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

Issues Leading to Delayed Compliance Based on the Approved GM CAP Assumptions

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Authorised by: **Date:**	Ian Palmer February 2022		

1 Introduction

1.1 This Report sets out a summary of how the recent analysis conducted since the modelling for the post-Consultation version of the Greater Manchester Clean Air Plan (GM CAP) in June 2021 means that the conclusions relating to delivery of compliance by 2024 are no longer robust.

1.2 The June 2021 modelling was undertaken to incorporate the outcomes of the 2020 Consultation and approved GM CAP Policy, along with the approach to incorporating the then known Covid-19 impacts on vehicle fleet, for scheme approval and submission with the Full Business Case (FBC). This modelling was based on the methodology agreed with JAQU and the Technical Independent Review Panel (TIRP), and utilised the input datasets and assumptions that were available and appropriate at March 2021 when the modelling conducted to feed into the reporting and governance process. The modelling outputs and deliverables have been submitted to and reviewed by JAQU and the TIRP, however the final FBC has not been submitted or published.

1.3 Subsequently, evidence has been assembled of significant vehicle availability issues for businesses. The findings of the GM-commissioned review of the light goods vehicles (LGVs) supply chain (see Appendix A) demonstrate significant price increases in the second-hand used van market, ranging between 13% and almost 60%, alongside longer lead times for new vehicles.

1.4 At the same time, sales of new cars have been significantly reduced during 2020 and 2021, slowing the natural turnover of the private car fleet on the road network. This will worsen the baseline position with respect to roadside concentrations of nitrogen dioxide (NO_2), meaning that compliance being delivered in 2024 was already less likely, even if the assumptions around commercial vehicle prices and behaviour were not altered.

1.5 This document discusses how the separate issues around used van prices and slower than projected sales of private cars are expected to impact on the conclusions of the Approved GM CAP modelling. It will reflect upon the sensitivity testing available in preparation of the FBC to inform a view of where the risk of exceedance beyond 2024 would be most likely to occur.

2 Background & Modelling Framework

2.1 The GM CAP is underpinned by an evidence base and modelling. The modelling for the study is being undertaken using the CAP modelling suite as illustrated below in Figure 2-1:

Figure 2-1 CAP Modelling Suite

2.2 The modelling system consists of five components:

- The demand sifting tool, which has been developed to allow measures to be tested in a quick and efficient way prior to detailed assessments being undertaken using the highway and air quality models. The sifting tool uses fleet specific Cost Response models to determine behavioural responses to the CAP proposals (pay charge, upgrade vehicle, change mode, cancel trip etc.) The outputs comprise demand change factors which are applied to the do-minimum Saturn matrices to create do-something demands for assignment.
- The highway (Saturn) model, which uses information about the road network and travel demands for different years and growth scenarios to estimate traffic flows and speeds for input to the emissions model and forecasts of travel times, distances and flows for input to the economic appraisal.
- The emissions model, which uses TfGM's EMIGMA (Emissions Inventory for Greater Manchester) software to combine information about traffic speeds and flows from the Saturn model with road traffic emission factors and fleet composition data from the Emission Factor Toolkit (EFT) 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.
- The dispersion model, which uses ADMS-Urban software to combine information about mass emissions of pollution (from EMIGMA) with dispersion parameters such as meteorological data and topography to produce pollutant concentrations.
- Finally, the outputs of the dispersion model are processed to convert them to the verified air quality concentrations, using Defra tools and national background maps.

2.3 The purpose of the modelling is to identify the preferred option for delivering air quality compliance in the shortest possible time, and to provide supporting analyses for the development of the business case submissions.

2.4 The results of the modelling are set out in the following reports:

- Local Plan Transport Modelling Tracking Table (T1), which is intended to demonstrate that the modelling requirements for the study are being met;
- Local Plan Transport Highway Model Validation Report (T2), which explains in detail how the road traffic model was validated against real-world data in the base year (2016);
- Local Plan Transport Modelling Methodology Report (T3), which describes the approach taken to forecast traffic in 2021 and beyond to 2023 and 2025;

- Local Plan Transport Model Forecasting Report (T4), which describes the transport modelling process and results for the Greater Manchester Clean Air Plan Project;
- Local Plan Air Quality Modelling Tracker Table (AQ1) and Methodology Report (AQ2), which provides an overview of the air quality modelling process and evidence base; and
- Local Plan Air Quality Modelling Report (AQ3), which provides details of modelled NOx and NO_2 concentrations for the base and forecast years, including comparisons with measured concentrations for the base year.

