

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 Transport Modelling Tracking Table (T1)



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 transport 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)(this document), 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), 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_x and NO₂ 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 Greater Manchester 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 (NO₂) in the shortest possible time. The legal limit being defined as the long-term annual mean legal limit of 40 µg/m³.
- 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 NO₂ 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 test¹.
- 2.1.4 In March 2019, the ten GM Local Authorities collectively submitted an Outline Business Case (OBC)² for the GM CAP to JAQU outlining a package of measures to deliver regional compliance with legal limits for NO₂ 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 C³ 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.

¹ 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)

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

³ <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 NO₂ 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 report⁴ on 25th June 2021⁵ 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.

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

⁵ 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 market⁶. 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 2022⁷ 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 NO₂ 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 NO₂ compliance, with any proposed changes, must ensure the achievement of NO₂ compliance in the shortest possible time and by 2026 at the latest. It should also ensure that human exposure to concentrations of NO₂ 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 Plan⁸ 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.

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

⁷ [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/106444/Environment_Act_1995_Greater_Manchester_Air_Quality_Direction_2022.pdf)

⁸ 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 NO₂ 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 NO₂ 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 Network⁹ (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.

⁹ 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'¹⁰ in July 2022, the GM Authorities were asked by government in January¹¹ 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'¹². 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 conditions¹³. This new evidence followed a JAQU-funded study to quantify nitrogen oxide (NO_x) and NO₂ 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-NO₂ (as opposed to NO_x) were highly variable, potentially worsening roadside NO₂ concentrations despite an overall reduction in NO_x 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.

¹⁰ https://assets.ctfassets.net/tlpgbv1k6h2/7jtkDc5AODypDQlw0cYwsl/67091a85f26e7c503a19ec7aeb2e8137/Appendix_1_-_Case_for_a_new_Greater_Manchester_Clean_Air_Plan.pdf

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

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

¹³ <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 guidance¹⁴ 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.

¹⁴ 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'¹⁵ on the 12th September 2024. The key findings of this report include that the retrofit technology fitted onto retrofitted buses is not reducing NO_x 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.

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

Local Air Quality Modelling Tracking Table (T1)

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.

Local Plan Transport Modelling Tracking Table (T1)

Ref	Requirement	LA Proposal Description (OBC 2019)	JAQU Review Comments (OBC 2019)	January 2020 Update on outstanding points	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
1	Transport model specification: Model Selection						
1.1	Present year validation if the model is more than 5 years old (e.g. ANPR, journey times etc.).	Existing model with appropriate user-class disaggregation for 2016 base year has been validated at county-wide level. The level of validation in and around specific JAQU-identified links has been reviewed.	Can you confirmation what year the calibration statistics are reported. Is it 2013 and then later factored to 2016? Can you confirm for all data presented?	The suitability of the base year model has been discussed with JAQU through various technical discussions and through feedback from the TIRP/DIRP.	No further response.	Given the age of the base model, sensitivity testing has been undertaken which has considered the review of the modelled traffic demand in the vicinity of the Regional Centre (the locations of last remaining sites of exceedance), v's 2024 observed traffic flows from automatic traffic counters covering a partial cordon of the Regional Centre area. The outputs of this tests will be documented within the Sensitivity Testing report (currently being prepared at the time of writing this document).	
		The model has been validated for a base year of 2016. The link flow comparisons presented in Section 5 of the T2 report compare modelled 2016 flows with observed counts. The traffic counts that have been used in the validation have been factored to a 2016 October average weekday using local count conversion factors. The journey time validation (described in Section 6 of the T2 report) compares modelled 2016 journey times with observed travel times estimated from Trafficmaster data collected during the period September 2013 to August 2014.	Counts are (mainly) from 2010 onwards with locally derived factors used to bring up to 2016. No breakdown provided by year of data (i.e. how many counts are 2014 etc.).	Following these discussions, the base year highway model remains unchanged. <i>Technical Report T2</i> documents the base year highway model.			
		We now have observed journey time data for 2016 for all of the routes described in the T2 report. The journey time validation results could therefore be updated using 2016 data, if necessary.	Journey time data is 2013/14.				
1.2	The coverage of the transport model should be robust enough to capture if any route choice will be impacted due to the proposed measures.	Highway modelling is being undertaken using TfGM's county-wide Saturn model, which covers all of GM and the surrounding area. The model represents all motorways, A roads and B roads, plus all of the yellow coloured roads on the Ordnance surveys Landranger maps of the area.	Yes – good model coverage.	No further response.	No further response.	No further response	
1.3			See above for clarity on model years. Either is within five years. So would be acceptable.		No further response.		

