



Derby City Council Air Quality Action Plan

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

January 2020

Derby City Council – Air Quality Action Plan – 2020

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Executive Summary

This Air Quality Action Plan (AQAP) has been produced as part of our statutory duties required by the Local Air Quality Management framework. It outlines the action we will take to improve air quality in Derby between 2019 and 2025.

This action plan replaces the previous action plan published within the 2018 Annual Status Report. Projects delivered through the past action plan include:

- eBike Sharing Scheme (now ended)
- Feasibility study for *Local Roadside NO₂ Plan*
- Development of a Draft Low Emissions Strategy for the City
- Feasibility study for a locally targeted mobility credits scheme
- Awareness raising, engagement and data sharing for the *Local Roadside NO₂ Plan*
- Funding secured to retrofit bus fleet
- Go Ultra Low project – including promotions, engagement and investment in network charging points

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 billion³.

Derby City Council (DCC) is committed to reducing the exposure of people in Derby to poor air quality in order to improve health.

We have developed actions which fall under three key priorities:

- Priority 1: Tackling NO₂ hotspots
- Priority 2: Improving the overall air quality across Derby
- Priority 3: Managing PM_{2.5} exposure

The measures that fall under these priorities are summarised in the following figure.

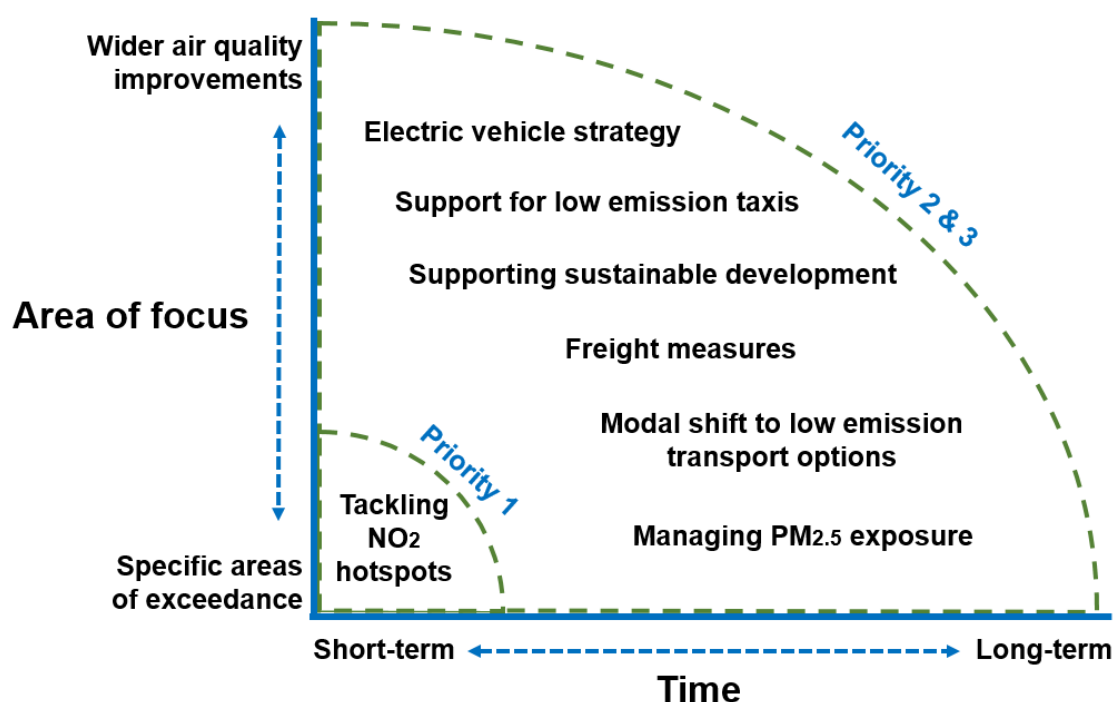
¹ Environmental equity, air quality, socioeconomic status and respiratory health, 2010

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

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Figure E1: Priority areas for addressing air quality in Derby



Our priorities have been developed to tackle the city's long-term problem with NO₂ concentrations, which have exceeded the National Air Quality Objective (NAQO) annual mean target of less than 40 µg.m⁻³ in several areas of relevant human exposure. DCC also include within this plan, measures to reduce the concentration of PM_{2.5}, tiny inhalable air particles which can lead to cardiopulmonary related diseases after prolonged exposure.

In this AQAP, we outline how we plan to effectively tackle air quality issues within our control. However, we recognise that there are a large number of air quality policy areas that are outside of our influence (such as vehicle emissions standards agreed in Europe), but for which we may have useful evidence, and so we will continue to work with regional and central government on policies and issues beyond DCC's direct influence.

Responsibilities and Commitment

This AQAP was prepared by the Communities, Environment and Regulatory Services Department of Derby City Council.

This AQAP has been approved by:

- Councillor Matthew Holmes (Cabinet Member for Regeneration, Planning and Transportation)
- Robyn Dewis (Acting Director of Public Health)
- Rachel North (Strategic Director of Communities and Place)

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This AQAP will be subject to an annual review, appraisal of progress and reporting to the relevant Council Committee. Progress each year will be reported in the Annual Status Reports (ASRs) produced by Derby City Council, as part of our statutory Local Air Quality Management duties.

If you have any comments on this AQAP please send them to Karl Suschitzky at:

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1 Introduction

This report outlines the actions that Derby City Council (DCC) will aim to deliver between 2020 – 2024 in order to reduce concentrations of air pollutants and exposure to air pollution; thereby positively impacting on the health and quality of life of residents and visitors to the city of Derby.

The plan has been developed in recognition of the legal requirement on the local authority to work towards Air Quality Strategy (AQS) objectives under Part IV of the Environment Act 1995 and relevant regulations made under that part and to meet the requirements of the Local Air Quality Management (LAQM) statutory process. Additionally this plan has made further consideration towards the likely future legislative requirements and how best to protect the citizens of Derby from the adverse impacts of poor ambient air quality.

This plan will be reviewed at least every five years and progress on measures set out within this Plan will be reported annually within Derby's air quality ASR (Annual Status Report).

2 Development and Implementation of Derby City Councils' AQAP

2.1 Consultation and Stakeholder Engagement

In developing/updating this AQAP, we have worked with other local authorities, agencies, businesses and the local community to improve local air quality. Schedule 11 of the Environment Act 1995 requires local authorities to consult the bodies listed in Table 1.

On 17th May 2019, a Stakeholder Engagement Workshop was held to discuss the measures included in the draft AQAP, at the DCC Council Chamber. The Workshop included the completion of a SWOT (Strengths, Weaknesses, Opportunities and Threats) and Gap Analysis exercise – the findings of which are presented in Appendix A.

The response to our stakeholder consultation and engagement process is given in Appendix A.

Table 1: Consultation Undertaken

Yes/No	Consultee
Yes	the Secretary of State
Yes	the Environment Agency
Yes	the highways authority
Yes	all neighbouring local authorities
Yes	other public authorities as appropriate, such as Public Health officials
Yes	bodies representing local business interests and other organisations as appropriate

2.2 Steering Group

An Action Plan Steering Group was established in early 2019 (chaired by Karl Suschitzky, Senior Environmental Health Officer). Members of the Steering Group included:

- Nicola Weekly (Group Manager, Traffic Management)
- Laura Simpson (Transportation Engineer)
- Richard Kniveton (Fleet & Depot Manager)
- Mike Kay (Head of Service, Environmental Protection, Housing Standards, Licensing and Emergency Planning)

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- Paul Clarke (Head of Service, Planning)
- Nicky Bartley (Planning Policy Team Leader)
- Sara Claxton (Development Control Team Leader)
- Owen Swift (Participation Pathway Manager)
- Ian Wallis (Senior Signals and Projects Engineer)
- Adam Sendall (Better Ways to Work Coordinator)
- Richard Antcliff (Director of Public Protection and Streetpride)
- Dave Dowbenko (Group Manager, Passenger Transport Operations)
- David Hilton-Barber (Traffic and Transportation Officer)
- Karl Suschitzky (Senior Environmental Health Officer)

3 Summary of Current Air Quality in Derby

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 correlation between poor air quality and more deprived areas^{4,5}.

In the UK, the annual health cost to society of the impacts of particulate matter is estimated to be around £16 billion⁶. DCC is committed to reducing the exposure of people in Derby to poor air quality in order to improve health.

Derby has undertaken regular reviews of ambient air quality since the year 2000, fulfilling its obligations set by Part IV of the Environment Act (1995). The act sets out the Local Air Quality Management (LAQM) process; which requires authorities to regularly review and assess ambient air quality and work towards a target limit value for concentrations of six pollutants in areas where the population is regularly exposed⁷. Following the enactment of the Environment Act, DCC began a monitoring campaign to identify areas within the city that are in exceedance of the NAQS target limit values.

The table below provides details of the current National Air Quality Objectives (NAQS) for Nitrogen Dioxide and Particulate Matter:

Table 2: National Air Quality Objectives (NAQS) for NO₂ and PM₁₀

Pollutant	Concentration	Objective
Nitrogen Dioxide (NO₂)	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, ≤ 10 µm (PM₁₀)	50 µg.m ⁻³ not to be exceeded more than 35 times a year	24 hour mean
	40 µg.m ⁻³	Annual mean
Particulate matter, ≤ 2.5 µm (PM_{2.5})	25 µg.m ⁻³	Annual mean
	Target of 15% reduction in concentrations in urban background areas	

⁴ Environmental equity, air quality, socioeconomic status and respiratory health, 2010

⁵ Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006

⁶ Defra. Abatement cost guidance for valuing changes in air quality, May 2013

⁷ <https://uk-air.defra.gov.uk/air-pollution/uk-eu-limits>

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In accordance with the LAQM process, DCC declared two Air Quality Management Areas (AQMAs) to highlight areas where the population are exposed to concentrations of NO₂ in exceedance of the NAQOs. The two AQMAs consist of a grouping of linked roads, described in the declaration as the following⁸:

- **AQMA No. 1, Ring roads** – An AQMA encompassing the Inner and Outer Ring-Roads in the city, as well as some sections of radial roads and the entire length of Osmaston Road.
- **AQMA No. 2, A52** – Sections of the A52, Derby Road and Nottingham Road in Spondon.

Following the declaration of the AQMAs, DCC undertook a more detailed study of NO₂ concentrations and released its first strategy for reducing NO₂ concentrations in 2006⁹. The last AQAP (2011) set out a number of measures which aimed to reduce NO₂ concentrations to below the NAQS target limit value.

This AQAP details Derby's new plan to reduce NO₂ concentrations in the two AQMA's and across the city, and also details further measures to reduce the level of PM_{2.5}.

Since the publication of the last AQAP, Derby was identified as one of six cities requiring urgent assistance to comply with the limit value for NO₂, in the '*UK plan to tackle roadside Nitrogen Dioxide concentrations*'¹⁰. As a result, Derby has received additional financial and policy support to reduce concentrations to below the limit values in the shortest possible time. In response to this, DCC produced a *Local Roadside NO₂ Plan (March 2019)*, which sets out the preferred options for achieving compliance in the shortest time possible. Although the *Local Roadside NO₂ Plan* falls outside of the requirements of LAQM, the preferred options have been referred to in this AQAP.

⁸ Mapped location and further details can be found from: https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=77

⁹ DDC (2006) Detailed Assessment for Nitrogen Dioxide

¹⁰ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/633269/air-quality-plan-overview.pdf

4 Derby City Council's Air Quality Priorities

4.1 Public Health Context

There is increasing scientific evidence demonstrating the impact of poor ambient air quality on human health. In 2016, the Royal College of Physicians reported that exposure to poor air quality contributed to the equivalent of 40,000 deaths per year¹¹. In 2018, the Committee on the Medical Effects of Air Pollutants (COMEAP) provided an updated report on the association between long-term exposure to increased levels of NO₂ and mortality, which estimated that between 28,000 and 36,000 premature deaths in the UK could be linked to air pollution every year¹². The impact on the economy is estimated to be approximately £20 billion every year, through healthcare related costs and the loss of workplace productivity.

There are several air pollutants that may contribute to poorer health. In Derby, the primary pollutant of concern is NO₂, which has been found to exceed the objective in several areas. PM₁₀ and PM_{2.5} have also been identified as posing a serious risk to public health. At present, ambient concentrations of particulate matter in Derby comply with air quality standards and whilst this Plan includes measures to reduce exposure to this pollutant, the AQMA does not include consideration of PM under the LAQM regime.

