## CONTENTS

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Background</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Outline Business Case</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>STRATEGIC CASE</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Analysis of Air Quality Problems in Nottingham</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Actions to Improve Air Quality</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Proposed Measures</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Summary and Conclusions</td>
<td>22</td>
</tr>
<tr>
<td>3</td>
<td>ECONOMIC CASE</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Introduction</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Short list of potential options</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Economic Appraisal</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Cost-Benefit Analysis (CBA)</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Qualitative Assessment</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>Distributional Analysis</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>Summary assessment</td>
<td>49</td>
</tr>
<tr>
<td>4</td>
<td>MANAGEMENT CASE</td>
<td>53</td>
</tr>
<tr>
<td>5</td>
<td>COMMERCIAL CASE</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>Proposals to Improve Air Quality</td>
<td>62</td>
</tr>
<tr>
<td>6</td>
<td>FINANCIAL CASE</td>
<td>66</td>
</tr>
<tr>
<td>7</td>
<td>SUMMARY</td>
<td>70</td>
</tr>
</tbody>
</table>
List of Tables

Table 1: Damage costs by pollutant, location and source (2015 prices) 6
Table 1-2: Social cost and Health Impact from NO2 (2013) 6
Table 2-1: WPL match funding 17
Table 2-2: Bus fleet for Euro VI retrofitting 19
Table 3-1: Wider considerations in development of options 25
Table 3-2: Long list of CAZ options 28
Table 3-3: Summary overview of SWOT analysis 31
Table 3-4: Shortlist options initial ranking (prior to full economic analysis) 32
Table 3-5: Short-listed options assessed 33
Table 3-6: Key calculations and data 35
Table 3-7: Monetised impacts associated with CAZ options (cumulative discounted impact (PV) from 2020-30 (Million £, 2018 prices) 36
Table 3-8: Qualitative analysis of options against impacts not covered by core CBA 40
Table 3-9: Impact appraisal matrix: Air quality 43
Table 3-10: Summary of air quality distributional impacts 43
Table 3-11: O-licence data for HGV operators based in in the CAZ boundary 47
Table 3-12: Summary of business affordability distributional impacts 48
Table 3-13: Summary assessment of distributional analysis 49
Table 3-14: Options ranking 50
Table 4-1: Milestones 54
Table 4-2: Nottingham Clean Air Zone Key Team members and their Role 56
Table 4-3: Key Stakeholders in the project 56

List of Figures

Figure 2-1: Air quality monitoring Sites and Areas of exceedance, Nottingham City area 8
Figure 2-2: Outputs from Pollution Climate Mapping (PCM) model showing areas of Nottingham Exceeding limit value for NO2 9
Figure 2-3: Model output 2016 base model results (Target Determination) 10
Figure 2-4: Air Quality monitoring results from AURN sites 11
Figure 2-5: Monitoring from Selected diffusion tube sites 12
Figure 2-6: Clear Zone area and restrictions 16
Figure 3-1: Proposed CAZ boundaries 27
Figure 3-2: PV of impacts and NPV of charging CAZ/Revised Clear Zone options 36
Figure 4-1: Nottingham Governance and Delivery Chart 56
INTRODUCTION

1.1 The following Outline Business Case makes the case for change, and provides an analysis of the current situation, with regard to Nottingham City Council’s Clean Air Strategy for Nottingham. It identifies the required changes, the outcomes that are expected, and how these fit with local requirements - as well as wider policies and objectives.

1.2 An initial Strategic Outline Business Case (SOBC) identifying how air quality will be improved in Nottingham was submitted in March 2017. A subsequent Outline Business Case (OBC) was then submitted in February 2018 (without Economic Case). This document forms the final version of the OBC and sets out progress and developments since the previous submission of the outline business case in March 2017. The OBC describes the progress made to date, summarises Nottingham City Council’s analyses, and identifies our preferred option for the reduction of Nitrogen Dioxide in Nottingham in advance of the Final Business Case submission in September 2018.

Background

1.3 In December 2015 the Department for Environment Food and Rural Affairs (DEFRA) released draft plans to improve air quality in the UK “Tackling Nitrogen Dioxide in our towns and cities”. The document also contained the results of DEFRA’s analysis, which concluded that concentrations of Nitrogen Dioxide (NO₂) in six UK cities, including Nottingham, were above the legal levels set by the EU First Daughter Directive on air quality (99/30/EC) and the UK Air Quality Strategy 2000. The document concluded that modelled levels of NO₂ (in Nottingham) along the Ring Road and around Crown Island would exceed the legal limit of 40µg/m³ in 2020.

1.4 The document identified road traffic as a major source of NO₂ and, as a result, DEFRA asked Nottingham City Council to prepare a plan aimed at reducing the level of Nitrogen Dioxide in the city. The plan was expected to consider the implementation of a Clean Air Zone, which would charge a fee for the most polluting vehicles to enter the zone. The aim of this approach was to reduce concentrations of Nitrogen Dioxide such that they would be brought into compliance with the Air Quality Directive by the year 2020.

1.5 The 2015 plan was challenged in the High Court by Client Earth and in October 2016, and the high court ruled that the plan was not sufficient to meet the aims of the Air Quality Directive. The High Court then quashed the plan and ordered that DEFRA produce a revised plan. Subsequently, in May 2017, DEFRA released its Clean Air Zone Framework. This outlined four classes of Clean Air Zone, each of which charge non-compliant vehicles of different types for entry into each classified Zone. Vehicles would be compliant, and therefore not charged to enter the Zone, depending on their emission standard (i.e. Euro 6 or higher for Diesel, or Euro 4 or higher for petrol). The vehicle types within each class of clean air zone are as follows:
1.6 In July 2017 DEFRA and the Department for Transport (DfT) jointly released the “UK Plan for Tackling Roadside Nitrogen Dioxide Emissions”. This plan again named Nottingham and a number of other Local Authorities areas as having persistently high levels of Nitrogen Dioxide. Shortly after the release of the plan, the Secretary of State for Environment directed that Nottingham City Council produce a local plan, to be submitted by 15th September 2018. The local plan must show how compliance with the air quality directive would be reached in the soonest possible timeframe, but before 2020 at the latest. DEFRA strongly advised that, when preparing, their plans Local Authorities should consider all measures aimed at achieving compliance with the directive, with charging for access into Clean Air Zones considered necessary only if other measures failed to achieve compliance.

1.7 The July 2017 plan again showed that, according to the government’s own analysis, the areas within Nottingham with highest concentration of Nitrogen Dioxide are on the Ring Road and at Crown Island. The City Council carries out its own monitoring of Nitrogen Dioxide levels as part of the Local Air Quality Monitoring (LAQM) process. Results from this monitoring show that the areas of highest Concentration of Nitrogen Dioxide are located in the City Centre. Levels of NO₂ are particularly high around Canning Circus, Maid Marian Way and London Road.

Policy Context

1.8 The following section outlines the national and local policy contexts that underpin the need to improve Air Quality.

National policy

1.9 As indicated above, National Policy consists of two main documents; the UK plan for tackling roadside emissions and the Clean Air Zone Framework, both of which were published in 2017. These make very clear the national emphasis on improving air quality in our urban areas, and the need for local authorities to take urgent action where concentrations are most significant.
Local Policy Extent

Nottingham City Council Local Transport Plan Strategy 2011-2026

1.10 The Nottingham Local Transport Plan 2011-2026 sets out five key objectives through which transport can improve the lives of citizens living and working in Nottingham:

- World class sustainable transport system
- Low carbon and resilient transport system
- Access to key services, employment and training
- Improving quality of life and transforming Nottingham’s neighbourhoods
- Safe, independent and active healthy lifestyles

1.11 The objective around “Safe, independent and active healthy lifestyles” has a particular focus upon air quality. This presents the benefits of supporting and encouraging more people to undertake a larger number of journeys by active modes, (i.e. walking and cycling), ultimately benefiting their health and wellbeing. This objective also sets out the need to create safer streets and environments; emphasising the City Council’s role in minimising poor air quality and noise impacts from transport. This links to the objectives relating to a low carbon and resilient transport system, and creating a world-class sustainable transport system. The implementation of the LTP strategy has resulted in an increased use of sustainable transport measures and a reduction in the volumes of road traffic in Nottingham, evidence of which is documented in Appendix A.

1.12 Nottingham City Council will use the evidence generated during the development of this clean air strategy to produce its own air quality plan. This plan will look to align the clean air strategy with the existing Local Air Quality Management methodology and will be produced later in 2018.

The Case for Change

The Health Impacts of Poor Air Quality

1.13 Air pollution is associated with a number of adverse health impacts. It is recognised as a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society - notably children and older people, and those with heart and lung conditions. There is also often a strong correlation with equality issues, because areas with poor air quality are also often less-affluent areas with higher levels of deprivation. As such air pollution can also be seen as a matter of social injustice, given the most deprived 20% of neighbourhoods in England have higher air pollution levels than the least deprived neighbourhoods. Those communities that are both most polluted and that emit the least pollution tend to be amongst the poorest in Britain.

1.14 Despite great improvements in air quality in the UK since the Clean Air Act of 1956, current background levels of air pollution still pose a significant risk to health. Long-term exposure to air pollution at the levels experienced in many urban areas in the UK is now known to
cause respiratory and cardiovascular disease and lung cancer. Short-term exposure to episodes of high air pollution also leads to a worsening of symptoms for those with existing asthma, respiratory or cardiovascular disease, and can trigger acute events such as heart attacks in vulnerable individuals.

1.15 In 2008, the Department of Health’s Committee on the Medical Effects of Air Pollutants estimated that particulate air pollution brought forward, or contributed to, the early deaths of up to 29,000 people each year in the UK. Throughout 2015 and 2016 these estimates have been reviewed and increased, since it is recognised there is likely to be an overlap in the health burden associated with the ambient concentrations of particulate matter and nitrogen dioxide. The health impacts of ‘air pollution’ are now often reported as ‘40,000 deaths brought forward in the UK each year’. In Nottingham City, 6.4% of all adult mortality (150 deaths) was attributable to long term exposure to human-made particulate air pollution in 2010.

1.16 There are two Air Quality Management Areas in Nottingham City, one aligned with the main arterial routes of the City Centre, and the other at Beeston Road, Dunkirk, where levels of nitrogen dioxide (NO2) exceed nationally set air quality objectives. One of the Key drivers of high NO2 levels is the use of diesel engine vehicles. In addition, background (ambient) particulate matter (PM2.5) levels exceed World Health Organisation guidelines across the majority of Nottinghamshire County and Nottingham City. Further reductions in levels of PM2.5 and NO2 are required to protect human health. AQMA’s also exist on the City-County Boundary notably at Trent Bridge and on Mansfield Road at the north of the Ring Road. These areas have large amounts of traffic traveling through them into Nottingham City Centre (and as the most direct North-South route across the City) it is likely that the measures to improve air quality will have beneficial effects on these AQMA’s.

1.17 There are cost-effective, achievable local actions that can be taken to address air quality. In Nottingham, considerable emphasis has been placed on encouraging a shift towards greater use of active travel (walking and cycling), public transport and cleaner low and ultra-low emission vehicles over a sustained period. These actions also produce benefits across local priorities, including reduction in hospital admissions, increase in physical activity and healthy weight and tackling climate change.

1.18 In Nottingham, there have also been a number of initiatives aimed at improving air quality and minimising the impacts of air pollution:

- **Health and Wellbeing Strategy 2016-2020** - The Joint Health and Wellbeing Strategy sets out the problems facing our citizens with regard to health. Our Ambition, as set out in the strategy, is to create an environment in which people can live their lives with a greater sense of wellbeing as this is hugely significant to reducing health inequalities.

---

1 Royal College of Physicians (2016) *Every Breath We Take*. Available at: [https://www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution](https://www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution)
The strategy highlights the need to create an environment that encourages walking and cycling as a way in which its objectives can be achieved. It also highlights the need to reduce air pollution levels in Nottingham.

- **Joint Strategic Needs Assessment** - The Joint Strategic Needs Assessment (published in May 2015) acts as a local assessment of our current and future health and social care needs. The document contains a number of recommendations on how the City Council and its partner organisations could work to improve air quality. These measures include promoting the use of public transport, walking and cycling together with anti-idling campaigns, mobile phone alerting systems and measures that would help to reduce exposure to poor air quality.

- **Air Quality Action Plan** - It has been recognised that the current Air Quality Action Plan (embedded within the Local Transport Plan) is focussed solely on reducing emissions from road transport. The Air Quality Action Plan is therefore currently being revised to reflect that air quality is also affected by emissions from fixed sources and that technological advances now allow emissions from a wider range of sources to be reduced or negated altogether. In 2016, Nottingham City Council successfully obtained funding from JAQU to investigate and trial the feasibility of replacing natural gas fired boiler plant with zero NO2/NOx emission fuel cell technology. This project is currently underway.

**The Economic Impact of Poor Air Quality**

1.19 The quality of the air affects people’s health and the environment. In the last 5 years, the estimates of costs to public health have been revised several times (in light of new health impact studies) to account for the impact on health of particles and nitrogen dioxide both separately and combined (but assuming the effects are completely independent), and if there is an overlap in health impacts.

1.20 The national economic impacts have been derived, calculated and revised following research and an approach recommended by COMEAP and detailed in: ‘Valuing impacts on air quality: Updates in valuing changes in emissions of Oxides of Nitrogen (NO\(_x\)) and concentrations of Nitrogen Dioxide (NO\(_2\)) September 2015’.

1.21 The impacts are presented in two forms:
- A damage cost per tonne of emission change
- An annual social cost based on health impacts (data from 2013)
### Table 1-1: Damage costs/tonne by pollutant, location and source (2015 prices)

<table>
<thead>
<tr>
<th>NOx Damage Costs by Location and Source</th>
<th>Central Estimate</th>
<th>Low Central Range</th>
<th>High Central Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport average</td>
<td>£25,252</td>
<td>£10,101</td>
<td>£40,404</td>
</tr>
<tr>
<td>Transport urban large</td>
<td>£36,617</td>
<td>£14,647</td>
<td>£58,587</td>
</tr>
<tr>
<td>Transport urban medium</td>
<td>£28,788</td>
<td>£11,515</td>
<td>£46,061</td>
</tr>
</tbody>
</table>

### Table 1-2: Social cost and Health Impact from NO₂ (2013)

<table>
<thead>
<tr>
<th>Annual Equivalent attributable deaths</th>
<th>Central (2.5%)</th>
<th>Low (1%)</th>
<th>High (4%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Social Cost</td>
<td>£13.3bn</td>
<td>£5.3bn</td>
<td>£21.4bn</td>
</tr>
</tbody>
</table>

1.22 The methodology detailed in part 5 of the guidance and amended in ‘National data inputs for Local Economic Models (DEC2017)’ will be used in conjunction with detailed modelled NOx reductions to calculate the Damage Cost in Nottingham and the Conurbation.

### Outline Business Case

1.23 Nottingham City Council has, for many years, promoted sustainable transport with the aim of supporting economic growth, reducing congestion and improving air quality. Significant investment has been made to improve public transport; including in the tram network, the electric and gas powered bus fleet, integrated ticketing and bus information systems, and the implementation of a Workplace Parking Levy that seeks to both deter commuter car use and generate additional revenue to pay for these transport improvements. The Council is also implementing a range of measures to incentivise the use of cleaner vehicles, and has invested heavily in its cycle network in recent years. These measures have already gone a long way to creating a cleaner city, but it is recognised that further measures are needed to reduce levels of NO₂ to meet legal limits.

1.24 The remainder of this document details the Outline Business Case in the specific context of the above policies, and the needs of Nottingham city.
2 STRATEGIC CASE

2.1 The following Strategic Case provides our analysis of current air quality problems in Nottingham, the actions already in place to address these, and proposed additional measures that are required to further improve the current situation.

Analysis of Air Quality Problems in Nottingham

2.2 The Local Air Quality Management (LAQM) process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely, the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) that defines the measures it intends to implement to pursue the objectives. This Annual Status Report (ASR) is a requirement showing the strategies employed by Nottingham City Council to improve air quality and any progress that has been made.

2.3 Nottingham has two Air Quality Management Areas, both for Nitrogen Dioxide, where measurements have demonstrated that the Nitrogen Dioxide annual mean objective of 40 µg/m³ is being, or was likely to be, exceeded. These two AQMAs were designated primarily due to Nitrogen Dioxide emissions from traffic, although NOx from gas-fired boilers, (commercial and domestic heating and cooking) also contribute to ambient NO₂ concentrations in the City area.

2.4 Figure 2-1 shows the areas where regular monitoring shows exceedances of the limit value for NO₂. The areas of exceedance are predominantly located on the most heavily-trafficked routes within the city centre, and on Ilkeston Road and Crown Island to the west of the city centre. Monitoring on the Ring Road to the south of Crown Island has shown that Nitrogen Dioxide levels have reduced to below 40 µg/m³.
Analysis carried out by DEFRA ahead of the release of the 2017 UK plan for the reduction of roadside Nitrogen Dioxide indicated that the worst areas in Nottingham for Nitrogen Dioxide concentrations are located on the ring road. Figure 2-2 shows the areas where concentrations are above annual mean limit of 40μg/m³ in red and where concentrations are below but close to the limit in yellow.
2.6 The evidence from our LAQM process appears to show a degree of variation from the evidence derived from the Pollution Climate Mapping (PCM) model. The LAQM monitoring data appears to show the higher levels of Nitrogen Dioxide towards the centre of the city whereas the PCM model results show a particular problem on the ring road.