Ref	Requirement	LA Proposal Description (OBC 2019)	JAQU Review Comments (OBC 2019)	January 2020 Update on outstanding points	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
	Validation should be based on comparison between observed (i.e. from ANPR data) and modelled vehicle composition, flows (on links and across screenlines/cordons), traffic pattern and journey time within the study area (WebTAG Unit M3.115).	<p>The model has been validated for a base year of 2016. The local fleet composition has been estimated from ANPR surveys undertaken in 2016. Link flows have been validated on cordons and screenlines at key locations within the study area for 2016, separately for car, LGV and HGV flows. Modelled 2016 journey times have been validated against TrafficMaster data collected during the period September 2013 to August 2014. We will consider updating the journey time validation results to make use of observed data for 2016, if possible.</p> <p>The age profile of the bus fleet has been obtained using local data collected during TfGM's (bus service) Punctuality and Reliability Monitoring Survey.</p>	Acceptable now model years confirmed.	<p>The suitability of the base year model has been discussed with JAQU through various technical discussions and through feedback from the TIRP/DIRP.</p> <p>Following these discussions, the base year highway model remains unchanged. <i>Technical Report T2</i> documents the base year highway model.</p>		<p>Given the age of the base model, sensitivity testing has been undertaken which has considered the review of the modelled traffic demand in the vicinity of the Regional Centre (the locations of last remaining sites of exceedance), v's 2024 observed traffic flows from automatic traffic counters covering a partial cordon of the Regional Centre area. The outputs of this tests will be documented within the Sensitivity Testing report (currently being prepared at the time of writing this document).</p>	
1.4	For light and heavy goods vehicles, validation will need to be reported for short screenlines using grouped counts to ensure a larger sample size.	See above.	LGV and HGV reported.	No further response.	No further response.	No further response	
1.5	The assignment convergence meets WebTAG convergence criteria (WebTAG unit M3.1, section 3.3, Convergence Measures and Acceptable Values).	Highway model convergence will be monitored using WebTAG convergence criteria and reported in modelling reports.	Yes, reported and meets criteria.	No further response.	No further response.	No further response	
1.6	Vehicle disaggregation: the transport model must split modes (e.g. HGV, LGV) to provide capability to distinguish the impact of measures that are targeting different vehicle types, such as freight logistic or different classes or charging CAZs.	Separate user classes are modelled for car, LGV, HGV and taxi trips, for compliant and non-compliant vehicles (where applicable). Buses are represented as fixed loads, separately by service/operator.	Good	No further response.	The highway assignment matrices have been updated in line with changes to projected splits of petrol and diesel cars and taxis in version 9.1a of Defra's Emissions Factors Toolkit (EFT) and the latest DfT figures for the projected fleet split (by vkms).	<p>The highway assignment matrices have been updated in line with changes to projected splits of petrol and diesel cars and taxis in Defra's EFT and the latest DfT figures for the projected fleet split (by vkms).</p> <p>Changing economic conditions (including the impacts of the COVID-19) have led to a reduction in new vehicle for private cars and taxis. Consequently, the predicted age of the fleet has been reviewed based on available data, with delays to the natural turnover of the fleet applied accordingly. These are discussed within the <i>T3 Report</i>.</p>	

Ref	Requirement	LA Proposal Description (OBC 2019)	JAQU Review Comments (OBC 2019)	January 2020 Update on outstanding points	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
					<p>COVID-19 led to a substantial reduction in new vehicle sales in 2020, which continued into 2021 for private cars and taxis. Consequently, the predicted age of the fleet in the core scenario used for the Consultation Option modelling is now considered to be optimistic, as lower sales reduce the rate of vehicle upgrades and also impact on the second-hand market.</p> <p>The impacts of these changes were assessed based on analysis of new vehicle sales. As a result of this analysis, it was agreed with JAQU as part of the Case for a New GM Clean Air Plan (submitted to government on the 1st July 2022)¹⁶ that a six month delay would be assumed for the renewal of the car fleet, 3 months for LGVs and a one year delay for taxi and private hire vehicles. It was assumed that the delays would be maintained throughout the lifetime of the CAP and they were applied equally in the 2021, 2023 and 2025 models.</p> <p>No adjustments were made to the HGV or bus fleet mixes as it was considered that the impacts of the pandemic on fleet renewals for these vehicle types would be limited.</p>	<p>The impacts of these changes were assessed based on analysis of new vehicle sales. As a result of this analysis, it was agreed with JAQU as part of the Case for a New GM Clean Air Plan (submitted to government on the 1st July 2022) that appropriate delays to the natural renewal of: no delay for HGV, 1 month delay for LGVs, 12 months delay for taxis, and 12months delay for car. It was assumed that the delays would be maintained throughout the lifetime of the CAP and they were applied equally in the 2025 and 2026 models.</p>	

