Bristol City Council Clean Air Plan: Strategic Outline Case

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Acronyms and Abbreviations

ANPR	Automatic Number Plate Recognition
AQMA	Air Quality Management Area
AQAP	Air Quality Action Plan
AQO	Air Quality Objective
B&NES	Bath and North East Somerset
BCC	Bristol City Council
CAZ	Clean Air Zone
CSF	Critical Success Factor
Defra	Department for Environment, Food & Rural Affairs
DfT	Department for Transport
EFT	Emission Factor Toolkit
EU	European Union
EV	Electric Vehicle
FBC	Full Business Case
GBATS4M	Greater Bristol Area Transport Study v4M
GVA	Gross Value Added
HGV	Heavy Goods Vehicle
IMD	Indices of Multiple Deprivation
JAQU	Joint Air Quality Unit
JLTP	Joint Local Transport Plan
JTS	Joint Transport Study
JSP	Joint Spatial Plan
KRN	Key Route Network
LEP	Local Enterprise Partnership
LAQM	Local Air Quality Management
LGV	Light Goods Vehicle
NOx	Nitrogen Oxides
NO_2	Nitrogen Dioxide
NSC	North Somerset Council
OBC	Outline Business Case
PCM	Pollution Climate Mapping
PHV	Private Hire Vehicle
PM	Particulate Matter
RAG	Red-Amber-Green
SOC	Strategic Outline Case

SGC	South Gloucestershire Council
WECA	West of England Combined Authority
WPL	Workplace Parking Levy

Introduction

1.1 Overview of Study

The UK has in place legislation passed down from the European Union, to ensure that certain standards of air quality are met, by setting Limit Values on the concentrations of specific air pollutants. In common with many EU member states, the EU limit value for annual mean nitrogen dioxide is breached in the UK and there are on-going breaches of the nitrogen dioxide limit value in Bristol. The UK government is taking steps to remedy this breach in as short a time as possible. Within this objective, the government has published a UK Air Quality Plan and a Clean Air Zone Framework, both published in 2017. The latter document provides the expected approach for local authorities when implementing and operating a Clean Air Zone (CAZ).

Due to forecast air quality exceedances Bristol City Council has been directed by the Minister to produce a Clean Air Plan to achieve air quality improvements in the shortest possible time. In line with Government guidance, as part of the Plan Bristol City Council is considering implementation of a Clean Air Zone (CAZ), including both charging and non-charging measures. CH2M has been commissioned by Bristol City Council (BCC) to produce a Strategic Outline Case for the delivery of a package of measures which will bring about compliance with the Limit Value for annual mean nitrogen dioxide in the shortest time possible in Bristol. The focus of this Clean Air Plan is on achieving results in the shortest time possible, and in accordance with the High Court Order in November 2016[1] will only consider cost when comparing between two equally quick schemes.

1.2 Purpose of This Report

This report sets out the Strategic Outline Case for the Clean Air Plan, a package of measures which will bring about compliance with the Limit Value for annual mean NO_2 in the shortest time possible in Bristol. It has been produced in line with the Inception, Evidence and Options Appraisal packages of Guidance issued by the Joint Air Quality Unit (JAQU) in 2017, and the HM Treasury Green Book.

The report sets out the development of a long list of options to improve air quality in Bristol, the assessment of these options against a list of critical success factors, and the development of a list of packages of measures to be taken forward for more detailed assessment.

The remainder of this report is structured around the five cases, namely;

- **Strategic Case** – sets out the case for change and the spending objectives of the Plan
- **Economic Case** – develops a long list of options to achieve the spending objectives and appraises them against the defined critical success factors
- **Commercial Case** – details the possible routes to procurement, supplier capability and likely delivery solution
- **Financial Case** - sets out the indicative costings for the Plan and available funding sources
- **Management Case** – provides the governance and management arrangements to deliver a successful project

The Plan, and associated business case, will be further progressed within the Outline and Full Business Cases.

[1] November 2016 in R (ClientEarth) (NO_2) V Secretary of State for Environment Food and Rural Affairs [2016] EWHC 2740 (Admin).

Strategic Case

2.1 Introduction

The purpose of the Strategic Case within this SOC is to set out the case for change by comparing the existing conditions, statutory and regulatory obligations and the desired goals of this intervention. In accordance with the Inception package of JAQUs guidance this Strategic Case considers the following;

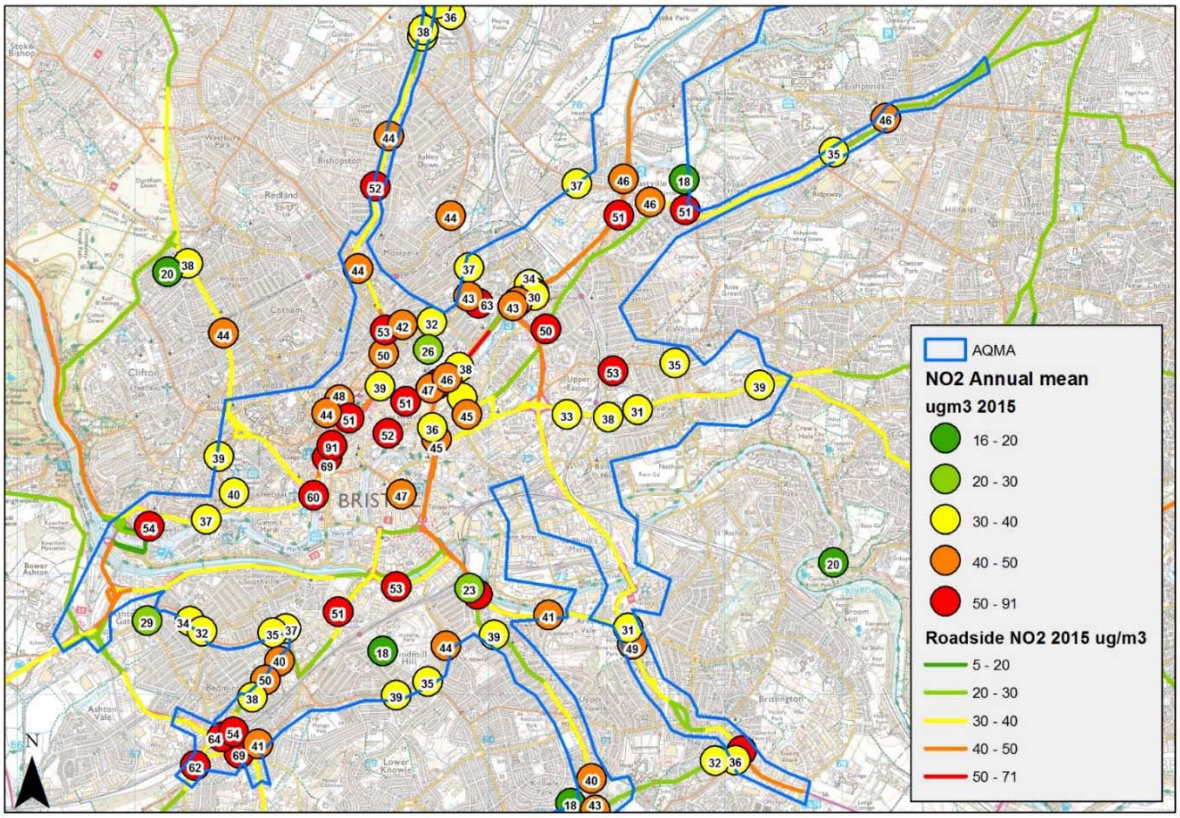
- An outline of the strategic context, in particular the national air quality plan for tackling roadside nitrogen dioxide, impact assessment and Clean Air Zone framework.
- An overview of the local situation and how the proposal fits with existing local authority's strategies.
- a local air quality assessment including reference to health impacts
- A determination of the spending objectives
- Determination of the benefits, risks, constraints and dependencies related to address the identified issue.
- Logic map or theory of change as consideration of evaluation develop.

2.2 Background and Strategic Context

The UK has both a national and international obligation to regulate air pollution concentrations based on legal requirements for all its 43 air quality reporting zones. The legal requirement is that concentrations of Nitrogen dioxide (NO_2) and Particulate Matter smaller than 10 μm (PM_{10}) must not be more than 40 μg/m^3 as an annual mean (i.e. measured across a year). The UK makes use of Defra's Pollution Climate Mapping (PCM) model, in addition to monitoring, as its approved means of reporting air quality information to assess legal compliance across the different zones. In 2015, 37 of the 43 zones were in exceedance of the statutory annual mean limit value for NO_2, including the Bristol Urban Area as shown in Figure 2-1. It should be noted that monitoring locations are not necessarily at the same distance from the road as is assumed in the PCM model, and hence some differences would be expected between the PCM outputs and monitored exceedances. Monitoring locations largely represent relevant exposure where practical.

Bristol City Council collects NO_2 monitoring data using a combination of automatic (a series of reference method instruments approved for use by Defra) and non-automatic (passive diffusion tube) monitoring. All available NO_2 monitoring data for 2015 is presented in Figure 2-1, which consists of a combination of different monitors with different associated standards and precisions.

Figure 2-1– Latest PCM model exceedances showing non-compliant links in Bristol in 2015 (coloured lines) as a comparison against measured concentrations across Bristol and South Gloucestershire Councils (coloured dots). (All measurements mapped have been taken from diffusion tubes).



The results of the national modelling indicate widespread exceedances in NO_2 along several arterial routes into the city centre of Bristol, in particular the M32. Local authorities that have persistent NO_2 exceedances beyond 2020 are required to develop local plans to reduce pollution to compliant levels in the shortest possible time. The measures implemented as part of the local plan need to be informed by local evidence and understanding. Local authority feasibility studies will provide robust evidence on the impact of measures, informed by local traffic and air quality models. This will provide a more detailed assessment of the specific local situation than the national air quality model.

Alongside the European process, the Local Air Quality Management (LAQM) regime requires every authority to carry out regular reviews and assessments to identify whether Air Quality Objectives (AQOs) have been achieved at relevant locations. If not, the authority must declare an Air Quality Management Area (AQMA), and prepare an action plan which identifies appropriate measures in pursuit of the Objectives. The Objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the Objective.

There is an important distinction between the assessment and delivery of the European Limit Values and UK Air Quality Objectives. Although there is a great deal of overlap of the two, such as the numerical value of the targets, Air Quality Objectives and Limit Values have separate origins and are assessed in a different way. Air Quality Objectives apply at locations of relevant exposure (over a particular averaging period, in the case of AQMAs). By contrast, the EU obligations have been transposed into UK law such that compliance with Limit Values is a Central Government responsibility and is based on exceedances identified by national monitoring and modelling. The EU Directives have very specific location requirements for the application of Limit Values (Directive 2008/50/EC, Annex III) which means that relevant locations for Air Quality Objectives and Limit Values may not be the same. For example, Air Quality Objectives typically apply at the highest pollution hotspot and therefore can apply around busy road junctions, whereas compliance with Limit Values must be assessed at least 25m from major road junctions and be representative of at least 100m road length ("major" is defined in the Directive as a junction which interrupts the traffic flow on the road).

Poor air quality is the largest environmental risk to public health in the UK and investing in cleaner air and doing even more to tackle air pollution are priorities for the UK government. However, action must be proportionate to the quantum of the air quality problem, with the interests of local people at the heart of action to improve air quality.

Following the publication of the UK Government's latest air quality plan (July 2017), Bristol City Council were directed to produce a Local Clean Air Plan to address the air quality exceedances within their Local Authority. The national plan sets out actions to reduce concentrations of NO_2 to meet the Limit Values in the shortest time possible, while recognising that assessment by local authorities may reveal alternative approaches informed by specific local knowledge. The national plan identifies that for the majority of non-complying zones, a network of Clean Air Zones is the most effective route to compliance of annual mean NO_2 with legal limits. Defra's vision for Clean Air Zones is: "*Clean Air Zones improve the urban environment to support public health and the local economy, making cities more attractive places to live, work, do business and spend leisure time. They support cities to grow and transition to a low emission economy thus ensuring these benefits are sustainable for the long term*."

The Clean Air Zone framework sets out the principles for the operation of Clean Air Zones in England. It provides the expected approach to be taken by local authorities when implementing and operating a Clean Air Zone. The need for a Clean Air Zone is to be determined by local feasibility studies aimed at understanding the extent of reduction in NO_2 concentrations to achieve compliance in these zones.

2.3 Consistency with Broader Transport Strategies

2.3.1 Background and Context

Bristol City Council and the wider West of England local authorities are embarking on an ambitious programme of transport and planning policy reform underpinned by the emerging Joint Transport Study (JTS) and Joint Spatial Plan (JSP). As a result, it is necessary to assess how the various options considered to improve the air quality in Bristol will align with, and support, the realisation of the strategic objectives contained within the emerging policy documents.

The key strategic themes and principles of the existing policies overlap with several of critical success factors used in the economic assessment, including those related to air quality improvements, benefits to the economy, social inclusion and public health benefits.

At the time of writing, the West of England Combined Authority (WECA) is considering the contents of JTS and JSP to produce a future Vision and a final Joint Local Transport Plan for the West of England. WECA is working with Bristol City Council in the development of these plans, to ensure consistency with the progress of this Plan.

The West of England was awarded £7m Go Ultra Low (GUL) Funding to spend over 5 years to encourage the wider use of low emission transport. The project, which is underway, will focus on increasing provision of public charging points, match funding business charge points and demonstrator cars, providing car club bays and converting 20% council fleets to ULEV. The Clean Air Plan will be developed with the GUL project in mind, to avoid inclusion of measures which are already funded and/or progressing.

It should also be noted in the context of this Strategic Outline Business Case, that Bath, another key conurbation within the West of England is undertaking a similar study with the same objectives.

2.3.2 Key Objectives of Transport Strategies

A review of the JTS and JSP consultation documents reveal a number of strategic objectives, with some consistency across both policy documents. Specifically, the 'West of England Joint Transport Study; Final Report (October 2017) identifies the following key objectives:

- Support economic growth;
- Reduce carbon emissions;
- Improve quality of life and a healthy natural environment;
- Contribute to better safety, health & security;
- Promote accessibility.

At the same time, the 'West of England Joint Spatial Plan: Towards the Emerging Spatial Strategy Document' (November 2016) presents the following strategic objectives:

- **Economic:** To identify and meet the need for housing and accommodate the economic growth objectives of the LEP Strategic Economic Plan.
- **Social:** To ensure that the JSP benefits all sections of our communities.
- **Environment:** To protect and enhance the sub-region's diverse and high quality environment and ensuring resilience including through protection against flood risk.
- **Infrastructure:** To ensure a spatial strategy where new development is properly aligned with infrastructure.

Given the similarities between the objectives underpinning both the JTS and JSP, these objectives can be condensed into three broad themes of objectives as described below;

- Economic:
  - Improving transport economic efficiency, related to journey time, delay and reliability enhancements.
  - Safeguarding existing economic activity and promoting economic development to unlock new additional economic activity.
- Environmental:
  - Reducing carbon dioxide and local air pollution emissions and coverage of West of England AQMAs.
  - Promoting mode shift to more sustainable modes of transport.
- Social:
  - Promoting social inclusion, equality and affordability.
  - Enhancing quality of life and standards of public health.

2.3.3 Consistency with Strategies

The main objective of the schemes considered in this SOC is to improve air quality within Bristol. Those schemes which make the most significant improvements to air quality will demonstrate the most consistency with the environmental aims of the existing transport strategies, particularly those related to local air pollution.

Emissions are likely to reduce most in a Plan with wider geographies and with more vehicle classes incorporated, since this maximises the number of polluting trips affected and is likely to produce the greatest mode shift to more sustainable modes. Overall, alignment with the environmental theme of policy objectives is therefore greatest for options that cover a larger geography and encompass more types of vehicles.

The Plan is not aimed at achieving economic benefits and it is possible that benefits or harm will arise depending on the selected schemes. There are two constituent elements influencing the overall economic performance of the Plan considered in this SOC; the impact of the options in terms of transport economic efficiency (reflecting congestion relief and reduction in journey times) and the impact on existing/new economic activity. It is desirable to select a Plan which achieves the environmental goals and has the most positive overall benefit on the economy.

There are two constituent parts influencing the social theme of policy objectives; the impact on social inequality, particularly low income groups, and the impact on public health. To maximise the public health benefits the plan should aim to encompass as many trips as possible. However, the inclusion of a greater number of trips will increase the likelihood of negative impacts on low income groups. Minimising the dis-benefits on vulnerable groups will maximise the likelihood of public and political acceptance of the Plan. At this early stage, it is desirable to select a Plan which achieves public health benefits without creating a significant negative impact on vulnerable groups, including low income households.

2.4 Spending Objectives

The primary spending objective of the Plan, in accordance with JAQU Options Appraisal Guidance, is to deliver a scheme that leads to compliance with NO_2 concentration Limit Values[2] in the shortest possible time.

A secondary spending objective is also proposed; to deliver a scheme which leads to compliance with the LAQM air quality Objectives as set out in the Air Quality (England) Regulations (SI 2000/ 928 as amended). The difference between Limit Values and LAQM air quality Objectives are set out in Section 2.2 of this document.

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

2.5 Assessment of Existing Local Air Quality

2.5.1 Air Quality in Bristol

Bristol has successfully controlled private motorised traffic growth in recent years, and transport policies have driven exceptional growth in cycling and walking. A bus rapid transit system (Metrobus) is planned for completion in 2018 and bus patronage has grown in recent years. However, air quality problems remain.

Bristol declared an AQMA in 2001 for NO_2 and PM_{10}. The boundary has been amended since but still covers the city centre and arterial routes. Approximately 100,000 people live within the AQMA and it also includes the central employment, leisure and shopping districts, major hospitals and dozens of schools. Therefore, many more than the 100,000 people who live within the AQMA are exposed to air pollution concentrations exceeding the Air Quality Objectives in their daily lives. The designation of an AQMA does not require that a Clean Air Zone be put in place; but it does require the local authority to take action to reduce levels of pollution. It should be noted that Bristol currently achieves the relevant Air Quality Objectives for PM_{10}, although the AQMA remains as a precautionary measure.

