Birmingham Clean Air Zone


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| **Title** | **Birmingham Clean Air Zone**<br>**Full Business Case** |
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| 3 | Cameron McGlennon | | 4th December 2018 |

## Contents

# 1 Strategic Case

## 1.1 Context

This Case sets out the final case for change and the preferred way forward in terms of spending objectives, short-listed options and the preferred option for Birmingham Clean Air Zone, in light of the additional baseline traffic and air quality modelling which developed as part of the Preferred Option Business Case. It is worth noting that there has been only one key change in the Strategic Case since the submission of the Preferred Option Business Case (POBC). This key change relates to identification of the preferred option for Birmingham CAZ, which is subsequently appraised in the Economic Case. That said, in accordance with the JAQUs guidance this Strategic Case for the Full Business Case (FBC) stage considers the following:

- An outline of the strategic context, in particular the European, national and local policies which either influence or will be impacted by the project
- Local traffic and air quality modelling for the project's counterfactual case, using the agreed target determination values
- Final position regarding the project's case for change (including the logic map), spending objectives and critical success factors
- Project's short-listed options which are appraised in detail in the Economic Case of the OBC, and the preferred option which is appraised in the Economic Case of this FBC – see section 2
- Summary views of the project's benefits, risks, constraints and dependencies, with further details presented in subsequent Cases of this FBC
- Stakeholder engagement to date and next steps.

### 1.1.1 Organisational Overview

Birmingham City Council (BCC) is the largest urban local authority in the UK and the largest council in Europe with 101 councillors representing 69 wards. It has a population of over 1 million residents spread over an area of approximately 26,777 hectares (103 square miles). It has a population density of 36.5 persons per hectare, which makes it the most densely populated of the West Midlands local authorities.

The city has a very complex road network with about a dozen major radial roads and two ring roads traversing the city. In addition, there are three heavily trafficked motorways, M5, M6, M6 Toll and M42 forming a box around the city with a section of the A38M running through the city.

BCC declared itself an Air Quality Management Area in respect of Nitrogen Dioxide ($NO_2$) in 2010. The Council has recognised the importance of environmental health on its residents for many years. The commitment to improving the environment for all residents is encapsulated within its strategic and community plans.

### 1.1.2 Policy Context

Growing concern regarding air quality and health related problems have motivated legislative bodies at all levels to implement air quality standards to be achieved through actions and policies which must be transversal and aligned across institutions. This case presents the key policy drivers which will inform the development of the project. It is worth noting that some of these policies will also impact the project.

### 1.1.3 European Context

In 2008 the EU issued the ambient air quality and clean air for Europe Directive, which set out emissions limits which member states must comply with. The European Union standards have been evolving since 1990 through 6 standard levels (from EURO 1 to EURO 6) having reduced the limit standards of some pollutants up to 96% from the release of EURO 1, thanks to technology advancements. European emission limits are associated to *Carbon Monoxide, Hydrocarbons, Particulate Matter*, and lately more focused on *Oxides of Nitrogen* concentrations. Many European Countries are struggling to reach the objectives set by the EU, including the UK, finding major difficulties alongside some of the busiest roads.

### 1.1.4 National Context

Air quality legislation was first introduced in the late 1990s as part of the **Environmental Act (1995),** in which was defined the concept of local air quality management. In 2007, DEFRA published the **Air Quality Strategy** which sets the national objectives for further improving air quality and how they would be achieved. Related to the Air Quality Strategy, the UK set its own **Air Quality Standards Regulations in 2010** which limit the concentrations of $NO_2$ for being harmful for the environment and having serious health implications. The concentration limits are aligned with the World Health Organization guidelines:

- Hourly mean limit value not exceeded more than 18 times in a calendar year: 200 µg/$m^3$
- Annual mean limit value: 40 µg/$m^3$.

To tackle roadside $NO_2$ concentrations, DEFRA proposed in 2015 a series of measures which were related to current infrastructure management and supply, the implementation of new technologies and incentives. These included:

- *Charging measures*: creation of Clean Air Zones. 5 cities excluding London have been required to implement a CAZ, one of them being Birmingham.
- *Infrastructure measures*: investment in national and local road network to relieve congestion, improve safety and promote sustainable modes of transportation.
- *Vehicles and technologies*: Investment in low and ultra-low emission busses and retrofit technology schemes aimed to the oldest vehicles.
- *Programmes and incentives*: promoting fuel efficient driving styles, encouraging the use of alternative fuels, grants towards purchase of new ultra-low-emissions vehicle (ULEV) and tax incentives for ULEVs.

### 1.1.5 Regional and Local Context

For the West Midlands region, air quality issues are addressed at two different levels.

At a *metropolitan level*, in 2016, the West Midlands Combined Authority (WMCA) launched the **WMCA Strategic Transport Plan** 'Movement for growth' to support the improvement of the transport system, economic growth and regeneration, and environment and social inclusion. In relation to environment implications, the WMCA aims to improve air quality, reducing carbon emissions and improving road safety. The objectives of this Plan are aligned with the European Union emission limits and the national levels for $NO_x$. Specific measures include the improvement of public transport services, transport capacity, parking management to support intramodality and ULEV promotion and the associated infrastructure and facilities.

The **Low Emissions Towns and Cities Programme** (LETCP) was born as a partnership between seven West Midlands local authorities with the objective of producing various regional strategies to improve air quality, with a view to meeting national air quality objectives. The outcomes are a Low Emissions Strategy focused on **Low Emission Zones** (LEZ) which discourage the most polluting vehicles to access defined boundaries and a Good Practice Guidance on Planning and Procurement.

At a *local level*, Birmingham City Council key outcomes are related to the implementation of the Clean Air Zone Programme and allow benefits to be realised. These are consistent with four out of five of the outcomes in the City Councils plan 2018-2020:

- Outcome 1 – Birmingham is an entrepreneurial city in which to learn, work and invest in;
- Outcome 2 – Birmingham is an aspirational city to grow up in;
- Outcome 3 - Birmingham is a fulfilling city to age well in;
- Outcome 4 – Birmingham is a great city to live in.

Improving air quality as soon as possible, consistent with other statutory responsibilities is a key ambition of the Birmingham Health and Wellbeing Strategy and supports the delivery of policies included in the

'Birmingham Connected Transport White Paper', which in turn, supports delivery of the adopted Birmingham Development Plan and Movement for Growth. The Health and Social Care Act 2012 requires Local Authorities in England to have a Health and Wellbeing Board (HWBB). A key responsibility of the HWBB is to develop a Health and Wellbeing Strategy (HWBS). Improving air quality is a key ambition of the Birmingham Health and Wellbeing Strategy

Air quality competences are transferred to local authorities through the Localism Act (2011). The City Council is responsible for assessing whether air quality standards and objectives are achieved locally and identify those spots where pollutants exceed the maximum levels. To comply with the legislation, the City Council must:

- Designate an Air **Quality Management Area** (AQMA) to monitor air pollution and to predict how it will change in the next few years.
- Prepare an Air **Quality Action Plan** (AQAP), proposing measures to improve air quality in the area ensuring the compliance of National Air Quality Objectives. The measures outlined in Birmingham are maximising national levers, promoting local policies and programmes, developing local infrastructure and promoting positive behaviour change through organisational actions.

In parallel with the AQAP, in the context of growth and development of the city centre, the Council is working towards the **Birmingham Development Plan** (BDP). In line with the general vision of the Council, this plan seeks to define a sustainable way of growth to meet the needs of its population and strengthening its global competitiveness comprising the period from 2011 to 2031. The global objectives are to design sustainable environments to ensure high-quality of life, build around a diverse base of economic base of economic activities supported by a skilled workforce and enhance the cultural heritage of the city. Improving air quality is set as one of the main actions to meet the goals of the Plan.

Also, the **Big City Plan** is focused on the transformation of the city covering every aspect of the built environment. One of the objectives is to ensure construction companies are keeping emissions to a minimum and that they deliver sustainable developments aligned with the sustainable growth planned in the BDP. Currently, the **Snow Hill Development** is identified as one of the City's most valuable assets creating thousands of new jobs and becoming a principle transport hub. However, the adjacent highway network is constrained by the current level of traffic and is at risk of affecting the development of the area. By implementing LEZ or CAZ frameworks, it is expected to improve the air quality in the area and increase the capacity of the network, enabling the growth and supporting a healthy environment in the district.

As a result of these plans, some of the policies regarding the development of the city have air quality as key consideration and are supported by local programmes and initiatives:

- **Brum Breathes** – Tackling Air Quality in Birmingham. This programme is committed to improve the quality of life and well-being in the city, tackling health inequalities and increasing life expectancy by making people aware of the air quality issues and building sustainable environments.
- **Birmingham Connected** (Moving Our City Forward). It is focused on the development of a mass transit network, the establishment of Green Travel Districts and the promotion of a city Centre Low Emissions Zone. Since its implementation the major improvements include the redevelopment of the New Street Station, the extension of the metro through the city centre, the implementation of bus priority measures, cycling network, speed limits and the improvement of congestion hotspots.

## 1.2 Clean Air Zone

Moving forward on the process to meet the objectives set across institutions within the shortest time possible and in the context of Birmingham's future growth, makes it necessary to address the challenge by implementing more restrictive and concise measures. The BDP forecasts an increase of 30,000 people living in the city centre and 51,000 new jobs, leading to an increase of 30% trips to and within the city centre by 2031. According to the National Air Quality Plan, 5 cities were identified to require urgent action in terms of air quality, Birmingham being one of them, and a Clean Air Zone Framework has been proposed to the local authorities.

A Clean Air Zone (CAZ) defines an area where targeted action is taken to improve air quality and resources are prioritised in a way that delivers improved health benefits and supports economic growth and the low-emission economy. A charging system is defined according to the vehicle emission standards to enter the CAZ area. Compliant vehicles will not be subject to charge.

The main objectives are to improve the vehicle type profile in the city of Birmingham, encouraging people to buy compliant vehicles and drive a model shift diverting demand to public transport or other sustainable modes as an alternative of a charging CAZ.

The expected outcome is to reduce $NO_2$ levels below the standards within the shortest possible time and accelerating the transition to a low emission economy. Revenues from the Birmingham CAZ will be a source of investment to enhance the development of the city towards a more sustainable environment and will help decoupling growth and pollution.

## 1.3 Assessment of Baseline Air Quality

### 1.3.1 Drivers for Developing a Robust Baseline

Air quality is a term used to describe the air that we breathe, and the level of pollutant concentrations that are considered to be reasonably 'safe' from a health perspective[1]. The main pollutants of concern in the UK are nitrogen dioxide ($NO_2$) and fine particulate matter (PM). Specific health impacts for these pollutants reported in the literature[2] are summarised as follows:

- $NO_2$: At high concentrations, $NO_2$ causes inflammation of the airways. Long-term exposure is associated with an increase in symptoms of bronchitis in asthmatic children and reduced lung development and function
- PM: Long-term exposure contributes to the risk of developing cardiovascular and respiratory diseases, including lung cancer. Research shows that $PM_{10}$ particles with a diameter of 10 microns and smaller ($PM_{10}$) are likely to be inhaled deep into the respiratory tract. The health impacts of particles with a diameter of 2.5 microns or smaller ($PM_{2.5}$) are especially significant as smaller particles can penetrate even deeper.

Preliminary work undertaken in 2015 as part of the West Midlands (LETC) Programme[3] provided estimates of the current impacts of $NO_2$ pollution on Birmingham City Centre and the wider West Midlands Conurbation[4].Table 1.1 presents the 2011 and 2018 estimates of deaths per year that are attributable to $NO_2$ pollution. In 2011, it was estimated that 906 deaths in the West Midlands Metropolitan Districts were attributable to $NO_2$ pollution, including 371 in Birmingham. Section 4.4 – "Health impacts associated with air pollution", of the West Midlands Low Emission Zones: Technical Feasibility Study[4], provides details of the approach adopted to estimate deaths attributable to $NO_2$ pollution.

The data forecasts that, under the counterfactual case, the number of deaths attributable to $NO_2$ pollution would reduce notably across all West Midlands Metropolitan Districts by 2018. That said, the forecasts demonstrate that between 2011 and 2018 the number of deaths attributable to $NO_2$ pollution would reduce at a slower rate in Birmingham compared to the wider West Midlands Metropolitan area.

[1] It can also relate to impacts on eco-systems, but this is beyond the scope of this Preferred Option Business Case.
[2] Ambient (Outdoor) Air Quality and Health Fact Sheet. World Health Organisation (2016). Accessed February 2018.
[3] West Midlands Low Emissions Towns and Cities (LETC) Programme. Accessed February 2018.
[4] HYPERLINK "https://go.walsall.gov.uk/Portals/0/Uploads/PollutionControl/west_midlands_letcp_low_emission_zones_-_technical_feasibility_study_wp2_economic_and_health_impacts-2.pdf" West Midlands Low Emission Zones: Technical Feasibility Study. Economic and Health Impacts of Air Pollution Reductions. Ricardo-AEA. February 2015. Accessed February 2018.

Table 1.1 Numbers of Deaths, Asthmatic Children with Bronchitic Symptoms and Respiratory Hospital Admissions Attributable to NO2 Pollution: 2011 and 2018 estimates

| Local Authority | Deaths per year attributable to $NO_2$ pollution: 2011 | Deaths per year attributable to $NO_2$ pollution: 2018 |
|---|---|---|
| Birmingham | 371 | 175 |
| Coventry | 70 | 21 |
| Dudley | 72 | 21 |
| Sandwell | 147 | 71 |
| Solihull | 62 | 24 |
| Walsall | 107 | 43 |
| Wolverhampton | 78 | 29 |
| **West Midlands Metropolitan Districts** | **907** | **384** |

Since the publication of this report, it has been established that for many diesel vehicles the predicted emissions used in these estimates was lower than the measures real-word emissions. That would make these figures an underestimate.

Table 1.2 presents the estimated burden on local mortality attributable to man-made particulate air pollution for 2011 and 2018. In particular, it presents the annual numbers of attributable deaths to $PM_{2.5}$ air pollution. Section 4.4 – "Health impacts associated with air pollution", of the West Midlands Low Emission Zones: Technical Feasibility Study[4], provides details of the approach adopted to estimate deaths attributable to $PM_{2.5}$ pollution. It is estimated that there were 1,359 deaths attributable to particulate air pollution in 2011 in the West Midlands Metropolitan Authorities, including 486 in Birmingham. The counterfactual case forecasts indicate that the number of deaths attributable to $PM_{2.5}$ air pollution would only reduce marginally across all West Midlands Metropolitan Districts by 2018. It is worth noting that the rate of reduction of deaths attributable to $PM_{2.5}$ air pollution between 2011 and 2018 is considerably lower than that forecast for deaths attributable to $NO_2$ pollution across all seven local authority areas.

Table 1.2 Local Mortality Burden Associated with Particulate Air Pollution in West Midlands Local Authorities

| Local Authority | **Annual Deaths Per Year Attributable to $PM_{2.5}$ Particulate Air Pollution: 2011** | **Annual Deaths Per Year Attributable to $PM_{2.5}$ Particulate Air Pollution: 2018** |
|---|---|---|
| Birmingham | 486 | 441 |
| Coventry | 156 | 142 |
| Dudley | 158 | 142 |
| Sandwell | 178 | 161 |
| Solihull | 103 | 94 |
| Walsall | 147 | 133 |
| Wolverhampton | 131 | 118 |
| **West Midlands Metropolitan Districts** | **1,359** | **1,231** |

The preliminary assessments undertaken as part of the West Midlands (LETC) Programme also estimate other indicators including:

- Asthmatic children with bronchitic symptoms attributable to $NO_{2,}$
- Respiratory hospital admissions attributable to $NO_2$ pollution and
- Life years lost per year attributable to $PM_{2.5}$ air pollution

These indicators for the seven West Midlands Metropolitan Districts are presented in the Birmingham Clean Air Zone Feasibility Study: Air Quality Modelling Report.

Review of Birmingham specific data presented in Table 1.1 and 1.2 indicates that in 2011, 857 deaths annually were attributable to $NO_2$ and $PM_{2.5}$ air pollution in the City. The data suggests that annual deaths attributable to $NO_2$ and $PM_{2.5}$ air pollution in Birmingham would reduce to 616 by 2018. Department for Transport's WebTAG Data book June 2018 version 1.10.1 presents estimates for average (economic) value of prevention per fatality by element of cost. In particular, Table A 4.1.1 estimates the economic costs per fatality (including lost output and human costs, excluding medical costs) at £1,547,190 in 2010 prices and 2010 values. Applying this ready reckoner to deaths annually attributable to $NO_2$ and $PM_{2.5}$ air pollution suggests that the economic implications of air quality in Birmingham was at least £1.3 billion (in 2010 prices) in 2011. The same approach suggests that air pollution driven economic implications in Birmingham would reduce to £0.95 billion (in 2010 prices) by 2018.

Despite the forecast reduction between 2011 and 2018, the fatalities attributable to poor air quality and subsequent economic costs, when measured in terms of monetised value of deaths annually attributable to $NO_2$ and $PM_{2.5}$ air pollution, remains considerably high in Birmingham. Such evidence, along with the City's policy ambition summarised earlier in the Strategic Case and the regulatory requirements outlined below, act as the key drivers for developing a robust baseline position for the City's air quality.

Driven by such public health priorities, the Air Quality (Standards) Regulations 2010 set legal limits (called 'limit values') for concentrations of pollutants in outdoor air. These are based on the EU Air Quality Limit Values[5]. The UK government is currently responsible to the EU for ensuring that it complies with the

[5] Taken from: ec.europa.eu/environment/air/quality/standards.htm. Accessed February 2018.

provisions of the EU Air Quality Directives[6], which are legally binding. However, under the Localism Act (2011), the UK government has discretionary powers to pass on any fines (or a proportion) to local authorities.

The UK government is currently in negotiations with the EU over breaching Limit Values for $NO_2$ and $PM_{10}$. On the UK government's behalf, the Department for Transport (DfT) and Department for Environment Food and Rural Affairs (DEFRA) are responsible to ensure that the UK meets the EU Air Quality Limit Values. The UK makes use of DEFRA's Pollution Climate Mapping (PCM) model, in addition to monitoring, as its approved means of reporting air quality information to assess legal compliance across the different zones. To model air quality, Birmingham City Council use the Airviro modelling software produced by the Swedish Meteorological and Hydrological Institute (SMHI) and Apertum. Further details regarding Airviro and its alignment with PCM are presented in the Birmingham Clean Air Zone Feasibility Study: Air Quality Modelling Report.

The legal limits for pollutants of most concern for the West Midlands Urban Area (including Birmingham) along with the 2016 compliance assessment are shown in Table1.3.

[6] Ambient Air Quality Directive 2008/50/EC and Directive 2004/107/EC. Accessed February 2018.

Table 1.3 Legal Limits for Pollutants of Most Concern in the West Midlands Urban Area, Including Birmingham

| **Pollutant** | Concentration (limit value) µg $m^{-3}$ | Averaging Period | Target and Limit Values | Number of permitted exceedances each year | Compliance assessment for 2016 in the West Midlands Urban Area (Including Birmingham)[7] |
|---|---|---|---|---|---|
| $PM_{2.5}$ | 25[8] | 1 year | Target value came into force on 1 January 2010 Limit value came into force on 1 January 2015 | n/a | Compliant |
| $PM_{10}$ | 50 | 24 hours | Limit value came into force on 1 January 2005 (time extension granted to June 2011) | 35 | Compliant[9] |
| | 40 | 1 year | Limit value came into force on 1 January 2005 | n/a | Compliant |
| $NO_2$ | 200 | 1 hour | Limit value came into force on 1 January 2010 | 18 | Compliant |
| | 40 | 1 year | Limit value came into force on 1 January 2010 | n/a | Non-Compliant |

In 2015/16, most of the 43 air quality reporting zones were in exceedance of the statutory annual mean limit value for $NO_2$ emissions in the UK, including the Birmingham urban area. This $NO_2$ emissions non-compliance also drives the need for robust baselining, development of interventions and ongoing monitoring for air quality in Birmingham.

### 1.3.2 Air Quality Baseline: Traffic modelling inputs

Developing a robust air quality baseline requires a series of sequential steps, including modelling of the City's road network, not least to calculate the emissions from traffic into $NO_2$ concentrations. The traffic modelling was undertaken using a variety data sources, research and existing modelling platforms to fully comply with DEFRA's Joint Air Quality Unit (JAQU) guidance. The road network modelled is outlined in Figure 1.1. Further details regarding the modelling approach and tools adopted are presented in the Birmingham Clean Air Zone Feasibility Study: Transport Modelling Report and summarised in the Birmingham Clean Air Zone Feasibility Study: Air Quality Modelling Report.

[7] Air Pollution in the UK 2016. DEFRA (2016). Accessed February 2018.
[8] An obligation to reduce exposure to concentrations of fine particles also came into force from 2015.
[9] Following the subtraction of natural sources in accordance with the directive

The primary purpose of the transport modelling is to estimate traffic for the base year and develop reference case and intervention case forecasts, which ultimately feed into air quality modelling. Traffic forecasting utilised the 2016 base year Birmingham City Council's SATURN model, which was calibrated against 2016 traffic data. The 2016 model results were audited by JAQU in August 2017 and approved for use within subsequent calculations.

The analysis of the 2020 reference case (the do-minimum scenario) involved an evaluation of how base year traffic flows would change by 2020 in the absence of any interventions. That said, the modelling of this scenario included a consideration of planned transport improvements to the local road network, demographic and development implications, regional traffic growth and changes to the traffic fleet.

Table 1.4 presents a summary comparison between 2016 base traffic estimates and the 2020 do-minimum scenario forecasts. The table highlights that the growth rate of car / taxi traffic in Birmingham City Centre between 2016 and 2020 is forecast to be considerably higher than that estimated for the rest of the City or the wider West Midlands. The data also indicates that LGV traffic across all geographies analysed is forecast to grow by more than 10% between 2016 and 2020. Lastly, the modelling results indicate that HGV based traffic growth would be highest in Birmingham City Centre.

Table 1.4 BCC Traffic Growth 2016 to 2020

| Sector | AM Peak | | | Inter Peak | | | PM Peak | | |
|---|---|---|---|---|---|---|---|---|---|
| | Car/ Taxi | LGV | HGV | Car/ Taxi | LGV | HGV | Car/ Taxi | LGV | HGV |
| City Centre | 7.9% | 10.8% | 3.5% | 8.0% | 10.8% | 3.6% | 7.4% | 10.8% | 3.6% |
| Rest of Birmingham | 3.7% | 10.7% | 3.2% | 3.7% | 10.7% | 3.1% | 3.7% | 10.7% | 3.1% |
| **Birmingham (Total)** | **4.2%** | **10.7%** | **3.2%** | **4.2%** | **10.7%** | **3.2%** | **4.1%** | **10.7%** | **3.2%** |
| Rest of West Midlands | 4.4% | 10.6% | 2.9% | 5.3% | 10.7% | 2.9% | 4.6% | 10.8% | 3.0% |
| **Total** | **4.3%** | **10.7%** | **3.0%** | **4.7%** | **10.7%** | **3.0%** | **4.4%** | **10.7%** | **3.0%** |

Such traffic modelling results have been adopted as a key input for developing air quality baseline for the City.

### 1.3.3 Air Quality Baseline: 2016 baseline

Whilst utilising the traffic modelling and other inputs, air quality modelling requires to follow the process of target determination which has been specified by the JAQU. Further details of the air quality modelling approach and key inputs, which follow the target determination process, are presented in the Birmingham Clean Air Zone Feasibility Study: Air Quality Modelling Report. This section summarises the 2016 baseline results generated using Birmingham City Council's Airviro model, which includes a total of 124 receptors that have been included to represent the PCM road links. A further 54 sites have been included to represent local hotspots beyond the PCM network.

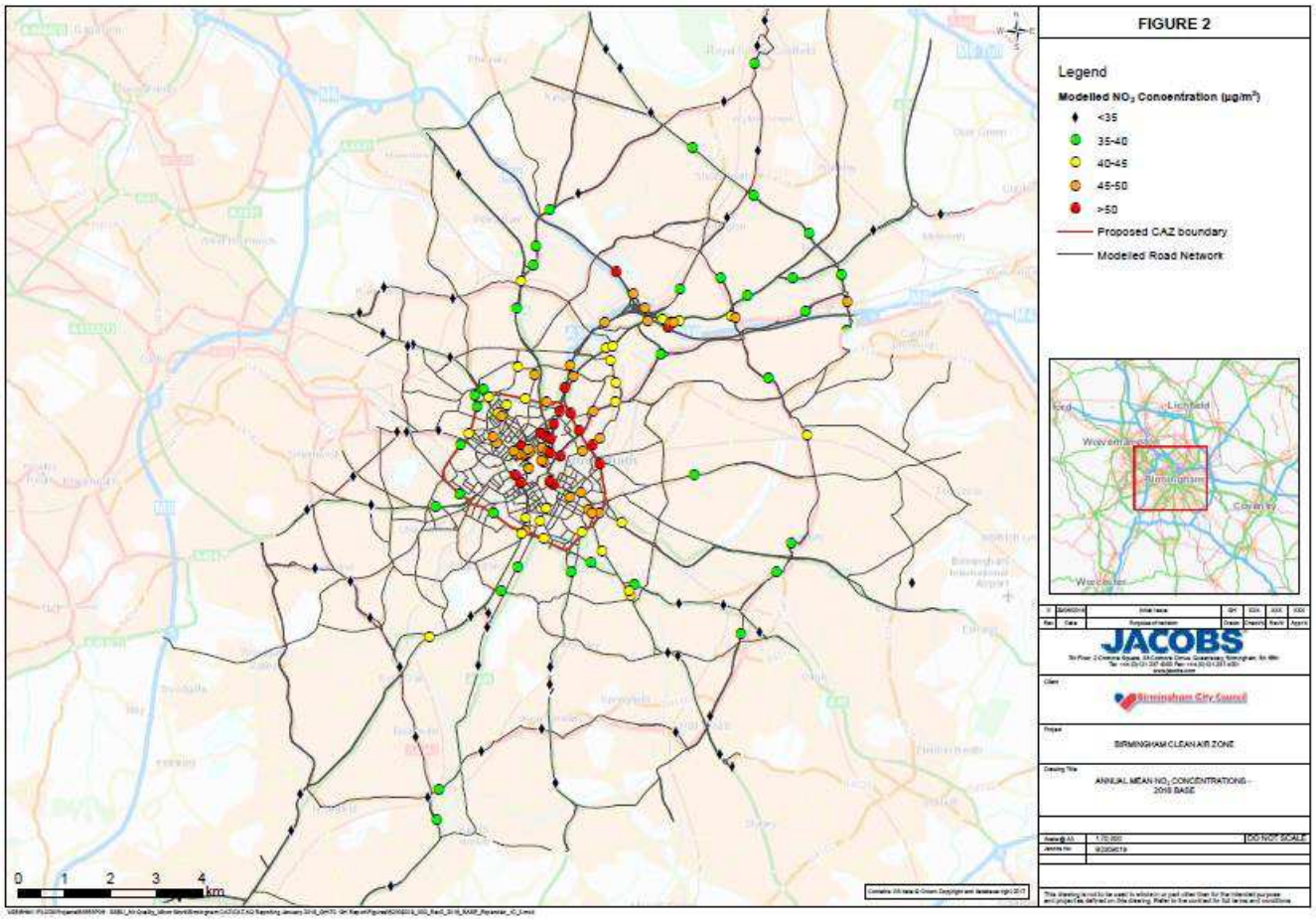
Birmingham is currently compliant with legal limits for PM. However, further reductions are needed (especially to $PM_{2.5}$ levels) to protect human health. Annual average $PM_{10}$ and $PM_{2.5}$ concentrations are well within the legal limit values of 40 and 25 µg/m$^3$ respectively. Although compliance has officially been achieved, by reducing PM concentrations even more, the health benefits will be even greater.

Birmingham City Council believes that even with compliance with the legal limit there will remain a health burden i.e. there is no recognised safe limit for PM at this point in time.

In contrast, annual average $NO_2$ concentrations still exceed the legal limit on several road links in and around Birmingham City Centre. Meeting the $NO_2$ legal limit poses a huge challenge for many cities in the UK and across Europe. One of the key reasons why ambient levels of $NO_2$ remain higher than had been previously expected is the driving conditions in urban areas and concerns over the performance of the more recent Euro emissions standards for some diesel vehicles (see Appendix A of the Birmingham Clean Air Zone Feasibility Study: Air Quality Modelling Report for more information on Euro standards). In general, Euro standards have failed to reduce oxides of nitrogen ($NO_x$)[10] emissions from light-duty diesel vehicles (e.g. cars and vans), despite tightening emissions standards for $NO_x$. However, Euro VI (for heavy vehicles) is performing well and the standard for light vehicles is still bringing about a significant reduction, albeit not as much as it should.

Whilst air quality remains a problem across Birmingham and the wider West Midlands conurbation, there are areas of the city centre where the problem is more pronounced than others. The 2016 baseline position for Birmingham is clearly illustrated in Figure 1.1.

Figure 1.1 - Air quality baseline – 2016 baseline




[10] Vehicle emissions are measured in terms of total $NO_x$. $NO_x$ is made up of nitrogen oxide (NO) and $NO_2$, although the NO is subsequently converted into additional $NO_2$ by interaction with ozone in the atmosphere – this reaction being dependent on the availability of ozone.

Figure 1.1 highlights that most exceedances in Birmingham in 2016 were within and around the City Centre, bounded by the ring road. Figure 1.1 also identifies some significant exceedances on the A38 approaching the City Centre. Other locations of significant exceedances are identified on the motorway in the northern part of Birmingham. Figure 1.1 also highlights some exceedances on the A47 approaching the motorway.

### 1.3.4 Air Quality Baseline: 2020 baseline

Following a similar approach as identified for 2016 baseline analysis, this section summarises the 2020 baseline results generated using Birmingham City Council's Airviro model. Again, a total of 124 receptors have been included to represent the PCM road links. A further 54 sites were selected to represent local hotspots beyond the PCM network.

A summary of the Airviro results for 2020 baseline is presented in Table 1.5, and the full results for each of the 178 locations are presented in the Birmingham Clean Air Zone Feasibility Study: Air Quality Modelling Report. The analysis indicates that 15 PCM sites are estimated to exceed the statutory annual mean limit value for $NO_2$ emissions in 2020. A further 26 local network sites, not identified on the PCM network, are also estimated to exceed the statutory $NO_2$ emissions limits in 2020.

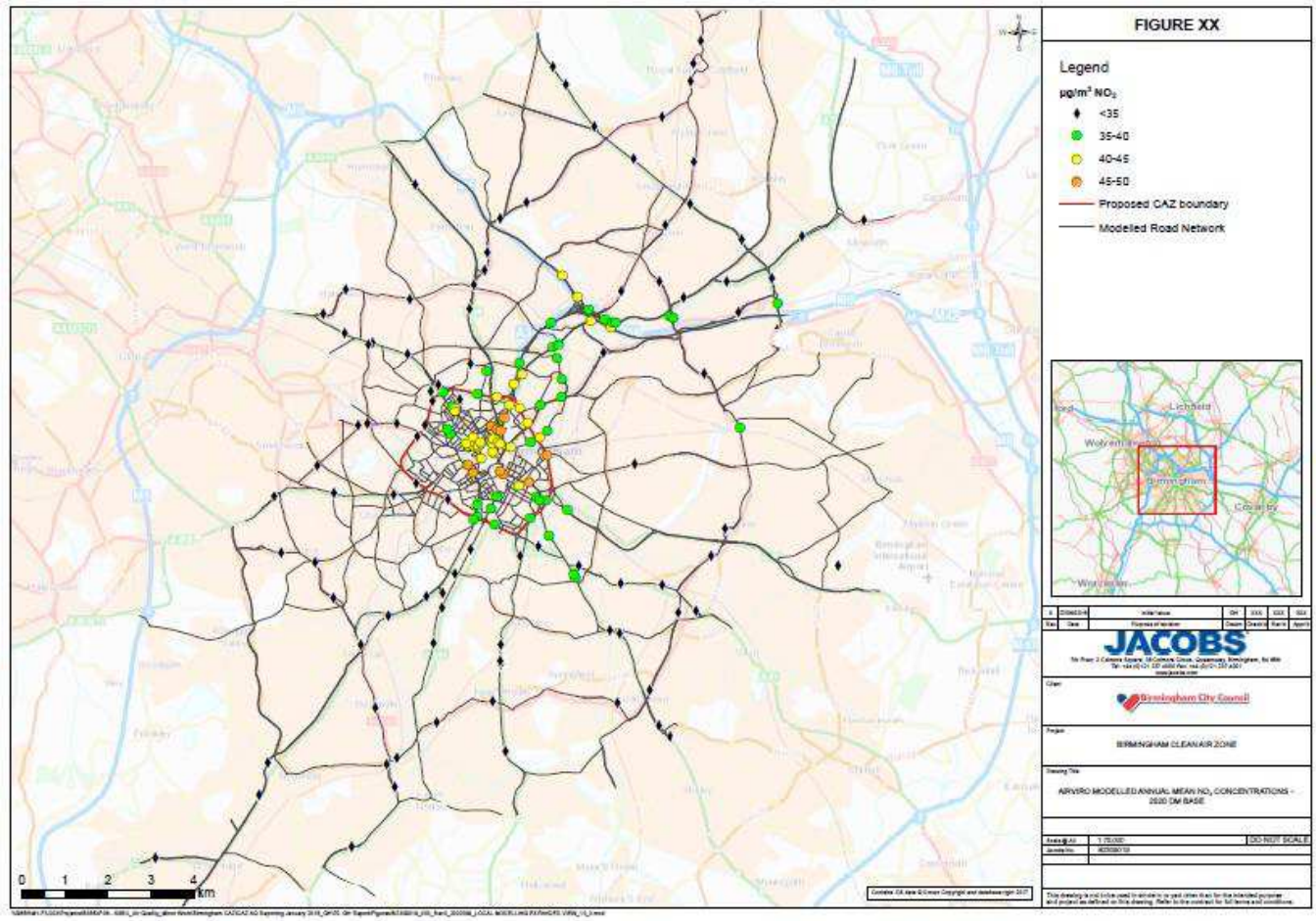
Table 1.5 - Summary of Local and PCM Modelling Results

| Site Type | Number of sites > 40 µg/m$^3$ | Maximum $NO_2$ Concentration µg/m$^3$ |
|---|---|---|
| PCM sites (PCM output) | 11 | 50.5 |
| PCM sites (Airviro output) | 15 | 48.8 |
| Local network sites (Airviro output) | 26 | 49.4 |

The 2020 baseline position is clearly presented in Figure 1.2. A comparison between 2016 and 2020 baseline indicates that Birmingham's air quality is expected to improve, although further and more urgent action will be required. Like the improvement across the wider City, the proportion of Birmingham City Centre where annual average $NO_2$ concentrations exceed the legal limit is expected to decrease by 2020, due to anticipated reductions in background concentrations, ongoing upgrade of the local vehicle fleet and other local interventions. However, modelling indicates that, if nothing further is done, concentrations will continue to exceed the limit on some major roads in and around the City Centre, including the A38, A38M, A4400, A452 and A4540.

In particular, as with the 2016 analysis, the 2020 baseline highlights that most locations of exceedances are forecast to be within the City Centre, bounded by the ring road. Outside this area, highlighted with a redline boundary in Figure 1.2, other notable exceedances are located on A38 approaching the City Centre and the motorway in the north of the City. Such locational specific analysis forms part of key evidence for identifying the boundary of Birmingham's Clean Air Zone and any additional measures.

Figure 1.2 - Air quality baseline – 2020 baseline




### 1.3.5 Air Quality Baseline: Specific sources of exceedance

Nitrogen oxides is a generic term which includes both NO and $NO_2$. According to the National Atmospheric Emissions Inventory (NAEI) estimates, around a third of the UK $NO_x$ emissions in 2015 arose from road transport, most of which came from diesel vehicles (NAEI, 2017).[11]. Some disparities exist due to the increase in the proportion of $NO_x$ emitted directly as $NO_2$ (also known as primary $NO_2$) from the exhausts of modern diesel vehicles, as a result of emission control systems that aim to reduce total NOx and particulate matter emissions.

The starting point of establishing a robust baseline regarding Birmingham's air quality in relation to $NO_2$ emissions is to establish the specific sources of exceedances. The majority of this pollution is typically associated with combustion emissions, including from road transport, rail, aircrafts, industry and domestic activities.

An assessment of $NO_x$ emissions, which are a combination of nitrogen oxide (NO) and $NO_2$, was undertaken for Birmingham. The findings were presented across the following two key categories:

- Road $NO_x$: $NO_x$ emissions resulting from road traffic
- Background $NO_x$: $NO_x$ emissions made up of a contribution of remote road traffic emissions and other sources including industrial, domestic, air transport and rail transport.

This assessment highlights that road traffic (Road NOx. in Birmingham is the predominant source of total oxides of nitrogen in the City. The assessment also confirms that remote road traffic emissions are a significant proportion of the Background NOx. The findings of this assessment across a number of key

[11] NAEI, Air Quality Pollutant Inventories for England, Scotland, Wales, and Northern Ireland: 1990-2015 (August 2017)

locations is summarised in the table below. The data below highlights that road based NOx in Birmingham, which includes Road NOx and remote traffic emissions in Background NOx, is considerably higher than the national average estimated in NAEI assessment.

Table 1.6 - Road NOx and Background NOx for key locations in Birmingham: 2020 estimates (reference case)

| Receptor | Position | Easting | Northing | Census ID | Road | 2020 Modelled Road NOx µg/m3 | 2020 Modelled Background NOx µg/m3 |
|---|---|---|---|---|---|---|---|
| PCM_0 | Inside Ring Road | 406752 | 286515 | 81490 | A4400 Suffolk St. Queensway | 49.2 | 44.5 |
| PCM_2 | Inside Ring Road | 407477 | 287785 | 56394 | A38 Corporation St. | 48.5 | 40.8 |
| PCM_6 | Outside Ring Road | 408473 | 286918 | 27736 | A4540 Watery Lane Middleway | 53.6 | 37.9 |
| Non_PCM_10 | Inside Ring Road | 407458 | 286475 | N/A | Moat Lane | 47.5 | 43.8 |

The reference case analysis summarised in Table 1.6 highlights the need to focus effort on reducing Road $NO_x$ and background $NO_x$ resulting from remote traffic. These emissions are dependent on the type of vehicle both in terms of size and age. A breakdown of vehicle emissions or 'source apportionment' was undertaken for 2020 baseline at a number of specific receptor points in and around Birmingham City Centre, the key location of exceedances, to provide specific information on the emission sources.

The respective source apportionments indicate significant contributions from a number of vehicle classes as summarised in Table 1.7. The table highlights that in 2020 diesel cars will be the single largest contributor of $NO_2$ emissions at most locations in and around the City Centre. Diesel LGVs and Rigid HGVs are also envisaged to be notable contributors of $NO_2$ emissions. In certain locations, buses and coaches are forecast to be the key driver of $NO_2$ emissions. Petrol cars, petrol LGVs and Arctic HGVs are forecast to be amongst the smallest contributors of $NO_2$ emissions across in and around the City Centre. Such analysis provides evidence around vehicle categories which would need to be considered for Clean Air Zone interventions.

Table 1.7 - Road NOx and Background NOx for key locations in Birmingham: 2020 estimates

| Vehicle Type | A38 (Between Children's Hospital and Dartmouth Circus) | Suffolk St Queensway (Near Bank st) | A4100 Digbeth | A540 Lawley Middleway - Garrison Circus |
|---|---|---|---|---|
| Diesel Cars | 54% | 53% | 25% | 42% |
| Petrol Cars | 6% | 6% | 3% | 5% |
| Buses/Coaches | 3% | 0% | 49% | 0% |
| Artic HGVs | 2% | 2% | 2% | 4% |
| Rigid HGVs | 13% | 14% | 13% | 28% |
| Diesel LGVs | 22% | 25% | 8% | 21% |
| Petrol LGVs | 0% | 0% | 0% | 0% |

## 1.4 Case for Change

### 1.4.1 Public health and regulatory context

Humans can be adversely affected by exposure to air pollutants in ambient air. As such the real driver for tackling pollution is the benefit to public health. It is also a social justice issue for more vulnerable people as well as a health and environmental concern, particularly given the exposure of poor air quality on disadvantaged communities and social infrastructure such as schools, hospitals and care homes. $NO_2$ and PM, the two pollutants identified earlier in this document, are primary causes of air quality related public health concerns in Birmingham and other major cities across the UK.

Over the years the European Union and the UK Government have developed an extensive body of legislation which establishes health based limits for a number of pollutants present in the air. These limits apply over differing periods of time because the observed health impacts associated with the various pollutants occur over different exposure times. Part IV of the Environment Act (1995) and resultant initial Air Quality Strategy, in the late 1990s, introduced the concept of Local Air Quality Management (LAQM) in the UK. It was expected that the forthcoming vehicle emissions standards for road vehicles and industrial permitting would deliver, if not all, then the majority of the air quality improvements needed to meet legislation.

Birmingham inability to meet the legislation, lead to the whole of Birmingham being declared an Air Quality Management Area (AQMA) for nitrogen dioxide in January 2003. Pursuant to the AQMA declaration Environmental Health led on the development and publication of an Air Quality Area Plan (AQAP) in 2006, which was updated in 2011. The original plan focused on a wide selection of actions, which were narrowed down to be more targeted for the 2011 plan.

In 2010, the Air Quality (Standards) Regulations 2010 set legal limits (called 'limit values') for concentrations of pollutants in outdoor air. These are based on the EU Air Quality Limit Values[12]. The UK continues to fail to meet air quality limit values for nitrogen dioxide set at an annual mean limit value of 40 µg/m3. This was to have been achieved by 2015 following an extension from the original deadline of 2010. Currently, the UK continues to have significant exceedances of the annual mean legal limit for $NO_2$ and the EU has indeed started infraction proceedings in the European Courts of Justice where as a result fines may be imposed.

### 1.4.2 Drivers for change in Birmingham

Poor air quality in Birmingham is acknowledged as a major public health burden and Public Health England suggest that it is the fourth largest risk to public health, behind cancer, obesity and cardiovascular disease. It is estimated that poor air quality was responsible for around 900 premature deaths a year in Birmingham and in excess of 2,000 attributable deaths across the West Midlands per year (based on 2011 estimates). This results in a significant economic cost burden on the City and the wider region.

The Council is responsible for ambient air quality and cleaner air under the Air Standard Regulations. The Council undertook an Air Quality Survey in March 2017. Among the 1,104 responses to the survey:

- 87% thought air quality is a 'serious issue' to be tackled now
- 88% said air quality has a very serious impact on health
- 67% said air quality is an important consideration when making travel choices.

The top three contributors to air pollution were considered by respondents to be (1) congestion, (2) vehicles idling in queues and (3) lorries, vans, and diesel cars. As with the wider UK, the two pollutants of most concern in Birmingham are nitrogen dioxide and fine airborne particulate matter. Both pollutants contribute to the health burden.

The air quality baseline analysis presented in the earlier section highlights that $NO_2$ emissions exceedances in parts of the City are in excess of 20% of the legal limits. Meeting the $NO_2$ legal limit poses a huge challenge for many cities in the UK. Birmingham is no different in this aspect. Although Birmingham's air quality is forecast to improve by 2020 under the counterfactual case, the predicted reductions in pollution concentrations of $NO_2$ are not forecast to reduce rapidly enough to achieve compliance levels.

[12] Taken from: ec.europa.eu/environment/air/quality/standards.htm. Accessed February 2018.

Failure to reduce the $NO_2$ emissions (and PM) will continue to expose the City to significant economic cost burden associated with public health on the City, which were estimated at nearly £1 billion for 2018. Equally, failing to take action towards achieving nitrogen dioxide compliance could lead to legislative issues for the Council. In particular, the City Council would be exposed to legal challenge for a failure to meet its statutory duty to comply with the Ministerial direction. Furthermore, the legal challenges could also relate to its obligation under air quality legislation to achieve compliance with legal $NO_2$ limits in the shortest possible time.

Within the above context, the Preferred Option Business Case concluded that this $NO_2$ compliance in the shortest possible time in Birmingham needed to be taken forward as the project's primary spending objective. In addition, the Outline Business Case also concluded that other public health driven economic and legislative drivers outline the wider rationale for intervention in Birmingham. These driver of change still valid as part of this Final Business Case for Birmingham Clean Air Zone.

Birmingham has poor health outcomes for many of the causes of death that poor air quality contributes to. Compared to the England average and adjusted to take into account demographic differences of the population, Birmingham has more deaths per 100,000 population under 75 from cardiovascular disease [1], respiratory disease [2] and deaths considered preventable [8].

[1] PHOF indicator 4.04i "Under 75 mortality rare from all cardiovascular diseases" 2014-16
[2] PHOF indicator 4.07i "Under 75 mortality rate from respiratory disease" 2014-16
[3] PHOF indicator 4.03 "Mortality rate from causes considered preventable" 2014-16

### 1.4.3 Need for targeted action

As summarised above and in the POBC, lack of action to achieve compliance would result in public health driven economic and regulatory implications for Birmingham City Council. The air quality baseline analysis outlined earlier in this document highlights road traffic as a primary source of harmful emissions in the city, with diesel vehicles, including private cars, taxis, buses, LGVs and HGVs, as the most significant contributors to nitrogen dioxide emissions.

The Government issued the UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations in July 2017 which identified Birmingham as one of the areas experiencing the greatest problem with nitrogen dioxide exceedances. The Government's Plan requires the Council to deliver the best Clean Air Zone option to achieve statutory nitrogen dioxide limit values within the shortest possible time.

The 2016 and 2020 air quality baseline assessments highlight that most locations of exceedances are forecast to be within the City Centre, bounded by the ring road. Outside this area, other notable exceedances are located on A38 approaching the City Centre. This drives the need for CAZ around the City Centre, which is bounded by the A4540 Ring Road. In particular, a CAZ defined by the ring road would not only tackle exceedances within the City Centre, it would also indirectly mitigate the other notable exceedances located on A38 approaching the City Centre.

The air quality baseline analysis also identifies that there are notable exceedances on the motorways in the north of the City. It is understood that Highways England are addressing such exceedances as part of their national plan.

Considering the source apportionment analysis, a CAZ around the city centre would need to consider restrictions or charges for all vehicle categories, including private cars. Furthermore, considering that the annual mean $NO_2$ concentrations remain above the legal thresholds consistently following the implementation of various restriction and complementary measures in Birmingham, there is a need to bring about a significant shift in local behaviours in the City. The stated preference analysis undertaken highlights the need for a charging CAZ to achieve such behavioural change.

That said, early modelling undertaken as part of the development of the project's Strategic Outline Case clearly highlights that achievement of the required improvement in air quality is unlikely to be feasible in Birmingham if only charging options are considered. This inference was reinforced as part of the additional

analysis carried out as part of the Outline Business Case. Consistent with the conclusions of the OBC, this continues to drive the need for inclusion of additional measures.

### 1.4.4 Other key considerations

Given its statutory equality duty, Birmingham City Council wants to ensure that compliance of $NO_2$ emissions will not create any significant dis-benefits to disadvantaged groups. In particular, the OBC concluded that depending on the preferred option for a Clean Air Zone, there could be some impacts on people on lower incomes and those in minority ethnic communities that need to be recognised and mitigated where possible, in order to avoid any particular group being disproportionately affected.

The OBC also indicated that there could be an impact on local small and medium sized enterprises who employ Birmingham residents. Within this context, the OBC concluded that any scheme-specific equalities issues will be identified and mitigation measures (and / or exemptions) would be designed to reduce any negative impacts as far as possible. Further work carried out as part of this Full Business Case adopts this approach to underpin the rationale for relevant mitigation measures and exemptions. An overview of the key findings is presented later in the Strategic Case, with further details outlined in the Economic Case.

On a different note, as summarised earlier in this document and in the OBC, Birmingham has strong growth forecasts. A significant proportion of the City's growth is envisaged to be delivered around the city centre. This growth is currently constrained by the current capacity of the city's transport infrastructure in the short to medium term. Within this context, the Council expect that the emerging CAZ will act as an enabler of development and growth in the city centre. In particular, a city centre based CAZ can facilitate capacity on the city centre's road network, which can unlock development and growth locally. Whilst enabling such developments, like the mixed-use plans for Snowhill Station and surrounding areas, the OBC concluded that the Council will need to ensure that their transport demand is multi-modal and any vehicle based demand is met through modern fleet of low-emission vehicles. This conclusion remains valid as part of the updated case for change presented in this Full Business Case.

The above outlines the project's case for change, to achieve compliance with legal limits of $NO_2$ emissions and outlines the potential for Birmingham to further improve air quality. This rationale for intervention, which was first established as part of the Strategic Outline Case and advanced further as part of the Outline Business Case, informed the development of the project's spending objectives and critical success factors. This Strategic Case prepared as part of the Full Business Case reinforces the project's case for change which developed as part of the Outline Business Case. Furthermore, the project's spending objectives and critical success factors stated in the Outline Business Case remain unchanged as part of this Full Business Case.

The spending objectives and critical success factors acted as key inputs for short-listing the options for detailed economic appraisal at the Outline Business Case stage. These remain unchanged as part of this Full Business Case and are summarised in the subsequent section of this Strategic Case.

Furthermore, as stated in the Outline Business Case, whilst determining the preferred option for the project, the Council will ensure that the identified air quality exceedances are not displaced elsewhere in the City. This principle

The project's logic map which captures its core aspects of case for change is presented in the

Table 1.8.

Table 1.8 - Logic Map of Birmingham CAZ and Additional Measures (including mitigation measures and exemptions)

| Inputs | Outputs | Outcomes | Impacts |
|---|---|---|---|
| Implementation Fund | Clean Air Zone (geography and price structure by vehicle category) | Change in journey characteristics: journeys made in less polluting vehicles, cancelled or diverted journeys | Improved air quality |
| Clean Air Fund | Infrastructure to monitor and enforce the Clean Air Zone | Increased mode share of public transport | Increased physical activity |
| Other local funding | Additional measures | Increased mode share of active travel modes | Improved human health |
| Local Plan | Mitigations and exemptions | Changes to vehicle fleet | Loss of some economic activity (supply side effects) |
| Equality Duty | | Cost of compliance | Enable economic growth in the City Centre |
| | | Behaviour change | |
| | | Reduction in local $NO_2$ concentrations | |
| | | 'Neutralised' negative impacts on SMEs / micro businesses and disadvantaged groups | |
| | | Additional capacity on the network in the City Centre | |

## 1.5 Scheme Objectives and Success Factors

Underpinned by the rationale for intervention outlined as part of the assessment of Case for Change, BCC have defined its spending objectives to shape a clear way forward. The spending objectives will also allow Birmingham to deliver the outcomes sought by the national Air Quality Plan and support the wider policies set out in the Birmingham Development Plan, Clean Air Zone Framework and Brum Breathes.

Following the identification of spending objectives, JAQU's Options Appraisal Package guidance requires determination of Critical Success Factors (CSFs). The guidance states that a list of CSFs is required to

conduct a high-level comparative assessment of the options. This process is considered to result in a shortlist of options which are envisaged to be appraised in greater detail as part of the development of the Full Business Case.

Building on the above context, this section presents the project's spending objectives and CSFs.

It is worth noting that project's spending objectives and critical success factors were first established as part of the Strategic Outline Case, and subsequently refined as part of the Outline Business Case. The spending objectives and critical success factors presented in the final Outline Business Case remain valid and are adopted as part of this Final Business Case.

### 1.5.1 Spending Objectives

Following JAQU's guidance the spending objectives are presented across two categories: primary objectives and secondary objectives. Birmingham City Council's primary spending objective for Birmingham is to:

- **SO1 Compliance** - Deliver a scheme that leads to compliance with $NO_2$ concentration limits[13] in the shortest possible time.

Birmingham City Council also has a series of supplementary spending objective that support solutions:

- **SO2 Value for money** - Demonstrate value for money for Birmingham City Council and, where central government funding is required, for the Government.
- **SO3 Evidence based** - Are driven by need, are based on real-time local evidence of air quality, emission sources, and levels of air pollution in Birmingham or in specific pollution hotspots, and where necessary the potential benefits and impacts are capable of being modelled.
- **SO4 Fair and proportionate** - Are targeted to minimise the impacts on local residents and businesses, including on disadvantaged groups, such that:
- there are no unintended consequences,
- ordinary working families who bought diesel vehicles in good faith are not unfairly penalised,
- support is made available to owners of affected vehicles where access restrictions or charging prevents certain vehicles from using particular roads at particular times, and
- **SO5 Transition to Low Emission and healthier economy** - Contribute to, and not compromise, Birmingham City Council's ambition to half the level of all pollutants by 2030 whilst supporting Birmingham's growth and accelerating the transition to a low emission economy, and creating a healthy place to live, visit and work.

### 1.5.2 Critical Success Factors

JAQU's Options Appraisal Package guidance also suggests that local authorities need to identify two types of CSFs: primary CSF and secondary CSF. The project's CSFs, which were defined as part of the Strategic Outline Case (SOC) for shortlisting the options, and their relationship with the above-mentioned spending objectives is summarised below. Further details regarding the CSFs and their relationship with the spending objectives are set out in Appendix 1B.

JAQU require that local authorities appraise their options against one primary (pass/fail) CSF and any options which do not meet this CSF should be rejected. Building on the guidance provided in the Options Appraisal Package document, the primary CSF for the Plan is:

- CSF1 Compliance: Deliver a scheme that leads to compliance with NO2 concentration limits (annual mean NO2 concentration of 40µg/m2) in the shortest possible time. This CSF directly supports Spending Objective SO1.

[13] The $NO_2$ annual mean value may not exceed 40 micrograms per cubic metre (µg/m3) as defined in the air quality directive (2008/EC/50) and as reported in Air Pollution in the UK report.

JAQU's Options Appraisal Package guidance highlights that there is a need to define other secondary CSFs to further differentiate amongst options. In particular, options that meet the primary CSF are required to be considered against the secondary CSFs. A number of secondary CSFs were defined against which options have been assessed, these are:

- CSF2 Value for money: This CSF considers the full range of costs and benefits to society of the proposed option (such as the health benefits of improved air quality and the costs to the public in complying with a measure) rather than just looking at the financial impacts to determine if the measure is viable within an economic context. This CSF directly contributes to Spending Objective SO2.
- CSF3 Evidence based: This CSF considers to what extent, the case for an option is based on real-time local evidence of air quality, emission sources, and levels of air pollution in Birmingham or in specific pollution hotspots, and (where applicable) the potential benefits and impacts are capable of being modelled. This CSF directly contributes to Spending Objective SO3.
- CSF4 Distributional impacts: This CSF considers the potential impacts on key groups of the proposed option, in order to determine whether there is likely to be a disproportionate impact on one or more particular groups. This CSF directly contributes to Spending Objective SO4.
- CSF5 Strategic and wider air quality fit: This CSF considers how the proposed option interacts with other local policies already in place, in particular the transitioning to a low emission and healthier economy by 2030 This CSF directly contributes to Spending Objective SO5.
- CSF6 Supply side capacity and capability: This CSF considers whether or not there is sufficient commercial capacity or capability in the supply chain to successfully deliver the proposed option and whether or not this is available. This CSF reflects the considerations made in the Commercial Case.
- CSF7 Affordability: This CSF considers if the option can be delivered given the potential resources available (for example staffing levels) and management structures in place as outlined in the management case. This CSF reflects the considerations made in the Financial Case.
- CSF8 Achievability: This CSF considers if the option can be delivered given the potential resources available (for example staffing levels) and management structures in place as outlined in the management case. This CSF reflects the considerations made in the Commercial and Management Cases.

## 1.6 Optioneering

This section summarises the optioneering process adopted to determine the shortlist of options for Birmingham CAZ as part of the Outline Business Case. The shortlisted options were subsequently appraised in the Economic Case of the Outline Business Case to determine the preferred way forward.

### 1.6.1 Developing and shortlisting CAZ options and additional measures

Driven by the project's spending objectives a long-list of CAZ options were identified. The initial CAZ optioneering took place based on sifting using the primary and secondary Critical Success Factors. The results qualitative and quantitative analysis was used to determine the shortlist of CAZ options. More detail of the long to shortlist sifting can be found in Appendix 1A, Table 6.1.

### 1.6.2 Selection of CAZ D Inner Ring Road

As identified earlier in this document, early modelling undertaken as part of the development of the project's Strategic Outline Case clearly indicated that achievement of the required improvement in air quality is unlikely to be feasible in Birmingham if only CAZ charging options are considered. In particular, the modelling indicated that under the counterfactual case, where no CAZ is imposed, nearly 207,000 vehicles will enter the area bounded by inner ring road on a daily basis in 2020. This area, within and around the City Centre, includes most locations of $NO_2$ exceedances in the City. It requires targeted action not least because some 57,400 non-compliant vehicles are forecast to enter this area every day by 2020, resulting in more than 40 locations of $NO_2$ exceedances.

Modelling for a CAZ C for inner ring road indicated a marginal reduction in the number of vehicles entering the proposed charging zone by 2020 every day. In addition, the introduction of CAZ C for inner ring road, is forecast to reduce the number of non-compliant vehicles entering the proposed charging zone by more than 16,000 vehicles daily by 2020. Despite such forecasts the modelling estimates that there will be 19 locations of $NO_2$ exceedances in 2020. A CAZ C option for inner ring road achieves the $NO_2$ emission compliance level across all exceedance locations much after 2022. Based on this analysis, CAZ C for the inner ring road was discounted from the optioneering process.