2.7 Figure 2-3 shows the outputs from the base 2016 model run. It shows high concentrations of NO$_2$ in the centre of the city with additional exceedances along Derby Road and at Crown Island. There is a strong correlation between the LAQM monitoring results and the locally produced modelling used to inform the analysis contained within this report. This difference is due to fact that there is a larger amount of locally derived air quality data used to develop the local model. In addition, the local model made use of locally derived traffic flows. The PCM model uses the five AURN sites around Nottingham together with nationally derived traffic flows. The result is that the local model has a greater degree of granularity and therefore more accurately represents the levels of NO$_2$ in the City.

Because of this analysis, efforts to tackle the air quality problems were largely informed by the local model and were focussed on the city centre.
Current Air Quality Trend

2.8 Nottingham City Council carries out regular monitoring of air quality as part of the LAQM process. The vast majority of monitoring is undertaken using over 40 diffusion tubes to provide cost effective monitoring with respect to the spatial distribution of Nitrogen Dioxide across the City. The data is reported as average monthly mean concentrations and the diffusion tubes supplement three City Council owned/operated Real Time Analysers which provide accurate, precise and temporally resolved monitoring data within the Air Quality Management Areas. There are also two DEFRA-funded Automatic Urban Rural Network (AURN) real time analysers that collected data on Nitrogen Dioxide levels and particulate matter. The locations of these monitoring sites are shown in Appendix B.

2.9 The data collected from the five real-time analysers is shown in Figure 4. The average level of Nitrogen Dioxide across the sites can be seen to be reducing from around 42μg/m³ in 2010 to approximately 36μg/m³ in 2016. All five of the real time analyser sites monitored at or below 40μg/m³ in 2016. 2017’s monitoring data shows an increase (1 ug/m³) in levels at St Andrews Road and Carter Gate (the reasons for this are considered in the Annual Status Report 2018) however the other sites do show a downward trend.

The Data shown in Figure 2-4 and Figure 2-4a allows us to conclude that overall the levels of Nitrogen dioxide are falling in Nottingham.
Figure 2-4: Air Quality monitoring results from AURN sites

Nottingham (real time analyser sites) annual mean nitrogen dioxide concentrations ug/m3

Figure 2-4a: Air Quality monitoring results from real time analyser sites

Nottingham (real time analyser sites) annual mean nitrogen dioxide concentrations ug/m3
2.10 A similar picture is shown with our diffusion tube data. Figure 2-5 shows data from selected locations with the highest Nitrogen Dioxide levels. Monitoring data for most of the sites dates back to 2013, which allows us to look at the picture over time up to 2017.

This graph also shows that, across all locations, the levels of Nitrogen Dioxide are falling over time in Nottingham.

Figure 2-5: Monitoring from Selected diffusion tube sites

2.11 One site of particular interest is 87 Castle Boulevard (Navy Blue on the above Chart); which is located close to our Western Cycle Corridor Scheme. The scheme has provided a high quality segregated cycle route from the City Centre out to the west of the city serving a number of key sites including business parks, the QMC hospital and the University of Nottingham. The scheme was completed in October 2016 allowing a full year of air quality in 2017. The 2017 data shows a sharp drop in the level of Nitrogen Dioxide since the cycle corridor was introduced.

**Actions to Improve Air Quality**

Current Actions to Improve Air Quality

2.12 Nottingham’s primary approach to reducing Nitrogen Dioxide concentrations from road traffic thus far has been to implement schemes that encourage the use of alternative modes of transport to the private car, supported by encouraging take up of low emission vehicle technologies. There are several initiatives currently in place where Nottingham City Council and partners are actively working to increase the use of sustainable modes of transport to
reduce the reliance on the private car as well as the take up of cleaner vehicles. These include:

*Integrated public transport system*

2.13 Nottingham City Council recognises that public transport is a major part of the solution to poor air quality and therefore has developed a comprehensive strategy to improve the public transport offering to citizens and businesses. For the last 15 years Nottingham City Council has been developing an integrated public transport system, in partnership with local operators, which offers a viable and high-quality alternative to car travel. The bus and tram network has grown from 67 million (2004) and currently carries over 78 million passenger journeys annually.

2.14 Investment has seen the development of the Nottingham Express Transit tram network, now spanning three lines with associated park and rides serving the key junctions of the M1 motorway. In summer 2015, two new lines opened serving the south and south-west corridors of the conurbation and key employment destinations such as the Queens Medical Centre, University of Nottingham, Boots and the NG2 Business Park, along with the city centre via Nottingham Railway Station. Nearly 18 million passenger journeys are taking place per year on the system and approximately 30% of users previously made their journeys by car or public transport.

2.15 Nottingham has a strong history of promoting bus travel through close partnership working. In 2010, the country’s first city-centre-wide Statutory Quality Partnership Scheme (SQPS) was introduced to deliver competitive and attractive bus services by specifying the standards of quality of local services. The Council has invested in modern, illuminated shelters with electronic real-time information displays at the 96 city centre stops. Operators using the facilities are meeting quality standards of service, with all vehicles being accessible low floor variants that comply with low emission standards.

2.16 Following the introduction of the Bus Services Act (2017), negotiations are currently underway with all local bus operators over the implementation of a new partnership arrangement. This will further regulate departures from on-street city centre bus stops, where all local services terminate within the city’s main Air Quality Management Area (AQMA). By 2019-20, it is intended a Euro VI minimum entry standard will be in place across the full local authority area for all bus services.

2.17 The implementation of this will further support a reduction in bus-derived emissions through a decrease in bus mileage and higher entry standards for all buses that operate into the city and throughout Greater Nottingham. These entry standards will also be applied to key high frequency routes which pass through a number of AQMAs in Greater Nottingham, and which sit within Nottinghamshire County Council’s administrative area. This means that a reduction of NOx emissions in these additional hotspots with problematic concentrations of roadside
NO$_2$ will also be achieved, significantly extending the benefits of this project beyond Nottingham City Council’s boundary.

2.18 Coupled with the enhancements to the core bus service provision, investment is being made to transition the bus fleet to low and ultra-low emission vehicles. The City Council runs a subsidised Linkbus network to plug the gaps in the commercial network. Interchanging with key destinations such as city centre, the two hospitals, park and rides, major shopping centres and out of town employment sites. The fleet of 58 buses is fully electric with a series of Optare and BYD electric buses in operation. The fleet of 45 Optare buses has now travelled 1 million miles and has saved 15 tonnes of Nitrogen Dioxide.

2.19 In April 2016, the City Council introduced the Robin Hood Card smart card for use on bus and tram services. The smartcard offers unlimited multi-operator travel across all services in the urban area. The network is supported by on-street ticket vending machines located at tram stops, city centre bus stops across the conurbation along with a network of Payzone outlets at 175 shops and improved retail website.

**Contactless Payments on public transport services**

2.20 Nottingham City Council successfully secured £2.4m funding from the National Productivity Investment Fund that will enable the use of contactless payments across the public transport network. This will reduce passenger loading times and improve journey time reliability on all routes. Nottingham will be the first city outside London where payments for bus and tram journeys can be made by contactless bank card or phone, with a daily cap to give best value fares.

**Go Ultra Low Nottingham**

2.21 Nottingham City Council was successful in its bid for over £6m to help fund a range of innovative measures that will deliver the uptake of an additional 8,000 ULEVs on our roads by 2020. It is the first project of its scale to invest in measures to incentivise the use of cleaner commercial and private vehicles. These include:

- Funding the installation of up to 230 fast and rapid charging points across the Nottingham, Derby and Nottinghamshire areas
- The Workplace Travel Service, offering grants for electric vehicle charging infrastructure, employer events and fleet reviews
- ULEV promotions and ride and drive events showcasing the benefits of ULEVs and their performance
- A business to business knowledge sharing network (called Low Emission Vehicle Enterprise and Learning) providing workshops, events and conferences on a range of subjects relating to low carbon vehicle technologies
- Support for the Daleside Road ULEV priority lane (see below)

2.22 Further details regarding the programme can be found at www.goultralownottingham.org.uk
2.23 The Go Ultra Low programme will deliver benefits across the whole D2N2 Local Enterprise Partnership area.

**Daleside Road ULEV Corridor Scheme**

2.24 The scheme has created a low emission corridor that benefits from lengths of new bus lanes, junction alterations, bus stop/shelter upgrades and real-time information. The corridor connects settlements to the east of Nottingham with the City Centre, the Racecourse park and ride site, and Waterside Regeneration area. ULEVs are permitted to use the new bus lanes along this corridor, which are the first of their kind in the UK.

2.25 In addition to investment in an integrated public transport system and cleaner vehicles, the City Council has expanded the sustainable transport offer to provide more choice and availability. This has included:

**Cycle Ambition Programme**

2.26 The City Council secured £6.1m through the Local Enterprise Partnership to kick-start an overhaul of Nottingham’s cycling facilities. The aim of the programme has been to increase the number of people cycling on a regular basis by 10% by 2025. To do that the City Council has built a series of cycle routes, with four main cycle corridors into the city centre, these have achieved high quality routes based on Transport for London best practice and segregated from traffic where possible. The development of a high quality city centre cycle hire facility is also an important component of this strategy.

**Behaviour Change programme**

2.27 Nottingham City Council was recently successful in winning £2.7m funding from the DfT’s Access Fund to deliver a programme of behaviour change activities working with households and businesses to promote sustainable travel options to improve air quality, including support for cycling. A broad range of initiatives are being delivered across Nottingham and beyond.

2.28 Access Fund monies received from the Department for Transport (alongside funding from WPL, Go Ultra Low and some DEFRA monies) are being used to offer an integrated Workplace Travel Service. This service provides support for public, private sector and voluntary organisations to help save money, reduce staff travel costs, improve staff health, fitness and wellbeing, reduce local road congestion and improve air quality.

**Clear Zone**

2.29 The Clear Zone encompasses a number of restrictions that prevent general traffic from accessing the largely pedestrianised central core of the City Centre, though special access permits are issued by the Council to allow loading and unloading between 10am and 4.30pm.
2.30 Figure 2-6 shows the extent of the existing Clear Zone and the type of restrictions currently in place across the zone. The City Council is currently in the process of revising the Clear Zone policy, it is intended that the Clear Zone restrictions will be extended to operate over a 24-hour period. The zone itself will cover a larger geographic area. New restrictions on parking and waiting will be aligned with emissions criteria. Together these proposals will act to restrict the most polluting types of vehicles within the zone it will also protect the investment by operators in low emissions vehicles.

**Figure 2-6: Clear Zone area and restrictions**

*Workplace Parking Levy (WPL)*

2.31 A Major aspect of Nottingham City Council’s Approach to promoting sustainable transport is the Workplace Parking Levy (WPL). The WPL scheme is a congestion charge designed to encourage employers to reduce the number of free workplace parking places they provide to staff and switch to alternative modes of transport.

2.32 Nottingham’s WPL was introduced in October 2011, with the charging commencing in April 2012. The levy works as a demand management tool focusing on commuter parking, which is
pertinent given commuters account for about 70% of congested peak hour traffic in Nottingham. Congestion costs Nottingham £160m every year and over half of this cost falls directly on businesses, who are the main beneficiaries of the Levy.

2.33 The WPL is an annual charge levied on all employers within Nottingham City Council’s administrative boundary who provide 11 or more liable workplace parking places. The scheme is largely administrative with employers managing their own account online. Since charging began in 2012 over £44 million of revenue has been generated with 100% compliance from liable employers, and over 99.9% of potential revenue has been collected. The WPL team operates at less than 5% of revenue cost, and their prevailing ethos is about achieving compliance rather than taking enforcement action.

2.34 WPL revenues are ring-fenced for spending on transport initiatives contained within the City Council’s Local Transport Plan. It has facilitated a step-change in transport infrastructure; providing the funding to more than double the size of the city’s tram network through extensions, redevelop the city’s mainline railway station, and support our award-winning fully electric Link bus network.

2.35 It has also contributed towards the development of Nottingham's integrated pay-as-you-go Robin Hood smartcard, its extensive real time information system with over 1,500 displays, refurbished bus stations and technology for priority and late running buses at key signalised junctions. It is also partly financing a new bus station within the ongoing redevelopment of the Broadmarsh area of the City Centre.

2.36 Significantly, the WPL revenue is used as local match funding to enable the City Council to bid for external funds from the Department of Transport and elsewhere, shown in Table 2-1.

<table>
<thead>
<tr>
<th></th>
<th>WPL local contribution (£M)</th>
<th>External funds (£M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tram extension</td>
<td>199</td>
<td>371</td>
</tr>
<tr>
<td>Train stations</td>
<td>12</td>
<td>48</td>
</tr>
<tr>
<td>Electric buses</td>
<td>5.8</td>
<td>9.2</td>
</tr>
<tr>
<td>Bus stations</td>
<td>1.7</td>
<td>1.3</td>
</tr>
<tr>
<td>Smartcard system</td>
<td>1.1</td>
<td>1.0</td>
</tr>
<tr>
<td>Real time info system</td>
<td>1.2</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>220.8</strong></td>
<td><strong>431.5</strong></td>
</tr>
</tbody>
</table>

2.37 This investment of over £650m has led to a 4.5% patronage increase in bus/tram usage since 2013/14 from an already high level of 75m passengers per annum. Nottingham has the highest level of bus/tram usage per head outside of London, with customer satisfaction levels continuing to rise across all areas to over 95%.
Additional Measures to Improve Air Quality

2.38 Following the release of DEFRA’s 2015 plan to improve air quality a number of funding sources were made available to cities with proven air quality issues. Nottingham City Council bid for funding DEFRA’s clean bus fund together with the Clean Air Early measures fund. The following section describes initiatives taken.

DEFRA Early Measures Fund

2.39 In July 2017, DEFRA made £1m available for each of the five original Clean Air Zone Cities named in the 2015 plan. The funding, known as the early measures fund to improve air quality, was aimed at improving cycling facilities and encouraging the uptake of low emission vehicles. The City Council was successful in bidding for funding for a project to purchase a number of ULEV taxis, which would then be leased to the operators by Nottingham City Council. Cycling Infrastructure improvements have also been funded, along with a series of research initiatives aimed at encouraging the use of battery electric vehicles.

2.40 The early measures fund was then extended in March and the City Council was given the opportunity to bid for a further £2m. The bid was aimed at transitioning the City Council’s own fleet of vehicles away from diesel to battery electric vehicles and we were successful in receiving £1.5m. The funding will enable the purchase of 10 electric Sweepers, 15 electric Cage Tippers, the conversion of three 18 tonne refuse collection vehicles, and the purchase of one fully-electric 26t refuse collection vehicle.

2.41 The transition of the city council’s fleet to electric vehicles will provide an immediate contribution to the improvement of air quality in and around the centre of Nottingham.

Buses

2.42 Nottingham City Council sees public transport as part of the solution to tackling poor air quality in the city. Historic investment in our bus fleet means that Nottingham City Transport (NCT) has a relatively modern fleet of mainly Euro 5 diesel buses the oldest of which is just over 7 years. Nottingham has set ambitious targets of having one of the least polluting bus fleets in the country. The city council saw retrofitting of its fleet of Euro 5 buses as a way of achieving this.

2.43 In 2017 The City Council applied for £2.7m to the clean bus fund. The fund would enable the retrofit of a 161 Euro V buses to Euro VI standard by NCT (in addition 5 Euro III training vehicles would also be retrofitted to Euro VI standard) and 5 Vehicle Euro V vehicles operated on our contracted Locallink service would be retrofitted to Euro VI standard.
### Table 2-2: Bus fleet for Euro VI retrofitting

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Euro Rating</th>
<th>Average Age (as of 31.03.18)</th>
<th>Routes Served</th>
<th>Accredited Tech</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 x Scania OmniDekka</td>
<td>V</td>
<td>7 yrs</td>
<td>35,48,49,100,UoN,A1/A2</td>
<td>Baumot BNox</td>
</tr>
<tr>
<td>62 x ADL E400</td>
<td>V</td>
<td>3 yrs, 6 months</td>
<td>1,4,34,56,57,59,78,79</td>
<td>Baumot BNox</td>
</tr>
<tr>
<td>16 x Optare Solo SR</td>
<td>V</td>
<td>6 yrs, 2 months</td>
<td>30,31,41,70,71,72</td>
<td>Baumot BNox</td>
</tr>
<tr>
<td>5 x Optare Solo SR</td>
<td>V</td>
<td>7 yrs 5 months</td>
<td>L10, L11, L14</td>
<td>Baumot BNox</td>
</tr>
<tr>
<td>22 x ADL E200 (10.2m)</td>
<td>V</td>
<td>4 yrs, 8 months</td>
<td>15,16,46,47,87,88</td>
<td>Baumot BNox</td>
</tr>
<tr>
<td>11 x ADL E200 (11.3m)</td>
<td>V</td>
<td>4 yrs, 6 months</td>
<td>39,40,42,53</td>
<td>Baumot BNox</td>
</tr>
<tr>
<td>5 x Scania Omnicity III</td>
<td>III</td>
<td>14 yrs, 6 months</td>
<td>Driver Training Vehicles</td>
<td>Baumot BNox</td>
</tr>
</tbody>
</table>

2.44 The retrofit programme has now started and the first of the upgraded buses are already operating on routes out to Clifton. By early 2019, the conversion of the above vehicles will help deliver Euro VI NOx compliance across 70% of the Nottingham City Transport (NCT) fleet this will include 53 Biomethane powered Double Decker buses, which are already in service with NCT.

