SNC·LAVALIN

Bath Clean Air Zone

Peer Review – Report

Bath and North East Somerset Council

27 August 2019

Notice

This document and its contents have been prepared and are intended solely as information for Bath and North East Somerset Council and use in relation to a review of the air quality, modelling and strategy elements of the Outline Business Case for the Bath Clean Air Plan.

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This document has 22 pages including the cover.

Document history

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
Rev 1.0	Draft Report	SG/SP/PJT	AC	LS	AC	19/08/2019
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Client signoff

Client	Bath and North East Somerset Council
Project	Bath Clean Air Zone
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Executive summary

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The conclusions and recommendations provided in this high-level review are therefore based on BANES' and its consultants technical assessments undertaken to date, with acknowledgement of the uncertainty as to the degree of post-opening response.

Overall, the Options Assessment Report and Outline Business Case follow a structured, evidenced based approach in line with best practice in business case development.

It should be noted that modelling and forecasting assessments undertaken to produce the CAZ proposal are based on following best practice and statutory and non-statutory guidelines.

Air quality

The air quality review contains some specific recommendations that could increase the understanding of the potential impact of the options, we would be happy to discuss these further with your technical team.

It is recognised however that (a) the modelling and assessment work has been undertaken within the relatively short timescales prescribed by JAQU and (b) there appear to be specific, local factors which have a substantial influence on air pollutant concentrations in Bath (e.g. road gradient). It is acknowledged that BANES felt required to develop a bespoke approach for undertaking its air quality assessments; this review highlights some recommendations to improve this approach, with the aim of ensuring it becomes more robust against potential scrutiny,

Traffic modelling

The modelling/forecasting for the CAZ is providing forecasts of the response of road users to the introduction of charges to entering Bath. Road users may respond by upgrading vehicle fleets, choosing to pay the charge to enter the CAZ, change model of transport or decide not to travel.

The London congestion charge is an example of the complexities of such forecasts, and variability against real-world results, as traffic reduction levels far exceeded the forecast when the scheme went live. It should be noted however, that London congestion charge's key aim to reduction in traffic flows, whereas the CAZ aims relate to reductions in emissions.

Uncertainty

The absence of an extensive pool of real-world evidence presents difficulty in evaluating the effects of delivering CAZs. The current lack of evidence on the response of road users when faced with the choice to pay a fee, upgrade their vehicles, or choose active modes, means that the technical forecasts undertaken for the CAZ proposal is subject to uncertainty.

A further consideration with CAZ is the extent and speed that commercial bodies and private individuals can adapt to any charge, e.g., how many vehicles are in the taxi fleet and how long would it take to convert that fleet?

The air quality review contains several recommendations for further work that could increase the understanding of alternative scenarios. We recognise that some of these issues may have already been or are currently being considered in technical work and would be happy to meet with your consultant team to discuss these areas in more detail.

Overall, with limited experience of charging schemes and emissions control schemes around the world there should be contingency plans to allow measures to increase the effectiveness should emissions not decrease as planned. **[**It is subsequently understood that this work is currently in progress and will be included in the FBC**]**.

Summary

Whilst there are limitations with any modelling of CAZ, we do recognise that that CAZ C, with traffic management, has the potential to use wider control of traffic flows to achieve the desired outcomes. It will be

important that the traffic management approach implemented is able to respond and either restrict or relax the flow of general traffic as the real-world applications and impacts of the CAZ are monitored.

Critical to the successful implementation of CAZ will be robust monitoring and evaluation of the performance of the scheme, alongside a willingness to review and alter the scheme should the real-world performance differ from significantly from the business case.

1. Introduction

A high-level peer review of the air quality, traffic modelling and strategic case elements of the Outline Business Case (OBC) for Bath and North East Somerset Council's (BANES) Bath Clean Air Plan (CAP) has been undertaken. The following documents have been reviewed across the three topic areas:

Table 1-1 - Reviewed documents[1]

Air quality	Traffic modelling	Strategic case
Outline Business Case	Outline Business Case	Outline Business Case
Options Assessment Report	Options Assessment Report	Options Assessment Report
AQ2 Local Plan Air Quality Modelling Methodology Report	T3 Local Plan Transport Modelling Methodology Report	BANES Technical Independent Review Panel Responses (June 2019 draft)[2]
AQ3 Air Quality Modelling Report	ANPR Data Analysis and Application	
ANPR Data Analysis and Application	Local Model Validation Report (Addendum: LGV and HGV Validation)	
Primary Behavioural Response Calculation Methodology	Sensitivity Testing Technical Note	
Sensitivity Testing Technical Note	Analytical Assurance Statement	
Analytical Assurance Statement	BANES Technical Independent Review Panel Responses (June 2019 draft)[2]	
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[1]Documents have been sourced from BANES' Bath Breathes website and were published in March 2019 unless stated.

