



Bristol Clean Air Plan
Outline Business Case

Explanatory Note on CAZ System Cost Estimates

OBC-33

October 2019

Bristol City Council



Bristol Clean Air Plan

Project No: 673846.ER.020
 Document Title: Scheme Costs
 Document No.: OBC-33
 Revision: 1
 Date: October 2019
 Client Name: Bristol City Council
 Project Manager: HO
 Author: SA

Jacobs Consultancy Ltd.

1 The Square, Temple Quay
 2nd Floor
 Bristol, BS1 6DG
 United Kingdom
 T +44 (0)117 910 2580
 F +44 (0)117 910 2581
www.jacobs.com

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Document history and status

Revision	Date	Description	By	Review	Approved
1	Oct 2019	Draft	SA	HO	HO

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Appendix A. Breakdown of CAZ System Cost Estimates

Acronyms and Abbreviations

AED	Approved Enforcement Device
BCC	Bristol City Council
BT	British Telecom
CAF	Clean Air Fund
CAP	Clean Air Plan
CAZ	Clean Air Zone
CCTV	Closed Circuit Television
CEO	Civil Enforcement Officer
DNO	Distribution Network Operator (electricity service provider)
Defra	Department for the Environment, Food, and Rural Affairs
DfT	Department for Transport
DVLA	Driver and Vehicle Licensing Agency
EV	Electric Vehicle
HE	Highways England
JAQU	Joint Air Quality Unit
LEP	Local Enterprise Partnership
MaaS	Mobility as a Service
MEV	Mobile Enforcement Vehicle
OBC	Outline Business Case
P&R	Park and Ride
PCN	Penalty Charge Notice
QRA	Quantitative Risk Assessment
SRN	Strategic Road Network
TPT	Traffic Penalty Tribunal
TRO	Traffic Regulation Order
VCA	Vehicle Certification Agency

1. Introduction

The UK has in place legislation transposing requirements in European Union law, to ensure that certain standards of air quality are met, by setting Limit Values on the concentrations of specific air pollutants. In common with many EU member states, the EU limit value for annual mean nitrogen dioxide (NO₂) is breached in the UK and there are on-going breaches of the NO₂ limit value in Bristol. The UK government is taking steps to remedy this breach in as short a time as possible, with the aim of reducing the harmful impacts on public health. Within this objective, the government 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, in 2017 Bristol City Council has been directed by the Minister Therese Coffey (Defra) and Minister Jesse Norman (DfT) 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 has considered a range of options for the implementation of a Clean Air Zone (CAZ), including both charging and non-charging measures, in order to achieve sufficient improvement in air quality and public health and in line with legal requirements as set out below. Bristol City Council (BCC) have produced an Outline Business Case (OBC) for the delivery of an option including a package of measures which will be most likely to bring about compliance with the Limit Value for annual mean NO₂ in the shortest time possible in Bristol and reducing human exposure as quickly as possible.

Subsequently Minister Rebecca Pow (Defra) has instructed Mayor Marvin Rees (in a letter dated 26 September 2019) to present the Hybrid and Medium CAZ D options in the Outline Business Case which must be submitted no later than 6 November 2019. They have asked that the Full Business Case is submitted no later than 28 February 2020.

An Outline Business Case (OBC) has been produced for the delivery of the CAP; a package of measures which will bring about compliance with the Limit Value for annual mean NO₂ in the shortest time possible in Bristol. The OBC assesses the shortlist of options set out in the Strategic Outline Case, and proposes a preferred option including details of delivery. The OBC forms a bid to central government for funding to implement the CAP.

Jacobs has been commissioned to support BCC to produce an Outline Business Case (OBC) for the delivery of the CAP; a package of measures which will bring about compliance with the Limit Value for annual mean NO₂ in the shortest time possible in Bristol. The OBC builds upon options identified within the Strategic Outline Case¹, and proposes the “hybrid” option to achieve compliance with air quality requirements, and this is compared to the Medium CAZ D + Option 1 scenario, the benchmark option. The OBC forms a bid to central government for funding to implement the CAP.

This note provides reference information and explanatory detail on how the capital and revenue cost estimates have been derived for the proposed CAZ system. Terms and abbreviations used are set out above.

A breakdown of the estimated costs for the two scheme options is provided in the tables in Appendix A of this document. This divides the various elements of the system into the following sections:

1) Capital costs for the enforcement system, including:

- Supply, installation, configuration and testing of fixed Approved Enforcement Devices (AED) with intelligent data processing;
- Supply, installation, configuration and testing of fully-equipped mobile enforcement vehicles (MEVs);
- Supply, installation, configuration and testing of a back-office system and associated servers;
- Provision of a control room facility including fitting out of the premises, fixtures, fittings, furnishing and ancillary items;