The UK Government has responded to the latest research on the effects of PM_{2.5}, which indicates there is no real safe threshold for the pollutant, by outlining aims to reduce concentrations below the World Health Organisation's (WHO) recommended limit values by 2030. At present, Derby is under no statutory obligation to monitor PM_{2.5} concentrations, but is required to consider options for addressing emissions of PM_{2.5} at a local level. Many of the measures implemented within this action plan, designed to target reductions in NO₂, will also have co-benefits for reducing concentrations of particulate matter.

4.2 Planning and Policy Context

National Air Quality Plans

Air quality modelling carried out by Defra in 2015 as part of its responsibilities under the Air Quality Directive showed that Derby was one of six cities (others included London, Birmingham, Leeds, Nottingham and Southampton) in the United Kingdom expected to exceed the Limit Value for nitrogen dioxide concentrations of 40 µg.m⁻³ by 2020. Concentrations greater than 40 µg.m⁻³ were predicted on a 550 m stretch of the A52 in Eastgate and on a 390 m stretch of the A601 at Holmes Bridge. The government was

¹¹ <https://www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution>

¹² <https://www.gov.uk/government/publications/nitrogen-dioxide-effects-on-mortality>

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expected to draw up a National Plan that would bring about compliance by 2020. This plan involved the introduction of Clean Air Zones¹³. These are defined as geographical areas where only the cleanest vehicles are encouraged. The Clean Air Zones were defined in terms of vehicle types (to include buses, coaches, taxis, HGVs, LGVs and cars) with each zone class progressively including more of the various vehicle types (Derby was initially assigned to CAZ class B). Vehicle owners are required to pay a charge if they enter a Clean Air Zone which has a (euro) standard for their type of vehicle and it does not meet that standard.

However, considering the requirement to bring about compliance in the shortest time possible, Defra updated their NO₂ Plan in July 2017. The accompanying modelling showed nearly 4 km of road link exceeded 40 µg.m⁻³ on sections of the A52 and A601, with the highest concentration of 49.4 µg.m⁻³ predicted in Holmes Bridge.

Local Roadside NO₂ Plan

Following the identification of the NO₂ exceedances in Derby in the Government's NO₂ Plan, the Council commissioned an air quality study, using local knowledge of the vehicle fleet, street canyons, meteorology and local air quality monitoring data, to gain a more representative prediction of the NO₂ concentrations in the city.

The study predicted a maximum concentration in 2020 of 49.4 µg.m⁻³ but at a different location – on Stafford Street, near to the junction with Friar Gate. This is the expected concentration if there are no changes in traffic volumes, or in the vehicle fleet, and background concentrations continue according to current emission predictions.

The modelling also allowed the Council to develop a package of measures to deliver compliance with roadside NO₂ concentrations in the shortest possible time. The shortlisted measures were grouped into three categories:

- Option 1: Traffic management measures
- Option 2: Chargeable Clean Air Zone within Inner Ring Road
- Option 3: Chargeable Clean Air Zone within Outer Ring Road

Following a public consultation, the overwhelming support was for Option 1.

The Local Roadside NO₂ Plan also proposed schemes to help with the early uptake of low emission vehicles and to provide greater encouragement of the use of sustainable and active travel choices. This included further promotion of sustainable and active travel options and

¹³ London was exempt from introducing Clean Air Zones because the Mayor had already agreed to introduce a range of measures including the introduction of the Ultra Low Emission Zone.

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other supporting schemes to assist the public in making informed travel choices, such as improvements to electric vehicle charging infrastructure and other measures to support electric vehicle uptake to accelerate fleet renewal.

Derby City Centre Masterplan 2030

The Masterplan will align with the delivery of the new Derby Transport Strategy (see below). It aims to improve facilities and accessibility for cars and public transport, as well as walking and cycling. This will include a review of the car parking strategy in the city centre. It is also intended to maximise connections with HS2, and collaborate with Network Rail in the delivery of electrification of Midland Mainline, as well as improving Derby Station.

Derby & Nottingham Metropolitan Strategy 2030

The Strategy aims to improve accessibility and capitalise on the 40,000 daily commuters between the two cities, by improving the rail and airport interchanges, developing new transport technologies and enabling the shared development of transport corridors. The impact of the strategy will be measured over a 15-year period. The strategy's key aims are to:

- *“CM1: Strengthen our connections across the Midlands and beyond”*
- *“CM2: Build better connections between our cities”*
- *“CM3: Develop sustainable transport options and addressing air quality challenges”*

Under CM3, the Strategy lists various objectives, including:

- The promotion and encouragement of sustainable travel, and improved travel choices for local residents;
- The submission of a joint bid for funding to allocate in the wider travel to work/learn area;
- Develop a joint bid for D2N2 Low Carbon funding;
- The development and refinement of a cleaner/greener transport agenda;
- The development of a regional ULEV support network, led by Derby, building on successful Nottingham-led joint bid for OLEV funding; and
- To seek a common approach across both cities to the EU 2020 Air Quality Targets.

Derby Local Cycling and Walking Infrastructure Plan (LCWIP)

Derby City Council has been working on the development of an LCWIP for the past few years, which was due for completion in November 2019. The LCWIP was borne out of the Infrastructure Act 2015 with the primary objective to make a strategic case for investment in cycling and walking infrastructure in accordance with the *National Cycling and Walking Investment Strategy* (Department for Transport, 2017).

The Plan is being developed to produce a detailed cycling/walking network designed to connect key origins and destinations across the City, with primary outputs being:

- Production of a network plan/map for cycling and walking, highlighting preferred routes and priority zones for further developments; and
- Production of a prioritised programme of infrastructure improvements for future investment.

Derby City Local Plan – Part 1: Core Strategy

The Core Strategy outlines several aims for the city of Derby relating to both traffic and emissions. These include:

- **CP23 – Delivering a Sustainable Transport Network**
“The Council will ensure that people living, working and travelling within Derby will have viable travel choices and effective, efficient and sustainable transport networks which meet the needs of residents and businesses while supporting sustainable economic growth and competitiveness.”
- **CP24 – Transport Infrastructure**
“The Council will work with partners to deliver the Council’s long term transport strategy in association with the Local Transport Plan and support the implementation of strategic proposals and initiatives that help create an economically and environmentally sustainable transport network.”

The Core Strategy refers to the following initiatives:

- Supporting the implementation of Highways England’s A38 Derby Junctions Grade Separation scheme
- Implementation of ‘T12’ and the ‘South Derby Integrated Transport Link’ Phases 1 and 2

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- Implementation of improvements to the A52 between Raynesway and the Pentagon Island, including improved access to Pride Park
 - Implementation of improvements at the A50 junctions with the A514 and A38
 - Supporting the implementation of the Boulton Moor Park and Ride site in South Derbyshire
 - Implementation of the Park and Ride at Royal Derby Hospital
 - Implementation of the ‘Statement of Actions’ in the Rights of Way Improvement Plan
 - Implementation of a strategic cycle network
 - Supporting the implementation of Network Rail’s Electrification of the Midland Mainline
 - Implementing the restoration of the Derby Canal
 - Ensuring connectivity to HS2
- **AC4 – City Centre Transport & Accessibility**

“The Council will deliver a transport strategy for the City Centre that supports its continued economic growth through the facilitation of movement of people, goods and services. In particular, it will seek to maximise the efficiency of the transport network and provide equality of opportunity through sustainable access choices, providing for and promoting the use of cycling, walking and public transport.”

Local Transport Plan 3

The Local Transport Plan (LTP) sets out the strategies and proposals for the transport system in and around Derby up to 2026. It provides both a long-term strategy and short-term implementation plans, and focuses on four key areas: asset management, network management, active travel and public transport. The reduction and management of traffic flows is the focus of the LTP, and the Draft LES, if implemented, would provide measures which support the LTP, with a focus on the promotion of clean technologies.

Derby Transport Strategy

The Derby Transport Strategy considers how the long-term strategic aims of the city will impact transport requirements. It sets out several concepts & schemes to improve capacity, connectivity and communities in the city. These are summarised in Table 3.

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Table 3: Derby Transport Strategy Concepts and Schemes

Target area	Concepts and schemes		
	Capacity	Connectivity	Communities
City Centre	Bus station extension; new bus station on the west side of the city centre; park & ride; Eastgate/Pentagon improvements along the A52 corridor.	Station Access Improvements; Darwin Place (reducing actual and perceived barrier of inner ring road).	Clean Air Zone; car park provision; cycleways.
Derby Urban Area	Workplace parking levy; road user charging; park and ride; Derby southern integrated transport link; A38 Derby Junctions; A61 corridor improvements; local junction improvements; dynamic congestion management.	Tram-train; new railway station in South Derby; cycle network; local bus service improvements, priority and information; cycle hire, smarter choices (e.g. travel plans).	Electric charging points; public realm; maintenance of existing assets.
Metropolitan Area	A52 Sustainable Transport Corridor; A52 Widening; North-East Derby Link Road; Park and Ride.	A52 Sustainable Transport Corridor; A50 junction; integrated ticketing; cycle network improvements.	
Regional Approach	Smart Motorway (introduction of hard shoulder running on the M1 between J23a and J25); A50 (improve east-west corridor between the M1, Derby, Stoke and the M6); Midland Mainline Capacity (capacity released by HS2); Rail Freight Interchanges (Completion of one or both proposed interchanges at EMA and EMIP to improve the transfer of rail freight and reduce road freight).	Links to East Midlands Airport (train-tram, bus); electrification of the Midland Mainline; regional rail improvements.	Freight consolidation centre (reduce the number of HGVs entering the city).

East Midlands HS2 Growth Strategy

The Strategy outlines the options for connecting Derby with HS2, with the aim of increasing transport choices and connecting people to jobs and services. The strategy describes the potential for linking Derby to HS2 via a tram or train, and considers the socio-economic costs and benefits of each.

Highways England - A38 Derby Junctions Highway Improvement Scheme

Currently, a Development Consent Order (DCO) is being examined by the Secretary of State in relation to a major road infrastructure project in Derby, which has the potential to significantly influence traffic flows across the City and therefore, air quality.

The proposals involve 'grade separation' of the highway (through the creation of either an underpass or bridge) at three major junctions where the A38 intersects with arterial routes into the City of Derby; at Little Eaton (A61), Markeaton (A52) and Kingsway (A5111). These three junctions are currently 'at grade' and are known to create significant queuing during peak hours as well as halting the continuous flow of traffic on the A38.

Based on modelling produced by Highways England within an Environmental Statement, the completed scheme (expected in 2024) is likely to have net benefits for air quality (particularly NO₂) in Derby, primarily as a result of redistributing traffic away from congested inner-city routes and onto the A38. Importantly, the A38 has fewer relevant points of public exposure close to the carriageway compared with the inner-city routes currently used by local traffic and therefore, this is considered to have positive benefits in terms of public health associated with air pollution.

There is however expected to be a 4 year construction cycle in order to develop the scheme, which has the potential to negatively impact upon local roads and consequently, air pollutant concentrations, during that period. This is primarily due to potential diversion traffic routes and also additional HGV construction traffic.

Derby City Council believes that, if managed appropriately, the long-term benefits that the completed scheme will provide in terms of air pollutant reductions within the City, outweigh the potential temporary impacts associated with the construction period. It is important to note however that, predicted compliance with the NO₂ objectives within Derby's AQMAs has the potential to be affected during the A38 Scheme construction period (2020-2024).

Climate Change, Carbon Reduction Programmes and Sustainability Strategies

DCC has developed a climate change strategy¹⁴. This strategy aims to take a proactive approach to climate change mitigation and resilience. Six strategic level priority themes were defined:

- A thriving sustainable economy;
- Smarter travel options;

¹⁴ <https://www.derby.gov.uk/media/alluncategorised/DerbyCityCouncil-Derbys-Climate-Change-July-2015.pdf>

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- Energy efficient homes;
- A secure local and renewable energy supply;
- Being prepared for a changing environment; and
- An active economy.

Carbon dioxide emissions from the transport sector were calculated to contribute nearly a quarter of the total carbon dioxide emissions within Derby, hence the Smarter travel options would help contribute to lower NO_x and NO₂ emissions. Derby CC aims to provide local people with sustainable travel choices and measures within the Core Strategy and the Local Transport Plan will aim to coordinate transport options and facilitate behaviour change.

Derby City Council is also working on an updated Cleaner Fleet Policy, in order to improve emissions from council-owned and operated vehicles as well as those owned by staff (referred to as the 'Grey Fleet').