2.5 Versions of these reports were produced at Outline Business Case (OBC) stage and revised versions were produced setting out the process applied to testing of the Package for Consultation and the results of that modelling[1]. Revised versions of the reports have been produced to support the FBC, based on the updated modelling methodology reflecting the impacts of the Covid-19 pandemic, and the approved Policy following Consultation. The assumptions used for this modelling reflected the best available datasets and evidence at approximately March 2021 when the modelling conducted to feed into the reporting and governance process.

2.6 The changes made to the modelling methodology for the FBC are set out in the Reports T3: Local Plan Transport Modelling Methodology Report, T4: Local Plan Transport Model Forecasting Report and AQ3: Local Plan Air Quality Modelling Report, and are discussed in the Analytical Assurance Statement.

2.7 The Policy for Consultation sets out the proposals and measures contained in the GM CAP as approved by GM's ten local authorities in July and August 2021[2].

2.8 Fundamentally, the air quality improvement predicted in the GM CAP's modelling appraisal is dependent on assumptions around how commercial vehicle owners will respond to the proposed Clean Air Zone (CAZ) charge and associated set of funding support packages.

1 Available at https://cleanairgm.com/technical-documents/
2 GM CAP Policy following Consultation: https://assets.ctfassets.net/tlpgbvy1k6h2/2VNncClzejAvGh3CrVn0oo/54d03145b03adfdab15e4323e76d7781/Appendix_1_-_GM_Clean_Air_Plan_Policy_following_Consultation.pdf

3 Limitations, risks and uncertainty

3.1 The reporting is supported by an Analytical Assurance Statement (AAS). The purpose of the AAS is to consider the limitations, uncertainties and risks in the evidence base, and the implications of these for decision makers. It considers whether an appropriate procedure has been followed, in terms of the modelling process and the source data, and whether appropriate checks have been carried out. It considers whether appropriate expertise has been utilised, and whether sufficient time and resources have been allocated to the analysis.

3.2 An AAS was prepared in spring 2019 to support the package of documents submitted as part of the Outline Business Case (OBC) submission, and in January 2020 to support the proposed Package of Measures for Consultation.

3.3 An updated AAS was prepared and submitted to JAQU to support the final development of the FBC. That analysis was needed to support the following decisions by GM:

- The agreement of forecast exceedances that must be tackled by the GM CAP through the **revised Do Minimum forecasting** exercise, taking into account the impacts of Covid-19 on vehicle fleets;
- The **specification of policies and scheme design for each of the identified measures**, to form the GM CAP Policy following consultation designed to meet the requirements of the Ministerial Direction; and
- The **decision to proceed** with submission of the FBC in order to secure funding.

3.4 The updated AAS, already reviewed by JAQU, means that GM and JAQU have a greater understanding of the uncertainties and limitations associated with current modelling, which is useful given the rapidly evolving evidence base.

<u>Sensitivity Testing</u>

3.5 In order to inform the AAS and its assessment of the limitations, uncertainties and risks in the evidence base, GM has carried out a programme of sensitivity testing for the FBC submission.

3.6 The purpose of the sensitivity testing is to understand the possible impact of uncertainty in the appraisal of the Plan. In particular, to understand whether variations in the assumptions underpinning the modelling, or the modelling methodology, would lead to a different decision or outcome or provide additional confidence in the conclusions.

3.7 For the GM CAP, the key questions were:

- Are there any plausible circumstances under which the GM CAP would no longer be required, or would not be required in its current form? How confident can GM be in the results of its analysis?

- Are there any plausible circumstances under which the GM CAP would not achieve compliance in the shortest possible time, compared to another deliverable option? How confident can GM be in the results of its analysis?

3.8 A summary of the sensitivity testing report has been provided in the next section, setting out the derivation of the relevant tests and their key conclusions, as carried out to support the assessment of uncertainty for the FBC.

4 Sensitivity testing

4.1 GM developed a programme of sensitivity testing based on the following inputs:

- JAQU guidance
- Feedback from JAQU's Technical Independent Review Panel (TIRP)
- JAQU's Covid-19-related guidance
- Joint working between the GM CAP and JAQU Technical Teams

4.2 Tests of the Do Minimum scenario were run to consider the impact on the GM CAP of variations to assumptions in terms of traffic flow and composition, delays to the delivery of planned schemes (other than the GM CAP), travel patterns and factors affecting the calculation of emissions and concentrations. This specifically included tests relating to the age of vehicle fleet. Tests that affect the Do Minimum scenario were then run for the Do Minimum and Do Something scenarios, in order to understand the impact on compliance.