[2]BANES' responses to the Technical Independent Review Panel (T-IRP) were requested and provided.

The intention of this report is to provide a high-level review of the key inputs, assumptions and decision points that were made by BANES and its consultants in preparing the preferred Clean Air Zone (CAZ) option. In order to provide an independent and impartial review, Atkins did not contact BANES' consultants (Jacobs and Air Quality Consultants).

This report is set out as follows:

- Section 2 provides the background context of Bath CAZ, setting out the national guidance and subsequent decision-making process that BANES and its consultants took in delivering its proposals;
- Section 3 sets out the air quality review findings;
- Section 4 sets out the traffic modelling review findings; and
- Section 5 provides commentary on the strategic case and presents conclusions and next steps.

2. Background

The OBC and its supporting technical documents have been reviewed and a simple diagram produced illustrating the decision-making process which was followed during the development of the OBC (see Figure 2-1).

2.1. JAQU guidance

This review has been undertaken with reference to the following guidance issued by JAQU:

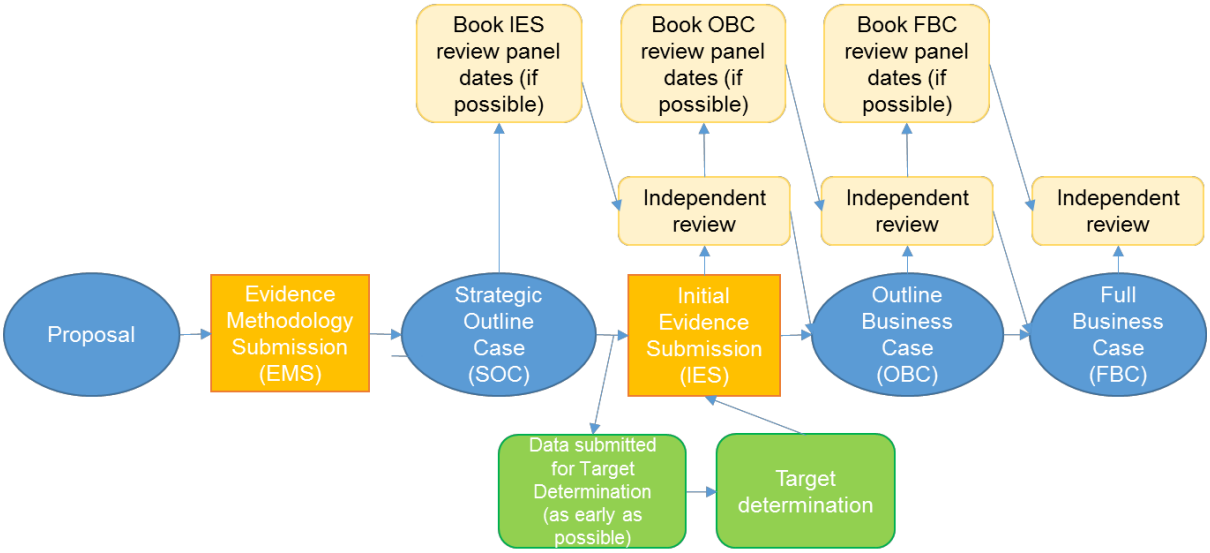
- Evidence – Transport and Air Quality;
- Options Appraisal; and
- Evidence – Supplementary Note of Sensitivity Testing.

It should be noted that the evidence base developed to support BANES' Local Plan has previously been reviewed at several stages as part of JAQU's Evidence Assurance Programme to ensure a "*reasonable level of robustness and quality given the timeframe*". This process has included a number of independent reviews of BANES' entire evidence base by a group of external experts called the Technical Independent Review Panel (T-IRP), who have reviewed the evidence at key milestones respectively (see Figure 2-1).

The following additional documents, produced as part of and following these reviews, were therefore also requested from and provided by BANES and included in the review:

- BANES T-IRP Responses June 19 DRAFT; and
- Technical Note: Response to T-IRP Comments on Gradient Adjustments (March 2019).

Figure 2-1 - JAQU's evidence assurance process



2.1.1. Success factors

JAQU's Option Appraisal guidance is built around the principle of primary and secondary critical success factors (CSFs), such that the primary CSF always take precedence – in this case, to achieve compliance in the shortest possible time. Business cases therefore need to assess the expected year in which compliance with NO_2 limits will be achieved for each option. Options that are not expected to deliver compliance in the same calendar year as the fastest combination of options should therefore be rejected.

While the primary CSF determines whether an option achieves the minimum requirements of the project, other CSFs should be used to determine which option would be best relative to other considerations. These secondary CSFs should be scored on a sliding scale (e.g. from 1 to 4) and options might not be automatically rejected for performing poorly against a certain scored CSF if they perform well against others. Options should be accepted/rejected based on the final combined weighted score of these CSFs.