2.45 Upon completion of the retrofit programme, Euro V Diesel buses’ NOx emissions savings of 63,411kg and PM savings of 488kg will be achieved.

**Modelling analysis contained within the economic case (see section 3) evidences that these measures alone will be sufficient to bring Nottingham into compliance with the air quality directive before 2020.**

2.46 Furthermore, funding of this retrofit project will enable NCT to concentrate their capital reserves on a bid into the next round of the Ultra-Low Emission Bus Scheme (ULEBS). The capacity of Nottingham City Transport’s biomethane fuelling infrastructure will be doubled if the bid is successful. This will enable the size of NCT’s biomethane double decker fleet to grow from 53 to 120 buses.

2.47 The remainder of the fleet, 185 Euro V midi and double deckers will be retrofitted via funding from the clean bus technology fund to Euro VI emission standard, creating a 100% Euro VI compliant operation.

**This strategic plan is a central pillar in the package of measures that Nottingham City Council is delivering to ensure that exceedance of NOx is brought to within legal limits as soon as possible before 2020.**

2.48 This investment will further enable NCT to continue its journey towards becoming the UK’s first carbon-neutral bus company. The 67 additional biomethane double deckers which will enter service as a result of the investment in the fuelling infrastructure will replace 67 existing Euro III and Euro IV diesel double deckers. Furthermore, this investment will enable NCT to realise its medium term strategy to develop a full low and ultra low emission bus fleet. From 2022 onwards, as the diesel buses retrofitted via the Clean Bus Technology Fund begin to life expire, the company intends to begin the transition to full electric bus operation for both
double and single decker buses as it is felt that the battery technology will be mature enough at this stage to fulfil the operational requirements of the company.

**Nottingham Taxi and Private Hire Vehicle Strategy**

2.49 The City Council launched its new Taxi Strategy on 7th February 2017. The strategy has a number of key objectives, which tie into the overall strategy of improving air quality and enhancing the public transport offer.

The most important of these objectives is the target that every Hackney carriage in Nottingham should be an ultra-low emission vehicle (ULEV) by 2025, with at least 40% of the fleet an ULEV by 2020.

2.50 The full taxi strategy document is contained in Appendix C. It additionally aims to support the taxi trade with the development of app partnerships and other innovations to help operators remain competitive in the face of pricing and service competition from private hire operators.

2.51 As part of the proposals for the early measures bid, Nottingham is purchasing five ULEV hackney carriages that will be leased back to operators on a cost-per-mile (or similar) basis in order to counteract the high initial cost of such vehicles and make them affordable to the trade. The aim of this scheme is to act as a demonstrator, or “try before you buy”, for how a ULEV taxi fleet could operate, helping to dispel misconceptions about the flexibility or operational feasibility of the new propulsion technologies.

2.52 In addition to the physical measures, we are already exploring other barriers to the uptake of ULEV taxis. The majority of taxi operators are practising Muslims. The Islamic faith prohibits certain loan and other financial arrangements, which given the significant purchase costs of ULEV hackney carriages, can act as a barrier to existing taxi operators. Nottingham City Council has commissioned research on how these issues can be resolved.

**Future measures**

2.53 Nottingham City Council is currently exploring a number of potential schemes and measures that would also positively affect local air quality. These measures do not yet have funding, but the City Council will continue to petition central government to make funding available for their implementation:

- Extensions to the NET Tram system to link the proposed HS2 Station at Toton, with consideration for a potential link through to Derby.
- Working closely with Highways England to explore ways the trunk road network can be altered to encourage further the use of buses and other forms of sustainable transport.
- Using the evidence from our Clean Air Zone Analysis to create a detailed Air Quality Action Plan and review existing AQMA’s.
- Electrification of the Midland Mainline Railway between Nottingham and London.
Proposed Measures

2.54 From a legal perspective, the modelling work presented in this note has shown that Nottingham will achieve the threshold level for concentrations of Nitrogen Dioxide before 2020. However, the City Council has ambitious plans to further improve air quality by reducing other pollutants such as particulate matter. In addition, measures taken to improve air quality may result in distortions to local taxi markets and changes to fleet operator behaviour that would not be beneficial to the economy of Nottingham. The public consultation exercise has identified a clear desire on the part of stakeholders to do more to tackle air quality problems, particularly those resulting from taxi and buses.

Buses

2.55 As previously stated Nottingham City Council is engaged in negotiations with Bus Operating companies to extend and enhance the current Statutory Quality Partnership Scheme. The Extended Partnership Scheme will add to measures taken to improve air quality in Nottingham. The main measures will be to reduce the number of bus stops in the city centre and to impose waiting and idling restrictions on buses; these measures will help to increase the efficiency of bus movements in the centre of the city thereby improving journey times. It will also regulate to ensure that only Euro 6 Diesel, Gas and Electric buses can operate within the area.

2.56 The scheme is set up in partnership with bus operating companies and so their cooperation is required to implement the changes to these regulations. Bus companies operating in Nottingham have benefited from grants to help with the cost of retrofitting their vehicles in order to ensure they are compliant with the local air quality requirements. However, implementing the retrofit is onerous for bus operating companies as each bus must be taken out of service for at least two days and there are ongoing costs associated with the retrofit that will not be covered by the grants (such as increased maintenance and fuel costs). It is therefore necessary to incentivise the operating companies to complete the retrofitting programme.

2.57 The proposed clear zone permit scheme will ensure that the City Council has the regulatory powers to encourage all bus operating companies within Nottingham to implement the retrofit programme.

Taxis

2.58 The City Council’s Taxi Strategy has an ambitious target of ensuring that all of the taxis and private hire vehicles licensed by Nottingham City Council will be Euro 6 or above by 2020. An increasing proportion of Private Hire vehicles licensed in Nottingham are already Euro 6 or above and now, hackney carriages are following suit. Of the 411 hackneys operating in Nottingham 24 have now upgraded their vehicles to new Euro 6 diesel vehicles. There are also a two ULEV hackneys and a further one is on order.
2.59 The age and emissions policy contained in the Taxi Strategy contains provisions that no licenses will be issued for to taxis below Euro 6 from mid-2018. In light of this all 411 hackney carriages will be Euro 6 or above by Mid-2019. After 2025, no new internal combustion engined vehicles will be licensed to operate as taxis in the city of Nottingham.

2.60 These measures place the onus for upgrading vehicles onto the taxi operators themselves. In the case of hackney carriages, the costs associated with upgrading vehicles and renewing licenses for those vehicles is borne by the taxi drivers.

2.61 We are seeking to introduce measures to assist taxi operators to switch to newer vehicles. These measures will take a number of different forms the details of which are outlined in the commercial case. The City Council will be bidding funding of up to 1.14m in order to ensure these measures are implemented.

Public Consultation

2.62 An initial public consultation was carried out in May 2018. The consultation lasted for 8 weeks and served as an engagement and communications exercise. No details of the preferred scheme were included in the initial consultation. The results of which will be included in the June outline business case. Headline results from the consultation are outlined as follows:

- 81% of respondents were aware of the Government requirements to tackle air pollution
- 88% of respondents believe improving air quality should be a priority for Nottingham
- 57% of respondents believe Nottingham City Council is committed to tackling air pollution
- 60% of respondents were confident that Nottingham City Council schemes will reduce air pollution
- 72% of respondents believe a clean air zone would be a good idea for Nottingham

2.63 The full results of the public consultation exercise are included in Appendix D.

2.64 A second more detailed Public consultation exercise will take place August into and September 2018. This consultation will contain details of our proposals, the results of which will be included in the Final Business case to be submitted in September.

Summary and Conclusions

2.65 This Strategic Case has outlined the position on Air Quality in Nottingham, including the specific problems experienced in Nottingham and how we intend to tackle them.

2.66 This business case provides evidence that there is a significant difference in the monitoring of Air Quality in Nottingham compared to the modelling results taken from the PCM model. This disparity is evident both in terms of the concentrations of Nitrogen Dioxide and in terms of the locations of the worst affected areas.
The Strategic Case sets out evidence that Nottingham’s approach to dealing with the Air Quality issues thus far has been to encourage the use of sustainable modes of transport and, through the Workplace Parking Levy, proactively discourage commuter car use through pricing. We have also shown that this approach is having a positive impact on Air Quality particularly. Although some problems remain, monitoring is showing a general improvement in the concentrations of Nitrogen Dioxide in the worst affected areas. We expect this improvement to continue and accelerate as more projects aimed at improving Air Quality come into effect. Projects such as Go Ultra Low Nottingham, taxi demonstrator projects and the bus retrofitting project are either not yet started or in the early stages of development.

The following Economic Case goes further in analysing the beneficial impact of these additional measures. It concludes that, when they are fully implemented, Nottingham City Council will meet its air quality directive obligations, and concentrations of Nitrogen Dioxide will be reduced to below 40µg/m3. From an air quality perspective, this is good news, however in achieving this target, the City Council will be required to implement measures that could have adverse impacts on certain aspects of its economy. The changes will create distortions in the local taxi market and adversely affect taxis licensed in Nottingham. For this reason the city is seeking further support for taxi drivers to incentivise the uptake of ULEV taxi’s.
3 ECONOMIC CASE

Introduction

3.1 To ensure the optimum solution for Nottingham is delivered, so as to achieve compliance with air quality targets whilst minimising the socio-economic impacts on both residents and businesses, a comprehensive modelling process was required to evaluate all possible options. Those which do not meet the compliance threshold and/or have excessive socio-economic impacts were subsequently discounted.

3.2 The Economic Case detailed in this section evaluates all proposed options (including charge-based access restrictions) identified by the City Council to reduce air pollution levels in Nottingham. This analysis supports the identification of our preferred option for bringing about compliance with the EU Air Quality Directive, which is focused on reducing the emissions of Nottingham’s bus and taxi fleets.

3.3 The economic case follows the HM Treasury Green Book Five Case Model and will be submitted to the Joint Air Quality Unit (JAQU) for review. This section therefore contains:

- An assessment of the critical success factors for assessing options;
- An outline of an initial long-list of potential options;
- Assessment of the long-list using “Strengths Weakness Opportunities and Threats” analysis to refine it to a shortlist;
- Assessment of the benefits, costs and distributional impacts of the shortlisted options.

3.4 The detailed write up of the underlying economic assumptions and calculations are described in the Economic Appraisal Methodology Report (Appendix E). The detailed write up of the underlying assumptions and calculations relating to the distributional impact assessment are described in the Distributional impact assessment methodology report (Appendix F - Originally E3).

Critical success factors

3.5 We have identified the following set of critical success factors (CSFs) which the preferred option should achieve as part of the OBC. All options are assessed against these criteria:

- **Impact (Pass / Fail)** – Is the proposed Option likely to result in the achievement of limit values for Nottingham in the shortest possible time, and no later than 2020?
- **Minimise economic disruption** – Is the proposed option likely to result in significant disruption to the economy of Nottingham?
- **Maximise value for money** – The preferred charging option should represent the best value for money.
- **Achievable within timescales** – The preferred option must be implementable before the 2020 deadline.
- **Minimise impact on deprived areas of the city** – It is likely that the potential option will impact disproportionately on people living in more deprived areas of Nottingham.
Many of the most deprived areas in NCC are near the city centre. The potential option should be designed to reduce the impact on people living in those areas.

- **Complement Workplace Parking Levy** – any preferred option should be complementary with the operation of the Nottingham WPL.

3.6 The first CSF, related to impact, acts as a go/no-go gateway before any option is considered against the remaining factors.

**Short listing of potential options**

3.7 A long-list was created based on development options and CAZ classifications. This long list was considered against the critical success factors (CSFs) and tested through a SWOT analysis. The SWOT analysis also served to reduce the number of options to a shortlist. This shortlist was then taken forward for detailed analysis using traffic and air quality models.

**Defining a Long List of options**

3.8 The generation of the long-list of options originated from the key requirement to achieve compliance with air quality standards alongside the wider considerations presented in Table 3-1. Key questions around scope, technical issues, delivery & implementation were considered, together with ensuring the defined area is understandable for the public. Together this determined a wide range of options which would be relatively simple to develop and enforce. In coming up with potential options we considered a range of both non-charging and charging CAZ options, consistent with DEFRA's CAZ framework.

### Table 3-1: Wider considerations in development of options

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Key Points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scope</strong></td>
<td>• Would the measure suffice to deliver compliance in line with CSF1.</td>
</tr>
<tr>
<td></td>
<td>• How far should the measure extend, what is the most appropriate geographical location in order to minimise impact, but deliver compliance in line with CSF1?</td>
</tr>
<tr>
<td></td>
<td>• Which class of vehicle to apply to each option? The option will consider the strengths and weaknesses of including, or omitting each category of vehicle.</td>
</tr>
<tr>
<td></td>
<td>• Can implementation over a particular area and inclusion of each category of vehicle be supplemented by additional measures, for example ULEV uptake, transport mode shifts?</td>
</tr>
<tr>
<td><strong>Technical Issues</strong></td>
<td>• The technical aspects of the options. This may consider the complexity of an implementation in terms of enforcement, communication, or technological elements.</td>
</tr>
<tr>
<td><strong>Delivery</strong></td>
<td>• Will the options be delivered through internal resource; will external resource be considered or required? Is there sufficient technical, economic, modelling, planning or management resource internally? Will expertise be required?</td>
</tr>
</tbody>
</table>
### Considerations

<table>
<thead>
<tr>
<th>Key Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Options will be assessed with dependencies and stakeholders considered in terms of how key partners may support delivery elements of a scheme.</td>
</tr>
</tbody>
</table>

### Implementation

<table>
<thead>
<tr>
<th>Key Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The timescales for delivery, this is likely to be one of the main challenging elements of options and may be one of the deciding factors in terms of preferred options. Timescales are already short, with significant challenges in place. Options will have to be fixed to the shortest feasible timeline; however, this limits opportunity and restricts the ability to implement more significant additional measures.</td>
</tr>
</tbody>
</table>

### Funding

<table>
<thead>
<tr>
<th>Key Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Sources of funding are a crucial element of the scheme. The Financial Business Case considers the requirement to support potential schemes and whether funding has been secured to-date for work on feasibility and scoping of each potential measure. Identification of primary and additional funding for the options will be vital if the authority is to deliver the required scheme within available timeframes.</td>
</tr>
</tbody>
</table>

3.9 In defining options for the preferred scheme, the proposed approach was to aim for a scheme that achieves compliance in the shortest time possible and with the lowest level of cost to both the City Council, transport operators and members of the public in the city. On this basis, three initial boundary options were considered (shown in Figure 3-1):

- A Clean Air Zone with a City-Centre boundary.
- A Clean Air Zone with its outer boundary based on arterial routes to the outer ring road.
- A Clean Air Zone with its outer boundary based on the City Area and extension into borough arterial road links.
3.10 All options modelled were based on the classes detailed in the CAZ classification table, to ensure that there is clarity and consistency of approach and compliance with the National Framework. The long list of options presented in Table 3-2 was considered. This reflects the wide range of options that was put forward previously in the March 2017 submission to DEFRA. The long list of options has been considered against the CSFs and if an option did not meet CSF1, it has not been considered further.
## Tackling Roadside NO₂ Emissions