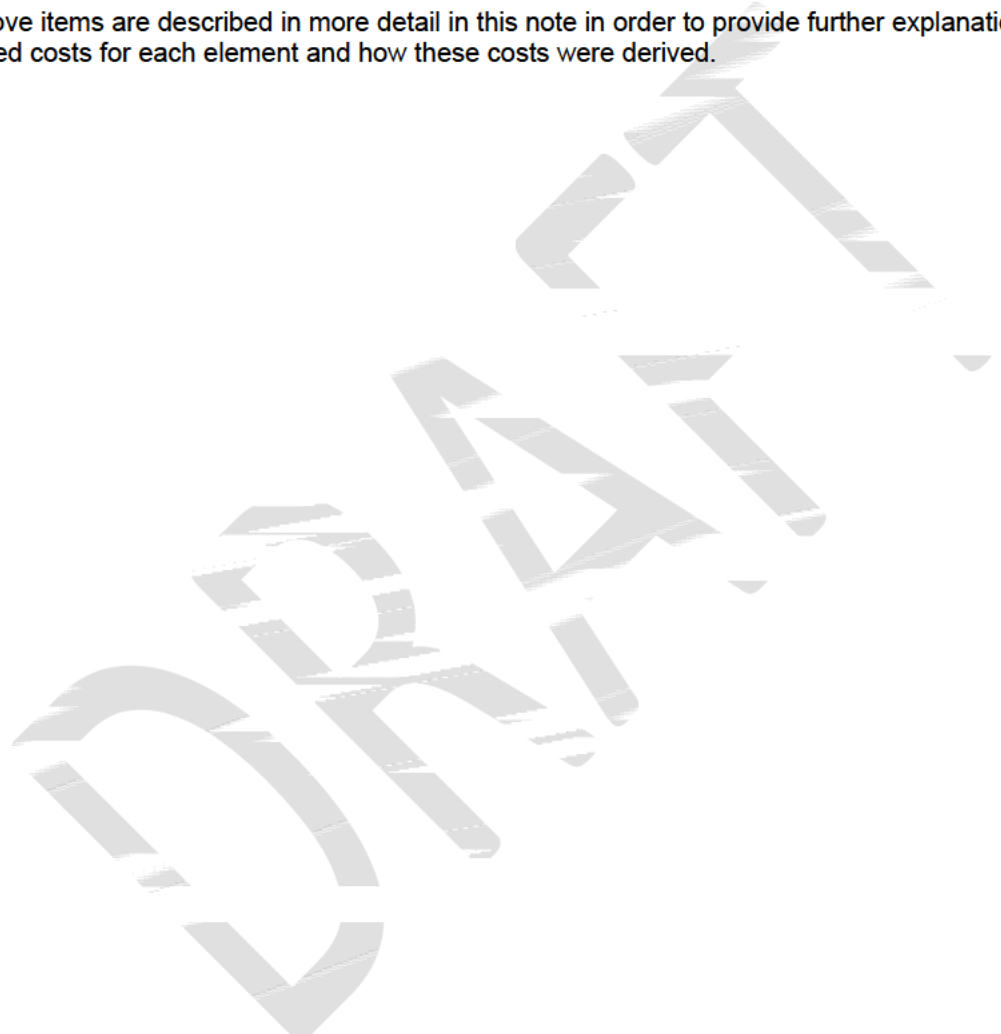
- Complete system test and site acceptance testing (SAT) including integration with external systems (e.g. central payment portal);
 - Design peer review and project management for systems integration and operational planning; and
 - Project management of delivery phase.
- 2) Capital costs for highway works, including:
- Supply, installation and testing of camera mounting masts, mountings, cabinets, power supplies and associated local ducting;
 - Decommissioning of existing cameras where such locations are required for CAZ AED installation;
 - Extension of BCC's existing optical fibre cable network including all required ducting, cabling and network termination equipment;
 - Supply and installation of new signage for the CAZ on local authority highway networks at the CAZ boundary and in advance of the CAZ;
 - Supply and installation of new signage for the CAZ on the Highways England Strategic Road Network (SRN) in advance of the CAZ;
 - Supply and installation of new signage identifying diesel ban zone, or diesel ban roads, on the BCC highway network at the zone boundary/road entry point and in advance of the boundary/road entry point;
 - Supply and installation of new signage for the diesel ban zone on the Highways England SRN in advance of the diesel ban zone;
 - Supply and installation of new signage showing vehicle weight limits on selected roads within the CAZ, located at the road entry point and in advance of the entry point;
 - Changes to existing advanced direction signage to ensure that non-compliant vehicles are not directed into the CAZ or onto diesel ban zones/roads;
 - Installation of all required kerb line alterations and carriageway realignment works to accommodate new and updated signage;
 - Traffic management on the local authority highway network and on the Highways England network for all signage and camera installations and for associated kerb line amendments;
 - Design review of each camera location checking for the presence of cellars, statutory utilities and other restrictions as well as foundation details; and
 - Design, project management and site supervision of all on-street works.
- 3) Capital costs for non-charging measures to reduce the disbenefit of the CAZ to vulnerable groups as well as increasing the impact of the CAZ.
- Implementation fund measures, including:
 - M32 Park & Ride, costed in a separate study;
 - Bedminster Bridge improvements, costed in a separate study;
 - Bus gate at Cumberland Road;
 - Upgrading of existing 12 Variable Message Signs (VMS) for provision of information to road users on CAZ operation.
 - Clear Air Fund (CAF) measures, which are detailed in Appendix Ci to the OBC (OBC-17)
- 4) Quantified risk during the implementation stage, which is detailed in Appendix L to the OBC (OBC-35)
- 5) Operational (revenue) costs, including:

- Civil enforcement officers and appeals officers, supervisory staff and staff to operate the MEVs, including overhead costs;
 - Running costs for the MEV including electricity, maintenance and software licencing;
 - Revenue payment (10%) to JAQU, which covers ongoing operation and development of JAQU central payment portal;
 - Enquiries to the DVLA database to identify captured vehicles;
 - Back-office hardware and software maintenance;
 - Annual licence costs for the back-office system;
 - Travel Plan advisors to inform public of scheme benefits and any appropriate measures available; and
 - Network management officer to monitor and manage network issues affected by, or affecting, CAZ operation, e.g. suspension of the CAZ during a major incident.
- 6) Ongoing (revenue) costs for maintenance and support, including that for:
- Replacement of irreparably damaged AEDs;
 - Roadside equipment maintenance, including required VCA compliance checks;
 - CCTV mounting post maintenance;
 - The operations centre, i.e. the building and its associated facilities; and
 - Replacement and repair of signage and road markings.
- 7) Ongoing (revenue) costs for the operation of power and data communications networks, including:
- Repair of B-Net optical fibre network and associated comms equipment;
 - Provision of 4G network data services for those cameras not connected to the B-Net optical fibre network; and
 - Electricity consumption of all on-street equipment including cameras, comms equipment and signage (where illuminated).
- 8) Ongoing operational costs for management of CAZ operations and non-charging measures including:
- Staff (part-time) to provide communications and publicity as and when required;
 - Infrastructure lead to monitor, manage and maintain all CAZ on-street and back office assets for continuous operation;
 - Community Liaison Officer to manage ongoing public engagement;
 - Site supervision officer (part-time) and supporting infrastructure officer to deal with site-based issues, e.g. repair/replacement/testing of cameras, comms and signage;
 - Financial controller (part-time) to manage CAZ scheme finances and financial reporting; and
 - Project manager for CAF measures.
- 9) Provision of staff for ongoing monitoring and evaluation of:
- Air quality monitoring systems;
 - Traffic volumes and movements;
 - Economic indicators;
 - Alternative travel modes (primarily walking and cycling); and
 - General scheme performance.

10) Ongoing (revenue) costs for other activities, including:

- PCN issue;
- CAZ publicity and advertising;
- Setup and operation of health and wellbeing study;
- Re-draft of legal charging order, should changes to CAZ be required;
- Enforcement of vehicle weight restrictions including production of TROs; and
- Decommissioning of all aspects of the CAZ system at the end of the scheme, including cameras, comms, back office systems and all signage;

The above items are described in more detail in this note in order to provide further explanation of the estimated costs for each element and how these costs were derived.



2. Assumptions and Exclusions

It is anticipated that BCC will own and operate the hardware and software required to carry out all CAZ processes, except for those external databases such as the DVLA database and the national tax database, which will be the responsibility of others (primarily JAQU). It is also assumed that the BCC system will use the central government payment portal, which is still in the process of being defined and developed.

Procurement of each part of the CAZ system is outlined within the separate Procurement Strategy document in Appendix I of the OBC (OBC-32).

