CABINET
Agenda

Date	Monday 27 January 2020
Time	6.00 pm
Venue	Crompton Suite, Civic Centre, Oldham, West Street, Oldham, OL1 1NL
Notes	1. DECLARATIONS OF INTEREST- If a Member requires any advice on any item involving a possible declaration of interest which could affect his/her ability to speak and/or vote he/she is advised to contact Paul Entwistle or Liz Drogan in advance of the meeting. 2. CONTACT OFFICER for this Agenda is Liz Drogan Tel. 0161 770 5151 or email elizabeth.drogan@oldham.gov.uk

Item No

9 Greater Manchester's Clean Air Plan - Tackling Nitrogen Dioxide Exceedances at the Roadside - Update (Pages 1 - 232)

Due to the size of the size of the appendices, Hard copies will be available in the Group Rooms, Access Oldham and the Civic Entrance.

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Report to CABINET

Greater Manchester's Clean Air Plan – Tackling Nitrogen Dioxide Exceedances at the Roadside – Update

Portfolio Holder: Cllr A Ur-Rehman, Cabinet Member for Neighbourhood Services

Officer Contact: Carol Brown, Director of Environmental Services

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27 January 2020

Reason for Decision

To set out the progress that has been made following the Government's response to Greater Manchester's Outline Business Case to tackle Nitrogen Dioxide Exceedances at the Roadside (OBC), and the implications for the 10 Greater Manchester (GM) local authorities in relation to the schedule of work and statutory consultation on the Clean Air Plan.

Executive Summary

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 nitrogen dioxide in the shortest possible time. The 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. The Council is also required to address the exceedances that have been identified within its boundary during the Target Determination exercise and the Council confirmed in its supplemental plan that the exceedance identified in Oldham was being addressed as part of the Greater Manchester plan. This has been acknowledged by government.

Oldham Council has therefore been developing the study collectively with the other 9 Greater Manchester local authorities and the GMCA, coordinated by TfGM in line with Government direction and guidance and an Outline Business Case (OBC) was duly submitted in April 2019.

The key features of Greater Manchester's feasibility study and its Outline Business Case (OBC) to reduce nitrogen dioxide exceedances in Oldham and across Greater Manchester in the shortest possible time were approved on 25 March 2019 at the Council's Cabinet meeting for submission to the government's Joint Air Quality Unit (JAQU).

Recommendations

a) note progress made to date;

b) note the ministerial direction under the Environment Act 1995 (Greater Manchester) Air Quality Direction 2019 which requires all ten of the Greater Manchester local authorities to implement a charging Clean Air Zone Class C across the region;

c) agree the need to continue to proceed towards developing the implementation and contract arrangements of a charging Clean Air Zone in Greater Manchester utilising the initial tranche of £36m of funding as required by the ministerial direction / feedback;

d) delegate authority to Deputy Chief Executive, Helen Lockwood in consultation with the Cabinet Member for Neighbourhood Services, to determine the preparatory implementation and contract arrangements that need to be undertaken utilising the initial tranche of £36m of funding to deliver the CAZ and other GM CAP measures, as set out at paragraph 4.11;

e) note that the report to determine the timings for commencing the consultation will be received in the Spring of 2020;

f) note the outstanding need to secure a clear response from the Government on clean vehicles funding asks;

g) note that Highways England have not been directed to act in relation to tackling NO_2 exceedances in the same way as the Greater Manchester local authorities, and that this will leave some publicly accessible areas of GM adjacent to trunk roads managed by Highways England, with NO_2 exceedances that are not being addressed by the Highways England plan;

h) delegate authority to Deputy Chief Executive, Helen Lockwood in consultation with the Cabinet Member for Neighbourhood Services, to agree the final content and submission of the documents listed in Appendix One for formal submission to JAQU and note their publication status;

i) delegate authority to Deputy Chief Executive, Helen Lockwood in consultation with the Cabinet Member for Neighbourhood Services, to determine any further technical reports for formal submission to JAQU; and

j) note that the Cabinet Member for Neighbourhood Services will co-sign a letter from the GM Authorities to the Transport Secretary asking them to bring forward the launch of a statutory consultation to strengthen rules on vehicle idling.

Greater Manchester's Clean Air Plan – Tackling Nitrogen Dioxide Exceedances at the Roadside – Update

1 Purpose of the Report

1.1 To set out the progress that has been made following the Government's response to Greater Manchester's Outline Business Case to tackle Nitrogen Dioxide Exceedances at the Roadside (OBC), and the implications for the 10 Greater Manchester (GM) local authorities in relation to the schedule of work and statutory consultation on the Clean Air Plan.

2 Background

2.1 To set out the progress that has been made following the Government's response to Greater Manchester's Outline Business Case to tackle Nitrogen Dioxide Exceedances at the Roadside (OBC), and the implications for the 10 Greater Manchester (GM) local authorities in relation to the schedule of work and statutory consultation on the Clean Air Plan.

2.2 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 nitrogen dioxide 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 Greater Manchester plan. This has been acknowledged by government.

2.3 Oldham Council has therefore been developing the study collectively with the other 9 Greater Manchester local authorities and the GMCA, and coordinated by TfGM in line with Government direction and guidance and an Outline Business Case (OBC) was duly submitted in April 2019.

2.4 The key features of Greater Manchester's feasibility study and its Outline Business Case (OBC) to reduce nitrogen dioxide exceedances in Oldham and across Greater Manchester in the shortest possible time were approved on 25 March 2019 at the Council's Cabinet meeting for submission to the government's Joint Air Quality Unit (JAQU).

3.0 Introduction

3.1 Government has instructed many local authorities across the UK to take quick action to reduce harmful Nitrogen Dioxide (NO_2) levels following the Secretary of State issuing a direction under the Environment Act 1995 to undertake feasibility studies to identify measures for reducing NO_2 concentrations to within legal limit values in the "shortest possible time". In Greater Manchester, the 10 local authorities, the Greater Manchester Combined Authority (GMCA) and Transport for Greater Manchester (TfGM), hereinafter collectively referred to as "Greater Manchester" or "GM", are working together to develop a Clean Air Plan to tackle NO_2 Exceedances at the Roadside, hereinafter referred to as GM CAP.

3.2 In its Outline Business Case (OBC) Greater Manchester proposed the following package of measures that delivers compliance in the shortest possible time, at the lowest cost, least risk and with the least negative impacts. They are:

- A charging Clean Air Zone (CAZ) which will target the most polluting commercial vehicles including older heavy goods vehicles, buses, coaches, taxis and private hire vehicles from the summer of 2021, and older polluting light goods vehicles from 2023 (i.e. a CAZ C with a van exemption until 2023). It has been assumed at OBC stage that the Clean Air Zone Charge would be £7.50 per day for taxis, private hire vehicles and light goods vehicles and £100 per day for heavy goods vehicles, buses and coaches.
- A Clean Freight Fund of c.£59m to provide financial support for the upgrade of light and heavy goods vehicles, minibuses and coaches, which will be targeted to support small local businesses, sole traders and the voluntary sector, registered in Greater Manchester.
- A Clean Taxi Fund of c.£28m, to support the upgrade of non-compliant Greater Manchester Licensed taxi and private hire vehicles.
- A Clean Bus Fund of c.£30m to provide, where possible, the retrofit of older engine standards to the less polluting Euro VI standard for those buses registered to run services across Greater Manchester.
- A package of supporting measures including a proposed Loan Finance scheme, sustainable journeys projects, additional EV charging infrastructure.

3.3 The OBC made clear the expectation that the UK Government would support the plans through:

- Clear arrangements and funding to develop workable, local vehicle scrappage / upgrade measures;
- Short term effective interventions in vehicle and technology manufacturing and distribution, led by national Government with local authorities;
- Replacement of non-compliant buses; and
- A clear instruction to Highways England with regard to air pollution from the Strategic Road Network (SRN) in Greater Manchester.

3.4 The OBC outlining these proposals and the supporting evidence was submitted to Government at the end of March 2019. Ministerial feedback was received in July 2019 along with a further direction under the Environment Act 1995 which requires all ten of the Greater Manchester local authorities to take steps to implement a plan to deliver compliance with the requirement to meet legal limits for nitrogen dioxide in the shortest possible time.

3.5 The 2019 Ministerial Direction and accompanying letter proposed some key amendments to GM's OBC proposals, including the implementation of a charging Clean Air Zone Class C *without* a van exemption until 2023, with additional measures; and for local authorities to jointly submit to JAQU revised evidence by 2 August and a Full Business Case (FBC) by 31 December 2019 at the latest.

3.6 The Ministerial letter set out that the GM plan looks to be on track to deliver compliance in the shortest possible time and that on the evidence provided to date Greater Manchester authorities should continue to proceed towards developing the implementation and contract arrangements of a charging Clean Air Zone in Greater Manchester and that the Government would provide an initial tranche of £36m of funding to take this forward.

3.7 Full detail of the government's response was set out in the GMCA – Clean Air Update report on 26 July 2019.

4 Progress Since Last Update

4.1 Following the ministerial feedback and 2019 Ministerial Direction, the GM Authorities sought clarification on the 2019 Ministerial Direction and the accompanying ministerial letter, questioned the government's lack of assurances around financial support for the broader GM CAP, outlined GM's approach to the requests for further options analysis, and detailed the issues GM faces in preparing to implement the scheme in terms of the timetable for FBC and statutory consultation.

4.2 The ministerial letter 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 public consultation, and by 2nd August 2019.

4.3 In the interests of the ongoing working relationship between the 10 GM Authorities and the government's Joint Air Quality Unit (JAQU) in developing the GM CAP, a total of 29 draft technical reports and notes have been issued to JAQU in draft form and are subject to approval as set out in Appendix One. These provide the specific information JAQU has requested about behavioural assumptions and sensitivity testing.

4.4 GM has also requested clarification of the 2019 direction, JAQU guidance and GM's legal obligations relating to the options appraisal process, and whether this impacts on the GM authorities' options appraisal work to date or the additional work required by the letter accompanying the 2019 Ministerial Direction.

4.5 In addition, GM set out that the delay of over two months in receiving Ministerial feedback on the OBC, compounded by the request for GM to submit further options appraisal information, has had a material impact on the timetable for the GM CAP.

4.6 The delay arising from the ministerial feedback and lack of clarity on the direction, JAQU guidance and GM's legal obligations relating to the options appraisal process means that consultation will now need to take place later than originally planned. Consultation must comply with the relevant public law principles which may be summarised as:

- consulting at a time when proposals are still formative;
- giving sufficient reasons for the proposals to allow intelligent consideration and response by consultees;
- giving adequate for consultees to respond; and
- ensuring that the responses to the consultation are conscientiously taken into consideration in finalising proposals.

4.7 In planning for a Statutory Consultation Officers have had to have regard to these principles. Given the continuing dialogue with Ministers to secure a clear response from government on our clean vehicles funding asks and lack of clarity on the 2019 Ministerial Direction, JAQU guidance and GM's legal obligations relating to the options appraisal process, Officers cannot at this time advise the GM Authorities to commence the Statutory Consultation.

4.8 In the absence of a Statutory Consultation GM Authorities will not be able to submit an FBC by the end of the year and therefore that aspect of the Ministerial Direction will not be fulfilled. Officers remain in dialogue with JAQU and have written to clarify GM's position in relation to our schedule of work. GM has been clear that improving air quality is a priority and to that aim we have set out how we have been progressing this work.

4.9 Despite this delay to undertaking a Statutory Consultation, in view of the 2019 Ministerial Direction GM must continue to proceed towards developing the implementation and contract arrangements of a charging Clean Air Zone in Greater Manchester utilising the initial tranche of £36m of funding.

4.10 GM Authority decision makers will receive a report next year to determine the timings for commencement of the consultation. The report will:

- Detail the outputs from the Public Conversation and deliberative research;
- Set out the outline of the proposals and what they mean for GM, including:
  - the basic key elements of the Clean Air Zone including the intended boundary and times of operation, proposed discounts/exemptions, vehicles affected and daily charges]
  - the supporting measures [the detail of proposals of the funds and vehicle finance scheme, sustainable journeys]

- An Equalities Impact Assessment that considers the draft proposals at a GM level.

4.11 In the interim, given the scale and challenging timeline to deliver a charging Clean Air Zone as required by the 2019 Ministerial Direction, there is preparatory work that needs to be undertaken. This is in order to maintain delivery momentum in line with the funding arrangements agreed with JAQU, for example in relation to automatic number plate recognition (ANPR) cameras, back office systems and service providers. Therefore, a delegation is sought to give Deputy Chief Executive, Helen Lockwood in consultation with the Portfolio Holder the necessary authority to determine the preparatory implementation and contract arrangements, utilising the initial tranche of £36m of funding that may need to be undertaken to deliver a Clean Air Zone and other GM CAP measures, ahead of the report that will determine progressing the statutory consultation.

4.12 The commencement of a charging Clean Air Zone scheme and the other measures are subject to both consultation as set out at 4.10 and to the GM authorities receiving the required government funding to enable them to meet the legal limits for nitrogen dioxide concentrations.

5.0 Government Asks

5.1 In addition to the response on the specific clean air proposals, additional asks were made of Government, as set out at 3.3

5.2 These include an ask for Government to direct Highways England to tackle NO_2 exceedances on the Strategic Road Network (SRN) in the same way that local authorities that have been directed to undertake a feasibility study are having to take action on the local road network. The ministerial feedback outlined that Highways England are working up plans for exceedances identified by national modelling on their network, and that this is not expected to include charging on the SRN but will instead focus on a range of measures such as traffic management, speed limits and barriers.

5.3 Officers have been advised that the measures proposed by Highways England in Greater Manchester focus on introducing 60mph speed limits on parts of the SRN. It highlights the concern that Highways England have not been directed to act in relation to tackling NO_2 exceedances in the same way as local authorities, and that this will leave some publicly accessible areas of GM adjacent to trunk roads managed by Highways England, with NO_2 exceedances that are not being addressed by the Highways England plan.

6 Vehicle Idling

6.1 The Clean Air conversation in Spring 2019 highlighted that many people are concerned about vehicle idling, prompting questions about what GM can do to crack down on people who leave their engines idling.

6.2 In the UK, it is illegal under the Road Vehicles (Construction and Use) Regulations 1986 to leave a vehicle's engine running unnecessarily while that vehicle is stationary on a public road. Doing this can incur a £20 fixed-penalty fine under the Road Traffic (Vehicle Emissions) Regulations 2002.

6.3 This is only imposed if the driver fails to turn off their engine when asked to do so. Enforcement of this legislation, either through a Fixed Penalty Notice (FPN) or via the magistrates' court sits with local authorities.

6.4 As the enforcing officer must give the driver the opportunity to switch off the engine first and the penalty for idling is relatively small (£20), Greater Manchester Local Authorities do not consider the Regulation to be an effective deterrent.

6.5 In addition, government has recently announced proposals to consult on toughen up rules on vehicle idling and increase fines for drivers who leave their engine running while parked.

6.6 Given the limited enforcement deterrent the GM Authorities are planning undertake more awareness raising campaigns to inform of the health impacts that idling has on air quality.

6.7 In parallel, GM Authorities write to the Transport Secretary asking them to bring forward the launch of the public consultation on this issue.

7 Next Steps

7.1 Officers will:

- Continue to work with JAQU to clarify the 2019 Ministerial Direction, JAQU guidance and GM's legal obligations relating to the options appraisal process, and the implications of that to our schedule of work and the timings for consultation on the Plan;
- Continue dialogue with JAQU to secure a clear response from government on our clean vehicles funding asks; and
- Continue stakeholder engagement and awareness raising with both groups in scope of the Clean Air Zone and the general public.

8 Recommendations

k) note progress made to date;

l) note the ministerial direction under the Environment Act 1995 (Greater Manchester) Air Quality Direction 2019 which requires all ten of the Greater Manchester local authorities to implement a charging Clean Air Zone Class C across the region;

m) agree the need to continue to proceed towards developing the implementation and contract arrangements of a charging Clean Air Zone in Greater Manchester utilising the initial tranche of £36m of funding as required by the ministerial direction / feedback;

n) delegate authority to Deputy Chief Executive, Helen Lockwood in consultation with the Cabinet Member for Neighbourhood Services to determine the preparatory implementation and contract arrangements that need to be undertaken utilising the initial tranche of £36m of funding to deliver the CAZ and other GM CAP measures, as set out at paragraph 4.11;

o) note that the report to determine the timings for commencing the consultation will be received in the Spring of 2020;

p) note the outstanding need to secure a clear response from the Government on clean vehicles funding asks;

q) note that Highways England have not been directed to act in relation to tackling NO_2 exceedances in the same way as the Greater Manchester local authorities, and that this will leave some publicly accessible areas of GM adjacent to trunk roads managed by Highways England, with NO_2 exceedances that are not being addressed by the Highways England plan;

r) delegate authority to Deputy Chief Executive, Helen Lockwood in consultation with the Cabinet Member for Neighbourhood Services to agree the final content and submission of the documents listed in Appendix One for formal submission to JAQU and note their Publication status;

s) delegate authority to Deputy Chief Executive, Helen Lockwood in consultation with the Cabinet Member for Neighbourhood Services to determine any further technical reports for formal submission to JAQU; and

t) note that the Cabinet Member for Neighbourhood Services will co-sign a letter from the GM Authorities to the Transport Secretary asking them to bring forward the launch of a statutory consultation to strengthen rules on vehicle idling.

9 Options/Alternatives

9.1 Agree to the recommendations as outlined in the report

9.2 Not to agree the recommendations

10 Preferred Option

10.1 The preferred option is to note the report update and agree the approach as outlined to enable compliance with air quality limits within the earliest possible time.

11 Financial Implications

11.1 It is currently anticipated that the implementation, contract arrangements and administration of the Clean Air Plan/Zone will be undertaken by the Greater Manchester Combined Authority and will be funded via government grant and fines income. As such there are no direct financial implications for the Council at this stage. However, the Council will need to review the implications of Clear Air Zone charges on both its directly operated fleet and any commissioned services that rely on vehicles subject to the proposed charges.

(James Postle)

12 **Legal Services Comments**

12.1 Legal matters are addressed in the body of the report. The approach and preferred option suggested are consistent with that of The Council's partner Authorities as outlined in the report. (Colin Brittain)

13 **Co-operative Agenda**

13.1 This work will require close working with businesses and general road users to modify behaviors which improve air quality across the region.

14 **IT Implications**

14.1 None

15 **Property Implications**

15.1 None

16 **Procurement Implications**

16.1 None

17 **Environmental and Health & Safety Implications**

17.1 There are proven health risks attached to poor air quality therefore this work is aimed at improving health impact for all.

18 **Equality, community cohesion and crime implications**

18.1 A full Equality Impact Assessment will be undertaken as part of the overall submission of a final business case.

19 **Equality Impact Assessment Completed?**

19.1 In progress

20 **Key Decision**

20.1 Yes

21 Key Decision Reference

21.1 NEI-19-19

22 Background Papers

22.1 The reports in Appendix 1, save for those marked with an asterisk, will be published once they have been approved. Upon publication, copies of these reports will be available at: www.CleanAirGM.com.

22.2 Those reports marked with a single asterisk (*) are unfinished documents and will remain unpublished until the beginning of the consultation.

22.3 As such, it is considered that the reports referred to above fall within the exception under regulation 12(4)(d) 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. Subject to the comments at 9.10 in relation to report number 11, all the reports referred to above will be made public shortly and in any event prior to public consultation so there will be an appropriate opportunity for public scrutiny of them. It is not considered that the public interest would be served by disclosing at this stage drafts which are incomplete.

22.4 In addition, reports numbers 4 and 11, marked with a double asterisk (**) 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, it is considered these reports fall 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.

23 Appendices

Appendix One - Summarises the purpose and contents of the additional supplementary technical Evidence Notes that are required to be formally submitted to JAQU to accompany the OBC and in response to the Minister's feedback.

Appendix One

23.1 This appendix summarises the purpose and contents of the additional supplementary technical Evidence Notes that are required to be formally submitted to JAQU to accompany the OBC and in response to the Minister's feedback.

23.2 Pursuant to the Ministerial Direction, and in discussions with the government's Joint Air Quality Unit (JAQU) GM has updated analysis that addresses issues raised around the behavioural assumptions used and provided assurance that the proposed Clean Air Zone will deliver compliance in the shortest possible time, and that compliance cannot be achieved earlier than 2024, such analysis includes:

- exploring whether measures targeted at the last remaining exceedance locations following implementation of a CAZ in 2021 would achieve compliance quicker;
- updating the behavioural assumptions used to model the impact of a CAZ, following the Technical Independent Review Panel's suggestions;
- providing further sensitivity testing on vehicle upgrade assumptions; and
- demonstrating that a Greater Manchester CAZ D cannot bring forward compliance, including outlining the delivery challenges discussed for a GM wide CAZ D.

23.3 In response 29 Evidence Notes, have been produced, namely:

1. GM CAP Data, Evidence and Modelling: post-OBC approach

2. GM CAP: Next steps for data collection and the development of analytical tools

3. GM CAP: Analysis of the freight market

4. GM CAP: Analysis of the coach market **

5. GM CAP: ANPR Surveys: Summary of Initial Findings

6. GM CAP: Behavioural response assumptions and available data sources*

7. GM CAP: LGV and HGV Operational Cost Models*

8. GM CAP: HGV Behavioural Responses Note*

9. GM CAP: LGV Behavioural Responses Note*

10. GM CAP: Taxi Behavioural Responses Note*

11. GM CAP: Analysis of Bus Upgrade Options to Deliver Air Quality Compliance**

12. GM CAP: Evidence of the impact of 2021 implementation of a CAZ C (without exemptions)

13. GM CAP Study: Traffic Impact on Neighbouring Authorities

14. GM CAP: Local exceedances: Update*

15. GM CAP: Implications of the EFT update for GM

16. GM CAP: Sensitivity testing of a CAZ C in 2023 with revised behavioural response assumptions.*

17. GM CAP: Evidence supporting the decision not to progress with a GM-wide CAZ D.*

18. GM CAP: Minibus Vehicle Research

19. GM CAP: Taxi and Private Hire Vehicle Fleet Research

20. GM CAP: Greater Manchester Specialised Goods Surveys: Results Summary

21. GM CAP: Sensitivity test: Full Electric Bus Fleet

22. GM CAP: Addendum to Note 3: GM Comparative Statistics

23. GM CAP: Summary update of ongoing work on local exceedances*

24. GM CAP: Updates to the Modelling Tools post-OBC Submission for the Do Minimum scenario

25. GM CAP: Modelling the impacts of Sustainable Journeys Measures*

26. GM CAP: Analysis of Funds*

27. GM CAP: Demand Sifting Tool Operating Manual*

28. GM CAP: Taxi and Private Hire Vehicle Operational Cost Model*

29. GM CAP: Option for Consultation Modelling Summary*

23.4 In the interests of the ongoing working relationship between the 10 GM authorities and JAQU in developing the GM CAP, all of the above reports have been issued to JAQU in draft form, and are now subject to approval.

23.5 The evidence base that will underpin the Full Business Case (FBC) is still being developed. Evidence was supplied to JAQU where it was possible to do so, with the recognition that the Notes represented a work-in-progress and that more work is required to properly understand the implications of the analysis from a policy, delivery, legal and analytical assurance perspective.

23.6 Contents of the supplementary Evidence Notes:

- **'Note 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).

- **'Note 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 specialized goods vehicle surveys; and the analysis of evidence emerging from the Conversation and other bodies.

- **'Note 3: Analysis of the freight market'** describes the number of Heavy and Light Goods Vehicles operating in GM, the compliance status of those vehicles, and the business and usage patterns of those vehicles.

- **'Note 4: 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.

- **'Note 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 Greater Manchester 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.

- '**Note 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 7: 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.

- **'Note 8: GM CAP: HGV Behavioural Responses'** 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 9: GM CAP: 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 10: GM CAP: Taxi Behavioural Responses'** sets out what behavioural response assumptions were applied at OBC for Hackney Cabs and Private Hire Vehicles (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 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:

- 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.
- 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).

- **'Note 12: 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.

- **'Note 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.

- **'Note 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.

- **'Note 15: 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.

- **'Note 16: GM CAP: Sensitivity testing of a CAZ C in 2023 with revised behavioural response'** 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 17: 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.

- **'Note 18: 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.

- **'Note 19: Taxi and Private Hire vehicle 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.

- **'Note 20: Greater Manchester 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.

- **'Note 21: 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.

- **'Note 22: 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.

- **'Note 23: 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.

- **'Note 24: '** 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.

- **'Note 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.

- **'Note 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.

- **'Note 27: GM CAP: Demand Sifting Tool Operating Manual' describes the Demand Sifting Tool and acts as a manual for use, settin**g 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.

- **'Note 28: GM CAP: Taxi and Private Hire Vehicle 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 Private Hire Vehicles. It is proposed that this tool replaces the methodology for assessing behavioural responses as applied in the OBC**.**

- **'Note 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.

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

Note 1: Data, Evidence and Modelling Post-OBC approach

Warning: Printed copies of this document are uncontrolled

Version Status:	DRAFT FOR APPROVAL	**Prepared by:**	Clare Sheffield 9th July 2019
Authorised by: **Date:**	Ian Palmer 12th July 2019		

1 Introduction

1.1 This note describes the process being undertaken to deliver the Data, Evidence and Modelling requirements in support of the GM CAP Full Business Case (FBC). It also describes the evidence that will be supplied to JAQU on the 12th July 2019 and in the following week; highlighted in green throughout and set out in Appendices 1 and 2.

1.2 The goal of the Data, Evidence and Modelling (DEM) workstream is to ensure that the GM CAP FBC is underpinned by robust and reliable evidence. It involves:

- Developing models and tools to facilitate analysis and using those models and tools to assess the impacts of the proposals;
- Collecting data and carrying out analysis of that data to support case making and impacts assessment; and
- Carrying out research to inform case making and impacts assessment.

1.3 Fundamentally, this evidence and modelling-based approach will ensure that the proposals contained in the GM CAP meet the objective of achieving compliance with NO2 legal limits in the shortest possible time.

2 Feedback from JAQU, the TIRP and DIRP

2.1 GM has received formal feedback from JAQU, the TIRP and DIRP. A fuller response to this feedback is presented in Appendices 2 (JAQU), 3 (TIRP) and 4 (DIRP). Key issues included the need to:

- Provide evidence of the impact of each implementation fund measure on compliance, and to provide supporting evidence for any CAF measures in line with the JAQU guidance;
- Assess the potential for additional measures at local exceedance sites to bring forward compliance;
- Update the behavioural response assumptions, grounded in a robust evidence base and better describe the methodology and test uncertainty;
- Collect evidence and develop assumptions for responses to the Funds/Loans (including new surveys) and other proposed measures (EV infrastructure, sustainable journeys, LA fleet);
- Carry out further sensitivity testing of the transport, air quality and economic impacts of the proposals;
- Better understand potential distributional impacts of the proposals; and

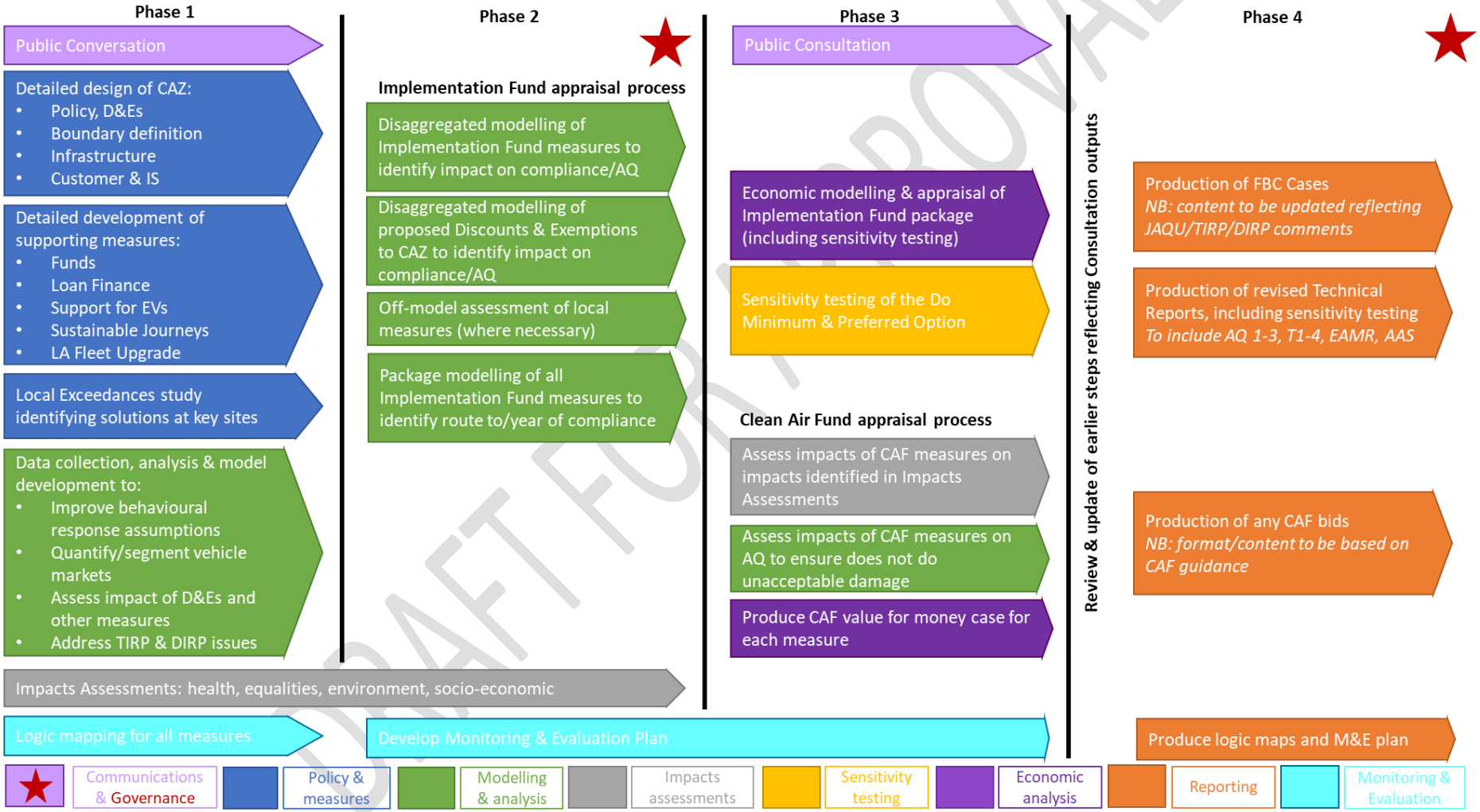
- Make the case for why a GM-wide CAZ D does not bring forward compliance, and why bringing forward the implementation of a GM-wide CAZ C to 2021 does not bring forward compliance.

3 Approach to delivering an improved evidence base for FBC

3.1 The process for delivering the proposals, evidence and policy for the FBC is shown overleaf. The Data, Evidence and Modelling workstream is feeding into all aspects of this work, but tasks owned by that workstream are Modelling and Analysis (shown in green), Economic analysis (shown in purple), Sensitivity testing (shown in yellow), and some reporting (shown in orange).

3.2 More detail about the proposed approach to each of these activities is supplied below in Figure 3-1.

Figure 3-1: Diagram of the process for delivering the GM CAP proposals, evidence and policy materials for the FBC



4 FBC Phase One: Improving the evidence base and supporting scheme design (Underway)

4.1 Improving our knowledge of the vehicle markets affected by the GM CAP

4.1.1 GM has carried out a data gathering exercise for each of the vehicle markets affected by the GM CAP, including buses, coaches, HGVs, LGVs, minibuses, and taxis (Hackney cabs and private hire vehicles (PHVs)). Notes describing the number of vehicles operating in GM, the compliance status of those vehicles, and the business and usage patterns of those vehicles are under production for each vehicle type – those for coach, HGV and LGV are available now; and analysis of bus, minibus, and taxi is underway. In particular, GM has improved our understanding of the complexity of freight activity and vehicle types; of the coach and minibus markets about which little was previously known; about the nature of vehicles in the bus fleet; and about the full taxi fleet including the substantial numbers of PHVs seemingly operating in GM but licensed elsewhere.

4.1.2 This evidence is being used to inform scheme design and to support the development of analytical tools and modelling assumptions.

4.1.3 **Papers to be supplied to JAQU on 12th July 2019:**

- **Note 3 GM CAP Analysis of the Freight Market**
- **Note 4 GM CAP Coach Vehicle Research**

4.2 Carrying out new primary data collection

4.2.1 GM has carried out new deliberative research with freight, taxi and coach operators to explore potential responses to and impacts of the proposals; these have informed the design of the Conversation, measures development and will be used to sense check the conclusions of the analytical work. The Conversation outputs will also feed into the evidence base and be used to identify any issues or risks with the analytical assumptions.

4.2.2 Surveys are under development to gather better information about freight activity in GM, and to better understand how key groups may respond to the CAZ and other proposals, using Stated Intention techniques. These surveys will be undertaken in July 2019 and used to validate the behavioural response assumptions, and to support the development of tools assessing the impact of the Funds and Loan Finance proposals.

4.2.3 An ANPR survey was conducted across a single week in January 2019 at 42 sites across GM. The survey was designed to provide a representative profile of the vehicle fleet operating in Greater Manchester in terms of vehicle type (including fuel used) and age profile. The new survey results are intended to update the previous data used in the OBC and collected in 2016 on a more ad hoc basis using ANPR data collected from pre-existing sites, which did not necessarily represent a robust coverage across Greater Manchester. The new ANPR dataset is more comprehensive and robust than the one used in the OBC and covers key areas where emissions had previously been estimated to be above legal levels. 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.

4.2.4 **Papers to be supplied to JAQU on 12th July 2019:**

- **Note 5 GM CAP ANPR Surveys: Summary of Initial Findings**

4.3 Gathering and analyzing new secondary data and research

4.3.1 GM has identified a number of sources of data offering 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.

4.3.2 **Papers to be supplied to JAQU on 12th July 2019:**

- **Note 6 GM CAP: Behavioural response assumptions and available sources of data**

4.4 Improve behavioural response assumptions for a CAZ

4.4.1 GM recognises the need to improve the robustness of the behavioural assumptions underpinning the suite of strategic modelling tools. This was a key requirement of the TIRP and DIRP. The behavioural responses assumed for each of the vehicle types have been considered and reassessed, based on new evidence, and including the development of new analytical tools. As a result:

- HGV responses were previously based on a response curve derived from two evidence points. It is proposed that this method is replaced at FBC by responses derived from an operational cost model, segmented by vehicle type and size, and allowing responses to upgrade, stay and pay or change mode to a smaller vehicle subject to a lower charge (LGV).

- LGV responses were previously derived from stated preference research carried out in Bristol. GM has investigated two alternative methodologies: utilising behavioural responses derived from stated preference research carried out in Sheffield, which offered a better sample of LGV drivers; or using an operational cost model similar to that used for HGVs. Both methods have been tested, and deliver similar responses, with the operational cost model appearing more credible and also allowing greater flexibility to be adapted for assessing measures beyond the CAZ. The operational cost model allows responses to upgrade, stay and pay or change mode to an out-of-scope vehicle (car).

- PHV responses were previously derived from stated preference research carried out in Bristol and adapted to be more suitable to GM. Analysis has been undertaken deriving behavioural responses from stated preference research carried out in Sheffield, which offered a better sample of PHV drivers. Provisional analysis suggests that these appear to perform better than the Bristol-derived assumptions but GM is also planning to test an operational cost model approach for PHVs as an alternative

4.4.2 In particular, the OBC assumed a 100% upgrade response for bus and Hackney cab, in the absence of alternative information. This was highlighted in the feedback from JAQU, the TIRP and DIRP as a particular source of concern and GM were asked to carry out sensitivity tests on the implications of this assumption. As a result:

- Hackney cabs were previously assumed to upgrade in full, in the absence of alternative information about likely responses. GM has undertaken analysis deriving behavioural responses from stated preference research carried out in Sheffield, which included a sample of Hackney cab drivers. These perform well when adapted to GM conditions, however GM is also planning to test an operational cost model approach for Hackney cabs as an alternative. Either approach will mean that the 100% upgrade assumption made at OBC will not be carried through to FBC. Because GM is no longer proceeding with the 100% upgrade assumption, it was not considered a good use of limited resources to carry out sensitivity tests on this aspect.

- Buses were previously assumed to upgrade in full, in the absence of alternative information about likely responses. The responses available to bus operators in a deregulated bus market are uniquely complex and carry wider public interest concerns. Therefore, the approach taken for bus has been to commence a logic mapping exercise to better illustrate the complexity of the challenge and the risks posed by a CAZ to the sustainable travel offer and to accessibility. GM has also developed an analytical method to act as a sensitivity test for bus, testing which routes must upgrade to achieve compliance, and which routes are less influential. It is not clear the extent to which this analytical division could be realised in practice and work is underway to better understand the policy and delivery implications of the findings. In summary this analysis found that around three quarters of routes pass a point at risk of

exceedance, and that for the larger operators with some opportunity to restructure their fleet, such routes accounted for just under half of their fleet. In comparison, for the same group just under one in ten buses are currently compliant.

4.4.3 GM has carried out 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 has been assumed as 100% for the purposes of this test as no alternative assumptions have been identified as yet. The results of this test will be available by the 12th July.

4.4.4 **Papers to be supplied to JAQU on 12th July 2019:**

- **Note 8 GM CAP: Updating behavioural responses for HGVs**
- **Note 9 GM CAP: Updating behavioural responses for LGVs**
- **Note 10 GM CAP: Updating behavioural responses for Taxis**
- **Note 11 Analysis of Bus Upgrade Options to Deliver Air Quality Compliance**

4.4.5 **'Note 16 GM CAP: Sensitivity testing of a CAZ C in 2023 with revised behavioural response assumptions' will be supplied in the week of 15th July 2019.**

4.5 Supporting the scheme design of the CAZ

4.5.1 Analysis has been carried out to support scheme design of the CAZ including:

- Modelling of boundary impacts of diverting traffic and advice on boundary selection issues (complete);
- Assessment of the impacts of potential discounts and exemptions, including the blue light fleet, community minibuses, and a range of scenarios for taxis linked with the implementation of Minimum Licensing Standards (underway), recognising the requirement to provide evidence of both the necessity of any discounts and exemptions and of any impact on the achievement of compliance; and
- Assessment of the costs and benefits of delaying CAZ C implementation until 2023 – this work is ongoing but an interim update is available.

4.5.2 **Papers to be supplied to JAQU on 12th July 2019:**

- **Note 12 Evidence of the impact of 2021 implementation of a CAZ C (without exemptions)**
- **Note 13 GM CAP Study: Traffic Impact on Neighbouring Authorities**

4.6 Supporting the scheme design of other non-CAZ measures

4.6.1 Analysis and research is underway, as outlined above, to support the development of the measures other than the CAZ. In particular:

- Supporting policy development in terms of who should be in scope for the Funds and Loan Finance schemes; how such schemes might operate and what the impacts would be, including providing advice on case-making from both an implementation and CAF perspective. Assessing these proposals will require evidence from local surveys (underway) and may require the development of new tools, potentially as extensions to the operational cost models;

- Gathering evidence to support the case for investment in EV infrastructure, promotional activity and help to upgrade to an EV in terms of how this investment would deliver increased uptake of EVs and the resulting air quality benefits;

- Developing a methodology for quantifying the air quality benefits of investing in measures to promote sustainable travel; and

- Gathering data from local authorities to inform the design of measures to upgrade the LA fleet and consider adaptations to local parking policy.

4.6.2 This work is underway. GM recognises the need to quantify the independent air quality and compliance impact of any Implementation Fund measures, and to demonstrate what impacts are mitigated by any CAF measures, the value for money of this investment, and the impact on air quality.

4.7 <u>Supporting the identification and assessment of key sites where local measures could bring forward compliance</u>

4.7.1 GM has identified 12 sites that are the last remaining exceedance locations in 2023/4 to explore whether local measures could mean that compliance could be brought forward or early benefits realised.

4.7.2 GM is taking the following approach to assessing these sites:

- Analysis of traffic flows, speeds and composition and assessment of modelled outputs compared to real-world conditions (complete);

- 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 (complete);

- Site visits and meetings with districts to review of the locality in terms of trip attractors etc and identify any planned development, changes to the road network etc (complete);

- Review by experts at TfGM, the relevant districts and the Lead Advisor team to identify a long list of possible solutions (complete);

- Shortlisting of possible solutions based on GM's Multi Criteria Assessment

Framework (underway);

- Initial scoping/development of those solutions including high level analysis of possible impacts on AQ – seeking a recommendation to proceed (to follow);

- If a decision is made to proceed, full development of any identified measures, including local modelling where appropriate.

4.7.3 **Papers to be supplied to JAQU on 12th July 2019:**

- **Note 14 GM CAP Local Exceedances: Update**

4.8 Investigating the implications of the revised EFT

4.8.1 GM's methodology for calculating traffic emissions applies emissions factors derived from DEFRA's Emission Factor Toolkit (EFT) version 8.0, which was originally released in November 2017. Subsequently, DEFRA released EFT v9.0 aligning the fleet figures in the EFT with those in the most recent PCM base year projections (2017). At the end of May 2019, JAQU issued an update to the toolkit, EFT version 9.1a. This is a non-standard EFT update, which has has been produced for local authorities (LAs) developing Clean Air Plans plans only (and thus is only available on Huddle). This version of 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.

4.8.2 The EFT release has implications for the emissions factors and fleet projections used in GM's emissions models, and incorporates revisions to background emissions maps and as well as for background emissions maps and the the NOx to NO_2 calculator. GM is carrying out work to better understand the implications of these updates and has carried out an initial sensitivity test looking at the impacts of the revised emissions factors and fleet projections, reported in the paper below.

4.8.3 **Papers to be supplied to JAQU on 12th July 2019:**

- **Note 15 Implications of the EFT update for GM CAP**

4.9 Supporting associated workstreams

4.9.1 Data, Evidence and Modelling are working closely with the teams carrying out the environmental, equalities, health and socio-economic Impacts Assessments and the Monitoring and Evaluation team to share evidence.

4.10 Providing further evidence for the case against a Greater Manchester-wide CAZ D

4.10.1 A Greater Manchester-wide CAZ D was developed initially as a theoretical 'maximum case', primarily to understand whether compliance could be achieved under any scenario by 2021, as Option 6 in the sifting stage of the GM CAP development. Importantly, the modelled scenario did not take account of the feasibility of delivering such a scheme or include the full package of supporting measures that would be required. A GM-wide CAZ D was ruled out on the basis that it would not deliver compliance in the shortest possible time, and would perform even more poorly in terms of reducing human exposure as there would be a long period without action on the ground; during which time considerable progress towards compliance would be expected with other options.

4.10.2 JAQU have asked GM to provide further evidence supporting that decision. This analysis is underway, and an update will be submitted by 19th July.

4.10.3 **Papers to be supplied to JAQU in the week of 15th July 2019:**

- **Note 17 Evidence supporting the decision not to progress with a GM-wide CAZ D**

5 FBC Phase Two: Modelling the impact of Implementation Fund proposals (To Follow)

5.1 Disaggregated modelling of Implementation Fund measures to identify impact on compliance/AQ

5.1.1 GM recognises the need - as set out by JAQU and the TIRP/DIRP - to provide evidence of the contribution of each of the proposed Implementation Fund measures separately and is intending to supply this at FBC, subject to any technical limitations. The methodology for assessing and modelling each measure is being designed in such a way to facilitate this disaggregated analysis as much as possible. Revised behavioural assumptions will be applied to the modelling of CAZ impacts as set out above.

5.2 Disaggregated modelling of proposed Discounts & Exemptions to CAZ to identify impact on compliance/AQ

5.2.1 Similarly, GM recognises the need - as set out by JAQU and the TIRP/DIRP - to provide evidence of both the justification for any discount or exemption, in terms of the impact being mitigated, and also of the impact on the achievement of compliance. GM understands that, where analysis can demonstrate that impacts are likely to be minimal, modelling is not required, but recognises that modelling will be required for any large-scale exemptions including the delayed implementation of the CAZ C until 2023. Analysis is underway of all discounts and exemptions currently being considered, recognising that further issues may emerge from the Conversation.

5.3 Off-model assessment of local measures (where necessary)

5.3.1 As discussed with JAQU technical staff, there is a concern that targeting the last exceedances risks targeting issues that aren't as likely to be apparent in the real world and we have been advised that JAQU would rather see something put forward that is likely to work in the real world but is difficult to represent in the modelling than vice versa. GM's modelling suite is at a strategic scale and it would be difficult to properly represent the benefits of very localised measures. It may be necessary to carry out off-model analysis based on supporting evidence to demonstrate the efficacy of local solutions, depending on the measures identified.

5.4 Package modelling of all Implementation Fund measures to identify route to/year of compliance

5.4.1 GM will re-model the revised full package of measures for the Preferred Option, using the updated tools and assumptions, to supply transport, air quality and compliance outputs as per the OBC.

5.5 It is intended that the package modelling and as much disaggregated modelling as possible will be available prior to public consultation.

6 FBC Phase Three: Economic appraisal, assessing the impact of CAF measures and sensitivity testing (To Follow)

6.1 It is currently intended to carry out this phase of work during the public consultation period.

6.2 Economic modelling & appraisal of Implementation Fund package (including sensitivity testing)

6.2.1 GM is carrying out a review of the economic appraisal methodology and applying improvements where appropriate. An economic appraisal will be carried out of the package of Implementation Measures, based on this updated methodology. Only basic sensitivity testing was conducted at OBC, and a more thorough programme of sensitivity testing will be carried out at FBC, supported by a clear explanatory narrative.

6.3 Sensitivity testing of the Do Minimum & Preferred Option

6.3.1 Sensitivity testing will be carried out of the Do Minimum and Preferred Options, considering key sources of uncertainty. This will involve replicating some tests conducted at OBC, applied to the updated measures and modelling tools/assumptions, and is likely to involve the addition of further tests, subject to time.

6.4 Appraisal of Clean Air Fund measures

6.4.1 If GM decides to apply for CAF funding, an appraisal will be conducted of all CAF measures based upon the JAQU guidance, demonstrating what impacts are mitigated by the measures, the value for money of this investment, and the impact on air quality. GM is currently developing a methodology to allow the assessment of any CAF measures based on the written JAQU guidance and advice provided by officers; this will ensure that the tools are in place to assess measures as they come forward.

7 FBC Phase Four: FBC production and reporting (To Follow)

7.1 Note that, prior to this phase, it may be necessary to re-run parts of the preceding work in response to outcomes of the Public Consultation.