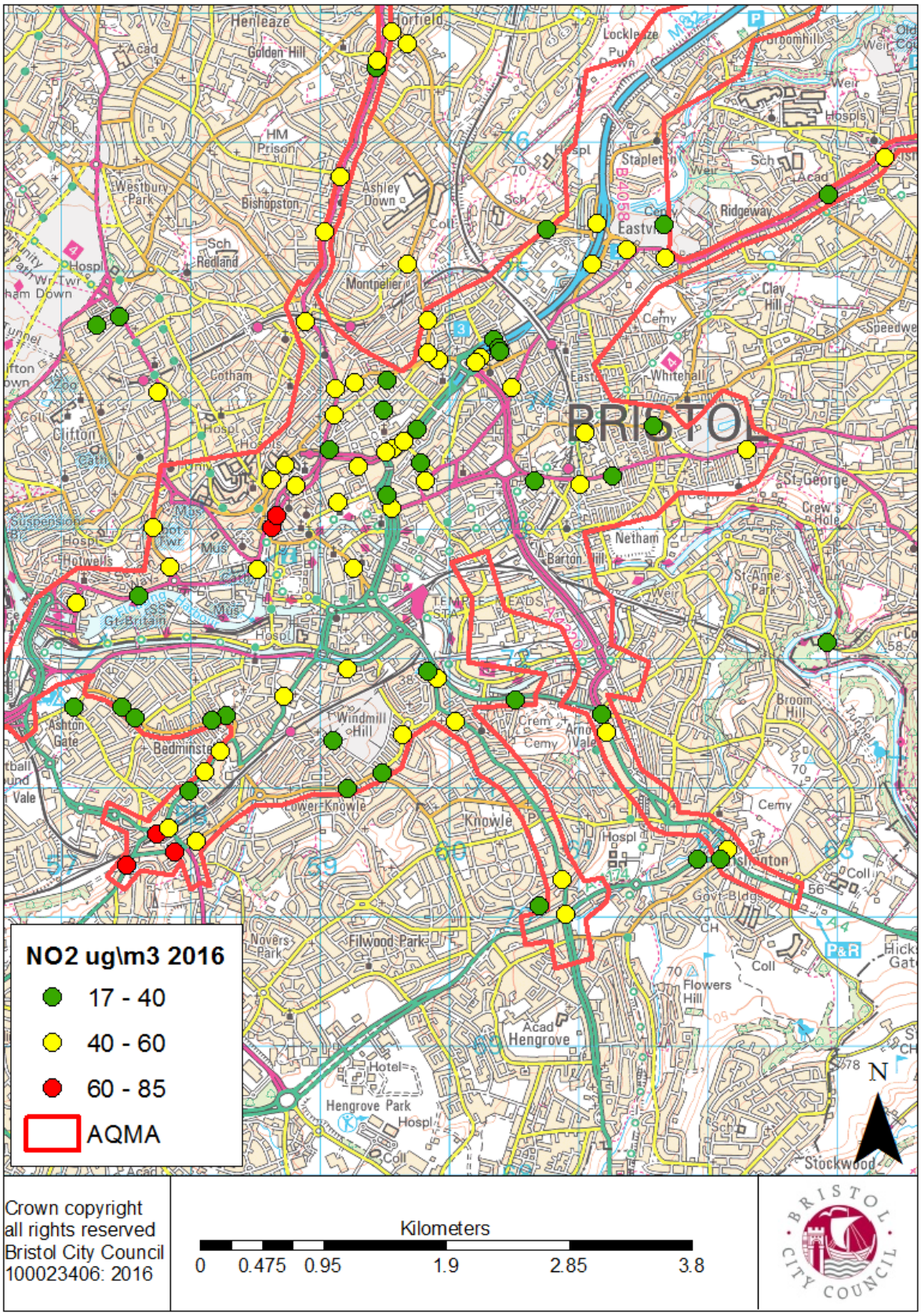
Within the city of Bristol there are also three small AQMAs in South Gloucestershire, in Kingswood/Warmley, Staple Hill and adjacent to the roundabout at Junction 17 of the M5. The breaches in these areas are not as significant as those within the BCC AQMA in central Bristol.

Air quality monitoring in Bristol is comprehensive and long standing. Bristol's monitoring network is focused on NO_2 as the concentrations of this pollutant near busy roads exceed the health-based national Objectives and European Limit Values. The current air quality situation in Bristol is presented in the form of a map in Figure 2-2 showing measurements of nitrogen dioxide at locations within the city, in the Bristol City Council and South Gloucestershire areas.

Bristol City Council collects NO_2 monitoring data using a combination of automatic (a series of reference method instruments approved for use by Defra) and non-automatic (passive diffusion tube) monitoring. The automatic monitoring stations are located at:

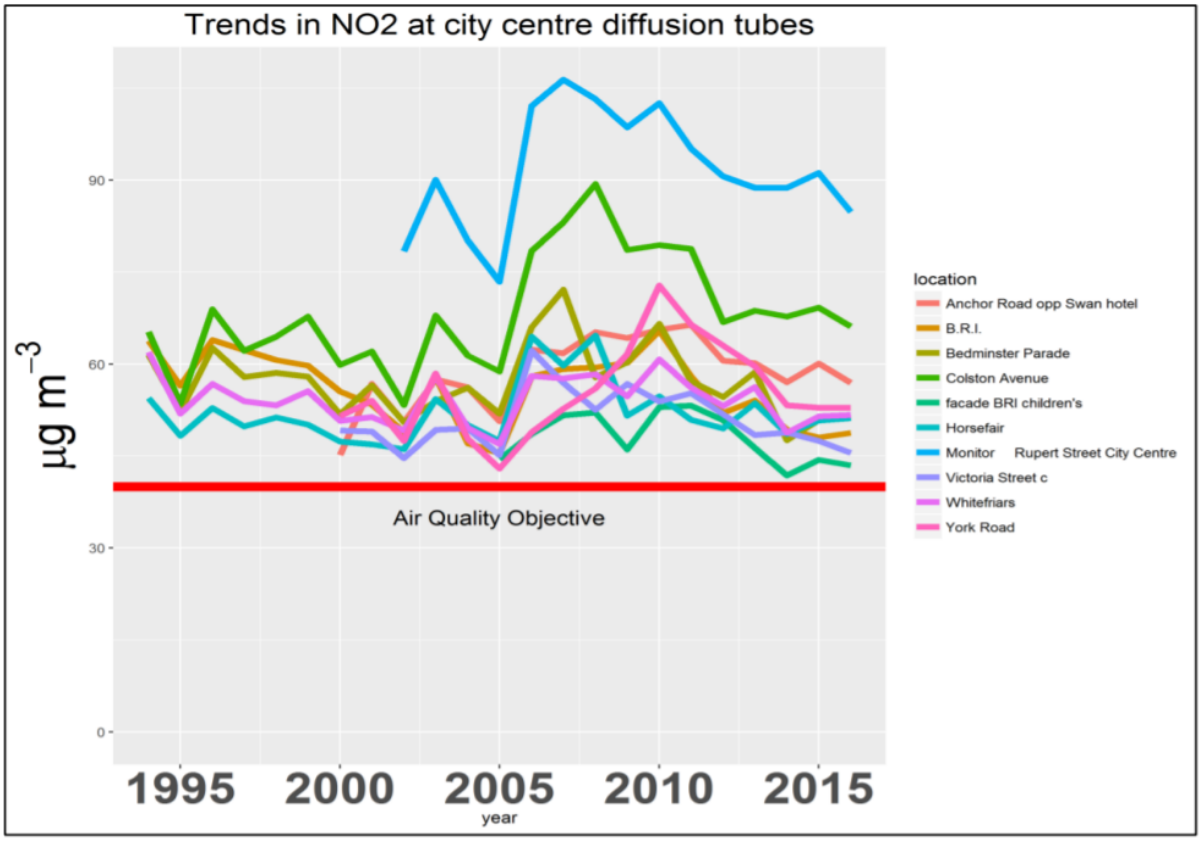
- Brislington Depot, Bath Road
- Create Centre Roof, Smeaton Road
- Fishponds Road
- Parson Street School, Parsons Street
- Junction of Wells Road and Airport Road

Figure 2-2 – Annual mean NO_2 concentrations across the Bristol Urban Area in 2016 (taken from BCC's Air Quality Annual Status Report, 2017). (All measurements mapped have been taken from diffusion tubes).



In Bristol's recent Annual Status Report for 2017, NO_2 concentrations are shown to still be at a similar level to those measured in 2000. Trends in NO_2 concentrations have shown some slight improvement over the last 5 years. At some locations in Bristol city centre, annual mean concentrations exceed 60 ug/m^3 and widespread locations of exceedance of the annual mean Objective for NO_2 exist. The highest measured concentrations of NO_2 were recorded on Rupert Street, where annual mean NO_2 concentrations exceeded 90 µg/m^3 in 2015. The city centre NO_2 measurements shown in Figure 2-3 are all above the Air Quality Objective. All these sites are at roadside locations, which is an indication of the source of the air quality problem. As is shown in Figure 2-2 and Figure 2-3**,** many parts of Bristol, especially near busy roads and in the city centre, NO_2 exceeds legal national Objectives and European Limit Values.

Figure 2-3 – Annual Nitrogen Dioxide at City Centre Locations in Bristol (taken from BCC's Air Quality Annual Status Report, 2017)



Air pollution has negative impacts on the health of people in Bristol, especially vulnerable members of the population. Evidence suggests that it can cause permanent lung damage in babies and young children[3] and exacerbates lung and heart disease in older people[4]. A recent report into the health effects of air pollution in Bristol concluded that around 300 premature deaths each year in the City of Bristol can be attributed to exposure to NO_2 and fine particulate matter ($PM_{2.5}$), with roughly an equal number attributable to both pollutants. This represents about 8.5% of deaths in the administrative area of Bristol being attributable to air pollution[5]. It should be noted that since this assessment was published, an updated interim methodology has been published by the Committee on Medical Effects of Air Pollution (COMEAP) in the National Air Quality Plan, which effectively reduces the impact of NO_2 on mortality. Methodologies for quantifying the effects of air pollution are still under review by COMEAP and the analysis will be updated when the guidance is finalised.

Defra's PCM model predicts annual mean concentrations of NO_2 across the country from current levels to 2020 and beyond. In central Bristol only one location, on Newfoundland Way at the southern end of the M32, is predicted in the PCM to remain non-compliant past 2020, with compliance projected to be met in 2022 without measures in place. The CAZ PCM model scenario forecasts compliance in all of Bristol by 2021. The PCM model is strategic in nature, and hence should be supplemented with more detailed local measurements and assessments. A preliminary assessment based on use of air quality monitoring data projected past 2020 concluded that compliance is not expected to be achieved across Bristol, at all monitoring locations, until 2025 without additional measures. In particular, monitors located on Rupert Street and Bedminster Down Road currently record significant exceedances of the annual mean Air Quality Objective and these locations are predicted to remain uncompliant for several years, although this is not shown in Defra's PCM model. It should be noted that monitoring locations are not necessarily at the same distance back from the road as is assumed in the PCM model. The anticipated improvement in air quality by 2025 is mainly attributed to improvements in ambient air quality from expected reductions in vehicle emissions as a result of newer technology.

2.5.2 Source Apportionment

There are many sources of NOx and PM_{10} in the UK, including, but not limited to, power stations, transport, domestic combustion (including wood burning stoves), agriculture and industrial processes. The National Atmospheric Emissions Inventory (NAEI) provides estimates of the amount of different pollutants that are emitted to the air each year from human activity in the UK. Road transport is the main contributor of emissions of nitrogen oxides (NOx), particularly at roadside locations, and therefore the predominant cause in locations where NO_2 concentrations are not complying with Limit Values or Air Quality Objectives.

Nitrogen oxides is a generic term which includes both NO and NO_2. According to NAEI estimates, around a third of the UK NOx emissions in 2015 arose from road transport, most of which came from diesel vehicles (NAEI, 2017).[6]. Some disparities exist due to the increase in the proportion of NOx emitted directly as NO_2 (also known as primary NO_2) from the exhausts of modern diesel vehicles, as a result of emission control systems that aim to reduce total NOx and particulate matter emissions. Contributions from transport to NOx emissions, in central Bristol will be higher than the UK as a whole.

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[3] Royal College of Paediatrics and Child Health, Every breath we take – The lifelong impact of air pollution, February 2016 (URL: https://www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution)

[4] Simoni et al., Adverse effects of outdoor pollution in the elderly, Journal of Thoracic Disease, January 2015 (URL:https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4311079/)

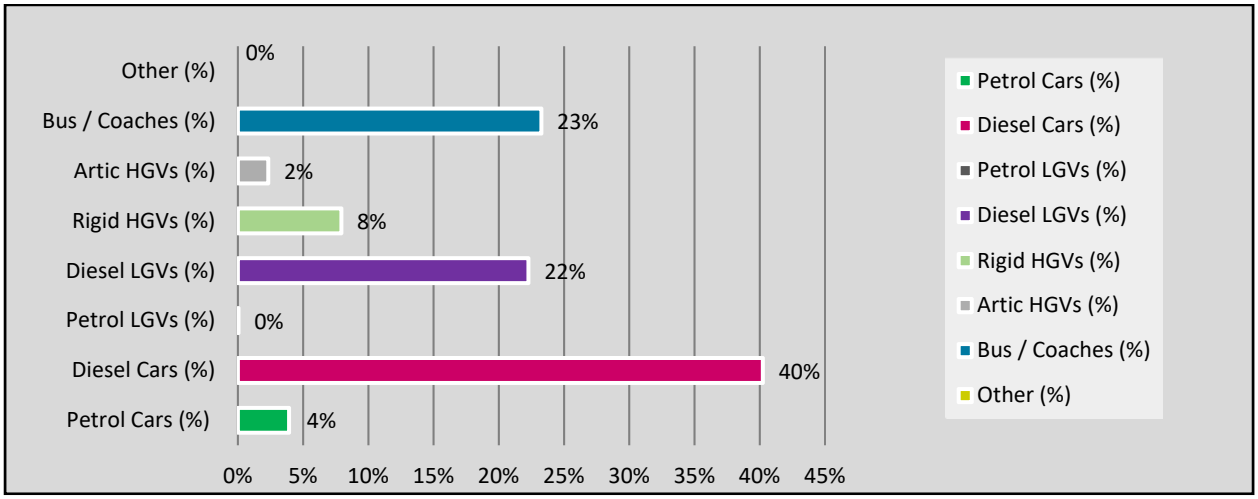
[5] Air Quality Consultants, Health Impacts of Air Pollution in Bristol, February 2017

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

No other major sources of NOx (e.g. from energy production, domestic combustion or other industrial processes) have been identified within the Bristol area, and other sources of NOx are included in the background concentrations. Background concentrations are those measured well away from any significant sources of pollution, such as busy roads, railway lines or industrial sites with emissions to air, or modelled based on monitored background concentrations.

Emissions of NOx are a combination of nitrogen oxide (NO) and NO_2 and are dependent on the type of vehicle (both in terms of size and age of the vehicle). Figure 2-4 shows the proportion of NOx emissions by the vehicle fleet in the centre of Bristol in 2015, calculated from the vehicle movements in the GBATS model, and the latest vehicle emission factors provided by Defra specifically for work contributing to the National Air Quality Plan. This shows that diesel vehicles contribute around 96% of the total, with diesel cars (40%), Buses and Coaches (23%) and diesel Light Goods Vehicles (22%) being the largest contributors.

Figure 2-4 – NOx source apportionment by vehicle category across Bristol city centre



2.6 Benefits, Risks, Constraints and Dependencies

2.6.1 Benefits

The Clean Air Plan could provide benefits in the following areas:

- Public Health, including mortality rates
- Transport (decongestion, journey times, accident rates)
- Financial revenue streams

Public Health

The most substantial benefit of the Plan is an improvement in public health through a reduction in NO_2 concentrations. These benefits are associated with a reduction in both morbidity and mortality. The most recent analysis commissioned by Bristol City Council[7], based on evidence from the Committee on the Medical Effects of Air Pollutants (COMEAP), calculated that around 300 deaths each year in the City of Bristol can be attributed to exposure to both nitrogen dioxide and fine particulate matter. COMEAP has since amended, in draft, some of the assumptions for NO_2 upon which these calculations are based, but the figure is anticipated to remain at a substantial level. To put it in context, the number of people killed in traffic collisions in 2016 was 5.

Health experts now believe that compliance with the Limit Values and national Objectives for NO_2 and particulate matter will not prevent these pollutants from causing harm to public health. Hence improvements in public health are anticipated with reduced concentrations regardless of compliance with the European Limit Value or national Objectives. The improvements to public health, specifically the number of premature deaths, will be calculated and monetised within the Outline Business Case. Impacts on morbidity are more difficult to calculate but will be assessed quantitatively if suitable data can be obtained or qualitatively where there is no robust method for quantification.

Transport

Road transport is responsible for the largest proportion of NO_2 concentrations in Bristol and hence the Plan will include measures to tackle this source and either reduce traffic volumes or reduce the emissions from this source. Any reductions in levels of private motorised traffic would also reduce congestion and delays in the city, and realise improvements in journey times and reliability. This may also produce a reduction in road traffic collisions and noise pollution.

The Plan could also include measures which increase travel by sustainable modes such as public transport, walking and cycling. An increase in use of these modes would produce health benefits through increased physical activity, resulting in reduced risk of premature death and reduced absenteeism from work.

[7] Health Impacts of Air Pollution in Bristol, February 2017, Air Quality Consultants

Revenue Streams

If the selected Plan involves a charging element (either a CAZ or alterations to parking charges) then this could provide Bristol City Council with an ongoing additional revenue stream (if the costs are less than the income generated). Defra's Clean Air Zone Framework (May 2017) prevents Local Authorities from setting a charge as a revenue raising measure, but any charging scheme will need to be set at a level to produce a change in behaviour. As a result, the Plan may produce revenue in excess of the operational costs of running the scheme. In accordance with the Transport Act 2000 this revenue should be re-invested to facilitate the achievement of local transport policies which aim to improve air quality and support the delivery of the ambitions of the Plan. In this way, the Plan may realise additional benefits through supporting further measures with any excess revenue. The anticipated revenue from the Plan will be calculated alongside the operational costs to understand the potential for excess revenue.