4.3 Further sensitivity tests were carried out considering variations in the assumed impact of the GM CAP on bus, taxi and freight upgrades to cleaner vehicles. These tests affect the Do Something scenario only.

4.4 For freight vehicles (HGV and LGV), tests were carried out to estimate the 'break point' of the scheme, in other words, testing the percentage increase in 'stay and pay' responses for each vehicle type that would be sufficient to delay the first year of compliance to 2025, all other things remaining equal.

4.5 Following the identification of this estimated 'break point', analysis was undertaken to understand the scale of change required for each contributing factor to reach the 'break point'. For example, how much would LGV prices need to rise to increase the proportion of vehicles choosing to 'stay and pay' enough to delay the year of compliance?

4.6 This break point analysis was undertaken based on a request from TIRP.

4.7 It is this break point analysis that is most informative on how recent evidence regarding increased used vehicle prices would affect the predictions of improvements to air quality as a result of the CAP. The tests relating to fleet age can be used to understand how the latest information on vehicle sales would impact on the projected concentrations.

5 Sensitivity testing programme for FBC summary

5.1 Table 5-1 sets out the sensitivity testing that has been carried out for the FBC relating to fleet age and the break point analysis.

5.2 It provides a description and brief methodology, information on the source of the test and whether it has been run before. It also sets out whether the test is being applied to the Do Minimum (DM) and/or Do Something (DS) scenarios and which years are being modelled.

5.3 For more details on these sensitivity tests, refer to Appendix B.

Table 5-1 FBC Sensitivity Testing Programme (excerpt from the Sensitivity Testing Report)

Test no.	Test	Description	Brief methodology	Source information	DM	DS	2023	2024 (i)	2025	Has test been run before?
A: Fleet age										
1	Older fleet	Fleet is older than modelled due, for example, to greater-than-expected impacts of Covid-19 pandemic or other factors.	• HGV, LGV, Car +1 year older than Consultation Option Do Minimum (DM) • Taxi +2 years older than Consultation Option DM • No change to Bus	Test as per JAQU Covid-19 guidance, adapted for taxi to reflect inclusion of one year delay to fleet replacement in the core scenario. Test responds to feedback from TIRP (April 2021).	Yes	Yes	Yes	Yes	Yes	Partially – an earlier iteration run as part of Covid-19 impacts testing.
D: Freight										
15	Freight stay and pay 'breakpoint analysis'	More HGVs and/or LGVs may choose to 'stay and pay' than currently forecast.	Analysis using AQ modelling and behavioural response models to identify what scale of change to behavioural responses of HGV and LGV owners could cause a delay in the year of compliance.	JAQU and TIRP (OBC) feedback.	No	Yes	Yes	Yes	Yes	No
16	Cost of charge	Non-compliant vehicle owners may be able to pass on some or all of the cost of the charge to customers, effectively reducing the impact of the charge on them.	Reduce the cost of the charge within the LGV/HGV cost models to test impact on behavioural responses.	JAQU guidance/feedback and TIRP feedback (OBC and January 2020).	No	Yes	Yes	No	No	A version of this test was run previously, reported as Technical Note 31.
17	Vehicle pricing	The cost of a compliant vehicle may be higher than assumed.	Increase the cost of upgrade within the LGV/HGV cost models to test impact on behavioural responses.	JAQU guidance/feedback and TIRP feedback (OBC and January 2020).	No	Yes	Yes	No	No	No

6 Sensitivity testing results summary: Fleet Age

6.1 This section sets out a summary of the sensitivity testing results carried out in relation to vehicle fleet age. This is distinct from the break point analysis for freight vehicles, considered in section 7.

6.2 The Do Minimum fleet mix as modelled at Consultation assumed a normal pattern of vehicle upgrades, including the purchase of new vehicles, trading of second-hand vehicles and the scrapping of the oldest vehicles from the fleet. For more discussion on the methodology applied to estimate the do minimum vehicle fleet, see Appendix B.

6.3 GM's analysis of the impacts of the Covid-19 pandemic concluded that capital investment in replacement vehicles has been delayed and as a result the fleet on GM's roads is likely to be older and more non-compliant than would otherwise have been the case. The impacts of the Covid-19 pandemic on fleet upgrade include:

- Reduction in the number of new vehicles manufactured due to lockdowns;
- Delay in transactions due to lockdown constraints;
- Reduction in vehicle upgrades due to direct economic impact of lockdown or wider recessionary impacts, or because vehicles are not being used as heavily as before; and therefore
- The oldest vehicles remaining in the fleet for longer.