Considering the results for CAZ C for the inner ring road, CAZ A and CAZ B options for the inner ring road were also discounted, as they would not be able to achieve compliance at the earliest possible time.

Modelling for a CAZ D for inner ring road indicated a notable reduction in the number of vehicles entering the proposed charging zone by 2020 every day, when compared to the counterfactual case. In addition, the introduction of CAZ D for inner ring road, is forecast to reduce the number of non-compliant vehicles entering the proposed charging zone by more than 50,000 vehicles daily by 2020, when compared to the counterfactual case. Despite such forecasts the modelling estimates that there will be 12 locations of $NO_x$ exceedances in 2020. A CAZ D option for inner ring road is estimated to achieve the $NO_2$ emission compliance level across all exceedance locations post 2022.

The transport and air quality modelling results for the reference case, CAZ C for inner ring road and CAZ D for inner ring road options are summarised in Table 1.9.

Table 1.9 - Modelling results for Counterfactual Case, CAZ C and CAZ D inner ring road options

| CAZ Option | Geography | Total vehicles entering CAZ (2020) | No of non-compliant vehicles entering CAZ (2020) | Percentage of vehicles entering CAZ, which are non-compliant (2020) | No of location of exceedances (2020) |
|---|---|---|---|---|---|
| No CAZ – counterfactual case | Inner Ring Road | 206,900 | 57,400 | 27.7% | 41 |
| CAZ C | Inner Ring Road | 205,100 | 41,300 | 20.1% | 19 |
| CAZ D | Inner Ring Road | 190,900 | 6,500 | 3.4% | 12 |

Although the CAZ charging options for outer ring road failed to meet the requirements of the primary Critical Success Factor due to significant deliverability risks related to physical implementation and enforcement, initial transport modelling was undertaken for a CAZ D outer ring road option to assess its ability to reduce the number of non-compliant vehicles beyond those delivered by CAZ D inner ring road option discussed above.

This analysis indicated that a CAZ D for the outer ring road would result in some 197,500 vehicles entering the charging zone, of which some 16,800 vehicles would be non-compliant. Furthermore, the analysis indicated that the number of non-compliant vehicles entering the area bounded by the inner ring road, the location of most $NO_2$ exceedances in Birmingham, CAZ D outer ring road option is only marginally lower than those forecast for the CAZ D inner ring road option. This demonstrates the diminishing returns for expanding the CAZ boundary in terms of reducing the number of non-compliant vehicles, a key driver for $NO_2$ emissions in Birmingham.

Based on these results, it was concluded that the performance of the CAZ D outer ring road option would only be marginally better than that of the CAZ D inner ring road option in terms of reducing $NO_2$ emissions. This marginal change was considered not to be sufficient enough to ensure that $NO_2$ compliance in Birmingham would be achieved earlier if CAZ D outer ring road option was delivered rather than the CAZ D

inner ring road options. Considering the diminishing returns to limit non-compliant vehicles from approach locations of exceedances and its inability to provide any improvements in regarding $NO_2$ compliance, CAZ D outer ring road was again discounted from the optioneering process.

### 1.6.3 CAZ D Inner Ring Road Price Sensitivities

Based on the analysis summarised in the section above, options which integrate CAZ D inner ring road option were considered to be an appropriate way forward. That said, some additional price sensitivity analysis was undertaken to determine the appropriate level of charging. Lower levels of charges, compared to the proposed rates, were deemed inappropriate as they continued to encourage significant volume of non-compliant traffic into the charging zone. Furthermore, transport modelling results indicated that significantly higher charges, compared to the proposed rates, still resulted in large volume of traffic, including a notable number of non-compliant vehicles. These traffic modelling results for various price sensitivities are summarised in Table 1-10.

Table 1.10 - Modelling results for Counterfactual Case, CAZ C and CAZ D inner ring road options

| CAZ Option | Geography | Price Sensitivities (as discussed with TOM) | Total vehicles entering CAZ (2020) | No of non-compliant vehicles entering CAZ (2020) | Percentage of vehicles entering CAZ, which are non-compliant (2020) |
|---|---|---|---|---|---|
| CAZ D | Inner Ring Road | Ultra-high – 200% of proposed charges | 197,200 | 1,300 | 0.7% |
| CAZ D | Inner Ring Road | High – proposed charges | 190,900 | 6,500 | 3.4% |
| CAZ D | Inner Ring Road | Medium – 50% of proposed charges | 193,800 | 17,200 | 8.9% |
| CAZ D | Inner Ring Road | Low – 25% of proposed charges | 196,800 | 23,800 | 12.1% |

Achieving compliance for $NO_2$ emissions requires significant reduction in traffic volume in the zone, not just a reduction in the number of non-compliant vehicles entering the zone. As summarised in Table 1.10, there is only marginal difference in traffic volume between the high (proposed charges) and ultra-high (200% of proposed charges) CAZ D inner ring road options. Considering the diminishing returns to reduce number of vehicles entering the zone by significantly increasing the charges and the inability of increased charges to provide any improvements in regarding $NO_x$ compliance, CAZ D inner ring road ultra-high charges option was discounted from the optioneering process.

### 1.6.4 Need for additional measures

The above analysis demonstrates that CAZ D inner ring road high charges (proposed) option was considered to be the appropriate way forward. That said, the option is estimated to achieve the $NO_2$ emission compliance level across all exceedance locations post 2022. Within this context, there was a need to identify a long-list of complementary additional measures.

In order to identify the additional measures that could be considered in conjunction with a CAZ to achieve compliance, a desk top study has been undertaken to review existing evidence on local, regional and national measures to improve air quality. In addition, Birmingham City Council, Transport for West Midlands and key local stakeholders were consulted to identify further measures to take through an initial sifting process. This generated a longlist of 104 potential options. The longlist of additional measures is set out in Table 1 (p3-26) of the "Birmingham Clean Air Zone Feasibility Additional Measures Study".

The long-list of additional measures (104 in total) went through a three-phased short-listing process. Phase 1 involved assessing a longlist of additional measures against some high-level criteria to eliminate those that clearly do not contribute to the Critical Success Factors. A total of 31 options were identified within the context of contributing to the primary objective.

Phase 2 involved developing and applying a Multi Criteria Analysis (MCA) framework to rigorously appraise each option taken forward from Phase 1 to identify those that should be taken forward for further development. This involved assessing each option against multiple criteria and scoring each measure. A total of 18 options were recommended for further development and assessment in Phase 3. In addition, a further 14 additional measures have been identified that have the potential to contribute to further improving air quality post 2020 in support of the wider spending objectives and local air quality policy.

Following the completion of Phase 3 assessment, a shortlist of 11 additional measures / packages of measures were taken forward for quantitative traffic and air dispersion modelling. The results of this modelling were analysed to determine the package of additional measures, which includes:

- All BCC controlled parking which is currently free will have a charge applied.
- Banning traffic travelling northbound on Suffolk Street Queensway (A38) that exits onto Paradise Circus to then access Sandpits Parade and southbound traffic from Paradise Circus accessing the A38.
- Close Lister Street and Great Lister Street at the junction with Dartmouth Middleway.

The above mentioned additional measures are deliverable by 2020. Additional measures which can be delivered in 2021 and 2022, are presented in Appendix 1D. The modelling results indicate that a CAZ D inner ring road plus additional measures option indicates that $NO_2$ compliance will be achieved at all but one location by 2021. However, Suffolk Street Queensway is forecast to achieve compliance by 2022. BCC will continue working on to see if compliance can be achieved before 2022 at this one location (see table below for further details).

Table 1.11 – Exceedance by location (intervention case)

| Road name | Site Description | Model ID | **2020** NOx µg/m3 | **2021** NOx µg/m3 | **2022** NOx µg/m3 | **2023** NOx µg/m3 |
|---|---|---|---|---|---|---|
| **A4400 Suffolk Street Queensway** | Inside CAZ S PCM | PCM_0 | **42.1** | **40.6** | 39.0 | 37.5 |
| **A38 CORPORATION STREET** | Inside CAZ N PCM | PCM_2 | **40.3** | 38.7 | 37.1 | 35.5 |
| **A4540 WATERY LANE MIDDLEWAY** | Ring Road East | PCM_6 | **40.6** | 38.8 | 37.0 | 35.2 |
| **M6** | M6 | PCM_21 | **41.0** | 39.4 | 37.7 | 36.1 |
| **A38 St Chads Queensway** | Inside CAZ N PCM | PCM_158 | **40.5** | 38.9 | 37.3 | 35.7 |
| **A38 Queensway (Tunnel)** | Inside CAZ S PCM | PCM_161 | **40.5** | 39.1 | 37.7 | 36.3 |
| **Digbeth** | Digbeth | ObjectID_15_@4m | **40.6** | 39.2 | 37.8 | 36.4 |

### 1.6.5 Need for further mitigation measures and exemptions

Responding to the final distributional impacts assessment of CAZ D inner ring road option a long list of mitigation measures was developed. These were appraised against primary and secondary CSF to determine the final proposals for mitigation measures, summarised in the table below.

Table 1.2 – Final Proposals for Mitigation Measures

| Ref | Measure | Group impacted | Geographic scope |
|---|---|---|---|
| M1a | Mobility support for individuals working within the CAZ (20c) | Private car/van owners who work or live within the CAZ | Not restricted to geographic area for vehicle owner (place of work in CAZ) |
| M1b | Mobility support for individuals residing outside of the CAZ (20c) | Private car/van owners | West Midlands |
| M2a | Hackney carriage support package (20b) | Hackney carriages | Birmingham and surrounding areas (licenced BCC drivers) |
| M2b | Council Hackney carriage leasing scheme (20b) | Hackney carriages | |
| M2c | Private Hire Vehicle upgrade support (20b) | Private Hire Vehicles | |
| M3 | 'Free miles' for ULEV LGVs (20b) | Van fleets | Birmingham |
| M4 | HGV & Coach compliance fund (20b) | HGV and Coach fleets | West Midlands |
| M5 | Marketing and engagement campaign (20b) | Owners of non-compliant vehicles) | - |
| M6 | Resident parking scheme | Residents living close to the CAZ | Areas surrounding CAZ |

On a similar note, community groups that would be negatively impacted by a CAZ D inner ring road option were identified and a long list of exemption categories were identified. This was then used to inform an initial sifting of the longlist to remove those measures which would impact the compliance date, relative to a scenario where there were no exemptions. The increased number of trips, in AADT terms, was estimated for each of the twelve exemptions on the longlist. The next level of sifting was to eliminate areas of overlap between the different exemption options to ensure the most efficient package is created.

The final proposed exemptions include the following categories: CAZ HGVs and coaches; HGVs with existing finance agreements; SME Vans; Vans with existing finance agreements; CAZ residents; Income deprived working within the CAZ; Key workers working within the CAZ; selected medical locations; Section 19 registered community and school transport.

Further details of the options development and short-listing process is summarised in the Economic Case. Details regarding State Aid Compliance of the proposed mitigation measures and exemptions are presented in Birmingham City Council's Clean Air Fund Report (November 2018).

## 1.7 Shortlisted options

Following the process summarised above, three options were short-listed for detailed economic appraisal as part of the final Outline Business Case. Building on the baseline evidence base and short-listing process, all shortlisted options include a charging based CAZ for entering the City Centre, bounded by A4540 Ring Road (inner ring road).

The three options shortlisted at the

- **Option 1 - CAZ D inner ring road:** non-compliant class D vehicles (i.e. buses, coaches, taxis, heavy goods vehicles, light goods vehicles and private cars) would be charged to enter the CAZ
- **Option 2 - CAZ D plus additional measures package:**
- All on-street free parking in CAZ becomes paid for.
- Banning traffic travelling northbound on Suffolk Street Queensway (A38) that exits onto Paradise Circus to then access Sandpits Parade and southbound traffic from Paradise Circus accessing the A38.
- Close Lister Street and Great Lister Street at the junction with Dartmouth Middleway.
- **Option 3 - CAZ D plus additional measures, mitigation measures and exemptions package:**
- Same package of additional measures as identified for Option 2
- Mitigation measures and exemptions as identified in Section 1.6.5.

Due to data limitations, only Option 1 (CAZ D inner ring road) and Option 2 (CAZ D plus additional measures package) were appraised and reported in the Economic Case of the Outline Business Case. Of the two options appraised, Option 2 was considered to deliver better value for money. That said, considering the Council's equality duty, other legislative requirements and a need to minimise the negative distributional impacts, the Outline Business Case highlighted the need to include a final package of mitigation measures and exemptions along with the additional measures to define the preferred way forward for Birmingham Clean Air Zone project. This forms the scope of Option 3 (CAZ D plus additional measures, mitigation measures and exemptions package).

This Economic Case of the project's Full Business Case revisits the value for money position of Option 2 (CAZ D plus additional measures package) and compares it with that of the preferred option, Option 3 (CAZ D plus additional measures, mitigation measures and exemptions package).

## 1.8 Benefits, Risks, Constraints and Inter-Dependencies

### 1.8.1 Benefits

The implementation of a CAZ and additional measures in Birmingham presents an opportunity to deliver a wide range of benefits. JAQU has provided guidance and supporting data to ensure consistent assessment of quantified and non-quantified impacts of the project.

Core benefits of the project relate to the *Public Health and the environment* due to the reduction of $NO_2$ and other pollutants.

- Reduced impacts on human health measured through reduction in health expenditure (hospital admissions, mortality impacts and chronic bronchitis impacts)
- Increased productivity which is evaluated through work absenteeism caused by ill-health
- Reduced damage on built environment (residential dwellings and historical and cultural buildings) measured by the surface cleaning costs and amenity costs.

- Reduced impact on ecosystems (nature conservation and green spaces within the boundary)
- Reduced emissions having an impact on climate change.

Other benefits reflect the improvement of the *use and performance of the transport network*:

- Impact on journey times for both private and public transport due to reduction of traffic load and consequently more reliable over-ground PT services.
- Increased travel by sustainable modes such as walking, cycling and public transport as an alternative to CAZ charges.
- Reduced operating costs due to traffic congestion mitigation.
- Reduction in accident rates on road.

Further benefits generated by *potential revenue streams* will include:

- Reinvestment in local transport policies which aim to improve air quality and support the delivery of the ambitions of the Plan.

The above presents an overview of the project's impacts. A detailed assessment of the project's preferred option's economic impact is presented in the Economic Case. Impact assessment of other two short-listed options is presented in the Outline Business Case.

### 1.8.2 Risks

The key risks, as identified as part of the Outline Business Case, are associated to social acceptance, economic and human resources and traffic and emission impacts.

- The level of acceptance within the population which can be translated into dissatisfaction around the charging scheme. Health and environmental benefits should be the main discussion around the CAZ in the Communication Plans and programmes to get recognition from stakeholders and citizens.
- Disproportional penalization to vulnerable groups in the society by geographical location, scale and structure of vehicle compliance standards.
- The transition from diesel vehicles (which produce high levels of $NO_2$) to petrol vehicles to be compliant with the CAZ framework could lead to increase the levels of carbon dioxide.
- The potential impacts on the network, displacing traffic going to or through the city centre and re-routing and consequently displacing negative outcomes to other areas of the city.
- The availability of economic and human resources is also key to fund and run the implementation of the CAZ and the posterior management, monitoring and enforcement of the required initiatives.
- Severity on the impact of economic activity in the city centre, where significant proportion of jobs are located and the ability to mitigate.

These risks continue to remain valid for the project as it progresses through the Full Business Case stage.

### 1.8.3 Constraints and inter-dependencies

The most significant constraint on the Plan is to meet the national air quality standards in the shortest time possible. The priority in the optioneering and appraisal process is the capacity to deliver the expected outcome in a quicker way rather than in a cheaper way. This time constraint is dependent on many factors at a national, regional and local level which contribute to lead the change towards a more sustainable and clean environment. These factors can be governmental institutions, local entities and public and private companies which through their programmes and policies, projects and transparency processes can make the progress effective.

The reduction of $NO_2$ emissions is achieved by transforming the road vehicles fleet structure to be compliant with the emission standards. The success on influencing users to uptake cleaner vehicles is highly related to the availability of new vehicles in the market (private companies producing Low Emission Vehicles), the provision of the appropriate infrastructure and facilities to support this type of vehicles, and promotional programmes and incentives to buy low emission vehicle (LEV).

To improve the performance of the implementation and operation there is also a great dependency on those organizations that own data which are key to understand the CAZ operation and the regional air quality challenge, such as data bases provided by taxi levy, transport operators, national data base of vehicle compliance and monitoring data. Operating the CAZ at a local level or from a central operations centre might have influence in the way data is effectively transferred.

Furthermore, CAZ is not the only measure which contributes towards the achievement of the objectives. It is the sum of actions, plans and specific projects and developments which are responsible for enhancing sustainable and healthy environments. Birmingham is currently growing support by a group of connectivity packages such as Snowhill Development and HS2 arriving to the city. Both are working together with relevant authorities to maintain air quality, especially where construction or operations may have significant air quality effects such as air quality management areas or zones with plans or measures directed at compliance with national standards. Then, the delivery of these schemes will be crucial to improve the air quality.

### 1.8.4 Stakeholder Engagement

The Council has identified a preferred plan for implementation of a Clean Air Zone and a key part of that will be consultation with residents, businesses and other stakeholders. Whilst the legislation does not prescribe the consultation requirements, the Council has sought Counsel's advice on the approach for the CAZ consultation process.

There is a high prospect of challenge with regard to any action the Council decides to take, from either environmental interest groups who do not consider that the proposals go far enough or / and from specific individuals or groups that may be especially adversely affected by the proposals.

Travel patterns and behaviours continue to be a key part of the challenge in tackling air quality and there is a need to continue to encourage the use of more efficient forms of transport and where possible reduce the overall demand for travel.

The Council undertook a six-week consultation process on the preferred option between July and August 2018. This public consultation received a record number of responses for a Birmingham City Council consultation (exceeding 10,000 responses). This included a number of stakeholder events, including targeted focus group meetings with taxi and Hackney Carriage drivers. The consultation responses were used to inform the scope of mitigation measures and exceptions outlined in Section 1.6.5 earlier.

The Council continues to engage with key stakeholders. Officers and Cabinet Members have taken part in a number of events to build awareness of the issues with air quality and explain the rationale behind introducing a CAZ in Birmingham. The Council will shortly commence organising a press conference and subsequent release as part of the publication of the Full Business Case. Furthermore, a marking and communication campaign is also being planned for the New Year, which will focus on raising awareness of the CAZ and the final package of mitigation measures and exemptions

# 2 Economic Case

## 2.1 Introduction

This document sets out the Economic Case for the preferred option to implement the Birmingham Clean Air Zone (CAZ). Defined as the option that achieves compliance with the EU limit values for air quality in the shortest possible time.

The Birmingham Clean Air Zone Scheme, referred to as CAZ D plus Additional Measures consists of:

- CAZ D – all non-compliant class D vehicles must pay a charge when entering the Clean Air Zone (buses, coaches, taxis, heavy goods vehicles, light goods vehicles and private cars);
- Three additional measures to increase health and environmental benefits:
    - All BCC controlled free parking in the CAZ becomes charged.
    - Banning traffic travelling northbound on Suffolk Street Queensway (A38) that exits onto Paradise Circus to then access Sandpits Parade and southbound traffic from Paradise Circus accessing the A38.
    - The closure of Lister Street and Great Lister Street at the junction with Dartmouth Middleway. This allows more green time on the A4540, apart from buses.
- Mitigation and exemptions packages created for groups identified as adversely impacted from scheme implementation.

The Do Minimum used for comparison recognises changes in accordance to exogenous factors, such as fleet composition, and assumes no new local or national policies are implemented targeting air quality.

A cost-benefit analysis has been undertaken based on five distinct, but related, assessments:

- Costs to BCC – associated with setting up and operating a CAZ and additional measures.
- Costs to transport users – associated with complying with the CAZ.
- Health and environmental benefits –from the reduction in $NO_2$, $PM_{10}$ and $CO_2$ emissions generated for each option.
- Mitigation and exemptions – costs and benefits associated with certain groups being exempt from CAZ charges or receiving compensation through mitigation schemes.
- Distributional impact assessment – analysis, following JAQU guidance, of the potential distributional and equality impacts on different groups.

The economic assessment in this Economic Case has been conducted in accordance with JAQU guidance. Impacts are presented for the central case, however sensitivity tests are also performed.

### 2.1.1 Summary of Findings

The CAZ D plus Additional Measures scheme was selected through an optioneering process where a long list of options was assessed and reduced to a short list of potential options. These potential options were then assessed in the Outline Business Case where the preferred scheme was selected. This process is discussed in Section 2.2.

The CAZ D plus Additional Measures scheme delivers substantial benefits in terms of reduced emissions, many of which have been monetised. In addition, the CAZ will lead to non-monetised impacts, including the following.

- Reduced material damage (particularly to historical and cultural buildings).
- A positive effect on nature conservation/green sites within the CAZ boundaries.
- A positive effect on climate change through reduced greenhouse gas (GHG) emissions, measured in $CO_2$ equivalent tonnes.

The monetised value of environmental benefits for the CAZ D plus Additional Measures scheme over the appraisal period is £50m. This figure is broken down in Table 2.1. It is notable that the damage cost estimates from DEFRA do not account for all the improved health outcomes associated with improved air quality and behavioural changes associated with the CAZ. For example, they do not account for the impact of $NO_2$ on hospital admissions, and therefore, morbidity impacts are potentially underestimated.

Table 2-1 Total health and environmental benefits of reduced NO2 and PM10 emissions and CO2 (£m, 2018 discounted prices)

| **Pollutant** | **CAZ D plus Additional Measures** |
|---|---|
| $NO_2$ and $PM_{10}$ | 46 |
| $CO_2$ | 4 |
| **Total** | **50** |

Traffic and Air Quality modelling indicate that air quality compliance, defined as all receptors forecast to measure an annual average $NO_2$ level below 40 µg/$m^3$, is not achieved in 2020 by the CAZ D plus Additional Measures scheme. However, the modelling does forecast that compliance will be achieved in 2021, apart from one location that BCC will continue working on to see if compliance can be achieved before 2022.

The traffic modelling shows that the introduction of Additional Measures reduces the AADT (Average Annual Daily Traffic) accessing the CAZ area by 1.5%. As a result, the inclusion of the Additional Measures increases the health and environmental benefits by £13m. This is a significant benefit, particularly when viewed with the £1.25m cost estimated to implement the Additional Measures.

Table 2-2 summarises the economic impacts of the CAZ D plus Additional Measures scheme over the 10-year appraisal period. The table shows that along with health benefits the scheme delivers benefits in the form of journey time savings and reduced vehicle operating costs. These benefits arise from the reduction of non-compliant vehicle traffic lowering congestion levels.

This disbenefit associated with the implementation of parking charges if offset by corresponding gains in the form of government and private sector revenue. Although these offset, they are not treated as a transfer as a resource (parking space use) is used.

The disbenefit associated with individuals accelerating their vehicle upgrades to have a compliant vehicle and from individuals changing their travel behaviour are significant. Exhibiting this, prior to the introduction of mitigations for impacted users the scheme generated a negative Present Value of Benefits (PVB). However, the inclusion of Clean Air Fund (CAF) mitigation measures within the scheme offsets a portion of disbenefit arising from scheme implementation. The combined result is the scheme producing a positive present value of benefits (PVB).

The present value of costs (PVC) for the scheme is negative as the revenue generated from the CAZ charges is considered a transfer and is not included in the appraisal. Therefore, only scheme costs and government parking revenues are considered. The PVCs are greater than the PVBs, resulting in a Benefit Cost Ratio of 0.30 and a NPV of negative 64.

Further descriptions of each monetised benefits and dis-benefits is provided in the Section 2.6.

Table 2-2 Scheme Net Present Value, £m 2018 discounted prices

| Analysis of Monetised Costs and Benefits (AMCB) | CAZ D plus Additional Measures |
|---|---|
| Benefits - health and non-health, damage costs | 46 |
| Benefits - reduced CO2 emissions | 4 |
| Benefits to transport users - changes in journey time and vehicle operating costs | 60 |
| Benefits from CAF | 44 |
| Cost to Transport Users - Parking charges | -38 |
| Cost to Transport Users - upgrading | -53 |
| Transaction Cost - vehicle upgrade | -0.1 |
| Transaction Cost - paying CAZ charge | -10 |
| Welfare (trips foregone) | -15 |
| Welfare Remoded | -18 |
| Parking welfare loss | -22 |
| Private Sector Benefits - Parking revenues | 30 |
| **Present Value of Benefits (PVB)** | **28** |
| Costs to BCC capex | 19 |
| Costs to BCC opex | 35 |
| Cost from CAF Grant | 46 |
| Revenues from Parking Charges | -8 |
| **Present Value of Costs (PVC)** | **92** |
| **Net Present Value (NPV)** | **-64** |

## 2.2 Clean Air Zone scheme option appraisal

As part of the Strategic Outline Case (SOC), a longlist of options that are likely to be effective in countering the specific sources of $NO_2$ exceedances in Birmingham were considered and assessed against a set of Critical Success Factors (CSFs).

### 2.2.1 Critical Success Factors

Please refer to section 1.5.2 of the strategic Case for full details of the primary and secondary critical success factors.

### 2.2.2 Additional Measure Optioneering

A desktop study was undertaken reviewing existing evidence on local, regional and national measures to improve air quality to identify the additional measures that could be considered in conjunction with a CAZ to achieve compliance. In addition, BCC, Transport for West Midlands and key experts from the Birmingham CAZ work stream were consulted to identify further measures to take through an initial sifting process. This generated a long list of 104 potential options. The long list of additional measures is set out in Table 1 (p3-26) of the Birmingham Clean Air Zone Feasibility Additional Measures Study.

#### *2.2.2.1 Sifting*

As explained Appendix 1B, the additional measures were sifted through 3 phases. Several different tests were run to select the package of additional measure options that would be shortlisted. Review determined that some measures would not be practical to implement by 2020, these were excluded prior to full modelling.

Through this process, a shortlist of 11 additional measures/packages of measures were taken forward for quantitative traffic and air dispersion modelling. The 11 additional measures reviewed as part of the short-list were the following.

- Increase LPG refuelling for Hackney Carriages, the installation of rapid EV infrastructure for taxi and private hire vehicles, retrofitting of black taxis to LPG and zero emission buses/retrofitting of public transport fleet.
- Parking Strategy – remove free parking, parking charging and permits graded by vehicle standard or zone charges.
- Speed Enforcement – average speed enforcement along the A38 and near Dartmouth Circus to manage traffic and smooth flows.
- Speed reduction – reduce speed limits on certain routes and use variable speed limits.
- Public Transport Improvement Measures - Highway/infrastructure improvements to bus services to make them more viable and accessible to the public and increase bus priority schemes, to restrict traffic on Moor Street Queensway to bus, taxi and cycle only and to close Park Street to all traffic.
- Incentivise or subsidise sustainable travel by up to 50% to improve public transport patronage.
- Ban the route of traffic travelling northbound on Suffolk Street Queensway that exits onto Paradise Circus to then access Sandpits Parade.
- Ban the route of traffic travelling northbound on Suffolk Street Queensway that exits onto Paradise Circus and St Chads.
- Close junction on Dartmouth Middleway between Lister Street and Great Lister Street to all traffic except buses; avoid stop start traffic and reduce congestion.
- Re-signing and rerouting scheme for the A38 and banning all through traffic (and HGVs) on the A38 around Paradise Circus, diverting traffic to A4540.
- Enhanced bus partnership with the wider area of Birmingham.

The modelling results were analysed to determine the optimal package, which includes:

- All BCC controlled free parking in the CAZ becomes charged.
- Banning traffic travelling northbound on Suffolk Street Queensway (A38) that exits onto Paradise Circus to then access Sandpits Parade and southbound traffic from Paradise Circus accessing the A38.
- The closure of Lister Street and Great Lister Street at the junction with Dartmouth Middleway. This allows more green time on the A4540, apart from buses.

The optimal additional measure package consists of works that are deliverable by 2020. Additional measures that can be delivered in 2021 and 2022 are presented in Appendix 1C.

### 2.2.3 Shortlisting of CAZ Options

To begin the option appraisal process, a long-list of CAZ options was identified. These included nine CAZ variants.

- Four charging CAZ options (class A, B, C and D).
  - CAZ A included buses, coaches, taxis and private hire vehicles.
  - CAZ B added heavy goods vehicles.
  - CAZ C added also large vans, minibuses, small vans/light commercials.
  - CAZ D added cars.
- A packages of additional measures considered in conjunction with each CAZ scheme variant (class A, B, C and D);

- A non-charging CAZ with a package of measures.

In order assess the longlisted options against the primary CSFs, traffic and air quality modelling was undertaken on the CAZ C and CAZ D options to determine their relative positions in achieving compliance. These model runs demonstrated that the implementation of a charging 'class C' or 'class D' Clean Air Zone, would be insufficient to achieve compliance with the defined air quality in 2020. As CAZ D has great impacts on traffic volumes, due to including the car vehicle class, it will achieve compliance in the shortest possible time and was brought forward.

Although the CAZ A and CAZ B schemes have not been explicitly modelled, it is clear that if a 'class C' or 'class D' CAZ would be insufficient to ensure compliance, then a CAZ A or CAZ B scheme would also be insufficient.

Under a CAZ D scheme (where non-compliant cars are subject to charging), concentrations of $NO_2$ reduce by an additional 1.8 µg/m3 inside the CAZ, beyond the CAZ C scenario. There are still places, however, where the legal limits are predicted to be exceeded during the scheme's initial years of operations.

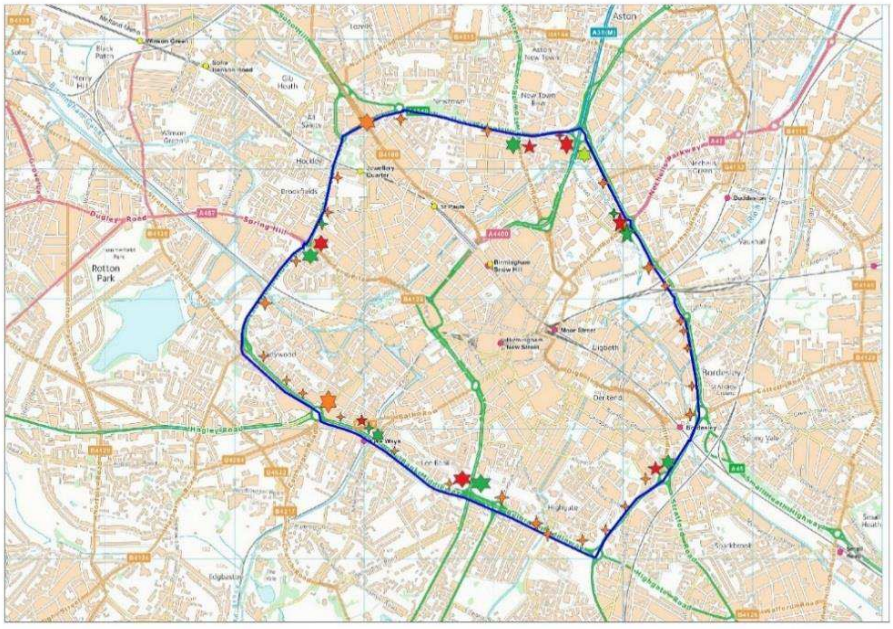
The modelling conducted forecasts that neither a 'class C' nor a 'class D' CAZ alone will achieve compliance with the $NO_2$ concentration limits in all locations in Birmingham by 2020. The modelling does show that a CAZ D results in the largest improvement in air quality, indicating that a CAZ D scheme will likely achieve compliance in the shortest possible time. Consequently, the short-listed schemes assessed in this economic case are the CAZ D scheme and the CAZ D scheme plus the identified Additional Measures.

Full details of the method, data, and models used by BCC to estimate the impact of CAZ options on vehicle emissions and the resulting concentrations of $NO_2$ are set out in the Transport Modelling Forecasting Report. The Air Quality Modelling report provides a summary of where additional reductions in emissions from road traffic would be required to achieve compliance.

### 2.2.4 Proposed CAZ Boundary

The Clean Air Zone is proposed to be the area within the A4540 Ring Road around the city centre. A zone boundary at the ring road would provide a sensible and logical decision point for traffic to avoid the CAZ by using the ring road as the alternative route. The location of the proposed CAZ is shown in Figure 2-1

Figure 2-1 Proposed CAZ boundary




Although the CAZ charging options for outer ring road failed to meet the requirements of the primary Critical Success Factor due to significant deliverability risks related to physical implementation and

enforcement, initial transport modelling was undertaken for a CAZ D outer ring road option. As per section **Error! Reference source not found.** of the strategic case, it was concluded that the performance of the AZ D outer ring road option would only be marginally better than that of the CAZ D inner ring road option in terms of reducing $NO_2$ emissions. This marginal change was considered not to be sufficient enough to ensure that $NO_2$ compliance in Birmingham would be achieved earlier if CAZ D outer ring road option was delivered rather than the CAZ D inner ring road options.

## 2.3 Determining the preferred option

The option identification and shortlisting process identified two potential CAZ schemes, summarised in Table 2-3.

Table 2-3 Shortlisted Options

| Option | Commentary |
|---|---|
| Class D Clean Air Zone<br>(CAZ D) | A charging CAZ D<br>Class D vehicles (buses, coaches, taxis, heavy goods vehicles, light goods vehicles and private cars) that do not meet Euro emission standards would be charged. |
| Class D Clean Air Zone plus Additional Measures | A charging CAZ D with the identified Additional Measures |

The traffic modelling shows that the introduction of Additional Measures reduces AADT accessing the CAZ area by 1.5%. Consequently, the Additional Measures increase the health and environmental benefits by £13m. Accounting for the Additional Measures' impacts on other benefit area, such as travel time, the cumulative impact is a £12m improvement of the scheme's NPV. This is a substantial improvement, particularly considering the £1.5m cost of the Additional Measures. Due to an improved NPV and improved health and environmental benefits, the CAZ D scheme plus Additional Measures was put forth as the preferred option at OBC stage.

The modelling results indicate that a CAZ D within the ring road plus Additional Measures option will achieve $NO_2$ compliance at all but one location by 2021. The air quality at the Suffolk Street Queensway monitoring unit is forecast to achieve compliance by 2022. BCC will continue work to see if compliance can be achieved before 2022 at this location or at least consider measures which could reduce exposure.

Subsequent to the determination of the preferred option, two updates were performed.

- The results from the OBC's Distributional Impact Assessment report identified groups that were going to be negatively impacted by the CAZ and in need of support in the form of mitigation measures. Accordingly, a long list of mitigation measures was generated and refined. Following the OBC, delivery plans for the mitigation measures and proposed exemptions were designed and their impacts were quantified and included in the traffic modelling and cost-benefit analysis. The main findings, as well as the corresponding decision process, can be found in the CAF Report delivered in conjunction with this business case.
- The charge price of the CAZ was reduced. Steer produced the *Birmingham CAZ Behavioural Research report*[14] assessing drivers' price sensitivity to various charge levels. The Steer paper noted that research in Bristol indicates that the propensity to pay to enter the proposed Bristol CAZ decreases as the charge levels increase up to £7, and then remains relatively stable at higher charge levels. London stated preference surveys found that the proportion of respondents who were willing to pay the charge decreases swiftly (from approx. 50% at £3.00 to 25% at £8.00), and thereafter, decreases at a slower rate to reach just under 20% at £12.50.

[14] Birmingham CAZ Behavioural Research, Steer (2018)

Accordingly, the final charge scenario modelled for the full business case was reduced from £12.50 to £8.00

The CAZ D plus Additional Measures scheme assessed for FBC includes the mitigations and exemptions and the lower CAZ charge. A comparison of the benefits of the CAZ D plus Additional Measures scheme at OBC and the CAZ D plus Additional Measures scheme at FBC is shown in Table 2-4. The change in benefits is further assessed and discussed in Section 2.9.5.

Table 2-4 Impact of mitigation and exemptions

| **Analysis of Monetised Costs and Benefits (AMCB)** | **CAZ D plus Additional Measures** (OBC) | **CAZ D plus Additional Measures** (FBC) |
|---|---|---|
| Present Value of Benefits (PVB) | -75 | 28 |
| Present Value of Costs (PVC) | 41 | 92 |
| **Net Present Value (NPV)** | **-116** | **-64** |

## 2.4 Cost-Benefit Analysis Framework

The cost-benefit analysis undertaken to assess the options and the final scheme is based on five distinct, but related, assessments:

- Costs to BCC
- Costs to transport users.
- Health and environmental benefits
- Mitigation and exemptions
- Distributional impact assessment (DIA)

The Economic Case combines the results of the first four assessments to derive the Net Present Value (NPV) of the shortlisted options. The distributional impact assessment considers the impact on key groups to determine whether there is likely to be a disproportionate impact on one, or a number of, particular groups. NPV and DIA outputs were assessed in conjunction to determine the preferred option.

### 2.4.1 Key assumptions

The CAZ area is assumed to be the area within the A4540 Ring Road, around the city centre. The opening year for the CAZ scenario is assumed to be 2020, the year for which traffic modelling has been conducted. The options have been appraised over the ten-year period from 2020 to 2029.

All figures presented are in 2018 prices and have been discounted to 2018 present value, unless noted. Additional assumptions underpinning the forecast impacts are presented in the Economic Assessment Methodology Report and are discussed in detail in the relevant appendices.

Full details on the method, data sources and results of the traffic modelling is presented in the Transport Model Forecasting Report.

### 2.4.2 Uncertainties

The key uncertainties related to this assessment include the following.

- Behavioural responses are based on a number of sources which are further detailed in the *Birmingham CAZ Behavioural Research Report* as per 2.3.
- The exact number of vehicles impacted by the CAZ is not known due to gaps in existing ANPR data.

- Current trends in car purchasing behaviour are changing, with fewer diesel cars being bought and fewer cars being bought in general. Future purchasing patterns may differ from underlying assumptions.
- The emissions rates of vehicles in the real world may differ from those modelled.

Sensitivity tests have been performed to assess the potential impact of these areas of uncertainty. Section 2.10 presents the sensitivity ran through the economic modelling suite while the Traffic Model Forecasting Report and Air Quality Modelling Report test many of the above as well as additional scenarios.

## 2.5 Costs to Birmingham City Council

Costs and revenues to BCC are presented in the Economic Case in market prices (including VAT). This is to maintain a consistent unit of account in market prices across all costs and benefits.

Optimism Bias (OB) and contingency are applied to the capital costs. Contingency accounts for known risks where OB is included for unforeseen circumstances. An OB rate of 15% for road projects is applied to the majority of implementation cost items. This is the WebTAG recommended OB levels for projects at the Outline Business Case stage (OBC). However, as procurement for implementation is ongoing there is a higher level of uncertainty regarding project costs than that normally experienced for a project at FBC stage. Accordingly, it is appropriate to use the level of OB commiserate to the current specificities.

A quantified risk assessment (QRA) was undertaken and 52 risks associated with implementation costs were identified and quantified. The risks identified in the QRA cover various aspects of the implementation stage and a wide range of technical disciplines. Each risk was assessed based on their likelihood, cost impact and time impact.

Table 2-5 shows the impact to public funds with ongoing operation of the CAZ over the appraisal period.

Table 2-5 Costs to BCC (£m 2018 discounted values)

| | CAZ D plus Additional Measures |
|---|---|
| Implementation costs | 19 |
| Operation costs | 35 |
| Revenue (parking) | -8 |
| Net Present Value | 46 |

In addition to the costs incurred, the scheme is also forecast to generate a surplus of revenue over operational costs. It is anticipated that the revenue generated will be invested in initiatives to realise the vision set out in 'Movement for Growth' for a greatly improved transport system which supports economic growth and regeneration, social inclusion and improves air quality and the environment.

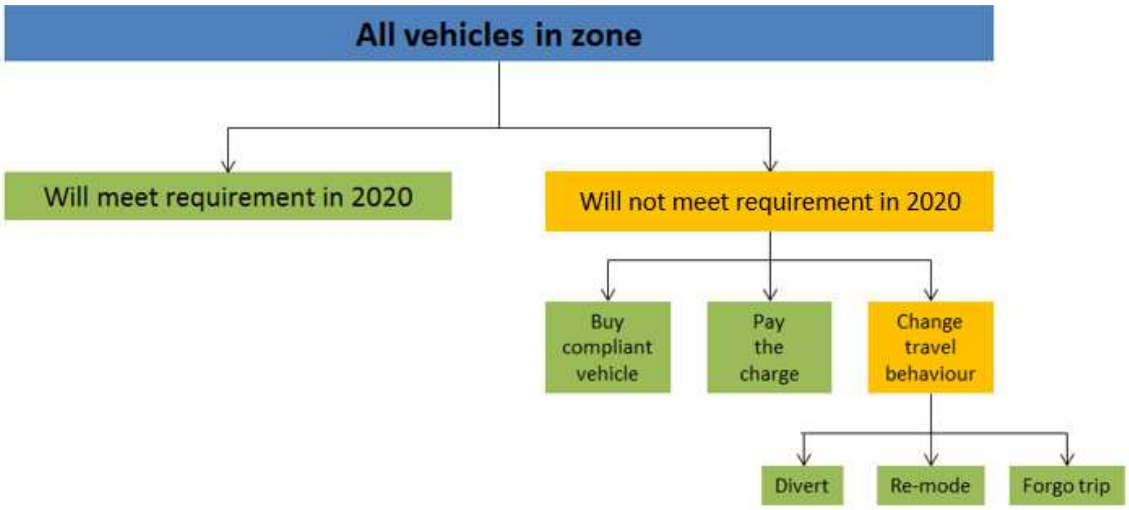
## 2.6 Costs to Transport Users

### 2.6.1 Non-compliant user options

The number of transport users that would already be compliant with the CAZ emission standards in 2020 was estimated using automatic number plate recognition (ANPR) surveys undertaken in 2016 and assuming a constant fleet age to update to 2020 based on guidance from JAQU. This method forecasts that 93% of vehicles would be compliant with the CAZ emission standards by 2020.

The analysis of costs to transport users has therefore focused on the remaining 7% of users that are expected to be non-compliant in 2020. The nature and scale of the impacts on these transport users ultimately depends on the actions that users take to meet or avoid the CAZ standards. Figure 2-2 provides a schematic of the possible responses drivers may have to the CAZ vehicle standards.

Figure 2-2 Schematic of possible responses to CAZ




The proportion of non-compliant vehicles that choose different behavioural responses was estimated initially using stated preference survey data from the London Ultra Low Emission Zone expansion, with modifications to make it appropriate for use in the Birmingham context. The behavioural assumptions were then further refined with the recommendations set out in the Steer's *Birmingham CAZ Behaviour Research* report.[15] More information on the behavioural assumptions is provided in the Economic Assessment Methodology Report and the Traffic Model Forecasting Report.

### 2.6.2 Impact of mode shift of public transportation

The behavioural model predicts that 20% of personal journeys impacted by the introduction of the CAZ would be shifted to other modes. This category includes public transport as well as other active modes. While capacity on local public transportation is currently constrained, we have not modelled the impacts of additional ridership due to mode shift. It is anticipated that the additional trips will be supported by the public transportation network. Bus operators have also been engaged with regards to providing additional capacity. Work is being undertaken by TfWM to increase network capacity and the following schemes are under development.

**By 2020**

- Increased park and ride capacity for the West Midlands rail network: expansion at Tipton, Sandwell and Dudley, Whitlock's End and Longbridge.
- Metro tram extensions:
  - Wolverhampton city centre
  - Westside extension to Centenary Square
- Bus fleet environmental enhancements through retrofitting existing buses, new Euro VI buses and hydrogen powered buses.
- Core bus corridor and central Birmingham bus priority improvements including the Bartley Green - Harborne – Birmingham corridor

By 2022

[15] Steer. 2018. Birmingham CAZ Behavioural research – Draft report.

- New suburban rail stations at Moseley, Kings Heath, Hazelwell, Darlaston and Willenhall
- Increased suburban rail capacity: 20,000 extra rail seats am peak into central Birmingham
- Metro tram extensions:
  - Edgbaston Five Ways
  - Birmingham Eastside
  - Wednesbury – Brierley Hill extension Phase One to Dudley
  - three new Bus Rapid Transit routes:
  - Birmingham – Perry Barr – Walsall
  - Birmingham – Solihull/Birmingham Airport
  - Birmingham – Langley/Peddimore – Sutton Coldfield

By 2026

- Metro tram extensions:
  - Wednesbury – Brierley Hill extension Phase Two to Brierley Hill by 2023
  - East Birmingham Solihull Extension by 2026
- Further new Bus Rapid Transit routes:
  - Birmingham – Halesowen
  - Birmingham – Dudley
  - Birmingham – Longbridge Hall Green – Solihull

### 2.6.3 Cost of upgrading to compliant vehicle

This economic appraisal uses the consumer surplus approach recommended by JAQU to estimate the welfare loss to users who choose to change from their preferred non-compliant vehicle to a compliant vehicle in response to the CAZ. The cost to upgrade early is calculated as half of the difference in depreciation between the baseline vehicle and the upgraded vehicle in the CAZ scenario. This analysis assumed that:

- The vehicle owner would purchase a compliant vehicle in the do-minimum by the year 2029.
- Each owner would upgrade to the cheapest possible vehicle that is at least one Euro standard higher than their current vehicle.
- For buses, coaches, and taxis, retrofitting options exist and are assumed to be used for a portion of the fleet. Retrofitting is assumed for all buses and coaches, and the Hackney carriages eligible for LPG retrofitting.

There would also be a transaction cost to users for the effort required to find and purchase a new vehicle. This was estimated using JAQU's recommended methodology.

Table 2.5 shows the number of vehicles predicted to be upgraded or retrofitted due to the scheme. The majority of vehicles that would upgrade as a result of the scheme are cars, with 9,856 upgrading in the CAZ D plus Additional Measures scheme. PHVs make up the next largest group with 3,060 upgrading. Taxis make up the next largest group with1, 185 upgrading. Over 700 HGVs are expected to upgrade and 460 LGVs are expected to be upgraded.

Taxis have the largest upgrading costs, with a loss of £24m. This is mostly due to high cost of new electric taxis and new diesel euro 6 taxis. The impact on HGVs and LGVs is expected to be approximately £9m and £2m, respectively. The low upgrading cost borne by LGVs is explained by the relatively few LGV users who would choose to upgrade, according to behavioural modelling. The total economic cost of upgrading to compliant vehicles is £52.9m.

Table 2-6 Number of vehicles upgraded or retrofitted and economic impact (£m, 2018 discounted values)

| | Cars | LGVs | HGVs | PHVs | Taxis (Hackney) | Buses | Coaches | Total |
|---|---|---|---|---|---|---|---|---|
| Vehicles impacted | 9,856 | 460 | 717 | 3,060 | 1,185 | 0 | 451 | 15,278 |
| Economic impact, £m | -10 | -2 | -9 | -8 | -24 | 0 | -9 | -57.9 |

It is assumed that by 2020 all buses serving the CAZ will be compliant through new vehicles (purchased through alternative funding), retrofits or fleet redistributions. Thus no buses are estimated to upgrade due to the scheme.

### 2.6.4 Impact of non-compliant vehicles moving to outside the CAZ

Users that travel into the CAZ w upgrading to compliant second-hand vehicles will likely result in their non-compliant vehicles being sold on to individuals not impacted by the CAZ. Therefore, pollutants from these vehicles will continue to be emitted in areas external to the CAZ. As many cities are employing a CAZ to combat air pollution, it is likely that second hand non-compliant vehicles be purchased by those living in rural areas of the UK.

DfT analysis shows that 64% of car miles, 66% of LGV miles, and 88% of HGV miles travelled are on rural roads and motorways.[16] Air quality is a location-specific issue and concentrations in rural areas are unlikely to reach levels where impacts would be comparable to urban areas. Accordingly, increasing the proportion of older vehicles on extra-urban roads is unlikely to have a significant impact on local air quality.

### 2.6.5 Costs of paying charges

User charges would be collected from users each day that they enter the CAZ with their non-compliant vehicle. It was assumed that following the second modelled year (2022) the non-compliant fleet will continue to upgrade to newer, compliant vehicles at the same rate as predicted by the modelling for the Do Minimum scenario. Thus, the costs of user charges will decrease over time, as fewer vehicles will pay the charge due to increasing rates of compliance.

Scheme revenue is forecast in the Financial Model and calculations are described in the Financial Case. Per section 5.1.5 of CAZ Option Appraisal Guidance, these payments are considered transfers and not included in the value for money assessment. However, the user charges by vehicle class are provided in Table 2-7 in nominal terms.

Table 2-7 Cost of CAZ Charges by vehicle class over the scheme period (£m, nominal)

| | CAZ charge | PCN |
|---|---|---|
| Car | 40 | 14 |
| Taxi/PHV | 0 | 0 |
| LGV | 59 | 22 |
| HGV | 25 | 2 |

[16] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/722302/road-traffic-estimates-in-great-britain-2017.pdf

| | | |
|---|---|---|
| Coach | 0 | 0 |
| **Total** | **124** | **39** |

Table 2-7 shows that LGVs are expected to pay the most in user charges, paying nearly 50% of the total user charges.

Along with paying an access fee to enter the CAZ, users of the CAZ driving non-compliant vehicles will also incur a time cost related to payment of the CAZ charge on the online platform. It is assumed that each transaction requires five minutes.

Revenues and welfare disbenefit associated with CAZ implementation fall in line with non-compliant unique vehicle cordon crossings, as shown in Figure 2-3. Two modelled years (2020 and 2022) were used for creating a non-compliant vehicle profile, where a year to year percentage changed was interpolated for year 2021, and from 2022 onwards figures were extrapolated assuming a constant fleet age.

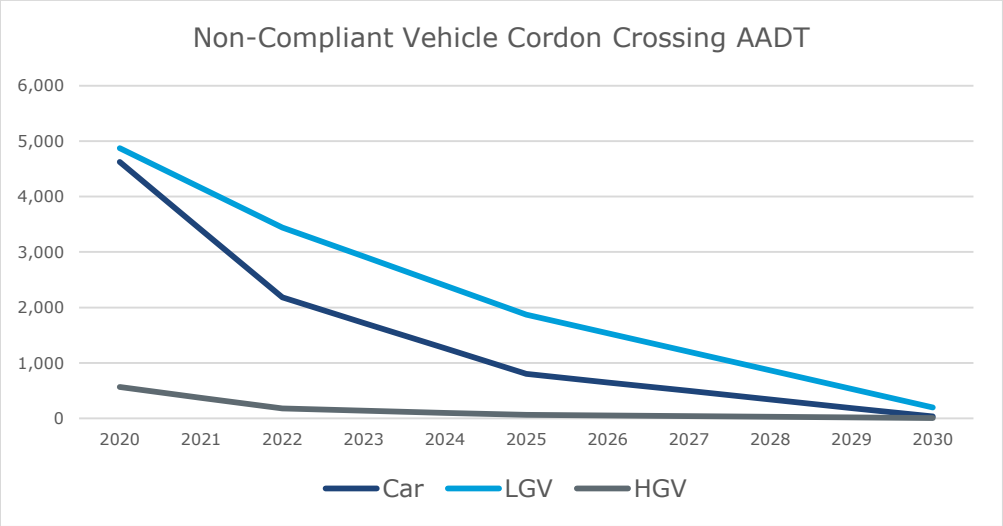



Figure 2-3 Non-compliant vehicle cordon crossings

### 2.6.6 Note on Taxis

The CAF report produced by Element Energy (EE) describes the mitigation measures relevant to taxis. The analysis monetises the expected cost to taxi operators based on CAZ implementation. To counter the proposed cost to taxi operator's, mitigations will offer impacted taxi operators financial assistance as part of the CAZ programme. The mitigation measure M2 describes mitigation measures targeting taxis (refer to section 2.9 for more detail)

### 2.6.7 Impact of parking charges

Parking charge impacts were estimated for cars only (i.e. potential impacts to LGV users were not estimated). The behavioural impacts of parking charges were estimated by applying the average cost of a parking stay in Birmingham, calculated to be £4.94, to a subset of trips to the CAZ zone that currently use on-street parking, found to be 15%. This results in behavioural responses from compliant and non-compliant users who may elect to cancel or re-mode their trip, or to pay the charge. There is also a slight impact on upgrade rates, because non-compliant users who may have upgraded in the CAZ D plus Additional Measures scenario, now choose to forego journeys to the CAZ (through cancellation or re-mode response) and thus no longer upgrade their vehicles.

The cost to users and revenue to BCC and to private off-street car parks have been estimated.

Table 2-8 Revenues and costs to users of parking charges (£m 2018, discounted values)

| | CAZ D plus Additional Measures |
|---|---|
| Revenue to BCC | -8 |
| Revenue to Private Car Parks | 30 |
| Cost to Car users | -38 |

### 2.6.8 Loss of Welfare from Changing Travel Behaviour

Car owners who change their behaviour in response to the CAZ incur a disbenefit. The new action is favoured less than their baseline behaviour, otherwise they would have been doing it already. Hence these vehicle owners will incur an additional cost, termed welfare loss in economics.

The loss of welfare from changing travel behaviour was estimated using the rule of half for trips foregone (cancelled), and trips re-moded (i.e. change to public transport). This method assumes that the disbenefit to the users fall along a continuum between £0 and the price of the charge. The midpoint is taken to be the average dis-benefit and is multiplied by the number of trips foregone and re-moded to determine the overall welfare loss. This effect would only be felt by non-work car users as it was assumed that business user trips would be replaced.

The full effect of welfare loss would be incurred in 2020, and then would reduce in future years as more vehicles become compliant and trips re-instated. For trips diverted around the CAZ, the welfare impact would be captured in the journey time and vehicle operating cost appraisal. In theory, the user will balance all the costs and benefits of the trip and therefore the estimated loss in welfare should capture the utility change as well as changes in fuel cost, operating cost, and travel time.

Table 2-9 shows the number of trips cancelled or re-moded and their forecast welfare losses.

Table 2-9 Impact of trips foregone and re-moded

| | CAZ D plus Additional Measures |
|---|---|
| Number of trips cancelled (millions) | 4.5 |
| Number of trips re-moded (millions) | 5.5 |
| Consumer surplus (welfare) loss (£m) | -33 |

The introduction of a CAZ in Birmingham would result in a change in travel patterns that could impose additional costs or benefits on transport users in terms of journey times and vehicle operating costs (VOC). With the introduction of the Birmingham CAZ a reduction in traffic overall results in less congestion, and hence time savings (i.e. a benefit to transport users). However, there may be instances of vehicles changing route to avoid the zone causing congestion and increasing journey times (i.e. a cost to transport users) in certain route segments. Changes in these costs were estimated using Department for Transport TUBA software. Full details on the method used to estimate the impact of each CAZ option on journey times and vehicle operating costs, and the results, are presented in the Economic Assessment Methodology Report. The travel time and VOC numbers output are presented in Table 2-10.

Table 2-10 Summary of travel time and vehicle operating cost impacts (£m, 2018 discounted values)

| | CAZ D plus Additional Measures |
|---|---|
| Travel Time | 75 |
| Vehicle Operating Costs | -14 |
| **Total** | 60 |

Travel time and VOC benefits are expected to be £60m for the proposed Birmingham CAZ. These benefits are due mostly to lower congestion throughout Birmingham and the region as a result of fewer trips entering the CAZ due to non-compliant vehicle owners cancelling or re-moding journeys.

## 2.7 Distributional Impact Assessment Summary

A Distributional Impact Assessment (DIA) was undertaken on the preferred scheme proposed in the Outline Business Case, the CAZ D plus Additional Measures scheme. The first version of this report (Revision 1.1) was issued as an appendix to the Outline Business Case. The report has subsequently been updated to account of some additional analysis of some of the potential impacts, together with some information from the consultation that was undertaken for the Birmingham CAZ project

The development of mitigation proposals has taken place since the Outline Business Case as a separate work stream, taking into account distributional impacts as well as other types of impact such as broader economic and implementation issues, which are beyond the scope of distributional appraisal. The final mitigation proposals, and their estimated costs, have now been taken into account as part of the Full Business Case reported for the proposed Birmingham CAZ.

An updated version of the report, Revision 2, is issued as a background document for the Full Business Case. However, it should be noted that it has not been comprehensively updated since its purpose, to inform selection of the preferred option and where to target mitigation, has been served. It is therefore provided for information only.

The following summarises the DIA findings of CAZ impacts. These findings were a fundamental basis for creating the mitigations and exemptions that compose the proposed Birmingham Clean Air Zone.

The impacts of the CAZ D plus Additional Measures scheme, without mitigations, can be summarised as:

- Large beneficial impact to the most deprived communities in terms of improvement in air quality;
- Large adverse impact to Accessibility for Community Transport Dependent Groups;
- Large adverse impact to Accessibility for taxi dependent wheelchair users;
- Moderate adverse impact to personal affordability; and,
- Moderate adverse impact to business affordability for SMEs and PHV drivers and Large adverse for hackney taxi drivers.