Summary

These policies and strategies indicate that it is an extremely active period for the development of Derby and its transport system. Many of the transport activities will contribute to the reduction of emissions and the likely improvement of air quality. The AQAP will need to complement the wider transport schemes, adding value to ensure that emission reductions are generated, and in particular, ensure that support is provided for the uptake of low emission vehicles.

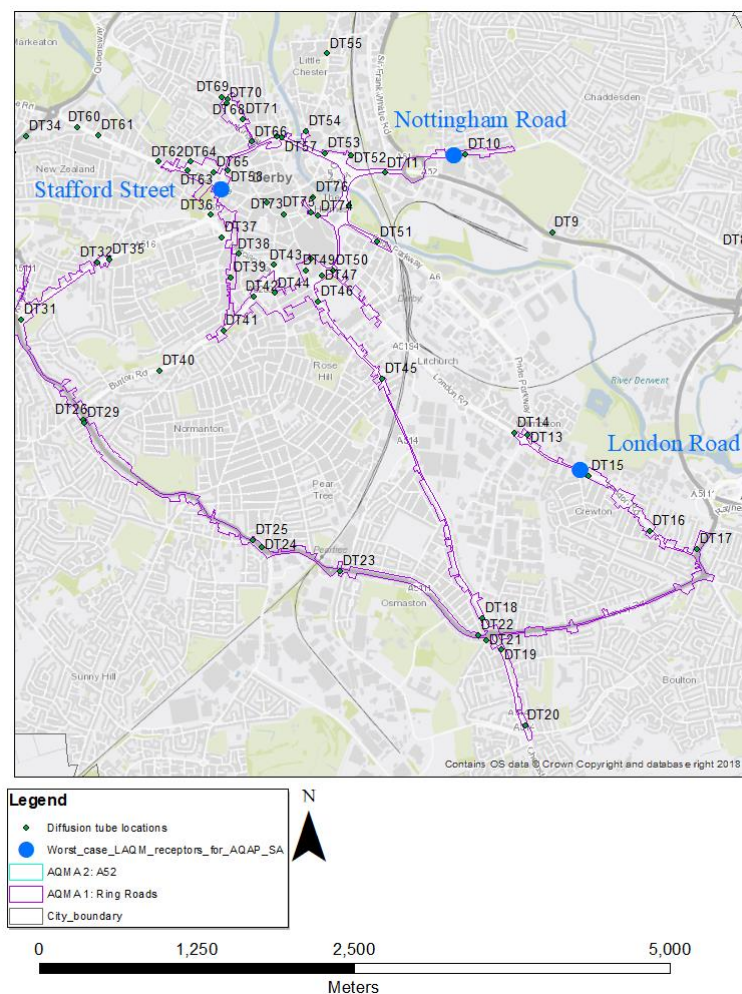
4.3 Source Apportionment

Selection of locations for source apportionment

Source apportionment allows us to gain a better understanding of the nature of vehicles resulting in exceedances along roads in Derby. A review was undertaken to determine the most appropriate locations for the source apportionment. This was based on the maximum NO₂ concentration predicted for the 2020 base case within the AQMAs.

As expected the largest concentration was predicted in Stafford Street (located 24m from DT59). Two other locations exhibited notably high modelled annual average NO₂ concentrations (using LAQM modelling methodology) and therefore these locations were also considered. This included a section of Nottingham Road (located 81 m from the nearest diffusion tube, DT10) and a section of London Road (located 75 m from the nearest diffusion tube, DT15). These concentrations are presented in Table 3 and their locations presented in Figure 1.

Figure 1: Locations of worst case LAQM receptors



Required Reduction in Emissions

The three highlighted locations – Nottingham Road, London Road and Stafford Street – are considered to pose the greatest challenge for ambient NO₂ concentrations in Derby. The three locations were chosen due to both the measured (2016) and predicted (2020) concentrations indicating the annual average NO₂ concentrations are likely to remain above the NAQO limit value for several years. Addressing annual average NO₂ concentration levels in these three areas, without creating new areas of exceedance, has been identified as being the most effective way of improving air quality in the city of Derby. Measures to address exceedances at these locations are a central theme in this AQAP.

The monitoring locations at Nottingham Road (DT10), London Road (DT15) and Stafford Street (DT59) have been identified as being the most appropriate locations to determine the required NO_x emission reductions from road transport. The reductions in NO_x concentrations required to meet the NO₂ objective of 40 µg.m⁻³ were calculated using monitoring data from the three locations, in accordance with Section 7.86 (and Box 7.6) of the Technical Guidance LAQM (TG16). The required NO_x reductions from road traffic at these three locations is presented in Table 4.

Table 4: Nitrogen dioxide concentrations measured within the AQMAs and the required NO_x emissions from road traffic required to achieve compliance

Code	NO ₂ measured at sampling site in 2016, µg.m ⁻³	NO _x background, µg.m ⁻³	Roadside NO _x from NO ₂ calculator, µg.m ⁻³	Road NO _x to achieve compliance, µg.m ⁻³	Road NO _x reduction required µg.m ⁻³	Percentage road NO _x reduction, %
DT10	47.4	31.4	58.8	40.3	18.5	31.5
DT15	43.7	41.7	40.7	31.0	9.7	23.8
DT59	50.9	30.2	63.5	38.9	24.7	38.8

The calculated emission reductions reflect the situation along these routes without any interventions. Therefore, it is important to consider the impact of the preferred options assessed in support of the Local Roadside NO₂ Plan, which are described below.

Impact of Local Roadside NO₂ Plan

The AQAP measures presented in this report are intended to be targeted towards the predominant sources of emissions within Derby City Council's area. As part of the review of the package of measures to help address roadside NO₂ concentrations in Derby, in the Local Roadside NO₂ Plan, a substantial evidence base has been accumulated which allows detailed source apportionment to be carried out both for 2016 and a number of scenarios for 2020.

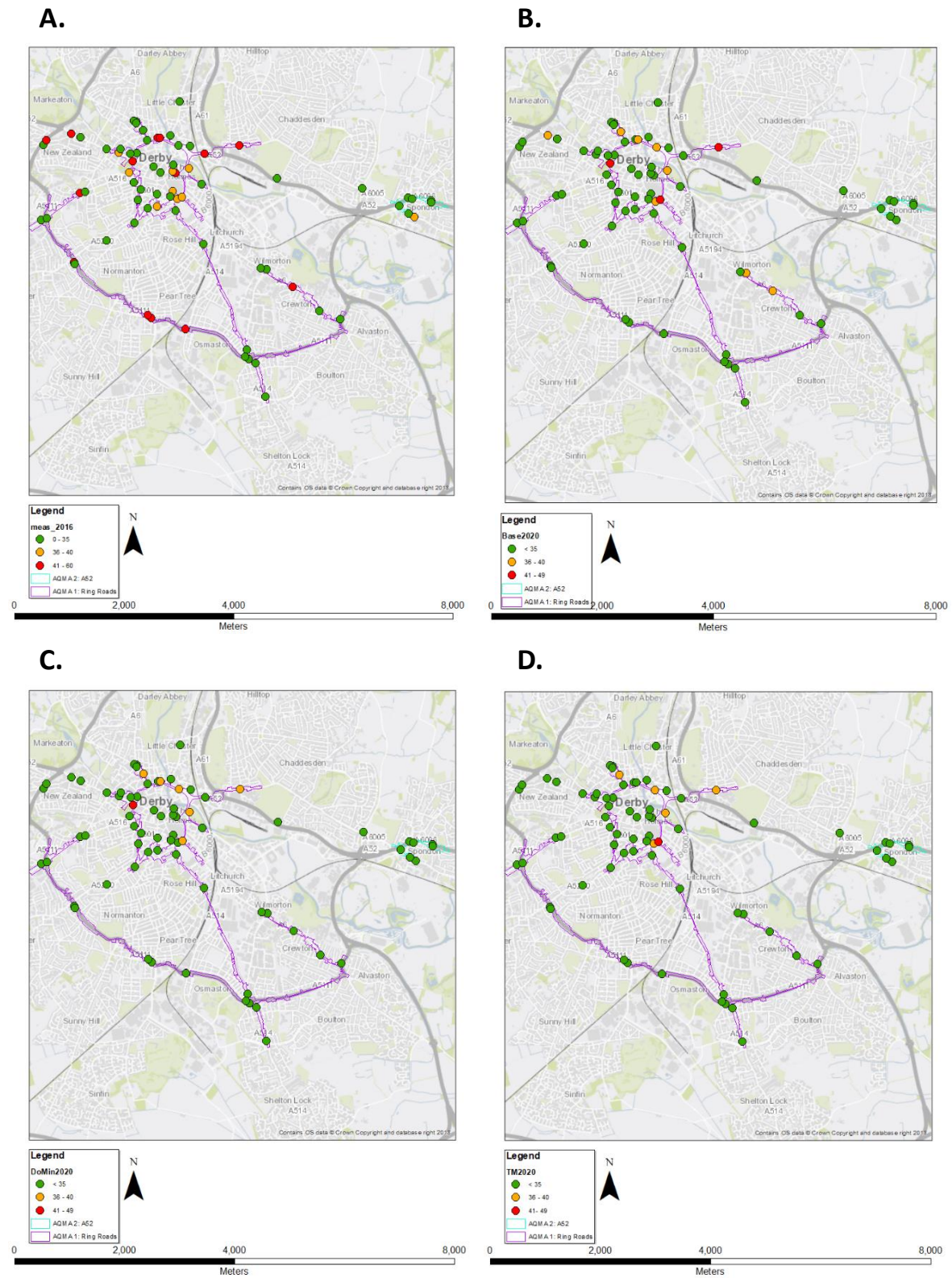
The scenarios included:

- **2016 Base Case** – A standard baseline assessment based on local ANPR data
- **2020 Base Case** – A standard baseline assessment using the transport model results for 2020 and the projected fleet mix for 2020 based on local ANPR data
- **2020 Do Minimum** – Accounts for measures that have already received funding approval but were not in the original baseline assessment (including the Clean Bus Technology Fund)
- **2020 Traffic Management** – The Stafford Street Traffic Management Scheme

Figure 2 shows how NO₂ concentrations changed at diffusion tube locations across Derby under these four scenarios.

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Figure 2: Location of diffusion tubes and nitrogen dioxide concentration ranges for measurements in 2016 (A) and predicted for the 2020 base case (B), the 2020 Do Minimum (C) and the 2020 Traffic Management Scheme Scenarios (D)¹⁵



¹⁵ Concentrations have been converted to integer values

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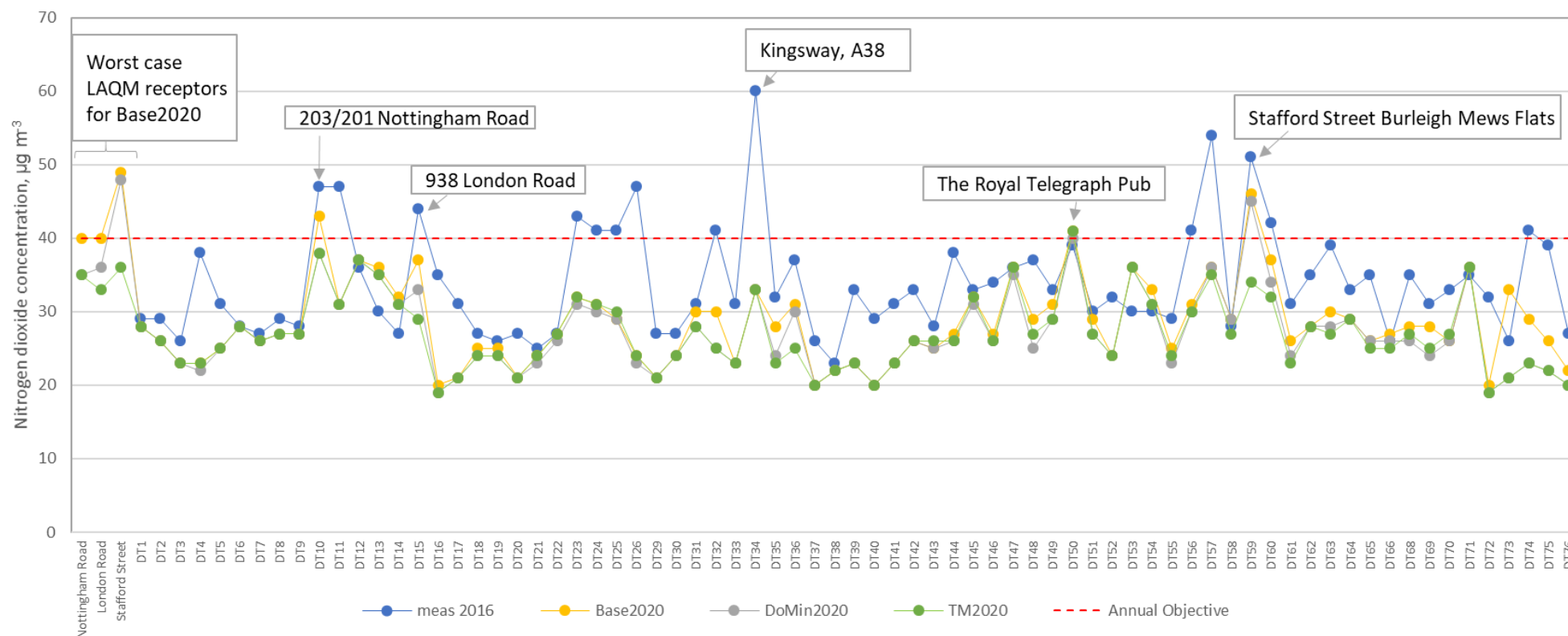
Table 5 and Table 6 show the source apportionment in terms of percentage contribution of the major vehicle types to the total vehicular NO_x emission and amount of NO_x originating from each of these sources (in $\mu\text{g.m}^{-3}$), respectively.