### Table 3-2: Long list of CAZ options

<table>
<thead>
<tr>
<th>Option</th>
<th>CAZ Class</th>
<th>Boundary</th>
<th>Description</th>
<th>Anticipated to meet CSF 1</th>
<th>Timescales for implementation</th>
<th>Funding required</th>
<th>Minimise Economic Impact/Distributional Analysis</th>
<th>Adverse secondary outcomes?</th>
<th>Shortlisted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Do- Minimum Baseline</td>
<td>Includes ongoing schemes such as the Local Taxi Strategy and the Clean Bus technology fund.</td>
<td>Yes</td>
<td>2019</td>
<td>N/A</td>
<td>N/A</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Do something multi zone option</td>
<td>Option 2 is described as a multi Zone option. The purpose of this would be to tailor the intervention to impact specific vehicles in specific areas. One example could be a Class D CAZ in the inner central area of the city with a class B in the outermost area of the city with a Class C in the middle area. The intension would be to minimise the impact of the CAZ on the outermost residential areas of the city while tackling commuting to the central core of the City.</td>
<td>No (time for delivery +3 years)</td>
<td>2021+</td>
<td>Yes</td>
<td>Medium to High impact</td>
<td>Displacement</td>
<td>No. The baseline modelling showed that the main issue is buses within the city centre and to a smaller extent HGVs. Time frame for implementation would go beyond 2020</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Class B</td>
<td>City Centre</td>
<td>Only affecting HGV as all non-compliant buses and Taxis are already captured under option 1</td>
<td>Yes</td>
<td>2020</td>
<td>Yes</td>
<td>Low</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>Class B</td>
<td>Ring Road</td>
<td>Only affecting HGV as all non-compliant buses and Taxis are already captured under option 1</td>
<td>Yes</td>
<td>2020</td>
<td>Yes</td>
<td>Medium</td>
<td>No</td>
<td>No. The baseline modelling showed that the main issue are buses within the city centre and to a smaller extent HGVs.</td>
</tr>
<tr>
<td>5</td>
<td>Class B</td>
<td>City Boundary</td>
<td>Only affecting HGV as all non-compliant buses and Taxis are already captured under option 1</td>
<td>No</td>
<td>2021</td>
<td>Yes</td>
<td>Medium</td>
<td>No</td>
<td>No. The baseline modelling showed that the main issue are buses within the city centre and to a smaller extent HGVs. Doubt as to whether it can be implemented in full by 2020.</td>
</tr>
<tr>
<td>6</td>
<td>Class C</td>
<td>City Centre</td>
<td></td>
<td>Yes</td>
<td>2020</td>
<td>Yes</td>
<td>Medium</td>
<td>Displacement</td>
<td>No. The baseline modelling showed that the main issue is buses within the city centre and to a smaller extent HGVs.</td>
</tr>
<tr>
<td>7</td>
<td>Class C</td>
<td>Ring Road</td>
<td></td>
<td>Yes</td>
<td>2020</td>
<td>Yes</td>
<td>Medium</td>
<td>Displacement</td>
<td>No. The baseline modelling showed that the main issue are buses within the city centre and to a smaller extent HGVs.</td>
</tr>
<tr>
<td>Option</td>
<td>CAZ Class</td>
<td>Boundary</td>
<td>Description</td>
<td>Anticipated to meet CSF 1</td>
<td>Timescales for implementation</td>
<td>Funding required</td>
<td>Minimise Economic Impact/Distributional Analysis</td>
<td>Adverse secondary outcomes?</td>
<td>Shortlisted</td>
</tr>
<tr>
<td>--------</td>
<td>-----------</td>
<td>----------</td>
<td>-------------</td>
<td>---------------------------</td>
<td>-------------------------------</td>
<td>----------------</td>
<td>---------------------------------</td>
<td>---------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>8</td>
<td>Class C</td>
<td>City Boundary</td>
<td>No</td>
<td>2021</td>
<td>Yes</td>
<td>Yes</td>
<td>Medium - High</td>
<td>No</td>
<td>No. The baseline modelling showed that the main issue are buses within the city centre and to a smaller extent HGVs. Doubt as to whether it can be implemented in full by 2020</td>
</tr>
<tr>
<td>9</td>
<td>Class D</td>
<td>City Centre</td>
<td>Yes</td>
<td>2020</td>
<td>Yes</td>
<td>Yes</td>
<td>Medium - High</td>
<td>Displacement</td>
<td>No. The baseline modelling showed that the main issue are buses within the city centre and to a smaller extent HGVs.</td>
</tr>
<tr>
<td>10</td>
<td>Class D</td>
<td>Ring Road</td>
<td>Yes</td>
<td>2020</td>
<td>Yes</td>
<td>Yes</td>
<td>High</td>
<td>Displacement</td>
<td>No. The baseline modelling showed that the main issue are buses within the city centre and to a smaller extent HGVs.</td>
</tr>
<tr>
<td>11</td>
<td>Class D</td>
<td>City Boundary</td>
<td>No</td>
<td>2021</td>
<td>Yes</td>
<td>Yes</td>
<td>High</td>
<td>No</td>
<td>No. The baseline modelling showed that the main issue are buses within the city centre and to a smaller extent HGVs.</td>
</tr>
<tr>
<td>12</td>
<td>Revised Clear Zone (NCCAZ)</td>
<td></td>
<td>Yes</td>
<td>2020</td>
<td>Yes</td>
<td>Yes</td>
<td>Low</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis and further refinement of the options

3.11 The longlist provided an initial set of options to evaluate. The time-intensive nature of modelling necessitated further refinement of the options to allow more comprehensive analysis of fewer options. A SWOT analysis was performed to facilitate this process on the basis that detailed modelling would be undertaken for the shortlisted options. The detailed SWOT analysis is presented in Appendix G and draws on the CSF criteria outlined previously.

3.12 As described above, options that cannot be implemented by the 1st January 2020 were discarded without further appraisal. This timeframe includes consultation, submission of the full business case and funding approval, procurement and implementation of the network, and allowing sufficient time for vehicle owners to both order and receive vehicles or alternatively to retrofit their existing models. Any of the additional measures that require major works i.e. city-wide packages are not expected to be deliverable by 2020, so have not been considered in the context of this Outline Business Case but may have scope to deliver longer-term air quality benefits should they be required in future.

Options 2, 5, 8 and 11 all have an implementation timescale longer than 3 years, so these options would fail to achieve a reduction in the NO\textsubscript{2} concentration in the shortest time possible or by 2020. These four options were discarded immediately.

3.13 One of the key unwanted secondary impacts identified is the potential for displacement of traffic from the ring road scenarios to residential areas. This would be unacceptable from both an air quality point of view, as well as the associated road safety and noise issues that would be displaced into areas of Nottingham with higher levels of deprivation.

3.14 The requirement for funding was also considered. A smaller scheme will cost less in terms of camera infrastructure than a larger scale CAZ. However, the higher the class of CAZ the greater the requirement for more comprehensive support packages.

3.15 The summary scores of the SWOT analysis are presented in Table 3-3.
## Table 3-3: Summary overview of SWOT analysis

<table>
<thead>
<tr>
<th>Option</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Do Minimum (already includes ongoing schemes such as the Local Taxi Strategy and the Clean Bus technology fund)</td>
<td>Multi-zone CAZ, differing vehicle classes, over City Centre/City area</td>
<td>Class B City Centre Zone</td>
<td>Class B City Boundary Zone</td>
<td>Class C City Centre Zone</td>
<td>Class C City Boundary Zone</td>
<td>Class C City Centre Zone</td>
<td>Class C City Boundary Zone</td>
<td>Class D City Centre Zone</td>
<td>Class D City Boundary Zone</td>
<td>Revised Clear Zone (HGVs only)</td>
<td></td>
</tr>
<tr>
<td>Service Solution</td>
<td>Local Taxi Strategy and the Clean Bus technology fund</td>
<td>Multiple zoned, ANPR enforced areas</td>
<td>City Centre ANPR enforced area</td>
<td>Inside Ring Road ANPR enforced area</td>
<td>City-wide ANPR enforced area</td>
<td>City Centre ANPR enforced area</td>
<td>Inside Ring Road ANPR enforced area</td>
<td>City-wide ANPR enforced area</td>
<td>City Centre ANPR enforced area</td>
<td>Inside Ring Road ANPR enforced area</td>
<td>City-wide ANPR enforced area</td>
<td>City Centre permit enforced area for unloading of goods</td>
</tr>
<tr>
<td>Implementation</td>
<td>1-2 years</td>
<td>3+ years</td>
<td>2 years</td>
<td>2-3 years</td>
<td>3-years</td>
<td>2-3 years</td>
<td>3-years</td>
<td>2-3 years</td>
<td>2-3 years</td>
<td>3-years</td>
<td>2 years</td>
<td></td>
</tr>
<tr>
<td>Funding</td>
<td>all measures already fully funded</td>
<td>Publically funded, High Cost</td>
<td>Publically funded, Low Cost</td>
<td>Publically funded, Medium Cost</td>
<td>Publically funded, Medium Cost</td>
<td>Publically funded, Low Cost</td>
<td>Publically funded, Medium Cost</td>
<td>Publically funded, Medium Cost</td>
<td>Publically funded, Low Cost</td>
<td>Publically funded, Medium Cost</td>
<td>Publically funded, Medium Cost</td>
<td></td>
</tr>
<tr>
<td>Total Score</td>
<td>56</td>
<td>19</td>
<td>41</td>
<td>33</td>
<td>22</td>
<td>30</td>
<td>28</td>
<td>24</td>
<td>9</td>
<td>8</td>
<td>0</td>
<td>41</td>
</tr>
</tbody>
</table>
3.16 The options from the long-list that have not been considered for further assessment have been identified as not suitable on the basis of their failure to satisfy CSFs, complexity, uncertainty or potential cost. However, the primary concern has been to identify solutions that would deliver compliance in the shortest time possible – the gateway success factor that we must achieve.

3.17 The result of this analysis was a refinement of the list of options, leaving only three potential options for detailed modelling and further consideration:
- Option 1 – Do Minimum Baseline,
- Option 3 – a city centre wide CAZ B; and,
- Option 12 a Revised Clear Zone.

**Modelling and identification of the short-list**

3.18 Local transport and air quality modelling has been undertaken to perform an assessment of each of the 3 options that can achieve air quality compliance by 2020 or sooner, summarised in Table 3-4. Option 1 is the 2020 Do Minimum baseline used for the economic assessment, and as such has not been assessed further. The baseline rapidly evolved as part of the study. As such the Do Minimum baseline is not the same baseline used for Target Determination, but was developed as an alternative baseline with measures already fully-funded and partially implemented. The original baseline used for the Target Determination process has been superseded by the Do Minimum baseline and, as such, is no longer relevant.

**Table 3-4: Shortlist options initial ranking (prior to full economic analysis)**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Option</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Do-Minimum (Baseline for economic assessment)</td>
<td>• Achieves air pollutant emission reductions by 2020 or sooner&lt;br&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Minimises additional funding required</td>
</tr>
<tr>
<td>2</td>
<td>Charging CAZ B City Centre</td>
<td>• Option meets CSF 1, achieving compliance in shortest time possible and no later than 2020&lt;br&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Would achieve further reductions in NO2 compared to baseline&lt;br&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Requires significant additional funding</td>
</tr>
<tr>
<td>3</td>
<td>Revised Clear Zone B</td>
<td>• Option meets CSF 1, achieving compliance in shortest time possible and no later than 2020&lt;br&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Would achieve further reductions in NO2 compared to baseline&lt;br&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Requires additional funding</td>
</tr>
</tbody>
</table>
Economic Appraisal

Overview of approach and key assumptions

3.19 This section provides an overview of our approach to the economic analysis. A methodology paper is provided in Appendix E that provides a more detailed guide to the analysis.

3.20 JAQU has provided detailed guidance regarding the appraisal of suitable options. This provides a steer for many of the key data inputs and assumptions that have framed our analyses. The key documents that have provided this guidance include:

- Options Appraisal – Guidance (2017) (and preceding versions of this guidance)
- National data inputs for Local Economic Models (2017)

3.21 The analysis is also underpinned by the following general assumptions:

- Each impact associated with each option is assessed relative to a ‘Do Minimum’ baseline;
- All impacts are presented in real terms with a Price Year of 2018;
- A lifetime approach has been adopted (rather than an annualised approach) and all impacts are assessed over a 10-year appraisal period from 2020-30;
- All impacts are discounted to 2020 applying Green Book discount factor of 3.5%.

3.22 The methodology developed has been designed to be consistent with the JAQU guidance.

Scenarios

3.23 The options assessed as part of the Economic Case are set out in Table 3-5. The Do Minimum Baseline is used as the baseline for the economic assessment, considering all measures are fully funded and have partly been implemented already. As such it is not considered as a new option to be assessed through this process.

Table 3-5: Short-listed options assessed

<table>
<thead>
<tr>
<th>Option</th>
<th>Details (all introduced in 2020)</th>
</tr>
</thead>
</table>
| Charging CAZ B City Centre | • Introduced by 2020  
• CAZ operating within city centre  
• only HGVs and out town bused and taxi’s affected as local taxis/buses assume to comply by 2020  
• Assumes no cancel avoid – as not modelled in transport model – but that in turn was due to small zone area / assumed market response |
| Revised Clear Zone      | • Introduced by 2020  
• Permit scheme operating within Clear zone, a subset of the city centre  
• only HGVs affected as taxis/buses assume to comply by 2020 – As outcome  
• All HGVs entering the zone have to have a permit in order to load/unload goods. Permits are only granted to HGVs EURO 6 which lead to assume that 100% of HGVs entering the zone will be compliant |
Cost-Benefit Analysis (CBA)

3.24 A CAZ will impact various parts of the environment, economy and society. The economic analysis seeks to quantify and value as many of these impacts as possible, and the scope of impacts considered in this analysis were:

- **Upgrade costs** – the impact on those vehicle owners, either households or businesses, that respond to CAZ/Revised Clear Zone implementation by replacing their vehicle. These are the upfront costs for vehicle owners associated with switching from a non-compliant to a compliant vehicle. This encompasses the vehicle scrappage cost and the consumer welfare impact as described in the JAQU guidance.

- **Air quality emissions** – the impact on affected populations by a change in NOx and PM emissions as a result of scheme implementation. Calculating the economic impact is dependent on the output of air quality and transport models which provide air quality outputs for the baseline and scheme options for NOx and PM2.5. The marginal impact on air pollution of each option has been calculated (in tonnes of pollutant) and combined with the air pollution damage costs provided by JAQU, which convert emission concentrations into monetised health impacts, to estimate the total benefit (in damage costs saved) for each option.

- **Greenhouse Gas impacts** - here vehicle owner’s upgrade vehicles or cancel their journeys, this will have an impact on fuel consumption and in turn on the emissions of GHG’s. The marginal impact of options has been calculated for upgraded vehicles and valued using BEIS carbon prices as specified by JAQU.

- **Operating cost impacts** - those savings or additional costs that can result from scheme implementation. This includes both changes in fuel consumption and the associated cost, and change in operating and maintenance costs.

- **Implementation costs** - Alongside costs to vehicle owners, there will also be costs for monitoring and enforcement for the implementing authority. These will be drawn from estimates developed for the Financial Case, which will present implementation costs in detail.

3.25 Congestion impacts (vehicle owners cancel journeys, shift mode or avoid the zone) and Welfare Costs (vehicle users change their travel patterns) were not considered as part of the economic assessment because:

- Congestion impacts - In the SYSTRA transport model, the ‘Cancel’ behavioural response is suppressed. Due to the very small size of the CAZ and the fact that only HGVs are impacted, the ‘Avoid’ response was also suppressed. Congestion impacts are expected to be negligible given the small size of the CAZ and the fact that only HGVs are affected.

- Welfare Costs - Similarly to the case of congestion impacts, as the behavioural responses of ‘Avoid’, ‘Cancel’ and ‘Mode shift’ are not modelled in the SYSTRA transport model, it was not possible to estimate welfare loss. However, given that only HGVs are
affected and the zone is small, welfare impacts are predicted to be very small in comparison to other modelled impacts.

3.26 The general approach to calculating economic impacts is as follows:

\[ \text{Total Economic Impact} = \text{Volume} \times \text{Unit Economic Value} \]

3.27 For example, in the case of air pollutant emissions, volume will be tonnes of NOx and associated economic values are Damage Costs per tonne of NOx. This framework allows us to present our calculations in the format shown in Table 3-6.

**Table 3-6: Key calculations and data**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Volume</th>
<th>Unit economic values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Quality Emissions</td>
<td>Output of air quality modelling for each option, utilising the Emissions factors Toolkit (EfT)</td>
<td>PM$_{2.5}$ and NOx damage costs provided by JAQU</td>
</tr>
<tr>
<td>GHG Emissions</td>
<td>Output of air quality modelling</td>
<td>BEIS Carbon Prices</td>
</tr>
<tr>
<td>CAZ charge</td>
<td>Non-compliant trips defined by transport modelling</td>
<td>CAZ charge</td>
</tr>
<tr>
<td>Fuel/maintenance cost</td>
<td>Change in vehicle fleet defined by ANPR data combined with transport model outputs</td>
<td>Fuel prices provided by BEIS Fuel consumption provided by WebTAG databook</td>
</tr>
<tr>
<td>Costs associated with fleet change</td>
<td>ANPR data and JAQU behavioural responses to define number of non-compliant vehicles upgraded</td>
<td>Vehicle Prices</td>
</tr>
<tr>
<td>Implementation Costs</td>
<td>Labour and equipment required</td>
<td>Unit costs for labour, monitoring equipment etc</td>
</tr>
</tbody>
</table>

**Results of cost-benefit analysis**

**Quantification and valuation of impacts**

3.28 The results of our economic analysis are presented below in Figure 3-2 and Table 3-7.
Figure 3-2: PV of impacts and NPV of charging CAZ/Revised Clear Zone options

Note: Bars represent present value (PV) of impacts; dots represent aggregate net present value (NPV) of all impacts associated with CAZ option; all impacts are assessed relative to ‘do nothing’ baseline; NPV is also presented with congestion costs as a sensitivity to the central NPV estimate; all impacts presented in 2018 prices.