2.2. Clean Air Zones

Charging Clean Air Zones are zones where vehicle owners are required to pay a charge to enter, or move within, a zone if they are driving a vehicle that does not meet the particular emission standard for their vehicle type in that zone. Defra / DfT's Clean Air Zone Framework[1] defines four classes of charging CAZ, each of which affect a different combination of vehicle types, as summarised in Table 2-1.

Table 2-1 - CAZ classes

CAZ	Buses	Coaches	Taxis & private hire	HGVs	LGVs	Cars
Class A	X	X	X			
Class B	X	X	X	X		
Class C	X	X	X	X	X	
Class D	X	X	X	X	X	X

2.3. Non-official guidance

Whilst not intended as legal advice, ClientEarth have issued guidance[2] to local authorities on the legal tests which should be applied to local air quality plans based on recent High Court judgements against the UK Government, namely that plans must:

1. Aim to achieve compliance as soon as possible;
2. Choose a route to compliance which reduces human exposure as quickly as possible; and
3. Ensure that compliance with the limit values is not just possible, but likely.

These three tests have been taken into account when considering the outcomes of this review.

2.4. Decision-making process

A high-level summary of the decision-making process followed during the development of BANES' OBC is set out below in Figure 2-2.

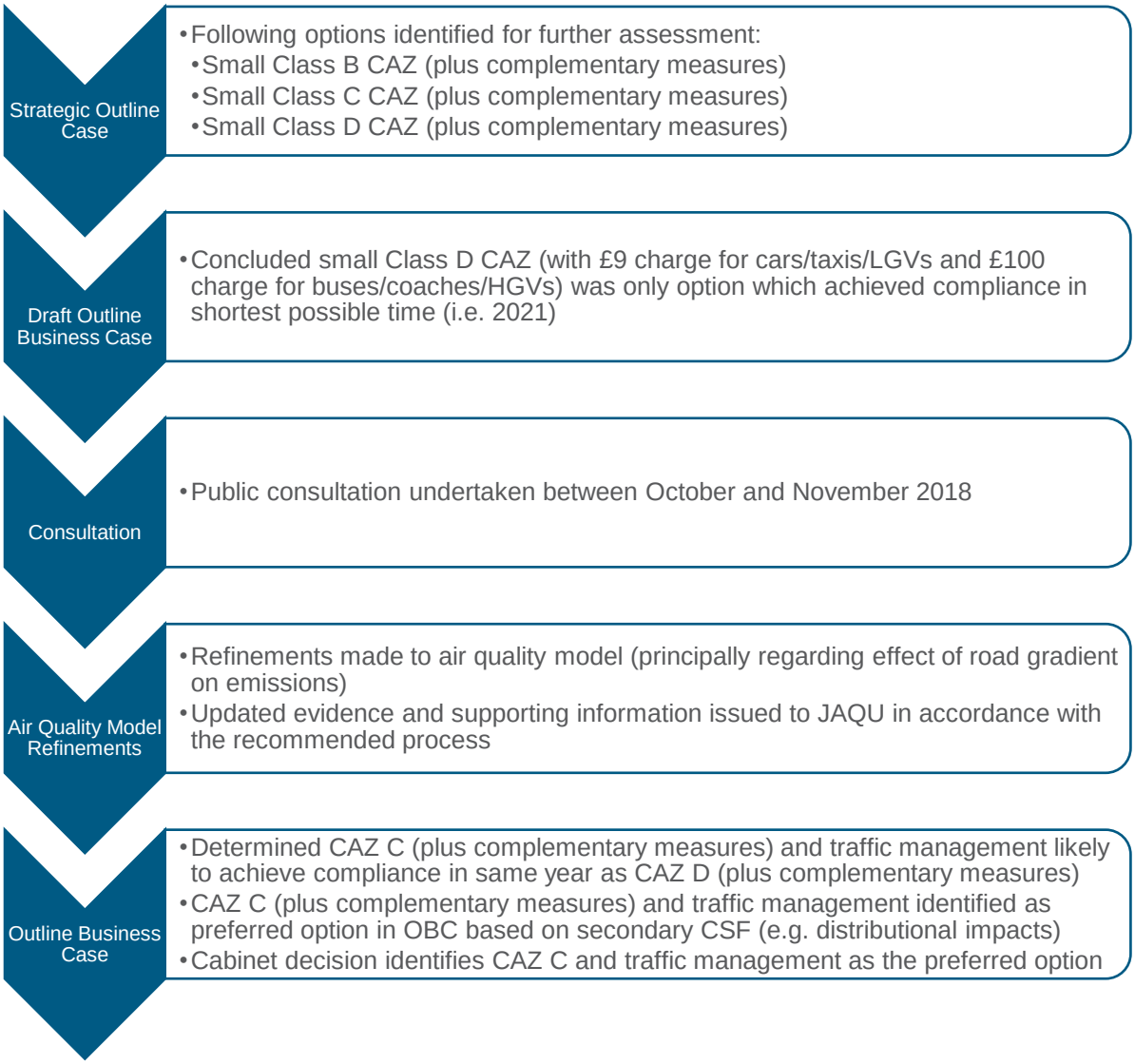
On 5th March 2019, Cabinet decided on the preferred CAZ option, which is a Class C CAZ with traffic management. This decision was made following the production of the OBC which demonstrated that two options were found to achieve compliance in the shortest possible time, and were therefore deemed to be equally effective in terms of compliance. These two options were:

- A Class C CAZ with traffic management (the OBC's preferred option and decided to be the Cabinet's preferred option); and
- A Class D CAZ.

A key focus of this review has therefore been on seeking to understand the model refinements made following the draft OBC, which resulted in the preferred option in the OBC changing from a Class D CAZ to a Class C CAZ with traffic management measures. The Class D CAZ proposal was initially considered to be the best performing option during the preceding SOBC phase.

[1] Defra / DfT (2017), Clean Air Zone Framework, Principles for setting up Clean Air Zones in England.
[2] ClientEarth (2018), What do ClientEarth's legal cases mean for Feasibility Studies for nitrogen dioxide compliance in England?

Figure 2-2 - Summary of OBC development process



3. Air quality review

The findings of this review are summarised in tabular format in Appendix A. **[**It is understood that the responses / clarifications to the medium/high risk items described in Appendix A, are currently being developed by Jacobs on behalf of BANES**]**. Those observations which are considered to be the most significant in terms of the primary CSF are discussed in more detail below – where 'most significant' relates to the confidence BANES can have that the preferred option identified in the OBC is likely to achieve compliance with the EU Limit Value in the 'shortest possible time'.

3.1. Review findings

3.1.1. Road gradient adjustment

It is acknowledged (including by JAQU) that road gradients can have a significant impact on vehicle NOx emissions, particularly for HDVs (heavy duty vehicles: HGVs, buses and coaches). JAQU's preferred approach for modelling road gradients is that set out in LAQM.TG16[3], however JAQU state that "*the limitations and uncertainties around this approach must be acknowledged"*.

Between the draft OBC and current OBC, a different and bespoke approach to reflecting the effect of road gradient on emissions was developed by the consultants employed by BANES to undertake the air quality modelling for the OBC. This was in an attempt to better account for the effect of uphill road gradients on emissions, which at some locations in Bath appear to result in substantially increased emissions. The objective was to improve the performance of the air quality model, which tended to substantially underpredict at locations with substantial uphill gradients. As this change affected the air quality modelling baseline results and Target Determination datasets, an updated set of evidence reports and supporting information were developed and issued to JAQU (additional to the defined stages of submission), in accordance with the recommended process, to seek JAQU comment on the approach prior to Final OBC submission.

The approach currently employed within the air quality modelling undertaken on behalf of BANES therefore multiplies estimated LGV and HGV emissions on selected uphill road sections by a factor of 7.392 to more closely match measured concentrations, whereas all other road traffic emissions are multiplied by a factor of 1.575. Which roads the two separate adjustments are applied to (compared to PCM exceedance locations) is not clear from the documents reviewed.

JAQU's Technical Independent Review Panel's (T-IRP) response to this approach, which they initially gave a 'red' risk rating to (i.e. significant development is needed in important areas), stated:

"*The calibration factor applied to LGV/HGV on gradient sections is far greater than an expected value as implied by other studies. As example, the study undertaken at Caerphilly suggests a calibration factor of approximately 2 to be appropriate for cars and for vans. It appears this factor has only been applied to LGV/HGV and no factor has been applied to cars within the fleet. There is concern that in not applying this factor to all diesel vehicles, this may be disproportionately over-estimating the impact of the CAZ C+ measure package".*

The T-IRP's concern was that the approach employed substantially increases the contribution made by LGVs and HGVs to NO_2 concentrations adjacent to certain road links, relative to other vehicle types (especially diesel cars). This in turn increases the modelled effectiveness of a Class C CAZ (which affects buses, coaches, taxis, PHVs, HGVs and LGVs).

In other words, by not applying the same magnitude of gradient adjustment to diesel cars, the assumed benefits of a Class C CAZ (i.e. the preferred option), at locations where the gradient adjustment is applied, is substantially increased. This therefore introduces uncertainty in the likely effectiveness of the preferred option.