The impact of CAZ D plus Additional Measures scheme is likely to affect affordability (personal and business) more than a CAZ D alone due to the increased cost in parking, although this is not indicated in the quantified impacts on affordability since the increased cost of parking is not factored into the method.

A summary of key distributional impacts across the various CAZ levels are summarised in table 2.11.

Table 2-11 summary of distributional impacts

| Scenario | Impact | Affected Groups | Suggested Mitigation |
|---|---|---|---|
| CAZ C High; CAZ C High with Additional Measures; CAZ D High and CAZ D High with Additional Measures | Increase in cost or decrease in availability of community transport | Disabled people | Sunset period for vehicles registered under Section 19 of the Transport Act 1985 |
| | | Elderly people | |
| | | Children | |
| | Increase in cost or decrease in availability of school transport | | |
| | Increase in cost of business travel through requirement to pay CAZ charge/upgrade to CAZ compliant vehicle | SMEs within the CAZ who maintain a vehicle | Exemptions for business vehicles registered to SMEs which enter the CAZ on regular (e.g. twice or more per week) basis |
| | | SMEs supplying businesses within the CAZ (locations currently unknown) | |
| | Increase in cost of travel via private vehicle due to loss of free parking in Birmingham City Council controlled areas | Residents of the CAZ and surrounding areas, an area of high income deprivation, who have more limited ability to avoid the CAZ | None suggested |
| | Increase in cost of travel via private vehicle due to requirement to pay CAZ charge/upgrade to CAZ compliant vehicle | | Sunset period to allow residents of the CAZ time to make the necessary financial adjustments if needed |
| | | People with religious beliefs who attend the large places of worship within the CAZ area | Travel plans to help congregants to modify their travel mode |
| | | Guardians of children undergoing treatment at Birmingham Children's Hospital | Time limited and/or means tested exemptions for long stay patients (as currently in operation for parking) |
| | | Disabled people who have limited alternative modes of transport | Sunset period to allow residents time to make the necessary financial adjustments if needed |
| | Fare increase/reduction in availability of hackney taxis and PHVs | Women | Financial incentive package for hackney taxi drivers to retrofit vehicles where possible or alternatively upgrade their vehicles to wheelchair accessible ULEVs |
| | Increase in cost of business travel | Hackney taxi owner/drivers and PHV owner/drivers | |

## 2.8 Health and Environmental Impacts

### 2.8.1 Introduction

The key driver for action on air quality in Birmingham, through implementation of a CAZ, is the effect of poor air quality on human health. There are economic and social costs associated with the health and environmental impacts of poor air quality which are summarised in the following sections, drawing upon a variety of evidence and research. Secondary to this, there are also economic and social costs associated with the health impacts of physical inactivity and poor mental health. This chapter considers both the health and environmental impacts of a CAZ arising from changes in air quality within Birmingham, and also those health impacts that are not directly related to changes in air quality which may occur as a result of changes in traffic patterns and flows and their influence on the use of active travel modes and social cohesiveness. Where possible these have been described quantitatively, and elsewhere a qualitative approach has been used.

Defra's Impact Pathway model has been used to provide monetised values of the air quality impacts of the proposed CAZ option. This was applied to the options considered at the Outline Business Case (OBC) stage and is also being applied for the FBC. This is the recommended methodology for use in cases where the estimated impacts, using damage cost methodology, are valued at over £50 million. The impact pathway approach considers variations in pollutant concentrations and population density across the UK and uses pollution concentration response coefficients, to assess the effects on health.

The application of the impact pathway method to date has resulted in relatively modest health benefits from the proposed CAZ. However, the method only quantifies the following impacts:

- $PM_{10}$ Chronic mortality – the impact on life expectancy of long-term exposure to average levels of pollutants in the air
- $NO_2$ Chronic mortality – the impact on life expectancy of long-term exposure to average levels of pollutants in the air
- $PM_{10}$ Respiratory hospital admissions – emergency admissions to hospital due to pollution induced respiratory problems
- $PM_{10}$ Cardiovascular hospital admissions – emergency admissions to hospital due to pollution induced cardiovascular problems
- $PM_{10}$ Productivity – the impact on the efficiency with which an input is used in the production process e.g. labour, human capital, natural capital.

There are many other positive health outcomes linked to reduced concentrations in air pollution, which are not captured in the impact pathway approach. For example:

- cognitive decline and dementia, which have been linked to traffic-related air pollutants (Power et al., 2016);
- lower lung function in early life which has been associated to exposure during pregnancy (Morales et al., 2015);
- self-reported life satisfaction has been linked to $NO_2$ (after controlling for other economic, social and environmental factors) (Knight and Howley, 2017).

It is likely that the full health benefits are not captured in the business case, however there is currently no approved methodology for valuing these health outcomes for use in a FBC.

It is proposed to prepare a Health Impacts Addendum to support the FBC. This is in acknowledgement that the approved Impact Pathway approach used in the FBC only captures some health benefits and that there are other tools, such as the Public Health England's (PHE) air pollution tool, which can be applied for the project to provide further monetised values of health impacts. Whilst these other techniques are not approved for use in business cases, and have their own limitations, the inclusion of some of the results in the addendum will illustrate that the valuation of health benefits is an emerging field and that any decisions on the financial benefit or costs of the CAZ are done so on limited understanding of the likely overall value of health benefits.

### 2.8.2 Health Impacts Associated with Air Quality

Air pollution is linked to a wide range of illnesses and health conditions. The air pollutants from traffic emissions of most concern in terms of health impacts are particulate matter (PM) and nitrogen dioxide

(NO2). Long term exposure to air pollution can lead to the development of some of these health conditions, whilst short-term exposure can exacerbate existing conditions. Health conditions associated with air pollution are as follows:

- Respiratory diseases – including asthma and chronic obstructive pulmonary disease (COPD)[17]
- Cardiovascular disease (heart disease and stroke)[18]
- Diabetes[19]
- Cognitive decline and dementia[20]
- Low birth weight, still births, infant death and poor organ development in children[21]

Children are particularly susceptible to the health impacts of poor air quality. This is because their immune system and lungs are not fully developed, and also because they tend to spend a larger proportion of the day outdoors and have higher metabolic rates. There is evidence to suggest that for children the health impacts of poor air quality can be initiated prior to birth through a mother's exposure to pollutants, with potential for life long consequences. Children living in high pollution areas are four times more likely to have reduced lung function when they become adults.[22]

Other groups that are at increased risk of exposure to poor air quality include car commuters, taxi drivers, and bus and lorry drivers, all of whom spend a higher than average amount of time in close proximity to traffic pollutants [23,24]. In addition, people living in areas of deprivation tend to be more susceptible to the health impacts of air quality as a result of living in poor housing conditions with greater exposure to pollutants and experiencing greater stress, which reduces the body's resilience to toxicants present in polluted air[23].

The link between mortality and long-term exposure to air pollution is also well evidenced[25]. Cohort studies looking at the effects of air pollution on health over several years have shown that the deaths from respiratory and cardiovascular causes, in combination with other factors, increase with long term exposure to air pollution. This occurs at both high and low levels of pollution and relates mostly to fine particulate matter, such as particular matter of less than 2.5 µm diameter ($PM_{2.5}$). Research by Public Health England conducted in 2014 suggested that exposure to fine particles from road transport emissions was contributing to 1,460 premature deaths per annum in the West Midlands conurbation and 520 within the city of Birmingham.[26]

The impacts of air pollution on human health, in turn, have a number of social and economic impacts such as impacts on quality of life, school attendance, reduced productivity (resulting from absence from work or sub-optimal performance at work due to ill-health), and increased health expenditure due to increased hospital admissions as well as prescribed medication to manage health conditions. The full monetary costs of these impacts are as yet unknown, but some techniques have been applied to calculate some costs associated with air pollution. These are set out in 2.8.5 and also include environmental damage costs.

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[17] Anderson, Z. (2010) Chronic Obstructive Pulmonary Disease and Long-Term Exposure to Traffic-related Air Pollution. A Cohort Study. American Journal of Respiratory and Critical Care Medicine. 183:4
[18] Newby, D.E. et al. (2015). Expert position paper on air pollution and cardiovascular disease. European Heart Journal. Vol. 36(2), pp. 83–93b.
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[20] Power, M.C. et al. (2016). Exposure to air pollution as a potential contributor to cognitive function, cognitive decline, brain imaging, and dementia: A systematic review of epidemiological research. Neurotoxicology. Vol 56, pp.235-253
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[22] Royal College of Physicians. (2016). every breath we take: the lifelong impact of air pollution. Report of a working party. London: RCP.
[23] Wargo, J. 2002. Children's Exposure to Diesel Exhaust on School Buses. Environment and Human Health. Available at: http://www.ehhi.org/reports/diesel/
[24] Johns, T. 2016. How much diesel pollution am I breathing in? Available at: http://www.bbc.co.uk/news/magazine-35717927
[25] COMEAP. 2016. Long-term Exposure to Air Pollution and Chronic Bronchitis. A report by the Committee on the Medical Effects of Air Pollutant.
[26] Public Health England. 2014. Estimating Local Mortality Burdens Associated with Particulate Air Pollution.

### 2.8.3 Schools and Distribution of Nitrogen Dioxide Improvements

As children are particularly susceptible to the health impacts of air pollution, some spatial analysis has been carried out of the likely benefits of the preferred CAZ option at locations of key importance to children.

Figure 2-4 shows $NO_2$ concentrations across Birmingham under the 'Do Minimum' (i.e. if no CAZ were implemented) relative to the locations of nurseries and schools for children aged under 16. Those nurseries and schools that fall within areas where $NO_2$ concentrations are greater than 30 µg/m$^3$ (as indicated by the orange and red contours) are considered to be most risk of experiencing $NO_2$ concentrations which exceed the legal limit of 40 µg/m$^3$ $NO_2$. In the absence of a CAZ there would be 135 schools within Birmingham within this higher risk category, of which 57 are located within the CAZ area itself.

It should be noted that air quality can differ considerably over very short distances and periods of time, and therefore whilst schools located in areas where average $NO_2$ levels are below 30 µg/m$^3$ are at lower risk of experiencing $NO_2$ exceedances this does not mean that exceedances could not occur at these locations, and the converse is true for those located in areas where average $NO_2$ levels are below 30 µg/m$^3$. Furthermore, there is no safe level of air pollution.

Figure 2-4 NO2 concentrations across Birmingham under the 'Do Minimum' scenario

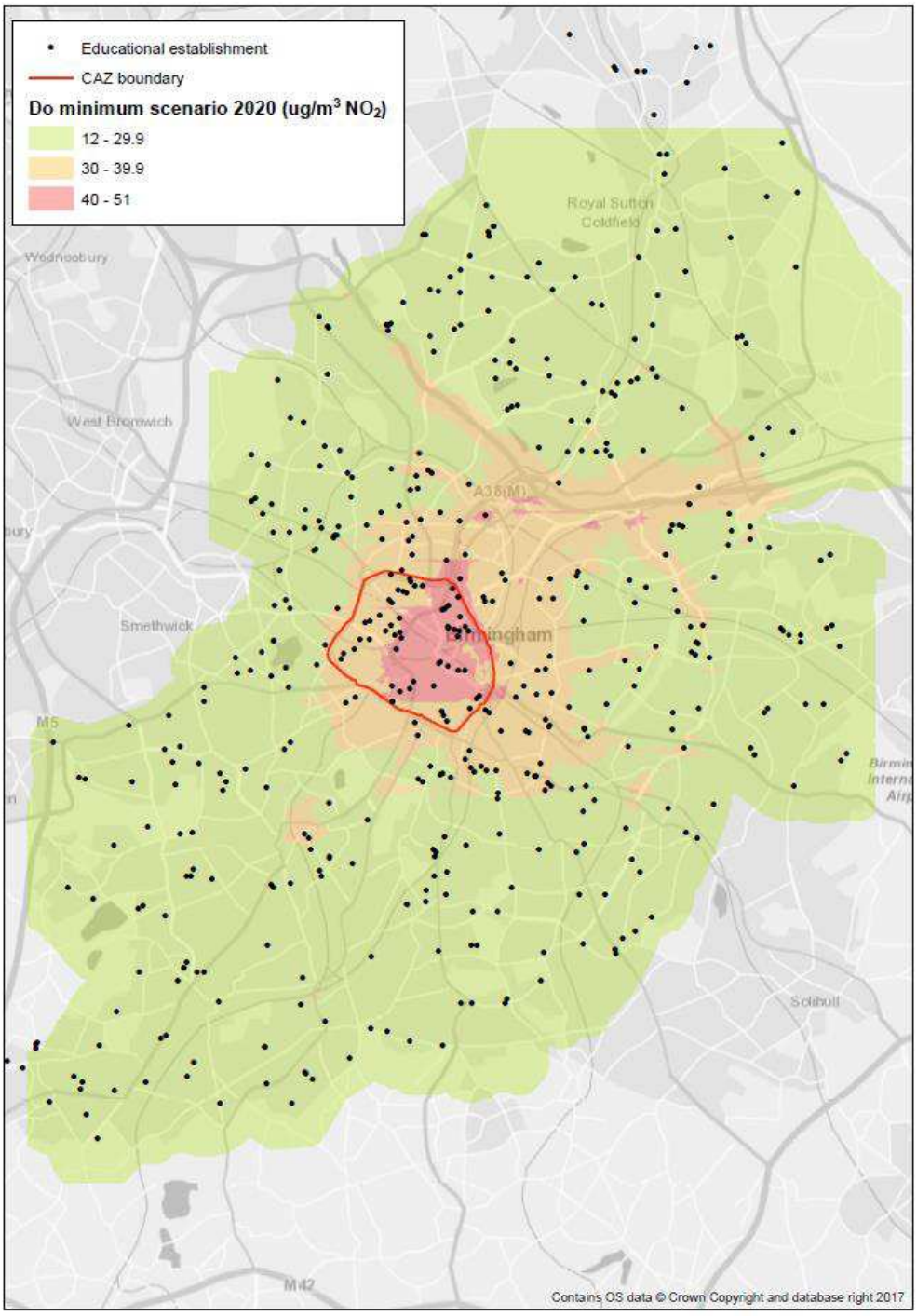
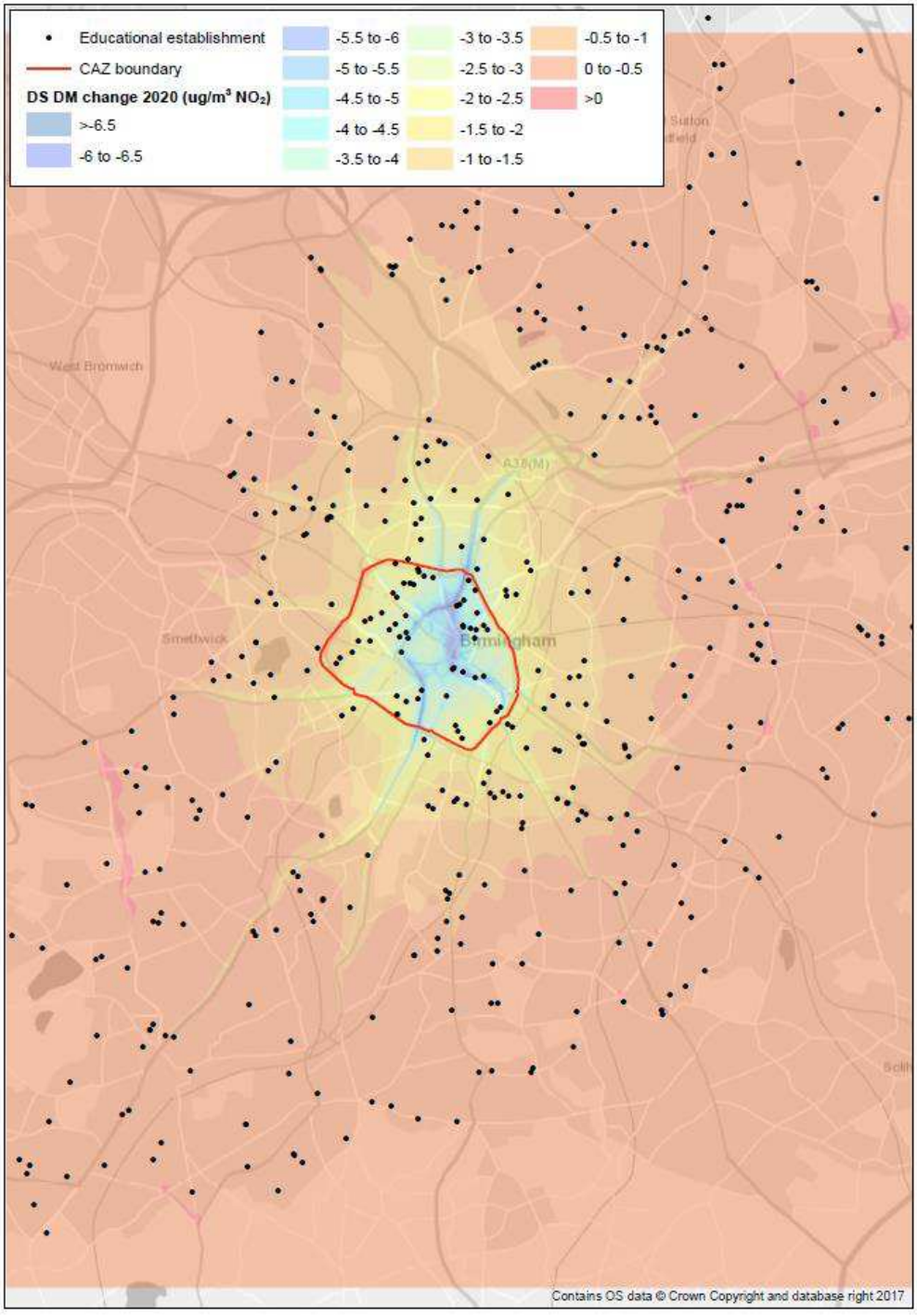


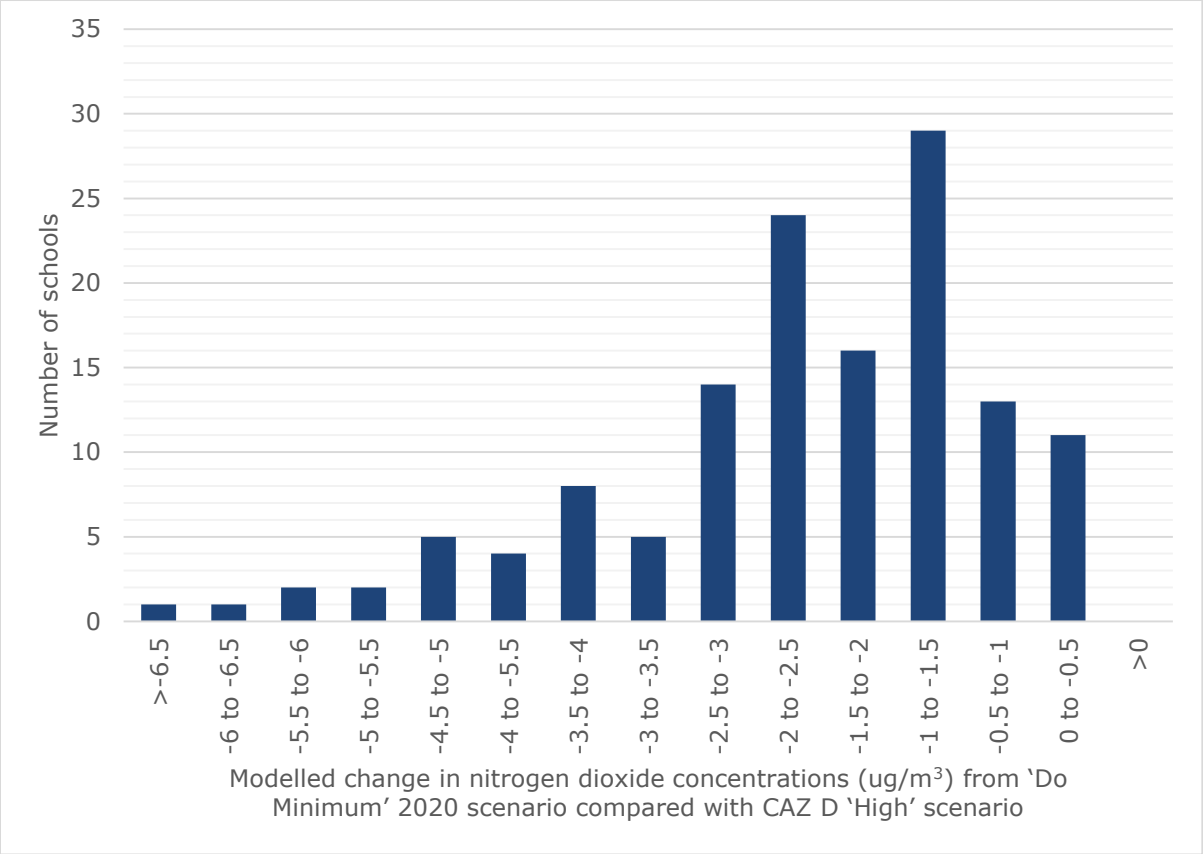

Figure 2.5 shows the degree of increase or decrease in NO2 concentrations modelled following implementation of a CAZ D 'High' relative to locations of nurseries and schools as described above. Air quality modelling data is not currently available for the preferred option; however, it is not anticipated that the results discussed in this chapter would differ significantly between a CAZ D High scenario and the preferred option. Modelling work undertaken for the CAZ D 'High' scenario suggests that all of the nurseries and schools at highest risk of NO2 exceedances as shown in Figure 2.5 would experience a reduction in NO2 concentrations as a result of the CAZ.

Figure 2-5 Changes in NO2 concentrations across Birmingham under a 'CAZ D High' scenario




In approximately half of cases this improvement would be relatively small, between 0 and -0.5 µg/m3, but others would experience reductions in excess of 6.5 µg/m3. Figure 2.6 shows the frequency distribution of improvements in NO2 concentrations. Approximately 20% of those schools which fall within the higher risk banding for NO2 exceedances in the absence of a CAZ would no longer do so with a CAZ in place. Current air quality modelling results suggest that one educational facility within the Birmingham area would experience a slight increase in NO2 concentrations, and further work will be undertaken to validate the modelling and identify potential mitigation for this receptor.

Figure 2-6 Number of schools mapped within zones of 30 µg/m3 nitrogen dioxide concentrations in 'Do Minimum 2020' which be within areas of where NO2 concentrations are predicted to decrease in a CAZ D 'High' scenario




Overall this analysis suggests that the preferred option would have a widespread beneficial impact on air quality at locations of key importance to children.

### 2.8.4 Health Impacts related to Behavioural Change

*2.8.4.1 Relationship between traffic patterns, travel modes and health*

Daily physical activity is hugely important for maintaining health[27], and inactivity directly contributes towards one in six deaths in the UK[28]. It is estimated that physical inactivity costs the UK approximately £7.4 billion per year when the impact on NHS, social care, sickness absence from work and other factors are taken into account[29]. The costs to business of absenteeism and presentism (working whilst sick can cause productivity loss and further poor health) are significant. In 2014 the cost of absences was approximately £14 billion[30], of which approximately £5 billion can be attributed to physical inactivity[31]. The costs of presentism may be even more[32].

[27] Department of Health. 2011. Start Active, Stay Active: A report on physical activity from the four home countries' Chief Medical Officers. Available at: https://www.gov.uk/government/publications/start-active-stay-active-a-report-on-physical-activity-from-the-four-home-countries-chief-medical-officers
28 Lee I. M. et al. 2012. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy.
29 Public Health England. 2016. Working Together to Promote Active Travel: A briefing for local authorities. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/523460/Working_Together_to_Promote_Active_Travel_A_briefing_for_local_authorities.pdf
30 Confederation of British Industry/Pfizer.Fit for purpose. 2013. Absence and workplace health survey 2013. Available at: https://www.centreformentalhealth.org.uk/managing-presenteeism
31 Sustrans: The Role of Active Travel in Improving Health. Toolkit Part 1: How active travel can improve health and wellbeing in the workplace. Available at: https://www.bma.org.uk/collective-voice/policy-and-research/public-and-population-
healthhttps://www.sustrans.org.uk/sites/default/files/activetraveltoolbox_healthandwellbeing_part1v3.pdf
32 Centre for Mental Health. 2011. Managing presenteeism. Available at: https://www.centreformentalhealth.org.uk/managing-presenteeism

For most people, the easiest forms of physical activity are those that can be built into daily life, for example by using walking or cycling as an alternative to motorised transport for everyday journeys such as commuting to work or school[29]. Traffic speeds and volumes are known to influence how individuals choose to travel, with higher volumes of walking and cycling where traffic is less and vice versa[33]. Active forms of travel, such as walking and cycling, are associated with a range of health benefits. These include improved mental health, reduced risk of premature death and prevention of chronic diseases such as coronary heart disease, stroke, type 2 diabetes, osteoporosis, depression, dementia and cancer[34]. Research also suggests that countries with highest levels of active travel generally have amongst the lowest obesity rates[35]

High traffic volumes and speeds can reduce opportunities for positive contacts with other residents in a neighbourhood, contributing towards increased social isolation and reduced community cohesion[3637]. Individuals who are socially isolated are more likely to make use of public services due to lack of support networks and have increased likelihood of developing certain health conditions such as depression and dementia[38]. They are also more likely to be physically inactive, which is again linked to increased likelihood of developing certain diseases as discussed above. People experiencing high levels of social isolation have significantly higher mortality levels than those with low or average levels of isolation[39]. It has been estimated that better community cohesion could save the UK around £530 million per year[40].

#### *2.8.4.2 Health in Birmingham*

The health of the people in Birmingham is generally worse than the national average as evidenced by several markers. Life expectancy is lower than the national average, and is heavily influenced by neighbourhood area. The city experiences higher rates of death than the national average from preventable diseases such as coronary heart disease, stroke and certain cancers, as well as high levels of diabetes amongst its resident's[41]. All of these can be improved by increased levels of physical activity[41]. The proportion of people who are overweight or obese is also higher than the national average, as is the proportion of people with severe mental illnesses. In contrast, the proportion of adults who regularly undertake physical activity is relatively low[42].

#### *2.8.4.3 Anticipated Behavioural Changes as a result of a CAZ*

The introduction of a CAZ will increase the cost of travelling in and out of Birmingham centre for non-compliant HGVs, Coaches vans and cars, both as a result of the CAZ charge and through the loss of free parking within the CAZ area. It is anticipated that following implementation of the CAZ, a significant proportion of non-compliant HGVs, LGVs and cars (between 29 and 47% depending on vehicle type) would either change their travel patterns to avoid the zone or cancel their trip altogether. It is anticipated that approximately 2 % of journeys made by car would instead by undertaken by public transport, cycling or walking. Whilst public transport is not a form of active travel in itself, many public transport users walk or cycle to points of access as part of their overall journey.

#### *2.8.4.4 Benefits of a CAZ*

33 Appleyard, D. and Lintell, M. 1972. The environmental quality of city streets: The residents' viewpoint. Journal of American Institution of Planners. Vo. 38: pp84-101.

34 British Medical Association. 2012. Healthy transport = Healthy lives. Available at: https://www.bma.org.uk/collective-voice/policy-and-research/public-and-population-health/transport

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36 Appleyard, D. 1981. Liveable Streets. University of California Press.

37 Hart, J and Parkhurst, G. 2011. Driven to excess: Impacts of motor vehicles on the quality of life of residents of three streets in Bristol UK. World Transport Policy and Practice, 17 (2). pp. 12-30. ISSN 1352- 7614.

38 Social Finance. 2015. Investing to tackle loneliness. A discussion paper. Available at: https://www.socialfinance.org.uk/sites/default/files/publications/investing_to_tackle_loneliness.pdf

39 Steptoe A et al (2013) Social isolation, loneliness, and all-case mortality in older men and women. Proceedings of the National Academy of Sciences of the United States of America vol 110 no 15, 5797–5801, doi: 10.1073/pnas.121968611

40 Public Health England. 2017. Promoting active travel. Available at: https://trl.co.uk/reports/2017-academy-symposium-presentation-carl-petrokofsky-public-health-england-4-6

41 Birmingham City Council. 2015. A means to an end – increasing participation in sport and physical activity. Available at:https://www.birmingham.gov.uk/download/downloads/id/424/increasing_participation_in_sport_february_2015.pdf

42 Public Health England (2017). Better mental health: JSNA toolkit. Available at: https://www.gov.uk/government/publications/better-mental-health-jsna-toolkit

An increase in the number of journeys made on foot or cycle would be expected to have a beneficial impact on public health. The proportion of journeys anticipated to be re-moded to public transport, walking or cycling (2 %) appears small, but when considered against the population of Birmingham (over one million) the number of journeys and people affected are potentially significant. Reductions in traffic flows within the city centre and across the wider Birmingham area of changes to traffic patterns may also have a beneficial impact on health by further encouraging people to walk or cycle in preference to using a car, particularly for short journeys. Reductions in traffic flows may also help to improve social cohesiveness and reduce social isolation.

Whilst impacts of this nature cannot currently be quantified or monetised, it is anticipated that there would be beneficial health impacts associated with increased use of active travel modes and improved social cohesion. Most changes to traffic flows and increases in active travel journeys would likely occur within those areas within and in close proximity to the CAZ, however the CAZ would be important in contributing towards other Birmingham City Council initiatives in initiating a step change in the approach and mentality surrounding active travel with consequential improvements in public health.

### 2.8.5 Environmental Impacts of Air Pollution

NOx, $NO_2$ and $PM_{10}$ emissions not only affect human health but also have adverse impacts on the built and natural environment:

- $PM_{10}$ and Soiling - Soiling of buildings by combustion particulates is one of the most obvious signs of pollution in urban areas. Soiling is an optical effect (a visual darkening of exposed surfaces) by deposition of atmospheric particles. The soiling of buildings includes both residential dwellings and historic/cultural buildings and causes economic damages through cleaning costs and amenity costs;
- NOX, NO2 and Damage to Cultural Heritage and Ecosystems - Emissions of NOX are linked with damage to building materials, historic buildings and objects of cultural value. Material corrosion occurs from acidic deposition and affects almost all materials. Increased nitrogen deposition in the form of NOX and NO2 also pose a risk to biodiversity, through increased nitrogen deposition and overloading by nitrogen favourable species, reducing plant diversity in natural and semi-natural ecosystems.

In addition to reducing NOx and PM10 emissions, the introduction of a CAZ would result in reduced greenhouse gas – including carbon dioxide (CO2) – emissions from road transport. These reductions would be generated as a result of actions by vehicle owners to replace or upgrade their vehicles to comply with the CAZ standards.

### 2.8.6 Monetised Benefits: CAZ D scheme

The introduction of a CAZ in Birmingham, therefore, is expected to generate a range of benefits:

- reduced costs from ill health;
- beneficial impact on productivity;
- reduced material damage (particularly to historical and cultural buildings);
- a positive effect on nature conservation/green sites within the CAZ boundaries;
- a positive effect on climate change through reduced greenhouse gas (GHG) (measured in $CO_2$ equivalent tonnes) emissions.

DEFRA's updated damage cost estimates are used to monetise these impacts for the Birmingham CAZ scenarios[43]. The Economic Methodology Report sets out full details on the methodology that has been used to quantify and monetise these benefits for each CAZ option.

It is noted that the damage cost estimates from DEFRA do not account for all the improved health outcomes associated within improved air quality and behavioural changes associated with the CAZ. For example, they

[43] The damage cost values used reflect the JAQU national data inputs for local economic models

do not account for the impact of NO2 on hospital admissions and therefore the morbidity impact is potentially underestimated.

Implicit in this analysis is the comparison against the "do minimum" scenario, where costs due to the impacts listed above are incurred by society.

Table 2-12 presents the total estimated reduction in $NO_X$ and $PM_{10}$ emissions and the monetised benefits of reduced emissions in the first year and over the lifetime of the scheme. This table deals with the mass emissions changed as a result of the scheme (i.e. the total change measured in tonnes). The legal targets for air quality are set in terms of a level of concentrations of pollutants that must not be exceeded. Thus, the legal limits cannot be expressed in terms of tonnes and are not directly comparable.

The monetary benefit shown here is attributable to the behavioural change that results from the CAZ. The CAZ is expected to result in users upgrading to cleaner vehicles or changing travel behaviour to result in less emissions from transport.

Table 2-12: Total Health and Environmental Benefits of Reduced $NO_X$ and $PM_{10}$ Emissions (2018 discounted values)

| **Pollutant** | **unit** | **CAZ D plus Additional Measures** |
|---|---|---|
| $NO_x$ | tonnes | 4,240 |
| | £m | 34 |
| $PM_{10}$ | tonnes | 79 |
| | £m | 11 |
| Total | £m | 46 |

Table 2-12 shows that CAZ D plus Additional Measures provides significant total health and environmental benefits resulting in a reduction of roughly 4,240 tonnes of $NO_x$ emissions and 79 tonnes of $PM_{10}$ emissions over the appraisal period.

DEFRA's updated damage cost estimates have been used to monetise some of these impacts for the Birmingham CAZ scenarios. However, the damage cost estimates from DEFRA do not account for all the improved health outcomes associated within improved air quality and behavioural changes associated with the CAZ. For example, they do not account for the impact of $NO_2$ on hospital admissions and therefore morbidity impacts are potentially underestimated

Figure 2-7 shows the monetised value of the reductions in emissions of $NO_x$ and $PM_{10}$ over the appraisal period. From this it can be seen that the opening year results in around £8m of benefits from reductions from $NO_x$ and around £3m in benefits from reductions in $PM_{10}$. These benefits decline steadily over time reaching about £0.5m for $NO_x$ and £0.1m for $PM_{10}$ in 2029.

Figure 2-7 Forecast emissions reductions over appraisal period CAZ D plus Additional Measures

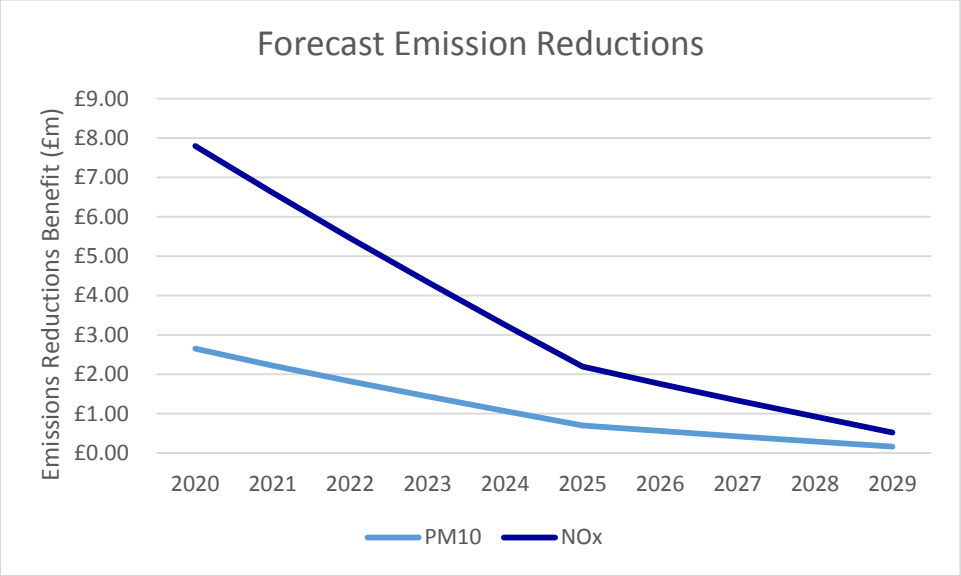



Table 2-13 also presents the total estimated reduction in greenhouse gas (GHG) emissions and the monetised benefits of reduced GHG emissions in the first year and over the lifetime of the scheme. This was assessed based on the change in total vehicles kilometres driven, as well as the change in terms of fleet, having been upgraded to newer cars with lower carbon emissions. Table 2-13 shows that over the appraisal period the CAZ D plus Additional Measures scheme would result in a net reduction of around 79,261 tonnes of greenhouse gas emissions. In monetary terms this amounts to around £4m over the appraisal period.

Table 2-13 Total Quantified and Monetised Benefits of Reduced GHG Emissions (£m, 2018 discounted values)

| **Pollutant** | **unit** | **CAZ D plus Additional Measures** |
|---|---|---|
| **Greenhouse Gases** | **Tonnes $CO_2e$** | 79k |
| | **£m** | 4.3 |

### 2.8.7 Summary of Health and Environmental Benefits

Reductions in air pollution and travel behavioural changes will bring a number of social, environmental and economic benefits. These include:

- benefits to human health;
- improved productivity (as a consequence of health improvements);
- Reduced material damage (particularly to historical and cultural buildings);
- a positive effect on nature conservation/green sites within the CAZ boundaries;
- a positive effect on climate change through reduced greenhouse gas (GHG) (measured in $CO_2$ equivalent tonnes) emissions.

Given the strong links between both air pollution and travel mode and a variety of health impacts, particularly on children, all reductions in air pollutant concentrations associated with the implementation of the CAZ D 'High' with Additional Measures are expected to bring benefits. Although initial changes in pollutant concentrations by 2020 may be modest and the predicted modal shift towards active travel relatively small, the accumulation of small changes, when considered across the population, is likely to

bring benefits to public health outcomes in Birmingham. The results of ongoing air quality modelling will be reported in the Distributional Impact Appraisal Report which will be submitted to support the business case.

## 2.9 Mitigation and exemptions

Given its statutory equality duty, BCC wants to ensure that compliance of $NO_2$ emissions will not create any significant dis-benefits to disadvantaged groups. Mitigations and exemptions have been created for groups identified by the Distributional Impact Assessment (DIA). The following describes the processes for creating the mitigation and exemption packages.

### 2.9.1 Mitigation measures

Designing mitigation measures to request funding from the Clean Air Fund (CAF) involved the following steps:

- Creation of a longlist of measures: A wide range of measures were considered which could mitigate the negative impacts of the CAZ introduction. This list was deliberately broad and considered all options that could be enacted to help targeted user groups.
- Assessing the longlist measures: Each measure on the longlist was assessed against the primary and secondary Critical Success Factors (CSF) described in Appendix 1A.
- Reviewing the shortlist of measures: All measures were compared assessed against the CSFs mentioned above and a qualitative decision was made whether to progress the measure to the shortlist. During this process the details of the measure in question was finalised.
- The short list measures were then analysed and quantified before a final decision was made on the items taken forward to the final package of mitigations seeking CAF allocation.

The decision process evaluation the longlist of mitigations and creating the shortlist is summarised in Table 2-14.

Table 2-14 Mitigation measure of longlist leading to the shortlist summary

| Mitigation measure | Primary CSF: delay reaching compliance | Secondary CSFs | Decision to bring forward to short list |
|---|---|---|---|
| Mobility package for private vehicle owners | No: encourages use of the public transport | Unless scheme is targeted cost will become excessive | Yes – but limit package to low income residents of the CAZ and low-income individuals working within the CAZ |
| Scrappage scheme for private vehicle owners | No: in some instances, this will result in a compliant trip rather than a cancelled/re-routed trip, however the modelling suggests this does not impact the compliance date | Logistical and feasibility issues relating to the proof of scrappage, must be targeted to limit cost | Yes – but limit package to low-income residents of Birmingham and target at those who regularly enter CAZ |
| ULEV taxi grant | No: encourages transition to ULEV vehicle | State aid and double funding issues | No |
| ULEV taxi leasing scheme | No: encourages the transition to ULEV vehicles | Would require significant funding or, alternatively, a large loan amount | Not in this form. Edited to include a limited number of taxis for the council to lease on a 'Try before you buy' basis |
| Taxi scrappage scheme | No: encourages the transition to ULEV vehicles | Feasibility and logistical issues, objection from the taxi trade | No |

| Mitigation measure | Primary CSF: delay reaching compliance | Secondary CSFs | Decision to bring forward to short list |
|---|---|---|---|
| ULEV taxi operational support package | No: encourages transition to ULEV vehicle | Satisfies all secondary CSFs and positive feedback received from trade | Yes – Combined award where drivers receive equal funding for either retrofit solution or ULEV operational support package |
| Taxi retrofit fund | No: encourages transition to a compliant vehicle technology | Satisfies all secondary CSFs and positive feedback received from trade | |
| SME grant for HGVs/LGVs | No: encourages transition to a compliant vehicle technology | State aid and double funding issues | Not in this form. Edited to include a fund for HGVs only where fleets can apply for a funding award to aid with either retrofit technology or the upfront cost of a compliant vehicle. Coaches added to this scheme. |
| Retrofit scheme for HGVs/LGVs | No: encourages transition to a compliant vehicle technology | Issues with technology readiness for HGVs, for LGVs the cost of retrofit compares poorly with cost of new vehicle | |
| Freight consolidation centre | No: would reduce the amount of CAZ entries from freight vehicles | Would require significant investment, negative feedback from Birmingham fleets, not feasible in the timeframe available | No |
| Free public charging electricity credit for LGVs | No: encourages transition to ULEV vehicle | Satisfies all secondary CSFs | Yes |
| Marketing and engagement campaign | No: encourages transition to ULEV vehicles | Satisfies all secondary CSFs | Yes |
| Residents parking scheme | No | Satisfies all secondary CSFs | Yes |
| Improving Birmingham's cycling and walking infrastructure | No: encourages residents to walk and cycle | Costs and timeframe are not considered feasible in relation to CAF | No (could be developed at a later date outside of the CAF framework) |

From this assessment eight mitigation measures were brought forward to the final package of mitigation measures. Table 2-15 describes the mitigation measures proposed, including how the group is impacted by the scheme and the proposed budget required for the mitigation measure. Funding for the mitigations measures is sought through the Clean Air Fund.

The cost of the mitigation measures is £48.3m in 2018 prices. An additional £2.2m has been added to the mitigation measure cost to account for administering the mitigation and exemption measures. Adding this administration cost brings the total to £50.4m and nominalising the administrative cost profile in accordance with it's spend profile brings the total CAF allocation request to £50.9m. This results in a total cost of £46.0m in 2018 discounted prices.

Table 2-15 Mitigation package summary

| Ref | Measure | Type | Group impacted | Geographical scope | Summary of mitigation measure | Distributional analysis (how group is impacted) | Cost |
|---|---|---|---|---|---|---|---|
| M1a | Mobility support for individuals working within the CAZ | 20c | Private car/van owners who work or live within the CAZ | Not restricted to geographic area for vehicle owner (place of work in CAZ) | Individual can access the choice of a £1000 mobility credit offered in form of SWIFT travel card or a £2,000 package (Swift credit or contribution to compliant vehicle) in return for scrapping a non-compliant vehicle_card | Class D CAZ will force residents to either upgrade vehicle or pay charges if they wish to enter. For many individuals, public transport may be the only alternative, these measures decrease the cost of that switch or facilitate the purchase of a compliant vehicle. | **£10.84 million** *(5,420 x £2,000)* |
| M1b | Mobility support for individuals who reside outside of the CAZ | 20c | Private car/van owners | West Midlands | With evidence of scrapping a non-compliant car individual receives either:<br>▪ £2,000 cash payment toward the purchase of a compliant car (not eligible for PiG).<br>▪ £2,000 mobility credit. Credit to be supplied on a SWIFT card with no expiration for use. | | **£6.50 million** *(3,250 x £2,000)* |
| M2a | Hackney carriage support package | 20b | Hackney carriages | Birmingham and surrounding areas (licensed BBC drivers) | Drivers offered £5,000 as:<br>• support payments to be paid towards operational expenses of ULEV vehicles (4 annual instalments of £1,250)<br>• support for an LPG retrofit of their current or newly purchased vehicle | Changes in licencing conditions will force over 90% of the 1280 vehicles currently operational to change (upgraded/retrofit). All options on the market require significant capital expenditure, this helps drivers to switch to a compliant vehicle.<br>As above, changes in licencing conditions are expected to result in 95% of the 4,321 current vehicles needing to be upgraded to continue operation | **£5.0 million** *(1000 x £5,000)* |
| M2b | Council hackney carriage leasing scheme | 20b | Birmingham (licenced BCC drivers) | | BCC bulk purchase 50 ULEV taxis through public procurement tender and lease them to the drivers who are most vulnerable as well as on a try-before-you-buy basis | | **£2.75 millio**n *(50 x £55,000)* |

| Ref | Measure | Type | Group impacted | Geographical scope | Summary of mitigation measure | Distributional analysis (how group is impacted) | Cost |
|---|---|---|---|---|---|---|---|
| M2c | Private Hire Vehicle upgrade support | 20b | Private Hire Vehicles | | Private hire vehicle owners who upgrade to a compliant vehicle where the priority will be beyond the minimum BCC's 2020 licencing criteria i.e hybrid or ultra-low emission vehicles. | | **£7 million** *(3,500 x £2,000)* |
| M3 | 'Free miles' for ULEV LGVs | 20b | Van fleets | Birmingham | ULEV van drivers receive £1000 credit to spend on BCC public charging network | SMEs operating coaches/HGVs/LGVs or relying on road transport will be disproportionately impacted. Vehicle capital costs are high, and many fleets must enter CAZ as part of business operation. This helps fleets change to a compliant vehicle. | **£0.75 million** *(750 x £1000)* |
| M4 | HGV & Coach compliance fund | 20b | HGV and Coach fleets | West Midlands | Fleets compete for £15,000 funding package to contribute towards:<br>▪ Installing a retrofit solution<br>▪ Upfront or lease costs of a compliant vehicle | | **£10.05 million** *(670 x £15,000)* |
| M5 | Marketing and engagement campaign | 20b | Owners of non-compliant vehicles (All types) | | Marketing and engagement campaign to provide information on the CAZ and reach out to groups eligible for support through mitigation measures | Ensures maximum uptake/knowledge of measure, to minimise negative impact and maximise effectiveness of the mitigation measure package | **£0.38million** |
| M6 | Resident parking scheme | n/a | Residents living close to the CAZ | Areas surrounding CAZ | Implementation of residents parking schemes to prevent overcrowding on margins of CAZ; will be deployed only if issues arise | Prevents vehicle overcrowding on residential streets on the margins of the CAZ | **£5 million** |

### 2.9.2 Exemptions

This report section describes the process to identify the exemptions included in the final CAZ scheme. The first stage of the identification and evaluation mitigation options was to develop an initial longlist solution to moderate the impact groups identified as disproportionately impacted by the CAZ. In practise this involved identifying groups impacted by the scheme, then identifying a mechanism for lessening their disbenefit from CAZ implementation. This was based on the conclusions of the distributional impact analysis (DIA) report. The groups and targeted exceptions that comprised the longlist are shown in Table 2-16.

Table 2-16 Groups impacted by the CAZ

| Group | Description |
|---|---|
| CAZ HGVs and coaches | HGVs and coaches registered within the CAZ |
| HGVs travelling to the CAZ | HGVs registered within the Birmingham City area with existing finance agreements |
| SME van and LGV owners | Vans and LGV registered to SMEs within the CAZ |
| Vans within Birmingham City area | Vans registered within the Birmingham City area travelling to the CAZ with an existing finance agreement |
| Residents inside the CAZ | All residents in the CAZ |
| Workers whose job is inside the CAZ | Workers whose job is inside the CAZ and live outside the CAZ |
| Income deprived | Income deprived living in the CAZ |
| Income deprived | Income deprived living outside the CAZ, travelling inside the CAZ to work (commute) |
| Income deprived | All income deprived travelling inside the CAZ |
| Key workers whose job is inside the CAZ | Key workers living within the CAZ |
| Key workers whose job is inside the CAZ | Key workers living outside the CAZ, travelling inside the CAZ to work (commute) |
| Hospital visitors | All visitors of Birmingham Children's hospital |
| Community and school transport | All holders of Section 19 permits |
| Night workers | All travelling inside CAZ for work purposes during unsocial hours |
| Faith groups | All travelling to larger or more unique places of worship within the CAZ |
| Disabled vehicle owners | Vehicles with a 'disabled' or 'disabled passenger vehicles' tax class |

To evaluate the potential to exempt these groups from paying the CAZ charge, the increased number of trips, in AADT terms, was estimated for each of the exemptions on the longlist. This volumetric assessment was used to inform an initial sifting of the longlist to remove those measures that would impact the compliance date. The eligibility for the exemption for CAZ workers has been given a salary cap, as if the exemption were to include all CAZ workers this would result in delayed rate of compliance.

The next level of sifting, evaluation the shortlist, involved eliminating areas of overlap between the different exemption options to ensure the most efficient package is created. Table 2-17 summarises which exceptions are included in the overall package, and the rationale for including or excluding each option.

Table 2-17 Description of longlist exemption leading to a decision on whether to take each measure forward to the shortlist. The exemption duration and groups are summarised in the Mitigation measures and exemptions section in the financial case chapter (Section 3.4).

| | Group | Description of exemption | Included in package | Rationale |
|---|---|---|---|---|
| 1 | Commercial vehicles registered within the CAZ.<br>CAZ HGVs/LGVs and coaches | Commercially owned LGVs, HGVs and coaches registered within the CAZ. Limited to 2 vehicles per company (companies two cleanest non-compliant vehicles). | Y | Businesses with HGVs/LGVs or coaches registered within the CAZ are not numerous and they will have little time to upgrade their vehicles. |
| 2 | Commercial vehicles with pre-existing finance agreements | Commercially owned LGVs, HGVs and coaches with finance agreements that extend beyond 2020 will be given a 1-year exemption | Y | Finance agreements will limit an organisations ability to upgrade vehicle. Jacobs 'Freight and Logistics'44 report showed that many fleet operators have lease arrangements into the early 2020's. |
| 3 | Private vehicles registered within the CAZ | Private vehicles registered within the CAZ are exempted for a 2-year exemption | Y | Individuals with vehicles registered within the CAZ will have a limited ability to avoid the charges and will be disproportionately impacted. Areas within the CAZ have been shown to have high levels of income deprivation compared to Birmingham as a whole |
| 4 | Individuals travelling into the CAZ for work | Individuals with a non-compliant who work within the CAZ will be exempt from paying the CAZ charges. (A salary eligibility cap of £30,000 will be applied). | Y | Low income individuals will be disproportionally impacted by the CAZ, especially those that must regularly enter the zone for work.<br><br>Key works provide essential services and BCC wants to ensure that their employment is retained within the CAZ |
| 5 | Income deprived | Income deprived living in the CAZ | N | Overlaps with option 3 so excluded |
| 6 | Low wage | Income deprived living outside the CAZ, travelling inside the CAZ to work (commute) | N | There is little opportunity to change behaviour to avoid the CAZ. In addition, the insecure nature of income deprived individuals means their access to employment should be protected |
| 7 | Income deprived | All income deprived travelling inside the CAZ (limited number of exemptions, address and income dependent) | N | Some groups will be particularly impacted, as their quality of life is dependent on traveling into the CAZ. This will be limited to a small number of exemptions as there is opportunity to change behaviour to avoid the CAZ charges, i.e. mode shift. In addition, the mobility and vehicle upgrade mitigation measures also offers some relief to those not covered by the exemption. |
| 8 | Key workers whose job | Key workers living within the CAZ | N | Overlaps with option 4 so excluded |

[44] Jacobs: Clean Air Zone - Freight & Logistics, 2017

| | Group | Description of exemption | Included in package | Rationale |
|---|---|---|---|---|
| | is inside the CAZ | | | |
| 9 | Hospital visitors | All visitors of Birmingham Children's hospital | Y | Birmingham Children's hospital is a regional specialist so there is little opportunity to change behaviour to avoid the CAZ. The vulnerable nature of patients mean family members should not be dis-incentivised from visiting them |
| 10 | Community and school transport | All holders of Section 19 permits | Y | Community and school transport are often provided by small operators and local charities that provide important access to services (health and social care, education and training) for people who may otherwise be isolated. |
| 11 | Night workers | All travelling inside CAZ for work purposes during unsocial hours | N | The DIA only identifies key workers as those who work unsociable hours as a group who should be protected from the costs.<br>As income deprived workers are covered in option 4, this exemption was not taken forward for packaging. |
| 12 | Disabled vehicle owners | Vehicles with a 'disabled' or 'disabled passenger vehicles' tax class | Y | There is little opportunity to change mode to access the CAZ. |

Table 2-18 presents the final exemption package with the forecast increase in AADT for each exemption. Exemptions from paying the CAZ charge for non-compliant vehicles meeting the requirements will last through 2020 (1 year) for most exemption measures, with the exception of E5 which will last 2 years and E9b will last through the entire CAZ period.

Table 2-18 Final mitigation package

| ref | Exemption | Increase in CAZ D plus Additional Measures over OBC (AADT) |
|---|---|---|
| E1 | CAZ HGVs/LGVs and coaches | 0.05% AADT increase overall<br>1.35% increase of HGV AADT |
| E2 | HGVs/LGVs with existing finance agreements | 0.15% AADT increase overall<br>3.50% increase of HGV AADT |
| E3 | SME Vans/LGV within the CAZ | 0.20% AADT increase overall<br>1.65% increase of LGV AADT |
| E4 | Vans/LGV with existing finance agreements | 0.45% AADT increase overall<br>4.10% increase of LGV AADT |
| E5 | CAZ residents | 0.85% AADT increase overall<br>1.10% increase of car AADT |
| E6 | CAZ workers | 1.30% AADT increase overall<br>1.65% increase of car AADT |
| E7 | Key workers working within the CAZ | 0.75% AADT increase overall |

| ref | Exemption | Increase in CAZ D plus Additional Measures over OBC (AADT) |
|---|---|---|
| | | 1.00% increase of car AADT |
| E8 | Hospital and GP visits | 0.05% AADT increase overall<br>0.07% increase of car AADT |
| E9 | Community and school transport and vehicles registered with disabled status | 0.25% AADT increase overall<br>0.65% increase of LGV AADT |
| E10 | Two wheeled vehicles | Not modelled – increase in non-compliant vehicles entering CAZ expected to be negligible |

Note that the full forecast fleet impacts of the mitigations and exemptions are provided in the Economic Appraisal Methodology Report.

### 2.9.3 Interrelations between mitigations and exemptions

The exemption and mitigation measures that have been proposed are both designed to minimise the negative impacts identified by the distributional impact analysis. As such, there is expected to be overlap between the groups targeted by the mitigations and those eligible for exemptions. Details of how exemptions are integrated into the implementation of the mitigation measure are covered in detail in the delivery plan of each mitigation measure (See CAF Report). However, each follows a general approach, as set out below.

- Receiving support through one of the mitigation measures proposed in no way affects an individual's/organisation's eligibility for an exemption, and vice versa.
- The implementation of the mitigation measures will be extended through early 2021 this allows individuals/organisations to continue to use their vehicle during the exemption period and is organised so that the mitigation measure is available at the end of the exemption.
- Those that are eligible for mitigation measures but are not eligible for exemptions can receive the mitigation packages/funding to coincide with the implementation date of the CAZ.

### 2.9.4 Mitigations and exemptions impact on compliance

The first year of compliance will be 2022, which is the shortest possible time in which Birmingham can achieve compliance. The mitigation measures are shown to not negatively impact the date of compliance, they also deliver a number of other benefits.

- The mitigations measures are designed to help individuals and organisations switch to cleaner compliant vehicles earlier than they normally would.
- For commercial fleets, especially in the case of taxis and HGVs, it is assumed that the vast majority would switch their vehicle as a result of the CAZ irrespective of any mitigation measures. Therefore, the measures should not impact the rate of compliance but instead make it financially easier for those who are forced to switch their vehicles.

The mitigations and exemptions have been processed through the traffic model and AQ modelling suites and do not impact compliance dates. This is due to the fact that impacted participants only make up a small proportion of daily traffic, under 6% of AADT. Additionally, as most of exemptions are only valid through 2020, these will not impact compliance being achieved in 2021.

### 2.9.5 Mitigations' and exemptions' Value for Money

This section of the report provides an overview of the method used to calculate how the proposed mitigations independently would impact consumer surplus and the value for money assessment of the CAZ scheme. Overall the implementation of a CAZ scheme impacts users by changing their consumer surplus. The following table provides and overview of the value for money assessment for each of the mitigations. This analysis is further elaborated in the CAF Application delivered with this FBC.

| Ref | Measure | Description |
|---|---|---|
| M1a | Mobility support for individuals working within the CAZ | Mobility credit or scrappage payment to recipients directly offsets consumer surplus loss due to scheme implementation at a 1 to 1 ratio.<br>This mitigation is anticipated to increased public transport mode share. However, as a conservative assumption of no impact on vehicle trip rates was made in the traffic modelling. |
| M1b | Mobility support or cash payment toward the purchase of a new car with evidence of scrappage | Mobility credit or scrappage payment to recipients directly offsets consumer surplus loss due to scheme implementation at a 1 to 1 ratio.<br>The additional traffic resulting from this mitigation is ran through the traffic model and the traffic impacts are reflected in<br>Table 2-19 |
| M2 | Hackney carriage and Private Hire Vehicle support package | The mitigation payments made to taxi and PHV drivers directly offsets consumer surplus loss due to scheme implementation at a 1 to 1 ratio.<br>All taxis and PHVs are assumed compliant in the traffic model therefore impacts are not included in the modelled outputs. |
| M3 | 'Free miles' for ULEV LGVs | The mitigation payments made to LGV drivers directly offsets consumer surplus loss due to scheme implementation at a 1 to 1 ratio.<br>The mitigation is aimed to encourage the uptake of ULEV LGVs. However, as a conservative assumption of no impact on vehicle ownership rates was made in the traffic modelling. |
| M4 | HGV & Coach compliance fund | The mitigation payments made to HGV and Coach drivers directly offset consumer surplus loss due to scheme implementation at a 1 to 1 ratio.<br>HGVs are assumed to have a fixed trip matrix. Although some HGVs may not re-route due to the mitigation measure now making their vehicle compliant, these are forecast to be small numbers and no change in HGV traffic is assumed in the traffic modelling. |
| M5 | Marketing and engagement campaign | No benefit assumed |
| M6 | Resident parking scheme | The mitigation cost is assumed to directly offset consumer surplus loss due to scheme implementation at a 1 to 1 ratio. |

The following table summarises modelled outputs of the cost-benefit assessment of CAZ D plus Additional Measures, CAZ D plus Additional Measures with Exemptions and CAZ D plus Additional Measures with Mitigations and Exemptions. As noted, these modelled outputs represent the impact of the M1b scrappage scheme.