Table 3-7: Monetised impacts associated with CAZ options (cumulative discounted impact (PV) from 2020-30 (Million £, 2018 prices)

<table>
<thead>
<tr>
<th>Option</th>
<th>AQ impacts</th>
<th>Upgrade costs</th>
<th>Implementation costs</th>
<th>Opex costs (Upgrade only)</th>
<th>Fuel costs (Upgrade only)</th>
<th>CO₂ costs (Upgrade only)</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAZ B</td>
<td>2.54</td>
<td>-5.08</td>
<td>-13.92</td>
<td>0.65</td>
<td>2.16</td>
<td>1.07</td>
<td>-12.59</td>
</tr>
<tr>
<td>Revised Clear Zone</td>
<td>2.62</td>
<td>-11.55</td>
<td>-1.59</td>
<td>1.47</td>
<td>4.91</td>
<td>2.42</td>
<td>-1.72</td>
</tr>
</tbody>
</table>

Notes: +ve values denote benefit / -ve values denote costs; all impacts are in 2018 prices; all impacts are discounted to 2020
Detailed analysis

Air quality impacts

3.29 CAZ B and Revised Clear Zone are found to have similar impacts on NOx emissions despite the difference in the number of HGVs which upgrade between scenarios.

3.30 CAZ B results in a saving of 10.32 tonnes NOx/year in 2020 representing a benefit of £73.8k while the Revised Clear Zone produces a saving of 12.1 tonnes/year representing a benefit of £86.9k. Annual benefits reduce over the appraisal period as the baseline fleet naturally upgrades. The impacts of PM are also very similar between scenarios; however monetary benefits of reductions are more significant. CAZ B results in a saving of 3.6 tonnes/year representing a benefit of £462.8k and Revised Clear Zone results in a saving of 3.65 tonnes/year representing a benefit of £467.5k.

3.31 The small difference in total emissions between scenarios may be due to the fact that HGVs represent a small proportion of total emissions within Nottingham city and the AQ modelling domain (See Target Determination Report). Due to the fact that many more vehicles have upgraded under the Revised Clear Zone, it is assumed that there must be greater air quality benefits but that these will therefore fall outside of the modelled domain (See Qualitative analysis).

3.32 Taken together, the air pollutant impacts represent a smaller net effect across the CBA than vehicle upgrade costs in the case of both options, and a smaller net effect than implementation costs in the case of CAZ B.

Vehicle upgrade costs

3.33 A key impact in the CBA is the cost of upgrading non-compliant vehicles. This covers a number of impacts: the scrappage cost of non-compliant vehicles, cost of purchasing new compliant vehicles and the cost of swapping a non-compliant used for a compliant used vehicle.

3.34 There is a significant cost associated with each option as, under each one, a significant proportion of non-compliant vehicle owners (100% in the case of revised clear zone) are assumed to choose to upgrade their vehicle in response to the CAZ.

3.35 This impact is a net effect associated with the CAZ scenario: there are also costs in the baseline scenario as the predominant impact of the CAZ is simply assumed to be bringing forward activity (in this case upgrading vehicles) which otherwise would have happened anyway at a later date. Hence the costs of the baseline activity are removed from those of the CAZ scenario to present the net cost of the CAZ. The overall NPV is therefore particularly sensitive to assumptions made in modelling the upgrade costs.

3.36 The unit cost of upgrading an HGV is large. Therefore, upgrade costs associated with both options are high relative to the air quality benefits. In both scenarios, the net impact of
upgrade costs exceeds the value of air quality benefits, most significantly in the Revised Clear Zone where 100% of non-compliant HGVs upgrade.

**Implementation costs**

3.37 Estimates of this impact are taken directly from the costings developed by NCC in preparation of the Financial Case. Over the ten-year appraisal period, implementation costs are not an insignificant impact. These costs are far greater in the case of CAZ B that in Revised Clear Zone due to the additional investment and infrastructural requirements. With that said, the cost estimates for the Revised Clear Zone may be an underestimate and may need to be reviewed for the FBC assessment. Enforcement of a permit scheme will need similar systems in place to a CAZ e.g. cameras or employment of staff. Alternatively, lower costs may mean that enforcement is lower, leading to greater uncertainty around delivery of objectives and higher risk around whether AQ limits will be achieved.

3.38 All options deliver a benefit through savings in operating costs of vehicles, fuel consumption and CO₂ emissions. Newer, compliant vehicles are likely to be much more efficient and less costly to maintain (e.g. they are likely to require fewer repairs), hence upgrading to these vehicles will deliver additional benefits to the vehicle owner through operating and fuel cost savings.

3.39 Comparing this to the other impacts captured, these impacts form a significant secondary benefit (after air pollutant emission reductions), particularly in the case of fuel consumption benefits.

**Comparing the options**

3.40 The CBA results present an assessment of the key monetised costs and benefits associated with the CAZ options and a partial NPV (it has not been possible to quantitatively assess some of the impacts - see following Qualitative Assessment).

3.41 Comparing between the two options, CAZ B has greater implementation costs, resulting a more negative NPV than that of the Revised Clear Zone. Both scenarios deliver very similar air quality benefits. The greater upgrade costs associated with the Revised Clear Zone do not bring with them a significantly greater reduction in air pollution concentrations, but does result in greater secondary benefits in terms of reduced operational expenditure, fuel costs and greenhouse gas emissions.

**Based on the analysis conducted, it appears that CAZ B and Revised Clear Zone options both deliver a negative NPV on central assumptions: i.e. the costs of implementing these options would be greater than the benefits. This is largely due to increased costs to businesses. Therefore, there does not appear to be an economic case to pursue these options, provided that air quality objectives are met by the achieved compliance of buses and taxis in the baseline.**
Sensitivity analysis

3.42 To determine whether these errors have a significant impact on the recommendations in this report, a sensitivity analysis was undertaken. This involves developing lower and upper bounds for significant assumptions and input values used in the analysis. If the recommendations stand up to this ‘stress testing’, the robustness of the analysis is confirmed.

3.43 The sensitivity analysis is constructed around the following key inputs:
   - Damage Costs
   - Uplift factors (applied to identify number of unique vehicles travelling into the areas)
   - Price reduction of non-compliant vehicles in response to CAZ
   - Ownership profile

Although the sensitivity analysis shows that the NPV assessment of the two options is sensitive to the assumptions, it demonstrated that uncertainty around the parameters tested does not influence (significantly) the relative ranking of the options.

Qualitative Assessment

3.44 The approach outlined above sought to quantify and monetise the impacts associated with the CAZ options. However, in some cases, due to limitations in data or methodologies available, it has not been possible to assess all impacts quantitatively. In this case, these impacts have instead been assessed qualitatively.

3.45 Through the development of the methodology, a number of impacts were identified as being unquantifiable; specifically:
   - NOx and PM impacts outside the modelling domain: the NOx impacts captured have been limited by the domain of the air quality model. However, where vehicles travel outside of this area, there will also be impacts through upgrading of vehicles and other behavioural responses associated with the CAZ. This is particlarly relevant here given that HGVs tend to cover much longer distances than other vehicle types.
   - Externalities/welfare loss associated with cancelled and rerouted trips: Due to the SYSTRA transport model not modelling ‘cancel’ or ‘avoid’ behavioural responses, it was not possible to model the impacts of congestion and welfare. However, it is likely that both of these responses will occur to some extent. Changes in traffic flows around the city will also imply changes in noise levels, accident rates and potential requirement for infrastructure maintenance. In addition to this, there will be air quality, CO₂, fuel, and operational expenditure impacts associated with these changes in traffic flows.

3.46 Furthermore, several impacts were identified as being associated with the CAZ, but were deprioritised for assessment due to less significant effects. This particularly applied to transaction costs associated with upgrading vehicles. An initial analysis suggested
transaction costs would be very small relative to upgrade costs, hence these were not included as part of the core analysis.

3.47 A qualitative analysis of these impacts across the scenarios is included in Table 3-8.

| Table 3-8: Qualitative analysis of options against impacts not covered by core CBA |
|-----------------------------------|-----------------------------------|
| NOx, and PM impacts outside modelling domain | CAZ B | Revised Clear Zone |
| 🔄 | Upgraded vehicles will travel outside zone, delivering additional emissions benefit. HGVs likely to do most significant proportion of annual vkm outside zone across vehicle types, hence impact moderate. | 🔄/✓ | Upgraded vehicles will travel outside zone, delivering additional emissions benefit. HGVs likely to do most significant proportion of annual vkm outside zone across vehicle types, hence impact moderate. Impacts likely to be greater than CAZ B due to much more upgraded vehicles- As this is not reflected in the modelled domain, it is likely that there will be significant air quality benefits yielded outside of the zone. |

| Transaction costs | 🔄 | Will be a cost and will move in line with number of vehicles upgraded. However, initial assessment suggested costs are small in comparison to cost of upgrade. | 🔄 | Will be a cost and will move in line with number of vehicles upgraded. However, initial assessment suggested costs are small in comparison to cost of upgrade. |

| Welfare loss associated with rerouted and cancelled trips | 🔄 | Where vehicle users change their travel patterns, there will be a cost for the user associated with not being able to take their first preference, for example a cancelled trip will result in lost welfare from the purpose of that trip. Welfare loss was not able to be quantitatively modelled as cancel and avoid responses were not modelled in the SYSTRA model. It is likely that there will be some of such impacts associated with the zone. | - | Under the permit scheme 100% of vehicles are assumed to upgrade |

| Wider externality effects associated with cancelled/re-routed journeys (AQ, CO2, noise, infrastructure, accidents) | ✓ | Effects measured by time spent travelling (veh-hours) and distance travelled; hence effect uncertain as cancel and avoid response not included in transport model. The assumption is that as the zone is small rerouting will be minimal and any HGV cancellation will be replaced by another firm. Cancelled trips lead to AQ benefits while rerouted trips lead to net/displaced effects. There may be some rerouting leading to costs for the HGV driver. However, this should be outweighed by benefits in AQ, CO2, noise, infrastructure and accidents. | ✓ | Effects measured by time spent travelling (veh-hours) and distance travelled; hence effect uncertain as cancel and avoid response not included in transport model. The assumption is that as the zone is small rerouting will be minimal and any HGV cancellation will be replaced by another firm. Cancelled trips lead to AQ benefits while rerouted trips lead to net/displaced effects. There may be some rerouting leading to costs for the HGV driver. However, this should be outweighed by benefits in AQ, CO2, noise, infrastructure and accidents. |

| Welfare loss associated with upgrading vehicles | ✓/✓ | Will scale with number of vehicles upgraded. However, in some cases vehicle users may derive a utility benefit from upgrading to a new vehicle. Hence overall impact is uncertain | ✓/✓ | Will scale with number of vehicles upgraded. However, in some cases vehicle users may derive a utility benefit from upgrading to a new vehicle. Hence overall impact is uncertain |

Note: ✓ Small to moderate benefits. ✓✓ Large benefits. ✓/✓ Neutral to slightly positive or slightly negative effects. ✓ = small to moderate costs. ✓✓ Large costs.

3.48 The impacts not captured by the quantitative analysis could represent both costs and benefits for the options:
All options will deliver emissions savings outside the modelling zone, delivering an additional benefit as upgraded vehicles will travel outside zone. Further, HGVs are likely to drive larger proportion of annual vehicle kilometres outside the zone, hence a large proportion of emissions impacts may fall outside the zone. However, given the majority of these additional miles will take place on motorways outside densely populated areas, the exposure and damage cost will be lower, thereby moderating the impact somewhat.

All options will likely deliver additional CO₂ emission reductions and wider congestion and noise and accident benefits associated with reductions in vehicle kilometres and travel time. These are associated with the number of vehicle operators adopting either ‘cancel’ or ‘avoid’ responses. Neither the ‘cancel’ nor ‘avoid’ responses were considered in the transport model. However, given ‘upgrade’ and ‘pay the charge’ are likely the most predominant responses for the CAZ B, the size of these benefits is expected to be relatively small. Considering that both options only look at HGVs, there would also be a benefit attributed to noise and health. However, these are expected to be very small given the limited option for HGVs to actually avoid/cancel their trips. These will also be balanced by the welfare cost to vehicles which adopt these alternative responses.

**Distributional Analysis**

3.49 JAQU provided detailed guidance regarding the appraisal of CAZ options. This gives a steer for many of the key data inputs and assumptions that have framed the analysis undertaken.

3.50 The key guidance documents include:
- Options Appraisal – Guidance (2017)² (and preceding versions of this guidance)

3.51 With respect to distributional analysis, the JAQU Guidance strongly leans on supporting Webtag guidance issued by DfT⁴.

3.52 The methodology used to undertake the distributional analysis is based on this guidance. In some cases, we have sought alternative methods, or elaborated additional steps and assumptions where the study team felt that such approaches were warranted to facilitate or improve the analysis. In particular, this is the case where additional output metrics were deemed useful to convey the distributional impacts of the options.

3.53 As such, our approach has adopted and followed the three steps defined by Webtag: Screening, assessment and appraisal. A detailed description of the underlying assumption, methodology and results can be found in the Distributional Analysis Methodology Report (E3).

---

² Unpublished – provided directly by JAQU to cities
³ Unpublished – provided directly by JAQU to cities
Throughout the development of the approach to the distributional analysis, the proposed methodology was presented to NCC and JAQU through a series of Scoping Papers. The methodology followed is consistent with the final version of this paper submitted (version 3).5

On the basis of the screening, the following effects have been ‘screened-in’:
- Air quality - changes in concentrations of NO₂
- Affordability – including user benefits, considering local businesses only

As part of the assessment we have not considered traffic impacts (changes in traffic as a proxy for noise and safety/accidents) and accessibility impacts (through changes in journey times). Both are assumed to be insignificant and will only be assessed qualitatively using information on changes in traffic flow and travel time from SYSTRA. The city centre is not a key traffic route for HGVs and the transport model does not assume any through traffic. Only HGVs delivering to the city centre will be impacted by the either the CAZ B or revised Clear Zone.

The effects of a CAZ city-wide would be regional, and in some cases national (considering the travel patterns of HGVs). To ensure proportionality in our approach, we have identified a domain within which the most significant effects of the CAZ are considered to fall. To do so we used census data to identify those zones in Nottingham and surrounding areas which contribute the greatest number of trips into the CAZ area.

The approach to appraising each of the impacts closely follows the methodology set out in the JAQU and supporting WebTAG guidance. Namely, the ‘impact variable’ (describing how the impacts vary or are distributed across a geographic area) are overlaid with the ‘grouping variable’ (describing how different societal groups are distributed across the same area). The appraisal is then made on the basis of splitting both the grouping and impact variables into quintiles, and then judging whether the impact on a given population group is proportionate to the representation of that group in the wider population. In some cases, we have also produced alternative output metrics to help further explore and present the distributional nature of some of the impacts.

The spatial distribution of costs, noise and accident impacts have not been modelled as part of the economic analysis, hence impacts on businesses must be assessed ‘indirectly’ using proxies to illustrate where costs, noise and accident impacts could fall.

**Appraisal – Air quality**

The analysis was undertaken on the model outputs for the year 2020. All impacts are presented as a change relative to the Do Minimum baseline. The two shortlisted scenarios use the CAZ B Boundary. Both scenarios show similar differences in NO₂ concentration compared to the Do Minimum baseline. The strongest decrease occurs within the CAZ area.

---

boundary, as traffic will be mostly affected within the CAZ. Outside the CAZ zone, a very small difference (less than -0.05 μg/m3) is found compared to the Do Minimum baseline. However, the focus of the distributional analysis is not the difference in the impacts of the various options, but the variation in the distribution of their impacts.

3.61 A summary of the distributional impacts is contained in Table 3-9 and Table 3-10.

Table 3-9: Impact appraisal matrix: Air quality

<table>
<thead>
<tr>
<th>Impact</th>
<th>Grouping variable</th>
<th>Scenario</th>
<th>Distributional impact – quintile</th>
<th>Are impacts distributed evenly?</th>
<th>Key impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air quality</td>
<td>IMD</td>
<td>CAZ B</td>
<td>✓✓</td>
<td>✓✓</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Revised Clear Zone</td>
<td>✓✓ ✓✓ ✓✓ ✓✓</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Children</td>
<td>CAZ B</td>
<td>✓✓ ✓✓ ✓✓ ✓✓ ✓✓ ✓✓ ✓✓ ✓✓</td>
<td>Yes</td>
<td>Only one category shows a worsening of the air quality however too small to be significant.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Revised Clear Zone</td>
<td>✓✓ ✓✓ ✓✓ ✓✓ ✓✓ ✓✓ ✓✓ ✓✓</td>
<td>Yes</td>
<td>All LSOAs observe improvement in air quality, hence benefits felt by all quintiles</td>
</tr>
</tbody>
</table>

Table 3-10: Summary of air quality distributional impacts

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Summary assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAZ B</td>
<td>✓✓</td>
</tr>
<tr>
<td></td>
<td>• A large majority of LSOAs see improvement in air quality concentrations and all within the CAZ Boundary, hence quintile analysis shows no distributional impact</td>
</tr>
<tr>
<td></td>
<td>• That said, impact on concentrations increases as the IMD quintile ranking decreases (no distributional impact observed for Children Grouping).</td>
</tr>
<tr>
<td></td>
<td>• Option achieves reduction at all sensitive receptors</td>
</tr>
<tr>
<td></td>
<td>• Hence option has progressive distributional impact</td>
</tr>
<tr>
<td>Revised Clear Zone</td>
<td>✓✓</td>
</tr>
<tr>
<td></td>
<td>• A majority of LSOAs see improvement in air quality concentrations and all within the CAZ Boundary, hence quintile analysis shows no distributional impact</td>
</tr>
<tr>
<td></td>
<td>• That said, impact on concentrations increases as the IMD quintile ranking decreases (no distributional impact observed for Children Grouping).</td>
</tr>
<tr>
<td></td>
<td>• Option achieves reduction at all sensitive receptors</td>
</tr>
<tr>
<td></td>
<td>• Hence option has progressive distributional impact</td>
</tr>
</tbody>
</table>
Appraisal – Affordability for businesses

3.62 Assessing the impacts on businesses is very challenging. A wide range of businesses can be impacted in a variety of different ways. In turn, these impacts will flow upwards and downwards through supply chains, and no formal model was available to assess the full extent and flow of impacts through the economy. Only limited data and evidence exists around the number of businesses that could be affected, and even less regarding how they might respond to the CAZ and any additional costs placed on them. There are a wide range of factors which feed into the decision making of firms and it is extremely difficult to identify how the proposals interact with all these other factors to produce a decision outcome, in particular given incentives make it difficult to obtain an objective opinion from those who may be affected.

