Clean Air Greater Manchester

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

Data Evidence and Modelling: Consultation Summary Report

Prepared by Transport for Greater Manchester on behalf of the 10 Local Authorities of Greater Manchester

October 2020

Bolton • Bury • Manchester • Oldham • Rochdale • Salford • Stockport • Tameside • Trafford • Wigan

1. Contents

2. Executive Summary

2.1 The Greater Manchester (GM) authorities are now consulting on key elements of the GM Clean Air Plan (GM CAP), which aims to reduce concentrations of NO_2 in areas which have been forecast to exceed the legal limits in the shortest possible time and by 2024 at the latest, in line with Government guidance.

2.2 This document sets out the evidence base that underpins the proposed Option for Consultation. Further information about the methodology, data collection and analysis that has been undertaken has been published in a series of Technical Reports and Technical Notes. A full list of these Reports and Notes is provided as Appendix D of this report, and all published materials can be found at https://cleanairgm.com/technical-documents.

2.3 GM has conducted the analytical work in line with Government guidance and in liaison with technical experts at the Joint Air Quality Unit (JAQU) and the Technical Independent Review Panel (TIRP). A programme of data collection and research has been carried out to support the GM CAP. This evidence has been used to inform the development of policies and proposals, and has also been used to inform and underpin the modelling approach. GM has also developed a modelling process to allow quantification of the impact of traffic by vehicle type on emissions and consequently on concentrations of NO_2 at the roadside.

2.4 The analytical work is an ongoing process; the evidence presented here reflects the modelling conducted to support the decision to proceed with consultation and further changes to the evidence base will be required post-consultation. In particular, this work has not considered the impact of the COVID-19 pandemic; GM has begun to consider the pandemic's impacts, and has committed to updating the government as the picture becomes clearer over time.

2.5 GM's modelling predicts that there are 203 points along 160 stretches of road across GM where concentrations of NO_2 are forecast to be above required levels in 2021. The local modelling identified that all ten GM local authorities contained areas of exceedance for NO_2 in 2021. Without action, compliance is not expected to be achieved in GM until 2027.

2.6 GM has been directed by the Government to introduce a charging Clean Air Zone (CAZ) Class C across the region. This means that owners or registered keepers of in-scope vehicle types will be required to pay a daily charge for driving inside the zone, if the vehicle does not comply with the vehicle emission standards in the Government's CAZ Framework[1].

[1] Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/863730/clean-air-zone-framework-feb2020.pdf

2.7 GM has proposed a package of funding support to help owners or registered keepers of non-compliant buses, coaches, HGVs, LGVs, taxis and minibuses with the cost of upgrading their vehicles, as well as a Try Before You Buy scheme for Zero Emission Capable (ZEC) hackney carriages and a network of 40 taxi-only rapid electric vehicle charging points.

2.8 The proposed CAZ, supported by these funds, is forecast to bring forwards the upgrade of the fleet of vehicles based in GM, so that by 2025 with the GM CAP implemented:

- All buses are assumed to become compliant;
- Close to 100% of HGVs operating in GM are expected to be compliant with emissions standards, compared to around 89% without action;
- 91% of LGVs operating in GM are expected to be compliant with emissions standards, compared to around 64% without action;
- 90% of hackney carriages operating in GM are expected to be compliant with emissions standards, compared to around 64% without action[2]; and
- 97% of PHVs operating in GM are expected to be compliant with emissions standards, compared to around 86% without action.

2.9 The GM CAP is forecast to deliver total reductions in nitrogen oxides (NOx) emissions from road traffic of 22% in 2023, a reduction of around 1,335 tonnes of NOx per year.

2.10 The results show that, with the GM CAP Option for Consultation:

- two authorities (Wigan and Trafford) are forecast to become compliant in 2021[3], with 57 points of non-compliance remaining across the rest of the region;
- by 2023 eight authorities are forecast to be compliant, with three non-compliant sites remaining in Manchester and Bury; and
- GM achieves compliance in 2024, by removal of the last 12 exceedances which were predicted without action.

2.11 The GM CAP aims to deliver compliance in the shortest possible time in a way that takes into account the need to reduce human exposure. The GM CAP delivers reduced concentrations even at sites remaining in exceedance in that year. This also shows that the number of sites close to exceedance reduces in each year as a result of the Plan. Health benefits continue to be delivered by reductions in NO_2 concentrations below the annual mean limit.

[2] Note that the potential impact of proposed Minimum Licensing standards has not been taken into account for Hackney Cabs or PHVs.
[3] Note that, due to the COVID 19 pandemic, the proposed implementation date has been moved to 2022. The implications of this have not yet been assessed in the modelling process, and for the purposes of modelling the assumed implementation date remains 2021.

3. Introduction

3.1 Air pollution affects the health of people living, working and travelling in Greater Manchester. Pollutants such as nitrogen dioxide (NO_2) - which is the harmful form of nitrogen oxides (NOx) - and particulate matter ($PM_{2.5}$ and PM_{10}) are found at dangerous levels in many urban areas across the UK and particularly on busy roads.

3.2 Air pollution affects people's lungs, worsening respiratory issues such as asthma or bronchitis as well as cardiovascular problems, and reduces life expectancy. The air you breathe inside your vehicle can be dirtier than the air outside so people who spend a lot of time in their cars, taxis, vans or lorries are particularly at risk. Further information on the health impacts of poor air quality is set out in the Strategic Case of the Outline Business Case (OBC), available at https://cleanairgm.com/technical-documents/.

3.3 The Greater Manchester (GM) authorities are now consulting on key elements of the GM Clean Air Plan (GM CAP), which aims to reduce concentrations of NO_2 in areas which have been forecast to exceed the legal limits in the shortest possible time and by 2024 at the latest, in line with Government guidance. For more information about the legal basis of the GM CAP, see Appendix A.

3.4 This document sets out the evidence base that underpins the proposed Option for Consultation. Further information about the methodology, data collection and analysis that has been undertaken has been published in a series of Technical Reports and Technical Notes. A full list of these Reports and Notes is provided as Appendix D of this report, and all published materials can be found at https://cleanairgm.com/technical-documents.

Important caveats

3.5 The analytical work is an ongoing process; the evidence presented here reflects the modelling conducted to support the decision to proceed with consultation. Since the modelling contained in this report was completed, the Government have supplied GM with £41m of funding towards the retrofit and purchase of compliant buses, coaches, HGVs, minibuses and PHVs (includes Government-estimated delivery costs at 5%). The Government have also confirmed that they do not support the proposed Sustainable Journeys measure and a new Ministerial Direction was issued in March 2020. Some changes have also been made to the detailed policies and proposals locally. As the impact of the Government's decisions and local policy changes on the results and conclusions contained in this report was considered likely to be minor, the modelling has not yet been updated. Updated modelling will be carried out post-consultation to reflect these and any further changes to the policy and proposals arising from the consultation.

3.6 Further technical feedback has been received from the JAQU expert team, and from the Technical Independent Review Panel (TIRP). Their recommendations will be incorporated in future iterations of the modelling and analysis work.

3.7 In 2018, the GM authorities agreed to collectively develop a common set of minimum licensing standards (MLS) for Hackney carriage and Private Hire Vehicle (PHV) services that cover GM as a whole. The consultation on MLS, is running at the same time as GM CAP proposals[4]. The MLS proposals have not been modelled in the GM CAP Option for Consultation; a review to determine the most appropriate modelling approach for taxis will be undertaken post-consultation.

3.8 Finally, this work has not considered the impact of the COVID-19 pandemic. GM is mindful of the significant changes that could result from these exceptional times. The Government has asked GM to continue to progress the CAP, and to continue with the consultation, based on proposals developed before the COVID-19 pandemic. The Government has also asked that an assessment of the possible impacts of the pandemic on the proposals is undertaken to inform decision-makers in the GM local authorities. This will include the impact of the decision to delay implementation of the CAZ until spring 2022. GM has begun to consider the impacts of the pandemic, and has committed to updating the Government as the picture becomes clearer over time.

[4] For more information, see www.gmtaxistandards.com

4. Proposed Option for Consultation

4.1 GM has been directed by the Government to introduce a charging Clean Air Zone Class C across the region. This means that owners or registered keepers of in-scope vehicle types will be required to pay a daily charge for driving inside the zone, if the vehicle does not comply with the minimum vehicle emission standards in the Government's CAZ Framework5. The key characteristics of the proposed GM CAZ are set out in **Table 4-1**.

4.2 The CAZ vehicle categories and minimum emission standards as set out in the CAZ Framework are provided in **Table 4-2**. Vehicles which meet the emissions standards will not be subject to charges. Cars are not in scope for the CAZ charges[6]. It is proposed that the CAZ will launch in spring 2022.

4.3 GM proposes the following package of funding support to help owners or registered keepers of non-compliant vehicles with the cost of upgrading their vehicles. The funding proposals are:

- A Clean Commercial Fund to provide financial support for the upgrade of non-compliant LGVs and HGVs, minibuses and coaches, which will be targeted to support smaller local businesses, sole traders, individuals and the charity/voluntary sector;
- A Clean Taxi Fund to provide financial support for the upgrade of non-compliant GM Licensed Hackney carriage and PHVs;
- A Clean Bus Fund to provide financial support for the upgrade of non-compliant buses registered to run services across GM; and
- A Hardship Fund to support individuals, companies and organisations who are considered to be the most vulnerable to the potential economic impacts of the GM CAZ.

4.4 The proposals also include a Try Before You Buy Hackney Scheme, offering GM-licensed Hackney drivers the opportunity to hire a Zero Emission Capable (ZEC) hackney carriage on a trial basis. Finally, GM is proposing a network of 40 taxi-only rapid electric vehicle charging points, tailored to locations to support ZEC taxis to operate across GM.

4.5 For the detailed policy proposals, see the Policy for Consultation, available at https://cleanairgm.com/.

4.6 Collectively, the proposals set out above are referred to within this document as the 'Option for Consultation', the modelling results of which are discussed in greater detail within Technical Note 29 and in the Technical Reports T4 and AQ3 (Consultation Option). The approach taken to representing the proposals within the modelling process is set out in Appendix B.

[5] Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/863730/clean-air-zone-framework-feb2020.pdf

[6] For more information about the Options Appraisal process, please see the Strategic Case of the OBC, available at https://cleanairgm.com/technical-documents

Table 4-1: Key Characteristics of the GM CAZ

Clean Air Zone: Boundary	Primarily aligned with the administrative boundary of Greater Manchester Authorities, excludes the Strategic Road Network (SRN)[7].
Clean Air Zone: Times of Operation	24 hours a day, 7 days a week, 365 days per year
Clean Air Zone: Vehicles Affected	Licensed Hackney carriages Licensed PHVs Buses Coaches Minibuses LGVs HGVs
Clean Air Zone: Exemptions	Certain vehicle types may be eligible for exemptions as detailed in the Policy for Consultation[8] para 3.8.
Clean Air Zone: Discounts	Certain vehicle types may be eligible for discounts as detailed in the Policy for Consultation para 3.8
Clean Air Zone: Daily Charges	Daily charges would apply for each day a non-compliant vehicle is used within the GM CAZ, with one charge imposed per vehicle, per 'Charging Day' (midnight to midnight), however much a vehicle drives within the GM CAZ in that 24-hour period. • Licensed Hackney carriages – £7.50 per 'Charging Day' • Licensed Private Hire Vehicles – £7.50 per 'Charging Day' • Buses – £60 per 'Charging Day' • Coaches – £60 per 'Charging Day' • Minibuses – £10 per 'Charging Day' • LGVs – £10 per 'Charging Day' • HGVs – £60 per 'Charging Day' Owners or registered keepers of non-compliant vehicles used within the GM CAZ will be required to pay the relevant charge via a Central Government Payment Portal. The Government intends that a user can pay 7 days in advance, including the journey date (Charging Day), or 7 days retrospectively including the journey date (Charging Day).
Penalty for non/late payment of CAZ charge	£120 (in addition to the daily charge) will be applied to all relevant vehicles (reduced to £60 plus the daily charge if paid within 14 days of Penalty Charge Notice being issued)

[7] The SRN consists of roads which are not managed by local and regional GM authorities, namely motorways and trunk roads managed by Highways England. The SRN is illustrated on the Highways England Network Management Map available at: https://www.gov.uk/government/publications/roads-managed-by-highways-england

[8] Policy for Consultation is available at: https://cleanairgm.com/clean-air-plans

Table 4-2: CAZ vehicle categories and minimum emission standards as set out in the Clean Air Zone Framework[9]

Vehicle Type	Euro Category	Minimum[10] CAZ Compliant Euro Emission Standard	Example vehicles[11]
Bus	**M3** (Gross Vehicle Weight over 5000kg and more than 8 seats in addition to the driver)	Euro VI	Public Buses (single decker, double decker and midi), Coaches (single and double decker).
Coach		Euro VI	
HGV	**N2** (Gross Vehicle Weight[12] over 3500 kg and ref. mass over 2610 kg) **N3** (Gross Vehicle Weight over 5000 kg)	Euro VI	Articulated vehicles, rigid HGVs, flatbed lorries, concrete mixers, 2-axle lorry, some motorised caravans (>3.5t) and motorised horseboxes (>3.5t).
Minibus	**M2** (Gross Vehicle Weight not exceeding 5000 kg, reference. mass not exceeding 2840 kg and more than 8 seats in addition to the driver	Euro 6 and VI (diesel) Euro 4 and IV (petrol)	Minibuses (excluding those which are licensed as a Taxi or Private Hire Vehicle – see Taxi and Private Hire Vehicles below).
LGV	**N1** (Gross Vehicle Weight not exceeding 3500 kg and reference. mass not exceeding 1305 kg)	Euro 6 (diesel) Euro 4 (petrol)	Vans (short and long wheelbase), some car derived vans, some light 4x4 utility vehicles and pickups.
Hackney carriage and Private Hire Vehicles	Minibus – **M2** (Gross Vehicle Weight not exceeding 5000 kg, reference. mass not exceeding 2840 kg and more than 8 seats in addition to the driver) **M1** Passenger vehicle with up to 8 seats in addition to the driver	Euro 6 (diesel) Euro 4 (petrol)	Vehicles licensed as Hackney carriages and/or Private Hire Vehicles.

[9] Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/863730/clean-air-zone-framework-feb2020.pdf
[10] Note the minimum compliant standard is specified in Table 3.1.2. Vehicles which meet Euro 5 (V) and 6 (VI) petrol standards will also be compliant.
[11] As set out by GM. These example vehicles do not feature in the Government Guidance and are provided for guidance only.
[12] The weight of a vehicle or trailer, including the maximum load, that can be safely carried when it is being used on the road. This will be listed in the owner's manual. Also known as the maximum authorised mass (MAM) or permissible maximum weight.

5. Methodology

5.1 The GM CAP is underpinned by an evidence base derived from data collection, research, analysis and modelling. The results of that analysis are summarised in this report, and set out in detail in a series of Technical Reports and Technical Notes. A full list of these Reports and Notes is provided in **Appendix D** of this report, and all published materials can be found at https://cleanairgm.com/technical-documents.

