 2016 identified only 5 studies linking interventions to reduce emissions from vehicular sources with health outcomes. Findings were mixed, and all evidence was rated as having low certainty according to GRADE guidelines²⁷.
85. A further search of key databases (MEDLINE, PsycINFO, Web of Science, Embase, Global Health, Transport Database; from 2016 to July 2019 using the key words [(low emission zone OR LEZ or clean air zone OR CAZ) AND (health)]) identified only one UK-based study examining the impact of the London Low Emission Zone (LEZ, implemented in 2008)²⁸. In this annual cross-sectional study, Mudway et al²⁸ found that the London LEZ showed modest improvements in NO₂ (~1ug/m³), but no impact on children's lung capacity, probably due to the small improvements in air quality. No comparator was used and data was only collected after LEZ implementation. The LEZ was less ambitious than the Government's proposed CAZ policy, targeting only lower tailpipe emissions of PM, with limited impact on NO₂²⁹. London has recently switched on an 'ultra low emission

²³ Public Health England. Improving outdoor air quality and health: review of interventions. London, 2019.

²⁴ Bigazzi AY, Rouleau M. Can traffic management strategies improve urban air quality? A review of the evidence. *Journal of Transport & Health* 2017;**7**:111-24 doi: <https://doi.org/10.1016/j.jth.2017.08.001>[published Online First: Epub Date].

Wang L, Zhong BQ, Vardoulakis S, et al. Air Quality Strategies on Public Health and Health Equity in Europe-A Systematic Review. *International journal of environmental research and public health* 2016;**13**(12) doi: 10.3390/ijerph13121196[published Online First: Epub Date].

²⁵ Boogaard H, van Erp AM. Assessing health effects of air quality actions: what's next? *The Lancet Public Health* 2019;**4**(1):e4-e5 doi: 10.1016/S2468-2667(18)30235-4[published Online First: Epub Date].

²⁶ Burns J, Boogaard H, Polus S, et al. Interventions to reduce ambient particulate matter air pollution and their effect on health. *The Cochrane database of systematic reviews* 2019;**5**:CD010919 doi: 10.1002/14651858.CD010919.pub2[published Online First: Epub Date].

²⁷ Secondary. [What is GRADE guidance](#)

²⁸ Mudway IS, Dundas I, Wood HE, et al. Impact of London's low emission zone on air quality and children's respiratory health: a sequential annual cross-sectional study. *The Lancet Public Health* 2019;**4**(1):e28-e40 doi: [https://doi.org/10.1016/S2468-2667\(18\)30202-0](https://doi.org/10.1016/S2468-2667(18)30202-0)[published Online First: Epub Date]

²⁹ Carslaw DC, Beevers SD, Tate JE, Westmoreland EJ, Williams ML. Recent evidence concerning higher NO_x emissions from passenger cars and light duty vehicles.

zone' (a CAZ where all non-compliant vehicles are charged to enter). We are aware of an ongoing evaluation of the impact of this upon lung function using a parallel controlled cohort study of primary school children in inner London and Luton³⁰. To our knowledge there are no evaluations of these types of interventions outside London.

86. Born in Bradford have been working closely with the Bradford Air Quality Board and have developed a comprehensive evaluation plan for the Bradford Air Quality plan, maximising on the strong research infrastructure embedded within Bradford. A summary of the research is in Box 1. The costs of the research will be £933k over 5 years. The successful application is funded by the National Institute for Health Research Public Health Research Board (Principal Investigator Dr Rosie McEachan), and work on the project commenced in July 2020 following ethical approval.



³⁰ Griffiths CJ, Grigg J, Mihaylova B, et al. Investigating the impact of London's Ultra Low Emission Zone on children's respiratory health: Protocol, 2018. <https://www.journalslibrary.nihr.ac.uk/programmes/phr/1613901>

Box 1 - Lay Summary Evaluation of the Bradford Air Quality Plan

BACKGROUND: Poor air quality is a major cause of early death and illness. It has been linked to lung and heart disease in children and adults and low birth weights. During periods of poor air quality, health deteriorates, leading to more hospital admissions and deaths; children and the elderly are particularly vulnerable. Poorer areas of the country typically have worse air quality, contributing to health inequalities. The UK has high levels of air pollution with an annual cost to the NHS and wider economy of £20 billion/year. Thirty-three local authorities with particularly high pollution levels are required to implement air quality plans, of which 'Clean Air Zones' (CAZ) are a key component. Bradford will introduce a CAZ in 2021 which will try to reduce pollution by policies such as charging polluting vehicles which enter the zone. However, the evidence about whether these types of initiatives are effective in improving air quality and/or health or reducing health inequalities is scarce.

AIMS: To evaluate the impact of a Clean Air Plan, including a CAZ, and subsequent improvement in air quality, on health and health inequalities in the city of Bradford.