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3. Capital Cost Estimates

Capital cost estimates are based wherever possible on known base costs and schedules of rates for equipment and services and are thus considered reasonably robust. All cost estimates quoted in the main body of this report exclude contingency. However, allowance has been made for contingency in the two cost breakdown tables in Appendix A – these tables, one for each CAZ option, show the base cost alongside the adjusted cost with a nominal 15% contingency.

3.1 Enforcement System

The CAZ system supply and installation costs form 9.2% of the total capital cost for the Hybrid CAZ scheme and 7.5% for the Medium CAZ D + Option 1. This comprises the on-street camera equipment together with all housing, mounting and cabling infrastructure (excluding that for the data communications network, which is included in section 3.2.1 as part of highway works activities). An allowance has also been made for provision of two mobile enforcement vehicles (MEVs). All back-office hardware, software, cabling and connection is included in these estimates as well as system integration by contractors and BCC staff. Costs for setting up of the control facility (i.e. the building in which CAZ operation is to take place) are also outlined. Finally, costs have been included for design, project management and other related activities.

3.1.1 On-Street Camera Equipment

For the supply of AEDs an estimate of [REDACTED] per camera was made based upon previous known camera installations for systems utilising AED data processing at the roadside. This includes supply-only of the camera hardware, i.e. camera and any associated on-street processing hardware as well as any required mounting and fixing hardware (e.g. bracket).

A total of [REDACTED] cameras at [REDACTED] is estimated to be required for the proposed Hybrid CAZ option and [REDACTED] locations for the Medium CAZ D + Option 1. [REDACTED]. These estimates were each derived from a detailed street-level desktop study of the proposed zone boundary and key routes within the CAZ. A combination of AutoCAD® drawings, Google Maps™ and Google Street View™ were used to identify where cameras are needed to identify all vehicles entering the zone at each possible entry point. The chosen methodology assumes that each camera is capable of capturing vehicles from a single lane, thus for a single lane only one camera is required, two are needed for a two-lane carriageway, and so on. In both options there are a limited number of cameras proposed for operation within the zone to capture vehicles moving inside the CAZ and not thus not entering or exiting. These internal cameras will be supplemented by MEV operation to capture vehicles inside the CAZ.

Installation and configuration of the camera(s) at each location is estimated at [REDACTED] per camera, again based on previous known rates for similar installations. [REDACTED]

[REDACTED] This is an average installation cost per camera allowing for economy of scale where there are multiple cameras installed at a single location.

Two electric-powered MEVs are also included at a cost of [REDACTED] which applies to both CAZ options. This includes supply of the vehicles as well as supply and installation of all required equipment (camera, mountings, recording equipment, user interface), cabling and fitting out. It also allows for any modifications that may be necessary (e.g. auxiliary power supply) as well as suitable livery.

3.1.2 Back-Office System and Control Facility

The cost for the back-office system is estimated at [REDACTED] for both of the identified options. This figure is based on extrapolation of known figures for similar enforcement systems, assuming the implementation of an “in-house” solution, i.e. all hardware and software purchased, installed and operated by BCC at a suitable local authority facility and including all required servers. Although the back-office system may have elements of it related to the extent of camera equipment installed (e.g. data storage, workstations) in practice the majority of the system is unlikely to be size-dependent as the required hardware and software will be needed irrespective of the number of cameras used. However, the design and functionality of the back-office system is still ongoing so this value is only a broad indication of cost based on those known for other enforcement applications. This should allow for a considerable degree of additional software development and other “bespoke” work for the BCC solution.

A nominal estimate of [REDACTED] is also included for setting up the CAZ control facility. This assumes that a building is already available at no additional cost to BCC and that the costs to be covered are for fitting out and furnishing the facility including furniture, lighting, power and communications cabling, terminations and for any supporting services needed (e.g. administration and building security).

A sum is also included for the contractor(s) to integrate the new CAZ systems infrastructure with existing BCC systems, primarily the Notice Processing System (NPS) and the B-Net optical fibre communications network. This has been calculated as 5% of the CAZ system (camera and back office) cost, which is broadly in line with integration costs for other similar systems. [REDACTED]

3.1.3 Project Management and Other Services

Additional capital costs are included for design review, project management and other associated CAZ system activities by CAZ system suppliers/contractors. This is estimated at 10% of the CAZ system (on-street and back office) cost, which is again considered a standard rate for such schemes. A sum of [REDACTED] has been included for such activities for the Hybrid Option and [REDACTED] for the Medium CAZ D + Option 1 which, again, reflects the slightly smaller system size for this option.

The final element of capital cost for the CAZ system is that for project management and other related activities. It covers BCC financial, legal, procurement and HR support whilst developing and delivering the CAZ. A sum of [REDACTED] per month is estimated for a period of 18 months, [REDACTED] based upon prior project expenditure and requirements from similar parking/enforcement schemes. This sum applies to both CAZ options.

3.2 Highway Works

Costs for highway works comprise 7.2% of the total capital cost for the Hybrid Option and 5% for the Medium CAZ D + Option 1. This includes all required cabinets, mounting posts, ducting and cabling for camera installation as well as ducting, cabling and connection of the data communications network. Cost estimates for associated road signing and markings are also included, as well as required kerbing alignments, traffic management, design reviews, project management and site supervision.

3.2.1 Camera and Communications Network Infrastructure

A cost estimate was made for camera posts and mountings, which was derived from known costs and rates for similar installations carried out in Bristol. This estimate was based on a site-by-site analysis of preferred mounting options for each individual camera, including mounting multiple cameras on a single post wherever possible.

The preferred mounting solution at the majority (80%) of camera sites is to mount camera(s) on street lighting columns, which avoids needing to install additional mounting infrastructure and minimises street clutter, as well as making the camera installation more discrete. However, it was estimated that approximately 1 in 3 of

the identified street lighting columns may not be structurally capable of mounting the camera(s) and will therefore need to be replaced. The cost for replacing these columns was therefore included in the estimate at [REDACTED] per column. This includes an allowance for structural assessment of the existing columns at [REDACTED] each.

10 sites were also identified where cameras can be installed on traffic signal columns, which will require replacement of these columns to provide additional height for camera mounting. This has also been included in the cost estimate at [REDACTED] per site.

A further 10 sites were identified where existing AEDs are operating as part of a dual system to provide BCC with network journey time information and to provide Avon & Somerset Police with data to support their activities. Installation of CAZ cameras at these sites will require removal and decommissioning of the existing cameras to allow for optimal placement of the CAZ cameras. A per-site cost of [REDACTED] is estimated for these sites for this activity. A sum is also included in the cost estimate for the CAZ system for provision of data from the CAZ cameras to BCC and Avon & Somerset Police to ensure that they continue to receive AED data from these sites.