2.6.2 Risks

The Clean Air Plan has the following risks associated with it:

- Changes in carbon emissions
- Changes in particulate matter emissions
- Economic impacts
- Conflicts with infrastructure demand
- Impacts on vulnerable groups, particularly low income groups

Carbon

The Plan is focused on one pollutant; nitrogen dioxide. However, the main sources of nitrogen dioxide, vehicles, also produce other pollutants including carbon dioxide and particulate matter. There is a risk that the selected Plan could achieve compliance with the legal limit for NO_2 concentrations, but simultaneously result in an increase in other harmful pollutants.

Carbon dioxide is particularly relevant, since the growth in diesel vehicles (which produce high levels of NO_2) is largely down to the promotion of their benefits in reducing carbon emissions. A reduction in the number/usage of diesel vehicles in favour of petrol vehicles could increase levels of carbon dioxide. In addition, the declaration of a charging zone or access restrictions may result in vehicles re-routing around the zone. This could increase fuel consumption and subsequently carbon emissions.

Particulate Matter

In addition, there are Limit Values and Air Quality Objectives for particulate matter (PM), specifically PM_{10} and $PM_{2.5}$ which will need consideration. Recent monitoring data has demonstrated that particulate matter emissions in Bristol have been under both Limit Values and Objectives for several years. It is not anticipated that the Plan will produce an increase in particulate matter emissions as a reduction in traffic levels or acceleration of fleet renewal will both result in a reduction in PM.

Economy

The Plan has the potential to impact the local economy depending on the measures selected. A significant proportion of jobs in Bristol are located within the city centre where some of the most significant exceedances are located. It is therefore likely that the measures will be targeted at reducing emissions in the central area of Bristol, and depending on the measures selected could restrict access to the jobs or services within the same area.

Infrastructure Demand

This Plan is one of 15 similar plans being developed across the country within the same time frame. The objectives of all these plans are to achieve compliance with the NO_2 Limit Values. It is therefore likely that similar schemes could be proposed in multiple locations, putting pressure on the market supply of particular items, such as ANPR cameras and compliant buses.

Vulnerable Groups

There are specific risks that relate only to the implementation of a charging zone which may form part of the Plan. There is potential to disproportionately penalise vulnerable groups in society, depending on the geographic location, scale and the structure of vehicle compliance standards. In particular, it is appropriate to consider the differential impacts of the Plan on low income households since this is correlated to the likely public and political acceptance of the Plan.

2.6.3 Constraints

The most significant constraint on the Plan is the legal situation through which it has materialised. Specifically, the requirement for the UK Government to achieve compliance with the Limit Values in the shortest time possible, and only considering cost when comparing between two equally quick schemes. Specifically, in November 2016 the High Court found that *'I reject any suggestion that the state can have any regard to cost in fixing the target date for compliance or in determining the route by which the compliance can be achieved where one route produces results quicker than another. In those respects, the determining consideration has to be the efficacy of the measure in question and not their cost. That, it seems to me, flows inevitably from the requirements in the Article to keep the exceedance period as short as possible".*[8]

2.6.4 Dependencies

The Plan is dependent on the progression of other workstreams which may feed into the development of the schemes which form the final package of measures. Specifically, projects considering the most effective public transport priority schemes and walking/cycling schemes have recently been commissioned by WECA and will be relied upon by this Plan in order to meet the required timescales.

WECA have yet to determine which parts of the existing highway network will be managed and operated by them instead of the local authority. This will be known as the Key Route Network (KRN) and its extent is expected to be announced early in 2018. The development of the Plan will depend on the involvement of WECA regardless of the KRN, but the inclusion of links with large exceedances within the KRN may require a greater involvement from WECA.

Similarly, Highways England currently manage and operate the M32 into central Bristol. There are key exceedances of the NO_2 Limit Value at the southern end of this route on Newfoundland Way. In fact, this is the only location that Defra's PCM model predicts will continue to exceed the Limit Value beyond 2020. As such, the management of traffic along the M32 is likely to form a key part of the Plan and will rely on the involvement of Highways England to progress the business case and possibly to implement the final Plan.

[8] November 2016 in R (ClientEarth) (NO_2) V Secretary of State for Environment Food and Rural Affairs [2016] EWHC 2740 (Admin).

2.7 Conclusions

Evidence from local monitoring data indicates that there are widespread exceedances of the Limit Value and Air Quality Objective for NO_2 across Bristol. Defra predicts that without further action exceedances will exist beyond 2020, but local assessments suggest that compliance would not naturally occur until 2025. Approximately 300 deaths can be attributed to nitrogen dioxide and fine particulate matter pollution in Bristol every year and hence there is an urgent need to reduce pollution, and specifically to comply with the Limit Values and Air Quality Objectives. Due to the forecast air quality exceedances Bristol City Council has been directed by the Minister to produce a Clean Air Plan to achieve air quality improvements in the shortest possible time.

The Clean Air Plan fits well with the objectives of existing policies in the region, including the JTS and JTP. The measures proposed within the Clean Air Plan are likely to be complimentary to existing policy objectives and to support wider transport initiatives. Bristol City Council is working closely with the newly formed WECA to ensure that emerging policy also reflects the magnitude of the air quality problem and the urgent need to address it.

Any intervention will have impacts across the region which are both positive and negative. There are likely to be benefits to public health, and also possibly a reduction in congestion and the associated impacts. Conversely, there is a risk that the chosen measures could increase carbon or particulate matter emissions, or negatively impact the economy or vulnerable groups. In addition, the development of similar plans across the country could result in high demand for particular infrastructure or services, which the existing market cannot fulfil. The selection of measures to include within the Clean Air Plan will consider these risks and seek to mitigate them wherever possible whilst maximising the benefits.

Economic Case

3.1 Introduction

The Strategic Case presented in the earlier chapter outlines the case for change by comparing the existing conditions, statutory and regulatory obligations, and the desired goals of this local government intervention. Within this context the purpose of the Economic Case in the Strategic Outline Case document, as outlined in the Joint Air Quality Unit's (JAQU) Inception Package, is to identify a long list of options and refine them to a short-list of options / packages which will be appraised in greater detail as part of the Outline Business Case and Full Business Case.

The Inception Package document states that shortlisting of the long list of options requires an early appraisal of options against Critical Success Factors as well as the intervention's spending objectives and benefit assessment criteria. The document also states that the options' other strengths, weaknesses, opportunities and threats may also need to be considered for the shortlisting process. Finally, the Inception Package document states that this multi-criteria analysis should be used to short list approximately four options to be explored further.

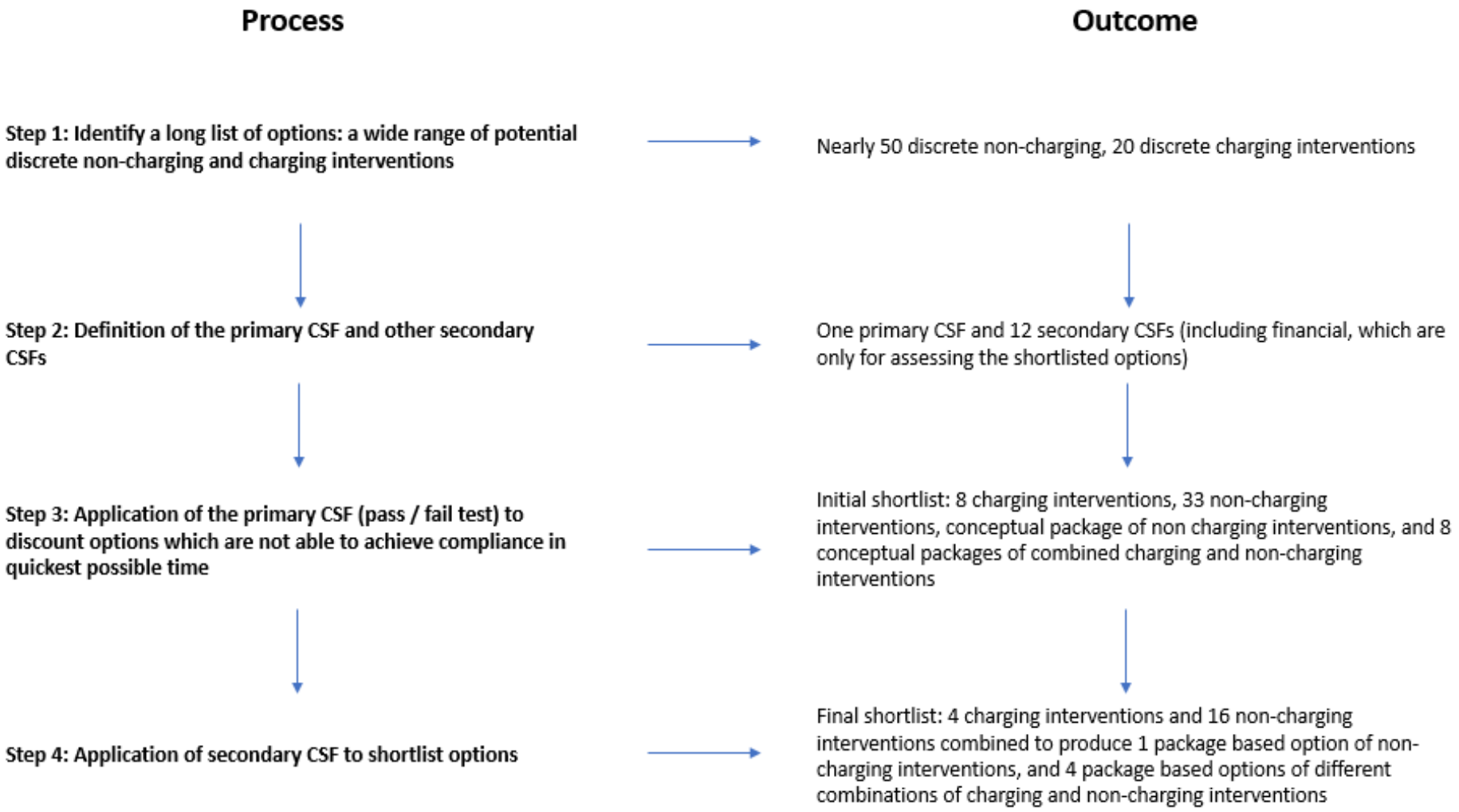
Within the above context, this Economic Case chapter includes the following:

- Identify a long-list of options for delivering the desired goal
- Establish the Critical Success Factors, including the primary Critical Success Factor and other secondary Critical Success Factors as identified in the JAQU's Options Appraisal Package document
- Establish the multi-criteria appraisal framework, including the Critical Success Factors, and the process for appraising the long list of options
- Determination of a short list of options / packages, which will be appraised in greater detail as part of the Outline Business Case and the Full Business Case.

3.1.1 Assessment Process

A process to assess the long list of measures has been determined, in accordance with JAQUs Inception Package guidance and the HM Treasury Green Book. The process is summarised in Figure 3-1 overleaf.

Figure 3-1: Summary of Options Shortlisting Process



3.2 Long List of Measures

3.2.1 Overview

The Green Book, as recognised in the JAQU's Options Appraisal Package document, requires generation of a broad range of options to ensure that all realistic interventions have been considered against the Plan's reference case. Considering the need for change and the evidence regarding specific sources of local exceedances outlined in the Strategic Case chapter, this section of the Economic case outlines the wide range of measures which can meet the Plan's spending objectives. Namely, to meet the statutory nitrogen dioxide Limit Values and Air Quality Objectives within the shortest possible time. DEFRA's Clean Air Zone Framework suggests that options broadly fall within two categories: non-charging and charging options. Hence, the long list of options is initially presented across these two categories in this section before being combined into packages of complimentary measures.

3.2.2 Reference case

The Options Appraisal Package document states that the long list of options should include a 'do nothing' option which acts as a reference case for the intervention options. A comparison between the reference case and the intervention options allows appraisers to assess the efficiency and effectiveness of public sector investments.

The reference case for the Bristol CAZ is expected to achieve compliance at all BCC monitoring locations in 2025. By 2021, it is anticipated that 8 out of 204 monitoring locations in BCC and SGC would remain in exceedance of the air quality objectives. As outlined in the Strategic Case chapter, the forecast non-compliance acts as the rationale for public sector intervention.

3.2.3 Justification for Consideration of Charging Measures

3.2.3.1 Strategic assessment

Defra has undertaken a high level assessment of the impact of various scenarios in the Greater Bristol Area, including the introduction of a charging zone, using their PCM model. According to the PCM model, compliance with the EU Limit Value is achieved by 2021 with a CAZ in place. No other measures in Bristol were numerically assessed by Defra. This is supported by the overall conclusion of Defra's Air Quality Action Plan, that a CAZ is the most likely solution to achieve compliance by the earliest possible time.

The relation between drive cycles and NOx emissions is subject to significant uncertainty and many variables, including typical driving dynamics, the extent of acceleration, weather conditions, and others. However, overall, non-charging interventions are expected to result in localised improvements in emissions, particularly if coupled with other more influential interventions such as charging or access restrictions. Defra and Ricardo (May 2016) reviewed evidence of the effectiveness of road transport policy measures to improve air quality, to assist in the selection of measures and to estimate the future effects of such measures on air quality. Over 400 academic papers were reviewed to assess the impact of 72 policy measures on improving air quality. According to the study, the most effective measures involve traffic management (such as discouraging zone peripheral parking) and access control measures (such as low emissions zones) with an expected decrease in NOx emission of 7.9%. Results show that all other measures would have a small impact (i.e. less than 2% reduction in NOx emissions)[9].

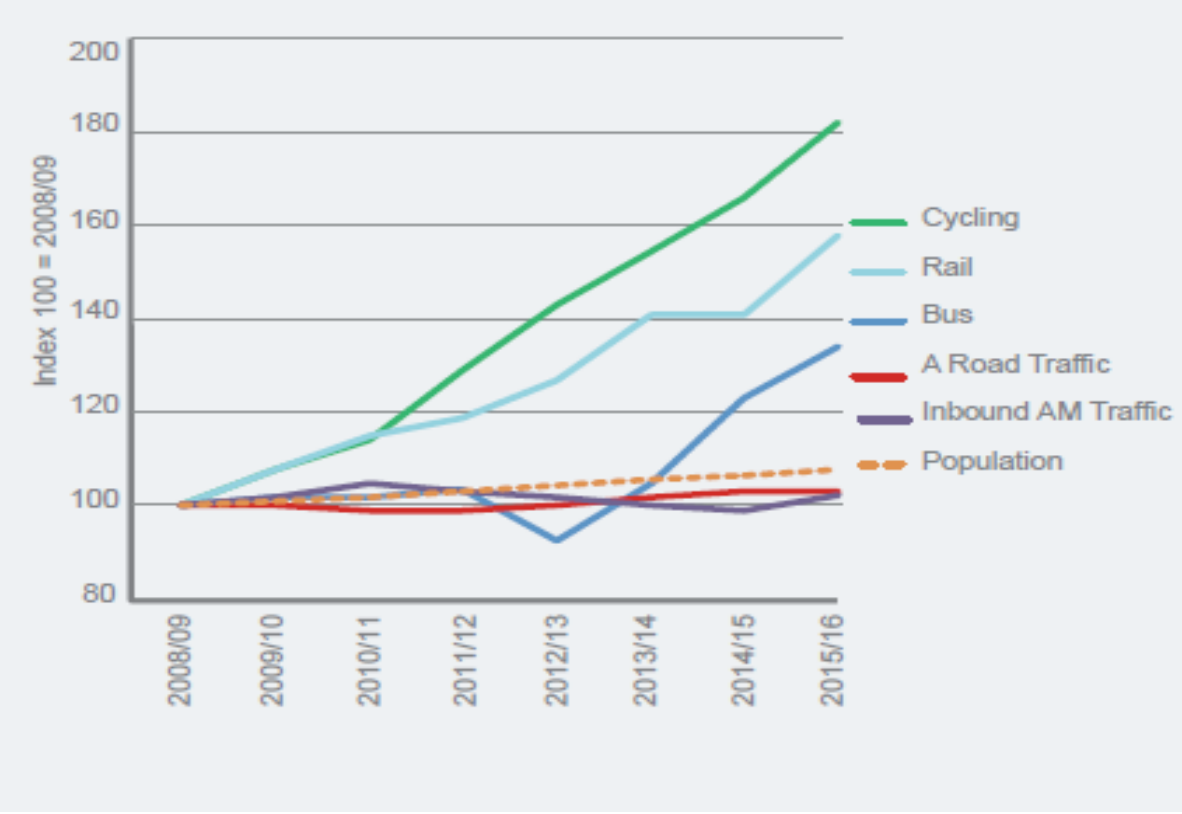
[9] Defra, Ricardo, 'Exploring and appraising proposed measures to tackle air quality' (May 2016).

Promotion of low emission vehicles, as opposed to reducing traffic volumes, can also be considered to be effective in delivering air quality improvements, but only if uptake rates are substantial, and if real world emissions of the vehicles are substantially lower than those of the vehicles they replace.

3.2.3.2 Impact of Bristol's Air Quality Action Plan

Bristol published its current Air Quality Action Plan (AQAP) in 2004, which set out a number of measures to improve air quality, including their expected outcomes, achievement dates and implementation methods. Bristol City Council has taken a collaborative approach with good engagement between transport planners, air quality officers and public health officers (and others more widely across the council) over a sustained period of time. The Action Plan, alongside other policy processes such as the Local Transport Plan has led to a marked increase in cycling and use of public transport, as shown in Figure 3-2. However, despite this increase in sustainable travel, car use has not reduced, in part as a result of inward migration and population increases. Historical evidence from Bristol's air quality monitoring data shows these measures have not been sufficient to achieve compliance with the Limit Values or Air Quality Objective.