3.63 Businesses operating in Nottingham could be affected through one or more pathways, including:

- Direct effects where they own non-compliant vehicles and travel into the area (notably taxi operators in the city)
- Indirect effects on deliveries
- Indirect impacts via commuting employees
- Indirect effects on their supply chains, either upstream or downstream
- Indirect effects via impacts on customers and footfall

3.64 Implementing a non-charging zone lead to the same effects as a CAZ, in addition businesses delivering into the city centre will not have other options but to upgrade the HGVs to the Euro 6 standard. Taxi and private hire operators would also face similar requirements.

3.65 This list of impacts is inherently focused on affordability for businesses, focussing on impact pathways which result in changes in cashflow or costs affecting the businesses. It is also important to note that there is a further indirect effect associated with the health benefit from improved air quality as a result of the CAZ: less absences, better productivity, etc. It is likely that all businesses located in and around the scheme will be affected to some extent. That extent will be determined by a number of parameters, including both the location of the business but also the type of businesses (which in turn determines the likelihood of it operating vehicles, its reliance on deliveries, and potential impact on its supply chain). Depending on how businesses are directly affected, they may take one or more different responses. Including:

- Upgrading non-compliant vehicles, either through:
  - Investing in new compliant vehicles, whether those vehicles are brand-new or compliance second-hand vehicles
  - Retrofit existing vehicles to make them compliant
  - Renting compliant vehicles
- Avoiding the zone
The response adopted by the owner of a non-compliant vehicle will be complex, unique to the operate and depend on a wide range of factors such as: the size of their fleet, the geographic area(s) in which they currently do businesses, number, location and range of customers, the sector they are in, and whether the affected vehicle is specialized.

Businesses may adopt different approaches at different times (e.g. they may first pay the charge for a CAZ, then upgrade at a later date when they have greater certainty around their compliance costs) or may adopt different approaches simultaneously (e.g. upgrading part of their fleet, whilst avoiding the zone on other routes where possible). The response options available will vary by businesses. For example, “avoiding the zone” is not an option for businesses located inside the zone. Likewise, smaller businesses are unlikely to have the option of (or lower potential to) redistributing fleet nationally.

All these different responses carry costs for businesses in different forms – the compliance costs or compliance burden of the CAZ and non-charging scheme. E.g. upgrading would entail an upfront cost to purchase the new vehicle, and a change in operating costs. There will be a transaction cost to arranging and implementing the response: for example, even redistributing a fleet normally will carry administrative re-organisations costs. That said, in some cases there may be some benefits associated with compliance actions: e.g. there may be a net benefit in certain circumstances to upgrading some non-compliant vehicles due to the savings in OPEX and fuel of operating a newer, typically more efficient vehicle.

In theory, firms will choose the strategy that minimises the impact and costs for their businesses. The costs of different strategies will vary by businesses depending on their individual circumstances. Where it is possible to minimize the financial impact of a proposed charging zone using fleet redistribution, this is likely to be a preferred response due to the relatively low costs involved.

All these responses by owners of non-compliant vehicles directly affected will also have second-order effects for the wider company. Second-order impacts can be negative (for example, lowering business profitability and impacting jobs) or positive (e.g. creating a market demand for more businesses that retrofit emissions technology onto existing vehicles).

Business could be affected by a CAZ or a Revised Clear Zone through many different pathways. The impact is likely to be greatest on those who own and operate non-compliant vehicles – i.e. the direct effects – who will have to act to become compliant or pay the
charge. All actions businesses can take will place costs of the affected businesses, the over-
arching impacts are likely to be negative (although the impacts for some businesses will be
positive and it is worth noting that issues posed to achieve compliance may not simply be
financial).

3.72 For Nottingham, under a CAZ B or a Revised Clear Zone, with measures already taken for
taxi and buses to use compliant vehicles by 2020, there will be direct impacts on:
- HGV operators – encompass a wide range of businesses types and sizes, serving a wider
  range of end-customers.
- Coach operators – There is limited data available on coaches operating in and around
  Nottingham, but operators range from those service regular local routes (e.g. school
  buses), large national firms serving regular but less frequent inter-city routes (e.g.
  National Express) or one-off coaches serving visitor attractions or events.
- Other businesses may be significantly affected by options, even where they do not
directly operate non-compliant vehicles. These could come from a wide range of
sectors, but are most commonly affected indirectly through the impacts on of HGVs
delivery goods.

**Anticipated impacts on hackney carriage and private hire operators in Nottingham**

3.73 In addition, the impact of hackney carriage drivers and Private Hire operators licensed in
Nottingham needs to be particularly considered. Measures outlined in the Taxi Strategy and
the age and emissions policy will have a significant direct impact on the taxi trade in
Nottingham. These policies are required in order to achieve compliance in the do minimum
scenario, but will require taxi operators to purchase new Euro6 taxis to be able to operate in
the city without detrimentally impacting on air quality. This will present a sizeable financial
challenge for taxi operators, who are often individuals on low incomes and with poor access
to finance needed to fund the purchase of new vehicles. We therefore intend to deliver a
package of measure aimed at mitigating these impacts and helping the taxi trade to make
the transition to cleaner vehicles.

3.74 As outlined in the Strategic Case, efforts to ensure the taxi fleet are compliant with emission
standards may lead to distortions in the market should a charging clean air zone not be
implemented. Taxis licensed in Nottingham would have to incur vehicle upgrade costs which
out of town taxi operators would not be subjected to.

3.75 Operators based inside the zone such as Hackney carriage drivers are likely to be affected to
a greater extent than those based outside. Further, smaller operators (who tend to be greater
in number, but operate fewer vehicles) are likely to face greater costs given they tend to:
- Operate older fleets
- Undertake a greater proportion of trips in CAZ
- Upgrade vehicles less often
Do not have large fleets which can be redistributed, reducing the response options available to them
- Are likely to have smaller cash reserves to fund upgrades
- Have smaller operations over which costs can be spread
- May also find it more difficult to access capital, or may face higher borrowing charges
- Serve repeat rather than one-off customers (e.g. coaches)

3.76 Any knock-on effects from smaller firms are likely to be greater given they tend to be more locally based and have small fleets operating in a defined geographic area. Where a scheme places a cost on businesses, there is an inherent risk to whether the business can “afford” those costs. If a firm cannot pass through costs or internalise them, a business may:
- Cancel trip/activity (but carry on other unaffected operations) – with potential subsequent impacts on economic activity in Nottingham (and potentially jobs)
- Go out of businesses altogether – impacting on jobs and activity in Nottingham
- Shift locations – potentially impacting on jobs and “local” economic activity, if shift is far enough.

3.77 All these responses could have subsequent impacts on employment and economic activity in the local area. Our analysis suggests that some affected operators would have some ability to pass through or internalise costs, like national coach operators. However, a number of operators could struggle to afford additional costs: Affordability risk is therefore expected to be highest for smaller local bus, coach, taxi and HGV operators.

3.78 O-licence data for HGV operators based in the CAZ boundary shows the high proportion of small HGV operators with less than 6 vehicles, Table 3-11.

<table>
<thead>
<tr>
<th>No. of HGV's per company</th>
<th>No. of licenced companies</th>
<th>No. of vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 5</td>
<td>99</td>
<td>123</td>
</tr>
<tr>
<td>6 to 10</td>
<td>15</td>
<td>108</td>
</tr>
<tr>
<td>11 to 15</td>
<td>4</td>
<td>49</td>
</tr>
<tr>
<td>16 to 20</td>
<td>4</td>
<td>68</td>
</tr>
<tr>
<td>21 to 30</td>
<td>6</td>
<td>164</td>
</tr>
<tr>
<td>31 to 50</td>
<td>12</td>
<td>440</td>
</tr>
<tr>
<td>51 to 100</td>
<td>9</td>
<td>566</td>
</tr>
<tr>
<td>&gt;100</td>
<td>10</td>
<td>2,072</td>
</tr>
<tr>
<td>Total</td>
<td>159</td>
<td>3,590</td>
</tr>
</tbody>
</table>

3.79 The key impact of the scheme is to bring vehicle upgrades forward, by mandating them to be able to enter the affected boundary in case of a Revised Clear Zone option. As such, the baseline is anticipated to “catch-up” at some point, increasing the potential that more firms can internalise costs. In addition, for larger firms it is worth emphasizing that risks are significantly decreased through the ability to redistribute fleets between different geographical areas. Furthermore, although the scheme will likely place significant costs and affordability risk for those directly (and some indirectly) affected in the short-term, in the
longer-term balancing forces in the economy will limit the knock-on effects and potentially mitigate some of the short-term impacts. Hence there will be shorter (more apparent) and longer-term impacts, and the latter will depend on how the Nottingham economy will be able to adjust to the structural changes.

3.80 Table 3-12 summarises the above results.

**Table 3-12: Summary of business affordability distributional impacts**

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Summary assessment</th>
</tr>
</thead>
</table>
| CAZ B               | • O-Licence data show that half of the HGV fleet is registered in the CAZ boundary area, but a very small number of key links are within the CAZ boundary (including those serving the Enterprise Zone which may capture a large number of HGVs which do not travel to the city centre). Implementing a CAZ B leads to increase and decrease in traffic flow within the CAZ boundary  
|                     | • Wider boundary captures key amenities (e.g. schools and tourist attractions) likely to be served by coaches.                                                                                                         |
|                     | • CAZ boundary will also capture a great number of businesses (almost 70%) which could be indirectly affected by the CAZ.                                                                                               |
| Revised Clear Zone | • O-Licence data show that half of the HGV fleet is registered in the CAZ boundary area, but a very small number of key links are within the CAZ boundary (including those serving the Enterprise Zone which may capture a large number of HGVs which do not travel to the city centre). Implementing a Revised Clear Zone B leads to increase and decrease in traffic flow within the CAZ boundary, although reduced compared to the CAZ B.  
|                     | • Wider boundary captures key amenities (e.g. schools and tourist attractions) likely to be served by coaches.                                                                                                         |
|                     | • CAZ boundary will also capture a great number of businesses (almost 70%) which could be indirectly affected by the CAZ.                                                                                               |
|                     | • As all HGVs entering the CAZ must be compliant, the burdens on businesses inside or outside the CAZ are larger.                                                                                                    |
Summary appraisal of distributional impacts

3.81 Summaries of the distributional analysis assessment are presented in Table 3-13.

**Table 3-13: Summary assessment of distributional analysis**

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Air quality</th>
<th>Affordability for businesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revised Clear Zone</td>
<td>✓ ✓</td>
<td>× ×</td>
</tr>
<tr>
<td>CAZ B</td>
<td>✓ ✓</td>
<td>×</td>
</tr>
</tbody>
</table>

3.82 Across the options, the WebTAG quintile analysis shows that the benefits and costs assessed are evenly distributed for each option – hence suggesting none of the CAZ options have a skewed distributional effect across groups in society. However, this analysis is limited by the granularity of the modelling and approach. For example, all LSOAs observe an improvement in air quality under all options. Hence all residents in all LSOAs are labelled as ‘winners’. But the analysis does not account for the size of impacts in each LSOA, only that an LSOA either observes an overall improvement, no change or worsening of air quality.

3.83 Businesses could be affected by a CAZ or a Revised Clear Zone through many different pathways - it is likely that all businesses located in and around the scheme will be affected to some extent, and particularly local taxi (Hackney Carriage) operators. The impact is likely to be greatest on those who own and operate non-compliant vehicles – i.e. the direct effects – who will have to act to become compliant or pay the charge. Under the CAZ B options, there will be direct impacts on: HGV, coach operators and taxi operators. Bus companies have funding to upgrade their vehicle fleets however there will still be an element of disruption to their operations while the retrofit takes place.

3.84 Other businesses may be significantly affected by the CAZ or Revised Clear Zone, even where they do not directly operate non-compliant vehicles. These could come from a wide range of sectors, but are most commonly affected indirectly through the impacts on HGVs.

**Summary assessment**

3.85 The economic analysis conducted on the options has taken three forms: the focus has been on undertaking CBA of the options and monetisation of impacts. This has been complemented with qualitative assessment of the benefits not captured by the core CBA, and with distributional analysis exploring how the impacts may fall across different groups in society.

3.86 The key focus of the CAZ options is to reduce emissions and help meet legal limits for NO\textsubscript{2} concentrations within the shortest period possible and no later than 2020. However, the achievement of legal limits is not addressed directly as part of the economic analysis. That
said, generally the greater the emission reduction, the more the risk of not achieving legal limits is reduced. From the CBA, both options have a very similar impact on total NOx emissions and as such on NO2 concentrations, with the impact being relatively small due to the size of the CAZ zone.

3.87 This is the case despite one option affecting twice as many HGVs. This indicates that there are likely going to be impacts of the options outside of the zone that are not captured as part of this assessment.

3.88 A second key impact in analysis is the cost of upgrading vehicles. Costs will move in proportion with number of vehicles affected; hence the costs are smaller for CAZ B than for the Revised Clear Zone which sees a larger number of HGVs upgrade. Through these costs (and a number of other effects associated with the CAZ), both options will have an impact on businesses. However, the impacts are likely to be larger for the Revised Clear Zone option which will require all operators to upgrade to obtain a permit to deliver into the area, preventing some from taking an alternative (e.g. paying the charge) which would minimise their costs.

3.89 The NPV of both CAZ options modelled is negative, which suggests the costs of work to address urban air quality issues in Nottingham will outweigh any benefits. The CAZ B is substantially more negative due to greater implementation costs outweighing the lower upgrade costs when compared with the Revised Clear Zone. Although air quality benefits outside the zone may be significant for both options, it is unlikely that they would push the NPV to become positive (given much of these emissions will occur in areas with low exposure reducing the damage cost – this also assumes implementation costs of Revised Clear Zone are underestimated and should be more in line with those of the CAZ B).

3.90 Both options also pose a significant impact on business costs. Under the Revised Clear Zone all HGV operators would have to upgrade their vehicles regardless of the size of the business if they want to retain business within the CAZ area, which may drive some of these smaller firms out of business. As noted previously, local taxi operators based within the city will be particularly affected by the proposals, since the majority are not well equipped to invest in newer vehicles as will be required under all modelled options.

3.91 A summary ranking of options can be drawn from the economic and distributional impact analysis are presented in Table 3-15.

Table 3-14: Options ranking

<table>
<thead>
<tr>
<th>Rank</th>
<th>Option</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Do-Nothing Baseline</td>
<td>• Due to the upgrading of buses and taxis in the baseline, the AQ modelling indicates that AQ limits are met in this scenario</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No negative impacts on affordability or accessibility on businesses or vulnerable groups, aside from local taxi operators</td>
</tr>
<tr>
<td>Rank</td>
<td>Option</td>
<td>Rationale</td>
</tr>
<tr>
<td>------</td>
<td>-------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2</td>
<td>CAZ B</td>
<td>• Challenging Delivery Timescale</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Negative NPV - Large implementation costs coupled with vehicle upgrade costs are not outweighed by air quality benefits or secondary benefits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Larger implementation costs but smaller upgrade costs compared to Revised Clear Zone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Medium impact on business affordability affecting both HGV and coach operators.</td>
</tr>
<tr>
<td>3</td>
<td>Revised Clear Zone</td>
<td>• Doubts as to whether NCC are able to implement the scheme in time and no later than 2020</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Highest (least negative) NPV – delivers moderate air pollutant emission reductions with moderate cost, with significant secondary benefits.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Larger upgrade costs (hence higher impacts on affordability risk for businesses) but smaller assumed implementation costs when compared to CAZ B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• High impact on business affordability, potentially driving smaller HGV operators out of business if they cannot afford to upgrade and as such cannot obtain a permit to deliver goods into the CAZ zone.</td>
</tr>
</tbody>
</table>

3.92 Further, there are some key risks associated with the two CAZ options:

- A Category B CAZ and Revised Clear Zone may encourage some HGV users and or owners to switch to LGVs as an alternative mode for smaller deliveries to avoid a daily charge and or permit. This could create an unplanned change to fleet profiles that would risk compliance, if this option was taken up in any significant number.

- A Revised Clear Zone would adversely affect smaller haulage firms more than centralised bigger haulages firms with a diverse fleet of complaint and non-compliant vehicles, some of which might be unable to afford the upgrade without support. Considering the majority of haulage firms registered within the CAZ boundary are small with less than 6 vehicles, this would lead to higher distributional impacts and would not be acceptable from an equalities perspective.