Table 2-19 Mitigation impact allocation, (£m, 2018 discounted)

| Analysis of Monetised Costs and Benefits (AMCB) | CAZ D plus Additional Measures (OBC) | CAZ D plus Additional Measures - Medium charge | CAZ D plus Additional Measures w/Exemptions | CAZ D plus Additional Measures w/Mitigations & Exemptions |
|---|---|---|---|---|
| **Column Number** | **1** | **2** | **3** | **4** |
| Benefits - health and environmental | 43 | 50 | 46 | 46 |
| Benefits - reduced CO2 emissions | 6 | 5 | 4 | 4 |
| Benefits to transport users - changes in journey time and vehicle operating costs | 11 | 81 | 70 | 60 |
| Benefits from CAF | 0 | 0 | 0 | 44 |
| Cost to Transport Users - Parking charges | -36 | -37 | -38 | -38 |
| Cost to Transport Users - upgrading | -61 | -50 | -53 | -53 |
| Transaction Cost - vehicle upgrade | -0 | -0 | -0 | -0 |
| Transaction Cost - paying CAZ charge | -11 | -18 | -11 | -10 |
| Cost to Transport Users - welfare (trips foregone) | -21 | -21 | -16 | -15 |
| Welfare Remoded | -4 | -25 | -20 | -18 |
| Parking welfare loss | -30 | -22 | -22 | -22 |
| Private Sector Benefits - Parking revenues | 30 | 30 | 30 | 30 |
| **Present Value of Benefits (PVB)** | **-73** | **-7** | **-10** | **28** |
| Costs to BCC capex | 19 | 19 | 19 | 19 |
| Costs to BCC opex | 29 | 41 | 33 | 35 |
| Cost from CAF Grant | 0 | 0 | 0 | 46 |
| Revenues from Parking Charges | -6 | -6 | -8 | -8 |
| **Present Value of Costs (PVC)** | **42** | **54** | **44** | **92** |
| **Net Present Value (NPV)** | **-115** | **-61** | **-54** | **-64** |

As the scheme progressed post-OBC, a second modelled year was introduced into the economic appraisal process. The second modelled year, 2022, exhibited less traffic than the default proportion of non-compliant vehicles to intervention year. Additionally, behavioural assumptions were updated and responses were altered by the lowering of the CAZ charge levels. Specifically, the proportion of trips remoded increased significantly. The combined impact resulted in higher disbenefit associated with changed trip patterns and significant journey time and vehicle operating cost savings due to less congestion on the road network. These changes are shaded in the second table column where the combined impact of the second modelled year and behavioural changes is seen to have a substantial impact on journey time savings and vehicle operating costs. The increased traffic stemming from the lower CAZ charge has also increased the transaction costs associated with paying the CAZ charge.

The figures shaded in the third column are the benefit areas where allowing for certain groups to have their non-compliant vehicles exempt from CAZ charges had a significant impact. The introduction of exemptions is shown to reduce the disbenefit associated with cancelling trips and changing transport modes by £10m. Travel time savings and vehicle operating cost benefits also reduce as more vehicles are on the road, increasing congestion and vehicle operating costs when compared to the without exemptions scenario. The disbenefit associated with time required to pay the CAZ charge also drops as few non-compliant vehicles are required to pay the charge.

The introduction of the mitigations, is shown in the fourth column. The most notable result is that as the mitigation measure funds distributed to impacted groups directly offset consumer surplus loss at a 1 to 1 ratio the PVB turns positive. This indicates that the mitigations are of an adequate size to allow the scheme to be beneficial to society, as prior to mitigation inclusion the scheme had negative benefits. There is a moderate decrease in the scheme's NPV due to increased road congestion reducing travel time and vehicle operating cost savings, as well as the administrative cost of the CAF spend not accounted for in the CAF costs, but not the CAF benefits.

Additionally, there are many non-monetised benefits that arise due to the introduction of the mitigation measures. The numbers represented here only reflect outputs form the traffic modelling suite where information was available to change modelled assumptions. The breadth of non-monetised benefits is described in the CAF Report delivered in conjunction with this document.

## 2.10 Sensitivity Testing

A sensitivity testing was performed to test the impact of altering assumptions underpinning the economic appraisal. A multitude of scenarios and sensitivities were run through the traffic and AQ modelling suites and are discussed in their respective reports. The vast majority of assumptions in the economic model are provided in JAQU guidance where no sensitivity testing is recommended. A test has been performed flexing the fleet scaling factor used to determine fleet size as this is an uncertain assumption used in the economic modelling.

### 2.10.1 Scaling factor

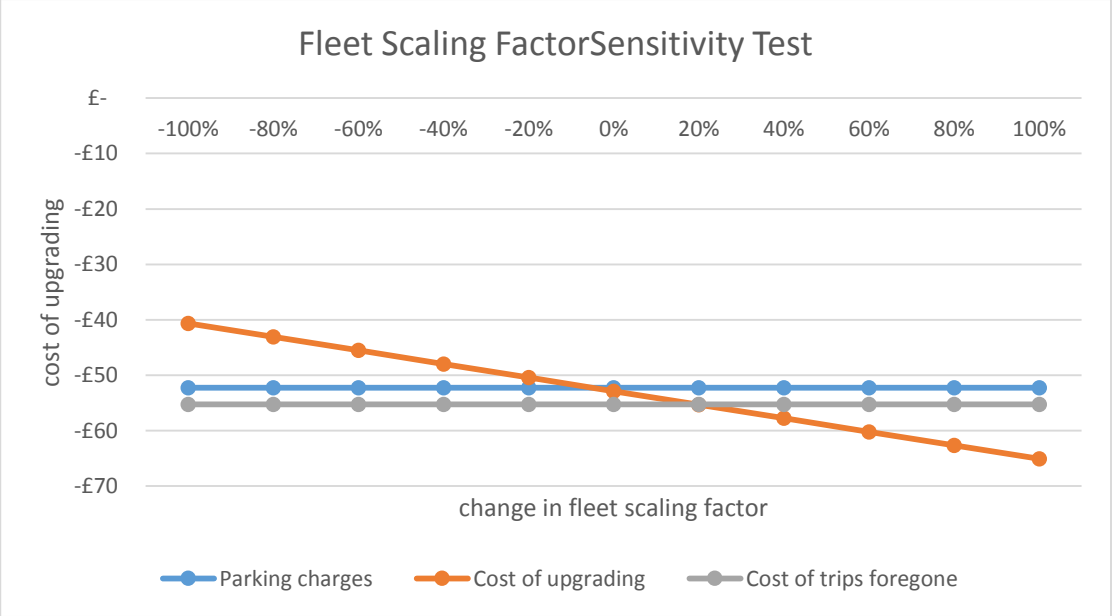
The fleet scaling factor used to uplift the number of vehicles impacted by the Birmingham CAZ scheme from AADT figures forecast by the traffic model to total fleet figures. This figure is used to determine the size of the fleet that would upgrade their vehicles due to the introduction of the BCC CAZ. At £53m, the welfare disbenefit associated with the cost of upgrading is over 1/3rd of the total scheme disbenefit.

The fleet scaling factor is calculated as a direct proportional relationship between populations surrounding and the number of vehicles entering the BCC CAZ and London's Low Emission Zone. A sensitivity test had been undertaken on the CAZ D plus Additional Measures scenario to explore how sensitive the estimated cost to upgrade for transport users is to the fleet scaling factor. The test is set up to vary the scaling factor by intervals of ±20% between -100% (no non-compliant vehicles) and +100% (doubling the number of compliant vehicles).

Figure 2-8 plots changes in cost to upgrade for transport users versus percent changes to the assumed scaling factor. The cost of parking charges, CAZ charges and welfare costs are not impacted by the scaling factor since these are estimated as a function of observed and forecast AADT (this captures frequency of entry to the CAZ). The cost of upgrading varies proportionally with the scaling factor, a 20% change in the scaling factor is found to drive a 5% change in the cost of upgrading.

However, overall this assumption has minimal impact on the overall cost to transport users where the doubling of the scaling factor increases costs by less than 20%, or just over £10m. This indicates that changes in the scaling factor have a low impact on overall benefits

Figure 2-8 Upgrade Cost Sensitivity for the CAZ D plus Additional Measures (£m, 2018 discounted values)



## 2.11 Cost Benefit Analysis

### 2.11.1 Monetised Costs and Benefits

Table 2-20 summarises the economic impacts of the CAZ D plus Additional Measures scheme over the 10-year appraisal period. The table shows that along with health benefits the scheme delivers benefits in the form of journey time savings and reduced vehicle operating costs. These benefits arise from the reduction of non-compliant vehicle traffic lowering congestion levels.

This disbenefit associated with the implementation of parking charges if offset by corresponding gains in the form of government and private sector revenue. Although these offset, they are not treated as a transfer as a resource (parking space use) is used.

The disbenefit associated with individuals accelerating their vehicle upgrades to have a compliant vehicle and from individuals changing their travel behaviour are significant. Exhibiting this, prior to the introduction of mitigations for impacted users the scheme generate a negative Present Value of Benefits (PVB). However, the inclusion of Clean Air Fund (CAF) mitigation measures within the scheme offsets a portion of disbenefit arising from scheme implementation. The combined result is the scheme producing a positive present value of benefits (PVB).

The present value of costs (PVC) for the scheme is negative as the revenue generated from the CAZ charges is considered a transfer and is not included in the appraisal. Therefore, only scheme costs and government parking revenues are considered. The PVCs are greater than the PVBs, resulting in a Benefit Cost Ratio of 0.30 and a NPV of negative 64.

Table 2-20 Scheme Net Present Value (£m 2018 discounted prices, central values)

| **Analysis of Monetised Costs and Benefits (AMCB)** | **CAZ D plus Additional Measures** |
|---|---|
| Benefits - health and non-health, damage costs | 46 |
| Benefits - reduced CO2 emissions | 4 |
| Benefits to transport users - changes in journey time and vehicle operating costs | 60 |
| Benefits from CAF | 44 |
| Cost to Transport Users - Parking charges | -38 |
| Cost to Transport Users - upgrading | -53 |
| Transaction Cost - vehicle upgrade | -0.1 |
| Transaction Cost - paying CAZ charge | -10 |
| Welfare (trips foregone) | -15 |
| Welfare Remoded | -18 |
| Parking welfare loss | -22 |
| Private Sector Benefits - Parking revenues | 30 |
| **Present Value of Benefits (PVB)** | **28** |
| Costs to BCC capex | 19 |
| Costs to BCC opex | 35 |
| Cost from CAF Grant | 46 |
| Revenues from Parking Charges | -8 |
| **Present Value of Costs (PVC)** | **92** |
| **Net Present Value (NPV)** | **-64** |

## 2.12 Summary of Key Points and Conclusions

- The initial traffic and air dispersion modelling undertaken by BCC has demonstrated that implementation of a Clean Air Zone and additional measures in Birmingham would not be sufficient to ensure compliance with $NO_2$ concentration limits in all locations by 2020 in any of the modelled scenarios. AQ modelling of the CAZ D plus Additional Measures high charge scenario forecasts that compliance will be achieved in 2021, apart from one location that BCC will continue working on to see if compliance can be achieved before 2022.
- The CAZ D plus Additional Measures scenario is the preferred option as it is most likely to achieve compliance in the shortest possible time, which remains the primary critical success factor.
- The Cost Benefit Analysis (CBA) forecasts that the CAZ D plus Additional Measures and mitigation and exemptions would generate a NPV of -£64m.
- Although the quantified health and non-health benefits are significant for CAZ D plus Additional Measures (valued at approximately £50m) and there are additional benefits and savings in terms of reduced $CO_2$ emissions, journey times and vehicle operating costs. These benefits are outweighed by the projected costs to the public, BCC, and Government.
- The analysis presented in this Economic Case rests on some key assumptions, some of which are uncertain. Additionally, a number of potentially significant health and non-health impacts that have not been quantified or monetised.
- The distributional impacts appraisal show that the following groups have been identified as potentially experiencing a disproportionate or differential adverse impact as a result of the implementation of the scheme.
  a) Residents of the CAZ, and also surrounding areas (CAZ D scenarios only)
  b) Disabled people (all scenarios)
  c) Children (all scenarios)
  d) People with religious beliefs (CAZ D scenarios only)
  e) In terms of impacts on business affordability, the following groups would be most adversely affected:
     - SMEs within the CAZ
     - Suppliers to SMEs within the CAZ
     - Taxi drivers

A package of mitigations and exemptions has been introduced to mitigate the impacts of the scheme on groups receiving disproportionate disbenefit. This package of mitigations and exemptions is shown to have a significant impact on impacted users. This is shown as the Present Value of Benefits changes from negative to positive following their introduction (+£44m NPV improvement, excluding admin), indicating that overall the combined scheme benefits to society outweigh its disbenefit.

# 3 Financial Case

## 3.1 Introduction

The Financial Case assesses the potential financial impacts to Birmingham City Council (BCC) of setting up, running and enforcing a Clean Air Zone (CAZ) in Birmingham City Centre.

As discussed in the Economic Case, the results of the traffic and air quality modelling conducted indicate that a CAZ D scheme plus Additional Measures is most likely to deliver compliance with the EU limit values for air quality in the shortest possible time. The Financial Case focuses on this option.

The CAZ D plus Additional Measures scheme implements charges on all class D vehicles (buses, coaches, taxis, heavy goods vehicles, light goods vehicles and cars) entering Birmingham's inner Ring Road that do not meet the defined emission standards. The additional measures assessed in the preferred scheme are:

- All BCC controlled free parking in the CAZ becomes charged.
- Banning traffic travelling northbound on Suffolk Street Queensway (A38) that exits onto Paradise Circus to then access Sandpits Parade and southbound traffic from Paradise Circus accessing the A38.
- The closure of Lister Street and Great Lister Street at the junction with Dartmouth Middleway. This allows more green time on the A4540, apart from buses.

Mitigation and exemptions targeted at groups impacted by the introduction of the CAZ D plus Additional Measures scheme have been added to the preferred scheme. The resultant scheme, a CAZ D plus Additional Measures scheme with mitigations and exemptions, is assessed in this Financial Case.

## 3.2 Purpose

The purpose of this Financial Case is to support the application for drawdown from the DEFRA Implementation Fund and the Clean Air Fund (CAF). The bid for the Clean Air Fund grant drawdown is set out in more detail in the CAF Report delivered in conjunction with this business case. The Financial Case for the implementation fund grant assesses the potential affordability of the costs to BCC of setting up and operating CAZ D plus Additional Measures scheme, and the potential revenues that would be generated through the scheme's operation.

The intention is that any surplus CAZ charging revenues generated would be spent on future City Council initiatives to improve air quality.

The Financial Case also presents identified mitigation measures toward targeted groups impacted by the implementation of the CAZ scheme. Funding from the Clean Air Fund (CAF) is requested for these mitigations.

The Financial Case is structured as follows:

- section 3.3 and 3.4 estimate the capital and operating costs for the CAZ D scheme and the additional measures;
- section 3.5 describes the mitigations and exemptions costed with the scheme:
- section 3.6 summarises the scheme's total cost impact;
- section 3.7 estimates the revenues that would be generated through scheme operation, where section 3.7.4 discusses potential use of revenue surplus;
- section Financial Summary**Error! Reference source not found.** combines the costs and revenue streams to present a financial appraisal;
- sub-section 3.8.1 identifies potential funding sources;
- section 0 describes the accounting treatment of costs and revenues associated with the CAZ;
- section 0 discusses sensitivity tests performed; and,
- Sub-section 3.11 presents key findings.

The appendices include a full set of financial statements. Additional information on the mitigations applying for the Clean Air Fund can be found throughout the FBC and in the appended document, the CAF Report, which provides all of the CAF information in a single location.

### 3.2.1 Units of account

The figures presented in the Financial Case are in nominal values, unless otherwise stated.

### 3.2.2 Project costs

The costs for introducing and maintaining the CAZ are split into two categories: implementation costs (capital costs) and operating and maintenance costs (O&M). Where available, costs were estimated using local information and local data. Some of the costs (e.g. costs of signs and ANPR cameras) were derived from per item cost estimates and a forecast number of assets required, based on an analysis of the estimated CAZ boundary area and the required infrastructure that would likely need to be introduced. In other cases, costs were estimated on the basis of additional analysis, simplifying assumptions, professional judgement or relevant cost information from similar local schemes.

Information on how each cost was estimated is provided in the Financial Case and further details are set out in the Financial Model**.** The majority of the costs are determined by the area of the CAZ. However, some operational costs, Penalty Charge Notice Processing fees for example, are calculated from forecast traffic volumes. It was assumed that BCC can reclaim any Value Added Tax (VAT) that it incurs, therefore, all costs presented here are in factor costs (excluding VAT).

### 3.2.3 Assumptions and limitations

Scheme costs are largely calculated with bottom up estimates where a per item cost is applied to an estimated required quantity. Per item costs are taken from similar schemes, technical advisor market intelligence, or market data where it was available from market soundings. These costs have been reviewed by BCC while they are concurrently undertaking market engagement. The costs will be refined through the procurement process and detailed design development as the scheme progresses. Assumption sources and further details are set out in the assumptions sheet of the financial model.

Scheme revenues are calculated from traffic model outputs. The traffic model behavioural assumptions are taken from similar schemes and modified to the local context. Local user responses to the implementation of a charged CAZ may differ from the forecast values.

It should be noted that at the time of submitting this FBC the City Council has not been able to procure the works and or services required to deliver the implementation phase of the project. As such, costs from the procurement activities are not yet known and therefore the costs included in this FBC are an estimate. The City Council has reached an agreement with Government that a revised cost will be supplied to Government in the form of a written report when the costs have been firmed up. The costs for the main civil engineering works Design and Build contract and the 'Technology' works will be confirmed in January 2018. The costs for the Additional Measures are unlikely to be confirmed until later in 2019.

In order to avoid delaying the implementation of the additional measures Government have agreed that the City Council can include an estimate in this FBC which is comparative to similar works undertaken by the City Council. Government have also indicated that there will be a minimum of eight weeks required to review the FBC and Evidence Reports. Subsequently this means that there will also be a minimum of eight weeks before the funding of the project can be agreed. In light of this the City Council has agreed to draw down an interim amount of funding from their corporate reserves to enable the implementation phase to begin straight away. When Government funding is agreed and received by the City Council the interim funding drawn down from reserves will be replenished in full.

### 3.2.4 Treatment of risk and market engagement

Optimism Bias (OB) and contingency are applied to the capital costs. Contingency accounts for known risks where OB is included for unforeseen circumstances. An OB rate of 15% for road projects is applied to the majority of implementation cost items. DfT's WebTAG recommends that this level of OB is applied to the risk-adjusted scheme cost estimate at the Outline Business Case stage (OBC). However, as procurement for implementation is ongoing there is a higher level of uncertainty regarding project costs than that normally experienced for a project at FBC stage. Accordingly, it is appropriate to use the level of OB commiserate to current project characteristics.

A quantified risk assessment (QRA) was undertaken and 52 risks associated with implementation costs were identified. The risks identified in the QRA cover various aspects of the implementation stage and a wide range of technical disciplines. They are similar in nature to those recommended in the *Supplementary Green Book guidance on financial cost estimates of infrastructure projects and the treatment of uncertainty and risk*. Individual risks were assessed based on their likelihood, cost impact and time impact. The risk categories are presented in Table 3-1. Multiplying the potential cost impacts with the likelihood provided the cost impacts associated with the risk categories. The total cost of risk is estimated at £2.3m, which is equal to 19% of base capital costs before the application of optimism bias.

Table 3-1 : Results of QRA for implementation cost, £'000 2018 prices

| **Risk categories** | **Cost of risk (£ 000's)** |
|---|---|
| Approvals and Procedures | 135.5 |
| Change/Uncertainty of Design/ Scope | 87.0 |
| Unforeseen Conditions | 602.5 |
| Construction Activities | 366.5 |
| Statutory Authorities/ Services/ Others | 545.5 |
| Program | 470.3 |
| Third Parties/PR | 2.5 |
| Commissioning/Handover | 18.0 |

The largest risk (£602.5k) is allocated to unforeseen conditions, which includes risk of works on congested footways and junction that may impact the installation of poles, signs, cameras and power supply. This represents a 9% risk adjustment on the total implementation cost (£6,5m) related to signs and cameras.

Birmingham City Council is currently engaging the market to attain implementation and operating cost quotes. One supplier has provided indicative pricing for the installation and maintenance of the ANPR cameras. The quote received provides an implementation cost 36% below the ANPR camera acquisition and installation capex estimate. However, the quote provided assumes that all equipment will be mounted on existing posts and that all connections will be made available at installation points by BCC. Comparing the operational and maintenance cost indicates that the ANPR camera opex forecast is reasonable.

## 3.3 CAZ D and Additional Measures Implementation Costs

Implementation costs are the expenses required for the initial design and set-up of the CAZ. BCC will procure the civil engineering contractors and technology suppliers via existing Framework Agreements. This enables BCC to go to market with proven contractors who know and have experience undertaking works on BCC's road networks. The existing framework procurement routes are further explained in the Commercial Case.

In the Procurement Delivery Model, it has now been decided that separately contracted contractors for the civil works (i.e. civil engineering, sign installation etc.) and technology will be the most effective way to deliver the works, recognising the specialist nature of the technology design. It is proposed that the supply and installation of each technology aspect (i.e. ANPR Cameras) will be by the specialist contractor that will then be a Nominated Subcontractor within the Main Contract (Civil Package). The civils contractor will manage the technology contractor within their contract with the risk associated with delivery passed directly to themselves. For civil related works BCC will use the NEC3 Engineering and Construction (Option C) contract for the works delivery.

Table 3-2 identifies seven broad categories of installation costs and the contingency overlay:

- Detailed Design - this includes the costs of designing the CAZ (including the costs of scoping/feasibility studies to produce local plans) and the marketing costs. Behavioural change support (mitigation efforts) in response to CAZ measures may also be needed but have not been estimated at this stage.
- Air Quality monitoring - the CAZ will require the installation of additional air quality monitoring stations.
- Signs - signs will be required on main (strategic) roads and entry points along local (distributor) roads crossing the CAZ boundary. Main road signs have higher costs as they include power supply and communication infrastructure.
- ANPR cameras – there will be costs associated with the purchase and installation of ANPR cameras that are required to enforce the CAZ. The cameras capture the number plates of vehicles and check vehicle details to identify those that fail to meet the required emissions standards.
- Back office payment and enforcement function (IT and staff office accommodation) – IT includes the provision of a back office to monitor the camera network, IT equipment for staff and staff recruitment costs. Costs are currently based on a BCC standalone system with BCC in ongoing discussions with JAQU regarding system specificities.
- Implementation of Additional Measures – costs associated with implementing the parking and network change additional measures.
- Project management of implementation – includes the provision of staff (programme manager, project managers, assistant PM, site supervisors and others) required to set up the CAZ and the mobilisation cost associated with staffing and training the operational team. Costs are based on the grade and utilisation of each staff member.

Table 3-2: Derivation of implementation cost estimates

| Cost Item | Description | Costing Method | Key assumptions |
|---|---|---|---|
| **Detailed Design** | Outline Design | Actual costs | Cost assumed to be incurred in the period post-FBC prior to funding award. |
| | Detail Design | Bottom up assessment of labour requirements for detail design works | Design, Quantity Surveying, Technical and Planning teams accounted for in estimate. |
| | Marketing and Communications costs | BCC marketing and communication teams estimate | Assumes portion for initial marketing and communications campaign and continued spend throughout the scheme life. |
| **Air quality** | Air Quality monitoring set up costs | Assumed number of sites | A specified value, based on previous experience, for AQ monitoring for station is used. |
| **Signs** | Number of main road (strategic) signs | Bottom up per unit cost assumption based on proposed CAZ area | Along each major route feeding into entering CAZ area |
| | Cost per main road (strategic) sign | Costs taken from similar schemes | Cost of equipment, installation, power supply and communications |
| | Number of local road (distributor) signs | Bottom up per unit cost assumption based on proposed CAZ area | 2 signs for each camera |
| | Cost per local road (distributor) sign | Costs taken from similar schemes | Cost of equipment and installation, assumed unlit and no communications |

| Cost Item | Description | Costing Method | Key assumptions |
|---|---|---|---|
| **ANPR cameras** | Number of cameras | Bottom up per unit cost assumption based on proposed CAZ area | One per each lane of entry and exit across cordon. Includes two cameras at each outer ring crossing for monitoring flows. |
| | ANPR Camera cost | Costs taken from similar schemes | Cost of equipment, installation, power supply and communications. Assumes that cameras are installed on new poles, though may be possible to use existing poles for some |
| **Back office payment and enforcement function (IT and staff recruitment and mobilisation)** | Control room | Provisional estimate | Based on similar schemes and discussion with Birmingham bus lane enforcement scheme.<br>This is an area of uncertainty due to the need to agree final arrangements with JAQU. |
| | Staff recruitment | Bottom up estimate | Recruitment and IT set up cost assumed at £5k (£2k for IT and £3k for recruitment) |
| | Cost of training CAZ staff | Based on estimated staff required for 2020. | Prior to opening date, senior managers are required for 3 months, supervisors for 2 and rest of staff for 1 month for onboarding and training purposes. |
| **Additional Measures – Parking and Network Changes** | Remove all free parking from BCC controlled areas and replaced with paid parking spaces | Provisional estimate | Capital construction costs estimate. Costs include allowance for new meters, and signage |
| | Network Changes described in Section 3.3.1. | Provisional estimate for associated infrastructure works and signage | Capital construction costs estimate |
| **Project management of implementation** | Work associated with managing the CAZ implementation | Bottom up estimate based on scheduled hours for each activity. | Grade, utilisation and period for each FTE was established. Staff include project managers, administration team and others. |
| **Contingency** | Risk assessment on civil design and build risk | Bottom up estimate | Based on likelihood, cost impact and time impact. |

Table 3-3 shows a summary of the estimated costs for each of the implementation cost items. In accordance with DfT's WebTAG guidance Optimism bias (OB) has been added to each item. The total implementation cost is estimated £17.8m for the CAZ D plus Additional Measures scheme implementation. £1.1m of DEFRA grant funding (Feasibility Grant, Air Quality Grant and National Clean Air Grant) has already been made available to BCC for feasibility works. An additional £1.4m of funding has been awarded to the City Council for feasibility development; neither of these costs are not included in these estimates.

Table 3-3: Implementation cost estimate

| Cost | Cost (£) | Optimism Bias (%) | Total w/OB |
|---|---|---|---|
| **Design & Installation** | -7,600,888 | 15% | -8,741,021 |
| **IT** | -1,500,000 | 100% | -3,000,000 |
| **Staff resourcing** | -1,937,492 | 15% | -2,228,115 |
| **Additional measures** | -1,080,992 | 15% | -1,243,141 |
| **Contingency** | -2,289,130 | 15% | -2,632,499 |
| **TOTAL implementation costs** | **-14,408,501** | | **-17,844,777** |

### 3.3.1 Additional Measures

Additional schemes are included in the proposed clean air zone, these are referred to as Additional Measures. The Additional Measures costed are the following.

- Implementation of charged parking - Remove all free parking from BCC controlled areas with the implementation of paid parking spaces.
- Network changes
  - Banning the route of traffic travelling northbound on Suffolk Street Queensway (A38) that exits onto Paradise Circus to then access Sandpits Parade. Ban southbound traffic from Paradise Circus accessing the A38.
  - Closing Lister Street and Great Lister Street at the junction with Dartmouth Middleway. This allows more green time for buses on the A4540.

The capital cost of the additional measures is forecast at £1.2m. As these local measures will improve air quality in the CAZ, funding is sought from the DEFRA national funding for locally implemented CAZ schemes.

## 3.4 CAZ and Additional Measures Operating and Maintenance Costs

Operating and maintenance costs are the ongoing costs required to maintain the CAZ on an annual basis. Table 3-4 identifies multiple broad categories of operating costs, including the following.

- Sign maintenance – required maintenance for road signs. It has been assumed that these assets will be transferred to the PFI operator for maintenance and the costs reflect the charges for such assets under the PFI scheme.
- ANPR camera maintenance – required maintenance for ANPR cameras.
- IT support and maintenance – annual maintenance charge to support IT back office.
- Air quality monitoring – continual monitoring if air quality sites.
- JAQU processing fees -cost estimate based on JAQU assumptions for their review of ANPR data to identifying non-compliant-vehicles and match and process payments.
- PCN DVLA cost - the cost to check number plate registration data.
- PCN transaction costs – accounts for the credit card transaction charges for collection of penalty revenue.
- Staffing – staff required to issue penalty charge notifications, assess representation and appeals, overall scheme supervision and benefit realisation monitoring.
- Office accommodation – rental costs of physical office location CAZ staff.
- PCN postage – cost of posting PCNs.
- Communication costs – marketing and communication costs

- CAF fund – costs associated with granting funds and their associated administrative burden.
- Sinking Fund - Fund created for risk mitigation and to cover decommissioning.
- Decommissioning - Costs associated with removing scheme infrastructure.

Table 3-4: Derivation of operating costs estimate (see financial model for additional details)

| Cost | Description | Costing Method | Key assumptions |
|---|---|---|---|
| **Sign maintenance** | Annual maintenance per main road (strategic) sign | Bottom up per unit cost assumption | Based on maintenance costs for similar assets managed by the Amey PFI scheme. |
| **ANPR camera maintenance** | Annual maintenance per camera | Bottom up per unit cost assumption | Based on information provided for camera maintenance for similar schemes.<br>This is consistent with Section 5.11. |
| **IT support and maintenance** | Annual maintenance charge to support the IT back office. Hardware and software and data handling and storage | Bottom up cost assessment applying an average cost per ANPR camera | Based on maintenance costs for similar assets. Includes support for hardware, software and data storage. |
| **Air quality monitoring** | Analysis of air quality testing | Bottom up staffing assessment | Staffing required for additional 6 monitoring sites, equivalent to 1 Grade 5 FTE.<br>This cost will be updated as the ongoing monitoring and evaluation plan is further developed. |
| **JAQU processing** | Cost for reviewing ANPR data and identifying non-compliant-vehicles and matching and processing payments | Applied to all CAZ revenue collected by JAQU | 5% of revenue from CAZ charges, assumption provided by JAQU. |
| **PCN Processing**<br>**-DVLA database query and Transaction fees** | Fees paid to check number plate registration data | Cost applied to non-compliant vehicles that JAQU has informed have not paid the CAZ charge. | Birmingham bus lane enforcement pays £0.11 per number plate query with the Driver and Vehicle Licensing Authority. |
| | Fees paid to payment facilitators | Cost as a proportion of revenue | Transaction fee of 1% based on assessment of current market transaction processing fees. |
| **Staffing** | Cost of running CAZ | Based on agreed operating/handling rates and non-compliant vehicles and number of PCN, representations | PCN review – staff to issue PCN, rate of review of 15 per hour taken from current Bus Lane Enforcement operations.<br>Representation staff – rate of dealing with PCN initial disputes estimated as 1 per hour. |

| Cost | Description | Costing Method | Key assumptions |
|---|---|---|---|
| | | and appeals. | Appeal staff – rate of dealing with appeals on representation outcomes is one per day as this involves a larger administrative process.<br>Supervisors and senior managers to manage of staff are assumed at a staff ration of 5:1 and 25:1. |
| **Office accommodation** | Cost of accommodating BCC staff responsible for CAZ | Bottom up assessment based on staffing levels | 100sq ft. per employee and average Birmingham office space rental costs. |
| **PCN postage** | Cost of posting PCNs | Based on unit cost | Postage cost per mail is 67 pence. Based on Birmingham Bus Lane Enforcement data. |
| **Marketing and communication** | Marketing and Communications costs | Birmingham marketing and communications teams | Annual marketing cost estimated based on anticipated marketing and communication strategy. |
| **CAF funding mitigations** | Costs per mitigation measure, detailed in Section 3.5 | Based on applications | Based on fleet analysis to right size the measures for intended impact. |
| **CAF funding administration cost** | Staff costs related to mitigation measures | Based on established staff schedule | FTE for application set up, help desk, assessment and implementation. Include employees from grades 2-5. |
| **Sinking fund** | Fund created for risk mitigation and to cover decommissioning | Accrual to sinking fund is calculated as a proportion of O&M costs | An additional 22.5% is added to O&M costs and is accrued during the first six years of scheme operation. Fund grows to cover decommissioning and a year of annual operating costs as a risk mitigation measure. |
| **Decommissioning** | Costs associated with removing scheme infrastructure | Bottom up assessment or removing scheme related infrastructure | Removal cost per item applied to all scheme related infrastructure. |

Operation of the technology-related aspects of the CAZ scheme will be under the remit of Service Birmingham who will be compensated by BCC. Maintenance of infrastructure will be under the remit of BCC. Air quality monitoring will be conducted by BCC. It is assumed that the control room and billing system for the CAZ charges will be highly automated. Staffing and overhead costs, such as office space, will be the responsibility of BCC. It is assumed that a proportion of revenue collected will be paid to intermediary financial services providers (i.e. credit card transaction services fees). It is assumed that delinquent payments that are sent to an external collections agency for collection will be revenue neutral (i.e. cost of employing collections agency paid for by the fee). It is assumed that parking schemes will be under the remit of BCC and that the operating costs of the parking schemes will be covered by penalty charge notice revenue.

Birmingham City Council has a contract with Amey that includes the maintenance of signs on the BCC network, this is referred to as the Birmingham PFI contract. The signs currently being maintained are almost identical to those being installed. The PFI agreement will be expanded to include the CAZ signs.

Table 3-5 provides a summary of the estimated costs for each of the items included in the operating costs in 2020. Do note that CAF related spend is primarily in this year. Without this spend the opex cost is £6.6m and drops to £2.0m in the final year due to variable costs decreasing with the reduction of non-compliant vehicle traffic. The total O&M costs over the life of the scheme, not including CAF funded items, is forecast at £36.2m.

Table 3-5: Annual operating cost estimate (2020)

| Cost | Cost (£) | Optimism Bias (%) | Total w/OB |
|---|---|---|---|
| **Maintenance** | -895,990 | 15% | -1,030,389 |
| **Processing** | -2,191,827 | 15% | -2,520,601 |
| **AQ monitoring** | -81,613 | 15% | -93,855 |
| **Staff resourcing** | -2,544,579 | 15% | -2,926,267 |
| **Communications** | -47,680 | 15% | -54,832 |
| **CAZ sub-total** | **-5,761,689** | | **-6,625,943** |
| **CAF funding - mitigations** | -18,245,250 | 0% | -18,245,250 |
| **CAF funding - admin** | -831,233 | 0% | -831,233 |
| **2020 annual operating costs** | **-24,838,172** | | **-25,702,425** |

Operating cost are assumed to be incurred in each year from 2020-2029 (with the exception of mitigation costs and CAF funding being incurred in 2019). All costs include real price growth where staff wages are grown at Average Wage Earnings (AWE) and all other costs are grown at the retail price index (RPI).

### 3.4.1 Decommissioning

It is assumed that the CAZ infrastructure will be decommissioned at the end of the ten-year scheme period, in 2030. Decommissioning costs relate to removing scheme infrastructure and are forecast from a per item cost build up. This results in a forecast decommissioning cost of £3.4m.

### 3.4.2 Sinking Fund

A sinking fund will be established to provide mitigation against potential realised risks during operation. The fund's target capacity was determined as the cost of decommissioning and a year of operating costs. The yearly contribution to reach this amount was calculated by multiplying the forecast annual operating costs by 22.5% to be accrued over the first six years of scheme operation. The sinking fund will be ring-fenced within the Clean Air Zone accounts to ensure its availability as a contingency fund for realised risks and decommissioning costs. The details of the sinking fund management are being considered but may follow the principles adopted by BCC for its PFI schemes.

## 3.5 Mitigation measures and exemptions

Mitigation measures are proposed to help target groups with the transition to the Clean Air Zone scheme. Table 3-6 describes the mitigation measures proposed, including how the group is impacted by the scheme and the proposed budget required for the mitigation measure. Funding for the mitigations measures is sought through the Clean Air Fund.

The total cost of the mitigation measures is £48.3m in in 2018 prices, an additional £2.2m is included to cover the management and administration costs of delivering the mitigation measures and exemptions. Adding this administration cost brings the total to £50.4m and nominalising the administrative cost profile in accordance with it's spend profile brings the total CAF allocation request to £50.9m.

Table 3-6 Mitigation measure summary table

| Ref | Measure | Type | Group impacted | Geographical scope | Summary of mitigation measure | Distributional analysis (how group is impacted) | Cost (2018 prices) |
|---|---|---|---|---|---|---|---|
| M1a | Mobility support for individuals working within the CAZ | 20c | Private car/van owners who work or live within the CAZ | Not restricted to geographic area for vehicle owner (place of work in CAZ) | Individual can access the choice of a £1000 mobility credit offered in form of SWIFT travel card or a £2,000 package (Swift credit or contribution to compliant vehicle) in return for scrapping a non-compliant vehicle_card | Class D CAZ will force residents to either upgrade vehicle or pay charges if they wish to enter. For many individuals, public transport may be the only alternative, these measures decrease the cost of that switch or facilitate the purchase of a compliant vehicle. | **£10.84 million** *(5,420 x £2,000)* |
| M1b | Mobility support for individuals who reside outside the CAZ | 20c | Private car/van owners | West Midlands | With evidence of scrapping a non-compliant car individual receives either:<br>▪ £2,000 cash payment toward the purchase of a compliant car (not eligible for PiG).<br>▪ £2,000 mobility credit. Credit to be supplied on a SWIFT card with no expiration for use. | | **£6.50 million** *(3,250 x £2,000)* |
| M2a | Hackney carriage support package | 20b | Hackney carriages | Birmingham and surrounding areas (licensed BBC drivers) | Drivers offered £5,000 as:<br>▪ support payments to be paid towards operational expenses of ULEV vehicles (4 annual instalments of £1,250)<br>▪ support for an LPG retrofit of their current or newly purchased vehicle | Changes in licencing conditions will force over 90% of the 1280 vehicles currently operational to change (upgraded/retrofit). All options on the market require significant capital expenditure, this helps drivers to switch to a compliant vehicle. | **£5.0 million** *(1000 x £5,000)* |
| M2b | Council hackney carriage leasing scheme | 20b | Birmingham (licenced BCC drivers) | | BCC bulk purchase 50 ULEV taxis through public procurement tender and lease them to the drivers who are most vulnerable as well as on a try-before-you-buy basis | | **£2.75 million** *(50 x £55,000)* |

| Ref | Measure | Type | Group impacted | Geographical scope | Summary of mitigation measure | Distributional analysis (how group is impacted) | Cost (2018 prices) |
|---|---|---|---|---|---|---|---|
| M2c | Private Hire Vehicle upgrade support | (20b) | Private Hire Vehicles | | Private hire vehicle owners who upgrade to a compliant vehicle where the priority will be beyond the minimum BCC's 2020 licencing criteria i.e hybrid or ultra-low emission vehicles. | As above, changes in licencing conditions are expected to result in 95% of the 4,321 current vehicles needing to be upgraded to continue operation | **£7.0 million** (3,500 x £2,000) |
| M3 | 'Free miles' for ULEV LGVs | 20b | Van fleets | Birmingham | ULEV van drivers receive £1000 credit to spend on BCC public charging network | SMEs operating coaches/HGVs/LGVs or relying on road transport will be disproportionately impacted. Vehicle capital costs are high, and many fleets must enter CAZ as part of business operation. This helps fleets change to a compliant vehicle. | **£0.75 million** *(£1000 x 750)* |
| M4 | HGV & Coach compliance fund | 20b | HGV and Coach fleets | West Midlands | Fleets compete for £15,000 funding package to contribute towards:<br>▪ Installing a retrofit solution<br>▪ Upfront or lease costs of a compliant vehicle | | **£10.05 million** *(670 x £15,000)* |
| M5 | Marketing and engagement campaign | 20b | Owners of non-compliant vehicles (All types) | West Midlands | Marketing and engagement campaign to provide information on the CAZ and reach out to groups eligible for support through mitigation measures | Ensures uptake/knowledge of measure, to minimise negative impact and maximise effectiveness of the mitigation measures | **£0.38 million** |
| M6 | Resident parking scheme | n/a | Residents living close to the CAZ | Areas surrounding CAZ | Implementation of residents parking schemes to prevent overcrowding on margins of CAZ; will be deployed only if issues arise | Prevents vehicle overcrowding on residential streets on the margins of the CAZ | **£5.0 million** |

The total Clean Air Fund request, including the administrative cost, is summarised in Table **3-7**.

Table 3-7 Clean Air Fund request

| | **Cost** |
|---|---|
| **Capital** | -24.8 |
| **Revenue** | -26.1 |
| **Total** | **-50.9** |

A package of exemption measures will be implemented for targeted groups to lessen the impacts of the CAZ on them. Aside from the administration costs accounted for in the preceding text, there are no costs associated with these exemptions. However, the mitigations will result in certain vehicles not being charged to enter the CAZ and will result in an associated drop in revenue.

A summary table of the exemptions measures is provided in Table 3-8.

Table 3-8 Package of exemption measures

| **Ref** | **Vehicle** | **Group** | **Description** | **Length** |
|---|---|---|---|---|
| E1 & E3 | Commercial vehicles | Commercial vehicles registered within the CAZ | LGVs/HGVs/Coaches registered within the CAZ will receive an exemption (max 2 vehicles per company) | 1 year |
| E2 & E4 | Commercial vehicles | Commercial vehicles with an existing finance agreement | LGVs/HGVs/Coaches registered in the Birmingham City area travelling to the CAZ with and existing finance agreement beyond 2020 (max 2 vehicles per company) | 1 year |
| E5 | Car | Residents of the CAZ | All private car and van owners who are residents of the CAZ, as defined by DfT registration information | 2 years |
| E6 | Car | Individuals working within the CAZ | Individuals traveling into the CAZ for work (no geo limit). Eligibility will be limited through a salary cap of £30,000. | 1 year |
| E7 | Car | Residents who live outside the CAZ | A limited number of exemptions offered, allocation based on distance to CAZ and income | 1 year |
| E8 | Car | Hospital visitors | Visitors to select hospitals in the CAZ, GP offices and care homes | 1 year |
| E9a | Van/LGV | Community and school | Vehicles classified as Section 19 operators, registered for operation in Birmingham | 1 year |
| E9b | Car | Disabled vehicles | Vehicles with disabled or disabled passenger tax class | All years |

## 3.6 Total Financial Costs

The total financial cost for CAZ D plus Additional Measures over the period 2018-2030 is estimated to be £108.3m in nominal prices. Table 3-9 summarises the breakdown of the total financial costs. This table excludes the sinking fund as this is a contingency reserve also used for decommissioning.

Table 3-9: Financial costs of CAZ D plus Additional Measures £m nominal

| | CAZ D and Additional Measures |
|---|---|
| **Implementation Costs** | -17.8 |
| **CAF capital costs** | -24.8 |
| **Total Implementation Costs** | -42.6 |
| **O&M Costs** | -36.2 |
| **CAF revenue funded items** | -26.1 |
| **Decommission Cost** | -3.4 |
| **Total** | **-108.3** |

## 3.7 Project Revenues

This section describes the revenues forecast from charging non-compliant vehicle owners who enter the CAZ. The intention is that revenues will be utilised for future City Council initiatives aimed at improving air quality in the city.

### 3.7.1 CAZ Charges

Charging CAZ schemes are based on charging an entry fee to vehicles that do not meet the required emission standards. Multiple charge levels were tested and the behavioural changes that would result at different charge levels can be seen in the Transport Modelling Forecast Report. Table 3-10 sets out the charges used in the traffic model to estimate the impact of the CAZ D plus Additional Measures scheme.

Table 3-10: CAZ Charge and Penalty Charge by vehicle type

| Vehicle | Car | LGV | HGV | Bus | Taxi |
|---|---|---|---|---|---|
| CAZ Charge | £8.00 | £8.00 | £50.00 | £50.00 | £8.00 |
| Penalty Charge | £120.00 | £120.00 | £120.00 | £120.00 | £120.00 |
| Penalty Charge (discounted) | £60.00 | £60.00 | £120.00 | £120.00 | £60.00 |

The charges are set at different levels for different vehicle types to reflect the contribution each type of vehicle makes on a per-vehicle basis to air pollution and to ensure that vehicles with the highest emissions are incentivised to comply with the standard. The car and LGV charges have been set at this level to enable those people making infrequent trips to continue to do so if they do not want to change their vehicle.

This charge structure also reflects the fact that while cars make up the majority of the traffic, they make a smaller contribution to air pollution on a per vehicle basis. In contrast, HGVs, coaches and buses make a large contribution to air pollution on a per vehicle basis. A daily charge of £50 reflects this and is intended to deter older more polluting vehicles. Charges may be adjusted to reflect additional research as work is progressed.

It is assumed that the charge levels remain constant in current prices (i.e. £8.00 in 2020 and £8.00 in 2029) and, hence, fall in real terms. The charge is planned as a daily charge, so vehicles that have entered will not have to pay twice for re-entering on the same date. The behavioural response of users was estimated based on a stated preference survey data modified to be applicable to the Birmingham context.

The traffic for 2020 and 2022 modelled years was used to forecast the number of non-compliant cordon-crossing flows in the Do Minimum and the CAZ D plus Additional Measures scenarios. The number of non-compliant cordon-crossing flows in the CAZ D plus Additional Measures scenario, minus the number of exemptions, was multiplied by the charge level per vehicle to determine the revenue. Table 3-11 displays the Average Annual Daily Traffic (AADT) of CAZ based area crossing flows output from the traffic model in the Do Minimum scenario. Table 3-12 displays the number of CAZ based area crossing flows output from the traffic model in the CAZ D plus Additional Measures scenario. These are unique crossing figures where each unique vehicle is counted only once.

Table 3-11: AADT entering CAZ area crossing flows in Do Minimum scenario, by vehicle type (2020)

| | Car | Taxi /PHV | LGV | HGV | Bus |
|---|---|---|---|---|---|
| **Compliant** | 127,152 | 2,691 | 13,232 | 4,651 | 3,269 |
| **Non-compliant** | 37,584 | 6,470 | 9,299 | 2,496 | 2,196 |
| **Total** | 164,736 | 9,161 | 22,531 | 7,146 | 5,465 |

Table 3-12: AADT entering CAZ area crossing flows in CAZ D plus Additional Measures scenario by vehicle type (2020)

| | Car | Taxi / PHV | LGV | HGV | Bus |
|---|---|---|---|---|---|
| **Compliant** | 134,170 | 9,448 | 14,455 | 5,839 | 5,466 |
| **Non-compliant charged** | 4,622 | - | 4,872 | 569 | - |
| **Non-compliant exempt** | 5,992 | - | 1,274 | 331 | - |
| **Total** | 144,784 | 9,448 | 20,601 | 6,739 | 5,466 |

The number of non-compliant vehicles entering the CAZ is expected to reduce over time as a result of two major factors:

- With the introduction of a charge, owners are incentivised to exchange their non-compliant vehicle for a compliant vehicle earlier than they would have done without the scheme.
- Older, non-compliant, vehicles dropping out of the fleet as they are exchanged at the normal replacement rate with compliant vehicles.

As a result, the revenues collected are expected to decrease. The revenue analysis was conducted for the modelled years for 2020 and 2022 and factors were applied to the subsequent years to account for this decrease.

### 3.7.2 Penalty Charges

Penalty charges are charges paid by users who do not pay the daily CAZ charge within a pre-determined timeframe. These users are subject to a penalty charge notice (PCN) and required to pay a fine. The assumed penalty charge rates are found in Table 3-10, with discount penalty charge rates applicable if the penalty is paid within a pre-determined timeframe.

If a user receives a PCN but believes they have received it in error (i.e. they have paid the charge or were exempt) they have the opportunity to make their case as a representation online or in writing. A decision will be made whether to accept this representation or reject it. Users then have an option to appeal the rejection, which will be taken to an independent adjudicator.

Compliance rates and penalty payment rates are sourced from London congestion charge data. London congestion charge requires next charging day by midnight and allows 14 days for discounted PCN rate.

Based on data from the London congestion charge, we have made the following assumptions about penalty charges based on TfL congestion charge data where it is available:

- Rate of unpaid charges that receive a penalty charge notice is 5%.
- Rate of penalty charges paid is 70%.
- 30% of PCNs go unpaid. Non-payment includes non-paying delinquent charges, as well as charges that successfully represent or appeal their case and have penalty charges dropped. No revenue is assumed to be collected from either.
- Rate of appeals on PCNs is 1% of all PCNs.
- Rate of PCNs paid within discount time period is 80%.

### 3.7.3 Parking Revenue

The removal of free on street parking (which is controlled by BCC), to be replaced with charged parking, would result in the scheme generating additional revenue for BCC. This revenue stream was based on a study of parking spaces and charges, the ULEZ behavioural response model, and assumptions regarding payment options by users. Although parking revenues change as part of the impact of changes associated with the CAZ, the revenues form part of BCCs parking revenue stream rather than the CAZ income stream for financial management and reporting purposes.

Based on analysis of parking spaces within the CAZ area, approximately 15% of trips ending in the CAZ use free of charge on-street parking spaces. These users will face a new decision after the parking charges are introduced; whether to pay the charge or change their behaviour. This decision falls to both compliant and non-compliant users. User responses were forecast using the London ULEZ stated preference survey and a calculated average parking charge.

Table 3-13 shows the behavioural responses expected of the slightly over 22,000 cars that utilise the free parking spaces on a regular basis. It shows that the majority will continue to park in the CAZ area and pay for parking. The next largest group will avoid the zone, choosing to make a trip elsewhere. Fewer will cancel their trip and the smallest response group is those who choose to shift travel modes.

Table 3-13: Behavioural responses of those impacted by new charging on-street parking (average day users)

| | Non-compliant | Compliant |
|---|---|---|
| Pay Charge | 420 | 14,860 |
| Avoid Zone | 49 | 719 |
| Cancel Trip | 156 | 2,310 |
| Mode Shift | 191 | 2,824 |
| Total | 816 | 20,713 |

In order to convert these parking paying users into revenue figures, they were split into three categories of parking users based on assumptions:

- 40% of these users continue to park on-street
- 60% park in off-street lots
  - Of which 20% are owned by BCC, the remaining being privately owned

On-street and BCC owned off street parking will result in revenue to BCC. Off-street private parking was calculated as a benefit to private operators in the economic case, and is not included in the financial case.

The average rate for parking was calculated to be £4.94 per user per stay for off-street parking and £1.93 per user per stay for on-street parking. The off-street parking rate is derived from a study of current off-street parking charges for longer stays. The on-street parking rate is taken an independent study Jacobs' performed, the Birmingham City Centre Parking Review. The assumptions applied to factor the revenue results were as follows.

- Annualisation factor of 250 was applied to account for a larger proportion of revenue accruing to weekdays.
- It was assumed 40% of on-street users pay for an annual permit, resulting in a fee discounted by 80%.
- It was assumed that 60% of off-street users will purchase a season ticket/monthly pass, resulting in a fee discounted by 20%.

### 3.7.4 CAZ Revenue

In the financial year 2020/21, the scheme's first full financial year of operations, CAZ revenues are forecast at £43.1m. This includes CAZ charge revenue and Penalty Charge Notice revenue. This figure drops to £4.5m in 2028/29, the scheme's last full financial year as a greater number of vehicle achieve compliance with the emission standards. Revenue from parking charges remain relatively stable at £3.0m throughout the ten-year assessment period. It is anticipated that the revenue generated will be invested in initiatives to realise the vision set out in 'Movement for Growth' for a greatly improved transport system that supports economic growth and regeneration, social inclusion and improves air quality and the environment.

Table 3-14 shows that CAZ D plus Additional Measures is expected to generate £204.9m over the appraisal period.

Table 3-14: Total revenue forecast, £m nominal

| | **Total revenue forecasts** |
|---|---|
| CAZ revenue | 175.3 |
| Non-CAZ revenue | 29.6 |
| **Total** | 204.9 |

The Clean Air Zone will be introduced under Part 3 of the Transport Act 2000, and schedule 12 para 8 of the Act requires that the 'net proceeds' of a charging scheme shall be applied by the authority "for the purpose of directly or indirectly facilitating the achievement of local transport policies of the authority". From the Capital Programme, some programmes have been identified which could potentially be part or whole funded, or a local contribution could be given to support, from the CAZ revenue. All programmes are subject to full business case approval and will be selected following a prioritisation process. The programmes identified are:

- The Big City Plan;
- Birmingham Development Plan, growth and sustainable transport area;
- Local Cycling Walking Initiative Programme;
- Journey Time Improvement; and,
- Rail and Rapid Transit.

## 3.8 Financial Summary

Table 3-15 provides the financial profile for the CAZ D plus Additional Measures scheme. Operating costs remain relatively stable throughout the scheme while revenues experience a significant decrease due to increased user compliance with the defined emission standards. However, revenues exceed costs throughout the forecast period, resulting in net positive cash flows throughout the scheme evaluation period.

Table 3-15 CAZ D plus Additional Measures scheme financial profile, £m nominal

| | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Capex | -32.7 | -26.5 | -5.2 | -2.1 | -2.0 | -0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| CAZ revenue | | 45.8 | 35.0 | 24.1 | 19.8 | 15.4 | 11.1 | 9.1 | 7.0 | 5.0 | 3.0 | |
| CAF grant | -15.7 | -26.1 | -4.9 | -2.1 | -2.0 | -0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Parking revenue | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| O&M | 0.0 | -6.6 | -5.5 | -4.3 | -3.9 | -3.4 | -2.9 | -2.7 | -2.5 | -2.3 | -2.0 | |
| CAF spend | 15.7 | 26.1 | 4.9 | 2.1 | 2.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Decommissioning costs | | | | | | | | | | | | -3.4 |
| Sinking fund | | -1.5 | -1.2 | -1.0 | -0.9 | -0.8 | -0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 6.0 |
| **Net cash flows exc parking revenue** | **-32.7** | **11.2** | **23.0** | **16.7** | **13.0** | **11.1** | **7.5** | **6.3** | **4.5** | **2.7** | **1.0** | **2.6** |
| **Net cash flows** | **-32.7** | **14.2** | **26.0** | **19.7** | **16.0** | **14.1** | **10.5** | **9.3** | **7.5** | **5.7** | **3.9** | **2.6** |

### 3.8.1 Funding

Based on the current available funding guidelines issued by DEFRA, BCC will be applying for funding to support the CAZ and other transport initiatives to aid improving air quality in Birmingham. Delivery of this scheme is not dependent on any other funding requirements

BCC is applying for the DEFRA implementation fund dedicated to funding locally implemented CAZ schemes. It is assumed the full fund drawdown of £17.8m will occur at the beginning of 2019. BCC is also requesting allocation from the Clean Air Fund to provide mitigation measures to those impacted by the scheme. The total Clean Air Fund request is £50.9m.

Table 3-16: Summary funding request, £m nominal summarises the total funding request for the Birmingham Clean Air zone, separated by capital and revenue funded allocations. The spend profile is indicated in Table 3-17.

Table 3-16: Summary funding request, £m nominal

| | **Total values** |
|---|---|
| **Capital funded** | |
| Implementation costs | 17.8 |
| CAF capital costs | 24.8 |
| **Total capital funded items** | 42.6 |
| **Revenue funded** | |
| CAF funding - mitigations | 23.5 |
| CAF funding - administration | 2.6 |
| **Total revenue funded items** | 26.1 |
| **Total funding request** | 68.7 |

Table 3-17 Implementation fund and CAF spend profile, £m nominal

| | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** |
|---|---|---|---|---|---|---|
| Implementation Fund | -17.845 | | | | | |
| Clean Air Fund | -15.656 | -26.051 | -4.894 | -2.085 | -2.025 | -0.150 |
| total | -33.500 | -26.051 | -4.894 | -2.085 | -2.025 | -0.150 |

## 3.9 Accounting Treatment

### 3.9.1 CAZ

The initial cost to establish the Clean Air Zone (implementation measures) will be treated as capital and related assets depreciated in accordance with BCC accounting policies. Certain assets purchased by BCC will be accrued schedule of maintained asset and maintained under BCC's PFI contract to agreed standards for an annual charge. The assets are on balance sheet and the revenue costs accounted for as a charge, along with other PFI operational costs.

The grant will be held on balance sheet and amortized (taken to revenue) over the life of the relevant asset.

Operating costs are expensed.

