Bath Clean Air Plan

Bath and North East Somerset Council

Primary Behavioural Response Calculation Methodology

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Bath Clean Air Plan

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Author:	KW

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

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2	17.01.2020	Final FBC	KW	JB	CB

Contents

1. Introduction

Poor air quality is the largest known environmental risk to public health in the UK[1]. Investing in cleaner air and doing more to tackle air pollution are priorities for the EU and UK governments, as well as for Bath and North East Somerset Council (B&NES). B&NES has monitored and endeavoured to address air quality in Bath, and wider B&NES, since 2002. Despite this, Bath has ongoing exceedances of the legal limits for Nitrogen Dioxide (NO_2) and these are predicted to continue until 2025 without intervention.

In 2017 the government published a UK Air Quality Plan for Nitrogen Dioxide[2] setting out how compliance with the EU Limit Value for annual mean NO_2 will be reached across the UK in the shortest possible time. Due to forecast air quality exceedances, B&NES, along with 27 other Local Authorities, was directed by Minister Therese Coffey (Defra) and Minister Jesse Norman (DfT) in 2017 to produce a Clean Air Plan (CAP). The Plan must set out how B&NES will achieve sufficient air quality improvements in the shortest possible time. In line with Government guidance B&NES is working towards 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.

Jacobs has been commissioned by B&NES to produce an Outline Business Case (OBC) and Full Business Case (FBC) for the delivery of the CAP; a package of measures which will bring about compliance with the Limit Value for annual mean NO_2 in the shortest time possible in Bath. The OBC assessed the shortlist of options set out in the Strategic Outline Case[3], and proposed a preferred option including details of delivery. The FBC develops the preferred option set out in the OBC, detailing the commercial, financial and management requirements to implement and operate the scheme. The OBC and FBC form a bid to central government for funding to implement the CAP.

1.1 Purpose of this Report

This document is written to support the FBC and the methodology for calculating the behavioural response rates of non-compliant vehicles when they enter the Bath CAZ.

[1] Public Health England (2014) Estimating local mortality burdens associated with particular air pollution. https://www.gov.uk/government/publications/estimating-local-mortality-burdens-associated-with-particulate-air-pollution
[2] https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017
[3] Bath and North East Somerset Council Clean Air Plan: Strategic Outline Case, March 2018 (http://www.bathnes.gov.uk/sites/default/files/siteimages/Environment/Pollution/strategic_outline_case_bath_28.03.2018_with_annexes.pdf)

2. Overview of Methodology

The aim is to determine the local proportions for each of the four primary responses for non-compliant vehicles to the implementation of the CAZ, which will replace the percentages shown in Figure 2-1 'Table 2 – Behavioural responses to charging Clean Air Zones' within the JAQU Evidence package.

Proportions of non-compliant vehicle trips which react to the zone								
	Petrol Cars	Diesel Cars	Petrol LGVs	Diesel LGVs	RHGVs	AHGVs	Buses	Coaches
Pay charge – Continue into zone	7.1%	7.1%	20.3%	20.3%	8.7%	8.7%	0.0%	15.6%
Avoid Zone – Trips removed, modelled elsewhere	21.4%	21.4%	10.0%	10.0%	4.3%	4.3%	0.0%	0.0%
Cancel journey – trips removed completely	7.1%	7.1%	6.0%	6.0%	4.3%	4.3%	6.4%	12.5%
Upgrade Vehicle – trips replaced with compliant trips	64.3%	64.3%	63.8%	63.8%	82.6%	82.6%	93.6%	71.9%

Figure 2-1: 'Table 2 – Behavioural responses to charging Clean Air Zones' from JAQU Evidence Package

Note: RHGVs – Rigid HGVs and AHGVs- Artic HGVs

The results from the local stated preference surveys have been used to determine primary behavioural responses rates for non-compliant cars when a CAZ is implemented in Bath. For non-compliant light goods vehicles, employer's business responses from the stated preference surveys were used. For heavy goods vehicles the responses are determined by looking at the upgrade cost compared to the charge on entering the CAZ. Bus and Taxi responses are based on discussions with B&NES and the service providers. For coaches, there are ongoing discussions with local coach operators to understand the fleet and likely responses, however due to the uncertainty and the relatively small proportion of the fleet that are coaches, the national response rates have been used as taken from 'Table 2 – Behavioural responses to charging Clean Air Zones' within the JAQU Evidence package, also shown above.