METHODS: We will explore changes in air quality in the city using routinely collected Council pollution monitoring data supplemented by data collected across 12 schools using low-cost air quality sensors. In addition, 240 children in these schools will be asked to wear air sensors for three separate months in the year before the CAZ is implemented and the year after. The impact of the CAZ on key health indicators (lung and heart health, birth weight) will be assessed by comparing health trends in the three years before the CAZ is implemented with trends up to three years after implementation, using a dataset of over 500,000 Bradford residents. We will examine whether certain groups benefit more than others (e.g. from more deprived areas, or different ethnic groups), using the detailed information collected on >13,500 children who are part of the Born in Bradford (BiB) study. We will look at whether the CAZ has influenced the way people choose to travel by conducting a survey with 4000 BiB families. To explore factors which have helped or hindered implementation of the CAZ, and any unintended consequences, we will conduct group discussions and interviews with key groups of people including businesses, transport companies, families, and pedestrians. We will also explore if the CAZ represents good value for money in terms of improvements in population health, and which groups benefit from those improvements.

PATIENT/PUBLIC INVOLVEMENT: 100 community members and two schools have been involved in the development of intervention plans and research methods. We also worked closely with Bradford council and DEFRA in developing this proposal. Community, school and local authority representatives are part of our study team and will be actively involved in the development and ongoing management of our research.

DISSEMINATION: We will share our findings widely using tailored methods. For researchers, policy and decision makers (local, national, and international) we will produce academic papers, policy briefings, and hold dissemination events. For communities, we will prepare a series of short 'in a nutshell' finding reports and publicise these widely, via our established social media channels, local media links, and engagement events. We will develop school curriculum materials based on our findings to inspire the next generation of researchers.

Health References

1. World Health Organisation. Ambient (outdoor) air quality and health. Secondary Ambient (outdoor) air quality and health 2018. [https://www.who.int/en/news-room/fact-sheets/detail/ambient-\(outdoor\)-air-quality-and-health](https://www.who.int/en/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health)
2. Shah PS, Balkhair T. Air pollution and birth outcomes: a systematic review. *Environment international* 2011;**37**(2):498-516 doi: 10.1016/j.envint.2010.10.009[published Online First: Epub Date]].
3. Hoek G, Krishnan RM, Beelen R, et al. Long-term air pollution exposure and cardio-respiratory mortality: a review. *Environmental health : a global access science source* 2013;**12**(1):43 doi: 10.1186/1476-069x-12-43[published Online First: Epub Date]].
4. Requia WJ, Adams MD, Arain A, Papatheodorou S, Koutrakis P, Mahmoud M. Global Association of Air Pollution and Cardiorespiratory Diseases: A Systematic Review, Meta-Analysis, and Investigation of Modifier Variables. *American journal of public health* 2018;**108**(S2):S123-S30 doi: 10.2105/ajph.2017.303839[published Online First: Epub Date]].
5. Raaschou-Nielsen O, Andersen ZJ, Beelen R, et al. Air pollution and lung cancer incidence in 17 European cohorts: prospective analyses from the European Study of Cohorts for Air Pollution Effects (ESCAPE). *The Lancet. Oncology* 2013;**14**(9):813-22 doi: 10.1016/s1470-2045(13)70279-1[published Online First: Epub Date]].
6. Fu P, Guo X, Cheung FMH, Yung KKL. The association between PM2.5 exposure and neurological disorders: A systematic review and meta-analysis. *The Science of the total environment* 2019;**655**:1240-48 doi: 10.1016/j.scitotenv.2018.11.218[published Online First: Epub Date]].
7. Elliot AJ, Smith S, Dobney A, Thornes J, Smith GE, Vardoulakis S. Monitoring the effect of air pollution episodes on health care consultations and ambulance call-outs in England during March/April 2014: A retrospective observational analysis. *Environmental Pollution* 2016;**214**:903-11 doi: <https://doi.org/10.1016/j.envpol.2016.04.026>[published Online First: Epub Date]].
8. Li M, Wu Y, Tian Y-H, et al. Association Between PM2.5 and Daily Hospital Admissions for Heart Failure: A Time-Series Analysis in Beijing. *International journal of environmental research and public health* 2018;**15**(10):2217
9. Macintyre HL, Heaviside C, Neal LS, Agnew P, Thornes J, Vardoulakis S. Mortality and emergency hospitalizations associated with atmospheric particulate matter episodes across the UK in spring 2014. *Environment international* 2016;**97**:108-16 doi: <https://doi.org/10.1016/j.envint.2016.07.018>[published Online First: Epub Date]].