Sensitivity testing was therefore undertaken on behalf of BANES in response to this comment, the outcomes of which reduced the T-IRP's perceived risk associated with this assumption to amber / green (i.e. some amendments/additions needed), however the T-IRP still stated that:

"*The panel remain unconvinced that the selected method for gradient uplift factors is the most robust. The sensitivity testing done in this area appears to demonstrate that it does not impact the outcome of the study. However, the panel recognise that this a topic with a high level of residual uncertainty.*

[3] Defra (2016), Local Air Quality Management Technical Guidance (LAQM.TG16).

Please ensure that monitoring on gradient roads is conducted and that the source apportionment on these roads is regularly evaluated during implementation. Errors in the source apportionment contribution at the modelling stage can be projected forward and so compound in the future. "

Therefore, whilst the T-IRP remain unconvinced of the robustness of the gradient correction approach adopted, they seem content that any associated risks are managed going forwards as part of the monitoring and evaluation process. There are two potential issues with this:

- The costs for monitoring and evaluation will be much higher (albeit these should be funded by JAQU); and
- It is unclear what BANES would be required to do if the preferred option once implemented is shown not to achieve compliance at locations where the bespoke gradient adjustment has been applied.

It would therefore seem prudent that additional work is undertaken to develop a contingency plan should monitoring and evaluation show the preferred option does not achieve compliance at locations where the assumed effectiveness of the preferred option has been influenced by the gradient adjustment approach applied. **[**It is subsequently understood that this work is currently in progress and will be included in the FBC**]**.

3.1.2. Background pollutant concentrations

It is common practice to verify and adjust (where necessary) background maps (i.e. the assumed contribution from sources which have not be specifically modelled), by comparing modelled concentrations (provided by Defra) with measured background concentrations in a particular area and deriving an appropriate adjustment factor.

This process has been undertaken within the air quality modelling undertaken on behalf of BANES, however in this instance, the comparison and adjustment factor applied (+41%) is based on a comparison at a single diffusion tube site in Bath. As such, it is considered that there is significant uncertainty as to whether:

- This comparison is truly accurate (given the uncertainty associated with diffusion tube measurements, which are typically adjusted for bias based on measurements undertaken at roadside locations where concentrations are much higher than at background sites); and/or
- Whether the adjustment factor derived at this single monitoring site is representative of the difference between estimated and real-world background concentrations across the study area as a whole.

3.1.3. Sensitivity testing

A large number of sensitivity tests have been undertaken and presented and discussed with the Sensitivity Testing Note and Analytical Assurance Statement (AAS), however other than the sensitivity testing for gradients discussed in Section 3.1.1 (which is not presented within either the Sensitivity Testing Note or AAS), no sensitivity testing is presented for the current preferred option (i.e. a Class C CAZ with traffic management), which is unusual. It is assumed therefore the sensitivity tests were undertaken when the preferred option was still a Class D CAZ.

3.2. Conclusions

It is considered that the identification of a charging Class C CAZ plus traffic management as the preferred option is particularly dependent upon the magnitude of the bespoke gradient correction factor derived by the consultants employed by BANES, in which there is significant uncertainty, and regarding which concerns have been raised by the T-IRP.

Because this approach significantly increases the relative contribution made by HGVs and LGVs on roads with uphill gradients, were this approach not applied, it is assumed that a charging Class C CAZ plus traffic management would potentially not be the preferred option (i.e. the Primary CSF of achieving compliance in the shortest possible time would potentially not be met).

In other words, by not applying the same gradient adjustment to diesel cars, the relative benefits of CAZ D and CAZ C are not compared on a common footing, which may unduly add uncertainty to the identification of the preferred option. Given this degree of uncertainty, it is unclear whether the preferred option as defined in the OBC is actually 'likely' (rather than just 'possible') to 'achieve compliance in the shortest possible time', thereby increasing the risk of potential challenge to BANES' current Clean Air Plan.

3.3. Recommendations

It is considered prudent to undertake the following to reduce the uncertainty and risk in the selection of BANES' current OBC preferred option:

- A map of the locations in the air quality study area where gradient adjustments were applied (compared to PCM exceedance locations) is required (and should be presented in AQ2) to understand the extent to which the road gradient approach applied affects modelled annual mean NO_2 concentrations in Bath and the estimated year of compliance for each option;
- Sensitivity tests of the CAZ C and CAZ D scenarios, with the same gradient adjustment factors applied to diesel cars as to LGVs and HGVs;
- Develop a contingency plan which could be employed should the implementation of the preferred option fail to achieve compliance at locations with substantial uphill road gradients. This should include how the monitoring and evaluation plan would identify if and when additional intervention was required, what this intervention might be and how it would be implemented and funded. **[**It is subsequently understood that this work is currently in progress and will be included in the FBC**]**; and
- Update the Sensitivity Testing Note and AAS with the results of sensitivity testing of the preferred option. **[**It is subsequently understood that this work is currently in progress and will be included in the FBC**]**.