6.4 Analysis shows that these impacts vary between different vehicle types and business sectors with some more affected than others. For further information, see the Impacts of Covid-19 on the GM CAP Report[34].

6.5 Adjustments were made to the car, van and taxi fleets to reflect the emerging evidence in spring 2021 that the normal pattern of vehicle upgrades had been affected for those fleets. This was represented by calculating the difference between the predicted annual sales (or actual for 2020) and the typical pre-Covid levels which are reported as the equivalent of typical sales each year.

6.6 This resulted in the quantum of lost new private car sales equivalent to 62% (or approx. 7 months) of a year's worth of renewal from 2023 onwards. For vans, where sales had been more resilient, the rate of lost vehicle sales was equivalent to 28% of a year's worth of renewal in 2023, reducing to 7% in 2025, because sales had been extrapolated to levels above those in 2019 to reflect the strong demand evident in the market. These adjustments are described in more detail in T3 & AQ3.

3 GM CAP Impacts of Covid-19 https://assets.ctfassets.net/tlpgbvy1k6h2/2vJXVuLxfXON7HexGli29Q/4726e8696145d9f10bd1b19c16bdc1dd/Appendix_5_____Impacts_of_COVID-19_Report.pdf

6.7 By implementing a change to the fleet in response to the pandemic in the core modelling for the Approved GM CAP scenarios, GM sought to mitigate the risk that the fleet is older than forecast. However, the latest evidence suggests that these adjustments were not sufficiently pessimistic for private cars.

6.8 Table 6-1 sets out the results of the Older Fleet Age sensitivity test.

6.9 The conclusion of this test is that the GM CAP is sensitive to assumptions about fleet age, with an older fleet creating a risk of delay to the year of compliance.

Table 6-1 Sensitivity test results: (A) Fleet Age (excerpt from the Sensitivity Testing Summary Report)

Test no.	Test	Narrative as at summer 2021	Change in max concentration in 2023	Change in no. of exceedances in 2023	Forecast Compliance Year	Impact
1	Older fleet	This test showed increased concentrations and was sufficient to delay the year of compliance. The roads outside of the IRR are more sensitive to this test, because car and LGV emissions are more prevalent. However, it is considered unlikely that the fleet age would be as pessimistic as this test, given that changes have already been applied to the core to reflect Covid-19 related delays in vehicle upgrades. Current evidence suggests that whilst vehicle sales have not caught up with pre-pandemic conditions, LGV and car sales have not been delayed to the extent of a full year.	+2.0	+13	2026	Risk of delay to year of compliance with the CAP in place.

6.10 In preparation for the implementation of a Performance Management Plan, (which is the mechanism by which GM proposed to monitor relevant factors, identify issues and propose solutions), GM has continued to monitor vehicle sales and forecast information.

6.11 In relation to the assumptions and datasets tested under the fleet age test, for those vehicles in scope for the GM CAP:

- **HGVs**: GM is reviewing all available information relating to HGV sales and supply issues over 2021, with the key dataset from SMMT sales due to be available in February 2022.
- **Taxis**: GM is reviewing the latest licensing records to understand the composition of the current GM-licensed taxi fleet (including Hackney Cabs and PHVs). GM has also sought data from JAQU on the composition of the taxi fleet serving GM but licensed elsewhere. A full further one-year delay in the sensitivity test (beyond the one-year delay already applied as a result of COVID 19) is expected to be pessimistic about the real-world rate of taxi fleet upgrades. Whilst taxi drivers' profitability was significantly impacted in 2020/21, the relaxation and removal of Covid-related restrictions in 2021/22 is assumed to have resulted in a return towards more typical operations. However, a number of factors, including drivers awaiting confirmation of CAP and Minimum Licensing Standards policies and the opening of the Funds may have acted to delay upgrades somewhat.
- **Vans:** Sales forecasts projections from the SMMT are released quarterly and reflected the volatility in the van manufacturing sector. In the latest information (October 2021), the SMMT has slightly upgraded van sales forecast compared to the January 2021 forecast which the GM modelling pivots from[5]. This change is not currently considered to be sufficient to materially change the projections. However, GM will continue to monitor vehicle sales patterns and projections with the next update due in February 2022.

