

# Greater Manchester's Clean Air Plan to tackle Nitrogen Dioxide Exceedances at the Roadside

## Evidence Submission for a new GM Clean Air Plan

### Local Plan Air Quality Modelling Tracking Table (AQ1)



Salford City Council



Oldham Council

TRAFFORD COUNCIL



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# 1 Purpose of this Document

1.1.1 This document sets out feedback received from the government's Joint Air Quality Unit on the air quality modelling process and provides Greater Manchester's responses to that feedback.

1.1.2 This document is part of a suite of documents that have been produced to describe the transport and air quality modelling deliverables for the study. The documents in the series include:

- Local Plan Transport Modelling Tracking Table (T1), which demonstrates that the transport modelling requirements for the study are being met;
- Local Plan Transport Model Validation Report (T2), which explains in detail how the road traffic model was validated against real-world data;
- Local Plan Transport Modelling Methodology Report (T3), this document details the development of the future year without scheme model (Do Minimum);
- Local Plan Transport Model Forecasting Report (T4), which presents baseline and scenario forecasts for GM CAP;
- Local Plan Air Quality Modelling Tracking Table (AQ1)(this document), which demonstrates that the air quality modelling requirements for the study are being met;
- Local Plan Air Quality Modelling Methodology Report (AQ2), which provides an overview of the air quality modelling process;
- Local Plan Air Quality Modelling Report (AQ3), which provides details of modelled NO<sub>x</sub> and NO<sub>2</sub> concentrations for the base and forecast years, including comparisons with measured concentrations for the base year;
- Sensitivity Testing Report, which provides a summary of the sensitivity tests carried out on the core scenarios to test areas of uncertainty, understand whether the tests result in a positive or negative benefit and the scale of benefit; and
- Analytical Assurance Statement, consider the limitations, uncertainties and risks in the evidence base, and the implications of these for decision makers.

## 2 Clean Air Plan Overview

### 2.1 Background to the Clean Air Plan

- 2.1.1 In 2017 the Secretary of State (SoS) for Environment, Food and Rural Affairs issued directions under the Environment Act 1995 requiring many local authorities, to produce feasibility studies to identify the option which will deliver compliance with the requirement to meet legal limits for nitrogen dioxide (NO<sub>2</sub>) in the shortest possible time. The legal limit being defined as the long-term annual mean legal limit of 40 µg/m<sup>3</sup>.
- 2.1.2 In Greater Manchester (GM), the ten local authorities, the Greater Manchester Combined Authority (GMCA) and Transport for Greater Manchester (TfGM) are working together to develop a Clean Air Plan to tackle NO<sub>2</sub> exceedances at the roadside, herein known as Greater Manchester Clean Air Plan (GM CAP).
- 2.1.3 The development of the GM CAP is funded by government and is overseen by the Joint Air Quality Unit (JAQU), the joint Department for Environment, Food and Rural Affairs (DEFRA) and Department for Transport (DfT) unit established to deliver national plans to improve air quality and meet legal limits. The costs related to the business case, implementation and operation of the GM CAP are either directly funded or underwritten by government acting through JAQU and any net deficit over the life of the GM CAP will be covered by the New Burdens Doctrine, subject to a reasonableness test<sup>1</sup>.
- 2.1.4 In March 2019, the ten GM Local Authorities collectively submitted an Outline Business Case (OBC)<sup>2</sup> for the GM CAP to JAQU outlining a package of measures to deliver regional compliance with legal limits for NO<sub>2</sub> emissions in the shortest possible time.
- 2.1.5 In July 2019, the Environment Act 1995 (Greater Manchester) Air Quality Direction 2019 was made, which required all ten of the GM local authorities to implement a charging Clean Air Zone Class C<sup>3</sup> with additional measures. There was also an obligation to provide further scenarios appraisal information to demonstrate the applicable Class of Charging CAZ and other matters to provide assurance that the local plan would deliver compliance in the shortest possible time and by 2024 at the latest.

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<sup>1</sup> The new burdens doctrine is part of a suite of measures to ensure Council Tax payers do not face excessive increases. [New burdens doctrine: guidance for government departments - GOV.UK \(www.gov.uk\)](https://www.gov.uk/guidance/new-burdens-doctrine-guidance-for-government-departments)

<sup>2</sup> <https://cleanairgm.com/technical-documents/#outline-business-case>

<sup>3</sup> <https://www.gov.uk/government/publications/air-quality-clean-air-zone-framework-for-england/annex-a-clean-air-zone-minimum-classes-and-standards>

- 2.1.6 In March 2020, the Environment Act 1995 (Greater Manchester) Air Quality Direction 2020 was made, which required the submission of an Interim FBC (along with confirmation that all public consultation activity has completed) as soon as possible and by no later than 30 October 2020. The 2020 direction confirmed that legal duty remains to ensure the GM CAP (Charging Clean Air Zone Class C with additional measures) is implemented so that NO<sub>2</sub> compliance is achieved in the shortest possible time and by 2024 at the latest and that human exposure is reduced as quickly as possible. The Ministerial letter accompanying the March 2020 direction confirmed that the minister was satisfied that the main evidence queries from the July 2019 direction had been addressed.
- 2.1.7 A statutory consultation on the proposals took place in Autumn 2020.
- 2.1.8 The GMCA - Clean Air Final Plan report<sup>4</sup> on 25th June 2021<sup>5</sup> endorsed GM's Final CAP and policy in compliance with this direction, following a review of all of the information gathered through the GM CAP consultation and wider data, evidence and modelling work. Throughout the development of the previous Plan, the JAQU reviewed and approved all technical and delivery submissions. Within this document, this is referred to as the Previous GM CAP.