An estimate of [REDACTED] is made for provision of electricity supply to each site. This includes design, installation and testing by the DNO and BCC. An additional per-site cost estimate of [REDACTED] was also applied to around 50% of all sites for provision of an electricity supply feeder pillar. The other sites are expected to utilise a direct power connection from an existing source and will therefore not require a feeder pillar.

Consideration was given to the cost of installing the digital communications network, which is proposed to be a combination of optical fibre and 4G mobile network communications. Some of the proposed sites are at locations where B-Net is already present but others will require additional ducting and cabling to connect to the nearest existing B-Net network point. The proposed use of fibre or 4G was considered on a site-by-site basis according to the distance of the existing fibre network from each camera. For the proposed 360 cameras of the Hybrid Option, half (180) will be connected to fibre and the other half will utilise the 4G mobile network. For the 273 cameras in Medium CAZ D + Option 1, 131 will be linked to B-Net and the remaining 142 will use 4G communications.

Through analysis of the existing B-Net network in Bristol it was estimated that 1,431 metres of new ducting and fibre cabling will need to be installed for the Hybrid Option, and 1,061 metres for the Medium CAZ D + Option 1. An average cost of [REDACTED] for this work was estimated, which includes supply and installation of all materials including ducts, duct chambers, fibre cable and cable terminations; it also includes installation works (excavation, ducting, reinstatement) across a range of different surface conditions (e.g. verge, footway, carriageway crossing). [REDACTED]

The cameras proposed for connection via 4G in both options are not expected to incur any costs for installation.

Estimates were also made for the provision of traffic management at each location during installation of the posts/columns and camera(s) and for the B-Net installation. This varied from [REDACTED] per location depending on the type of location (e.g. residential road, dual carriageway). The total cost for this is estimated at [REDACTED] for the Hybrid Option and [REDACTED] for the Medium CAZ D + Option 1.

3.2.2 Road Signing and Minor Kerb Realignment

Various estimates were made for civils works associated with the provision of road signing as well as minor realignment of kerb-lines. It is anticipated that no major carriageway or footway re-alignment work will be needed for any part of the proposed CAZ boundary for either of the two options.

For both CAZ options a detailed street-level analysis was undertaken of the signing requirement for each of the entry and exit points at the proposed CAZ boundary. Signing was also considered at the boundaries of the

diesel ban area in the Hybrid Option, the diesel ban roads in the Medium CAZ D + Option 1 and the weight limit ban roads in both options.

Advanced warning signs were also considered essential to provide road users, and especially HGV drivers, with prior notice that they were heading towards the restricted zone/road (either CAZ, diesel ban or weight limit) to provide the opportunity for them to take a suitable alternative route. A detailed street-level analysis was carried out to determine the exact locations for such advanced signing.

From this the following requirements were determined for the Hybrid Option, along with estimated costs:

- Supply and installation of 263 non-illuminated signs at the CAZ boundary notifying road users of entry to and exit from the CAZ. These are estimated to cost an average of [REDACTED] per sign. This gives a total estimated cost of [REDACTED]
- Supply and installation of 278 illuminated advanced warning signs on BCC and neighbouring local authority roads upstream of the CAZ boundary advising road users of their approach to the CAZ. These are estimated to cost [REDACTED] per sign - higher when compared to boundary signs, which is largely due to the requirement for illumination of the signs and which is considered essential for such advanced warning information. This gives a total estimated cost of [REDACTED]
- Supply and installation of 9 advanced warning signs on the Highways England Strategic Road Network (SRN) at an estimated cost of [REDACTED] each, giving a total cost of [REDACTED]. It is expected that HE contractors will undertake this work. The high cost for these signs compared to those on local authority roads is due to the required size of the sign and the significant amount of work required for installation. This includes the likely extensive traffic management required for such installations on the SRN. Proposals for installation of the signs and the costs for installation are subject to discussion with Highways England and thus may change depending upon the outcome of those discussions.
- Supply and installation of 170 non-illuminated signs on the boundary of the diesel ban area notifying users of entry into and exit from the diesel ban area. These are estimated to cost an average of [REDACTED] per sign, giving a total cost of [REDACTED]
- Supply and installation of 307 illuminated advanced warning signs on BCC and neighbouring local authority roads upstream of the diesel ban area boundary advising road users of their approach to it. They are estimated to cost [REDACTED] each, resulting in a total cost of [REDACTED]
- Supply and installation of 8 diesel ban area advanced warning signs on the SRN at an estimated cost of [REDACTED] each, giving a total cost of [REDACTED]. As for the proposed CAZ advance warning signs on the SRN, these are expected to be supplied and installed by HE contractors. Again, the required size of the sign and the extent of work required for installation on the SRN accounts for the higher per-sign cost compared to those proposed for local authority roads. This includes the likely extensive traffic management required for such SRN installations. As for the other SRN signs, proposals for installation of these signs and costs for installation are subject to discussion with Highways England and thus may change depending upon the outcome of those discussions.
- Supply and installation of 44 non-illuminated signs at the entry and exit points of roads subject to a weight limit ban to provide notice of entry onto these restricted roads. The average cost of each sign is estimated at [REDACTED] giving a total cost of [REDACTED]
- Supply and installation of 19 illuminated advance warning signs on BCC roads upstream of the weight limit ban roads advising road users of their approach to the restricted roads. As illuminated signs they are costlier compared to the entry/exit signs, with an estimated cost of [REDACTED]. Thus, the total cost for all signs is [REDACTED]
- Replacement of, or modification to, existing advanced direction signs on the inbound approaches to the CAZ around Bristol to ensure that drivers of non-compliant vehicles are not directed into these restricted/banned areas and thus made liable for payment of a CAZ charge and/or PCN. The precise requirements for sign replacement are still subject to review but a nominal estimate of [REDACTED] has been included to allow for such work.
- Kerb line alterations for an estimated 1 in 10 of all boundary and advanced signs described above (excluding those on the SRN) to allow for placement of the signs in accordance with design

standards. An average cost of [REDACTED] was estimated for each alteration, which totals [REDACTED] for 108 signs.