7.2 Data, Evidence and Modelling will feed into the production of the FBC (particularly the Strategic and Economic cases) and will provide the following supporting updated Technical Reports:

- T1, T2, T3 and T4 including the results of sensitivity testing
- AQ1, AQ2, AQ3 including the results of sensitivity testing
- EAMR, including the results of sensitivity testing
- Analytical Assurance Statement
- Full response to TIRP and DIRP feedback

8 Next steps

8.1 GM proposes that a workshop to run through the materials supplied, discuss outstanding questions and agree next steps would be valuable.

APPENDIX ONE: PAPERS TO BE SUPPLIED TO JAQU ON 12TH JULY 2019

1. GM CAP Data, Evidence and Modelling: post-OBC approach
2. GM CAP: Next steps for data collection and the development of analytical tools
3. Analysis of the freight market
4. Analysis of the coach market
5. GM CAP ANPR Surveys: Summary of Initial Findings
6. GM CAP: Behavioural response assumptions and available data sources
7. LGV and HGV Operational Cost Models
8. GM CAP: HGV Behavioural Responses Note
9. GM CAP: LGV Behavioural Responses Note
10. GM CAP: Taxi Behavioural Responses Note
11. Analysis of Bus Upgrade Options to Deliver Air Quality Compliance
12. Evidence of the impact of 2021 implementation of a CAZ C (without exemptions)
13. GM CAP Study: Traffic Impact on Neighbouring Authorities
14. GM CAP Local exceedances: Update
15. Implications of the EFT update for GM

TO FOLLOW IN THE WEEK OF 15TH JULY:

16. GM CAP: Sensitivity testing of a CAZ C in 2023 with revised behavioural response assumptions
17. Evidence supporting the decision not to progress with a GM-wide CAZ D

APPENDIX TWO: DATA, EVIDENCE AND MODELLING RESPONSE TO LETTER FROM ANDREW JACKSON, 23RD MAY 2019

Issues raised in letter of 23rd May	GM response	Evidence supplied?
Confirmation of which measures have been modelled as being needed for compliance	The OBC assumes all measures are required for compliance. The modelling includes a representation of the following measures: • CAZ B in 2021, CAZ C in 2023; • Funds to support the upgrade of all buses, and some freight vehicles and taxis; and • Investment in EV charging points. Measures to promote sustainable journeys have not been modelled. At FBC, GM intends to provide disaggregated modelling to demonstrate the impact of each implementation measure on compliance (subject to any technical limitations). This will be carried out once the measures are fully defined.	No
Assessing whether additional measures targeted at the longest outstanding exceedances can bring forward compliance.	GM has identified 12 sites that are the last remaining exceedance locations in 2023/4 to explore whether local measures could mean that compliance could be brought forward or early benefits realised. This study is underway and an interim report will be provided to JAQU on the 12th July.	Yes
Reviewing with you the vehicle upgrade assumptions used, particularly for buses and taxis/private hire and whether these have an impact on the option chosen	GM is undertaking a review of all vehicle upgrade and behavioural response assumptions and is developing a revised approach for HGV, LGV, PHV and Hackney Cab responses. This means that the 100% upgrade assumption applied to Hackney Cabs will be replaced at FBC with an evidence-based behavioural response. These are described in a series of papers to be provided on the 12th July. GM has discussed the complexity of assessing and modelling possible bus upgrade responses and has developed a sensitivity testing methodology to assess what proportion of buses must be upgraded to achieve compliance. To be supplied in a paper on the 12th July.	Yes
Justifying the contribution to compliance of individual measures, such as electric vehicle upgrade, sustainable transport and local authority fleet upgrade	GM is gathering further evidence on the efficacy of investment in EV infrastructure and sustainable transport to deliver AQ improvements. Modelling or analysis will be provided to justify the contribution of any measures proposed for implementation funding to compliance. If measures are proposed under the CAF, evidence will be supplied in accordance with the relevant guidance.	No
Demonstrating that a GM CAZ D cannot bring forward compliance, including outlining the delivery challenges discussed for a GM wide CAZ	Work is underway to further demonstrate that a GM CAZ D cannot bring forward compliance and an interim update will be supplied week of 15th July.	Yes

Issues raised in letter of 23rd May	GM response	Evidence supplied?
Further justifying your case that bringing forward the CAZ C exemption cannot bring forward compliance	Work is underway to further justify the case that bringing forward the CAZ C exemption cannot bring forward compliance and an interim update will be supplied on the 12th July.	Yes
For all [Clean Air Fund] schemes, justifying the cost, the assumptions used about uptake, and further information on how these have been are arrived. Further detail on how the schemes are intended to operate and how they are they targeted at those most affected.	Work is underway to develop detailed case-making and scheme designs for each of the measures. If a decision is made to progress with any measures under the Clean Air Fund, a bid will be developed in line with JAQU's guidance. Health, environment, equalities and socio-economic impacts assessments are underway to inform the assessment of any CAF measures.	No
Immediate priority 1: Exploring whether measures targeted at the last remaining exceedance locations following implementation of a CAZ in 2021 would achieve compliance quicker	As described above, GM is undertaking a study of key local exceedance locations and will supply an interim report on the 12th July.	Yes
Immediate priority 2: Updating the behavioural assumptions used to model the impact of a CAZ, following the TIRP's suggestions	As described above, GM is updating the behavioural assumptions used to model the impact of the CAZ, using new data and tools and informed by the TIRP's suggestions, and will supply a series of papers describing the process and findings on the 12th July.	Yes
Immediate priority 3: Providing further sensitivity testing on your vehicle upgrade assumptions	GM has undertaken sensitivity testing, using an off-model analysis method, testing the minimum bus upgrade required to achieve compliance, supplied 12th July. GM has undertaken a sensitivity test of the impact of a CAZ C in 2023 (without supporting measures) applying updated behavioural response assumptions, to be supplied week of 15th July.	Yes

APPENDIX THREE: INITIAL DATA, EVIDENCE AND MODELLING RESPONSE TO TIRP FEEDBACK

Summary of requirements/feedback	Source & rating	Initial GM response
Model validation – review implications of poor validation	TIRP	Underway at key sites via the local exceedances work – see interim report for initial findings.
Model validation – validation by vehicle class	TIRP	This can be reported although caution is required around less well represented classes. Will be supplied at FBC as a revision to T2.
Demand sifting tool assumptions need to be better explained and justified	TIRP	GM has carried out a full audit of the Demand Sifting Tool and is producing a manual. GM recognises the need to provide a thorough description of the methodology and this will be supplied as a revision to T4 at FBC.
Behavioural responses – better description of methodology and sources for assumptions, discussion of uncertainty, issues of lack of destination choice	TIRP	A thorough review of the behavioural response assumptions is underway and it is intended that the responses applied at FBC will be grounded in more robust evidence. Papers have been described providing updates on this work and an initial sensitivity test of the impacts. This process, the sources and methodology will be supplied at FBC as a revision to T4. Further sensitivity testing will be conducted on the revised tools and updated preferred option, and these will be supplied alongside a discussion of uncertainty as an update to the AAS at FBC. An appropriate variable demand model was not available and so it will not be possible to resolve the lack of representation of destination choice. This is considered less significant given the regional scale of the scheme.
Behavioural responses – segmentation of vans by user type	TIRP	A segmentation of vans by user type has been applied in the revised methodology for deriving LGV behavioural responses.
Behavioural responses – incorporate car to van response	TIRP	A van to car response is being applied in the revised methodology for deriving LGV behavioural responses.
Behavioural responses – identifying 'point of failure' for scheme	TIRP	This is complex to assess but sensitivity testing will be carried out to inform our understanding at FBC. Some relevant analysis is underway as part of the local exceedances project – see interim report.
Behavioural responses – reconsider and justify use of Bristol SP data	TIRP	GM has developed a revised methodology for assessing behavioural responses and is no longer dependent on the Bristol SP data for assessing the preferred option.
Behavioural responses – need to improve responses to grant/loan schemes via new surveys	TIRP	GM is carrying out data collection and analysis to inform the assessment of responses to grant/loan schemes, including surveys. New tools will be developed. The results and methodology will be supplied as an update to T4 at FBC.

Summary of requirements/feedback	Source & rating	Initial GM response
Behavioural responses – need to consider changes to second hand market resulting from scheme	TIRP	Analysis is underway to better understand the potential for changes to the second hand market resulting from the scheme, but it is not yet clear if it will be possible to take this into account in the quantification of impacts.
Sensitivity testing – further testing focussed on specific policies and uncertainties	TIRP	Some early sensitivity testing has been carried out, as described above. A full programme of sensitivity testing will be conducted to inform the FBC, following scheme design and package modelling.
Overlapping policies – provide more detail on supporting schemes as part of the package	TIRP	Modelling or analysis will be provided to justify the individual contribution of any measures proposed for implementation funding to compliance. This will be presented in the main body of the FBC and as an update to AQ3.
Calibration – analysis and sensitivity testing of AQ model calibration	TIRP	Further model runs to test model parameterisation can be undertaken at FBC, to be supplied as an update to AQ3.

APPENDIX FOUR: INITIAL DATA, EVIDENCE AND MODELLING RESPONSE TO DIRP FEEDBACK

Summary of requirements/feedback	Source & rating	Initial GM response
Cost/benefit analysis - Although the guidance has been followed correctly the analysis relies heavily on the LGV/HGV upgrade response which is uncertain (similar issues for taxis/PHVs).	DIRP	Improvements to the methodology for deriving behavioural responses should resolve this issue. It would also be possible to carry out sensitivity testing of for the preferred option looking at the impact of uncertainty in transport modelling on the economic appraisal, to be supplied as at update to the EAMR at FBC.
Uncertainty - Not detailed in the economic methodology report or economic case. Will be particularly important given the comments given for Q2 and the additional information forthcoming from a number of ongoing stakeholder consultations as noted in the OBC.	DIRP	GM will provide further narrative on the sensitivity testing of the OBC economic appraisal and will ensure that further tests are supplied with a full explanatory narrative, as an update to the EAMR at FBC.
Distributional analysis / mitigation - More consideration is needed with regard to potential regional distributional impacts given the size of the study area, the nature of the preferred option and the differences in characteristics between the LAs/areas involved. Currently the business case does not specify which measures should be funded from the CAF.	DIRP	Health, Environment, Equalities and Socio-economic Impacts Assessments are underway and will inform a consideration of potential regional distributional impacts, to be supplied as an additional appendix to the FBC and considered in the Economic Case. The OBC assumes that all measures will be funded via the Implementation Fund. The FBC will specify whether measures are proposed as Implementation or CAF and will supply supporting evidence reflecting the relevant guidance.

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Note 1: Data, Evidence and Modelling Post-OBC approach
Update to Appendices for JAQU workshop 24th October 2019

***UPDATE* APPENDIX TWO: DATA, EVIDENCE AND MODELLING RESPONSE TO LETTER FROM ANDREW JACKSON, 23RD MAY 2019**

Issues raised in letter of 23rd May	Response as at 12th July 2019		Response as at 24th October 2019	
	GM response	Evidence supplied?	GM response	Evidence supplied?
Confirmation of which measures have been modelled as being needed for compliance	The OBC assumes all measures are required for compliance. The modelling includes a representation of the following measures: • CAZ B in 2021, CAZ C in 2023; • Funds to support the upgrade of all buses, and some freight vehicles and taxis; and • Investment in EV charging points. Measures to promote sustainable journeys have not been modelled. At FBC, GM intends to provide disaggregated modelling to demonstrate the impact of each implementation measure on compliance (subject to any technical limitations). This will be carried out once the measures are fully defined.	No	Revised package modelling has been conducted to support the Consultation. The following measures have been included in the core strategic modelling: • GM-wide CAZ C • Clean Bus, Taxi and Commercial Vehicle Funds • Sustainable Journeys measures The following measures are included within GM's funding ask but are not required for compliance and have not been included in the modelling: • Vehicle Finance • Charging infrastructure for electric vehicles Additional modelling has been carried out separately investigating the impact of the City Centre Transport Strategy proposals on emissions. Initial modelling of traffic management measures at local exceedance sites has also been conducted. Initial modelling has been carried out to test the effectiveness of different scheme design options and to identify the impact of each measure – this was carried out in an interim version of the modelling suite. Further modelling using the fully updated modelling suite will be carried out in November 2019 to provide a disaggregated view of the impact of each Implementation Fund measure, plus any CAF fund measures that also contribute to compliance.	Revised package modelling supplied Initial modelling of individual measures to be supplied shortly Further disaggregated modelling to be supplied by end 2019

Issues raised in letter of 23rd May	Response as at 12th July 2019		Response as at 24th October 2019	
	GM response	Evidence supplied?	GM response	Evidence supplied?
Assessing whether additional measures targeted at the longest outstanding exceedances can bring forward compliance.	GM has identified 12 sites that are the last remaining exceedance locations in 2023/4 to explore whether local measures could mean that compliance could be brought forward or early benefits realised. This study is underway and an interim report will be provided to JAQU on the 12th July.	Yes	Initial reports of the local exceedances exploratory study were supplied on 12th July and 2nd August. The local exceedances study within the city centre has been subsumed into the work to develop the City Centre Transport Strategy (CCTS) proposals. The CCTS proposals have been modelled in GM's city centre Paramics model and an assessment has been made of their possible impact on emissions and exceedances in addition to the core CAP package. It should be noted that the CCTS tests are based on a draft set of proposals, and currently do not have a formal status. Traffic management and sustainable journeys proposals have been identified at three sites, representing the final points of exceedance outside the city centre. These measures cannot be effectively represented in the strategic modelling at present. It has been agreed with JAQU that it is not sensible to proceed with the development of any proposals at the A57 Regent Road in Salford given that the major junction re-modelling scheme has only just re-opened. Monitoring will be undertaken to assess real-world conditions post-opening.	Yes

Issues raised in letter of 23rd May	Response as at 12th July 2019		Response as at 24th October 2019	
	GM response	**Evidence supplied?**	**GM response**	**Evidence supplied?**
Reviewing with you the vehicle upgrade assumptions used, particularly for buses and taxis/private hire and whether these have an impact on the option chosen	GM is undertaking a review of all vehicle upgrade and behavioural response assumptions and is developing a revised approach for HGV, LGV, PHV and Hackney Cab responses. This means that the 100% upgrade assumption applied to Hackney Cabs will be replaced at FBC with an evidence-based behavioural response. These are described in a series of papers to be provided on the 12th July. GM has discussed the complexity of assessing and modelling possible bus upgrade responses and has developed a sensitivity testing methodology to assess what proportion of buses must be upgraded to achieve compliance. To be supplied in a paper on the 12th July.	Yes	GM has carried out a review of all vehicle upgrade and behavioural response assumptions and has developed a revised approach for HGV, LGV, PHV and Hackney Cab responses. This means that the 100% upgrade assumption applied to Hackney Cabs at OBC has been replaced with an evidence-based behavioural response in the Consultation package. Initial updates on the revised methodology for each vehicle type were supplied to JAQU on 12th July. Updated notes will be supplied by 1st November 2019 to inform JAQU and the TIRP, alongside a table outlining how these notes relate to/replace the contents of the strategic modelling Technical Reports. A full update of the strategic modelling Technical Reports (T1-4, AQ1-3, AAS) is planned for end December 2019, to be published alongside the Consultation. The series of technical notes supplied to date will also be published, subject to limitations in terms of commercially sensitive or personal data. GM has undertaken sensitivity testing, using an off-model analysis method, testing the minimum bus upgrade required to achieve compliance, supplied 12th July as 'Note 11: Analysis of Bus Upgrade for compliance'. A further sensitivity test of the impact of a fully electric GM bus fleet was supplied as 'Note 21: GM CAP Sensitivity test of full electric bus fleet'.	Yes
Justifying the contribution to compliance of individual measures, such as electric vehicle upgrade, sustainable transport and local authority fleet upgrade	GM is gathering further evidence on the efficacy of investment in EV infrastructure and sustainable transport to deliver AQ improvements. Modelling or analysis will be provided to justify the contribution of any measures proposed for implementation funding to compliance. If measures are proposed under the CAF, evidence will be supplied in accordance with the relevant guidance.	No	A review of evidence with regards to the impact of investment in EV charging infrastructure was undertaken and following consultation with JAQU, the decision was taken to remove any assumed additional EV uptake for passenger cars and LGVs from the Consultation package modelling. GM has evidence that investment in sustainable journeys interventions can be effective in achieving mode shift. A sensitivity test was carried out to establish whether such investment could have an impact on compliance. The proposals were found to have a minor beneficial impact and thus have been incorporated in the Consultation package modelling as an assumed Implementation Fund measure. GM is no longer planning to include a funding bid for LA Fleet upgrade in the CAP as modelling showed the impact to be insignificant.	Yes

Issues raised in letter of 23rd May	Response as at 12th July 2019		Response as at 24th October 2019	
	GM response	**Evidence supplied?**	**GM response**	**Evidence supplied?**
Demonstrating that a GM CAZ D cannot bring forward compliance, including outlining the delivery challenges discussed for a GM wide CAZ	Work is underway to further demonstrate that a GM CAZ D cannot bring forward compliance and an interim update will be supplied week of 15th July. *UPDATE* Note that in fact the provision of this Note was delayed.	~~Yes~~ No	'Note 17: Evidence supporting the decision not to progress with a GM-wide CAZ D' has been supplied to JAQU in October 2019.	Yes
Further justifying your case that bringing forward the CAZ C exemption cannot bring forward compliance	Work is underway to further justify the case that bringing forward the CAZ C exemption cannot bring forward compliance and an interim update will be supplied on the 12th July.	Yes	'Note 12: Evidence of the impact of a 2021 CAZ C' was supplied to JAQU on 12th July and further discussions and evidence sharing have taken place since then. Revised estimates of the number of LGVs expected to upgrade to new and secondhand vehicles have been supplied to JAQU on 22nd October 2019.	Yes
For all [Clean Air Fund] schemes, justifying the cost, the assumptions used about uptake, and further information on how these have been are arrived. Further detail on how the schemes are intended to operate and how they are they targeted at those most affected.	Work is underway to develop detailed case-making and scheme designs for each of the measures. If a decision is made to progress with any measures under the Clean Air Fund, a bid will be developed in line with JAQU's guidance. Health, environment, equalities and socio-economic impacts assessments are underway to inform the assessment of any CAF measures.	No	Work has been carried out to develop detailed case-making and scheme designs for each of the measures – initial information on how funding offers and uptake have been estimated will be supplied on 24th October and in Technical Notes to follow that meeting. Initial drafts of the health and socio-economic impacts assessments have been received and reviewed by the project teams. An equality impact assessment is underway to inform the assessment of any CAF measures. Full CAF bids are being developed in line with JAQU guidance.	Yes, further information to follow
Immediate priority 1: Exploring whether measures targeted at the last remaining exceedance locations following implementation of a CAZ in 2021 would achieve compliance quicker	As described above, GM is undertaking a study of key local exceedance locations and will supply an interim report on the 12th July.	Yes	Initial modelling suggests that the CCTS proposals could be effective in delivering emissions reductions in the regional centre. Incompatibility between the CAP strategic modelling suite and the Paramics model make it difficult to assess whether compliance would be brought forward. The CCTS is only at pre-consultation stage and so has yet to be adopted and therefore has no agreed timetable for delivery. Initial modelling suggests that traffic management and sustainable journeys measures at three sites could reduce emissions, but again it is unclear whether this would bring forward compliance at these sites.	Yes

Issues raised in letter of 23rd May	Response as at 12th July 2019		Response as at 24th October 2019	
	GM response	**Evidence supplied?**	**GM response**	**Evidence supplied?**
Immediate priority 2: Updating the behavioural assumptions used to model the impact of a CAZ, following the TIRP's suggestions	As described above, GM is updating the behavioural assumptions used to model the impact of the CAZ, using new data and tools and informed by the TIRP's suggestions, and will supply a series of papers describing the process and findings on the 12th July.	Yes	As described above, GM has updated the behavioural assumptions used to model the impact of the CAZ, using new data and tools and informed by the TIRP's suggestions, and will supply an updated series of papers describing the process and findings on the 1st November, following the submission of draft notes on the 12th July and 2nd August and discussions at fortnightly Technical Review sessions with JAQU technical experts.	Yes
Immediate priority 3: Providing further sensitivity testing on your vehicle upgrade assumptions	GM has undertaken sensitivity testing, using an off-model analysis method, testing the minimum bus upgrade required to achieve compliance, supplied 12th July. GM has undertaken a sensitivity test of the impact of a CAZ C in 2023 (without supporting measures) applying updated behavioural response assumptions, to be supplied week of 15th July.	Yes	GM has undertaken sensitivity testing, using an off-model analysis method, testing the minimum bus upgrade required to achieve compliance, supplied 12th July as 'Note 11: Analysis of Bus Upgrade for compliance'. A further sensitivity test of the impact of a fully electric GM bus fleet was supplied as 'Note 21: GM CAP Sensitivity test of full electric bus fleet' on 5th August 2019. GM supplied on 16th July 2019 a sensitivity test of the impact of a CAZ C in 2023 (without supporting measures) applying updated interim behavioural response assumptions as 'Note 16: GM CAP GM-wide CAZ C with revised behavioural responses'. As part of the development process for the scheme design, GM has carried out a number of sensitivity tests of the impact of different charge levels, funding offers and terms, and EV uptake assumptions. These informed the conclusions presented in the workshop on the 24th October and will be supplied as Notes subsequently in mid-November.	Yes

***UPDATE* APPENDIX THREE: INITIAL DATA, EVIDENCE AND MODELLING RESPONSE TO TIRP FEEDBACK**

Summary of requirements/feedback	Source & rating	Initial GM response	GM response as at 24th October 2019
Model validation – review implications of poor validation	TIRP	Underway at key sites via the local exceedances work – see interim report for initial findings.	Analysis has been undertaken at all sites identified as part of the local exceedances study. It was identified that the local exceedance site in Oldham was modelled with too narrow road widths and this has been corrected, removing it from consideration as one of the last points of exceedance. Further off-model analysis is underway to investigate the validity of low speeds at the A6 site.
Model validation – validation by vehicle class	TIRP	This can be reported although caution is required around less well represented classes. Will be supplied at FBC as a revision to T2.	No change.
Demand sifting tool assumptions need to be better explained and justified	TIRP	GM has carried out a full audit of the Demand Sifting Tool and is producing a manual. GM recognises the need to provide a thorough description of the methodology and this will be supplied as a revision to T4 at FBC.	GM has carried out a full audit of the Demand Sifting Tool and is producing a manual, to be supplied to JAQU for the TIRP by 1st November 2019, alongside updated notes setting out the behavioural response assumptions and methodological base sitting behind the Demand Sifting Tool. A thorough description of the methodology and this will be supplied as a revision to T4 by end December 2019.
Behavioural responses – better description of methodology and sources for assumptions, discussion of uncertainty, issues of lack of destination choice	TIRP	A thorough review of the behavioural response assumptions is underway and it is intended that the responses applied at FBC will be grounded in more robust evidence. Papers have been described providing updates on this work and an initial sensitivity test of the impacts. This process, the sources and methodology will be supplied at FBC as a revision to T4. Further sensitivity testing will be conducted on the revised tools and updated preferred option, and these will be supplied alongside a discussion of uncertainty as an update to the AAS at FBC. An appropriate variable demand model was not available and so it will not be possible to resolve the lack of representation of destination choice. This is considered less significant given the regional scale of the scheme.	GM has carried out a review of all vehicle upgrade and behavioural response assumptions and has developed a revised approach for HGV, LGV, PHV and Hackney Cab responses. Initial updates on the revised methodology for each vehicle type were supplied to JAQU on 12th July. Updated notes will be supplied by 1st November 2019 to inform JAQU and the TIRP, alongside a table outlining how these notes relate to/replace the contents of the strategic modelling Technical Reports. A full update of the strategic modelling Technical Reports (T1-4, AQ1-3, AAS) is planned for end December 2019, to be published alongside the Consultation. The series of technical notes supplied to date will also be published, subject to limitations in terms of commercially sensitive or personal data. Variable demand model – no change.
Behavioural responses – segmentation of vans by user type	TIRP	A segmentation of vans by user type has been applied in the revised methodology for deriving LGV behavioural responses.	No change – see ‘Note 7: LGV and HGV Operational Cost Model’ for details.

Summary of requirements/feedback	Source & rating	Initial GM response	GM response as at 24th October 2019
Behavioural responses – incorporate car to van response	TIRP	A van to car response is being applied in the revised methodology for deriving LGV behavioural responses.	No change – see 'Note 7: LGV and HGV Operational Cost Model' for details.
Behavioural responses – identifying 'point of failure' for scheme	TIRP	This is complex to assess but sensitivity testing will be carried out to inform our understanding at FBC. Some relevant analysis is underway as part of the local exceedances project – see interim report.	GM has undertaken sensitivity testing, using an off-model analysis method, testing the minimum bus upgrade required to achieve compliance, supplied 12th July as 'Note 11: Analysis of Bus Upgrade for compliance'. A further sensitivity test of the impact of a fully electric GM bus fleet was supplied as 'Note 21: GM CAP Sensitivity test of full electric bus fleet'. GM supplied a sensitivity test of the impact of a CAZ C in 2023 (without supporting measures) applying updated interim behavioural response assumptions as 'Note 16: GM CAP GM-wide CAZ C with revised behavioural responses'. As part of the development process for the scheme design, GM has carried out a number of sensitivity tests of the impact of different charge levels, funding offers and terms, and EV uptake assumptions. These will be described in the workshop on the 24th October and supplied as Notes subsequently. Further sensitivity testing will be carried out over the coming months.
Behavioural responses – reconsider and justify use of Bristol SP data	TIRP	GM has developed a revised methodology for assessing behavioural responses and is no longer dependent on the Bristol SP data for assessing the preferred option.	No change. See 'Note 6: GM CAP: Behavioural response assumptions and available data sources' for a discussion of available data sources.
Behavioural responses – need to improve responses to grant/loan schemes via new surveys	TIRP	GM is carrying out data collection and analysis to inform the assessment of responses to grant/loan schemes, including surveys. New tools will be developed. The results and methodology will be supplied as an update to T4 at FBC.	GM has carried out data collection and analysis to inform the assessment of responses to grant/loan schemes including: • Data gathering and market analysis as reported in Notes 3, 4, 18 and 19 describing the freight, coach, minibus and taxi and private hire fleets respectively; • New surveys including ANPR surveys (Note 5), specialised goods vehicle counts (Note 20), and fieldwork with van drivers, Hackney cab and private hire drivers (results to follow in November 2019); and • Data gathering on credit worthiness and other aspects related to vehicle finance (underway). The Operational Cost Models have been developed to allow the testing of grant funding options (described in Note 7 and forthcoming notes on the OCM tools for taxi, coach and minibus), and an analytical tool has been developed to assess loan finance scheme design options and impact on uptake.

Summary of requirements/feedback	Source & rating	Initial GM response	GM response as at 24th October 2019
Behavioural responses – need to consider changes to second hand market resulting from scheme	TIRP	Analysis is underway to better understand the potential for changes to the second hand market resulting from the scheme, but it is not yet clear if it will be possible to take this into account in the quantification of impacts.	Some analysis of possible impacts has been undertaken, but it is considered that this depends on many factors beyond the control and remit of the GM CAP, including CAP interventions elsewhere in the UK. It is not possible for GM to undertake this analysis on our own and hence would be purely speculative for GM to take this into account in the quantification of impacts.
Sensitivity testing – further testing focussed on specific policies and uncertainties	TIRP	Some early sensitivity testing has been carried out, as described above. A full programme of sensitivity testing will be conducted to inform the FBC, following scheme design and package modelling.	See above notes on sensitivity testing carried out to date. Further sensitivity testing is planned.
Overlapping policies – provide more detail on supporting schemes as part of the package	TIRP	Modelling or analysis will be provided to justify the individual contribution of any measures proposed for implementation funding to compliance. This will be presented in the main body of the FBC and as an update to AQ3.	Modelling or analysis will be carried out to justify the individual contribution of any measures proposed for implementation funding to compliance and will be provided to JAQU by end December 2019 and published alongside the consultation.
Calibration – analysis and sensitivity testing of AQ model calibration	TIRP	Further model runs to test model parameterisation can be undertaken at FBC, to be supplied as an update to AQ3.	No change.

***UPDATE* APPENDIX FOUR: INITIAL DATA, EVIDENCE AND MODELLING RESPONSE TO DIRP FEEDBACK**

Summary of requirements/feedback	Source & rating	Initial GM response	GM response as at 24th October 2019
Cost/benefit analysis - Although the guidance has been followed correctly the analysis relies heavily on the LGV/HGV upgrade response which is uncertain (similar issues for taxis/PHVs).	DIRP	Improvements to the methodology for deriving behavioural responses should resolve this issue. It would also be possible to carry out sensitivity testing of for the preferred option looking at the impact of uncertainty in transport modelling on the economic appraisal, to be supplied as at update to the EAMR at FBC.	No change.
Uncertainty - Not detailed in the economic methodology report or economic case. Will be particularly important given the comments given for Q2 and the additional information forthcoming from a number of ongoing stakeholder consultations as noted in the OBC.	DIRP	GM will provide further narrative on the sensitivity testing of the OBC economic appraisal and will ensure that further tests are supplied with a full explanatory narrative, as an update to the EAMR at FBC.	No change.
Distributional analysis / mitigation - More consideration is needed with regard to potential regional distributional impacts given the size of the study area, the nature of the preferred option and the differences in characteristics between the LAs/areas involved. Currently the business case does not specify which measures should be funded from the CAF.	DIRP	Health, Environment, Equalities and Socio-economic Impacts Assessments are underway and will inform a consideration of potential regional distributional impacts, to be supplied as an additional appendix to the FBC and considered in the Economic Case. The OBC assumes that all measures will be funded via the Implementation Fund. The FBC will specify whether measures are proposed as Implementation or	Initial drafts of the health and socio-economic impacts assessments have been received and reviewed by the project teams. An equality impact assessment is underway. An environmental impacts assessment is no longer planned. Whilst GM remains clear that all measures are required in order to meet the objectives and needs of

Summary of requirements/feedback	Source & rating	Initial GM response	GM response as at 24th October 2019
		CAF and will supply supporting evidence reflecting the relevant guidance.	the region, the Consultation Package contains a clear differentiation between Implementation Fund and CAF measures and we anticipate that this will be specified in all future materials.

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

Note 2: Next steps for data collection and the development of analytical tools

Warning: Printed copies of this document are uncontrolled

Version Status:	DRAFT FOR APPROVAL	**Prepared by:**	Frank Mohan 9th July 2019
Authorised by: **Date:**	Ian Palmer 12th July 2019		

1 Introduction

1.1 In their letter to TfGM of 23rd May 2019, JAQU requested details on a number of analytical areas where TfGM have been progressing work in order to develop the Full Business Case (FBC) in support of their Clean Air Plan (CAP). Details of ongoing work in those areas is provided in summary form as part of the formal response from TfGM to that letter.

1.2 This note provides further detail on additional data collection and the development of tools planned beyond the work already carried out.

2 Additional Research / Evidence

2.1 Overview

2.1.1 A number of areas have been identified where either the working groups, or individual projects within the overall CAP, require additional evidential support or analysis to ensure the successful implementation of the CAP, beyond the work already undertaken and described in the various papers to be provided to JAQU on the 12th July 2019.

2.1.2 These include:

- Behavioural research for LGVs;
- Desktop reviews of other emerging evidence;
- Development of operating cost models for Taxis; and
- Additional data collection on the freight market.

2.2 LGV Behavioural Research

2.2.1 A review of the freight market in GM has already been undertaken and is reported separately in the draft presentation “Analysis of the Freight Market”, prepared in May 2019. This helped to support the development of operating cost models for LGVs and HGVs, which reflect the practical operating costs of a number of vehicle types and the impact that CAZ related charges may have.

2.2.2 However it is recognised that the LGV (van) market is particularly complex and comprises a large number of what are termed ‘sole traders’. These are small businesses, typically with a single van used for business that may also serve as the primary, or secondary, transport for domestic use.

2.2.3 This sector of the market can be challenging to reach in terms of standard consultation activities and is likely to have limited awareness of the proposals relative to larger businesses within GM. The options available to them in terms of making changes to their business vehicle are also likely to be more complicated due to:

- Lack of resilience (only one or maybe two vehicles available);

- Proportionately larger direct financial impact of vehicle change;
- Scope for changing to a vehicle type not affected by the CAZ (downsizing from van to estate car); and
- Mixed use of vehicle (business and domestic).

2.2.4 TfGM have therefore commissioned specific market research to target these small business van users to help better understand their likely response to the CAZ and inform a number of areas in the FBC relating to the wider CAP including:

- Demand response (emission levels and economic case);
- Distributional Impact Analysis; and
- Potential need for financial support (economic and financial case).

2.2.5 The outputs from the work will be available later in the summer and will be reported to JAQU as well as ultimately feeding into the FBC.

2.3 Behavioural Research for other groups

2.3.1 GM is also considering whether similar behavioural research will be required for other groups, particularly taxi drivers and operators.

2.4 Development of Operating Cost Models for other groups

2.4.1 We are already developing and using operating cost models for LGVs and HGVs and it has become clear that there could be value in adopting a similar approach for the taxi sector, particularly private hire vehicles (PHV).

2.4.2 This is to ensure that:

1. Behavioural responses in the transport and subsequent AQ modelling are appropriately assessed; and
2. The potential need for financial assistance to this sector can be robustly estimated.

2.4.3 There are some very valuable datasets available that can feed this tool, notably a comprehensive record of GM registered PHVs that includes vehicle type and age information. But there are also challenges in this field, notably the number of PHVs registered elsewhere in the country which operate, and are actually based, in GM.

2.4.4 The operating cost model will reflect the most common vehicle makes, and the associated age profile thereof, used as PHVs in GM based upon the registered database. It will then adopt a similar decision tree structure to the LGV and HGV operating cost models to identify the most realistic response to a CAZ charge assuming that individuals seek to minimise their overall cost.

2.4.5 The starting point will be an analysis of the costs for these common vehicle profiles in 'no CAZ charge' environment taking account of:

- Purchase price;
- Operating Costs based on typical Mileage; and
- Fare Revenue.

2.4.6 The decision tree will then help to determine whether or not the CAZ charge, as currently defined, would impact the balance of costs and revenues enough for the operator to change their behaviour / vehicle.

2.4.7 The responses in the model are likely to include:

- Pay charge (i.e. zero impact on AQ though effect on economy of operation either directly or passed through to customer);
- Cease GM operation (it may be practical for some operators to continue running a PHV but operate in a neighbouring area); and
- Upgrade to compliant vehicle by purchase or lease of either new or second hand vehicle (differentiating by fuel type including EV option).

2.4.8 We are actively seeking to obtain robust data to quantify the scale of this issue and to ensure this feeds into downstream activities.

2.4.9 Similarly, GM is also considering whether it would be possible to develop a similar cost model for coaches and/or minibuses.

2.5 Additional Data Collection on the GM Freight Market

2.5.1 The work to date, including the ""Analysis of the Freight Market", has utilised a variety of desktop based evidential reviews including third party reports and national and regional statistics.

2.5.2 One of the areas that has only limited available data currently is the commodity types carried by the GM freight fleet (including those not based within GM) and the relative proportion of various company types, in particular the scale of sole trader operations.

2.5.3 A potential partial solution to this evidence gap is to undertake Specialised Goods Vehicle Counts (SGVCs) at key locations within GM. SGVCs are a technique developed by AECOM's Freight Team and are conducted at specifically chosen locations with the purpose of assessing commercial vehicle age, size, type, industry category, commodity and direction of travel. This is a unique approach to understanding freight movements and enables a range of relevant and accurate information to be collected in direct relation to a project brief. A typical SGVC covers 12 hours from 7am to 7pm on a typical weekday. The technique can be extended to not only collect HGV data but van data if required but this requires more resource.

2.5.4 The survey shows registration number of the vehicle, haulier name (if available), vehicle type, body type, industry type and direction. What is more, once the analysis of the data is performed we are able to establish the proportion of traffic by sector, proportion of body type and proportion of Euro engines by type. It allows us to know many of the names of hauliers that have the oldest vehicles and what sectors they are working in. Typically a list of the top 10 hauliers using a route is produced and this allows direct consultation with those companies if required.

2.5.5 A key issue with doing SGVCs is they cannot tell us the exact origin or destination of vehicles accounted for in the survey. But it is a useful "snap-shot" of traffic on specific roads in question and can be tailored to the roads with the worst air quality. Due to the time it takes to perform one survey and the sheer quantity of vehicles on the road, it is difficult to collect enough data to have an accurate representation of the total population. Nevertheless, it can have a role to play on understanding core corridors. Freight tends to operate in very regular patterns.

2.6 Evidence arising from the conversation

2.6.1 Analysis is currently underway of the responses to the public conversation conducted in Spring 2019. This will provide useful insight on possible behavioural responses to the various measures proposed, and on the possible impacts of the scheme that may need to be taken into account as part of the Data, Evidence and Modelling workstream.

2.7 Emerging Evidence from other bodies

2.7.1 There are a range of studies emerging that are either local authority led or being promoted by interested stakeholder groups. TfGM are reviewing these to identify any relevant information which may support the projects / workstreams.

2.7.2 A recent local example is a survey by the Federation of Small Businesses (FSB), which was undertaken in May and June of this year, for which results are now emerging.

2.7.3 TfGM are in discussion with FSB to see if we can be provided with details of the survey in order to supplement our own data sources.

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Note 3: Analysis of the Freight Market

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Terminologies

Vans(LGVs, LCVs)= Vehicles below 3.5 tonnes

HGVs = Vehicles above 3.5 tonnes

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Vehicle Numbers Assumptions
Based on MCR-Theory

- The goods vehicles transportation is part of the transportation service sector
- Providing transportation service to the population of Greater Manchester
- Estimation of the number of vehicles based on population ratio

	Population	Unit
UK population	66.04	million
Greater Manchester	2.799	million
Factor	4.2%	
UK	HGV	500,000
	vans	4,000,000
Greater Manchester	**HGV**	**21,192**
	vans	**170,071**

Vans Market (≤3.5 tonnes)

The LCV's contribution to the UK economy

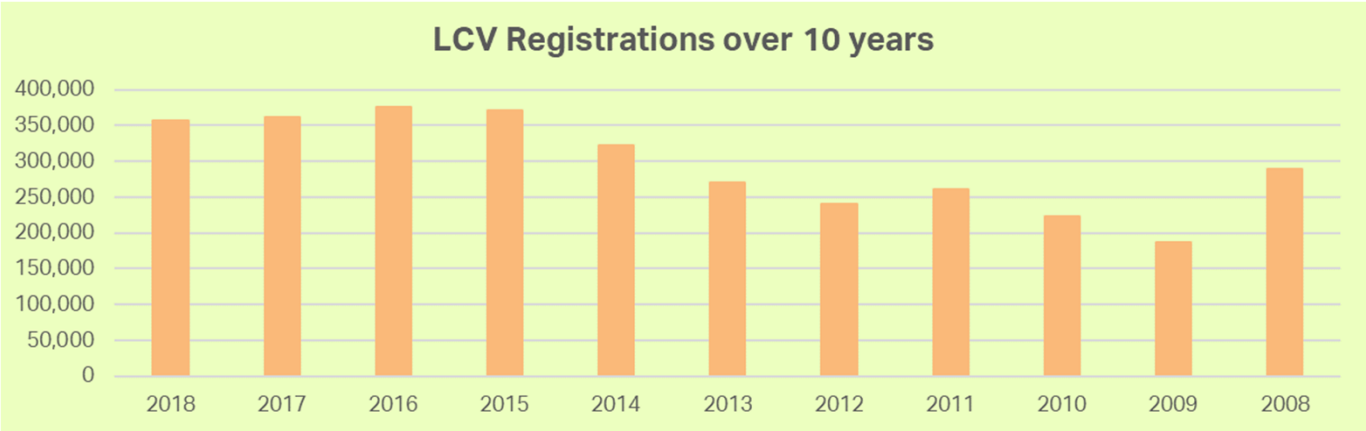
- 3.4 million people use or depend on vans for their work
- 500,000 people drive a van as the main part of their job
- Vans support 10% of the UK's workforce, delivering a combined wage bill of £56 billion, or 11% of UK GDP

The LCV parc

- Large LCVs were the dominant type of van to be registered from 2003-2017, tripling in number
- LCVs only represent 15.4% of total UK traffic. But they are most affected by congestion at a cost of £6.5 billion.
- By pro rata implications congestion costs van users £273m/year in Greater Manchester

Source: Mainly from SMMT 2019 Van Report

LCV Sector Growth



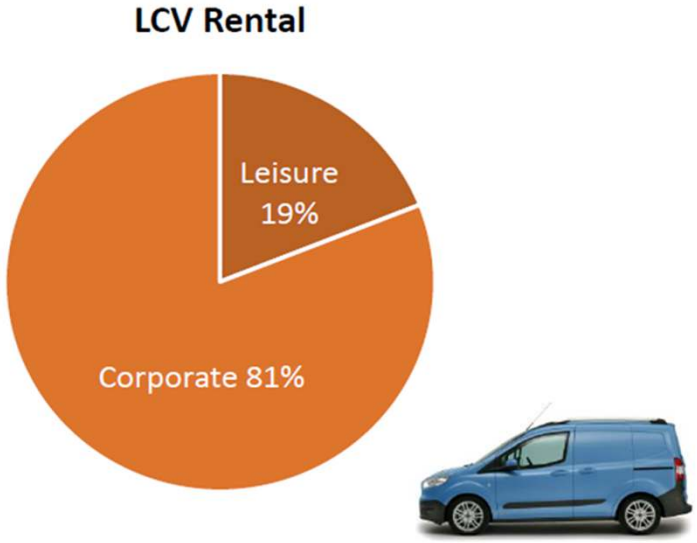
Year of First Reg	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008
No of vans(000s)	357	362	376	372	322	271	240	260	223	186	289
% of Vans	9%	9%	10%	10%	9%	8%	7%	8%	7%	6%	9%
Euro Standard	Euro 6			Euro 5 and below							

In numbers

59% growth in the LCV sector since 2000, mainly in the 2.6 to 3.5 tonne market. This demand for larger vans is driven by increase in the number of self-employed tradesmen and the rapid rise in online-shopping.