## **2.2 The Previous GM CAP and the impacts of Covid-19**

- 2.2.1 Under the Previous GM CAP, GM was awarded £123 million by government for funds aimed at encouraging vehicle upgrades to secure compliance and mitigating the impacts of the GM-wide CAZ. The funds included £15.4 million for bus retrofit, £3.2 million for bus replacement, £10.2 million for Private Hire Vehicles (PHVs), £10.1 million for Hackney Carriages, £7.6 million for Heavy Goods Vehicles (HGVs), £4.4 million for coaches, £2.0 million for minibuses and £70.0 million for Light Goods Vehicles (LGVs).
- 2.2.2 The June 2021 Clean Air Final Plan report set out that the Air Quality Administration Committee (AQAC) had the authority to establish and distribute the funds set out in the agreed GM Clean Air Plan policy. On 21 September 2021 the AQAC approved the establishment and distribution of the agreed bus replacement funds.
- 2.2.3 On 13 October 2021 the AQAC agreed the distribution of Clean Air funds set out in the agreed GM Clean Air Plan policy as follows:
- From 30 November 2021 applications for funding would open for HGVs.
  - From the end of January 2022 applications for funding would open for PHVs, Hackney Carriages, coaches, minibuses and LGVs.

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<sup>4</sup> <https://democracy.greatermanchester-ca.gov.uk/documents/s15281/GMCA%20210621%20Report%20Clean%20Air%20Plan%20-%20FINAL%20FINAL.pdf>

<sup>5</sup> Also considered by the GM authorities through their own constitutional decision-making arrangements.

2.2.4 On 20th January 2022, the AQAC considered the findings of an initial review of conditions within the supply chain of LGVs in particular following Covid-19 related impacts, which were impacting the availability of compliant vehicles and supply-side constraints resulting in price increases, particularly in the second-hand market<sup>6</sup>. The AQAC agreed that a request should be made to the SoS to pause the opening of the next phase of Clean Air Funds. This was to allow an urgent and fundamental joint policy review with government, to identify how a revised policy could be agreed to deal with the supply issues and local businesses' ability to comply with the GM CAP.

2.2.5 On 8th February 2022, the AQAC noted the submission of a report "Issues Leading to Delayed Compliance Based on the Approved GM CAP Assumptions". The report concluded that on balance, the latest emerging evidence suggested that with the approved plan in place, it was no longer likely that compliance would be achieved in 2024. Members also requested that arrangements were put in place for those vehicles owners who had already placed orders pending funding opening at the end of January to ensure they are not detrimentally impacted by the decision to pause the opening of the funds. Government subsequently issued The Environment Act 1995 (Greater Manchester) Air Quality Direction 2022<sup>7</sup> which confirmed that the March 2020 Direction had been revoked and required that by 1st July 2022 the GM authorities should:

- Review the measures specified in the local plan for NO<sub>2</sub> compliance and associated mitigation measures; and
- Determine whether to propose any changes to the detailed design of those measures, or any additional measures.

2.2.6 This Direction ('the Direction') also stated that the local plan for NO<sub>2</sub> compliance, with any proposed changes, must ensure the achievement of NO<sub>2</sub> compliance in the shortest possible time and by 2026 at the latest. It should also ensure that human exposure to concentrations of NO<sub>2</sub> above the legal limit is reduced as quickly as possible.

### **2.3 The Case for a new GM CAP**

2.3.1 On 1st July 2022, the AQAC noted that the 'Case for a new Greater Manchester Clean Air Plan<sup>8</sup> document and associated appendices would be submitted to the SoS as a draft document subject to any comments of GM Authorities.

2.3.2 On 17th August 2022, the AQAC agreed to submit the 'Case for a new Greater Manchester Clean Air Plan' to the SoS as a final version and approved the Case for a New Plan - Air Quality Modelling Report for submission to JAQU.

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<sup>6</sup> <https://democracy.greatermanchester-ca.gov.uk/documents/s18685/ARUP%20Technical%20Note.pdf>

<sup>7</sup> [The Environment Act 1995 \(Greater Manchester\) Air Quality Direction 2022 \(publishing.service.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/111111/The_Environment_Act_1995_(Greater_Manchester)_Air_Quality_Direction_2022_(publishing.service.gov.uk))

<sup>8</sup> [https://assets.cfmassets.net/tlpgbv1k6h2/7jtkDc5AODypDQlw0cYwsl/67091a85f26e7c503a19ec7aeb2e8137/Appendix\\_1\\_-\\_Case\\_for\\_a\\_new\\_Greater\\_Manchester\\_Clean\\_Air\\_Plan.pdf](https://assets.cfmassets.net/tlpgbv1k6h2/7jtkDc5AODypDQlw0cYwsl/67091a85f26e7c503a19ec7aeb2e8137/Appendix_1_-_Case_for_a_new_Greater_Manchester_Clean_Air_Plan.pdf)