5.2 This section sets out the process undertaken by GM, working with JAQU, describes the data collection and research that has been undertaken, and provides a brief overview of the modelling approach followed to assess the air quality impacts of the GM CAP proposal.

Government guidance and approvals process

5.3 Eight of GM's local authorities were directed by Government[13] to undertake feasibility studies to identify measures for reducing NO_2 concentrations to compliant levels in the 'shortest possible time'. As part of the feasibility study process, GM was required to produce its own local modelling and to produce a series of business cases for assessing and implementing the relevant Measures as part of the GM CAP. Following that more detailed local modelling, the remaining GM local authorities of Wigan and Rochdale were identified as containing roads which are expected to have NO_2 exceedances in 2021, and therefore it was agreed that the GM CAP should also include these local authorities.

5.4 This local modelling was necessary to provide a more comprehensive understanding of the air quality across the entirety of GM. The local modelling identified a larger number of locations which are expected to exceed the EU Limit Value, and higher concentrations of NO_2 in specific locations. This meant that all ten local authorities contained locations expected to be in exceedance of EU Limit Value for NO_2 after 2020. This reflected the fact that the local modelling used more detailed sources of data and more refined analytical tools. This resulted in three fundamental differences compared to the national modelling. Firstly, that the vehicle fleet in GM is older and more polluting than assumed in the national model. Secondly, that in some areas, vehicles are moving more slowly than assumed in the national model. And finally, that the background concentrations from non-road vehicle emissions sources (for example, electricity production, industry, local heating etc.) are higher than expected and needed to be increased in the modelling to reflect real-world conditions.

5.5 GM submitted the results of its local modelling to JAQU in summer 2018. Following review by JAQU and a Technical Independent Review Panel (TIRP), the local model process has been accepted as the reference for determining compliance with the EU Limit Value.

[13] Bolton, Bury, Manchester, Salford, Stockport, Tameside, Trafford were directed in July 2017 and Oldham in March 2018.

5.6 After receiving the 'Initial Evidence' from GM, including the local modelling, JAQU undertook a process called 'Target Determination', which involves comparing the outputs of the local and national modelling, verifying the local modelling process and then agreeing the forecast exceedances. JAQU also ensure consistent approaches to local modelling are being used by different local authorities. The outcome of this process was an agreement reached between JAQU and GM's local authorities in autumn 2018 of the NO_2 exceedances that GM must resolve in the GM CAP.

5.7 The OBC[14], submitted in March 2019, set out the Options Appraisal Process undertaken by GM in the Strategic and Economic Cases and associated appendices, supported by a series of Technical Reports.

5.8 Following GM's submission of the OBC in March 2019, a Ministerial letter was received in July 2019 requesting further options appraisal information (including transport and air quality modelling as well as due regard to economic, financial and deliverability considerations) to be submitted by 2nd August and prior to statutory consultation.[15]

5.9 A series of Technical Notes were submitted to JAQU in July 2019 to provide the specific information JAQU had requested about behavioural assumptions and sensitivity testing, with further Notes produced and submitted subsequently. An updated version of the Technical Reports was produced in January 2020, drawing together the methodological improvements set out in the various Technical Notes, and describing the results of the modelling and analysis carried out in support of the Option for Consultation, presented in this report.

5.10 The analytical work has been carried out in line with Government guidance and in liaison with technical experts at JAQU. GM has submitted elements of the evidence base to the TIRP for review on several occasions, including as an Initial Evidence Submission; at OBC; and in November 2019, February and August 2020 in support of the modelling of the Option for Consultation. GM has responded to their feedback to ensure the evidence base is robust and fit for purpose. JAQU have confirmed acceptance of the methodology applied by GM. GM will continue to work with JAQU and the TIRP post-consultation and throughout the development of the Full Business Case.

[14] Available at https://cleanairgm.com/technical-documents
[15] For further details see https://democracy.greatermanchester-ca.gov.uk/documents/s1209/14%20GM%20Clean%20Air%20Plan%20-%20Update_FINAL.pdf

Data collection and research

5.11 A programme of data collection and research has been carried out to support the GM CAP. This evidence has been used to inform the development of policies and proposals, and has also been used to inform and underpin the modelling approach.

5.12 In particular, Technical Notes 3, 4, 6, 10, 11, 12, 18, 19 and 22 set out the findings of relevant secondary data, whilst Technical Notes 5 and 20 set out the results of an ANPR survey and Specialised Goods Vehicles Counts respectively, both carried out to inform the GM CAP.

5.13 Evidence has been drawn from responses to the Clean Air 'conversation', carried out in spring 2019, and from research carried out with drivers and operators of in scope vehicles[16], including:

- Four deliberative workshops carried out in March 2019 with drivers and operators of taxis (hackney carriages and PHVs), coaches, HGVs and LGVs;
- Two further deliberative workshops carried out in October 2019 with hackney carriage and PHV drivers and operators;
- A quantitative survey of 800 small and micro businesses and sole traders who operated a van and a qualitative survey of 150 depth interviews with a subset of participants to the quantitative survey, carried out in September/October 2019; and
- Twenty depth interviews with small and micro businesses and sole traders who operated HGVs, carried out in January/February 2020.

5.14 A qualitative survey of coach operators was underway in March 2020 and had to be put on hold due to the 'lockdown' caused by the COVID-19 pandemic. Fieldwork has now restarted.

[16] Summary of responses to the Conversation and all research reports are available at https://cleanairgm.com/technical-documents

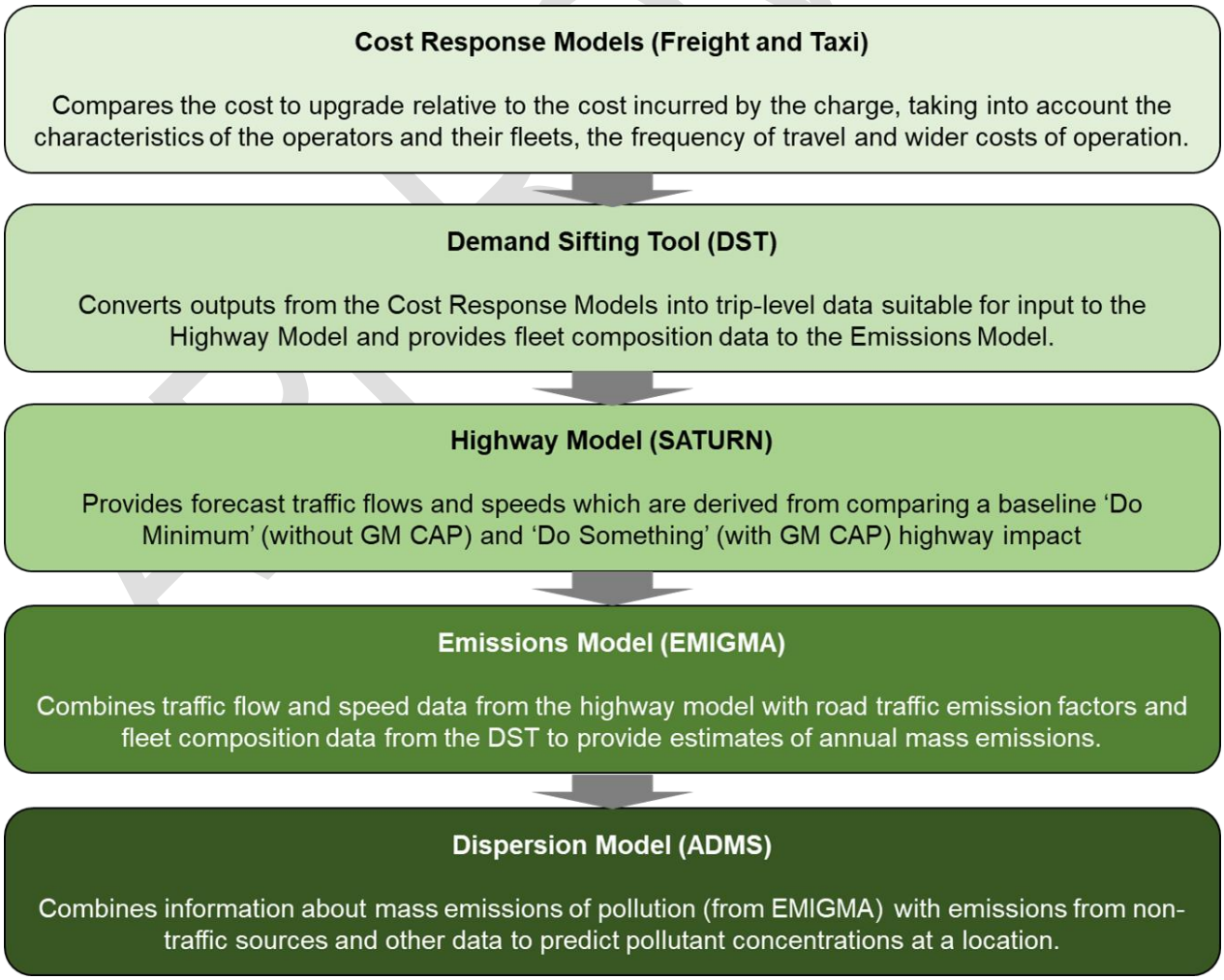
Summary of the Modelling Approach

5.15 The purpose of the modelling process is to quantify the impact of traffic by vehicle type on emissions and consequently on concentrations of NO_2 at the roadside in GM.

5.16 The modelling process provides a forecast of NO_2 concentrations in the baseline, if no action is taken, and then allows GM to test the impact of different policies and proposals on vehicle fleets, traffic and emissions. Using these modelling tools, GM forecasts NOx emissions and NO_2 concentrations under a range of scenarios for the years 2021, 2023 and 2025. NO_2 concentrations for interim years and beyond 2025 are interpolated from the results in modelled years.

5.17 A brief summary of the modelling input steps feeding into the appraisal is presented in **Figure 5-1**, which shows each of the modelling components and their linkages within the modelling suite. For a full description of the modelling methodology, please see the Technical Reports T1-4 and AQ1-3 (Option for Consultation).

Figure 5-1 Overview of the Modelling Process



Changes to the modelling approach since OBC

5.18 Since the submission of the OBC, the modelling process has been refined to reflect an improved evidence base and collaboration with Government and stakeholders. As a result, there have been several modelling updates which have impacted both the 'Do Minimum' and 'Do Something modelling scenarios which form the Option for Consultation. Technical Note 24 sets out the updated approach to modelling the 'Do Minimum' scenario, whilst the various improvements that have been made to the 'Do Something' scenario are set out in Technical Note 29 and T4: Local Plan Transport Model Forecasting Report - Consultation Option January 2020.

Further ongoing changes to the modelling approach

5.19 Whilst the core methodological approach for the modelling of the Option for Consultation has been accepted by JAQU, model development will remain an ongoing process until the submission of the Full Business Case. In particular, as set out in the Introduction, the Government has provided further feedback to which GM will need to respond; some changes have been made to the proposed Measures which will need to be taken into account, alongside any further changes arising from the consultation; and finally work is underway to better understand the impacts of the COVID-19 pandemic and to assess how best to approach this within the modelling and analysis process.

6. The Air Quality Challenge in GM

6.1 GM's modelling predicts that there are 203 points along 160 stretches of road across GM where concentrations of NO_2 are forecast to be above legal levels in 2021.

6.2 Air quality monitoring of NO_2 concentrations in GM has demonstrated that exceedances of the NO_2 annual mean standard of 40 ug/m^3 occur across GM. However, it is not feasible to monitor everywhere, and therefore air quality modelling is used to understand how air quality varies across the full road network. It is also required to understand how air quality will change in the future, as transport emissions change, both as a result of the vehicle fleet gradually becoming newer and cleaner, and also as the types and number of vehicles using the road network change over time.

6.3 The GM CAP modelling has calculated the concentrations of NO_2 in GM in the baseline year 2016, and forecast for 2021, 2023 and 2025. Model outputs for 2016 have been compared with the results of the monitoring carried out across GM to ensure that the predicted concentrations best reflect real-world conditions.

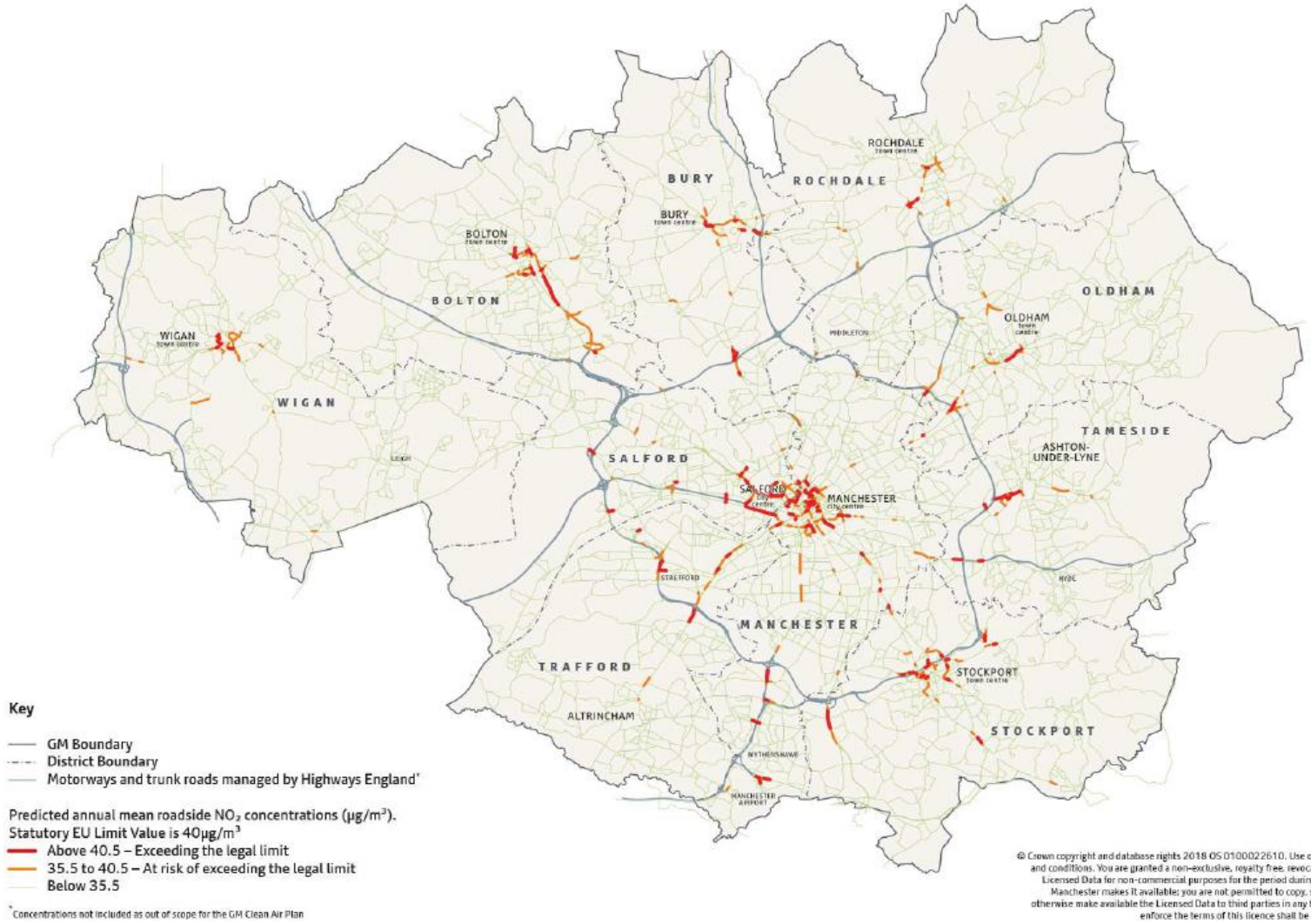
6.4 The future forecasts provide an estimate of the position if no additional interventions were carried out beyond the funded plan; these are known as the Do Minimum scenarios.