¹⁶ https://assets.ctfassets.net/tlpgbvy1k6h2/7jtkDc5AODypDQlw0cYwsl/67091a85f26e7c503a19ec7aeb2e8137/Appendix_1_-_Case_for_a_new_Greater_Manchester_Clean_Air_Plan.pdf

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1.7	If modelling does not fully meet above requirements in the key study area, please provide mitigation measures/implications.	Targeted matrix estimation from counts has been used to improve the link flow validation. Matrix estimation procedures have been applied separately for different vehicle types, and the impacts monitored.	<p>It would be useful to understand a bit more about the matrix development:</p> <p>Can we have access to Trafford Park Calibration report? Reference 4.</p> <p>ME applied to Prior matrix. Can some information on changes to the prior matrix (as per WebTAG).</p> <p>Some information on what changes the TEMPRO factoring made to the base matrices.</p>	<p>The suitability of the base year model has been discussed with JAQU through various technical discussions and through feedback from the TIRP/DIRP.</p> <p>Following these discussions, the base year highway model remains unchanged. <i>Technical Report T2</i> documents the base year highway model.</p>	No further response.	No further response	
		<p>A copy of the Trafford Park highway model validation report has been supplied.</p> <p>Details of the changes brought about by the matrix estimation process have been included in Appendix A of the <i>T2</i> report, including comparisons of matrix totals, trip end totals and trip length distributions for the prior and updated matrices.</p> <p>Details of the changes made by the TEMPRO factoring have been included in paragraph 3.6.8 of the <i>T2</i> report. Comparisons of modelled versus NTEM Growth for car trips between 2016 and 2021 are included in Table 5.3 of the <i>T3</i> report.</p> <p>Although the changes in the peak period car trip length distributions reported in Trafford Park model validation report were significant, the mean trip length for the post matrix estimation car matrices compared reasonably well with figures from the 2012 National Travel Survey, which indicated that the average trip length for car/van drivers in 2012 was around 8.5 miles (13.7 km), compared to 14.2 km and 14.0 km for the post ME AM peak and PM peak hour car matrices respectively.</p>	<p>Trafford Park highway model validation report supplied which includes ME details as requested.</p> <p>ME: Zonal trip end changes meet WebTAG reqmts for car and total veh wrt slope and R2 but not intercept. LGV and OGV generally don't meet criteria.</p> <p>Significant TLD changes (well in excess of WebTAG recommendations) – generally increasing short distance trips.</p> <p>Sector to sector changes also greater than recommended but this is more common.</p>	<p>The suitability of the base year model has been discussed with JAQU through various technical discussions and through feedback from the TIRP/DIRP.</p> <p>Following these discussions, the base year highway model remains unchanged. <i>Technical Report T2</i> documents the base year highway model.</p>	No further response.	No further response	

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2	Overall model assessment						
2.1	Base model fit.	Described in <i>Model Validation Report (T2)</i> .	<p>Cordon Count Calibration</p> <p>Generally good cordon calibration, although IP is weaker. Would be useful to see cordon split into screenlines too.</p> <p>AM cordon calibration is good.</p> <p>IP – weaker with only one out of six cordons passing WebTAG</p> <p>PM Peak is good.</p> <p>Individual Count</p> <p>Generally, seems good.</p> <p>Can you present a table summarising numbers of counts that pass GEH and WebTAG count criteria, by ME count, PCM count, etc.</p>	<p>The suitability of the base year model has been discussed with JAQU through various technical discussions and through feedback from the TIRP/DIRP.</p> <p>Following these discussions, the base year highway model remains unchanged. <i>Technical Report T2</i> documents the base year highway model.</p>	No further response.	No further response	
		The link flow validation results in the <i>T2</i> report have been updated to breakdown the cordon results into shorter screenlines, as presented in Appendix B of the updated Report. A summary table reporting the number of counts passing the WebTAG link flow criteria for the cordon and PCM counts combined has been include in Table 4.10 of the revised <i>T2</i> report.	<p>Journey Time Validation</p> <p>AM and PM journey time validation is weak. With the model tending to run quicker than observed. Further commentary/ clarification is needed.</p> <p>Further count details to be provided in revised <i>T2</i> report.</p>				