- 2.3.3 The 'Case for a new Greater Manchester Clean Air Plan' set out that challenging economic conditions, rising vehicle prices and ongoing pandemic impacts meant that the original plan of a GM-wide charging CAZ was no longer the right solution to achieve compliance, instead proposing an investment-led, non-charging GM CAP.
- 2.3.4 The primary focus of the 'Case for a new Greater Manchester Clean Air Plan' was to identify a plan to achieve compliance with the legal limit value for NO<sub>2</sub> in a way that considered the cost-of-living crisis and associated economic challenges faced by businesses and residents. This would be achieved through an investment-led approach combined with wider measures that the GM Authorities are implementing and aimed to reduce NO<sub>2</sub> emissions to within legal limits, in the shortest possible time and at the latest by 2026.
- 2.3.5 The 'Case for a new Greater Manchester Clean Air Plan' proposed using the remaining funding that the government has awarded to GM for the Previous GM CAP to deliver an investment-led approach to invest in vehicle upgrades, rather than imposing daily charges, and deliver new Zero Emission Buses (ZEBs) as part of the Bee Network<sup>9</sup> (a London-style integrated transport network for GM). The new plan would ensure that the reduction of harmful emissions would be at the centre of GM's wider objectives. Within this document, this plan is referred to as the 'Investment-led Plan'.
- 2.3.6 The GM Authorities committed to a participatory approach to the development of the new plan to ensure that the GM Authorities' proposals would be well-grounded in evidence in terms of the circumstances of affected groups and possible impacts of the new plan on them, and therefore the deliverability and effectiveness of that plan.
- 2.3.7 Between August and November 2022, the GM Authorities carried out engagement and research with key stakeholders - vehicle-owning groups and representatives of other impacted individuals, such as community, business, environment and equality-based groups. This activity included targeted engagement sessions with all groups, and an online survey and supporting qualitative research activity with vehicle-owning groups.
- 2.3.8 Input from those engaged informed the ongoing policy development process as the GM Authorities developed the package of measures forming the Investment-led Plan.

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<sup>9</sup> The Bee Network is Greater Manchester integrated transport system joining together bus, Metrolink, rail and active travel  
<https://tfgm.com/corporate/business-plan/case-studies/bee-network>

## 2.4 The Investment-led Plan and the impact of bus retrofit issues

2.4.1 Having submitted the 'Case for a new Greater Manchester Clean Air Plan'<sup>10</sup> in July 2022, the GM Authorities were asked by government in January<sup>11</sup> 2023 to:

- *Provide modelling results for a benchmark CAZ to address the persistent exceedances identified in central Manchester and Salford, in order for these to be compared against your proposals.*
- *Identify a suitable approach to address persistent exceedances identified in your data on the A58 Bolton Road in Bury in 2025, and to propose a suitable benchmark.*
- *Set out how the measures you have proposed will be modelled and evidenced overall, and to ensure that they are modelled without any unnecessary delay.*

2.4.2 The GM Authorities undertook the work required to supply this further evidence and on 8th March 2023 submitted the report 'Approach to Address Persistent Exceedances Identified on the A58 Bolton Road, Bury'<sup>12</sup>. GM Authorities also worked to address the remaining two requests from government by June 2023 on the basis of providing further information to support its Investment-led Plan and testing the proposal against a suitable benchmark CAZ, herein referred to as the 'CAZ Benchmark'.

2.4.3 In April 2023, government advised TfGM that it was to pause any new spending on bus retrofit as it had evidence that retrofitted buses have poor and highly variable performance in real-world conditions<sup>13</sup>. This new evidence followed a JAQU-funded study to quantify nitrogen oxide (NO<sub>x</sub>) and NO<sub>2</sub> emissions from buses under real-world driving conditions in three cities across the UK, including Manchester (monitoring took place in Manchester City Centre between 21st November and 12th December 2022). The monitoring indicated that retrofitted buses were not reducing emissions as expected, with significant variation in performance between bus models with retrofit technologies. Furthermore, emissions of primary-NO<sub>2</sub> (as opposed to NO<sub>x</sub>) were highly variable, potentially worsening roadside NO<sub>2</sub> concentrations despite an overall reduction in NO<sub>x</sub> emissions.

2.4.4 Government therefore commenced a six-month focused research programme to quickly investigate the causes of this poor performance and scope how it could be improved, which was anticipated to be reported in Autumn 2023.

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<sup>10</sup> [https://assets.ctfassets.net/tlpgbv1k6h2/7jtkDc5AODypDQlw0cYwsl/67091a85f26e7c503a19ec7aeb2e8137/Appendix\\_1\\_-\\_Case\\_for\\_a\\_new\\_Greater\\_Manchester\\_Clean\\_Air\\_Plan.pdf](https://assets.ctfassets.net/tlpgbv1k6h2/7jtkDc5AODypDQlw0cYwsl/67091a85f26e7c503a19ec7aeb2e8137/Appendix_1_-_Case_for_a_new_Greater_Manchester_Clean_Air_Plan.pdf)

<sup>11</sup> <https://democracy.greatermanchester-ca.gov.uk/documents/s24937/Appendix%201.%20Ministerial%20Letter%20to%20GM%20with%20attachment.pdf>

<sup>12</sup> <https://democracy.greatermanchester-ca.gov.uk/documents/s24939/Appendix%203.%20GM%20CAP%20A58%20Bury%20Measure%20Report%20DRAFT%20for%20AQAC%20Approval%20Feb%202023.pdf>

<sup>13</sup> <https://democracy.greatermanchester-ca.gov.uk/documents/s27699/Appendix%201.%20Letter%20from%20DfT%20to%20Greater%20Manchester%20regarding%20Bus%20Retrofit%20Update.pdf>

- 2.4.5 In the light of government's new evidence, JAQU issued revised general guidance<sup>14</sup> to authorities producing CAPs nationwide. In summary, this required that air quality modelling should no longer assume any air quality benefits from a retrofitted bus.
- 2.4.6 GM incorporated the revised guidance, as agreed with JAQU, into the modelling which underpins the development of its CAP to produce a report that appraises the ability of the Investment-led Plan and the CAZ Benchmark to deliver compliance with the legal limit value in the shortest possible time and by no later than 2026. The key findings from government's six-month focused research programme were not available at the time this work was undertaken.
- 2.4.7 The first version of the *Appraisal Report* and supporting documentation was submitted to government in December 2023. The *Appraisal Report* concluded that GM's Investment-led Plan can deliver compliance in 2025 and performs better than a CAZ Benchmark.