6.5 The GM CAP modelling is based on Government guidance, and also uses additional refined local evidence (such as local fleet mix information for buses and taxis from licensing records, along with data from local ANPR cameras for other vehicles such as HGVs, vans and cars) to better understand likely NO_2 concentrations in GM.

6.6 The local modelling identified that all ten GM local authorities contained areas of exceedance for NO_2 in 2021. Without action, compliance is not expected to be achieved in GM until 2027.

6.7 The map in **Figure 6-1** shows the location of exceedances across GM in 2021.

Figure 6-1: Map of predicted NO_2 concentrations on GM's road network in 2021 without further action ('Do Minimum')



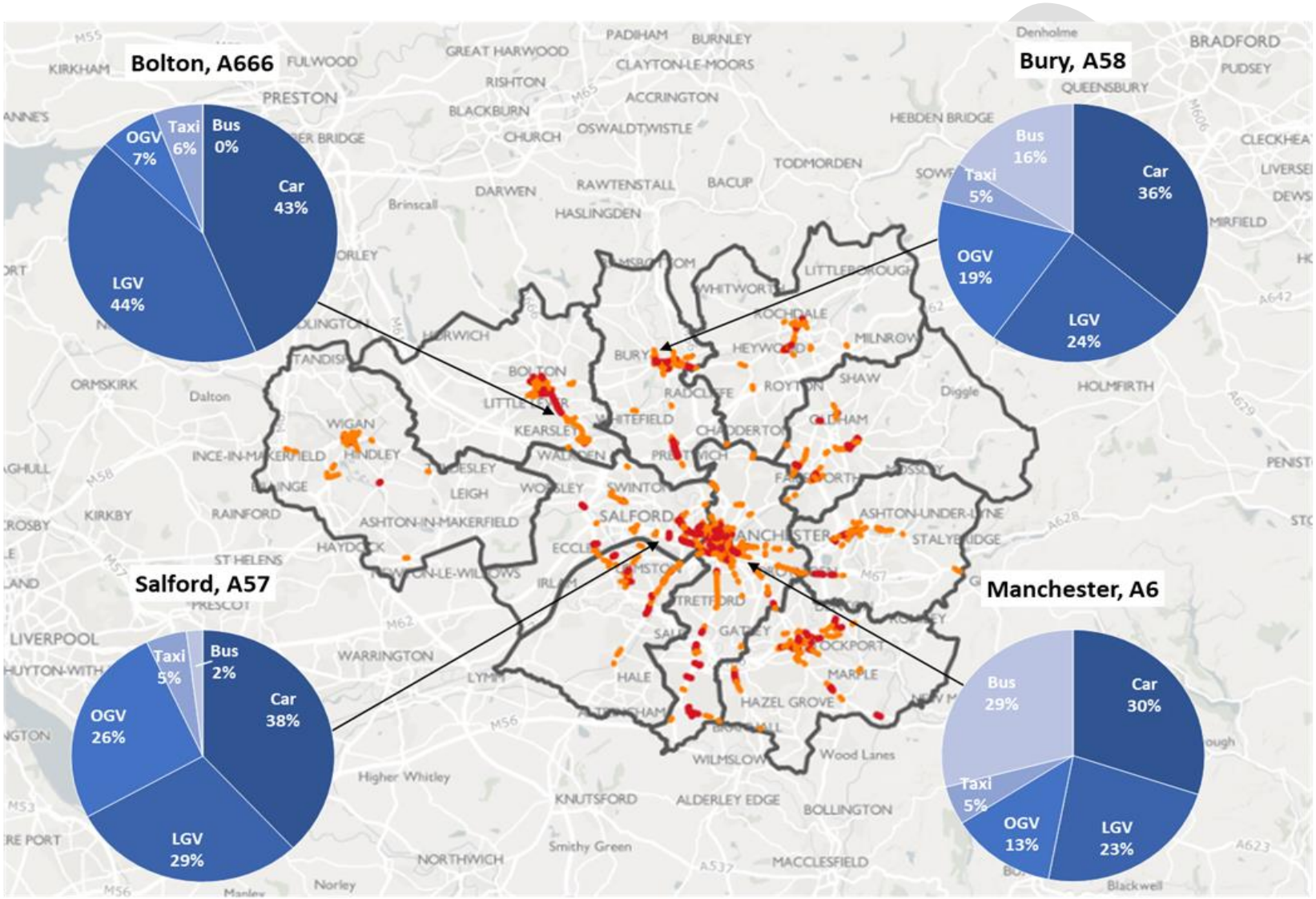
6.8 **Table 6-1** shows forecast NO_2 concentrations on GM's road network in 2021, 2023 and 2025 without interventions. The results demonstrate that, without action taken to address forecast pollutant levels, there will be 203 sections of road within GM that are non-compliant in 2021. The reduction in the number of non-compliant sites in 2023 and 2025 reflects the normal cycle of vehicle upgrades as older, non-compliant more polluting vehicles are swapped out for newer, compliant vehicles.

Table 6-1: Predicted NO_2 concentrations on GM's road network in 2021, 2023 and 2025 without further action ('Do Minimum')

Scenario Year	Compliant sites		Non-compliant sites			
	Very compliant (below 35 µg/m3)	**Compliant but marginal** (35 to 40 µg/m3)	**Non-compliant** (>40 to 45 µg/m3)	**Very non-compliant** (>45 to 50 µg/m3)	**Extremely non-compliant** (>50 µg/m3)	**Total non-compliant** (>40 µg/m3)
2021	1,851	485	143	49	11	**203**
2023	2,287	209	55	13	1	**69**
2025	2,463	109	12	0	0	**12**

6.9 The proportion of emissions by vehicle type contributing to exceedance locations on GM's roads vary site by site. The graph in **Figure 6-2** shows how different vehicle types contribute to the total road transport emissions on a given road. For example, buses are an insignificant fraction on the selected example Bolton and Salford roads (but may represent a significant contribution elsewhere in the local authority), whereas the selected example sites in Manchester and Bury comprise 16-29% bus emissions. Emissions from goods vehicles at the selected example link in Salford are over 50% of emissions, likely to be associated with accessing Trafford Park. The selected Bolton example is dominated by cars and vans, whilst the selected example site in Bury has a relatively even distribution of vehicle type contribution.

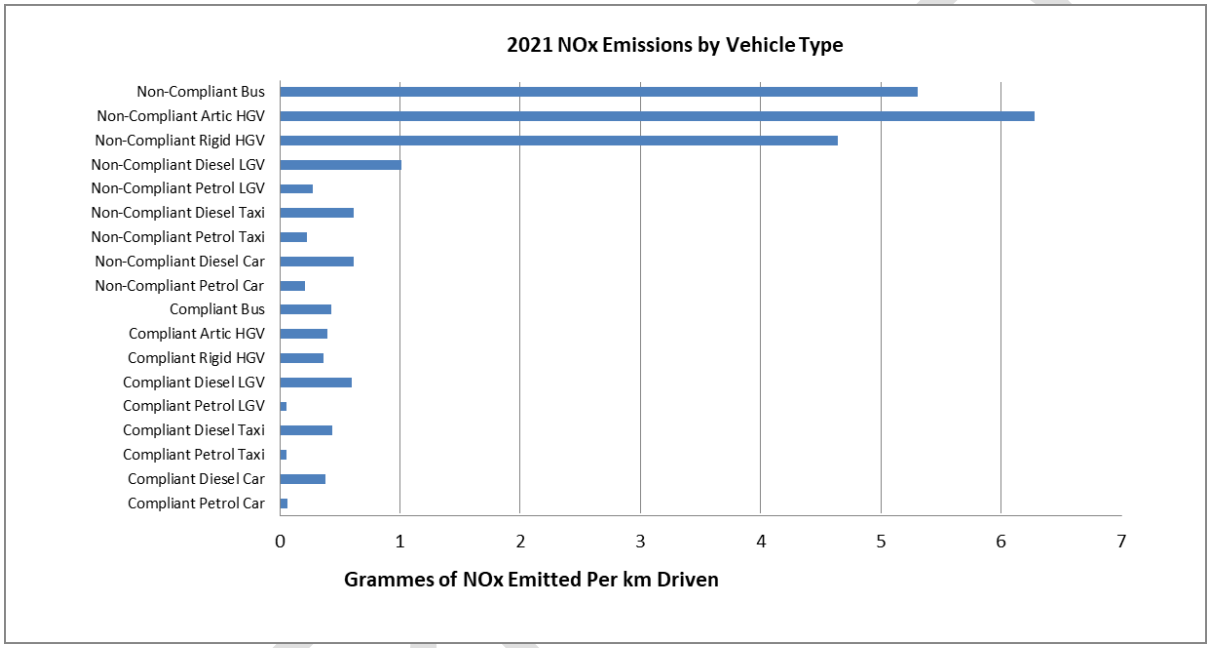
Figure 6-2: Examples of how transport-related sources of NOx vary across in GM



6.10 The emissions on a road are a function of three main factors; the total flow of each vehicle type including fuel, the age or more simply the Euro standard compliance (see **Table 4-2**), and the traffic speed.

6.11 There are varying levels of emissions based on vehicle types and whether they are deemed compliant or non-compliant. **Figure 6-3** shows NOx emission rates (grammes per km travelled) for different vehicle types from the 2021 air quality modelling.

Figure 6-3: NOx Emissions from Different Vehicle Types, grammes per km, 2021



6.12 In general, the figure shows that non-compliant vehicles have higher emissions than equivalent compliant vehicle types, and that diesel vehicles have higher emission rates than petrol powered vehicles. It can also be seen that non-compliant HGVs and buses have much higher emission rates than other vehicle types, and will therefore have a disproportionate impact on air quality levels relative to their overall contribution to the total traffic flow, but also that they deliver the greatest benefit in terms of emissions reductions when switching from a non-compliant to a compliant vehicle.

6.13 To deliver compliance, emission reductions equivalent to reducing traffic by as much as 40% are required at some locations. The proposed GM CAP has assessed solutions that aim to deliver equivalent reductions in emissions in the shortest possible time and without limiting the ability to travel around the region and restricting business operations. In many locations where there are significant exceedances, such as on roads in a city/town centre, the road network performs a variety of complex transport functions and therefore carries a diverse range of traffic, including cars, vans, HGVs, buses and taxis.

7. Impact of the GM CAP on Compliance by Vehicle Type

Vehicle Type Overview

7.1 This section provides an overview of the impact of the proposed Option for Consultation on compliance, in other words, on the proportion of the vehicle fleet serving GM that is compliant (Euro 4 or newer petrol, Euro 6 diesel or ZEC) compared to the proportion that is non-compliant. The section covers the following vehicle types:

- HGVs;
- LGVs;
- Hackney carriages;
- PHVs;
- Local Bus Services;
- Coaches; and
- Minibuses.

7.2 Under the GM CAP Option for Consultation, private cars are exempt from CAZ charges so are not discussed here.

7.3 Across all vehicle types, it is assumed within the Cost Models that the total volume of vehicles serving GM remains the same throughout the lifetime of the GM CAP, but that the fleet gradually becomes more compliant over time as businesses and owners replace their older, non-compliant vehicles with newer, compliant vehicles as part of their business-as-usual operations.

Heavy Goods Vehicles (HGVs)

7.4 HGVs are defined as any goods vehicle with a Maximum Gross Weight (MGW) of over 3.5 tonnes. There are number of variations of rigid HGVs with 32 tonne, 26 tonne and 7.5 tonne MGW vehicles, as well as articulated HGVs at 44 tonnes.

7.5 Analysis of the commercial vehicle market in business-as-usual conditions in GM and the tools developed to assess the GM CAP impacts are set out in Technical Notes 3 and 7.

7.6 HGV fleet sizes were derived from data collected in 2019 from an ANPR survey and Vehicle Licensing Statistics data.

7.7 In the 'Do Minimum' scenario, without the GM CAP:

- There were an estimated 25,700 HGVs based in GM in 2019, of which approximately 13,500 (53%) were non-compliant;
- Between 2019 and 2025, compliance is forecast to rise from 59% to 89% of the total HGV fleet (vehicles based in and serving GM); and
- In 2025, it is estimated that 11% of HGVs still in operation within GM would be classed as non-compliant.

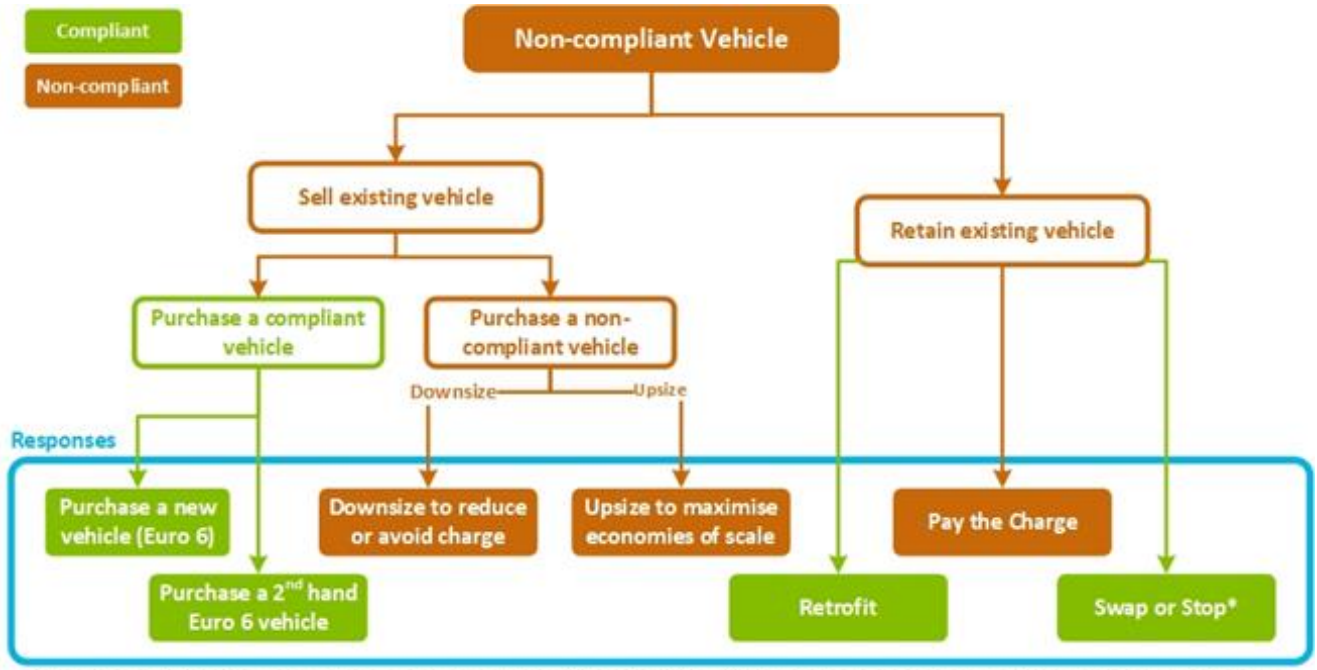
7.8 It is proposed that non-compliant HGVs will be in scope for a charge of £60 per day from 2022.[17] The possible options available to HGV owners and operators in responding to the GM CAP are set out in **Figure 7-1**.