10. Lelieveld J, Klingmüller K, Pozzer A, et al. Cardiovascular disease burden from ambient air pollution in Europe reassessed using novel hazard ratio functions. *European Heart Journal* 2019;**40**(20):1590-96 doi: 10.1093/eurheartj/ehz135[published Online First: Epub Date]].
11. Public Health England. Estimation of costs to the NHS and social care due to the health impacts of air pollution: summary report, 2018.
12. Royal College of Physicians. Every breath we take: the lifelong impact of air pollution. London, 2016.
13. World Health Organisation. WHO Global Urban Ambient Air Pollution Database. Secondary WHO Global Urban Ambient Air Pollution Database 2016. http://www.who.int/phe/health_topics/outdoorair/databases/cities/en/.
14. Unicef UK. A breath of toxic air: UK Children in danger. London, 2018.
15. WHO Regional Office for Europe. Review of evidence on health aspects of air pollution – REVIHAAP Project: Technical Report [Internet]. Copenhagen, 2013.
16. Brunt H, Barnes J, Jones SJ, Longhurst JWS, Scally G, Hayes E. Air pollution, deprivation and health: understanding relationships to add value to local air quality management policy and practice in Wales, UK. *Journal of public health (Oxford, England)* 2017;**39**(3):485-97 doi: 10.1093/pubmed/fdw084[published Online First: Epub Date]].
17. Rodriguez-Villamizar LA, Berney C, Villa-Roel C, Ospina MB, Osornio-Vargas A, Rowe BH. The role of socioeconomic position as an effect-modifier of the association between outdoor air pollution and children's asthma exacerbations: an equity-focused systematic review. *Reviews on environmental health* 2016;**31**(3):297-309 doi: 10.1515/reveh-2016-0005[published Online First: Epub Date]].
18. Tonne C, Beevers S, Armstrong B, Kelly F, Wilkinson P. Air pollution and mortality benefits of the London Congestion Charge: spatial and socioeconomic inequalities. *Occupational and environmental medicine* 2008;**65**(9):620-7 doi: 10.1136/oem.2007.036533[published Online First: Epub Date]].
19. Fecht D, Fischer P, Fortunato L, et al. Associations between air pollution and socioeconomic characteristics, ethnicity and age profile of neighbourhoods in England and the Netherlands. *Environmental pollution (Barking, Essex : 1987)* 2015;**198**:201-10 doi: 10.1016/j.envpol.2014.12.014[published Online First: Epub Date]].
20. Office for National Statistics. 2011 Census. Secondary 2011 Census 2011. <https://www.ons.gov.uk/census/2011census>.

21. Ministry of Housing CaLG. English Indices of Deprivation 2015 - LSOA Level. Secondary English Indices of Deprivation 2015 - LSOA Level 2015. <http://opendatacommunities.org/data/societal-wellbeing/imd/indices>.
22. Public Health England. Local Authority Health Profiles. Secondary Local Authority Health Profiles 2019. <https://fingertips.phe.org.uk/profile/health-profiles/data#page/0/gid/1938132696/pat/6/par/E12000003/ati/102/are/E08000016>.
23. Eeftens M, Beelen R, de Hoogh K, et al. Development of Land Use Regression models for PM(2.5), PM(2.5) absorbance, PM(10) and PM(coarse) in 20 European study areas; results of the ESCAPE project. *Environmental science & technology* 2012;**46**(20):11195-205 doi: 10.1021/es301948k[published Online First: Epub Date]].
24. Vrijheid M, Slama R, Robinson O, et al. The Human Early-Life Exposome (HELIX): Project Rationale and Design. *Environmental Health Perspectives* 2014;**122**(6):535-44 doi: 10.1289/ehp.1307204[published Online First: Epub Date]].
25. Pedersen M, Giorgis-Allemand L, Bernard C, et al. Ambient air pollution and low birthweight: a European cohort study (ESCAPE). *The Lancet Respiratory Medicine* 2013;**1**(9):695-704 doi: 10.1016/S2213-2600(13)70192-9[published Online First: Epub Date]].
26. Mebrahtu TF, Feltbower RG, Parslow RC. Incidence and Burden of Wheezing Disorders, Eczema, and Rhinitis in Children: findings from the Born in Bradford Cohort. *Paediatric and perinatal epidemiology* 2016;**30**(6):594-602 doi: 10.1111/ppe.12310[published Online First: Epub Date]].
27. Mueller N, Rojas-Rueda D, Khreis H, et al. Socioeconomic inequalities in urban and transport planning related exposures and mortality: A health impact assessment study for Bradford, UK. *Environment international* 2018;**121**(Pt 1):931-41 doi: 10.1016/j.envint.2018.10.017[published Online First: Epub Date]].
28. Lomas J, Schmitt L, Jones S, et al. A pharmacoeconomic approach to assessing the costs and benefits of air quality interventions that improve health: a case study. *BMJ Open* 2016;**6**(6):e010686 doi: 10.1136/bmjopen-2015-010686[published Online First: Epub Date]].
29. Clemente DBP, Vrijheid M, Martens DS, et al. Prenatal and Childhood Traffic-Related Air Pollution Exposure and Telomere Length in European Children: The HELIX Project. *Environmental Health Perspectives* 2019;**127**(8):087001 doi: 10.1289/EHP4148[published Online First: Epub Date]].
30. Public Health England. Improving outdoor air quality and health: review of interventions. London, 2019.

