

Technical Note: Proposed Southampton CAZ

Project: 1863 Southampton CAZ
Client: Local Residents
Date: 31 August 2018

Introduction

1. Brook Cottage Consultants was instructed by a group of local residents to undertake a quick review of the proposals for a Clean Air Zone in Southampton.
2. This note has been written by Dr Claire Holman. Her air quality management experience is outlined in Appendix A.
3. The following documents have been reviewed:
 - Joint Air Quality Unit of Defra and DfT (JAQU), Guidance on Option Appraisal, undated;
 - JAQU, Guidance on Evidence –Transport and Air Quality, undated;
 - Ricardo Energy & Environment, Southampton Clean Air Zone – Air Quality Modelling Methodology Report (AQ2), 09.02.2018;
 - Ricardo Energy & Environment, Southampton Clean Air Zone – Air Quality Assessment options, 29.03.201;
 - Southampton City Council, Cabinet, Clean Air Zone Consultation, 19.06.2018;
 - Southampton City Council, Record of Executive Decision, 19.06.2018;
 - Southampton City Council and New Forest District Council, Clean Air Zone Draft Outline Business Case, 21.06.2018;
 - Consultation FAQs; and
 - Consultation questionnaire.
4. Several documents listed in the Joint Air Quality Unit (JAQU) guidance on transport and air quality evidence (see paragraph 4.2.2 Local authority deliverables) have not been provided. These include the draft local air quality modelling report (AQ3), and target determination outputs which were due to be submitted to JAQU as part of the initial evidence submission.

EU Air Quality Directive

5. The Secretary of State for Environment, Food and Rural Affairs is responsible for ensuring compliance with the Air Quality Directive in England and reporting compliance throughout the UK to the European Commission. This Directive was transposed into national legislation by the Air Quality Standards Regulation 2010 with separate Regulations for the devolved administrations.

6. The most recent submission to the European Commission¹ refers to the year 2016 and states.

“The UK met the limit value for hourly mean nitrogen dioxide (NO₂) in all but two zones.”

“Six zones were compliant with the limit value for annual mean NO₂. The remaining 37 exceeded this limit value.”

7. The 2017 Air Quality Plan (AQP) shows that with no new measures Southampton will remain non-compliant until 2024.
8. The 2015 AQP² required Southampton, and four other cities, to introduce a charging Clean Air Zone by the end of 2019 to bring forward compliance to 2020. The four classes of Charging CAZ were defined in the 2015 AQP³ as shown in Table 1. The Government’s CAZ framework provides more details, and includes motorcycles in the Class D CAZ⁴.

Table 1: Clean Air Zone (CAZ) Classes, extracted from the 2015 Air Quality Plan

Clean Air Zone Class	Vehicles included
A	Buses, coaches and taxis (including private hire vehicles)
B	Buses, coaches, taxis (including private hire vehicles) and heavy goods vehicles (HGVs)
C	Buses, coaches, taxis (including private hire vehicles), HGVs and light goods vehicles (LGVs)
D	Buses, coaches, taxis (including private hire vehicle), HGVs, LGVs and cars

9. The 2015 AQP envisaged that a Class B CAZ would be required in Southampton (2015 AQP Table 6, page 24) but:

“The class and extent of any Zone ultimately required in each city will depend upon the outcome of a more detailed local assessment” (paragraph 107).

10. This suggests the local authorities have some flexibility regarding the choice of CAZ.

11. The 2017 AQP states (paragraph 112)⁵:

“The UK government continues to expect local authorities in the five cities named above to deliver their Clean Air Zones by the end of 2019, with a view to achieving statutory NO₂ limit values within the shortest possible time, which the latest assessment indicates will be in 2020”.

12. On 19 December 2017 the Minister responsible for air quality, Thérèse Coffey MP, issued a direction under section 85 (7) of the Environment Act 1995 requiring Southampton City Council (SCC) to submit to the Secretary of State a full business case by 15th September as part of the 2017 AQP.

¹ Defra, Air Pollution in the UK 2016: Compliance Assessment Summary. September 2017.

² Paragraphs 55 & 56 and section 3.6, Defra, Improving air quality in the UK: Tackling nitrogen dioxide in our towns and cities, UK overview document, December 2015.

³ As above, Table 4.