7.9 Based on the behavioural responses, 97% of non-compliant vehicles would be upgraded with a CAZ implemented in 2021 with supporting funds, rising to 98% of non-compliant vehicles by 2025, meaning that very few operators are choosing to pay the charge. The impact of the GM CAP on HGV compliance is shown in **Figure 7-2**. It is assumed that very few vehicles choose to downsize or upsize.

7.10 In total, by 2025 it is anticipated that around 70,500 of the total fleet of 70,800 HGVs, estimated to be serving GM, would be compliant with the GM CAP[18]. For more details about the assumed behavioural responses and vehicle volumes, see Technical Note 37.

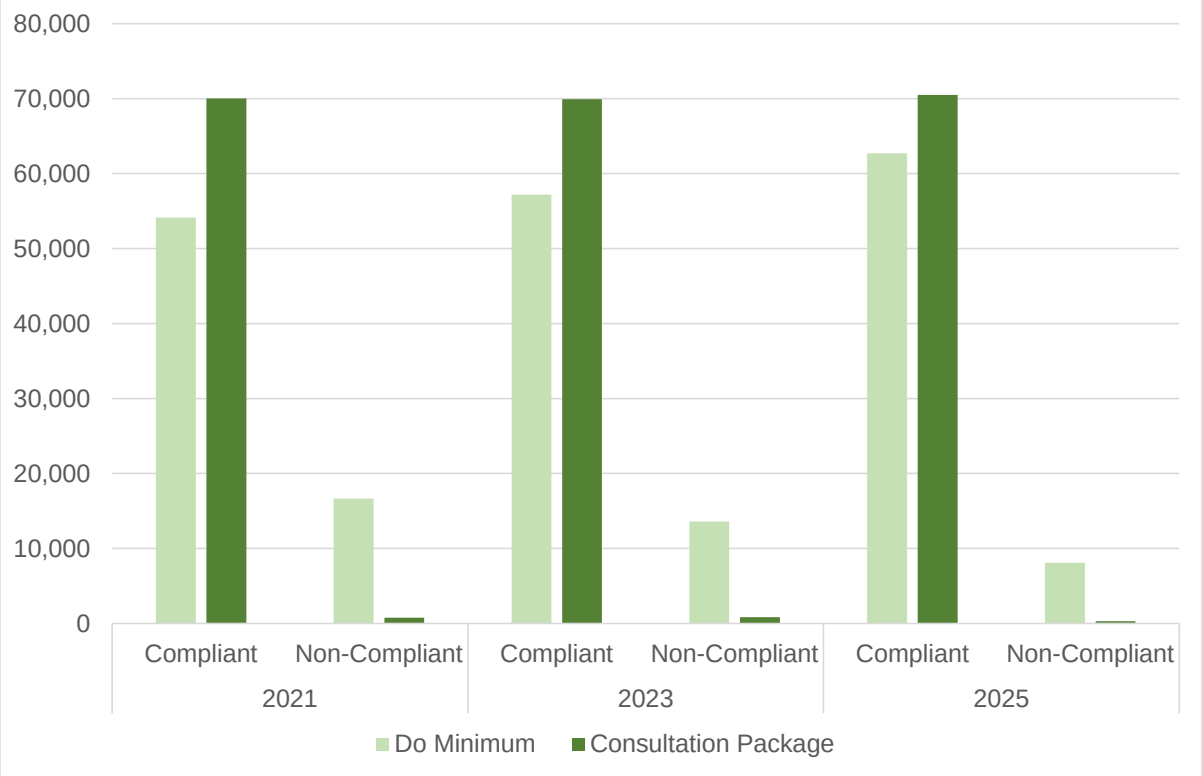
[17] Note that, due to the COVID-19 pandemic, the proposed implementation date has been moved to 2022. The implications of this have not yet been assessed in the modelling process, and for the purposes of modelling the assumed implementation date remains 2021.
[18] Assuming the implementation of the CAZ and provision of funds as per the Option for Consultation.

Figure 7-1 HGV vehicle owner/operator behavioural response options



*This option is for low frequency vehicles registered outside of the North West. It allows for large organisations to rotate compliant vehicles in their fleet to complete trips in GM while allows SME's to avoid this trip which is then assumed to be taken up by a compliant vehicle from a different organisation.

Figure 7-2 HGV compliance with the GM CAP



Source: Technical Note 37

Light Goods Vehicles (LGVs)

7.11 LGVs are goods vehicles with an MGW of 3.5 tonnes or less and are commonly known as vans. LGVs serve a wide variety of purposes, including construction, removals, food, communications pick-up, parcel home delivery and supermarket home delivery vans.

7.12 Analysis of the commercial vehicle market in business-as-usual conditions in GM and the tools developed to assess the GM CAP impacts are set out in Technical Notes 3 and 7.

7.13 LGV fleet sizes were taken from data collected in 2019 from an ANPR survey and Vehicle Licensing Statistics data.

7.14 In the 'Do Minimum' scenario, without the GM CAP:

- There were an estimated 135,700 LGVs based in GM in 2019, of which approximately 108,500 (80%) were non-compliant;
- Between 2019 and 2025, total LGV compliance is forecast to rise from 37% to 64% of the total fleet (based in and serving GM); and
- In 2025, it is estimated that 36% of LGVs still in operation within GM would be classed as non-compliant.

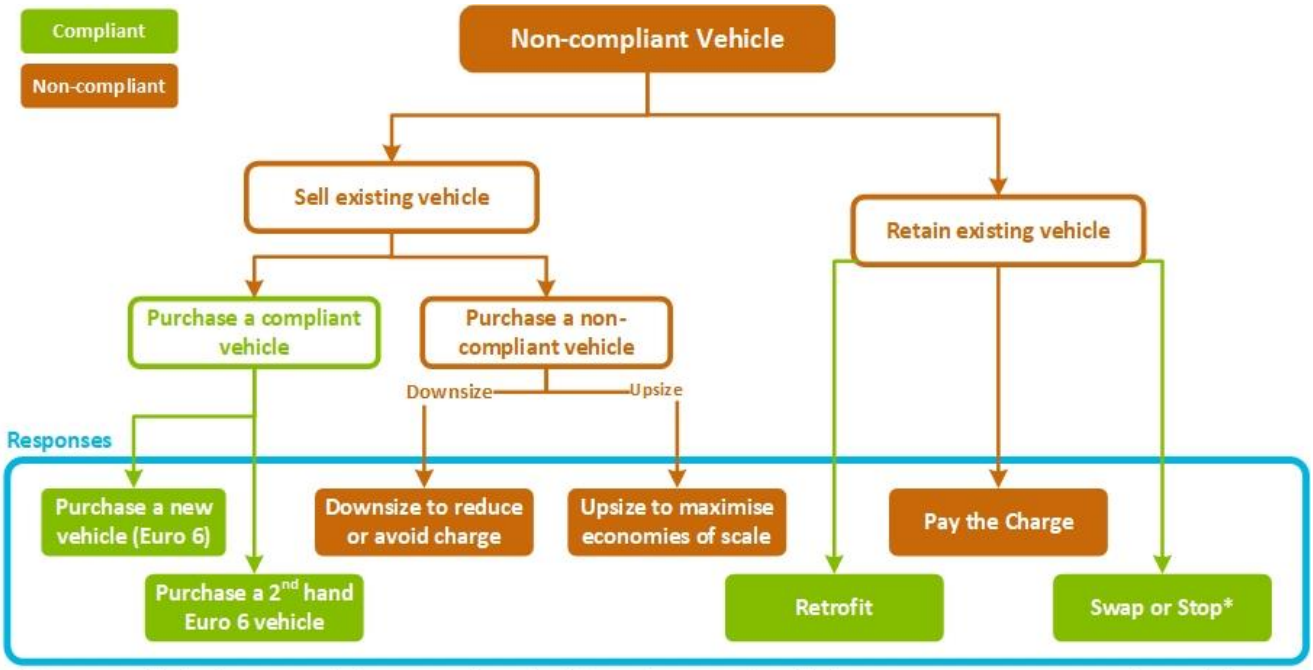
7.15 It is proposed that LGVs would be eligible for a temporary exemption to the end of 2022, with non-compliant LGVs in scope for a charge of £10 per day from 2023. The possible options available to LGV owners and operators in responding to the GM CAP are set out in **Figure 7-3**.

7.16 Based on the behavioural responses, 85% of non-compliant vehicles would be upgraded with a CAZ implemented in 2023 with supporting funds, rising to 86% of non-compliant vehicles by 2025. The impact of the GM CAP on LGV compliance is shown in **Figure 7-4**. It is assumed that very few vehicles choose to downsize or upsize.

7.17 In total, by 2025 it is anticipated that around 251,300 of the total fleet of 277,400 LGVs estimated to be based in and serving GM would be compliant with the GM CAP[19]. For more details about the assumed behavioural responses, see Technical Note 37.

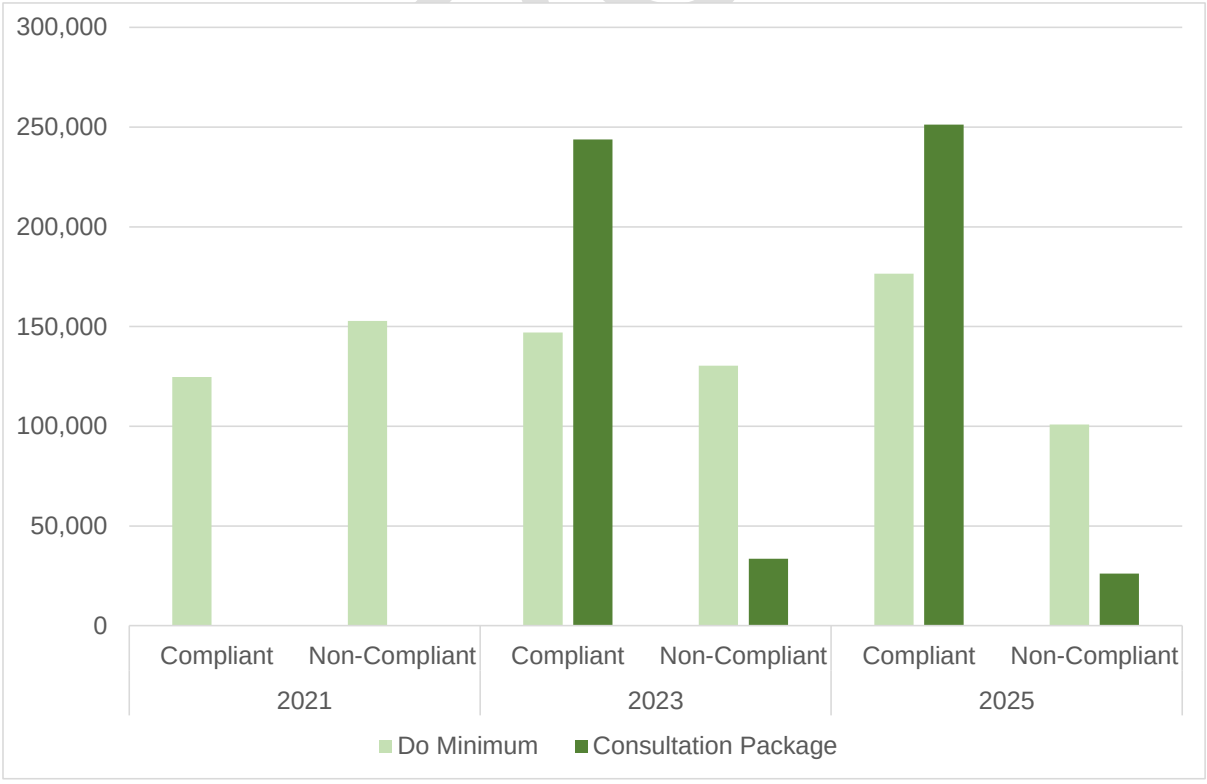
[19] Assuming the implementation of the CAZ and provision of funds as per the Option for Consultation.

Figure 7-3 LGV vehicle owner/operator behavioural response options



*This option is for low frequency vehicles registered outside of the North West. It allows for large organisations to rotate compliant vehicles in their fleet to complete trips in GM while allows SME's to avoid this trip which is then assumed to be taken up by a compliant vehicle from a different organisation.

Figure 7-4 LGV compliance with the GM CAP



Source: Technical Note 37

Hackney Carriages

7.18 Taxis (hackney carriage and PHVs) offer a flexible form of door-to-door public transportation. Hackney carriages can be hailed by passengers in the street, pick up fares from taxi ranks and take pre-bookings from within their licensing authority or outside their area.

7.19 Analysis of the Taxi market is provided in Technical Note 19. Technical Note 28 provides details of the tools developed to assess the impacts of the GM CAP on taxis.

7.20 Hackney carriage fleet sizes were taken from data collected in 2019 from an ANPR survey and Vehicle Licensing Statistics data, as well as licensing data supplied by GM's ten local authorities.

7.21 In the 'Do Minimum' scenario, without the GM CAP:

- There were an estimated 2,100 hackney carriages licensed to a GM local authority in 2019, of which approximately 1,900 (90%) were non-compliant;
- Between 2019 and 2025, hackney carriage compliance is forecast to rise from 10% to 64% of the total GM licensed fleet; and
- In 2025, it is estimated that 36% of hackney carriages still in operation serving GM that would be classed as non-compliant.

7.22 Non-compliant hackney carriages will be in scope for a charge of £7.50 per day from 2022. It is proposed that Wheelchair accessible vehicles licensed as a hackney carriage with one of GM's 10 local authorities, over 90% of the fleet, would be eligible for a temporary exemption to the end of 2022, with such vehicles in scope for a charge of £7.50 per day from 2023.[20] The possible options available to hackney carriage owners and operators in responding to the GM CAP are set out in **Figure 7-5**.