Response rates have been determined for the following CAZ scenarios:

- Class D CAZ;
- Alternative Class D CAZ with diesel car E4/5 concession and grant scheme for pre Euro-4 car owners
- Class C CAZ

Note, the CAZ Class D option was modelled without the loan / grant schemes since details of these schemes had not been identified at the time the option was modelled. This therefore presents a worst case assessment in this regard since the loan / grant schemes would be expected to improve the non-compliant vehicle replacements rates. The grant scheme was reflected in the modelling of the Alternative CAZ D option since the details were available at the time of the modelling and hence it was included to gauge the impacts. The inclusion of this scheme is expected to have a limited impact due to the relatively low numbers of (pre-Euro 4) vehicles that would be eligible. The loan / grant schemes are subject to funding at the time of writing. Further discussion is provided in FBC-08 Option Assessment Report in Appendix C of the FBC.

3. Stated Preference Surveys

Stated preference surveys have been undertaken to determine local behavioural responses to the implementation of a CAZ in Bath. The structure, implementation and outcomes of the survey are provided fully in FBC-30 Stated Preference Survey Report in Appendix L of this FBC, whilst a brief summary is set out in this report.

The main part of the survey are two stated preference exercises, the first asked the respondent to consider their most recent trip through the zone and how they would have responded from the following choices:

- Paid the charge and travelled as before;
- Made the same journey but changed mode;
- Not have made the journey at all;
- Made the same journey purpose but changed the destination;
- Made the same journey but changed route to avoid the zone; or,
- Made the same journey but switched to another compliant vehicle in their household (this option will only be shown if the respondent has indicated in an earlier question that such a vehicle exists).

The second exercise asked respondents about the longer-term choice of whether they would continue to pay the charge to travel in the zone or would pay upgrade the vehicle to a compliant one for a given hypothetical cost.

Once completed, the survey data underwent a cleaning process to identify and discard nonsensical questionnaires.

Statistical models were fitted to the data for each exercise and then combined into a single model in order to allow predictions to be made on behavioural changes in response to a specified charge level and upgrade cost. This information was then fed into the highway transport model as detailed in the FBC-13 Local Plan Transport Modelling Methodology Report (T3) in the FBC and outputs are detailed in FBC-17 Local Plan Transport Modelling Forecasting Report (T4) in the FBC.

4. Upgrade Costs

In order to determine the primary response rates over a range of CAZ charges from the stated preference surveys, an upgrade cost is required. The methodology for calculating the upgrade costs for Cars, LGVs and HGVs is outlined below.

The upgrade costs of other vehicle types (Taxi, Buses and Coaches) were not used to calculate the primary response rates. The primary response rates were determined by other information collated and this is discussed in the next section.

4.1 Cars

The cost of a new car was calculated by determining the most popular car models in the local area. A national list was obtained from the www.smmt.co.uk website, which is comparable with the most popular car models identified from the Bath Automatic Number Plate Registration (ANPR) data. Prices for Petrol and Diesel models of the list of popular cars were extracted from the Parkers database for new car prices. Table 4-1 shows the new car prices for the most popular cars.

Table 4-1: New Car Prices based on Most Popular Cars

Model	New					
	Petrol			Diesel		
	High	Low	Ave	High	Low	Ave
Ford Fiesta	£ 20,000	£ 13,200	**£ 16,600**	£ 19,000	£ 14,200	**£ 16,600**
Ford Focus	£ 22,400	£ 17,600	**£ 20,000**	£ 22,500	£ 19,100	**£ 20,800**
Vauxhall Corsa	£ 19,300	£ 11,800	**£ 15,550**	£ 17,500	£ 13,500	**£ 15,500**
Vauxhall Astra	£ 23,400	£ 14,500	**£ 18,950**	£ 21,900	£ 16,100	**£ 19,000**
Volkswagen Golf	£ 25,000	£ 18,500	**£ 21,750**	£ 24,500	£ 19,100	**£ 21,800**
BMW 3 Series	£ 29,000	£ 22,900	**£ 25,950**	£ 32,500	£ 24,500	**£ 28,500**
MINI	£ 15,905	£ 20,635	**£ 18,270**			**£ -**
Volkswagen Polo	£ 17,500	£ 15,500	**£ 16,500**	£ 17,400	£ 15,800	**£ 16,600**
Renault Clio	£ 15,000	£ 11,000	**£ 13,000**	£ 15,500	£ 12,500	**£ 14,000**
Audi A3	£ 33,500	£ 20,500	**£ 27,000**	£ 31,000	£ 20,500	**£ 25,750**
Toyota Yaris	£ 14,500	£ 12,500	**£ 13,500**			**£ -**
Mercedes C Class	£ 35,500	£ 26,000	**£ 30,750**	£ 38,000	£ 27,000	**£ 32,500**
Average	**£ 22,584**	**£ 17,053**	**£ 19,818**	**£ 23,980**	**£ 18,230**	**£ 17,588**