Representatives of Atkins' Air Quality team are available to meet Bath and North East Somerset Council's air quality consultants to discuss the specifics of the additional modelling (should you wish to proceed with it) to best develop a way forward. We also recognise that some testing may already have been done since or around the revised OBC and would be happy to receive or discuss such information as this could change our recommendations above.

4. Traffic modelling review

The findings of the traffic modelling review are summarised in tabular format in Appendix B. **[**It is understood that the responses / clarifications to the medium/high risk items described in Appendix B, are currently being developed by Jacobs on behalf of BANES**].** Those observations which are considered to be the most significant in terms of the primary CSF are discussed in more detail below – where 'most significant' relates to the confidence BANES can have that the preferred option identified in the OBC is likely to achieve compliance with the EU Limit Value in the 'shortest possible time'.

4.1. Review findings

The main data utilised in the modelling is provided in the ANPR Data Analysis and Application and Appendix I Stated Preference survey report, with reference to its usage in the Modelling Methodology report. In general, the quality and quantity of the data utilised, and how it was processed and used is considered acceptable and provides confidence in the outputs of the modelling. A number of checks on the consistency of the data with the quoted sources and how it was used showed there to be no major concerns.

Based on the information provided in the modelling reports, the suitability of the base model to replicate observed traffic conditions and its ability to realistically respond to changes in infrastructure pricing and demand are considered acceptable. The primary calibration metric (volumetric check on traffic flows) generally looks to be acceptable, particularly with respect to LGV and HGV freight traffic.

A number of issues and questions potentially remain, these being:

4.1.1. Freight (prior) demand matrix data)

There is minimal detail on how the freight (prior) demand matrix data was developed before checking the assignment. There is no discussion on checks on trips ends, trip distribution and how the "post adjustment" process was applied.

A high-level review of the matrix prompts the following questions and observations:

- What age is the data and how much confidence do we have in it?
- There is also concern about applying NTEM and RTF growth to 2014 data to derive 2017 data.
- Does this meet local observations?
- The ANPR data has not been used to potentially check the freight trip patterns through the CAZ. How well does the model replicate these?
- Whilst the calibration of the model using volumetric traffic counts matches to a reasonable standard, further checks on the distribution patterns would provide confidence that the model is responding plausibly to how these trips will respond to the CAZ.

4.1.2. Stated preference surveys

The modelling relies on stated preference (SP) surveys to predict responses to the CAZ. This prompts the following questions and observations:

- Whilst this is presumably the only source of information currently available, are there any examples of how freight actually responds to a similar freight demand scheme elsewhere?
- Some of the assumptions for replacement rates of (in particular) Taxis, HGVs and buses (in excess of 80% within two years) would appear to be very high without evidence that this is plausible behaviour.
- Clarification of how changes from the SP survey have been applied to the model. The responses from the SP appear to be based on change in VKM but absolute changes in demand have been applied to the demand matrix.

4.1.3. Other issues and questions

- It may be prudent to check historic observed (short term) trends in travel to check if projected growth to 2021 is plausible. Does the annual increase in demand forecast met with recent observed on-site trends?
- It has been noted and agreed that the modelling incorporates no variable demand element. The highway model does include some VDM and realism testing, but these have not been utilised in the CAZ testing as it only applies to car trips.

4.2. Conclusions

It would be preferable to have some evidence of how freight traffic actually responds to a similar scheme, as opposed to reliance on a SP survey, but if this data is not available then the modelling approach undertaken is the most robust to provide information to the AQ modelling and is considered acceptable to assess the suitability of the preferred option. Whilst there are some localised issues, these would not appear to have a material impact on forecasting the impact of the scheme.

In general, the approach is considered the most proportionate and the execution of the modelling is reasonable.

4.3. Recommendations

It is considered prudent to undertake the following to reduce the uncertainty and risk in the selection of BANES' current OBC preferred option:

- Is there any (recent) evidence as to behavioural response to schemes similar to the CAZ? Reliance on SP surveys requires a high level of uncertainty as to actual behaviour;
- Additional clarification and detail on how well freight trip patterns have been replicated in the model and its reliability to predict changes from the CAZ;
- Confirmation of how the SP survey responses have been implemented in the model (change in distance or demand?); and
- A check on recent historic trends to confirm the reliability of near-term forecasts.

5. Strategic case and conclusions

The key inputs, assumptions and decision points taken in forming the current Bath CAZ proposal have been reviewed across three topic areas: air quality, traffic modelling and the strategic case. The purpose of this high-level independent and impartial review is to provide BANES with feedback whilst providing recommendations for further investigation. The review process does not provide technical or analytical assurance of the work undertaken.

The conclusions and recommendations provided in this high-level review are therefore based on BANES' and its consultants technical assessments undertaken to date, with acknowledgement of the uncertainty as to the degree of post-opening response.