⁴ Defra & DfT, Clean Air Zone Framework: Principles for Setting up Clean Air Zones in England, May 2017.

⁵ Defra and DfT, UK plan for tackling roadside nitrogen dioxide concentrations: Detailed plan, July 2017.

13. The Council acknowledge that the deadline for submission of the Full Business Case will not be achieved, but state that this delay will not affect the date of implementing the scheme and will therefore not impact on the Council's ability to achieve compliance with the nitrogen dioxide limits within the shortest possible time.⁶

14. The test of compliance with the Air Quality Directive (2008/50/EU) was defined by Mr Justice Garnham in *ClientEarth No 2* and re-iterated in *ClientEarth No 3*⁷ as a three-fold obligation as follows (my emphasis):

"As I explained in the November 2016 judgment, the proper construction of Article 23 imposes a three-fold obligation on the Secretary of State; he must aim to achieve compliance by the soonest date possible; he must choose a route to that objective which reduces exposure as quickly as possible; and that he must take steps which mean meeting the value limits is not just possible, but likely. It follows that the Secretary of State must ensure that there is in place a plan for each zone which meets the three-fold obligation."

15. In summary the "Garnham tests" of compliance are:

- Soonest date possible;
- Reduce exposure as soon as possible; and
- Must be likely not just possible.

16. These are the tests that should be used to assess the proposals for a CAZ by Southampton City Council (SCC).

17. Garnham J. also made it clear in *ClientEarth No 2* that costs cannot be taken into account unless there are two equally effective measures that will achieve compliance at the same earliest possible date.

Local Air Quality Management

18. In England there are two parallel air quality management systems:

- Compliance with the EU Directive
- Local air quality management (LAQM)

19. Part IV of the Environment Act 1995 sets out the statutory requirements for LAQM regime. It requires local authorities to review and assess air quality in their area against a series of air quality objectives.

20. For nitrogen dioxide (NO₂) these objectives have the same numerical value as the EU Directive but apply in different locations and have different requirements for accessing compliance.

⁶ Southampton City Council, Record of Executive Decision, 19 June 2018.

⁷ *Client Earth v Secretary of State for the Environment, Food and Rural Affairs (No. 2)* [2017] PTSR 203 [2016] EWHC 2740 (Admin) ("*ClientEarth No. 2*")⁷; and *ClientEarth (No. 3) v Secretary of State for Environment, Food and Rural Affairs & ors* [2018] EWHC 315 (Admin).

21. Local authorities are only required to work towards achieving the objectives; achievement is a policy target and, unlike the Directive's limit values, is not mandatory.
22. The Southampton CAZ baseline modelling⁸ shows that although in 2015 there are several locations where concentrations were greater than the objective ($40 \mu\text{g}/\text{m}^3$); by 2020 they will all achieve the objective with no additional measures. This is because older vehicles will be retired from the car fleet and replaced by newer models with lower emissions.

The consultation

23. Four options were modelled by Ricardo Energy & Environment on behalf of SCC which were:
 - Option 1 - City-wide CAZ B;
 - Option 1a – City-wide CAZ for heavy goods vehicles (HGVs) with bus restrictions and taxi incentives to upgrade;
 - Option 2 - City-centre CAZ A (i.e. affecting buses, coaches and taxis) plus some additional HGV measures; and
 - Option 3 - Non charging CAZ.
24. The consultation also considers four options, but one is different from those assessed in the Air Quality Assessment of Options Report⁸ and confusingly the numbering of the options has changed.
25. All consultation options apply city wide:
 - Option 1 - non charging measures;
 - Option 2 - HGV charging (i.e. a non-standard CAZ – see Table 1);
 - Option 3 - Class B CAZ; and
 - Option 4 - Class D CAZ
26. No evidence for Option 4 was provided in the Air Quality Assessment of Options Report⁸, nor in the Draft Business Plan⁹ that accompanied the consultation.
27. The preferred option in the consultation is for a city wide CAZ B. The reason given is

“The assessment process has identified one option that appears to achieve the objectives more effectively than the other options”.
28. No other, more detailed reasons were found in the consultation questionnaire.
29. The draft business case defines the preferred option as

“The option which meets all objectives of the local plan, i.e. delivers compliance with the AQD within the shortest possible time, increases likelihood of compliance and best

⁸ Ricardo Energy & Environment, Southampton Clean Air Zone – Air Quality Assessment of Options, 29 March 2018.