### 3.9.2 Clean Air Funding

Although nearly all of the CAF mitigations will not create either an asset used by the Council or a future economic benefit which the Council controls, there is a statutory exemption available for Revenue Expenditure Funded by Capital Under Statute (REFCUS). This allows items that commonly require revenue funding to be funded through a capital grant.

Each mitigation measure has been assessed to determine the capital and revenue funding split. Mitigations that will not generate assets (ex. free miles for ULEV LGVs) and those where it is uncertain the level of asset to be generated (ex. choice between mobility credit and payment toward purchase of a compliant car) are requesting revenue funds. The mitigations anticipated to generate assets are requesting capital funds. Revenue funded items will be treated as revenue for accounting purposes. Capital funded items will use REFCUS to be expensed in the year of expenditure although they are capital funded.

The REFCUS allows BCC a certain degree of agency when determining capital and revenue grant allocations. Accordingly, BCC is open to coordinating with JAQU to determine the optimum split between capital and revenue funding to secure the funding allocation requested.

The CAF mitigations and their related funding type is summarised in Table 3-18.

Table 3-18 CAF mitigations and funding type

| Mitigation measure | Description | Funding type |
|---|---|---|
| M1a | Mobility support for workers | Revenue |
| M1b | Mobility support for residents outside the CAZ | Revenue |
| M2a | Hackney carriage support package | Revenue |
| M2b | Council Hackney Carriage leasing scheme | Capital |
| M2c | PHV upgrade support | Capital |
| M4 | Free miles' for ULEV LGVs | Revenue |
| M5 | HGV/coach compliance fund | Capital |
| M6 | Marketing and engagement campaigns | Revenue |
| M7 | Residents parking scheme | Capital |
| All | Administrative costs (incl. exemptions) | Revenue |

## 3.10 Sensitivities

Sensitivity tests were run flexing assumptions to ascertain the impact implementation costs and net cash Assumptions to test were identified by their relative uncertainty, sensitivity to changes, and ability to significantly alter modelled results. A summary table of the most impactful sensitivities runs is provided in Table 3-19.

Table 3-19 Sensitivity test summary table (£m, nominal)

| Sensitivity area | Test description | Impact |
|---|---|---|
| Implementation and operational cost OB | Optimism bias lowered from 15% to 3%. This lowers OB levels to those commonly seen at FBC level, however this does not account for the higher level of contingency that would also be anticipated at FBC. | Capital cost, excluding decommissioning, drop £4.0m to £18.4m, a drop of 18%.<br>Total costs dropped 6% over the life of the scheme to £65.9m |
| Revenue shortfall / Strong behavioral response to charges | CAZ charge and Penalty Charge Notice enforcement charges were lowered by 50%. This is an extreme test to assess a much larger behavioral response than anticipated impacted traffic flows. | Reducing scheme revenues by half reduces the operating revenue net operating costs surplus by over 50% as although the costs reduce, they do so at a much smaller scale. The scheme has a negative net cash flow in the final year of operations, however, at c£500, this is covered by the sinking fund. |
| Revenue shortfall and increased operating costs | CAZ charge and Penalty Charge Notice enforcement charges were lowered by 50%.<br>Operating costs increased by 50%. | The increase in operating costs combined with the lower revenue results in the scheme operating at a loss during its final three years. However, as the sinking fund pivots off of operating costs, the increased sinking fund covers the operating loss.<br>However, if in this revenue scenario operating costs double, the scheme operates at a loss for the final five years of operations. In this scenario the sinking fund is inadequate to cover the scheme's final two years of operations. |

The sensitivity tests indicate that flexing the assumptions seen to have the least certainty, highest sensitivity and biggest impact on modelled outputs has moderate impacts on forecast cash flows. Only in extreme circumstances is the scheme not able to operate throughout its anticipated duration. The test lowering the level of optimism bias applied does not have significant impact on implementation costs.

However, it is possible that as the scheme design progresses that additional cost will surface and/or additional areas requiring risk contingencies will be identified.

## 3.11 Key Findings

Cost and revenue forecasts indicate that the revenues generated from operating the CAZ D plus Additional Measures scheme exceed the setting up and operating of the scheme. The surplus is significant in initial years and slowly decreases as the proportion non-compliant cars in car and HGV fleets is just 1% relative to the base year make up. There could therefore be an opportunity for BCC to reinvest revenues in initiatives to accelerate the take up of low/zero emission vehicles, improve air quality through other measures, or help mitigate unforeseen disbenefit to impacted groups due to the scheme's introduction.

# 4 Commercial Case

## 4.1 Introduction

This Commercial Case details the commercial viability and deliverability of Birmingham's Clean Air Zone (CAZ). The following section covers the procurement, tendering and contract strategy to be used to engage the Contractors and suppliers to deliver the scheme. The key viability factors identified by Birmingham City Council (BCC) are:

- Time (speed or certainty of completion date)
- Cost (price level or cost certainty)
- Quality (functionality and performance)

Consideration for these key criteria has been made throughout the development of this commercial case and provides a basis for the recommendations and proposals delivered herein. It must be stated that the key criteria of Time, Cost, and Quality may be considered interdependently and are accepted as potentially conflicting in being able to mitigate one without compromising another. Therefore, emphasis on only one of the key criteria will almost certainly have a negative effect upon the others.

It has been agreed that a CAZ D plus a package of additional measures will be implemented, therefore BCC will need to support the project with capital work activities. The CAZ 'D' will include civils work which will typically comprise of camera bases/foundations, poles and sign installations and the technology work which will typically be comprising of the installation of Automatic Number Plate Recognition (ANPR) cameras and the supporting system / interfaces. Additionally, there are mitigation measures that will include the requirement to provide funding for initiatives including scrappage and credits to existing travel schemes; the funding of this will be from the mitigation measures fund awarded from the Clean Air Fund (CAF) and not subject to procurement.

As defined in Section 5.10 of the Management Case, a back-office system will be required to manage and administer the charging and penalty functionalities of the CAZ. The decision as to whether the system will be delivered by BCC or centrally by Government is still outstanding, however it is anticipated that a viable procurement route will be available via one of BCC's currently available contracts. Birmingham City Council have carried out some exploratory supply chain engagement, using their supply chain for similar enforcement systems to gauge a benchmark. Whilst this business case is written on the assumption that the system will be delivered by BCC and indicative pricing has been provided for in the Financial Case, a robust procurement strategy cannot be defined until the decision from Government is made on the delivery and operating model.

As stated above, a package of additional measures is being proposed as an enhancement to the CAZ D which will aid BCC in achieving compliance with the emission limits set out by the EU. The additional measures being proposed consist of network alterations and the installation of car park charging infrastructure, both of which are types of schemes which BCC has experience of delivery, thus increasing viability of the additional measures being proposed. The additional measures will be implemented using frameworks which are currently available to BCC, using the NEC3 Contract options to manage the works. The package of additional measures being proposed is further defined throughout this business case however they are summarised below:

Additional Measures

- Ban northbound traffic on the Suffolk Street Queensway (A38) which exits onto Paradise Circus then accesses Sandpits Parade;
- Ban southbound traffic from paradise Circus accessing the A38;
- Close Lister Street and Great Lister Street at the junction with Dartmouth Middle Way;
- Car park charging – all currently free parking which is located within the CAZ which is controlled by BCC will be converted into spaces which have a charge applied.

The procurement approach set out in this case accounts for the fact that the CAZ D plus additional measures will be implemented on BCC's highway network. It is proposed that some of the infrastructure assets which are being introduced will be integrated onto the existing maintenance agreements in place under the Highways Maintenance

and Management PFI (HMMPFI) contract. Assets not suitable for inclusion onto the existing maintenance agreements may be subject to maintenance by specialist Contractors.

Asserts maintained under the HMMPFI will include signs, sign posts, kerbing and surfacing and other assets that are typically maintained under the existing provisions of the contract. Upon completion of the works, the assets will be added to the asset register and be subject to the maintenance levels of services defined in the contract.

Where assets are installed for the operation of the CAZ but are not currently part of the assets maintained under the HMMPFI these will be covered by a separate maintenance agreement as noted above. Such works would include the maintenance of the ANPR technology and associated equipment including poles and systems through to the back-office operation.

For details of the interface, please see Management Case section 5.12.

## 4.2 Procurement Strategy

### 4.2.1 Works and/or Services to be 'procured'

The main construction works and supporting detailed design and any additional measures are to be procured through the approach detailed below. The work type and outline scope are as detailed in Table 4.1;

Table 4.1 Work Type and Outline Scope

| | |
|---|---|
| Design (Consultancy support) | Additional Measures feasibility and detailed design<br><br>Project Management Support (seconded support to the City Council)<br><br>Commercial and Construction Management Support<br><br>Project definition scoping<br><br>Marketing and engagement campaign<br><br>Residents parking scheme – Feasibility and Detailed Design |
| Civils (Contractors) | Main CAZ- Detail Design & Construction of:<br><br>Signing<br><br>Foundations<br><br>Poles<br><br>Sign posts and/or gantries,<br><br>Highway accommodation works<br><br>Main roads (strategic) signs and Local road (distributor) signs.<br><br>Additional Measures Packages that are proposed e.g. minor highway alterations,<br><br>▪ Civils works to ban northbound traffic on the Suffolk Street Queensway (A38) which exits onto Paradise Circus then accesses Sandpits Parade;<br><br>▪ Civils works to ban southbound traffic from paradise Circus |

| | |
|---|---|
| | accessing the A38;<br><br>▪ Civils and Signals works to Close Lister Street and Great Lister Street at the junction with Dartmouth Middle Way<br><br>Residents parking scheme: infrastructure required for parking enforcement including marking / signing and supporting on street equipment. |
| Technology (Suppliers / Contractors) | ANPR Camera (including communications)<br><br>ECI Support to Main Caz D&B Contractor for Camera location designs<br><br>Supply of Back-office requirements for data storage, monitoring and charging and the supply of new software requirements to connect Back Office to JAQU system.<br><br>Car park charging –Additional Measures package proposed e.g. parking enforcement systems / on street equipment. |
| Birmingham City Council In house Delivery | Main CAZ - Programme and Project Management Delivery Additional Measures - Programme and Project Management Delivery<br><br>Mitigation Measures - Resident parking scheme Programme and Project Management Delivery |
| Birmingham City Council – CAZ Administration | Administration of Mitigation Measures that are proposed<br><br>M1a Mobility support for individuals working within the CAZ (20c)<br><br>M1b Mobility support for individuals who regularly enter the CAZ (20c)<br><br>M2a Hackney carriage support package (20b)<br><br>M2b Council Hackney carriage leasing scheme (20b)<br><br>M2c Private Hire Vehicle upgrade support (20b)<br><br>M3 'Free miles' for ULEV LGVs (20b)<br><br>M4 HGV & Coach compliance fund (20b)<br><br>M5 Marketing and engagement campaign (20b)<br><br>M6 Resident parking scheme |

### 4.2.2 Procurement Routes to Market

It was initially thought that a centralised procurement activity would be undertaken for all cities requiring the implementation of a CAZ. However, the decision has now been made to run separate procurement activities per local authority. This decision was made due to the uniqueness of each cities requirements in relation to one another; whilst there are similarities in terms of the required infrastructure, the scale and complexity of the schemes varies largely.

BCC have identified a benefit to procuring the civil engineering Contractors and technology suppliers via existing Framework Agreements. The rationale behind the decision to engage under existing Frameworks is based upon the relationships formed with the appointed Contractors and the ability not to tender through the Official Journal of the European Union (OJEU), meaning it will not be subject to the potentially prolonged procurement times associated with this process. It also enables BCC to go to market with proven Contractors who, particularly with the civils works, have experience of undertaking works on BCC's road network whilst interfacing with the PFI contractor. The PFI contractor is responsible for the maintenance of some of the infrastructure which is located on the Birmingham highway; infrastructure which may need to be modified in order to enable the CAZ construction activities; therefore, managing that interface is crucial to ensuring timely access is granted. The PFI contractor also manages the road space booking system on behalf of BCC and all Contractors on the existing Framework have an understanding of how this system works, which will be key to successfully programming the works.

Table 4.2 shows the existing framework Procurement Routes identified by BCC and their associated Contract Lengths:

Table 4.2 Existing Available Frameworks

| Type | Description | Framework Procurement Route | Framework Start Date | Framework End Date **note |
|---|---|---|---|---|
| Design | All design and implementation | Birmingham City Council<br><br>Multi-Disciplinary Transportation Professional Services Framework (WMTPS) | October 2015 | September 2019 (works orders placed during the contract can extend past completion date) |
| Civil; Infrastructure works | All civils works | Birmingham City Council<br><br>Highways and Infrastructure Works Framework | October 2014 | 31st March 2020 |
| Technology; ANPR cameras and supporting systems | All works relating to the ANPR Camera and supporting systems (including Communications) | Capita ICTDS (Existing service provider) | March 2013 | March 2021 |
| Technology; Parking Enforcement supporting systems | Parking Enforcement | Capita ICTDS (Existing service provider)<br><br>Existing Parking Enforcement Team | March 2013<br><br>In house service | March 2021 |

** Note - All potential existing frameworks are viable in terms of framework start and end dates.

The frameworks referred to above are enablers for the provision of professional services and the construction of the works, however several of the mitigation measures are linked to the provision and administration of funding related to the proposed initiatives e.g. Marketing, scrappage schemes, and funding travel and are therefore not subject to procurement. These schemes will be managed by an in house team set up within Birmingham City Council to manage and administer the various mitigation measures packages

The availability of existing framework procurement routes is imperative to the efficient mobilisation of procurement activities and a key factor of deliverability for the project. Alternative traditional Procurement routes would offer greater client control over costs however to comply with the current project programme timescales these routes are not achievable.

### 4.2.3 Contractor Delivery Model

Based on the intended use of existing procurement frameworks and contracts as the route to market, it has been identified that engaging with contractors for the civil (i.e. civil engineering, sign installation etc.) and independent specialist technology works will allow the detailed design element of the technology scope to be developed by the specialist contractor concurrently with the detail design being undertaken by the main civils contractor during the ECI and Design stages, reducing the risks to programme and incompatibility with the existing BCC provisions. This recognises the specialist nature of the technology design and the proposal to use suppliers currently appointed by the BCC for the operation and maintenance of similar existing systems.

On approval of detailed design works, the specialist technology contractor will become a Nominated Subcontractor within the Main Contract (Civil works package), where the Main Contractor will manage the construction-phase works and co-ordinate with the Nominated Subcontractor to programme the works with all parties working together collaboratively to deliver against the programme. The direct management of the Subcontractor and the risk associated with any non-performance in terms of delivery would remain with BCC to manage. The main Civils contractor will have responsibility for co-ordinating the overall programme for installation of the poles and cameras with the nominated sub-contractor but would not take on the risk of the Subcontractors performance.

This model supports the viability factors of Time, Cost and Quality by enabling efficient on-boarding of Contractors including improved contract development timescales, reduced cost risks through project-wide collaboration and creation of a project environment that stimulates innovation, improving quality of works and delivery.

### 4.2.4 Procurement Delivery Models

To deliver the main CAZ works, BCC has identified that a procurement delivery model involving a combination of Early Contractor Involvement (ECI) and Design & Build (D&B) methodologies will provide the optimum balance of Time, Cost and Quality.

The following table shows how different Procurement Strategies can affect the balance of risk between the Client and Contractor

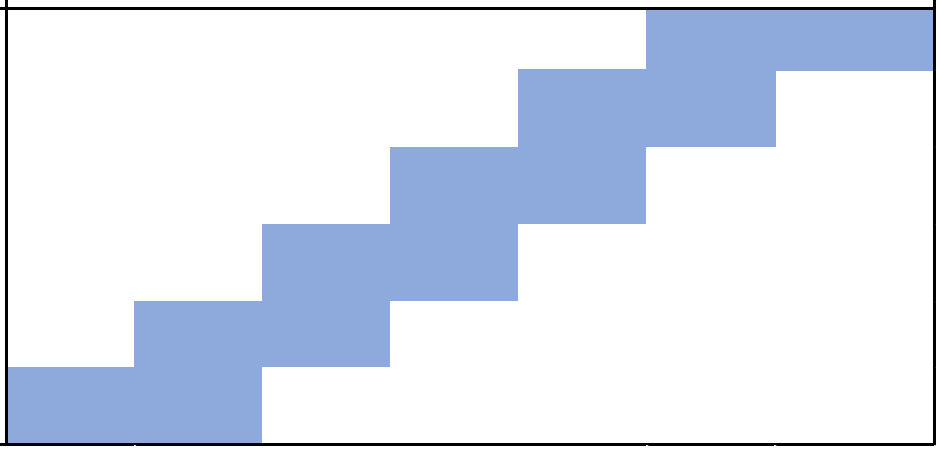
| Procurement Route | Client | Contractor |
|---|---|---|
| Design and Build<br>Two Stage Design and Build of Develop and Construct<br>Traditional Procurement (lump sum fixed price)<br>Traditional Procurement (re-measured)<br>Management Contracting<br>Construction Management |  | |

Figure 1- Risk balance between client and contractor for different procurement strategies

As can be seen from the options above, under the Design and Build Route, the tendering Main Contractor enters into a contract at an early point in the design stage of the project, giving certainty on cost and time. With a full understanding of all implications of the construction of the project the Main Contractor can therefore carry and mitigate most of the risk burden.

As per figure 1 above the balance of risk is transferred down from the Contractor towards the client based on the responsibility and risk ownership depending on the procurement route. An example based on the above is a Design and Build Contract transfers the majority of the risk to the Contractor, whereas the Construction management procurement route transfers the bulk of the risk to the Client.

The D&B approach is one which is well recognised and known to mitigate schedule pressures by consolidating the tendering process into a single tender, as opposed to splitting the work into separate contract awards. It also enables contracts to be placed with low scope definition maturity.

In addition to the Design and Build approach the adoption of ECI is considered critical in this circumstance. The ECI stage will enable detailed designs to be developed by the specialist technology contractor(s) prior to Main Contractor appointment, thus, due to the interdependency of some Civils and Technology works, optimising lead-times for civils works designs by the Main Contractor. This approach also provides an environment for collaboration among client and contractor stakeholders, increasing opportunity for innovation throughout design and construction. Having earlier contractor input into design solutions, delivery and sequencing of works etc. will also help to reduce risk within the scheme and therefore further supports deliverability of the project.

### **4.2.5** Tendering Model Options

The tendering route to be implemented by BCC is the utilisation of its existing Technology Contract to undertake the Camera and Back Office works and an optimised two stage tendering process for Civils works. The two-stage tendering process will involve an initial Pre-Qualification stage to identify two Contractors to take forward to stage two which will be the main tender for the ECI and Design and Build package. Elaboration on the benefits and considerations made are detailed below:

#### *4.2.5.1* Tendering Model - Civils

- The Pre-Qualification stage will enable a focus on the contractor's quality and capability requirements, in order to effectively filter down to a minimum of two preferred Contractors who have demonstrated the relevant experience and methodology to give assurance that the delivery complexities and programme challenges can be met.
- Stage two will be the main tender which will obtain Time, Cost and Quality assurance from the successful contractor prior to Contract Award, whilst also ensuring an efficiency is realised in the Tender Evaluation process through the reduced number of Tender Proposals and the improved pre-emptive understanding of the proposal by BCC, enabled due to the collaborative development.

#### *4.2.5.2* Tendering Model - Technology

- In support of the deliverability of the project BCC have identified that existing contracts with their technology suppliers, who delivered the bus lane enforcement solution around the city, can be used to procure the CAZ ANPR solution and associated charging systems. This will see BCC's partner procure and manage the installation of the ANPR system and appropriate interfaces to the existing Penalty Charge Notice system used within BCC. It is considered this approach will de-risk the implementation and commissioning of the ANPR system which is a critical element of the effective delivery and enforcement of the CAZ, thus further supporting viability and deliverability of the overall scheme of works.

#### *4.2.5.3* Tendering Model – Mitigation Measures

Two elements of the proposed Mitigation Measures packages that will require procuring are the Council Hackney carriage leasing scheme and the proposed Resident parking scheme.

- The purchasing of the Taxis for leasing will be financed through the Clean Air Funding submitted for by BCC. At present there is only one supplier on the market who has the capability to meet the requirements of BCC's proposed purchase of 50 ULEV taxis. As such, the route to will be via a Single Contract Negotiation

(SCN); enabling a direct purchase of the vehicles. Once purchased, BCC will be responsible for managing the leasing and 'try-before-you-buy' scheme. In the event that a second supplier comes to market within the timescales for delivering this scheme, with the capability to meet the demand, BCC will post a notice to OJEU to open the procurement up to a competitive tender. Due process would then be followed to ensure a value for money and fit for purpose delivery. BCC currently proposes to manage the leasing and 'try-before-you-buy' scheme in-house. However, a further value for money assessment will be undertaken once the supply chain has been formally engaged to ensure that a fit for purpose delivery solution is employed. The Residents Parking Schemes will be funded from the CAZ charging revenue. The need for Resident Parking schemes will be identified and processed once the CAZ is in operation. BCC has delivered a number of resident parking schemes and will design and consult on the scheme with their in-house delivery team and use the existing Highways and Infrastructure Works Framework to deliver the infrastructure required.

As noted in section 1.2.2 above the remaining mitigations measures that have been identified are not subject to tendering processes and will be subject to providing funding in support of the initiatives identified through BCC. It is envisaged that BCC will employ a 'CAZ Administration Team' to administer the various initiatives proposed under the mitigation measures. This team will need to be in place for a minimum of 2 years following the implementation of CAZ.

## 4.3 Phasing of the Implementation works

### 4.3.1 Main CAZ Works

The actual phasing of the Main CAZ construction works will be critical in achieving the key milestones for CAZ operation. The dates below highlight the current timescales around the delivery of the project:

| Activity | Target Date |
|---|---|
| Engagement with Contractors for Expressions of Interest on the Design and Build (D&B) Contract | June 2018 |
| Tender Stage 1 - Pre-Qualification (to reduce tenders down to 2) | November 2018 |
| Tender Stage 1 - Pre-Qualification Evaluation | November 2018; |
| Tender Stage 2 - D&B and ECI Contract | November/December/January 2018 |
| FBC to DEFRA for Approval | December 2018 |
| BCC FBC for Approval of Funding and to appoint Contractors | January 2019 |
| Tender Stage 2 - D&B and ECI Contract Evaluation | January 2019 |
| Appoint Design and Build Contractor(s) including ECI | Mid-January 2019 |
| Works Stage 1 –Detailed Design with ECI to support and undertake Construction Planning<br><br>Camera Supplier to procure Cameras | January 2019 to April 2019; |
| Works Stage 1- ECI contractor(s) to develop and to agree a Final Target cost | January 2019 to April 2019; |
| Works Stage 1 – If D&B/ECI Contractors Final Target Price within approved budget in January FBC proceed to stage 2 and appoint for Main Works Contract | April 2019 |

| | |
|---|---|
| Works Stage 2 - Construction mobilisation period | April 2019 |
| Works Stage 2 – Main Works Contract - Construction Period | May 2019 to December 2019 (Camera Installation May 2019 to September 2019) |
| CAZ Enforceable | January 2020 |
| Post Implementation Review | Mid 2020 |

The installation of the technology on site is as noted in Stage 2 – Main Contract works with the associated systems being developed in advance of the camera system installation.

### 4.3.2 Additional Measures

*4.3.2.1 CPZ's /Network Change Schemes*

Given the value of these schemes which will be much smaller than the Main CAZ scheme they will be delivered using a more traditional route. The current delivery programme is set out below:

| **Activity** | **Target Date** |
|---|---|
| Final Business Case to Defra Approval | December 2018 |
| PDD Outlining Procurement Strategy | December 2018 |
| BCC FBC Approval | January 2019 |
| Mini Bids to engage with Consultants on BCC's Multi-Disciplinary Transportation Professional Services Framework Contractors for Design of Additional Measures | January 2019 |
| Appoint Consultant for each Additional Measures package to undertake Feasibility and Detail Design | February to May 2019 |
| Engage with Lot 2/3 Contractors with Tenders for the Delivery of each Additional Measures Package | May to June 2019 |
| Tender Evaluation | June 2019 |
| Appoint Contractor(s) for Build Contracts | June/ July 2019 |
| Construction Mobilisation | June/ July 2019 |
| Main Works Contract - Construction Period – July 2019 to January 2020 | In case of CPZ's this will extend up to 2 years beyond January 2020) |
| Post Implementation Review | End 2020 |

## 4.4 Preferred Types of Contract

The intention is to use existing frameworks, relevant to the specific areas of scope to deliver the CAZ. This approach limits the need for a full OJEU procurement, supporting the need to deliver the CAZ as quickly as practically possible, whilst allowing work to be commissioned through both competitive and direct award routes already known by BCC.

### 4.4.1 CAZ Design and Development

Contracts have been placed by BCC to deliver the feasibility study, including the programme management, outline design and various elements of traffic and air quality monitoring. These contracts have all been placed using existing BCC frameworks including the Highways and Infrastructure Professional Services Framework. Where further support in the form of professional services is required BCC will appoint via the frameworks identified. Using the established frameworks for the appointment of professional services is the most viable option as a contract will be entered into with consultants who have been appointed to their Framework by BCC and have experience of working with their processes and procedures.

### 4.4.2 CAZ Implementation (Civil Engineering) Works

For Civils related works (including the Additional Measures) BCC will use the NEC3 Engineering and Construction (ECC) contract for the works delivery, as this is the basis of the Highways and Infrastructure Framework call-off contracts and is the predominant form of contract used for infrastructure works in the UK. The Framework allows the use of various options however BCC will adopt the following:

**Option C** – Target Cost contract with Activity Schedule

Benefits to Option C include:

- Enables the tender documentation to be issued earlier and therefore meet planned tender issue programme dates;
- Can prevent contractor from overpricing risk;
- Ability to manage changes to the scope of the works and any potential future changes through change controls;
- Offers more flexibility in accommodating on going design development;
- Accommodates improved post contract change;
- BCC pays actual defined cost-plus contractor's fee and has re-assurance on the cost of the activity rather than the price;
- The use of a sensible percentage share model between the Contractor and BCC to incentivise delivery of the works under target to the best possible cost.

During the lifetime of the contract, the Main Contractor will update their price (i.e. Target Cost) based on the latest available designs. The Contractor is also incentivised to find savings in the ECI and detail design stages to identify value engineering solutions to reduce the actual cost of the scheme against the Target Price submitted at Tender.

A Cost Plan is being developed to accurately price the scheme based on the current design information. The exercise will serve as a tool which can be used as a reasonable benchmark in determining the final Target Cost provided by the Contractor and aid in the drafting of the Activity Schedule contained within the tender documents. As the Target Cost should be a genuine pre-estimate of the most likely outturn cost for the Project as defined in the Contract documentation, it will be built up in the same way and contain all the same items as a Contractor will include in a traditional tender.

The Target Cost will include the expected cost of everything for which the Contractor is responsible including risk. The target cost will comprise of the following;

- Direct costs: These are the estimated most likely costs for undertaking the physical construction works;
- Indirect costs: These are the specific project costs necessary to support the direct cost element of the project delivery. These will be defined in a separate document. Nevertheless, typical examples will include site facilities, project insurances and so on.

Once BCC is satisfied with the Target Price position, contract documentation can be finalised and contractor(s) allowed to start construction.

### 4.4.3 CAZ Implementation (Technology) Works

To support the procurement of the intended Technology works it is proposed to use the existing Partnering arrangement with Capita ICTDS to deliver the CAZ technology element using existing contracts with the current supplier of parking/bus lane enforcement.

Birmingham City Council is in a joint venture arrangement with Capita to be its exclusive provider of ICT, for the term of the Contract. If the Council has a requirement for a new element of ICT, that has not been previously provided to the Council by Capita ICTDS (formally Service Birmingham), the Council can seek an alternative provider, but in all instances Capita ICTDS must be provided the opportunity to cost the work, and Capita ICTDS has to procure the service from the 3rd party provider on behalf of the Council (the only exception being where they cannot provide such a service). In addition, if the new ICT service requires connection to the Council's ICT infrastructure, Capita ICTDS are responsible for providing the work to undertake such activities and as this is not a stand-alone system but requires integration with other existing ICT applications managed by Capita ICTDS and therefore also forms part of the exclusivity arrangements in the existing contract.

The provision of the ANPR cameras was through open tender in 2013 and is due to co-terminate with the Capita ICTDS in 2021. This contract is between the supplier and Capita ICTDS; but was scrutinised by Birmingham City Council to ensure competitiveness and value for money. The contract is supply and maintain. It is felt that in this instance the ICT requirements relating to the procurement of camera and back office systems to enable the Clean Air Zone to be enforced is in line with ICT services already provided by Capita ICTDS, so as such the Council are contractually obliged to procure via Capita ICTDS

*4.4.3.1* Benefits of this approach include*:*

- Established procurement route;
- Not subject to OJEU timescales for advertising opportunity to tender;
- Ability to access proven suppliers / Contractors to deliver compatible systems to de-risk integration / timescales for implementation;
- Compatible with procurement for the main contractor;
- Ability to manage changes to the scope of the works and any potential future changes through change controls;
- Ability to procure technology equipment early in programme – reducing risk of supply chain delivery issues.

Obvious financial risks to BCC associated with a target cost contract have been identified, should the target be incorrect, or the share percentage not be capped. Therefore, a robust yet challenging Target Cost will be set prior to contract award.

To meet delivery of the challenging programme it has been decided that the technology elements will be nominated under one supplier with an existing contract with BCC and who will be centrally managed by the main civils contractor. This has been identified as the most appropriate way to manage the risks to delivery and establishes the one contractor to manage the coordination of works across the BCC network and its interaction with the (HMMPFI).

## 4.5 Service Streams and Required Outputs

The required services and outputs are summarised in Table 4.3: -

Table 4.3 Service Streams and Outputs

| Service / Objective | Provider | Scope | Output | Key Stakeholder (s) | Flexible for change in scope | Flexible for future changes |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| Civils Works / deliver the civil engineering works and manage the technology works as Main Contractor to support the CAZ implementation | Existing contractors from BCC frameworks | Detailed Design as Design / Build contractor, coordination of the technology contractor. | Detailed Design / Coordination with all parties (BCC / PFI contractor / technology contractor / public) and build of works. | BCC | ✓ | ✓ |
| Technology Works / deliver the ANPR and PCN hardware and software to support the CAZ implementation | Existing contractor provider. | Provision and installation of ANPR and PCN hardware and software. Coordination with the main contractor and existing BCC information and communication technology (ICT) provider(s) | Detailed Design and implementation of the solution and integration with existing / DEFRA systems. | BCC / DEFRA | ✓ | ✓ |
| Design and Project Management Support / the effective delivery of an outline design for the appointment of contractors. Support to the project management / technical assurance and delivery / commissioning of systems / works. | Engaged through existing BCC framework (WMTPS) as required. | Support as required to provide project management / technical specialists in support of delivery | Project Management and Controls / Technical Reports / Specifications to support the design and delivery of the scheme justification / delivery. | BCC / JAQU / DEFRA | ✓ | ✓ |
| Mobility Package for low income individuals | BCC | Individual receives £1000 mobility credit offered in form of SWIFT travel card | Promotion of modal shift where impact on low income individuals is identified. | BCC | ✓ | ✓ |
| Scrappage scheme for low income individuals | BCC | With evidence of scrapping a non-compliant car individual receives either:<br><br>£2,000 cash payment toward the purchase of a compliant car (not eligible for PiG).<br><br>£2,000 mobility credit. Credit to be supplied on a SWIFT card with no expiration for | Support to upgrade of vehicles promoting improved compliance | BCC | ✓ | ✓ |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | use. | | | | |
| Hackney carriage support package | BCC | Drivers offered £5,000 as:<br><br>support payments to be paid towards operational expenses of ULEV vehicles (4 annual installments of £1,250)<br><br>support for an LPG retrofit of their current or newly purchased vehicle | Promotion and support to the replacement / upgrade of the Hackney carriage fleet | BCC | ✓ | ✓ |
| Council hackney carriage leasing scheme | BCC | BCC bulk purchase 50 ULEV taxis through public procurement tender and lease them to the drivers who are most vulnerable as well as on a try-before-you-buy basis | Promotion and support to the replacement / upgrade of the Hackney carriage fleet. Support to those less able to upgrade. | BCC | ✓ | ✓ |
| Private Hire Vehicle upgrade support | BCC | Private hire vehicle owners who upgrade to a compliant vehicle where the priority will be beyond the minimum BCC's 2020 licencing criteria i.e hybrid or ultra-low emission vehicles. | Promotion and support to the replacement / upgrade of the Hackney carriage fleet. Support to those less able to upgrade. | BCC | ✓ | ✓ |
| 'Free miles' for ULEV LGVs | BCC | ULEV van drivers receive £1000 credit to spend on BCC public charging network | Promotion of ULEV vehicles with cost incentive. | BCC | ✓ | ✓ |
| HGV & Coach compliance fund | BCC | Fleets compete for £15,000 funding package to contribute towards:<br><br>Installing a | Support for improving fleet | BCC | ✓ | ✓ |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | retrofit solution<br><br>Upfront or lease costs of a compliant vehicle | | | | |
| Marketing and engagement campaign | BCC | Marketing and engagement campaign to provide information on the CAZ and reach out to groups eligible for support through mitigation measures | Promotion of the CAZ to ensure people know the purpose of the CAZ and positive impacts.<br><br>Managing the negative perspective by ensuring those affected understand potential support available. | BCC | ✓ | ✓ |
| Residents parking scheme | BCC | Implementation of residents parking schemes to prevent overcrowding on margins of CAZ; will be deployed only if issues arise | Consultation, Detailed Design and implementation of Residents parking schemes once identified. On-going Administration of the Residents parking scheme | BCC | ✓ | ✓ |

## 4.6 Risk Allocation and Transfer

The procurement, tendering and contracting approach has been developed to reflect the principle of risk being owned by the party best placed to mitigate or manage that risk, including the consequence should a risk event arise.

BCC has maintained a live Risk Register (see Figure 2 below) throughout the feasibility stage which will transition into delivery and be amended to incorporate delivery risks as they emerge on both the main CAZ and Additional Measures works packages. As the Risk Register is developed the cost implications of the risks being realized will be incorporated, enabling the development of a robust and justifiable contingency allocation.

After the Tender stage and once the Contractor is appointed for the Main CAZ an initial risk workshop will be undertaken. During this workshop the risks will be allocated to the party who will manage that risk through the design phase. In the Risk Register the risk owner will be named and the mitigation measures to be undertaken recorded. The Design and Build contractor will have submitted a price for managing elements of this risk such as undertaking trial holes and advanced preparation and agreement of traffic management proposals as part of the ECI element, supporting viability by enabling transfer of risk from BCC to the contractor.

Through the ECI phase a clear and robust delivery schedule will be developed which will identify interdependencies between activities and the different contract parties. All elements of risk associated with the design will pass to the contractor to manage and be either removed or mitigated through the design process. The outcomes will be reviewed in line with the BCC integrated schedule to evaluate and understand cross- schedule interdependencies.

During the design stage regular reviews of the Risk Register will be undertaken to track progress and ensure that the correct party is still identified to manage the risk. Through the life of the design stage the size of the contingency allocation should be reduced, with a final risk workshop held at the completion of the ECI and design stage prior to construction commencing.

Figure 2 Procurement risk register

| Clean Air Zone | | | | | | Civils Design and Build Risk | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Level | Probability/Likelihood | % | Cost Impact (£ k) | Prog Impact (wks) | Impact Level | | | | Contract Value | £12,000,000 | | | | | | |
| 1 | Improbable | 10% | < 5 | < 1.00 | VL | RAG Status | | | | Risk Owner | | | | | | |
| 2 | Remote | 25% | 10 | 2 | L | KEY | | | | BCC AQDG - AQ Delivery Group | BCC IP - Infrastructure Projects | | | | | |
| 3 | Occasional | 50% | 40 | 3 | M | Red | Risk missed its target and needs immediate attention | | | BCC TB - Technical Board | BCC CM - Cabinet Member | | | | | |
| 4 | Probable | 75% | 75 | 4 | H | Amber | Risk may not be completed within timescales | | | DB - Design and Build Contractor | BCC PT - Policy Team | | | | | |
| 5 | Frequent | 90% | > 150 | > 5 | VH | Green | Risk on target for completion within timescales | | | FC - Feasibility Consultants | | | | | | |

| Risk ID | Risk Description | Prob | Cost Impact | Prog Impact | Highest Impact Score | RAG Status | Owner | Comp Date | Progress/Mitigation | Further Actions | Likelihood | Cost Impact (£k) | Time Impact (wks) | Cost Prob (£k) | Time Prob (wks) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | Target Cost Over Budget | 5 | 5 | 4 | 25 | Red | BCC IP/DB | | Develop Target Price through D&B stage | | 90% | 150 | 4.0 | 135 | 3.6 |
| A2 | Delay in Agreeing Fees | 1 | 1 | 1 | 1 | Green | BCC IP | | | | 10% | 5 | 1.0 | 0 | 0 |
| A3 | Starting in advance without agreeing fees - leading to problems in design | 5 | 1 | 1 | 5 | Green | BCCIP/DB | | | | 90% | 5 | 1.0 | 4.5 | 0 |
| A4 | Non-approval/late approvals by DEFRA | 5 | 1 | 5 | 25 | Red | BCC PT | | | | 90% | 5 | 5.0 | 4.5 | 4.5 |
| A5 | Non-approval/late approvals by City Council | 5 | 1 | 5 | 25 | Red | BCC PT/ BCC IP | | | | 90% | 5 | 5.0 | 4.5 | 4.5 |
| A6 | Delay to PDD - delaying procurement | 5 | 1 | 5 | 25 | Red | BCC PT/ BCC IP | | | | 90% | 5 | 5.0 | 4.5 | 4.5 |
| A7 | Delay to BCC FBC - delaying appointment of D&B Contractor | 5 | 1 | 5 | 25 | Red | BCC IP | | | | 90% | 5 | 5.0 | 4.5 | 4.5 |
| A8 | Delay in Safety Audit | 5 | 1 | 3 | 15 | Amber | DB | | | | 90% | 5 | 3.0 | 0 | 2.7 |
| A9 | Procurement Strategy Approval - civils | 2 | 2 | 3 | 6 | Amber | BCC IP | | Procurement strategy submitted to BCC Procurement for approval | | 25% | 10 | 3.0 | 2.5 | 0.75 |
| A10 | Procurement Strategy Approval - Camera's | 2 | 2 | 2 | 4 | Green | BCC IP | | Procurement strategy submitted to BCC Procurement for approval | | 25% | 10 | 2.0 | 2.5 | 0 |
| A11 | Approval by Senior Officers/CM of CAZ Stategy | 4 | 4 | 5 | 20 | Red | BCC CM | | | | 75% | 75 | 5.0 | 56.25 | 3.75 |
| | **Change/Uncertainty of Design/Scope** | | | | | | | | | | | | | | |
| U1 | Design changes leading of prolongation of design - by Client | 5 | 4 | 2 | 20 | Red | BCC IP | | Linked to DEFRA finalising all design guidance | | 90% | 75 | 2.0 | 67.5 | 1.8 |
| U2 | Council changes arising from change in political control | 1 | 1 | 1 | 1 | Green | BCC | | | | 10% | 5 | 1.0 | 0 | 0 |
| U3 | Uncertainty in Specification | 2 | 4 | 5 | 10 | Amber | BCC IP | | Linked to DEFRA finalising all design guidance. Early enangement with technology supplier. | | 25% | 75 | 5.0 | 18.75 | 1.25 |
| U4 | Increase in scope around type of CAZ (by client) | 5 | 4 | 5 | 25 | Red | BCC IP | | Linked to DEFRA finalising all design guidance | | 90% | 75 | 5.0 | 67.5 | 4.5 |
| U5 | Quantities uncertainty | 3 | 3 | 1 | 9 | Amber | DB | | | | 50% | 40 | 1.0 | 20 | 0 |
| U6 | Changes due to Public Consultation | 5 | 5 | 5 | 25 | Red | BCC | | | | 90% | 150 | 5.0 | 135 | 4.5 |
| U7 | Lack of Availability of Resources | 3 | 1 | 4 | 12 | Amber | BCC | | Frameworks in place to appoint conractors and consultants | | 50% | 5 | 4.0 | 2.5 | 2 |
| U8 | Delivery of Back Office | 5 | 1 | 5 | 25 | Red | BCC IP | | Discussion ongoing to establishing BO through Imperial / BCC for different roles | | 90% | 5 | 5.0 | 4.5 | 4.5 |
| U9 | Management of Back Office | 4 | 1 | 5 | 20 | Amber | BCC | | Discussion ongoing to establishing BO through Imperial / BCC for different roles | | 75% | 5 | 5.0 | 3.75 | 3.75 |

At the completion of the design and ECI stage any risk that has not been designed out by the contractor may be reallocated back to BCC to manage. As the project progresses through pre-contract stages, the contingency allocation will be significantly refined down from the initial risk register produced. At the completion of the design and ECI stage any risk that has not been designed out by the contractor may be reallocated back to BCC to manage. BCC can then include the remaining contingency allocation in the final approvals for the scheme and ensure sufficient funds are available to cover the remaining risks.

The process for the Additional Measures delivery will vary slightly from that for Main CAZ in that BCC will work with the designer appointed to design the schemes to manage risk during the design stages. Following completion of the design stage and once the Contractor has been appointed for each scheme a risk workshop will be undertaken to discuss the remaining risks and the Contractor will be given the opportunity to propose further value engineering solution and mitigations for the remaining risks.

Prior to commencement of the construction stage, negotiations will take place with the contractor to discuss the possibility of transferring some of the remaining risk(s) to the contractor to own and to manage. The cost of this will then be included in the contractor's target price and be removed from BCC's contingency allocation. This will give BCC further cost certainty on the overall scope of works.

Warranties for the design element of the works package will be included in the Contract Documents and therefore the design risk will remain with the Design and Build Contractor. As noted above an element of risk will be managed through the NEC Contract using the NEC Option C – Target Price. This mechanism allows the financial performance of the contractor to be rewarded for any underspend or the Employers financial risk exposure to be limited if any overspend occurs.

In relation to delivery and Programme risks, BCC will apportion and potentially transfer risk(s) to those best placed to own these due to their involvement in undertaking elements of the works. This will help to ensure that the proposed ownership of risk provides value for money to the council.

- The principle outlined above would be implemented on all works contracts across the CAZ delivery including the Technology Contract for supply and Install of the ANPR Cameras and the Additional Measures contracts for civils works on Suffolk Street Queensway (A38), the scheme to ban southbound traffic from paradise Circus accessing the A38 and the Signals works to Close Lister Street and Great Lister Street at the junction with Dartmouth Middle Way..

## 4.7 Payment Mechanisms

Due to the key programme drivers and challenges that will be encountered in co-ordination and delivery of both the civils and technology related construction works (based on procuring these separately); there are a number of incentive models that may be adopted as shown below;

- Contractor Share Percentage – Allows the financial performance of the contractor to be rewarded for any underspend or the Employers financial risk exposure to be limited if any overspend occurs;
- Milestone Incentives - Contractor(s) can be incentivised against meeting key dates of a particular contract or programme;
- KPI Incentives - Contractor(s) are already incentivised on meeting performance level set against key performance indicators within the existing Framework Contract.

Through collaborative discussions on the most appropriate Payment Mechanisms to all project stakeholders, a win-win scenario will be created ensuring positive negotiations take place, further supporting the deliverability of the CAZ D plus additional measures.

The pricing model for the civil works the Contractors will be invited to bid based on preliminary designs and specifications. The use of a model scheme would allow earlier appointment of the contractor to support the development of a realistic implementation programme and to arrive at a fair and reasonable target cost position.

If a model scheme was used it will include the major work types allowing;

- A comparison of tenders based on a common set of information to bidders.
- The development of a target cost the works.

A two stage tender approach will be adopted, with the first stage focusing on quality and ensuring pre selection of suitable and capable Contractors is achieved. This will be followed by a main tender stage where an initial Target Price will be submitted which will include design, ECI and works costs with preliminaries, Overhead and Profit also priced. This will enable the contractor to develop the design of the scheme through the design and ECI stage which will enable them to produce a more accurate final Target Price. Provided this remains within approved limits set out in the business case the contractor will be retained to deliver the works.

Once at a preferred contractor stage BCC, the contractor and the design team will hold interactive planning workshops to assess risk, opportunities and dependencies to develop and manage risk mitigation strategies and update the scheme's quantified contingency allocation.

The contractor will update their price (i.e. Target Cost) based on the latest available designs (note that a final scheme definition and design will not be possible until the detail design element of the scheme has been completed).

A Cost Plan will be undertaken separately from the Contractor which can be used as a reasonable benchmark and negotiating tool, in helping to agree on a final Target Cost provided by the Contractor. As the Target Cost should be a genuine pre-estimate of the most likely outturn cost for the Project as defined in the Contract documentation, it should be built up in the same way and contain all the same items as a Contractor would include in a traditional tender.

The Target Cost will include the expected cost of everything for which the Contractor is responsible including risk.

The target cost will compromise of the following;

- Indirect costs: These are the specific project costs necessary to support the direct cost element of the project delivery. These will be defined in a separate document. Nevertheless, typical examples will include site facilities, project insurances and so on.

- Direct costs: These are the estimated most likely costs for undertaking the physical construction works

Once BCC is satisfied with the Target Price position, contract documentation can be finalised and the contractor will be allowed to start the construction phase.

For the Additional Measures and Mitigation Measures infrastructure works contracts, as these will be build only contracts, the target price for the work will be accepted after the Tender Stage.

For the technology works, it may still be possible to increase the project definition to a point that enables a fixed price to be established and agreed with the Contractor. If this is achievable then a priced activity schedule could be developed and implemented.

## 4.8 Payment Terms

The existing frameworks proposed have payment terms as detailed in Table 1.4 below:-

| Type | Framework/Contract Procurement Route | Payment Terms |
|---|---|---|
| Design | BCC's Multi-Disciplinary Transportation Professional Services Framework (WMTPS) | 30 Day from application |
| Civil; Infrastructure works | Birmingham City Council Highways and Infrastructure Works Framework | 30 Day from application |
| Technology; ANPR cameras and supporting | Existing BCC service provider Contract (ICTSD Capita) | 30 Day from application |

| | | |
|---|---|---|
| systems | | |

Note for Mitigation Measures as there is no works procured, only an in-house administration team, no payment terms are required.

The assessment of the works that will be due for payment will ultimately be determined by the final contract options. Nevertheless, it is proposed that payments to Contractors will either be linked to milestone activity completion (as within Activity Schedules) or based or monthly applications from the Contractors in relation to actual costs spent to date.

As the proposed contract option for the civils work for Main CAZ, Additional Measures and Mitigation Measures will be target cost, then payment is made on the basis of actual costs payable upon the completion an activity. This form of Contract requires the Contractor to account using an 'open book' approach, and as such the NEC form of Contract operates under a Defined Cost approach. The Defined cost is the amount due for payment to the Contractor less disallowed cost. So the Contractor is paid his Defined Cost plus the Fee.

Disallowed Costs can include;

- Costs which cannot be justified
- Costs incurred as a result of failing to follow contract procedures
- Costs incurred as a result of failing to follow Works Information procedures
- Correcting Defects after Completion
- Excessive waste/poor management of resource
- Costs incurred in preparing for an adjudication
- All the Contractor's costs which are not included in the Defined Cost or Disallowed are treated as included in the Fee.

The Project Manager will assess the amount due not less than seven days before the assessment date. As per the contract the Project Manager certifies a payment within one week of each assessment date. Within 7 days of the Contractor receiving the Project Manager's certificate, the Contractor submits a VAT invoice for the amount payable certified by the Project Manager. If the Contractor fails to submit an invoice within 7 days then the final date for payment is postponed by the same number of days as the time taken to submit the VAT invoice.

### 4.9 Incentivisation

Due to the programme drivers and challenges that will be encountered in co-ordination and delivery of work between both civil related and technology related construction works (assuming current preference to procure both parts separately) it is proposed that an incentivisation model will be used.

It has been decided that using the Contractor share percentage will be the most appropriate approach based on:

#### 4.9.1 Contractor Share Percentage

NEC 3 Option C for civils - based on the contract strategy, there is a contractual mechanism (Contractor's Share) that allows the financial performance of the contractor to be rewarded for any underspend or the Employers financial risk exposure to be limited if any overspend occurs. The share percentages vary between contracts and projects as the Employer sets the shares.

Under the cost reimbursable option of NEC ECC Option C, the Contractor's share will encourage effective management and control of the final Price of Work Done to Date (PWDD) relative to the target (the Total of the Prices). The Contractor receives a share of any saving or pays a share of excess when the final PWDD is compared to the target (adjusted for compensation events).

Each range is defined by levels of a ratio, PWDD/Prices expressed as a percentage. The share percentage is still to be decided subject to the on-going procurement.

### 4.10 Social Value

Compliance with the Birmingham Business Charter for Social Responsibility (BBC4SR) is a mandatory requirement that will form part of the conditions of the Birmingham City Council Highways and Infrastructure Works Framework contract. The Contractors undertaking this project will work under the Council's Highways and Infrastructure Framework Agreement and are certified signatories to the BBC4SR as part of requirements under the overarching Framework Contract and will provide additional actions proportionate to the value of each contract awarded. The actions will be monitored and managed during the contract period.

Additionally, in each contract issued for works on the CAZ project suppliers will be assessed on social value questions that relate specifically to the tasks and areas where the works will be undertaken. The Social Value Assessment is designed to assist with the evaluation of works packages by providing information on how the supplier will deliver their commitments included in their Birmingham Business Charter for Social Responsibility Action Plan.

All social value questions will be specific and measurable and relevant to the area where the work is being undertaken. It is expected that submissions will demonstrate where suppliers can offer added value and achieve standards in excess of the specification.

The performance of the social value actions proposed forms part of the Contract Management and Monitoring for the existing Birmingham City Council Highways and Infrastructure Works and BCC's Multi-Disciplinary Transportation Professional Services Framework (WMTPS) Framework and these are monitored monthly as part of the Contract Management and Monitoring for the existing Framework.

## 4.11 Accounting Treatment

### 4.11.1 CAZ

The initial cost to establish the Clean Air Zone (implementation measures) will be treated as capital and related assets depreciated in accordance with BCC accounting policies. Certain assets purchased by BCC will be transferred to and maintained under BCC's PFI contract for an annual charge. The assets are on balance sheet and the revenue costs accounted for as a charge along with other PFI operational costs.

The grant will be held on balance sheet and amortized (taken to revenue) over the life of the relevant asset.

Operating costs are expensed.

#### 4.11.2 Clean Air Funding

Except where an asset is created which is owned by BCC, the cost of mitigation measures and related funding will be treated as revenue for accounting purposes.

## 4.12 Summary of Commercial Case

The current intention is to deliver the CAZ using existing Framework Agreements already procured and/or accessible by BCC.

The proposed model will utilise existing Framework Agreements to appoint separate Contractors for the civils works (through the Council's Highways and Infrastructure Works Framework) and for the technology works (ANPR and associated systems) through existing frameworks and contracts currently in place with BCC.

Using Frameworks and Contracts already available to BCC means that a reduced procurement timescale will be realised and enables BCC to procure Contractors who are known to BCC and who have past knowledge and experience of working on BCC's road networks.

It is proposed to use the NEC Option C target cost contracting option for the civil works and an incentivised model to help drive cost and programme certainty through collaboration and interaction between the civils and technology contractor.

The mitigations measures proposed as part of the CAZ D are based on the provision in many cases of funding and grants to offset the impact of the CAZ D zone and do not on the whole involve any physical works. The administration of these mitigation measures will be undertaken by an in house team set up and managed by BCC.

The intended approach is considered the most appropriate way to manage the risks associated with time, cost and quality in delivering the CAZ 'D' plus additional measures, thus demonstrating the viability of the project. The inclusion of industry-recognised best practice methodologies such as Early Contractor Involvement and Framework utilisation also demonstrates the ability of BCC to deliver the project congruent to scope requirements, specifically value for money to the public purse.

As stated earlier in this case, there are some areas of the scope of work which are still subject to confirmation from Government before a robust commercial case and assessment of procurement routes can be undertaken, areas which are to be confirmed:

- The charging system – discussions are underway between BCC and JAQU as to whether the system will be implemented and managed at a local or national level;

The mitigation measures – a deliverable plan is detailed in the CAF Report and summarised in section 5.10 of the Management Case.

# 5 Management Case

## 5.1 Introduction

This Management Case forms the fifth and final case of this Full Business Case (FBC) as required under the Governments 'Five Case' business case model as set out in the Green Book Guidance. This FBC is the fourth business case to be submitted to Government for approval, following submissions of a Strategic Outline Case (SOC), Outline Business Case (OBC) and Full Business Case (FBC). The afore mentioned business cases have been subject to detailed Government review via their Delivery Independent Review Panel (DIRP) and Technical Independent Review Panel. Comments have been taken on board by the City Council and incorporated into this FBC, this is the final business case to be submitted and acts as the mechanism for applying for the funds required to deliver the programme of work.

This case sets out the management methodology, governance processes and delivery plan of the final proposals for the Birmingham Clean Air Zone programme. The methodologies and processes set out in this case serve to outline how the City Council will manage the various aspects of the programme lifecycle. This section lays out proposed timelines, governance processes, programme structure, change control, risk management, stakeholder management, reporting and monitoring, contract management, operational management and benefits realisation. The programme/project management methodology set out in this case is standardised by the City Council across similar highways and infrastructure projects and takes its principles from the industry recognised methodologies; PRINCE2 and Managing Successful Programmes (MSP).

Upon successful delivery of the project, the CAZ infrastructure will transition into an operational phase. It should be noted that not all infrastructure and subsequent operations will be delivered/managed by the City Council. See Section 5.10, the diagram shows the division of responsibilities between the City Council and Government. The scope of work which will be delivered and managed by Government will be addressed under a separate FBC which will be produced by Government under their Charging Infrastructure Project. There will be an element of integration required to achieve effective communication and operation between the two systems (City Council and Government), this is partly addressed in this case however is further explored in the Government 'Charging Infrastructure Project' FBC.

In addition to the highways and infrastructure improvements being delivered under the CAZ programme, a package of 'Mitigation Measures' have been devised by the City Council to address the potential negative impacts to various socio-economic groups affected by the introduction of a CAZ. These measures are further explained in Section 5.9.1. Whilst standardised governance and project management methodologies are to be utilised wherever possible for the delivery of the Mitigation Measures, their bespoke nature requires individual delivery plans; set out in the Clean Air Fund Report.

In the interest of adhering to a strict programme and achieving the highest value for money solutions, existing frameworks are being utilised for all procurement activities (where possible). City Council frameworks are given priority and are to be utilised for the majority of the highways and infrastructure works. However, national frameworks will be called off where the locally managed frameworks do not have sufficient provisions for the project requirements.

## 5.2 Programme and Project Management, Structure and Methodology

### 5.2.1 Brum Breathes Programme Structure

Birmingham City Council has initiated the Brum Breathes programme, which aims to` improve the city's air quality. Five sub-programmes contribute towards achieving this overarching aim; encouraging mode shift, reducing traffic volume and increasing the number of 'cleaner' cars on the city's roads. Each sub-programme sitting underneath the Brum Breathes programme is outlined below.

#### *5.2.1.1 Early Measures*

A suite of early measures were identified by the City Council which could be implemented as 'quick wins', enabling the gap between compliance to be closed in the shortest possible time. Government approved the proposed set of measures and granted funding for their delivery in April 2018, implementation of the early measures is currently underway with each at varying stages of the project lifecycle. The five early measures are set out below, each measure is being delivered as an individual project.

- Network Signing Strategy and VMS – To improve the efficiency of the city's signing network, incorporating Variable Message Signs (VMS) in order to streamline traffic flows into and around the city centre, reducing congestion and improving air quality;
- Bus Priority Measures – The implementation of new bus priority measures, at pre-defined locations around the city centre in order to improve public transport offering improved journey times and reliability.;
- Traffic Signalling – To implement improvements to traffic signals at strategic locations around the city; improving the efficiency of signal changeovers therefore reducing waiting time, easing congestion and improving air quality;
- Technology Air Quality Monitoring - In order to improve the city's air quality data set, air quality monitors will be installed by this project at 3 strategic locations (same locations as above) around the city centre;
- Customer Experience Monitoring- this project is a promotional scheme for which Transport for West Midlands (TfWM) are responsible. The scheme will promote use of buses as more 'air quality' friendly mode of transport.

#### *5.2.1.2 Clean Air Zone*

See 5.2.2.

#### *5.2.1.3 Air Quality Policy*

There will be a review and further development of planning policies/guidance to ensure that development proposals consider air quality and are accompanied by an appropriate scheme of mitigation measures where negative impacts are identified. Furthermore, there will be an additional review of transport policies/guidance to ensure alignment with Air Quality Strategy and CAZ requirements.