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		<p>The modelled journey times in the peak hours tend to be too low when compared to observed journey times, with approximately 59% of the non-motorway routes meeting the WebTAG criteria for an acceptable journey time validation in the AM peak hour and 41% of the non-motorway routes satisfying the criteria in the PM peak hour. However, considering all of the routes together, the total modelled time for the non-motorway routes is within 4% of the observed time in the AM peak hour, which is reasonably good, although there is a difference of approximately 16% in the PM peak hour, which suggests that the model is too fast in the evening peak period in particular. The journey time validation for the non-motorway routes in the inter-peak hour is acceptable, with 84% of the routes meeting the WebTAG criteria that the modelled time should be within 15% of the observed time.</p> <p>We have investigated how errors in the journey time validation might impact on modelled road traffic emission totals for 2016 by applying adjustment factors to the modelled link speeds (at an aggregate level) to give a closer fit between the modelled and observed speeds across the County-as-a-whole, which were then run through the EMIGMA software. The results of these tests indicated that there was relatively little impact on the calculated emissions, with an increase of approximately 3% in total road traffic NOx emissions within the county. Discrepancies of this size are considered to be acceptable, especially taking into account the size and complexity of the modelled area.</p> <p>It should also be borne in mind that the errors associated with the journey time validation are just one extra source of uncertainty that are addressed by the application of adjustments to the modelled NO₂ concentrations from the ADMS urban software to improve the fit between modelled and observed concentrations as part of the model verification process.</p>	<p>In terms of journey times, the AM model is balanced in the sense of an equal number of fast and slow (model to observed > +/- 15%) routes; the IP is generally good for non-motorway routes; and the PM unbalanced in terms of most routes being too fast. The model is too fast on motorway routes for the AM and PM peaks and too slow in the IP.</p> <p>The comparison of total model to total observed time is not a good indicator of performance.</p> <p>However, the work done using adjusted speeds and the ENIGMA model appears to show that the impacts of these journey time issues are not significant in the NOx estimation. This needs to be discussed further between the modelling and AQ teams.</p>				

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2.2	Model calibration/validation.	Described in <i>Model Validation Report (T2)</i> .	No independent validation screenlines presented. This is not strictly WebTAG compliant but can be acceptable given timescales. Some commentary required.	See response to 2.1 above.	No further response.	No further response		
		Additional commentary has been included in paragraph 4.5.3 of the updated T2 report.	Detail to be provided					
2.3	Present year validation (if relevant)	Described in <i>Model Validation Report (T2)</i> .	Some clarity on 2013/2016 as described above.	See response to 2.1 above.	No further response.	No further response		
		Additional commentary has been included in the updated T2 report.	Detail to be provided					
3	Transport Model Methodology							
3.1	Baseline forecast (demand growth assumption as per WebTAG guidance) including the review of committed schemes and local development plan.	Baseline forecast for 2021, described in <i>Modelling Methodology Report (T3)</i> .	<p>Growth based on Trafford Model, with adjustments made for committed developments to 2020. Adjustment made to growth to account for the latest version of TEMPRO (V7.2).</p> <p>Development assumptions based on Trafford work, have these assumptions been reviewed against latest development plans?</p> <p>Given that you state that the growth has been adjusted to NTEM V 7.2 can you explain why the output growth rates are different.</p>	<p>The suitability of the highway model has been discussed through various technical discussions and feedback received from the TIRP.</p> <p>Following these discussions, the highway modelling approach is unchanged but there have been updates to the forecast year modelling to reflect:</p> <p>Latest information on bus operating services within GM; and</p> <p>ppm / ppk values derived from the latest version of the WebTAG Databook.</p>	<p>Bus services updated to include zero emission buses (ZEB) deployed on routes to and from Manchester city centre.</p> <p>Further ZEBs are planned and funded for implementation by 2023 and have been included in the 2023 and 2025 models.</p> <p>Details of the bus routes affected are provided in the Local Transport Plan <i>Air Quality Modelling Report at FBC (AQ3)</i>.</p>	<p>The representation of bus services within the modelling was enhanced within the 2024 model updates. This included updating service routings and frequencies to reflect 2023 services.</p> <p>The bus vehicle deployment data was also updated within the EMIGMA emissions modelling to include the latest position with regard to GM Bus Franchising.</p> <p>This also includes the latest position with regard to deployment of ZEBs due to be deployed within GM.</p> <p>Also, with regards to the growth assumptions for traffic demand, a sensitivity test has been undertaken which has considered the review of the modelled traffic demand in the vicinity of the Regional Centre (the locations of last remaining sites of exceedance), vs 2024 observed traffic flows from automatic traffic counters covering a partial cordon of the Regional Centre area. The outputs of this tests will be documented within the Sensitivity Testing report (currently being prepared at the time of writing this document).</p>		