Leasing Market Statistics for LGVs in 2018

	Av. Age	Euro 6	Diesel	CAZ Compliance
	YEARS	%	%	%
Rental Van Fleet	1.7	56%	100%	56%
UK Van Fleet	8.1	13%	97%	13%



Source: BVRLA

Types of Vans

By Weight

1.6t van

3.5t van

Removals 3.5 tonnes GVW

Food 3.5 tonne GVW

Communications Pick-up

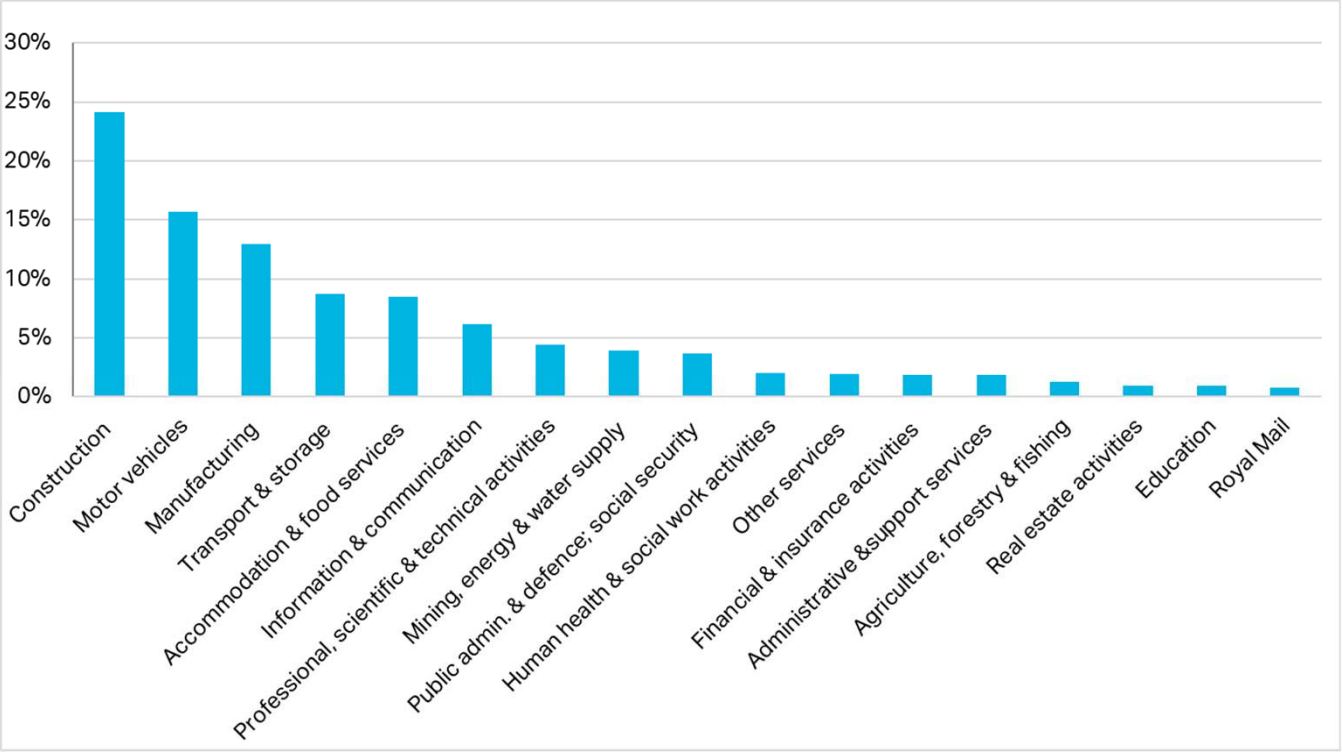
SSE Energy company Pick-up

Parcel Home Delivery

Supermarket Home Delivery

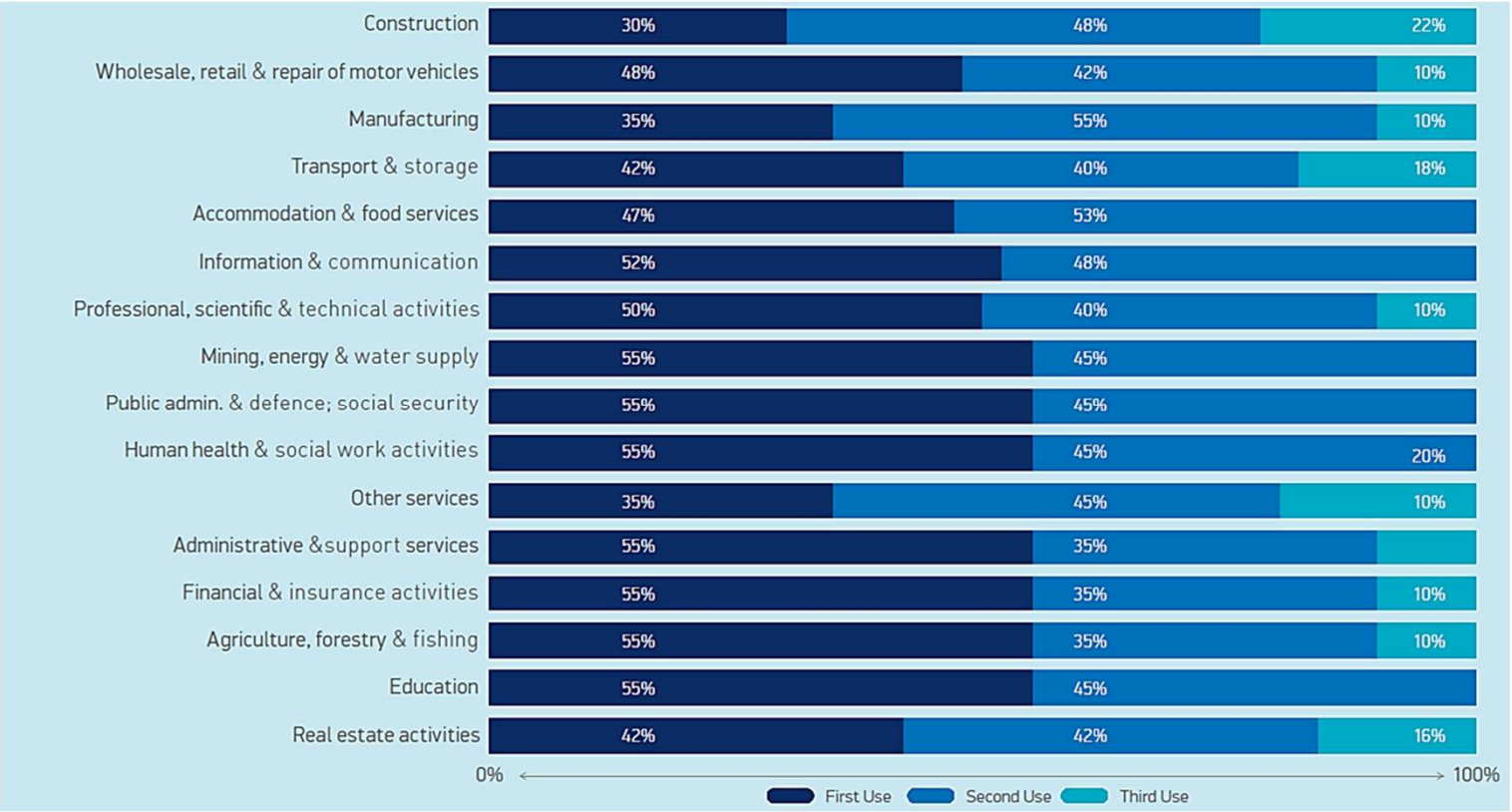
NW Emergency Ambulance

Van Sector Market SMMT



- 60% of LCV parc is driven by: construction, wholesale, retail and repair of motor vehicles, manufacturing (transport and storage)
- Construction is the biggest single user of LCVs with 1 million vans in construction

Vans Used Market



The second (and third) life of the LCV

- 900,000 used vans change hands each year
- Second and third life vans play a key role in the UK economy where they are typically operated by SMEs and sole traders

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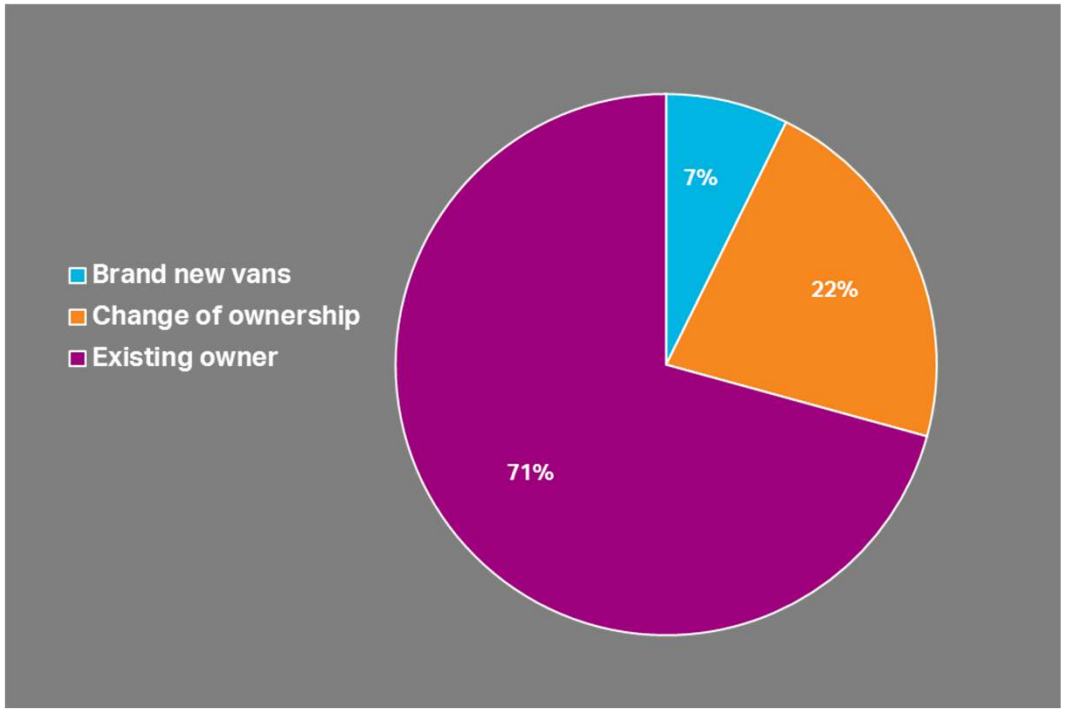
Vans Used Market



The van market consists of approximately 4.1 million vans of which:

- 300,000 are brand new per year
- 900,000 change ownership every year
- Thus, 2.9 million are retained by their owner

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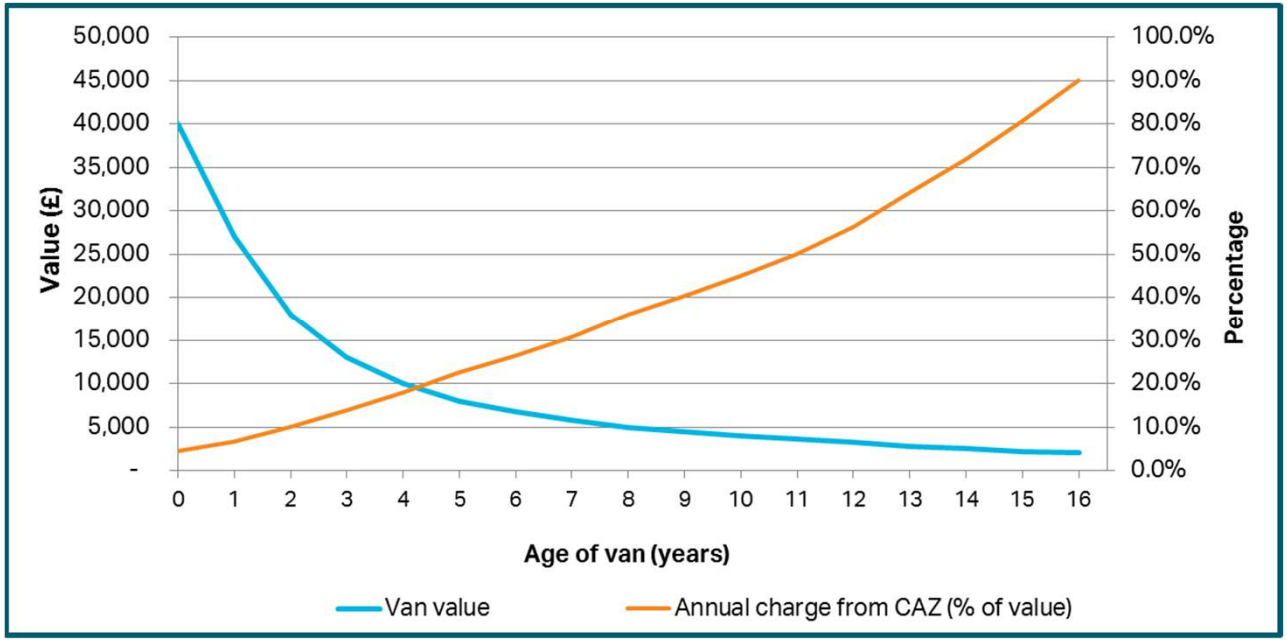
Vans Used Market



Sectors with an active second hand van market are more directly impacted (i.e. construction – 70% second hand, manufacturing – 65% second hand)

The impact of the CAZ charge has been calculate by assuming vans will be used five days per week, 48 weeks per year. It is expressed as a percentage of the van value.

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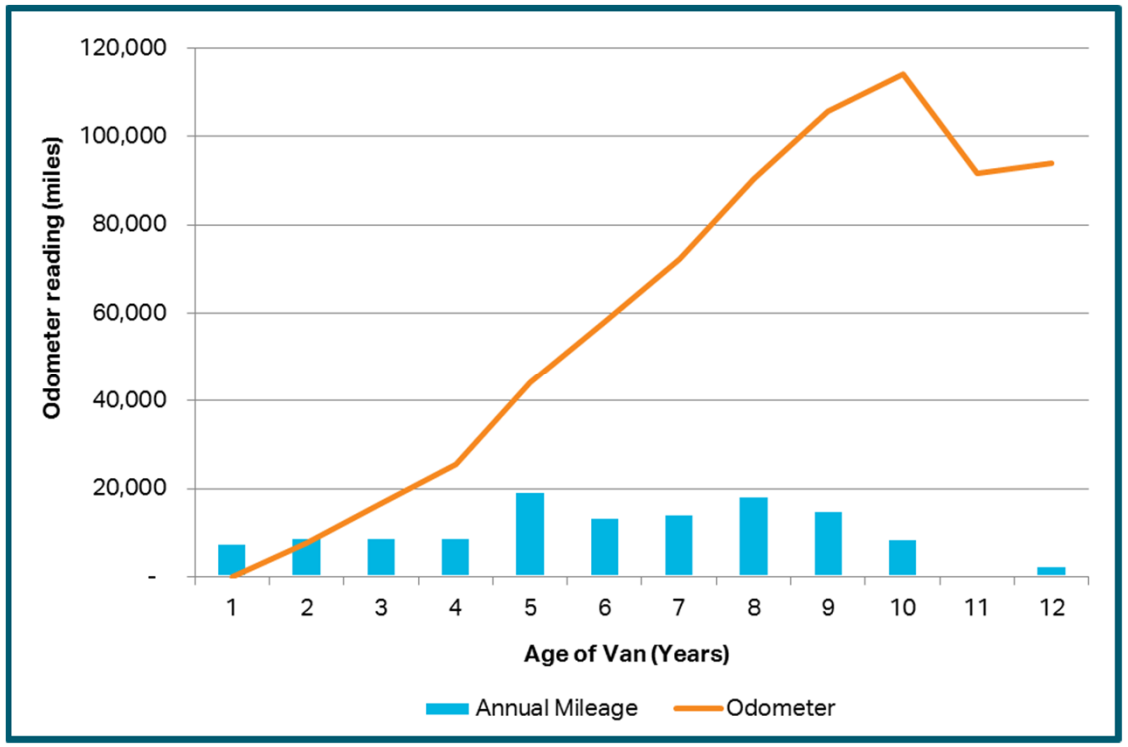
Case study – 12 year old van



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Royal Mail

Key Information

Estimated vans in Manchester: **1,300**; Vans% in Manchester: **1%**

Annual Mileage: **8,000**; Vehicle Utilisation: **Very Low**

Vehicle Operation Time: **9 years**

Estimated Percentage of vans to be affected by 2023:**0%**

Numbers of vans to be affected by 2023:**0**

Key Concerns

- Delivering on time
- Getting to all drops in time to do collections
- Knowing delivery points if not on a regular run
- Meeting up with colleagues if doing a 2 person round(s)
- Where to park in certain busy areas

Method of Communication

- Internal notice-board
- Personal data assistant
- Daily de-brief
- Weekly updates
- In-house magazine

Comments

The Royal mail has 41,000 vans used for domestic and commercial post. The 1,300 vans in Manchester are based in the local areas e.g., Altrincham. Vans are typically kept for 9 years. Royal Mail has introduced around 300 electric vehicles in other places. Their response to the London ULEZ was to re-locate 600 vehicles so that the entire London fleet was complaint. They may not to do much/any re-location to be compliant in Manchester.

Vulnerability

Scale 1: Very Low

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Methodology

- Created persona sheet for each van sector
- Used elements of data from the sheets to populate the assessment table
- Vulnerability of business mainly depends on how long vehicles are kept
- The longer the vehicles are typically kept, the more vulnerable business sectors are
- The lower the utilisation of vehicle is, the more of an issue it is to the owner

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Van: Vulnerability Assessment

	Estimated Vehicles in Greater Manchester	Market Share %	Annual mileage	Vehicle Utilisation	Vehicle Operation Life Time	% of Sector affected	Vehicles Affected	Vulnerability
Construction	41112	24%	20,000	Medium	15	51%	21104	Very High
Wholesale, retail & repair of motor vehicles	26702	16%	20,000	Medium	10	27%	7209	Medium
Manufacturing	22039	13%	30,000	High	10	27%	5951	Medium
Transport & storage	14834	9%	30,000	High	10	27%	4005	Medium
Accommodation & food services	14410	8%	20,000	Medium	9	19%	2722	Low
Information & communication	10596	6%	35,000	High	9	19%	2001	Low
Professional, scientific & technical activities	7629	4%	20,000	Medium	10	27%	2060	Medium
Mining, energy & water supply	6781	4%	20,000	Medium	10	27%	1831	Medium
Public admin. & defence; social security	6358	4%	20,000	Medium	12	39%	2490	High
Human health & social work activities	3475	2%	10,000	Low	12	39%	1361	High
Other services	3391	2%	10,000	Low	12	39%	1328	High
Financial & insurance activities	3179	2%	10,000	Low	9	19%	600	Low
Administrative &support services	3179	2%	10,000	Low	12	39%	1245	High
Agriculture, forestry & fishing	2119	1%	10,000	Low	15	51%	1088	Very High
Real estate activities	1483	1%	10,000	Low	9	19%	280	Low
Education	1483	1%	10,000	Low	10	27%	401	Medium
Royal Mail	1,300	1%	8,000	Low	9	0%	0	Very Low
Total	**170071**	**100%**	-	-	-	**33%**	**55677**	-

Vulnerability Criteria	
10% and below	Very Low
10%-20%	Low
21%-30%	Medium
31%-40%	High
40% above	Very High

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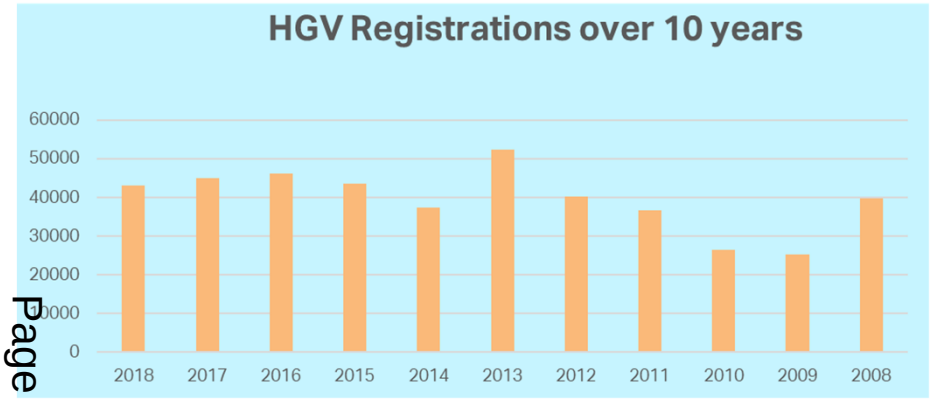
HGV Market



Year of First Reg.	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005
No. of HGVs (000's)	43.1	45	46.2	43.5	37.3	52.2	40.1	36.6	26.5	25.3	39.7	32.8	31.5	27.8
% of HGVs	8.6	9	9.2	8.7	7.5	10.5	8.1	7.4	5.3	5.1	8.0	6.6	6.3	5.6
Euro Standard	Euro 6					Euro 5					Euro 4			

- Since 2000, total HGV numbers have been relatively stable (2% reduction overall)
- The chart and table above show fluctuations in new vehicle registrations by year
- There is also evidence of downsizing from HGVs to LCVs = more agile supply chains

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Types of HGVs

7.5 tonne GVW Box vehicle 4 wheeler

18 tonne GVW Skip lorry 6 wheeler

26 tonne GVW Fuel Tanker

8 wheeler 32 tonne GVW Construction tipper

6 axle Artic 44 tonne GVW Curtainsider

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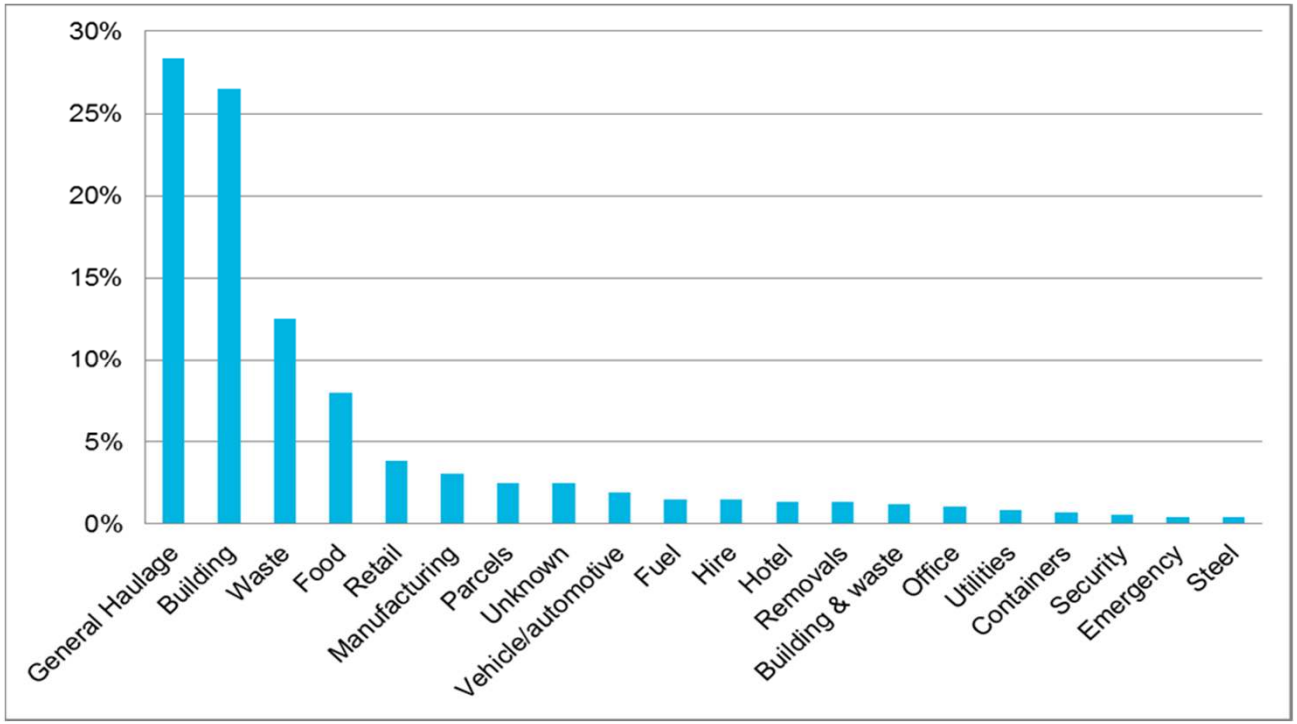
HGV Sector Summary



- 55% of freight operators are from general haulage and building industries
- Waste and food related freight operators make up around 13% and 8%

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HGV: Vulnerability Assessment

Sector	Estimated Vehicles in Greater Manchester	Sector%	Typical Vehicle Weight	Annual mileage	Vehicle Utilisation	Vehicle Operation Life Time	% of Sector affected	Vehicles Affected	Vulnerability
General Haulage	6171	29.1%	**44t**	100,000	High	12	33%	2057	High
Building	5610	26.5%	**32t**	40,000	Low	12	33%	1870	High
Waste	2649	12.5%	**26t**	40,000	Low	14	43%	1135	Very High
Food	1683	7.9%	**18t**	60,000	Medium	10	20%	337	Low
Retail	810	3.8%	**18t**	60,000	Medium	10	20%	162	Low
Manufacturing	748	3.5%	**44t**	80,000	Medium	10	20%	150	Low
Parcels	530	2.5%	**7.5t**	40,000	Low	10	20%	106	Low
Unknown	530	2.5%	**7.5t**	60,000	Medium	11	27%	144	Medium
Vehicle/automotive	405	1.9%	**44t**	100,000	High	10	20%	81	Low
Fuel	312	1.5%	**44t**	80,000	Medium	10	20%	62	Low
Vehicle Rental and Hire	312	1.5%	**18t**	60,000	Medium	10	20%	62	Low
Hotel& office supplies	499	2.4%	**18t**	40,000	Low	10	20%	100	Low
Removals	280	1.3%	**7.5t**	40,000	Low	15	47%	131	Very High
Scrap metal & building waste	249	1.2%	**18t**	40,000	Low	12	33%	83	High
Utilities	405	1.9%	**18t**	40,000	Low	12	33%	135	High
Total HGVs:	**21192**	**100%**	-	-	-	-	**31.2%**	**6615**	-

Vulnerability Criteria	
10% and below	Very Low
10%-20%	Low
21%-30%	Medium
31%-40%	High
40% above	Very High

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Cost Impact of the current proposal

£100 - HGV & £7.50 - vans

- Total costs = 60% Fixed Cost + 40% Running Costs
- Fixed Costs include drivers' wages, overheads, vehicle insurance, depreciation and profit allowance (5%)
- Running Costs include fuel, tyres and maintenance

	HGV: Artic	HGV: Rigid			Vans	
Maximum Gross Weight (MGW)	44t	26t	18t	7.5t	3.5t	1.6t
Fixed cost	372	322	294	225	171	163
Trailer cost	15	0	0	0	0	0
Total Fixed Cost	387	322	294	225	171	163
Fixed cost percentage	60%	60%	60%	60%	60%	60%
The total cost (incl. variable costs)	645	537	490	375	285	272
Clean Air Zone Charge in £	100	100	100	100	7.5	7.5
Charge% of Total Cost	**15.5%**	**18.6%**	**20.4%**	**26.7%**	**2.6%**	**2.8%**

Impact:

- The charge represents on average 2.7% of daily total cost for vans
- The charge represents over a quarter of the daily cost for a 7.5t Rigid
- The lighter the HGVs is, the greater % of the daily cost represented by the charge, due to relatively lower daily costs

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Cost impact/ tonne

Analysis of CAZ charge on each unit of goods delivered

- Vans are assumed to make 5 full payload runs per day
- Rigid HGVs are assumed to make 2 full payload runs per day
- 44t articulated HGV with a trailer are assumed to make 1 full payload run per day

	HGV: Artic	HGV: Rigid			Vans	
Maximum gross weight	44t	26t	18t	7.5t	3.5t	1.6t
Payload (tonnes)	28	15.5	10	3.2	1.5	0.6
Number of deliveries per day	1	2	2	2	5	5
Daily load (tonnes)	28	31	20	6.4	7.5	3
Total cost without charge (from previous)	645	537	490	375	285	272
Cost per tonne without charge (£)	23.0	17.3	24.5	58.6	38.0	90.6
Cost of charge (£/ tonne)	**3.6**	**3.2**	**5.0**	**15.6**	**1.0**	**2.5**

Impact:

- In terms of cost per tonne of goods, larger vans incur £1 and smaller vans £2.50
- 7.5t rigid HGVs take the highest additional charge (£15.60 per tonne of payload) due to the limited payload
- 44 and 26t HGVs incur lower costs per tonne of goods due to the greater capacity (£3.60 and £3.20 respectively)

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Cost Impact on SMEs with 2nd life vehicles

- Small and medium-sized enterprises (SMEs) and sole traders tend to operate second or third life vans
- SMEs, such as shop owners, often get their main income from other sources other than just delivering goods
- Fixed cost is based on ¼ of normal drivers' wages and ½ of first-life vehicle related cost (including depreciation, insurance finance costs, etc.)
- Running cost remains the same

	HGV: Artic	HGV: Rigid			Vans	
Maximum Gross Weight (MGW)	44t	26t	18t	7.5t	3.5t	1.6t
Fixed cost	150	124	112	79	58	54
Trailer cost	15	0	0	0	0	0
Total Fixed Cost	165	124	112	79	58	54
Running Cost	258	215	196	150	114	109
The total cost including fuel and maintenance	423	339	308	229	172	163
Clean Air Zone Charge in £	100	100	100	100	7.5	7.5
Charge% of Total Cost	**23.64%**	**29.50%**	**32.47%**	**43.67%**	**4.36%**	**4.60%**
Original Charge% of Total Cost	15.50%	18.60%	20.40%	26.70%	2.60%	2.80%
Increase% from Scheme 4	53%	59%	59%	64%	68%	64%

- This shows that the cost increase experienced by SMEs running second life vehicles would be around 50-70% higher than that of larger businesses running first life vehicles in many cases

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Vulnerability Analysis Summaries

- Estimated 33% of vans (55.6k) and 31% HGVs (6.6k) in GM will be affected by CAZ, assuming 2021 implementation of CAZ B and 2023 implementation of CAZ C

Vans Sectors

- Nearly half of affected vans are from construction sector
- Construction, Agriculture, forestry & fishing industries are the most vulnerable van sectors, based on the criteria applied here

HGVs Sectors

- The majority of affected HGVs are from the general haulage, building and waste industries
- HGVs in removals and the waste sector are assessed as ‘highly vulnerable’ based on the criteria used here

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Cost impact analysis Summary

- For businesses operating first life vehicles, the cost increase imposed by the charge represents between around a 3% increase for vans and between 25-28% increase for HGVs
- On a per tonne carried basis, this represents a cost increase of between £1 and £16, depending on the size of vehicle, with 7.5t HGVs facing the greatest increase in costs per tonne of goods
- For businesses operating second life vehicles, typically SMEs, the cost increase imposed is around 50-70% higher than that of larger businesses running first life vehicles in many cases

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Next steps

- GM is investigating further sources of freight data, as listed in this table.
- GM has also commissioned four Specialised Goods Vehicle Surveys at key local exceedance sites with high freight flows
- GM is developing a survey of small businesses operating LGVs, to better understand their usage patterns, limitations and possible behavioural responses
- Further analysis is required to better understand the implications of the CAP for freight

Data Source	Key Information
DVLA sample data	Vehicle types, age and fuel type
Real-Time Origin Destination Analysis Tool (RODAT)	Vehicle type
DfT Annual Average Daily Flows (AADF)	The level of traffic by vehicle types
Continuous Survey of Road Goods Transport (CSRGT)	Activity of GB-registered HGVs (vehicles weighing 3.5+ tonnes) operating in the UK with commodity types contained
Specialised Goods Vehicle Survey (SGVC)	Data on commercial vehicle age, size, type, industry category, commodity and direction of travel
SMMT	Data on national vans and HGV growth trend
Vehicle Booking Management Systems (VBMS)	Vehicle numbers, types and commodities
ANPR data - Air Quality	Comprehensive vehicle information
DVSA/ATF – MOT data	MOT data from DVSA on detailed vehicle information including age, model and emission standards, etc.
British Vehicle Rental and Leasing Association (BVRLA)	Data on rental vehicles
Trade Associations – FTA, RHA	Data about the number operators and number of vehicles in GM
Unliveried Non-Compliant Vehicles Review	Data on unliveried goods vehicles on the roads
Traffic Commissioners (TOs)	Data on licensed operators and their fleets
List of Local Authority Fleet Registrations	Data on fleet operated by LAs in GM

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

Note 5: GM CAP ANPR Surveys: Summary of Initial Findings

Warning: Printed copies of this document are uncontrolled

Version Status:	DRAFT FOR APPROVAL	**Prepared by:**	Joao Ribierio 9th July 2019
Authorised by: **Date:**	Ian Palmer 12th July 2019		

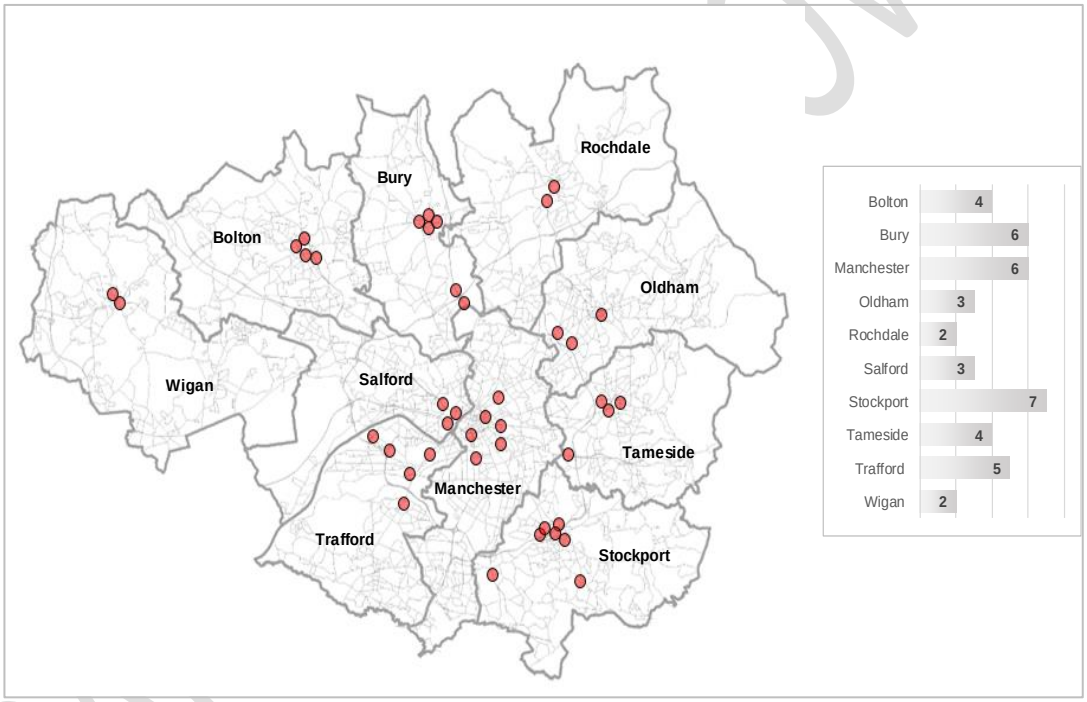
1 Introduction

1.1 Overview

1.1.1 This Technical Note reports on the initial analysis of the Automatic Number Plate Recognition (ANPR) survey that was undertaken in relation to TfGM's Clean Air Plan (CAP). The survey covered a total of 42 locations across Greater Manchester (GM) as shown in **Figure 1-1**. Data was collected for a single week in January 2019.

1.1.2 Registration plates collected were submitted to the Driver and Vehicle Licensing Agency (DVLA) who processed the data set to append anonymised information concerning each vehicle identified.

Figure 1-1. ANPR camera locations



1.2 Purpose of the Survey

1.2.1 The survey was designed to provide a representative profile of the vehicle fleet operating in Greater Manchester in terms of:

- Vehicle type (including fuel used); and
- Age profile.

1.2.2 The new survey results are intended to inform trend analysis, when comparing against the ANPR data available for the OBC modelling which came from Greater Manchester Police. The DVLA dataset parameters enable further refinement in identifying vehicle type and size. This dataset will also be used to underpin a range of analytical tasks to support the development of the Full Business Case (FBC) being prepared in relation to the CAP.

1.3 Key Dates

1.3.1 Key dates in relation to the survey are as follows:

- Start date: Monday, 21st January 2019 (00:00);
- End date: Sunday, 27th January 2019 (23:59); and
- Processed dataset received back from DVLA on 18th April 2019.

1.3.2 Confirmation of issues associated with DVLA assumptions on estimated Euro Class on 15th May 2019

1.4 DVLA Analysis

1.4.1 The processed dataset received from the DVLA included the following information for each vehicle:

- Vehicle categorisation by body and propulsion type;
- Year of manufacture;
- Registration address (postcode sector); and
- Vehicle age.

1.4.2 This was used to derive a breakdown of compliant and non-compliant vehicles by type and location.

2 Survey and Analysis Headlines

2.1 Key Statistics

2.1.1 The key statistics from the survey and the subsequent processing by DVLA are set out in **Table 2-1**.

Table 2-1. ANPR Key Statistics

Item	Number	Notes
Total unique vehicle registrations	9,277,572	Number of ANPR entries sent to the DVLA for processing
Total matched to DVLA database as reported by the DVLA	8,948,866	Implies the DVLA processed data accounts for 96.5% of all vehicles recorded by the ANPR survey
Actual total survey records received from the DVLA	8,822,494	Implies the received DVLA processed data accounts for 95.1% of all vehicles recorded by the ANPR survey
Total records received from the DVLA with postcode sector information	8,651,434	Implies 93.3% of all vehicles captured by the ANPR survey can be allocated to a UK registered address

Source: TfGM 2019 CAP ANPR Survey

2.1.2 The breakdown of the vehicle fleet, using the 8.65 million postcode matched records returned by DVLA, is summarised in the following sections.

2.2 Breakdown by Vehicle Type

2.2.1 **Table 2-2** summarises the ANPR data received from the DVLA by vehicle type. It should be noted that taxis will only include Hackney cabs since the DVLA data does not distinguish Private Hire Vehicles (PHV) from other vehicle types. PHVs will be included under the car category. Minibuses have been separated from buses and coaches as these are usually classified as LGV.

Table 2-2. ANPR Data by Vehicle Type

DVLA Body Type	Vehicle Category	No. Records	% Records
Buses & Coaches (excluding Minibus)	Bus	83,251	1.0%
Cars	Car	7,313,319	84.5%
Goods – Light	LGV	946,865	10.9%
Buses & Coaches (Minibus only)	Minibus (MNB)	24,578	0.3%
Motorcycles, Mopeds & Scooters	Motorcycles (MOT)	2,529	0.0%
Goods – Heavy	OGV	211,395	2.4%
Agricultural Not Recorded Others Special Purpose Tricycles	Other (OTH)	16,130	0.2%
Taxis	Taxi	53,367	0.6%
Total		**8,651,434**	**100%**

2.3 Breakdown by Registered Location

2.3.1 From the postcode sector relating to the registered address, vehicles have been categorised as being based either within GM or elsewhere. This breakdown is shown in **Table 2-3**.

2.3.2 Overall 72% of vehicles operating within GM are registered within GM. For freight vehicles this proportion is significantly lower with only around 50% of vehicles registered in GM. However, it is recognised that for commercial vehicles, including freight, the potential for a difference between the operational location versus the registered location is also greater than for private vehicles, with vehicle fleets operating regionally. This does however mean that a greater number of non-compliant vehicles are potentially in-scope for a penalty charge although frequency of visits would also need to be estimated too.

Table 2-3. ANPR Data by Vehicle Type by Registered Location

DVLA Body Type	GM Records	Non-GM Records	% GM	% Non-GM
Car	5,527,598	1,785,721	76%	24%
LGV	502,108	444,757	53%	47%
OGV	77,599	133,796	37%	63%
Bus	68,943	14,308	83%	17%
Taxi	51,748	1,619	97%	3%
MNB	20,769	3,809	85%	15%
MOT	493	2,036	19%	81%
OTH	3,597	12,533	22%	78%
Total	6,252,855	2,398,579	72%	28%

2.4 Breakdown by Vehicle and Fuel type

2.4.1 Vehicle types have been further broken down by fuel type with the distribution shown in

2.4.2 as follows:

- (P): Petrol;
- (D): Diesel;
- (E): Electric;
- (HE): Hybrid Electric; and
- (O): Other[1]

[1] including Steam; Gas; Petrol/Gas; Gas Bi-Fuel; Gas Diesel; Electric Diesel; New Fuel Technology

Table 2-4. ANPR Data by Vehicle Type and Fuel Type

Fuel Type	Vehicle Category	No. Records	% Records	% Vehicle Category	Vehicle Category	No. Records	% Records	% Vehicle Category
Petrol	Car	3,666,903	42.4%	50.1%	TAXI	-	-	-
Diesel		3,412,144	39.4%	46.7%		52,940	0.6%	99.2%
Electric		13,085	0.2%	0.2%		-	-	-
Hybrid Electric		212,271	2.5%	2.9%		427	0.0%	0.8%
Other		8,916	0.1%	0.1%		-	-	-
Petrol	LGV	4,533	0.1%	0.5%	MNB	84	0.0%	0.3%
Diesel		941,432	10.9%	99.4%		24,482	0.3%	99.6%
Electric		592	0.0%	0.1%		-	-	-
Hybrid Electric		17	0.0%	0.0%		-	-	-
Other		291	0.0%	0.0%		12	0.0%	0.0%
Petrol	OGV	10	0.0%	0.0%	MOT	2,522	0.0%	99.7%
Diesel		211,217	2.4%	99.9%		1	0.0%	0.0%
Electric		45	0.0%	0.0%		6	0.0%	0.2%
Hybrid Electric		-	-	-		-	-	-
Other		123	0.0%	0.1%		-	-	-
Petrol	Bus	34	0.0%	0.0%	OTH	208	0.0%	1.3%
Diesel		83,022	1.0%	99.7%		15,648	0.2%	97.0%
Electric		15	0.0%	0.0%		92	0.0%	0.6%
Hybrid Electric		-	-	-		163	0.0%	1.0%
Other		180	0.0%	0.2%		19	0.0%	0.1%

2.5 Breakdown by Vehicle Type and Compliance

2.5.1 Vehicle compliance has been defined following JAQU guidelines and based on the European Emissions Standard estimated for each ANPR record, not those supplied by the DVLA (which are also only estimated). Euro Standards have been defined for each record based on (i) the year of manufacture of the vehicle or (ii) the year of first registration of the vehicle, where (i) was not available.

2.5.2 Compliance of vehicles varies depending on the fuel type as set out below:

- Euro 4: Petrol Cars, LGV, Minibuses and Taxis;
- Euro 6: Diesel Cars, LGV, Minibuses and Taxis;
- Euro 3: Motorcycles;
- Euro VI: Buses/Coaches and OGV; and
- Electric Vehicles.

2.5.3 For the purposes of initial reporting, hybrid electric vehicles have been considered compliant although compliance will ultimately depend on the level of emissions. Other fuel types, not included in this list, have been considered to be compliant from Euro 6/VI standards for simplification.

2.5.4 **Table 2-5** presents the level of compliance observed within the fleet captured by the ANPR survey. The data shows that there is a majority of non-compliant vehicles in the Taxi, LGV, Minibus, OGV and Bus/Coach categories currently operating in Greater Manchester through the sites surveyed.

Table 2-5. ANPR Data by Vehicle Type and Compliance (2019)

Fuel Type	Vehicle Category	Compliant	Non-Compliant	Vehicle Category	Compliant	Non-Compliant
Petrol	CAR	89%	11%	TAXI	-	-
Diesel		39%	61%		13%	87%
Electric		100%	0%		-	-
Hybrid Electric		100%	0%		100%	0%
Others		28%	72%		-	-
TOTAL		66%	34%		13%	87%
Petrol	LGV	58%	42%	MNB	26%	74%
Diesel		40%	60%		12%	88%
Electric		100%	0%		-	-
Hybrid Electric		100%	0%		-	-
Others		1%	99%		0%	100%
TOTAL		40%	60%		12%	88%
Petrol	OGV	0%	100%	MOT	67%	33%
Diesel		60%	40%		100%	0%
Electric		100%	0%		100%	0%
Hybrid Electric		-	-		-	-
Others		89%	11%		-	-
TOTAL		60%	40%		67%	33%
Petrol	BUS	0%	100%	OTH	3%	97%
Diesel		23%	77%		36%	64%
Electric		100%	0%		100%	0%
Hybrid Electric		-	-		100%	0%
Others		100%	0%		21%	79%
TOTAL		23%	77%		36%	64%

2.5.5 The same methodology previously used at the OBC stage has been applied to project the new dataset forward to 2023 to estimate the levels of non-compliance that would be expected to be observed in 2023. The results of this forecast are presented in **Table 2-6**. (This analysis excludes the impacts of taxi minimum standards proposals).

Table 2-6. ANPR Data by Vehicle Type and Compliance (2023)

Fuel Type	Vehicle Category	Compliant	Non-Compliant	Vehicle Category	Compliant	Non-Compliant
Petrol	CAR	98%	2%	TAXI	-	-
Diesel		72%	28%		48%	52%
Electric		100%	0%		-	-
Hybrid Electric		100%	0%		100%	0%
Others		54%	46%		-	-
TOTAL		86%	14%		49%	51%
Petrol	LGV	77%	23%	MNB	26%	74%
Diesel		71%	29%		30%	70%
Electric		100%	0%		-	-
Hybrid Electric		100%	0%		-	-
Others		4%	96%		0%	100%
TOTAL		71%	29%		30%	70%
Petrol	OGV	0%	100%	MOT	78%	22%
Diesel		84%	16%		100%	0%
Electric		100%	0%		100%	0%
Hybrid Electric		-	-		-	-
Others		93%	7%		-	-
TOTAL		84%	16%		78%	22%
Petrol	BUS	15%	85%	OTH	7%	93%
Diesel		56%	44%		73%	27%
Electric		100%	0%		100%	0%
Hybrid Electric		-	-		100%	0%
Others		100%	0%		26%	74%
TOTAL		56%	44%		73%	27%

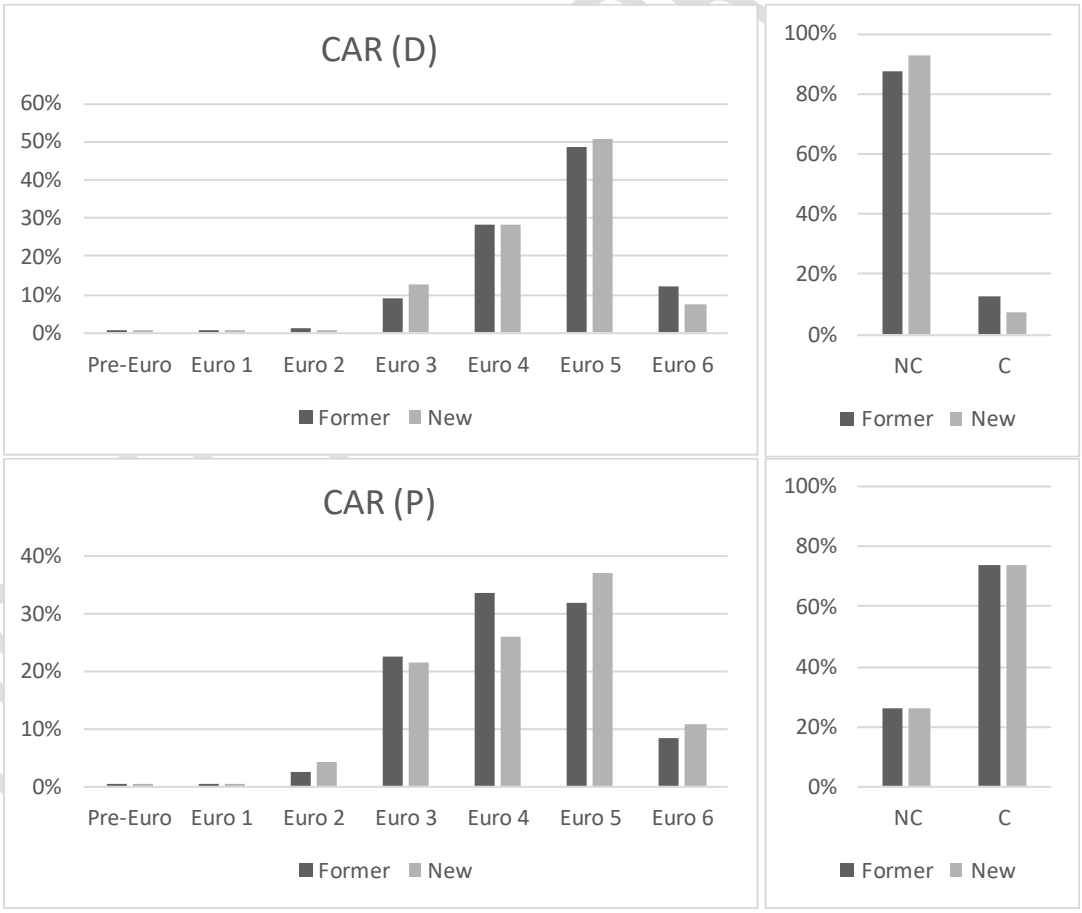
2.6 Comparison to previous dataset

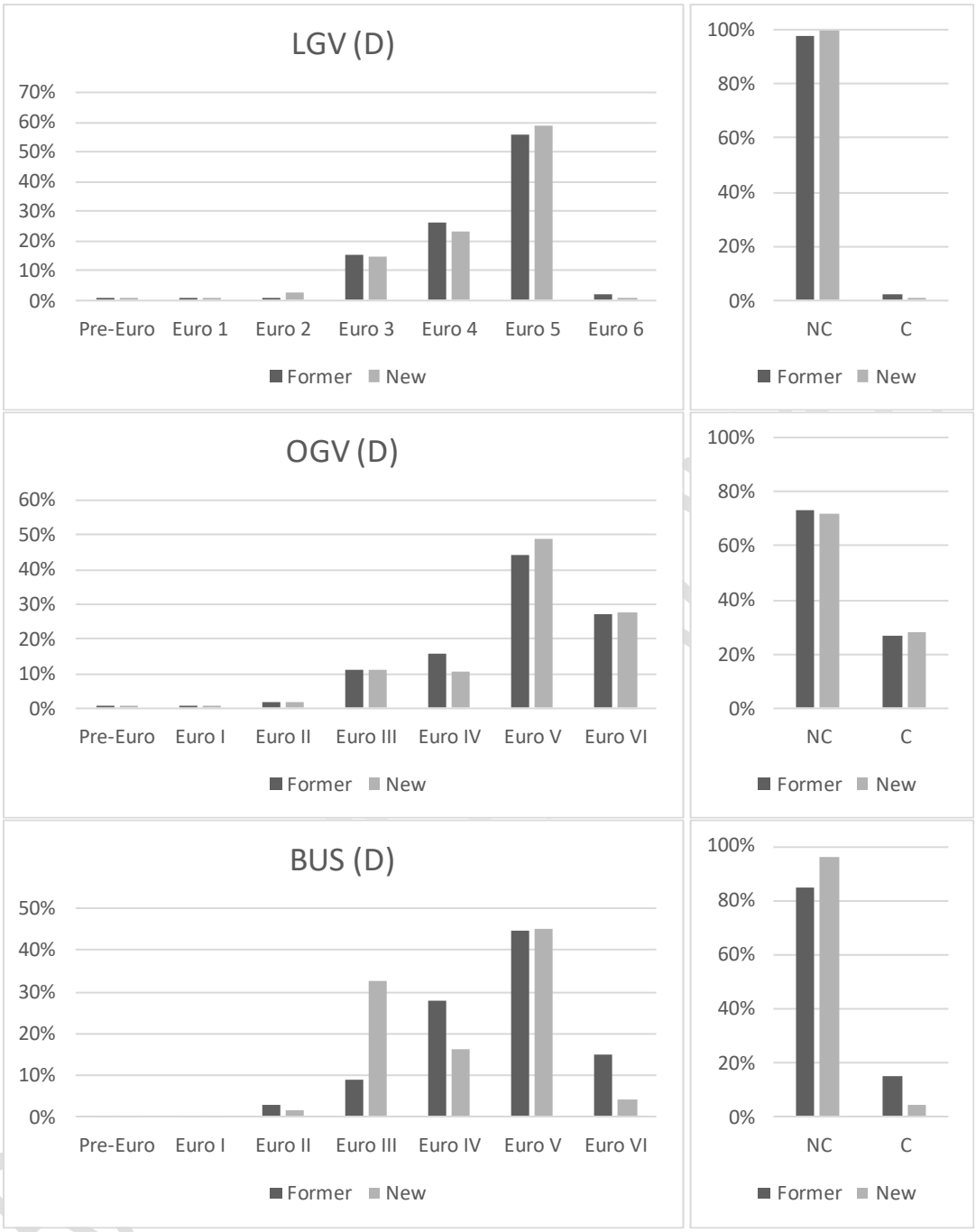
2.6.1 The new dataset age profile was compared to the outputs from the dataset previously used at the OBC stage which was projected from a 2016 ANPR dataset. The same roll-over methodology used to forecast compliance levels in 2023 was used to backcast the 2019 dataset to 2016 to allow a comparison with the earlier dataset.