At Nottingham Road the reduction in NO_x emissions from buses would result in a decrease of about $10 \mu\text{g.m}^{-3}$ from the 2016 base case to the 2020 base case. This decrease along with all the other reductions for the 2020 base case are sufficient to achieve compliance of the annual objective concentration by 2020. Implementation of the Clean Bus Technology Fund would significantly decrease the NO_x contribution from buses – to about $2 \mu\text{g.m}^{-3}$. This would result in a NO₂ concentration of $34.9 \mu\text{g.m}^{-3}$. Modelling of the Clean Bus Technology Fund assumes all buses achieve Euro VI compliance, which may be achieved through either retrofitting or replacement of the existing fleet. In practice, changes to the bus fleet will be achieved through a combination of both.

At London Road, the reduction in NO_x emissions from buses would result in a decrease of about $15 \mu\text{g.m}^{-3}$ from 2016 base case to the 2020 base case however the emission from diesel cars is expected to increase by about $4 \mu\text{g.m}^{-3}$. Nevertheless, compliance of the annual objective concentration is expected. Implementation of the Clean Bus Technology Fund would also significantly reduce NO_x emissions. This would result in an NO₂ concentration of $30.6 \mu\text{g.m}^{-3}$.

At Stafford Street, emissions are dominated by diesel cars, followed by light goods vehicles and heavy goods vehicles. In terms of reductions from vehicular types, the TMS is mostly impact emissions from HGVs (rigid).

Figure 3: Nitrogen dioxide concentrations measured in 2016 and predicted for each of the 2020 scenarios at both the worst LAQM receptors and the diffusion tube locations¹⁶



¹⁶ Concentrations have been converted to integer values for comparison with the annual objective

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Table 5: Source apportionment for all road transports in Nottingham Road, London Road and Stafford Street (%) for 2016 and 2020 base case and 2020 Do minimum scenarios

	Receptor	Cars (petrol)	Cars (diesel)	Motorcycle	Bus	HGV (Rigid)	HGV (Artic)	LGV	Taxi (Petrol)	Taxi (diesel)	Hackney cab	Total
2016	Nottingham Road	3.33	31.78	0.00	42.69	3.95	0.65	12.94	0.03	2.23	2.41	100
2020 Base	Nottingham Road	2.95	33.98	0.00	33.26	4.11	0.43	18.70	0.05	2.92	3.59	100
2020 Do Min	Nottingham Road	4.15	47.76	0.00	6.19	5.78	0.61	26.29	0.07	4.10	5.05	100
2020 Traffic Measures	Nottingham Road	4.18	48.07	0.00	6.35	5.71	0.60	25.87	0.07	4.10	5.05	100

	Receptor	Cars (petrol)	Cars (diesel)	Motorcycle	Bus	HGV (Rigid)	HGV (Artic)	LGV	Taxi (Petrol)	Taxi (diesel)	Hackney cab	Total
2016	London Road	1.83	17.65	0.00	67.68	3.25	0.54	6.35	0.01	1.28	1.41	100
2020 Base	London Road	2.88	33.50	0.00	44.21	4.01	0.42	9.37	0.04	2.47	3.10	100
2020 Do Min	London Road	4.68	54.50	0.00	9.25	6.52	0.69	15.25	0.07	4.01	5.04	100
2020 Traffic Measures	London Road	3.61	42.26	0.00	15.91	8.10	0.85	20.41	0.06	3.89	4.91	100

	Receptor	Cars (petrol)	Cars (diesel)	Motorcycle	Bus	HGV (Rigid)	HGV (Artic)	LGV	Taxi (Petrol)	Taxi (diesel)	Hackney cab	Total
2016	Stafford Street	5.38	51.41	0.00	2.68	16.59	2.75	17.02	0.02	2.04	2.11	100
2020 Base	Stafford Street	5.13	57.78	0.00	1.59	11.89	1.27	17.89	0.03	2.05	2.37	100
2020 Do Min	Stafford Street	5.20	58.58	0.00	0.23	12.05	1.29	18.13	0.03	2.08	2.40	100
2020 Traffic Measures	Stafford Street	4.84	54.58	0.00	0.43	12.09	1.29	23.57	0.02	1.47	1.71	100

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Table 6: Source apportionment for all road transports in Nottingham Road, London Road and Stafford Street ($\mu\text{g.m}^{-3}$) for 2016 and 2020 base case and 2020 (NO₂ concentrations were derived from NO_x to NO₂ calculator)

Year	Description	Background	Cars (petrol)	Cars (diesel)	Motorcycle	Bus	HGV (rigid)	HGV (artic)	LGV	Taxi (petrol)	Taxi (diesel)	Hackney cab	Total NO _x	NO ₂
2016	Nottingham Road	31.7	2.0	19.3	0.0	26.0	2.4	0.4	7.9	0.0	1.4	1.5	92.5	48.3
2020 Base	Nottingham Road	26.1	1.3	15.3	0.0	15.0	1.9	0.2	8.4	0.0	1.3	1.6	71.3	39.6
2020 Do Min	Nottingham Road	26.1	1.3	15.3	0.0	2.0	1.9	0.2	8.4	0.0	1.3	1.6	58.1	34.9
2020 Traffic Measures	Nottingham Road	26.1	1.3	15.1	0.0	2.0	1.8	0.2	8.1	0.0	1.3	1.6	57.5	34.6

Year	Description	Background	Cars (petrol)	Cars (diesel)	Motorcycle	Bus	HGV (rigid)	HGV (artic)	LGV	Taxi (petrol)	Taxi (diesel)	Hackney cab	Total NO _x	NO ₂
2016	London Road	43.5	0.8	8.02	0.0	30.7	1.5	0.2	2.9	0.0	0.6	0.6	88.9	46.6
2020 Base	London Road	36.4	1.0	12.1	0.0	16.0	1.5	0.2	3.4	0.0	0.9	1.1	72.6	40.2
2020 Do Min	London Road	36.4	1.1	13.0	0.0	2.2	1.6	0.2	3.6	0.0	1.0	1.2	60.3	36.5
2020 Traffic Measures	London Road	36.4	0.7	7.98	0.0	3.0	1.5	0.2	3.9	0.0	0.7	0.9	55.3	33.1

Year	Description	Background	Cars (petrol)	Cars (diesel)	Motorcycle	Bus	HGV (rigid)	HGV (artic)	LGV	Taxi (petrol)	taxi (diesel)	Hackney cab	Total, NO _x	NO ₂
2016	Stafford Street	30.3	3.8	36.2	0.0	1.9	11.7	1.9	12.0	0.0	1.4	1.5	100.8	53.5
2020 Base	Stafford Street	24.6	3.4	38.1	0.0	1.1	7.8	0.8	11.8	0.0	1.4	1.6	90.6	49.2
2020 Do Min	Stafford Street	24.6	3.2	36.4	0.0	0.1	7.5	0.8	11.3	0.0	1.3	1.5	86.8	48.1
2020 Traffic Measures	Stafford Street	24.6	1.7	19.4	0.0	0.2	4.3	0.5	8.4	0.0	0.5	0.6	60.1	35.6

The results show compliance with the NO₂ Objectives are expected to be achieved at all locations under the 2020 Traffic Management Scheme Scenario. The only exception to this is The Royal Telegraph Pub, which is not considered to be a relevant point of exposure under the TG(19) definitions as there are no long-term receptors at ground level. The NO₂ concentrations at the worst-case locations are compared to the NO₂ concentrations predicted at the diffusion tube locations for each of the 2020 scenarios in Figure 4. The model results indicate that by implementing the Traffic Management Scheme, and bus retrofit programme, Derby would become compliant in all areas by 2020. Full details of the modelling studies completed in support of Derby's Air Quality Plan can be found at the Council website¹⁷. The modelling highlights the need to ensure that the proposed programmes are fully implemented.

Modelling Caveats/Uncertainties

When attempting to interpret modelling results, it is important to understand and appreciate the model's limitations. In the case of air quality modelling, there are many.

Firstly, the AQ model relies heavily on traffic data, which itself has been produced by a model with inherent limitations and uncertainties. In terms of the traffic data used in the above modelling, this was based on data available at a fixed point in time (around December 2018) and therefore it does not take into account changes in circumstances which have taken place since that time.

Most notably, the modelling undertaken in relation to this Plan does not take into account more recent changes to the delivery of the Bus Retrofit Scheme or the impacts of the changes to the Taxi Licensing Strategy. Whilst it considers confirmed or planned development (highlighted under Local Plans) for the time the modelling was completed, there will inevitably have been new development proposed or conversely, that will no longer go ahead, since that time.

In addition, there are a number of factors that can create differences between real-world conditions and the assumptions that have to be made when choosing modelling input data. These include variable meteorological conditions (especially wind speed/direction), assumed vehicle speeds, the predicted uptake of low emission vehicles in the future and the effects of surfaces and buildings on the way pollutants are dispersed, amongst other factors.

¹⁷ <https://www.derby.gov.uk/transport-and-streets/air-quality-in-derby/tackling-poor-air-quality/air-quality-business-case/>

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Consequently, the results of the above modelling should only be seen as a ‘best guess’ or ‘guide’ to the main sources of air pollution within Derby, whilst acknowledging that this is still considered the best available technique for designing air quality improvement measures.

Whilst Derby City Council will continue to update the modelling wherever necessary and possible, the view of the Council is that the strongest focus of resources in this area should be towards the delivery of air quality improvement measures. This is as oppose to repeatedly attempting to update modelling in response to continuously changing circumstances which quickly renders the latest set of modelling out of date.

4.4 Key Priorities

DCC's key priority is to protect its citizens from the harmful impacts of poor air quality and the Council is therefore committed to reducing concentrations of NO₂ to within legal limits and beyond, in all areas of the city where the population is at risk to exposure. Alongside this objective, DCC are also committing to reducing levels of all pollutants in ambient air, with a particular focus on PM_{2.5}.

As discussed in Section 4.3, the primary cause of air pollution in the city is vehicle emissions. A closer look at the vehicle mix tells us that diesel cars, LGVs and buses are responsible for the greatest proportion of emissions along most roads where exceedances of the air quality objective are occurring. However, DCC have already made significant progress in developing measures to tackle these sources through the Local Roadside NO₂ Plan, emission reduction measures and significant sustainable transport programme. This work indicates that those measures being put forward under the Roadside NO₂ compliance feasibility study, including the bus retrofit programme and the proposed traffic management scheme around Stafford street, should achieve compliance by the end of 2020.

Despite it being expected that compliance will be achieved, it is imperative DCC maintain momentum in addressing air pollution in the city. The AQAP should therefore both support the success of the Local Roadside NO₂ Compliance Plan and ensure continued progress in reducing emissions beyond the recognised standards. As such the key priorities for the AQAP are:

Priority 1: Tackling NO₂ hotspots

The measures under Priority 1 have been designed to address specific areas of NO₂ exceedance across Derby. These have been developed through the Local Roadside NO₂ Compliance Plan and include provisions to retrofit the city's bus fleet to achieve Euro VI emission standards, and the introduction of traffic management changes to reduce traffic flows and congestion along Stafford Street. According to the modelling, these interventions are expected to result in compliance with the long-term NO₂ objective being achieved in all areas of relevant exposure in Derby in the shortest possible time.