#### *5.2.1.4 Environmental Developing Infrastructure*

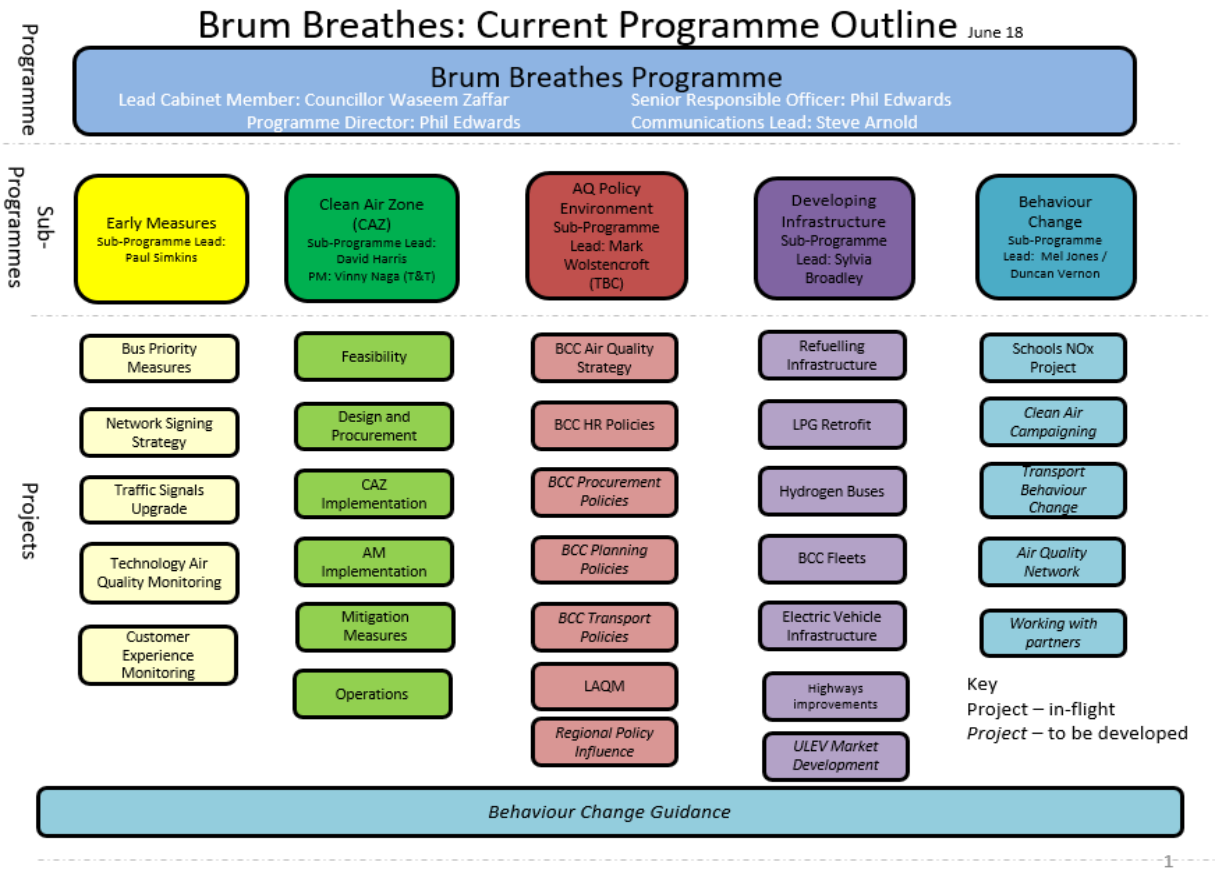
Throughout the CAZ programme there will be initiatives to create infrastructure for low/zero emission fuels. In addition to this, there is will be further development and implementation of proposals to improve the existing BCC fleet through a structured vehicle replacement strategy and fleet retrofit programme. Through this, it is also planned to introduce 22 hydrogen buses into the fleet operating within Birmingham.

#### *5.2.1.5 Behaviour Change*

The plan is to develop and agree an approach that embeds behavioural change into all areas of activity within the CAZ programme. This is championed through engagement with partner organisations to explore ways of working together to promote awareness of air quality issues and develop solutions.

Figure **9** shows the Brum Breathes Programme structure.

Figure 9 Brum Breathes Programme Structure



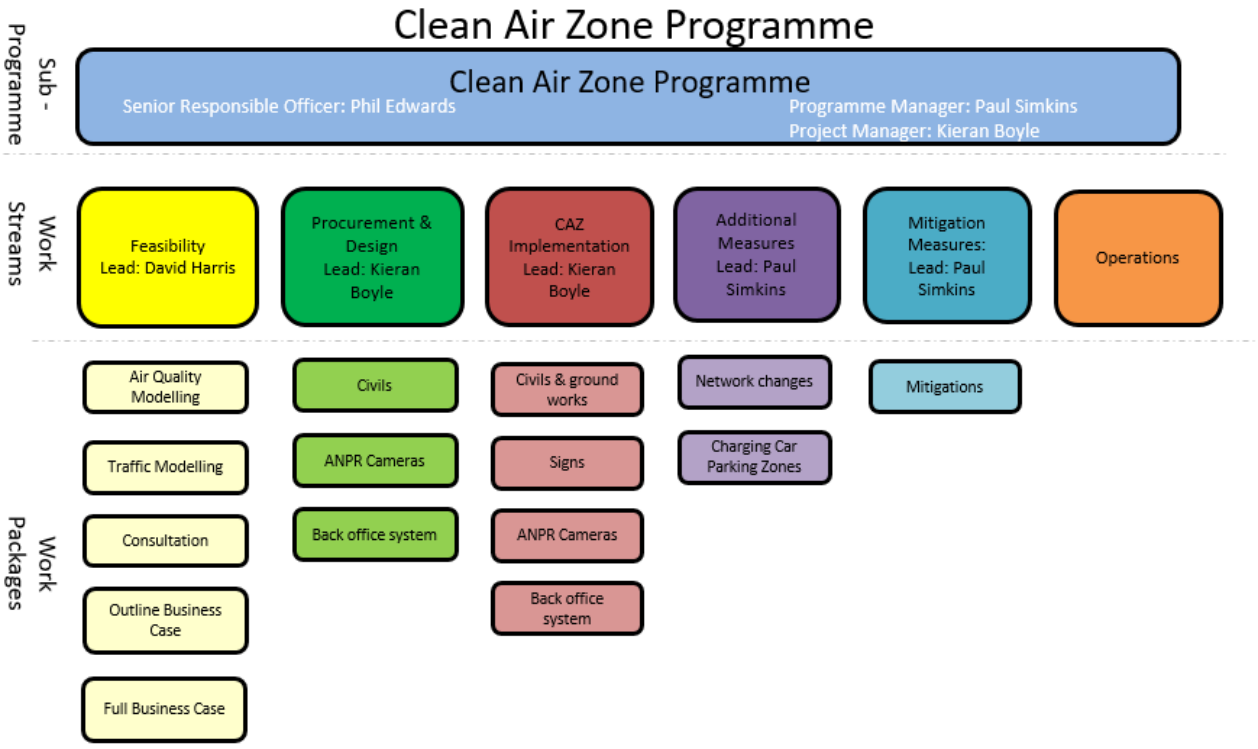

### 5.2.2 Clean Air Zone Programme Structure

The CAZ Programme has been divided into six work streams, each of which have a series of work packages sitting under them (see Figure 101). The programme has been divided to enable a structured and manageable delivery which generally follows the project lifecycle set out in PRINCE2, as below.

Table 5.1 PRINCE2 alignment

| Lifecycle phase | CAZ work stream |
|---|---|
| Initiation Stage | Feasibility |
| Delivery Stage | Procurement and Design<br>CAZ Implementation<br>Additional Measures<br>Mitigation Measures |
| Final Delivery Stage | Operations |

Figure 10 CAZ Programme Structure




The following narrative provides a brief description of each work stream:

- Feasibility – as per Section 5.1, the feasibility work stream is focused on the delivery of the suite of business cases as per the 'Five Case' model. Supportive work to produce the evidence required to substantiate each business case is carried out in the form of transport, air quality, economic and financial modelling. The submission and approval of this FBC concludes the feasibility phase.
- Procurement and Design – this work stream is focused on the delivery of an outline and detailed design for the CAZ including the boundary configuration, camera specification, sign and camera location and the back office charging infrastructure. The necessary goods and services to enable delivery will also be procured under this work stream in line with the Procurement Strategy.
- CAZ Implementation – this work stream will manage the physical implementation of the schemes which are designed in the 'Procurement and Design' phase, including site works, testing and commissioning.
- Additional Measures Implementation – due to the scale of Birmingham's air quality problem the introduction of a CAZ alone will not be sufficient to meet compliance, as such the City Council have selected a package of Additional Measures to enable compliance to be achieved within the prescribed timescale. The measures being proposed are changes to the road network and the introduction of parking restrictions within the CAZ. This work stream will manage the full project lifecycle of the additional measures, i.e. the outline and detailed designs, implementation and testing/monitoring.
- Mitigation Measures Implementation – As per Section 5.1, a package of Mitigation Measures are being proposed to mitigate the impact to the most significantly affected socio-economic groups. This work stream focused on the delivery of these mitigation measures throughout the full project lifecycle. Section 5.9.1 and in the Clean Air Fund Report provide further details of the package of Mitigation Measures being proposed.
- Operations – upon the completion of a successful delivery the programme will transition into an operational phase which will involve a handover between the project delivery team and the operations and enforcement teams. A further explanation of the operational process is set out in Section 5.10.

The table below provides details of the responsible person/organisation for the management and or delivery of each of the work packages under each work stream.

Table 5.2 CAZ Programme management/delivery matrix

| Work stream | Work Package | Management | Delivery |
|---|---|---|---|
| Feasibility | Air quality modelling | BCC and Turner & Townsend | Air Quality Consultants<br>Jacobs |
| | Traffic modelling | | Steer Group |
| | Consultation | | BCC<br>Turner & Townsend<br>Pell Frischmann |
| | Business Case | | Turner & Townsend<br>Jacobs |
| Design | Signs | BCC | Outline Design – Jacobs<br>Detail Design – Note 1 |
| | ANPR | | Capita ICTSD – Note 2 |
| | Back Office (IT Infrastructure) | BCC | Capita ICTSD – Note 2 |
| Implementation | Signs | BCC | Main contractor - Note 1 |
| | ANPR | BCC | Capita ICTSD – Note 2 |
| | Back office (IT infrastructure) | BCC | Capita ICTSD – Note 2 |
| | Civils/ground works | BCC | Main contractor - Note 1 |
| Additional Measures | Network Changes | BCC | Contractor - Note 3 |
| | Car Park Charging | BCC | Contractor - Note 3 |
| Mitigation Measures | Mitigation Measures | BCC | BCC – Note 4 |
| Operations | Data collection | BCC | BCC |
| | Image capture & local whitelist check | BCC | Capita ICTSD – Note 2 |
| | Payment and national whitelist check | Government | Government |
| | Enforcement | BCC | 3Sixty and Capita ICTSD – Note 2 |
| Note 1 | A competitive tender is currently underway to procure a contractor under the City Councils Highways and Infrastructure Framework through a Design and Build (D&B) contract for the 'Civils' work. Contract award is scheduled for January 2019. The successful contractor will be responsible for producing the detailed design for the CAZ and subsequently installing all of the 'Civils' work. In line with the existing partnering arrangement Capita ICTDS will be nominated as the supplier of the ANPR cameras. In the D&B contract, the contractor will be responsible for managing the interface between the civils works and the ANPR camera supplier. | | |
| Note 2 | In line with the existing partnering arrangement Capita ICTDS will be responsible for the delivery of the back office charging/ processing system. | | |
| Note 3 | The delivery of the Additional Measures will be procured using the City Councils Highways and Infrastructure Framework, tender documentation for these procurement activities is currently being prepared. | | |
| Note 4 | Due to the nature of the Mitigation Measures being proposed, BCC will be responsible for the delivery of the measures. Some procurement activities will be required however these are likely to be for goods rather than services. | | |

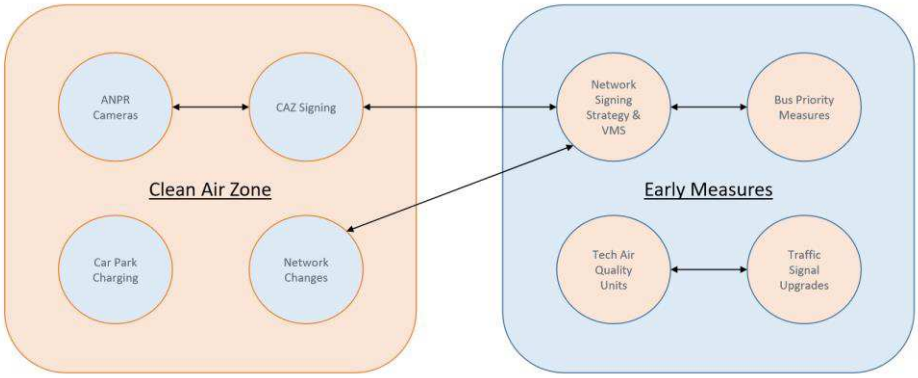
## 5.3 Programme/Project Interdependencies

Whilst each sub-programme under the Brum Breathes programme is being managed independently, certain interdependencies exist between the CAZ and Early Measures programmes; illustrated below in Figure 5.3. The

interdependencies shown in Figure 5.3 highlight the considerations which must be taken when developing the designs and subsequently implementing each of the work packages.

For example, the CAZ Signing and Network Signing Strategies must be developed in consideration for one another. Both schemes will be installing/modifying signs on Birmingham's transport network and therefore the risk of 'clashes' between the two is reasonably high.

Figure 11 Project/Programme Interdependencies

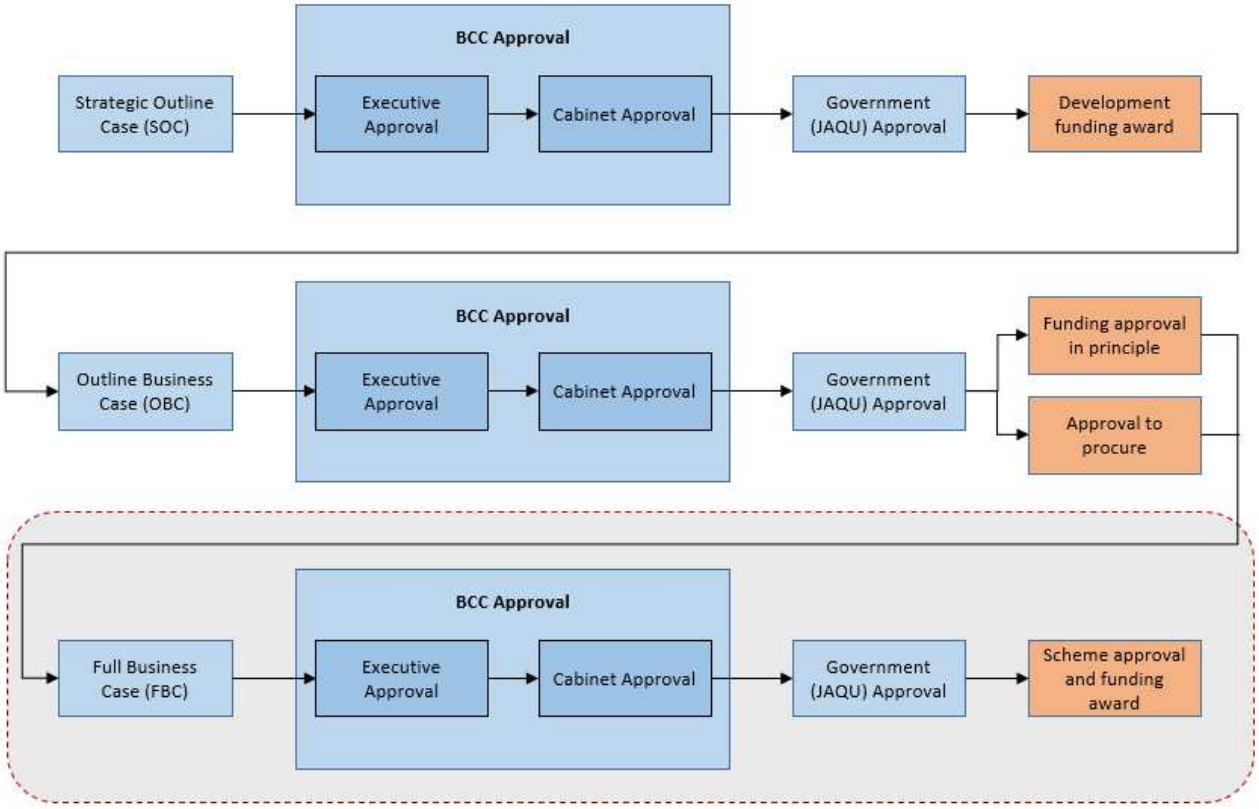



In addition to this a number of interdependencies exist between the CAZ programme and a number of other major programmes of work being undertaken within Birmingham; High Speed 2 (HS2), the Commonwealth Games, the Midland Metro Extension, Snow Hill Development and the Paradise Circus Development. Each of these other major programmes will be undertaking construction activities within the city centre at the same time as construction is planned for CAZ. In particular, the interface between CAZ, HS2 and the Midland Metro Extension is being carefully managed with regular planning and coordination meetings taking place with all parties. Not only is there an interdependency between the construction phases of each programme but considerations must also be taken during the design phase to ensure that the design of one scheme does not impact upon that of another. The coordination between each major programme is a significant task for the City Council and one which places a heightened risk on the CAZ delivery programme – see Appendix 5A, entries R-038 to R-040.

## 5.4 Governance

As above, this FBC has been produced in line with the 'Five Case' business case model. Three other business cases have preceded this FBC; SOC, OBC and POBC. Standard process does not specify the requirement for a POBC, however the City Council submitted this revision to Government to demonstrate the progress being made on the programme and give visibility of the areas still being worked on. Figure 5.4 outlines the standard business case process and the approvals which are sought with each submission, note the POBC is not included as no approvals were sought with its submission. The grey highlighted area of Figure 5.4 shows the stage which the project is currently at.

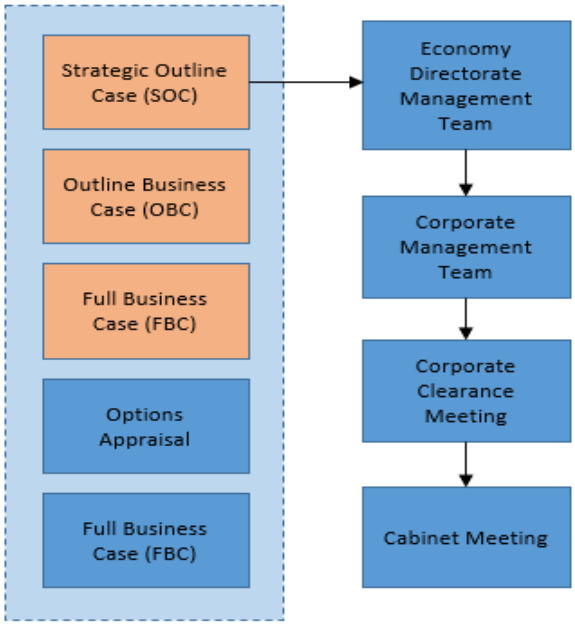
Figure 12 Government governance process for business case approval




Each business case which has been submitted to Government undergoes a review and approval process via their DIRP and TIRP during which technical experts scrutinise the business case and provide comments to the City Council which must be addressed in the next business case. A RAG status is also given to each case individually and an overall RAG is assigned to the business case. The FBC is the mechanism for requesting funding from two separate funding streams; funds to deliver the CAZ and Additional Measures are sought from the 'Implementation Fund' and funds to deliver the Mitigation Measures are sought from the Clean Air Fund (CAF). Once funding has been awarded, the City Council become fully responsible for cost control, tracking and reporting.

The City Councils internal governance process must also be adhered to when seeking authority to submit a business case and request capital funding from Government. Each business case submitted to Government must first undergo review and approval by the City Council, Figure 5.5 illustrates this process.

Figure 13 BCC Governance process




As per Figure 13 each of the documents which are shown on the left hand side of the diagram are subject to the City Councils governance process and are submitted to the process individually to gain the appropriate approvals. Each document is accompanied by a cabinet report, under normal practice the details of the documents and accompanying reports will be shared in the public domain. However in some cases the contents are commercially sensitive and are therefore kept private. The Options Appraisal and FBC which are shown in 'blue' in Figure 13 are the internal City Council approval documents which allow the City Council to accept the funding grant(s) given by government and proceed with the procurement of services to deliver the programme. The City Councils FBC's are required for each individual work stream, for example one will be required for the CAZ, another for the network changes under the Additional Measures and another for the car park charging scheme.

Table **5.3** below shows the responsible person(s) for approving each stage of City Council governance as per Figure 13.

Table 5.3 Responsible party for approval of City Council governance

| Approval gate | Role |
|---|---|
| Economy Directorate Management Team | Corporate Director of Economy |
| Corporate Management Team | Chief Executive |
| Corporate Clearance Meeting | Chief Executive<br>Chief Finance Office |
| Cabinet Meeting | Birmingham City Council Cabinet |

It should be noted that at the time of submitting this FBC the City Council has not been able to procure the works and or services required to deliver the implementation phase of the project. As such, costs from the procurement activities are not yet known and therefore the costs included in this FBC are an estimate. The City Council has reached an agreement with Government that a revised cost will be supplied to Government in the form of a written report when the costs have been firmed up. In order to avoid delaying the implementation of the additional measures Government have agreed that the City Council can include an estimate in this FBC which is comparative to similar works undertaken by the City Council. Government have also indicated that there will be a minimum of eight weeks required to review the FBC and Evidence Reports. Subsequently this means that there will also be a minimum of eight weeks

before the funding of the project can be agreed. In light of this the City Council has agreed to draw down an interim amount of funding from their own resources to avoid delaying the implementation phase. When Government funding is agreed and received by the City Council the interim funding drawn down from reserves will be replenished in full.

The timescales for delivering firmed up costs for each of the work streams are as set out below:

| Work Stream | Work Phase | Date |
|---|---|---|
| Main Civil Engineering Works | Detailed Design (Target Cost) | Mid-January 2019 |
| Main Civil Engineering Works | Construction (Target Cost) | April 2019 |
| Technology (Cameras & Charging Infrastructure) | Detailed Design | Mid-January 2019 |
| Technology (Cameras & Charging Infrastructure) | Construction | April 2019 |
| Additional Measures – Network Changes | Design & Build | March 2019 |
| Additional Measures – Parking Restrictions | Design | March 2019 |
| Additional Measures – Parking Restrictions | Construction | March 2019 |
| Mitigation Measure – Hackney Carriage leasing | Procurement | March 2019 |

For Clarity, we will be utilising a target-cost based procurement strategy for the main civil engineering work. Option 3 of the NEC3 suite of Contracts refers to a Target Contract with Activity Schedule. A realistic target cost and a fair 'share mechanism' will be agreed between the Contractor and Client, whereby both parties work together to share the risk and reward. If the Contractor delivers the scope whilst underspending against the target, the saving is shared whilst if the target is exceeded, the Contractor will pay a share of the excess agreed by both parties this contains a mechanism for sharing risk and rewards known colloquially as a "pain/gain" mechanism. The target price can be amended throughout the contract if/when the compensation events are raised and agreed between the contractor and the employer (e.g. for changes in scope or schedule). This strategy provides a cost incentive for the contractor to work efficiently to deliver the project objectives within the target cost, providing better value for money.

A further point to note is that whilst the costs included in the Monitoring and Evaluation Plan (Appendix 5D) are correct and supporting evidence can be provided for the cost estimate, these costs were not available in time for the finalisation of the financial modelling. As such, the financial model does not include the full cost for monitoring and evaluation. The monitoring and evaluation costs will be included in the financial model which will be re-submitted in January 2018 when the Target Cost is agreed for the main civil engineering works (as above).

Similarly to the above, the Clean Air Fund Report contains accurate cost information. Unfortunately some of the administration costs were confirmed too late to be run through the financial model. As such, the financial model is out of date by circa £110,000 in terms of the costs for administering the mitigation measures. The financial model will be updated to contain accurate information for the re-submission in January.

**Schedule Management**

### 5.4.1 Key Milestones and Stage gate

The programme for delivery of the CAZ Programme is appended as Appendix 5B, stage gates have been identified which align to the project lifecycle and key milestones set to drive the project team to adhere to the programme. The submission of this FBC forms one of the stage gates, the subsequent approval by Government and funding award is crucial to ensuring that the timescales are met. Any delays in funding award could result in the programme being delayed respectively. The stage gates and key milestones are set out below.

Table 5.4 Stage gates

| Stage Gates | |
|---|---|
| **Stage Gate** | **Forecast date** |
| Full Business Case submission to Government | December 2018 |
| City Council Options Appraisal submission | December 2018 |
| Funding awarded by Government | February 2019 |
| Construction starts | April 2019 |

| | |
|---|---|
| User Acceptance Testing starts | September 2019 |
| Handover to operations | December 2019 |
| **Key Milestones** | |
| City Councils FBC approved | January/February 2019 |
| Contract award – Civils | January 2019 |
| Contract award – Technology | January 2019 |
| Construction start | April 2019 |
| User Acceptance Testing starts | September 2019 |
| CAZ live | January 2020 |

### 5.4.2 Reporting Arrangements

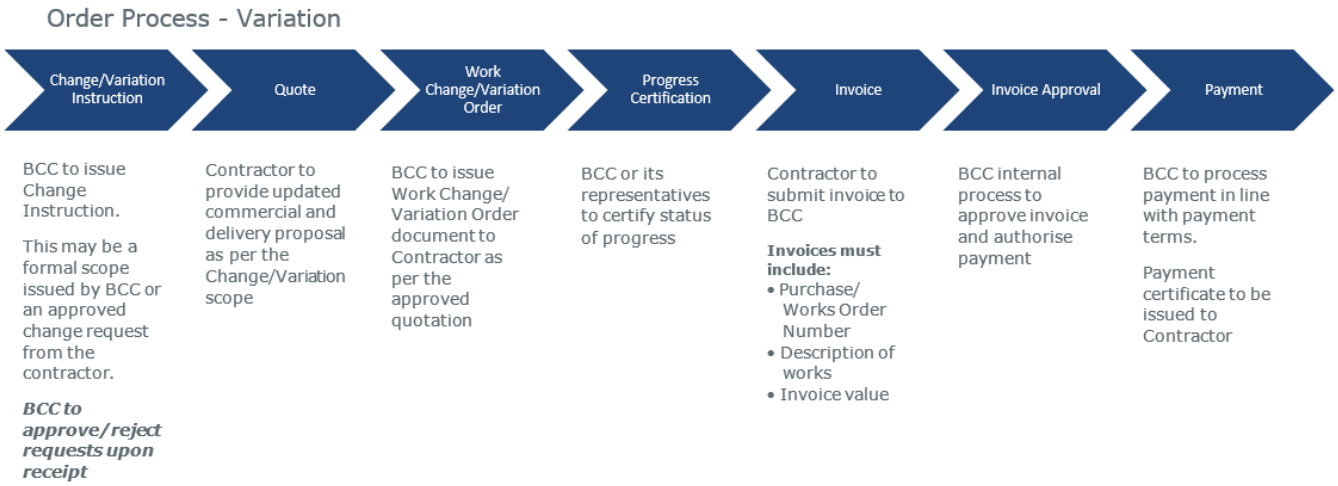
Programme progress is reported at weekly progress meetings, the agenda for these meetings covers programme, cost, risk, and opportunity, issues and change control. This weekly meeting also provides the forum for raising issues which require escalation. The weekly meeting is attended by the Project Managers, Cost Managers, Transport Policy Manager and relevant consultants. A Technical Board meets on a bi-weekly basis which is attended by the Programme Manager, Transport Policy Manager, Traffic Manager and relevant consultants. The Technical Board serves as the method of escalating issues from the weekly meetings, decisions are made at this meeting and then communicated to the project team via the Programme Manager. The Brum Breathes Programme Board meets on a monthly basis, the purpose of this board is to provide programme assurance and 'health check', and is attended by the senior management team and Brum Breathes Programme Manager. Programme and Commercial 'dashboards' are presented at this meeting by the CAZ Programme Manager and any issues which require escalation are raised to the board.

In addition to this, a briefing note is presented by the Programme Manager to the Cabinet Member at the weekly members briefing when a key milestone or stage gate has been achieved. AdHoc reporting and progress updates are also provided to members of the executive team and cabinet, reports are standardised in the form of the programme dashboards to ensure that a consistent message is communicated.

The project team also undertake regular informal peer reviews on the programme to ensure that basic project controls are being implemented and processes are being adhered to. These peer reviews are recorded and recommendations for improvement are communicated to ensure best practice across the programme.

## 5.5 Change Management

The bespoke and complex nature of the CAZ programme carries a heightened level of uncertainty compared to 'standard' highways and infrastructure projects, therefore a robust change management process is in place to ensure that changes to scope, cost and programme are tightly controlled. The below sets out the process which is being followed.




By implementing a robust change control procedure, the following benefits are realised:

- Any movements to the agreed baseline are properly understood, controlled, recorded and reported
- The review and approval of changes are carried out by the correct people
- The process allows a single, consistent and auditable mechanism for managing project baselines

The programme baseline will be established upon approval of the FBC by Government, the scope, programme and budget will be set in line with the position agreed with Government. Once established, the baseline will be agreed first with the CAZ Technical Board and then approved at the Brum Breathes Programme Board. The process outlined in the diagram above will be implemented to manage change against the agreed baseline.

### 5.5.1 Change Management Matrix

A Change Management Matrix has been created to manage and delegate responsibility for any contractual changes. It should be noted that changes made to specific projects may impact on other overlapping projects with the change managed accordingly. The matrix forms basis to delegate responsibility to implement contractual changes based on cost and/or schedule deviations.

Table 5.5 Change management matrix

| Role | <£25k | £25k - £100k | £100k - £200k | £200k - £1m | >£1m |
|---|---|---|---|---|---|
| Programme Manager | ✓ | | | | |
| Head of Infrastructure Delivery | | ✓ | | | |
| Assistant Director of Transportation and Connectivity | | | ✓ | | |
| Corporate Director of Economy | | | | ✓ | |
| Cabinet Member | | | | | ✓ |

## 5.6 Risk & Contingency Management

A robust risk management process is being utilised on the CAZ programme, whereby risk workshops are held periodically with attendance by all key stakeholders. The work shop is utilised to identify risks, prioritise them in terms of significance and likelihood of occurrence, decide mitigating actions and agree action owners. The risks are then

reviewed at the weekly project progress meetings, with the highest priority risks being reviewed at the monthly Brum Breathes Programme Board. Below is an extract from the risk register (Appendix 5A) and shows the top 10 risks in terms of priority.

| ID. | Date Raised | Risk Influencer | Risk Description | Consequence | Effect | Owner | Likelihood (1-4) | Impact (1-4) | Risk Score | Mitigation Action | Mitigation owner | Residual likelihood | Residual Impact | Residual Mitigation Score | Date Updated | Comments | Status |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R-004 | 23/10/18 | Programme | There is a risk that compliance may not be achieved by the 2020 deadline. | The council may be received sanctions including fines for failing to meet compliance in time.<br>Residents and Business in Birmingham still impacted by poor air quality. | Reputational damages on Birmingham for non compliance | BCC - Executive | 4 | 4 | 16 | Robust modeling which identifies interventions which make a big impact.<br>See if there is potential to expand those initiatives to achieve compliance by 2020. | BCC - transport policy team | 3 | 4 | 12 | 30/09/18 | The traffic and air quality modelling shows that compliance will be achieved in all but 3 locations by 2020, 2 will be met by 2021 and one on Suffolk St Queensway in 2022. | Open |
| R-006 | 23/10/18 | Funding | There is a risk that JAQU's funding approvals process is prolonged for final delivery of preferred option | The consequence is a potential for project slippage and failure to meet compliance within the respective timescales.<br>Not recognising that there is significant local impacts from not having the funding in place | Additional measures are not delivered in time | BCC - Transport policy team | 4 | 4 | 16 | Demonstrating to JAQU the impacts of a prolonged approval process for funding.<br>Revised timeline that reduces the legal limits (e.g. consultation). | BCC - transport policy team | 3 | 4 | 12 | 19/02/18 | | Open |
| R-010 | 23/10/18 | Modelling | There is a risk that the current city traffic model (Saturn) does not account for road networks outside of the city centre. | The consequence would be delays to the overall programme and implementation of CAZ initiatives.<br>Further funding not available to improve areas outside of City Centre.<br>Raise issues around validity on the evidence<br>Remodelling = further delays | Incorrect assessment of the current impact and preferred option | BCC - Transport policy team | 3 | 4 | 12 | Model contingency plans for traffic data and their impact on Air Quality and devise whether additional measures are required to meet Air Quality compliance.<br>Updates to the model are underway for the potential cordons | BCC - transport policy team | 2 | 2 | 4 | | Still need to be identified, | Open |
| R-011 | 23/10/18 | Consultation | There is a risk that CAZ has an impact on Highways England network resulting in H.E objecting to CAZ | The consequence would be that lack of engagement could potentially mean retrospective changes, increasing the cost to the council.<br>Adverse comments at the consultations phase | Delay to implementation | BCC - transport policy / corporate | 2 | 3 | 6 | Ensure a robust communication and engagement strategy to enable the most useful and most recent information to be available to inform BCC. | BCC - corporate comms | 2 | 2 | 4 | 22/08/17 | M6 - knock on consequences | Open |
| R-012 | 23/10/18 | Programme | There is a risk that there is insufficient Public Transport Capacity to support modal shift. (programme risk) | The consequence would be that it would be more difficult to influence people to get the modal shift | It will take longer to meet the Air Quality requirements. | BCC | 2 | 3 | 6 | Already working with TfWM for certain corridors, and specifically uplifting mode share, eg extra buses | BCC - transport policy team | 2 | 2 | 4 | 22/08/17 | National policy, can anything drive transport issues in terms of compliance the number of patronage even changes are small. | Open |
| R-014 | 23/10/18 | Modelling | There is a risk our assumptions from the transport and AQ modelling are incorrect. | The consequence would be that inaccurate modelling results may cause delay to the programme.<br>The consequence would be additional cost for interventions as a result of poorer air quality than predicted.<br>The consequence would be a legal challenge from the Government resulting in cost and delay. | Programme delays in going back to revaluate the modelling | BCC - transport policy | 2 | 3 | 6 | Independent verification undertaken on all results and these will be matched with what JAQU has provided as indicative areas of poor air quality. | BCC - transport policy team | 1 | 3 | 3 | | BCC air quality modelling assumptions | Open |
| R-016 | 23/10/18 | Political | There is a risk that political members would be unsupportive of CAZ. | The consequence would be unsupportive members may cause the decision making and schedule to be delayed significantly causing.<br>FBC isn't signed off | Programme delays - Cost overruns | BCC - Cabinet Member (Economy) | 2 | 3 | 6 | Proactive communications and engagement with influential political stakeholders and demonstrate impact to cost and schedule from lack of decision making. | BCC - transport policy team & corporate comms | 1 | 2 | 2 | 30/09/18 | FOBC passed through cabinet and scrutiny by a political vote, the mayor is also still supportive of the scheme. | Open |
| R-018 | 23/10/18 | Legislation | There is a risk of lack of guidance and legal understanding in how the traffic regulation order approval can be used to implement the scheme. | The consequence would be judicial review as a result of objections. | delay on the delivery | BCC - transport policy | 4 | 4 | 16 | Engage with the supply chain to procure external support for the drafting of the charging order from specialist resource. | BCC - project team | 1 | 3 | 3 | 22/08/18 | Review before we can accept TRO, we can still go ahead and implement, will politicians support that | Open |
| R-017 | 23/10/18 | Funding | There is a risk that JAQU doesn't understand the complexity and scale involved in BCC completing their Feasibility Study | The consequence would be there is the possibility of a delay to agreeing a preferred solution impacting timescales to achieve compliance. | Negative impact on the wider economy<br>Impact on deprived areas and smaller businesses | BCC - transport policy | 2 | 3 | 6 | Provide JAQU with draft modelling results to prevent delays in achieving a preferred solution.<br>Keep JAQU informed of developments and progress on the overall Air Quality Programme. | BCC - transport policy | 1 | 2 | 2 | 22/08/18 | Issues with conservative councillors on CAZ charging zone | Open |
| R-020 | 23/10/18 | Funding | There is a risk that the capital costs for the CAZ interventions exceed initial forecast spend. | The consequence could be failing to deliver all interventions to improve Air Quality and reach compliance resulting in a financial penalty to the council. | Delay in compliance | BCC - project team / city finance | 2 | 3 | 6 | Ensure budget is sufficient to deliver the respective interventions<br>Close monitoring of financial during the delivery of the various interventions.<br>Appropriate contingencies | BCC - project team / city finance | 1 | 2 | 2 | 01/08/17 | Implementation risk, procurement strategy before FBC, FBC will finalise costs | Open |

In order to establish an estimate for the required contingency allocation a quantitative assessment of the risks on the risk register has been undertaken. This is the process whereby the financial implications of the risk being realised are quantified as a monetary value which is then assigned to the risk in the contingency fund. It must be noted that some of the risks for the CAZ programme contain too much uncertainty to enable a meaningful quantification to be carried out, therefore an optimism bias remains against some elements of scope.

## 5.7 Stakeholder Management

Effective stakeholder management is crucial to the success of a project such as the CAZ, where public support and cooperation is essential. The City Council has undertaken a public consultation (Jul – Aug 18) whereby residents, workers, businesses and visitors of Birmingham were invited to give their views on the proposed CAZ. The response to this consultation was greater than any other consultation ever run by the City Council, with over ten thousand responses. The stakeholder groups targeted by the consultation were identified via the creation of a stakeholder management plan, a summary of which is provided below in Table 5.6 Key Stakeholders. The full Stakeholder Management Plan is appended as Appendix 5C.

The stakeholder management plan will remain as a live document throughout the delivery and operation of the CAZ. In order to retain support from the public, a continued effort will be made by the City Council to ensure that all stakeholder groups will be kept informed throughout. This ongoing communication will be delivered via digital and traditional media forms with regular updates being provided on the City Councils webpage and Twitter page. A marketing campaign is also being proposed as one of the Mitigation Measures to ensure that all of the targeted groups are made aware of the Mitigation Measures being offered and that they receive the required take up.

Table 5.6 Key Stakeholders

| Stakeholder sector | Stakeholder |
|---|---|
| Individuals | Younger people |
| | Disabled people |
| | Pregnant women |
| | People from BME communities |
| | City centre residents |
| | City centre workers |
| | Residents along major roads |
| | People frequently driving to the city centre in diesel cars |
| | People driving significant distances in Birmingham within job |

| Stakeholder sector | Stakeholder |
|---|---|
| Business & Economy | Business Improvement Districts (especially city centre) |
| | Chamber of Commerce |
| | Federation of Small Businesses |
| | Greater Birmingham and Solihull LEP |
| | Individual businesses |
| Education & Skills | Universities |
| | Colleges |
| | Schools |
| Environment & Sustainability | Environmental Groups |
| Health & Wellbeing | Public Health England/Lap |
| | Clinical Commissioning Groups |
| | Hospitals, GP surgeries, etc. |
| Housing & Communities | Housing Associations |
| | Tenants' and residents' groups |
| Media, Communication & Marketing | Local Press/Media |
| | BBC WM |
| | West Midlands Growth Company |
| Science & Technology | Universities |
| | Science Parks |
| Transport | Transport for West Midlands |
| | Highways England |
| | Public Transport operators |
| Political | Birmingham Councillors |
| | Birmingham MPs/MEPs |
| | WM Mayor |
| | WMCA |
| | Other WM elected members/LAs |
| Major projects | High Speed 2<br>Midland Metro extension<br>Paradise Circus development<br>Snow Hill development<br>Commonwealth Games |

In addition to the public consultation which was carried out for the main CAZ proposals, further consultation will be required during the implementation of the Additional Measures once the outline design phase has completed. This further consultation is required under statutory process mandated for implementing parking schemes and changes to the highways network due to the potential implications they can have on members of the public and businesses. Further consultation will also be required for the Residents Parking Scheme being proposed as one of the Mitigation Measures for the same reason. The Stakeholder Engagement Plan will be used to inform the planning phase of each of the consultations.

## 5.8 Use of Specialist Advisors

A variety of specialist advisors have been procured to support with the development of the feasibility phase, final option selection and FBC production. These specialist advisors were procured due to their expertise in certain subject matters such as programme management, air quality, transport modelling, economic appraisal, etc. All specialist advisors report directly to the City Council programme manager and were appointed via existing framework agreements.

| Work stream | Service provider | Scope of work |
|---|---|---|
| Programme Management | Turner & Townsend | Provision of Programme and Project Management for the Feasibility phase of the project. Including cost management, stakeholder management and engagement. Production of the Management Case of each business case and collation of the SOC, OBC, POBC and FBC. |
| Transport Modelling | Steer (subcontractor to WSP) | Undertaking of the transport modelling process including all sensitivity tests and production of the Evidence Reports T1-T4 and the Analytical Assurance Statement. |
| Air Quality Modelling | Air Quality Consultants | Undertaking of the air quality modelling process including all sensitivity tests and production of the Evidence Reports AQ1-AQ3 and the Analytical Assurance Statement. |
| AirViro modelling | WSP | Undertaking of the AirViro modelling of the sensitivity tests and production of the gridded outputs required for the Health Impact Analysis. |
| Business Case production and technical support | Jacobs | Production of the Strategic, Economic, Financial and Commercial Cases of the business case. Also responsible for undertaking the Integrated Impact Assessment and for the production of the Evidence Reports E1-E3. |
| Additional Measures selection | WSP | Undertaking the long list short list process to select the proposed package of additional measures. |
| Consultation | Turner & Townsend and Pell Frischmann | Turner & Townsend were appointed to Project Manage the consultation process. Pell Frischmann were appointed to provide technical and logistical support throughout the consultation. |
| Procurement | Jacobs | Preparation of a Procurement Strategy for the CAZ D and authority of contractual documentation for the 'Civil Engineering' works Main |

| | | |
|---|---|---|
| | | Contractor. |
| Outline Design | Jacobs | Production of an outline design for the CAZ D including initial site surveys, location identification and quantification of the CAZ signs and cameras. |
| Legal services | Bircham Dyson Bell | Drafting of the CAZ Order which will be used to enforce the charging of the CAZ. |
| Delivery | Various | A variety of contractors and consultants will be appointed to deliver the implementation phase of the CAZ. Procurement routes are set out in section XX of the Commercial Case. |

### 5.9 Mitigation Measures and Exemptions

The POBC presented a proposed set of Mitigation Measures and Exemptions which was subject to finalisation following completion of modelling activities which were still in progress at the time of writing. This FBC presents the final set of Mitigation Measures and Exemptions which are being put forward by the City Council for approval by Government, full details can be found in the Clean Air Fund Report. The final set of Mitigation Measures and Exemptions being proposed have been selected following a long list/short list process against a set of primary and secondary critical success factors. The viability and suitability of the measures was then confirmed by running them through the air quality, transport, economic and financial models.

Whilst the Mitigation Measures and Exemptions are grouped together in this section of the FBC it should be noted that the delivery of each will follow distinctly different routes. Due to the nature of the Mitigation Measures, an individual delivery plan is being worked up for each of the measures which will involve various procurement activities, stakeholder engagement and interfaces with numerous departments in the City Council. The Mitigation Measures being proposed and their respective delivery plan are summarised in the followig pages.

#### 5.9.1 Mitigation Measures

Table 5.7 Mitigation measure summary

| Ref | Measure | Summary |
|---|---|---|
| M1a | Mobility support or individuals working within the CAZ. | Individual can access the choice of a £1000 mobility credit offered in form of SWIFT travel card or a £2,000 package (Swift credit or contribution to compliant vehicle) in return for scrapping a non-compliant vehicle |
| M1b | Mobility support for individuals who reside outside of the CAZ | With evidence of scrapping a non-compliant car individual receives either:<br>• £2,000 cash payment toward the purchase of a compliant car (not eligible for PiCG).<br>• £2,000 mobility credit. Credit to be supplied on a SWIFT card with no expiration for use. |
| M2a | Hackney carriage support package | Drivers offered £5,000 as:<br>• support payments to be paid towards operational expenses of ULEV vehicles (4 annual instalments of £1,250)<br>• support for an LPG retrofit of their current or newly purchased vehicle |
| M2b | Council Hackney carriage leasing scheme | BCC bulk purchase 50 ULEV taxis through public procurement tender and lease them to the drivers who are most vulnerable as well as on a try-before-you-buy basis |
| M2c | Private Hire Vehicle (PHV) upgrade support | Private hire vehicle owners who upgrade to a compliant vehicle where the priority will be beyond the minimum BCC's 2020 licencing criteria i.e hybrid or ultra-low emission vehicles. |
| M3 | 'Free miles' for ULEV LGVs | ULEV van drivers receive £1000 credit to spend on BCC public charging network |
| M4 | HGV & Coach compliance fund | Fleets compete for £15,000 funding package to contribute towards:<br>• Installing a retrofit solution<br>• Upfront or lease costs of a compliant vehicle |
| M5 | Marketing and engagement campaign | Marketing and engagement campaign to provide information on the CAZ and reach out to groups eligible for support through mitigation measures |
| M6 | Residents parking scheme | Implementation of residents parking schemes to prevent overcrowding on margins of CAZ; will be deployed only if issues arise |

The CAF Report provides details of the delivery plan for each mitigation measure, also summarised below:

M1a - Mobility support or individuals working within the CAZ:

- Target groups will be communicated with via the City Councils marketing campaign, contacting individuals either directly or indirectly. Applicants who believe themselves to eligible for the mitigation measure would then inform their employer.
- Their employer will then register the company/business via an online application portal submitting evidence of the company's registration. The employer will then submit details of each of their employees who is eligible for the mitigation measure, providing validation of their income.
- The City Council will then undertake a validation exercise of each applicant's submission, making a determination on whether they are eligible for the mitigation. Those deemed eligible will then be contacted and given the choice as to whether they want to take up the offer of £1,000 SWIFT credit or if they want to scrap their non-compliant vehicle.
- For those who choose to take up the £1,000 SWIFT credit; the individual will be required to register for a SWIFT account, the City Council will then be notified by TfWM and subsequently apply the appropriate credit to that individuals account.
- For those who choose to scrap their non-compliant car; a certificate of destruction must be provided to the City Council as part of the application process.
- For those who opt for the £2,000 credit on a Swift card, they will apply in the same manner as described above. For those who chose to purchase a compliant vehicle at a discounted price, the individual will provide the council with proof of purchase plus the certificate of destruction for their non-compliant car and the council will reimburse them for the purchase.
- Where the individual does not have the upfront capital to purchase the vehicle, the council will set up agreements with second hand dealerships where individuals can take their non-compliant vehicles. The second hand dealerships will then scrap the car and provide a discount to the individual on their purchase of a compliant vehicle.

M1b – Mobility support for individuals who regularly enter the CAZ

- Individuals will register themselves for application in the same manner as in M1a, successful applicants will be prioritised based on their distance from the CAZ (closest being high priority).
- Successful applicants will then be eligible for a scrappage scheme identical to that described above for M1a (the option for £1,000 Swift credit is not available under M1b).

M2a – Hackney carriage support package/M2b – Council hackney carriage leasing scheme: delivery plan to vary depending on whether the driver is requesting funds for a retrofit technology or for offsetting the costs of a ULEV vehicle:

- Retrofit technology: registration for the scheme will be up to the responsibility of the driver, who will submit their details and book a slot for the retrofit to be carried out; £5,000 will then be deducted from the total cost. Details of the retrofit must then be provided to the City Council to enable them to licence the taxi.
- Operational finance package for ULEV vehicles: any driver who purchases a ULEV Hackney carriage post September 2018, will be eligible for reimbursement. Proof of purchase must then be provided to the City Council who will validate with the manufacturer and upon successful validation will make four consecutive annual payment s for £1,250 to the driver.

M2c – Private Hire Vehicle upgrade support : the delivery plan for this mitigation measure is as follows:

- Drivers will register their interest in the scheme with the Council's licencing team. To register they will be required to contact the licencing department directly and verify that they are a licenced PHV driver with a non-compliant vehicle currently licenced by the Council as a PHV since at least September 2018.
- Once the information has been verified and approved the individual will be given confirmation that they have been accepted onto the funding scheme. The Council will keep a database of approved drivers as well as a record of their current non-compliant vehicle.

- After receiving approval, the individual will then purchase a vehicle which meets the criteria of the funding award. The vehicle must be; CAZ compliant, under 3 years of age in January 2020 and comply with all other council PHV licencing conditions. Aside from this, the individual is free to choose the vehicle of their choice.
- The individual will then provide proof of vehicle upgrade to the council, this will either be in the form of a valid sales receipt or alternately a leasing contract.
- The council will validate the evidence to ensure the new vehicle meets all the funding requirements and once this has been confirmed will provide a £2,000 funding award to the individual.

M3 – 'Free miles' for ULEV LGV's

- Any 'plug in' van will be eligible for the scheme, once the vehicle is purchased the driver must submit their details and proof of purchase to the City Council. They will then be provided with a reference code to register with the EV network provider who will issue the credit amount to their account, credit which can be used anywhere on Birmingham's EV network

M4: HGV and coach compliance:

- Stage 1: A targeted marketing and communications scheme will be undertaken to ensure that all fleets are aware of the funding which is on offer and the requirement on them to register themselves.
- Stage 2: As only a limited amount of funding is available, the funding will be granted following a competition which will be run by the BCC procurement team who have experience in writing and designing funding assessments.
- Stage 3: the funding will be awarded with an expiration date of January 2021 and the retrofit technology or the purchase/lease of a compliant vehicle be allowed to be implemented at any point in this time frame.

M5 – Marketing and engagement campaign:

- Funding has already been secured for this scheme and suppliers identified to undertake the marketing campaign which is planned to launch in October 2018 and will continue until December 2019. The intention is for the City Council to provide updates and information in relation to the implementation of the CAZ and/or the mitigation measures.

M6 – Residents parking scheme

- Residents in the immediate surrounding area of the CAZ will be able to raise concerns about increased volumes of cars parking in residential areas using established forums for raising concerns.
- Concerns will be monitored by the City Council and action taken on a needs basis, i.e. when the volume of concerns being raised reaches a suitably high threshold consideration will be given as to whether a residents parking scheme is required.

### 5.9.2 Exemptions

The Exemptions which are being offered are detailed in the table below.

| Target Group | Exemption | Duration |
|---|---|---|
| Commercial Vehicles registered within the CAZ | LGV/HGV/Coaches registered within the CAZ will receive an exemption (max 2 vehicles per company). | 1 year |
| Commercial Vehicles with an existing finance agreement | LGV/HGV/Coaches registered in the Birmingham City area travelling to the CAZ with an existing finance agreement beyond 2020 (max 2 vehicles per company). | 1 year |
| Residents of the CAZ (private vehicles registered within the CAZ). | Private non-compliant vehicles registered within the CAZ will be exempted. | 2 years |
| Individuals travelling into | Individuals with non-compliant vehicles | 1 year |

| | | |
|---|---|---|
| the CAZ for work. | registered outside of the CAZ who travel into the CAZ for work and who meet the income criteria will be exempted. | |
| Hospital visitors | Visitors to select hospitals in the CAZ, GP offices and care homes. | Duration of their stay. (Exemption will run for a 1 year period) |
| Community and schools and disabled vehicles. | Vans and mini buses registered as providing essential community and school transport services and those classified as section 19 operators, registered for operation in Birmingham. | All years |

*5.9.2.1* Process overview

The package of exemptions being proposed will be offered to a number of target groups (above) who have been identified as those who will be most significantly impacted by the introduction of a CAZ. A person who believes that they are part of one of the target groups and therefore qualifies for an exemption must apply by submitting their personal details and a package of evidence which proves their eligibility. The application and evidence pack will then be assessed by the City Council against a set of fixed criteria and exemptions will be granted as required.

Details of those qualifying for an exemption will be entered into a database which will form the local 'whitelist'. A whitelist is a database containing data which is considered to be allowable under a particular set of criteria, the opposite of a blacklist. In this case the whitelist will be populated with the details of all of the exempt people and their vehicle details. This whitelist will then be used as an input to the enforcement solution being developed for the CAZ, which will assign each vehicle on the whitelist with a virtual permit. The enforcement solution will be integrated with the ANPR cameras, so that a check of each licence plate captured on camera against the whitelist will be done in 'real time' at source. Where the camera check finds a permit against the vehicle no action will be taken and the vehicle will pass through the CAZ free of charge. Any vehicles which aren't on the local whitelist and therefore are not exempt will follow the process set out in Section 5.10.

*5.9.2.2* Application requirements

The documents that will be required for each exemption are listed below, this is a provisional list and subject to further review.

| Exemption | Documents requested |
|---|---|
| E1 + E3: Commercial vehicles in CAZ | Proof of company registration: company number<br>Proof of vehicle ownership: vehicle registration document(s)<br>Proof of address within the CAZ: building lease agreement or land register |
| E2 + E4: Commercial vehicles with finance | Proof of company registration: company number<br>Proof of vehicle ownership: vehicle registration document(s)<br>Proof of address within the CAZ: building lease agreement or land register<br>Proof of finance agreement: finance/lease agreement document |
| E5: CAZ residents | Proof of address: utility bill, council tax or bank statement<br>Proof of vehicle ownership: Vehicle registration document (V5) |
| E6: CAZ workers | Proof of company registration: company number<br>Proof of company address within the CAZ: building lease agreement or land register<br>Proof of vehicle ownership: vehicle registration document (v5)<br>Proof of individuals address: utility bill, council tax or bank statement<br>Proof of individual's income: P60 or pay slips<br>Confirmation that vehicle is primary method of individuals |

| | |
|---|---|
| | commute |
| E7: Residents outside CAZ | Proof of vehicle ownership: vehicle registration document (v5)<br>Proof of individuals address: utility bill, council tax or bank statement<br>Proof of individual's income: P60, pay slips, housing benefits ID, jobs seeker allowance id |
| E8: Hospital visitors | Treated separately |
| E9a: Community and school | Proof of vehicle ownership: vehicle registration document<br>Proof of eligibility: valid section 19 permit |
| E9b: Disabled vehicles | Registration process is to be defined. |

The exemptions for hospital visitors will be treated separately as the exemption is not for a fixed period of time but is over a short flexible time period covering the duration of their visit. This will be operated by the council in conjunction with hospital staff. On their visit to the hospital, upon proving a valid purpose for their visit, individuals can request a code from hospital staff which can then be used on the online portal to provide the individual an exemption. The code will have a time period associated with it, so a long-term visitor will only have to provide the code once and will be given an exemption for the duration of their visit.

#### *5.9.2.3* Marketing and communications

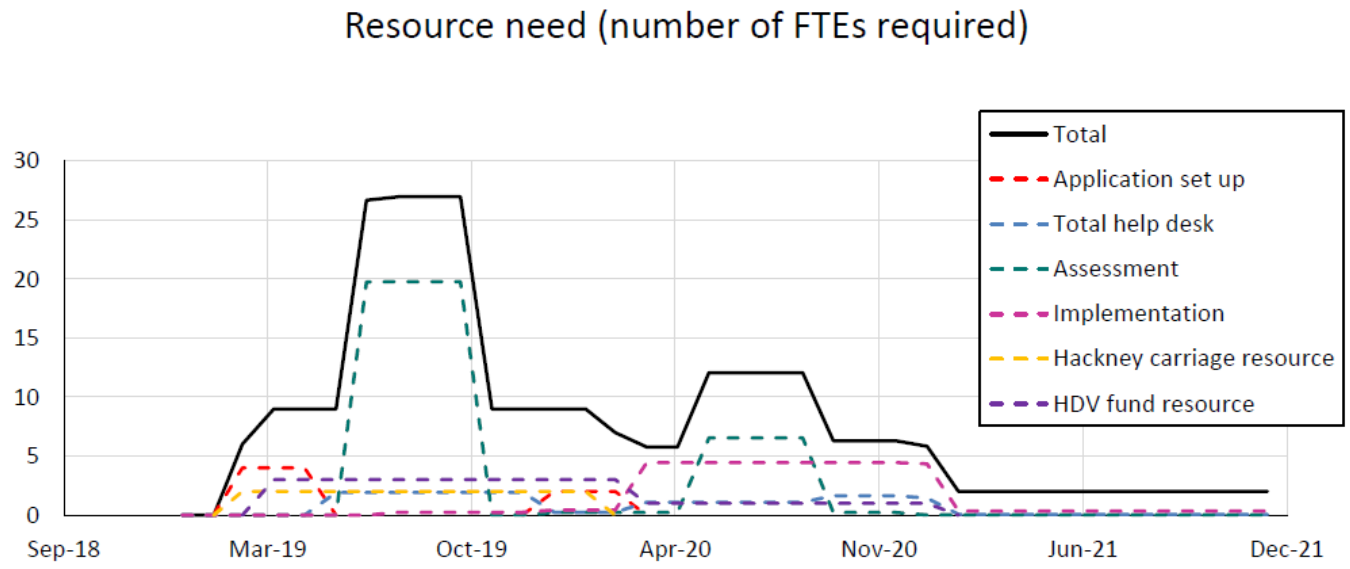
The bulk of the marketing and communication related to exemptions will be delivered through the CAF mitigation measure; 'M6: Marketing and engagement campaign'. The purpose of this campaign will be to ensure that all eligible individuals and business are aware of the exemptions and the application process and timelines. The table below shows the communication channels that will be used to contact eligible individuals and businesses for each exemption.

| Communication channels | Exemption |
|---|---|
| Business engagement through Birmingham Connected Business Travel Network | • E1 + E3: Commercial vehicles in CAZ<br>• E2 + E4: Commercial vehicles with finance |
| Stakeholder events | • E1 + E3: Commercial vehicles in CAZ<br>• E2 + E4: Commercial vehicles with finance |
| Physical outdoor advertising | • E1 + E3: Commercial vehicles in CAZ<br>• E2 + E4: Commercial vehicles with finance<br>• E6: CAZ workers<br>• E7: Residents outside CAZ |
| Online advertising | All |
| Social media | All |
| Community engagement | • E6: CAZ workers<br>• E7: Residents outside CAZ |
| Community events | • E6: CAZ workers<br>• E7: Residents outside CAZ |

### **5.9.3** Mitigation Measures and Exemptions – delivery team

The City Council are proposing to establish a CAZ management team who will be responsible for the delivery, management and administration of the mitigation measures and exemptions. The team will be required between February 2019 and December 2021, with a core team of 10 people required for the majority of the overall duration. The resource profile is set out below. The team will consist of a combination of management and

administration employees although there will be a higher proportion of administration staff, particularly during the peak time.