5 https://www.smmt.co.uk/2021/10/uk-new-car-and-van-forecast-october-2021/

6.12 Private cars, whilst not in scope for the GM CAP, form an important contribution to overall road traffic emissions. New vehicle sales rates have fallen and sales projections have been reduced by the SMMT further since the Approved GM CAP modelling. Based on the latest data, the forecast for cars now approaches the assumptions made in the Older Fleet test, equivalent to 91% (or approx. 11 months) of a year's worth of renewal from 2023 onwards. GM will review the latest available ANPR data, to better understand private car fleet data, versus projections undertaken in the modelling, including in relation to the uptake of hybrid and battery electric models. However, these data will need to be treated with caution because driving patterns are not yet considered to have recovered from the restrictions in place as a result of Covid-19.

6.13 The pro-active approach taken by GM to representing local fleet age, which already builds in assumptions around the adverse impacts of Covid-19, plus the suite of sensitivity tests already produced, has helped to increase the insight on the scale of potential impacts based on the latest revisions to vehicle sales and fleet on the predicted year of compliance.

Impact on the CAP Modelling Predictions

6.14 Modelling carried out to support the decision to approve the GM CAP, supplied in June 2021, demonstrated that the Plan was forecast to achieve compliance with legal limits of NO_2 concentrations by 2024, based on the proposals set out in the Policy and the assumptions made at that time in terms of the age of the fleet and the cost of upgrade amongst other factors.

6.15 The target determination process set out the NO2 concentrations position, against which measures were needed to reduce vehicle emissions and deliver compliance with the NO_2 limits. The revised CAP modelling for the Approved GM CAP package, took into account the impacts of Covid-19 leading to lost vehicle sales for private cars, vans and taxis based on data published by the SMMT, using a methodology agreed with JAQU and reflecting the position up to March 2021. The recorded sales from 2020 and revised projections of future sales in 2021 to 2025, used for this analysis were published in February 2021. The SMMT have subsequently published update projections in October 2021.

6.16 These projections were similar for vans to those used for the Approved CAP modelling, but the new private car sales were revised down such that emissions from the private cars would now not be predicted to have improved at the rate modelled. This means that the starting position in the Without CAP or Do Minimum scenario, is worsened and therefore the improvements in NO2 concentration in response to the CAP package of measures as they were predicted in June 2021 may no longer be sufficient.

6.17 Evidence on how HGV and taxi fleet age may have been impacted by Covid-19 is not yet available, and is still under review. Further analysis of on-road vehicle fleet data from recent ANPR data would also be beneficial to confirm analysis from sales data, if possible.

7 Sensitivity testing results summary: Freight Break Point Analysis

7.1 The freight tests were more complex, as they operated in two parts. The purpose of these tests is, firstly, to assess the extent to which the Plan is sensitive to assumptions about the behavioural responses of HGVs and LGVs and secondly, to understand what specific factors underpin those behavioural responses and how sensitive the GM CAP is to those factors.

7.2 The analysis shows that a relative change of 10% in the proportion of either HGVs or LGVs upgrading is sufficient to delay compliance by one year, all other things being equal.

7.3 The analysis set out in Table 7-2 considers what changes would be required to assumptions underpinning the modelling of behavioural responses for this change to be realised. Where it states that behavioural responses are sensitive to a factor, that means that changes in that factor could lead to a reduced upgrade response, and therefore to increases in emissions and concentrations.

Table 7-1 Sensitivity test results: (D) Freight- behavioural responses (excerpt from the Sensitivity Testing Report)

Test no.	Test	Narrative	Change in max concentration in 2023	Change in no. of exceedances in 2023	Forecast Compliance Year	Impact
15	Freight stay and pay 'breakpoint analysis'	The purpose of this test was to identify how much change would be required to upgrade assumptions (i.e.: the proportion choosing to upgrade vs stay and pay) in order to delay compliance by one year. The test found that an increase of 10% in the proportion of HGVs or LGVs choosing to upgrade was sufficient to delay compliance to 2025.	+0.3	+2	2025	Risk of delay to year of compliance.