Figure 3-2: Change in Transport use in Bristol (% growth since 2008/9)



Defra have also appraised some of the transport measures included in the AQAP[10] and found that the performance of non-charging measures in achieving compliance with environmental objectives is extremely site-specific. They concluded that greater overall environmental benefits could be achieved if the selected approaches are larger or city-wide schemes, rather than focused solely on NO_2 hot-spots. The fact that the annual mean NO_2 concentrations remain above the legal thresholds 15 years after the implementation of the AQAP in Bristol is clear evidence that these measures cannot provide sufficient air quality improvements to achieve compliance with the legal standards.

[10] Defra and Ricardo, Exploring and appraising proposed measures to tackle air quality Project summary report for contract AQ0959, May 2016

3.2.3.3 Potential Impact of Non-Charging Measures

The air quality assessment for Metrobus carried out in 2013 predicted that a scheme of this magnitude would be expected to deliver a decrease in private motorised traffic flows of up to 19.9% (for example on Avon Crescent and Merchants Road), resulting in a maximum decrease of 5.5% in nitrogen dioxide concentrations. This is based on modelling carried out over 4 years ago that made use of older Defra air quality tools that may not be representative of current knowledge on emissions or fleet euro-class composition. However, if a similar magnitude of change were to be applied to the worst-case monitoring data available in the Bristol area on Rupert Street, this would equate to a reduction of approximately 4 $\mu g/m^3$. The reference case analysis undertaken as part of the development of the Strategic Case suggests that a reduction in nitrogen dioxide of up to 20 - 30 $\mu g/m^3$ will be required at worst-case locations in the city.

Given the timescales taken to build major schemes such as Metrobus, (MetroBus scheme will be completed in 2018 and has taken 6 years from initial planning to completion) it is unlikely that schemes of a similar magnitude can form part of a package of measures which could achieve compliance within the shortest time possible.

However, to assess the impact of an intervention of this scale, a 5% reduction in car emissions within the medium CAZ area has been applied to the EFT outputs for the reference case scenario. This is intended as a proxy to reflect an ambitious level of reduction in car trips that might be produced by non-charging measures (excluding access restriction/prohibition measures). The assessment found that such a reduction would not be sufficient to alter the year that compliance is achieved compared to when this would occur in the reference case.

This analysis demonstrates that measures related to mode shift and improvement of the fleet would need to be substantial (i.e. at least of the order of magnitude of Metrobus) in order to achieve sufficient improvements in air quality. Measures of this level of significance are unlikely to be deliverable within the short term.

3.2.3.4 Summary

Achievement of the required improvement in air quality is unlikely to be feasible in Bristol if only non-charging options (excluding access restrictions/prohibitions) are considered for this Plan. This drives the need for inclusion of either measures to restrict vehicle access or targeted charging options as part of the long list of potential interventions for the Plan. A long list of non-charging interventions, including access restrictions/prohibitions, has been identified and are considered alongside charging measures.

3.2.4 Non-Charging Measures

The long list of non-charging measures considered for the Plan are;

- Expansion of Portway Park and Ride site (550 spaces with 350 additional to be unlocked)
- Development of new and / or improved cycle paths to encourage more active travel mode (further details regarding locations to developed subsequently)
- Electric bike hire scheme (with 1,000 bikes)
- Allow electric vehicles to use bus lanes
- Introduction and enforcement of anti-idling zones for buses in the city centre
- Introduction and enforcement of anti-idling zones for taxis and private hire vehicles in city centre
- Increased Euro Standard requirements for taxis and private hire vehicles in licensing agreements
- Provision of grants for taxi, private hire and LGV drivers to upgrade and / or retrofit their vehicles
- Enforcement of mandatory compliance for buses, taxis and private hire vehicles to access bus lanes and / or franchise routes
- Increase long stay parking charges significantly to discourage car travel (consider double tariffs)

- Reduce availability of long stay parking (reduce supply to half)
- Introduction of variable parking tariffs in the Council owned car parks to discourage polluting vehicles and / or incentivise take up of electric vehicles
- Traffic management measures to relocate queues on Newfoundland Way southbound to M32 north of Junction 2
- Retrofitting of Council and privately-owned waste vehicles
- Expansion of Car Club to areas of the City with high level of 'uncompliant' vehicles
- Remove bus layover / timing points from AQMA (in particular Rupert Street)
- Optimisation of traffic signal timings across the city
- Investment in freight consolidation centre to encourage usage
- Variable tariffs for Residents Parking Zones to discourage diesel vehicles and incentivise electric vehicles
- Expansion of RPZ system to limit opportunities to park on residential streets outside CAZ (or inside CAZ)
- Automatic enforcement of yellow boxes
- Introduction of further Bus Priority Schemes (further details regarding schemes to be developed subsequently)
- Installation of electric vehicle charging infrastructure on residential streets
- Installation of electric vehicle charging infrastructure at Temple Meads
- Installation wireless taxi/private hire electric vehicle charging infrastructure at Temple Meads
- Introduction of subsidised (e.g. free) bus travel for certain demographic or income groups
- Introduction of free vehicle servicing for low income households
- Restrictions on goods vehicles movements in the City Centre and / or AQMA during peak hours
- AM peak prohibition for non-compliant vehicles (with linkages to concessionary travel passes for low income areas)
- Development and rollout of a mobility app (access to info, tickets, concessions)
- Targeted traffic management measures on Rupert Street and Bedminster Down Road
- Soft traffic gating, including real time traffic management system, across the City
- Pedestrianisation of the Old City
- Prohibition of diesel cars from polluted parts of the city
- Restrict traffic movements in city centre (as in Queens Square)
- Introduction of a Workplace Parking Levy (exemptions for electric vehicle spaces)
- Introduction of Parking Levy (on all parking including privately owned public parking)
- Expansion of other P&Rs (assumed 4,000 spaces)
- Traffic gating (hard)
- Local scrappage scheme
- Subsidised local rail season tickets
- Rapid Transit Schemes
- Odd/Even number plate access restrictions (possibly restricted to certain weeks or time periods)
- Planning condition to compel use of freight consolidation for new developments in AQMA
- Strategic Assessment of air quality impacts in all Spatial Plans
- Stronger planning policy to minimise air quality impacts developments within the AQMA including STOR and secure developer contributions
- Planning Conditions to control construction vehicle/machinery emissions

3.2.5 Charging Measures

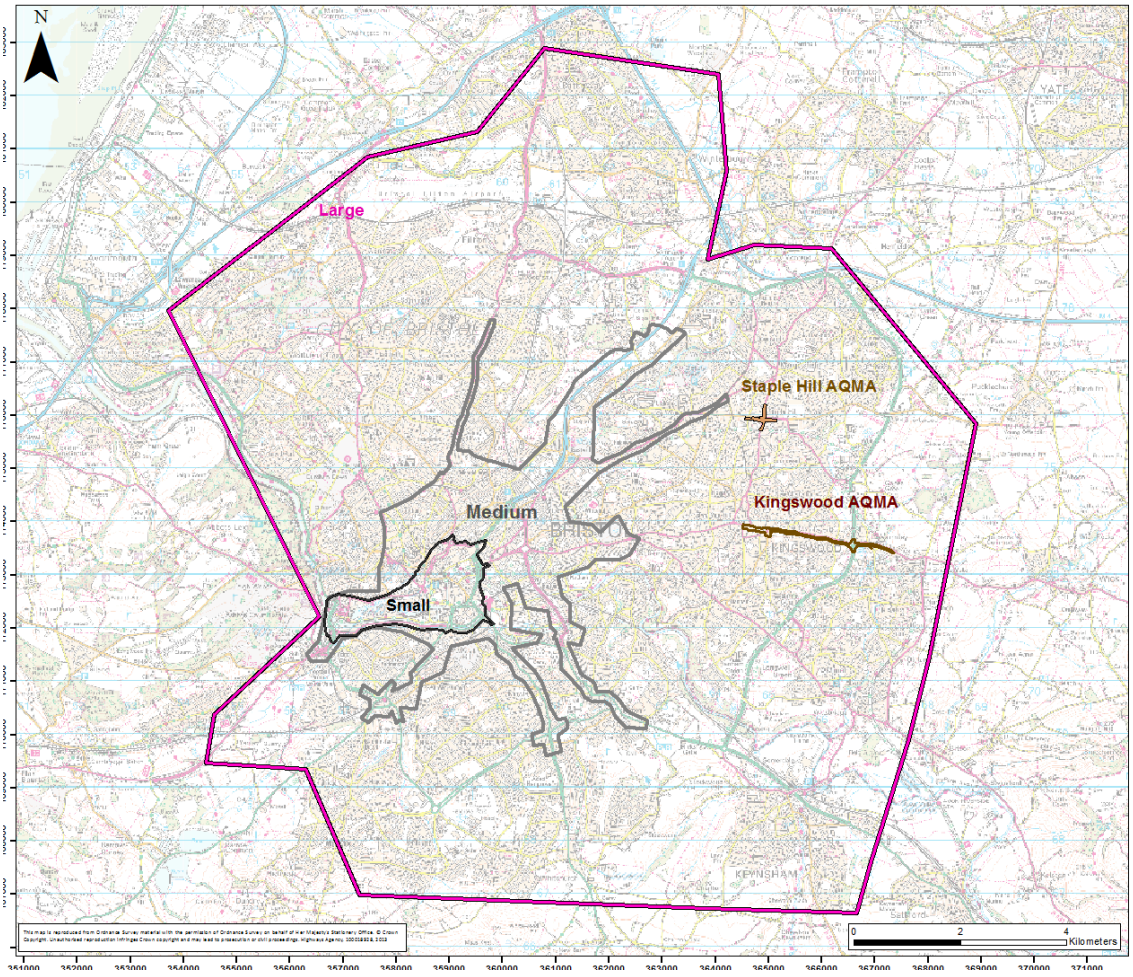
Charging options considered include all possible combinations of five geographical scopes and four charging classes of CAZ.

In the first instance, the five geographical scopes of the Plan include:

1. Large - the Bristol urban area within the boundary of the M4 and M5 and excluding areas within B&NES and NSC.
2. Medium - BCC AQMA
3. Medium - BCC & SGC AQMA combined
4. Medium - BCC & SGC AQMA separate
5. Small - within the Inner Ring Road

Figure 3-3 shows the boundary of each zone assessed. These are anticipated to evolve throughout the length of the study. Consultation with key stakeholders including internal transport colleagues will take place in order to establish boundary for modelling purposes.

Figure 3-3: Initial CAZ geographies



The CAZ classes assessed were as defined in the Defra/DfT's Clean Air Zone Framework. The framework sets out which vehicles are affected by each CAZ class and what the minimum Euro standards are for each vehicle type. The four CAZ classes include:

1. Class A charging – buses, coaches, taxis, private hire vehicles
2. Class B charging – buses, coaches, taxis, private hire vehicles and HGVs
3. Class C charging – buses, coaches, taxis, private hire vehicles, HGVs and LGVs
4. Class D charging – buses, coaches, taxis, private hire vehicles, HGVs, LGVs and cars

All potential combinations of the five geographic scopes and four CAZ charging classes results in a long list of twenty charging options for the Plan.

3.3 Critical Success Factors and Evaluation Criteria

JAQU's Options Appraisal Package document states that a list of Critical Success Factors (CSFs) is required to conduct a high-level comparative assessment of the options This process is considered to result in a shortlist of options which are envisaged to be appraised in greater detail as part of the Outline Business Case and Full Business Case. Guidance from JAQU suggests that local authorities need to identify two types of CSFs: primary CSF and secondary CSF. These CSFs for the Plan and the rationale for their inclusion is presented in this section.

3.3.1 Primary Critical Success Factor

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

- Deliver compliance with NO_2 air quality Limit Values and Air Quality Objectives in the shortest possible timescales

It should be noted that the primary critical success factor reflects both the primary and secondary spending objectives by including compliance both the EU Limit Values and the UK Air Quality Objectives.

3.3.2 Other Secondary Critical Success Factors

JAQU's Options Appraisal Package document states that while the primary CSF allows appraisers to test whether an option meets the minimum requirements, other secondary CSFs are needed to undertake a comparative assessment of the options. The guidance states that these may include factors such as value for money, distributional impacts, wider strategic air quality policy alignment, affordability and achievability.

Following this guidance, a number of secondary CSFs have been defined for the Plan against which each of the options has been assessed. The secondary CSFs defined for this Plan have been grouped using the five case model approach set out in the DfT's guidance on 'Transport Business Cases' (2013) as a framework. The CSF's are;

Strategic

- Provide equity across different vehicle type and trip purpose
- Compliance with Defra Draft CAZ framework, including minimum requirements

Economic

- Mitigate financial impact on low income households
- Improve health of low income households
- Maximise positive effects on the economy, whilst minimising any negative impacts
- Improve public health across Bristol

Commercial

- Delivery timescale risks of procurement

Financial

- Likelihood of revenue equating to implementation/operational costs[11]
- Upfront capital required for scheme[11]
- Risk of financial penalty to the Council/s

- **Management**
  - Public acceptability which could impact on the option's deliverability
  - Political acceptability which could impact on the option's deliverability

3.3.3 Evaluation Criteria

The primary CSF has been brought together with the other secondary CSFs to develop the evaluation criteria with which the options will be refined. The evaluation criteria are summarised in Table 3-1.

Table 3-1: Summary of Evaluation Criteria

Cases	ID	Evaluation Criteria	Priority
Strategic	1	Deliver compliance with NO_2 air quality Limit Values and Air Quality Objectives in the shortest possible timescales	Pass/Fail
	2	Provide equity across different vehicle types and trip purposes	Low
	3	Compliance with the CAZ framework	High
Economic	4	Mitigate financial impact on low income households	Very High
	5	Improve health of low income households	Very High
	6	Economic effects	Medium
	7	Improve public health	Very High
Commercial	8	Delivery timescale risks of procurement	Low
Financial	9	Likelihood of revenue equating to implementation/operational costs[11]	n/a
	10	Upfront capital required for scheme[11]	n/a
	11	Risk of financial penalty to the Council/s	Low
Management	12	Public acceptability	Medium
	13	Political acceptability	Medium

The primary CSF, evaluation criteria 1, is scored on a pass or fail basis. For all other evaluation criteria, a scoring system was devised for the option assessment which provides a score of High (3), Medium (2) or Low (1) for each option. The options have been scored relatively within each evaluation criteria; a low score does not necessarily indicate a negative impact, just that of all the options considered it is among the worst performing (and vice versa for high).

Each evaluation criteria was given a priority level of either Low (1), Medium (2), High (3), or Very High (4) based on a judgement of their importance. These priority scores were multiplied with the 1-3 score to give an overall weighted score for each option. The priority score of each criteria is summarised in Table 3-1.

[11] Complying with the legal test which was set out by the High Court in November 2016 in R (ClientEarth) (NO_2) V Secretary of State for Environment Food and Rural Affairs [2016] EWHC 2740 (Admin), only shortlisted options which achieve compliance with the NO_2 Limit Value in the shortest possible time, are appraised across this criterion. The relevant analysis is presented in the Financial Case chapter.

The legal test which was set out by the High Court in November 2016 in R (ClientEarth) (NO_2) V Secretary of State for Environment Food and Rural Affairs [2016] EWHC 2740 (Admin) confirms that when selecting measures to tackle air quality exceedances, the determining factor must be which measure will achieve compliance in the shortest time. The test also indicates that only where two measures are equally timely and effective can considerations such as cost be taken into account. Hence, no assessment is undertaken for the Financial Evaluation Criteria 9 and 10 as part of the shortlisting of options. Whilst indicative scores are provided for presentational purposes in Table 3-2, they do not influence the weighted scoring and selection of shortlisted options. Instead, the shortlisted options which meet compliance in the shortest possible time and perform better than other alternatives have been appraised across these criteria and the analysis is presented in the Financial Case chapter.

3.4 Primary Critical Success Factor Test

This section sets out the assessment of the very long list of options against the primary Critical Success Factor: Deliver compliance with NO_2 air quality Limit Values and Air Quality Objectives in the shortest possible timescales.

3.4.1 Non-charging Measures

Considering the evidence regarding sources of local exceedances, Bristol City Council has considered a wide range of deliverable non-charging options. It is not anticipated that any of these measures in isolation could achieve compliance in the required timescales, but at this stage, with such a lengthy list, it is difficult to propose plausible packages of these measures. Given the primary spending objective of achieving compliance with EU Limit Values and Air Quality Objectives in the shortest possible time, any options which were not deemed to be deliverable by 2021 were discounted from this initial very long list of non-charging options. It is worth noting that many of the non-charging options discounted as possible interventions for this Plan will continue to be considered as part of the long term air quality strategy for the city within the Air Quality Action Plan.

Following the application of the primary CSF, the following long list of non-chargeable options were considered as possible interventions for this Plan:

- Expansion of Portway Park and Ride site (550 spaces with 350 additional to be unlocked)
- Development of new and / or improved cycle paths to encourage more active travel mode (further details regarding locations to developed subsequently)
- Electric bike hire scheme (with 1,000 bikes)
- Allow electric vehicles to use bus lanes
- Introduction and enforcement of anti-idling zones for buses in the city centre
- Introduction and enforcement of anti-idling zones for taxis and private hire vehicles in city centre
- Increased Euro Standard requirements for taxis and private hire vehicles in licensing agreements
- Provision of grants for taxi, private hire and LGV drivers to upgrade and / or retrofit their vehicles
- Enforcement of mandatory compliance for buses, taxis and private hire vehicles to access bus lanes and / or franchise routes
- Increase long stay parking charges significantly to discourage car travel (consider double tariffs)
- Reduce availability of long stay parking (reduce supply to half)
- Introduction of variable parking tariffs in the Council owned car parks to discourage polluting vehicles and / or incentivise take up of electric vehicles
- Traffic management measures to relocate queues on Newfoundland Way southbound to M32 north of Junction 2
- Retrofitting of Council and privately-owned waste vehicles
- Expansion of Car Club to areas of the City with high level of ‘uncompliant’ vehicles
- Remove bus layover / timing points from AQMA (in particular Rupert Street)

- Optimisation of traffic signal timings across the city
- Variable tariffs for Residents Parking Zones to discourage diesel vehicles and incentivise electric vehicles
- Expansion of RPZ system to limit opportunities to park on residential streets outside CAZ (or inside CAZ)
- Automatic enforcement of yellow boxes
- Introduction of further Bus Priority Schemes (further details regarding schemes to be developed subsequently)
- Installation of electric vehicle charging infrastructure on residential streets
- Installation of electric vehicle charging infrastructure at Temple Meads
- Installation wireless taxi/private hire electric vehicle charging infrastructure at Temple Meads
- Introduction of subsidised (e.g. free) bus travel for certain demographic or income groups
- Introduction of free vehicle servicing for low income households
- Restrictions on goods vehicles movements in the City Centre and / or AQMA during peak hours
- AM peak prohibition for non-compliant vehicles (with linkages to concessionary travel passes for low income areas)
- Development and rollout of a mobility app (access to info, tickets, concessions)
- Targeted traffic management measures on Rupert Street and Bedminster Down Road
- Soft traffic gating, including real time traffic management system, across the City
- Pedestrianisation of the Old City
- Prohibition of diesel cars from polluted parts of the city

Annex A provides further detail on the assessment of the non-charging measures, including the year in which each scheme is estimated to be deliverable.