The team outlined above will undertake duties which include:

- Data collection and collation;
- Data verification and validation;
- Data input into the enforcement software;
- Managing and responding to queries raised by applicants;
- Routine maintenance of the data;
- Interfacing with other City Council teams and relevant stakeholders.

The 'team' set out above will be responsible for the delivery of the mitigation measures however, as stated in Section 5.9 the delivery of the package of exemptions differs from the mitigation measures. Whilst the 'team' will be responsible for managing the application process for the exemptions, once the data has been collected and successful applicants entered into a database the list of those exempt must then be passed to the enforcement team who will be responsible for administering the enforcement solution, see Section 5.10.

### 5.10 Operations

Upon successful completion of the implementation phases of the programme, the CAZ will transition into operations and enforcement and the CAZ will become live. The FBC which was submitted in September 2018 presented three potential options for the operation of the CAZ charging and enforcement infrastructure. Since FBC submission some further work has been undertaken to firm up the operating methodology, the final proposal is illustrated in the process map on the following page and described below.

In essence, the system will operate in the following way;

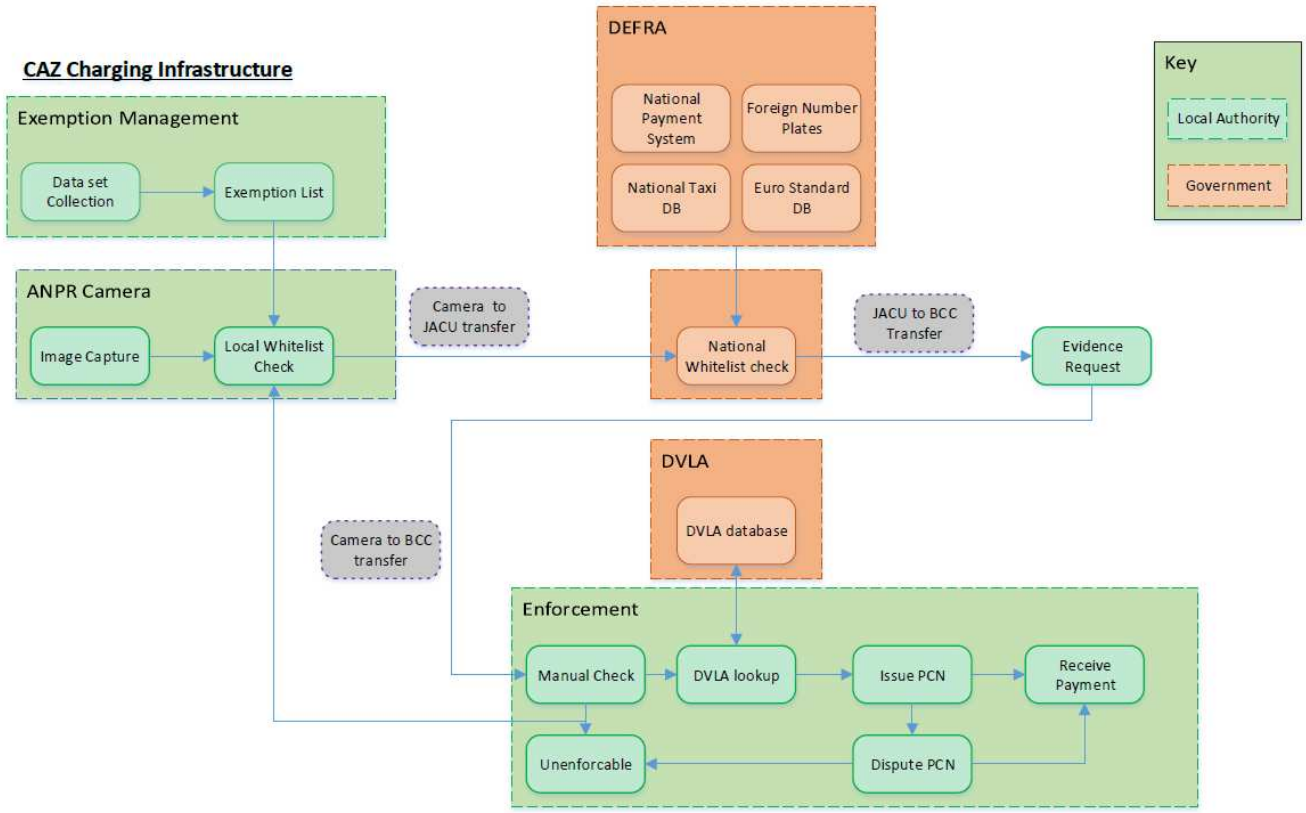
1. The City Council will be responsible for the collection of data for those people who are eligible for an exemption (see Section 5.9.2) at a local level and a whitelist will be populated accordingly. The whitelist will be read by the ANPR cameras, at source, discounting all of the locally exempt vehicles and taking no further action;
2. A list of all of the vehicles which do not appear on the local whitelist will be compiled periodically (frequency to be confirmed, likely to be once per day). This list of non-exempt vehicles will be sent to the central Government processing system as a package of data, again the periodicity of this transfer is yet to be confirmed with Government;
3. The central Government processing system will perform the required database look-ups to confirm whether payments have been received where they are due and then a second exemption check will be

performed however this time against a national whitelist. The national whitelist is being compiled from various databases such as the DVLA link to the euro emissions data base, the national low emission taxi data base and a data base of foreign number plates. The output from this central Government processing system will be a list of vehicles who are not exempt at either a local or national level and have failed to make the required payment. This list will then be sent back to the City Council for action;

4. The City Council will be responsible for enforcing the failed payment which will be done via their supplier 3Sixty who currently provide enforcement services on similar schemes. In the first instance, a request for the missed payment will be requested within a set period of time (timeline to be confirmed). Should the offender fail to make the required payment they will be issued with a Penalty Charge Notice (PCN) with details of the fine which must be paid.

There may be some overlap between the duties of the team set up to manage the application process of the exemptions and that of the team responsible for managing the operations. This will be coordinated by the City Council and outsourced where suitably qualified and experienced personnel cannot be identified within the City Councils staff.

City Council Charging System Proposal




## 5.11 Maintenance

A number of assets will be delivered by the CAZ Programme, as such, maintenance of these assets will be required both on a preventative and corrective basis. At this stage the delivery of maintenance is still being finalised however the below detail summarises what are currently the preferred options for each asset type:

- Signs: The City Council have an existing Private Finance Initiative (PFI) with their supplier Amey, for the maintenance of certain highways assets, this includes signs as a standard item. As such, the City Council propose to vary the PFI to increase the number of signs covered to include those being delivered by the CAZ, the maintenance regime which is currently in place would therefore apply to the CAZ signs.

- ANPR Cameras: Unlike signs, ANPR Cameras are not covered under the Amey PFI, therefore the City Council plan to set up a service and maintenance contract with the supplier of the ANPR Cameras;
- Camera poles and power supplies: At present there are two options for mounting the ANPR cameras; (1) the cameras will be mounted on existing lighting columns or (2) new poles will be erected for the camera mounting; to be confirmed during the detailed design phase. The maintenance will be dependent upon the option chosen;
  - Option 1 – An electrical contractor is under contract to provide service and maintenance. This contract would be varied to include any additional hardware which is required for the CAZ ANPR cameras;
  - Option 2 – A separate SLA would be set up with an appropriately qualified electrical contractor for the service, testing and maintenance of the new poles and power supplies;
- Back office charging system: the maintenance of the software and hardware components of the charging system will be undertaken by the supplier of the equipment. Service Level Agreements will be put in place with the supplier(s) of the equipment and managed by Capita ICTDS.

## 5.12 Monitoring and Evaluation

A monitoring and evaluation plan has been drawn up to support the implementation of the CAZ and the evaluation of the project post completion. Birmingham has an existing network of monitoring stations to monitor traffic data and air quality. This existing network will be supplemented with new monitoring stations to ensure that a robust data set is maintained. Monitoring will be undertaken throughout the implementation phase of the project to assess the impact of the work being carried out and also to establish whether there is any early behaviour change.

The post project evaluation will establish whether Birmingham achieves compliance with the air quality targets, this will be demonstrated through data averages covering the period January 2020 to December 2020 using the monitoring outlined in the Economic Case. During the ten year appraisal period benefits are anticipated to continue increasing post implementation as modal shift occurs and modern, less polluting, vehicles and technologies become more prevalent. See Appendix 5D for the full monitoring and evaluation plan.

The direct post project evaluation is expected to be undertaken in January 2021 to reflect on the completed implementation and benefits realisation period covering January 2020 to December 2020. The scope of this evaluation will be in line with HMT Magenta Book, which sets out criteria for evaluation, encompassing examination of benefits realisation, actual cost comparison against planned, lessons learnt throughout project delivery and any opportunities to increase the CAZ benefits through further works.

Table 5.8 Benefit and Evaluation Criteria

| Benefit | Evaluation Criteria |
|---|---|
| Reduced impact on human health | Measured through improved health outcomes and reduction in health expenditure (e.g. hospital admissions, mortality impacts and chronic bronchitis impacts) |
| Increased productivity | Evaluated through work absenteeism caused by ill health |
| Reduced damage on built environment | Measured by surface cleaning costs and amenity costs |
| Improved journey times for both private and public transport due to reduction of traffic load and consequently more reliable PT services. | Measures by assessing journey times against baseline for both public and private journeys. |
| Increased travel by sustainable modes such as walking, cycling and public transport | Evaluated through questionnaires and comparisons with baseline data |
| Reduction in accident rates on the roads | Quantifiable data available from police records against baseline. |
| Reinvestment in local transport policies which aim to improve air quality and support the delivery of the plan. | Evaluation of new schemes and initiatives post implementation. |

# 6 Appendices

## Appendix 1A CSF and High Level Appraisal of Options

### Critical Success Factors and High Level Appraisal of Options against Critical Success Factors

#### Introduction

This appendix:

- identifies the longlist of options that have been considered to reduce the specific sources of local exceedances of NO2 concentrations in Birmingham;
- lists the Critical Success Factors which have been used to appraise the longlist of alternative options; and,
- Describes the assessment that has been undertaken to date to reduce the longlist of options to a shortlist of options, for detailed appraisal in the Preferred Option Business Case.

#### Longlist of Options

The longlist of options is set out in Table 6-1. The longlist of additional measures (104 in total) is set out in Table 1 (p3-26) of the "Birmingham Clean Air Zone Feasibility Additional Measures Study."

Table 6-1 Longlist of Options

| Option | | Commentary |
|---|---|---|
| L1 | Do Minimum | Baseline option to demonstrate why taking action is necessary |
| L2 | Class A Clean Air Zone (CAZ A) | A charging CAZ A<br>Class A vehicles (Buses, coaches, taxis and private hire vehicles) that do not meet Euro emission standards would be charged. |
| L3 | Class B Clean Air Zone (CAZ B) | A charging CAZ B<br>Class B vehicles (Class A plus Heavy goods vehicles (HGV's)) |
| L4 | Class C Clean Air Zone (CAZ C) | A charging CAZ C<br>Class C vehicles (Class B plus Large vans, minibuses, small vans/light commercials) that do not meet Euro emission standards would be charged. |
| L5 | Class D Clean Air Zone (CAZ D) | A charging CAZ D<br>Class D vehicles (Class C plus cars) that do not meet Euro emission standards would be charged. |
| L6 | Non charging CAZ -with additional measures | A non-charging CAZ with additional measures |
| L7 | Class A Clean Air Zone (CAZ A) - with additional measures | A charging CAZ A with additional measures |

| Option | | Commentary |
|---|---|---|
| L8 | Class B Clean Air Zone (CAZ B) - with additional measures | A charging CAZ B with additional measures |
| L9 | Class C Clean Air Zone (CAZ C) - with additional measures | A charging CAZ C with additional measures |
| L10 | Class D Clean Air Zone (CAZ D) - with Additional Measures | A charging CAZ D with additional measures |

It is clear from Table 6-1that three broad types of options have been identified:

- 4 charging CAZ options (class A, B, C and D);
- 4 packages of options, with additional measures considered in conjunction with a CAZ scheme (class A, B, C and D);
- a non-charging CAZ with a package of measures.

**Additional Measures: Option Generation**

In order to identify measures that could be considered in conjunction with a CAZ to achieve compliance, a desk top study was undertaken to review existing evidence on local, regional and national measures to improve air quality. In addition, BCC, Transport for West Midlands and key experts from Birmingham CAZ work streams were consulted to identify further measures to take through an initial sifting process. This generated a total of 104 potential options (as noted above, these measures are set out in Table 1 of the "Birmingham Clean Air Zone Feasibility Additional Measures Study").

**Critical Success Factors**

The Critical Success Factors that have been used to evaluate the long-list of options and additional measures are set out, together with details on how each CSF is considered and scored.

**Primary (Pass/fail) Critical Success Factor (CSF)**

The primary CSF is:

- CSF1 Compliance: Deliver a scheme that leads to compliance with NO2 concentration limits (annual mean NO2 concentration of 40µg/m2) in the shortest possible time.

Assessment against the primary CSF only has two outcomes: pass or fail. Following JAQU guidance, all options that fail to meet the primary objective will be rejected.

This CSF directly supports Spending Objective SO1 (set out in section 1.5.1).

Key questions that were asked in the case of additional measures include:

- **CSF1.1** Is the measure likely to materially contribute to achieving compliance?
- **CSF1.2** Is the measure already being applied on a local, regional and/or national basis?
- **CSF1.2i** If 'Yes'; can it be up scaled and accelerated?
- **CSF1.2ii** If 'No'; is the option viable given the timeline for compliance?
- **CSF1.2iii** If 'No', is the option viable post 2020?

Only measures and packages of measures that are likely to lead to compliance as quickly as possible have been accepted. Options that are not expected to deliver compliance in the same calendar year as the fastest combination of options have been rejected.

Secondary Critical Success Factors

Options that meet the Primary Critical Success Factor will be considered against the following secondary CSFs:

- **CSF2 Value for money:** This CSF considers the full range of costs and benefits to society of the proposed option (such as the health benefits of improved air quality and the costs to the public in complying with a measure) rather than just looking at the financial impacts to determine if the measure is viable within an economic context. Key questions to consider include:
- **CSF2.1** Do the likely overall benefits to society of this option exceed the overall costs to society?
- **CSF2.2** Has the option been designed to deliver effectively while maximising benefits and minimising cost?
- This CSF directly contributes to Spending Objective SO2 (see section 1.5.1).
- **CSF3 Evidence based:** This CSF considers to what extent, the case for an option is based on real-time local evidence of air quality, emission sources, and levels of air pollution in Birmingham or in specific pollution hotspots, and (where applicable) the potential benefits and impacts are capable of being modelled. Key questions to consider include:
- **CSF3.1** Is the need and the likely contribution of this option based on real-time local evidence of air quality, emission sources, and levels of air pollution in Birmingham or in specific pollution hotspots?
- **CSF3.2** Can the option be represented within the CAZ traffic and air quality modelling in order to assess the benefits and impacts**?**
- This CSF directly contributes to Spending Objective SO3 (see section 1.5.1)
- **CSF4 Distributional impacts:** This CSF considers the potential impacts on key groups of the proposed option, in order to determine whether there is likely to be a disproportionate impact on one or more particular groups. Key questions to consider include:
- **CSF4.1** Is the option likely to be acceptable within a social context?
- **CSF4.2** Does the option significantly affect one or a number of particular groups of stakeholders?
- **CSF4.3** Is there potential to insure some groups or provide mitigation against the detrimental impacts of this option?
- **CSF4.4** Does this measure protect and enhance social equality?
- This CSF directly contributes to Spending Objective SO4 (section 1.5.1).
- **CSF5 Strategic and wider air quality fit:** This CSF considers how the proposed option interacts with other local policies already in place, in particular the transitioning to a low emission and healthier economy by 2030Key questions to consider include:
- **CSF5.1** Does the option fit and/or complement other existing and planned policies?
- **CSF5.2** How does the option affect overall exposure and to what extent does it reduce overall exposure?

- **CSF5.3** Does the option permit sustained improvement to human health within short timescales?
- **CSF5.4** Does the option support the promotion of a low emission economy?
- **CSF5.5** Does this option facilitate local growth and ambition?
- This CSF directly contributes to Spending Objective SO5 (section 1.5.1).
- **CSF6 Supply side capacity and capability:** This CSF considers whether or not there is sufficient commercial capacity or capability in the supply chain to successfully deliver the proposed option and whether or not this is available. This CSF reflects the considerations made in the Commercial Case. Key questions to consider include:
- **CSF6.1** Are there capable suppliers or contractors available to provide the required services or facilities required by this option?
- **CSF6.2** Is there a sufficiently well-developed market to support the efficient delivery of the option?
- **CSF7 Affordability:** This CSF considers if this option can be delivered given the potential resources available (for example staffing levels) and management structures in place as outlined in the management case. This CSF reflects the considerations made in the Financial Case. Key questions to consider include:
- **CSF7.1** Is this option likely to be financially viable?
- **CSF7.2** Is the option likely to be affordable in both the short and long run in comparison to other options considered?
- **CSF8 Achievability:** This CSF considers if this option can be delivered given the potential resources available (for example staffing levels) and management structures in place as outlined in the management case. This CSF reflects the considerations made in the Commercial and Management Cases. Key questions to consider include:
- **CSF8.1** Can the option be delivered on a local scale?
- **CSF8.2** Can this option be targeted geographically?
- **CSF8.3** Given market limitations, are adequate resources available (currently or can be obtained in sufficient time) to manage and implement such an option successfully?
- **CSF8.4** Is the option based on proven / existing technology?

The Critical Success Factors largely reflect the CSFs suggested by JAQU. However, some of the secondary CSFs and the key questions have been modified to reflect the criteria adopted in the initial sifting of additional measures and the second phase of appraising additional measures. In the initial sifting process, for example, each potential additional measure was assessed against the following criteria:

- **CSF1.1** Is the measure likely to materially contribute to achieving compliance?
- **CSF1.2** Is the measure already being applied on a local, regional and/or national basis?
- **CSF1.2i** If 'Yes'; can it be up scaled and accelerated?
- **CSF1.2ii** If 'No'; is the option viable given the timeline for compliance?
- **CSF1.2iii** If 'No', is the option viable post 2020?
- **CSF4.1** Is the option likely to be acceptable within a social context?

The more detailed second phase of appraising additional measures identified and used the following criteria to appraise each option:

- CSF3.2 Representation within CAZ traffic and air quality scenarios modelling;
- CSF5.3 Sustained improvement to human health within a short timeline;

- CSF8.2 Ability for measure to be targeted geographically;
- CSF5.4 Promotion of a low emission economy;
- CSF5.5 Facilitate local growth and ambition;
- CSF4.4 Protect and enhance social equality;
- CSF7.1 Financial viability.

In addition to the criteria, each measure underwent an appraisal to determine if any of the following anticipated category responses – in terms of traffic flow and vehicle use – are applicable:

- Reduce – reduce congestion, remove traffic from the network or links;
- Shift – encourage modal shift;
- Improve – encourage transition to cleaner vehicles.

Appendix A1 illustrates the relationship of the CSFs to the Spending Objectives (section 1.5.1) and the initial sift, and multiple criteria analysis, assessment criteria.

**Scoring System**

The options presented in Table 6-1 will be assessed against the CSFs according to the scale presented in Table 6-2.

Table 6-2 Scoring criteria for Options

| | | |
|---|---|---|
| **Primary (Pass/ Fail) CSF** | P | Pass |
| | F | Fail |
| **Secondary (Scored) CSF** | ✓✓ | Excellent |
| | ✓ | Good |
| | - | Satisfactory or no score |
| | × | Poor |

An alternative scoring system has been developed and applied to appraise and rank the performance of additional measures, as detailed in Table 6-3. This scoring method focuses on the potential of a measure to contribute to the primary objective, whilst preserving and/or promoting the other criteria. Therefore, a positive potential score indicates that a particular measure in question is considered to have a higher potential in terms of upholding the criterion and contributing to the primary objective versus the other measures being assessed. The opposite is true for a negative score.

Table 6-3 Option appraisal scoring against MCA framework criteria

| Score | Potential to uphold respective criterion and contribute to primary objective |
|---|---|
| +3 | Large positive potential |
| +2 | Medium positive potential |
| +1 | Small positive potential |
| 0 | Neutral |
| -1 | Small negative potential |
| -2 | Medium negative potential |
| -3 | Large negative potential |

Assessment of the Long-list of Options Using the CSFs

The assessment that has been conducted to date has involved:

- Undertaking detailed traffic and air dispersion modelling to determine if the introduction of a 'class C' or 'class' CAZ scheme in Birmingham would be sufficient to pass the primary CSF; and
- A detailed and rigorous appraisal of additional measures.

**CAZ Options**

The initial traffic and air quality modelling that has been undertaken by BCC to date, has demonstrated that implementation of a charging 'class C' or 'class D' Clean Air Zone (CAZ), would be insufficient to pass the project's primary CSF.

Under a class C CAZ, exceedances are still predicted to occur on the A38 and ring road. It is estimated that additional reductions of up to 11% and 31% would be required, outside and inside the CAZ, respectively, to achieve compliance. Even if all the vehicles restricted by 'category C' which entered the zone had a compliant engine, the levels of NO2 would still be too great. This reflects the fact that over 80% of the vehicles entering the CAZ area are private cars (or private hire vehicles) and these are not restricted by a CAZ C scheme.

Under a class D CAZ (where non-compliant cars are subject to charging), concentrations of NO2 reduce by an additional 1.5 µg/m3 inside the CAZ, with a medium charge, and by 1.8 µg/m3 for a high charge, beyond the CAZ C high scenario. There are still places, however, where the legal limits are predicted to be exceeded on the A38 and ring road. It is estimated that additional reductions of up to 9% and 19% are required, outside and inside the CAZ, respectively, to remove these exceedances.

Although a CAZ 'A' and CAZ 'B' scheme have not been explicitly modelled, it is clear that if a 'class C' or 'class D' CAZ would be insufficient to ensure compliance, then a CAZ 'A' or CAZ 'B' scheme would also be insufficient.

Options L2 - L5 in Table 6-1 have therefore been rejected.

**Appraisal of Additional measures**

The appraisal of additional measures has been delivered in 3 phases:

- Phase 1 involved assessing the longlist of additional measures (104 in total) against some high-level criteria to eliminate those that clearly do not contribute to the Critical Success Factors. A total of 31 options were identified within the context of contributing to the primary objective;
- Phase 2 involved developing and applying a Multi Criteria Analysis (MCA) framework to rigorously appraise each option taken forward from Phase 1 to identify those that should be taken forward for further development. This involved assessing each option against multiple criteria and scoring each measure. A measure scoring +10 ('medium positive potential) was recommended to proceed to Phase 3. Also each measure had to achieve a positive score on two criteria (i.e. potential impact on human health and ability to be represented within quantitative traffic and air quality modelling). In addition to these determinants, extra weight was given to those measures which are more likely to have an impact across at least one more category response themes (i.e. reduce/shift/improve). A total of 18 options were recommended for further development in Phase 3. The outcomes of the MCA appraisal and associated justification for the scores assigned to each measure, are summarised in Table 3 of "Birmingham Clean Air Zone Feasibility Additional Measures Study". In addition, this study identifies a further 14 additional measures that have the potential to contribute to further improving air quality post 2020 in support of the wider spending objectives and local air quality policy. These are presented in Table 4 of the aforementioned study;
- Phase 3 involved considering whether traffic and air quality modelling approaches could be developed for the selected measures to determine the potential for measures to be represented within the respective CAZ modelling scenarios. This resulted in a shortlist of 11 additional measures/packages of measures to be taken forward for quantitative traffic and air dispersion modelling.

Shortlist of Options

The shortlisted packages of options from Table 6-1 are presented in Table 6-4.

Table 6-4 Shortlisted Options

| **Shortlisted Options** | **Commentary** |
|---|---|

| | | |
|---|---|---|
| 1. | Class C Clean Air Zone (CAZ C) - with additional measures | A charging CAZ C |
| 2. | Class C Clean Air Zone (CAZ C) - with additional measures | A charging CAZ C with additional measures |
| 3. | Class C Clean Air Zone (CAZ D) | A charging CAZ D |
| 4. | Class C Clean Air Zone (CAZ D) - with Additional Measures | A charging CAZ D with additional measures |

The shortlist of additional measures for further consideration, as part of the above CAZ options, are:

- Increase LPG refuelling for Hackney Carriages, the installation of rapid EV infrastructure for taxi and private hire vehicles, retrofitting of black taxis to LPG and zero emission buses/retrofitting of public transport fleet;
- Parking Strategy – remove free parking, parking charging and permits graded by vehicle standard or zone charges;
- Speed Enforcement – average speed enforcement along the A38 and near Dartmouth Circus to manage traffic and smooth flows;
- Speed reduction – reduce speed limits on certain routes and use variable speed limits
- Public Transport Improvement Measures - Highway/infrastructure improvements to bus services to make them more viable and accessible to the public and increase bus priority schemes, restrict traffic on Moor Street Queensway to bus, taxi and cycle only and close Park Street to all traffic;
- Incentivise or subsidise sustainable travel by up to 50% to improve public transport patronage;
- Ban the route of traffic travelling northbound on Suffolk Street Queensway that exits onto Paradise Circus to then Access Sand pits parade;
- Ban the route of traffic travelling northbound on Suffolk Street Queensway that exits onto Paradise Circus and St Chads;
- Close junction on Dartmouth Middleway between Lister Street and Great Lister Street to avoid stop start traffic and reduce congestion;
- Re-signing and rerouting scheme for the A38 and banning all through traffic (and HGVs only) on the A38 around Paradise Circus diverting traffic to A4540;

Enhanced bus partnership with the wider area of Birmingham.

## Appendix 1B Long List/Short List optioneering process

Summary table of impacts

| CAZ Option Summary | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Option** | **Air Quality Impact** | **Exceedance Locations** | **Impact** | | **Costs** | **Summary** | | | | |
| | | | Congestion / Travel Time / Operating Costs | Users - Welfare | Users - Charges | Health/ Environmental | Vehicle Upgrade | Implementation | +ves: | –ves |
| **CAZ C** Inside the Ring Road (A4540) (Higher price band) | Improvement in emissions does not achieve sufficient reductions in order to meet compliance in 2020<br>Predicted concentrations are still above the NO2 limit on the A38 and ring road.<br>Additional reductions of up to 11-31% are required (outside and inside the CAZ, respectively). | A4540 Lawley Middleway<br>Garrison Circus (Outside CAZ) = 41.8 µg/m3<br>A4100 Digbeth = 41.5 µg/m3<br>A38 between Children's Hospital and Dartmouth Circus = 42.6 µg/m3<br>Suffolk St Queensway (nr Beak St) = 45 µg/m3 | Negative but small impact:- £6m | No welfare impacts as cars not impacted | Negative impacts on taxi, LGV, HGV owners<br>= - £112m | CAZ C delivers lower benefits in terms of emissions of NOx and $PM_{10}$ although the differences are not very large when measured in gross emissions (i.e. tonnes rather than concentrations ). ~£24m | Both CAZ C & D share similar costs across vehicle types - CAZ C is slightly better as it does not include cars:- £37m | £45m across 10 years<br>Costs for both CAZ scenarios are similar | Affects fewer vehicles (resulting in lower upgrade costs); Less significant economic impacts | Delivers compliance later ~ 2022<br>Reduced wider health benefits<br>Does not achieve compliance in 2020 |
| **CAZ C + Additional Measures** | Improves air quality with reductions in the | A4540 Lawley Middleway | Negative impact: | Welfare impacts from | Negative impacts on taxi, LGV, | The CAZ D plus additional measures | Both CAZ C & D share similar costs | £47m across 10 years + ongoing costs | Affects fewer vehicles (resulting in | May deliver compliance later, but due |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Inside the Ring Road (A4540) (Higher price band) City Centre Network Changes + Signing & Rerouting Further retrofits/upgrades - Taxis, LGVs Parking Measures | number of exceedance locations to 17 exceedance locations remaining | - Garrison Circus (Outside CAZ) = 42.0 µg/m3<br>A4100 Digbeth = 39.9 µg/m3<br>A38 between Children's Hospital and Dartmouth Circus = 42.3 µg/m3<br>Suffolk St Queensway (nr Beak St) = 45.1 µg/m3 | -£22m | cancelled trips due to parking charges = -£40m | HGV owners = - £162m | represents £36m in total benefits over the 10-year period - additional improvements of £12m compared the CAZ C alone. | across vehicle types - CAZ C is slightly better as it does not include cars: -£35m | of Additional Measures (being calculated) | lower upgrade costs);<br>Less significant economic impacts | to better distributional impacts it may be worth investigating the level of difference between this option and CAZ D plus additional measures |
| **CAZ D** Inside the Ring Road (A4540) (Higher price band) | Improves air quality further by reducing emissions from cars but predicted concentrations would still be above NO2 limit on the A38 and ring road in 2020. | A4540 Lawley Middleway - Garrison Circus (Outside CAZ) = 41.5 µg/m3<br>A4100 Digbeth = 40.3 µg /m3<br>A38 between Children's Hospital and Dartmouth Circus = 40.6 µg /m3<br>Suffolk St Queensway (nr Beak St) = 42.7 µg /m3 | Shows benefits in terms of transport user travel time and vehicle operating cost savings: £23m | welfare impacts from cancelled trips due to CAZ charges = -£21m | Negative impacts on taxi, LGV, HGV, and cars<br>Greater impact on population = - £176m | CAZ D delivers additional benefits in terms of emissions of NOx and $PM_{10}$ although the differences are not very large when measured in gross emissions (i.e. tonnes rather than concentrations ). ~£26 | Would result in cars upgrading as well as other vehicles upgrade costs -£55m | £53m across 10 years<br>Costs for both CAZ scenarios are similar | Delivers compliance faster ~ 2021<br>Greater health benefits<br>More upgrades under CAZ D delivers greater $CO_2$ emission savings and other secondary benefits | Affects more vehicles (hence greater upgrade costs);<br>More significant economic impacts<br>Does not achieve compliance in 2020 |
| **CAZ D + Additional Measures** Inside the Ring Road (A4540) | Significant reductions in the number of exceedance locations from 12 with a CAZ D | A4540 Lawley Middleway - Garrison Circus (Outside CAZ) = 41.5 µg /m3<br>A4100 Digbeth | Shows benefits in terms of transport user travel time and | welfare impacts from cancelled trips due to parking | Negative impacts on taxi, LGV, HGV, and cars<br>Greater | The CAZ D plus additional measures represents £38m in total benefits over | Cost of compliance for users who upgrade their vehicle is estimated to | £55m across 10 years + ongoing costs of Additional Measures (being | Delivers compliance faster ~ 2021 (but could be 2020 depending on | Additional welfare impacts due to cancelled trips due to parking charges are |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| (Higher price band)<br>City Centre Network Changes + Signing & Rerouting<br>Further retrofits/ upgrades - Taxis, LGVs<br>Parking Measures | alone, to 6 exceedances in 2020 with additional measures | = 38.8 µg /m3<br><br>A38 between Children's Hospital and Dartmouth Circus = 40.3 µg /m3<br>Suffolk St Queensway (nr Beak St) = 42.7 µg /m3 | vehicle operating cost savings, though less than CAZ D alone<br>= £11m | and CAZ charges = -£54m | impact on population = - £224m | the 10-year period - additional improvements of £12m compared the CAZ D alone. | be lower than the CAZ D<br>This is because some users face an additional parking charge in the city centre and will thus choose to change mode or avoid the CAZ zone<br>= -£54m | calculated) | impact of upgrade to petrol and Euro6d)<br>CAZ D plus additional measures represents £38m in total benefits over the 10-year period - additional improvements of £12m compared the CAZ D alone. | expected to result in a consumer surplus loss of around £54m, over the 10-year period. |

Table 6-5 Other Measures Considered

| Type | Tests | Reason to Exclude | Additional Testing |
|---|---|---|---|
| Network | Average speed enforcement near to Dartmouth Circus to manage traffic and smooth flows. | Analysis of modelled speeds indicated that average speeds were lower than the optimal speeds for limiting emissions, so no benefit in reducing the speed limit. | None |
| | Average speed enforcement along the A38 to manage traffic and smooth flows | Analysis of modelled speeds indicated that average speeds were lower than the optimal speeds for limiting emissions, so no benefit in reducing the speed limit. | None |
| CAZ Variations | Ban on HGV and LGVs on the Eastern section of the ring road (A4050) | The reconfiguration of junctions along on the A4050, as a result of HS2 construction means that HGVs cannot be U-turned on the ring road. This would prevent access to the HS2 construction site and freightliner terminal which means it is not a feasible option. | None |
| | Outer CAZ C Charge (Within A4040) | The options tested already increases traffic on the A4040 and on Highways England motorway network. An additional CAZ will worsen these impacts to an unacceptable level.<br><br>A City Centre CAZ results in a relatively high number of vehicles to be bought/ swapped. An additional outer CAZ will affect a significantly larger number of vehicles with significant likelihood that this would put pressure on the 2nd hand market.<br><br>The cost and practicality of implementing the option will be prohibitive. | An updated SATURN model is being produced adding network detail outside the City Centre allowing for a more robu assessment of impacts outside of the Cit Centre.<br><br>An outer CAZ will be tested in this mode assess the impacts of removing through traffic on AQ in the City Centre. This cou help support policies, such as signage to remove through traffic. |
| | Outer CAZ D Charge (Within A4040) | The options tested already increases traffic on the A4040 and on Highways England motorway network. An additional CAZ will worsen these impacts to an unacceptable level.<br><br>A City Centre CAZ results in a relatively high number of vehicles to be bought/ swapped. An additional outer CAZ will affect a significantly larger number of vehicles with significant likelihood that this would put pressure on the 2nd hand market. | As above. |

| Type | Tests | Reason to Exclude | Additional Testing |
|---|---|---|---|
| | | The cost and practicality of implementing the option will be prohibitive. | |
| | Higher charges during the peaks. | Legal AQ limits cannot be achieved when applied across the whole day so no little benefit likely in reducing charges in the off peak. | This can be considered when more detai implementation of the scheme is conside for FBC. |
| | Incentivisation of petrol over diesel | No practical/ legal process to do this has been identified. | To be considered if sensitivity testing indicates that this will provide benefits a if a practical solution can be identified. |
| Public Transport | Incentivise or subsidise sustainable travel by up to 50% to improve public transport patronage | Ongoing work with TfWM and operators to develop an option that can deliver mode shift for reasonable costs. | Ongoing |
| Car Sharing | Incentivise Car Sharing | Ongoing work with TfWM to develop a car sharing policy | Ongoing |

Table 6-6 Additional Measures to Test

| Type | Test ID | Summary | Results | FBC |
|---|---|---|---|---|
| Fleet (low emission) | Fleet 1 | Increase LPG refuelling for Hackney Carriages and the installation of rapid EV infrastructure for taxi and private hire vehicles.<br>Retrofitting of black taxis to LPG<br>**Assumptions tested:**<br>85 taxis upgraded to Electric vehicle<br>441 PHVs upgraded to Electric Vehicle<br>65 taxis retrofitted to LPG | Electric Vehicle upgrade estimated to remove 1.6% of total vehicle kilometres from the City Centre network in a CAZ D scenario. Given that taxi and PHVs are predominately the AQ impacts are amplified and provide a significant reduction in $NO_2$ emissions.<br>LPG retrofit has a less significant impact on overall AQ levels, but will provide benefits at locations with high taxi flows. | Include i **FBC** |
| | Fleet 2 | Zero emission buses (new Hydrogen buses) | Reduction in emissions focused on key corridors | Include i **FBC** |
| Parking | Parking 1 | Remove all free parking from BCC controlled areas. Replaced with paid parking spaces. Assume cost of parking in line with BCC off-street parking. | Around 15% of traffic parking in the City Centre currently parks on free on street parking. Our modelling indicates that this will reduce car demand with free parking by around 30%. This leads to around a 2.5% reduction in overall vehicles KMs, resulting in a reasonably significant reduction in emissions, although this is limited in the key locations (failing the legal limits) as the impacts are focused on the outer areas of the City Centre.<br>An additional benefit is that it raises revenues of the City Centre which will be re-invested in mitigating the effects of the CAZ. | Include i **FBC** |
| Network Changes | Network 1 | Ban traffic entering (SB) or leaving (NB) Suffolk Street Queensway (A38) from Paradise Circus, other than local access. | Provides a reduction in overall traffic levels and reduces delays on the A38 at a key location, forecasted to exceed legal emission levels.<br>Reduces traffic through Paradise Circus an area with high pedestrian flows linking one of Birmingham's main cultural quarters, to the shopping/ business district and New Street Station. Paradise is the focus of one the city centre's main masterplan areas, so removing traffic will support this regeneration. | Include i **FBC** |

| Type | Test ID | Summary | Results | FBC |
|---|---|---|---|---|
| | Network 2 | Close Lister Street and Great Lister Street at the junction with Dartmouth Middleway. This allows, more green time for the A4540. | Reduction in delay on the A4540 ring road, including less traffic needing to stop (and accelerate away from the junction) due to the removal of the signal stage for traffic crossing the road.<br><br>This also provides a mitigation for increases in traffic caused by the CAZ charge for through trips on the A38. | Include i **FBC** |
| | Network 3 | Ban on CAZ through trips for all vehicle types. | Provides significant improvement to air quality in the City Centre. However, this causes significant increases on the Eastern section of the ring road which exceeds the legal $NO_2$ limits.<br><br>In addition, the model shows large increases on local roads outside of the CAZ area which worsens AQ on these local residential roads.<br><br>There are also issues with the practicality of implementing this option on the ground. | Exclude from **FB** |
| | Network 4 | Ban on CAZ through trips for LGV and HGV vehicles. | As above | Exclude from **FB** |
| | Network 5 | CAC C or D on the ring Eastern section of the ring road. | Significant diversion to local roads outside the CAZ increasing emissions on these smaller residential roads.<br><br>There is a need to reduce overall traffic (not just non-compliant) to meet compliance so the CAZ does not solve the issue on its own. | Exclude from **FB** |
| Public Transport | PT_1 | Highway/infrastructure changes to provide bus priority 4 corridors were tested, as agreed with TfWM who said they could delivered by 2020 **ID 19 & 21** | Impact on mode shift forecast to be small, less than 1% reduction in overall trips into the City Centre, with high costs to implement. | Exclude from **FB** |

**Appendix 1C Measures not modelled**

| ID (As per 'Additional Measures Study') | Potential Additional Measure | Earliest delivery date | Modelling status |
|---|---|---|---|
| 1 | Development of a freight partnership for city centre deliveries | 2021 | Not currently modelled |
| 2 | Freight consolidation centres | 2022 | Not currently modelled |
| 3 | Cargo hopper/ULEV deliveries from freight centres | 2022 | Not currently modelled |
| 4 | Local delivery hubs including cycle/EV logistics | 2022 | Not currently modelled |
| 5 | Provide hold back parking for HGV's | 2022 | Not currently modelled |
| 6 | Off peak loading and unloading permits | 2021 | Not currently modelled |
| 7 | Loading and Unloading code of practice | 2021 | Not currently modelled |
| 22 | Develop and implement a mass transit network (Sprint) | 2022 | Not currently modelled |
| 24 | Increase the number and use of park and ride schemes to coincide with rail and metro services | Post 2022 for the scale of implementation needed | Not currently modelled |

| ID (As per 'Additional Measures Study') | Potential Additional Measure | Earliest delivery date | Modelling status |
|---|---|---|---|
| 26 | Further extensions of the Metro system | Post 2022; subject to availability of additional funding | Not currently modelled |
| 27 | Reopen Camp Hill Rail Chords line for rail commuters | Post 2022 - part of long term plan | Not currently modelled |
| 28 | Open stations on the Camp Hill Line at Moseley, Kings Heath and Hazelwood to passenger services | 2022 | Not currently modelled |
| 29 | New Street Station - night freight deliveries | Post 2022 - untested due to physical delivery and collaboration requirements | Not currently modelled |
| 30 | Birmingham Canal Network | Post 2022 due to physical delivery and collaboration requirements | Not currently modelled |
| 45 | Enforce the existing network of red routes | 2021 | Not currently modelled |
| 46 | Extend the network of red routes | Post 2022 for the scale of implementation needed | Not currently modelled |
| 57 | Walking and cycling Infrastructure including adopting a 'safe systems' approach to road safety | Post 2022 for the scale of implementation needed | Not currently modelled |
| 70 | Use the NEC car park for parking outside of the city with direct links for train and bus services into the city | Post 2022 due to collaboration constraints; and impact unclear | Not currently modelled |

| ID (As per 'Additional Measures Study') | Potential Additional Measure | Earliest delivery date | Modelling status |
|---|---|---|---|
| 90 | Regional low emission refuelling networks | Post 2022 for the scale of implementation needed; and impact unclear | Not currently modelled |
| 91 | Mass transit network | Post 2022 for the scale of impact needed; and impact unclear | Not currently modelled |
| 92 | Link up the Birmingham Urban Traffic Management Control (UTMC) with that of Highways England | Post 2022 - impact unclear | Not currently modelled |
| 96 | West Midlands Borough's Consolidation centre | Post 2022 - impact unclear | Not currently modelled |
| 103 | Standardised approach to regional out of hours deliveries | Post 2022 - collaboration constraints | Not currently modelled |

## Appendix 1D Planned Sensitivities

Planned Sensitivities

These planned sensitivities are still under discussion with JAQU and the final list of sensitivities run may be different that the list in Table 6-7.

Table 6-7 Planned Sensitivities

| Model Elements | Tests | Purpose | Method |
|---|---|---|---|
| Traffic Growth | 1) Low Growth - City Centre traffic is flat + existing model assumptions for outer areas.<br>2) Low/ Medium Growth - TEMPRO trip growth for City Centre (rather than PRSIM growth updated with TEMPRO demographic/ land use), with PRISM growth for outer areas (lower than TEMPRO directly).<br>3) High Growth - Apply TEMPRO trip growth to the outer areas on existing City Centre growth. | Impact of different levels of traffic growth. Uncertainty around growth of the city and highway mode share.<br>PRISM forecasts higher City Centre growth and lower wider Birmingham growth highway trip growth than taken directly from TEMPRO, so this will test the difference between the two models.<br>*NB - PRISM is updated with TEMPRO demographic growth and trip generation/ mode share generated by PRISM based on locally calibrated data.* | Mixture of quantitative assessment of likely impacts and Full model rerun. |
| Behavioural Responses to Charging | 1) Apply published JAQU responses<br>2) Apply TfL ULEZ responses directly<br>3) Emerging research implemented into BCC CAZ. | Uncertainty around response to charge tested by using other projects research looking at Clean Air Charging. | Mixture of quantitative assessment of likely impacts and Full model rerun. |
| Cost to Upgrade | 1) Assume JAQU latest, new vehicle costs to current assumptions.<br>2) Apply JAQU behavioural assumptions on new vehicle upgrades<br>3) Apply JAQU behavioural assumptions on new vehicle upgrades, and assume all old non-compliant vehicles scrapped (£0 sale value and no fee for scrappage)<br>4) Assume HGV users assess cost to upgrade over 3 rather than 5 years. | Uncertainty around cost to upgrade, people's choice of upgrade vehicle and impact on secondary market in large increase in vehicle purchasing/ sales. | Mixture of quantitative assessment of likely impacts and Full model rerun. |
| Base Year Correction | 1) Scale up HGV flows based on mismatch between base year and observed counts crossing the screen line.<br>2) Scale up PM peak flows by | Impact of errors in base year model assessed, particularly the PM peak models overall impact on results. | Post model Factoring |

| | | | |
|---|---|---|---|
| | 5%<br>3) Scale down PM peak flows 5% | | |
| Taxi | 1) Develop test that does not force an upgrade to compliant vehicle based on licensing rules.<br>2) Factor flows at key locations based on traffic counts/ ANPR to ensure that taxi/ phv proportions are correctly captured, and that any benefits to the policy is correctly captured. | Impact of Taxi Assumptions. | Full model rerun (only taxis changed) |
| Congestion | 1) Increase delays by 5%<br>2) Decrease delays by 5%<br>3) Assess Delays at key locations and if applicable increase modelled speeds by more than above. | Impact of congestion on AQ. Risk that over/ underestimation of delay is impacting AQ results and where to focus policy. | Post model Factoring |
| Fleet | 1) Latest assumptions on when Euro classes enter the fleet tested (this test is underway).<br>2) Assume age of fleet increases over time (less compliant vehicles naturally enter the fleet)<br>3) Assume petrol proportion increases over time.<br>4) Assume more people upgrade to electric. | Uncertainty in change in fleet makeup. | Mix of full model rerun and post model factoring. |
| Parking | 1) Low Parking Test - assume proportion of traffic will have access to parking permits reducing cost of parking for frequent users. As being developed in current policy.<br>2) High Parking Test - Removing free parking pushes up cost to park in off-street parking. | Test on impact of parking policy. | Mixture of quantitative assessment of likely impacts and Full model rerun. |
| Strategic Rerouting | 1) Test preferred policy in new SATURN model with better detail in the wider model to better understand strategic rerouting/ rat-running.<br>2) Test rerouting option of an outer CAZ to demonstrate full impact of an outer CAZ and | Better understand impacts beyond City Centre. | Mixture of quantitative assessment of likely impacts and full model rerun. |

| | | | |
|---|---|---|---|
| | potential for removing wider area rerouting. | | |
| Trip distribution | Compare with analysis being undertaken by wider team, using ANPR, postcode data etc. to ensure that knowledge of trip distribution in the area is being correctly collected. | Build in checks on observed data to ensure synthetic matrices do not under/ overestimate key movements and that this biases the results. | Comparative Analysis |
| Mode Shift/ Distribution etc. of full policy | Depending on available time/ budget changes in demand/ distribution will be assessed by:<br>· Benchmarking sensitivities and deriving responses to measures to apply to demand matrices<br>· Rerun of PRISM demand model | Check removal of highway capacity and increased cost to drive is reflected in traffic growth. | Mixture of quantitative assessment of likely impacts and Full model rerun. |
| Copert Emissions Factors | BCC awaiting advice from JAQU on how to respond to this issue, including evidence referenced by the T-IRP, and whether JAQU will respond to the T-IRP on behalf of all cities.<br>Potential tests might include adjustment of the emissions factors for certain vehicle types/fuels/Euro standard. | Determine if changes to fleet due to CAZ interventions are appropriate | Applications of uplifts in EFT. Comparison of modelled $NO_x$ outputs. |
| Met data | Use of hourly sequential met data. | Test whether use of statistical (and scaled data by SMHI) met data impacts dispersion | Run Base, DM and CAZ in AirViro. |
| Verification using f- $NO_2$ from CMs | Use of local $NO_x$ to $NO_2$ relationship vs EFT to test f-$NO_2$ | Uncertainty in f- $NO_2$ in emissions factors | Apply road $NO_x$ from CM only, and then total not from DTs (if sufficient no. of analysers) |

## Appendix 2A High Level Appraisal of Options against CSF's

### High Level Appraisal of Options against Critical Success Factors

#### Introduction

This appendix:

- identifies the longlist of options that have been considered to reduce the specific sources of local exceedances of NO2 concentrations in Birmingham;
- lists the Critical Success Factors which have been used to appraise the longlist of alternative options; and,
- Describes the assessment that has been undertaken to date to reduce the longlist of options to a shortlist of options, for detailed appraisal in the Preferred Option Business Case.

#### Longlist of Options

The longlist of options is set out in **Error! Reference source not found.**. The longlist of additional measures 104 in total) is set out in Table 1 (p3-26) of the "Birmingham Clean Air Zone Feasibility Additional Measures Study."

Table 6-8 Longlist of Options

| Option | | Commentary |
|---|---|---|
| L1 | Do Minimum | Baseline option to demonstrate why taking action is necessary |
| L2 | Class A Clean Air Zone (CAZ A) | A charging CAZ A<br>Class A vehicles (Buses, coaches, taxis and private hire vehicles) that do not meet Euro emission standards would be charged. |
| L3 | Class B Clean Air Zone (CAZ B) | A charging CAZ B<br>Class B vehicles (Class A plus Heavy goods vehicles (HGV's)) |
| L4 | Class C Clean Air Zone (CAZ C) | A charging CAZ C<br>Class C vehicles (Class B plus Large vans, minibuses, small vans/light commercials) that do not meet Euro emission standards would be charged. |
| L5 | Class D Clean Air Zone (CAZ D) | A charging CAZ D<br>Class D vehicles (Class C plus cars) that do not meet Euro emission standards would be charged. |
| L6 | Non charging CAZ -with additional measures | A non-charging CAZ with additional measures |
| L7 | Class A Clean Air Zone (CAZ A) - with additional measures | A charging CAZ A with additional measures |

| Option | | Commentary |
|---|---|---|
| L8 | Class B Clean Air Zone (CAZ B) - with additional measures | A charging CAZ B with additional measures |
| L9 | Class C Clean Air Zone (CAZ C) - with additional measures | A charging CAZ C with additional measures |
| L10 | Class D Clean Air Zone (CAZ D) - with Additional Measures | A charging CAZ D with additional measures |

It is clear from Table E1 that three broad types of options have been identified:

- 4 charging CAZ options (class A, B, C and D);
- 4 packages of options, with additional measures considered in conjunction with a CAZ scheme (class A, B, C and D);
- A non-charging CAZ with a package of measures.

Long list option assessment

In order to gauge the primary CSF's relation to the longlisted options traffic and air quality modelling undertaken on CAZ C and CAZ D options to determine their relative position to achieving compliance. These model runs demonstrated that implementation of a charging 'class C' or 'class D' Clean Air Zone (CAZ), would be insufficient to achieve AQ compliance in 2020. As CAZ D has great impacts on traffic due to including the car vehicle class, it will achieve compliance in the shortest possible time and was brought forward.

Under a class D CAZ (where non-compliant cars are subject to charging), concentrations of $NO_2$ reduce by an additional 1.5 µg/m3 inside the CAZ, with a medium charge, and by 1.8 µg/m3 for a high charge, beyond the CAZ C high scenario. There are still places, however, where the legal limits are predicted to be exceeded on the A38 and ring road. It is estimated that additional reductions of up to 9% and 19% are required, outside and inside the CAZ, respectively, to remove these exceedances.

Although a CAZ 'A' and CAZ 'B' scheme have not been explicitly modelled, it is clear that if a 'class C' or 'class D' CAZ would be insufficient to ensure compliance, then a CAZ 'A' or CAZ 'B' scheme would also be insufficient.

Options L2 - L5 in **Error! Reference source not found.** have therefore been rejected.

Appraisal of Additional measures

The appraisal of additional measures has been delivered in 3 phases:

- Phase 1 involved assessing the longlist of additional measures (104 in total) against some high-level criteria to eliminate those that clearly do not contribute to the Critical Success Factors. A total of 31 options were identified within the context of contributing to the primary objective;
- Phase 2 involved developing and applying a Multi Criteria Analysis (MCA) framework to rigorously appraise each option taken forward from Phase 1 to identify those that should be taken forward for further development. This involved assessing each option against the CSF and scoring each measure. A total of 18 options were recommended for further development in Phase 3. The outcomes of the MCA

appraisal and associated justification for the scores assigned to each measure, are summarised in Table 3 of "Birmingham Clean Air Zone Feasibility Additional Measures Study".

- Phase 3 involved considering whether traffic and air quality modelling approaches could be developed for the selected measures to determine the potential for measures to be represented within the respective CAZ modelling scenarios. This resulted in a shortlist of 11 additional measures/packages of measures to be taken forward for quantitative traffic and air dispersion modelling.

Shortlist of Options

The shortlisted packages of options from **Error! Reference source not found.** are presented in **Error! ference source not found.**.