## **2.5 Key developments since December 2023 submission**

- 2.5.1 Since the submission of evidence to JAQU in December 2023 there have been a number of key developments, resulting in a need to update the modelling, the *Appraisal Report* and supporting documentation.
- 2.5.2 Further modelling was undertaken in Summer 2024 to consider and address the following key developments:
- Delay to Stockport all-electric bus depot;
  - Changes to bus fleets (operational and planned); and
  - Correction to Euro V retrofit bus modelling emission values.
- 2.5.3 Drafts of the *Appraisal Report* and supporting documentation were updated to take account of the key developments and the Summer 2024 modelling, in preparation for submission to government. These updates did not change GM's conclusion that the Investment-led, non-charging plan can deliver compliance in 2025 and performs better than a CAZ Benchmark.

## **2.6 Developments following Summer 2024 modelling**

- 2.6.1 Following the substantial drafting to update the *Appraisal Report* and supporting material (to address the key developments since the December 2023 submission), two additional issues have arisen.
- 2.6.2 Firstly, a risk identified in the December 2023 submission "Delays to bus depot electrification" has materialised and there is now a delivery delay to the electrification of Queens Road depot. This was due to take place by January 2025, which was the assumed delivery date in the modelling of the Investment-led Plan.

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<sup>14</sup> Bus Retrofit Update - Technical Guidance for Local Authorities, JAQU Guidance, May 2023



- 2.6.3 This poses a significant challenge to achieving compliance in 2025, as 73 ZEBs are to be operated out of Queens Road depot. The issue affects 12 bus services, which run through 17 forecast 'Do Minimum' exceedance sites in 2025.
- 2.6.4 Secondly, in July 2024 National Highways also advised TfGM that the temporary speed limit on the M602 is to be removed, and the 70mph speed limit reinstated. The M602 temporary speed limit is assumed to be in place in the Investment-led Plan modelling assumptions.
- 2.6.5 The implications of these two issues are addressed in the Supplementary Appraisal Report, included as part of this evidence submission documentation. Therefore, the Appraisal Report and associated documentation, including this report, should be read in conjunction with the Supplementary Appraisal Report.
- 2.6.6 In addition, since the drafting of the Appraisal Report and supporting material, government published the 'Bus Retrofit Performance Report'<sup>15</sup> on the 12th September 2024. The key findings of this report include that the retrofit technology fitted onto retrofitted buses is not reducing NOX emissions to the levels expected and retrofit performance is highly variable. These findings are consistent with the guidance issued in May 2023. Therefore, the publication of the study findings has no impact on the Investment-led Plan, the Appraisal Report and supporting material.

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<sup>15</sup> <https://assets.publishing.service.gov.uk/media/66e1ab11951c1776394a003c/bus-retrofit-performance-24.pdf>

### 3 Local Air Quality Modelling Tracking Table (AQ1)

These tables incorporate comments from the TIRP based on the December 2023 submission, and resultant updates to the modelling and sensitivity testing elements of the appraisal.

#### A: Air Quality Model Specification

A	Air Quality Model Specification	LA Proposal Description (OBC 2019)	JAQU Review Comments (OBC 2019)	2021 Updates to Modelling for Full Business Case	September 2024 Evidence for a new GM CAP: CAZ Benchmark	September 2024 Evidence for a new GM CAP: Investment-led Plan
<b>A1</b>	<b>Model Selection</b>					
A1.1	Details of emissions model based on COPERT 5 emissions to be used.	<p>EFT 8.0.1 has been used to calculate emissions for the TfGM EMIGMA process. It is understood that the emissions and all associated assumptions are not altered from EFT7.4a, with only additional functionality added. The projection of fleet mix was undertaken before the new tool became available.</p> <p>A review of the fleet projections indicates that method applied tends to fall between the two projection options in EFT.</p>	OK	The modelling has been updated to incorporate EFT v9.1a. It is not possible to update to EFT v10 as that is not compatible with a 2016 baseline. A sensitivity test has previously been carried out to assess the possible implications of applying EFT v10 which showed that some reductions in emissions could be expected, providing greater confidence that compliance can be achieved as forecast.	The modelling has been updated to incorporate EFT v9.1a. It is not possible to update to EFT v10 or later versions, because they are not compatible with a 2016 baseline.	A sensitivity test has been carried out to assess the possible implications of applying EFT v12 (Copert v5.6) which showed that some reductions in emissions could be expected if v12 was used compared to those in EFTv9 (Copert v5.0).
A1.2	Gradient effects included?	<p>Gradient effects will not be taken into account directly, but local verification has been applied to Mottram. If the assessment process identifies key areas of AQ risk, then local modelling will be considered at that stage.</p> <p>Not updated during OBC or for Consultation Option. Key final exceedance sites were reviewed and are not affected by gradient.</p>	OK. Please keep us in the loop with any changes to modelling (e.g. if gradient effects are applied at a later date)	No changes, approach is as at OBC.	No changes, approach is as at OBC.	
A1.3	Details of air quality dispersion model to be used.	ADMS Urban version 4.0.1.0	OK	No response required.	No response required.	
A1.4	Canyon effects included?	Yes, within the Manchester city centre Inner Relief Road. In all other areas the Canyons module is not used. Further information is provided to the approach in AQ3.	OK	No response required.	No response required.	
A1.5	Tunnels and flyovers included?	<p>Significant elevated sections modelled, no significant tunnels. Elevated roads:</p> <ul style="list-style-type: none"> <li>A627, Oldham Way, Oldham</li> <li>A57(M), Mancunian Way, Manchester</li> </ul>	OK	No response required.	No response required.	No changes, approach is as at OBC