4.2 LGVs and HGVs

The cost of a new LGV, rigid HGV and artic HGV have been calculated from the publication 'Out of our hands' in the January 2018 edition of Transport Engineer covering LGV and HGV operating costs[4]

[4] http://www.transportengineer.org.uk/article-images/166209/Out_of_our_hands.pdf

Table 4-2: LGV and HGV 2018 New Vehicle Costs

Vehicle type	Detailed Vehicle Type	2018 Cost
LGV	Car derivative Vans - diesel	£14,244
	Vans of 3.5 tonnes gvw - diesel	£26,186
	Average	**£20,215**
Rigid HGV	7.5 tonne gvw	£42,570
	10 to 12 tonnes gvw	£50,419
	12 to 14 tonnes gvw	£53,934
	16 to 18 tonnes gvw	£70,929
	3 axle rigid veh 26 tonnes gvw	£90,457
	4 axle rigid tipper	£98,334
	Average	**£67,774**
Artic LGV	33 tonne gvw artic, 2 axle	£56,579
	38 tonne gvw artic, 2 axle	£81,300
	38 tonne gvw , 3 axle	£81,300
	32.5 tonne gvw drawbar combination, 2 axle	£63,363
	40 tonne gvw, 3 axle	£99,747
	44 tonne gvw, 3 axle	£106,680
	Average	**£81,495**

4.3 Depreciation Rates

A non-compliant vehicle will not always be replaced with a new compliant vehicle; therefore, depreciation rates were used to calculate the value of differing vehicles and ages. Table 4-3 shows the depreciation rates from the National data inputs for Local Economic Models, provided by JAQU for this project. These have been used, since no locally derived depreciation values are available.

Table 4-3: Depreciation Rates

Veh Type	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10+
Cars	37%	18%	16%	16%	16%	16%	16%	16%	16%	16%
LGVs	37%	18%	16%	16%	16%	16%	16%	16%	16%	16%
RHGVs	35%	18%	18%	18%	18%	18%	18%	18%	18%	18%
AHGVs	35%	18%	18%	18%	18%	18%	18%	18%	18%	18%
Buses	35%	18%	18%	18%	18%	18%	18%	18%	18%	18%

4.4 Vehicle value by age and vehicle type

The depreciation rates were used to calculate the value of Cars (Petrol and Diesel), LGVs and HGVs (Rigid and Artic) by age pivoting from the new prices calculated above. Table 4-4 shows the value by age and vehicle type.

Table 4-4: Value by Age and Vehicle Type

Year >>	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005
Cars (Petro	£12,486	£10,238	£8,600	£7,224	£6,068	£5,097	£4,282	£3,597	£3,021	£2,538	£2,132	£1,791	£1,504
Cars (Diese	£11,080	£9,086	£7,632	£6,411	£5,385	£4,524	£3,800	£3,192	£2,681	£2,252	£1,892	£1,589	£1,335
LGVs	£12,735	£10,443	£8,772	£7,369	£6,190	£5,199	£4,367	£3,669	£3,082	£2,589	£2,174	£1,827	£1,534
Rigid HGV	£44,053	£36,123	£29,621	£24,289	£19,917	£16,332	£13,392	£10,982	£9,005	£7,384	£6,055	£4,965	£4,071
Artic HGV	£52,972	£43,437	£35,618	£29,207	£23,950	£19,639	£16,104	£13,205	£10,828	£8,879	£7,281	£5,970	£4,896

Year >>	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992
Cars (Petro	£1,263	£1,061	£892	£749	£629	£528	£444	£373	£313	£263	£221	£186	£156
Cars (Diese	£1,121	£942	£791	£665	£558	£469	£394	£331	£278	£233	£196	£165	£138
LGVs	£1,289	£1,083	£909	£764	£642	£539	£453	£380	£319	£268	£225	£189	£159
Rigid HGV	£3,339	£2,738	£2,245	£1,841	£1,509	£1,238	£1,015	£832	£682	£560	£459	£376	£309
Artic HGV	£4,014	£3,292	£2,699	£2,213	£1,815	£1,488	£1,220	£1,001	£821	£673	£552	£452	£371

4.5 Average upgrade cost by vehicle type

Upgrade costs for each vehicle type and Euro Standard (and fuel type for cars) were calculated using the depreciated vehicle values presented in Table 4-4, comparing the resale cost of a non-compliant vehicle and the cost of purchasing a compliant vehicle.