7.23 Based on the behavioural responses, 72% of non-compliant vehicles would be upgraded by 2025 with a CAZ implemented alongside supporting funds. The impact of the GM CAP on hackney carriage compliance is shown in **Figure 7-6**.

7.24 In total, by 2025 it is anticipated that around 2,100 of the total fleet of 2,400 hackney carriages estimated to be serving GM would be compliant with the GM CAP[21]. For more details about the assumed behavioural responses, see Technical Note 37.

7.25 Note that the potential impact of the proposed GM Minimum Licensing Standards has not been taken into account in this analysis.

[20] Note that for modelling purposes it has been assumed that all Hackney Carriages will qualify for the temporary exemption, and that no PHVs will qualify.
[21] Assuming the implementation of the CAZ and provision of funds as per the Option for Consultation.

Figure 7-5 Hackney carriage vehicle owner/operator behavioural response options (without MLS)

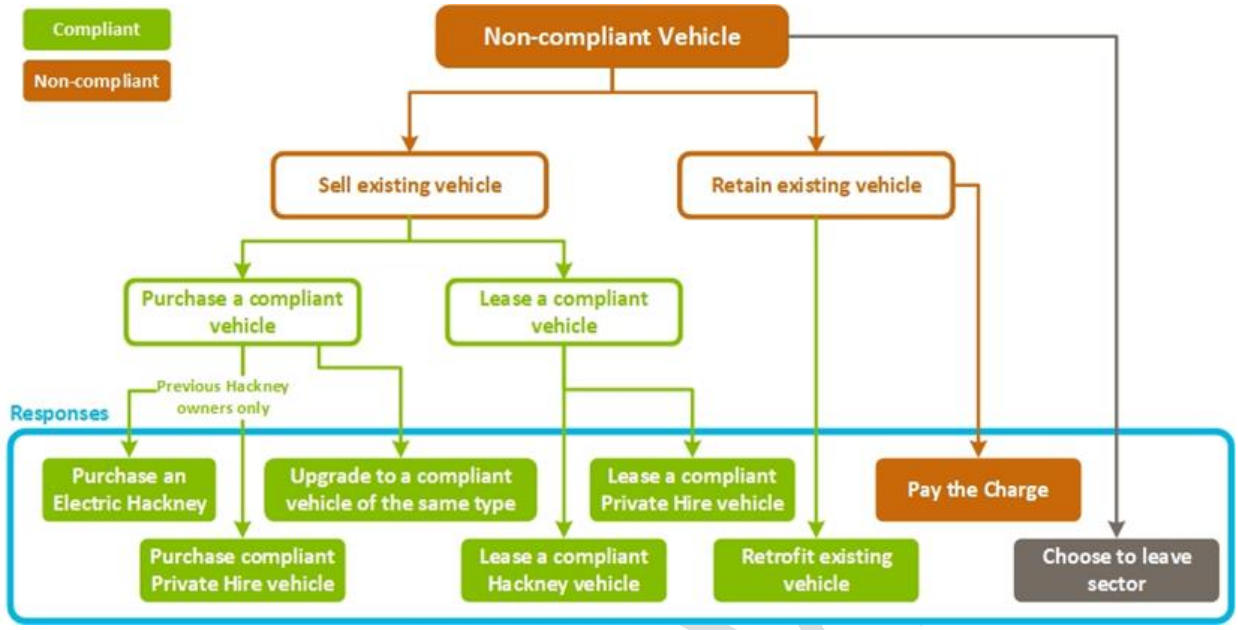
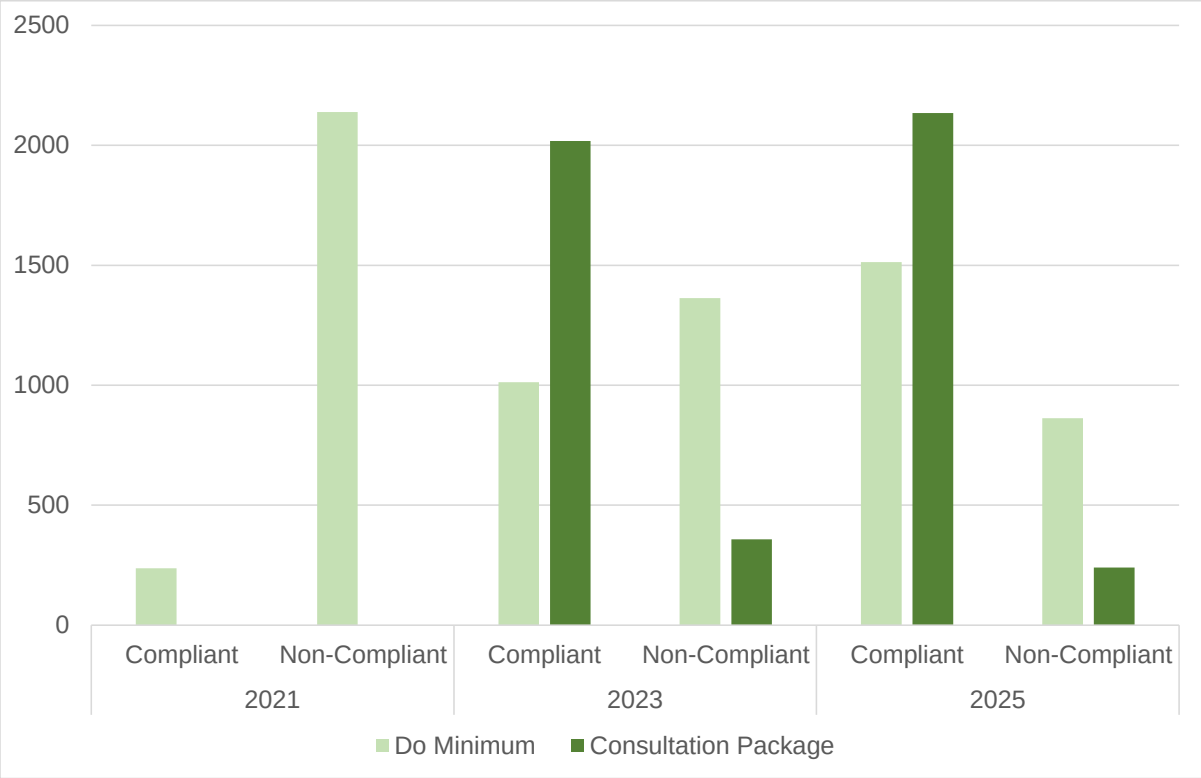


Figure 7-6 Hackney carriage compliance with the GM CAP



Source: Technical Note 37

Private Hire Vehicles (PHVs)

7.26 Taxis (hackney carriage and PHVs) offer a flexible form of door-to-door public transportation. PHVs must be pre-booked through a licensed operator and cannot be hailed on street.

7.27 Analysis of the Taxi market is provided in Technical Note 19. Technical Note 28 provides details of the tools developed to assess the impacts of the GM CAP on taxis.

7.28 PHV fleet sizes were taken from data collected in 2019 from an ANPR survey and Vehicle Licensing Statistics data, as well as licensing data supplied by GM's ten local authorities. An estimate of the number of out-of-region licensed PHVs based and operating in GM was derived from Freedom of Information requests to commonly used licensing authorities.

7.29 In the 'Do Minimum' scenario, without the GM CAP:

- There were an estimated 12,400 PHVs licensed to a GM local authority[22] in 2019, of which approximately 8,800 (71%) were non-compliant; and
- Between 2019 and 2025, total PHV compliance is forecast to rise from 29% to 86% of the total fleet.

7.30 Non-compliant PHVs will be in scope for a charge of £7.50 per day from 2022.[23] It is proposed that Wheelchair accessible vehicles licensed as a PHV with one of GM's 10 local authorities would be eligible for a temporary exemption to end 2022, less than 10% of PHVs, with such vehicles in scope for a charge of £7.50 per day from 2023. It is also proposed that vehicles licensed as a PHV with one of GM's ten local authorities and also used as a private car would be eligible for a permanent discounted weekly charge of £37.50. The possible options available to PHV owners and operators in responding to the GM CAP are set out in **Figure 7-7**.

7.31 Based on the behavioural responses, around 82% of non-compliant vehicles by 2025 would be upgraded with a CAZ implemented alongside supporting funds. The impact of the GM CAP on PHV compliance is shown in **Figure 7-8**.

7.32 In total, by 2025 it is anticipated that around 16,700 of the total fleet of 17,200 PHVs estimated to be serving GM would be compliant with the GM CAP[24]. For more details about the assumed behavioural responses, see Technical Note 37.

7.33 Note that the potential impact of the proposed GM Minimum Licensing Standards has not been taken into account in this analysis.

[22] Note that GM is aware that there is also a substantial number of out of area licenced taxis which are based in and operate within GM.
[23] Note that, due to the COVID-19 pandemic, the proposed implementation date has been moved to 2022. The implications of this have not yet been assessed in the modelling process, and for the purposes of modelling the assumed implementation date remains 2021
[24] Assuming the implementation of the CAZ and provision of funds as per the Option for Consultation.

Figure 7-7 PHV vehicle owner/operator behavioural response options (without MLS)

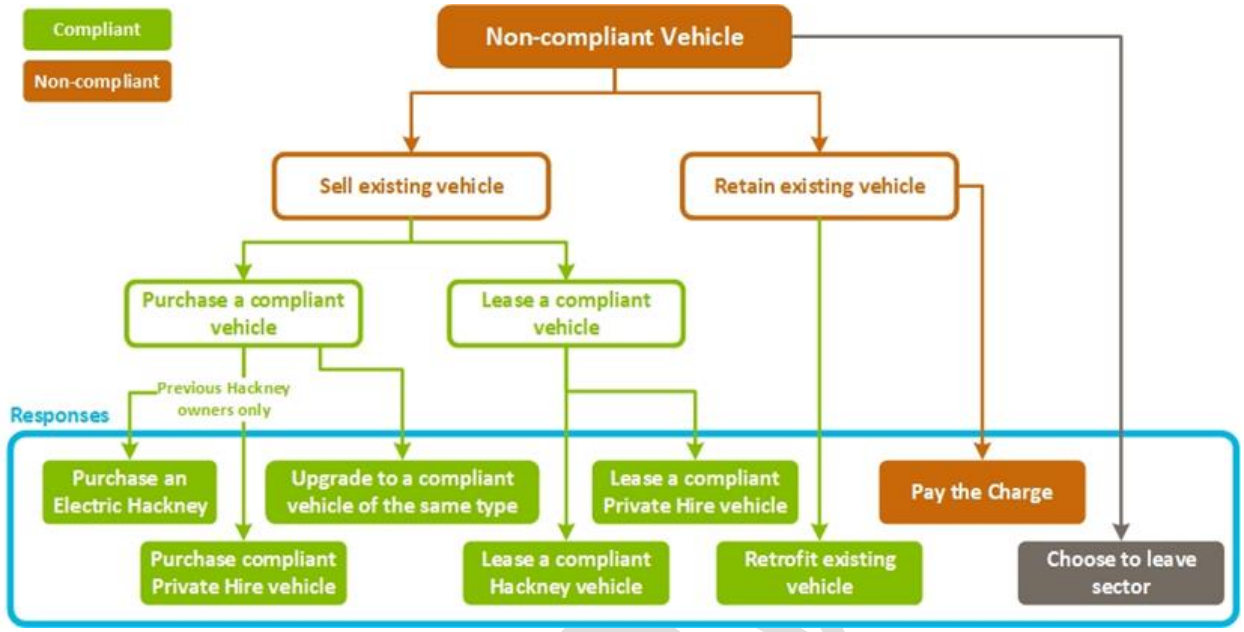
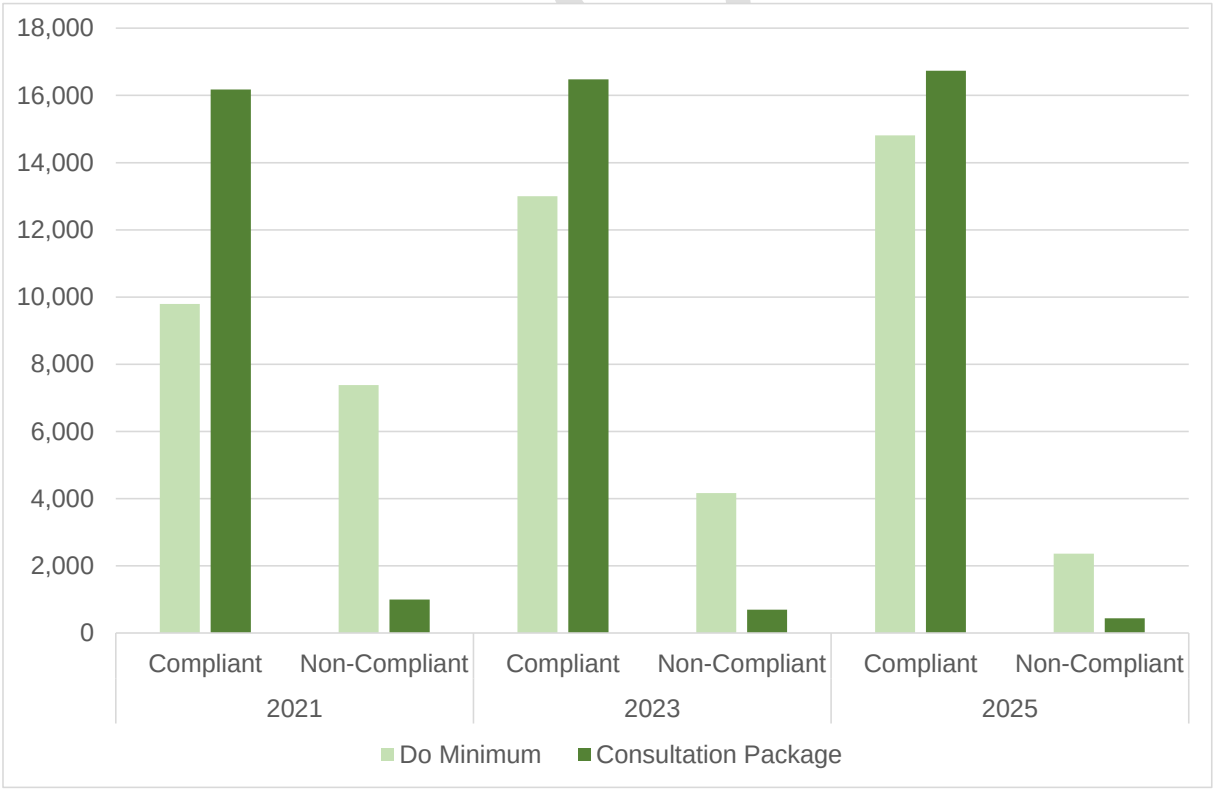


Figure 7-8 PHV compliance with the GM CAP



Source: Technical Note 37

Bus

7.34 Buses are defined as registered vehicles offering passenger transport services on registered bus routes. Over 627,000 trips a day are made on public transport in GM, of which over 465,000 (74%) are made by bus[25].