A	Air Quality Model Specification	LA Proposal Description (OBC 2019)	JAQU Review Comments (OBC 2019)	2021 Updates to Modelling for Full Business Case	September 2024 Evidence for a new GM CAP: CAZ Benchmark	September 2024 Evidence for a new GM CAP: Investment-led Plan
		<ul style="list-style-type: none"> <li>M60 Junction 10-11, Salford/Trafford</li> <li>Figure added into A2 for OBC. Elevated sections applied into ADMS.</li> </ul>	Please confirm methodology used in AQ methodology document (AQ2)	No changes, approach is as at OBC		
<b>A.2 Air Quality Model Domain</b>						
A2.1	Please provide a map (in report) showing model domain in relation	<p>Full coverage of GM, consistent with the Saturn modelling described in T1. Map to be provided in modelling methodology reports.</p> <p>The currently issued maps show all of the modelled roads, which extend ~200m beyond the GM boundary. No modelling of receptors has taken place beyond the GM boundary.</p>	OK	No response required.	No response required.	
A2.2	Locally identified exceedance locations included?	Yes, using AQMA and monitoring to define receptor locations. Initial modelling results have been used to identify roads where PCM TD receptors in 2021 are >35ug/m <sup>3</sup> . Receptors at junctions of these roads have then been manually selected, based on building usage in Ordnance Survey Address Base+ datasets.	OK	No response required.	No response required.	
A2.3	Domain includes displacement routes?	<p>GM Saturn model will represent re-routing, although as the model extends beyond the GM boundary, it becomes less spatially detailed. The response of the model to any re-routing measures will be reviewed, particularly at the edge of the model domain.</p> <p>The maps show all of the modelled roads, which extend ~200m beyond the GM boundary. No modelling of receptors has taken place beyond the GM boundary.</p> <p>The preferred options which are GM-wide limit the potential for re-routing, and the model is not capable of handling regional scale re-routing.</p>	<p>OK</p> <p>You may like to consider sensitivity analysis focussed on the edges of the model domain where the model is less well verified</p>	<p>No response required.</p> <p>We have not progressed this sensitivity testing because none of the last points of exceedance were at or close to the edge the model domain.</p>	Yes, because the modelling covers the whole of GM, displacement routes associated with the local traffic management measures at A57 Regent Road, Salford, and the St John's area in Manchester have been included for the Investment-led Plan modelling, and around the IRR boundary for the CAZ benchmark test are all included.	
<b>A.3 Air Quality Model Receptor Locations</b>						
A.3.1	Details of receptor grid size and other receptor locations.	<p>As per JAQU requirements, (ie 10 x 10m grid close to roads), with 50m spacing &gt;50m from modelled roads.</p> <p>ADMS intelligent gridding is being used for all modelled roads, with a regular grid beyond.</p> <p>Model run times are being reviewed to determine the balance of resolution that is feasible.</p> <p>This will give a full spatial output to enable the distributional analysis and population weighted means, including locations that are not in exceedance.</p>	OK	No response required.	No response required.	

A	Air Quality Model Specification	LA Proposal Description (OBC 2019)	JAQU Review Comments (OBC 2019)	2021 Updates to Modelling for Full Business Case	September 2024 Evidence for a new GM CAP: CAZ Benchmark	September 2024 Evidence for a new GM CAP: Investment-led Plan
A.3.2	Methods to be used to assign subset of receptors for AQD assessment	<p>As per JAQU requirements, 4m back from PCM links at 2m height, representing 100m stretches of road &gt;25m from major junctions. Plus other locations beyond the PCM network meeting these criteria.</p> <p>The mid point of each link has been autogenerated using GIS on both sides of the road. These points were then manually reviewed and excluded based on professional judgement.</p> <p>Where a PCM link is represented by multiple SATURN links and receptors, the maximum receptor location will be used. Clarification from JAQU will be required whether which road operator (HE or LA) is responsible for locations close to the strategic road network.</p>	OK	No response required.	No response required.	