3.4.2 Charging Measures

The assessment of the timescales to achieve compliance for charging measures is presented in this section in two parts; the timescales to deliver the scheme, and the timescales from delivery to achieve compliance. Both parts are equally important in selecting a scheme which will deliver compliance in the shortest time possible.

3.4.2.1 Delivery Timescales for Charging Options

The stages of the project leading up to, and including, full implementation are listed below. It is assumed that these tasks would start in early 2019. The time anticipated for some elements is dependent on the number of camera locations required for the CAZ (though not the class of CAZ) whilst other elements are common to all options, as indicated below in brackets. Table 3-2 also shows the estimated timescales for completion of each stage for each scheme from initial design through to installation and operation.

- Refinement of ANPR camera locations (dependent on CAZ option)
- Non-Site Specific Detailed Design (common to all CAZ options)
    - Technical specification for ANPR cameras and back office system
    - Standard designs for ANPR installations (e.g. mountings, pillars, cabinets, cabling)
    - Standard designs for signage and publicity
- Site Specific Detailed Design (dependent on CAZ option)
    - Site visits to confirm camera/signage position, obstructions, etc
    - General arrangement drawings (and other information) for each ANPR location
    - General arrangement drawings (and other information) for signage
    - Source and location of power supplies

- Tendering and Procurement (common to all CAZ options)
    - Production of contract documents
    - Production of tender package and supporting information
    - Tender period (assuming OJEU single stage tender approach)
    - Tender assessment and shortlisting
    - Identification of preferred bidder
    - Council approval of preferred bidder(s) and proposed solution
    - Contract award
- Implementation (dependent on CAZ option)
    - Installation of cameras
    - Back office installation to run in parallel with ANPR camera installation – this assumes premises and staff already available as extension to existing control room arrangements
    - Signage installation to run in parallel with ANPR installation

Table 3-2 Estimated timescales for design, procurement and installation of each scheme

Activity	Time to Completion (months)		
	Small	**Medium**	**Large**
Conceptual and outline design	3	3	3
Refinement of ANPR camera locations	2	4	8
Detailed design (non-site specific)	2	2	2
Detailed design (site specific)	4	12	24
Tendering, procurement and contract award	12	12	12
Implementation	3	12	24
Total for all stages in years	**1.83**	**3.33**	**5.67**

For the purposes of this assessment it is assumed that the timescales required to design, procure and implement the three medium CAZ options is the same since the number of cameras required is of a similar magnitude. An indicative programme for the design, procurement and implementation of each CAZ option is shown in Figure 3-4.

There may be potential to reduce the detailed design stage – possibly by 6-12 months for the medium and large zones - by increasing design resource. However, this would also require a corresponding increase in resource within BCC in order to review, revise (and where necessary, approve) site design, and relies on the market being able to meet such demands.

Consideration will also be given to undertaking the tendering and procurement elements of the project simultaneous to the consultation of the Outline Business Case at the end of 2018. If this is possible, the timescales to implementation would be reduced. However, it is not yet known whether this is achievable in practice, or whether this is in line with Bristol City Council's policy, and therefore the timescales set out reflect experiences on recent ITS projects, including within in Bristol.

Implementation timescales also adopted an assumed rate of camera installation based upon two cameras per day for the small zone, three for the medium zone and four for the large zone. It may be possible to increase this rate, and thus reduce implementation timescales, if additional resource can be made available by system installers. However, it is not known to what extent, if any, existing systems providers/installers could achieve this, particularly if they are simultaneously undertaking CAZ installations for other authorities. Given the large number of cameras and associated mountings, housings and other equipment required for the medium and large zones, the ability of such hardware to be manufactured at the desired rate may also be a determining factor, again particularly if there is simultaneous demand from other authorities.

There are also other practical limitations to the rate at which implementation could be achieved, such as the need to accommodate other streetworks activities and to ensure that disruption to vehicles, pedestrians and others is minimised during CAZ works, e.g. through restricted hours working, streetworks embargos over Christmas and/or public holidays. The ability of third-party service providers such as power and communications network services to deliver at an equal rate also needs to be taken account of when considering how rapidly implementation can be achieved.

In comparison with site installation, provision of back office systems is not expected to be a determining factor, assuming control centre premises and staff are already in place.

It should be noted that the predicted time required to implement the largest CAZ is the least certain, and could be significantly longer than estimated here given the risks around procurement discussed later in this chapter.

Figure 3-4: Summary of projected timescales to implementation for each CAZ option

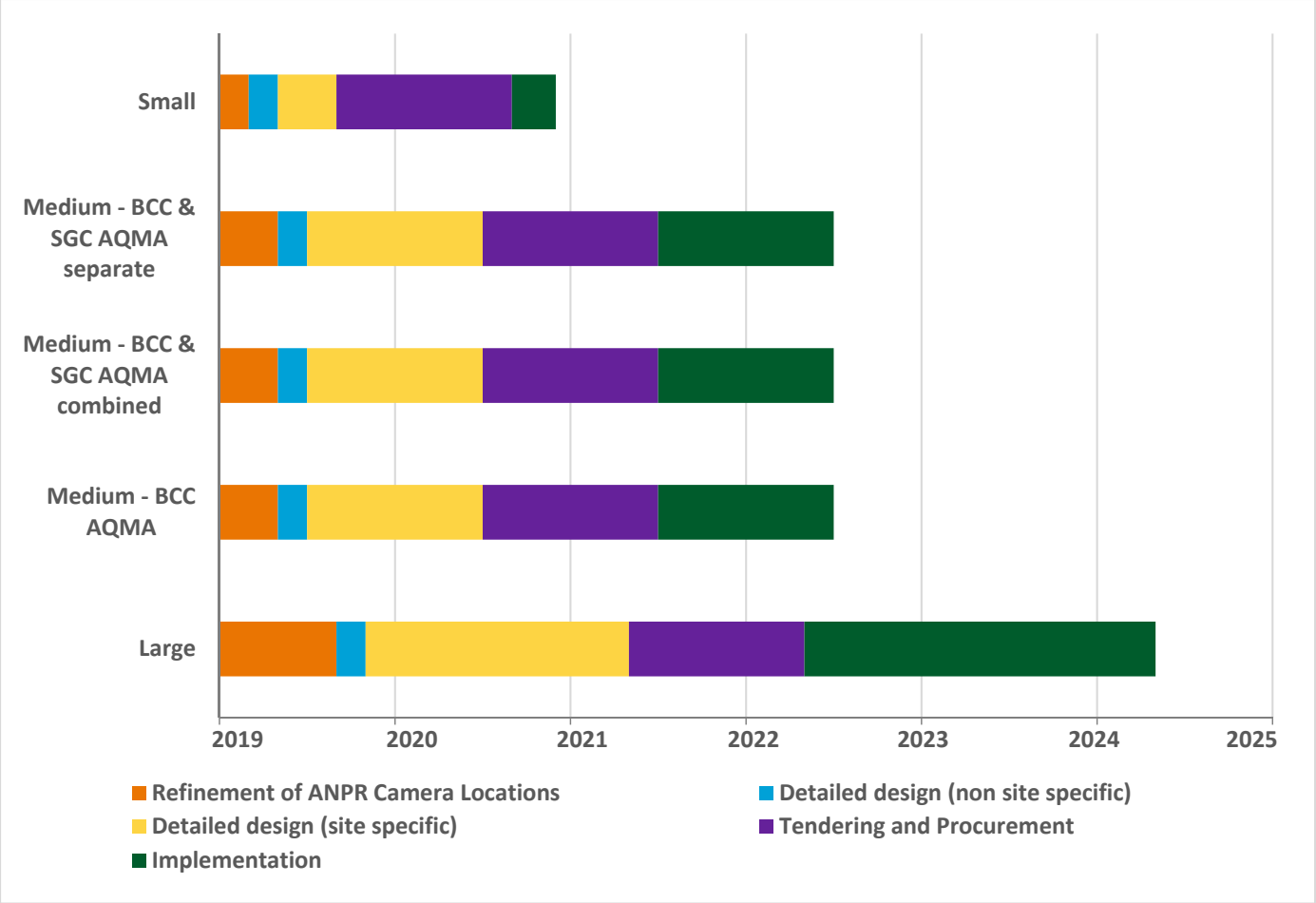


Figure 3-4 demonstrates that geographical area is a key influencer on time taken to implement a CAZ. Specifically, refinement of ANPR camera locations, the site specific detailed design and implementation phases are all estimated to take longer as the size of the CAZ increases.

Implementation of a CAZ in the small geography is estimated to take under half the time required for the largest geography. Additionally, it is estimated that a medium sized CAZ could be implemented almost 2 years before the large CAZ.

3.4.2.2 Timescales to Compliance

In each year, the number of existing monitoring sites within BCC and SGC not expected to achieve compliance following implementation of each charging CAZ option has been calculated, and is summarised in Figure 3-5 and Figure 3-6 below alongside the reference case (no CAZ). At this stage, the analysis reflects the impact of the charging zone in isolation of any non-charging measures. Further details of this assessment are provided in Annex C.

Figure 3-5: Number of Monitoring Sites Not Expected to Achieve Compliance with a Small CAZ

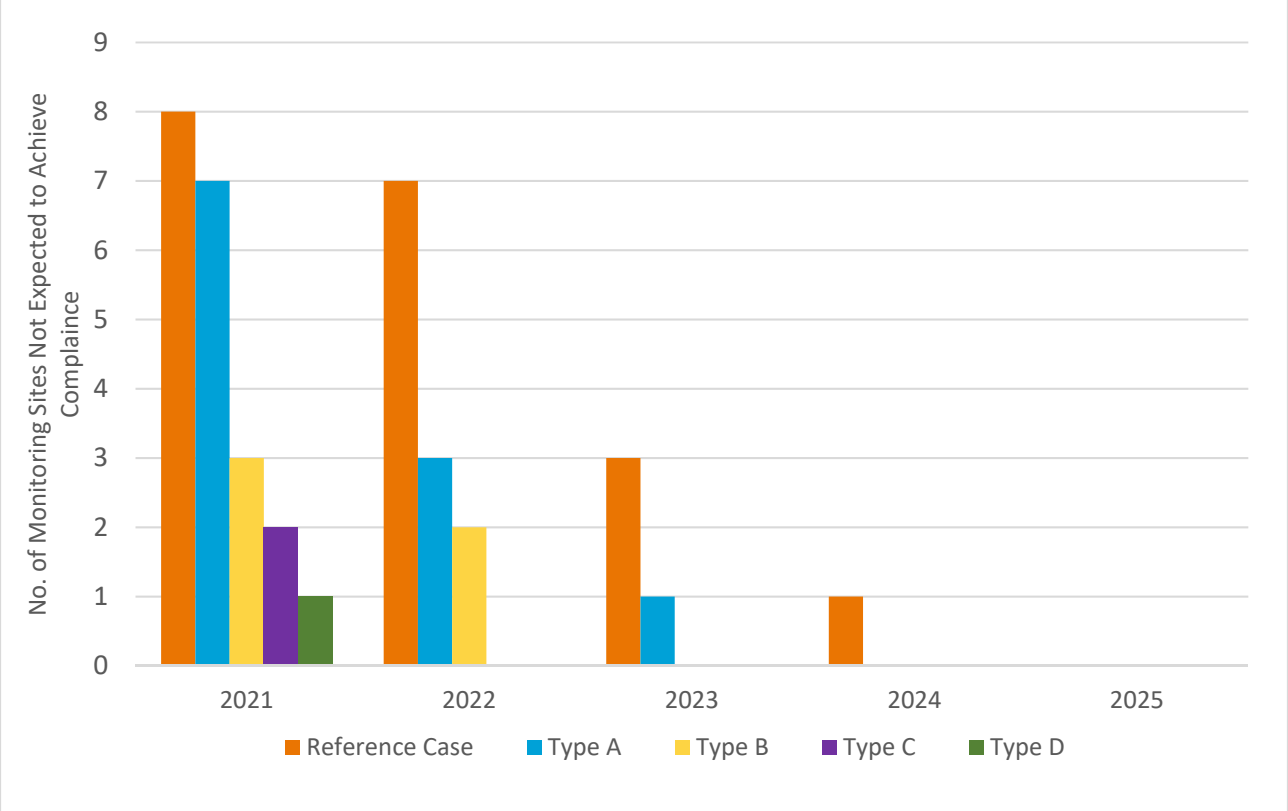
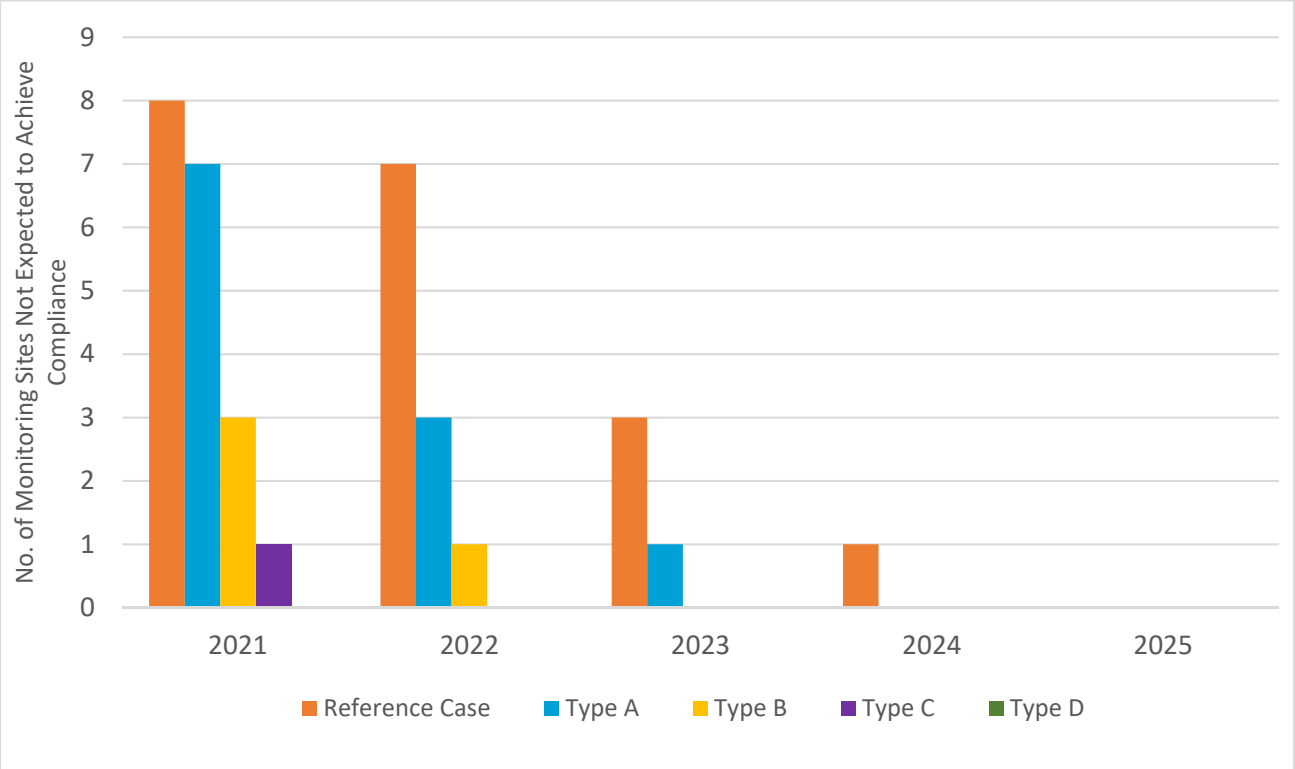


Figure 3-6: Number of Monitoring Sites Not Expected to Achieve Compliance with a Medium CAZ



The assessment demonstrates that compliance is expected to be achieved in all locations by 2025 without a CAZ. The most successful option in bringing forward this timescale is a Class D medium CAZ which is predicted to achieve compliance in 2021. However, it is anticipated that a medium CAZ could not be implemented until 2022, by which time both a type C and D would be sufficient to achieve compliance.

It should be noted that the analysis undertaken to determine the year of compliance is suitable to provide a relative comparison between options, but it relies on a number of assumptions which mean that the year of compliance calculated is indicative only. The assumptions will be revisited and revised as appropriate in the more detailed modelling of the OBC and as such the year of compliance may subsequently change.

The maximum annual mean NO2 concentrations following implementation of each charging CAZ option are presented in Figure 3-7 and Figure 3-8. These figures demonstrate the level of change that non-charging measures combined with a charging scheme would need to achieve to meet compliance sooner than a charging scheme in isolation.