2.6.2 A comparison between the original 2016 dataset and the backcast 2019 dataset is contained in the charts in **Figure 2-1**. Overall these charts demonstrate a similar level of compliance in both sets of data and variations are less than 5% (Car Diesel), though in most cases less than 2%, in the backcasting process.

2.6.3 The new data seems to indicate a slightly higher level of non-compliance for Diesel Cars which would be expected given the change in trends of purchasing new diesel cars, though are compensated by improvements in petrol cars. Variations of bus fleet are more likely to be due to systematic changes to sampling locations than for other vehicles types, reflecting the differing fleet ownership of bus operators serving specific routes. Additionally, for the bus emissions modelling, the ANPR fleet mix data was not used to define the fleet, rather TfGM service surveys were used, due to the detailed existing information held by TfGM on the operation of bus services within GM.

Figure 2-1. Comparison of OBC ANPR data (2016) and FBC ANPR data (2019 rolled back to 2016)





3 Conclusions

3.1.1 The new ANPR dataset is considered to be more comprehensive and robust than the data used in the previous (OBC) stage of the GM Clean Air Plan. This is because the survey has been conducted to cover key areas where emissions had previously been estimated to be above legal levels, and has more reliable vehicle classification from cross reference with the DVLA dataset, which was not possible with the GMP data due to data protection reasons.

3.1.2 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 provides confidence in the general findings from the OBC stage, and the implications of more contemporary fleet mix data in conjunction with revised guidance of fleet project from JAQU is currently being reviewed.

3.1.3 This data set is now being widely used as part of the ongoing work to refine the proposals as part of the FBC development for the CAP.

3.1.4 Some of the areas of analysis currently underway as part of that FBC analysis, which the ANPR data will contribute to, include:

- Development of operating cost models for LGVs and HGVs using existing fleet mix as part of the input;
- Further analysis of the coach market;
- Further analysis of the private hire (PHV) and hackney carriage market;
- Further analysis on the number of blue light fleet in operation
- Potential development of operating cost models for PHV and Hackney;
- Understanding of non-GM movements; and
- Linkages to financial and models supporting the FBC.

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

Note 12: Evidence of the impact of 2021 implementation of a CAZ C without exemptions

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Version Status:	DRAFT FOR APPROVAL	**Prepared by:**	Geoff Clarke 8th July 2019
Authorised by: **Date:**	Ian Palmer 12th July 2019		

1 Introduction

1.1 A Clean Air Plan (CAP) has been proposed by Greater Manchester's (GM) ten local authorities aiming to target and mitigate areas of poor air quality within the GM boundary, which is being managed on behalf of the 10 districts by Transport for Greater Manchester (TfGM). Currently, the CAP includes plans for a Clean Air Zone (CAZ) across Greater Manchester, implemented as a category B in 2021 and as a category C in 2023 which would apply different charges to Heavy Goods Vehicles (HGVs) and Light Goods Vehicles (LGVs or vans) alongside buses, coaches, minibuses and taxis. The proposed charges for freight vehicles are shown in **Table 1-1.**

1.2 The current CAZ proposal includes charging schemes in different introduction years for HGV and vans, considering the fact that vans were one of the last vehicle categories to adopt the Euro 6 emissions standards in 2016. This note provides analysis on the impact of the CAZ charge on the van sector, particularly in terms of the potential impact of introducing the CAZ charge in 2021 versus 2023.

Table 1-1 Greater Manchester Clean Air Zone Charges for freight vehicles

Vehicle Group	Proposed CAP Charge (per day)	Introduction Date
HGVs	*£100*	*2021*
LGVs	*£7.50*	*2023*

1.3 The report will discuss the impact of an earlier adoption of CAZ charging scheme for vans from the following aspects:

- Vulnerability Analysis
- Market distortion and impact on SMEs
- Upgrading Choice Limitation

2 Vulnerability Analysis

2.1 One aspect of the vulnerability of a sector is the non-compliant vehicle ratio at the time a CAZ is introduced. The higher proportion of non-compliant vehicles a sector has, the more vulnerable towards the effects of CAZ charge it is assumed to be. Other factors will also determine how vulnerable a sector is, such as the availability of compliant vehicles at an affordable cost, ability to access equity or credit, and the profitability and predictability of business operations.

2.2 Businesses in different sectors tend to keep their vehicles for different lengths and time. For example, the financial sector tends to keep vehicles for a shorter period than the construction sector does. It is sensible to assume that different sectors replenish their fleet at different rates based on the replacement age. For example, sectors with average replacement age of 10 years are assumed to replenish on average 1/10 of their fleet each year. Therefore, the vehicle compliance ratios will ultimately be based on van replacement ages as well as the time gap between the year when Euro 6 emissions standards were adopted and the date when the CAZ charge is introduced. This means that sectors that have longer vehicle replacement age will have a higher proportion of non-compliant vehicles and will therefore be more vulnerable to CAZ charge impact. Equally importantly, the sooner a CAZ charge is introduced, the less time sectors will have for upgrading their fleets, the fewer compliant vehicles that will be available and therefore, the more vulnerable those sectors will become.

2.3 As shown in

2.4 Sectors	*Vehicle Replacement Age*	*CAZ Introduced at the end of 2021*			*CAZ introduced at the end of 2023*		
		Non-compliant Ratio	*No of vehicles affected*	*Vulnerability*	*Non-compliant Ratio*	*No of vehicles affected*	*Vulnerability*
Construction	*15*	*65%*	*26,700*	*Very High*	*51%*	*21,100*	*Very High*
Wholesale, retail & repair of motor vehicles	*10*	*47%*	*12,700*	*Very High*	*27%*	*7,200*	*Medium*
Manufacturing	*10*	*47%*	*10,500*	*Very High*	*27%*	*6,000*	*Medium*
Transport & storage	*10*	*47%*	*7,000*	*Very High*	*27%*	*4,000*	*Medium*
Accommodation & food services	*9*	*42%*	*6,000*	*Very High*	*19%*	*2,700*	*Low*
Information & communication	*9*	*42%*	*4,400*	*Very High*	*19%*	*2,000*	*Low*
Professional, scientific & technical activities	*10*	*47%*	*3,600*	*Very High*	*27%*	*2,100*	*Medium*
Mining, energy & water supply	*10*	*47%*	*3,200*	*Very High*	*27%*	*1,800*	*Medium*
Public admin. & defence; social security	*12*	*56%*	*3,600*	*Very High*	*39%*	*2,500*	*High*
Human health & social work activities	*12*	*56%*	*2000*	*Very High*	*39%*	*1,400*	*High*
Other services	*12*	*56%*	*1,900*	*Very High*	*39%*	*1,300*	*High*

Financial & insurance activities	*9*	*42%*	*1,300*	*Very High*	*19%*	*600*	*Low*
Administrative &support services	*12*	*56%*	*1,800*	*Very High*	*39%*	*1,200*	*High*
Agriculture, forestry & fishing	*15*	*65%*	*1,400*	*Very High*	*51%*	*1,100*	*Very High*
Real estate activities	*9*	*42%*	*600*	*Very High*	*19%*	*300*	*Low*
Education	*10*	*47%*	*700*	*Very High*	*27%*	*400*	*Medium*
Royal Mail	*9*	*42%*	*500*	*Very High*	*0%*	*0*	*Very Low*
Total	**-**	***52%***	***87,900***	-	***33%***	***55,700***	**-**

2.5 **,** a 'vulnerability' analysis of the CAZ charge impact on van-owning business sectors has been carried out for scenarios where the CAZ charge for vans is introduced either in 2023 or in 2021. The analysis is based on the main criteria for assessing 'vulnerability' as shown in

2.6 Non-Compliant Ratio	*Vulnerability*
10% and below	*Very Low*
10%-20%	*Low*
21%-30%	*Medium*
31%-40%	*High*
40% above	*Very High*

2.7 and assumes that any sector where more than 40% of vehicles are non-compliant at launch is 'very vulnerable' to the proposals. More work is required to better understand what drives vulnerability for different groups.

2.8 The total number of registered vans in the UK, along with the distribution of the van fleet by industrial segments, are provided by "Light Commercial Vehicles Delivering for The UK Economy 2019" report issued by The Society of Motor Manufacturers & Traders (SMMT) in 2019[1] . The number of vans serving in Greater Manchester area is further estimated from the national vans number, using the population ratio between GM and the UK. This is based on the fact that the freight sector is essentially regarded as a service industry, which aims at providing a transportation service to the people and businesses in Greater Manchester area, which is also the boundary of the Clean Air Zone. Therefore, the number of vans in GM is best estimated by Aecom Freight Team, based on the size of the population in Manchester.

[1] *https://www.smmt.co.uk/reports/light-commercial-vehicles-delivering-for-the-uk-economy/*

Table 2-1: Vulnerability' Comparison 2023 vs 2021

Sectors	Vehicle Replacement Age	CAZ Introduced at the end of 2021			CAZ introduced at the end of 2023		
		Non-compliant Ratio	No of vehicles affected	Vulnerability	Non-compliant Ratio	No of vehicles affected	Vulnerability
Construction	15	65%	26,700	Very High	51%	21,100	Very High
Wholesale, retail & repair of motor vehicles	10	47%	12,700	Very High	27%	7,200	Medium
Manufacturing	10	47%	10,500	Very High	27%	6,000	Medium
Transport & storage	10	47%	7,000	Very High	27%	4,000	Medium
Accommodation & food services	9	42%	6,000	Very High	19%	2,700	Low
Information & communication	9	42%	4,400	Very High	19%	2,000	Low
Professional, scientific & technical activities	10	47%	3,600	Very High	27%	2,100	Medium
Mining, energy & water supply	10	47%	3,200	Very High	27%	1,800	Medium
Public admin. & defence; social security	12	56%	3,600	Very High	39%	2,500	High
Human health & social work activities	12	56%	2000	Very High	39%	1,400	High
Other services	12	56%	1,900	Very High	39%	1,300	High
Financial & insurance activities	9	42%	1,300	Very High	19%	600	Low
Administrative &support services	12	56%	1,800	Very High	39%	1,200	High

Agriculture, forestry & fishing	*15*	*65%*	*1,400*	*Very High*	*51%*	*1,100*	*Very High*
Real estate activities	*9*	*42%*	*600*	*Very High*	*19%*	*300*	*Low*
Education	*10*	*47%*	*700*	*Very High*	*27%*	*400*	*Medium*
Royal Mail	*9*	*42%*	*500*	*Very High*	*0%*	*0*	*Very Low*
Total	**-**	***52%***	***87,900***	-	***33%***	***55,700***	**-**

Table 2-2: Classification criteria for 'Vulnerability'

Non-Compliant Ratio	*Vulnerability*
10% and below	*Very Low*
10%-20%	*Low*
21%-30%	*Medium*
31%-40%	*High*
40% above	*Very High*

2.9 As can be seen clearly in the

2.10 **Table** *2-1*, within the same CAZ charge introduction year, the longer a sector keeps their van fleet, the more non-compliant vehicles they have and the more 'vulnerable' they have been assumed to be in this analysis to the impact of the charge. This can be specifically illustrated by the construction and agriculture, forestry & fishing sectors which have the longest average van replacement age (15 years) and are classified as the most 'vulnerable' with a 2023 CAZ implementation.

2.11 Comparing the 'vulnerability' of sectors between different CAZ introduction years, if a CAZ was introduced in 2021, all industries would be classified as 'highly vulnerable' based on these assumptions, with an estimated 40% or more of their fleet being non-compliant. In comparison, only two sectors remain in this category by 2023. In total, this analysis suggests that around a third of vans in GM would be non-compliant in 2023 compared to more than half in 2021, a total difference of around 32,000 vans.

2.12 Early introduction of the CAZ C would increase the impact on sectors classified as 'highly vulnerable', such as construction, agriculture, forestry & fishing, from a 51% non-compliant ratio to 65%. Around 30% of all affected vans (26k) are expected to be from the construction sector. Moreover, the non-compliant ratio increases dramatically from 19% to 42% for sectors, such as accommodation & food services, information & communication, etc., which appear to have lower 'vulnerability' as classified here with a later introduction. It is important to note that even if CAZ C was introduced in 2023 the vulnerability of the sector will still be classed as "High".

3 Market distortion and impact on SMEs

3.1 The analysis below shows that the implementation of a GM-wide CAZ C in 2021 has the potential to cause serious market disruptions as there would be insufficient compliant, but older, Euro 6 vans in the second-hand market.

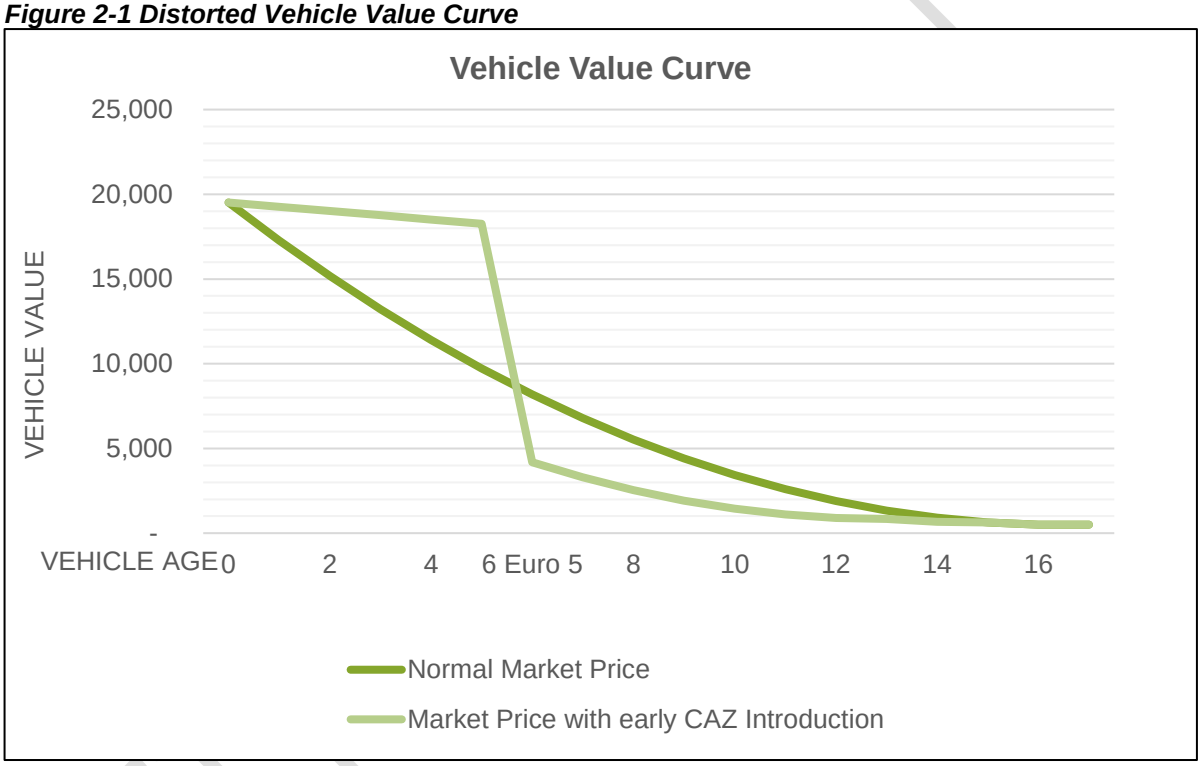
3.2 According to the most recent report[2] issued by The Society of Motor Manufacturers & Traders (SMMT) in 2019, around 900,000 vans change hands each year illustrating how the used market is critical for the van-dependent economy. To put this into perspective there are around 300,000 new vans each year so about a third of transactions relate to new purchases. More importantly, the report evaluates that vehicles purchased from new tend to be de-fleeted after 4-5 years and the majority of second-hand vehicles are typically operated by SMEs.

3.3 The early introduction of a van scheme at the end of 2021 would mean that the oldest euro 6 (and therefore compliant) vans available at that point would be around 5 years-old. However, the evidence suggests that typically second-hand vans start to be released from large organisations after 4 years. This means only one-years' worth of compliant second-hand vehicles will be available in the van market, while half of all the vans are affected by early introduction of CAZ charging scheme as discussed in Section 2. The high demand for compliant second-hand vans and low supply on the market will inevitably distort the vehicle values on the market as shown in the **Figure 2-1**Error! Reference source not found. below based on local analysis, where compliant vehicle values below 5 years will be inflated in price and older non-compliant vans prices are expected to be pushed down, with the need for them to be sold outside of regions where CAZ schemes are being introduced. This is particularly concerning for SMEs who may be more likely to have relatively low net profit margins, and less flexibility in terms of access to equity or credit, and the majority of which rely on second-hand vehicles.

[2] *Light Commercial Vehicles Delivering for The UK Economy 2019 report*

3.4 Around 20% of all vans on the road are leased or rented. A high proportion of new vans are acquired in this way whereas few vehicles over 10 years are still on lease or contract hire. As typically vans have an active life of 16 years, their second or third owners tend to buy them outright. Lease lengths are typically four to five years however a small number of rental companies may renew their fleet from as short as three years, such as Enterprise. The BVRLA (the trade body for the vehicle rental and leasing sector) reported a growth of 30% in van leasing in 2016 and they had 387,000 LGVs in their member's lease fleet that year predominantly on business contract hire.

Figure 2-1 Distorted Vehicle Value Curve



Source: AECOM analysis for GM CAP 2019

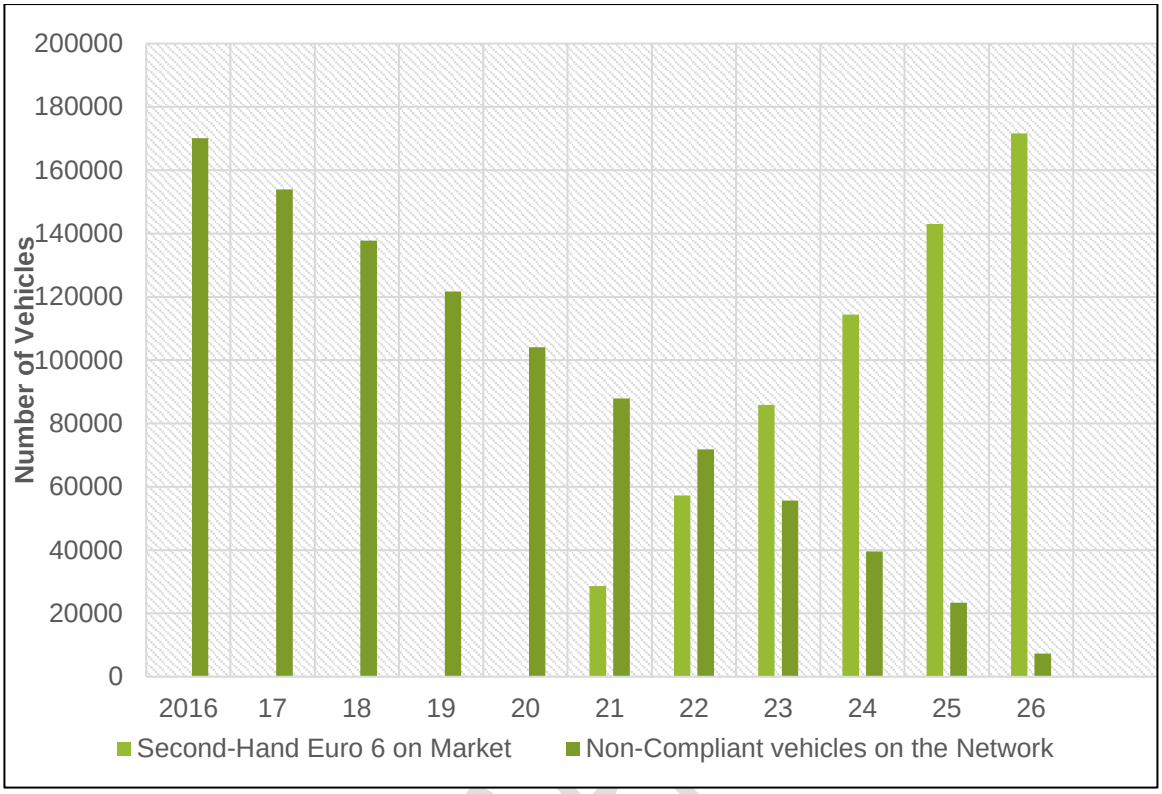
3.5 It is worth noting that the vehicle value curves above represent disturbance of early CAZ introduction in the Greater Manchester (GM) second-hand vehicle market. There is the potential that certain small and medium-sized enterprises (SMEs) and sole traders could purchase compliant second-hand Euro 6 vans from outside GM. However, the number of van owners likely to do this is estimated to be small due to the following supply and demand reasons.

3.6 CAZ schemes are expected to be rolled out nationwide. Clean Air Zones are already confirmed in Birmingham (category D) and Leeds (category B) and Bath have announced their intention to progress with a Category C CAZ. Clean Air Plans are under production in tens of cities and towns and it is likely that more CAZ schemes will come forward over similar timescales to the GM proposals. London implemented the Ultra Low Emission Zone (ULEZ) in the city centre in 2019 and has confirmed the expansion of the ULEZ to the area of inner London bordered by the North/South Circular roads in 2021 requiring Euro 6 for all diesel-engined vans. This means that the market for Euro 6 vans in many cities may be affected.

3.7 Furthermore, it is known that most second-hand vehicles are operated by SMEs who tend to just own only one or two vans and look to regular local dealers they get good service from. Considering the small size of fleet operated by individual SMEs, it is seems less likely that SMEs and sole traders will purchase second-hand compliant vans outside of GM.

3.8 Delaying the CAZ introduction date for vans would help alleviate the potential distortion, as it allows more second-hand Euro 6s to be released into the market and reduces the brought-forward demand for compliant vehicles, with old non-compliant vehicles being naturally replaced each year. This can be further illustrated in the **Figure 2-2**, where the supply of second-hand Euro 6 vehicles start to be released into the market in late 2020/early 2021 and the demand for second-hand Euro 6 (the number of non-compliant vehicles on the network) is projected to meet the supply some time during 2023. According to SMMT in 2019, around 900,000 vans change hands each year nationwide. The turnover of vans becoming second-hand in GM is calculated based on the population ratio between GM and the UK. It should be noted that the turnover number has been discounted by a factor in order to reflect a number of second-hand vans which are becoming third-hand, which are unlikely to be compliant Euro 6 vans, as they have already changed hands once. Note that this analysis does not take into account the distorting impact of an announcement of the intention to proceed with a CAZ, which would be expected to accelerate compliance and affect market availability and sale prices before launch.

Figure 2-2 Second-hand euro 6 vehicles demand vs supply



Source: AECOM analysis for GM CAP 2019

4 Upgrading Choice Limitation

4.1 Bringing the van charging scheme forward to 2021 is estimated to increase the difficulty in upgrading, in terms of the limited upgrading choices available. Here we discuss the options and argue that by leaving the introduction of the CAZ for vans to 2023 it helps in all of the following instances.

4.2 Vans were one of the last vehicle categories to adopt the Euro 6 emissions standards in 2016, which means there are more Euro 5 diesel vans in legacy fleets. In general, retrofit solutions can be relatively high in cost and difficult to fit. This means that it is often cheaper to replace than to retrofit vans. The retrofitting technology for vans is not expected to be ready and affordable by the year 2021 as type approval is lengthy and the market capacity to make physical changes is limited. It could be that retrofitting could be a more developed option by 2023.

4.3 As an alternative to purchasing a compliant diesel van, operators could alternatively upgrade to a compliant petrol or electric van. However, the fleet of petrol vans is small (less than 5% of the total LGV fleet) and most are relatively new. The availability of electric vans is also low, although several options are in development and expected to be put to market in the early 2020s.

5 Conclusion and next steps

5.1 Analysis by sector of potential 'vulnerability' to the implementation of charging, based on the proportion of the fleet in that sector that would be expected to be non-compliant, suggests that in 2021, more than 40% of the LGV fleet in all sectors is likely to be non-compliant. In comparison, by 2023 just two sectors are in this position, with several sectors expected to have compliant fleets of 80% or more.

5.2 Evidence suggests that around 300,000 new LGVs are purchased each year and that most vehicles have a 'first life' before being sold for the first time of around four to five years. Lease periods are typically of a similar length although some large van-rental companies may release their fleet after three years.

5.3 The early introduction of a van scheme at the end of 2021 would mean that the oldest euro 6 (and therefore compliant) vans available at that point would be around five years-old. This means only one-years' worth of compliant second-hand vehicles will be available in the van market, around 300,000 vehicles.

5.4 Estimates suggest that up to 90,000 non-compliant vans may be affected by a CAZ if implemented in 2021.

5.5 By 2023, this would be expected to fall to around 56,000 based on average turnover rates. Compliant vehicles up to 7 years old would be available.

5.6 The evidence suggests that SMEs tend to buy second or third life vehicles and would therefore be reliant on the availability of affordable second-hand Euro 6 vehicles in order to be able to comply.

5.7 Further analysis is underway to better understand the potential impacts and effectiveness of implementing a CAZ C in 2021 GM-wide without exemptions. In particular, this will focus on the availability of vehicles and deriving assumptions about the impact on sale prices and residual vehicles values, and on the implications in terms of the effectiveness of a 2021 implementation date in terms of bringing forward compliance. Other relevant factors will also be considered.

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

Note 13: Traffic Impact on Neighbouring Authorities

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Version Status:	DRAFT FOR APPROVAL	**Prepared by:**	Tony Morris 10th July 2019
Authorised by: **Date:**	Ian Palmer 12th July 2019		

1 Introduction

1.1 This note presents an analysis of vehicle flows from the highway models developed for the appraisal of the Greater Manchester Clean Air Zone (CAZ). The analysis has been undertaken to inform discussions concerning the potential road traffic impacts of the proposed CAZ on roads in neighbouring district authorities.

1.2 The impacts of the CAZ have been measured by using the traffic models to determine the proportions of non-compliant through trips (i.e. trips crossing the GM county boundary that have an origin and destination in the external area) which could re-route to avoid paying the CAZ charge.

1.3 Separate analyses have been carried out for 2021 and 2023.

2 GM CAP Proposals

2.1 The GM CAP proposals comprise a Category B CAZ implemented in Phase 1, which would extend to a Category C CAZ in Phase 2. The opening year for Phase 1 of the scheme would be 2021, with phase 2 opening in 2023.

2.2 Under the proposals, the drivers of non-compliant vehicles would have to pay a daily charge to enter the CAZ, which would cover the whole of Greater Manchester and include all non-compliant vehicles travelling on roads inside the County, excluding trips made entirely on the motorway network. Vehicles included in the category B CAZ comprise buses, coaches, taxis plus private hire cars and Heavy Goods Vehicles (HGVs). The category C CAZ would be extended to include Light Goods Vehicles (LGVs).

2.3 The minimum emission standards for compliant vehicles entering the CAZ are shown below in **Table 2-1**.

Table 2-1 CAZ Emission Standards

Vehicle Type	Euro Standard
Cars	Not Applicable
Taxis + Private Hire Cars	Euro 4 (petrol), Euro 6 (diesel)
Light Goods Vehicles	Euro 4 (petrol), Euro 6 (diesel)
Heavy Goods Vehicles	Euro VI
Buses	Euro VI

3 Overview of the Highway Modelling

3.1 The CAP highway modelling has been carried out using TfGM's county-wide Saturn model for a 2016 base year and three forecast years comprising:

- 2021, which represents the assumed opening year of the CAZ scheme
- 2023
- 2025

3.2 The 2023 and 2025 models were developed to assist in confirming the year of compliance and to help with modelling the phased introduction of the GM-wide CAZ C.

3.3 The Saturn model represents 3 time periods comprising:

- a weekday morning peak hour 0800-0900
- an evening peak hour 1700-1800
- an average inter-peak hour for the 1000-1530 time period

3.4 The results presented in this report show average daily traffic flows calculated from the hourly data.

3.5 The assignment matrices that are used with the model represent 8 user classes comprising:

- Compliant Car trips
- Non-Compliant Car trips
- Compliant LGV trips
- Non-Compliant LGV trips
- Compliant OGV trips
- Non-Compliant OGV trips
- Compliant Taxi trips (including private hire cars)
- Non-Compliant trips (including private hire cars)

3.6 Buses are not included in the assignment matrices, but are represented in the model as fixed link loads, with routes defined as chains of nodes in the buffer and simulation networks. Modelled bus services are based on 2015 service patterns and flows for scheduled services operating within the County. Coaches are not represented in the models.

3.7 Geographically, the model is focused on Greater Manchester, although it does extend to cover all of Great Britain, albeit in increasingly less detail with increasing distance from the county boundary, as illustrated

3.8

3.9

3.10 Figure 4-1**.**

3.11 The analysis presented in this report has been undertaken using the 2021 and 2023 do-something models, which represent what is forecast to happen following the introduction of the CAZ.

3.12 **Modelling Behaviour Change**

3.12.1 The nature of the CAP proposals mean that non-compliant vehicles will face a daily charge for travelling in parts of Greater Manchester. The modelling therefore assessed what proportion of vehicles are likely to be non-compliant and therefore 'in scope' for a charge, and how they might respond.

3.12.2 The behavioural responses to the CAP proposals were modelled using a spreadsheet application developed as part of the option sifting and assessment exercise. The application uses stated preference data weighted towards the characteristics of Greater Manchester to estimate the impact of the introduction of a charging Clean Air Zone and the travel demand responses of non-compliant vehicle users.

3.12.3 For those vehicles that are 'in scope' for a daily charge, there are a number of possible responses, as described below:

- continue to travel into, within or through the CAZ and pay the charge ('stay and pay')
- change their behaviour to avoid travelling into, within or through the CAZ, for example by travelling by a different mode or cancelling their trip. (Some 'cancelled' trips would in fact move to a different destination to avoid the charging area, but the available model did not allow us to consider that option in this analysis).
- upgrade to a compliant vehicle – this is assumed to be a newly purchased vehicle but note that another possible response is to swap to a compliant vehicle already owned (e.g. another vehicle in the household or in a commercial fleet).

3.12.4 The choice to upgrade is dependent both on the charge level – with higher charges leading to more change – and on the frequency of travel. Those who need to travel frequently in a charged zone are more likely to choose to upgrade their vehicle as it is more cost effective for them; conversely, those who travel infrequently are more likely to 'stay and pay' as the cost of upgrade would outweigh the cost of the charge.

3.12.5 The behavioural responses that have been used in the modelling are summarised below in **Table 3-1**.

Table 3-1 Behavioural Response to the GM CAP by Vehicle Type (%)

Behavioral Response	Car	Taxis	Private Hire Vehicles (PHVs)	Light Goods Vehicles (LGVs)	Heavy Goods vehicles (HGVs)	Buses/ Coaches
Pay Charge	6.7%	0%	24.2%	9.6%	9.4%	0%
Change Mode	12.8%	0%	18.9%	7.5%	0.0%	0%
Cancel Trip	15.1%	0%	18.7%	7.5%	4.2%	0%
Upgrade Vehicle	65.4%	100%	38.2%	75.4%	86.5%	100%

Source: Greater Manchester Clean Air Plan Outline Business Case

4 Results

4.1 This section presents summary results of the analysis for roads crossing the GM county boundary. There are, however, a number of caveats and limitations with regards to the modelling in the external area (outside of Greater Manchester) that need be borne in mind when considering the results:

- The highway model uses a simplified network representation outside of the County, whose primary purpose is to allow traffic flows at the county boundary to be estimated within acceptable levels of accuracy
- The highway network is less dense outside of the County, and becomes increasing less detailed with increasing distance from the county boundary, which might prevent some diversion routes from being captured
- The highway network in the external area does not include planed (future year) road schemes
- Traffic zones in the external area are larger than those within the County, which will affect the accuracy of the trip and flow estimates
- Origin-destination (trip matrix) data is less accurate in the external area
- Taxi/private hire car trips with an origin and destination outside of Greater Manchester are not modelled in the external area
- The model has not been validated in the external area.

4.2 It should also be borne in mind that the forecasts include national changes to the vehicle fleet mix and engine technology over time, as older more polluting vehicles are replaced by newer models which are compliant with stricter Euro standards. (The modelled improvements to the vehicle fleet are based on national forecasts of the fleet turnover, and how long vehicles last before they are scrapped).

4.3 **Table 4-1** shows modelled all vehicle 24 hour Annual Average Weekday Traffic flows (AAWT) for roads crossing the GM county boundary for 2021 and 2023, excluding motorways. The figures in the columns headed ‘All Trips’ show modelled flows for all movements combined, comprising compliant plus non-compliant vehicles with an origin or destination inside Greater Manchester and vehicles with an origin and destination outside the county (external-external/through trips) that cross the county boundary. The figures in the columns headed ‘External-External (Through Trips)’ show modelled cordon crossing flows for external-to-external trips only (i.e. movements that enter Greater Manchester, excluding trips with an origin or destination inside the county). For the purpose of this analysis we have assumed that through trips made in non-compliant vehicles are the trips which would potentially divert (change their route/re-assign) to avoid entering the CAZ.

4.4 Features to note from **Table 4-1** include:

- Approximately 1.2 million vehicles are forecast to cross the county boundary in 2021 in terms the total 24 hour AAWT, rising to 1.25 million vehicles in 2023
- Overall, through trips (with an origin and destination outside Greater Manchester), represent approximately 17% of the total cordon crossing flow
- Approximately 98% of all trips are forecast to be compliant in both 2021 and 2023
- Approximately 95% of through trips are forecast to be compliant in 2021, with 96% of through trips forecast to be compliant in 2023
- The numbers of non-compliant heavy goods vehicles crossing the county boundary is forecast to fall between 2021 and 2023, due in part to improvements to the vehicle fleet over time, but also due to the impacts of the CAZ, and the expectation that the majority of operators of non-compliant vehicles with origins and destinations inside the county will choose to upgrade their vehicles. This is likely to deliver air-quality improvements in the external area as older more polluting vehicles are replaced by newer models.
- Overall, there is a small increase in the total number of non-compliant vehicles forecast to cross the county boundary between 2021 and 2023, due to the extension of the CAZ to include LGVs in 2023. In contrast, however, there is a small reduction in the number of non-compliant through trips that are forecast to cross the county boundary between 2021 and 2023, as the increase in the number of non-compliant LGV trips brought about by the extension of the CAZ in 2023 is off-set by a reduction in the number of non-compliant HGV through trips over this period, which make up a greater proportion of total through trips in the external area, partly due to their greater trip lengths.

4.5 **Table 4-2** shows modelled 24 hour AAWT flows broken down by site, as illustrated in

4.6

4.7

4.8 Figure 4-2.

4.9 As would be expected, the motorways carry the heaviest cordon crossing flows, with the M6 (sites 80 and 81) carrying between 140,000 and 145,000 vehicles per day in 2021, and the M62 (sites 78 and 79) carrying between 139,000 and 155,000 vehicles per day. There are, however, significant flows in other parts of the network, with the A580 on the border between St Helens and Wigan (site 67) having a 2021 forecast AADT flow of approximately 61,000 vehicles per day and the A555 on the border between Cheshire East and Stockport (sites 11/12) having a forecast flow of approximately 55,000 vehicles per day.**Notes***:*

4.10 **Figures *in*** columns A have been rounded to the nearest 100 trips

1. *Figures in columns B have been rounded to the nearest 10 trips*
2. *Percentages are based on unrounded totals*

4.11 Table 4-3 shows the 20 sites with the greatest numbers of non-compliant through trips and the percentage of the total flow through each site, excluding motorways.

4.12 In general, the numbers of non-compliant through trips at these sites are relatively small, with the possible exception of the A58 in St Helens (Site 65), where the modelled non-compliant through trip flow is approximately 950 vehicles per day in 2021, which is equivalent to approximately 8% of the total flow through the site. If all of these vehicles were to divert, this would be equivalent to a re-assignment of approximately 2 vehicles every 3 minutes throughout the day, although this figure would be higher in the peaks. It seems reasonable to assume, however, that not all of the non-compliant vehicles would re-assign, as some drivers would choose to either pay the charge or to upgrade their vehicles. (It has not, however, been possible to determine the scale of these responses, as the behavioural impacts of the CAP proposals were not modelled for through trips). It should also be borne in mind that whilst the GM CAZ is primarily designed to improve air quality with the county, it will also provide benefits outside the region from cleaner vehicles affected by the CAZ travelling elsewhere, which are likely to be greater for areas close to the scheme.

5 Conclusions

5.1 This report has described the analysis that has been carried out to assess the potential road traffic impacts of the proposed GM CAZ on roads in neighbouring district authorities.

5.2 The report highlights several limitations to the modelling in the external area which must be borne in mind when considering the results. It is not thought, however, that the CAZ will have a significant impact on traffic flows on roads in the surrounding area, although the impacts will clearly vary by location, depending on the level of interaction with Greater Manchester, flows of non-compliant vehicles and the availability of diversion routes. It is also likely, however, that the scheme will deliver air quality improvements on routes to and from the County, which will provide air quality benefits in the surrounding districts.

5.3 The analysis that has been carried out so far has focussed on the proportions of non-compliant vehicles at sites on the county boundary which could re-route to avoid paying the CAZ charge. It would, however, be possible to use the models to identify the origins and destinations of traffic that might re-assign and possible re-assignment routes, subject to the uncertainty surrounding the modelling in the external area referred to above. Neighbouring authorities might also have their own (more detailed) local models that could be used to assess the re-assignment effects outside the scheme area, if necessary.