- Design review of each proposed sign installation accounting for local environment, ground conditions, presence of statutory services, etc. This is estimated to cost [REDACTED] per sign location based on the total number of CAZ, diesel ban and weight limit sign locations plus one-third of the total number of all advanced signs (assuming location overlap for advanced signs that will reduce the per-sign design review cost). The total cost for this design work is estimated at [REDACTED]
- Design, project management and site supervision of sign installations at an estimated cost of [REDACTED] per sign location, again based on the total number of CAZ, diesel ban and weight limit sign locations plus one-third of the total number of all advanced signs (assuming location overlap for advanced signs that will reduce the per-sign design, project management and supervision cost). The total cost for this is estimated at [REDACTED]

For the Medium CAZ D + Option 1, the following requirements for signing were determined:

- The CAZ boundary is identical for both options so the Medium CAZ D + Option 1 also requires the supply and installation of 263 non-illuminated signs at the CAZ boundary at an average of [REDACTED] per sign, giving a total estimated cost of [REDACTED]
- Similarly, the Medium CAZ D + Option 1 requires an identical number of illuminated CAZ advanced warning signs as the Hybrid Option on BCC and neighbouring local authority roads upstream of the CAZ boundary to advise road users of their approach to the CAZ. At [REDACTED] per sign this gives a total estimated cost of [REDACTED]
- As for the Hybrid Option, supply and installation of 9 advanced warning signs on the SRN at an estimated cost of [REDACTED] each, giving a total cost of [REDACTED]
- Supply and installation of 30 non-illuminated signs on the boundary of the diesel ban roads to notify road users of their entry into and exit from these roads. These are estimated to cost an average of [REDACTED] per sign, giving a total cost of [REDACTED]
- Supply and installation of 20 illuminated advanced warning signs upstream of the diesel ban roads advising road users of their approach to these restricted roads. They are also estimated to cost [REDACTED] each giving in a total cost of [REDACTED]
- As for the Hybrid Option, supply and installation of 44 non-illuminated signs at the entry and exit points of those roads subject to a weight limit ban to provide notice of entry onto the restricted roads. The average cost of each sign is estimated at [REDACTED] giving a total cost of [REDACTED]
- As for the Hybrid Option, supply and installation of 19 illuminated advance warning signs on BCC roads upstream of the weight limit ban roads advising road users of their approach to the restricted roads. Again, they will be costlier compared to the entry/exit signs given that they are illuminated, so the estimated cost is [REDACTED] per sign. Thus, the total cost for all 19 signs is [REDACTED].
- Replacement of, or modification to, existing advanced direction signs on the inbound approaches to the CAZ around Bristol to ensure that drivers of non-compliant vehicles are not directed into these restricted/banned areas and thus made liable for payment of a CAZ charge and/or PCN. The precise requirements for sign replacement are still subject to review but a nominal estimate of [REDACTED] been included to allow for such work.
- Kerb line alterations for an estimated 1 in 10 of all boundary and advanced signs described above for the Medium CAZ D + Option 1 (excluding those on the SRN) to allow for placement of the signs in accordance with design standards. An average cost of [REDACTED] was estimated for each alteration, which totals [REDACTED] for 65 signs. This total is lower than for the Hybrid Option as there is no diesel ban area and therefore, fewer boundary and advanced warning signs to install.
- Design review of each proposed sign installation accounting for local environment, ground conditions, presence of statutory services, etc. This is estimated to cost [REDACTED] per sign location based on the total number of CAZ, diesel ban and weight limit sign locations plus one-third of the total number of all advanced signs (assuming location overlap for advanced signs that will reduce the per-sign design review cost). The total cost for this design work is estimated at [REDACTED]

- Design, project management and site supervision of sign installations at an estimated cost of [REDACTED] per sign location, again based on the total number of CAZ, diesel ban and weight limit sign locations plus one-third of the total number of all advanced signs (assuming location overlap for advanced signs that will reduce the per-sign design, project management and supervision cost). The total cost for this is estimated at [REDACTED].

3.3 Non-Charging Measures – Implementation Fund

3.3.1.1 Variable Message Signage

It is proposed to install 12 full LED Variable Message Signs (VMS) to replace existing route guidance VMS on key routes in Bristol. These VMS will display CAZ operational status as well as information on vehicle classes to which charges apply and will notify road users of the diesel ban and weight limit restrictions in operation. They will also be used to notify road users of any changes to these conditions, for example if CAZ operation is suspended due to a major incident. It is also anticipated that other information such as air quality levels will be displayed. BCC shares the same VMS back office system and has installed similar signs previously, so the cost of these is well-known and is estimated at [REDACTED] per sign. Thus, the total cost for all VMS is estimated at [REDACTED].

3.3.1.2 Other non-charging measures

The following non-charging measures to support the CAZ are proposed to be undertaken using funding from the Implementation Fund: The M32 Park and Ride cost was calculated as part of a study looking into Park and Ride options. The scheme cost has been taken from this work. The costs for the Bedminster Bridge Improvement and the Cumberland Road Bus Gate were calculated based on estimates provided by BCC from similar work.

3.4 Non-Charging Measures – Clean Air Fund (CAF)

The Clear Air Fund (CAF) measures are detailed and costed in Appendix Ci to the OBC (OBC-17). The package of measures totals £38.6m.

3.5 Quantified Risk Assessment

A quantified risk assessment (QRA) for the Hybrid Option has been developed and it set out in Appendix L to the OBC (OBC-35). The QRA figure in line with WebTag guidance (P(Mean)) is £6.5m during the project implementation stage. It is assumed that the Medium CAZ D + Option 1 would have a similar risk level, so the same cost has been used in this estimate.

4. Revenue Cost Estimates

4.1 CAZ Operation

The estimated CAZ operation revenue cost is ██████ per year for the Hybrid Option and ██████ per year for the Medium CAZ D + Option 1, which represents 39.7% and 46% respectively of the total estimated operational expenditure for both options. This cost primarily relates to the anticipated 10% annual payment to JAQU from revenue income for the use of the central payment portal, which totals ██████ per year for both options.

The other significant operational revenue cost is for staff salaries for enforcement activities, which totals ██████ per year for the Hybrid Option and ██████ per year for the Medium CAZ D + Option 1. The latter has the higher cost due to the greater number of expected vehicle contraventions given that the Medium CAZ D + Option 1 includes cars whereas the Hybrid Option does not. Estimates for PCN issue were made at 39,780 for the Hybrid Option and 94,381 for the Medium CAZ D + Option 1. Based on rates of PCN processing whereby each member of staff can process 10,000 PCNs per year, this equates to a need for 4 PCN review and processing staff for the Hybrid Option and 10 such staff for the Medium CAZ D + Option 1. Similarly, it was estimated that one Civil Enforcement Officer (CEO) is required per 30,000 PCNs issued which for the Hybrid Option equates to 2 CEOs and for the Medium CAZ D + Option 1 is 4 CEOs. Similarly, more Senior Appeals Officers are required for the Medium CAZ D + Option 1 than the Hybrid Option – 3 rather than 1 – given that there will be more PCNs issued and thus more appeals against those PCNs.