Overall, the Options Assessment Report and Outline Business Case follow a structured, evidenced based approach in line with best practice in business case development.

It should be noted that modelling and forecasting assessments undertaken to produce the CAZ proposal are based on following best practice and statutory and non-statutory guidelines. The air quality review contains some specific recommendations that could increase the understanding of the potential impact of the options, we would be happy to discuss these further with your technical team.

It is recognised however that (a) the modelling and assessment work has been undertaken within the relatively short timescales prescribed by JAQU and (b) there appear to be specific, local factors which have a substantial influence on air pollutant concentrations in Bath (e.g. road gradient). It is acknowledged that BANES subsequently felt required to develop a bespoke approach for undertaking its air quality assessments; this review highlights some recommendations to amend this approach, with a view to ensuring that it becomes more robust against potential scrutiny,

Overall, the modelling/forecasting for the CAZ is providing forecasts of the response of road users to the introduction of charges to entering Bath. Road users may respond by upgrading vehicle fleets, choosing to pay the charge to enter the CAZ, change model of transport or deciding not to travel.

The London congestion charge is an example of the complexities of such forecasts, and variability of forecasts against real-world results, as traffic reduction levels far exceeded the forecast when the scheme went live. It should be noted however, that London congestion charge's key aim to reduction in traffic flows, whereas the CAZ aims relate to reductions in emissions.

The absence of an extensive pool of real-world evidence presents difficulty in evaluating the effects of delivering CAZs. The current lack of evidence on the response of road users when faced with the choice to pay a fee, upgrade their vehicles, or choose active modes, means that the technical forecasts undertaken for the CAZ proposal is subject to uncertainty.

A further consideration with CAZ is the extent and speed that commercial bodies and private individuals can adapt to any charge, e.g., how many vehicles are in the taxi fleet and how long would it take to convert that fleet?

The air quality review contains several recommendations for further work that could increase the understanding of alternative scenarios. We recognise that some of these issues may have already been or are currently being considered in technical work and would be happy to meet with your consultant team to discuss these areas in more detail.

Overall, with limited experience of charging schemes and emissions control schemes around the world there should be contingency plans to allow measures to increase the effectiveness should emissions not decrease as planned. **[**It is subsequently understood that this work is currently in progress and will be included in the FBC**]**.

Whilst there are limitations with any modelling of CAZ, we do recognise that that CAZ C, with traffic management, has the potential to use wider control of traffic flows to achieve the desired outcomes. It will be important that the traffic management approach implemented is able to respond and either restrict or relax the flow of general traffic as the real-world applications and impacts of the CAZ are monitored.

Critical to the successful implementation of CAZ will be robust monitoring and evaluation of the performance of the scheme. It is therefore prudent to have robust contingency plans alongside a willingness to review and alter the scheme should the real-world performance differ from significantly from the business case.

5.1. Next steps

BANES should reflect on the conclusions and recommendations presented in this high-level peer review. Whilst the degree of uncertainty relating to the absence of real-world evidence is important, actioning the

recommendations provided across the three topic areas will assist in adding clarity and confidence to the technical work undertaken in establishing the preferred CAZ option.

Atkins and BANES' consultants may wish to discuss and agree the specifics of the actions to best develop a way forward quickly and recognising that some testing may already have been done since or around the revised OBC.

Appendices

Appendix A. Air quality review summary

Report	Aspect	Observation	Comment	Risk of challenge	Suggestion
AQ2 Air Quality Modelling Methodology Report	Vehicle emission factors	Latest version of EFT available at time of study used (v8.0.1a)	Standard practice	Negligible	None
	Dispersion model	ADMS Roads (v4.1) used	Standard practice	Negligible	None
	Street Canyons	Advanced Street Canyon model (with parameters manually defined)	Model has been widely used for similar studies but is subject to some uncertainty. Manual definition of street canyon parameters introduces risk of error.	Low	None
	Base year	2017	Standard practice	Negligible	None
	Model domain	Defined as per JAQU guidance	Spatial extent considered likely to be sufficient, however it is unclear whether or not more minor roads have been specifically excluded as exceedances considered unlikely or they are just not included within the traffic model.	Low	None
	Receptor locations (PCM)	Receptors modelled at 2m in height and 4m from the roadside adjacent to PCM model links	Required by JAQU guidance	Negligible	None
	Met data	Data used from Filton airport for 2017	Considered appropriate	Negligible	None
	Surface roughness	0.1m for met site, 1.0m for dispersion site	Considered appropriate	Negligible	None