To derive an average upgrade cost by vehicle type, the upgrade costs by vehicle type and Euro Standard were weighted by vehicle type sightings. The sightings of each vehicle type were calculated from the ANPR survey data for Bath, split by Euro standard. Table 4-5 shows the vehicle types split by euro standard.

Table 4-5: Vehicle Type by Euro Standard

Eurostandard	Cars		LGV	HGVs	
	Diesel	Petrol		Artic	Rigid
Euro 0	206	1633	498	0	34
Euro 1	636	3541	1314	7	61
Euro 2	3764	29783	4060	24	444
Euro 3	52670	127446	20012	225	1897
Euro 4	98292	157268	36359	347	2815
Euro 5	179839	174678	75949	2776	8600
Euro 6	118533	133503	22371	5401	9011
Total	453940	627852	160563	8780	22862

It was necessary to also account for 'secondary' behavioural responses within these calculations, to estimate the proportion of vehicles replaced by new or used vehicles, and the switch between diesel and petrol cars. In the absence of more accurate/local information, JAQU's assumptions from paragraph 3.3 of the Evidence Package, have been used, and are as follows:

- 25% of those with a non-compliant vehicle who upgrade will buy a brand-new vehicle of the same fuel type.
- The other 75% will replace their vehicle with a second-hand complaint vehicle. Of these, 75% of diesels owners will switch to petrol with the remainder keeping the same fuel type.

Table 4-6 shows the weighted upgrade cost calculations for Cars (Petrol and Diesel), LGV and HGVs (Rigid and Artic). The cost of resale is based on the lowest value of that vehicle type and euro standard. The cost of a compliant vehicle was calculated using on the secondary behavioural responses outlined above, and also based on an assumption that the lowest cost second-hand compliant vehicle will be purchased.

Table 4-6: Weighted Upgrade Costs

Vehicle Type	Euro Class	Euro Class Count	Resale Cost	Cost of Compliant Vehicle	Cost to Upgrade per vehicle	Cost to Upgrade total
Car (Petrol)	Euro 0	1633	£0	£ 6,297.58	£6,298	£10,283,951.78
	Euro 1	3541	£156	£ 6,297.58	£6,142	£21,747,597
	Euro 2	29783	£373	£ 6,297.58	£5,925	£176,456,458
	Euro 3	127446	£629	£ 6,297.58	£5,669	£722,430,846
	Weighted Average					**£5,732.15**
Car (Diesel)	Euro 0	206	£0	£ 6,835.12	£6,835	£1,408,035
	Euro 1	636	£138	£ 6,835.12	£6,697	£4,259,131
	Euro 2	3764	£331	£ 6,835.12	£6,504	£24,481,984
	Euro 3	52670	£558	£ 6,835.12	£6,277	£330,602,976
	Euro 4	98292	£1,335	£ 6,835.12	£5,500	£540,633,312
	Euro 5	179839	£3,800	£ 6,835.12	£3,035	£545,878,449
	Weighted Average					**£4,314.95**
Weighted Average Car						**£4,777.29**
LGVs	Euro 0	498	£0	£ 8,772	£8,772	£4,368,544.62
	Euro 1	1314	£159	£ 8,772	£8,613	£11,317,651
	Euro 2	4060	£380	£ 8,772	£8,392	£34,070,995
	Euro 3	20012	£642	£ 8,772	£8,131	£162,708,169
	Euro 4	36359	£1,534	£ 8,772	£7,238	£263,163,288
	Euro 5	75949	£4,367	£ 8,772	£4,405	£334,537,253
	Weighted Average					**£5,862.61**
HGV Rigid	Euro 0	0	£0	£29,621	£29,621	£0.00
	Euro 1	7	£309	£29,621	£29,313	£205,188.79
	Euro 2	24	£832	£29,621	£28,789	£690,935.62
	Euro 3	225	£1,509	£29,621	£28,112	£6,325,156.99
	Euro 4	347	£4,071	£29,621	£25,550	£8,865,798.51
	Euro 5	2776	£13,392	£29,621	£16,229	£45,051,227.18
	Weighted Average					**£18,093.61**
HGV artic	Euro 0	34	£0	£35,618	£35,618	£1,211,016.48
	Euro 1	61	£371	£35,618	£35,247	£2,150,074.22
	Euro 2	444	£1,001	£35,618	£34,617	£15,370,122.78
	Euro 3	1897	£1,815	£35,618	£33,803	£64,124,522.95
	Euro 4	2815	£4,896	£35,618	£30,722	£86,483,808.65
	Euro 5	8600	£16,104	£35,618	£19,514	£167,823,834.79
	Weighted Average					**£24,342.17**