7.35 Data on the bus fleet has been collected from GM's bus operators. This data is updated on a six-monthly basis.

7.36 As of March 2020, there were 420 compliant buses operating in GM, 19% of the total fleet of 1,910 vehicles. Funding is available via the Clean Bus Technology Fund to retrofit a further 337 buses, taking the proportion of the bus fleet that is compliant to around one third.

7.37 Non-compliant buses will be in scope for a charge of £60 per day from 2022.

7.38 For modelling purposes, it has been assumed that all buses operating in GM become compliant as a result of the CAZ and funds. More detail about the GM bus fleet was supplied to JAQU in Technical Note 11, although this has not been published as it contains commercially sensitive data[26].

[25] TfGM – GM TRADS Yrs 4-6 (2015-17)

[26] Note 11 contains commercial or industrial information in respect of which confidentiality is provided by law to protect a legitimate economic interest, and disclosure would adversely affect that confidentiality. As such, we consider this note falls within the exception under regulation 12(5)(e) EIR and that, in all the circumstances of the case, the public interest in maintaining the exception outweighs the public interest in disclosing the information.

Coach

7.39 Coaches are a type of passenger transport vehicle, typically designed for use over longer distances than buses, usually with more amenities and space for luggage. Coaches are also not permitted to carry standing passengers. Coach operators provide a range of services including international travel, regular intercity commercial services, school services, private services and one-off trips. Whilst some coaches operate as buses on registered bus services, these vehicles are considered to be buses for the purposes of the GM CAP.

7.40 Analysis of the coach market is set out in Technical Note 4, although this has not been published as it contains commercially sensitive data.[27]

7.41 Coach fleet sizes were taken from data collected in 2019 from an ANPR survey and a coach database[28], providing a record of coaches in operation across the UK.

7.42 In the 'Do Minimum' scenario, without the GM CAP:

- There were an estimated 700 coaches based in and serving GM in 2019, of which approximately two thirds, or 460 vehicles, were non-compliant;
- Between 2019 and 2025, it is estimated that as a result of normal fleet turnover, the proportion of coaches that are non-compliant will reduce to around three in ten.

7.43 Non-compliant coaches will be in scope for a charge of £60 per day from 2022.[29] It is proposed that coaches registered to a location within GM would be eligible for a temporary exemption to end 2022, with such vehicles in scope for a charge of £60 per day from 2023.

7.44 GM does not have the data or tools available to forecast the behavioural responses of coach owners and operators to the GM CAP. It has been assumed that all coach operators eligible for the funds will seek to access them.

[27] Note 4 contains commercial or industrial information in respect of which confidentiality is provided by law to protect a legitimate economic interest, and disclosure would adversely affect that confidentiality. As such, we consider this note falls within the exception under regulation 12(5)(e) EIR and that, in all the circumstances of the case, the public interest in maintaining the exception outweighs the public interest in disclosing the information.

[28] Transport Resources Limited. Database purchased from http://www.dougjack.co.uk/

[29] Note that, due to the COVID-19 pandemic, the proposed implementation date has been moved to 2022. The implications of this have not yet been assessed in the modelling process, and for the purposes of modelling the assumed implementation date remains 2021

Minibus

7.45 A minibus is a passenger-carrying motor vehicle with between nine and sixteen seats, excluding the driver's seat, and does not permit room for standing. Minibuses satisfy a passenger capacity requirement that sits in between a private car and a coach or bus.

7.46 Analysis of the minibus market is provided in Technical Note 18.

7.47 Minibus fleet sizes were taken from analysis of DVLA registered vehicle database records (2016)[30] and information obtained from the Minibus Market Analysis report, published in 2014 and based on DVLA data from 2012[31].

7.48 In the 'Do Minimum' scenario, without the GM CAP:

- There were an estimated 2,000 minibuses based in and serving GM in 2019, of which the vast majority, 94% or 1,900 vehicles, were non-compliant;
- Between 2019 and 2025, it is estimated that as a result of normal fleet turnover, the proportion of minibuses that are non-compliant will reduce to around 65%.

7.49 It is proposed that minibuses would be eligible for a temporary exemption to end 2022, with non-compliant minibuses in scope for a charge of £10 per day from 2023. It is also proposed that minibuses operated under a permit under section 19 or section 22 of the Transport Act (1985), issued by a body designated by the Secretary of State would be eligible for an exemption from the CAZ charge. Note that minibuses licensed as a taxi are considered taxis for the purpose of the GM CAP

7.50 GM does not have the data or tools available to forecast the behavioural responses of minibus owners and operators to the GM CAP. GM has estimated that around 680 minibuses would be in scope for funding. Due to a lack of evidence on demand or uptake, it has been assumed that around 400 minibuses choose to access funding.

[30] DfT (2018) *Analysis of DVLA registered vehicle database records* (version Q2 2016) by DfT
[31] *Minibus Market Analysis*; Transport and Travel Research. (2014)

8. Impact of the GM CAP on Emissions

8.1 **Figure 8-1** shows the impact of the GM CAP on forecast road traffic emissions of Nitrogen Oxides (NOx) for each of the forecast years.

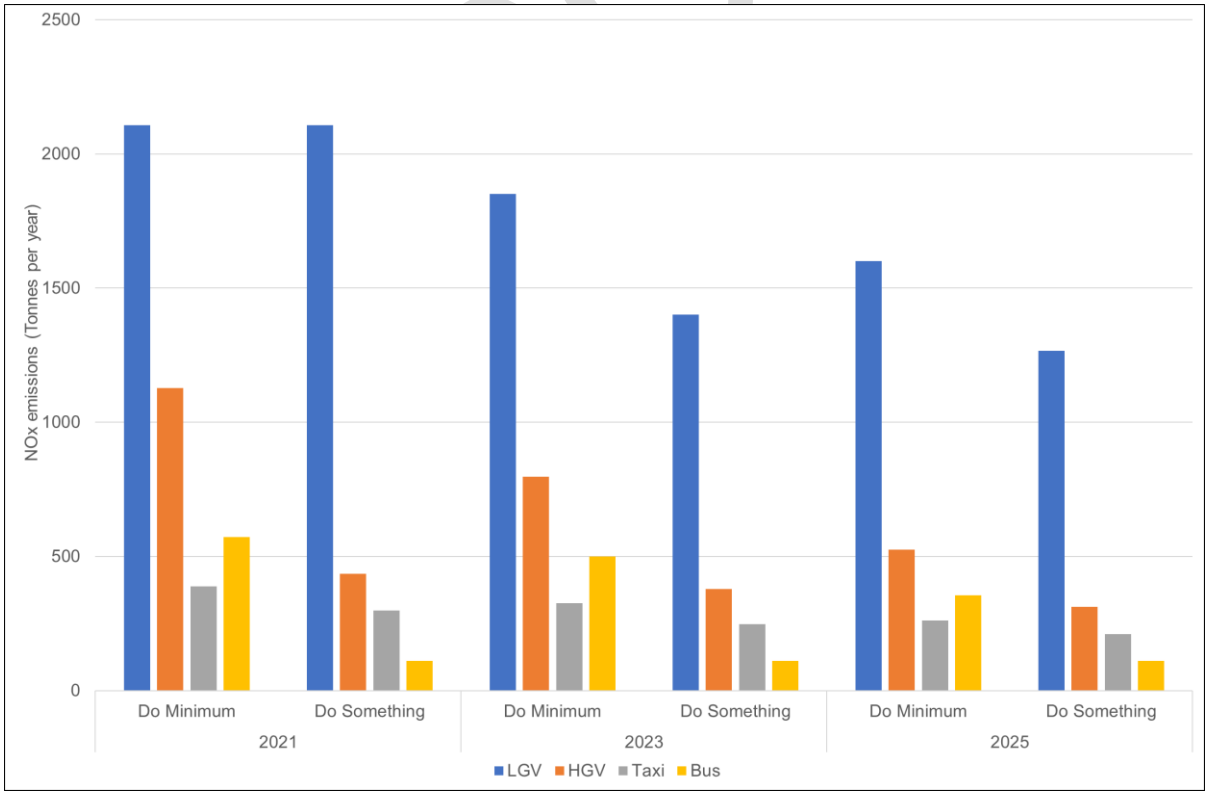
8.2 The GM CAP is forecast to deliver total reductions in NOx emissions from road traffic of:

- 17% in 2021;
- 22% in 2023; and
- 17% in 2025.

8.3 Note that NOx emissions fall in the Do Minimum scenario due to normal fleet turnover; the GM CAP effectively brings forwards that normal fleet turnover so that the benefits are experienced in earlier years. Without action, GM is expected to be compliant at all sites by around 2027.

8.4 For more detailed information about emissions reductions, see Report T4: Local Plan Transport Model Forecasting Report - Consultation Option January 2020.

Figure 8-1 Forecast Road Traffic Emissions (Tonnes of NOx per year)



8.5 GM has tested each element of the Option for Consultation on an incremental basis, set out in **Table 8-1**. Note that this testing was conducted prior to the Government's decision that they did not support the proposed Sustainable Journeys measure, and therefore that is included as test M1 below. Future modelling, post-consultation, will exclude the Sustainable Journeys measure. For details of how each measure has been represented in the modelling process for each test, see Appendix B.

8.6 In order to reflect JAQU guidance, tests M6 and M7, which include measures proposed under the Government's Clean Air Fund, were tested independently in addition to the full Implementation Package, represented by test M5.

8.7 In summary, the results show that:

- The Implementation Package, comprising the CAZ and Bus Fund (and also the Sustainable Journeys measure, which has not received Government support) reduces NOx emissions by nearly 20% compared to the Do Minimum scenario;

- The funds deliver a further reduction of 2% and also act to ensure that the behaviour change predicted as a result of the CAZ is realised and can be achieved without causing unacceptable impacts on those affected;

- In total, the Option for Consultation as modelled delivers a reduction in NOx emissions of around 22% in 2023, compared to the Do Minimum scenario, a reduction of around 1,335 tonnes of NOx per year.

Table 8-1 Implementation Modelling Forecast Road Traffic Emissions (2023, Tonnes NOx per year)

Test	Incremental Test Description	GM		
		NO_x emissions	% Change from Do Min.	% Incremental benefit from previous Test
Do Minimum	n/a	6,154	n/a	n/a
M1	Sustainable Journeys	6,150	-0.1%	-0.1%
M2	Sustainable Journeys + 100% bus upgrade	5,760	-6.4%	-6.3%
M3	Sustainable Journeys, 100% bus upgrade, CAZ charges for Hackney Cabs, PHVs	5,724	-7.0%	-0.6%
M4	Sustainable journeys measures, 100% bus upgrade, CAZ charges for Hackney Cabs, PHVs, HGVs	5,305	-13.8%	-7.3%
M5 Full Implementation Package	Sustainable journeys measures, 100% bus upgrade, CAZ charges for Hackney Cabs, PHVs, HGVs, LGVs	4,944	-19.7%	-6.8%
M6 (exc. M1)	100% bus upgrade, CAZ charges for Hackney Cabs, PHVs, HGVs and LGVs, Funds for Hackney Cabs, PHVs, including EV taxi uplift	4,905	-20.3%	-0.8% (vs M5)
M7 (exc. EV Taxi uplift)	Sustainable journeys measures, 100% bus upgrade, CAZ charges for Hackney Cabs, PHVs, HGVs and LGVs, Funds for HGVs, LGVs	4,859	-21.0%	-1.7% (vs M5)
Full GM CAP Option for Consultation (as modelled)	Sustainable journeys measures, 100% bus upgrade, CAZ charges for Hackney Cabs, PHVs, HGVs and LGVs, Funds for HGVs, LGVs, Hackney Cabs, PHVs, including EV taxi uplift	4,819	-21.7%	-2.0% (vs M5)

9. Impact of the GM CAP on Air Quality

9.1 As set out in Section 5, there are predicted to be 203 non-compliant sites across GM in 2021, 69 in 2023 and 12 remaining in 2025, with natural compliance forecast to occur in 2027.

9.2 **Table 9-1** shows the number of sites remaining in exceedance of legal limits in 2021, 2023, 2024 (interpolated) and 2025 under the Do Minimum scenario and with the Consultation Option by local authority.

9.3 The results show that, with the GM CAP Option for Consultation:

- two authorities (Wigan and Trafford) are forecast to become compliant in 202132, with 57 points of non-compliance remaining across the rest of the region;
- by 2023 eight authorities are forecast to be compliant, with two non-compliant sites remaining in Manchester and one non-compliant site remaining in Bury; and
- GM achieves compliance in 2024, by removal of the last 12 exceedances.

Table 9-1 Number of GM sites remaining in exceedance of legal limits for NO_2 concentrations by year and local authority

Local Authority	2021		2023		2024 (interpolated)		2025	
	Do Min.	Consult. Option	Do Min.	Consult. Option	Do Min.	Consult. Option	Do Min.	Consult. Option
Bolton	13	6	1	0	1	0	0	0
Bury	16	7	8	1	4	0	1	0
Manchester	76	22	39	2	20	0	9	0
Oldham	9	1	0	0	0	0	0	0
Rochdale	5	2	2	0	2	0	0	0
Salford	36	11	11	0	4	0	2	0
Stockport	21	4	3	0	0	0	0	0
Tameside	13	4	4	0	0	0	0	0
Trafford	7	0	1	0	0	0	0	0
Wigan	7	0	0	0	0	0	0	0
GM Total	**203**	**57**	**69**	**3**	**31**	**0**	**12**	**0**

Note: Calculation of 2024 was undertaken using linear interpolation between the 2023 and 2025 modelled NO2 results for each model output point.

[32] Note that, due to the COVID-19 pandemic, the proposed implementation date has been moved to 2022. The implications of this have not yet been assessed in the modelling process, and for the purposes of modelling the assumed implementation date remains 2021.

9.4 The GM CAP aims to deliver compliance in the shortest possible time in a way that takes into account the need to reduce human exposure. **Table 9-2** demonstrates the benefits being delivered in each year in terms of reduced concentrations even at sites remaining in exceedance in that year. This also shows that the number of sites close to exceedance reduces in each year as a result of the Plan. Health benefits continue to be delivered by reductions in NO_2 concentrations even below the annual mean limit. In particular:

- With action, there are no sites that are extremely non-compliant (with concentrations over 50 µg/m3) in the first year; and substantial reduction in the number that are very non-compliant (with concentrations between 45-50 µg/m3) in the same year.

- By 2023, all sites are at, or close to, compliance across GM. Three sites are predicted to remain non-compliant - two in Manchester and one in Bury, but in all cases the predicted concentrations are close to 40 µg/m3.

- With action, compliance is achieved in all local authorities across GM by 2024. With the vast majority of sites across the region predicted to have concentrations less than 35 µg/m3.