Priority 2: Improving the overall air quality across Derby

DCC recognise that the AQAP needs to both introduce measures that reduce pollution levels in specific areas to ensure national objectives are met and provide a broader strategy which aims to achieve continued improvement in air quality beyond the objectives. Priority 2 will introduce a broader range of measures designed to achieve emission reductions across the city, which both supplement the measures under Priority 1 and widen the coverage of the air quality benefits.

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Priority 3: Managing PM_{2.5} exposure

Recent scientific research has shown that prolonged exposure to particulate matter smaller than 2.5 µm in diameter can lead to cardiopulmonary related diseases. The World Health Organisation (WHO) has recommended that national governments work towards achieving concentrations of 10 µg.m⁻³ for PM_{2.5} in ambient air. The UK government has stated in its recent Clean Air Strategy that it intends to “*examine what action will be needed to meet this limit*” and halve the number of UK residents currently exposed to levels above this threshold by 2025.

DCC have made it a priority to be proactive in its role to protect its citizens from the effects of poor air quality and recognises the long-term cost-benefits of taking action now. DCC are therefore looking at future steps that can reduce levels of PM_{2.5} and will consider revising both the cities wood burning and urban planning policy to reduce the contribution of major PM_{2.5} pollutant sources.

4.5 Overview of Measure Priorities and Key Themes

The following section provides further detail on the measures under each of the three priority areas. Under each measure, information is provided on the nature of the actions to be implemented, progress to date, the expected impact on air quality, the roles and responsibilities of key actors and likely timescales.

Priority 1: Tackling NO₂ Hotspots

Some areas of Derby have experienced NO₂ concentrations in exceedance of the long-term national air quality objective for several years. In response to these exceedances, DCC declared two AQMAs in 2001 which highlight those areas identified as being in exceedance of the objective – details of which are provided in Table 7.

Table 7: Derby Air Quality Management Areas

AQMA	Description	Date Declared
Derby NO₂ AQMA No.1 Ring Roads	An AQMA encompassing the Inner and Outer Ring-Roads in the city, as well as some sections of radial roads and the entire length of Osmaston Road.	01/08/2001
Derby NO₂ AQMA No.2 A52	Sections of the A52, Derby Road and Nottingham Road in Spondon.	01/08/2001

Since declaration of the AQMAs, DCC have implemented a range of measures aimed at reducing NO₂ concentrations in areas of exceedance, under the Local Air Quality Management (LAQM) programme, and described in the Air Quality Action Plan.

DCC have also been subject to ministerial directions to address areas identified as exceeding the long-term NO₂ objective, in the shortest time possible. This follows the publication of the Government's "*UK plan for tackling roadside Nitrogen Dioxide concentrations*"¹⁸ in 2016. This falls outside of the requirements of LAQM, and has led to the development of the Local Roadside NO₂ Plan. However, the measures put forward in the Local Roadside NO₂ Plan are applicable to the Air Quality Action Plan, and as described in Section 4.3, are predicted to result in compliance with the long-term NO₂ objective being achieved, provided all of the measures are brought forward. Therefore, the measures under Priority 1 reflect those developed under the Local Roadside NO₂ Plan.

The implementation of a new traffic management scheme (TMS) in the area around Stafford Street, which was found to be exceeding the long-term NO₂ objective, was identified as the preferred option under the Local Roadside NO₂ Plan. It has been proposed that this measure

¹⁸ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/633269/air-quality-plan-overview.pdf

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will involve changes to the traffic control system, using a network wide urban traffic management control system (UTMC), and junction adjustments, to significantly limit traffic flows on Stafford Street.

The intention is to combine the TMS with improvements to Derby's bus fleet. During 2018, DCC undertook a review of possible measures to include in a future low emission strategy. An outcome of the review has been the desire to develop a new bus quality partnership with local operators that aims to improve service levels. DCC have already secured funding to support local bus operators to retrofit the existing bus fleet to Euro VI standards, operating on the core service routes. The retrofits are due to be undertaken by Derby's primary service provider; Arriva, which already has 19 new Euro VI compliant buses in service, and have planned to retrofit 55 of the remaining fleet from August 2019.

Unfortunately however, DCC has become aware that the full implementation of the Clean Bus Technology Fund is now not likely to be taken forward by local bus providers and therefore DCC will continue to work with those providers to ensure that bus emissions can be improved as a matter of urgency, through a fleet renewal programme. In addition, one of the providers that previously applied for funding (*Yourbus*), is no longer in operation.

The effects on ambient air quality of introducing a TMS and a bus retrofit programme were assessed under the Local Roadside NO₂ Plan, and compared with a 'Business-as-Usual' (BAU) or 'Do nothing' scenario, a benchmark chargeable access restriction and a reference case reflecting the completion of the A38 highway (expected in 2025).

The results of the study found that overall, ambient NO₂ concentrations were expected to fall under all scenarios, including the BAU. The TMS, bus retrofit programme and chargeable access restrictions were all predicted to result in further reductions in ambient NO₂ concentrations, with a combination of the TMS and bus retrofit programme being identified as the preferred option. The forecast reductions in long-term NO₂ concentrations under the BAU and preferred options are provided in Table 6 (see DCC website for further information on the analysis conducted in support of the Local Roadside NO₂ Plan¹⁹).

A Full Business Case was submitted in support of the Local Roadside NO₂ Plan in March 2019. The preferred option TMS Scheme received approval from Defra in May 2019 and these changes will therefore now be commissioned by DCC (subject to agreement on funding), with the aim of bringing forward compliance by 2020.

¹⁹

[https://www.derby.gov.uk/media/derbycitycouncil/contentassets/images/transport/airquality/CleanAirConsultationDocument%20FINAL%20\(web%20version\).pdf](https://www.derby.gov.uk/media/derbycitycouncil/contentassets/images/transport/airquality/CleanAirConsultationDocument%20FINAL%20(web%20version).pdf)

Priority 2: Improving the overall air quality across Derby

The results of the air quality assessments of the measures described under Priority 1 indicate the interventions put forward under the Local Roadside NO₂ Plan would be expected to result in the city's NO₂ hotspots (i.e. those areas found to exceed the long-term objective) falling within compliance. As a result, there should no longer be areas in exceedance, and thus air quality is expected to comply with the requirements of the 2008 Ambient Air Quality Directive (2008/50/EC). However, DCC is committed to continuous improvement in air quality across the city to beyond the standards and to ensure compliance is maintained as the city develops, notwithstanding any deviations from the modelled results which could occur in practice as a result of modelling uncertainty and other confounding factors (e.g. variable meteorological conditions, variations in background concentrations or unexpected pollution events). In order to achieve this continuous improvement, the Council must support and encourage the implementation of a wider range of measures to address pollutant emissions over and above those highlighted under Priority 1.

Priority 2 covers the measures that the Council will either implement, support or look to investigate further in order to achieve continued improvement in air quality.

Support for Low Emission Taxis

On a typical day, 10,000 taxi and private hire trips are estimated to be carried out across the city of Derby. DCC recognise that taxi and private hire services offer a vital service to our private and commercial residents and needs to be supported to maximise the opportunities to improve the quality of life in the city throughout the city.

In 2018, DCC published a Draft Low Emissions Strategy (LES), which stated *“measures directly involving the city's taxi fleet have the potential to significantly reduce emissions and have a high air quality impact based on the combination of the aging current taxi fleet and the high number of local miles covered by taxis.”* The Draft LES proposed the implementation of a Low Emission Taxi Programme, involving:

- Raising awareness regarding the cost and emission benefits of low emission / electric taxis;
- Dedicated taxi charge points;
- Recognition scheme for clean taxis;
- Procurement of low emission taxi services to raise emissions standards; and
- Support for taxi industry to transfer to low emission alternatives.

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In 2019, DCC published a Taxi and Private Hire Vehicle Strategy 2020 consultation paper (2019). The Strategy proposed the introduction of more stringent requirements for the emissions performance of the vehicles, including:

- All licensed vehicles to be zero emissions by 2030;
- 25% of the fleet to be ULEV by 2020 and 50% by 2025;
- 25% of the private hire fleet to be ULEV by 2020 and 50% by 2025; and
- No issuing of licenses for petrol/diesel vehicles older than 5 years that do not meet Euro VI.

The Strategy also included several actions that would support emissions reductions in the city, subject to appropriate funding, including:

- The introduction of low emission priority ranks and ULEV-only ranks in the city centre.
- Working with the trade to facilitate the early uptake of low emission vehicles (e.g. lease options, try before you buy, promotion of grant opportunities etc.).
- Consideration of eco driving course at point of licencing.
- Consideration for reduced license fees for ULEV for limited time.
- An investigation into opportunities to develop Taxi ULEV leasing following a 'try before you buy' scheme.
- Reducing maximum age of licensed vehicles to 10 years for petrol/diesel and 12 years for ULEV (10 years for ULEV from 2025).

Following a meeting of the Council's Licensing Committee on 22nd August 2019, the Taxi Strategy was approved in principle, but with some notable changes to the dates of implementation. Importantly, the compliance dates for the new emissions requirements and minimum age policy were put back.

DCC is now reviewing other ways in which the Taxi emission improvements can be brought forward more quickly than the agreed Taxi Strategy will now require.

Electric vehicle strategy

DCC aim to facilitate the uptake of electric vehicles in various fleets across the city, both to support efforts to reduce emissions and to contribute towards the Government's Road-to-Zero Strategy²⁰, which aims to achieve at least half of new cars being ultra-low emission by 2030.

²⁰ <https://www.gov.uk/government/news/government-launches-road-to-zero-strategy-to-lead-the-world-in-zero-emission-vehicle-technology>

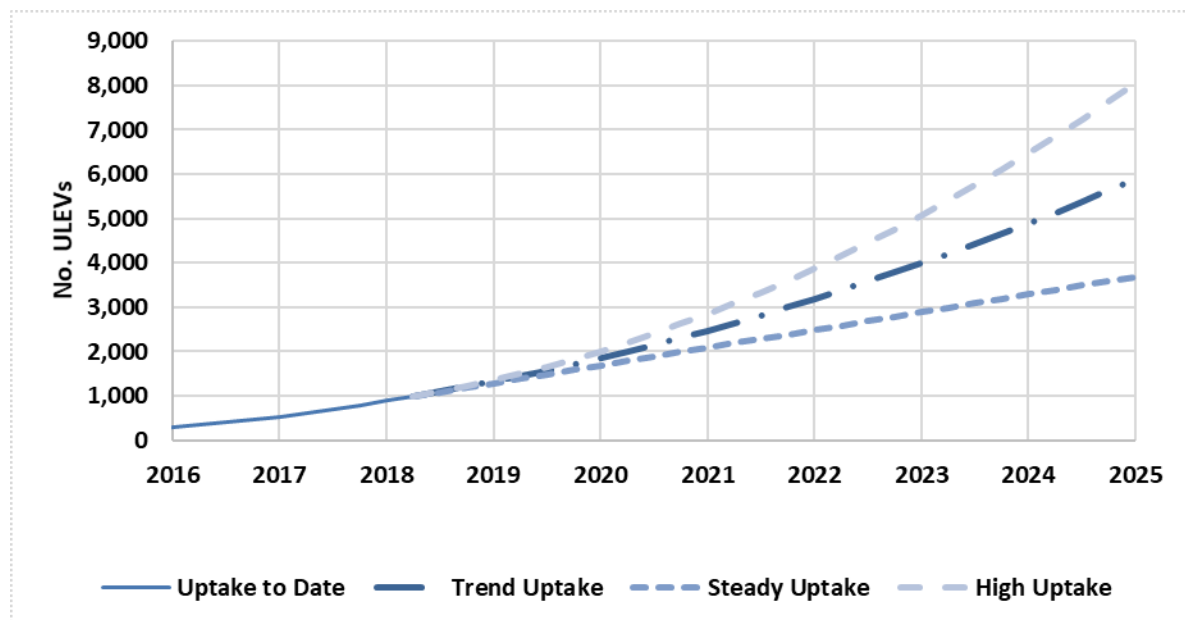
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DCC recently commissioned a review designed to assist with the development of electric vehicle charging infrastructure in the city²¹. The study was divided into two distinct tasks: the development of an EV public charging infrastructure strategy for Derby up to 2025; and the development of a charging infrastructure strategy to support hackney taxi trade in Derby transitioning to electric taxis.