## B: Air Quality Base Year Modelling

B	Air Quality Base Year Modelling	LA Proposal Description (OBC 2019)	JAQU Review Comments (OBC 2019)	2021 Updates to Modelling for Full Business Case	September 2024 Evidence for a new GM CAP: CAZ Benchmark	September 2024 Evidence for a new GM CAP: Investment-led Plan
<b>B.1</b>	<b>Model Selection</b>					
B1.1	Base year to be used.	2016	OK	No response required.	No response required.	
B1.2	Details of Meteorological data to be used.	Manchester airport, hourly sequential met data obtained from Manchester Airport. Data with null values of 00 set to -999 (unknown).	OK	No response required.	No response required.	
<b>B.2</b>	<b>Traffic Input Data</b>					
B2.1	Source of traffic activity data and vehicle types.	<p>GM Saturn model (see T1), and ANPR cross referenced with bus, black cab and PHV licensing information.</p> <p>Car (petrol &amp; diesel), vans (diesel), HGVs (diesel), buses. Coaches and motorcycles are not represented within the model.</p> <p>It will not be possible to incorporate coaches into the modelling assessment process at this stage within programme. We will analyse available datasets to understand the sensitivity of the modelling to this.</p> <p>No data available at this stage to understand total coach flows or ages.</p>	OK – should undertake a sensitivity test to estimate the potential impact of not explicitly modelling coaches	Since OBC, we have collated further information about the coach fleet, set out in <i>Technical Note 4: Analysis of the Coach Market</i> . This showed that the coach fleet is very small in comparison with the HGV fleet and therefore that it is not likely that the impact	No further update for Base year. Since OBC, we have collated further information about the coach fleet, set out in <i>Technical Note 4: Analysis of the Coach Market</i> . This showed that the coach fleet is very small in comparison with the HGV fleet and therefore that it is not likely that the impact of not explicitly modelling coaches is significant.	

B	Air Quality Base Year Modelling	LA Proposal Description (OBC 2019)	JAQU Review Comments (OBC 2019)	2021 Updates to Modelling for Full Business Case	September 2024 Evidence for a new GM CAP: CAZ Benchmark	September 2024 Evidence for a new GM CAP: Investment-led Plan
		ANPR analysis has identified that coaches and minibuses combined form less than 1% of traffic flows. There is no transport demand data to enable explicit modelling of coaches or minibuses, and they are not considered material to the modelling approach or assessment of the CAP.		of not explicitly modelling coaches is significant.		
B.2.2	Details of representation of road locations (achieved through use of a georeferenced transport model or another approach?).	Saturn model converted to real-world alignments using OS ITN.	OK	No response required.	No response required.	
B.2.3	Source of vehicle fleet composition information (local/EFT).	ANPR for 2016 for urban network, EFT for Motorways	OK	No response required.	No response required.	
B.2.4	Source of vehicle speed information.	<p>Modelled 2016 journey times from the Saturn model have been validated against Trafficmaster data collected during the period September 2013 to August 2014 for a selection of radial/orbital and motorway routes within the county, as described in the <i>Transport Model Validation Report (T2)</i>. We will consider updating the journey time validation results in the <i>T2 Report</i> to make use of observed data for 2016, if possible.</p> <p>Trafficmaster data has been used to confirm speeds at the worst case exceedance location where local knowledge and experience contradicted the Saturn model outputs.</p>	OK	No response required.	No response required.	
<b>B.3</b>	<b>NOx/NO2 emissions assumptions</b>					
B.3.1	Source of primary NO <sub>2</sub> emission fractions (f-NO <sub>2</sub> ).	<p>NAEI f-NO<sub>2</sub> and EFT 9.1a NOx emission factors</p> <p>The modelling process was developed before EFT 8.0.1 became available.</p>	OK	The modelling has been updated to incorporate EFT v9.1a. It is not possible to update to EFT v10 as that is not compatible with a 2016 baseline. A sensitivity test has been carried out to assess the possible implications of applying EFT v10 which showed that some reductions in emissions could be expected, providing greater confidence that compliance can be achieved as forecast.	<p>The modelling has been updated to incorporate EFT v9.1a. It is not possible to update to EFT v12 as that is not compatible with a 2016 baseline. A sensitivity test has been carried out to assess the possible implications of applying EFT v12 which showed that some reductions in emissions could be expected, providing greater confidence that compliance can be achieved as forecast.</p> <p>The JAQU guidance on modelling retrofit buses specified an increased proportion of f-NO<sub>2</sub> for the Core assumption of 35.8% for retrofitted vehicles, which has been applied to forecast year scenario buses.</p> <p>It is not possible to ascertain whether there were retrofit buses in the 2016 Base year but numbers would have been very small if any at all. The large scale the bus retrofit programmes, such as JAQU's Clean Bus Technology Fund (CBTF) and the CAP's Clean Bus Fund did not</p>	