⁹ Southampton City Council and New Forest District Council, Clean Air Zone Draft outline Business Case, 21.06.2018.

meets the strategic, economic, commercial and financial management needs of the Local Plan”.

30. The 'Local Plan' referred to above is SCC's plan to improve local air quality to comply with the Air Quality Directive's requirements.
31. The economic assessment showed that for the four options (see paragraph 23) the economic benefits outweigh the costs. However this is not a relevant test of compliance with the Directive (see paragraphs 14 to 17).
32. Options 1 and 1a were assessed to have the greatest air quality benefits⁸. Non charging options are dependent on voluntary behaviour change and are considered to have greater uncertainty than charging options.

Option 1a

33. A HGV charging CAZ is not within the CAZ framework issued by Defra and DfT⁴. The framework has been produced to ensure a degree of consistency across the country, and could cause confusion for drivers.
34. Option 1a includes a traffic condition order to require buses to meet Euro VI emission standards when operating in the city centre.
35. Taxis would not have a formal restriction but would be given incentives to upgrade their vehicles. This would apply to taxis licensed by SCC. It is unclear as to how many and how often taxis and private hire vehicles from outside Southampton drive in the city. The air quality modelling did not directly assess the impact of taxis. There is no national database for taxis and private hire vehicles, and without such a database it is likely to be difficult to capture these vehicles in charging CAZs unless it is a Class D CAZ which includes all cars.
36. This option also has the disadvantage that it would not include any measures for coaches, but the contribution of these vehicles to NO₂ level is unclear as they were not explicitly modelled.

Uncertainty in Air Quality Modelling

37. Garnham J. found that the modelling for the 2015 AQP was “*overly optimistic*”. New modelling was undertaken for the 2017 AQP using more realistic, higher, emission factors for certain diesel cars and vans. It also used updated traffic forecasts. It might have been expected that with more realistic modelling that more vehicle types would need to be included in the Southampton CAZ to meet the limit value as soon as possible.
38. The 2015 NO₂ concentrations from Ricardo Energy & Environment's local model (RapidAir) were compared with SCC monitoring data. The Root Mean Square Error (RMSE) is an estimate of the uncertainty of a model and the closer to 0 µg/m³ the better the model performance. The RMSE for the Southampton model was 6.7 µg/m³ reducing to 5.3 µg/m³ when the outliers were removed. The New Forest model performed better with a RMSE of 3.3 µg/m³. Following the comparison of the monitored and modelled concentrations the Southampton model was

adjusted by a factor of 1.7456 in line with the methodology in statutory LAQM technical guidance¹⁰.

39. Table 2 below provides a summary of the annual mean NO₂ concentrations in the 2020 baseline (i.e. no CAZ), as predicted by the two models for those road links¹¹ where one or both of the models forecasts concentrations above the limit value (40 µg/m³)¹². The higher concentration for each road link is shown in bold.

Table 2: Comparison of national and local predicted 2020 NO₂ concentrations for road links where one model predicts an exceedance of the limit value

Road link ID	Road	Predicted annual mean NO ₂ concentrations in 2020 baseline (µg/m ³)	
		National model	Local model
In Southampton			
26062	M271	31.3	43.5
56347	A33 ¹³	46.3	41.1
6368	A35	43.6	38.1
73615	A35	48.9	38.4
75258	M27	37.4	48.7
Outside Southampton			
16321	M3	29.5	41.9
17793	M27	37.8	61.1
28018	M27	43.3	32.5
38107	M27	46.5	51.4
48064	M27	35.4	75.6
73609	M27	34.5	57.2
75259	M27	43.8	58.0

40. It shows up to 40.2 µg/m³ difference (link 48064) between the national and local models on a road link outside Southampton. This is approximately 100% of the limit value. The maximum difference in the predicted concentrations in Southampton is much smaller, but still large (12.2 µg/m³, equivalent to 31% of the limit value). The local detailed model predicted higher concentrations more frequently than the national model where there is an exceedance.
41. The difference between national and local modelling has resulted in what Defra call “target determination”. Should the target be determined based on the national or local model results? Or should the worst case from each model be used? It is understood that a Defra panel will decide the target where the difference is more than the ±30%¹⁴.