Figure 3-7: Maximum Annual Mean NO_2 concentrations at air quality monitors with a Small CAZ

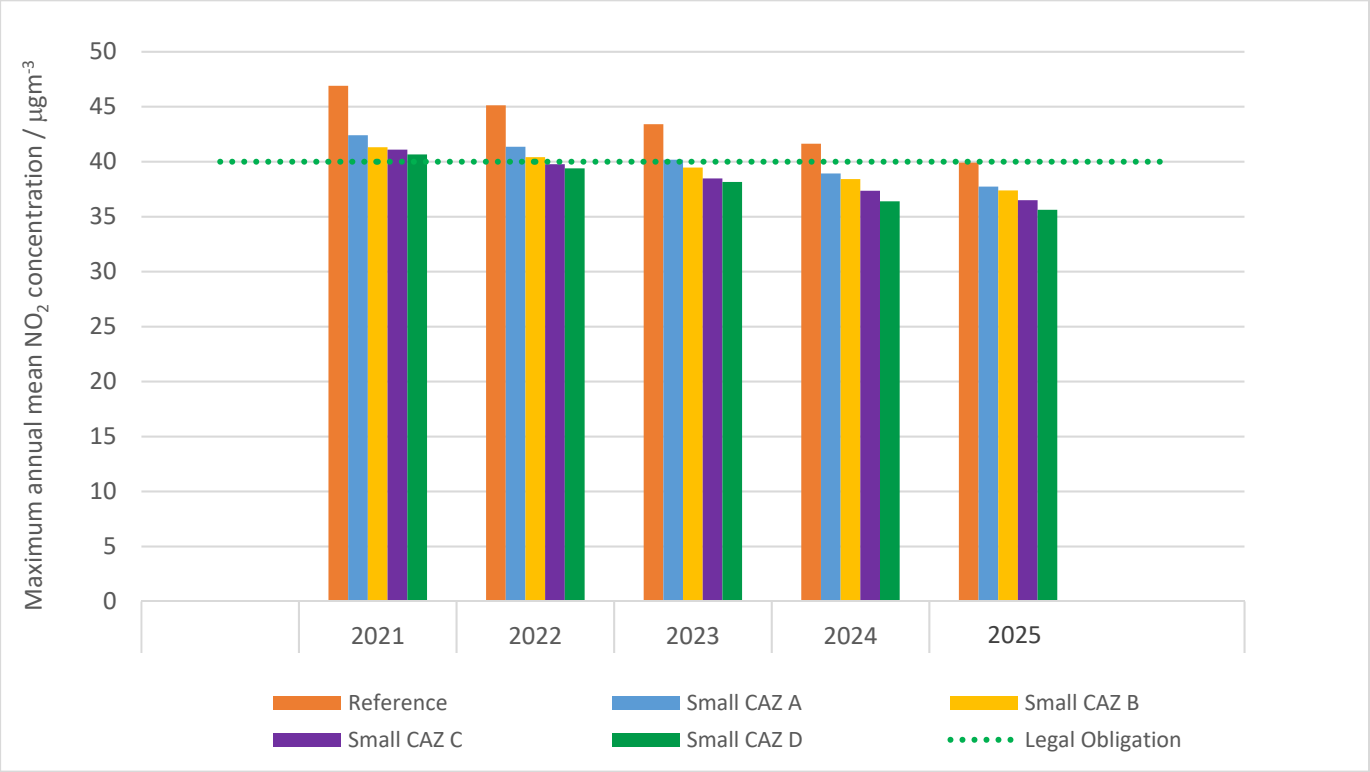
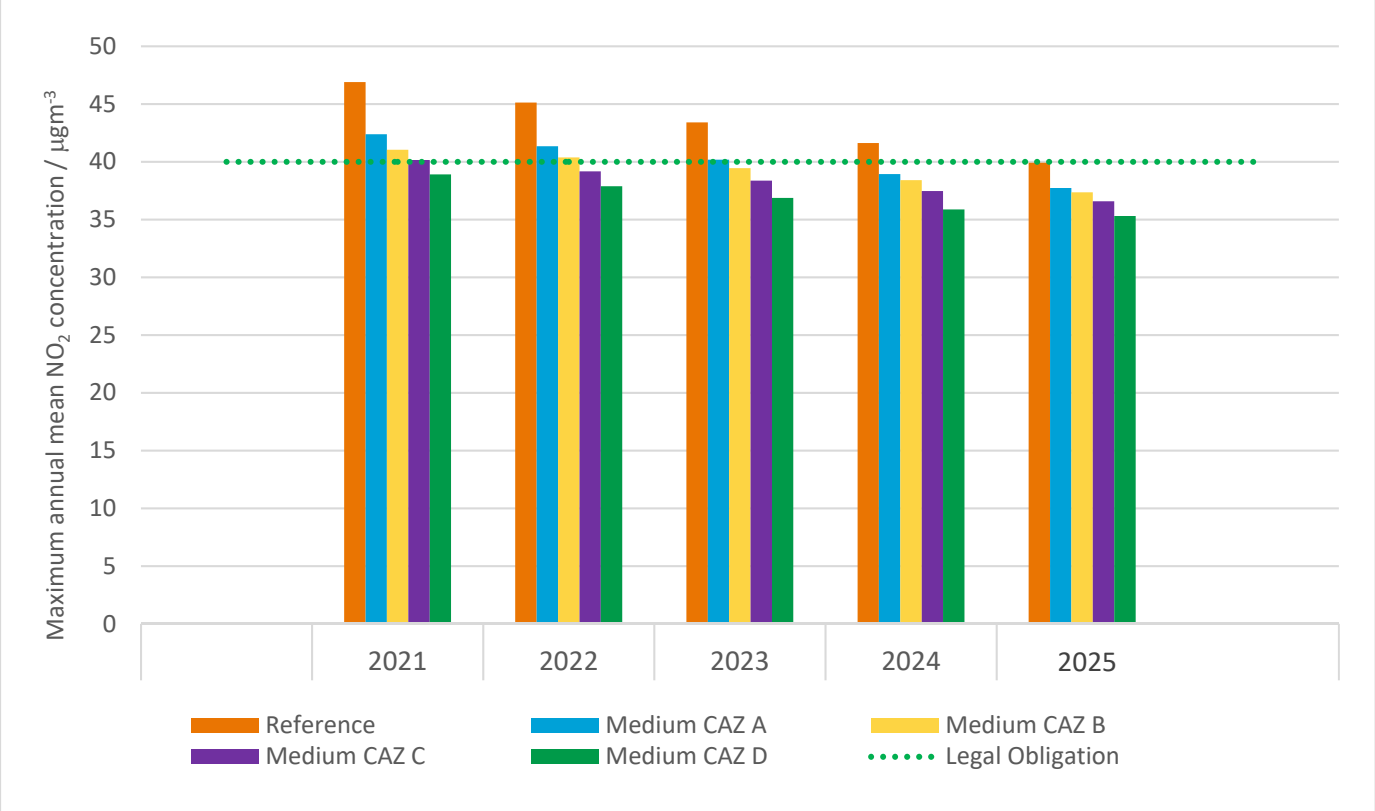


Figure 3-8: Maximum Annual Mean NO_2 concentrations at air quality monitors with a Medium CAZ



A Class D Medium CAZ is expected to achieve compliance at every monitoring location by 2021, bringing forward compliance by four years from compared to the reference case. A Class C (both Small and Medium) and Class D Small CAZ are expected to achieve compliance by 2022, however the remaining exceedances in these scenarios in 2021 are very small. It is possible that combining non-charging measures with each of these charging CAZs would elicit a greater change in behaviour which could achieve compliance in 2021.

Monitors on both Rupert Street and Bedminster Down Road currently record significant exceedances and these locations are predicted to remain uncompliant for several years into the future even with a charging CAZ. However, there are some uncertainties around the level of exceedance at these locations due to recent and ongoing changes to the highway network. The monitoring station on Rupert Street was not in place during 2016 due to road improvements to accommodate the MetroBus scheme, and the assessment undertaken here does account for the improvements due to the MetroBus scheme. Similarly, the data at Bedminster Down Road does not account for likely improvements resulting from the opening of the South Bristol Link Road in 2017. As a result, the prediction of these ongoing exceedances at Rupert Street and Bedminster Down Road may not be accurate. Should more detailed assessment predict that these locations will continue to exceed the Air Quality Objective it is anticipated that with some additional measures focused on these two locations, compliance may be achieved in 2021 with a Class C or D CAZ within either the small or medium sized boundary.

It is expected that the largest zone could not be implemented before 2024 at the earliest, by which time either the small or medium zones could have achieved compliance. Based on this test against the primary CSF, the large charging options have been discounted from this initial very long list of charging options since they cannot achieve compliance in the shortest time possible.

Class A and B charging zones are also discounted from this initial very long list of charging options since the analysis demonstrates that in both the small and medium zones these would take longer to achieve compliance than a Class C or D zone.

3.4.2.3 Summary

Following the test against the primary CSF, the following long list of chargeable options are considered as appropriate interventions for this Plan:

- Medium (BCC AQMA) geography, CAZ Class C – charging
- Medium (BCC AQMA) geography, CAZ Class D – charging
- Medium (BCC & SGC Kingswood-Warmley AQMA combined) geography, CAZ Class C – charging
- Medium (BCC & SGC Kingswood-Warmley AQMA combined) geography, CAZ Class D – charging
- Medium (BCC & SGC Kingswood-Warmley AQMA separate) geography, CAZ Class C – charging
- Medium (BCC & SGC Kingswood-Warmley AQMA separate) geography, CAZ Class D – charging
- Small geography, CAZ Class C – charging
- Small geography, CAZ Class D – charging

3.5 Conceptual Packages

Until this point the charging and non-charging measures have been considered separately from each other in order to refine the lists to a more manageable length. However, it is likely that a package of multiple measures would achieve compliance quicker than single measures in isolation. Hence it is necessary to consider how these long lists of measures might be logically brought together into packages. At this stage, there is still some further refinement of the long lists to be completed against the secondary CSFs and so the packages presented here are 'conceptual'. More clearly defined packages are presented in section 3.7 following further analysis of the options.

Evidence has been presented (in section 3.2.3) to demonstrate that either a charging zone or access restrictions are predicted to be required to deliver compliance in the shortest time possible. However, it is anticipated that the delivery of a charging zone or access restrictions could not be successfully achieved without simultaneous non-charging measures to either increase the impact of the Plan on air quality or mitigate undesirable impacts.

The analysis of the non-charging measures has been qualitative only and so there is merit in taking forward a package of non-charging interventions, which comprises of best performing non-charging solutions, as a shortlisted option in order to further assess the impacts.

Hence, the following conceptual packages of schemes are considered for assessment against the critical success factors;

- Medium (BCC AQMA) geography, charging CAZ Class C plus appropriate non-charging measures
- Medium (BCC AQMA) geography, charging CAZ Class D plus appropriate non-charging measures
- Medium (BCC & SGC Kingswood-Warmley AQMA combined) geography, charging CAZ Class C plus appropriate non-charging measures
- Medium (BCC & SGC Kingswood-Warmley AQMA combined) geography, charging CAZ Class D plus appropriate non-charging measures
- Medium (BCC & SGC Kingswood-Warmley AQMA separate) geography, charging CAZ Class C plus appropriate non-charging measures
- Medium (BCC & SGC Kingswood-Warmley AQMA separate) geography, charging CAZ Class plus appropriate non-charging measures
- Small geography, CAZ Class C plus appropriate non-charging measures
- Small geography, CAZ Class D plus appropriate non-charging measures
- A package of non-charging measures, including access restrictions/prohibition measures

It is envisaged that a selection of the non-charging measures would be included within each package which contains a charging scheme, excluding any access restriction/prohibition measures which would penalise the same vehicle types charged by the CAZ.

3.6 Assessment of Long List of Measures

This section presents an overview of the options' assessment against the secondary evaluation criteria, other than criteria 9 and 10, for the reasons outlined previously. Full details of the scoring can be found in Annex A and B.

3.6.1 Non-charging Measures

The number of non-charging options at this stage includes 33 individual measures. It is not considered feasible for all of these to be delivered simultaneously within the required timescales, with or without a charging zone. Hence, in order to include non-charging measures within a package of measures the list must be refined to only include those that are most likely to offer benefit to the Plan (either through improving air quality or offsetting potential negative impacts of the scheme), and are implementable within the required timescales. The evaluation criteria have been used to sift through the list and produce a refined list of options which can be assessed as part of a package of measures either with or without charging options. The primary CSF has already been applied to the very long list of non-charging measures to discount those not deliverable by 2021, in compliance with the required legal test. The primary CSF is used again in this secondary analysis to indicate of the level of impact of the measure in terms of air quality improvements, as a contribution towards achieving compliance.

A detailed assessment of the non-charging measures against the evaluation criteria is difficult due to the number of measures currently on the list (33) and the level of detail available for each measure. Instead a qualitative assessment has been undertaken to provide a score against each evaluation criteria.

A record of the scoring of each option, and the reasons for discounting them or otherwise, is provided in Annex A. It should be noted that some non-charging measures have been maintained on the list despite their anticipated minimal impact on air quality, since they represent a way to mitigate other undesirable effects of charging/access restriction measures.

Following the assessment against the evaluation criteria, the short list of non-charging measures is therefore;

- Development of new and / or improved cycle paths to encourage more active travel mode (further details regarding locations to developed subsequently)
- Introduction and enforcement of anti-idling zones for buses in the city centre
- Increased Euro Standard requirements for taxis and private hire vehicles in licensing agreements
- Provision of grants for taxi, private hire and LGV drivers to upgrade and / or retrofit their vehicles
- Enforcement of mandatory compliance for buses, taxis and private hire vehicles to access bus lanes and / or franchise routes
- Introduction of variable parking tariffs in the Council owned car parks to discourage polluting vehicles and / or incentivise take up of electric vehicles
- Traffic management measures to relocate queues on Newfoundland Way southbound to M32 north of Junction 2
- Retrofitting of Council and privately-owned waste vehicles
- Expansion of Car Club to areas of the City with high level of 'uncompliant' vehicles
- Optimisation of traffic signal timings across the city
- Introduction of further Bus Priority Schemes (further details regarding schemes to be developed subsequently)
- Introduction of subsidised (e.g. free) bus travel for certain demographic or income groups
- Restrictions on goods vehicles movements in the City Centre and / or AQMA during peak hours
- Targeted traffic management measures on Rupert Street and Bedminster Down Road
- Soft traffic gating, including real time traffic management system, across the City
- Prohibition of diesel cars from polluted parts of the city

3.6.2 Charging Measures

The long list of charging measures which comply with the primary CSF have been scored against secondary CSFs to determine their likely impact. The scoring is determined through a series of quantitative and qualitative assessments, detail of which is provided in Annex D. The final scoring of each charging measure is show in Table 3-3.

Note that whilst indicative scores are provided for the evaluation criteria 'likelihood of revenue equating to implementation/operational costs' and 'upfront capital required for scheme', these scores are only provided for presentational purposes. They do not influence the weighted scoring and selection of shortlisted options. Please see the Financial Case chapter for analysis and commentary related to these criteria, for the shortlisted options only.

A full summary of the scoring of charging measures against all CSFs is provided in Annex B.

Table 3-3: Scoring of Charging Measures against Evaluation Criteria

Scheme	Medium - BCC & SGC AQMA combined: C - charging	Medium - BCC & SGC AQMA combined: D - charging	Medium - BCC & SGC AQMA separate: C - charging	Medium - BCC & SGC AQMA separate: D - charging	Medium - BCC AQMA: C - charging	Medium - BCC AQMA: D - charging	Small: C - charging	Small: D - charging
Timescale to achieve compliance	2021	2021	2021	2021	2021	2021	2021	2021
Deliver compliance with NO_2 air quality limit values and objectives in the shortest possible timescales	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Provide equity across different vehicle types and trip purposes	2	3	2	3	2	3	2	3
Compliance with the CAZ framework	1	1	1	1	3	3	3	3
Mitigate financial impact on low income households	2	1	2	1	2	1	3	2
Improve health of low income households	2	2	2	2	2	2	1	2
Economic effect	1	1	1	1	1	1	2	1
Improve public health	2	2	2	2	2	2	1	2
Delivery timescale risks of procurement	2	2	2	2	2	2	3	3
Likelihood of revenue equating to implementation/operational costs	1	2	1	2	1	2	2	3
Upfront capital required for scheme	2	2	2	2	2	2	3	3
Risk of financial penalty to the Council/s	2	3	2	3	2	3	1	2
Public acceptability	2	1	2	1	2	1	2	1
Political acceptability	2	2	2	2	2	2	2	2
Weighted Average Score (excluding financial CSFs)	43	39	43	39	49	45	47	49
Decision	**Reject - Low scoring**	**Reject - Low scoring**	**Reject - Low scoring**	**Reject - Low scoring**	**Feasible**	**Feasible**	**Feasible**	**Feasible**

3.6.3 Way Forward

The assessment of long list of charging and non-charging measures against the evaluation criteria has provided a short list of both charging and non-charging measures which can be combined into packages to take forward for further assessment. A total of 16 non-charging measures and 4 charging measures remain on the shortlist.

The assessment demonstrates that the most successful charging measures across both primary and secondary CSFs are the small and medium, Class C and D charging options. That said, their performance can be enhanced further by supplementing these options with relevant non-charging options, particularly those which do not duplicate effort. This approach has been adopted in order to refine the conceptual packages of measures presented in 3.5.

Furthermore, the analysis demonstrates that a non-charging option including access restrictions may present similar air quality benefits to a charging zone which targets the same vehicle types. However, the analysis of the non-charging measures has been qualitative only at this stage and so there is merit in taking forward a package of non-charging interventions, which comprises of best performing non-charging solutions, as a shortlisted option in order to further assess the impacts.

3.7 Shortlisted Options

Based on the assessment of options presented earlier in this Chapter and the detailed scoring presented in Annex A and B, this section presents the details of the shortlisted options. These options along with the reference case will be appraised in greater detail as part of the Outline Business Case and Full Business Case. A logic map is provided in Annex E to capture the impacts of the proposed measures within the shortlisted packages.

3.7.1 Option 1 – Benchmark Option

JAQU's Option Appraisal Guidance identifies the need to establish a benchmark option that reflects a charging CAZ only. The benchmark needs to provide confidence that it is the lowest class required to achieve compliance in shortest possible timescales. The benchmark option represents an important tool for defining what the shortest possible timescale is and provides a comparator against which other policy options can be compared. Within this context, and following discussion with JAQU, the focus of this option will be to introduce charging for Class D at medium geography level.