Table 4-1 GM CAP Study Modelled Do-Something AAWT Flows for All Roads Crossing the GM County Boundary Broken Down By Vehicle Type (00:00 to 24:00, Inbound + Outbound Vehicles Flows, Excluding Motorways)

	2021						2023					
	All Trips			External-External (Through Trips)			All Trips			External-External (Through Trips)		
Vehicle Type	Compliant + Non-Compliant Vehicles (A)	Non-Compliant Vehicles (B)	Percentage Compliant (A-B/A)	Compliant + Non-Compliant Vehicles (C)	Non-Compliant Vehicles (D)	Percentage compliant (C-D/C)	Compliant + Non-Compliant Vehicles (A)	Non-Compliant Vehicles (B)	Percentage Compliant (A-B/A)	Compliant + Non-Compliant Vehicles (C)	Non-Compliant Vehicles (D)	Percentage Compliant (C-D/C)
Car	945,000	0	100%	166,000	0	100%	966,000	0	100%	168,000	0	100%
LGV	134,000	0	100%	7,000	0	100%	138,000	10,000	93%	7,000	2,000	69%
HGV	92,000	11,000	88%	34,000	10,000	71%	95,000	7,000	92%	35,000	6,000	82%
Taxi + Private Hire	49,000	7,000	86%	NA	NA	NA	51,000	4,000	93%	NA	NA	NA
Total	1,220,000	18,000	98%	207,000	10,000	95%	1,250,000	21,000	98%	210,000	8,000	96%

Notes:

1. External-external trips are not modelled for Taxi + Private Hire Vehicles
2. Totals have been rounded to the nearest 1000 trips
3. Percentages are based on unrounded totals

Table 4-2 GM CAP Study Modelled Do-Something Two-Way AAWT Flows for Roads Crossing the GM County Boundary (00:00 to 24:00, All Vehicles, Excluding Buses)

Site ID	Road Number	Neighbouring Authority	2021			2023		
			All Trips	External-External (Through) Trips		All Trips	External-External (Through) Trips	
			Compliant + Non-Compliant Vehicles	Non-Compliant Through Trips	Percentages of Non-Compliant Through Trips	Compliant + Non-Compliant Vehicles	Non-Compliant Through Trips	Percentages of Non-Compliant Through Trips
			(A)	(B)	(B/A)	(A)	(B)	(B/A)
1	A56	Cheshire East	37,600	60	0.2%	38,000	40	0.1%
2	Ashley Road	Cheshire East	3,800	0	0.0%	4,200	0	0.0%
3	Mill Lane	Cheshire East	1,200	10	0.4%	1,200	10	1.1%
4	A538	Cheshire East	37,900	480	1.3%	39,000	460	1.2%
5	B5166	Cheshire East	14,100	0	0.0%	14,700	0	0.0%
6	A555	Cheshire East	32,600	650	2.0%	33,800	460	1.3%
7	B5358	Cheshire East	26,700	50	0.2%	27,100	60	0.2%
8	A555	Cheshire East	36,200	560	1.5%	37,200	400	1.1%
9	Earl Road	Cheshire East	1,400	0	0.0%	1,500	0	0.0%
10	A34	Cheshire East	38,300	10	0.0%	40,100	40	0.1%
11	A555	Cheshire East	55,200	570	1.0%	57,300	420	0.7%
12	A555	Cheshire East	55,200	570	1.0%	57,300	420	0.7%
13	A5102	Cheshire East	13,000	100	0.7%	13,300	130	1.0%
14	A5149	Cheshire East	35,700	230	0.6%	36,700	240	0.7%
15	Woodford Road	Cheshire East	11,500	30	0.2%	11,400	20	0.2%
16	A523	Cheshire East	25,000	130	0.5%	25,200	250	1.0%
17	A6	Cheshire East	32,200	390	1.2%	31,800	430	1.3%
18	Jacksons Edge Road	Cheshire East	6,800	130	1.9%	7,300	80	1.1%
19	B6101	Cheshire East	6,900	110	1.6%	38,000	40	0.1%

Table 4 Continued

Site ID	Road Number	Neighbouring Authority	2021			2023		
			All Trips	External-External (Through) Trips		All Trips	External-External (Through) Trips	
			Compliant + Non-Compliant Vehicles	Non-Compliant Through Trips	Percentages of Non-Compliant Through Trips	Compliant + Non-Compliant Vehicles	Non-Compliant Through Trips	Percentages of Non-Compliant Through Trips
			(A)	(B)	(B/A)	(A)	(B)	(B/A)
20	Briargrove Road	High Peak	6,600	0	0.1%	7,200	80	1.1%
21	A626	High Peak	15,600	110	0.7%	7,000	10	0.1%
22	Long Lane	High Peak	10,700	0	0.0%	16,000	120	0.8%
23	A57	High Peak	31,600	140	0.4%	11,400	0	0.0%
24	A628	High Peak	18,000	580	3.2%	31,400	180	0.6%
25	A635	Kirklees	17,000	10	0.1%	18,900	470	2.5%
26	A62	Kirklees	20,300	110	0.5%	18,000	20	0.1%
27	A640	Kirklees	11,900	20	0.1%	20,800	100	0.5%
28	A672	Calderdale	6,500	10	0.1%	12,400	10	0.1%
29	A58	Calderdale	17,600	30	0.1%	6,700	10	0.2%
30	B6138	Calderdale	16,400	50	0.3%	18,000	50	0.3%
31	A6033	Calderdale	200	0	0.0%	16,900	70	0.4%
32	Calderbrook Road	Calderdale	4,400	70	1.7%	100	0	0.0%
33	A671	Rossendale	21,200	10	0.0%	4,400	70	1.5%
34	B6377	Rossendale	8,600	10	0.1%	21,600	0	0.0%
35	A680	Rossendale	12,800	30	0.2%	8,600	0	0.0%
36	Bury Road	Rossendale	600	0	0.0%	13,300	20	0.2%
37	A56	Rossendale	5,500	0	0.0%	700	0	0.0%
38	A676	Rossendale	11,600	0	0.0%	5,600	0	0.0%
39	B6214	Rossendale	21,500	60	0.3%	11,900	0	0.0%

Table 4 Continued

Site ID	Road Number	Neighbouring Authority	2021			2023		
			All Trips	External-External (Through) Trips		All Trips	External-External (Through) Trips	
			Compliant + Non-Compliant Vehicles	Non-Compliant Through Trips	Percentages of Non-Compliant Through Trips	Compliant + Non-Compliant Vehicles	Non-Compliant Through Trips	Percentages of Non-Compliant Through Trips
			(A)	(B)	(B/A)	(A)	(B)	(B/A)
40	Bury Road	Blackburn & Darwen	7,800	10	0.2%	8,000	10	0.1%
41	B6391	Blackburn & Darwen	3,200	0	0.0%	3,200	0	0.0%
42	A666	Blackburn & Darwen	21,000	140	0.6%	21,500	110	0.5%
43	Longworth Road	Blackburn & Darwen	5,000	0	0.0%	4,900	0	0.0%
44	A675	Blackburn & Darwen	5,700	0	0.1%	6,400	10	0.2%
45	Scout Road	Blackburn & Darwen	8,800	0	0.0%	9,200	0	0.0%
46	A673	Chorley	12,400	50	0.4%	12,900	30	0.2%
47	A6	Chorley	16,200	260	1.6%	17,300	200	1.2%
48	A5106	Chorley	19,800	130	0.6%	19,900	80	0.4%
49	A49	Chorley	29,700	450	1.5%	30,400	360	1.2%
50	Boundary Lane	West Lancashire	10,200	100	1.0%	10,100	90	0.9%
51	A5209	West Lancashire	28,500	520	1.8%	28,900	410	1.4%
52	Back Lane	West Lancashire	3,200	0	0.0%	3,500	20	0.7%
53	B5375	West Lancashire	7,200	0	0.0%	7,000	0	0.0%
54	MILL LANE	West Lancashire	2,100	0	0.0%	2,800	20	0.8%
55	A577	West Lancashire	2,700	0	0.0%	4,500	0	0.0%
56	Sefton Road	West Lancashire	2,600	0	0.0%	1,700	0	0.0%
57	Sandbrook Road	West Lancashire	6,000	40	0.7%	6,500	80	1.2%

Table 4 Continued

Site ID	Road Number	Neighbouring Authority	2021			2023		
			All Trips	External-External (Through) Trips		All Trips	External-External (Through) Trips	
			Compliant + Non-Compliant Vehicles	Non-Compliant Through Trips	Percentages of Non-Compliant Through Trips	Compliant + Non-Compliant Vehicles	Non-Compliant Through Trips	Percentages of Non-Compliant Through Trips
			(A)	(B)	(B/A)	(A)	(B)	(B/A)
58	Crank Road	St Helens	10,700	410	3.9%	9,900	220	2.2%
59	B5206	St Helens	10,300	110	1.1%	11,300	100	0.9%
60	A571	St Helens	8,800	10	0.1%	7,200	20	0.2%
61	Ashton Road	St Helens	2,800	0	0.0%	2,900	0	0.0%
62	Booth's Brow Road	St Helens	3,900	0	0.0%	3,900	0	0.0%
63	B5207	St Helens	2,100	0	0.0%	2,200	0	0.0%
64	Low Bank Road	St Helens	4,000	0	0.0%	4,000	0	0.0%
65	A58	St Helens	12,500	950	7.6%	12,300	810	6.6%
66	A49	St Helens	29,700	0	0.0%	30,000	0	0.0%
67	A580	St Helens	61,400	460	0.8%	62,200	430	0.7%
68	Rob Lane	St Helens	1,400	0	0.0%	1,300	0	0.0%
69	A573	St Helens	10,000	30	0.3%	10,400	30	0.3%
70	A572	St Helens	4,000	0	0.0%	4,200	10	0.1%

Table 4 Continued

Site ID	Road Number	Neighbouring Authority	2021			2023		
			All Trips	External-External (Through) Trips		All Trips	External-External (Through) Trips	
			Compliant + Non-Compliant Vehicles	Non-Compliant Through Trips	Percentages of Non-Compliant Through Trips	Compliant + Non-Compliant Vehicles	Non-Compliant Through Trips	Percentages of Non-Compliant Through Trips
			(A)	(B)	(B/A)	(A)	(B)	(B/A)
71	A579	Warrington	15,900	140	0.9%	16,200	110	0.7%
72	B5207	Warrington	3,900	10	0.3%	4,100	10	0.2%
73	A574	Warrington	18,300	30	0.2%	18,900	20	0.1%
74	A580	Warrington	42,000	590	1.4%	43,400	550	1.3%
75	A57	Warrington	30,000	30	0.1%	30,600	70	0.2%
76	Warburton Bridge Rd	Warrington	17,200	0	0.0%	17,400	0	0.0%
77	A6144	Warrington	8,700	0	0.0%	8,800	0	0.0%
78	M62	Warrington	155,200	3,990	2.6%	157,700	3,240	2.1%
79	M62	Calderdale	139,500	3,470	2.5%	144,400	3,170	2.2%
80	M6	St Helens	145,200	5,270	3.6%	151,900	6,010	4.0%
81	M6	West Lancashire	140,400	6,990	5.0%	143,900	7,380	5.1%
82	M58	West Lancashire	60,400	1,300	2.1%	61,600	1,090	1.8%
83	M66	Rossendale	70,300	1,670	2.4%	73,400	1,260	1.7%
84	M61	Chorley	92,900	390	0.4%	96,000	390	0.4%
85	M56	Cheshire East	152,500	1,490	1.0%	159,800	1,270	0.8%

Notes:

3. Figures in columns A have been rounded to the nearest 100 trips

4. Figures in columns B have been rounded to the nearest 10 trips

5. Percentages are based on unrounded totals

Table 4-3 20 Sites With Highest Non-Compliant Through Trip Flows (AAWT, 00:00 to 24:00, All Vehicles, Excluding Buses)

Site ID	Road Number	Neighbouring Authority	2021	% of Total flow Through Site	2023	% of Total Flow Through Site
65	A58	St Helens	950	7.6%	810	6.6%
6	A555	Cheshire East	650	2.0%	460	1.3%
74	A580	Warrington	590	1.4%	550	1.3%
24	A628	High Peak	580	3.2%	470	2.5%
11	A555	Cheshire East	570	1.0%	420	0.7%
12	A555	Cheshire East	570	1.0%	420	0.7%
8	A555	Cheshire East	560	1.5%	400	1.1%
51	A5209	West Lancashire	520	1.8%	410	1.4%
4	A538	Cheshire East	480	1.3%	460	1.2%
67	A580	St Helens	460	0.8%	430	0.7%
49	A49	Chorley	450	1.5%	360	1.2%
58	Crank Road	St Helens	410	3.9%	220	2.2%
17	A6	Cheshire East	390	1.2%	430	1.3%
47	A6	Chorley	260	1.6%	200	1.2%
14	A5149	Cheshire East	230	0.6%	240	0.7%
23	A57	High Peak	140	0.4%	180	0.6%
42	A666	Blackburn &h Darwen	140	0.6%	110	0.5%
71	A579	Warrington	140	0.9%	110	0.7%
16	A523	Cheshire East	130	0.5%	250	1.0%
18	Jacksons Edge Road	Cheshire East	130	0.6%	80	0.4%

Notes:

1. Flows have been rounded to the nearest 10 trips

Figure 4-1 2016 Saturn Network

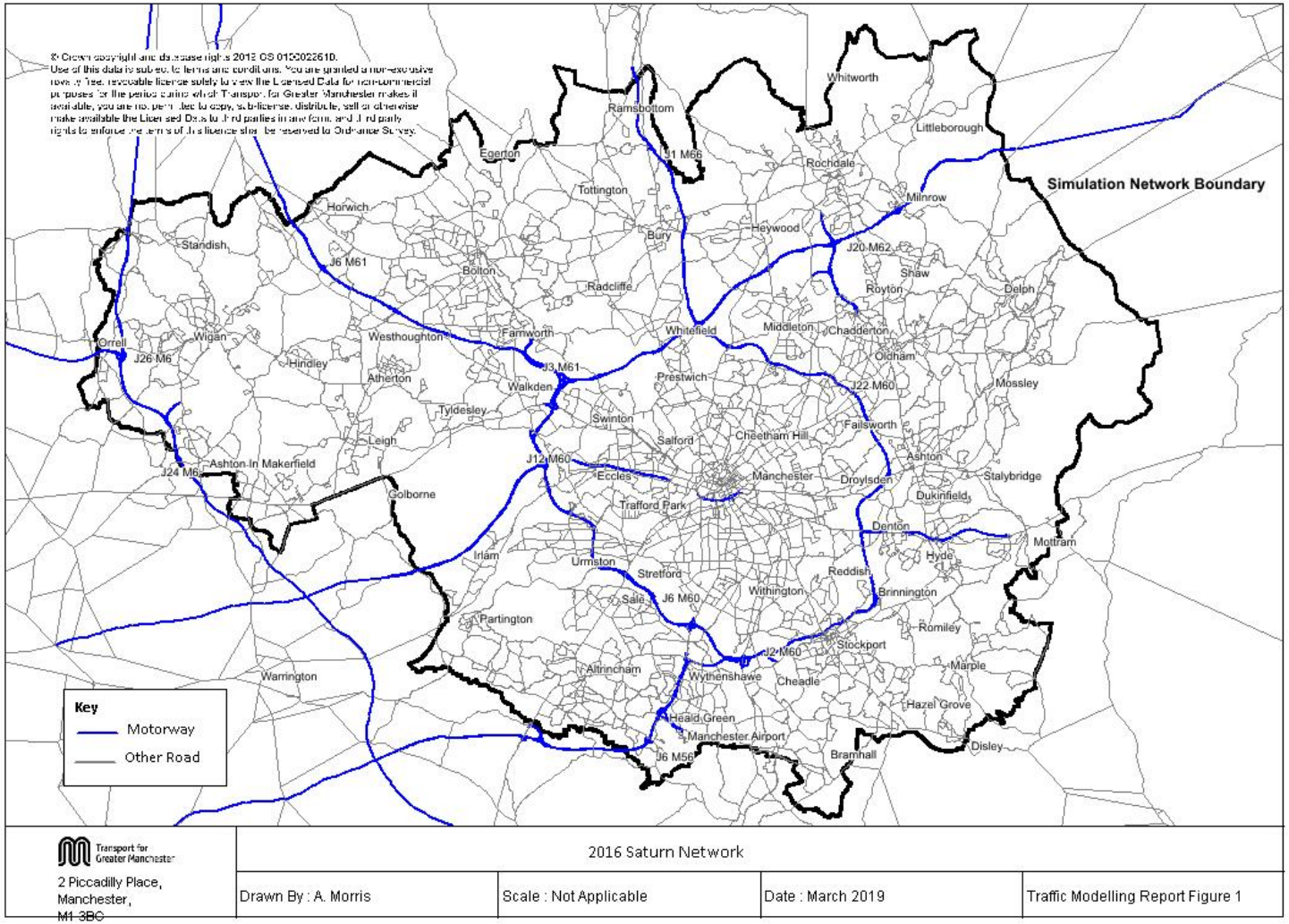
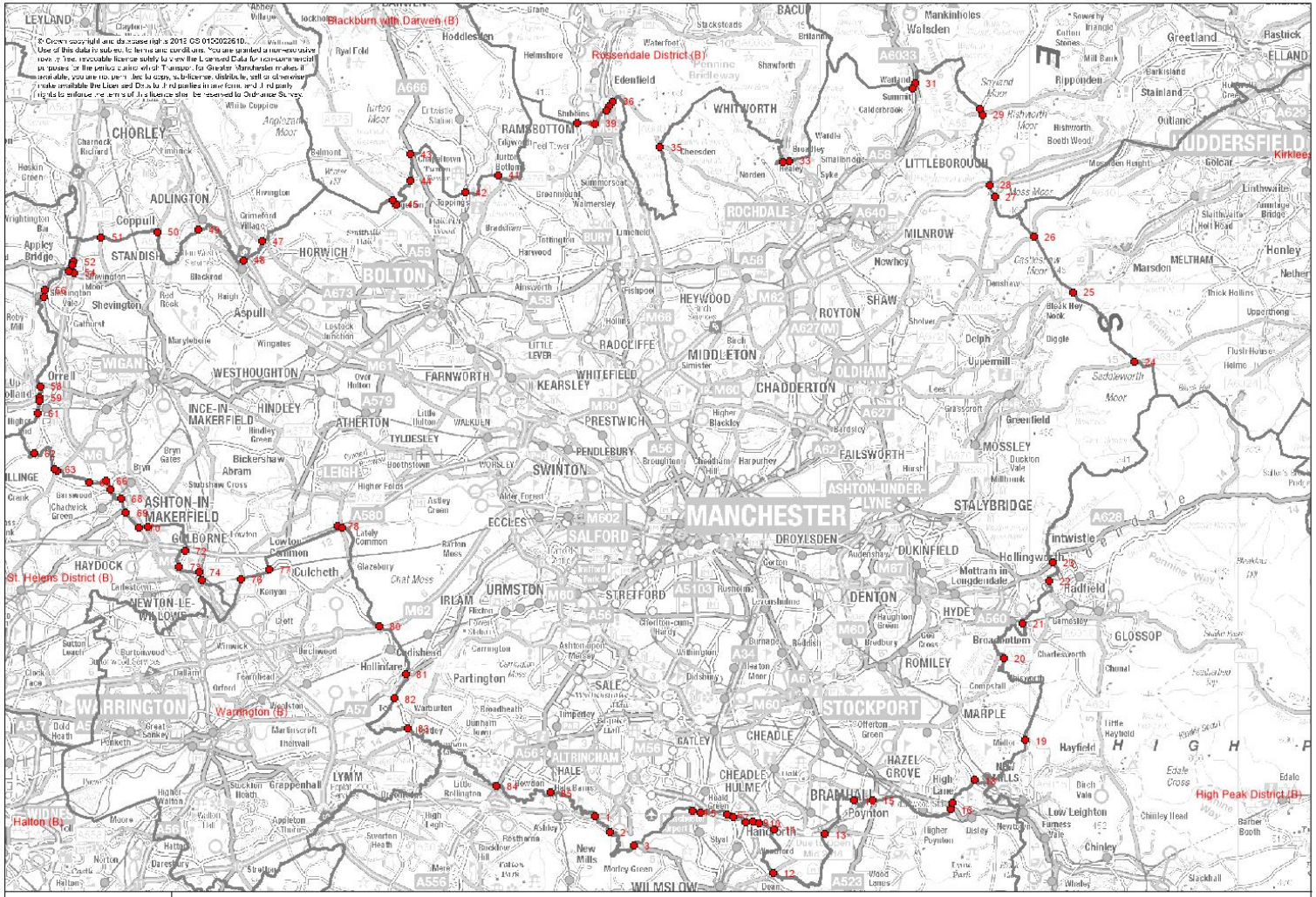


Figure 4-2 External Cordon Crossing Sites



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

Note 15: Implications of the EFT update for the GM CAP

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Version Status:	2nd DRAFT FOR APPROVAL	**Prepared by:**	Tony Morris 28th October 2019
Authorised by: **Date:**	Ian Palmer 1st November 2019		

1 Introduction

1.1 The purpose of this Note is to describe the implications of the revised Emissions Factor Toolkit (EFT) for the Greater Manchester Clean Air Plan (GM CAP). The analysis has been undertaken by running a sensitivity test to investigate the impacts of changes to the EFT on forecast NOx emission totals from the 2023 OBC do-minimum modelling. The note describes the test and presents the results of the analysis.

2 Update to EFT

2.1 GM's methodology for calculating traffic emissions applies emissions factors derived from the Department for Environment, Food & Rural Affairs (DEFRA) Emission Factor Toolkit (EFT). The air quality modelling for the OBC used outputs from version 8.0 of the software, which was released in November 2017.

2.2 Subsequently, DEFRA released EFT v9.0 aligning the fleet figures in the EFT with those in the most recent Pollution Climate Mapping (PCM) base year projections (2017).

2.3 At the end of May 2019, JAQU issued an update to the toolkit, EFT version 9.1a. This is a non-standard EFT update, which has has been produced for local authorities (LAs) developing Clean Air Plans plans only (and thus is only available on Huddle). This version of EFT contains fleet figures derived 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.

2.4 In particular, the update reflects the recent trends in new car sales, which have slowed overall and have also shown a shift away from diesel car purchases and towards petrol and electric cars.

2.5 Updates to the EFT between versions 8.0 and 9.1.a include:

- Updates to the basic fleet assumptions for 2017-2030 in line with DfT, National Atmospheric Emissions Inventory (NAEI) and Transport for London (TfL) projections;
- Updates to Euro class compositions for 2017-2030 in line with DfT, NAEI, and TfL data (inclusive of Euro 6 subcategories);
- Updated fuel scaling factors for Particulate Matter (PM); and
- An update of the basic fleet split assumptions and Euro class compositions for passenger cars for 2017-2030 in line with the latest DfT figures for the projected split (by vkms) of diesel, petrol and electric cars.

2.6 The updated tools also include several additional user options including:

- Inclusion of a new ‘Advanced Fleet Projection Tool’ that allows users to project their user defined Euro fleet information from a base year (e.g. a local Euro fleet derived from Automatic Number Plate Recognition (ANPR) surveys) to a future projection year;

- Inclusion of a function for projecting the proportions of diesel, petrol and electric cars from a base year of traffic monitoring to an assessment year; and

- Inclusion of CO2 emissions for User Defined Euro Classes, either entered via the Euro Compositions or Simple Entry Euro Compositions ‘Advanced Options’.

2.7 Further details of the EFT updates are available in ‘EFT v9.0 and v9.1a release summary’, DEFRA May 2019.

2.8 Associated air quality modelling tools were also released, these included an updated ‘NO_x to NO_2 Calculator’ and the background maps.

3 JAQU recommendations for local authorities

3.1 JAQU’s assessment is that the fleet projections in EFT v9.1a represent the best evidence currently available at a national level regarding the future of the vehicle fleet. JAQU have advised that second wave authorities still developing modelling, including GM, can use the updated EFT v9.1a in modelling provided this does not result in any delay to delivery against Ministerial Direction deadlines. Alternatively, they have advised that EFT v9.1a can be used to run a sensitivity test to provide reassurance that use of this updated tool would not change the overall conclusion of the assessment, again provided this does not result in any delay to delivery against Ministerial Direction deadlines.

3.2 It should be noted that, because JAQU deemed it necessary to provide NO_2 plan LAs with the latest DfT fleet projections as soon as possible, background maps have not been updated such that they are consistent with these fleet projections (and it is for this reason that EFT v9.1a has not been made publicly available). The latest (2017 base year) background maps are available on the LAQM website, and these maps are consistent with the fleet figures in EFT v9.0. JAQU’s assessment is that it is acceptable for NO_2 plan LAs to use EFT v9.1a in conjunction with the 2017 base year background maps to calculate total roadside NO2 concentrations, provided that this is noted as an inconsistency in modelling methodology reports and the analytical assurance statement.

3.3 The GM modelling uses the 2015 projection background mapping because the 2017 wasn’t published when the GM modelling was commenced. JAQU have confirmed that the guidance with respect to the use of inconsistent background maps/tools with the EFTv9.1 holds for all reference years, including the 2015 version.

3.4 The GM CAP OBC forecasts that compliance cannot be achieved until 2024 in the region. The relatively long forecasting window compared to other cities means that the impact of the trends underpinning the JAQU tools on the reliability of GM's modelling is potentially greater than for many cities developing plans.

4 GM approach to calculating traffic emissions at OBC

4.1 The base year (2016) fleet mix for the GM CAP study was derived using ANPR supplied by Greater Manchester Police (GMP). The Euro class composition for 2016 was obtained by identifying the date of registration from the licence plate number, which were matched against the date of enforcement of the relevant Euro standard to develop the Euro standard for that vehicle type. This approach was adopted because licence plates from GMP could not be issued onwards due to Data Protection, and therefore direct matching with the DVLA database was not possible.

4.2 The fleet mix for forecast years is estimated using a 'roll-over' model to adjust the base composition for forecast years. This approach keeps the vehicle age constant for any given future year (e.g. 2021), and then re-calculates the Euro standard at this point in time. The method conserves the age distribution of the vehicle population for each vehicle/fuel type. Details of the derived Euro and fuel fleets splits are provided in the GM CAP OBC supplementary report T3 (available at https://cleanairgm.com/outline-business-case) for each forecast year.

4.3 Additional project specific ANPR surveys have been undertaken in 2019 at areas of predicted exceedance, and a review of the data against assumptions of age and the projection methodology has been carried out. The results of this analysis are described in the accompanying note 'Note 5 - GM ANPR Surveys: Summary of Initial Findings'. The analysis shows that there are not major differences between observed levels of compliance in the overall GM fleet between the 2016 and 2019 surveys.

4.4 The road traffic emission factors for the OBC were derived using EFT version 8.0 by selecting the 'Advanced/Euro Composition' options. The appropriate Euro fleet splits were then entered in the 'UserEuro' worksheet to obtain emission rates in g/km for motorway and non-motorway road types, for speeds between 5kph and 115kph (at 5 kph intervals), for NOx and NO_2 to calculate f-NO_2, PM_{10} and $PM_{2.5}$. These derived emission rates were then fed into GM's in-house EMIGMA (EMissions Inventory for Greater Manchester) software to derive total emissions for each pollutant and vehicle type for each link in the highway model for each modelled scenario.

4.5 The EMIGMA software uses information about traffic speeds and flows from the highway model in association with the fleet-weighted emission rates (described above) to calculate mass road traffic emissions broken down by vehicle type, an approach accepted by the T-IRP.

4.6 The emission rates derived from the EFT represent the 'All Vehicle' figures from the 'Output' worksheet, which are calculated separately by vehicle type by setting the traffic flows in the 'Input Data' worksheet equal to 1 and the '% Petrol Car' figure equal to 100% to calculate petrol car rates, the '% Diesel Car' figure equal to 100% to calculate diesel car rates etc.

4.7 The allvehicle emission rates include contributions from alternative technologies based on national projections. This ensures that the increased proportions of EVs and hybrids in future years are captured in the emission factors that are input to the EMIGMA software, and therefore included in the forecasts.

4.8 These total emissions are then input into the dispersion model. The outputs of the dispersion model for NO_x and f-NO_2 at every monitoring site and receptor were used to calculate the f-NO_2 ratio for every output location for the OBC.

5 Petrol/Diesel Car Splits

5.1 The EMIGMA software uses information about petrol/diesel splits to disaggregate compliant and non-compliant vehicle flows from the highway model by fuel type.(The petrol/diesel splits are also used as part of process for building the compliant and non-compliant higway assignment matrices, to reflect differences in compliance by method of propulsion.)

5.2 JAQU's guidance for forecasting petrol/diesel splits makes use of information about the ratios of petrol and diesel powered cars in the base and forecast years from national data, which is then applied to the local base year ratio (calculated from ANPR data) to obtain local forecast splits for each vehicle category.

5.3 Updated information about petrol/diesel splits from national data for input to the above process are not currently available. It was decided, therefore, to investigate the potential use of the new Petrol/Diesel projection tool in version 9.1.a of the EFT to forecast the Petrol/Diesel car splits in GM based on observations from our 2016 ANPR data. It appears, however, that the tool can sometime produce anomalous results, whereby forecast petrol/diesel splits do not change despite changes to the base year figures. (DEFRA have been notified about this, but the issue has yet to be resolved). As an alternative, therefore, we decided to adopt a 'mixed' approach, which used the guidance provided by JAQU (described above), but replaced the base and forecast year petrol/diesel car splits from the national data which are used in process with information about petrol/diesel splits for forecast years derived from version 9.1.a of the EFT for roads in "England, Outside London".

5.4 These updated forecasts produce a small increase in the forecast proportions of petrol cars for years 2018-2025 (compared to our earlier forecasts), as illustrated in **Table 5-1**.

Table 5-1: Comparisons of GM Petrol/Diesel Split Forecasts in National Fleet Data (as applied at OBC) and the EFT v9.1a

	OBC Petrol/Diesel Splits based on Local Fleet Projection Methodology and National Fleet Data from Table 1				Revised Petrol/Diesel Splits based on Local Fleet Projection Methodology, but replacing National Fleet data from Table 1 with information about the Basic Fleet Split from Version 9.1.a of the EFT			
	Cars inc Taxis		Cars exc Taxis		Cars inc Taxis		Cars exc Taxis	
Percentage Journeys	Petrol Car %	Diesel Car %	Petrol Car %	Diesel Car %	Petrol Car %	Diesel Car %	Petrol Car %	Diesel Car %
GM 2016	50.7	49.3	54.1	45.9	50.7	49.3	54.1	45.9
GM 2017	49.2	50.8	52.6	47.4	48.9	51.1	52.4	47.6
GM 2018	48.2	51.8	51.7	48.4	50.2	49.8	53.7	46.3
GM 2019	47.7	52.3	51.2	48.8	50.4	49.6	53.8	46.2
GM 2020	47.7	52.3	51.1	48.9	50.7	49.3	54.2	45.9
GM 2021	47.8	52.2	51.2	48.8	51.3	48.7	54.7	45.3
GM 2022	48.1	51.9	51.5	48.5	51.9	48.1	55.3	44.7
GM 2023	48.6	51.5	52.0	48.0	52.6	47.4	56.0	44.0
GM 2024	49.2	50.8	52.7	47.4	53.4	46.6	56.8	43.2
GM 2025	50.2	49.8	53.6	46.4	54.3	45.7	57.7	42.3

5.5 The results are in line with expectations, with the new projections showing lower diesel proportions in future years and the difference between the old and new projections increasing over time. The updated results for 2023 indicate that approximately 56% of cars (excluding taxis) are forecast to be petrol powered, with 44% of cars being diesel powered. The earlier forecasts assumed that 52% of cars would be petrol powered with 48% of cars being diesel powered.

6 Sensitivity test applying EFT v9.1a to 2023 GM OBC Do-Minimum

6.1 The revised petrol/diesel splits described above were used as inputs to the sensitivity test to produce revised NO_x forecasts for the 2023 OBC do-minimum modelling. The sensitivity test was implemented in four steps:

- First updated emission factors and petrol/diesel splits were calculated as described above;
- Next, updated assignment matrices (for compliant and non-compliant vehicle types), which were consistent with the new fleet forecasts were formed;
- Next, the updated matrices were assigned to the highway networks and the networks 'converged'; and
- Finally, modelled flows and speeds from the assignments were input to EMIGMA to calculate mass emission totals for the test.

7 Inplications of The EFT Update for the GM CAP

7.1 Changes in modelled vehicle kilometre totals are shown in **Table 7-1**. The results show that non-compliant car vehicle kilometre totals for the test are approximately 5% lower compared to the OBC do-minimum forecast. Non-compliant Taxi vehicle kilometres are approximately 3% lower than OBC do-minimum. Compliant car and Taxi flows for the test are approximately 1% greater than the OBC do-minimum totals, in both the Regional Centre and across GM as a whole. This reflects the changes to the petrol/diesel splits highlighted in **Table 5-1**, and higher rates of compliance for petrol powered vehicles.

7.2 Modelled vehicle kilometre totals for other vehicle types (including LGVs) have not changed, as these vehicle types were assumed to be diesel powered in the modelling and are not therefore affected by the changes to the forecast petrol/diesel splits.

7.3 Changes in mass NO_x emission totals are shown in

7.4

7.5 **Table 7-*2***, for all vehicles combined. The results indicate that NO_x emissions in the Regional Centre are approximately 0.5% lower for the test compared to the OBC do-minimum figure, with corresponding reductions of approximately 3% for GM as a whole.

7.6 In general, the NO_x impacts of the test are less marked in the Regional Centre because the changes to the EFT mainly affect the proportions of petrol and diesel powered cars/taxis, and emissions from these vehicle types are proportionally lower in in the central area, where emissions from buses are more significant.

Table 7-1: Annual Vehicle KM Totals for Compliant and Non-Compliant Vehicle Types (Millions, 2023)

Vehicle Type	Regional Centre			GM		
	OBC DM	Sensitivity Test	% Change	OBC DM	Sensitivity Test	% Change
Compliant Car	48	48	0.8%	11,525	11,620	0.8%
Non-Compliant Car	8	8	-4.8%	1,971	1,877	-4.8%
All Car	56	56	0.0%	13,496	13,497	0.0%
Compliant LGV	7	7	0.1%	1,911	1,911	0.0%
Non-Compliant LGV	3	3	0.1%	903	903	0.0%
All LGV	10	10	0.1%	2,814	2,815	0.0%
Compliant OGV	1	1	0.0%	848	848	0.0%
Non-Compliant OGV	0	0	0.1%	185	185	0.0%
All OGV	1	1	0.0%	1,032	1,032	0.0%
Compliant Taxi	3	3	0.9%	677	683	0.8%
Non-Compliant Taxi	1	1	-3.1%	189	184	-2.8%
All Taxi	4	4	0.0%	866	866	0.0%
Bus	6	6	0.0%	118	118	0.0%
Total	77	77	0.0%	18,327	18,328	0.0%

Table 7-2: 2023 NOx Emissions (Tonnes Per Year)

Location	OBC Do Minimum	Sensitivity Test	% Change
Regional Centre	55	55	-0.5%
Greater Manchester	6,385	6,217	-2.6%

Notes: *Totals may not sum due to rounding.*

8 Summary

8.1 This Note has investigated the implications of the revised Emissions Factor Toolkit for the GM CAP. The analysis has been undertaken by running a sensitivity test to investigate the impacts of changes to the EFT on forecast NOx emission totals from the 2023 OBC do-minimum modelling.

8.2 The results of the analysis indicate that mass NO_x emissions across the County as a whole have reduced by approximately 3% compared to the OBC figure. The changes in petrol/diesel car splits will also have implications for NO_2 concentrations, with petrol cars having lower primary NO_2 emissions compared to diesel. The implications of this are reported separately in the note 'TfGM CAP Option for Consultation Modelling Summary v0.3 FINAL for JAQU 23-10-19'.

8.3 The revisions to the NO_x to NO_2 calculator (v7.1) and background maps (2017-based) will also affect the modelled concentrations. However, understanding the implications for this is difficult, because these tools do not contain a 2016 reference year, only covering the range 2017-2030. TfGM specifically contacted JAQU to request that the updated maps and tools were built to include 2016, but our understanding is that this has not happened.

8.4 It is noted that EFT v9.1a does include 2016 functionality, although the v9.0, which is publicly available for LAQM usage, is restricted to 2017-2030.

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

Note 18: Minibus Vehicle Research

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Version Status:	DRAFT FOR APPROVAL	**Prepared by:**	Oli Baldwin 31st July 2019
Authorised by: **Date:**	Ian Palmer 5th August 2019		

1 Introduction

1.1 The ten local authorities of Greater Manchester (GM) have been instructed by the government to produce a Clean Air Plan (CAP) to set out how they will target and mitigate areas of poor air quality within their boundaries. GM has decided to coordinate a Combined Authority response to this request, which is being managed on behalf of the 10 districts by Transport for Greater Manchester (TfGM).

1.2 Currently, the CAP includes plans for a Clean Air Zone (CAZ) which would apply a charge (Table 1) to commercial vehicles (buses, minibuses, coaches, Heavy Goods Vehicles (HGVs), Light Goods Vehicles (LGVs), taxis and private hire vehicles (PHVs)). To help mitigate the adverse effects of this charge, the CAP will include a number of 'Clean Vehicle Funds' and a Loan Finance Scheme. These will provide grants and affordable loans (respectively) to eligible businesses affected by the charge.

1.3 To determine the scope and definition of these funds, and the eligibility criteria, a wide range of policy development processes are being undertaken. Working Groups have been established to ensure the proposals that emerge can be stress-tested with those they will apply to. This research is designed to contribute to this body of evidence.

1.4 This technical note provides an overview of the market for the minibus vehicle category and an impact assessment of the proposed CAZ charge. It provides information on market characteristics including vehicle types, a breakdown of owners and operators, information on the second-hand and new vehicle sales markets and details of opportunities to purchase compliant vehicles or retrofit to achieve compliance. The research also identified key impacts and risks for different types of owner and operator, which will contribute to an understanding of the specific role the Clean Vehicle Funds can play in supporting these commercial sectors when the CAZ comes into force.

1.5 This information will primarily be used to assist the Coach and Minibus Working Group, Governance and Policy Workstream (WS11) and other relevant Working Groups in developing suitable policy proposals for the Funds (Freight; Taxi and LGV[1]) and Loan Finance. Depending on the type and quality of information available, it may also feed into the Data, Evidence and Modelling (DEM) Workstream (WS1) in which a lack of commercial vehicle evidence has already been identified as a project risk.

[1]The Bus Fund will be limited to operators running commercial bus route services in GM. These vehicles are not included in the scope of this research.

1.6 The objectives of this research are defined below:

Research Objectives

1. Define general market characteristics for the vehicle types in a GM context where available information allows.
2. Segment these markets by setting out the owner/user breakdown of each of these markets. Illustrate these users by providing in-depth profiles of some of the users in these markets. These case studies, or 'personas', will assist the WS11 and WS1 workstreams in developing and testing suitable policies for these sectors.

2 Study Background

2.1 Air Quality

2.1.1 Poor air quality is one of the largest environmental risks to the public's health. It is recognised that long-term exposure to elevated levels of Nitrogen Dioxide (NO_2) and microscopic particles of matter suspended in the air we breathe contributes to the development of cardiovascular or respiratory disease and reduce life expectancy. In particular, the youngest, oldest, those living in areas of deprivation and those with existing respiratory or cardiovascular disease are most likely to develop symptoms due to exposure to air pollution.

2.1.2 Whilst air quality has been generally improving over time across the United Kingdom, particular pollutants remain a serious concern in many urban areas. Since 2010, the UK has been found in breach of the legal limits of levels of NO_2 in major urban areas and in 2015 it was found that compliance with the legal limits of levels of NO_2 had still not been achieved. In response, the UK Government was held to be in breach of its legal obligations and was required to take action by the UK Supreme Court.

2.1.3 In the case of Greater Manchester, the city region has been highlighted as an area of concern with an urgent need to address air quality issues. Eight of the ten GM local authorities were identified by the Government as having roads which are expected to continue to exceed the maximum legal limits of NO_2 in 2021. Subsequently, each have been directed by Government to conduct studies to identify measures for reducing NO_2 concentrations to compliant levels in the 'shortest possible time'.

2.1.4 In response, the ten authorities of Greater Manchester, supported by Transport for Greater Manchester (TfGM), have collectively developed a draft package of measures that complies with the Government guidance for tackling NO_2 pollutants. An Outline Business Case (OBC) for these proposals was submitted to Government in early 2019[2].

[2] Greater Manchester's Outline Business Case to tackle Nitrogen Dioxide Exceedances at the Roadside

2.2 Greater Manchester's Clean Air Plan

2.2.1 The primary aim of the GM CAP is to enable Greater Manchester to reduce NO_2 concentrations to below the EU Limit Value in the shortest possible time. As outlined in the Outline Business Case (OBC), an initial package of measures that would allow the city region to meet compliance in the shortest possible time, at the lowest cost, with the least risk and with the least negative impacts, has been put forward. Key measures within the package include:

- A Clean Air Zone (CAZ) comprising charges for the most polluting commercial vehicles;
- Clean Vehicle Funds to help businesses and commercial vehicle operators to purchase compliant vehicles;
- A Loan Finance scheme, which would provide affordable loans to assist with compliant vehicle purchases;
- Investment in infrastructure, such as electric vehicle charging points; and
- Supplementary schemes such as behaviour change campaigns, Local Authority (LA) Fleet upgrades and targeted parking policy.

2.2.2 A key feature of the proposal is the CAZ charge, which targets the most polluting commercial vehicles by imposing a charge on the most polluting HGVs, LGVs, buses, coaches, minibuses and taxis and PHVs from the summer of 2021.

2.2.3 It is anticipated the charge will provide a financial incentive to the owners of commercial vehicles to invest in cleaner vehicles. At the OBC stage it was proposed that the CAZ charge would be £7.50 per day for taxis, PHVs and LGVs and £100 per day for HGVs, buses and coaches, as reflected in Table 2-1. The owners of vehicles that are subject to the charge who do not pay would be issued with a Penalty Charge Notice (PCN) and would be required to pay both that and the original charge.

Table 2-1: GM Clean Air Zone Charges

Vehicle Group	CAP Charge (per day)
Buses, Coaches and HGVs	£100 (from 2021)
Taxis and Private Hire Vehicles	£7.50 (from 2021)
Vans and Minibuses	£7.50 (from 2023)

2.2.4 Although the charges and dates outlined in the table above are those submitted as part of the OBC, recent developments within the wider CAP project has led to a proposed change in date the CAZ will come into effect. Of relevance to this study, in July 2019 a Ministerial letter providing feedback on the proposals and a Ministerial direction were received. As part of this, Government has requested that the £7.50 charge for vans and minibuses be brought into effect in 2021 in line with other vehicle types. While this development has not been formally agreed at the time of writing this report, for the purpose of this study the new working assumption is that the charge will come into effect from 2021 rather than 2023.

2.2.5 Additionally, while the charges outlined above are again from the OBC submission these are not formally agreed at this stage. Therefore, there is a possibility these chargers could change going forward. For the purpose of this study, the working assumption applied is the charges stated above.

2.3 The Need for the Study

2.3.1 The proposals to introduce a Clean Air Zone would affect minibuses, with noncompliant vehicle users required to pay the charge, upgrade their vehicle or change their behaviour. Currently, minibuses are not included in Greater Manchester's traffic model and there is no suitable source of data on the volume of minibus traffic on the local road network. There is also limited detailed information with regards to market size and user categorisations and behaviours.

2.3.2 To ensure GM understands more clearly the impact of a CAZ on the minibuses market, including owners, operators and users (i.e. passengers), this study intends to improve the knowledge of the market. This will enable a better assessment of the extent to which any potential support may be appropriate to mitigate negative impacts.

2.3.3 Leading this study is the Coach and Minibus Working Group (CMWG). The group comprises TfGM staff and consultants, such as Arup and AECOM, and reports to the GM Clean Air Steering Group. The CMWG members are responsible for ensuring that the impact of the proposals across the industry are fully understood. This involves designing the detail of the measures proposed to support the minibus market and industry and assessing the use of external funding to help renew and upgrade fleets and reduce harmful emissions. It is also envisioned that data collected on the minibus market may address the existing data gap on the sector to better inform future studies.

2.4 Document Structure

2.4.1 This report comprises the following structure:

- **The Sector:** Gives an overview of the GM minibus market, informed by existing research and data;
- **Owners and Operators:** Quantifies and profiles the owners, operators and users of the market; and
- **Findings and Recommendations:** Summaries the initial findings from this note and puts forward recommendations.

3 The Sector

3.1 This section provides an overview of the minibus market in relation to GM. This includes quantifying the market, a breakdown of compliance and an overview of low emissions, retrofitting and purchasing market.

3.2 Minibus Definition

3.2.1 A minibus is legally defined as "a vehicle with between 9 and 16 passenger seats"[3]. This does not include the driver's seat and does not permit room for standing.

3.2.2 With reference to DfT Vehicle Classifications, a minibus is considered to fall within vehicle category M, which is 'Motor vehicles with at least four wheels designed and constructed for the carriage of passengers.[4]' As **Table 3-1** shows, classification M vehicles are divided into three sub categories, with minibuses found under classification M2 as they comprise more than eight seats and exceed 5 tonnes.

Table 3-1: Categorisation of vehicles with at least four wheels and used for the carriage of passengers

Classification	Description
M1	Vehicles designed and constructed for the carriage of passengers and comprising no more than eight seats in addition to the driver's seat.
M2	Vehicles designed and constructed for the carriage of passengers, comprising more than eight seats in addition to the driver's seat, and having a maximum mass not exceeding 5 tonnes.
M3	Vehicles designed and constructed for the carriage of passengers, comprising more than eight seats in addition to the driver's seat, and having a maximum mass exceeding 5 tonnes.

[3] https://www.gov.uk/driving-a-minibus
[4] Vehicle Certification Agency, https://www.vehicle-certification-agency.gov.uk/vehicletype/definition-of-vehicle-categories.asp

3.3 Minibus Definition

3.3.1 A challenge for this study has been the lack of readily available of data on the minibus market. Where data has been available there have also been challenges surrounding the types of vehicles included within datasets and the possibility of double counting between various owner and operator types. Therefore, this study has used data that is readily available to make the most informative assumptions where possible. For the purpose of modelling as part of the wider CAP project, minibuses have not been modelled and therefore will not affect predictions for NO2 compliance but are still considered important as we consider mitigation and exemptions.

3.3.2 The primary source of data used for this study is DVLA data obtained by TfGM from DfT, for 2016 Q2[5]. While the data is from 2016, projections for 2019 and 2023 have been applied to provide estimations of the minibus market for the respective years. The estimations for 2019 have been sense checked with DfT data for March 2019[6].

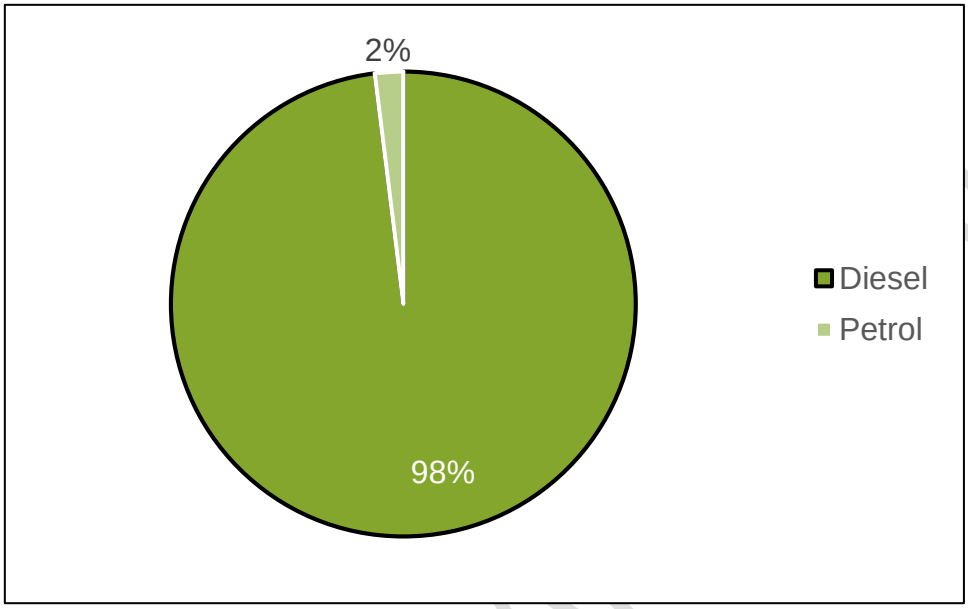
3.3.3 Furthermore, information on the minibus market has also been analysed from the Minibus Market Analysis report, prepared by the Transport and Travel Research Limited (TTR) for the Low Carbon Vehicle Partnership (LowCVP). The report was published in 2014 and is based on DVLA data from 2012, which was sense checked with The Society of Motor Manufacturers and Traders (SMMT) data.[7]

3.4 Market Overview

3.4.1 Informed by projections of the DVLA data from Q2 2016 it is estimated there are 2,693 minibuses licensed in GM (**Figure 3-1**). Of the total, 2,640 are diesel (98%) and 53 (2%) are petrol. There are no known hybrid or electric minibuses in GM based from the data provided. Sense checking these results against the DfT 2019 figures, there are 2,635 minibuses registered in GM in the 2019 data suggesting a strong alignment between the datasets and therefore providing confidence in the estimated totals. Given the confidence that the two datasets align, the remaining analysis within this report will be based on the 2016 dataset. This is because, although slightly older, this dataset has been used and analysed for other aspects across the CAP project and therefore ensures consistency of results.

[5] DfT (2018) *Analysis of DVLA registered vehicle database records* (version Q2 2016) by DfT
[6] DfT (2019) Buses and Coaches, Tables VEH06 **– please note these data were received directly from DfT.**
[7] *Minibus Market Analysis*; Transport and Travel Research. (2014)

Figure 3-1: GM Total Minibuses by Fuel Type[8]



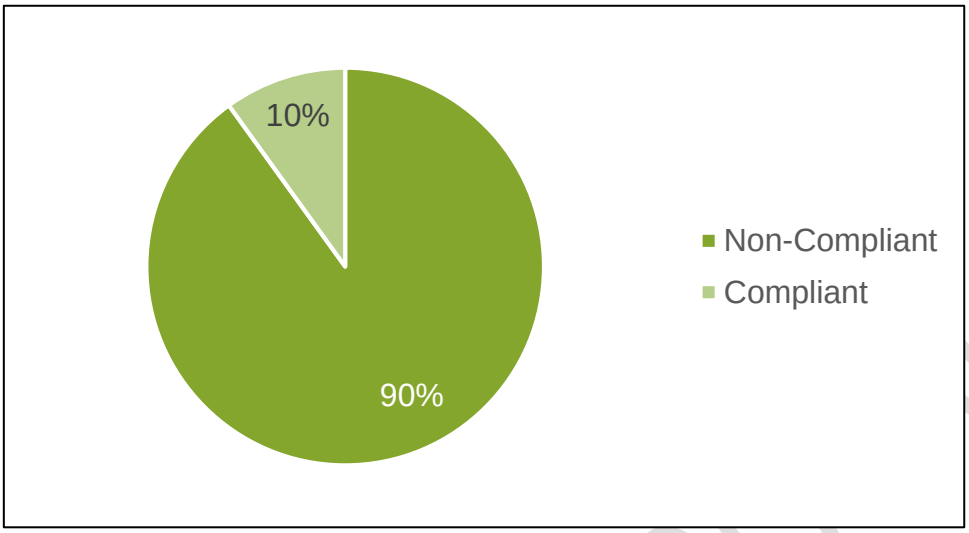
3.4.2 In terms of compliance, in relation to the CAZ, Euro 6 or later (2016) Euro Emission Standards for diesel minibuses vehicles will be considered compliant and will therefore avoid the CAZ charge. Those registered before 2016 and therefore pre-Euro 6 Emission Standards will be considered as non-compliant and will be liable to the CAZ charge.

3.4.3 The data shows there is a high rate of non-compliance (Figure 2). In total, 2,425 (90%) minibuses are non-compliant and only 268 are compliant (10%) within GM.