Table 6-9 Shortlisted Options

| Shortlisted Options | | Commentary |
|---|---|---|
| 1. | Class C Clean Air Zone (CAZ C) - with additional measures | A charging CAZ C |
| 2. | Class C Clean Air Zone (CAZ C) - with additional measures | A charging CAZ C with additional measures |
| 3. | Class C Clean Air Zone (CAZ D) | A charging CAZ D |
| 4. | Class C Clean Air Zone (CAZ D) - with Additional Measures | A charging CAZ D with additional measures |

The shortlist of additional measures for further consideration, as part of the above CAZ options, are:

- Increase LPG refuelling for Hackney Carriages, the installation of rapid EV infrastructure for taxi and private hire vehicles, retrofitting of black taxis to LPG and zero emission buses/retrofitting of public transport fleet;
- Parking Strategy – remove free parking, parking charging and permits graded by vehicle standard or zone charges;
- Speed Enforcement – average speed enforcement along the A38 and near Dartmouth Circus to manage traffic and smooth flows;
- Speed reduction – reduce speed limits on certain routes and use variable speed limits
- Public Transport Improvement Measures - Highway/infrastructure improvements to bus services to make them more viable and accessible to the public and increase bus priority schemes, restrict traffic on Moor Street Queensway to bus, taxi and cycle only and close Park Street to all traffic;
- Incentivise or subsidise sustainable travel by up to 50% to improve public transport patronage;
- Ban the route of traffic travelling northbound on Suffolk Street Queensway that exits onto Paradise Circus to then Access Sand pits parade;
- Ban the route of traffic travelling northbound on Suffolk Street Queensway that exits onto Paradise Circus and St Chads;
- Close junction on Dartmouth Middleway between Lister Street and Great Lister Street to avoid stop start traffic and reduce congestion;
- Re-signing and rerouting scheme for the A38 and banning all through traffic (and HGVs only) on the A38 around Paradise Circus diverting traffic to A4540;

- Enhanced bus partnership with the wider area of Birmingham.
- Option Shortlist Tests
- Table 6-10: Other Measures Considered

| Type | Tests | Reason to Exclude | Additional Testing |
|---|---|---|---|
| **Network** | Average speed enforcement near to Dartmouth Circus to manage traffic and smooth flows. | Analysis of modelled speeds indicated that average speeds were lower than the optimal speeds for limiting emissions, so no benefit in reducing the speed limit. | No |
| | Average speed enforcement along the A38 to manage traffic and smooth flows | Analysis of modelled speeds indicated that average speeds were lower than the optimal speeds for limiting emissions, so no benefit in reducing the speed limit. | No |
| **CAZ Variations** | Ban on HGV and LGVs on the Eastern section of the ring road (A4050) | The reconfiguration of junctions along on the A4050, as a result of HS2 construction means that HGVs cannot be U-turned on the ring road. This would prevent access to the HS2 construction site and freightliner terminal which means it is not a feasible option. | No |
| | Outer CAZ C Charge (Within A4040) | The options tested already increases traffic on the A4040 and on Highways England motorway network. An additional CAZ will worsen these impacts to an unacceptable level.<br>A City Centre CAZ results in a relatively high number of vehicles to be bought/ swapped. An additional outer CAZ will affect a significantly larger number of vehicles with significant likelihood that this would put pressure on the 2nd hand market.<br>The cost and practicality of implementing the option will be prohibitive. | An updated SATURN model is being produced adding network detail outside of the City Centre allowing for a more robust assessment of impacts outside of the City Centre.<br>An outer CAZ will be tested in this model to assess the impacts of removing through traffic on AQ in the City Centre. This could help support policies, such as signage to remove through traffic. |
| | Outer CAZ D Charge (Within A4040) | The options tested already increases traffic on the A4040 and on Highways England motorway network. An additional CAZ will worsen these impacts to an unacceptable level.<br>A City Centre CAZ results in a relatively high number of vehicles to be bought/ swapped. An additional outer CAZ will affect a significantly larger number of vehicles with significant likelihood that this would put pressure on the 2nd hand market.<br>The cost and practicality of implementing the option will be prohibitive. | As above. |
| | Higher charges during the peaks. | Legal AQ limits cannot be achieved when applied across the whole day so no little benefit likely in reducing charges in the off peak. | This can be considered when more detailed implementation of the scheme is considered for |

| Type | Tests | Reason to Exclude | Additional Testing |
|---|---|---|---|
| | | | FBC. |
| | Incentivisation of petrol over diesel | No practical/ legal process to do this has been identified. | To be considered if sensitivity testing indicates that this will provide benefits and if a practical solution can be identified. |
| **Public Transport** | Incentivise or subsidise sustainable travel by up to 50% to improve public transport patronage | Ongoing work with TfWM and operators to develop an option that can deliver mode shift for reasonable costs. | Ongoing |
| **Car Sharing** | Incentivise Car Sharing | Ongoing work with TfWM to develop a car sharing policy | Ongoing |

- Table 6-11 Additional Measures to Test

| Type | Test ID | Summary | Results | POBC |
|---|---|---|---|---|
| **Fleet (low emission)** | Fleet 1 | Increase LPG refuelling for Hackney Carriages and the installation of rapid EV infrastructure for taxi and private hire vehicles.<br>Retrofitting of black taxis to LPG<br>Assumptions tested:<br>85 taxis upgraded to Electric vehicle<br>441 PHVs upgraded to Electric Vehicle<br>65 taxis retrofitted to LPG | Electric Vehicle upgrade estimated to remove 1.6% of total vehicle kilometres from the City Centre network in a CAZ D scenario. Given that taxi and PHVs are predominately the AQ impacts are amplified and provide a significant reduction in $NO_2$ emissions.<br>LPG retrofit has a less significant impact on overall AQ levels, but will provide benefits at locations with high taxi flows. | Include in FBC |
| | Fleet 2 | Zero emission buses (new Hydrogen buses) | Reduction in emissions focused on key corridors | Include in FBC |
| **Parking** | Parking 1 | Remove all free parking from BCC controlled areas. Replaced with paid parking spaces. Assume cost of parking in line with BCC off-street parking. | Around 15% of traffic parking in the City Centre currently parks on free on street parking. Our modelling indicates that this will reduce car demand with free parking by around 30%. This leads to around a 2.5% reduction in overall vehicles KMs, resulting in a reasonably significant reduction in emissions, although this is limited in the key locations (failing the legal limits) as the impacts are focused on the outer areas of the City Centre.<br>An additional benefit is that it raises revenues of the City Centre which will be re-invested in mitigating the effects of the CAZ. | Include in FBC |
| **Network Changes** | Network 1 | Ban traffic entering (SB) or leaving (NB) Suffolk Street Queensway (A38) from Paradise Circus, other than local access. | Provides a reduction in overall traffic levels and reduces delays on the A38 at a key location, forecasted to exceed legal emission levels.<br>Reduces traffic through Paradise Circus an area with high pedestrian flows linking one of Birmingham's main cultural quarters, to the shopping/ business district and New Street Station. Paradise is the focus of one the city centre's main masterplan areas, so removing traffic will support this regeneration. | Include in FBC |
| | Network 2 | Close Lister Street and Great Lister Street at the junction with Dartmouth Middleway. This allows, more green time for the A4540. | Reduction in delay on the A4540 ring road, including less traffic needing to stop (and accelerate away from the junction) due to the removal of the signal stage for traffic crossing the road.<br>This also provides a mitigation for increases in traffic caused by the CAZ charge for through trips on the A38. | Include in FBC |
| | Network 3 | Ban on CAZ through trips for all vehicle types. | Provides significant improvement to air quality in the City Centre. However, this causes significant increases on the Eastern section of the ring road which exceeds the | Exclude from FBC |

| Type | Test ID | Summary | Results | POBC |
|---|---|---|---|---|
| | | | legal $NO_2$ limits.<br><br>In addition, the model shows large increases on local roads outside of the CAZ area which worsens AQ on these local residential roads.<br><br>There are also issues with the practicality of implementing this option on the ground. | |
| | Network 4 | Ban on CAZ through trips for LGV and HGV vehicles. | As above | Exclude from FBC |
| | Network 5 | CAC C or D on the ring Eastern section of the ring road. | Significant diversion to local roads outside the CAZ increasing emissions on these smaller residential roads.<br><br>There is a need to reduce overall traffic (not just non-compliant) to meet compliance so the CAZ does not solve the issue on its own. | Exclude from FBC |
| **Public Transport** | PT_1 | Highway/infrastructure changes to provide bus priority 4 corridors were tested, as agreed with TfWM who said they could delivered by 2020 ID 19 & 21 | Impact on mode shift forecast to be small, less than 1% reduction in overall trips into the City Centre, with high costs to implement. | Exclude from FBC |

## Appendix 5A Risk Register

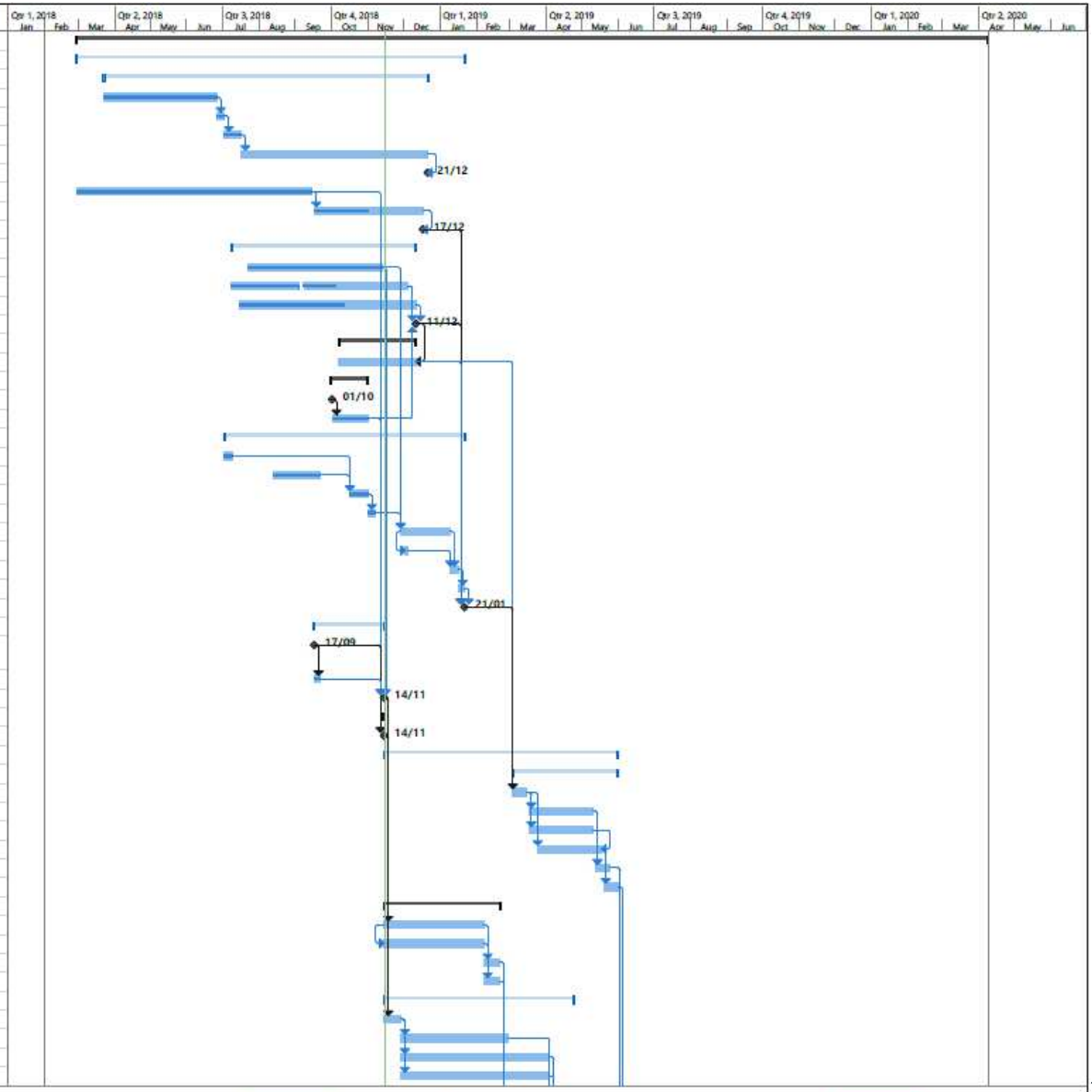
| ID | Date Raised | Risk influence | Risk Description | Consequence | Effect | Owner | Likelihood (1-4) | Impact (1-4) | Risk Score | Mitigation Action | Mitigation owner | Residual likelihood | Residual impact | Residual Mitigation Score | Date Updated | Comments | Status |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R-004 | 23/10/18 | Programme | There is a risk that compliance may not be achieved by the 2020 deadline. | The council may be received sanctions including fines for failing to meet compliance in time. Residents and Business in Birmingham still impacted by poor air quality. | Reputational damages on Birmingham for non compliance | BCC - Executive | 4 | 4 | 16 | Robust modelling which identifies interventions which make a big impact. See if there is potential to expand those initiatives to achieve compliance by 2020. | BCC - transport policy team | 3 | 4 | 12 | 30/09/18 | The traffic and air quality modelling shows that compliance will be achieved in all but 3 locations by 2020, 2 will be met by 2021 and one on Suffolk St Q'way in 2022. | Open |
| R-005 | 23/10/18 | Funding | There is a risk that JAQU's funding approvals process is prolonged for final delivery of preferred option | The consequence is a potential for project slippage and failure to meet compliance within the respective timescales. Not recognising that there is significant local impacts from not having the funding in place | Additional measures are not delivered in time | BCC - Transport policy team | 4 | 4 | 16 | Demonstrating to JAQU the impacts of a prolonged approval process for funding. Revised timeline that reduces the legal limits (e.g. consultation). | BCC - transport policy team | 3 | 4 | 12 | 19/02/18 | | Open |
| R-010 | 23/10/18 | Modelling | There is a risk that the current city traffic model (Saturn) does not account for road networks outside of the city centre. | The consequence would be delays to the overall programme and implementation of CAZ initiatives. Further funding not available to improve areas outside of City Centre. Raise issues around validity on the evidence Remodelling = further delays | Incorrect assessment of the current impact and preferred option | BCC - Transport policy team | 3 | 4 | 12 | Model contingency plans for traffic data and their impact on Air Quality and devise whether additional measures are required to meet Air Quality compliance. Updates to the model are underway for the potential cordons | BCC - transport policy team | 2 | 2 | 4 | | Still need to be identified, | Open |
| R-011 | 23/10/18 | Consultation | There is a risk that CAZ has an impact on Highways England network resulting in H.E objecting to CAZ | The consequence would be that lack of engagement could potentially mean retrospective changes, increasing the cost to the council. Adverse comments at the consultations phase | Delay to Implementation | BCC - transport policy / corporate | 2 | 3 | 6 | Ensure a robust communication and engagement strategy to enable the most useful and most recent information to be available to inform BCC. | BCC - corporate comms | 2 | 2 | 4 | 22/08/17 | M6 - knock on consequences | Open |
| R-012 | 23/10/18 | Programme | There is a risk that there is insufficient Public Transport Capacity to support modal shift. (programme risk) | The consequence would be that it would be more difficult to influence people to get the modal shift | It will take longer to meet the Air Quality requirements. | BCC | 2 | 3 | 6 | Already working with TfWM for certain corridors, and specifically uplifting mode share, eg extra buses | BCC - transport policy team | 2 | 2 | 4 | 22/08/17 | National policy, can anything drive transport issues In terms of compliance the number of patronage level changes are small. | Open |
| R-014 | 23/10/18 | Modelling | There is a risk our assumptions from the transport and AQ modelling are incorrect. | The consequence would be that inaccurate modelling results may cause delay to the programme. The consequence would be additional cost for interventions as a result of poorer air quality than predicted. The consequence would be a legal challenge from | Programme delays in going back to revaluate the modelling | BCC - transport policy | 2 | 3 | 6 | Independent verification undertaken on all results and these will be matched with what JAQU has provided as indicative areas of poor air quality. | BCC - transport policy team | 1 | 3 | 3 | | BCC air quality modelling assumptions | Open |
| R-015 | 23/10/18 | Political | There is a risk that political members would be unsupportive of CAZ. | The consequence would be unsupportive members may cause the decision making and schedule to be delayed significantly causing. FBC isn't signed off | Programme delays - Cost overruns | BCC - Cabinet Member (Economy) | 2 | 3 | 6 | Proactive communications and engagement with influential political stakeholders and demonstrate impact to cost and schedule from lack of decision making. | BCC - transport policy team & corporate comms | 1 | 2 | 2 | 30/09/18 | PQBC passed through cabinet and scrutiny by a political vote, the mayor is also still supportive of the scheme. | Open |
| R-016 | 23/10/18 | Legislation | There is a risk of lack of guidance and legal understanding in how the traffic regulation order approval can be used to implement the | The consequence would be judicial review as a result of objections. | delay on the delivery | BCC - transport policy | 4 | 4 | 16 | Engage with the supply chain to procure external support for the drafting of the charging order from specialist resource. | BCC - project team | 1 | 3 | 3 | 22/08/18 | Review before we can accept TRO, we can still go ahead and implement, will politicians support that | Open |
| R-017 | 23/10/18 | Funding | There is a risk that JAQU doesn't understand the complexity and scale involved in BCC completing their Feasibility Study | The consequence would be there is the possibility of a delay to agreeing a preferred solution impacting timescales to achieve compliance. | Negative impact on the vider economy Impact on deprived areas and smaller businesses | BCC - transport policy | 2 | 3 | 6 | Provide JAQU with draft modelling results to prevent delays in achieving a preferred solution. Keep JAQU informed of developments and progress on the overall Air Quality Programme. | BCC - transport policy | 1 | 2 | 2 | 22/08/18 | Issues with conservative councillors on CAZ charging zone | Open |
| R-020 | 23/10/18 | Funding | There is a risk that the capital costs for the CAZ interventions exceed initial forecast spend. | The consequence could be failing to deliver all interventions to improve Air Quality and reach compliance resulting in a financial penalty to the council. | Delay in compliance | BCC - project team / city finance | 2 | 3 | 6 | Ensure budget is sufficient to deliver the respective interventions Close monitoring of financial during the delivery of the various interventions. Appropriate contingencies | BCC - project team / city finance | 1 | 2 | 2 | 01/08/17 | Implementation risk, procurement strategy before FBC, FBC will finalise costs | Open |
| R-023 | 23/10/18 | Resources | There is a risk that there is a lack of resource in terms of capacity and capability within BCC to deliver the project. | Slippage in the programme which would mean a fine as a result of not being compliant. | Delay in compliance | BCC - project team | 1 | 3 | 3 | Create and manage a resource tracker for the overall programme delivery to ensure no project slippage. | BCC - project team | 1 | 2 | 2 | 05/04/18 | Resource tracker created, raised awareness of annual leave absences and needs for further resources | Open |
| R-024 | 23/10/18 | Political | There is a risk that there is a delay to scheme approval. Internal scheme approval - Mitigation, has to make it work (ministerial direction) Government led scheme - forced to timescales etc. | Delay to draft scheme submission and scheme approval could mean that Birmingham City Council miss the requirements of the proposed secondary legislation to mandate the implantation of a CAZ in Birmingham resulting in punitive measures. Delay to approval which will result in significant delivery pressures for implementation of the CAZ (to be operational by mid 2019). | Delay in compliance | BCC - transport policy | 1 | 4 | 4 | Constant management of the programme plan and review of critical activities to prevent slippage. | BCC - project team | 1 | 2 | 2 | | Delaying implementation of proposal | Open |
| R-023 | 23/10/18 | Technological | There is a risk that cashless payment systems for the CAZ charging zone are not user friendly. Interoperable system | No off the shelf system currently available. User complaints about the cashless payment system which may cause additional administration and cost to the city council. | Reputational damage Loss of revenue | BCC | 1 | 3 | 3 | Ensure proper testing prior to user roll out. | BCC - project team | 1 | 1 | 1 | 01/08/18 | We don't know what system will be introduced | Open |
| R-026 | 23/10/18 | Resources | There is a risk that specialist with technical and air quality knowledge is stretched as the number of cities identified to address AQ nationally increased from 5 to 45. | Specialist resources will be in the highest demand Potential slow down of the project Reduced funding Fragmented approach than being led from a national level | A programme delay Don't deliver compliance - to the required standard/guidance | BCC - project team | 4 | 3 | 12 | One of the first cities identified to address AQ, therefore ahead of the game Can provide useful lessons learned to other cities moving forward | BCC - project team | 3 | 4 | 12 | 21/06/2018 | | Open |
| R-033 | 23/10/18 | Delivery | There is a risk that that there is limited time to undertake detailed site work at design phase | The consequence would be that improper positioning of signs and cameras leads to obscure line of sight and increased street clutter. Potential unsuitability of location. | Delays to delivery programme and rework of tenders. | BCC - project team | 1 | 4 | 4 | Continued collaboration with the design team and the infrastructure delivery team to ensure efficiencies and knowledge is shared at all times. | BCC - project team | 1 | 2 | 2 | 21/06/2018 | | Open |
| R-035 | 23/10/18 | Delivery | There is a risk that some of the signage and camera locations are situated on adjacent authorities or privately owned networks. | The consequence could be that the authority does not agree to the location of the sign/camera. | Delay to programme, additional costs and possible rework of design. | BCC - transport policy / project team | 3 | 3 | 9 | Communication with JAQU to raise this as an issue, national assurance that authorities such as Highways England are on board with Clean Air Zone's and have a clear understanding. Communication directly with these authorities where there may be potential infrastructure on the network. | BCC - project team / transport policy | 2 | 2 | 4 | 21/06/2018 | | Open |
| R-038 | 23/10/18 | Delivery | There is a risk that the construction works being undertaken by HS2 will clash with the construction activities being planned by CAZ. | CAZ project may be unable to carry out the required works at the planned time (HS2 is likely to take priority). | Time and cost escalation. | BCC - project team | 4 | 4 | 16 | Early engagement with HS2 and BCC traffic management team. Quarterly meetings with HS2 with KB contacts, maximising time on site - using pre dug holes to standardize the hardware. Weekly city centre management meeting. | BCC - project team / traffic manager | 2 | 3 | 6 | 02/10/18 | | Open |
| R-039 | 23/10/18 | Delivery | Same as above but for the Midland Metro extension works. | As above. | Time and cost escalation. | BCC - project team | 4 | 4 | 16 | As above. | BCC - project team / traffic manager | 2 | 3 | 6 | 02/10/18 | | Open |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R-040 | 23/10/18 | Design | Changes planned on the BCC network by other major programmes could impact the design of the CAZ. | Redesign of the CAZ may be required to work around the works being planned by othe rmajor city centre programmes. | Time and cost escalation. | BCC - project team / traffic manager | 2 | 3 | 6 | As above early engagement required, where designs can be streamlined to incorporate changes being made by other programmes of work then this should be done. Relies on information being provided by the other schemes. | BCC - project team / traffic manager | 1 | 2 | 2 | 02/10/18 | | Open |
| R-041 | 23/10/18 | Design | Average speed cameras being installed on the A38M will also require new signage which will be similar in nature to the CAZ camera signs. | Sign clutter' on the network, reduced space to implement CAZ signage and confusion to drivers. | Some redesign may be result in escalated cost and schedule | BCC - project team / traffic manager | 2 | 1 | 2 | Designs have been provided to Jacobs for input into outline design. Will be made available to D&B contractor. | BCC - project team | 1 | 1 | 1 | 02/10/18 | | Open |
| R-042 | 23/10/18 | Design | Approval of the CAZ signing is not approved by DfT in a timely fashion. | All of the required information will not be available upon contract award for the next stage of design. | The target cost subitted by the contractor will contain an element of uncertainty which could result in escalated cost and time. | DfT | 3 | 3 | 9 | Information has been submitted to the DfT for approval.<br><br>Seek to collaborate with other LAs to ensure a consistent approach. | DfT/BCC | 2 | 2 | 4 | 02/01/00 | | Open |
| R-043 | 23/10/18 | Mitigations & Exemptions | A manager / accountable person has not been assigned within BCC to manage the delivery of the mitigation measures and exemptions. | Failure to deliver the mitigation measures and exemptions in time for the deadline. . | The mitigation measures and exemptions may not be available therefore having a negative impact upon the identified social groups. | BCC - SRO | 3 | 4 | 12 | The BCC behavioural change and benefits have been engaged. Escalated within BCC as a responsible person needs to be identified. | BCC - traffic manager | 2 | 2 | 4 | | | Open |
| R-044 | 23/10/18 | Mitigations & Exemptions | There is a risk that the marketing campaign for the mitigation and exemptions will be unsuccessful. | The target audience of the marketing campaign will not be engaged and therefore awareness of the mitigation measures and exemptions will be minimal. | Delivery of the mitigation measures and exemptions will be a failure. | BCC | 3 | 4 | 12 | Enagagement with the BCC comms team is underway. Behaviour Change team to take ownership and ensure marketing is started ahead of time. | BCC - corporate comms | 2 | 2 | 4 | | | Open |
| R-045 | 23/10/18 | Mitigations & Exemptions | There is a risk that mitiagation and exemptions will have a negative impact on compliance. | The consequence is the overall delays in reaching the deadline for compliance. | Delivery of the scheme will be a failure and potentially result in fines for BCC. | BCC - transport policy manager | 3 | 3 | 9 | Modelling of the impact to traffic and air quality is being undertaken to ensure the measures being offered will not have a negative impact. | BCC - project team | 1 | 3 | 3 | | | Open |
| R-046 | 23/10/18 | Reputational | There is a risk of loss of public and business support due to a failure to respond to queries raised during consultation. | Loss of public support for the scheme and the required engagement will not be achieved. | Reputational damage for BCC and potential failure to deliver key parts of the scheme. | BCC | 3 | 3 | 9 | As R007. Consultant being employed to respond to queries raised during the consultation and ensure all reasonable queries are answered. | BCC - project team | 1 | 2 | 2 | | | Open |
| R-047 | 23/10/18 | Delivery & Policy | David Harris has resigned from BCC and will be leaving at the end of Nov 18. A lot of knowledge and project history will be lost when he leaves. | Potential for deliverables to be misinterpreted. | The delivered scheme may not match the functional requirements resulting in rework, time and cost increased. | BCC - SRO | 4 | 3 | 12 | Derailing of requirements and deliverables from DH, ongoing support from Transport Policy, need some continuity and someone to take responsibility for supply chain management. | David H | 3 | 2 | 6 | | | Open |
| R-048 | 23/10/18 | Delivery | Consultations required for the CAZ car park charging additional measures will be extensive and difficult to resolve. | The delivery of the CAZ car park charging will not be delivered in the timescales delaying compliance. | This will effect the duration of the project which will impact the cost, as well as reputational damage. | BCC - project team | 4 | 4 | 16 | BCC delivery team to utilise information from previous parking schemes to avoid 'error traps'.<br><br>Consultant to be employed to undertake the outline design asap. | BCC - project team | 3 | 3 | 9 | | | Open |
| R-049 | 23/10/18 | Legislation | There is a risk that grants and incentives for taxi drivers for electric cars infringe on State Aid rules. | The specific mitigation measure could be undeliverable. | Reputational damage for BCC and potential failure to deliver key parts of the scheme. | BCC - projct team | 2 | 3 | 6 | Consider reducing the value of the package to avoid the regulation.<br><br>Engage with Policy Pioneers project and key involvement | BCC - project team / transport policy team | 1 | 2 | 2 | | | Open |
| R-050 | 23/10/18 | Legislation | There is a risk that there are legal challenges from external parties. | Legal challenges could result in the necessity to pause certain elements of work whilst disputes are resolved. | This will effect the duration of the project which will impact the cost, as well as reputational damage. | BCC - SRO | 3 | 3 | 9 | Engage with BCC legal team to start drafting charging orders.<br><br>Procure external support where possible to help accelerate the | BCC - legal | 1 | 2 | 2 | | | Open |
| R-051 | 23/10/18 | Legislation | Exempting drivers based on their personal circumstance or geography may not be possible. | The impact to identified social groups may not be mitigated adequately. | Reputational damage for BCC and potential failure to deliver key parts of the scheme. | BCC - SRO | 3 | 4 | 12 | Engagement with JAQU is ongoing with relation to CAZ exemptions along with BCC legal, Counsel.<br><br>BCC to engage with the WMCA to get their buy in. | BCC - project team | 1 | 2 | 2 | | | Open |
| R-052 | 23/10/18 | Delivery | The euro standards database will not be made available in time for CAZ charging infrastructure design and development. | The charging infrastructure for the CAZ will not be operational and therefore the scheme will be unenforceable. | The scheme will not be delivered on time and therefore compliance targets will not be met. | Central Government | 4 | 4 | 16 | Issue escalated to JAQU. Project initiated with the DVLA to provide the euro emmissions database. BCC require timescales in order to plan delivery. | BCC - project team | 3 | 4 | 12 | | | Open |
| R-053 | 23/10/18 | Benefits realisation | Due to the lack of baseline data the impact of the scheme cannot be measured. | Significance of the CAZ will be unknown. | Benefits cannot be realised. | BCC - SRO | 1 | 2 | 2 | AQ monitoring units are being installed across the CAZ to collect dare, the delivery of these units is being accelerated (pending JAQU approval). | BCC - project team | 1 | 1 | 1 | | | Open |
| R-054 | 23/10/18 | Delivery | Lighting columns will not be suitable for the installation of the CAZ signs. | New poles/columns may be required which werent originally priced for by the contractor. | Time and cost escalation. | BCC - project team | 3 | 3 | 9 | Send the sign schedule to Amey and engageent with Amey to assess the suitability of the existing columns. | BCC - project team | 2 | 2 | 4 | | | Open |
| R-055 | 23/10/18 | Procurement | The BCC FBC will not be submitted in line with the programme (Jan 19) | Procurement of contractor will not be possible. | This will effect the duration of the project which will impact the cost. | BCC - project team | 4 | 3 | 12 | Understand whether the design elementof the contract can be accelerated using BCC funding.<br><br>Phase the FBC's to increase the chances of getting them through | BCC - project team | 2 | 2 | 4 | | | Open |
| R-056 | 23/10/18 | Delivery | The charging order is not produced in time for delivery due to challenges. | The scheme would be non-enforceable. | Compliance would not be achieved. | BCC - project team / legal | 3 | 4 | 12 | Engage with BCC legal team to start drafting charging orders.<br><br>Procure external support where possible to help accelerate the process. | BCC - project team / legal | 2 | 2 | 4 | | | Open |
| R-057 | 23/10/18 | Delivery & Cost | There is a risk that the target cost is over budget. | The consequence is that there may not be enough budget to complete the implementation of CAZ. | Cost escalation. | BBC - project team | 3 | 4 | 12 | Quantify this risk register where possible, leave in the optimisim bias where possible and use a framework contractor to ensure value for money. | BCC - project team | 2 | 2 | 4 | | | Open |
| R-058 | 23/10/18 | Procurement | Supply chain unable to cope with the demand for ANPR cameras. | Not be enough cameras to implement CAZ which would require either a redesign of the project resulting in a less effiecent CAZ or delays to implementation. | This will effect the duration of the project which will impact the cost. | BCC - project team | 3 | 4 | 12 | Engage with the supply chain to establish whether they are planning for the surge in demand.<br><br>Consider a collaborative approach with other LA's to manage the demand. | BCC - project team | 2 | 2 | 4 | | | Open |
| R-059 | 23/10/18 | Delivery | Procurement governance is lengthy | Procurement of the necessary services cannot be concluded in a timely fashion. | The programme will be delayed and costs will escalate. | BCC - project team | 3 | 3 | 9 | Engagement with the procurement team early, group approvals and get delegated authorities in place to expedite procurement. | BCC - project team | 2 | 2 | 4 | | | |
| R-060 | 23/10/18 | Delivery | BCC do not have the resources available to deliver the CAZ. | The management of the delivery of the CAZ will be inefficient and some areas of the programme could slip. | This will effect the duration of the project which will impact the cost. | BCC - SRO | 3 | 4 | 12 | BCC are recruiting.<br><br>Consider the use of consultants to minimise the demand on internal resources. | BCC - SRO | 2 | 2 | 4 | | | Open |

## Appendix 5B Programme

See page below

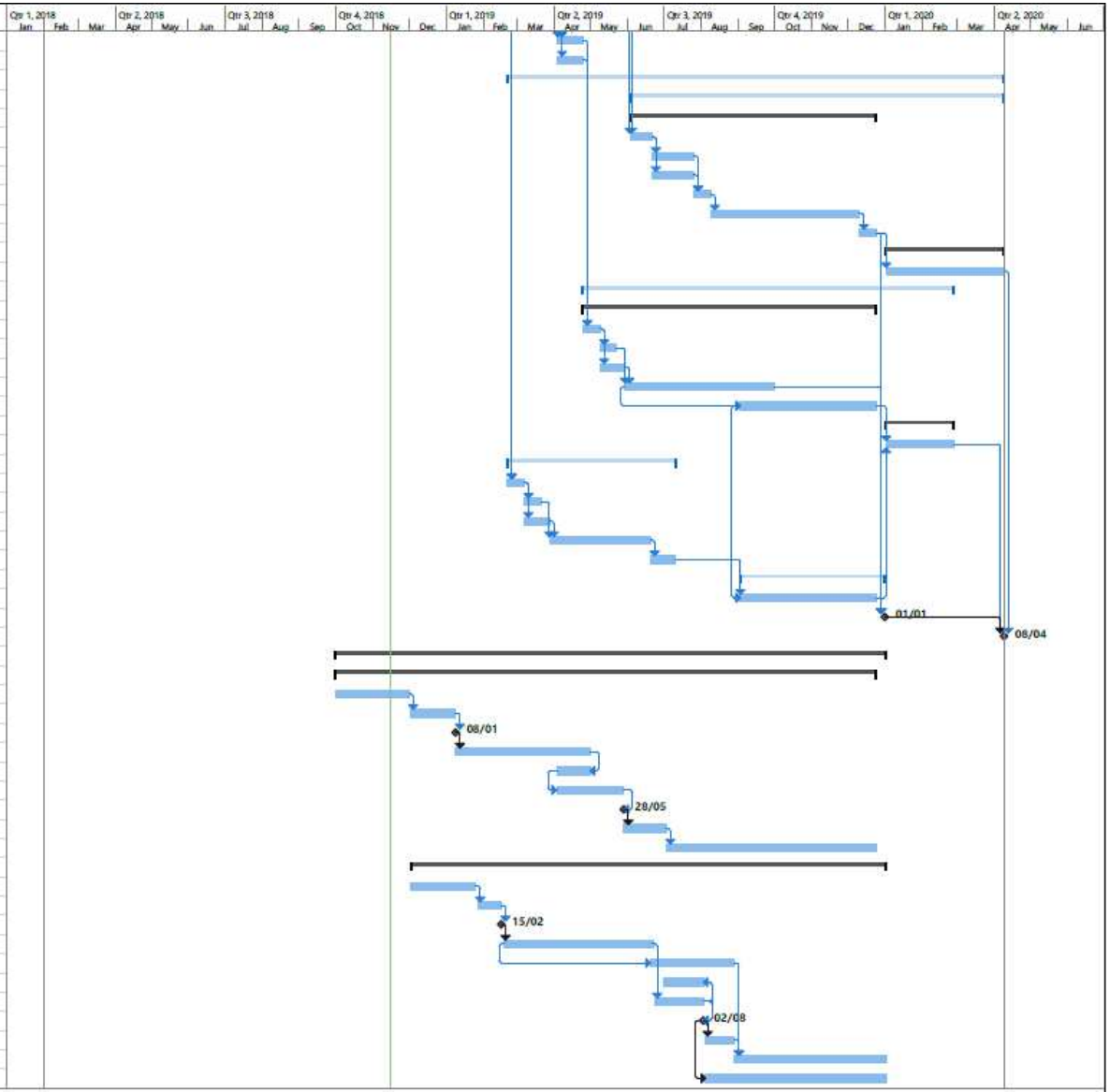
| ID | Task Name | Duration | Start | Finish | Predecessors | Resource Names |
|---|---|---|---|---|---|---|
| 1 | **MAIN CAZ DELIVERY** | **551 days** | **Wed 28/02/1** | **Wed 08/04/2** | | |
| 2 | **Feasibility Study** | **234 days** | **Wed 28/02/18** | **Mon 21/01/19** | | |
| 3 | **Outline Design** | **196 days** | **Fri 23/03/18** | **Fri 21/12/18** | | |
| 4 | Production | 67 days | Fri 23/03/18 | Mon 25/06/18 | | |
| 5 | BCC Review | 5 days | Tue 26/06/18 | Mon 02/07/18 | 4 | |
| 6 | Rework | 10 days | Tue 03/07/18 | Mon 16/07/18 | 5 | |
| 7 | Outline Design Approval | 114 days | Tue 17/07/18 | Fri 21/12/18 | 6 | |
| 8 | Outline Design Approved | 0 days | Fri 21/12/18 | Fri 21/12/18 | 7FF | |
| 9 | Preferred Outline Business Case (DEF | 143 days | Wed 28/02/1 | Fri 14/09/18 | | |
| 10 | Full Business Case (DEFRA) | 66 days | Mon 17/09/18 | Mon 17/12/18 | 9 | |
| 11 | FBC Complete | 0 days | Mon 17/12/18 | Mon 17/12/18 | 10FF | |
| 12 | **BCC Governance (Civils & Cameras)** | **112 days** | **Mon 09/07/18** | **Tue 11/12/18** | | |
| 13 | Procurement Strategy | 80.4 days | Mon 23/07/1 | Mon 12/11/1 | | |
| 14 | Options Appraisal (PDD) | 104 days | Mon 09/07/1 | Tue 04/12/18 | | |
| 15 | Cabinet Report | 107 days | Mon 16/07/1 | Tue 11/12/18 | | |
| 16 | PDD Approval | 0 days | Tue 11/12/18 | Tue 11/12/18 | 14,15,21 | |
| 17 | **BCC Full Business Case** | **47 days** | **Mon 08/10/1** | **Tue 11/12/18** | | |
| 18 | BCC Full Business Case | 47 days | Mon 08/10/1 | Tue 11/12/18 | 16FF | |
| 19 | **BCC Governance (Back Office System)** | **23 days** | **Mon 01/10/18** | **Wed 31/10/18** | | |
| 20 | JAQU strategy decision | 1 day | Mon 01/10/1 | Mon 01/10/1 | | |
| 21 | Procurement Strategy | 22 days | Tue 02/10/18 | Wed 31/10/1 | 20 | |
| 22 | **Civils Work - Tender Process** | **145 days** | **Tue 03/07/18** | **Mon 21/01/19** | | |
| 23 | Expression of Interest | 5 days | Tue 03/07/18 | Mon 09/07/18 | | |
| 24 | Resolve framework issues | 30 days | Mon 13/08/1 | Fri 21/09/18 | | |
| 25 | Pre-Qualification Questionaire | 11 days | Wed 17/10/18 | Wed 31/10/18 | 23,24 | |
| 26 | PQQ Evaluation | 5 days | Thu 01/11/18 | Wed 07/11/18 | 25 | |
| 27 | Tender Period | 30 days | Thu 29/11/18 | Wed 09/01/19 | 26,13 | |
| 28 | Mid-tender workshop | 2 days | Mon 03/12/1 | Tue 04/12/18 | 27SS | |
| 29 | Tender Review Period | 5 days | Thu 10/01/19 | Wed 16/01/19 | 27,28 | |
| 30 | Finalise Contract | 3 days | Thu 17/01/19 | Mon 21/01/1 | 29 | |
| 31 | Civils Work - Contract Award | 0 days | Mon 21/01/19 | Mon 21/01/19 | 16,11,18,30 | |
| 32 | **Camera Procurement - Tender Process** | **48 days** | **Mon 17/09/18** | **Wed 14/11/18** | | |
| 33 | Final JAQU Camera Specification Received | 0 days | Mon 17/09/18 | Mon 17/09/18 | | |
| 34 | Expression of Interest | 5 days | Mon 17/09/18 | Fri 21/09/18 | 33 | |
| 35 | Purchase Order Issued | 1 day | Wed 14/11/18 | Wed 14/11/18 | 34,9,13 | |
| 36 | **Back Office System Procurement** | **1 day** | **Wed 14/11/1** | **Wed 14/11/1** | | |
| 37 | Purchase Order Issued | 1 day | Wed 14/11/1 | Wed 14/11/1 | 33,21 | |
| 38 | **Detail Design** | **142 days** | **Thu 15/11/18** | **Fri 31/05/19** | | |
| 39 | **Civils Work - Phase 2** | **65 days** | **Mon 04/03/19** | **Fri 31/05/19** | | |
| 40 | Mobilisation | 10 days | Mon 04/03/19 | Fri 15/03/19 | 31,18 | |
| 41 | Undertake Early Contractor Involvement ( | 40 days | Mon 18/03/19 | Fri 10/05/19 | 40 | |
| 42 | Detailed Design | 40 days | Mon 18/03/19 | Fri 10/05/19 | 40 | |
| 43 | Development of Target Cost | 40 days | Mon 25/03/19 | Fri 17/05/19 | 42FF+5 days,40 | |
| 44 | BCC Design Review | 10 days | Mon 13/05/19 | Fri 24/05/19 | 42,41 | |
| 45 | BCC Review of Target Cost | 10 days | Mon 20/05/19 | Fri 31/05/19 | 43 | |
| 46 | **Back Office** | **70 days** | **Thu 15/11/1** | **Wed 20/02/1** | | |
| 47 | Detailed Design | 60 days | Thu 15/11/18 | Wed 06/02/1 | 37 | |
| 48 | Development of Target Cost | 60 days | Thu 15/11/18 | Wed 06/02/1 | 47SS | |
| 49 | BCC Design Review | 10 days | Thu 07/02/19 | Wed 20/02/1 | 47 | |
| 50 | BCC Review of Target Cost | 10 days | Thu 07/02/19 | Wed 20/02/1 | 48 | |
| 51 | **Cameras - Phase 1** | **115 days** | **Thu 15/11/18** | **Wed 24/04/19** | | |
| 52 | Mobilisation | 10 days | Thu 15/11/18 | Wed 28/11/18 | 35 | |
| 53 | Undertake Early Contractor Involvement ( | 65 days | Thu 29/11/18 | Wed 27/02/19 | 52 | |
| 54 | Detailed Design | 90 days | Thu 29/11/18 | Wed 03/04/19 | 52 | |
| 55 | Development of Target Cost | 90 days | Thu 29/11/18 | Wed 03/04/19 | 52 | |




Project: Clean Air Zone Program
Date: Fri 16/11/18

Task | Split | Milestone | Summary | Project Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | External Tasks | External Milestone | Deadline | Progress | Manual Progress

| ID | Task Name | Duration | Start | Finish | Predecessors | Resource Names |
|---|---|---|---|---|---|---|
| 56 | BCC Design Review | 15 days | Thu 04/04/19 | Wed 24/04/19 | 54,53 | |
| 57 | BCC Review of Target Cost | 15 days | Thu 04/04/19 | Wed 24/04/19 | 55 | |
| 58 | **Construction** | **295 days** | **Thu 21/02/19** | **Wed 08/04/20** | | |
| 59 | **Civils Work** | **223 days** | **Mon 03/06/19** | **Wed 08/04/20** | | |
| 60 | **Phase 2a** | **147 days** | **Mon 03/06/1** | **Tue 24/12/1** | | |
| 61 | Mobilisation | 14 days | Mon 03/06/19 | Thu 20/06/19 | 44,45 | |
| 62 | Procurement | 25 days | Fri 21/06/19 | Thu 25/07/19 | 61 | |
| 63 | RAMS | 25 days | Fri 21/06/19 | Thu 25/07/19 | 61 | |
| 64 | Traffic Management and Controls | 10 days | Fri 26/07/19 | Thu 08/08/19 | 62,63 | |
| 65 | Installation | 88 days | Fri 09/08/19 | Tue 10/12/19 | 64 | |
| 66 | Works Verification | 10 days | Wed 11/12/19 | Tue 24/12/19 | 65 | |
| 67 | **Phase 2b** | **70 days** | **Thu 02/01/2** | **Wed 08/04/2** | | |
| 68 | Ancillary Signs / Remedials | 70 days | Thu 02/01/2 | Wed 08/04/2 | 66 | |
| 69 | **Cameras Phase 1** | **220 days** | **Thu 25/04/19** | **Wed 26/02/20** | | |
| 70 | **Phase 1a** | **174 days** | **Thu 25/04/1** | **Tue 24/12/1** | | |
| 71 | Mobilisation | 10 days | Thu 25/04/19 | Wed 08/05/19 | 56,57 | |
| 72 | Camera Delivery | 10 days | Thu 09/05/19 | Wed 22/05/19 | 71 | |
| 73 | RAMS | 15 days | Thu 09/05/19 | Wed 29/05/19 | 71 | |
| 74 | Installation | 88 days | Thu 30/05/19 | Mon 30/09/19 | 72,73 | |
| 75 | Camera Testing & Remedials | 81 days | Tue 03/09/19 | Tue 24/12/19 | 74SS+68 days | |
| 76 | **Phase 1b** | **40 days** | **Thu 02/01/2** | **Wed 26/02/2** | | |
| 77 | Ancillary Cameras / Remedials | 40 days | Thu 02/01/2 | Wed 26/02/2 | 75,85 | |
| 78 | **Back Office System** | **100 days** | **Thu 21/02/19** | **Wed 10/07/19** | | |
| 79 | Mobilisation | 10 days | Thu 21/02/19 | Wed 06/03/19 | 50,49 | |
| 80 | Equipment Delivery | 10 days | Thu 07/03/19 | Wed 20/03/19 | 79 | |
| 81 | RAMS | 15 days | Thu 07/03/19 | Wed 27/03/19 | 79 | |
| 82 | Installation | 60 days | Thu 28/03/19 | Wed 19/06/19 | 80,81 | |
| 83 | Modular testing | 15 days | Thu 20/06/19 | Wed 10/07/19 | 82 | |
| 84 | **Commissioning** | **86 days** | **Tue 03/09/19** | **Wed 01/01/20** | | |
| 85 | Integrated testing | 81 days | Tue 03/09/19 | Tue 24/12/19 | 75SS,83 | |
| 86 | CAZ Operational | 0 days | Wed 01/01/2 | Wed 01/01/2 | 66,85,74 | |
| 87 | Programme Completion | 0 days | Wed 08/04/20 | Wed 08/04/20 | 77,68,86 | |
| 88 | **ADDITIONAL MEASURES** | **328 days** | **Mon 01/10/1** | **Wed 01/01/2** | | |
| 89 | **Network Changes** | **322 days** | **Mon 01/10/1** | **Tue 24/12/1** | | |
| 90 | Tender - Feasibility Design | 45 days | Mon 01/10/1 | Fri 30/11/18 | | |
| 91 | Evaluation | 20 days | Mon 03/12/1 | Tue 08/01/19 | 90 | |
| 92 | Appoint Consultant - feasibility design | 0 days | Tue 08/01/19 | Tue 08/01/19 | 91 | |
| 93 | Feasibility & Detail Design | 80 days | Wed 09/01/1 | Tue 30/04/19 | 92 | |
| 94 | Additional Measures Final Business C | 20 days | Wed 03/04/1 | Tue 30/04/19 | 93FF | |
| 95 | Contract Tender | 40 days | Wed 03/04/1 | Tue 28/05/19 | 94SS | |
| 96 | Appoint Contractor | 0 days | Tue 28/05/19 | Tue 28/05/19 | 95FF | |
| 97 | Mobilisation | 25 days | Wed 29/05/1 | Tue 02/07/19 | 96 | |
| 98 | Construction | 125 days | Wed 03/07/1 | Tue 24/12/19 | 97 | |
| 99 | **Controlled Parking Zone** | **283 days** | **Mon 03/12/1** | **Wed 01/01/2** | | |
| 100 | Tender - Feasibility Design | 40 days | Mon 03/12/1 | Fri 25/01/19 | | |
| 101 | Evaluation | 15 days | Mon 28/01/1 | Fri 15/02/19 | 100 | |
| 102 | Appoint consultant - feasibility design | 0 days | Fri 15/02/19 | Fri 15/02/19 | 101 | |
| 103 | Feasibility & Detail Design | 90 days | Mon 18/02/1 | Fri 21/06/19 | 102 | |
| 104 | Consultation | 50 days | Thu 20/06/19 | Wed 28/08/1 | 103SS+88 days | |
| 105 | CPZ Final Business Case | 25 days | Mon 01/07/1 | Fri 02/08/19 | 106FF | |
| 106 | Contract Tender | 30 days | Mon 24/06/1 | Fri 02/08/19 | 103 | |
| 107 | Appoint Contractor | 0 days | Fri 02/08/19 | Fri 02/08/19 | 106FF,105FF | |
| 108 | Mobilisation | 18 days | Mon 05/08/1 | Wed 28/08/1 | 107 | |
| 109 | Construction | 90 days | Thu 29/08/19 | Wed 01/01/2 | 108,104 | |
| 110 | Administration | 108 days | Mon 05/08/1 | Wed 01/01/2 | 107SS | |




Project: Clean Air Zone Program
Date: Fri 16/11/18

Task · Split · Milestone · Summary · Project Summary · Inactive Task · Inactive Milestone · Inactive Summary · Manual Task · Duration-only · Manual Summary Rollup · Manual Summary · Start-only · Finish-only · External Tasks · External Milestone · Deadline · Progress · Manual Progress

## Appendix 5C Stakeholder Management Plan

| Stakeholder sector | Stakeholder example (not comprehensive) | Social media | Existing email & other E comms | Traditional media (press release) | Stakeholder & community networks – incl. Councillors | One of: Roadside signs (recommend), Radio ads, Bus rear ads | Public transport user messaging | Printed flyers (distribution strategy tbc) |
|---|---|---|---|---|---|---|---|---|
| Individuals | Younger people | | | | | | | |
| | Disabled people | | | | | | | |
| | Pregnant women | | | | | | | |
| | People from BME communities | | | | | | | |
| | City centre residents | | | | | | | |
| | City centre workers | | | | | | | |
| | Residents along major roads | | | | | | | |
| | People frequently driving to the city centre in diesel cars | | | | | | | |
| | People driving significant distances in Birmingham within job | | | | | | | |
| Business & Economy | Business Improvement Districts (especially city centre) | | | | | | | |
| | Chamber of Commerce | | | | | | | |
| | Federation of Small Businesses | | | | | | | |
| | Greater Birmingham and Solihull LEP | | | | | | | |

| Stakeholder sector | Stakeholder example (not comprehensive) | Social media | Existing email & other E comms | Traditional media (press release) | Stakeholder & community networks – incl. Councillors | One of: Roadside signs (recommend), Radio ads, Bus rear ads | Public transport user messaging | Printed flyers (distribution strategy tbc) |
|---|---|---|---|---|---|---|---|---|
| | Individual businesses | | | | | | | |
| Education & Skills | Universities | | | | | | | |
| | Colleges | | | | | | | |
| | Schools | | | | | | | |
| Environment & Sustainability | Environmental Groups | | | | | | | |
| Health & | Public Health England/Lap | | | | | | | |
| Wellbeing | Clinical Commissioning Groups | | | | | | | |
| | Hospitals, GP surgeries, etc. | | | | | | | |
| Housing & Communities | Housing Associations | | | | | | | |
| | Tenants' and residents' groups | | | | | | | |
| Media, Communication ns & Marketing | Local Press/Media | | | | | | | |
| | BBC WM | | | | | | | |
| | West Midlands Growth Company | | | | | | | |
| Science & Technology | Universities | | | | | | | |
| | Science Parks | | | | | | | |
| Transport | Transport for West Midlands | | | | | | | |
| | Highways | | | | | | | |

| Stakeholder sector | Stakeholder example (not comprehensive) | Social media | Existing email & other E comms | Traditional media (press release) | Stakeholder & community networks – incl. Councillors | One of: Roadside signs (recommend), Radio ads, Bus rear ads | Public transport user messaging | Printed flyers (distribution strategy tbc) |
|---|---|---|---|---|---|---|---|---|
| | England | | | | | | | |
| | Public Transport operators | | | | | | | |
| Political | Birmingham Councillors | | | | | | | |
| | Birmingham MPs/MEPs | | | | | | | |
| | WM Mayor | | | | | | | |
| | WMCA | | | | | | | |
| | Other WM elected members/LAs | | | | | | | |
| BCC | BCC departments | | | | | | | |

## Appendix 5D Monitoring and Evaluation Plan

**Note – the cost information contained in this appendix is accurate, as per section 5.4 the financial model will be updated to reflect the costs in this appendix in January 2019.**

Birmingham City Council are proposing to implement a Clean Air Zone (CAZ) within the city centre, bounded by the middle ring road (A4540). The Birmingham CAZ will be a charging class D CAZ (CAZ D), meaning that all vehicles (apart from two wheelers) which aren't compliant under euro emission standards will be subject to a daily entry charge. The measure of compliance will be Euro 6 for diesel vehicles and Euro 4 for petrol vehicles. A set of additional measures are also being proposed as supplementary to the CAZ D in order to improve air quality within the zone to the required level:

- Parking restrictions will be implemented to convert all currently free, council controlled, free parking within the CAZ to spaces which have a charge applied;
- Closing the junctions between Lister Street and Great Lister Street and Dartmouth Middleway to all traffic apart from buses, i.e. making the road a through route;
- Banning northbound traffic on Suffolk Street Queensway that exits onto Paradise Circus to then access Sandpits Parade and banning southbound traffic from Paradise Circus entering the A38, i.e. making the road a through route.

The implementation of the above measures will be funded via the Governments 'Implementation Fund', a sufficient amount of funding inclusive of contingency is being requested via the submission of the Full Business Case to Government.

It is anticipated that the introduction of a CAZ D plus additional measures in Birmingham will have a negative impact on a number of socio-economic groups; this has been advised following a public consultation and extensive economic modelling and distributional impact analysis. As such, the City Council have developed a series of mitigation measures and exemptions to reduce the impact to those most significantly impacted.

| Mitigation measures | | |
|---|---|---|
| Ref. | Target group | Description |
| M1a | Individuals who work within the CAZ | Individuals can chose between £1,000 mobility credits applied to a SWIFT card or in exchange for scrapping their non-compliant vehicle they can receive £2,000 SWIFT credit or £2,000 towards a compliant vehicle. |
| M1b | Individuals who regularly travel into the CAZ | In exchange for scrapping their non-compliant vehicle individuals can receive £2,000 SWIFT credit or £2,000 towards a compliant vehicle |
| M2a | Hackney Carriage support package | Drivers offered £5,000 as support towards operating a ULEV vehicle or towards the costs of installing a retrofit solution or a newly purchased vehicle. |
| M2b | Hackney carriage leasing scheme | Access to a ULEV leasing scheme operated by the City Council as well as a try-before-you-buy scheme |
| M2c | Private Hire Vehicle upgrade support | PHV drivers who upgrade to a compliant vehicle which fulfils BCC licencing conditions and is under 3 years old will receive financial aid of £2,000. |
| M3 | Free miles for ULEV LGV's | ULEV van drivers receive £1,000 credit to spend on the BCC public charging network. |
| M4 | HGV's and Coach compliance fund | Fleets compete for £15,000 funding package to contribute towards installing a retrofit solution or the upfront costs of a lease or purchase of a compliant vehicle. |

| | | |
|---|---|---|
| M6 | All | Marketing and engagement campaign targeted at those eligible for a mitigation or exemption. |
| M7 | Residents around the CAZ | Implementation of residents parking schemes to prevent overcrowding on the margins of the CAZ. Will only be deployed if issues arise. |

| Exemptions | | |
|---|---|---|
| E1/E3 | Commercial Vehicles registered within the CAZ | LGV/HGV/Coaches registered within the CAZ will receive an exemption (max 2 vehicles per company). |
| E2/E4 | Commercial Vehicles with an existing finance agreement | LGV/HGV/Coaches registered in the Birmingham City area travelling to the CAZ with an existing finance agreement beyond 2020 (max 2 vehicles per company). |
| E5 | Residents of the CAZ | All private car and van owners who are residents of the CAZ, as defined by DfT registration information. |
| E6 | Individuals working in the CAZ | Individuals travelling into the CAZ for work. Key workers prioritised, the remaining exemptions will be allocated on income. |
| E7 | Residents who live outside the CAZ | A limited number of exemptions offered, allocation based on distance to CAZ and income. |
| E8 | Hospital visitors | Visitors to select hospitals in the CAZ, GP offices and care homes. |
| E9a | Community and schools | Vehicles classified as section 19 operators, registered for operation in Birmingham. |
| E9b | Disabled vehicles | Vehicles with disabled or disabled passenger class. |

A set of key outcomes have been identified by the City Council which must be achieved by the introduction of the CAZ D plus additional measures. The key outcome of the programme is:

- Deliver a scheme that leads to compliance with NO2 concentration limits (annual mean NO2 concentration of 40µg/m2) in the shortest possible time.

The scheme specific key outcomes are as follows:

- CAZ D:
  - The main objective is to modify the vehicle type profile in the city of Birmingham; encouraging people to buy compliant vehicles and delivering a modal shift to public transport and other sustainable modes.
  - The expected outcome is to reduce NO2 levels below the legal limits within the shortest possible time.
- Additional measures:
  - Reductions in traffic flows within the city centre and across the wider Birmingham area due to changes to traffic patterns may also have a beneficial impact on health by further encouraging people to walk or cycle in preference to using a car, particularly for short journeys.
  - Reductions in traffic flows may also help to improve social cohesiveness and reduce social isolation
- Mitigation measures and exemptions:
  - Minimal impact upon the socio economic groups identified as most impacted due to the introduction of a CAZ in the Distributional Impact Assessment.

- Increased public support for the CAZ due to a measured successful delivery of the mitigation measures and exemptions.

Birmingham City Council have availability of existing monitoring equipment, details below:

| Metric | Type | Quantity |
|---|---|---|
| RTMS (DEFRA) | NO2, PM10, PM2.5 | 1 |
| RTMS (BCC) | NO2 | 5 |
| Diffusion tubes | NO2 | 77 |

In line with the Joint Air Quality Unit (JAQU) guidance, the City Council plan to share the data collected from the above sources periodically on a three monthly basis. Additional data may be provided to JAQU however this must be agreed in advance between BCC and JAQU.

In order to improve Birmingham's monitoring and evaluation capabilities and increase the robustness of the data set, the City Council are proposing to introduce additional monitoring sites, as summarised below.

| Type | Location | Metric | Cost |
|---|---|---|---|
| Air Quality | Various | NO2, PM10, PM2.5 and weather station | **£132,630.00** |
| Traffic | Various | Traffic | **£89,040.00** |
| | | **Total** | **£221,670.00** |

There will also be an annual maintenance and operational cost associated with the running of each of these new monitoring stations, details are provided below:

| Air Quality Monitoring | |
|---|---|
| | **Cost** |
| Maintenance (annual) | £27,000.00 |
| Communications (annual) | £684.00 |
| Staffing | £50,000.00 |
| Total | £77,684.00 |

Quantitative Evaluation

**Air Quality monitored v modelled**

The City Council propose to compare the monitored AQ data from existing RTMS sites, proposed RTMS sites and diffusion tube sites with the model verification points every three months factored to annual, with therefore increasing accuracy as the year progresses.

The City Council also proposes to compare around ten of the worst case target determination (TD) points with new diffusion tube sites located as close to the TD point as feasible given site specific constraints.

As per Section 2.2.5, the City Council has decided to set the daily charging levels for the CAZ at £8.00 (Cars, Taxis and LGV's) and £50.00 (HGV's and Coaches). The charging levels have been set following detailed analysis and benchmarking against low emission zones across other European cities. The charging levels have been modelled in the transport, air quality, financial and economic models to confirm that the desired behavioural change is achieved and that compliance is achieved in the shortest possible time. The City Councils Corporate Charging Policy reviews all City Council enforced charges on an annual basis against the current level of inflation, the charges undergo a detailed review on a three yearly basis. The charges of the Clean Air Zone will be included in the scope of the City Councils Corporate Charging Policy and thus will be reviewed in line with the performance measures of the CAZ.

Qualitative monitoring and evaluation

In addition to the quantitative measures set out above, the City Council also propose to undertake some qualitative monitoring and evaluation to assess the change in travel behaviours and the impacts of the mitigation measures and exemptions. The proposed method for doing so is a Cohort Study. The Cohort Study would comprise of some general population sampling to assess the change in travel behaviours and support for the CAZ and some targeted sampling for the mitigation measures and exemptions. It is proposed to undertake the Cohort Study at regular intervals over a period of four years to get a measure of success and impact before, during and post mitigation measure and exemption life span.

The City Council will define a set of Key Performance Indicators (KPI's) which will be used to measure the success of the mitigation measures. KPI's to be included could include targets for take up of each measure.

The costs for undertaking a Cohort Study are set out below:

| | Year 1 | Year 2 | Year 3 | Year 4 | Total |
|---|---|---|---|---|---|
| Staffing | £52,500 | £32,000 | £32,500 | £32,00 | £149,000 |
| Study | £18,000 | £6,500 | £15,500 | £6,500 | £46,500 |
| Review | £1,000 | £0 | £0 | £1,000 | £2,00 |
| Hardware/software | £500 | £500 | £500 | £500 | £2,000 |
| Telecommunications | £250 | £250 | £250 | £250 | £1,000 |
| | | | | Total | £200,500 |

**Total costs**

| Type of monitoring | Cost |
|---|---|
| Traffic monitoring | £89,040.00 |
| Air quality monitoring | £210,314.00 |
| Travel behaviours, mitigation measures and exemptions | £200,500.00 |
| **Totals** | **£499,854.00** |