It has been estimated that the number of contraventions will fall after the first year of CAZ operation with a corresponding reduction in the number of PCNs issued and thus a reduction in the requirement for enforcement staff. It is anticipated that BCC will employ the above staff from the outset and once the number of PCNs reduces they intend to reduce staff levels accordingly.

Each MEV is assumed to be manned by a single member of staff and will incur an ongoing cost to utilise and maintain/operate the vehicle at an estimated ██████ per year. This includes vehicle maintenance, licencing of the enforcement software and electricity supply costs for charging the vehicle.

Estimates were also made for the cost of retrieving vehicle data from the DVLA database. This assumes a 'worst-case scenario' whereby BCC purchases a dedicated annual license for this data from the DVLA at a cost of ██████ per year. However, it is understood that other solutions are being discussed by JAQU and the DVLA to allow access to this data by those authorities operating CAZ schemes, which BCC would welcome.

Estimated revenue costs for back office equipment and services were also derived. Costs for back office system hardware and software maintenance/housekeeping are expected to cost ██████ based upon an assumption of 10% of the total back office system capital cost, which is considered as an acceptable guideline for such an estimate. This applies to both the Hybrid Option and the Medium CAZ D + Option 1.

The cost of licenses for back office system software will most likely depend upon the final agreed system. However, a general estimate of ██████ has been included pending more detailed discussions with system suppliers. Again, this applies to both scheme options.

A revenue cost has also been included for 4 travel plan advisors, who would ensure when the scheme is delivered that the general public and businesses are provided with detailed advice and information on scheme operation, as well as available transport measures and funds for visitors to Bristol. The cost for these travel plan advisors is estimated at ██████ per year for both scheme options.

The final operational revenue cost element is that for a network management officer, whose role will be to monitor and manage the traffic network in relation to CAZ operation, in particular when disruptions occur that impact upon the CAZ, or issues with CAZ operation impact upon network operation (e.g. if a major incident in the city centre requires temporary suspension of CAZ operation, or if major roadworks adjacent to the CAZ

boundary requires diversions into the CAZ). This senior staff role is expected to cost [REDACTED] per year and again applies to both scheme options.

4.2 Maintenance and Support

Annual maintenance and support accounts for 16.2% of the total revenue cost for the Hybrid Option and 10% for the Medium CAZ D + Option 1. Costs for maintenance and support of on-street equipment were calculated as follows:

- AED replacement due to irreparable damage or malfunction – [REDACTED] for a single camera. The number of cameras expected to be replaced was estimated at 2% (1 in 50) of the total number deployed. This means 8 cameras for the Hybrid Option and 6 cameras for the Medium CAZ D + Option 1. Thus, the annual revenue cost for the Hybrid Option is [REDACTED] and for the Medium CAZ D + Option 1 it is [REDACTED]
- Roadside equipment, including Vehicle Certification Agency (VCA) compliance check, calculated at [REDACTED] per camera. For the Hybrid Option this gives a total annual cost of [REDACTED] and for the Medium CAZ D + Option 1 this cost is [REDACTED];
- CCTV Camera post maintenance is estimated to cost [REDACTED] per year for each camera location, which equates to [REDACTED] for the Hybrid Option (149 locations) and [REDACTED] for the Medium CAZ D + Option 1 (112 locations);
- B-Net optical fibre data communications network - estimated at [REDACTED] for each camera that is connected to B-Net. For the Hybrid Option this equates to [REDACTED] (180 cameras) and for the Medium CAZ D + Option 1 it equates to [REDACTED] (49 cameras);
- 4G communications network – there is no maintenance cost associated with the 4G communications service as this will be integral to the ongoing service charges, which are covered later in this report.;
- A nominal building maintenance cost of [REDACTED] is also included.

Estimates were also included for the replacement of any CAZ boundary and advanced warning signs that may be irreparably damaged. A general cost of [REDACTED] per sign was assumed for this replacement for all sign types and that 5% of all signs (1 in 20) will need replacing each year. For the Hybrid Option this will require replacement of 14 CAZ boundary signs, 14 CAZ advanced warning signs, 9 diesel ban area boundary signs, 16 diesel ban area advanced warning signs, 3 weight limit boundary signs and 1 weight limit advanced warning sign; the total cost for this is estimated at [REDACTED] per year. For the Medium CAZ D + Option 1 this would require replacement of 14 CAZ boundary signs, 14 CAZ advanced warning signs, 2 diesel ban boundary signs, 1 diesel ban advanced warning sign, 3 weight limit boundary signs and 1 weight limit advanced warning sign; the total cost for this is estimated at [REDACTED] per year.

All signs proposed for the SRN include a maintenance contribution (commuted sum) within the CAPEX cost equating to [REDACTED] per sign. This would cover the limited period for which they would be in place. If maintenance is required then it is expected that provision will be made under the maintenance regime of the Highways England Area 2 term maintenance contractor.

4.3 Power and Data Communications Networks

Assuming the adoption of B-Net optical fibre and 4G communications, the annual costs for data communications and power provision are estimated to be 3.9% of the total annual revenue costs for the Hybrid Option and 2.8% for the Medium CAZ D + Option 1. This is based on an estimated maintenance cost for B-Net of £10/metre for the B-Net optical fibre installed for the CAZ. For the Hybrid Option this equates to [REDACTED] per year for the 1,431 metres installed. For Medium CAZ D + Option 1 this total is £ to [REDACTED] year for the 1,061 metres installed.

Annual costs for provision of the 4G mobile network service is expected to cost [REDACTED] per connection assuming a cost of [REDACTED] per month for each connection, which is a standard rate for such a service. Thus, the annual

cost for the Hybrid Option, with 180 connections, is [REDACTED] and that for the Medium CAZ D + Option 1, with 142 connections, is [REDACTED]

No allowance has been made at this stage for any additional communications networks for backhaul or backup services such as “landlines” from BT or Virgin Media, although it is considered unlikely that such services will be required.

In terms of mains power supplies for the cameras and communications equipment, a cost estimate was made of [REDACTED] per year for the Hybrid Option and £[REDACTED] for the Medium CAZ D + Option 1. This is based on an assumed power consumption of 100W per camera throughout the year (8,76KWh per year) at a rate of 13p per KWh.

A cost is also estimated for power provision to the illuminated advanced warning signs. This was estimated at [REDACTED] per year for the 71 illuminated signs in the Hybrid Option and [REDACTED] the 39 illuminated signs in Medium CAZ D + Option 1.