B	Air Quality Base Year Modelling	LA Proposal Description (OBC 2019)	JAQU Review Comments (OBC 2019)	2021 Updates to Modelling for Full Business Case	September 2024 Evidence for a new GM CAP: CAZ Benchmark	September 2024 Evidence for a new GM CAP: Investment-led Plan
					commence until 2017 or 2020 respectively. It has been assumed no retrofit buses were operating in the Base Year of 2016 and no updates are required.	
B.3.2	Details of method used to calculate projections for f-NO <sub>2</sub> and to calculate NO <sub>2</sub> concentrations from NO <sub>x</sub> concentrations.	<p>Defra NO<sub>x</sub> to NO<sub>2</sub>, using link specific f-NO<sub>2</sub> from EMIGMA</p> <p>The NAEI f-NO<sub>2</sub> factors were to determine the proportion of emissions from every link by vehicle type and Euro class based on local fleet mixes for the relevant year.</p> <p>The link specific total NO<sub>x</sub> and f-NO<sub>2</sub> (as NO<sub>2</sub>) emissions for every road link were input to the dispersion model. The outputs of the dispersion model for NO<sub>x</sub> and NO<sub>2</sub> at every monitoring site and receptor could be used to calculate the f-NO<sub>2</sub> for every output location.</p>	OK	No response required.	No response required.	
<b>B.4</b>	<b>Non-Road Transport Modelling</b>					
B.4.1	Details of modelling for non-road transport sources.	Defra background map (2015 based) have been used, with only road traffic emissions modelled explicitly in ADMS.	OK	No response required.	No response required.	
<b>B5</b>	<b>Measurement Data for Model Calibration</b>					
B.5.1	Details used for the model calibration e.g. dates, locations.	2016 annual mean monitoring data	OK	No response required.	No response required.	
B.5.2	Type of monitoring data (automatic and/or diffusion tubes) used for the model calibration.	Continuous analyser data for NO <sub>x</sub> , NO <sub>2</sub> , PM <sub>10</sub> and PM <sub>2.5</sub> , NO <sub>2</sub> diffusion tubes	OK	No response required.	No response required.	
B.5.3	All available automatic (and/or diffusion tube) monitoring data included in the model calibration.	AQ3 sets out the model verification process and how sites have been included for Defra background map verification, and roadside verification.	OK	No response required.	No response required.	
B.5.4	Quality assurance of measurement data.	<p>All monitoring data are collected and reported to Defra by TfGM for the Combined Authority through the Annual Status Report (ASR)</p> <p>Local Air Quality Management Technical Guidance (TG16) is followed for all Quality Assurance / Quality Control (QA/QC) information, such as data capture; Bias adjustment factors.</p> <p>All continuous monitoring data from the 16 sites is collected and ratified by Ricardo AEA, before being published.</p> <p>NO<sub>2</sub> diffusion tube data are corrected for bias, using the national bias adjustment factor for Staffordshire Scientific Services. Details regarding the laboratory performance and precision of the tubes is provided by Staffordshire Scientific Services.</p>	OK	No response required.	No response required.	

## C: Projections Modelling

C	Projections Modelling	LA Proposal Description (OBC 2019)	JAQU Review Comments (OBC 2019)	2021 Updates to Modelling for Full Business Case	September 2024 Evidence for a new GM Clean Air Plan: CAZ Benchmark	September 2024 Evidence for a new GM Clean Air Plan: Investment-led
C.1	<b>Baseline projections modelling</b>					
C1.1	Years to be modelled.	<p>Transport model years have been built for 2016 and 2021, with additional forecast years of 2023 and 2025 also built and used in the appraisal.</p> <p>Interim years will be calculated by linear interpolation.</p> <p>We are not aware of any committed major infrastructure projects that could lead to a significant risk of wider exceedances beyond 2021.</p>	OK	Note that the interim years of 2022 and 2024 have been calculated by linear interpolation for the FBC analysis.	Only forecast year models of 2025 and 2026 are being used for the Evidence for a New GM CAP submission. A consistent methodology has been applied for 2026, to that developed for 2025.	
C.1.2	Details of method for projected vehicle fleet composition.	<p>ANPR analysis using GMP vehicle class information was used to identify vehicle type and fuel, plus cross referencing with local authority licensing information on buses, and taxis (hackney carriage and PHV).</p> <p>Fleet projection was undertaken before EFT8.0.1a was released. Fleet mix projection is based on identifying the date of registration from the licence plate number. These are matched against the date of enforcement of the relevant Euro standard, to develop the Euro standard for that vehicle type. Licence plates from GMP cannot be issued onwards due to Data Protection, and therefore direct matching with the DVLA database is not possible.</p> <p>The projection approach keeps the vehicle age constant for any the given future year (e.g 2021), and then re-calculates the Euro standard at this point in time. The approach conserves the age distribution of the vehicle population for each class/fuel, to produce the fleet mix for the future year based on this constant distribution.</p> <p>A project specific ANPR survey in Jan 2019 was undertaken. Analysis of this showed that the projection methodology from the 2016 GMP data to 2019 observations was robust, and also highlighted the issue of changing proportion of petrol and diesel cars, reported from passenger car sales.</p> <p>The JAQU guidance on change in petrol to diesel splits for cars into future years was applied. This involved using JAQU assumptions on proportions of vehicles that would switch to diesel, and using ANPR trip frequency information to convert a journey based change (vehicle kilometre equivalent).</p> <p>This was updated to use the fleet splits available in EFT 9.1a, which updated the petrol/diesel fuel splits based on more recent changes in passenger car sales trends away from diesel.</p>	OK	Note that the vehicle fleet assumptions have been updated as a result of the Covid-19 pandemic, and as per the method set out in April 2021 and approved by the TIRP. For further information, see AQ3.	<p>The time gap between the Base Year of 2016 and 2025 is relatively long. This impacts the uncertainty on vehicle fleet and associated emissions projections. GM applies a roll-over model to forecast natural rates of fleet replenishment over time, pivoting from the 2016 ANPR base dataset, because the GM fleet age was older than the age profile of the EFT defaults. This process was developed for Target Determination, but the vehicle fleet assumptions have also been updated as a result of the Covid-19 pandemic and for the TAG Databook EV fleet projections. These updates have been submitted as technical reports and agreed with JAQU and the TIRP. For further information, see T3 and AQ3.</p> <p>As part of the sensitivity testing, GM has reviewed the accuracy of the fleet projections on vehicle emissions, using ANPR data from 2023 and comparing how vehicle emissions rates from the recent dataset compared with that used for the Target Determination.</p> <p>At the GM level in 2025, the difference between the core fleet projection methodology based on 2016 data (which has been adjusted to account for impacts from Covid on vehicle sales and the increased penetration of electric cars), and a post-Covid 2023 ANPR dataset rolled to 2025 is less than 1% in the DM. By comparison, the annual rate of NOx emission decrease is ~9%, so the discrepancy is comparable with approx. 1 month of natural fleet change. Whilst there is variability in the scale of impacts this creates at roads with differing car vs freight usage, this is considered a close agreement.</p>	