¹⁰ This is an acceptable adjustment factor.

¹¹ The road link numbers are those used by the Department of Transport to identify where traffic counts are undertaken (see <https://www.dft.gov.uk/traffic-counts/>).

¹² Extracted from Table 3, Ricardo Energy & Environment, Southampton Clean Air Zone – Air Quality Assessment of Options, 29 March 2018.

¹³ Wrongly labelled as A3024..

¹⁴ The Air Quality Directive requires compliance models to have an uncertainty within ±30%.

42. The Air Quality Assessment of the Options Report does not provide any information on what the target is or whether greater priority is given to the results of the national or local model.
43. The three links identified in the local modelling as exceeding the limit value in Southampton in 2020 are:
- 26062 M27
 - 56347 A33
 - 75258 M27
44. The r links identified in the national modelling as exceeding the limit value in Southampton in 2020 are:
- 56347 A33
 - 6368 A35
 - 73615 A35
45. The local model predicted lower concentrations on the A35, but higher concentrations on the motorways. An investigation to explain the divergence would be useful.
46. The source apportionment¹⁵ shows very much lower contributions from shipping than the PCM model. For the road link 56347 (A33) in 2020 the national model predicted 29.1% of the NO_x emissions will be from shipping whereas the Ricardo Report estimates that it will be 1.7%. Again this needs investigation.
47. Ricardo Energy & Environment are responsible for producing the Government's National Atmospheric Emissions Inventory and the national NO₂ modelling as well as the Southampton model and therefore are in a good position to be able to explain these differences.
48. Of the three roads identified as exceeding the limit value in the local modelling only the A33 is managed by SCC, the other two roads are managed by the Highways England and it is not clear what they intend to do to ensure compliance with the Directive, or whether Highways England will depend on the national model results
49. Highways England's 2017 Air Quality Strategy¹⁶ provides no clear actions to ensure the limit values are achieved in the shortest possible time. People live near the M27 and M271 and are likely to be exposed to high concentrations of NO₂.
50. One approach used to address the modelling uncertainty that has been adopted elsewhere¹⁷ is to use 90% of the limit value (i.e. 36 µg/m³) to indicate where there is a risk of exceeding the limit value. Another approach is to identified the uncertainty of the model and use this to identify where there is a risk of exceedence, Indeed, the Council's own draft outline business

¹⁵ Table 6, Ricardo Energy & Environment, Southampton Clean Air Zone – Air Quality Assessment of Options, 29 March 2018.

¹⁶ Highways England, Our strategy to improve air quality.

¹⁷ For example in the re-analysis of the Airports Commission's air quality report, undertaken by WSP for the Department for Transport. <https://www.gov.uk/government/publications/airport-expansion-further-updated-air-quality-re-analysis>.

plan, has adopted this approach when it says concentrations “above 35 µg/m³ places within the model’s level of uncertainty”¹⁸.

51. Using this approach with the results in Ricardo Energy & Environment’s assessment of options report shows there is a risk of the NO₂ levels exceeding 40 µg/m³ with the Class B CAZ at two locations Canute Road (not included in the national model) and Town Quay (part of the A33¹⁹).
52. The modelling provides no indication of the number of people that are at risk of being exposed to levels in excess of the limit. It should be noted that the World Health Organization²⁰ (WHO) the UK Committee on the Medical Effects of Air Pollutants²¹ have concluded that health effects due to exposure to NO₂ occur below the limit values. WHO are currently in the process of updating their air quality guidelines²².

Preferred option

53. The preferred option for the consultation is a city wide class B CAZ. This is predicted to reduce NO₂ concentrations by an average of 6.5 µg/m³.
54. Table 3 shows the predicted 2020 concentrations in the baseline and with the four options for the five links that either the local or the national (PCM) models have predicted an exceedance of the limit value in 2020.