4.4 Project Delivery and Ongoing Operational Management

This cost element relates to the additional staff considered essential for support to and operation of the CAZ and associated measures. This includes:

- Communications Lead Officer – this would require one member of staff for 1 day per month over a period of 2 years to direct communications/PR activities relating to the CAZ. Total cost for this will be [REDACTED] per year for both options.
- Infrastructure Lead Officer – this requires one member of staff full-time to manage the CAZ infrastructure (cameras, comms, back-office) to ensure continued operation. This will be at BCC BG13 rate, estimated to cost [REDACTED] for both options.
- Community Liaison Lead Officer – to ensure that communities views, queries, etc. are considered in relation to the CAZ, its impact and it’s benefits. This will be a full-time BCC BG13 rate position at an estimated cost of [REDACTED] per year.
- Site Supervision Lead Officer – this role is required during the CAZ construction phase to ensure that site installations are adequately supervised. It assumes an NEC3 Contract Manager at 90 hours per month a [REDACTED] per hour for the period of CAZ construction (12 months), thus giving a total of [REDACTED] for both options.
- Supporting Infrastructure Lead Officer – this role will require management of the supporting infrastructure (posts, columns, feeder pillars, power supplies) including liaison with third-parties (e.g. BCC Street Lighting officers) for shared infrastructure, particularly where CAZ maintenance work may impact on this infrastructure or work on the infrastructure may impact on CAZ operation of the CAZ. This is anticipated to be a full-time BCC BG11 position at an estimated cost [REDACTED] per year for both options.
- Financial Controller – for management of CAZ project finances; expected to be a BCC BG13 role requiring 5 days per month, with an annual cost [REDACTED] for both options.
- Project Manager for CAF measures – this is expected to require 3 full-time staff at BCC grade BG10 for a period of two years. Total estimated cost is [REDACTED] per staff member, i.e. [REDACTED] total per year, for both options.

4.5 Monitoring and Evaluation

These costs are a combination of staff and service costs relating to the monitoring of CAZ operation in terms of air quality levels, traffic volumes, economic impact and the effect on other active travel modes (primarily cycling and walking). This comprises:

- Air quality monitoring (installations) – for the operation of the Marlborough Road AQM site and including staff costs for management of 138 sites; this also includes decommissioning of 138 sites. Total cost estimated to be [REDACTED]
- Ongoing monitoring of air quality – [REDACTED] – which is explained in the Monitoring and Evaluation Plan Appendix O to the OBC];
- Ongoing monitoring of traffic levels - utilising existing BCC data supplemented with limited number of minor surveys. Estimated cost is £[REDACTED] per year;
- Ongoing monitoring of economic indicators - £[REDACTED] per year;
- Ongoing monitoring of active modes (cycling / walking) – including surveys, at an estimated cost of [REDACTED] per year;

Allowance is also made for staff to undertake ongoing CAZ scheme monitoring by BCC's Sustainability Team. This is expected to require 25% FTE staff time at BG10 level, which is estimated at [REDACTED] per year.

All of the above costs apply to both scheme options.

4.6 Other Activities and Services

These costs comprise 9.4% of the total operating costs for the Hybrid Option and 12.7% for the Medium CAZ D + Option 1, excluding costs for scheme decommissioning. Traffic Penalty Tribunal (TPT) charges are included as each PCN issued contributes a nominal 30 pence towards operation of this independent panel. For the Hybrid Option it is estimated that there will be 39,780 PCNs generated in the first year, costing [REDACTED] in TPT charges. This cost is likely to reduce during the life of the CAZ and is based upon an assumed non-payment rate of 8%. For Medium CAZ D + Option 1 this cost is estimated at [REDACTED] based on the generation of 94,381 PCNs in the first year. The higher number of PCNs generated for this option is due to the inclusion of class D vehicles, which is not the case for the Hybrid Option.

Printing each PCN for issue, including associated materials, is calculated to cost £[REDACTED] pence, based on known BCC costs for existing enforcement activities. The Hybrid Option would therefore incur PCN printing costs in year 1 of [REDACTED] and Medium CAZ D + Option 1 would incur costs totalling [REDACTED]. Sending the PCNs via first-class post (which is a requirement for PCN issue) currently costs 70 pence each. Therefore, the postage cost for all PCNs for the Hybrid Option are estimated to cost [REDACTED] the first year and the cost for the Medium CAZ D + Option 1 is estimated at [REDACTED]. As mentioned previously this cost should reduce as the scheme is established and fewer PCNs are issued.

A nominal cost estimate of [REDACTED] per year is also included for publicity and advertising prior to and during CAZ operation. It is likely, however, that this cost will reduce over time as the scheme becomes familiar to the public and the need for ongoing publicity diminishes, although it is expected that some publicity will always be required. This cost applies to both scheme options.

A cost of [REDACTED] has been estimated for setting up and conducting an annual health and wellbeing study of residents inside and outside the CAZ before and during CAZ operation. This cost allows for production of an initial report as well as three subsequent annual assessments and reports; thus it will apply to a four-year period. This estimate applies to both scheme options.

A cost has been included to cover the drafting and any subsequent changes required to the Legal Charging Order. Some consultation may also be required for this. This is anticipated to be of the order of [REDACTED] for both scheme options.