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		<p>We haven't been able to review individual development assumptions due to the study timescales and the size of the modelled area.</p> <p>There is a good agreement between NTEM 7.2 and output growths at the county level. There are modest differences at the district level due to spatial changes in the distribution of trips in the 2016 matrices brought about by the matrix estimation process, and the impacts of the variable demand modelling that was carried out for the Trafford Park model, and the adjustments that were made to its reference case matrices as a result of changes to generalised cost between its base and forecast year.</p> <p>Additional models have subsequently been built for 2023 and 2025, to assist in confirming the year of compliance for NO₂ concentrations and to help with modelling the phased introduction of a GM-wide CAZ C.</p> <p>The development of the 2023 and 2025 models is described in the updated T3 Report.</p>	Detail to be provided		PPM and PPK values updated using values of time, GDP growth rates and vehicle operating costs derived from the TAG data book, July 2020	PPM and PPK values updated using values of time, derived from the TAG data book, May 2023. It is noted a new version of the TAG Databook was released in May 2024, which was after the completion of the scheme modelling. On review of the updates, it is not expected these would have a material impact on the modelling undertaken using the May 2023 Databook values.	
3.2	An uncertainty log providing a clear description of the planning status of local developments.	<p>Attached as an Appendix to the T3 report.</p> <p>See above for comments on local developments.</p>	<p>As above – report is from 2014 so please confirm still relevant.</p> <p>Still relevant for these forecasts.</p>	See above response to 3.1.	No further response.	No further response	
3.3	Description of the future year transport supply assumptions (i.e. planned road networks examined for the baseline, core scenario and variant scenarios).	<p>Described in uncertainty log/T3 report.</p> <p>The future year transport supply assumptions are described in the T3 report, based on the Trafford Park model uncertainty log. We haven't made any changes to the uncertainty log, but have held meetings with district colleagues to review the development/transport assumptions. We will update the model to include any schemes that may have been omitted, if it is thought that they will have a material impact on the appraisal results.</p> <p>No fundamental concerns with regards to the modelling were raised at the meetings.</p>	<p>As above – report is from 2014 so please confirm still relevant.</p> <p>Still relevant for these forecasts.</p> <p>Will review schemes and update if required.</p>	See above response to 3.1 – The uncertainty log has been reviewed and is still relevant.	The transport supply assumptions have been reviewed for the FBC submission. The scheme review concluded that the majority of the schemes that had been included in the forecast year highway networks will go ahead but identified two schemes that will not be open in 2023 and where there is now significant uncertainty that they will still be delivered. These comprised the:	<p>The Do Minimum modelling also included the inclusion of the recently delivered and committed Regional Centre schemes, including City Centre Transport Strategy (CCTS) measures to be delivered by 2025. The T3 Report details the status of these schemes.</p> <p>In addition, the status of the non-Regional centre schemes were also reviewed.</p> <p>As reviewed in 2021 submission, the M60 Junction 24-27, and 1-4 managed motorway scheme, and the proposed WGIS scheme are currently not delivered and not expected to be complete by 2025. These schemes continue to be omitted from the future year modelling of 2025 and 2026.</p>	