C	Projections Modelling	LA Proposal Description (OBC 2019)	JAQU Review Comments (OBC 2019)	2021 Updates to Modelling for Full Business Case	September 2024 Evidence for a new GM Clean Air Plan: CAZ Benchmark	September 2024 Evidence for a new GM Clean Air Plan: Investment-led
					<p>Therefore, whilst the GM CAP is sensitive to the assumptions of fleet mix, the roll-over methodology as applied can be considered a relatively minor source of uncertainty overall.</p> <p>Further details are set out in T3 and the Sensitivity Testing report.</p> <p>Bus fleet for 2025 are now based on the specifications of the GM Bus Franchising contract awards, and the depot and fleet electrification programme (Design Freeze 1-11-23), with Euro V retrofit vehicles applied for all routes without minimum specifications which is a pessimistic assumption (albeit reasonable based on the known numbers of buses available to meet the contract standards).</p> <p>Amendments to the bus fleet specification have then been applied in the Do Something scenarios to deploy OEM Euro VI and ZEB at specified services where the CAP has identified exceedances in 2025.</p>	
C.1.3	Details of method for projected vehicle activity.	<p>Traffic forecasts from the Saturn model are based on the uncertainty log developed for the appraisal of the planned extension of the Greater Manchester Metrolink system through Trafford Park, which considered committed developments within 1km of the proposed alignment. Elsewhere, traffic growth rates are based on TEMPro growth forecasts, at a district level.</p> <p>See T1/2/3 Reports for additional information.</p>	OK	No response required.	No response required.	
C.1.4	Impact of RDE included?	Use of EFT 9.1a	OK	Use of EFT 9.1a.	Use of EFT 9.1a.	
C.1.5	Details of methods to calculate future fleet emissions 10 years beyond compliance year	Growth of traffic using TempPro, EFT 9.1a for emissions calculation, and ANPR projections as described in C.1.2.	<p>OK</p> <p>As for A.1.1 may be useful to compare your methodology with that using EFT 8.0.1</p>	No response required.	No response required.	
<b>C.2</b>	<b>With Measures Projections Modelling</b>					
C.2.1	Years to be modelled.	2021, 2023, 2025	OK	No response required.	2025, 2026.	
		See C.1.2.	OK			



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	<p>Details of method for projected vehicle fleet composition.</p>	<p>When modelling the behavioural response to a charging CAZ D, we are proposing to assume that car drivers who choose to replace a non-compliant vehicle with a compliant model would purchase compliant vehicles in the same proportions as compliant vehicles in the existing fleet mix. If, for example, the proportions of compliant cars in the local fleet mix in 2021 (estimated from ANPR data) were as shown in the Table below, then we would assume that 37.5% of drivers who choose to acquire a compliant car would purchase a diesel Euro 6 car, 26.2% of drivers would acquire a Petrol Euro 6 car, 21.8% of drivers would acquire a Petrol Euro 5 car and 14.5% of drivers would acquire a Petrol Euro 4 car.</p> <p>We are suggesting this approach due technical difficulties implementing the responses described by JAQU in the Evidence Package, which would be very difficult to model in a consistent way in all but the very simplest of networks, especially for GM where there is potentially more than one CAZ boundary, which would have implications for model run times and complexity. It is considered a realistic behavioural response.</p> <table border="1" data-bbox="596 869 1486 1220"> <thead> <tr> <th colspan="2">Proportions of Compliant Cars in 2021 GM Fleet Mix (From ANPR Data)</th> </tr> </thead> <tbody> <tr> <td>Petrol Euro 4</td> <td>14.5%</td> </tr> <tr> <td>Petrol Euro 5</td> <td>21.8%</td> </tr> <tr> <td>Petrol Euro 6</td> <td>26.2%</td> </tr> <tr> <td>Diesel Euro 6</td> <td>37.5%</td> </tr> <tr> <td>All Compliant</td> <td>100.0%</td> </tr> </tbody> </table> <p>Further details on the fleet profiles and measures modelling are provided in the OBC reports and appendices.</p> <p>A category D CAZ is not included within the Consultation Option, so this behavioural response and projection method has not been required.</p>	Proportions of Compliant Cars in 2021 GM Fleet Mix (From ANPR Data)		Petrol Euro 4	14.5%	Petrol Euro 5	21.8%	Petrol Euro 6	26.2%	Diesel Euro 6	37.5%	All Compliant	100.0%		<p>As noted above, the vehicle fleet assumptions have been updated as a result of the Covid-19 pandemic, and as per the method set out in April 2021 and approved by the TIRP. For further information, see AQ3.</p>	<p>As noted previously, the vehicle fleet assumptions have been updated as a result of the Covid-19 pandemic economic conditions and for the TAG Databook EV fleet projections. These updates have been submitted as technical reports and agreed with JAQU and the TIRP. For further information, see T3 and AQ3.</p>	
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	<p>Details of method for projected vehicle activity.</p>	<p>Please refer to C1.3 and T1/2/3 reports</p>	<p>OK</p>	<p>No response required</p>	<p>No response required.</p>													
<p>C.2.2</p>	<p>Details of methods to calculate future fleet emissions 10 years be</p>	<p>Growth of traffic using Tempro, EFT 9.1a for emissions calculation, and ANPR projections as described in C.1.5.</p>	<p>OK</p>	<p>No response required</p>	<p>No response required.</p>													