- A Category B CAZ and Revised Clear Zone may encourage some HGV users and or owners to use their compliant vehicles for deliveries within the zones and non-compliant vehicles for deliveries outside the zone which would lead to a shift in emissions rather than an overall improvement.

3.93 All things considered, the evidence suggests that the measures included within our ‘do-nothing baseline’ for modelling are sufficient to ensure compliance with the air quality limits in time for the 2020 deadline. Care needs to be taken through the implementation of this approach to mitigate against undesirable social and distributional impacts, which accrue particularly to micro- and small businesses that own and operate their own non-compliant...
vehicles. The measures described in the Strategic Case section, which include providing access to cost-effective finance and extended ‘try before you buy’ opportunities for vehicle loans, will help the city's taxi trade to comply more quickly with the new licensing conditions aimed at reducing vehicle emissions from taxis in Nottingham.
4 MANAGEMENT CASE

4.1 This Management Case sets out the framework through which the delivery of the air quality improvement measures will be managed. The City Council is acutely aware of the importance of scheme delivery and are pleased to report a proven record of accomplishment of effective delivery as a leading transport authority. For over a decade, Nottingham’s key strength has been an integrated planning and transport arrangement, adding value to the way solutions are proposed and delivered.

Deliverability and track record

As lead authority, the City Council will provide a clear and coordinated strategic approach to the management and delivery of the programme using PRINCE2 project management processes and will act as the central budget holder responsible for financial management. **Nottingham City Council is an award-winning authority** (Local Transport Authority and City of the Year, National Transport Awards 2012 and was again shortlisted Local Authority of the Year 2015). Success of this is demonstrated through recent externally funded programmes won through competitive bidding, including the successful £16m Local Sustainable Transport Fund and the £10m Better Bus Areas Fund programmes. Our clear transport vision has helped Nottingham to reinforce its position as a leader in sustainable, low emission and low carbon transport and supported the economic growth of the city: essential for improving quality of life, as more people travel on buses, trams and trains and walk and cycle to get to their places of study or work.

The City Council has become adept at designing, testing and implementing a range of highly innovative transport solutions, all within tight delivery timescales and meeting funding requirements. Nottingham is also unique in having implemented its own Workplace Parking Levy (WPL) to tackle problems associated with traffic congestion. The WPL both provides funding for major transport infrastructure initiatives and acts as an incentive for employers to manage their parking provision. Nottingham City Council also runs its own Bus Lane Enforcement Scheme; the revised Clear Zone will share some of the back office systems already used by the bus lane enforcement.

Project Plan

The programme Milestones shown in

4.2 Table 4-1 set out timelines for the development of the feasibility study to Full Business Case stage during 2018 in readiness for delivery from mid-2019. The Project Plan forms a ‘live’ document and as such will regularly be reviewed and updated by the Programme Manager in consultation with the delivery leads during the course of the revisions to the taxi measures. Progress/variations will be reported to the Delivery Board via the Programme Manager.
Critical path and key dependencies

4.3 Table 4-1 also includes key dependencies are noted relating to the measures that, if missed or not realised in time, could affect the delivery programme tolerances of cost, time or quality. Impacts may be felt in delays to implementation, compromised quality outputs, resource not in place in time to realise maximum benefits or missed opportunities.

Table 4-1: Milestones

<table>
<thead>
<tr>
<th>Programme milestone</th>
<th>Target date</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target determination (led by JAQU)</td>
<td>7th February 2018</td>
<td>Complete</td>
</tr>
<tr>
<td>Systra complete option sifting in their model and issue outcomes to Ricardo</td>
<td>19th February 2018</td>
<td>Complete</td>
</tr>
<tr>
<td>Identify preferred option plus two others for modelling</td>
<td>19th February 2018</td>
<td>Complete</td>
</tr>
<tr>
<td>Ricardo inputs to OBC submitted to City Council</td>
<td>26th February 2018</td>
<td>Complete</td>
</tr>
<tr>
<td>Draft Outline Business Case submitted to JAQU</td>
<td>End of February 2018</td>
<td>Complete</td>
</tr>
<tr>
<td>Public Consultation first phase (raising awareness) 5th –</td>
<td>26th March 2018</td>
<td>Complete</td>
</tr>
<tr>
<td>Ricardo/Systra 3 option detailed modelling</td>
<td>March - April 2018</td>
<td>Complete</td>
</tr>
<tr>
<td>Preferred option CBA assessment</td>
<td>May 2018</td>
<td>Complete</td>
</tr>
<tr>
<td>Supplementary OBC with CBA submitted to JAQU</td>
<td>22nd June 2018</td>
<td>Complete</td>
</tr>
<tr>
<td>Public consultation second phase</td>
<td>August to September</td>
<td></td>
</tr>
<tr>
<td>Project Assurance Group (PAG) review</td>
<td>July 2018</td>
<td></td>
</tr>
<tr>
<td>Formal approval to submit Business Case</td>
<td>31st July</td>
<td></td>
</tr>
<tr>
<td>Submit Full Business Case</td>
<td>By 15th September 2018</td>
<td></td>
</tr>
<tr>
<td>Secretary of State Sign off</td>
<td>October 2018</td>
<td></td>
</tr>
<tr>
<td>Detailed Design</td>
<td>October 2018</td>
<td></td>
</tr>
<tr>
<td>Procurement</td>
<td>November 2018</td>
<td></td>
</tr>
<tr>
<td>Build</td>
<td>Jan 2019</td>
<td></td>
</tr>
<tr>
<td>Operational</td>
<td>mid – end 2019</td>
<td></td>
</tr>
</tbody>
</table>

Governance and delivery arrangements

4.4 Our delivery approach is supported by a lean delivery framework; effective project/programme management processes based on PRINCE2 methods, comprehensive financial and risk management approaches, smart procurement and collaborative communications and monitoring arrangements.

4.5 Established governance and decision-making arrangements are in place for the LTP, Better Bus Areas and behaviour changes programmes, which will roll on and oversee the delivery of this programme. The established governance and management arrangements will be fully utilised to oversee delivery:
- **Strategic overview and direction**: this is comprised of the key senior groups that will endorse delivery, make decisions and provide input and overview in the wider planning and transport context, in particular to achieve economic growth and reduce carbon emissions;
- **Management**: this is comprised of the day-to-day project management, coordination and liaison, which will be led by the City Council’s Transport Strategy team and will provide an interface between the strategic bodies and delivery teams. Responsibility for procurement/contract management and monitoring and evaluation activities are also with this team;
- **Delivery**: this comprises of the key delivery teams responsible for executing the activities in line with the mandate set by the transport strategy team, escalating any issues and reporting progress/monitoring outcomes. This is strengthened by a number of delivery teams already in place and ready to go e.g. WPL Business Support teams, Clear Zone and Bus Lane Enforcement scheme.

4.6 Figure 4-1 illustrates the governance and delivery arrangements. The responsibilities of the key parties involved and how decisions will be made are covered by:

- The **Air Quality Strategy Working Group (AQSWG)** will have overall decision-making responsibility for ensuring the programme meets its wider objectives and delivers against the desired outcomes. Overseeing the development of the Air Quality Strategy and business case delivery to time, budget and quality, the AQSWG is responsible for the success of the proposals and owns the business case, provides leadership, manages relationships with partners/stakeholders and recommends opportunities to optimise cost/benefits.

- The existing **Transport Programme Delivery Board** has primary responsibilities of providing overall direction, management and assurances. The Board acts as the overarching programme management governance for all transport projects and programmes developing and informing the emerging new transport vision for Nottingham and surroundings. Membership of the Board includes the: Director for Traffic and Transport, Director of Major Projects, Head of Finance, Transport Strategy Manager and others as required (e.g. Chair of Greater Nottingham Transport Partnership). This Board will be further expanded to include senior representatives from partner authorities.

- The **Programme Manager (PM)** with previous experience of delivering the successful LSTF programme will manage the day-to-day delivery of the programme on behalf of the Delivery Board, ensuring it delivers to the required quality standards and within the specified tolerances of time, costs and resources. The PM is well placed to oversee delivery of the programme in collaboration with the wider partnership and can interact regularly with leads on the Bus and Taxi strands, which complement the proposals contained in this bid. The PM oversees the change control and risk management
functions; is responsible for commissioning activities; financial monitoring; reporting of progress to the Board and other stakeholders;

- The **Project Delivery team** will consist of specialist skilled staff responsible for delivery of the specified initiatives within the programme and of reporting project deliverables and other outputs to be fed into the overall evaluation activities. The delivery teams will be fully constructed once suppliers are appointed through new tendering exercises (in some cases). The team will meet formally through a monthly Air Quality Strategy Working group to discuss and inform the operational arrangements of programme delivery against baseline objectives and timescales. Regular liaison will take place with the PM and progress is reported back to Management Group meetings. For significant divergences to timescales, costs or any other variations, these changes are captured by the PM and where necessary escalated to the Board/SRO for resolution.

**Figure 4-1: Nottingham Governance and Delivery Chart**

4.7 Key members are identified in Table 4-2.

**Table 4-2: Nottingham Air Quality Strategy Team Members and their roles**

<table>
<thead>
<tr>
<th>Name</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Councillor Longford, Portfolio Holder for Energy and Environment</td>
<td>Project Sponsor</td>
</tr>
<tr>
<td>David Bishop, Deputy Chief Exec, Corporate Director Development Growth</td>
<td>Senior Responsible Officer</td>
</tr>
<tr>
<td>Zahur Khan, Director for Traffic and Transport</td>
<td>Quality Assurance</td>
</tr>
<tr>
<td>Chris Carter, Head of Transport Strategy, Nottingham City Council</td>
<td>Programme Lead</td>
</tr>
<tr>
<td>Steve Tough, Head of Major Projects</td>
<td>Project Manager</td>
</tr>
</tbody>
</table>
## Risk Management

4.8 Risks are tracked in accordance with the City Council’s corporate risk management principles, which draw upon the PRINCE2 methodology. This strategy requires the identification and recording of risks, an evaluation of their likelihood and any mitigation actions. This approach ensures that all risks are captured and processed in a consistent manner. The risk log attached in Appendix H includes risks that relate to political, financial and operational issues. Without mitigation, these could result in increased costs to the programme, reductions in the quality of outputs and slippages in timelines, all affecting the overall benefits and outcomes the bid seeks to deliver. Ownership of the risk register falls with the Programme Manager. These risks will be subject to on-going monitoring and mitigated through effective programme management and partnership working.

### Bus retrofit programme to Euro VI – management progress

As described in Strategic Case, Nottingham City Council through consultation with the Nottingham Bus Quality partnership is in the process of retrofitting Euro VI engines to 161 Euro V vehicles. This has followed a successful grant fund bid for £2,696,517 provided through the DEFRA clean bus fund.

A legal grant funding arrangement has been drawn up between Nottingham City Council and Nottingham City Transport (NCT), which includes clawback provisions in the unlikely event of the operator not delivering the required retrofit project. This has enabled NCT to directly procure and appoint Baumot as their CVRAS-accredited technology supplier.

An order has been placed with Baumot by NCT and a launch event of the first retrofitted midi bus happened on June 25th to kick off a public awareness campaign of the bus retrofit project.

The retrofit programme is currently on track to deliver on time or ahead of schedule.
Stakeholder management

4.9 A list of Key stakeholders is outlined in Error! Reference source not found..

4.10 Their power of influence and requisite levels of interest have been considered to maximise the consideration of their needs and influence on the success throughout the programme. This framework of stakeholder management and engagement will be continued throughout the programme to inform the communications and dissemination activities. Offering a flexible approach, activities will be directed to involve and communicate with stakeholders to become more interested if it can add to the success of the project.

Table 4-3: Key Stakeholders in the project

<table>
<thead>
<tr>
<th>Influence</th>
<th>High</th>
<th>Key player, engage closely</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Keep satisfied, meet needs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Residents</td>
<td>Nottingham City Transport</td>
</tr>
<tr>
<td></td>
<td>Citizens, including commuters</td>
<td>Community Transport for Nottingham</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trent Barton</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Taxi operators/driver, including private hire</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Councillors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Environmental action groups</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Road transport organisations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Major employers, businesses and business groups</td>
</tr>
<tr>
<td>Low</td>
<td>Minimal</td>
<td>Schools/pupils/parents</td>
</tr>
<tr>
<td></td>
<td>NET (tram)</td>
<td></td>
</tr>
</tbody>
</table>

| Low       | High                  |
|           | Low                   |
|           | Consider, keep informed |
|           | Staff                 |
|           | Local, regional and specialist media |
|           | Employers and businesses |

Communications and dissemination strategy

4.11 The key to achieving a good level of engagement, and ultimately introducing successful measures, will be raising awareness and understanding of air quality and the impact of air pollution on health. This will be done through provision of information, engagement and consultation, particularly with audiences most likely to be affected by the changes to taxi measures.

4.12 A public consultation exercise is scheduled to take place in August 2018 and will run to early September.

4.13 Key messages:
Air pollution has serious implications for public health, including increased chance of developing respiratory problems.

The council is committed to improving air quality so its citizens can live healthier lives.

The City Council has undertaken a number of measures over recent years to reduce air pollution, including starting to convert its own vehicle fleet to Ultra Low Emission Vehicles (ULEVs), achieving funding to provide one of the UK’s largest electric bus fleets and introducing the Workplace Parking Levy, which has reduced congestion and allowed investment in expanding the tram network.

The council offers support for businesses to convert to less polluting modes of travel through its Workplace Travel Service, and supports taxi and private hire businesses in particular through a new Taxi Strategy.

Thanks to existing citywide efforts, falling levels of air pollution have been seen in the city, and latest modelling shows compliance will be reached by 2020, meaning a Clean Air Zone is no longer under consideration.

However, transport emissions continue to contribute to poor air quality, and the council is proposing further measures for cleaner air, most importantly in the interests of public health.

This consultation is an opportunity for anyone who lives or works in the city and wider area to let the council know their thoughts on whether it is taking the right measures to address air quality, what more it could do and the impact of the proposed changes.

Consultation

4.14 An initial questionnaire aimed at raising awareness of the Air Quality Issues took place in April 2018. The results of which are outlined in Appendix G.

4.15 The formal eight-week statutory consultation will then take place in August 2018, asking respondents:

- Do you agree with the measures taken by the City Council to improve air quality?
- What can you do to reduce air pollution?

It will specifically seek views on the following existing measures:
- Supporting Nottingham City Transport in securing £2.7m to retrofit 161 buses to Euro VI standard
- A Taxi Strategy requiring vehicles to be Euro 6 standard by 2020
- Converting the council’s own fleet to ULEVs – minimum 20% by 2020

The consultation will also seek views on the following proposed measures to further reduce air pollution:
- Amending the city’s two Air Quality Management Areas to cover the whole city
- Enforcing anti-idling legislation
- Revising the city centre Clear Zone to include emissions criteria (this would prevent non-compliant vehicles licensed elsewhere, such as HGVs and taxis from entering the city centre)

4.16 The consultation will be located online on the Transport Nottingham website and promoted to citizens through mass channels including social media, local media, newsletters and material made available at public locations, such as leisure centres, libraries and surgeries. Key stakeholders, such as public transport operators, businesses and taxi operators, will be specifically targeted.

4.17 Consideration will also be given to ‘paid for’ options to ensure the consultation is widely promoted. This could involve radio advertising, posters or digital advertising.
5 COMMERCIAL CASE

5.1 The purpose of the commercial case is to provide evidence of the commercial viability of the proposals and set out the intended approach to procurement.

Capability and Skills of the Nottingham Delivery Team

5.2 Nottingham City Council has a proven track record for delivery of large transport schemes through effective partnership working with a range of organisations across the public, private and third sectors. Evidence of successful partnership delivery includes:

- Turning Point - a £12m suite of public realm, bus and highway improvements aimed at revitalising the north of the city centre, delivered in 2006
- Ring Road Major Scheme - £15m programme of improvements on Nottingham’s ring road.
- Delivery of the existing LSTF programme of £15.3 million comprising Key Component and Main Bid elements that resulted in significant travel behaviour change outcomes;
- Nottingham LTP programmes valued over £10m per annum and includes PTEG joint procurement approaches e.g. Better Bus Areas/Green Bus Fund packages;
- With private sector organisations through delivery of major infrastructure projects including NET Line One, the development of NET Phase Two and the Nottingham Station redevelopment;

5.3 These examples demonstrate the significant knowledge and expertise the in-house teams hold in delivery of both large-scale infrastructure and specialist service improvements. Furthermore, the advantages of taking forward the strongest elements of an existing programme mean that there will be minimal set up required in terms of procurement and recruitment processes as governance arrangements and working relationships with local delivery partners are already established. Skilled individuals are already in post and have undertaken all the exploratory work needed and have built up local knowledge, expertise and contacts that would be hard to replicate for alternative providers and would most likely result in added costs to the project.

Additional Measures

5.4 Nottingham City Council has a longstanding policy of encouraging the use of sustainable transport to tackle congestion climate change and air quality problems. The strategic case outlines the current measures the City Council has been taking to address issues with Air Quality.