31. Bigazzi AY, Rouleau M. Can traffic management strategies improve urban air quality? A review of the evidence. *Journal of Transport & Health* 2017;**7**:111-24 doi: <https://doi.org/10.1016/j.jth.2017.08.001>[published Online First: Epub Date]].
32. Wang L, Zhong BQ, Vardoulakis S, et al. Air Quality Strategies on Public Health and Health Equity in Europe-A Systematic Review. *International journal of environmental research and public health* 2016;**13**(12) doi: 10.3390/ijerph13121196[published Online First: Epub Date]].
33. Boogaard H, van Erp AM. Assessing health effects of air quality actions: what's next? *The Lancet Public Health* 2019;**4**(1):e4-e5 doi: 10.1016/S2468-2667(18)30235-4[published Online First: Epub Date]].
34. Burns J, Boogaard H, Polus S, et al. Interventions to reduce ambient particulate matter air pollution and their effect on health. *The Cochrane database of systematic reviews* 2019;**5**:CD010919 doi: 10.1002/14651858.CD010919.pub2[published Online First: Epub Date]].
35. Secondary. <https://bestpractice.bmj.com/info/toolkit/learn-ebm/what-is-grade/>.
36. Mudway IS, Dundas I, Wood HE, et al. Impact of London's low emission zone on air quality and children's respiratory health: a sequential annual cross-sectional study. *The Lancet Public Health* 2019;**4**(1):e28-e40 doi: [https://doi.org/10.1016/S2468-2667\(18\)30202-0](https://doi.org/10.1016/S2468-2667(18)30202-0)[published Online First: Epub Date]].
37. Carslaw DC, Beevers SD, Tate JE, Westmoreland EJ, Williams ML. Recent evidence concerning higher NO_x emissions from passenger cars and light duty vehicles. *Atmospheric Environment* 2011;**45**(39):7053-63 doi: <https://doi.org/10.1016/j.atmosenv.2011.09.063>[published Online First: Epub Date]].
38. Griffiths CJ, Grigg J, Mihaylova B, et al. Investigating the impact of London's Ultra Low Emission Zone on children's respiratory health: Protocol, 2018. <https://www.journalslibrary.nihr.ac.uk/programmes/phr/1613901>

Acronyms

ACRONYM	DEFINITION
AFC	Advance Fuel Centre
ANPR	Automatic Number Plate Recognition
BAME	Black and Minority Ethnic
BiB	Born in Bradford
CAF	Clean Air Fund
CAP	Clean Air Plan
CAPDT	Clean Air Plan Delivery Team
CAZ	Clean Air Zone
CBMDC	City of Bradford Metropolitan District Council
CCAZ	Charging Clean Air Zone
CCTV	Closed Circuit Television
CMT	Chief Executive's Management Team
CSF	Critical Success Factor
CSO	Charging Scheme Order
D-IRP	Delivery Independent Review Panel
DfT	Department for Transport
DEFRA	Department of the Environment, Farming and Rural Affairs
EU	European Union
EV	Electric Vehicle
FBC	Full Business Case
GIS	Graphical Information System
HGV	Heavy Goods Vehicle
HIA	Health Impact Area
IF	Implementation Fund
IT	Information Technology
JAQU	Joint Air Quality Unit
LED	Light Emitting Diode
LGV	Light Goods Vehicle
LNER	London North Eastern Railway
LSOA	Lower Super Output Areas
LTS	Local Transmission System
NO ₂ / NOX	Nitrous Oxide
OBC	Outline Business Case

ACRONYM	DEFINITION
OfGem	Office of Gas and Electricity Markets
PCM	Pollution Climate Mapping Model supporting EU Directive 2008/50/EC
PHV	Private Hire Vehicle
PM₁₀ / PM_{2.5}	Particulate Matter
PMO	Project Management Office
PRINCE2	Projects in Controlled Environments
SOC	Strategic Outline Case
SME	Small, Medium Enterprise
SP	Stated Preference Survey
SRO	Senior Responsible Owner
T-IRP	Technical Independent Review Panel
TRO	Traffic Regulation Order
TUPE	Transfer of Undertakings (Protection of Employment) Regulations 1981
ULEV	Ultra-Low Emission Vehicle
UTC	Urban Traffic Control
WAV	Wheelchair Accessible Vehicle
WYCA	West Yorkshire Combined Authority
WYLES	West Yorkshire Low Emission Strategy