3.7.2 Option 2 – Package of non-charging interventions

This option includes the following non-charging interventions:

- Development of new and / or improved cycle paths to encourage more active travel mode (further details regarding locations to developed subsequently) (mitigation)
- Introduction and enforcement of anti-idling zones for buses in the city centre (abatement)
- Increased Euro Standard requirements for taxis and private hire vehicles in licensing agreements (abatement)
- Provision of grants for taxi, private hire and LGV drivers to upgrade and / or retrofit their vehicles (mitigation)
- Enforcement of mandatory compliance for buses, taxis and private hire vehicles to access bus lanes and / or franchise routes (abatement)
- Introduction of variable parking tariffs in the Council owned car parks to discourage polluting vehicles and / or incentivise take up of electric vehicles (abatement)
- Traffic management measures to relocate queues on Newfoundland Way southbound to M32 north of Junction 2 (abatement)

- Retrofitting of Council and privately-owned waste vehicles (abatement)
- Expansion of Car Club to areas of the City with high level of 'uncompliant' vehicles (mitigation)
- Optimisation of traffic signal timings across the city (abatement)
- Introduction of further Bus Priority Schemes (further details regarding schemes to be developed subsequently) (abatement)
- Introduction of subsidised (e.g. free) bus travel for certain demographic or income groups (mitigation)
- Restrictions on goods vehicles movements in the City Centre and / or AQMA during peak hours (abatement)
- Targeted traffic management measures on Rupert Street and Bedminster Down Road (abatement)
- Soft traffic gating, including real time traffic management system, across the City (abatement)
- Prohibition of diesel cars from polluted parts of the city (abatement)

3.7.3 Option 3 – Medium Class C Charging Option with complementary non-charging interventions

The focus of this option will be to introduce charging for Class C at medium geography level. In addition, this option will also include the following complementary non-charging interventions:

- Development of new and / or improved cycle paths to encourage more active travel mode (further details regarding locations to developed subsequently) (mitigation)
- Introduction and enforcement of anti-idling zones for buses in the city centre (abatement)
- Provision of grants for taxi, private hire and LGV drivers to upgrade and / or retrofit their vehicles (mitigation)
- Introduction of variable parking tariffs in the Council owned car parks to discourage polluting vehicles and / or incentivise take up of electric vehicles (abatement)
- Traffic management measures to relocate queues on Newfoundland Way southbound to M32 north of Junction 2 (abatement)
- Retrofitting of Council and privately-owned waste vehicles (abatement)
- Expansion of Car Club to areas of the City with high level of 'uncompliant' vehicles (mitigation)
- Optimisation of traffic signal timings across the city (abatement)
- Introduction of further Bus Priority Schemes (further details regarding schemes to be developed subsequently) (abatement)
- Introduction of subsidised (e.g. free) bus travel for certain demographic or income groups (mitigation)
- Targeted traffic management measures on Rupert Street and Bedminster Down Road (abatement)
- Soft traffic gating, including real time traffic management system, across the City (abatement)

3.7.4 Option 4 – Medium Class D Charging Option with complementary non-charging interventions

The focus of this option will be to introduce charging for Class D at medium geography level. In addition, this option will also include all but one of the non-charging interventions included in Option 2. This option will not include variable parking tariffs in Council car parks to discourage polluting vehicles and/or incentivise electric vehicles. This is because the impacts of such an intervention are likely to be already be captured under class D charging regime.

3.7.5 Option 5 – Small Class C Charging Option with complementary non-charging interventions

The focus of this option will be to introduce charging for Class C at small geography level. In addition, this option will also include all of the non-charging interventions included in Option 2.

3.7.6 Option 6 – Small Class D Charging Option with complementary non-charging interventions

The focus of this option will be to introduce charging for Class D at small geography level. In addition, this option will also include all of the non-charging interventions included in Option 3. Like Option 3, this option will not include variable parking tariffs in Council car parks to discourage polluting vehicles and/or incentivise electric vehicles. This is because the impacts of such an intervention are likely to be already be captured under class D charging regime.

Commercial Case

4.1 Introduction

JAQU's Inception package guidance requires the Commercial case of the SOC to provide an assessment of relevant current procurement arrangements, likely services required and likely attractiveness of the project to potential service providers.

The predominant element of infrastructure in all packages of measures selected to be taken forward to the Outline Business Case is the installation of an ANPR system, regardless of whether they involve charging (the non-charging package requires ANPR to enforce the proposed access restrictions). As such, the procurement of ANPR and associated systems for all packages has been dealt with simultaneously.

Bristol City Council and its partners have considerable expertise in the procurement of similar technologies for Bristol and the surrounding region. Examples of recent similar technology procurements include those for the joint Bristol City Council / Avon & Somerset Police ANPR camera network and for the flagship MetroBus project. The City Council has also undertaken several procurement exercises for provision of the new integrated Bristol Operations Centre, integrating transport network monitoring and management services across the city into one cutting-edge fully-coordinated facility. The information provided within this chapter is informed by this experience.

An implementation group has been established, and will operate for the remainder of the year to work on design of the scheme and procurement of the required infrastructure.

4.2 Possible Routes to Procurement

The most appropriate procurement approach for the selected Plan is dependent upon several factors, namely:

- The final measures included within the Plan (non-charging and/or charging)
- The type of system to be implemented (centralised, localized or hybrid);
- The extent to which the technical and operational solution is specified (e.g. whether fully specified or open to market proposals as a performance-based solution);
- The method by which it is proposed to operate ("in-house" or third-party service provider);
- Ongoing maintenance and development;
- Whether it is to be designed, implemented and operated by a single service provider or by multiple providers; and
- Timescales for delivery.

There are three key procurement routes available:

- Local authority tendering through an Approved List (shortlist) of invited suppliers;
- Through existing City Council Frameworks
- Open tender through the Official Journal of the European Union (OJEU); and
- Through Crown Commercial Services (CCS), the UK Government's professional procurement service for the public sector.

Given the scale of CAZ implementation, it is not thought likely that the procurement value of any element of this work will fall under that required for the Approved List procurement approach, so this leaves either the OJEU or CCS processes as options for procurement.

4.2.1 Existing City Council Frameworks

There are several currently active frameworks established by Bristol City Council for highways design, installation and maintenance services. These frameworks offer the advantage of being readily available to provide "fast track" procurement of the various services required for the Plan. They are suitable for the design and specification elements of the Plan and for those parts of implementation relating to on-road and roadside infrastructure such as signage, road markings and physical changes to road layout. They can also be used for the communications network elements and for on-street electrical supplies. Maintenance of the CAZ roadside infrastructure can also be arranged under these frameworks.

These existing frameworks are likely to be suitable to procuring the traffic management measures proposed within the list of non-charging measures.

Other procurement routes are more suitable for the supply and implementation of the roadside and back office CAZ technology. These are described in further detail below.

4.2.2 OJEU Tendering

The OJEU tender process can take several forms - open, restricted, competitive dialogue, competitive procedure with negotiation or innovation partnership. Given the nature of the work proposed for this Plan, it is expected that only open or restricted procedures would apply. This is also a possible for procuring the delivery of the selected non-charging measures which relate to traffic management or fleet upgrades, should the existing BCC frameworks not be sufficient.

For implementation of the CAZ, OJEU tendering is considered an option secondary to that of using the CCS Framework (see below) if the CCS is not found to be sufficiently flexible in terms of available suppliers or delivery timescales.

4.2.3 Tendering via Crown Commercial Services

Central Government has committed to assisting local authorities as much as possible to ensure successful and quick delivery of their CAZs and have highlighted existing central frameworks, most prominently the aforementioned CCS, that can be used to purchase back office systems and ANPR cameras. Central Government is not looking at setting up any other frameworks for this purpose.

CCS offers a number of frameworks under which procurement of goods and services can be made. Of particular relevance to this Plan is the Traffic Management Technology 2 (RM1089) Agreement, more commonly known as the "TMT2 Framework". There are a number of Lots within TMT2 that could be used for the various proposed Plan elements. These include:

- Lot 2 - Traffic Monitoring and Traffic Enforcement Cameras
- Lot 6 - Environmental Monitoring Systems (fixed and mobile)
- Lot 11 - Traffic Management Communications
- Lot 12 - Traffic Management Professional Services
- Lot 13 - Ancillary Roadside Equipment
- Lot 14 - Intelligent Transport Systems (ITS)

One question that the CCS approach raises is whether it is possible under TMT2 to let a single contract to one service provider across a range of CAZ elements, i.e. covering several of these Lots, or whether it would be necessary to undertake a separate procurement exercise for each element that falls with a given Lot. This would obviously have implications for the delivery timescales in requiring more work to carry out procurement; it would also potentially involve multiple suppliers at the implementation and operations stage that could increase the challenge in managing these suppliers.

One other advantage of using CCS for procurement is that it offers services such as supplier events where local authorities can engage in dialogue with suppliers to communicate their requirements and understand what the market can provide. This also allows suppliers to gain an understanding of what the local authority needs and, crucially, when it needs to be delivered. The other advantage of such activities is that they allow local authorities across the country to come together in a coordinated approach to procurement. It should be noted that JAQU have offered to facilitate joint procurement across multiple local authorities through CCS. This could have considerable cost savings through economies of scale. However, it may increase delivery risk in needing all authorities to reach mutual agreement on requirements for tendering, which is likely to take more time than if a single authority determined its own requirements.

One other possible limitation of using CCS is that only those suppliers who have secured a place on the CCS framework for the specific Agreement (in this case TMT2) can provide goods and services. Thus, if there is a need or desire to consider any other supplier for any element of the Plan then it would need to be procured by another approach, most likely through OJEU. It has yet to be determined whether the key systems suppliers are able to provide goods and services under TMT2 or via other CCS agreement.

4.3 Division of Project Elements for Procurement

Irrespective of the procurement channel used, there are several areas where procurement could be split or combined depending on the preferred approach. These are:

- Design and specification
- Roadside technology (ANPR cameras)
- On-road infrastructure (signs, road markings, physical changes to the network)
- Communications networks (roadside to back office and back office system-to-system)
- Back office databases and data processing facilities
- Back office payment and penalty systems
- Operations (staffing, provision of control room facilities
- Enforcement/review of non-payment (e.g. appeals, civil proceedings)
- Maintenance and support
- Ongoing development (e.g. expansion of CAZ area, back office system functionality)

JAQU has considered three options for the type of CAZ adopted by each local authority:

- Centralised system, with one national front end portal and back office for all local authority CAZs
- Localised system, with each local authority CAZ having its own charging portal and back office
- Hybrid system, with a mixture of national and local elements.

The current JAQU preference is for each authority to employ a hybrid system. In this scenario, Central Government would take responsibility for elements of the back office data processing and payments, and possibly also penalty charge payment. The local authority would adopt all other responsibilities for procurement, implementation and operation.

If this hybrid approach was to be adopted then it is assumed that Central Government would undertake procurement of those elements for which they are responsible, leaving the remaining elements to be procured by each local authority (or collective of authorities) as they see fit.

4.4 Summary of Proposed Procurement Approach

Table 4-1 overleaf lists the various design, implementation and operations activities identified above along with the proposed procurement arrangement for each element, assuming adoption of the hybrid approach proposed above. This will be subject to further discussion with JAQU as to the CAZ elements to be procured centrally.

Table 4-1: Proposed Procurement Approach

Activity	Proposed Procurement Route
Traffic Management	Existing BCC Framework
CAZ design and specification	Existing BCC Framework
Roadside technology (ANPR cameras)	CCS
On-road infrastructure (signs, road markings, physical changes to the network)	Existing BCC Framework
Communications networks (roadside to back office and back office system-to-system)	Existing BCC Framework
Back office databases and data processing facilities (excluding DEFRA/DfT elements)	CCS
Back office payment and penalty systems (excluding DEFRA/DfT elements)	CCS
CAZ operations (staffing, provision of control room facilities)	Existing BCC Framework
Enforcement/review of non-payment (e.g. appeals, civil proceedings)	Existing BCC Framework
Maintenance and support – back office	CCS
Maintenance and support – roadside	Existing BCC Framework
Ongoing development (e.g. expansion of CAZ area, back office system functionality)	Existing BCC Framework

4.5 Attractiveness and Ability of Suppliers to Deliver

In terms of likely attractiveness of the CAZ to suppliers, and their capability to deliver, it is expected that from a purely commercial perspective they will of course wish to be involved given that the technology – both in terms of ANPR cameras and back office systems - is well-developed, so there is likely to be little in terms of technical development risk to them.

The key question is not necessarily one of attractiveness but of deliverability. This is difficult to answer without first determining a proposed timescale from contract award to completion and clarifying any dependencies, e.g. what elements other suppliers, or the local authority, need to provide or complete in order to maintain the required delivery timescale. This will depend to some degree upon what procurement approach is taken including how many different suppliers are involved and when their services are procured.

Suppliers' ability to deliver will also depend significantly upon the scale of the proposed Plan in Bristol; the larger the scheme, the more technology (and supporting infrastructure such as signage and communications networks) is needed and the more time required to implement. This will also be impacted by the extent of all other Clean Air Plans nationally, as the same suppliers are likely to be engaged to deliver those projects as well. As such, deliverability cannot be considered in isolation for Bristol and needs to be evaluated as part of a wider national picture. This is where a JAQU facilitated procurement approach through CCS involving many local authorities would provide significant advantages.

Financial Case

5.1 Financial Case Evaluation Approach

This chapter sets out the overall financial case for the delivery of each of the five shortlisted options identified in section 3.5 of the 'Economics case'. Whilst following the JAQU guidance outlined in Inception Package document, the approach has been based on a proportional assessment to reflect analysis required at a Strategic Outline Case stage.

The Financial Case evaluation criteria 9 and 10 presented in section 3.3.3, following the legal test set out by the High Court in November 2016 in R (ClientEarth) (NO_2) V Secretary of State for Environment Food and Rural Affairs [2016] EWHC 2740 (Admin), were not considered for shortlisting option. That said, the performance of the shortlisted options against these criteria is presented in this Chapter.

In summary, this chapter thus focuses solely on setting out:

- Indicative costs for the short list of options
- Discussion on existing capital and revenue constraints, including setting out our current cost assessment for each of the shortlisted options
- Setting out the current financial situation and available resources, including other funding sources that have been bid for to allow delivery and operations of the intervention and affordability of the scheme
- Next steps in order to further develop and refine the financial case, including a more detailed cashflow analysis of costs and funding requirements, including funding requirements from JAQU.

At this stage, the Financial Case presents the current assessment of shortlisted options. It does not provide any recommendation on shortlisted options.

5.2 Capital costs of shortlisted options

5.2.1 Evaluation Criteria 10: Upfront capital required for scheme

The assessment summarised in this section presents initial ranges of upfront capital costs required to implement the options. This assessment represents the analysis of the shortlisted options against evaluation criteria 10. It should also be noted that it has not been possible to assess the costs related to the non-chargeable interventions at this stage. This reflects the fact that these options are currently insufficiently scoped to be able to undertake a reasonable cost assessment. The cost estimates for these interventions will be developed as part of the development of the Outline Business Case.

Hence, the key drivers for the cost analysis, which focuses on the charging element of each of the shortlisted option, have been:

- The number and location of ANPR cameras
- Costs associated with road signs, road markings, equipment mounting and housing, data communications links and power supplies
- Costs associated with back office facilities, such as the central CAZ system

Based on the above criteria, the overall CAZ areas were assessed using a desktop (Google Earth©) analysis of the road network and analysis of link flow. Full details of this assessment are provided in Annex D.

At this SOC stage we have not considered the need for additional traffic management to restrict alternative movements around the CAZ.

To determine the total cost for each CAZ option, indicative unit costs were identified for each element of the CAZ system (e.g. ANPR camera, power supply, back office system, signage) based upon estimated market prices for this equipment. These were then factored according to the number of units calculated for each scheme by the method described above.

The summary of the charging elements of each of the shortlisted options is summarised in Table 5-1 below. The analysis confirms that the costs are sensitive to the geographic scale rather than the charging classes. In summary, the options which cover larger geographies will result in higher implementation costs.

Table 5-1: Summary of ANPR cameras required and approximate capital costs

	Number of ANPR Cameras	Approximate Capital Cost
Option 1 - Benchmark	1091	£50m - £60m
Option 2	n/a	Not assessed
Option 3 (charging elements only – Medium Class C)	1091	£50m - £60m
Option 4 (charging elements only – Medium Class D)	1091	£50m - £60m
Option 5 (charging elements only – Small Class C)	146	£5m - £10m
Option 6 (charging elements only – Small Class D)	146	£5m - £10m

The costs of the non-charging measures have not been included in this business case due to the level of detail currently identified for each of these schemes. Providing a figure for the cost of delivering these measures would be highly speculative and suggest a degree of certainty that has not yet been achieved. It is anticipated that these costs would be relatively minor in comparison to the cost of implementing a charge CAZ and so their exclusion will not alter the conclusions of a relative comparison of potential options.

The precise costs for the shortlist of options and the recommended option for implementation will be refined as further detail is understood for each option. It is likely that the boundary of the medium zone will be refined to a more comprehensible zone with the key corridors either included entirely within the zone, or excluded, reducing the number of cameras required. In addition, since developing these costs, the intention of Government to manage a central payment system has been established which will have implications for the local scheme costs.

5.3 Affordability

This section presents an initial comparison of likely costs and revenues for the shortlisted options. This assessment represents the analysis across evaluation criteria 9 presented in section 3.3.3 of this document. Furthermore, this section outlines the likely need for funding and potential funding sources for delivering the shortlisted options.

5.3.1 Evaluation Criteria 9: Likelihood of CAZ charges revenue equating to implementation / operational costs

The charging elements of the shortlisted options are likely to generate revenue. This assessment assumes that non-charging interventions will not be able to generate any revenue.