5.5 The City Council has also taken advantage of more recent sources of funding made available by DEFRA to continue to reduce Nitrogen Dioxide levels in the city. These Additional Measures are outlined as follows:
Bus Retrofitting Programme – The scheme will retrofit Euro 5 and Euro 3 diesel busses operating in Nottingham. All funding will help to achieve a conversion to cleaner Euro 6 standards buses. £2.7m Funding was provided through the DEFRA clean Bus Fund.

The ULEV taxi Demonstrator project funded by DEFRA to the tune of £300K is closely aligned to the City Council’s Taxis strategy and Age and Emissions policies.

NCC fleet change programme – The early measures fund also enabled a programme of replacing older diesel fleet vehicles with new ULEV vehicles. The Programme is aimed at replacing Cage Tipper Vehicles, Small Vans and Refuse Collection Vehicles and valued at £1.5m.

The Early Measures Fund also enabled £200,000 of funding for new cycling infrastructure aimed at linking existing cycle route to creating comprehensive network.

Proposals to Improve Air Quality

5.6 As outlined in the Strategic Case Nottingham City Council is proposing a range of measures aimed at reducing Nitrogen Dioxide levels in the city. Most measures are already funded and programmes have started to deliver benefits. However, Nottingham City Council is seeking further funding for the following:

- Funding to assist hackney carriage drivers with licensing costs.
- Funding to extend the ULEV Taxi try before you buy scheme.
- Funding to extend the charging infrastructure.
- Funding for personalised information for taxi drivers on the financial benefits of ULEV taxis.
- Funding for the creation of a ULEV only taxi rank.

5.7 This commercial case will outline how each of these measures is to be delivered.

ULEV Taxi re-Licensing Scheme

5.8 The Strategic Case outlines the need to encourage change in our existing hackney carriage fleet. The City Council’s new taxi strategy set age and emissions criteria for licensing new hackney carriages however this places a financial burden on drivers and operators licensed within Nottingham. This burden is not faced by taxis licensed outside of Nottingham and they are free to compete for trade alongside Nottingham licensed taxis. This places Nottingham taxis at a financial disadvantage, and the specific issues underlying this are outlined in the distributional impacts section of the economic case. In short, the Nottingham taxi trade tends to operate older fleets within the areas of the city where air quality is found to be worst, and has a culture of replacing these vehicles less often than private hire competitors. Their smaller cash reserves and difficulty in accessing capital makes it challenging for these operators to fund the purchase of Euro 6 and ULEV vehicles. As such the planned change to taxi licensing restrictions in Nottingham is expected to place some operators under financial pressure.
In order to redress the balance, the City Council will introduce measures to assist taxi operators with making the switch to newer, more efficient vehicles. The first of these measures will assist with the cost of relicensing new ULEV vehicles. The relicensing scheme will last for up to 3 years.

The costs of financing the relicensing scheme over 3 years is estimated at £780,000. The City Council will seek funding from the Clean Air Fund in order to finance the scheme. A breakdown of this estimate is contained in the Financial Case. The funding will cover the costs of medical driver medical exams and checks, together with the costs of driver and vehicle licensing. The scheme will be administered by the City Council’s established taxi licencing team.

ULEV Taxis ‘Try before you buy’ Scheme

Nottingham City Council received funding from DEFRA through the early measures fund to set up a try before you buy ULEV taxi scheme. The scheme proposes to offer drivers access to ULEV vehicles on a trial basis initially with the option to enter into a longer-term lease of the vehicle.

The justification of this measure is to support drivers with exposure to ULEV vehicles ahead of the council’s new Age and Emissions Policy coming into effect. From 1st January 2020, only Euro 6 compliant or ULEV hackney carriages will be licensed. This means all 411 taxis need to be replaced. So far 24 taxis have been switched to Euro 6 and only 2 to LEVC taxis; demonstrating that more support is needed to encourage drivers into ULEVs.

Following an OJEU compliant procurement, Drive Electric (https://www.drive-electric.co.uk/) was contracted to deliver an ULEV “try before you buy” scheme to local businesses. This “ULEV Experience” is funded through OLEV’s Go Ultra Low City funding. The scheme focuses on giving businesses the opportunity to trial ULEV cars and vans to assess the vehicles operational use. Drive Electric specialise in electric vehicle leasing to consumers and fleets and they are deploying a fleet of 10 ULEVs to be offered to businesses on a one-month trial. Experience shows one-month is the timeframe needed for users to become familiar enough with the ULEV to commit to purchasing/leasing one. Drive Electric will administer the bookings, vehicle delivery/collection and provide support to the drivers around vehicle familiarity and charging advice. As the company specialises in electric vehicle leasing, then should the business like their ULEV, a longer term lease can be readily arranged for the type of vehicle they are seeking.

Following discussion with Drive Electric, proposals are being drawn up to expand the ULEV Experience to include a ULEV Taxi Experience. The scheme is proposed to operate in a similar manner to the business ULEV Experience project, being delivered in partnership with the Council’s licensing and fleet team. The Council will own the vehicles (procured through DEFRA grant funding) and Drive Electric will administer the scheme on the council’s behalf. All vehicle bookings, payments, delivery/collection will be managed by Drive Electric.
5.15 The vehicles will be stored at the Eastcroft Depot (the council’s main fleet depot based in the city centre). Drivers will be required to insure the vehicles (a pre-existing licensing requirement) when they are booked out on the trial, and will hand over their existing vehicle and plate to the council for safekeeping whilst the driver participates in the trial.

5.16 The driver will be asked to pay a small financial contribution to participate in the trial, so as to cover the costs of administering the scheme. Should the driver like the vehicle, they will be offered the opportunity to take the vehicle on a longer-term lease (e.g. 5 years) at a competitive rate via Drive Electric. The taxi leasing element is currently being developed by Drive Electric to work on the same basis, so that the use of purchased vehicles are maximised beyond the ULEV Experience period.

5.17 The scheme will be live in October 2018.

**Charging Infrastructure**

5.18 Nottingham City Council is currently engaged in delivering the main elements of the Go Ultra Low project, which is aimed at encouraging the switch to Ultra Low Emission Vehicles (ULEVs). The £2m project will deliver a network of 230 charging points for ULEVs across the Nottingham and Derby conurbations and surrounding counties. In addition, the City Council secured £700k from the OLEV taxi fund a dedicated charge point network for ULEV taxis. The council has a 10-year contract with BP Chargemaster to build, operate and maintain both networks.

5.19 The need for dedicated taxi charging points was highlighted as one of the main concerns of local drivers in the Cenex Taxi Business Model (see Appendix I).

5.20 Site visits are currently underway for a number of sites across the city to support the trade. Most of the taxi chargers will be aligned near to existing taxi ranks, with the following locations currently being considered:

- Canal St – near station
- Station Street
- Queens Medical Centre
- Melville St (Broadmarsh redevelopment)
- County Hall (Nottinghamshire)
- Beeston Station

5.21 The Taxi Study also found that the majority of taxi operators were practicing Muslims and therefore the City Council has looked at providing charging stations at mosques throughout the city.

5.22 The City Council is investing over £3m into the Eastcroft Depot to convert 142 vehicles to ULEVs including small cars up to a fully electric Refuse Collection Vehicle (with Go Ultra Low and DEFRA Early Measures funding). In order to support the switch to ULEVs, a £1.5m Interreg funded Vehicle to Grid project is underway at the depot to invest in solar panels,
battery storage and vehicle to grid charging units for 40 ULEV fleet vans. The plan is for Eastcroft Depot to become the site of a one-stop shop ULEV garage offering service, maintenance and repair. To align all of these projects, the amount of electrical supply required is being investigated with Western Power Distribution. It is proposed to cater for 2mVA (upgradable to 4mVA) power to future proof the site. A new sub-station and electrical supply work is costing in the region of £250,000.

5.23 As part of the Eastcroft Depot works to provide a one-stop shop ULEV garage, the City Council wishes to provide a flagship dedicated taxi charging hub with provision of up to five rapid charging units (funding is currently only available for a maximum of two).

5.24 We also intend to offer up to 40% of taxi drivers at-home charging facilities, which is estimated to cost £100,000 to implement.

Personalised reports

5.25 The council has completed a taxi study which looked at the current duty cycle of the taxi trade (by placing devices in the cabs to collect real-world data on their daily mileage) and surveying drivers on their attitudes and perceptions on ULEVs. The study also provided a financial assessment of the savings benefits of the ULEV and Euro 6 vehicles in comparison to their existing diesel vehicles. Many drivers have welcomed the information on the cost savings of the Euro 6 and LEVC and Dynamo vehicles in comparison to the existing duty cycle of the taxis.

5.26 We are seeking £144,000 funding to provide up to 40% of taxi drivers with a personalised report to demonstrate the cost savings of ULEV taxis. An example of such a report is contained in Appendix J.

Contribution to the creation of a ULEV only taxi rank

5.27 In March 2018, the City Council introduced the UK’s first bus lane which provides an exemption to ULEVs. The scheme is operating well, with high compliance and is acting as an added incentive for ULEV drivers. ULEV taxis are also able to use this lane.

5.28 We are considering dedicating one taxi rank in the city as an ULEV-only taxi rank as an added incentive to ULEV taxi drivers, and therefore seek £56,000 of funding to cover the creation of this rank.
6 FINANCIAL CASE

6.1 The purpose of this Financial Case is to evidence a robust estimation of the package costs, set out the local contributions that will add value and illustrate the commitment of the project partners. The Financial Case sets out the basis on which the cost estimates have been derived.

Taxi Re-licensing Scheme

6.2 In order to encourage the uptake of ULEV Taxis Nottingham City Council is planning to remove the cost associated with acquiring driver and vehicle licenses for those operators who make the switch to Electric Taxis.

6.3 Table 6-1 below outlines the current costs associated with acquiring a new driver and vehicle license.

**Table 6-1: Relicensing costs for a hackney carriage driver and vehicle**

<table>
<thead>
<tr>
<th>Driver Costs</th>
<th>Driver License</th>
<th>£145.67 per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical exam</td>
<td>£50.00 per year</td>
<td></td>
</tr>
<tr>
<td>Enhanced DBS check</td>
<td>£44.00 per year</td>
<td></td>
</tr>
<tr>
<td>Annual Total</td>
<td>£239.67</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hackney Vehicle</th>
<th>Initial plating cost</th>
<th>£303.00 1st year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Annual renewal cost</td>
<td>£273.00 per year</td>
</tr>
<tr>
<td>Annual Total</td>
<td></td>
<td>£273.00</td>
</tr>
</tbody>
</table>

6.4 There are currently 2,000 taxi driver licenses in operation, however Nottingham City Council’s taxi driver license allows the holder to operate either a private hire or a hackney cab. It is estimated that around 600 drivers operate hackney cabs exclusively. The incentives will be offered on a first come first serve basis up to a maximum of 240 drivers/vehicles (representing the 40% target).

6.5 The cost of absorbing driver re-licensing fees is:

\[ 240 \times £240 = £57,600 \text{ per year} \]

6.6 There are currently 411 hackney carriage vehicles licenses, 40% of which is 165 vehicles. To cover the cost of relicensing this equates to:

\[ 165 \times £273 = £45,045 \text{ per year} \]

6.7 Therefore, to cover the costs of relicensing both driver and vehicle licenses for three years:
(£57,600 + £45,045) x 3 years = £307,935

6.8 The City Council is therefore bidding for £308,000 to fund the taxi relicensing initiative.

Try before you buy ULEV Taxi scheme

6.9 Nottingham City Council received funding from DEFRA through the early measures fund to set up a try before you buy ULEV taxi scheme utilising £270k funding. The scheme proposes to offer drivers access to ULEV vehicles on a trial basis initially with the option to enter into a longer-term lease of the vehicle.

6.10 The justification of this measure is to support drivers with exposure to ULEV vehicles ahead of the council’s new Age and Emissions Policy coming into effect. From 1st January 2020, only Euro 6 compliant or ULEV hackney carriages will be licensed. This means all 411 taxis need to have changed over. Currently 24 taxis have been switched to Euro 6 and only two to LEVC taxis, demonstrating more support is needed to encourage drivers into the electric cabs.

6.11 The City Council is in the process of procuring five ULEV taxis (a combination of 2x Dynamo Nissan ENV200 van conversions at £45k RRP and 3x LEVC purpose built cabs at £56k RRP).

6.12 It is proposed to bid to DEFRA for £280k additional funding to increase the number of vehicles available through the Try Before You Buy initiative from five to ten.

6.13 Given each driver has the opportunity to trial the vehicle for up to a month, with five vehicles the scheme can currently support a maximum of 60 drivers over the course of a 12 month period. We are keen to offer the opportunity to as many drivers as possible, and the Taxi Study conducted by Cenex (Appendix I) the drivers indicated that access to a try before you buy scheme is one of the top three most important incentives the City Council could invest in. With 10 vehicles the scheme would support 120 drivers over 12 months.

6.14 The city council is therefore bidding for £280,000 to double the number of taxi drivers who can trial an ULEV taxi as part of the Try Before You Buy initiative.

Charging Infrastructure

6.15 The need for dedicated taxi charging points was highlighted as one of the main concerns of local drivers in the Cenex Taxi Business Model (see Appendix I).

6.16 As part of the Eastcroft Depot works to provide a one-stop shop ULEV garage, the City Council wishes to provide a flagship dedicated taxi charging hub with provision of up to five rapid charging units (funding is currently only available for a maximum of two). As such £250,000 of funding is sought from DEFRA to contribute to the costs of three additional rapid chargers (£75,000 each), contribute to the costs of a new sub-station and installation (trenching etc.) and some improved access works to the site to allow 24-hour access for drivers.
6.17 A 40kW LEVC taxi takes approximately 30-minutes to charge up to 80% of its battery. To give drivers confidence in the ULEV taxis and to support the growth in taxis, the ability to invest in multiple rapid chargers is essential.

6.18 In addition, the taxi study showed 40% of drivers have access to off-street parking. We intend to offer home charging points for ULEV taxi owners to charge their vehicles overnight or while they are off duty. Assuming we are targeting 240 drivers (40%) with 7.5kw charge points at £400 each this equates to a request for up to £100,000. This proposal is similar to that offered by Sheffield City Council.

6.19 The City Council is therefore bidding for £350,000 to fund more widespread provision of rapid chargers and home charging facilities for taxi drivers.

**Personalised reports**

6.20 The taxi study completed by the City Council shows the business case of operating ULEV taxis over and above the diesel or Euro 6 vehicles is compelling.

6.21 Drivers have asked for more information on the savings/benefits of the ULEV taxis. It is proposed to generate personalised reports for the individual drivers. The scheme will cost £600 per driver to generate a report and provide the necessary advice.

6.22 Again, the target is to support 40% of the trade, so the offer will be made available to a maximum of 240 drivers.

6.23 The city council is therefore bidding for £144,000 for this component.

**Contribution to the creation of a ULEV-only taxi rank**

6.24 In March 2018, we introduced the UK’s first bus lane which provides an exemption to ULEVs. The scheme is operating well with high compliance and is acting as an added incentive for ULEV drivers. ULEV taxis are able to use this lane only.

6.25 The City Council is considering dedicating one taxi rank in the city as an ULEV only taxi rank as an added incentive to ULEV taxi drivers.

6.26 The DEFRA funding will contribute towards the creation of this rank, TROs, signing and lining works that will be required.

6.27 The city council is bidding for £56,000 for this project.

**Conclusion**

6.28 The City Council will bid for the following funding in order to implement our package of measures

- £308,000 for the relicensing scheme from the Clean Air Fund
- £280,000 for an extension to the ULEV taxi try before you buy scheme from the Clean Air Fund.
- £350,000 for the ULEV charging infrastructure.
- £144,000 for personalised financial reports for taxi drivers.
- £56,000 for the creation of a ULEV only taxi rank.

Our total funding bid is for £1.14m
7 SUMMARY

7.1 In summary:
- The **Strategic Case** outlines how the existing measures being taken by NCC will be sufficient to bring Nottingham into compliance with the air quality directive before 2020. With some additional funding, these benefits can be even greater.
- The **Economic Case** shows through modelling that all viable alternative options to the do minimum will have significant impact on the local economy, meaning the focus should be on the bus and taxi measures outlined.
- The **Management Case** demonstrates how the delivery team at NCC have a proven track record of successful delivery, and all best practice and experience will be given to further funded air quality measures.
- The **Commercial Case** provides evidence for the commercial viability of the proposed taxi measures for which we are seeking additional funding.
- The **Financial Case** provides a robust estimation of the package of costs.

7.2 The City Council’s air quality modelling has shown no need for a CAZ in order to achieve air quality compliance by 2020, this will continue to be monitored carefully by Nottingham City Council alongside the impact of measures proposed. The proposed package of measures for which we are seeking funding for are:
- £308,000 for the relicensing scheme.
- £280,000 for an extension to the ULEV taxi try before you buy scheme.
- £350,000 for the ULEV charging infrastructure.
- £144,000 for personalised financial reports for taxi drivers.
- £56,000 for the creation of a ULEV only taxi rank.

Our total funding bid is for **£1.14m**

7.3 These projects will be delivered by Nottingham City Council, with support from project delivery partners that are already engaged through the city’s Go Ultra Low and other programmes.