The strategy suggested:

- Despite the relatively high per capita uptake of EVs in Derby to date, the provision of public charging infrastructure in Derby is very limited.
- In January 2019, there were just 18 publicly available charging sockets in Derby, equating to one charging socket for every 59 EVs. This is far below the UK average of one charging socket for every 9.6 EVs.
- For Derby to achieve EV uptake in-line with the 'Road to Zero' targets, penetration of ULEVs needs to follow the higher part of the range presented below, corresponding to the Strategy's "high uptake" penetration scenario (corresponding to 16.8% of all vehicle sales in 2025).

Figure 4: Scenarios for the uptake of ULEVs in Derby



The review recommends installing lamp post charge points as a priority, as they are the most easily-implemented and usually the cheapest solution currently available on the market, and estimates 220 on-street residential charge points would be required to meet the 'Target'

²¹

<https://www.derby.gov.uk/media/derbycitycouncil/contentassets/documents/transport/airqualityplan/finalbusinesscase/Derby%20EV%20CAF%20%20Report%20March%202019.pdf>

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scenario. The report recommends potential locations for the installation of public charging infrastructure, as illustrated in Figure 5, and charging points to support the taxi fleet, as illustrated in Figure 6. At the time of writing the review, DCC had funding for 13 of the 20 sites identified to support the taxi fleet.

Figure 5: Recommended public charging locations in Derby

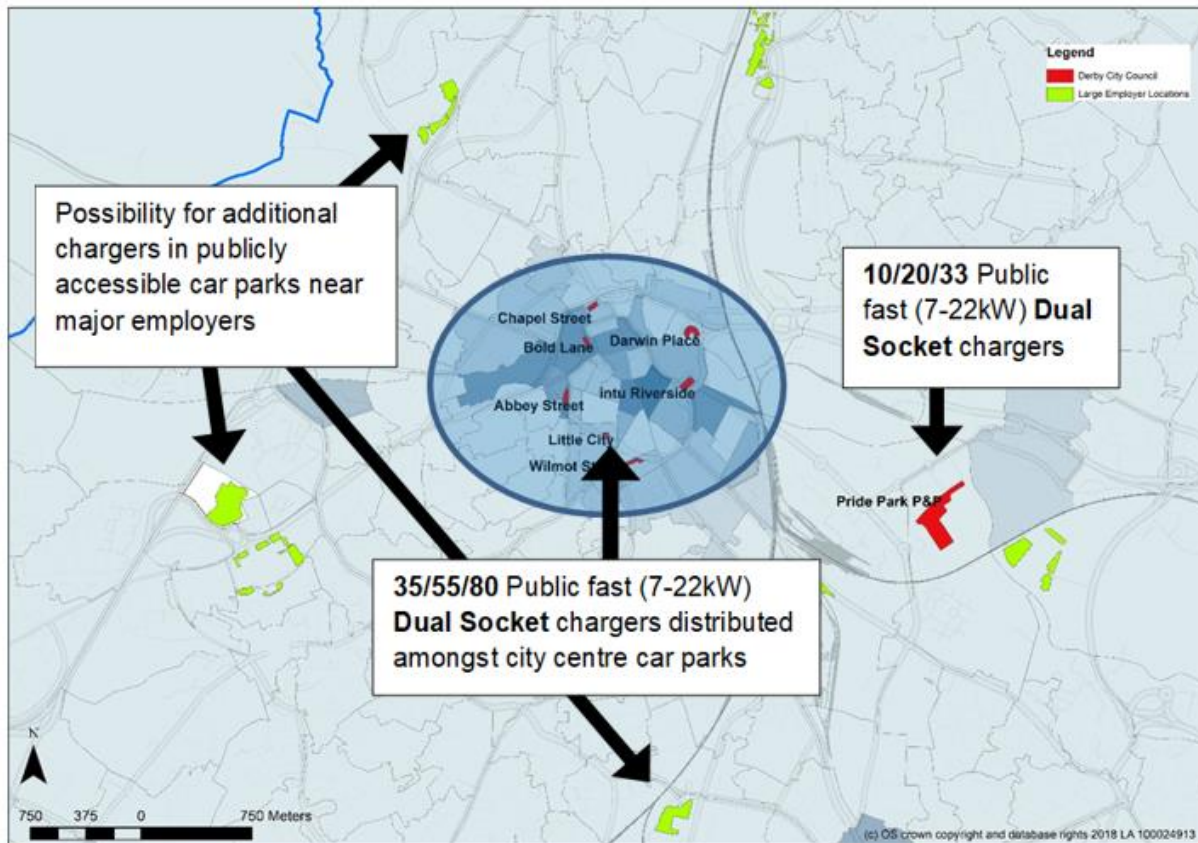
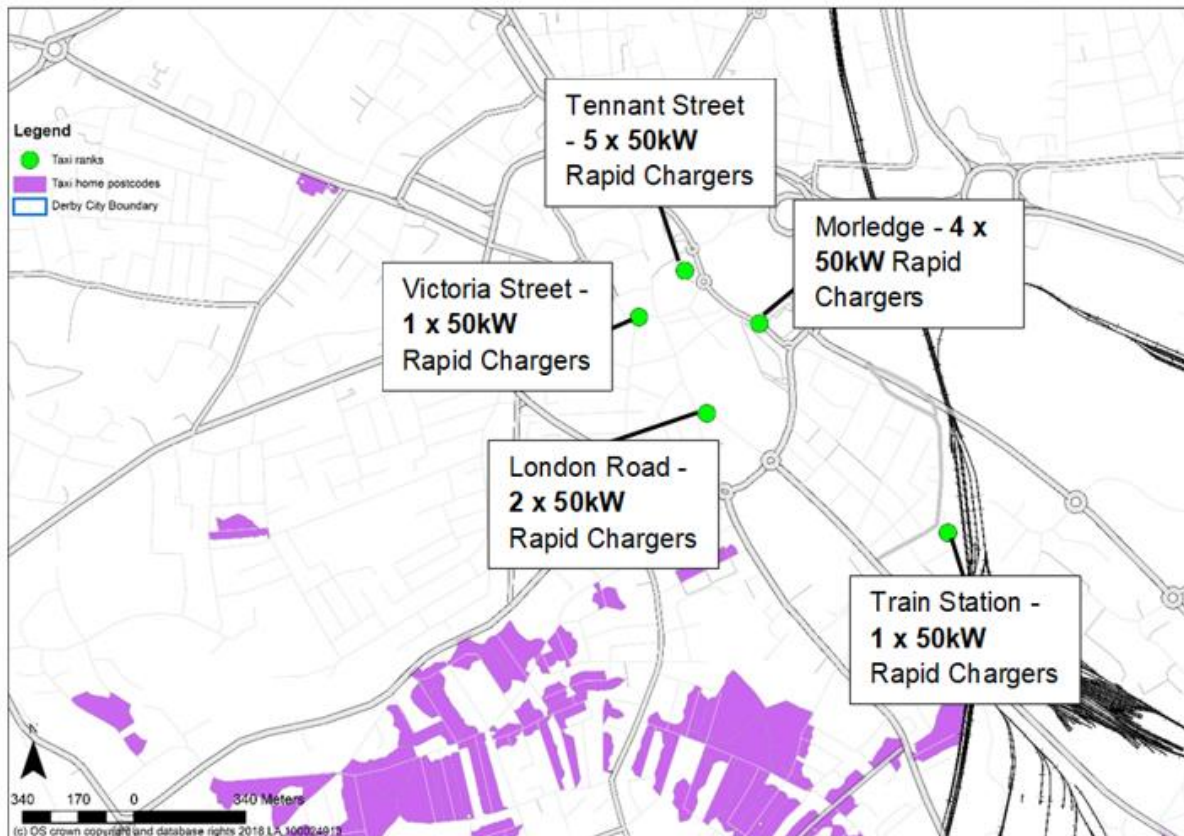


Figure 6: Recommended taxi charging locations in Derby



The report included an assessment of the change in total emissions resulting from the implementation of the recommended changes in charging infrastructure. The results indicate that if an EV charging infrastructure strategy can achieve an increase of 7,141 electric vehicles in Derby (not including vehicles already deployed in Derby), over a seven-year period, the scheme has the potential to result in the cumulative reduction in NO_x, PM₁₀ and PM_{2.5} emissions of up to 21.2, 2.8 and 1.6 tonnes, respectively. An economic assessment of the scheme indicated the recommended charging infrastructure changes would represent a positive monetary value of approximately £7m over a 10-year period; but also result in negative impacts due to the costs of implementation coupled with ongoing maintenance costs. Overall, the results indicate the EV charging infrastructure strategy could result in a positive Net Present Value (NPV) (i.e. the benefits for carbon emissions and air quality are predicted to outweigh the costs of implementing the scheme).

DCC have already been successful in a joint bid for funding with Nottingham City Council from the Office of Low Emission Vehicles (OLEV). Currently this money has funded the installation of 37 EV charging points in a number of city centre car parks. There is also funding available for promotion and business engagement activities, with events already held in relation to low emission vehicle promotion in conjunction with LEVEL (the Low Emission Vehicle Enterprise and Learning network) and CleanTech Business Ltd. Recent events

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include the ULEV Innovations conference and the Derby Ride & Drive Electric Vehicle Showcase.

Following the unsuccessful bid under the Clean Air Fund, DCC are currently reviewing further ways in which an Electric Vehicle Strategy can be more proactively developed.

In addition, DCC are currently undertaking a review of potential EV charging requirements through the Development Control (planning) regime and propose to develop a specific planning policy on EV charging. This is in conjunction with current proposals put forward by central government to amend the Building Regulations so that EV charging infrastructure becomes a regulatory requirement in some new (and significantly changed) buildings, in particular for new residential dwellings.

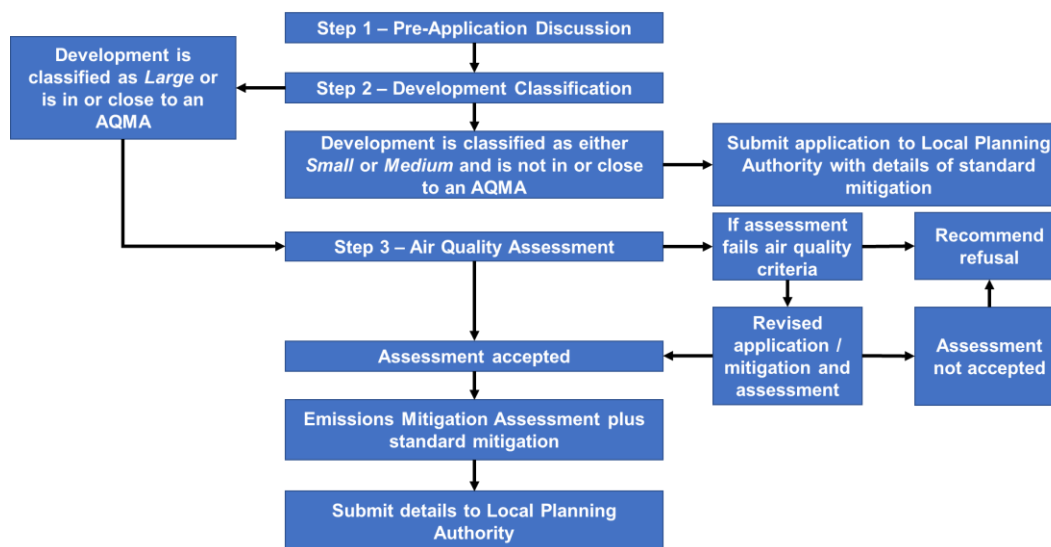
Supporting sustainable development

DCC is a member of the East Midlands Air Quality Network (EMAQN), which comprises professionals from environmental health, public health, planning and transport and aims to improve air quality across the East Midlands by sharing knowledge and best practice. The group is co-chaired by Public Health England and Kettering Borough Council.

EMAQN have developed some outline Guidance for Developers on how to mitigate against air quality impacts, which DCC is now working to include within its own local planning policy. The Guidance has been produced to provide a consistent approach to air quality in the planning regime across the East Midlands, by presenting clear information on how planning applications are evaluated in terms of air quality. The Guidance sets out a stepped approach which allows developers to identify which developments will require an air quality assessment, the method for determining the significance of any impacts and what mitigation would be required to make the development acceptable. Whilst not yet finalised, Figure 7 below gives a possible outline of the recommended air quality assessment process that could be included in such a policy:

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Figure 7: Representative Air Quality Assessment Process



Once implemented, this Guidance will offer improved transparency to developers operating in Derby, and ensure a level playing field in terms of investment in air quality mitigation. The mitigation measures will be tailored to the scale and potential impacts on air quality associated with the development under consideration. Mitigation measures are expected to be categorised as being Type 1 (all developments), Type 2 (Medium and Large developments) and Type 3 (Large developments only). The likely measures under each category are summarised in the following table.