3.4.4 **Figure 3-2** GM Total Compliant and Non-Compliant Minibuses

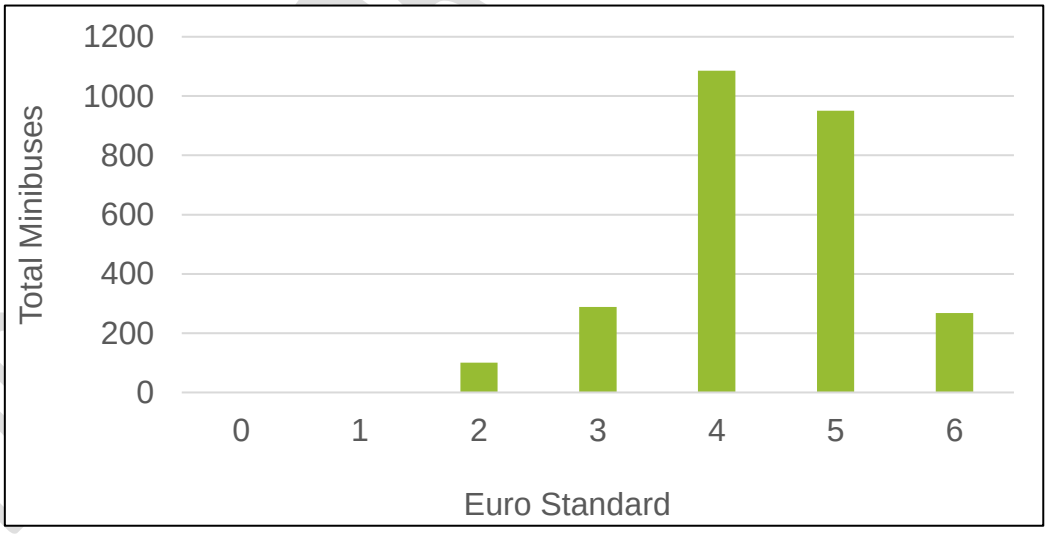
[8] DfT (2018) Analysis of DVLA registered vehicle database records (version Q2 2016) by DfT

Figure 3-2: GM Total Compliant and Non-Compliant Minibuses[9]



3.4.5 By Euro Standard (**Figure 3-3**), from the 2016 projections a total of 1,086 (40%) minibuses were identified as Euro 4 and 950 (35%) minibuses as Euro 5, making up the greatest proportion of Euro Standard types. The next largest Standard was Euro 3 with 288 (11%) vehicles, followed by Euro 6 with 268 (10%) and Euro 2 with101 (4%). No Euro 1 or pre-Euro 1 vehicles were identified within the database.

Figure 3-3: GM Total Minibuses by Euro Standard



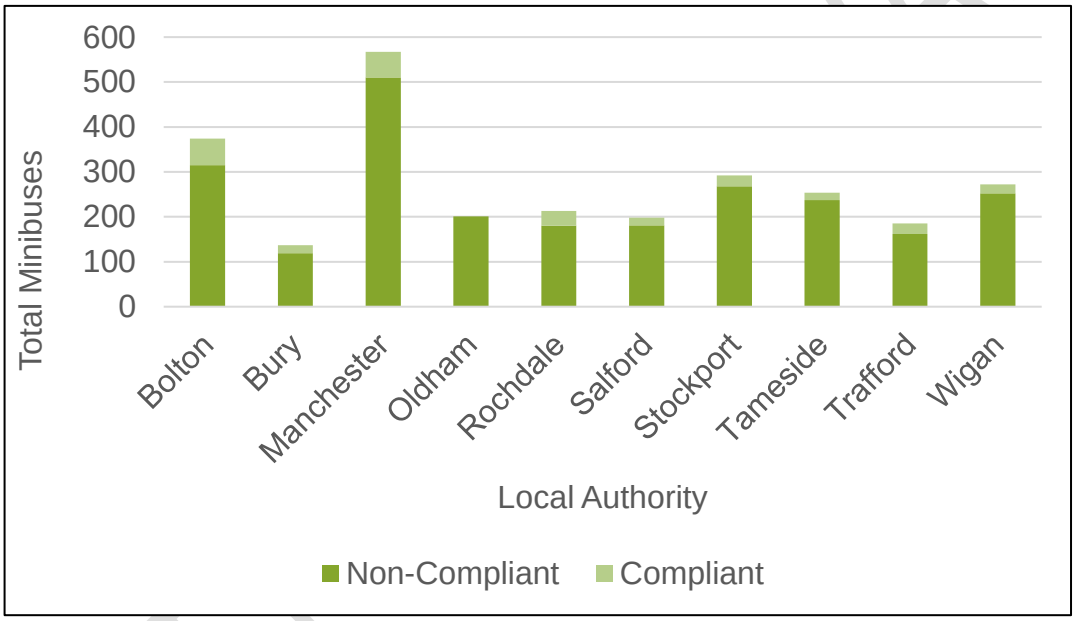
3.4.6 Breaking down the minibuses market by local authority (LA), Figure 4, the average number of minibuses across all ten authorises recorded is 269. Manchester has the highest proportion of vehicles in GM with 567 (21%), followed by Bolton with 364 (14%) and Stockport with 292 (11%). Bury was found to have the least number of minibuses, with 137 (5%) in total.

[9] DfT (2018) Analysis of DVLA registered vehicle database records (version Q2 2016) by DfT

3.4.7 In terms of compliance by LA (**Figure 3-4**), at least 85% of minibuses within each LA are non-compliant. By percentage of total fleets, Oldham is the least compliant as all 201 minibuses are not compliant. In terms of largest total number of non-compliant vehicles, Manchester has the highest amount with 510 vehicles (19% of all minibuses in GM) followed by Bolton with 315 (12%).

3.4.8 Despite having the largest number of non-complaint vehicles by LA, Manchester and Bolton also have the largest total number of compliant vehicles within GM. Bolton has a total of 59 compliant vehicles and Manchester has 57.

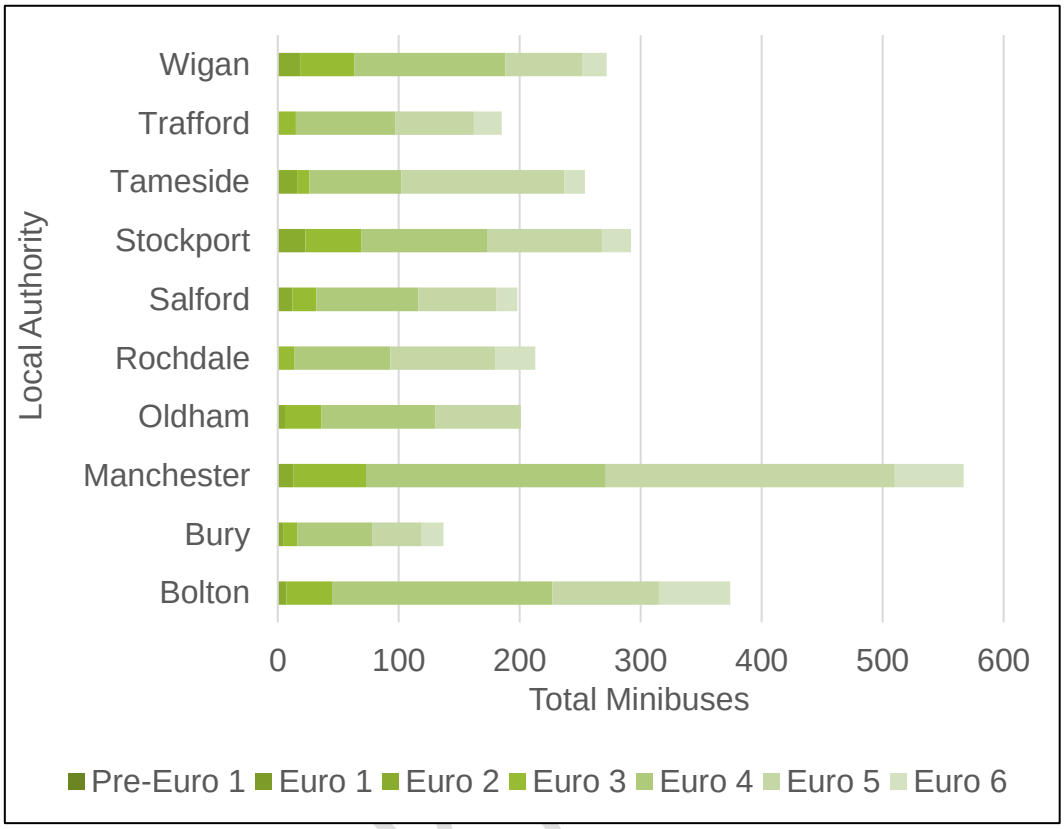
Figure 3-4: Total Compliant and Non-Compliant Minibuses by LA



3.4.9 Breaking down the number of minibuses within each LA by Euro Standard (**Figure 3-5**), as previously stated, there are no Pre-Euro 1 or Euro 2 minibuses in GM identified within the DVLA dataset. Of the 288 Euro 2 minibuses, Stockport has the most with 23 (23%). Manchester was identified as having the largest number of all other non-compliant Euro Standards (Euro 3, 4 and 5).

3.4.10 Considering the average of each Euro Standard by LA, the averages include 10 Euro 2 and 29 Euro 3. The highest averages were 109 Euro 4 and 95 Euro 5 by LA. The average for Euro 6 is 27.

Figure 3-5: Minibus Euro Standards in GM by LA



3.5 Minibus Vehicle Types

Manufactures and Models

3.5.1 According to the Minibus Market Study by TTR[10], the majority of minibuses are not purpose built but instead are either OEM (Original Equipment Manufacturer) or aftermarket conversions of various van models. Descriptions of these construction styles are outlined in **Table 3-2**. As a result of the methods discussed this creates a significant overlap between the van and minibus markets, with most major manufacturers occupying a large share of both.

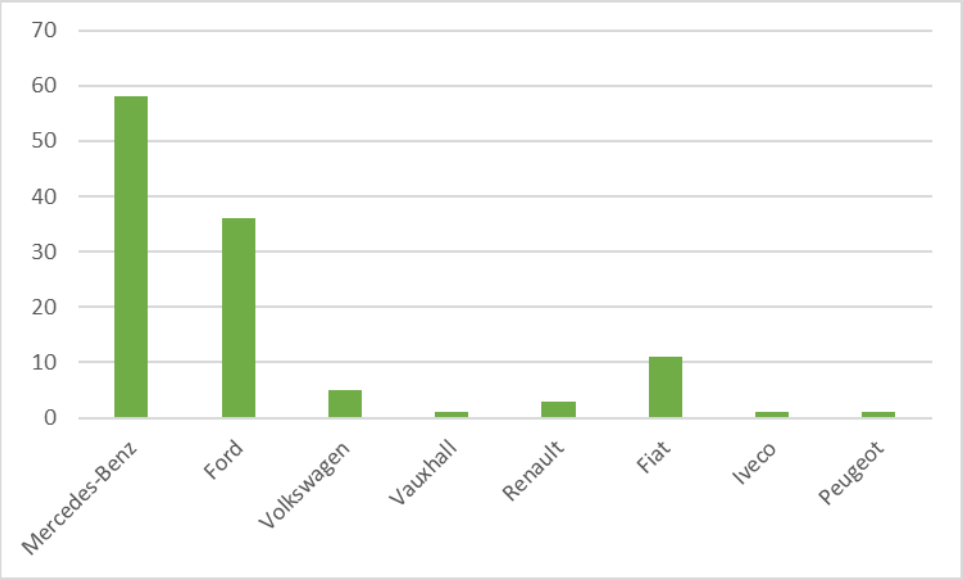
[10] *Minibus Market Analysis*; Transport and Travel Research. (2014)

Table 3-2: The Main Body Types of the Minibus Market in the UK[11]

Minibus Type	Description
Purpose Built	A vehicle that is built with minibus specification by a manufacturer
OEM	OEM is a method where a company produces parts or equipment for a vehicle which is then sold or marketed by another manufacturer. In the case of minibuses, this usually comprises vehicles that retain their original van engine, chassis and keep the majority of the van bodywork.
Aftermarket Conversion	A van or similar vehicle that is converted from its existing form to have the specification of a minibus. This often involves using aftermarket parts that are not from the original manufacturer of the vehicle.

3.5.2 Informed by data provided by TfGM[12], **Table 3-6** demonstrates the current breakdown of fleet composition by manufacturer across GM, which totals 116 vehicles. Due to data limitations, it was not possible to identify the manufacturer of all minibus vehicles identified within GM.

Figure 3-6: GM Local Authority Fleets by Manufacturer[13]



[11] *Minibus Market Analysis*; Transport and Travel Research. (2014), p5
[12] *Minibus Fleet Summary*; Transport for Greater Manchester. (2019)
[13] *Minibus Fleet Summary*; Transport for Greater Manchester. (2019)

3.5.3 The dominance of Mercedes-Benz and Ford is primarily informed by a single van model from each manufacturer: the Mercedes Sprinter and the Ford Transit, which have both seen significant longevity in the market as both OEM and aftermarket conversions. From the 2014 report by TTR[14], it was estimated that two thirds of all newly registered minibuses in 2012 were Ford Transit models and 11% were Mercedes Sprinter models.

3.5.4 It should also be noted that some manufacturers are owned by the same parent company, such as Fiat and Iveco who are owned by CNH Industrial. This can result in vehicles offered by 'different' manufacturers having the same or similar specifications (such as engine or chassis types) and the only difference being body work and branding.

Low Emission and Electric Minibus Vehicles

3.5.5 According to various articles from industry sources, there are a number of electric minibuses (termed e-minibuses for the purpose of this study) that are currently on or coming to the market. However, mass market options remain limited.

3.5.6 As with existing minibus models there are two forms of e-vehicles that currently do, or could, function as minibuses; outright e-minibuses and electric vans that can be modified or converted. In terms of purpose built e-minibuses, **Table 3-3** displays a sample of purpose built e-minibus vehicles that are either currently on the market or being developed and are expected to be released in the near term[15].

Table 3-3: Examples of known e-minibuses vehicles currently available or being developed

Model	Manufacturer	Range (Miles)	Charge Time (hours)	Size (metres)	Seating	Cost (estimated)	Release Date
Orion E	Mellor Coachcraft	100	4.25	7.5 by 2.2	16	Not stated	2017
V80	LDV	120	2	-	15	£60,000	-
Daily Electric	Iveco	120	2	-	16	£60,000	2019

[14] *Minibus Market Analysis*; Transport and Travel Research. (2014)
[15] https://www.adrianflux.co.uk/blog/2019/03/zero-emission-electric-minibus.html (March 2019)

Figure 3-7: The Daily Electric Minibus by Iveco

3.5.7 The review of e-minibus models suggests manufacturers are focusing their attention towards producing larger vehicle types (towards 16 seats) that are likely to be targeted at operators such as local authorities or stage carrying services (e.g. coach operators). For these larger models, vehicles are estimated to have a starting price of around £60,000. However, these prices are based on single battery, with double or triple costing more; for example, the Daily Electric model by Iveco is £60,000 for a single battery but will cost £80,000 for double and £100,000 for triple batteries.

3.5.8 In terms of smaller e-minibuses (8 – 12 seats), following a desktop research of the market no smaller vehicle model was considered readily available or to be released in the short-term. There are a number of major vehicle manufacturers, such as Tesla, Renault and Nissan, which previously expressed an interest in developing models. The progress on these concepts, however, is currently unknown. Therefore, it is considered smaller e-minibus models are highly unlikely to be available before the proposed CAZ opening date of 2021.

3.5.9 From an aftermarket conversion perspective, a number of leading manufactures are developing electric vans which are considered by industry sources to have the potential for conversion opportunities. While it is unclear whether it will be technologically practical or commercially viable to modify electric vans, it is quite possible this may be a potential low emission option for the minibus market in the near future. **Table 3-4** shows examples of e-vans that are currently available on the market or are currently being developed and are considered to have the potential to be converted into an e-minibus[16].

Table 3-4: Examples of e-vans that could be converted to a minibus product being developed

Model	Manufacturer	Potential Release Year
e-Vito	Mercedes-Benz	2022
eSprinter	Mercedes-Benz	2022
Kangoo ZE	Renault	Not stated
Master ZE	Renault	Not stated

3.5.10 Additionally, the anticipated costs of e-minibuses pose another challenge to owners and operators. Based on the findings above, it is estimated that e-minibuses may cost in the region of £60,000 which when compared with £20,000 for a second-hand compliant minibus, could make e-vehicles unappealing or unaffordable.

3.5.11 In summary, while there are positive signs of development in the e-minibus market but without the appropriate infrastructure and attractive incentives, such as policy/funding mechanisms, it is considered they are unlikely to be a primary choice for owners and operators in response to the proposed CAZ charge.

3.6 Purchasing, Leasing and Retrofitting

3.6.1 This section provides an understanding of the new and second-hand minibus markets in their current state, as well as a review of retrofitting solutions. Costs for new vehicles are often not available directly from the manufacturer, so a number of vehicle trading sites[17] have been analysed to gain an understanding of scale of costs.

3.6.2 Considering the prevalence of the Mercedes Sprinter and Ford Transit models seen in the previous section, the research has been focused on these two vehicle types. These two models are broadly representative of the upper and lower bands of the cost spectrum respectively, so this assessment is able to provide an overview of the core range of costs for both new and second hand vehicles.

[16] https://www.adrianflux.co.uk/blog/2019/03/zero-emission-electric-minibus.html (March 2019)
[17] Websites analysed include *Bristol Street, David Fishwick, Evans Halshaw.*

New Minibuses

3.6.3 The primary factors in the cost of a new minibus are the number of seats and the accessibility features.

3.6.4 The base purchase cost of the most common vehicle identified, the Ford Transit model minibus, ranges from just under £34,000 to £44,000 excluding VAT, with the number of seats varying from 11 – 17[18]. The average cost for this model was identified as £38,967 excluding VAT.

Table 3-5: Ford Transit Minibus Vehicle Cost Range

Price Range	Value
Lower	£33,825
Higher	£44,110
Average	£38,967

3.6.5 The cost of the vehicle can be increased by the addition of wheelchair access facilities, which are a necessity for many minibus services and can add an additional cost of £6,000 - £8,000.

3.6.6 A full breakdown of the cost for a new minibus offered by Ford directly through their official website is demonstrated in **Figure 3-8** below.

[18] https://www.ford.co.uk/content/dam/guxeu/uk/documents/price-list/commercial-vehicles/PL-Transit_Minibus_2019.pdf

Figure 3-8: Full Overview of Ford Transit Minibus Prices[19]

Bodystyle	GVM	Wheelbase	Roof line	Engine	SRW (Single Rear Wheel) DRW (Dual Rear Wheel)	Fuel	Transmission	VED	CO_2 Emissions g/km[8] Without optional Start/Stop	CO_2 Emissions g/km[8] With optional Start/Stop	Basic Recommended Retail Price (Excl VAT) £
LEADER											
11/12 Seat Bus	350	L2	H2	2.0L Ford EcoBlue 130PS RWD	SRW	Diesel	6 Speed Manual	TC34			33,825.00
11/12 Seat Bus	350	L2	H2	2.0L Ford EcoBlue 170PS RWD	SRW	Diesel	6 Speed Manual	TC34			34,845.00
14/15 Seat Bus	410	L3	H2	2.0L Ford EcoBlue 130PS RWD	SRW	Diesel	6 Speed Manual	TC34			34,625.00
14/15 Seat Bus	410	L3	H2	2.0L Ford EcoBlue 170PS RWD	SRW	Diesel	6 Speed Manual	TC34			35,645.00
14/15 Seat Bus	410	L3	H3	2.0L Ford EcoBlue 130PS RWD	SRW	Diesel	6 Speed Manual	TC34			35,775.00
14/15 Seat Bus	410	L3	H3	2.0L Ford EcoBlue 170PS RWD	SRW	Diesel	6 Speed Manual	TC34			36,795.00
17/18 Seat Bus	460	L4	H3	2.0L Ford EcoBlue 130PS RWD	DRW	Diesel	6 Speed Manual	TC34			39,525.00
17/18 Seat Bus	460	L4	H3	2.0L Ford EcoBlue 170PS RWD	DRW	Diesel	6 Speed Manual	TC34			40,545.00
TREND											
11/12 Seat Bus	350	L2	H2	2.0L Ford EcoBlue 130PS RWD	SRW	Diesel	6 Speed Manual	TC34			35,390.00
11/12 Seat Bus	350	L2	H2	2.0L Ford EcoBlue 170PS RWD	SRW	Diesel	6 Speed Manual	TC34			36,410.00
14/15 Seat Bus	410	L3	H2	2.0L Ford EcoBlue 130PS RWD	SRW	Diesel	6 Speed Manual	TC34			36,190.00
14/15 Seat Bus	410	L3	H2	2.0L Ford EcoBlue 170PS RWD	SRW	Diesel	6 Speed Manual	TC34			37,210.00
14/15 Seat Bus	410	L3	H3	2.0L Ford EcoBlue 130PS RWD	SRW	Diesel	6 Speed Manual	TC34			37,435.00
14/15 Seat Bus	410	L3	H3	2.0L Ford EcoBlue 170PS RWD	SRW	Diesel	6 Speed Manual	TC34			38,455.00
17/18 Seat Bus	460	L4	H3	2.0L Ford EcoBlue 130PS RWD	DRW	Diesel	6 Speed Manual	TC34			41,290.00
17/18 Seat Bus	460	L4	H3	2.0L Ford EcoBlue 170PS RWD	DRW	Diesel	6 Speed Manual	TC34			42,310.00
LIMITED											
11/12 Seat Bus	350	L2	H2	2.0L Ford EcoBlue 170PS RWD	SRW	Diesel	6 Speed Manual	TC34			38,610.00
14/15 Seat Bus	410	L3	H2	2.0L Ford EcoBlue 170PS RWD	SRW	Diesel	6 Speed Manual	TC34			39,410.00
14/15 Seat Bus	410	L3	H3	2.0L Ford EcoBlue 170PS RWD	SRW	Diesel	6 Speed Manual	TC34			40,655.00
17/18 Seat Bus	460	L4	H3	2.0L Ford EcoBlue 170PS RWD	DRW	Diesel	6 Speed Manual	TC34			44,110.00

Second Hand Compliant

3.6.7 Since almost all minibuses are diesel fuelled, the CAP compliance standards require a Euro 6 engine. As such, the majority of second hand compliant vehicles are in fairly comparable condition, and the price is still primarily driven by the number of seats.

3.6.8 **Table 3-6** shows the average costs for compliant second-hand vehicles with a range of capacities, taken from vehicles available on Autotrader[20]. Only a small number of Mercedes Sprinter vehicles were available on the market, leading to the lack of data for the 13-15 seat categories. This may simply be a reflection of the relative popularity of the vehicles, as described by the 2012 minibus registrations in which Ford Transits were around six times more commonly registered than Mercedes Sprinters nationally (2,593 Transits compared to 431 Sprinters).[21]

[19] https://www.ford.co.uk/content/dam/guxeu/uk/documents/price-list/commercial-vehicles/PL-Transit_Minibus_2019.pdf
[20] https://www.autotrader.co.uk/vans/used-vans/body-type/minibus
[21] *Minibus Market Analysis*; Transport and Travel Research. (2014)

Table 3-6: Second Hand Compliant Average Vehicle Cost

Model	9 – 12 Seats Price Range	13 – 15 Seats Prince Range
Ford Transit	£11,990	£19,871
Mercedes-Benz Sprinter	£29,498	-
Average	£20,744	-

Second Hand Non-Compliant

3.6.9 In contrast to compliant vehicles, the range of available second hand noncompliant vehicles vary significantly in terms of mileage, age and condition. The mileage of available vehicles varied from 30,000 to over 400,000 miles, with some vehicles on the market up to 20 years old. As such, the price is determined by a combination of these factors, rather than primarily by the number of seats.

3.6.10 The prices shown in **Table 3-7** are average costs taken from a range of second-hand vehicles available on Autotrader[22]. As noted previously, the pool of available vehicles to sample from was significantly larger for Ford Transit models than for Mercedes Sprinters.

Table 3-7: Second Hand Non-Compliant Average Vehicle Cost

Model	9 – 12 Seats Price Range	13 – 15 Seats Prince Range
Ford Transit	£11,990	£19,871
Mercedes-Benz Sprinter	£29,498	-
Average	£20,744	-

3.6.11 These values should be taken as broad guidelines only, as the range of factors contributing to the vehicle cost permits only high-level estimation without a much more in depth analysis being performed.

[22] https://www.autotrader.co.uk/vans/used-vans/body-type/minibus

3.6.12 It is anticipated that the CAZ potentially may disrupt the second-hand market for non-compliant minibus vehicles. For example, it is possible there may be an increase in owners or operators looking to sell non-compliant vehicles while the demand for non-compliant vehicles could also significantly decrease. This could therefore over saturate the market as well as significantly decreasing the value of non-compliant coaches, leaving owners and operators at risk of losing value on their assets. This could also increase the demand for scrappage, which could bring further market changes such as a reduction in the price paid for scrappage.

Leasing

3.6.13 Across the minibus market there are two common forms of leasing; the leasing of a vehicle through a commercial rental/leasing company and the leasing of a minibus vehicle from one owner/operator to another (e.g. LA leases a vehicle to a school). Due to data limitation, it is not possible to reasonably identify the proportion of leases across the GM market.

3.6.14 Minibuses that are owned by rental/leasing companies and that are leased commercially are considered a market segment in their own right, and this is discussed further within the owner/operator section of the technical note. In this instance, a company that own a minibus offer their vehicle as a service to a paying customer, whether it be an individual or business, but does not pass the rights of ownership of the asset to the temporary operator. The length and cost of a contract can vary on the needs of a customer, with short, medium and long term leases available. For businesses leases are typically longer, with some contracts between 46 to 52 months. In other cases, short term leases vary from a number of months to a couple of days.

3.6.15 Considering the impact of the CAZ on the leasing market, there are two potential outcomes that are notable. Firstly, for non-compliant vehicles in leasing markets the CAZ charge could potentially raise the operating cost of a company, with potential cost increases being passed on to the relevant customer. The scale of this impact at this stage however is unknown.

3.6.16 Furthermore, with a high proportion of the minibus market estimated as non-compliant the longer term leasing contracts of a minibus may act as a potential solution to support businesses upgrade. For those that may be struggling to upgrade for the CAZ could seek to lease a minibus from a company to continue operating and avoid the charge while they consider ways to reach compliance with their own vehicles.

3.6.17 Another common form of leasing is between owners of a vehicle such as LAs and secondary operators such as community and charity groups and educational establishments. This can be in the form of a lease for a minibus at a subsidised rate to support the needs of a certain group that may otherwise be impeded by a lack of access to a suitable means of transport. Similarly, LAs can also offer support with a minibus by operating special tender services for schools on behalf of operators.

3.6.18 In response to the introduction of the CAZ, a possible outcome is the shared impact between the owner leasing the vehicle and the leasing operator. As many operators who lease from the likes of LA benefit from subsidies to run the vehicle, if the CAZ impacts the decisions of the owners (i.e. need to upgrade and therefore increase the cost) this could put the functions of the leasing operator at risk. However, this impact may be mitigated if appropriate exemptions are made.

Retrofitting

3.6.19 Only retrofitting solutions approved by the government through the Clean Vehicle Retrofit Accreditation Scheme (CVRAS) will allow vehicles to be considered compliant as part of the CAZ. However, from a review of available solutions for minibuses it appears that retrofitting is currently limited as a sensible solution.

3.6.20 According to a list of recognised retrofitting providers by the Energy Saving Trust[23] (EST), there are no CVRAS available schemes available for vans/minibuses on the register. Furthermore, the EST suggest that the cost to replace a van and minibus is lower when compared to other commercial vehicle types, unless it is a highly specialised conversion. This, combined with the fact that retrofit solutions can be relatively high in cost and difficult to fit, means that it is often cheaper to replace than to retrofit vans. At the time of writing this report, however, research into potential retrofitting solutions has been requested by TfGM and is due to start in due course. If an approved solution is identified, this could open up opportunities for both van and minibuses vehicles, although it is unknown at this stage whether the technology would be market ready by the CAZ introduction date of 2021.

3.6.21 The EST does, however, identify that there may be some opportunity in the future for electrification or re-power solutions for highly specialised conversions with high replacement costs, but these are not available currently through CVRAS.

3.6.22 The findings suggest that at present retrofitting is not a common practice across the industry and until further developments occur in this area, retrofitting as a solution to meet compliance of the CAZ may not prove a highly likely solution.

Exemptions

3.6.23 As noted within the OBC, imposing a penalty charge on non-compliant vehicles is an effective way of encouraging drivers to upgrade their vehicles. However, there is a risk that for many owners, operators and users the CAZ charge may impose costs that cannot be absorbed, with a risk of consequent damage on the local economy and people's livelihood.

[23] https://www.energysavingtrust.org.uk/transport/freight-and-retrofit/clean-vehicle-retrofit-accreditation-scheme-cvras

3.6.24 As such, the OBC identifies that a potential measure to protect the most vulnerable is to offer temporary or permanent discounts and exemptions from the scheme. While it is acknowledged such measures may reduce unintended consequences from the charge, there is a risk this approach could reduce the overall effectiveness of the scheme in terms of reducing emissions. It is therefore important that the relative merits must be considered from both perspectives when considering discounts and exemptions.

3.6.25 Using the Ultra-Low Emissions Zone (ULEZ)[24] in London as an example, from 25th October 2021 to 29th October 2023 minibuses operated under a section 19 or section 22 permit by not-for-profit organisations will be eligible for a grace period exempting them from the ULEZ daily charge. For a vehicle to be eligible for the ULEZ grace period they must be:

- A minibus built or adapted to carry 8-16 passengers;
- Owned or leased by a not-for-profit organisation and operated using a valid section 19 or section 22 permit issued by an approved licensing body; and
- Owned (or leased) before 8 June 2018.

3.6.26 It is expected that the grace period for the ULEZ will expire from 30th October 2023 and all minibuses from this date onwards would need to meet emissions standards or pay the daily charge.

3.6.27 It is likely that a similar approach to the ULEZ may be considered for minibuses within GM to mitigate the impacts on the most vulnerable from the CAZ, notably community transport groups, charities and schools. However, for the purpose of this study exemptions will not be considered during the assessment. This is to ensure the report examines the impact and risk on all users considering a worst case scenario, therefore highlighting the owners, operators and users that may be most vulnerable to the full implementation of the CAZ. It is expected that the findings from this report may support the development of appropriate discounts and exemptions that may be outlined within the Full Business Case submission.

4 Owner and Operators

4.1 This section provides an overview of the various market segments of the coach sector, and the typical operators that serve within them.

[24] https://tfl.gov.uk/modes/driving/ultra-low-emission-zone/discounts-and-exemptions

4.2 Market Segments

4.2.1 According to the Public Passenger Vehicles Act 1981, an operator is considered the driver that drives the vehicle. For example, if the minibus is being driven on authorised school business, the operator is the governing body or LA, or proprietor. If the minibus is being driven on a school trip by a member of staff or volunteer, the operator would typically be the school. If the minibus is used to transport children to and from school at the beginning and end of the day, the operator might be the LA. For hired minibuses with drivers, the operator is the company.[25]

4.2.2 According to research conducted TTR[26], the minibus market comprises eight typical types of owner and operators, which are depicted in **Table 4-1**. Also informed by the report are the estimated proportions that each owner and operating group make up of the overall all market.

4.2.3 Although Taxi and PHV minibuses are considered a market segment by the TTR study, for the purpose of this study further analysis of this operator type will not be considered as it is considered these operator types fall within the Clean Taxi Working Group.

Table 4-1: Minibus Owner / Operator Market Segments[27]

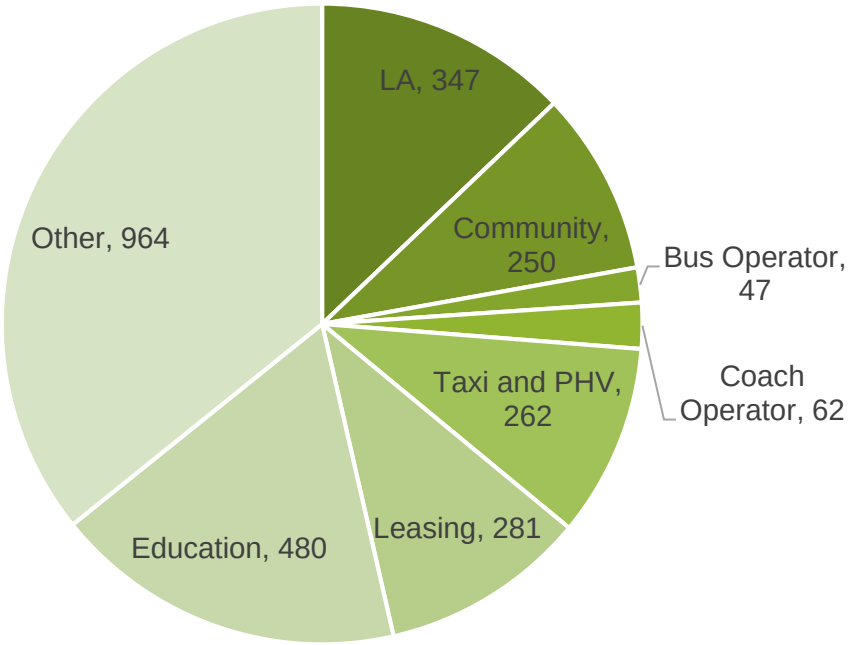
Market Segment	Definition	Market Proportion
Local Authorities	Public sector owned and operated vehicles.	13%
Community Transport	Vehicles that are operated for community groups and charities. In this group there can be cross over between charities and local authorities as operators.	9%
Local bus operators	A local bus operator that offers minibus services in parallel to bus services.	2%
Coach operators	Coach operators that offer minibus services in parallel to coach services (both commercial and private).	2%
Taxi and Private Hire Vehicles	Minibus vehicles that are operated as taxis or private hire vehicles. For the purpose of this study this operator group will not be analysed from this point onwards.	10%

[25] https://app.croneri.co.uk/topics/minibuses-procurement-and-maintenance/indepth
[26] *Minibus Market Analysis*; Transport and Travel Research. (2014)
[27] *Minibus Market Analysis*; Transport and Travel Research. (2014), p8 based on national values

Leasing/Rental companies	Rental companies that offer a range of vehicles for leasing, which includes a range of minibuses	10%
Education establishments	Institute that owns and operators their own minibus fleet, such as schools, specialist schools, colleges and universities.	18%
Other	Minibuses that are owned by individuals, such as sole traders or individuals for private use.	36%

4.2.4 Informed by the proportion estimated by TTR, the market proportion of each operator group has been applied to the market total of 2,693 minibuses identified previously in the report to estimate the number of vehicles within in group in GM. These are shown in **Figure 4-1**.

Figure 4-1: GM Minibus Market by Owner / Operator User Type[28]



4.3 Operator Personas

4.3.1 This section provides personas of the owner and operator groups within GM as outlined in **Error! Reference source not found.**, informed by the data and assumptions from the TTR report29. The purpose of the persona is to outline the characteristics of the operator to better inform the risk and impact analysis. Where possible, a case study for each is provided to add further insight into the profile. As noted, Taxi and PHV will not be analysed.

[28] DfT (2018) *Analysis of DVLA registered vehicle database records* (version Q2 2016) by DfT, with assumptions on market share applied from *Minibus Market Analysis*; Transport and Travel Research. (2014)
[29] *Minibus Market Analysis*; Transport and Travel Research. (2014)

Local Authorities

- Market segment is estimated to make up 347 minibus vehicles in GM (13%);
- Previous studies sampling the average percent of minibuses of LA fleets are estimated as 9.8%;
- LAs typically own their own minibus vehicles, although there are some cases where they are leased;
- There is often some crossover between LA, community transport and school markets, as LA often lease or operator on behalf of these user groups;
- LA minibuses can provide a variety of services for those with disabilities or who are otherwise unable to use other public transport modes, and therefore require accessibility features on vehicles; and
- These services can either be provided for free or a subsidised charge may apply to the user.

Community Transport

- Market segment is estimated to make up 250 minibus vehicles in GM (9%);
- Previous research has considered it difficult to gather sufficient data to be able to accurately determine the percentage of minibuses within community transport fleets;
- There is often some crossover when counting minibuses between LA owned minibuses and Community Transport operators, as LA vehicles are leased for community and social welfare purposes. Due to data limitations it is difficult to identify the extent of double counting;
- Community services are typically provided for free or a subsidised charge may apply to the user; and
- These services will also generally operate local trips within GM. From speaking to representatives from the industry, there may be some cases when a community ran service may briefly pass into GM from outside the boundary.

Case Study: Ring and Ride[30]

- Low cost transport service across GM for those with disabilities or difficulty walking
- The Ring & Ride service is operated by Greater Manchester Accessible Transport Ltd (GMATL) and is mainly funded by TfGM via a grant from the Greater Manchester Combined Authority (GMCA) Transport Levy, and fares incomes.
- For those that qualify, they are able to book a Ring and Ride minibus which would take the user door to door with an accompanying adult, for journeys up to 6 miles within GM.
- The services have minibuses that are suitable for wheelchairs.
- Prices for the service range between £1.10 and £3.10.

Local Bus Operators

- Market segment is estimated to make up the smallest number of minibus vehicles in GM, with 47 (2%); and
- As with other market segments, identifying the true number of minibuses as a percentage of the overall fleet was difficult. However, it is estimated that minibuses would make up a minor proportion of their fleet.

Coach Operators

- Market segment is estimated to make up the second smallest number of minibus vehicles in GM, with 62 (2%);

[30] https://tfgm.com/public-transport/ring-and-ride-minibuses

- It is considered there is a variation between the use of minibuses between operators; for instances, some operators use minibuses as commercial services while others only use minibuses to shuttle drivers around rather than a publicly available service;
- For commercial minibus services, the fleet age was seen as typically younger while those used to shuttle drivers around were much older;
- Although data may often influence what is considered a minibus within an operator's fleet, it was typically found that operators only had a small minibus fleet; and
- Based on desktop research, the cost of a minibus private hire varies depending on the number of passengers travelling, the origin and destination and time of travel. For minibus journey from Manchester City Centre to Manchester Airport for 12 people at 9am on a weekend quotes ranged from £100 to £150.

  - Coach operator registered in Trafford, Greater Manchester
  - The company offer a range of travel hire services, including education services and airport transfers, as well as social occasion hire, such as weddings
  - The company are estimated to have approximately 20 coaches (including midis) and 4 minibuses in their fleet

Rental / Leasing Companies

- According to estimates, there are approximately 281 (10% of all GM) minibuses within the rental / leasing market;
- TTR report estimated that minibuses make up approximately between 4% to 5% of a leasing or rental companies' fleet;

- The report also identified that the average length of a contract for this sector is 46 months and an average mileage of 80,000;
- In terms of main customers or users, 70% of minibuses are likely to be leased to education establishments, approximately 10% to commercial organisations for staff transport, less than 3% to Local Authorities, and approximately 2% to care homes; and
- In terms of vehicle specifications, minibuses are not typically purpose built and at the end of a contract vehicles are generally sold at auction or to a network of retailers who specialise in this market. Second life purchasers can include clubs and societies, care homes or community transport organisations.

Education Establishments

- It is estimated there are approximately 480 (18% of the GM total) minibus vehicles in this market segment, making it the second largest market;
- Schools make up about half of the leased UK minibus fleet which are used for education establishments. The other half comprises a range of establishments, such as Universities, colleges, and specialist schools; and
- It should be noted that while some educational establishments may own vehicles, the majority of vehicles operated by education establishments are believed to be leased.

Other

- It is estimated there are approximately 964 (18% of the GM total) minibus vehicles in this market segment, making it the largest owner/operator group in GM;
- However, as experienced with other studies, data limitations make it difficult to clearly determine the ownership of minibus vehicles in this group, in particular whether a vehicle is part of a fleet or owned by an individual;
- It is anticipated that the majority of these vehicles are likely to be owned by individuals, small businesses or large businesses and form fleets of only a few minibuses; and
- The TTR report suggests that these fleets are likely to be small in size.

5 Conclusions

- From the available data, the findings suggest that the CAZ is likely to have a widespread impact on the GM minibus market. This is because out of 2,693 minibuses registered in GM 2,640 (90%) are non-complaint.
- In terms of solutions to support operators reach compliance, there are no known CVRS approved retrofitting schemes available for minibuses, which makes it an unrealistic option to reach compliance in response to the CAZ at this stage.

- Additionally, while there are positive developments in electric minibuses, they are currently limited in availability. This, combined with the lack of readily available infrastructure and the comparatively high cost for vehicles, suggests that e-minibuses do not seem a likely solution in response to the CAZ.
- This means replacement is likely to be the most practical solution for the majority of the market. Currently, new vehicles cost in the region of £40,000 while second hand compliant vehicles cost around £20,000. For non-compliant vehicles the cost is around £5,000. However, it should be noted that once the CAZ charge is applied there is a high possibility this could disrupt the second hand market, resulting in an increase in demand for compliant vehicles and reducing the demand / increase supply of non-compliant vehicles. This may lead to increased costs and a loss of value for current assets.

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

Note 19: Taxi and PHV Fleet Research Post-OBC approach

Warning: Printed copies of this document are uncontrolled

Version Status:	DRAFT FOR APPROVAL	**Prepared by:**	Paul Davison 31th July 2019
Authorised by: **Date:**	Ian Palmer 5th August 2019		

1 Introduction

1.1 The ten local authorities of Greater Manchester (GM) have been instructed by the government to produce a Clean Air Plan (CAP) to set out how they will target and mitigate areas of poor air quality within their boundaries. GM has decided to coordinate a Combined Authority response to this request, which is being managed on behalf of the 10 districts by Transport for Greater Manchester (TfGM).

1.2 Currently, the CAP includes plans for a Clean Air Zone (CAZ) which would apply a charge (Table 1) to commercial vehicles (buses, minibuses, coaches, Heavy Goods Vehicles (HGVs), Light Goods Vehicles (LGVs), taxis and private hire vehicles (PHVs)). To help mitigate the adverse effects of this charge, the CAP will include a number of 'Clean Vehicle Funds' and a Loan Finance Scheme. These will provide grants and affordable loans (respectively) to eligible businesses affected by the charge.

1.3 To determine the scope and definition of these funds, and the eligibility criteria, a wide range of policy development processes are being undertaken. Working Groups have been established to ensure the proposals that emerge can be stress-tested with those they will apply to. This research is designed to contribute to this body of evidence.

1.4 This technical note provides an overview of the market for the taxi and PHV vehicle category and an impact assessment of the proposed CAZ charge. It provides information on market characteristics including vehicle types, a breakdown of owners and operators, information on the second-hand and new vehicle sales markets and details of opportunities to purchase compliant vehicles or retrofit to achieve compliance. The research also identified key impacts and risks for different types of owner and operator, which will contribute to an understanding of the specific role the Clean Vehicle Funds can play in supporting these commercial sectors when the CAZ comes into force.

1.5 This information will primarily be used to assist the Taxi Working Group, Governance and Policy Workstream (WS11) and other relevant Working Groups in developing suitable policy proposals for the Funds (Freight; Taxi and LGV[1]) and Loan Finance. Depending on the type and quality of information available, it may also feed into the Data, Evidence and Modelling (DEM) Workstream (WS1) in which a lack of commercial vehicle evidence has already been identified as a project risk.

1.6 The objectives of this research are defined below.

[1] The Bus Fund will be limited to operators running commercial bus route services in GM. These vehicles are not included in the scope of this research.

Research Objectives

1. Define general market characteristics for the vehicle types in a GM context where available information allows.
2. Segment these markets by setting out the owner/user breakdown of each of these markets. Illustrate these users by providing in-depth profiles of some of the users in these markets. These case studies, or 'personas', will assist the WS11 and WS1 workstreams in developing and testing suitable policies for these sectors.
3. Provide a high-level assessment of the extent of impact (how significant/widespread), and level of risk (according to the vulnerability of the user) upon each of the defined segments, if a charging Clean Air Zone were introduced in GM.

2 Study Background

2.1 Air Quality

2.1.1 Poor air quality is one of the largest environmental risks to the public's health. It is recognised that long-term exposure to elevated levels of Nitrogen Dioxide (NO_2) and microscopic particles of matter suspended in the air we breathe contributes to the development of cardiovascular or respiratory disease and reduce life expectancy. In particular, the youngest, oldest, those living in areas of deprivation and those with existing respiratory or cardiovascular disease are most likely to develop symptoms due to exposure to air pollution.

2.1.2 Whilst air quality has been generally improving over time across the United Kingdom, particular pollutants remain a serious concern in many urban areas. Since 2010, the UK has been found in breach of the legal limits of levels of NO_2 in major urban areas and in 2015 it was found that compliance with the legal limits of levels of NO_2 had still not been achieved. In response, the UK Government was held to be in breach of its legal obligations and was required to take action by the UK Supreme Court.

2.1.3 In the case of Greater Manchester, the city region has been highlighted as an area of concern with an urgent need to address air quality issues. Eight of the ten GM local authorities were identified by the Government as having roads which are expected to continue to exceed the maximum legal limits of NO_2 in 2021. Subsequently, each have been directed by Government to conduct studies to identify measures for reducing NO_2 concentrations to compliant levels in the 'shortest possible time'.

2.1.4 In response, the ten authorities of Greater Manchester, supported by Transport for Greater Manchester (TfGM), have collectively developed a draft package of measures that complies with the Government guidance for tackling NO_2 pollutants. An Outline Business Case (OBC) for these proposals was submitted to Government in early 2019[2].

[2] Greater Manchester's Outline Business Case to tackle Nitrogen Dioxide Exceedances at the Roadside

2.2 Greater Manchester's Clean Air Plan

2.2.1 The primary aim of the GM CAP is to enable Greater Manchester to reduce NO_2 concentrations to below the EU Limit Value in the shortest possible time. As outlined in the Outline Business Case (OBC), an initial package of measures that would allow the city region to meet compliance in the shortest possible time, at the lowest cost, with the least risk and with the least negative impacts, has been put forward. Key measures within the package include:

- A Clean Air Zone (CAZ) comprising charges for the most polluting commercial vehicles;
- Clean Vehicle Funds to help businesses and commercial vehicle operators to purchase compliant vehicles;
- A Loan Finance scheme, which would provide affordable loans to assist with compliant vehicle purchases;
- Investment in infrastructure, such as electric vehicle charging points; and
- Supplementary schemes such as behaviour change campaigns, Local Authority (LA) Fleet upgrades and targeted parking policy.

2.2.2 A key feature of the proposal is the CAZ charge, which targets the most polluting commercial vehicles by imposing a charge on the most polluting HGVs, LGVs, buses, coaches, minibuses and taxis and PHVs from the summer of 2021.

2.2.3 It is anticipated the charge will provide a financial incentive to the owners of commercial vehicles to invest in cleaner vehicles. At the OBC stage it was proposed that the CAZ charge would be £7.50 per day for taxis, PHVs and LGVs and £100 per day for HGVs, buses and coaches, as reflected in **Table 2-1**. The owners of vehicles that are subject to the charge who do not pay would be issued with a Penalty Charge Notice (PCN) and would be required to pay both that and the original charge.

Table 2-1 Proposed Greater Manchester Clean Air Zone Charges (as stated in the OBC)

Vehicle Group	CAP Charge (per day)
Buses, Coaches and HGVs	£100 (from 2021)
Taxis and Private Hire Vehicles	£7.50 (from 2021)
Vans and Minibuses	£7.50 (from 2023)

2.2.4 Although the charges and dates outlined in the table above are those submitted as part of the OBC, recent developments within the wider CAP project has led to a proposed change in date the CAZ will come into effect. Of relevance to this study, in July 2019 a Ministerial letter providing feedback on the proposals and a Ministerial direction were received. As part of this, Government has requested that the £7.50 charge for taxis and PHVs be brought into effect in 2021 in line with other vehicle types. While this development has not been formally agreed at the time of writing this report, for the purpose of this study the new working assumption is that the charge will come into effect from 2021 rather than 2023.