Table 7-2 Sensitivity test results: (D) Freight - parameters affecting behavioural responses (excerpt from the Sensitivity Testing Report)

Test no.	Test	Narrative as at summer 2021	Sensitivity
16	Cost of charge	This parameter is tested not to reflect changes to the CAZ charge itself, but rather how much business owners are able to pass on the charge to their customers and thus reduce the impact of the CAZ charge on their business. This is relevant because if they are not bearing the cost of the charge, it is less likely to represent good value for money for them to upgrade their vehicle. Behavioural responses would be substantively affected if LGVs could pass on between £1.50-£2 of the daily charge, or if HGVs could pass on £30 of the daily charge. Because this represents a lower cost and proportion of the charge, this is considered a greater risk for LGV than HGV.	Behavioural responses are sensitive to this factor
17	Vehicle pricing	This refers to the purchase cost of upgrading to a compliant vehicle. There are several reasons this value could be impacted, such as reduced production of new vehicles due to supply shortages or a sudden increase in demand, as well as the possible risk of market distortion as a result of the GM CAZ and other similar schemes. An increase of 8% in LGV prices could be sufficient to substantively affect behavioural responses, whilst an increase of over 50% would be required to achieve the same effect for HGVs. The evidence shows that LGV prices do fluctuate and given that a relatively small change in prices could be sufficient to delay the year of compliance, GM considers LGV vehicle prices to be a higher risk source of uncertainty in the performance of the Plan than HGV prices, given HGV prices have remained more stable and it seems unlikely that a price change of this scale would be borne by the market.	Behavioural responses are sensitive to this factor, particularly for LGVs

7.4 The LGV Cost Response Model is more sensitive to changes in the parameters than the HGV Cost Response Model.

7.5 For HGVs, very substantial changes would be required to most parameters in order to realise a sufficient decrease in upgrades to delay the year of compliance, and the model was not found to be sensitive to assumptions around depreciation costs for HGVs. On balance, this scale of change was not considered likely, although all elements to continue to be monitored and kept under review.

7.6 In contrast, the LGV Cost Response Model is sensitive to changes in the parameters, with the model showing that a delayed year of compliance is possible at relatively low proportional changes. The model shows particular sensitivity to changes in vehicle pricing and CAZ charging impacts (representing the ability of non-compliant vehicle owners to pass on some or all of the cost of the charge to customers), and to a lesser extent to assumptions around trip frequency.

Recent Analysis of Van Markets

7.7 GM-commissioned a review of the LGVs supply chain, which can be used in the light of the breakpoint analysis to determine whether the sensitivity test criteria is likely to have been exceeded. The full report is available in Appendix A, with a summary of the key conclusions below.

7.8 Pre-pandemic, there was significant growth in van mileage and van stock over a number of years and the expectation was that both growth trends would continue.

7.9 However, whilst the early phases of the pandemic and subsequent lockdowns and constraints in 2020 constrained demand, it appears that this effect was temporary and has been offset by growth in demand from some van-owning sectors.

7.10 The pandemic had a major impact on the number of new vans sold in the UK, initially due to the halting of production lines and local lockdowns around the world. Whilst new van sales recovered to some extent, they are still not back to 2019 levels and so there is a substantial ‘lost supply’ that has not been recovered equating to 80,000 vehicles on a conservative assumption that 2019 levels had been maintained.

7.11 The industry is reporting significant supply issues with extended lead times for new orders. It is also anticipated that the introduction of clean air zones at particular locations in the UK will introduce some regional disparity in terms of the availability of certain vehicles and place additional demand pressure on the market in general.

7.12 Whilst reliable data on the variation in the price of new vans is not readily available, there is substantial evidence of significant price increases in the second-hand van market. The scale of those rises has a high degree of variability depending on the particular vehicle. The extent of the reported rise varies between 13% and almost 60%.

7.13 Overall, the evidence suggests that demand for new and second-hand vans remains strong, and therefore that the loss of supply caused by lockdowns in 2020 and more recently by the semi-conductor shortage is leading to price rises in the new and second-hand markets, and to long lead times for new vehicle orders.

Impact on the CAP Modelling Predictions

7.14 Modelling carried out to support the decision to approve the GM CAP, supplied in June 2021, demonstrated that the Plan was forecast to achieve compliance with legal limits of NO_2 concentrations by 2024, based on the proposals set out in the Policy and the assumptions made at that time in terms of the age of the fleet and the cost of upgrade amongst other factors.

7.15 Sensitivity testing carried out in 2021 suggested that whilst HGV behavioural responses are relatively insensitive to vehicle price increases, for vans an increase of 8% in the price of vehicles (compared to the price as assumed in the modelling) could be sufficient to delay compliance by one year, all other things being equal.