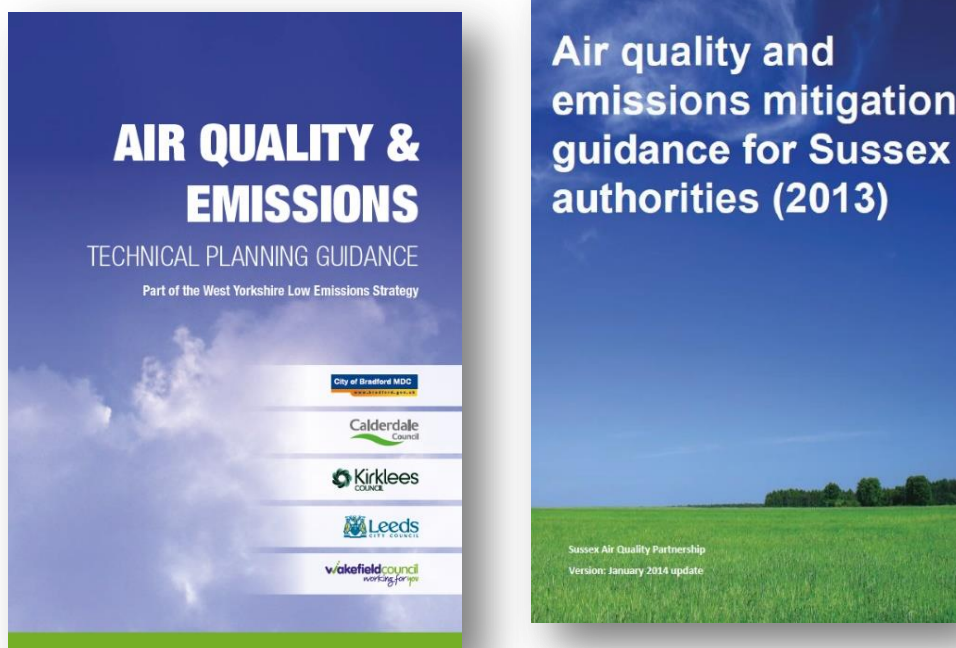
Table 8: Draft Developer Guidance mitigation requirements

Type 1	<ul style="list-style-type: none"> The adoption of an agreed protocol to control emissions from construction sites. Provision of Electric Vehicle Recharging. All gas-fired boilers to meet a minimum standard of 40mgNO_x/kWh or consideration of alternative heat sources.
Type 2	<ul style="list-style-type: none"> Practicable mitigation measures supported by the National Planning Policy Framework. Active travel (cycling/walking) infrastructure including, but not limited to: developing cycle routes or pedestrianised areas and infrastructure to support low emission modes of transport; improved facilities to encourage cycling or other non-motorised travel (shower facilities, secure cycle storage etc); and signage.
Type 3	<ul style="list-style-type: none"> Additional measures that may be required by either planning condition or Planning Obligation by a Section 106 Agreement to make the site acceptable, using reasonable endeavours.

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The Developer Guidance, once published, would ensure Derby follows examples of best practice set by other similar supplementary planning documents, including in West Yorkshire and Sussex, as illustrated in Figure 8.

Figure 8: Examples of air quality & emissions mitigation guidance



Freight

The source apportionment data presented in Section 4.3 shows that freight vehicles, including HGVs and LGVs, contribute approximately 25% of NO_x emissions on some road links in Derby. This highlights the need to implement measures which address emissions from freight vehicles.

DCC will pursue the implementation a fleet recognition scheme, such as ECO Stars²², to support the local heavy-duty fleet community to reduce emissions where possible. Such a scheme will help to build trust, recognise existing good practice and potentially help businesses save money.

DCC will also explore potential sites with the aim of developing a freight consolidation scheme. Potential sites include Junction 24 of the M1 or a more local peripheral site. This will provide businesses with the opportunity to combine the movement of goods to a smaller number of vehicles. This provides a greater opportunity of using freight vehicles within the City, that meet the latest emission standards.

²² <https://www.ecostars-uk.com/>

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The potential for improving the freight fleet was assessed in the 2018 LES study, which factored changes in freight into the assessment of Low Emission Corridors, which formed part of the Draft Low Emission Strategy. The measures associated with Low Emission Corridors were combined and assessed as a group of actions along the A61, A6 / A5194, A516 and A52. The assumed changes along these links included a 5% increase in bus speed, with all buses achieving Euro VI; a 3% reduction in car congestion; 3% of LGV assumed to be EV, with the oldest vehicles being replaced first; and a 5% reduction in total freight. The results indicated these changes could achieve a reduction in annual emissions of NO₂ by 2020 of 30.78 t/year for LGVs and 16.70 t/year for HGVs.

Modal Shift to Low Emission Transport Options

The transition from older, more polluting vehicles, to low emission alternatives is a key focus for improving air quality in Derby. DCC have successfully supported several measures in this area, including:

- DCC workplace sustainable travel campaign, including car sharing, cycle to work, smarter working and workplace travel planning.
- Derbyshire Cycle Plan, including infrastructure connectivity and communication campaigns to promote participation and reduced inequalities.
- School based sustainable travel solutions, including walk to school campaigns, temporary road closures outside schools, no parking zones and educational activities.

The Connected communication portal²³ has been a critical element of DCC's efforts to encourage smarter travel choices. Connected aims to raise awareness about sustainable travel and inspire Derby residents to consider options for cycling, public transport, walking and improved planning for journeys. Under the Roadside NO₂ Plan, DEFRA have now confirmed funding of around £450,000, set aside for measures designed to assist implementation of the Plan, with a particular focus on the design and production of material/events to promote active/sustainable travel.

The introduction of electric bikes in Derby²⁴ also saw positive results, with the scheme passing 100,000 miles travelled. Whilst the scheme was unfortunately discontinued due to unsustainable levels of vandalism in July 2019, DCC are still investing time researching ways of bringing a similar scheme back into operation.

²³ <https://www.derbyconnected.com/>

²⁴ <https://www.ebikesderby.com/>

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The 2018 Draft LES included an assessment of the impact of investing in communication campaigns to support improvements in air quality. The assessment assumed investment in the marketing of low emission transport options would result in a reduction in car vehicle kilometres²⁵. The assumption was applied to a bid submitted by DCC for air quality measures funding, of which £133,250 had been earmarked for improvements in online marketing, including links with the Connected Brand, and efforts to encourage active travel through training and cycle infrastructure provision. The assessment indicated this level of investment could achieve a fall in vehicle kilometers of 3.3 million per year, which would represent a reduction in annual emissions of NO₂ by 2020 of 1.03 t/year.

DCC have also secured more than £8million jointly with Nottingham under the *Transforming Cities Programme*. This programme has the aim of improving connectivity between centres of population and employment and focusses on three key themes: Mass transport, public transport innovation and expansion of walking and cycling. This includes bus priority at five key junctions along the A52 and a new cycling route between Derby and Nottingham along the former Spondon Canal.

DCC will continue to support the latest methods of encouraging modal shift to low emission travel. An example of which is Mobility-as-a-Service (MaaS), which is a system that enables users to access, pay for, and get real-time information on a range of public and private sustainable transport options.

DCC recently included this as a component of a bid for air quality funding, titled the Clean Air Mobility Scheme (CAMS) and although this bid was unsuccessful, a further bid has been made for development of MaaS data under the *Future Mobility Zones* Grant.

The originally proposed scheme proposed under the CAF fund would have offered financial support to local residents in the form of mobility credits, to be exchanged for access to public transport and other mobility services. The scheme would have been operated in two phases:

- **Phase 1** – Involving an initial incentive, offered in certain Derby wards. The value of the incentive would be roughly equivalent to the cost of an annual season ticket under the Derby PlusBus scheme.
- **Phase 2** – Involving the provision of a larger incentive to those residents who accepted the initial incentive under Phase 1. The incentive would only be provided on the basis residents were willing to voluntarily scrap their current vehicle, if it were found to be a heavy polluter. The incentives under Phase 2 would be used to access

²⁵ <http://www.toolsofchange.com/en/case-studies/detail/644/>

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public transport, car clubs and any existing bike-share schemes, as well as being put towards the purchase of bicycles and national rail cards.

An economic and emissions assessment of CAMS was completed in support of the Draft LES. The assessment assumed the scheme would initially be targeted at residents most likely to be affected by the proposed traffic management scheme to address the modelled NO₂ exceedance on Stafford Street, and that it achieves an uptake of 50% under Phase 1 and 20% under Phase 2. Under these assumptions, the assessment found CAMS has the potential to result in a reduction in NO_x and PM₁₀ emissions of up to 8.83 and 0.86 t/y under Phase 1 and 2.2 and 0.21 t/y under Phase 2. The economic assessment of this scenario indicates CAMS would result in a positive Net Present Value under Phase 1 and a negative Net Present Value under Phase 2 (i.e. the costs of implementing the scheme would be less than the relative financial benefits under Phase 1 and more than the relative financial benefits under Phase 2).

DCC will continue to try and source appropriate funding to deliver an advanced MaaS scheme in the city, with the aim of creating opportunities to support residents and businesses in moving away from personal vehicle use and towards sustainable forms of transport, as this will contribute to emissions reductions across the city.

Anti-Idling

Local Authorities have powers under The Road Traffic (Vehicle Emission) (Fixed Penalty) (England) Regulations 2001 to issue Fixed Penalty Notices (FPN) to drivers who allow their vehicle engines to run unnecessarily while the vehicle is parked. Currently, Derby City Council do not carry out enforcement under this legislation.

Derby City Council are aware of concerns with unnecessary idling across the city, and regularly receive complaints reporting issues, especially in relation to roads outside schools during school drop-off and pick-up times, at taxi ranks and in relation to buses.

As part of this Action Plan, Derby City Council will look into the necessary steps and resources needed to begin anti-idling enforcement in priority locations across the city.

Priority 3: Managing PM_{2.5} exposure

The recently published Clean Air Strategy²⁶ places a large emphasis on the issue of uncontrolled burning of wood and coal, and the resultant particulate emissions. The Strategy highlights the Government's aim to bring levels of fine particulate matter in the UK below the

²⁶ <https://www.gov.uk/government/publications/clean-air-strategy-2019>

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levels recommended by the World Health Organisation by 2030. In support of this, it intends to ban the sale of most polluting fuels by 2022 and will shortly be releasing an updated plan for the sale of wet wood and coal.

The Strategy also indicates Local Authorities will be given additional powers to enforce smoke control areas – but is yet to confirm what these will be.

DCC continue to regulate emissions from small combustion sources and the whole of Derby remains a smoke control area. DCC are currently increasing the number of Public Protection Officers and will consider the expansion of the remit of the team to include smoke enforcement.

The Council will also consider and consult on the development of an up to date Bonfire Policy, with the aim of setting enhanced restrictions on open burning, supported through a communication and engagement campaign.

4.6 List of all AQAP Measures

The three priority areas for air quality improvement are illustrated by the following figure. This illustrates how Priority 1 requires immediate attention to ensure areas of exceedance are addressed in the shortest time possible, and Priority 2 and 3 will provide wider benefits over a longer timeframe.