Table 9-2 Number of modelled GM sites by scale of NO_2 exceedance by year

Scenario	Compliant sites		Non-compliant sites				Change in no. of exceedances from Do Min.
	Very compliant (below 35 µg/m^3)	Compliant but close (35 to 40 µg/m^3)	Non-compliant (40 to 45 µg/m^3)	Very non-compliant (45 to 50 µg/m^3)	Extremely non-compliant (> 50 µg/m^3)	Total non-compliant (> 40 µg/m^3)	
2021							
Do Minimum	1,851	485	143	49	11	**203**	n/a
Consultation. Option	2,266	216	52	5	0	**57**	-146
2023							
Do Minimum	2,287	209	55	13	1	**69**	n/a
Consultation. Option	2,485	51	3	0	0	**3**	-66
2025							
Do Minimum	2,463	109	12	0	0	**12**	n/a
Consultation. Option	2,525	14	0	0	0	**0**	-12

9.5 **Table 9-3** shows the concentrations at the highest point of exceedance with each scenario in each year. This shows that, by 2023, the highest exceedance in the Consultation Option is below 42 ug/m3, whereas in the Do Minimum scenario the highest exceedance is nearly 51 ug/m3.

Table 9-3 Maximum NO_2 concentration as forecast in each year, in µg/m³

Scenario	2021	2023	2025
Do Minimum	56.9	50.8	45.4
Consultation Option	48.2	41.5	39.3

9.6 With the GM CAP Option for Consultation, there are predicted to be three exceedances remaining in 2023, two located inside the Manchester regional centre on the A34 and one at the A58 in Bury.

9.7 The maximum A34 Manchester point (John Dalton St) experiences a reduction of -9.3 ug/m^3 in 2023 with the GM CAP Option for Consultation, resulting in a concentration of 41.5 ug/m^3 in 2023. Both of the A34 sites have very similar source apportionment with emissions dominated by buses. Of the total change in emissions in 2023 with the GM CAP Option for Consultation at John Dalton St, 92% of this NOx reduction is related to the bus fleet, with a further 3% from both HGVs and LGVs.

9.8 The other remaining non-compliant site at A58 Bolton Road, Bury, experiences a reduction of 6.0 ug/m^3 in 2023 with the GM CAP Option for Consultation, resulting in a concentration of 40.9 ug/m^3 in 2023. Here, NOx emissions are distributed across all vehicle types. Of the total change in emissions in 2023 with the GM CAP Option for Consultation, 42% of this NOx reduction is related to the bus fleet upgrading to become compliant, with 27% from HGVs and 26% from LGVs upgrading.

9.9 These sites then become compliant in 2024, when the additional natural improvement in air quality further improves NO_2 concentrations sufficiently to meet the annual mean limit.

10. Appendix A – Legal basis of the GM CAP

In July 2017 the Government published the UK plan for tackling roadside nitrogen dioxide (NO_2) concentrations. This set out how the Government would bring UK concentrations of NO_2 within the statutory annual limit of 40 micrograms per cubic metre in the shortest possible time. The plan sets out several national and local measures that need to be taken. At this time, the Secretary of State issued a Direction under the Environment Act 1995 requiring seven GM local authorities[33] to produce a feasibility study to identify the option which will deliver compliance with the requirement to meet legal limits for NO_2 in the shortest possible time.

In March 2018 the Secretary of State issued a Direction under the Environment Act 1995 requiring Oldham Council to produce a feasibility study to identify the option which will deliver compliance with the requirement to meet legal limits for NO_2 in the shortest possible time. Oldham Council complied with this Direction by the production of a feasibility study submitted to the Government's Joint Air Quality Unit (JAQU) in July 2018. Oldham Council is also required to address the exceedances that have been identified within its boundary during the Target Determination exercise. Oldham Council confirmed in its supplemental plan that the exceedance identified in Oldham was being addressed as part of the GM plan. This has been acknowledged by Government.

Although the remaining two local authorities[34] were not required to act under the July 2017 Direction, they were required to address the exceedances of NO_2 that have been identified within its boundaries during the Target Determination exercise.

In accordance with the Directions and requirements set out above, the GM authorities have been developing the study collectively with the GMCA, coordinated by TfGM, in line with Government direction and guidance and an Outline Business Case (OBC) was duly submitted in March 2019.

Ministerial feedback was received in July 2019 along with a further direction under the Environment Act 1995 which required all ten of the GM local authorities to take steps to implement a plan to deliver compliance with the requirement to meet legal limits for NO_2 in the shortest possible time.

The ministerial letter that accompanied the July 2019 direction requested from GM further options appraisal information (including transport and air quality modelling as well as due regard to economic, financial and deliverability considerations) to be submitted prior to statutory consultation

[33] These authorities were: Bolton, Bury, Manchester, Salford, Stockport, Tameside and Trafford.
[34] These authorities were: Rochdale and Wigan.

The ten GM local authorities are now subject to a Ministerial direction dated 16 March 2020 requiring the submission of an Interim Full Business Case (FBC) (along with confirmation that all public consultation activity has been completed) as soon as possible and by no later than 30 October 2020. Under this direction, the local authorities are under a legal duty to ensure that the GM CAP (Charging Clean Air Zone Class C with additional measures) is implemented so that NO_2 compliance is achieved in the shortest possible time and by 2024 at the latest and that human exposure is reduced as quickly as possible.

11. Appendix B – GM CAP Option for Consultation Assumptions

The modelling to support air quality analysis includes the assessment of three forecast years, 2021, 2023, and 2025. The background to these assumptions is set out in detail in the Local Plan Transport Model Forecasting Report (T4) and the associated Appendix A (Cost Response Models and Demand Sifting Tool).

The specific assumptions regarding each of the modelled vehicle type and year are identified in the section below. However, there are also overarching assumptions as follows:

- Vehicle supply is not a constraint;
- Access to finance is not a constraint; and
- Vehicle pricing is not affected by the implementation of this, or any other clean air proposal.

2021 Modelling Assumptions

A summary of the key modelling assumptions for 2021 is provided in **Table B1**.

Table B1 Summary of Modelling Assumption – 2021

Vehicle Type	Charge Level	Funding Provision	Behavioural Response			
			Pay Charge	Change Mode	Cancel Trip	Upgrade
HGV	£60.00	7.5t - £2,500 18t - £3,500 26t - £4,500 32t - £5,500 44t - £4,500	2.7%	0.1%	0.0%	97.2%
LGV	n/a	n/a	n/a	n/a	n/a	n/a
Hackney	n/a	n/a	n/a	n/a	n/a	n/a
PHV	£7.50	£3,000	11.4%	0.0%	4.3%	84.3%
Bus	n/a	Assumed to be 100% Compliant				
Coach	n/a	Not modelled				
Minibus	n/a	Not Modelled				

In addition to the assumptions discussed above are the following key assumptions:

- All PHVs are non-Wheelchair Accessible Vehicles (WAV) and therefore in scope for a charge (In reality, there are circa 100 WAV PHVs licensed in GM);
- Discounted weekly charges cap of £37.50 has been applied to owner-driver PHVs licensed in GM;
- Eligibility criteria to apply for PHV funding support, requires vehicles to be GM licensed; SME only; Requires vehicle scrappage; and average value of £3,00 reflects funding offer of £2,000 for compliant ICE vehicle and £4,000 for a ZEC vehicle;
- Assumes all Hackneys are WAV, therefore exempt from GM CAZ charges in 2021. It is noted in practice that there are around 300 Non-WAV in GM; and
- Eligibility for HGVs for the funds requires to be GM Registered; SME Only; and requires vehicle scrappage.

2023 Modelling Assumptions

A summary of the key modelling assumptions for 2023 is provided in **Table B2**.

Table B2 Summary of Modelling Assumption – 2023

Vehicle Type	Charge Level	Funding Provision	Behavioural Response			
			Pay Charge	Change Mode	Cancel Trip	Upgrade
HGV	£60.00	7.5t - £2,500 18t - £3,500 26t - £4,500 32t - £5,500 44t - £4,500	4.8%	0.0%	0.0%	95.2%
LGV	£10.00	£3,500	12.2%	3.4%	0.0%	84.5%
Hackney	£7.50	ZEC - £10,000 Retrofit - £5,000	25.7%	0.0%	0.0%	74.3%
PHV	£7.50	£3,000	15.8%	0.0%	0.4%	83.8%
Bus	£60.00	Assumed to be 100% Compliant				
Coach	£60.00	Not modelled				
Minibus	£10.00	Not Modelled				

In addition to the assumptions discussed above are the following key assumptions:

- Discounted weekly charges cap of £37.50 has been applied to owner-driver PHVs licensed in GM;
- Eligibility criteria to apply for PHV funding support, requires vehicles to be GM licensed; SME only; Requires vehicle scrappage; and average value of £3,00 reflects funding offer of £2,000 for compliant ICE vehicle and £4,000 for a ZEC vehicle;
- Eligibility criteria for Hackneys applying for funds requires; GM licensed; and requires vehicle scrappage; and
- Eligibility criteria for LGV and HGV operators applying for funds requires; GM registered; SME Only and requires vehicle scrappage.

2025 Modelling Assumptions

A summary of the key modelling assumptions for 2025 is provided in **Table B3**.

Table B3 Summary of Modelling Assumption – 2025

Vehicle Type	Charge Level	Funding Provision	Behavioural Response			
			Pay Charge	Change Mode	Cancel Trip	Upgrade
HGV	£60.00	7.5t - £2,500 18t - £3,500 26t - £4,500 32t - £5,500 44t - £4,500	1.9%	0.0%	0.0%	98.1%
LGV	£10.00	£3,500	13.6%	0.0%	0.0%	86.4%
Hackney	£7.50	ZEC - £10,000 Retrofit - £5,000	27.6%	0.0%	0.0%	86.4%
PHV	£7.50	£3,000	17.7%	0.0%	0.0%	82.3%
Bus	£60.00	Assumed to be 100% Compliant				
Coach	£60.00	Not modelled				
Minibus	£10.00	Not Modelled				

In addition to the assumptions discussed above are the following key assumptions:

- Discounted weekly charges cap of £37.50 has been applied to owner-driver PHVs licensed in GM;
- Eligibility criteria to apply for PHV funding support, requires vehicles to be GM licensed; SME only; Requires vehicle scrappage; and average value of £3,00 reflects funding offer of £2,000 for compliant ICE vehicle and £4,000 for a ZEC vehicle;
- Eligibility criteria for Hackneys applying for funds requires; GM licensed; and requires vehicle scrappage;
- Eligibility criteria for LGV and HGV operators applying for funds; and requires; GM registered; SME Only and requires vehicle scrappage.

12. Appendix C – Components of the Option for Consultation

A summary of the components which form the Option for Consultation is provided in **Table C1**.

Table C1 Components of the Option for Consultation

ID Description	Assumptions	Measure Modelling Process	How Tested in this Report
M1 - Sustainable Journeys	Reduction in vehicle km	Applied within the highway model as a reduction in vehicle trips as drivers transfer to other modes. Mass emissions and concentrations calculated using EMIGMA and the dispersion model.	Incremental Implementation Measure (M1 only)
M2 - Clean Bus Fund and GM wide CAZ A for buses	100% upgrade bus fleet to compliant vehicles Implemented from 2021 onwards	Applied post highway model in EMIGMA	Incremental Implementation Measure (M1, M2)
M3 - GM wide CAZ A for taxis (Hackney carriages) and private hire vehicles (PHVs)	Charge level of £7.50 per day, with a discounted weekly charge of £50 for owner-driver PHVs, assumed for modelling purposes to apply to all PHVs Implemented from 2021 onwards WAV exemption to 2023, assumed for modelling purposes to apply to all	Behavioural response determined from bespoke Taxi Cost Model Implemented within Demand Sifting Tool (DST), assignment model (SATURN) and EMIGMA	Incremental Implementation Measure (M1, M2, M3)

	Hackneys and no PHVs		
M4 - GM wide CAZ B for HGVs	Charge level of £60 per day Implemented from 2021 onwards	Behavioural response determined from bespoke cost model Implemented within DST, assignment model (SATURN) and EMIGMA	Incremental Implementation Measure (M1, M2, M3, M4)
M5 - GM wide CAZ C for LGVs (Full Imp. Package)	Charge level of £10 per day Implemented from 2021 onwards, with full exemption assumed to 2023 (so for modelling purposes implemented from 2023)	Behavioural response determined from bespoke cost model Implemented within DST, assignment model (SATURN), EMIGMA and the dispersion model	Incremental Implementation Measure (M1, M2, M3, M4, M5) (Full Implementation Package)
M6 - Clean Taxi Fund	PHV Fund: (working assumption all PHVs are non-WAV). Funding values per vehicle assumed to be: – All PHV = £3,000 Hackney Fund: (working assumption that all Hackneys are WAV) Note: as majority of Hackneys are already WAV funds are not introduced until 2023. Funding values per vehicle assumed as:	Behavioural response determined from bespoke Commercial Vehicles Cost Model Implemented within DST, assignment model (SATURN), EMIGMA and the dispersion Model	CAF Measure Isolation Test (M1, M2, M3, M4, M5, M6) NB: excludes M7

	— Zero Emission WAV Hackney = £10,000 — Retrofit = £5,000		
M7 - Commercial Vehicles Fund	HGV Fund: varies by weight category (scrappage required) assumed to be: 7.5t = £2,500; 18t = £3,500; 26t = £4,500; 32t = £5,500; 44t = £4,500 LGV Fund assumed to be: (scrappage required) — £3,500 Fund level for all eligible LGVs	Behavioural response determined from bespoke cost model Implemented within DST, assignment model (SATURN), EMIGMA and the dispersion model	CAF Measure Isolation Test (M1, M2, M3, M4, M5, M7) NB: excludes M6
GM CAP Consultation Option	Includes all assumptions as set out above for Implementation and CAF proposals	As per methodology for each measure set out above	Full Implementation Package plus Clean Taxi Fund and Commercial Vehicles Fund as CAF measures

13. Appendix D – List of Technical Reports and Notes

Table D1 contains a list of Technical Reports and Notes, published at: https://cleanairgm.com/technical-documents.