7.16 The evidence suggests that currently price rises well in excess of 8% are being experienced in the van market. Therefore, given the reported constraints to new van supply into 2023 and the knock-on effect to the used van market it is anticipated that price rises would be sufficiently sustained into 2023. Assuming prices rises remain above the test threshold, and all other things being equal, it is not likely that compliance in GM would be achieved in 2024

7.17 This is because as van prices rise, more van owners are expected to stay-and-pay rather than upgrade their vehicle, and the emissions reductions would then be less than previously forecast. Therefore, more van owners would incur the charge, imposing costs on GM's businesses and their customers but without the associated air quality benefits. This is the opposite of what a CAZ aims to deliver.

8 Consideration of Locations at Risk of Exceedance in 2024

8.1 Both the assumptions associated with private car fleet age due to lower new car sales, and increases to the price of used vans, would be expected to increase the predicted NO2 concentrations. These effects will act additively in the Approved GM CAP scenario modelling, such that roads where compliance with the limit value in 2024 was marginal would now be expected to exceed until 2025 with the CAP in place.

8.2 The Approved GM CAP modelling and the sensitivity tests prepared for the FBC have been reviewed, to consider those sections of road most at risk of exceedance beyond 2024. The most relevant test scenario to provide insight is the Older Fleet Age sensitivity test. This scenario increased the fleet age of private cars and vans to one year older beyond pre-Covid-19 levels, with an additional year added for HGVs and taxis. Whilst this doesn't incorporate the poorer upgrade response for vans, this is still likely to be slightly pessimistic overall, on the balance of the differing factors under review.

8.3 The test results have been considered using the factors below, to gain an insight on the level of likelihood of delayed compliance. These factors are:

- Predicted concentration in 2024
- Proportion of NOx emissions contribution from private cars
- Proportion of NOx emissions contribution from vans

8.4 Under this sensitivity test scenario there were four points at three locations that were predicted to still exceed in 2024, with their associated risk level:

- A57 Regent Road, Salford - (High Risk)
- A34 John Dalton Street, Manchester - (Medium Risk)
- A58 Bolton Road, Bury (2 points) - (High Risk)

8.5 Model scenarios are only available for 2023 and 2025, with the 2024 concentration interpolated. Table 9 from AQ3 has been amended below to provide the 2024 sensitivity test concentration, in addition to the Approved GM CAP 2023 data as would be reported with the current (June 2021) model assumptions.

Table 8-1: Predicted annual mean NO_2 concentrations and source apportionment at key compliance points on the Greater Manchester road network – Approved GM CAP 2023 (excerpt from AQ3 with Older Fleet Age Sensitivity Test Results – interpolated for 2024)

Point ID	Census ID	Road name	Local Authority	Annual mean NO_2 conc (µg/m^3) CAP 2023	Background NOx conc (µg/m^3)	Background NO_2 conc (µg/m^3)	Road NOx contrib (µg/m^3)	Road NO_2 contrib (µg/m^3)	AADT	NOx contribution by vehicle type (%)					Change in Annual mean NO_2 conc (µg/m^3) (CAP-Do Min)	Older Fleet 2024 Sensitivity Test: Annual mean NO_2 conc (µg/m^3)
										Bus	Taxi	HGV	LGV	Car		
2799_3118_DW	58048	A673	Bolton	36.8	26.0	18.1	40.4	18.7	27,735	0%	6%	25%	24%	45%	-3.9	36.6
2650_2653_DW	7431	A666	Bolton	36.9	24.8	17.3	39.7	19.5	69,341	0%	6%	3%	39%	51%	-3.2	36.7
2237_3790_DW	38354	A58	Bury	42.3	21.4	15.2	60.7	27.1	79,421	7%	6%	15%	23%	47%	-5.6	**42.1**
3424_4940_DW	17924	A56	Bury	39.1	17.0	12.4	57.9	26.8	19,893	3%	6%	22%	22%	47%	-6.6	39.6
3056_3842_DW	26157	A6	Manchester	39.0	32.2	21.6	36.9	17.4	38,555	6%	8%	4%	27%	55%	-6.5	38.5
1268_1269	27974	A34	Manchester	41.3	35.6	23.4	51.5	17.9	9,285	63%	3%	3%	9%	22%	-7.8	**40.8**
1268_46301	7947	A34	Manchester	40.8	35.6	23.4	52.0	17.3	8,483	65%	2%	10%	9%	14%	-6.4	40.3
14523_14524	36632	A62	Oldham	36.3	24.5	17.1	39.5	19.2	24,917	0%	7%	9%	25%	58%	-3.3	35.3
2210_14216_DW	17322	A664	Rochdale	39.5	17.9	13.0	61.2	26.5	34,409	0%	5%	36%	25%	35%	-5.0	39.8
1349_2993_DW	73792	A57	Salford	41.7	24.7	17.2	52.5	24.5	57,324	0%	7%	11%	29%	52%	-5.0	**42.5**
1216_14503_DW	17926	A6	Salford	39.1	25.2	17.6	51.0	21.5	31,568	33%	5%	14%	16%	32%	-7.2	38.8
3973_14181_DW	58034	A5145	Stockport	38.4	20.9	14.9	50.7	23.5	26,274	10%	6%	17%	25%	43%	-4.4	38.4
2887_2430_DW	26352	A34	Stockport	38.6	19.0	13.8	51.3	24.9	40,144	0%	7%	7%	25%	61%	-3.4	38.7
3812_14478_DW	99618	A635	Tameside	38.4	25.5	17.7	44.2	20.7	41,231	4%	6%	15%	30%	45%	-4.6	38.5
7606_17100_DW	N/A	B5214	Trafford	33.6	19.6	14.1	43.1	19.4	28,949	22%	6%	15%	14%	43%	-7.5	33.8
3492_3511_DW	8566	A577	Wigan	32.5	29.1	19.7	26.3	12.8	22,366	2%	7%	13%	26%	52%	-3.3	32.5