2.2.5 Additionally, while the charges outlined above are again from the OBC submission, these are not formally agreed at this stage. Therefore, there is a possibility these chargers could change going forward. For the purpose of this study, the working assumption applied is the charges stated above.

2.3 The Need for the Study

2.3.1 The proposals to introduce a Clean Air Zone would affect taxis and PHVs, with noncompliant vehicle users required to pay the charge, upgrade their vehicle or change their behaviour. Currently there is limited data on the exact volume of taxi and PHV traffic on the local road network, in particular those PHVs registered outside GM, though operating within GM. There is also limited detailed information with regards to market size and user categorisations and behaviours.

2.3.2 To ensure GM understands more clearly the impact of a CAZ on the taxi and PHV market, including owners, operators and users (i.e. passengers), this study intends to improve the knowledge of the market. This will enable a better assessment of the extent to which any potential support may be appropriate to mitigate negative impacts.

2.3.3 Leading this study is the Taxi Working Group (TWG). The group comprises TfGM staff and consultants, such as Arup and AECOM, and reports to the GM Clean Air Steering Group. The CMWG members are responsible for ensuring that the impact of the proposals across the industry are fully understood. This involves designing the detail of the measures proposed to support the taxi and PHV market and industry and assessing the use of external funding to help renew and upgrade fleets and reduce harmful emissions. It is also envisioned that data collected on the taxi and PHV market may address the existing data gap on the sector to better inform future studies.

3 The Sector

3.1 This section will provide an overview of the taxi fleet registered to the Local Authorities in Greater Manchester.

3.2 Taxi and PHV Definitions

3.2.1 The Taxi and PHV licensing Councillors' handbook states how a taxi (also referred as 'Hackney carriages') and PHVs are licensed separately and highlights the differences between the two. The key difference being that PHVs cannot ply for hire, meaning that that all PHVs have to be pre-booked in advance through a licensed operator. Also, local councils can regulate fares charged by taxis, where as they have no power to do so with PHVs[3].

3.2.2 Looking at the vehicle categories provided by Department for Transport's (DfT) Vehicle Certification Agency, taxi's and PHVs are classed as Category M, defining them as 'Motor vehicles with at least four wheels designed and constructed for the carriage of passengers'. As shown in **Table 3-1**, category M is split into three sub categories with taxis and PHVs categorised as M1, these are defined as 'Vehicles designed and constructed for the carriage of passengers and comprising no more than eight seats in addition to the driver's seat'[4].

Table 3-1 Categorisation of vehicles with at least four wheels and used for the carriage of passengers

Classification	Description
M1	Vehicles designed and constructed for the carriage of passengers and comprising no more than eight seats in addition to the driver's seat.
M2	Vehicles designed and constructed for the carriage of passengers, comprising more than eight seats in addition to the driver's seat, and having a maximum mass not exceeding 5 tonnes.
M3	Vehicles designed and constructed for the carriage of passengers, comprising more than eight seats in addition to the driver's seat, and having a maximum mass exceeding 5 tonnes.

3.3 Data Availability

3.3.1 To gain the registered taxi data for GM, the local authorities provided their records of registered taxis and PHVs. From this, the data was processed and cleaned to remove any possible outliers and then matched with the Automatic Number Plate Recognition (ANPR) data to gain an accurate number of taxis operating within GM. Following on from the cleaning process the data was then analysed to provide a clearer picture of the fleets including a breakdown of taxi licenses and PHV licenses, the age of the fleet, fuel types, and the most common vehicle make used.

3.4 Market Overview

3.4.1 A number of taxis and PHVs were found to be registered to more than one LA, but for the purpose of this note they have all been included as they account for an insignificant amount in comparison to whole fleet. The true number of registered vehicles in GM will be just under 200 hundred less than what is recorded in this note.

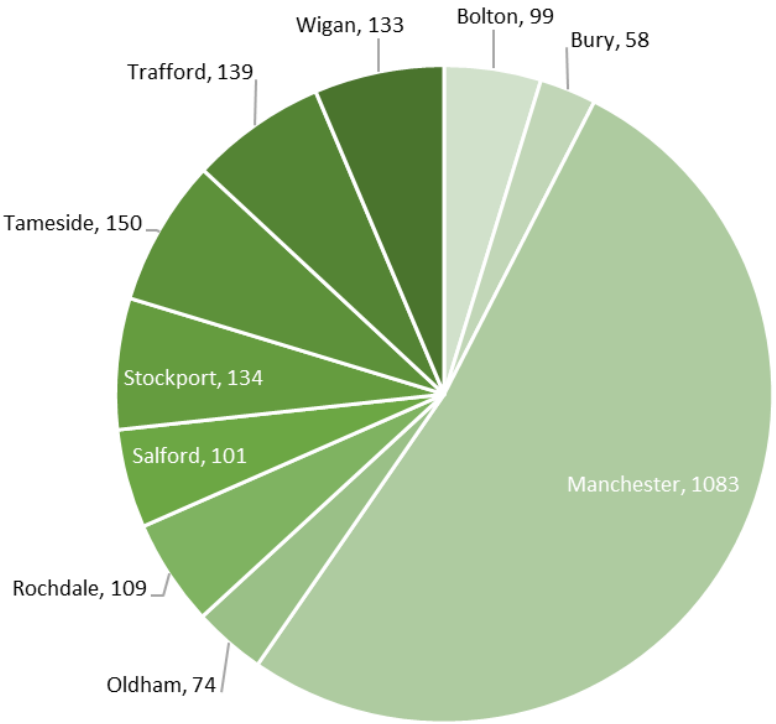
[3] Taxi and PHV licensing Councillors' handbook (England and Wales)
[4] Definition of vehicle categories, Vehicle Certification Agency

3.4.2 It is also important to note that there are taxis and PHVs that operate within GM that are not registered to any GM LAs that would be affected by the CAZ. Research has identified there are 1,017 vehicles registered with Sefton Council and 1,993 vehicles registered with Wolverhampton Council that are actually based within GM. We are aware that there may be other authorities whose licensed vehicles are based in GM but are unable to confirm the exact scale of the issue at this point.

3.4.3 Data provided by DfT shows that in 2018 the total number of licensed taxi and PHVs in England stood at 285,400, a rise of 1.7% from 2017. In regard to the North West there was a total of 35,900 taxis and PHVs registered, an increase of 0.5%. GM has a total of 14,481 which represents 40% of the North West fleet and 5% of the taxi and PHV fleet in England[5].

3.4.4 There was a total of 73,100 licensed taxis across England in 2018, 26% of the combined total. For PHVs there was 212,300 registered, this accounts for 74% of the combined total. In the NW, there are 8,300 taxis and this figure represents 11% of the taxi market in England. Whereas there are 27,600 PHVs in the NW, representing 13% of the overall figure in England. In GM there are a total of 2,080 taxis representing 3% of the market in England and 25% of the NW. There are 12,401 licensed PHVs in GM accounting for 6% of the market in England and 45% of the NW.

Figure 3-1 Total Registered Taxis by LA

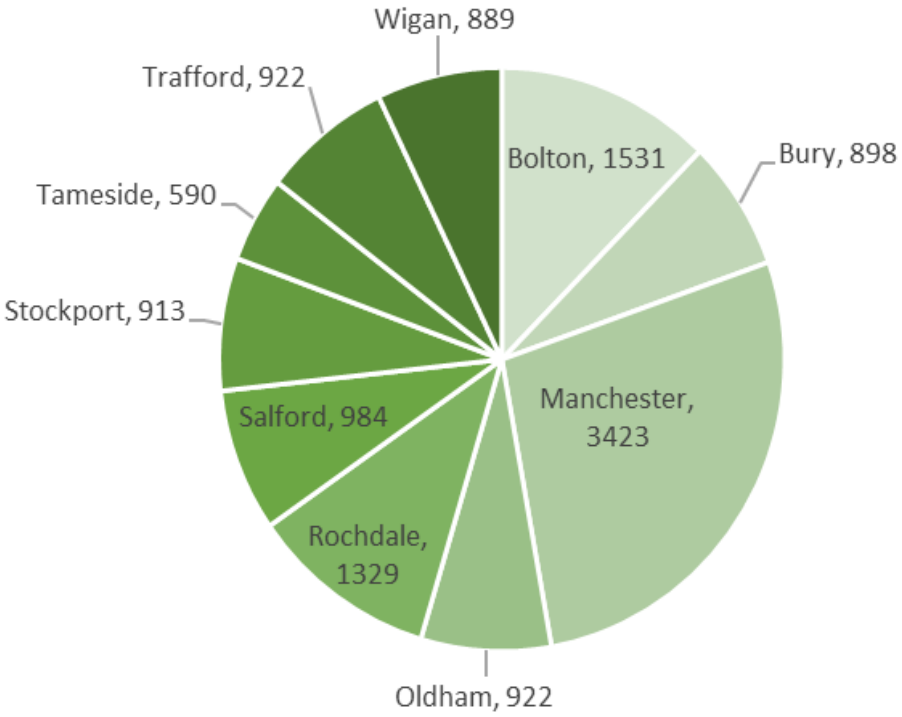


[5] Taxi and Private Hire Vehicle Statistics, England: 2018

3.4.5 As shown in **Figure 3-1**, Manchester has the largest amount of taxi licenses across all ten LAs with 1083 out of a total of 2,080, this represents a 52% share of the taxi market in GM and a 13% in the NW. The second largest figure of 150 comes from Tameside representing a 7% share of the GM market and 2% of the NW. These figures indicate that the larger customer market in Manchester makes it a more appealing place for taxis to operate.

3.4.6 The smallest fleets are from Bury with 58 registered taxis, 3% of the GM fleet and 1% of the NW fleet, whilst Oldham has the second smallest fleet of 74, 4% of the GM fleet and 1% of the NW. The average fleet size across all LAs is 208.

Figure 3-2 Total Registered PHVs by LA

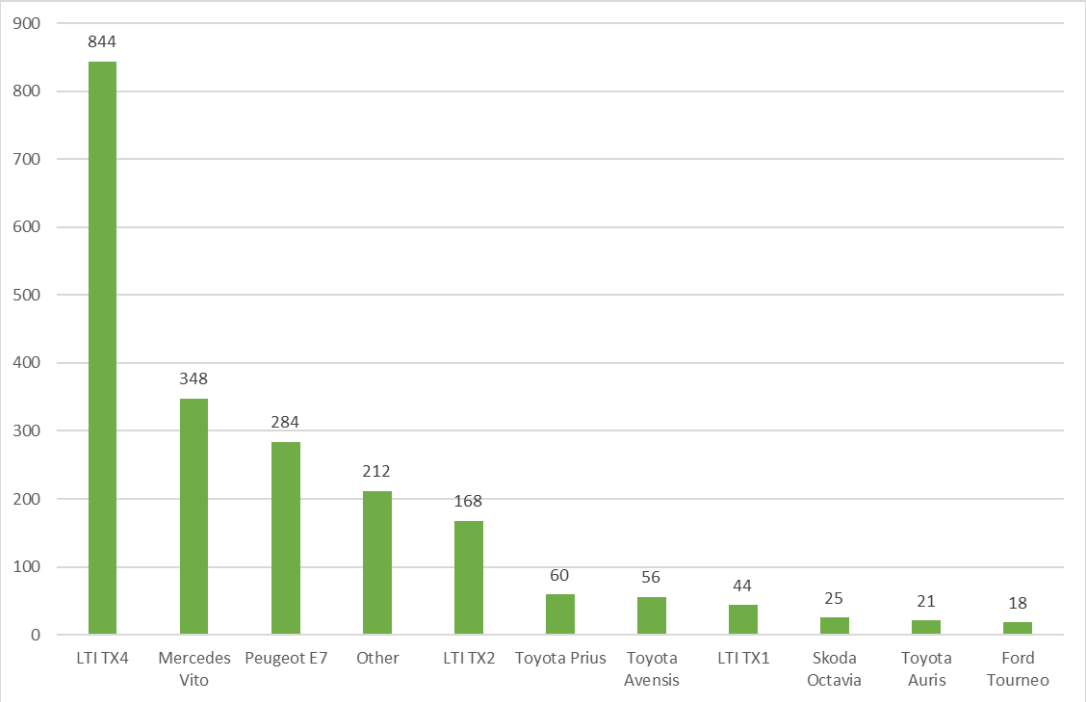


3.4.7 **Figure 3-2** highlights the registered PHVs across the 10 LAs and like the taxi fleet Manchester has the largest with 3,423, this represents 28% of GM and 12% of the NW. The second largest fleet of PHVs comes from Bolton with a total of 1,531, in GM this accounts for 12% and 6% in the NW. Rochdale have a slightly smaller fleet than Bolton but still have a significant proportion with 1,329, accounting for 11% across GM and 5% in the NW.

3.4.8 The smallest fleet of PHVs comes from Tameside where there are only 590 registered, this represents 5% of the total GM fleet and 2% of the NW. Wigan and Bury both have similar sized PHV fleets with 889 registered in Wigan and 898 in Bury, these figures account for 7% of the GM fleet and 3% of the NW.

3.5 Vehicle Make and Models

Figure 3-3 Taxi Vehicles used in GM



3.5.1 **Figure 3-3** above displays the most common vehicles used in the taxi fleet across GM. The most popular vehicle is the London Taxi Company TX4 (LTI TX4) with 844 registered vehicles, this represents almost half of GM's fleet with 41%. The LTI TX4 is the second newest instalment of the LTI range and was manufactured between 2007-2017 and operates off a diesel fuelled engine. LTI have released a Euro 6 standard TX4, however the majority of TX4s in operation were manufactured before 2015 with 763 out of 844, accounting for 90% of those vehicles.

3.5.2 The Mercedes Vito is the next most popular vehicle used with 348, this accounts for 17% of the GM fleet. In 2008 Manchester City Council allowed the Mercedes Benz Vito Taxi to be awarded a hackney carriage license if slight modifications were made to those with PHV licenses, these include a taxi roof sign, separate driver/passenger compartment and wheelchair accessibility as standard[6]. 260 of the 348 (75%) were manufactured before 2015 indicating that three quarters would not comply with EU engine standards.

3.5.3 The Peugeot E7 comprises 284 registered vehicles, representing 14% of the GM fleet. The E7 is purpose built for hackney carriages and is an adaption to the Peugeot Expert designed in collaboration with Cab Direct. The E7 is fuelled by diesel engines and with 236 of the 284 (84%) registered as being manufactured before 2015 it is likely that the majority would not comply with Euro 6 standards.

[6] Manchester City Council Report for Resolution, Licensing Policy Mercedes Vito Taxi

Figure 3-4 Most common vehicles used in Taxi fleet

LTI TX4

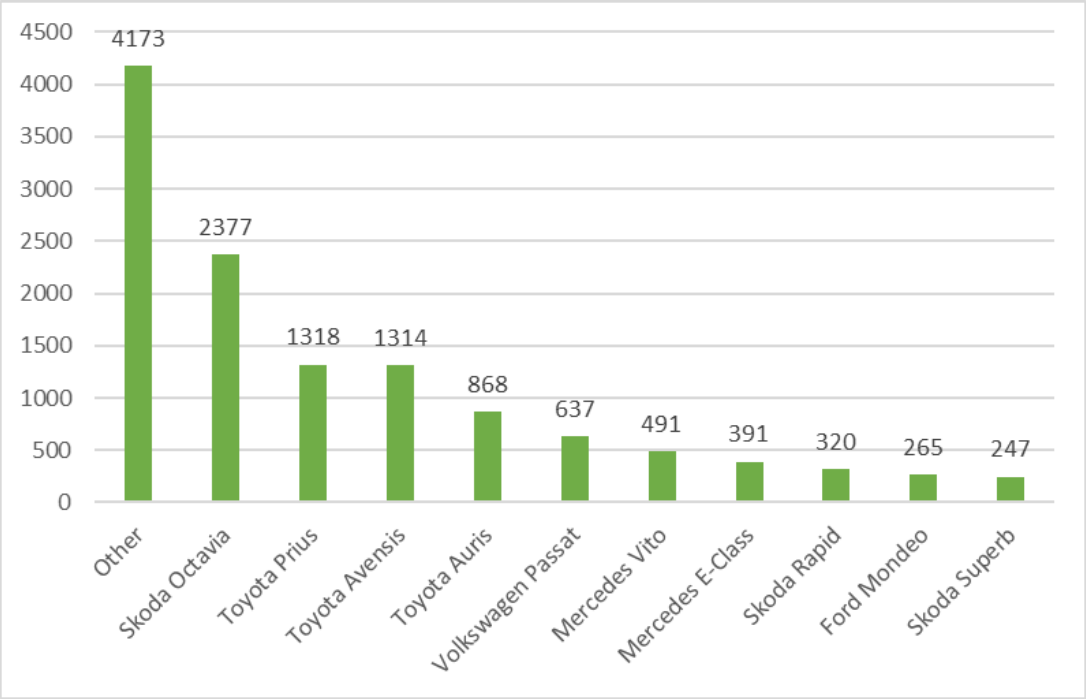
Mercedes Vito

Peugeot E7

LTI TX2

3.5.4 **Figure 3-4** above provides images of the four most common vehicles used in the taxi fleet.

Figure 3-5 PHV Vehicles used in GM



3.5.5 As shown in

3.5.6

3.5.7

3.5.8 Figure 3-5, the 'Other' category has the highest number of vehicles registered, this was due to the size of the PHV fleet (12,401) and the large variances of vehicle makes and models registered in GM. Some of the larger amounts include the Vauxhall Astra with 219, Renault Megane with 196, and 148 Seat Toledos. There were 505 Ford vehicles registered (131 Ford Focus, 103 Tourenos, and 147 Transits), as well as 465 Vauxhalls (173 Insignias, 123 Zafiras, and 95 Vivaros).

3.5.9 However, the most common PHV used in greater Manchester with 2377, accounting for 19% of the fleet is the Skoda Octavia. The second most common is the Toyota Prius, accounting for 11% of the fleet with 1318.

3.5.10 The Toyota Avensis is in a close third position with 1,314, representing 11% of the PHV fleet. Although unlike the Toyota Prius, the engines run off either petrol ranging from 1.6 to 2.0 litre or a 2.0 litre diesel. It is therefore likely that those driving this vehicle could be affected by the CAZ.

3.5.11

3.5.12

3.5.13

3.5.14 Figure 3-6 below provides images of the four most common vehicles used in the PHV fleet.

Figure 3-6 Most Common vehicles used in PHV fleet

Skoda Octavia

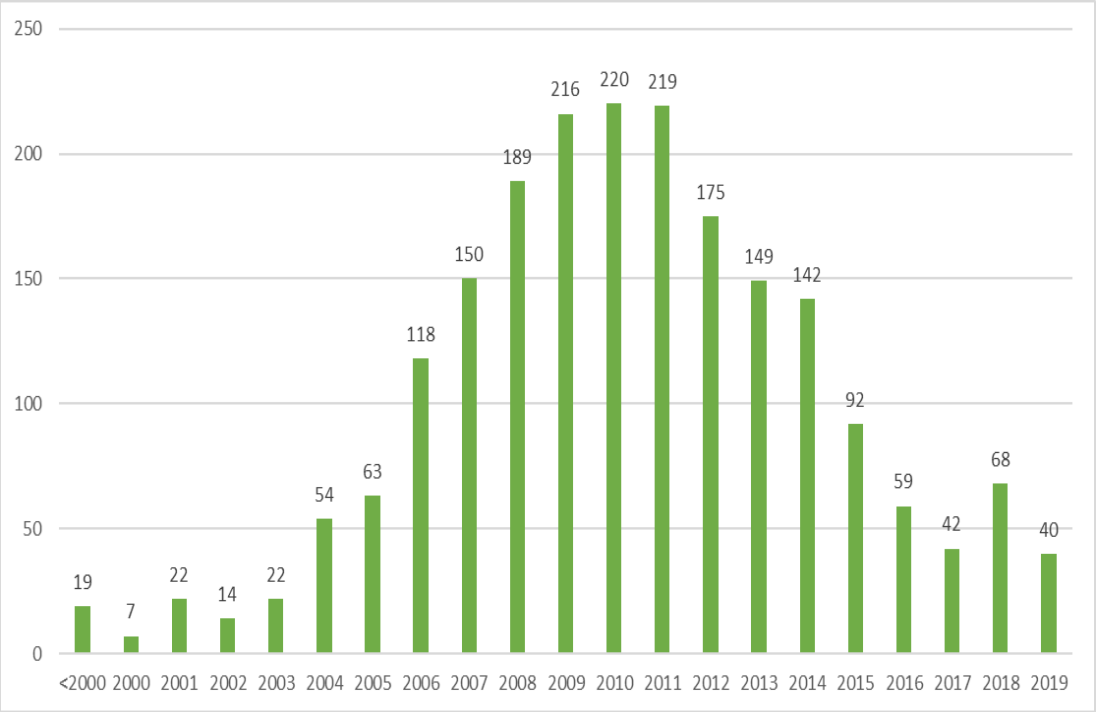
Toyota Prius

Toyota Avensis

Toyota Auris

3.6 Age of Fleet

Figure 3-7 Age of Taxi Fleet in GM



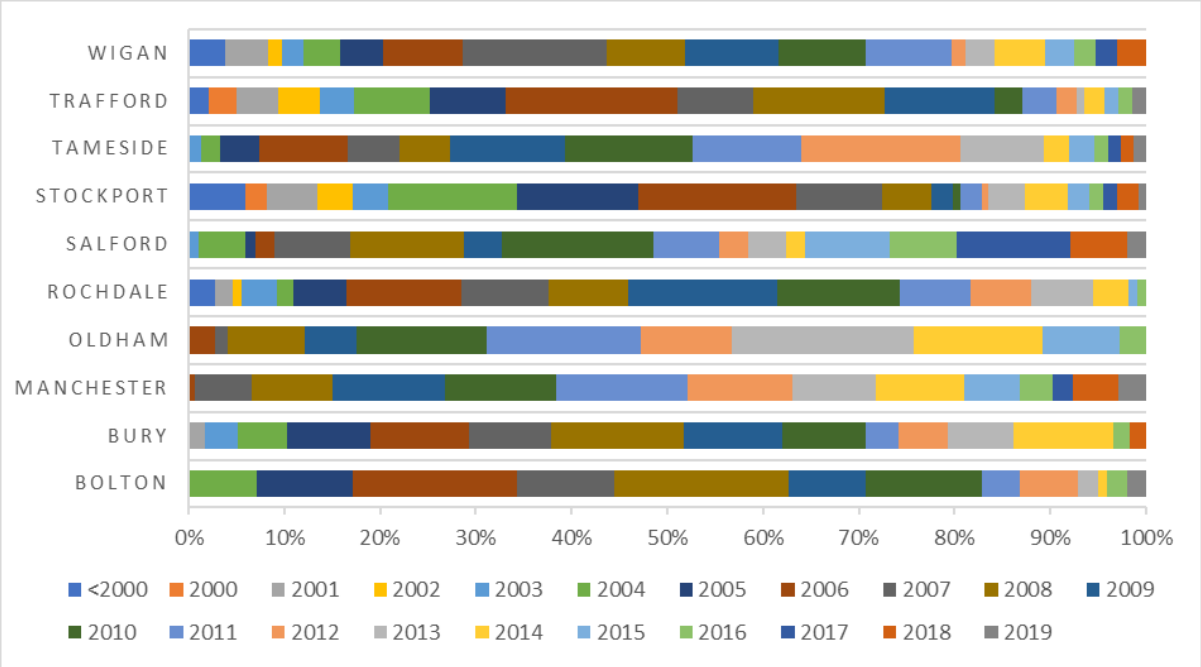
3.6.1 **Figure 3-7** provides an insight into the age of registered taxis across GM. The most common age of a vehicle are those registered in 2010 with a total of 220, accounting for 11% of taxis in GM. However, both 2009 and 2011 have a similar count to 2010 with a count of 216 and 219 respectively, these three years combined total 655 which account 31%.

3.6.2 Combining the years from pre-2000 up to 2009 which represents vehicles 10 years or older from the present, there are a total of 874 taxis, this figure represents 42% of the GM fleet.

3.6.3 When considering the European Union engine compliance of Euro 6 for diesel engines implemented in 2015 and Euro 4 for petrol engines in 2006, there are 1578 that are registered within that time period representing 76%. When looking at the fuel type section below 90% of taxis have diesel engines which implies that the vast majority of those vehicles would not comply with EU engine standards and therefore be affected by the CAZ.

3.6.4 The proposed Minimum Licensing Standards (MLS) set by GM whereby vehicles that are older than 5 years old will not be granted a license and therefore will not be able to operate within GM, currently 443 out of 2,080 (21%) would qualify meaning that 79% would have to change their vehicles. It is important to note however that these figures are subject to change as the MLS is not set to be introduced until 1st April 2020 for new vehicles licensed and 1st April 2021 for all other vehicles, also the conditions of the MLS may change as it is still in the consultation stage.

Figure 3-8 Age of Taxi Fleet by LA



3.6.5

3.6.6 **Figure** 3-8 and

3.6.7

3.6.8

3.6.9 ***Table*** 3-2 Age of Taxi Fleet by LAprovides a breakdown of the age of the taxi fleet by year and LA. When looking at Manchester's fleet from 2005 to 2014, 877 out of 1,083, giving a proportion of 81%, suggesting that over three quarters of Manchester's fleet may not comply with EU engine standards. Whilst, 778 (72%) are manufactured before 2014 meaning they would be affected by the proposed MLS if it was introduced in 2019. Although these figures will change by the time it is actually introduced in 2020 and 2021.

3.6.10 In contrast, the age of Stockport's taxi fleet seems to be much older when compared to the likes of Manchester's as 123 out of a possible 134 are from pre-2000 to 2014, accounting for 92% of Stockport's taxi fleet. This implies that a vast majority of Stockport's fleet would not achieve compliance against the EU's euro standard. Further to this, 117 (87%) of Stockport's fleet would be affected by the proposed MLS if it was introduced in 2019.

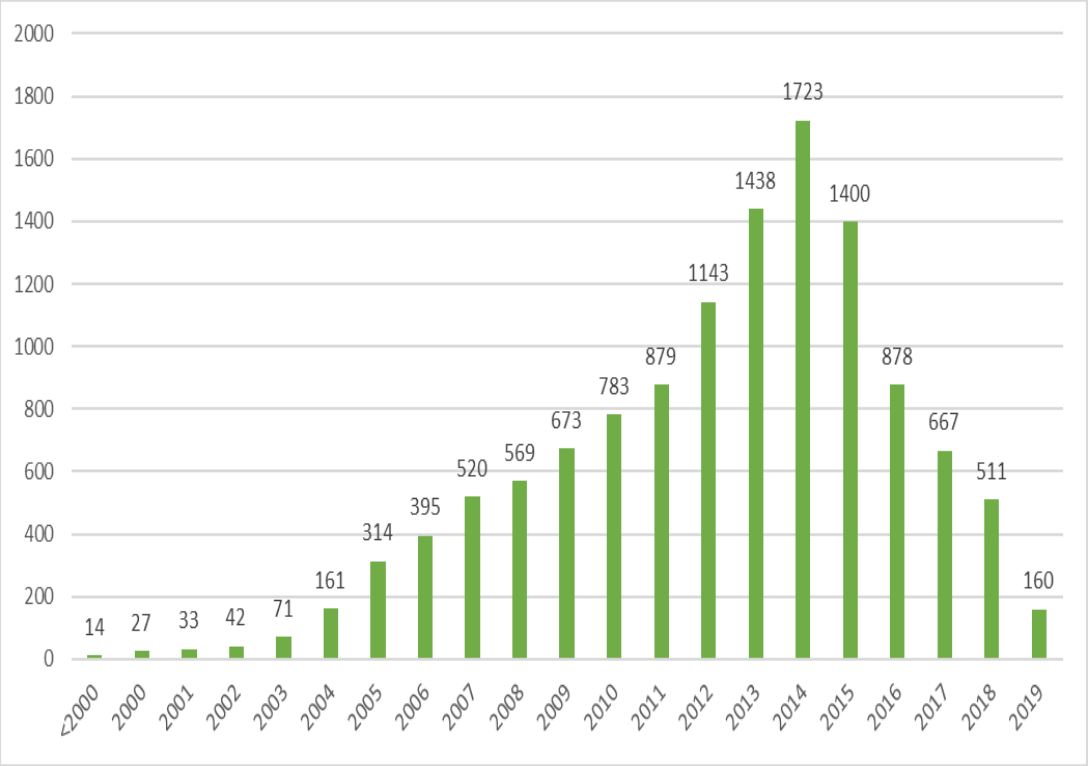
3.6.11 Similar to Stockport, Bolton's taxi fleet has a large majority of licensed taxis that would be considered old vehicles. 95 out of 99 are registered before 2015, representing 96% of Bolton's fleet, again highlighting that almost all of Bolton's taxi fleet may not meet EU standards and would not comply with the proposed MLS.

3.6.12 Salford appear to have to newest taxi fleet when it comes to proportions as 36 out 101 vehicles were manufactured from 2015 onwards, representing 36% of the fleet. However, the remaining 64% were manufactured pre-2015 which suggest they would not meet EU standards. If the proposed MLS were introduced in 2019 63 (62%) of Salford's fleet would not comply.

Table 3-2 Age of Taxi Fleet by LA

Year	Bolton	Bury	Manchester	Oldham	Rochdale	Salford	Stockport	Tameside	Trafford	Wigan	Total
<2000	0	0	0	0	3	0	8	0	3	5	**19**
2000	0	0	0	0	0	0	3	0	4	0	**7**
2001	0	1	0	0	2	0	7	0	6	6	**22**
2002	0	0	0	0	1	0	5	0	6	2	**14**
2003	0	2	0	0	4	1	5	2	5	3	**22**
2004	7	3	0	0	2	5	18	3	11	5	**54**
2005	10	5	1	0	6	1	17	6	11	6	**63**
2006	17	6	6	2	13	2	22	14	25	11	**118**
2007	10	5	65	1	10	8	12	8	11	20	**150**
2008	18	8	91	6	9	12	7	8	19	11	**189**
2009	8	6	127	4	17	4	3	18	16	13	**216**
2010	12	5	126	10	14	16	1	20	4	12	**220**
2011	4	2	149	12	8	7	3	17	5	12	**219**
2012	6	3	118	7	7	3	1	25	3	2	**175**
2013	2	4	95	14	7	4	5	13	1	4	**149**
2014	1	6	99	10	4	2	6	4	3	7	**142**
2015	0	0	63	6	1	9	3	4	2	4	**92**
2016	2	1	37	2	1	7	2	2	2	3	**59**
2017	0	0	23	0	0	12	2	2	0	3	**42**
2018	0	1	52	0	0	6	3	2	0	4	**68**
2019	2	0	31	0	0	2	1	2	2	0	**40**
Total	**99**	**58**	**1083**	**74**	**109**	**101**	**134**	**150**	**139**	**133**	**2080**

Figure 3-9 Age of PHV Fleet in GM



3.6.13 The ages of the PHV fleet in GM are displayed in

3.6.14

3.6.15

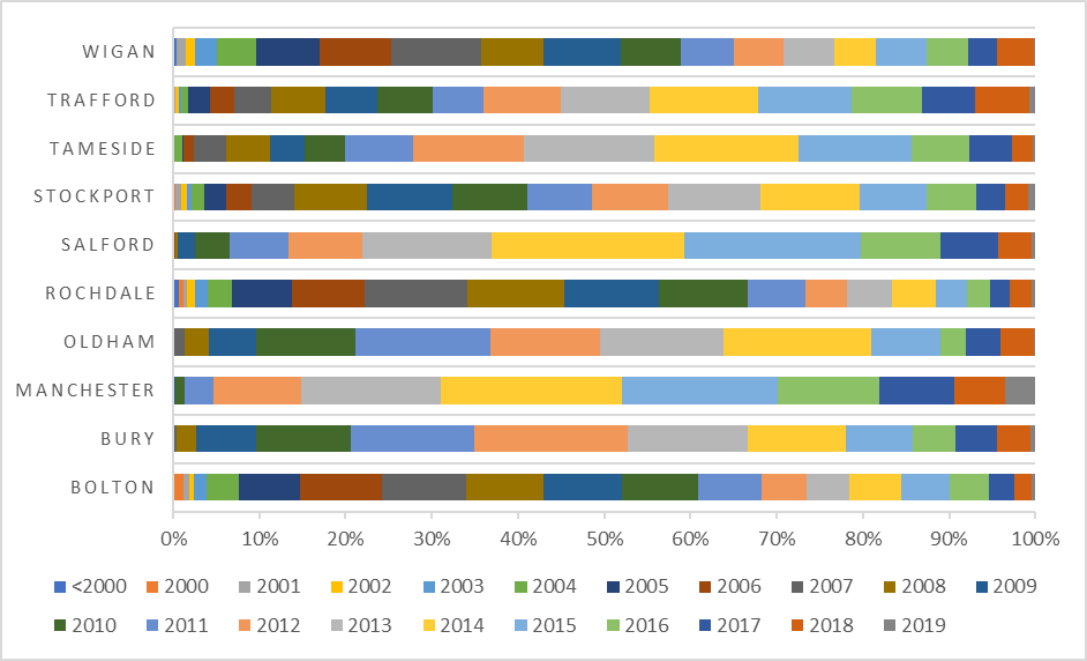
3.6.16 Figure 3-9. It shows that the most common age for a vehicle is 2014 with 1,723 (14%). The years from 2012 to 2015 have a total of 5,074 out 12,401 giving a proportion of 41%, this represents almost half of the whole GM fleet.

3.6.17 Combining the years from pre-2000 up to 2009 which represents vehicles 10-years or older from the present, there are a total of 2,819 PHVs, representing 23% of the GM fleet.

3.6.18 There are 8,785 PHVs registered from the years 2006 to 2014, which is the period of implementation of the Euro 4 petrol engine (2006) and the year before the Euro 6 diesel engine implementation (2015), this accounts for 71% of the fleet. Relating this to the fuel type section below, whereby 73% of the PHV fleet have diesel engines, indicating that almost three quarters of those PHVs may not comply with EU standards and will subsequently be affected by the CAZ.

3.6.19 With the MLS that are set to be introduced in 2020 and 2021 whereby taxis and PHVs must be no older than 5 years old, there are currently 7,062 out of 12,401 (57%) that would be affected by this policy. This would mean that over half of the PHV fleet would be required to change their vehicles in order to comply. It is important to note that these figures are set to change by the time the MLS is implemented.

Figure 3-10 Age of PHV Fleet by LA



3.6.20

3.6.21 **Figure** 3-10 and **Table 3-3** provide a breakdown of the PHV fleets by year and LA. Manchester appears to have one of the youngest fleets compared to the rest of the LAs, the oldest vehicles dating back to 2008 whereby there are only 4 registered, whilst the median age of the fleet is 2013. There are 1,782 that account for 52% of the fleet that were manufactured before 2015 which provides an indication that they may not comply with the EU regulation on engine standards. If the proposed MLS came into effect in 2019 1042 (31%) would not comply.

3.6.22 Bolton's fleet has an older age profile with the most common year of registration being 2007 with 150 vehicles, this represents 9% of Bolton's PHVs. 1,293 out of 1,531 are vehicles that were manufactured before the Euro 6 engine standard was introduced in 2015, this means that 84% of Bolton's fleet may not comply with EU standards. Also, 1200 (78%) of Bolton's fleet would not comply with the proposed MLS if introduced in 2019.

3.6.23 Rochdale has the third largest PHV fleet in GM with a total of 1,329 registered vehicles. The most common age of vehicle in the fleet is 2007 with 157, 12% of the Rochdale fleet. Although, 2008, 2009 and 2010 all have similar numbers with 149,147 and 136 respectively. Similar to Bolton the vast majority of its fleet may not comply with Euro 6 standards 1176 were manufactured before 2015, this represents 88% of the Rochdale fleet. If the proposed MLS came into effect in 2019 then 1,107 (83%) of Rochdale's fleet would not comply.

3.6.24 In contrast, Salford appear to have a much newer fleet in proportion than the other LAs. Of the 984 PHVs registered, 401 were manufactured from 2015 onwards, this figure accounts for 41% of Salford's PHV fleet. Whilst 620 (63%) would comply with MLS if it was introduced in 2019 as they were manufactured from 2014. Although more than half may not comply with Euro 6 standards, the proportion is much greater compared to the rest of the LA fleets.

Table 3-3 Age of PHV Fleet by LA

Year	Bolton	Bury	Manchester	Oldham	Rochdale	Salford	Stockport	Tameside	Trafford	Wigan	Total
<2000	2	0	0	0	9	0	0	0	0	3	14
2000	16	0	0	0	7	1	2	0	0	1	27
2001	10	0	0	0	5	0	7	0	2	9	33
2002	9	0	0	0	13	0	6	0	4	10	42
2003	22	0	0	0	20	0	5	0	2	22	71
2004	57	0	0	0	36	0	13	6	8	41	161
2005	109	0	0	0	93	0	23	1	23	65	314
2006	145	1	0	1	113	1	27	7	26	74	395
2007	150	2	0	11	157	0	45	22	40	93	520
2008	137	21	4	26	149	3	77	30	58	64	569
2009	140	62	4	51	147	20	91	24	55	79	673
2010	135	99	39	106	136	40	79	28	59	62	783
2011	112	129	115	144	89	66	68	46	55	55	879
2012	81	160	344	117	65	85	81	76	83	51	1143
2013	75	124	556	133	68	148	98	89	94	53	1438
2014	93	102	720	157	69	219	105	99	117	42	1723
2015	86	70	619	74	48	202	71	77	100	53	1400
2016	69	45	402	27	35	90	52	40	75	43	878
2017	45	43	299	38	30	66	31	29	57	29	667
2018	32	35	202	35	34	38	24	14	58	39	511
2019	6	5	119	2	6	5	8	2	6	1	160
Total	**1531**	**898**	**3423**	**922**	**1329**	**984**	**913**	**590**	**922**	**889**	**12401**

3.7 Fuel Type

3.7.1 The fuel types of all taxis registered in GM is shown in

3.7.2

3.7.3

3.7.4 Figure 3-11 Fuel types for GM Taxi Fleet. The graph shows that a significant proportion of taxis are fuelled by diesel with 1,881 out of 2,080, this represents 90% of all taxis.

3.7.5 The second largest fuel types come under ‘Other’, these fuels include, VPD Heavy Oil, Bi-fuels (which allow vehicles to run on two fuels, usually petrol and a natural gas), Liquefied Petroleum Gas (LPG), and finally biofuels, these represent 5% of the taxi fleet.

Figure 3-11 Fuel types for GM Taxi Fleet

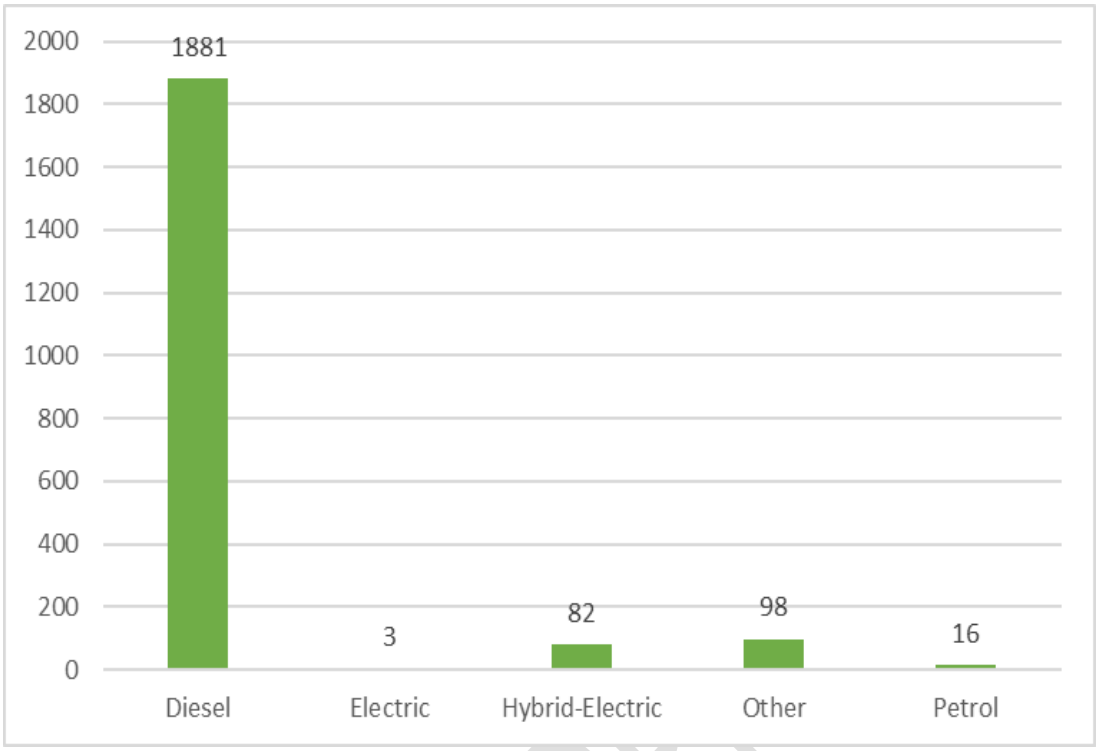
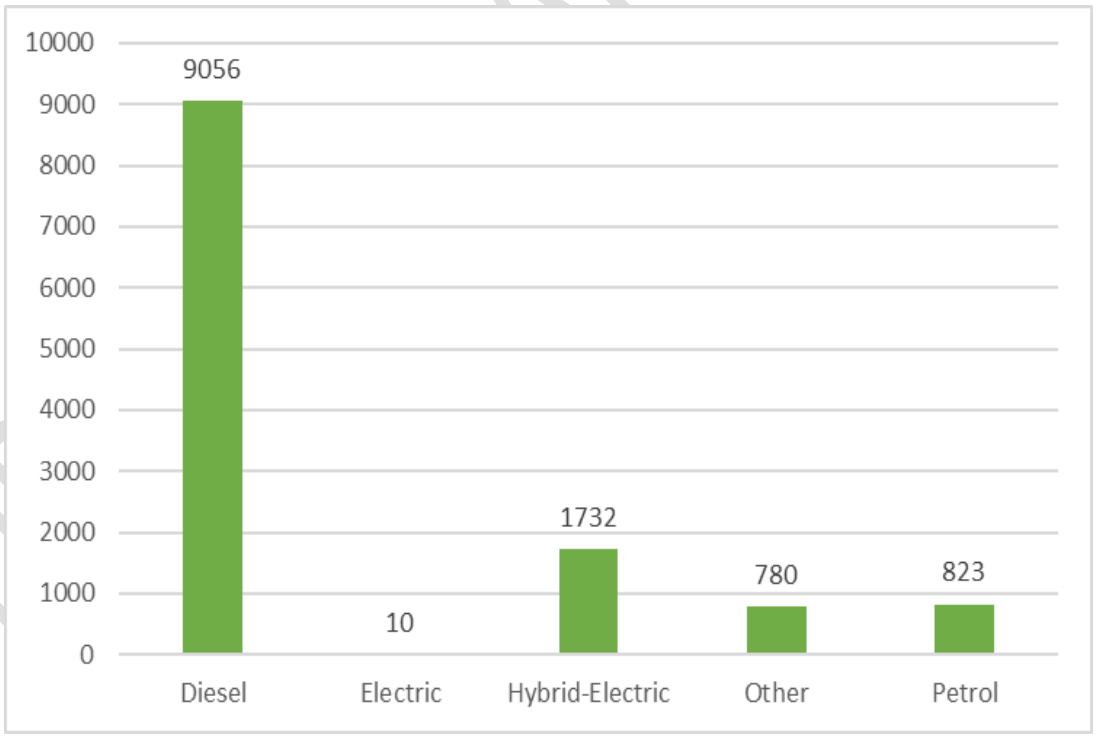


Figure 3-12 Fuel Type for GM PHV Fleet



3.7.6

3.7.7 **Figure** 3-12 Fuel Type for GM PHV Fleet displays the fuels types for PHVs in GM and shows that the vast majority of PHVs use diesel fuel with 9,056 out 12,401, representing 73% of the PHV fleet. Similarly to the taxi fleet, the majority of all the LA fleets had vehicles manufactured before 2015 which indicates that a large majority of GM's PHVs would not meet Euro 6 standards.

3.7.8 However, unlike the taxi fleet there is a significant proportion of PHVs that run on a hybrid-electric engine with 1,732, this accounts for 14% of all PHVs. Although there are still much fewer hybrid-electric PHVs in GM compared to diesel this data indicates more of shift to cleaner vehicles when compared to the taxi fleet.

3.8 Compliance

3.8.1 In relation to the GM CAZ, compliant vehicles are determined by whether the engine standards comply with those set by the EU. As shown in the previous section taxis and PHVs use both diesel and petrol engines, so for the purpose of this study Euro 6 diesel engines (2015) and Euro 4 petrol engines (2006) will be considered as compliant.

3.8.2 The compliance rates were determined by sectioning the years the euro standard was implemented, for instance Euro 5 was categorised from 2010 to 2014. Then using the vehicle's registration plate id, the year of registration was matched to the euro standard year which then provide the euro class.

3.8.3 **Figure 3-13** highlights the compliance rates for taxis across GM. As shown 85% of taxis do not comply with current Euro standards, meaning 15% do comply. This demonstrates that a significant proportion would be affected by the CAZ charge.