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					<ul style="list-style-type: none"> • M60 Junction 24-27 and Junction 1-4 Managed Motorway scheme; and • Secondary phases of the Western Gateway Infrastructure Scheme (WGIS) and its links with the motorway network. <p>The implications of including these schemes in the future year models has been investigated using sensitivity testing to assess the air quality impacts for scenarios where the schemes are and are not in operation. The results of the sensitivity tests are set out in the <i>Sensitivity Testing at FBC Report</i>.</p> <p>The transport supply testing indicates that changes to the transport supply assumptions have a negligible impact on locations where poor air quality is influencing the CAP, and that the main areas where traffic flows are materially altered are around the motorway network, which are not part of the CAP. Sites on the local road network where there are changes in traffic flows associated with the schemes do not have exceedances with the CAP in place.</p>	Due to the complexity in delivery of CCTS measures, a consistent set of CCTS measures was applied within the modelling of 2025, and 2026. With only those schemes due to be complete by the end of 2024 included.	
3.4	Description of the travel cost assumptions as per WebTAG guidance (e.g. fuel costs, PT fares, parking).	Provided in modelling methodology reports.	Methodology provided and looked correct.	No further response.	No further response.	No further response	

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3.5	Description on how the options are modelled in transport models (e.g. timeframes, eligibility etc).	To be provided in modelling methodology reports.	OK	No further response.	No further response.	No further response	
3.6	Description of forecasted vehicle composition assumptions, if deviating from EFT assumptions.	Based on local base year fleet mix (obtained from ANPR data), suitably adjusted to ensure that the age profile remains unchanged in the future, by vehicle type.	OK	No further response.	No further response.	ANPR data has been adjusted over time to account for impacts on economic conditions (including COVID-19 impacts). This has also been considered as part of sensitivity testing where projections from 2023 ANPR datasets indicated minimal deviation between from the core scenario.	
3.7	What and how to interpret and implement behavioural responses to all measures replacing vehicle for compliance, avoiding zone, cancelling journeys, mode shift and other	Re-routing responses to CAZ charges are represented in the Saturn model by coding monetary charges (tolls) for non-compliant vehicles into the highway networks, which may differ by vehicle type (e.g. cars, LGVs, OGVs and Taxis). The tolls are defined as charges per cordon crossing link and have been divided equally between inbound and outbound sites. Note, however, that charges are not coded into the Saturn model for GM-wide CAZs, as it assumed that there will be no-re-routing responses for these measures (as motorists cannot change their routes to avoid paying the charge) and that drivers of non-compliant vehicles will either choose to pay the charge or make a different behavioural response, as described below.	Is the option sifting tool going to be adapted for the full forecasting?	The calculation of behavioural responses due to the CAP have been refined following the OBC submission. These refinements included: Development of cost models to better understand the behavioural responses due to the CAZ & funds; and enhancements to the Demand Sifting Tool (DST) to improve way the behavioural responses are applied within the modelling tools. Details of these updates to the representation of then behavioural responses and updates to the DST are discussed in the updated T4 document (in particular Appendices A and D of this document). These updates have been developed through ongoing technical discussions with JAQU and in response to feedback received on the OBC submitted in March 2019.	No further response.	Methodology discussed within the T4 Report, and includes minor updates to the Cost Response models to better represent the characteristics of the fleet operating within the Regional Centre. Responses were also compared to responses and monitoring data from other authorities and were found to be comparable. Regional Centre CAZ boundary of inside the MSIRR (Manchester and Salford Inner Relief Road) was selected to minimize the impacts on traffic rerouting, due to minimal existing through trips currently accessing the Regional Centre	No further response – CAZ behavioural responses not relevant for investment-led scheme. Bus measures are not subject to behavioural response due to specification of GM bus franchising and ability to apply targeted deployment of buses within GM. Taxi emissions standards as part of GM taxi licensing standards have ability to provide upgrade response for GM licensed taxis
		An option sifting tool has been developed to assist in modelling the behavioural responses to the CAP measures based on guidance provided by JAQU concerning the proportions of drivers of affected vehicles who would pay the charge, cancel their journey, upgrade to a compliant vehicle etc. The output demand change matrices from the sifting tool are used to adjust the do-minimum demands in the Saturn model at a sector level to create do-something forecasts. The updated do-something matrices are then assigned to assess the demand changes on specific links in the Saturn model and the impact on emissions using EMIGMA.	Clarified.	No further response – CAZ behavioural responses not relevant for Investment-led Plan.			