Table D1 List of Technical Reports and Notes

Note No.	Name	Description	Publication Status
1	GM CAP Data, Evidence and Modelling: post-OBC approach	Sets out the process being undertaken to deliver the Data, Evidence and Modelling requirements in support of the FBC. It also describes the evidence to be supplied to JAQU and how this responds to the feedback received from JAQU and the Technical and Delivery Independent Review Panels (the T-IRP and D-IRP).	Published
2	GM CAP: Next steps for data collection and the development of analytical tools	Provides information about further data collection and the development of tools planned as next steps, namely behavioural research of van drivers and other groups; the development of further Operational Cost Models for other vehicle types; on-street specialised goods vehicle surveys; and the analysis of evidence emerging from the Conversation and other bodies.	Published
3	GM CAP: Analysis of the freight market	Describes the number of Heavy and LGVs operating in GM, the compliance status of those vehicles, and the business and usage patterns of those vehicles.	Published
4	GM CAP: Analysis of the coach market	Describes the number of coaches operating in GM, the compliance status of those vehicles, and the business and usage patterns of those vehicles. This evidence, and that contained in Note 3, is being used to inform scheme design and to support the development of analytical tools and modelling assumptions	Commercially Sensitive

Note No.	Name	Description	Publication Status
5	GM CAP: ANPR Surveys: Summary of Initial Findings	Sets out the results of an ANPR survey conducted in January 2019 at 42 sites across GM. The survey was designed to provide a representative profile of the vehicle fleet operating in GM in terms of vehicle type (including fuel used) and age profile, in order to update the previous data used in the OBC with a more comprehensive and robust dataset. The results show that there are not major differences between observed levels of compliance in the overall GM fleet between the 2016 and 2019 surveys. This data set is now being used widely as part of the ongoing work to refine the proposals as part of the FBC development for the CAP.	Published
6	GM CAP: Behavioural response assumptions and available data sources	Sets out evidence gathered from a number of sources offering an insight into the vehicle markets in question and how they might respond to the range of measures proposed in the GM CAP. These include Stated Preference surveys that have been carried out by other CAP authorities (Sheffield and Bradford) and shared with GM. NOTE: This note contains early work on revised behavioural response estimates which is superseded by later work – see Note 37 and Report T4 for the latest assumptions.	Published
7	GM CAP: LGV and HGV Operational Cost Models	LGV and HGV Operational Cost Models' describes a new analytical tool that has been developed in support of the GM CAP allowing the assessment of behavioural responses to a CAZ based on operational costs by vehicle type for HGVs and LGVs. It is proposed that this tool replaces the methodology for assessing behavioural responses as applied in the OBC.	Published

Note No.	Name	Description	Publication Status
8	GM CAP: HGV Behavioural Responses Note	Sets out what behavioural response assumptions were applied at OBC for HGVs, the revised behavioural assumptions proposed for future analysis based on the HGV Operational Cost Model, and proposed next steps for analysis. NOTE: This note contains early work on revised behavioural response estimates which is superseded by later work – see Note 37 and Report T4 for the latest assumptions.	Published
9	GM CAP: LGV Behavioural Responses Note	LGV Behavioural Responses' sets out what behavioural response assumptions were applied at OBC for LGVs, the revised behavioural assumptions proposed for future analysis based on the LGV Operational Cost Model, and proposed next steps for analysis. NOTE: This note contains early work on revised behavioural response estimates which is superseded by later work – see Note 37 and Report T4 for the latest assumptions.	Published
10	GM CAP: Taxi Behavioural Responses Note	Sets out what behavioural response assumptions were applied at OBC for Hackney Cabs and PHVs, and consider a possible approach to updating these assumptions based on evidence derived from stated preference surveys carried out in Sheffield. It sets out proposed next steps for analysis, including the development of an Operational Cost Model for Taxis (Hackney Cabs and PHVs). NOTE: This note contains early work on revised behavioural response estimates which is superseded by later work – see Note 37 and Report T4 for the latest assumptions.	Published

Note No.	Name	Description	Publication Status
11	GM CAP: Analysis of Bus Upgrade Options to Deliver Air Quality Compliance	Note 11: Analysis of Bus Upgrade Options to Deliver Air Quality Compliance' was produced in response to a request from JAQU for analysis scaling the proportion of bus compliance required to deliver compliance. Practically, this approach is very difficult to test in a way that would represent a real-world operational scenario that could be delivered as part of the CAP. Note 11 therefore presents two approaches to understand the influence of buses on compliance with the Air Quality Directive: o how many of the GM bus service routes pass the predicted exceedance locations and the number of buses this represents compared with the GM bus operator vehicle fleet. o how many of the modelled exceedances would remain if the preferred option (Option 8) excluded bus improvements at all (i.e. a CAZ that did not include buses as a type of vehicle to be charged).	Commercially Sensitive
12	GM CAP: Evidence of the impact of 2021 implementation of a CAZ C (without exemptions)	Describes analysis carried out by GM to assess the risks of implementing a CAZ C in 2021 without also implementing a two-year sunset period as was proposed in the OBC. The Note sets out analysis of vulnerability by sector, based on the proportion of the fleet that would be non-compliant in 2021 compared to 2023; analysis exploring the risk of market distortion and the potential impact on small businesses; and analysis of the likely availability (or lack of availability) of second-hand compliant vehicles.	Published
13	GM CAP Study: Traffic Impact on Neighbouring Authorities	Presents the results of highway modelling carried out to assess the likelihood and potential scale of traffic re-routeing to avoid a CAZ.	Published

Note No.	Name	Description	Publication Status
14	GM CAP: Local exceedances: Update	Sets out GM's approach to identifying and assessing sites where further measures may be required in order to achieve compliance in the shortest possible time. The Note presents the results of analysis carried out to assess real-world traffic conditions and to compare these to model outputs, and analysis of NOx source apportionment and any local conditions affecting concentrations, such as canyons, including checking how accurate the representation of such conditions is in the model itself. It also sets out an update on work carried out to identify possible local solutions.	Published
15	GM CAP: Implications of the EFT update for GM	Implications of the EFT update for GM' considers the implications of Emission Factor Toolkit (EFT) version 9.1a, released by JAQU at the end of May 2019. GM's methodology for calculating traffic emissions applies emissions factors has been derived from DEFRA's Emission Factor Toolkit (EFT) version 8.0, which was originally released in November 2017. Version 9.1a of the EFT contains fleet figures which have resulted from a recent Department for Transport (DfT) project to develop new passenger car fleet projections in light of emerging evidence regarding changes in consumer purchasing behaviour which show a shift away from diesel cars and towards petrol cars, alongside a slowing in overall new car sales.	Published

Note No.	Name	Description	Publication Status
16	GM CAP: Sensitivity testing of a CAZ C in 2023 with revised behavioural response assumptions.	Presents the results of a sensitivity test of the impacts of a CAZ C (without any supporting measures) in 2023, applying revised behavioural responses for HGV, LGV, PHV and Hackney Cab. The bus upgrade was assumed as 100% for the purposes of this test. This test was conducted at the request of JAQU. NOTE: Modelling contained in Note 16 was indicative modelling carried out at an early stage in the model development process and is superseded by the package modelling presented in Note 29, and Reports T4 and AQ3.	Published
17	GM CAP: Evidence supporting the decision not to progress with a GM-wide CAZ D	Sets out the options appraisal process applied at OBC and presents further evidence explaining why it is not considered that a GM-wide CAZ D cannot bring forward compliance.	Published
18	GM CAP: Minibus Vehicle Research	Describes the number of minibuses operating in GM, the compliance status of those vehicles, and the business and usage patterns of those vehicles.	Published
19	GM CAP: Taxi and PHV Fleet Research	Describes the number of taxis and PHVs licensed and operating in GM and the compliance status of those vehicles. This evidence, and that contained in Note 18, is being used to inform scheme design and to support the development of analytical tools and modelling assumptions.	Published
20	GM CAP: GM Specialised Goods Surveys: Results Summary	Sets out the results of on-street surveys carried out at three sites identified in the local exceedances study where freight was a significant contributor of emissions. The surveys provide estimates of vehicle volumes by size, compliance status and industry.	Published

Note No.	Name	Description	Publication Status
21	GM CAP: Sensitivity test: Full Electric Bus Fleet	Describes the results of a sensitivity test carried out to understand the impact on compliance of a fully electric bus network across GM. This was carried out as a theoretical test at the request of JAQU.	Published
22	GM CAP: Addendum to Note 3: GM Comparative Statistics	Presents the results of analysis carried out at the request of JAQU to test the reasonableness of GM's assumption that the region was typical of the UK in terms of economic and business activity. It acts as an Addendum to Note 3.	Published
23	GM CAP: Summary update of ongoing work on local exceedances	Provides an updated position on the local exceedances project, acting as a follow-up paper to Note 14 which was supplied to JAQU in draft three weeks earlier.	Published
24	GM CAP: Updates to the Modelling Tools post-OBC Submission for the Do Minimum scenario	Describes a series of improvements that have been made to the underlying assumptions in the Do Minimum modelling scenario, in particular reflecting the release of EFT v9.1a and newly available data on bus services and fleets.	Published
25	GM CAP: Modelling the impacts of Sustainable Journeys Measures	Sets out the methodology that has been developed to test the impacts of a package of sustainable journeys interventions, and the results of those tests.	Published
26	GM CAP: Analysis of Funds	Sets out how the available tools have been used to assess the impact of different funding offers in terms of likely uptake and impact on behavioural responses. This analysis has fed into the assessment of the funding offers, alongside other evidence.	Published
27	GM CAP: Demand Sifting Tool Operating Manual	Describes the Demand Sifting Tool and acts as a manual for use, setting out the underlying assumptions and methodology within the Tool. This Note has been developed to meet the TIRP request for further detail on the operation of the Tools.	Published

Note No.	Name	Description	Publication Status
28	GM CAP: Taxi and PHV Operational Cost Model	Describes a new analytical tool that has been developed in support of the GM CAP allowing the assessment of behavioural responses to a CAZ based on operational costs by vehicle type for Hackney Cabs and PHVs. It is proposed that this tool replaces the methodology for assessing behavioural responses as applied in the OBC.	Published
29	GM CAP: Option for Consultation Modelling Summary	Presents the results of a series of tests of the updated Do Minimum scenario and of the full package of measures proposed for consultation for the GM CAP. Test have been carried out for 2021, 2023 and 2025 and analysis has been carried out to estimate the forecast year of compliance, shown to be 2024 with the proposed package as per the Ministerial Direction. As such, this Note supersedes Note 16, which acted as an early test of a simplified CAZ-only scenario using an interim version of the updated tools.	Published
30	GM CAP: Alternative Sensitivity Test Modelling Summary Note	Sets out the results of a sensitivity test carried out to assess the possible impact of a CAZ D within the Inner Relief Road – in addition to the measures set out in Note 29 - on NO_2 concentrations and achieving compliance in the shortest possible time.	Published
31	GM CAP: Charge Level Sensitivity Testing	Describes modelling that has been carried out to test the impact of different charge levels on behavioural responses (i.e.: whether drivers choose to upgrade or stay and pay) and NOx emissions	Published
32	GM CAP: Option for Consultation – Incremental Measures Modelling Note	Sets out the results of a series of tests carried out to test the impact of each proposed Implementation and CAF measure on NOx emissions and NO_2 concentrations.	Published

Note No.	Name	Description	Publication Status
33	GM CAP: Sensitivity testing of electric taxi upgrade responses	Describes the sensitivity tests that have been carried out to assess the impacts of changes to the electric taxi assumptions on expected emissions and compliance with Air Quality Standards for NO_2.	Published
34	GM CAP: Vehicle finance subsidy	Sets out the development of the Vehicle Finance measure within the CAP, a Vehicle Finance Subsidy Model has been developed to calculate the level of subsidy required across vehicle types to offer the equivalent of an interest free or subsidised vehicle finance offering to prospective and eligible applicants.	Published
35	GM CAP: Forecasting the required number of rapid chargers for Hackney Cabs and PHVs	Quantifies the number of electric vehicle (EV) chargers that will be required for hackney carriages and PHVs (referred to collectively as taxis) across GM.	Published
36	GM CAP: Representing the Funds in the Cost Models and analytical inputs for the Funds/VF models	Describes how the funds are applied within the vehicle cost models, in terms of the methodology and assumptions applied and the nature of the outputs. Describes the calculation of the funds requirements from the cost model outputs and analysis developed, including the following tools/analyses that have been developed.	Published
37	GM CAP: Vehicle population estimates	Sets out the summary of the key vehicle volumetric information used in the project which is used to understand the behavioural responses for vehicle owners to the GM CAP.	Published
38	GM CAP: CAZ discounts and exemptions	Sets out the proposed discounts and exemptions, why GM have proposed them and the outlines the impact on compliance.	Published

Note No.	Name	Description	Publication Status
T1	Local Plan Transport Modelling Tracking Table - Consultation Option Jan 2020	Sets out feedback received to date from JAQU on the traffic and transport modelling process and supplies GM's responses to that feedback.	Published
T2	Local Plan Transport Model Validation Report - Consultation Option Jan 2020	Describes the development of the base year transport model for use in the GM CAP assessment. The report describes the main features of the transport model and presents details of the base year model validation, including comparisons of modelled and observed traffic flows and journey times in the study area. Note that this report has not been updated from the OBC version.	Published
T3	Local Plan Transport Modelling Methodology Report - Consultation Option Jan 2020	Describes the approach taken to forecasting road traffic for the GM CAP. The report describes the development of the future year highway networks and trip matrices and sets out the assumptions on which the forecasts are made. The report has been updated to reflect some methodology improvements and the incorporation of updated Government guidance and input values. Note that the sensitivity testing has not yet been updated from the OBC version and will be supplied to JAQU at a later date.	Published
T4	Local Plan Transport Model Forecasting Report - Consultation Option Jan 2020	Describes the transport modelling process for the GM CAP Project and presents baseline and scenario forecasts for the preferred option which will be taken forward for consultation. The report has been substantially updated to reflect the revised methodology for deriving behavioural responses to the measures, and now includes new appendices setting out the methodology applied in the Demand Sifting Tool and new Operational Cost Models for freight and taxi. Note that the sensitivity testing has not yet been updated from the OBC version and will be supplied to JAQU at a later date.	Published

Note No.	Name	Description	Publication Status
AQ1	'Local Plan Air Quality Modelling Tracking Table - Consultation Option Jan 2020	Sets out feedback received to date from JAQU on the air quality modelling process and supplies GM's responses to that feedback	Published
AQ2	Local Plan Air Quality Modelling Methodology Report - Consultation Option Jan 2020	Sets out the air quality modelling methodology that is and will be used to underpin any air quality modelling for the baseline (2016, 2021, 2023 & 2025) scenario and for scenario forecasts for the preferred option which will be taken forward for consultation. The report has been updated to reflect updates made to the methodology to incorporate updated Government guidance and input values	Published
AQ3	Local Plan Air Quality Modelling Report - Consultation Option Jan 2020	Provides the air quality results and discussion of the GM CAP options that have been assessed. Specifically, this document sets out the results of the proposed option for consultation. Details of the approach to model verification are provided in Appendix A, and the full set of air quality modelling results are tabulated in Appendix B as a separate pack of files. Note that the sensitivity testing has not yet been updated from the OBC version and will be supplied to JAQU at a later date	Published

Note No.	Name	Description	Publication Status
AAS	Analytical Assurance Statement for the 'Option for Consultation - Jan 2020	Considers the limitations, uncertainties and risks in the evidence base, and the implications of these for decision makers. In particular, 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. The report has been updated to describe the improvements that have been made to the evidence base and modelling approach since the OBC submission and therefore the extent to which there have been changes regarding limitations, uncertainties and risks in the analysis. Note that the sensitivity testing has not yet been updated from the OBC version and will be supplied to JAQU at a later date	Published
	Modelling Assumptions for the 'Option for Consultation - Jan 2020	Summarises the key modelling assumptions underpinning the analysis of the option proposed for consultation, the results of which are set out in reports T4 and AQ3	Published