Table 3: Impact of Options (local modelling)

Road link / name	Annual mean NO ₂ concentration in 2020 (µg/m ³)				
	2020 baseline (PCM)	Option 1 City-wide Class B CAZ	Option 1a City-wide HGV CAZ with bus restrictions and taxi incentives	Option 2 City-centre Class A CAZ with additional HGV measures	Option 3 Non charging CAZ
26026 / M27	43.5	40.2	40.3	41.6	41.7
567347 / A33	41.1	37.6	37.7	40.2	40.2
75258 / M271	48.7	42.6	42.7	46.6	46.7
6368 / A35	38.1	35.1	35.1	36.9	37.0
73615 / A35	38.4	33.9	33.9	36.2	36.2

55. None of the modelled options enable the limit value to be achieved along the M27 (link 26026) or M271 (link 75258). Along the A33 (link 567347) the Class B CAZ only reduces the NO₂ concentration to 37.6 µg/m³; this is within 6% of the limit value and within the uncertainty of the local model. Therefore there must be significant risk that this limit value will not be achieved. It may be possible, but not likely.

¹⁸ Page 14, Southampton City Council and New Forest District Council, Clean Air Zone Draft Outline Business Case 21.06.18.

¹⁹ The national model predicted 35.5 µg/m³ at this road link (38212) in the 2020 baseline.

²⁰ WHO, Review of evidence on health aspects of air pollution – REVIHAAP Project, Technical Report, 2013.

²¹ Public Health England, 2018, *Associations of long-term concentrations of nitrogen dioxide with mortality*, a report by the Committee on the Medical Effects of Air Pollutants.

²² <http://www.euro.who.int/en/health-topics/environment-and-health/air-quality/activities/update-of-who-global-air-quality-guidelines>.

56. The option modelling shows that the Class B CAZ option will reduce the NO₂ concentrations along the A35 by 3.0 µg/m³ (link 6368) and 4.5 µg/m³ (link 73615). If the 2020 NO₂ concentrations predicted by the PCM model better reflects reality than the local modelling a class B CAZ may not be sufficient to bring these links into compliance (the national modelling predicted 43.6 µg/m³ and 48.9 µg/m³ for links 6368 and 73615 respectively).

57. The draft business case²³ states that the primary objective of the CAZ is to achieve compliance with the limit value in the shortest possible time.

58. The secondary objectives are:

- Likelihood of compliance with EU AAQD NO₂ concentration limits within the shortest possible time
- Eliminate, reduce and mitigate unintended adverse consequences
- Assist other responsible authorities in delivering compliance
- Compliance with respect to Local Air Quality Management (LAQM)
- Ongoing improvements to public health
- Align with the Council's Strategies

59. The first secondary objective does not meet the 'Garnham tests' (see paragraph 15). This should be a primary objective. The last secondary objective is institutionally focused, is 'inward looking' and is not outcome based.

Class C or Class D CAZ

60. It is unlikely that a Class C or Class D CAZ would bring forward compliance with the limit value, because it could not be implemented earlier than a Class B CAZ. However, implementation of a Class C or D CAZ would result in larger NO₂ reductions across the city which would reduce exposure and benefit public health, and provide greater certainty that NO₂ levels in 2020 would be below the limit value.

Decision to remove a Class C or D CAZ from consideration

61. The Joint Air Quality Unit (JAQU) guidance requires a long list of measures to be compiled and from that a short list produced.

62. The Draft Outline Business Case²⁴ stated that

"The long list sifting exercise accessed a wide range of possible options that span the extent of the Clean Air Zone Framework's classification system and considered a number of geographical boundaries. The long list sifting recommended a City Wide Class B, a City Wide Class C and a Doughnut with City Wide Class B and City Centre Class D excluding the inner ring Road..."

²³ Section 1.11, Southampton City Council and New Forest District Council, Clean Air Zone Draft Outline Business Case, 21.06.2018.

²⁴Section 2.2 Southampton City Council and New Forest District Council, Clean Air Zone Draft Outline Business Case 21.06.18.

63. The baseline air quality modelling results suggested that the exceedence was smaller than anticipated and therefore could be addressed by a Class B CAZ, and the draft Outline business Case report stated that

“...any scheme more stringent than a Class B would not offer any benefits in addressing exceedances but increased negative economic impact on the city”

64. What this conclusion does not address is the uncertainty issue. The Garnham tests require the plan to be likely to ensure compliance with the limit value, not just possible.