5. Proposed Charge Rates

The range of charge rates considered for the Bath CAZ are shown in Table 5-1.

Table 5-1: Bath CAZ Charge Ranges

Charge Class	Lower Limit	Upper Limit
Cars	£3.00	£12.50
Taxis	£3.00	£30.00
LGVs	£3.00	£70.00
HGVs	£55.00	£150.00
Buses	£55.00	£150.00
Coaches	£55.00	£150.00

The charges were initially set for Cars, taxis and LGVs so that the responses of avoid zone, change mode / cancel journey and replace vehicle combined roughly equated to the combined JAQU CAZ responses in Table 5-1. There was an iterative process when choosing the final charge rates as the initial charges selected (£7.50 for cars/taxis/LGVs, £100 for HGVs/buses/coaches) did not bring about compliance with the European Limit Value for annual mean nitrogen dioxide in 2021. The final proposed charges are shown in Table 5-2. These are selected as the minimum charges which will achieve compliance in 2021, based on the traffic and air quality modelling.

Table 5-2: Bath CAZ Proposed Charges

Charge Class	Charge
Cars	£9.00
Taxis	£9.00
LGVs	£9.00
HGVs	£100.00
Buses	£100.00
Coaches	£100.00

5.1 Primary Behavioural Responses

5.1.1 Cars

The response of the non-compliant car user class that travels in the zone are derived directly from the stated preference survey, which provides proportions on the following responses:

- Pay Charge
- Avoid Zone
- Replace Vehicle
- Cancel Trip / Change Mode

To extract data from the stated preference survey statistical model an upgrade cost is required to be entered to determine a range of primary behavioural responses for different charge rates. The average upgrade costs for cars are shown in Table 4-6, with a weighted average value of £4,777.

A charge of £9.00 for cars has been identified as being required to address the air quality exceedances within Bath and is expected to bring about compliance with the European Limit Value for annual mean nitrogen dioxide in the shortest time possible. Based on a £9.00 charge, Table 5-3 shows the primary behavioural responses rates for Cars for a CAZ Class D.

Table 5-3: CAZ D Car Primary Behavioural Response Rates

Response	Cars
Pay Charge / Excluded	4.9%
Avoid Zone	19.6%
Cancel Journey	6.3%
Change Mode	12.1%
Replace Vehicle	57.2%

For an Alternative CAZ D option, the average upgrade costs for cars are shown in Table 4-6, with a weighted average value of £4,777 was taken and £2,000 subtracted due to the grant for pre-Euro 4 cars. Based on a £9.00 charge, Table 5-34 shows the primary behavioural responses rates for Cars for a Alternative CAZ D. Note, this assumes a full take-up of the grant scheme on the basis it would be well advertised. A more cautious assessment might assume a lower take-up of say 80% or 90%, however this would not be expected to make a material difference to the results due to the relatively low numbers of pre-Euro 4 vehicles.

Table 5-4: Alternative CAZ D Car Primary Behavioural Response Rates

Response	Cars
Pay Charge / Excluded	3.8%
Avoid Zone	14.2%
Cancel Journey	3.9%
Change Mode	9.9%
Replace Vehicle	68.2%

Cars are not included in a Class C CAZ, therefore no response rates are required for this scenario.

5.1.2 LGVs

LGV primary behavioural response rates are calculated from the stated preference survey responses who were identified as an 'Employers Business' trip purpose (all respondents were asked to state the purpose of their most recent trip). Again, to extract data from the stated preference survey statistical models an upgrade cost is required to be entered to determine a range of primary behavioural responses for different charge rates. The average upgrade costs for LGVs are shown in Table 4-6, with a weighted average value of £5,862.