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		We did consider modelling the impacts of the CAP schemes on suppressed traffic using the elastic assignment procedures available in Saturn. Tests suggested, however, that this would not be necessary as the schemes that were being considered would not have a significant impact on congestion. Tests showed, for example, that the implementation of a CAZ D for the Regional Centre with a CAZ B for GM as-a-whole would result in an approximate 2% reduction in vehicle kilometres on roads within the County in 2021 and a 3% reduction in total PCU hours, which was not thought to be significant.					
3.8	Outline of methodology for user behaviour research, if undertaken.	To be considered, but will be based on JAQU guidance initially	Useful to expand on how/ when this will be decided.	A series of research papers were prepared and submitted to JAQU in Summer/Autumn 2019 which provides research and evidence on each of the modelled vehicle types. This includes:			
		Initial modelling was based on data in JAQU's Evidence Package guidance, derived from the TfL ULEZ Stated Preference surveys, as local information for GM was not available. In August 2018, the model was revised to take into account newly available data from Stated Preference surveys conducted in Bristol. Bristol was considered more similar to GM than London. A re-weighting exercise was carried out to apply local travel patterns and demographics. Stated Preference research is not planned, due to time constraints and the type of vehicles in scope (commercial vehicles commonly without a driver-decider). Other Stated Intention research will be undertaken to validate the assumptions used in the modelling.		Technical Note 3 – Analysis of the Freight Market; Technical Note 4 – Coach Market Analysis; Technical Note 18 Minibus Vehicle Research; and Technical Note 19 Taxi and PHV Fleet Research. Development of Cost models to inform behavioural responses due to the CAZ and funds are discussed in document T4 (Appendix A).	No further response.	No further response	

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3.9	Describe how the transport modelling implications are fed into the air quality modelling (e.g. speed, congestion etc.).	Air quality modelling is being undertaken using TfGM's EMIGMA (Emissions Inventory for Greater Manchester) software. Procedures combine information about traffic speeds and flows from the Saturn model with road traffic emission factors and fleet composition data from DEFRA's Emission Factor Toolkit (EFT) and the National Atmospheric Emissions Inventory (NAEI) to provide estimates of annual mass emissions for a range of pollutants including Oxides of Nitrogen (NOx), primary-NO ₂ Particulate Matter (PM ₁₀ and PM _{2.5}) and CO ₂ .	Please confirm whether you have considered other sources of data (e.g. Trafficmaster) for speed and on what basis you have opted for the modelled speeds in the Saturn model.	The suitability of the base year model has been discussed with JAQU through various technical discussions and through feedback from the TIRP/DIRP. Following these discussions, the base year highway model remains unchanged. <i>Technical Report T2</i> documents the base year highway model.	No further response.	No further response		
		The Saturn model has been chosen as the primary source of information about vehicle speeds for input to the EMIGMA software as it was not considered practical to make use of other sources of information for estimating link speeds (such as traffic master or bluetooth data) due to the size and complexity of the modelled area, and also because of technical difficulties matching information from different data sources (which are coded to topologically different networks with different network structures and more/fewer links), which would be time consuming, complicated and subject to error.	Clarified.					
4	Overall forecasting methodology assessment							
4.1	Forecasting assumptions.	Described in modelling methodology reports and the uncertainty log.	OK	No further response.	No further response.	TIRP feedback provided in early 2024, in particular in context of fleet age and traffic demand has been addressed under sensitivity testing. This is explained within the Sensitivity Testing Reporting (being prepared at the time of preparing this version of T1)		
4.2	Policy options and the implementation in the model.	To be described in modelling reports.	OK	No further response.	No further response.	No further response		
4.3	Modelling vehicles behaviour change that are affected by measures	See above comments regarding the Option Sifting Tool. The results of the behavioural change and forecast modelling will be included in the <i>T4 (Transport Model Forecasting) Report</i> .	OK	No further response.	No further response.	No further response		

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5	Final Transport Forecasting Modelling							
5.1	The detailed vehicle fleet composition for each policy scenario and the baseline (broken down by vehicle type and Euro standard) so that changes to the fleet are clear.	To be assessed and described in modelling reports.	OK	No further response.	No further response.	No further response		
5.2	Details of modelling methodology.	To be described in modelling reports.	OK	No further response.	No further response.	No further response		
5.3	Forecast assumptions: demand growth, network changes and transport costs	Described in modelling reports and uncertainty log.	OK	No further response.	No further response.	TIRP feedback provided in early 2024, in particular in context of fleet age and traffic demand has been addressed under sensitivity testing. This is explained within the Sensitivity Testing Reporting (being prepared at the time of preparing this version of T1)		

APPROVED