65. The FAQs accompanying the consultation have the following statement:

“The study indicates that a Class B Clean Air Zone (which includes Buses, Coaches, Taxis and HGVs) is enough to reduce nitrogen dioxide to legal levels. Whilst it is evident that private vehicles, and in particular diesel cars, contribute significantly to emissions, we are steering away from including them in order not to cause any negative economic impact on the most vulnerable members of Southampton’s community.”

66. Mr Justice Garnham in *ClientEarth No2* addressed the question of proportionality, that is whether the government is required to ‘over achieve’ as follows;

“... There is no obligation in the Article, express or implied, that a Member State must take all imaginable steps aimed at reducing exposure. In fact, in my judgment, that would be disproportionate in the sense articulated above. But implicit in the obligation "to ensure" is an obligation to take steps which mean meeting the value limits is not just possible, but likely”.

67. For this reason it is important that the impacts of Class C and Class D CAZs are included in the evaluation of the best measures for Southampton, and that the modelling uncertainties are adequately taken into account to ensure compliance is likely.

Conclusions

68. There is large uncertainty in the modelling, and the national and local modelling predicts different annual mean NO₂ concentrations in 2015 and 2020. The Directive allows an uncertainty of ±30%. The national model is ±29% in the base year, 2015. Projecting future concentrations will have larger, but unknown, uncertainty.

69. The local modelling predicts that with either Class B CAZ (Option 1) or a HGV CAZ plus with bus restrictions and taxi incentives (Option 1a) the limit value will be achieved in 2020 at the key A33 link, but not at the M27 and M271 links, where there is public exposure nearby. The Highways England not SCC manages motorways and it is not clear whether Highways England intends to address this issue, or ignore it because the national modelling does not identify an exceedence in this location.

70. There is a risk that the limit value will be exceeded in 2020 even with a Class B CAZ along the A33, where the modelled concentration is within 6% of the limit value. A more stringent CAZ may be needed for it to be likely rather than just possible for the limit value to be achieved as required by the ‘Garnham tests’. Class C and D CAZ options need to be fully evaluated.

71. Additionally, If the PCM modelling better reflects reality than the local modelling, there is a risk of that a Class B CAZ may not be sufficient to meet the limit value in the shortest possible time along the A35.

Appendix A Experience Dr Claire Holman

Claire has worked on air quality management for over 35 years and is currently the Chair of the Institute of Air Quality Management (IAQM), the professional body representing air quality practitioners in the UK.

She has a Bachelor of Science degree in Molecular Science (chemistry) and a Doctorate for research into air pollution. She is a Chartered Scientist and Chartered Environmentalist, and a Fellow of both the IAQM and the Institution of Environmental Sciences.

She has experience of developing emission inventories, emission control, ambient monitoring, dispersion modelling, cost benefit and cost-effectiveness analysis and policy development. She has advised governments in Europe, Asia and Africa, as well as the European Commission and the Japan Clean Air Program on strategic air quality issues for the development of policy and new regulations.

She has a special interest in the impact of road transport on air quality, and has closely followed the development of vehicle emission legislation and its impact on emissions and air quality over several decades. She was, for example, a member of the Quality of Urban Air Review Group, established by the UK Department for the Environment, and contributed to its 1993 report on '*Diesel Vehicle Emissions and Urban Air Quality*'. She attended the European Commission's Motor Vehicle Emission Group for over a decade, and has undertaken technology assessments to inform the Commission's development of legislative proposals, including assessments on the feasibility of new vehicle pollution abatement technology and type approval test procedures. She was for many years a member of DfT's Clean Vehicles and Fuels Research Advisory Group.

She has undertaken a large number of air quality assessments for a wide range of land development projects and provided advice on local planning policies for the Greater London Authority and several London Boroughs and District Councils.

She led the IAQM working groups that produced "*Guidance on the Assessment of Dust from Demolition and Construction*" and "*Guidance on the Assessment of Mineral Dust Impacts for Planning*". She also contributed to the Environmental Protection UK / IAQM guidance "*Development Control: Planning for Air Quality*" and to the emerging Chartered Institute of Ecology and Environmental Management / IAQM document on assessing the air quality impacts on habitats due to be published in 2018.

She is an experienced expert witness having given evidence at a number of high profile planning inquiries and judicial reviews including acting as an expert for ClientEarth in its successful challenge of the Government's 2015 air quality plan.