A charge of £9.00 for LGVs has been identified as being required to address the air quality exceedances within Bath and is expected to bring about compliance with the European Limit Value for annual mean nitrogen dioxide in the shortest time possible. Table 5-5 shows the primary behavioural responses rates for LGVs.

Table 5-5: LGVs Primary Behavioural Response Rates

Response	LGV
Pay Charge	16.8%
Avoid Zone	12.2%
Cancel Journey	4.1%
Replace Vehicle / Upgrade	66.8%

Please note that the change mode response has been removed from the calculations as this is not possible for LGVs trips.

5.1.3 HGVs

The primary behavioural responses rates for HGVs were determined by comparing the cost to upgrade with the cost of paying the charge throughout a 5-year time period, with a tipping point of upgrading the vehicle when paying the charge becomes more expensive.

Trip frequency data from the ANPR surveys was used to establish the average annual cost of CAZ charges, with assumptions of how a two-week sample would be distributed over a year. The upgrade vehicle costs are based on the assumptions and calculations shown in the Chapter 4 and presented in Table 4-6.

This calculation represents a very simple comparison of costs for HGV operators, which does not fully reflect the complexity of the decision-making process faced by the operators. It is anticipated that in reality there would be significant variation in consideration of these costs between different operators and different operating models. Sufficient data or evidence does not exist to understand this complexity and come to any reliable conclusions. It is acknowledged that the simple calculation set out here is not comprehensive.

This is further corroborated by comparing a similar calculation for Cars and LGVs with the response rates calculated from the stated preference survey. In the absence of any more reliable data, the difference between the response rates calculated using this simple method and those calculated from the stated preference survey for LGVs has been used to give a reasonable estimation of the 'error' within the simple calculation process. The HGV response rates have been adjusted by this error factor to account for the simplicity of the calculation and the factors that are overlooked.

A charge of £100 for HGVs has been identified as being required to address the air quality exceedances within Bath and is expected to bring about compliance with the European Limit Value for annual mean nitrogen dioxide in the shortest time possible. Table 5-6 shows the primary behavioural responses rates for HGVs.

Table 5-6: HGVs Primary Behavioural Response Rates

Response	HGV rigid	HGV artic	Weighted HGVs
Pay Charge	11.2%	17.4%	12.2%
Avoid Zone	4.9%	4.9%	4.9%
Cancel Journey	1.7%	2.7%	1.9%
Replace Vehicle / Upgrade	82.1%	72.3%	80.5%

5.1.4 Taxis

The taxi response rate is based on B&NES enforcing a 100% compliance for Taxis through their licensing agreements with taxi operators. An exception has been made for wheelchair accessible taxi vehicles (WAVs) which are likely to be exempted from CAZ charges in order to ensure the continued provision of these services in the face of substantial vehicle upgrade costs. Other possible taxi concessions or exemptions are under consideration which are discussed in 674726.BR.042.FBC-05. Table 5-7 shows the compliance splits by fuel type and non-WAV/WAV. Table 5-8 shows the weighted (by fuel type) primary behavioural response rates for Taxis, taking into account the exception for WAV taxis.

Table 5-7: Taxi Compliance by fuel type and non-WAV/WAV (no. vehicles)

Compliance	Petrol		Diesel	
	non-WAV	WAV	non-WAV	WAV
Compliant	35	0	81	1
Non_Compliant	0	0	353	15
Total	35	0	434	16

Table 5-8: Taxi Primary Behavioural Response Rates

Response	Petrol	Diesel	Weighted Average
Exempt	NA	4%	4%
Avoid Zone	NA	0%	0%
Cancel Journey / Change Mode	NA	0%	0%
Replace Vehicle	NA	96%	96%

5.1.5 Coaches

The initial response rates for coaches were taken from 'Table 2 – Behavioural responses to charging Clean Air Zones' in the Evidence Package, provided by JAQU. Figure 2-1 shows these responses earlier in this note.