Defra's Clean Air Zone Framework states that the level of charging for a CAZ should not be set in order to raise revenue, however any excess revenue above the costs of operation should be 're-invested to facilitate the achievement of local transport policies and these should aim to improve air quality and support the delivery of the ambitions of the zone'. This is interpreted as any additional revenues received above the operating and maintenance costs for CAZ could be used by the Council to pursue other 'Clean Air' initiatives that are outside of the compliance criteria of the CAZ scheme.

The revenue accumulated from the CAZ will be used to cover the cost of operation and maintenance. However, should this not be sufficient it is expected that contributions from the Implementation Fund will cover this shortfall.

Currently, detailed revenue modelling has not been undertaken. However, initial qualitative assessment for charging elements of shortlisted options suggests that:

- Options with larger geographic coverage will have larger implementation and ongoing operational and maintenance costs
- Options with less overall traffic concentrations within them will provide less revenue even with all vehicle categories included
- On the above basis, it is expected that shortlisted options that have a higher concentration of traffic per square mile are most likely to recover sufficient revenues to cover operational and maintenance costs.
- Excluding vehicle categories from the charging mechanisms would reduce revenue and thus affordability of options.
- Increased proportions of non-charging components of options will reduce the affordability of options

5.3.2 Funding sources

There are three main funding sources for the implementation of CAZ. These are:

- **A £255 million Implementation Fund** - this is designed to support local authorities in the planning and delivery of targeted action to improve air quality
- **An Early Measures Fund -** this is expected to support small, ambitions and good value early measures to improve air quality and start to reduce concentrations in Clean Air Zone. A maximum of £3m per local authority has been allocated for this funding which is part of the Clean Air Fund.
- **A £220 million Clean Air Fund** - an opportunity for local authorities to implement additional measures tailored to their area which minimise the potential impact of local air quality plans - either by enabling the local authority to implement local plans that collectively impact on fewer people, or by providing direct support to those impacted.
- **Revenue from CAZ charges** - funding will become available from the charges that are applied to each CAZ. The appropriate level of charge for each option has not yet been determined and so at this stage the quantum of this value has not yet been assessed.
- **Low Emission Bus Fund 2018** – funding will become available in 2018 to support delivery of low emission buses.

Bristol Council will look to the Implementation, Clean Air and Early Measures funds from Central Government in order to implement the Plan and to cover the shortfall for any ongoing operational and maintenance costs. Bristol Council has not assigned any additional resources to the implementation of the Plan, it is not currently bidding for other funding sources to provide support for implementation and maintenance costs.

5.4 Next Steps

In order to progress the financial case from the Strategic Outline Case we will:

- Refine the shortlist options, including scope and associated capital costs of the non-charging options / components of options
- Assess the ongoing operating and maintenance costs of each of the options, including the non-charging options / components of options
- Assess the expected revenue from each option
- Assess the overall present value costs and present value benefits from each option to determine the most financially attractive option
- Assess the overall funding gap for operational costs
- Assess the funding requirement for capital costs
- Assess the overall funding requirement from the implementation fund / JAQU.

Management Case

6.1 Introduction

The purpose of the Management Case within this SOC is to set out how the scheme/s will be delivered successfully. In accordance with the Inception package of JAQUs guidance this Strategic Case considers the following;

- An outline of who is involved in the project including key stakeholders.
- An outline of how the project will be managed and any other key managerial considerations, including: change management, training, evaluation and timetable
- An indicative project plan
- An indicative organogram of project team and governance structure

6.2 Management of Project

The project will be run in accordance with the BCC Transport Programme Manual, which reflects the principles of PRINCE2 but is tailored to the BCC Transport Service environment. The project will sit within a wider programme of changes to movement in the city centre of Bristol. An organogram of the project team and governance structure is provided in Figure 6-1 overleaf.

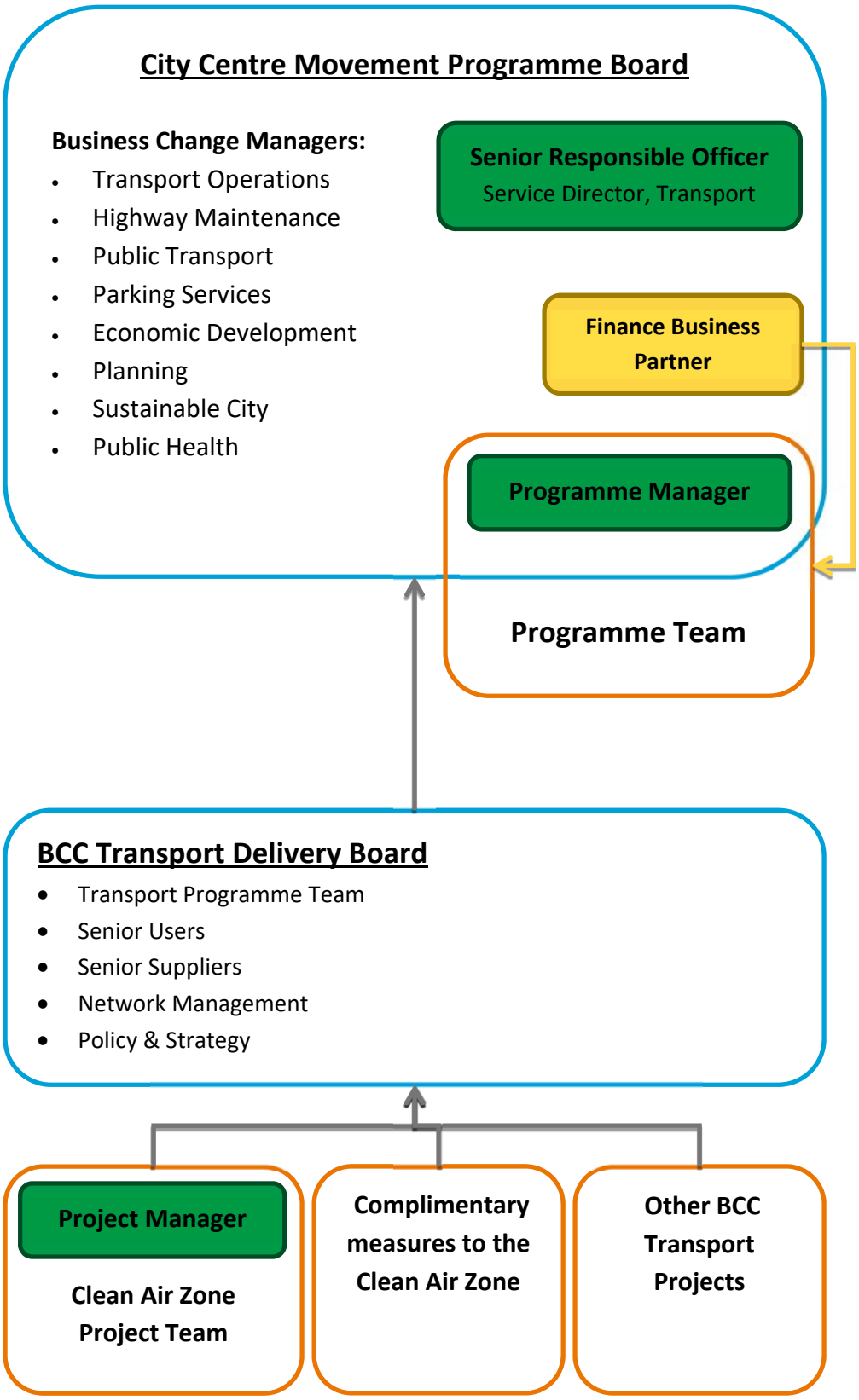
A number of key roles have been identified for delivery of the project within the organogram and are set out below along with the responsibilities of each role;

- **Programme Manager** – responsible for coordination of the project within the wider programme of infrastructure improvements as part of the City Centre Movement Programme, and managing the inter-dependencies with other projects and workstreams across the authority.
- **Programme Team** – will provide support to the programme manager and programme board.
- **Transport Delivery Board –** responsible for providing overall direction and management of the project, and making key decisions such as the commitment of resources. Responsible for making sure that the project delivers the required asset life and will meet the needs of users. Responsible for ensuring coordination and delivery of the supply chain partners and that materials, products and technologies are delivered in conformance with the specifications.
- **Project manager** – responsible for day-to-day management of the project and work tasks and will delegate responsibility for the delivery of these to the Project Team, specialists or consultants as appropriate.
- **Project Team** – will deliver work packages as identified by the Project Manager through utilisation of internal resources, consultants and technical specialists as appropriate e.g. Framework contract. The project team will comprise officers from Traffic Signals, Network Management, Engineering Design, Procurement, Legal Services, and others as appropriate.

Political oversight of the project will be through the Mayor's Congestion Task Group. The Clean Air Zone project will also be directly overseen by the Mayor's Air Pollution Working Group.

Key stakeholders in the delivery of this project will include JAQU, Highways England, WECA and the neighbouring local authorities; Bath & North East Somerset, South Gloucestershire and North Somerset.

Figure 6-1: Project Organogram



6.3 Financial Management

6.3.1 Financial Reporting

The Project Manager will be responsible for undertaking regular financial reporting to inform the Programme Board of the projects progress and performance. A Project Initiation Document will be developed to provide a firm foundation for the initiation of the project. It will set out the direction and scope of the project, and form the 'contract' between the Project Team, Project Manager, Transport Delivery Board and the Programme Board.

Following initiation, the Project Manager will produce monthly highlight reports which will be submitted to the Transport Delivery Board. These will record the progress of the project, the financial status and any issues arising. The Project Managers will also complete a monthly budget forecast in line with corporate requirements relating to the management of the overall BCC capital programme. The Council's Financial Regulations set the delegations for budget transfers and reprofiles, and the authorisation levels for project expenditure.

Scrutiny and oversight of the projects financial management will be provided by the Programme Team under the guidance and direction of the Finance Business Partner (member of the Programme Board).

6.3.2 Change Control

It is expected that elements of the agreed plan, budget, or scope will need to be changed at some point during the project. It is important that means of controlling these changes are agreed before starting so that they can be dealt with simply and at the correct level.

A change to the project will be identified through the monthly highlight report where activities are not being carried out according to the plan or for the agreed cost, or an issue has arisen to affect the scope. All changes will be recorded on a change request form that will be used to specify why the change has come about, what actions are proposed to counter it, and at what level decision-making sits.

A set of tolerances will be determined, in accordance with the BCC Transport Programme Manual, so that each level of management in the project has the defined authority to agree certain changes before having to refer to a higher level. The agreed tolerances will be recorded in the Project Initiation Document, as will the period within which changes are cumulative.

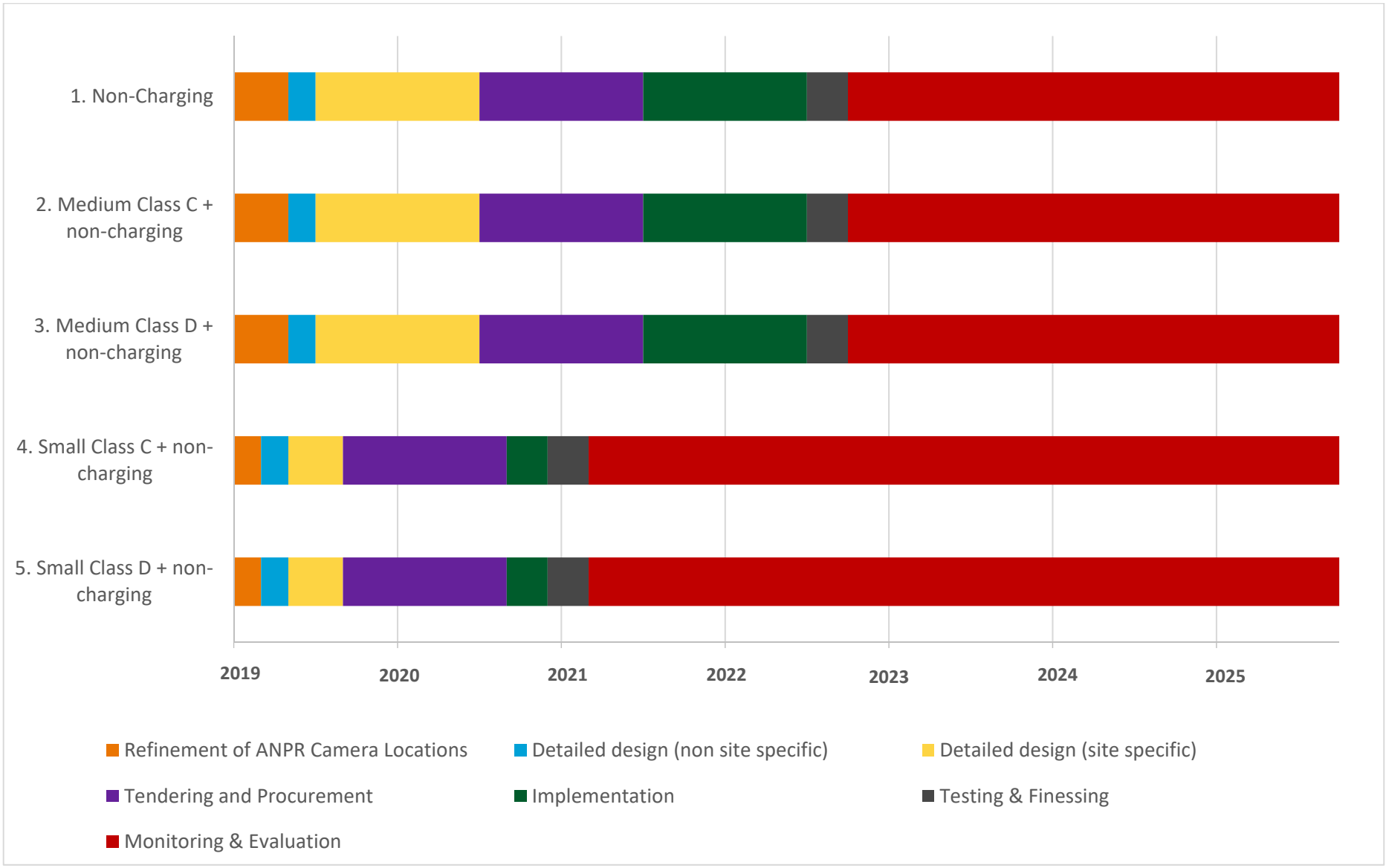
Changes that do not affect the plan or the budget by more than is reported in one month will likely sit within the tolerance of the project manager. Although additional decision-making will not be required, all such changes will be recorded on the monthly highlight report and an entry will be made on the change request log.

Changes of a higher tolerance will be clearly brought to the attention of the Transport Delivery Board (TDB) in the finances section of the highlight report. This will allow a discussion to take place and a way to proceed be agreed. Larger changes, which exceed the tolerance of the TDB, will need to be taken to a higher level of decision-making beyond the TDB.

6.4 Project Plan

An indicative project plan for each of the shortlisted options is provided in Figure 6-2 overleaf. This will be refined, and further detail added, as the project progresses within the OBC and FBC.

Figure 6-2: Indicative Project Plan



6.5 Monitoring and Evaluation

Bristol City Council has existing monitoring programmes for traffic and air quality which can be utilised, and if necessary developed, to provide a comprehensive method for monitoring and evaluating the impact of this project. The existing data will provide a baseline against which to assess any changes to traffic flows, and NO_2 and PM concentrations. All current monitoring listed below is intended to continue through the development, delivery and operation of the Clean Air Plan.

BCC currently undertakes an annual monitoring programme of air quality, specifically NO_2 concentrations, through their network of real-time monitoring stations and diffusion tubes. There are also two Defra air quality monitoring sites within Bristol, which can be used within the project to monitor PM concentrations.

BCC currently undertakes an annual monitoring programme of traffic flows including:

- Cordon, river screenline and link counts which measure traffic flows in, out and across the city.
- Pedestrian and cycle surveys
- Surveys to measure the progress of Greater Bristol's Joint Local Transport Plan (JLTP)
- Public transport surveys of Bus and Rail use

Records are also kept of occupancy within BCC car parks, and on-street parking usage where charges apply.

Depending on the final measures selected for the project, it may be necessary to monitor impacts on other aspects of the city. This could include impacts on retail activity or business in general, usage of installed infrastructure (for example car clubs or electric vehicle charging points) and uptake of grants/subsidies.

Summary of Shortlisted Options

7.1.1 Assessment of Shortlisted Options against CSF

The five shortlisted options have been assessed against the primary and secondary CSFs (including the financial evaluation criteria) by combining the analysis undertaken for the charging and non-charging measures individually. A summary of the scoring of each option is presented below in Table 7-1. These options will be taken forward to the OBC to be assessed in greater detail.

Table 7-1: Scoring of Shortlisted Options against Evaluation Criteria

Scheme	Package of non-charging interventions	Medium Class C Charging Option with comp. non-charging interventions	Medium Class D Charging Option with comp. non-charging interventions	Small Class C Charging Option with comp. non-charging interventions	Small Class D Charging Option with comp. non-charging interventions
Timescale to achieve compliance	2021	2021	2021	2021	2021
Deliver compliance with NO_2 air quality limit values and objectives in the shortest possible timescales	Pass	Pass	Pass	Pass	Pass
Provide equity across different vehicle types and trip purposes	3	2	3	2	3
Compliance with the CAZ framework	2	3	3	3	3
Mitigate financial impact on low income households	1	2	2	3	2
Improve health of low income households	3	2	3	1	2
Economic effect	1	2	1	3	2
Improve public health	3	2	3	1	2
Delivery timescale risks of procurement	2	2	2	3	3
Risk of financial penalty to the Council/s	1	1	2	2	3
Likelihood of revenue equating to implementation/operational costs	1	1	1	3	3
Upfront capital required for scheme	3	2	3	1	2
Public acceptability	3	2	1	2	1
Political acceptability	3	2	1	2	1
Weighted Average Score	61	56	63	61	64

Annex A
Scoring Table for Non-Charging Measures

Annex B
Scoring Table for Charging Measures

Annex C
Assessment of Timescales to Achieve Compliance for Charging Measures

Annex D
Assessment of Charging Options Against Secondary CSFs

Annex E
Logic Map for Shortlisted Options