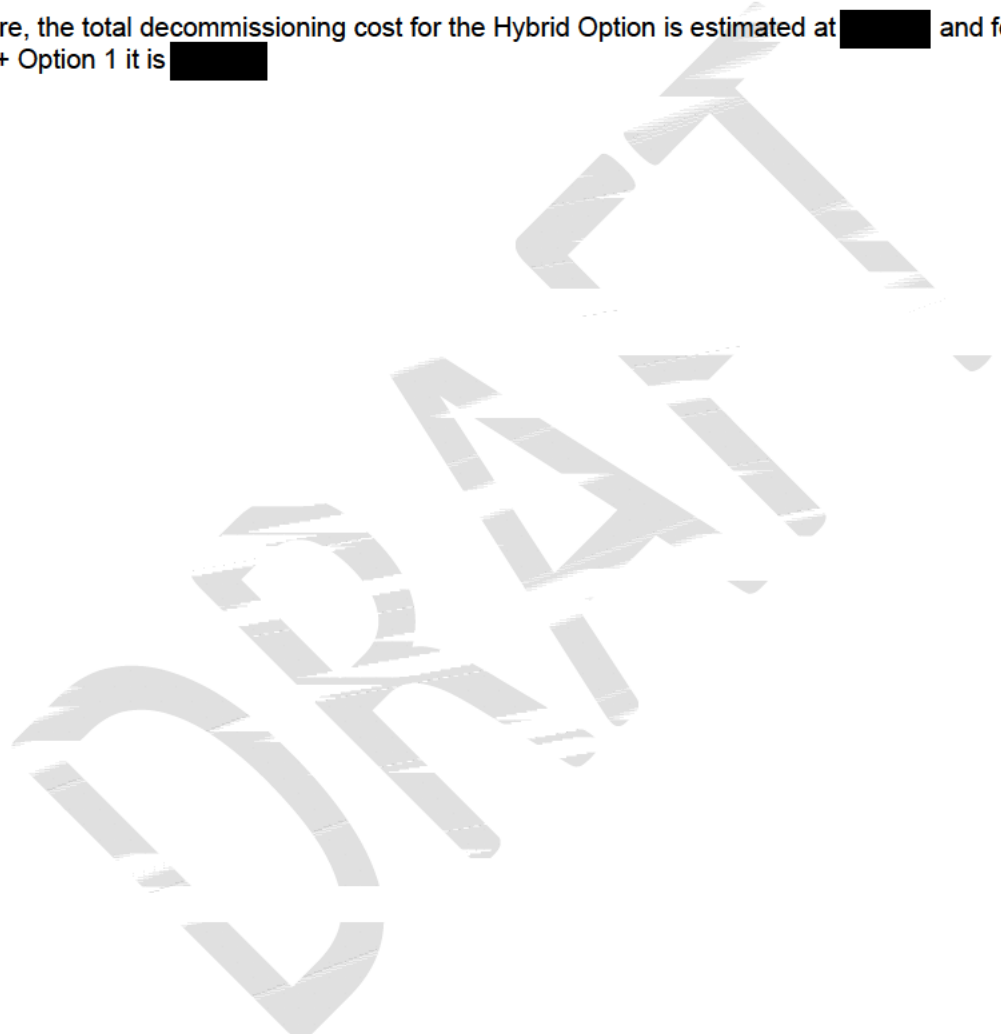
A cost has also included for a dedicated Trading Standards officer to ensure that any increase in the numbers of contraventions of the advertised TRO weight limits, particularly on the periphery of the CAZ, are minimised and, where relevant, prosecutions are enacted. This is estimated to cost [REDACTED] per year for one full-time staff member, applicable to both scheme options.

Finally, a nominal estimate of [REDACTED] per year is included for staff to produce and/or amend TROs for weight limit enforcement. Again, this applies to both scheme options.

4.7 Decommissioning Cost

An estimate was made for decommissioning the CAZ once air quality compliance levels have been achieved and the scheme is considered by BCC as no longer necessary. This will require the removal of all on-street camera and communications equipment, including cabinets, and the removal of all signage. It also includes removal of mounting posts for cameras and signage. For the Hybrid Option an estimate of [REDACTED] was derived for decommissioning of cameras and related equipment, and an estimate of [REDACTED] for decommissioning of signage. For Medium CAZ D + Option 1 these estimates are [REDACTED] and [REDACTED] respectively. For the camera equipment these values assume [REDACTED] per camera location plus [REDACTED] for the back-office system; for the signing it assumes [REDACTED] per sign, reduced by 20% to allow for per-sign savings where signs are co-located.

Therefore, the total decommissioning cost for the Hybrid Option is estimated at [REDACTED] and for the Medium CAZ D + Option 1 it is [REDACTED]



5. Contingency Estimates and Other Variations

It should be noted that all figures quoted in the preceding sections of this document exclude contingency. The cost breakdown table in Appendix A of this document provides the base costs along with a column to show base costs with a nominal 15% contingency applied

Contingency was not applied to risk cost items nor was it applied to staffing costs. All other costs were subject to contingency as described above and as shown in Appendix A.

It should be noted that all capital and revenue price estimates provided in this document are assumed to be firm and fixed for the duration of CAZ installation and operation. No allowance has been made for index-linked or any other such potential variations in prices over time.

With contingency applied, the total CAPEX cost for the Hybrid Option is adjusted from £99,502,500 to £113,452,875. Correspondingly, OPEX for the Hybrid Option is adjusted from £3,098,598 to £3,390,681.

With contingency applied, the total CAPEX cost for the Medium CAZ D + Option 1 is adjusted from £95,065,500 to £108,350,325. Correspondingly, OPEX for the Hybrid Option is adjusted from £3,295,394 to £3,570,072.

6. Summary of Capital and Revenue Costs

As can be seen in Appendix A of this document, allowing for the costs previously described - including risk but excluding uplift for contingency - the total base capital cost for the proposed Bristol Hybrid Option is estimated at £99,502,500 and for the Medium CAZ D + Option 1 this cost is £95,065,500.

Of these totals, the supply and installation of the enforcement system (cameras, enforcement vehicle, control room setup and back office hardware and software) along with various project management services is £9,154,000 for the Hybrid Option and £7,153,000 for the Medium CAZ D + Option 1. Highway works activities, including supply and installation of cabinets, mounting posts, signing and road marking and minor kerb realignment makes up £7,148,500 of the Hybrid Option CAPEX and £4,712,000 of the Medium CAZ D + Option 1 CAPEX. This includes estimates for various project management and site supervision activities.

The total capital cost for non-charging measures relating to the Implementation Fund is estimated at £38,100,000 for both scheme options. For the Clean Air Fund this totals £38,600,000 for both scheme options.

Risk is also incorporated into both scheme options at an estimated value of £6,500,000.

The ongoing base revenue cost for the CAZ to operate along with all other associated measures is estimated at £3,135,593 for the Hybrid Option and £3,383,168 for the Medium CAZ D + Option 1. This applies for the first year but then reduces in subsequent years as the number of issued PCNs decreases and enforcement costs reduce accordingly.

The summary table below provides an overview these capital and revenue costs for the Hybrid Option and for the Medium CAZ D + Option 1.

Table 1 Summary of scheme costs

	Cost Estimates (£)	
	Hybrid Option	Medium CAZ D + Option 1
CAPEX Requirements		
Enforcement System	9,154,000	7,153,000
Highway works	7,148,500	4,712,500
Non-charging measures CAF	38,600,000	38,600,000
Non-charging measures - Implementation Fund	38,100,000	38,100,000
QRA	6,500,000	6,500,000
TOTAL BASE CAPEX COST (EXCL. CONTINGENCY)	99,502,500	
OPEX Requirements		
Operations	1,244,242	1,557,062
Maintenance	506,900	337,200
Communications	79,110	61,730
Power (on-street)	43,099	32,253
Project Delivery and Operational Management	564,000	564,000
Monitoring and Evaluation	402,328	402,328
Other Costs (excl. decommissioning)	295,914	428,595
TOTAL BASE OPEX COST (EXCL. CONTINGENCY)	3,135,593	3,383,168

The final cost element not included above is for decommissioning the CAZ, estimated to be **£1.65m** for the Hybrid Option and **£1.12m** for the Medium CAZ D + Option 1 and which is excluded from the first-year costs.

Note: No contingency adjustment is made to risk costs or to staffing costs.

Appendix A. Breakdown of CAZ System Cost Estimates

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