An adjustment for school coaches was made to reflect the latest vehicle permit / concession discussions with operators of school coach trips at the time of the assessment which is discussed further in 674726.BR.042.FBC-05. The impact of this assumption is very small within the overall number of coaches operating in Bath. However, it was considered to be the 'worst case' outcome of the ongoing discussions in terms of the assessment and was therefore reflected in the model in this way whilst discussions continued. At the time of writing, concessions for coaches are no longer proposed and hence if this position was to be reflected in the assessment the response rate adjustment would not be made. Table 5-9 shows the coach primary behavioural response rates that have been modelled (with adjustment) and corresponding response rates without adjustment. It can be seen that the rates are very similar with the adjusted rates representing a slightly lower proportion of vehicles being replaced / upgraded.

Table 5-9: Coach Primary Behavioural Response Rates

Response	With Adjustment (modelled)	Without Adjustment
Pay Charge	20.12%	17.15%
Avoid Zone	0.00%	0.00%
Cancel Journey / Change Mode	11.50%	11.73%

Replace Vehicle / Upgrade	68.38%	71.13%

5.1.6 Buses

The response rates for buses was determined through discussions between B&NES and bus operators. These identified that approximately half the bus fleet could be expected to be fully replaced by 2021, and the remaining buses could largely be retrofitted with financial assistance.

It is possible that some services may stop running if they are deemed financially unviable. Whilst B&NES is working closely with the bus operators to minimise those risks, it is considered prudent within the modelling to assume a scenario where a small number of services are removed. Therefore, the percentage of trips cancelled for buses has been taken from 'Table 2 – Behavioural responses to charging Clean Air Zones' in JAQU's Evidence Package. Table 5-10 shows the bus primary behavioural response rates

Table 5-10: Bus Primary Behavioural Response Rates

Response	Buses
Pay Charge	0.0%
Avoid Zone	0.0%
Cancel Journey	6.4%
Replace Vehicle / Upgrade	93.6%

5.1.7 Foreign Vehicles

An adjustment for foreign vehicles has been applied to the responses rates calculated from the methodology set out above, as foreign vehicles cannot be reliably charged (their details are not captured in the DVLA database in order to determine if the vehicle is compliant and so enforcement can only occur through a manual process with limited powers). From the ANPR survey it has been identified that at least 98.35% of all journeys (not vehicles) are made be UK registered vehicles, leaving less than 2% of journeys made by foreign vehicles.

The final response rates will assume a 'worst case', i.e. that these vehicles continue to drive within the zone but do not pay the charge. In reality it is unlikely that this will be the case for all foreign vehicles.

6. Final Primary Behavioural Response Rates

Table 6-1 to 6-3 show the final primary behavioural response rates for the CAZ D, Alternative CAZ D and the CAZ C with Traffic Management scenarios respectively, by vehicle type, produced the methodology set out in this report. These are the response rates that have been applied to the core modelling scenarios within the traffic model.

Table 6-1: CAZ D Final Primary Behavioural Response Rates

Response	Cars	Taxis	LGVs	HGVs	Buses	Coaches
Pay Charge / Excluded	4.9%	4.1%	18.4%	11.9%	0.0%	20.1%
Avoid Zone	19.6%	0.0%	11.7%	4.4%	0.0%	0.0%
Cancel Journey / Change Mode	18.3%	0.0%	3.6%	1.1%	6.4%	11.5%
Replace Vehicle	57.2%	95.9%	66.3%	82.7%	93.6%	68.4%

Table 6-2: Alternative CAZ D Final Primary Behavioural Response Rates

Response	Cars	Taxis	LGVs	HGVs	Buses	Coaches
Pay Charge / Excluded	3.8%	4.1%	18.4%	11.9%	0.0%	20.1%
Avoid Zone	14.2%	0.0%	11.7%	4.4%	0.0%	0.0%
Cancel Journey / Change Mode	13.8%	0.0%	3.6%	1.1%	6.4%	11.5%
Replace Vehicle	68.2%	95.9%	66.3%	82.7%	93.6%	68.4%

Note: only applied to 2021 Alternative CAZ as the grant will not be available in 2031.

Table 6-3: CAZ C + TM Final Primary Behavioural Response Rates

Response	Cars	Taxis	LGVs	HGVs	Buses	Coaches
Pay Charge / Excluded	0.0%	4.1%	18.4%	11.9%	0.0%	20.1%
Avoid Zone	0.0%	0.0%	11.7%	4.4%	0.0%	0.0%
Cancel Journey / Change Mode	0.0%	0.0%	3.6%	1.1%	6.4%	11.5%
Replace Vehicle	0.0%	95.9%	66.3%	82.7%	93.6%	68.4%