Note: The JAQU definition of compliance is >40.4 ug/m^3.

9 Other Sensitivity Tests

9.1 The FBC sensitivity tests covered a wide range of factors and assumptions, affecting underlying issues that would impact on the Do Minimum position, and then those which might alter the behavioural responses and performance of the CAP.

9.2 Whilst some factors could worsen air quality, such as older vehicle fleets or high traffic growth, emerging evidence may be available to confirm trends that could act to reduce car or bus traffic for example. These factors include:

- Increased working from home;
- Lower than forecast traffic growth, as result of poor economic performance or changes in patterns of activity;
- Higher than forecast fuel prices; and
- Lower than forecast bus mileage as a result of falling passenger demand.

9.3 GM would seek to review aspects of the sensitivity testing where new information is available, and the FBC testing indicated further analysis is warranted.

10 Conclusions

10.1 As part of the CAP, and in preparation for the implementation of the Performance Management Plan, GM has continued to monitor vehicle sales and forecast information, and a range of wider assumptions and metrics that supported the development of the Plan.

10.2 This process has now identified two factors where emerging evidence suggests the divergence from expected trends is beyond the thresholds identified in the sensitivity testing as putting compliance by 2024 at risk. Independently either factor could be sufficient to delay compliance beyond 2024. This risk is amplified if both factors are occurring simultaneously.

10.3 Firstly, evidence suggests that the used van market has materially changed since the modelling was undertaken, with evidence suggesting that second-hand van prices have increased by between 13% and c.60% since the modelling was undertaken. If van prices have increased, this makes it less likely that van owners will choose to (or be able to) upgrade in response to the CAZ and devalues the funding offer for vans. If fewer vans than forecast upgrade to a cleaner vehicle, emissions reductions will be lower and compliance in 2024 becomes less likely.

10.4 Sensitivity testing shows a delayed year of compliance is possible at relatively low proportional changes in LGV upgrade responses to the CAZ charges and associated financial support packages. In particular, an increase of 8% in van prices (all other things being equal) – compared to those assumed in the modelling - could be sufficient to affect behavioural responses such that compliance is delayed by a year.

10.5 Therefore, the Plan is very sensitive to LGV prices and to whether businesses can afford to upgrade to a compliant van. Given the evidence supplied on price increases by the research on the van sector, suggesting price rises which clearly exceed the 8% threshold, this aspect in the modelled test increases the risk that the Plan will fail to deliver compliance in 2024.

10.6 Secondly, sales of new private cars have been lower than expected in 2021, reducing the natural rate of fleet upgrade. The approach taken by GM to representing local fleet age, which already builds in assumptions around the adverse impacts of Covid-19, plus the suite of sensitivity tests already produced, has provided insight on the scale of potential impacts based on revisions to vehicle sales and fleet on the predicted year of compliance. This indicates that the impacts of an older fleet of private cars based on recorded sales (in the absence of a corresponding modelled test), would be expected to lead to a delay in the predicted year of compliance for the Approved GM CAP, irrespective of any other changes to the assumptions (i.e. used van prices).

10.7 On balance, the latest emerging evidence suggests that with the Approved Plan in place, it is no longer more likely than not that compliance would be achieved in 2024.

Appendix A – Technical Note: Current Issues in the Van Sector

As previously supplied

Appendix B – Sensitivity Testing at FBC Report

Previously supplied