Figure 9: Priority areas for air quality improvement

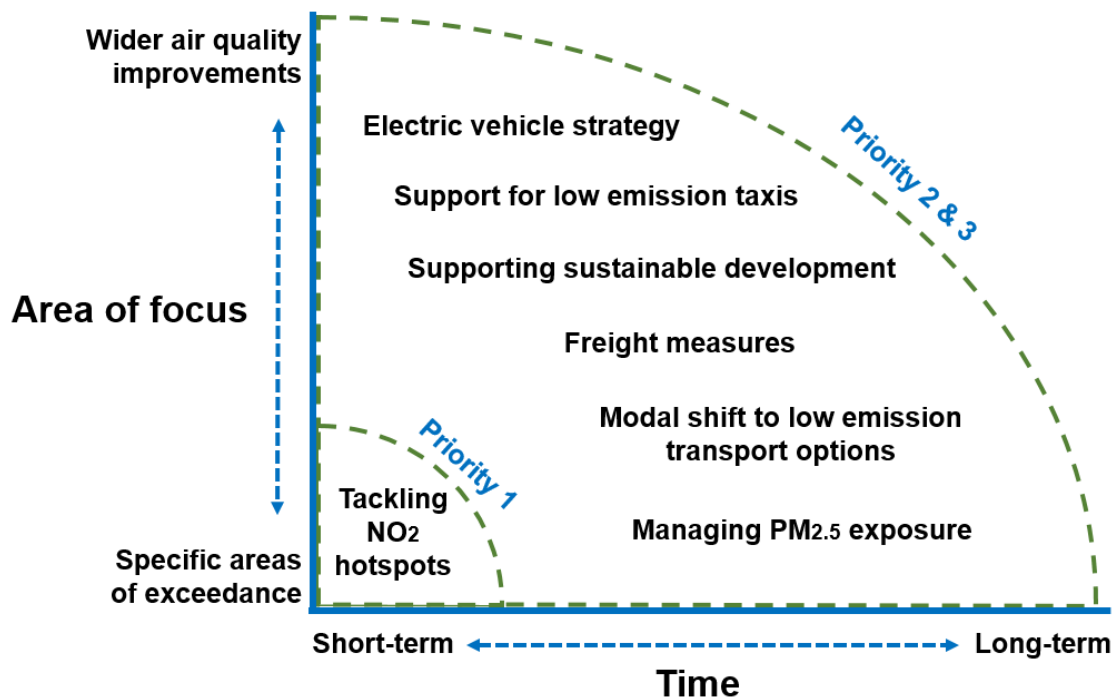


Table 9 provides a definitive list of all the actions that form part of this AQAP. For transparency the list includes:

- The responsible individual and departments/organisations who will deliver this action;
- Estimated cost of implementing each action (overall cost and cost to the local authority);
- Expected benefit in terms of pollutant emission and/or concentration reduction;
- The timescale for implementation; and
- How progress will be monitored.

The list includes measures which fall under the three priority areas discussed above.

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Table 9: Full List of Current and Planned Air Quality Action Plan Measures

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	Local Cycling and Walking Infrastructure Plan (LCWIP)	Transport Planning and Infrastructure	Cycle network	D2N2 Funding	Complete	Ongoing	Completion of Plan	Reduced vehicle emissions from mode shift.	Near completion	Due to be complete by November 2019	N/A
2	Updated Council Staff and Fleet Travel Plans and updated Cleaner Fleet Policy.	Promoting Travel Alternatives	Workplace Travel Planning	LA - existing budget	Ongoing	TBC	# of low emission vehicles in Council grey fleet and # business mode shift journeys	Reduced vehicle emissions	Development Phase initiated in June 2019 and Cleaner Fleet Strategy now approved by Cabinet.	TBC	Employee contractual issues and Trade Union agreement. Cost analysis for fleet.
3	Cleaner Taxis Project	Promoting Low Emission Transport	Taxi Licensing conditions	LA using CAZ Early Measures and AQ Grant Funding	Ongoing	TBC	# of taxis meeting minimum NOx emissions standards	Reduced vehicle emissions	Taxi Licensing Strategy approved, but with later implementation date. Taxi fleet emission study complete. Investment in Taxi E-Hubs and EV Taxi-only stands	TBC. Electric Taxis Project no longer possible following failure to secure funding under CAF	First phase successful, however further funding refused under Clean Air Fund bid. Taxi Strategy now less supportive of urgent change.
4	Travel Behaviour Change Programme	Promoting Travel Alternatives	Other	LA and Partners through Access Fund	Complete	Ongoing	AF data analysis	Reduced vehicle emissions	Implementation ongoing	31st March 2020	N/A

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5	EV Charging Infrastructure	Promoting Low Emission Transport	Procuring alternative refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	LA and OLEV (Go Ultra Low Cities) Funded	Ongoing	Summer 2019	# New EV Charge Points	Reduced vehicle emissions	Planning ongoing and funding sources to be identified. Also investigating private sector engagement, especially at key destination. Development of EV Charging Planning Policy.	TBC	Council resource pressures (government funding is capital only – no revenue). Concerns over future costs of maintaining publicly owned EV infrastructure.
6	Bus Retrofit Programme (CBTF)	Vehicle Fleet Efficiency	Vehicle Retrofitting programmes	To be delivered by local private bus operators using CBTF Funding with LA support	Ongoing	Imminent	# completed retrofitted buses	Reduced bus emissions	Funding now not being taken forward by all operators. Current position is retrofit of 55 buses by one operator.	end of 2019/20	Main barrier has been that the Council can only play a supporting role with private bus operators (no publicly owned buses in Derby) and the inherent variety of bus operator business plans, with some preferring vehicle replacement programmes over retrofitting, which will take longer to implement.
7	Council HGV Retrofit Programme	Vehicle Fleet Efficiency	Vehicle Retrofitting programmes	DEFRA AQ Grant	Complete	Cancelled	N/A	N/A	Project Cancelled	N/A	Project cancelled due to lack of retrofit technology accreditation

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											and perceived unworkable additional maintenance costs.
8	Anti-idling Enforcement	Traffic Management	Anti-idling enforcement	LA Enforcement	Initiated in June 2019	Summer 2019	New expanded PPO enforcement service operational, then # of Notices Served	Reduced vehicle emissions	Being considered as part of new Public Protection Officer Service. Publicity campaign required.	PPO service now expanded.	Question over remit of PPO Service and whether this can include anti-idling enforcement. Relevant powers of authority require approval.
9	Area and Regional Co-ordination of AQ Measures through AQWG and EMAQN	Other	Other	Using existing funding to work with Derbyshire and other East Midlands Authorities	Complete	Ongoing	AQWG Work Plan Implementation and annual reporting to Health Protection Board and Health and Well-being Boards	Wide range of measures proposed under Work Plan	Operational since 2016	Ongoing	Continued officer resource allocation possible barrier
10	AQ and Planning	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	LA resourced	ongoing	ongoing	Completion of Local Plan AQ Policy and subsequently, completion of Supplementary Planning Guidance (or Developer's Guide) on AQ and EV Charging Policy. Also developing specific Planning Guidance on Derby Local Roadside NO ₂ Plan TMS.	Ensuring AQ is at the heart of planning decisions	Ongoing	Ongoing	Some work being taken forward, however resource-constrained.

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11	Derby Roadside NO ₂ Local Air Quality Plan - Traffic Management Scheme	Traffic Management	UTC, Congestion management, traffic reduction	Subject to DEFRA Funding	Complete	2019/20 - Measures to bring forward compliance to 2020	Compliance with EU Limit Values	Reduction in annual average NO ₂ along Stafford Street to below 40µgm-3 by 2020 (reduction of 9.4µgm-3 NO ₂ based on 2020 baseline)	Feasibility study now complete and FBC submitted to DEFRA in March 2019	Measures for compliance - by 2020. Measures to maintain compliance - continued until 2025	Reliant on scheme costs being funded (by central government) and timely approvals processes - Now funded.
12	Derby Roadside NO ₂ Local Air Quality Plan - EV Charging Strategy	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	Bid under Clean Air Fund (CAF)	Complete	cancelled	# EV Charge points in City	Modelled decrease of 21.2 tonnes NO _x and 1.25 tonnes of PM _{2.5} by 2025	No funding awarded to take project forward. Need to look at other ways to bring this forward.	N/A	No grant funding awarded.
13	Derby Roadside NO ₂ Local Air Quality Plan - Clean Air Mobility Scheme (CAMS)	Promoting Travel Alternatives	Other	Bid under Clean Air Fund (CAF) and Future Mobility Zones.	Complete	cancelled	# people exchanging high emission vehicle for mobility credits	NO _x savings of 8.83 and 2.2 tonnes per year, under Phase 1 and 2 respectively	No CAF funding awarded to take project forward.	N/A	No grant funding awarded. Exploring other sources of funding and ways to implement a MaaS Scheme, but unlikely to take form of original CAMS proposals.
14	Updated Air Quality Action Plan (AQAP)	Other	Other	LA Funded	Ongoing	Ongoing	Completion of AQAP	Variety of measures proposed following source apportionment modelling across AQMAs	In Draft form, Due to go to public consultation in Feb 2020	April 2020	Resource/staff constraints and ownership of measures following completion of Plan
15	Air Quality Awareness-Raising	Public Information	Via other mechanisms	LA Delivery using Implementation Funding	Complete	Ongoing	# stakeholders actively engaged, assessed via click-through	Indirect reductions in pollutant concentrations due to	Taxi-engagement workshop and Clean	Ongoing	Currently insufficient staff to deliver funding. Appointment of

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							rates and average view length time on social media and web pages and # mailshots/ letters	behavioural change resulting from information	Air Day events complete. Ongoing updating of website including useful info and signposting. £450k implementation fund.		new officer?
16	Investigate the potential for promoting low emission freight initiatives in Derby	Promoting Low Emission Transport	Other	Derby City Council / Derbyshire County Council	Ongoing	Ongoing	Unknown	Unknown	Council to consider options for supporting a freight consolidation centre and promoting Eco Stars.	Ongoing	Possibly resource-constrained. Departmental ownership and resource allocation required.
17	Develop Derby Bonfire Policy	Public Information	Air Quality Planning and Policy Guidance	Derby City Council / PHE	Ongoing	Ongoing	Completion of Policy.	NO ₂ and PM _{2.5} emissions reduction. Hard to quantify.	Ongoing	Ongoing	Council to consider options for greater restrictions on open burning and bonfires. Some equalities issues to consider and conflicts with Bonfire Night celebrations. Political/public pressure needs to be considered.

Appendix A: Response to Consultation

Table A.1: Summary of Responses to Consultation and Stakeholder Engagement on the AQAP

Consultee	Category	Response
e.g. Chamber of Commerce	Business	E.g. Disagree with plan to remove parking on High Street in favour of buses and cycles; consider it will harm business of members.

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Figure A.1: Findings of the SWOT and Gap Analysis exercise from the Stakeholder Engagement Workshop, held on May 17th 2019

Electric vehicle strategy

Strengths	Weaknesses
Funding/grants are available. Charging points are already being installed. The number of EVs in the fleet is increasing. There is an appetite for more EV charging availability. Air quality benefit. Concept is becoming mainstream.	Home-charging difficult in terraced streets. Technology changing quickly. Payback not attractive - especially for taxis. Commercial availability limited. Multiple payment schemes for charging. Electricity supply may not be sufficient. Source of grants not well known. Requires significant investment. Doesn't reduce congestion. Doesn't enable active travel or modal shift.
Opportunities	Threats
New businesses to install charge points. Battery technology improvements. More photovoltaics and renewables in Derby. Increased publicity of grants. Increased availability of loans. Inclusion of EV charging in all new homes.	Increasing costs and environmental impacts of battery removal. Charging technology becoming obsolete. National and international regulation and other changes. Grants may run out. Timescale challenges.

Open burning

Strengths	Weaknesses
Enforcement - smoke from chimneys, bonfires, fly tipping / littering.	Funding / resources. Political (right to burn - inability to take to tip). Lack of knowledge / awareness by public.
Opportunities	Threats
Stop charging for bulky collections. Free bulky collection on exemption. Grants/funding. Bonfire ban. Clear political direction and clarity on rules and regulations. Education.	Politics. Unintended fires. Waste crime.

Freight

Strengths	Weaknesses
Freight routing - designated routes, restriction / weight restriction. Freight times - designated times, night-time bans, weekend bans. Public procurement policy - set & drive standards, reduce public sector deliveries.	Commercial sector - un-regulated, difficult to regulate and cost driven. High number of small operations working on low margins.
Opportunities	Threats
Consolidation - managing warehouse space. East-midlands freight hub - consolidation. Electric-taxi - opportunities to move small parcel freight. Internet shopping - collective delivery points, local shops / post office. Canals / waterways. Automation.	Internet shopping. Online home deliveries. Limited availability and high costs of electric / automated vehicles.

MaaS

Strengths	Weaknesses
Centralised fleet Total transport	Lack of coverage. Requirements for multi-drop locations. Requirements for combinations of buses. Demand too great. DCC does not currently own it's own fleet.
Opportunities	Threats
Potential to combine with personalised travel planning. Potential to build on Connected brand. Potential to pool resources between organisations. Total Transport seen as having more potential for Derby.	

Appendix B: Reasons for Not Pursuing Action Plan Measures

Table B.1: Action Plan Measures Not Pursued and the Reasons for that Decision

Action category	Action description	Reason action is not being pursued (including Stakeholder views)

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
AQS	Air Quality Strategy
ASR	Air quality Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
EU	European Union
LAQM	Local Air Quality Management
NO₂	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM₁₀	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