Traffic data	From SATURN (GBATH) traffic model	Considered appropriate	Negligible	None
Fleet composition	Derived from ANPR data	Considered appropriate	Negligible	None
Vehicle speed data	From SATURN (GBATH) traffic model (with manual adjustments)	Considered appropriate	Negligible	None
Gradient correction	LGV and HDV emissions adjusted upwards (by factor of 7.392) to account for increase in emissions when driving up hill	Bespoke approach subject to significant uncertainty	High	Undertake additional sensitivity testing
Background concentrations	Mapped background NO_2 concentrations uplifted by 41%	Uplift based on comparison at single diffusion tube site and therefore subject to significant uncertainty	Medium	Undertake additional sensitivity test for preferred option
Primary-NO_2	EFT used to calculate location specific values	Considered appropriate	Negligible	None
NOx to NO_2	NOx to NO_2 calculator used (v6.1)	Considered appropriate	Negligible	None
Model verification	Process in accordance with LAQM.TG16. Some monitoring sites excluded, with justification.	Considered appropriate	Negligible	None
Train emissions	Excluded	Considered appropriate	Negligible	None
Diurnal emissions profile	Based on generic traffic profile	Does not take into account local conditions and / or effects of varying speeds during different time periods	Low	None
Future fleet composition projections	2017 fleet project to 2021 using EFT	Considered appropriate	Negligible	None

AQ3 Air Quality Modelling Report	General	None	None	Negligible	None
Sensitivity Testing Technical Note	General	Sensitivity test results only presented for Do-Min and CAZ D scenarios	Ideally sensitivity tests would be undertaken for -preferred option (i.e. CAZ C + traffic management)	Medium	Undertake additional sensitivity testing of preferred option
Analytical Assurance Statement	General	No discussion of sensitivity testing undertaken in support of gradient adjustment.	Ideally sensitivity of modelling to gradient adjustment approach should be discussed	Medium	Include additional discussion and sensitivity testing undertaken of gradient adjustment.

Appendix B. Traffic modelling review summary

Report	Aspect	Observation	Comment	Risk of challenge	Suggestion
ANPR Data Analysis and Application	Use of ANPR Data	Data was only used to split existing demand matrices.	Could the ANPR data be used to check on the spatial distribution of the model? I.e. the proportion of through trips in Bath	Low	Use ANPR data to check model freight trip patterns
State Preference survey	Check of SP surveys	How did the local SP results compare with other similar surveys, were they consistent?	Checks undertaken, similar to TfL	Negligible	None
State Preference survey	Check of SP surveys	Is there any evidence that the SP responses are robust in practice?	The vehicle replacement rate for taxis, HGVs and buses are all in excess of 80% within two years, is this plausible? Is there evidence this will happen?	Medium	Without an actual CAZ elsewhere, this is difficult to confirm.
Local Model Validation Report (Addendum: LGV and HGV Validation)	Growth from 2014 to 2017	Adjustments were made from using NTEM 7.2 to generate a 2017 base.	Were any checks done on observed data to see if the demographic growth in NTEM or freight traffic forecasts are consistent with observed trips into the centre? Evidence in Bristol suggest that traffic into the centre has flatlined for a decade hence applying generic growth might not have been appropriate?	Low	Worth checking historic traffic trends, where available. Does this trend support modelled projection to 2021?
	Freight Demand and Trip Patterns	Minimal detail on what data was used to develop the (LGV & HGV) freight trip ends and spatial distribution.	What age is the data, what source? How confident are we in the information?	Medium	Further details requested

	ANPR Trip patterns	How well does the model replicate freight trip patterns	What is the observed vs modelled % volume of “through” trips in the CAZ? This data is available in the ANPR data but no check on how well the model replicates it.	Medium	High level check on trip patterns
	Model Adjustment	No explanation of HGV “post adjustment”.	Is this matrix estimation? What is the implication of the adjustment, the changes are very large?	Low	Further explanation of post adjustment or discussion of implications
	Freight proportion	Observed HGV % = 1.3-2% vs model = 2.8-5.5%.	The model has more than double the % HGVs. What are the implications of this? Does it result in an over prediction of the CAZ benefits?	Low	Explanation of implications
T3 modelling methodology report	Planned Infrastructure	There are no transport infrastructure schemes in Bath between 2017 and 2021.	Is this correct? It seems “odd” that nothing is planned or is being built in four years?	Low	Assume this is correct, but worth double checking
	LGV compliance	LGV modelled compliance is forecast to increase from 13% (2017) to 57% (2021).	Atkins cannot follow the calculation as default from EFT goes from ~50% (2017) to 80% (2021). Note that HGV is closer to default data	Low	Confirmation of the calculation
	VDM & Realism Testing	The modelling assumed fixed growth for 2021 and a highway only variable response for 2031.	The variable response only applies to the distributional of cars, which are not part of the response of the CAZ D testing. Is the VDM and subsequent realism testing actually being utilised?	Medium	This has been previously discussed by the review panel but clarity on what the model is actually doing