Figure 3-13 Taxi Compliance Rate

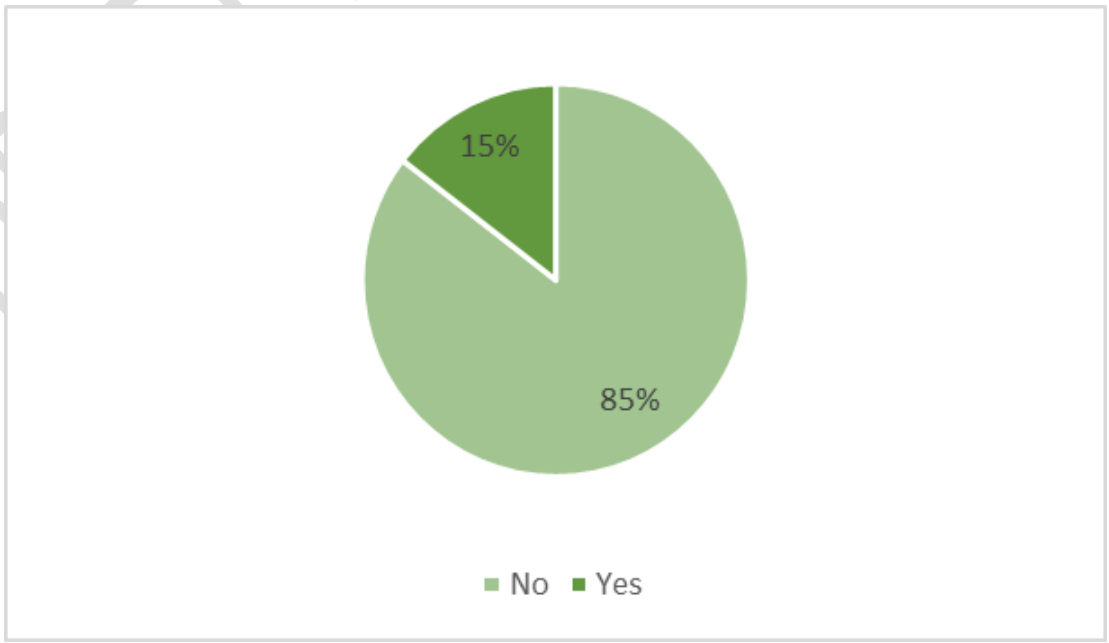
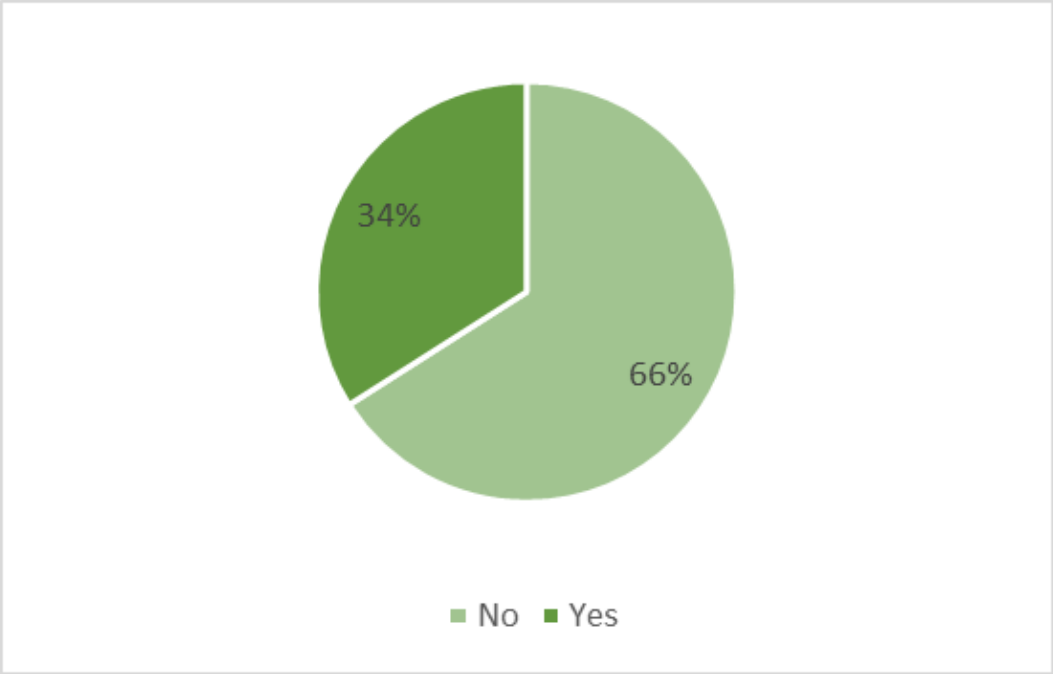


Figure 3-14 PHV Compliance Rate



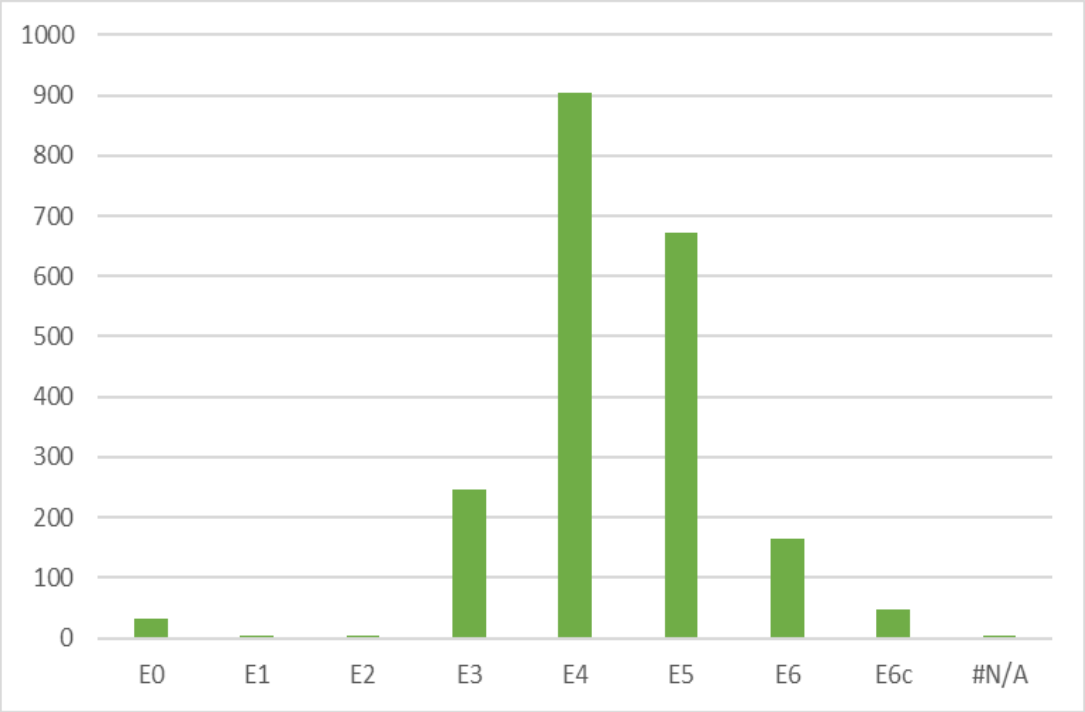
3.8.4

3.8.5

3.8.6

3.8.7 Figure 3-14 shows that PHVs have a greater percentage of their fleet that complies with Euro Standards compared to taxis with 34% in compliance and 66% non-compliant. Although PHVs have a higher percentage of compliant vehicles, 66% represents a significant proportion of non-compliant vehicles.

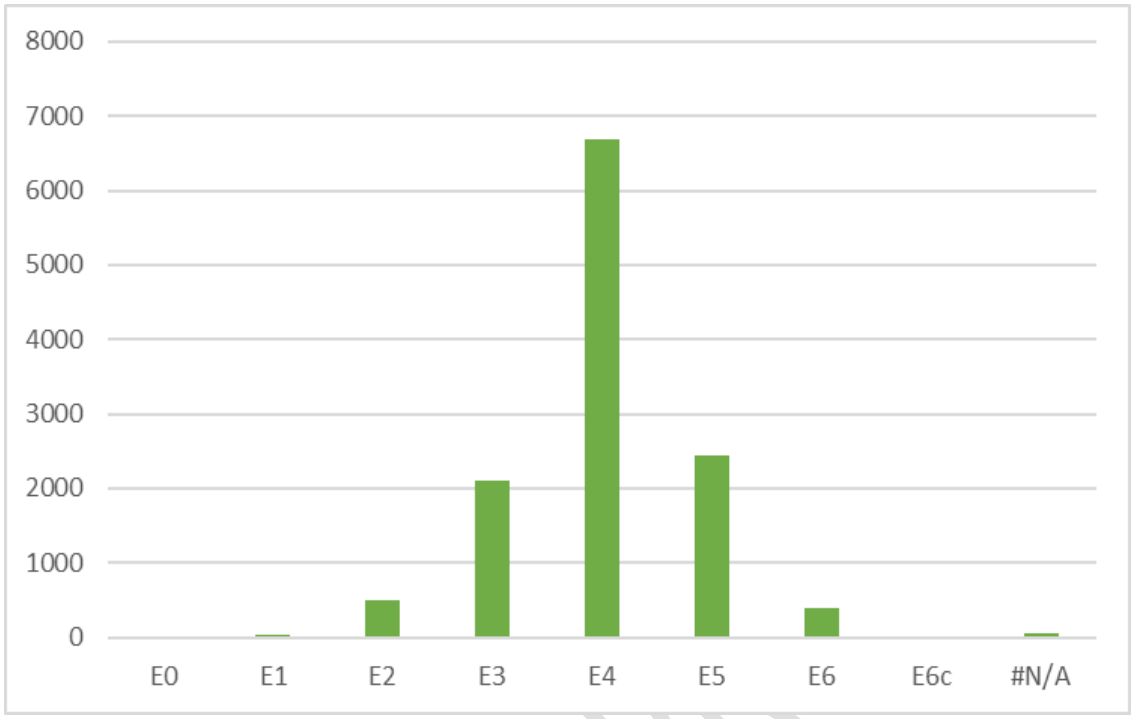
Figure 3-15 Taxi Euro Classification



3.8.8 The Euro classification for taxis in the GM fleet is displayed **Figure 3-15**. As shown the most common Euro class is Euro 4 with 904, representing 43% of the GM taxi fleet. The second most common Euro class is Euro 5 with 673 (32%).

3.8.9 There is a total of 213 that are Euro 6 standard (Euro 6/6c) that would comply with the CAZ, this represents 10% of the taxi fleet in GM. However, it is worth noting that 9% of GM's taxi fleet have alternative fuels to diesel and petrol meaning that there will be a larger number of taxis that comply.

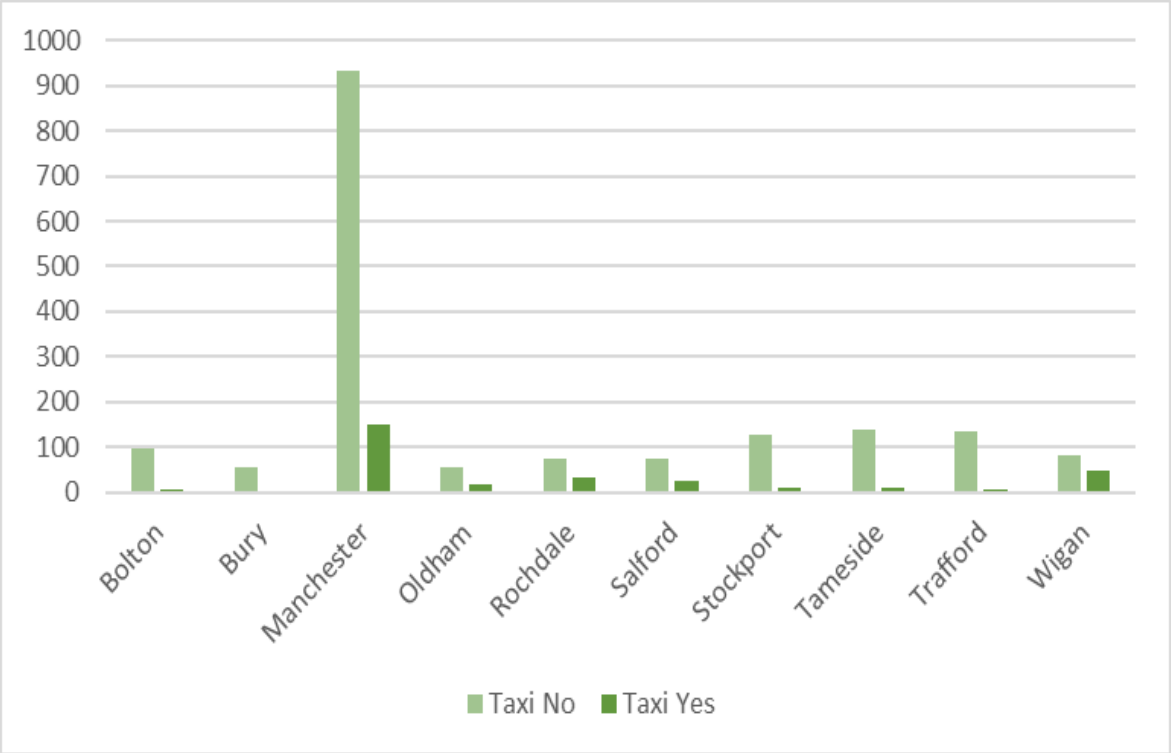
Figure 3-16 PHV Euro Classification



3.8.10 **Figure 3-16** displays the Euro classification for PHVs in GM. Comparable to taxis, the most common Euro standard engine is Euro 4 with 6,683, 54% of the GM fleet. Euro 3 and Euro 5 have similar numbers with 2111 (17%) and 2,437 (20%) respectively.

3.8.11 In comparison to the taxi fleet, there is a smaller proportion of Euro 6 and 6c engines with a total of 393, accounting for 3% of the GM fleet. This highlights a significant proportion that would not comply with EU standards and would likely be affected by the CAZ. Again, similar to the taxi fleet, 20% of vehicles use alternative fuels to diesel and petrol so there will be a greater number of vehicles that comply.

Figure 3-17 Taxi Compliance by LA



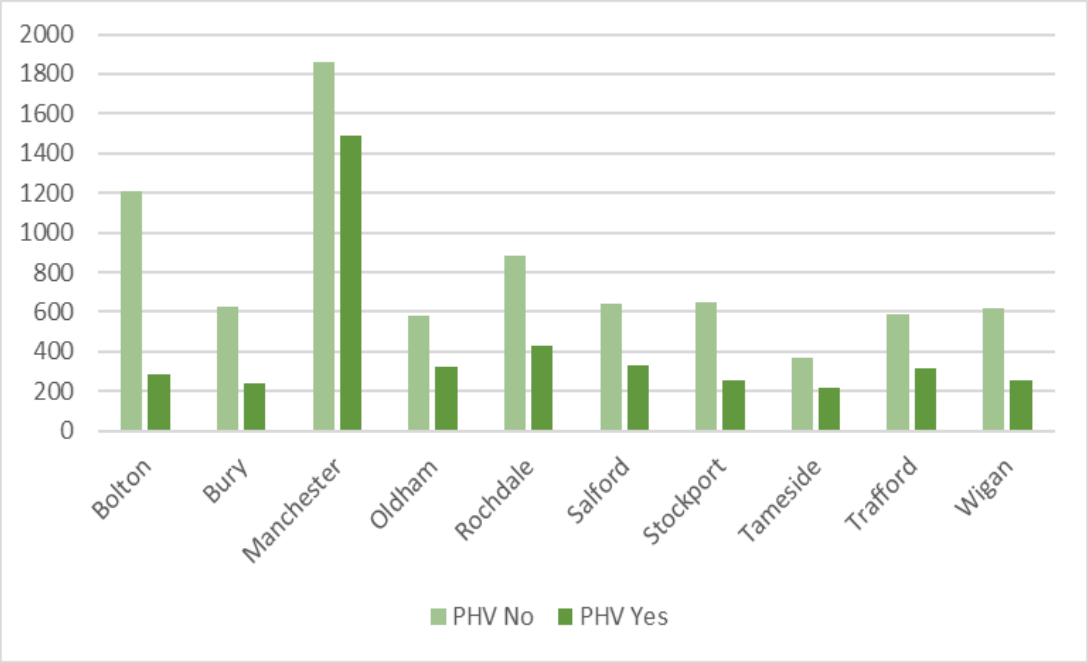
3.8.12 **Figure 3-17** shows the number of compliant and non-compliant taxis within GM by LA. Manchester have the largest number of non-compliant taxis with 932, representing 86% of the taxi fleet in Manchester. Tameside have the second largest non-compliant fleet with 140, this accounts for 94% of their taxi fleet.

3.8.13 Bolton, Trafford and Bury are the three worse performing LAs with the highest proportion of non-compliant taxis. 95 out of 99 (96%) of Bolton's fleet are non-compliant, 135 out of 139 (97%) of Trafford's fleet are non-compliant, and 56 out of 58 (97%) of Bury's taxis are also non-compliant. Although these three fleets are not the largest in GM they represent a significant imbalance between compliant and non-compliant taxis within GM.

3.8.14 Although Manchester have the largest non-compliant taxi fleet in GM, they also have the largest compliant fleet with 150 taxis, this represents 14% of Manchester's fleet. Wigan have one of the smaller taxi fleets in GM but also one of the best compliant rates proportionally with 48 out of 133 taxis compliant, accounting for 36% of their taxi fleet.

3.8.15 Rochdale, Salford and Oldham also have some of the better taxi compliant rates in GM. 34 of 109 (31%) of Rochdale's taxi fleet are compliant, 25 of 101 (25%) of Salford's taxi fleet are compliant, and 18 out of 74 (25%) of Oldham's fleet are compliant.

Figure 3-18 PHV Compliance by LA



3.8.16

3.8.17

3.8.18 **Figure** 3-18 shows that comparable to the taxi fleets Manchester have the largest non-compliant fleet in GM with a total of 1,857, this accounts for 57% of the PHVs in Manchester. With 1,212 (79%) non-compliant PHVs, Bolton have the second largest non-compliant PHV fleet in GM and also the least compliant proportionally across all LAs.

3.8.19 Bury and Stockport have the same proportion of non-compliant PHVs in their fleets with 72%. There are 627 non-compliant vehicles in Bury's fleet, whilst Stockport have 646.

3.8.20 As is the same with the taxi fleet, Manchester have the largest compliant fleet with a total of 1,489, representing 43% of Manchester's PHVs. Rochdale have the second largest number of compliant PHVs with 429, accounting for 33% of their fleet.

3.8.21 Unlike their taxi fleet Tameside have one of the better proportions of compliant PHVs with 217 compliant vehicles, representing 37% of their fleet. Oldham and Trafford have the same proportion of compliant vehicles with 320 and 318 respectively both representing 35% of their fleets.

3.8.22 After Bolton who have the lowest proportion of compliant vehicles with 19%, Bury and Stockport equally have the lowest proportion with 239 and 253 respectively, these represent 28% of their fleets.

4 Purchasing, Leasing and Retrofitting

4.1 This section aims to provide an understanding on the taxi and PHV market price in order to give a clearer picture on potential costs of upgrading for those affected by the introduction of the CAZ. As there is no information provided by DfT or any other external body a search of range of prices from online websites has been carried out[7].

4.2 It is important to note that due to the nature of purchasing a vehicle from various sites and companies, there are no set prices for vehicles even of the same make/model and manufacturing year. This means that prices can vary depending on the condition of the vehicle such as the mileage. The figures provided are simply estimates and guides of potential costs for purchasing a new or used vehicle.

4.3 New Taxis and PHVs

4.3.1 In regard to the taxi fleet, LTI TX4s are the most common vehicle used in GM with 844 registered, however the TX4 is no longer in production so therefore only second-hand vehicles are available. If a taxi operator wanted to upgrade to a new LTI they would have to purchase a London Electric Vehicle Company (LEVC) vehicle, as LTI was relaunched as LEVC in 2017.

4.3.2 Due to the large variety of possible taxis and PHVs on offer, the top 5 affected for each license as type as they represent the ones most likely affected. **Table 4-1** provides a summary of costing estimates for the top 5 taxi vehicles.

Table 4-1 Estimated Cost for Top 5 Taxi vehicles

Vehicle Make	Upgrade	Estimate Cost for Vehicle
LTI TX4	LEVC TX Electric Taxi	Prices starting from £55,599
Mercedes Vito	Euro 6 Upgrade	£41,995
Peugeot E7	Euro 6 Upgrade	£30,000
LTI TX2	LEVC TX Electric Taxi	Prices starting from £55,599
Toyota Avensis	Euro 6 Upgrade	£19,540 - £27,595

4.3.3 For new vehicles, car companies do not release their prices online and require individual enquiries to gain a quote, for this reason alternative websites were used to get prices. However, when researching for prices for Peugeots E7s there were few sites offering the taxi version as these are specially adapted versions of the of the Peugeot Experts, therefore the range of prices were limited.

4.3.4 During the research process it was discovered that the Toyota Avensis is no longer in production and was discontinued in 2018. With this in mind the estimated cost for a Toyota Avensis upgrade is based on the purchase of a new Toyota Prius as that was another popular Toyota make.

[7] For example, CabDirect https://www.cabdirect.com/

4.3.5 Like the taxi fleet there is a large variety of vehicles used for PHVs meaning only the top 5 were selected as examples as they represented the highest proportion of PHVs in GM. **Table 4-2** provides a summary of the costing.

4.3.6 The prices for the Skoda Octavia were able to be sourced from the Skoda website, therefore a more accurate and reliable price could be provided.

4.3.7 As was the same with the Toyota Avensis model for taxis, both the Avensis and Auris have been discontinued therefore the pricing for those models are based on new Toyota Prius models. Like the Skoda, Toyota provide their prices online meaning a more in-depth price range could be provided.

Table 4-2 Estimated Cost for Top 5 PHV vehicles

Vehicle Make	Upgrade	Estimate Cost for Vehicle
Skoda Octavia	Euro 6 Upgrade	£18,600 - £31,400
Toyota Prius	Euro 6 Upgrade	£19,500 - £27,600
Toyota Avensis	Euro 6 Upgrade	£19,500 - £27,600
Toyota Auris	Euro 6 Upgrade	£19,500 - £27,600
Mercedes Vito	Euro 6 Upgrade	£42,000

4.4 Second Hand Compliant

4.4.1 During the desktop search for second-hand compliant LTI TX4 it was discovered that there was only one vehicle listed that would comply, the vehicle had a 2017 registration plate and was listed for £31,495. Given the lack of listed TX4s, it was more worthwhile to search for the second-hand compliant Mercedes Vito as it is the second most common vehicle model used. It was apparent during the price search that there was no large variance in price aside for the odd vehicle, all vehicles had similar sized engine of 2000cc and all had diesel engines. Table 9 provides a simple price range of all Vitos listed with no variance in specifications or year of manufactured.

Table 4-3 Second Hand Compliant Mercedes Vito

Year of Manufacture	Price Range
2015-2019	£15,500 - £43,000

4.4.2 **Table 4-3** shows a price range of £15,500 to £42,995, however it is worth noting that the £42,995 vehicle is a 2019 whist the rest of the models ranged from 2015 to 2017. The most common price tended to be around £20,000.

Table 4-4 Second-Hand Compliant Skoda Octavia

Year of Manufacture	Fuel Type	Price Range
2015 – 2019	Diesel	£5,500 - £32,100
2005 – 2019	Petrol	£1,500 - £32,700

4.4.3 **Table 4-4** displays the price range for the Skoda Octavia due to its popularity among PHV drivers. Unlike the Mercedes Vito the Skoda Octavia is available with both a diesel or petrol engine. As there are different manufacturing years for the compliance of the Euro 6 for diesel engines and Euro 4 for petrol engines, the table provides the price ranges for both in order to give a clearer picture on the difference in the second-hand market.

4.4.4 Both engine types have roughly the same maximum price of just over £32,000, both of these prices were for 2019 models. However, there were cheaper vehicles available with petrol engines, the cheapest viable option being £1,450 whilst the cheapest diesel option was £5,490. It is however important to consider that the petrol cars date back to 2005 so are likely to be in worse condition and have a higher mileage than the oldest compliant diesel vehicle.

4.5 Second Hand Non-Compliant

4.5.1 Using the LTI TX4 as an example **Table 4-4**Table 4-5 highlights the cost of a non-compliant vehicle. Due to the differences in engine size and mileage there were clear variances in prices therefore a range of these have been provided. With the TX4 model being manufactured from 2007 to 2017 a range of 5-9 years and 9-12 years has bene provided.

Table 4-5 Second-Hand Non-Compliant LTI TX4

Age (Years)	Price
5-9	£3,800 - £20,995
9-12	£1,000 - £5,000

4.5.2 For the years 5-9 there was a minimal amount TX4 models for sale which limited the depth of the search and price variety. The cheapest vehicle found was £3,800 with the most expensive being £20,995, although the median price was £6350.

4.5.3 There was much greater choice for the years 9 to 12 which allowed for greater variety in prices. The cheapest TX4 model of that age range was £1000 with the most expensive being £5000, however the median price of vehicles found was £1900. As **Table 4-5** shows it's much cheaper for a driver or operator to buy an older vehicle of 9 to 12 years old than one that is 5 to 9 years old.

Table 4-6 Second-Hand Non-Compliant Skoda Octavia

Age	Price
5-9 years	£990 - £13,990
9-12 years	£595 - £7,988

4.5.4 For the PHVs the Skoda Octavia was used as an example to use as it is the single most popular vehicle of choice for PHV drivers and there for will be the most affected. **Table 4-6** provides a summary of the costs for a Skoda Octavia.

4.5.5 There is a large variance in price for the Skoda Octavia due to the factors mentioned previously in this section with differences in mileage, age and general condition of the vehicle. As expected the new cars of 5 to 9 years were overall more expensive with the most expensive being £13,990, whilst for 9 to 12 years the most expensive was £7,988. The cheapest vehicle for years 5 to 9 was £990, slightly more expensive than years 9 to 12 at £595.

4.6 Leasing

4.6.1 Leasing entails agreeing a contract with a provider to use an asset for a particular period of time. The user never owns the asset and typically pays the provider a monthly fee until the asset is returned at the end of the contact. There are alternative methods of leasing, these include:

- Hire purchase – This usually includes paying a deposit and fixed monthly instalments typically ranging between 12-72 months. When the contract is finished the vehicle is owned by the lessee.
- Lease Finance – A contract whereby the lessee pays for the use of the asset but never owns the asset. The lessee is responsible for maintenance, repairs and running costs.
- Operating Lease – Similar to lease financing the lessee pays to use the asset for a fixed period of time, however, the leasing party are responsible for maintenance and repairs.

4.6.2 It is considered that leasing may be a feasible option for operators or divers that need to upgrade their vehicles but may not have the immediate capital to do so.

4.6.3 Accurate pricing was limited at this stage as many companies required a personal enquiry into prices and contract conditions, and due to the number of variables that are specific to the leaser and lessees accurate prices would be difficult.

4.7 Retrofitting

4.7.1 A possible solution for drivers and operators is to retrofit their vehicles with technology that would make their vehicles compliant. The Energy Saving Trust website states that taxis are able to be retrofitted under the Clean Vehicle Retrofit Accreditation Scheme (CVRAS) that will enable CAZ compliance of fleet vehicles. Retrofitting a petrol engine that can run off LPG is the only retrofitting technology available for taxis and PHVs according to Energy Saving Trust[8].

[8] Energy Saving Trust - https://www.energysavingtrust.org.uk/transport/freight-and-retrofit/clean-vehicle-retrofit-accreditation-scheme-cvras

4.7.2 Only the technologies approved by the CVRAS are CAZ compliant therefore for the purpose of this study the prices provided by the CVRAS will be considered. LTI TX1, TX2 and TX4 are the only vehicles that are approved by the CVRAS to be retrofitted to be powered from LPG. A list of certified technologies and companies are provided on the Energy Trust website.

4.7.3 From the desktop search 'Vehicle Repowering Solutions Ltd' (VRS) appeared to be only CVRAS approved LPG Repower and LPG conversion company that provided a service of converting TX1, TX2 and TX4 taxis. In order to get a vehicle retrofitted the vehicle must be taken to their facility in Alcester approximately 20 miles south of Birmingham. This is an important point to consider due to the distance drivers would have travel in order to retrofit their vehicle.

4.7.4 **Table 4-7** provides the cost for retrofitting TX1, TX2 and TX4 taxis based on the prices provided by the Vehicle Repowering Solutions Ltd website[9]. The costs are for the retrofit of the new engine, fuel tank as well as other essential parts, although costs may vary depending on the condition of the vehicle.

4.7.5 The website states that they accept grants from LAs of up to £5,000 which would almost half the cost of the retrofit for the driver or operator. Currently London, Birmingham and Edinburgh are the only cities signed up to provide this grant, but it is a possibility for GM.

Table 4-7 Taxi Retrofitting Costs

Vehicle	Cost
LTI TX1/TX2	£11,760
LTI TX4	£12,480

4.8 Greater Manchester Minimum Licensing Standards

4.8.1 The Minimum Licensing Standards (MLS) is still in draft for consultation so the conditions are subject to change, however with the current proposed conditions the taxi and PHV market in GM are likely to be affected by this as well as the CAZ. This section aims to provide an overview on some of the key measures that are proposed to be implemented in the next couple of years[10].

4.8.2 To fit in line with the EU Euro standards for vehicles all taxis and PHVs must comply with Euro 4 standard for taxis, and Euro 6 standard for diesel engines. As well as comply with engine standards, vehicles must not be older than 5 years old. Using the age data in the previous section of this note, 79% of the taxi fleet and 57% of the PHV fleet would be affected Although those figures would change by the time the minimum standards come into effect.

[9] Vehicle Repowering Solutions Ltd - https://www.vehiclerepoweringsolutions.com/repowering-process
[10] Taxi & Private Hire Minimum Standards Consultation, April 2019

4.8.3 It is also stated that the vehicle colour of all PHVs must be white and all taxis must be in black. The justification for this policy is to provide a unified appearance of the vehicle fleet across GM to remind customers of the consistent brand and what to look out for. The figures of vehicle colours for taxi and PHVs are not known at this stage so an indication on the impact cannot be provided, but there will be a number of drives and operators that will have to pay for either a new vehicle or pay for their current one to be repainted in order to comply.

4.8.4 If taxis or PHVs wan to retrofit emissions technology in order to comply with the CAZ they must have been approved as part of the CVRAS.

4.8.5 All vehicles must conform to M1 vehicle standards either via manufacture or if converted must be inspected to attain M1 status.

4.8.6 These measures are due to be introduced on the 1st April 2020 for all new vehicles being licensed, whilst all other vehicles will be required to meet these standards by 1st April 2021. With the CAZ implantation date set to come into force in 2021 these measures may cause added complications for compliance in the taxi and PHV market.

5 Owner and Operators

5.1 This section provides personas of the major types of taxi and PHV operators, operating within GM. The purpose of the persona is to outline the characteristics of the operator to better inform the risk and effect analysis.

5.2 Operator Personas

5.2.1 Unlike other fleet-based transport industries, the majority of taxi and PHV drivers are self-employed (81%) [11]and own or rent the vehicles they use. Often drivers will work for a taxi firm who have an established customer base and will send out jobs to the nearest available driver. As most drivers own or rent their vehicles and cover the costs of fuel, drivers prefer a vehicle with good fuel economy, but are equally restricted by the substantial initial cost of a vehicle.

5.2.2 The taxi and PHV profession is predominantly male, with males accounting for 96% of the workforce. The average age of a driver is 48 years, with 26% of drivers aged under 40[12]. As the majority of drivers are self-employed, the hours and shifts worked are flexible and often determined by the individual, with one in four drivers reporting that they work part time. The majority of drivers usually work 5 days a week (40%), however it is common for drivers to work 6 days (22%) or 7 days a week (23%).

[11] Taxi and Private Hire Vehicle Statistics, England: 2018 (DfT, 2018) – pg12
[12] Taxi and Private Hire Vehicle Statistics, England: 2018 (DfT, 2018) – pg11

5.2.3 Taxi drivers operate on a 24-hour basis working in shifts, with Friday and Saturday evenings being the busiest period for custom. In 2017 nearly half (46%) of taxi or PHV trips were between 2 and 5 miles, and over a quarter (26%) were less than 2 miles. Relatively fewer taxi journeys are made over longer distances, with approximately 16% of journeys between 5 and 10 miles, and 9% between 10 and 25 miles. Due to the reduced cost efficiency of long-distance taxi travel to the customer, only 3% of total taxi trips are further than 25 miles[13].

5.2.4 Whilst many of the taxis and PHVs that operate in GM are licensed from one of its boroughs, it is common for vehicles licenced in other areas to operate within the region. There are many reasons why this would be necessary, for instance if a driver from outside GM accepts a fare to travel into the region, or that travels through the GM boundary to access a destination. Although PHV drivers and their vehicles have a right to roam in different licensing areas, PHV operators may only accept a booking in the area for which they are licensed. 'Cross-border hiring' of vehicles has attracted increased attention in recent years, due to the emergence of ride-hailing and ride-sharing platforms such as Uber. New mobility technologies have raised questions over who technically receives a booking and the implications for licensing legislation, as the driver communicates directly with the customer, bypassing a traditional taxi operator. 'Cross-border hiring' is particularly common in GM's town centres and urban areas where there is a higher density of fares.

5.2.5 Due to the individual and flexible manner in which the taxi industry functions, operators have been categorised into three personas which broadly cover the different types of operator; taxi, PHV and Uber. Whilst Uber vehicles are technically PHVs, they are distinguished from other traditional PHV operations by their use of a digital platform used to connect driver and customer.

5.2.6 Arguably, a further persona affected by a CAZ would be an operator who leases vehicles to their drivers and would therefore need to consider the types of vehicles they provide.

5.3 Taxi

- There is a total of 8,300 taxis registered in the NW of which 2,080 are licensed in GM. Whilst the majority of GM taxis will operate within the region, drivers from other areas of the NW may enter the CAZ to complete a fare.
- May own or lease a vehicle from an operator or other third party.
- Taxis can be hailed from the streets, collect fares from taxi ranks or take pre-bookings.
- Rates are and regulated by local council.

[13] Taxi and Private Hire Vehicle Statistics, England: 2018 (DfT, 2018) – pg15

- Permitted to drive in bus lanes.
- More likely to be found in urban areas where taxi ranks or passing fares are more frequent.
- Authorised vehicle types may be specified by the licencing authority. The most common taxi vehicle used in Greater Manchester is the LTI TX4.
- 15% of taxis comply with CAZ engine requirements.
- As a specialist vehicle, new taxis generally cost more to purchase than a vehicle that could be used as a PHV.
- Drivers may work for taxi companies or be self-employed.
- Drivers may own their vehicle or rent from a taxi company or a vehicle renting company.
- Some authorities require drivers to pass a test before a licence is awarded.

5.4 PHV

- There are 27,600 PHVs registered in the NW of which, 12,401 are licensed in GM. There may be additional PHVs operating in the region under 'cross-border hiring'.
- May own or lease a vehicle from an operator or other third party.
- PHV bookings must be made in advance of travel and vehicles cannot be hailed in the street or from taxi ranks.
- Traditionally, PHV bookings are made by phone or by entering the office of a taxi company.
- Local authorities do not have the jurisdiction to regulate PHV fares but may authorise the fares used by licensees.
- More likely to be found in urban areas but also provide a vital service to more rural areas of GM with less public transport connectivity.
- The most common PHV vehicle used in Greater Manchester is the Skoda Octavia.
- Greater percentage of PHV fleet is compliant with the CAZ in comparison to taxis, with 34% meeting the requirements.
- Drivers may work for taxi companies or be self-employed.
- Drivers may own their vehicle or rent from a taxi company or a vehicle renting company.

5.5 Uber

- Whilst technically a PHV, Uber drivers operate using an app to connect to a customer, accept a fare and receive payment.
- The platform uses a dynamic pricing model based on the supply and demand for the service at the time it is requested. 'Surge prices' are enforced during busy periods.
- Drivers are only able to use the app within the region in which they are licensed (e.g. North West, Yorkshire, Midlands); however there may be a significant number of drivers operating from outside GM under 'cross-border hiring'.
- Compliance of vehicles operating in GM is unknown as drivers may be licensed from an external authority but is likely to be similar to PHVs Uber's vehicle requirements state that vehicle model year must be 10 years or newer.
- More likely to be found in urban areas where there is a higher density of customers to connect to.
- Although Uber drivers were previously classed as self-employed, in 2019 the Court of Appeal upheld the decisions of the Employment Tribunal which concluded that drivers are workers employed by Uber and entitled to minimum wage and holiday pay. It is likely that Uber will appeal this decision.
- Drivers may own their vehicle or lease from a vehicle renting company.

6 Conclusions

6.1 Registered Taxi and PHV Vehicles

6.1.1 The analysis has shown that in total there are 14,481 registered taxis and PHVs in GM, representing 40% of the NW market and 5% of the fleet in England. Of the GM fleets Manchester has the largest for taxi and PHV with 52% and 28% respectively, whilst Bury has the smallest taxi fleet in GM with 3% and Tameside has the smallest PHV fleet with 5%.

6.1.2 In regards to the most common vehicle make and model the LTI TX4 is used the most for taxis representing 41%, the Mercedes Vito is the second most common representing 17%. For PHVs the Skoda Octavia is the most common accounting for 19% of the fleet, the Toyota Prius and Avensis both represent 11%.

6.1.3 The vast majority of taxis and PHVs use diesel engines with 1881 out of 2080 (90%) of the taxi fleet using diesel, whilst 9056 out of 12,401 (73%) of PHVs use diesel.

6.1.4 The most common age of taxi vehicles is 2010 with a count of 220, accounting for 11% of taxis. The most common year for PHVs is 2014 at 1723 which represents 14% of the PHV fleet. Another finding was that 76% of taxis and 71% of PHVs were manufactured before 2015, the year the Euro 6 standard was implemented for diesels. Although this does not mean that all of the 76% of taxis and 71% of PHVs would not have EU standard engines as there are some petrol, electric-hybrid, and alternative fuel engines used, it does provide an indication of the number they may be affected.

6.1.5 Stockport and Bolton had the highest percentages of taxis that are unlikely to comply with the EU engine standards with 92% of Stockport's fleet aged older than 2015 and 96% of Bolton's also older than 2015. Proportionally Salford had the newest fleet with 36% being manufactured after 2015.

6.1.6 Bolton and Rochdale have two of the oldest PHV fleets with 84% of Bolton's fleet being manufactured before 2015 and 88% of Rochdale's fleet also being manufactured before 2015. Like the taxi fleet, Salford have the newest fleet with 41% of the fleet being manufactured post 2015.

6.2 Purchasing and retrofitting

6.2.1 In a general review via a desktop search the following assumptions were found:

- For new purchases that would comply with the new Euro standards drivers and operators could expect to pay from £19,420 to £55,599 for taxis and £18,610 to £41,995 for PHVs.
- For taxis, there are a are a limited market for second-hand non-compliant LTI TX4s 5 to 9 years old with prices ranging from £3,800 to £20,995. Whilst for vehicles 9 to 12 years there were more vehicles available at prices from £1,000 to £5,000.
- Whereas for PHVs there were more Skoda Octavias available for all ages with vehicles ranging from 5 to 9 years costing between £990 and £13,990 and 9 to 12 years from £595 to £7,988.
- Second-hand compliant vehicles for taxis using the Mercedes Vito as example would cost drivers and operators between £15,500 and £42,995.
- Whilst second-hand compliant vehicles for PHVs using the Skoda Octavia as example would cost drivers and operators between £5,490 and £32,175 for diesel vehicles and £1,450 and £32,685 for petrol vehicles.
- Retrofitting a Taxi to run LPG costs £11,760-£12,480 depending on the model.

6.3 Owners and Operators

6.3.1 Informed by desktop research and previous studies, three typical market segments were found across the market sector. These include:

- Taxi Drivers: Self-employed, often driving Hackney-style vehicles that are able to pick up passengers without a booking. This can be from anywhere, although most frequently from taxi ranks at busy locations such as train stations or the airport.
- Private Hire Vehicle drivers: Working for a taxi operator, who provides the means for taking bookings via in-car technology in return for a fee (e.g. monthly). Passengers can only be carried if a booking is made in advance
- Uber-style driver: Quasi-self-employed, driver takes bookings via an app and pays a percentage to the operator.

6.4 Summary

6.4.1 From the data available, the taxi market is seen to have a high level of non-compliance in line with the proposed CAZ charge. As a result, the majority of drivers within GM are seen to have some level of vulnerability to the proposed charge.

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

Note 21: Sensitivity test: Full Electric Bus Fleet

Post-OBC approach

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Version Status:	DRAFT FOR APPROVAL	**Prepared by:**	Nigel Bellamy 2nd August 2019
Authorised by: **Date:**	Ian Palmer 5th August 2019		

1 Introduction

1.1 2019. The methodology applied to modelling of conditions with and without action was set out in the supplementary Air Quality reports (AQ1/2/3) and Transport reports (T1/2/3/4), and the Economic Appraisal Methodology Report, set alongside a discussion of the limitations, uncertainties and risks of the evidence base in the Analytical Assurance Statement (AAS).

1.2 Following OBC submission, GM is now undertaking further data collection, analysis and modelling to improve the data and tools supporting the GM CAP and reduce the uncertainty of the conclusions reached.

1.3 As a result, a series of potential improvements have been identified to the assumptions about behavioural responses to a Clean Air Zone. Note 16 sets out the results of a sensitivity test carried out of those assumptions using GM's strategic modelling suite, based on a GM-wide CAZ C in 2023.

1.4 JAQU asked GM to investigate the potential impact of electric buses on the remaining exceedances. This test builds on the scenario used for Note 16, and switches the buses which were all set to be Euro VI in that test, to full electric, i.e. removing all NOx/NO2 emissions from buses.

2 Road Transport Emissions - EMIGMA

2.1 **Table 2-1** shows mass NOx emission totals for the sensitivity test from the EMIGMA model and percentage changes relative to the 2023 do-minimum. Totals are presented separately for the Regional Centre (inside the IRR - the boundary is illustrated in **Figure *3-3***) and the whole of Greater Manchester.

Table 2-1 Forecast Mass NOx Road Traffic Emissions with Percentage (2023)

Vehicle Type	Do Minimum	GM CAZ C test	% Change	GM CAZ C test plus All Electric Buses	% Change
Regional Centre	55	41	-26%	24	-35%
GM	6,385	5,432	-15%	5,305	-17%

2.2 The results for the test show a reduction in road traffic NOx emissions relative to the do-minimum forecast of approximately 17% for the whole of Greater Manchester. NOx emissions in the Regional Centre, which is more congested and has higher bus flows, are forecast to fall by approximately 35%, which is an additional 9% compared to the CAZ C alone.

3 Air Quality Summary and Impact on Compliance

3.1 The revised vehicle emissions for GM wide CAZ C in 2023 were then used in the dispersion modelling process to produce NO2 concentrations. The AQ modelling process is identical to that used in the OBC modelling, as set out in AQ2 and AQ3, as described in Note 16.

3.2 This sensitivity test focusses on providing an understanding of the impacts of removal of bus emissions in addition to the revised behavioural responses to a charging CAZ. Other measures included in the preferred option from the OBC, such as incentivisation funds for freight and investment in electric vehicles, are not included in this test. Therefore, direct comparison with any of the Options developed in the OBC is not relevant as all of these included the full suite of non-charging measures.

3.3 A summary of the results of this sensitivity test are presented in **Table 3-4**, alongside the Do Minimum results. The table provides the number of sites remaining in exceedance of legal limits by local authority.

Table 3-1 Number of sites remaining in exceedance of legal limits for NO2 concentrations, by local authority

Local Authority	Do Minimum 2023	GM CAZ C test 2023	GM CAZ C test plus All Electric Buses 2023
Bolton	3	0	0
Bury	12	4	3
Manchester	29	10	4
Oldham	3	0	0
Rochdale	2	0	0
Salford	10	2	2
Stockport	4	0	0
Tameside	4	0	0
Trafford	0	0	0
Wigan	0	0	0
GM Total	**67**	**16**	**9**

3.4 The results show that the updated GM CAZ C test substantially reduces the number of predicted exceedances in 2023 compared with the Do Minimum scenario. The addition of an all-electric bus fleet further reduces the number of exceedances, many of which are the most persistent in GM. However, a number of exceedances are predicted to remain. The majority of the removed exceedances are located in Manchester city centre, with five removed inside the IRR and the sixth on the A6 just south of the IRR.

Table 3-2 Number of modelled sites by scale of NO2 exceedance

Test Scenario	Compliant sites		Non-compliant sites			
	Very compliant (below 35 µg/m3)	Compliant but close (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)
Do minimum 2023	16,856	210	58	10	0	68
GM CAZ C test 2023	17,020	97	16	0	0	16
GM CAZ C test plus All Electric Buses 2023	17,050	74	9	0	0	9

3.5 Greater Manchester aims to deliver compliance in the shortest possible time in a way that takes into account the need to minimise human exposure.

3.6 Test Scenario	Compliant sites		Non-compliant sites			
	Very compliant (below 35 µg/m3)	Compliant but close (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)
Do minimum 2023	16,856	210	58	10	0	68
GM CAZ C test 2023	17,020	97	16	0	0	16
GM CAZ C test plus All Electric Buses 2023	17,050	74	9	0	0	9

3.7 **Table *3-2*** demonstrates the benefits being delivered 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 considerably in the updated GM CAZ C scenario with the addition of fully electric bus fleet.

3.8

3.9 **Table *3-3*** shows the concentrations at the maximum concentration point by local authority. This shows that, in 2023, the highest exceedances are in Manchester in the Do Minimum and GM CAZ C test, but other exceedances are predicted to remain in Bury and Salford. The addition of the fully electric bus fleet has reduced concentrations most significantly in Manchester and Bury, which had the greatest maximum predicted concentrations in the GM CAZ C test. The scale of the reductions in Manchester and Bury, mean that Salford would be authority with the maximum concentration in GM under this scenario. This is because there are very few buses operating on the A57 Regent Road, in Salford.

3.10 The greatest reduction is predicted to be in Wigan on King St West, which has very high bus frequencies, but this location was already compliant in 2023.

Table 3-3 Maximum predicted NO2 concentration in each local authority (ug/m3)

Vehicle Type	Do Minimum 2023	GM CAZ C test 2023	GM CAZ C test plus All Electric Buses 2023	Reduction Due to All Electric Bus from the GM CAZ C test
Bolton	40.5	38.2	38.1	-0.1
Bury	49.0	43.1	41.8	-1.3
Manchester	46.6	44.2	41.8	-2.4
Oldham	46.4	37.1	37.0	-0.1
Rochdale	44.0	39.8	39.6	-0.2
Salford	46.9	42.9	42.7	-0.2
Stockport	42.6	39.7	39.7	0.0
Tameside	42.7	39.5	39.3	-0.2
Trafford	39.1	35.3	35.1	-0.2
Wigan	38.4	33.5	26.8	-6.7
All GM	**49.0**	**44.2**	**42.7**	**-1.5**

3.11 Figure **Figure 3-1** and **Figure 3-2** provide maps of the exceedances across GM and focussed on the city centre. Overall, the exceedances in this test are located in sites where the OBC Option 7 contained persistent hot spots, and Local Measures are already being reviewed and developed where feasible in these locations. However, there is now only one site left in exceedance inside the IRR, on Quay Street.

3.12 There are two new sites (circled in red), which will be reviewed in further detail. These will feed into further work in the Local Exceedances work if package modelling indicates that they are not solved by the preferred scheme package.

Figure 3-1 Map of exceedances identified in the with-GM CAZ C plus all electric bus test (2023)

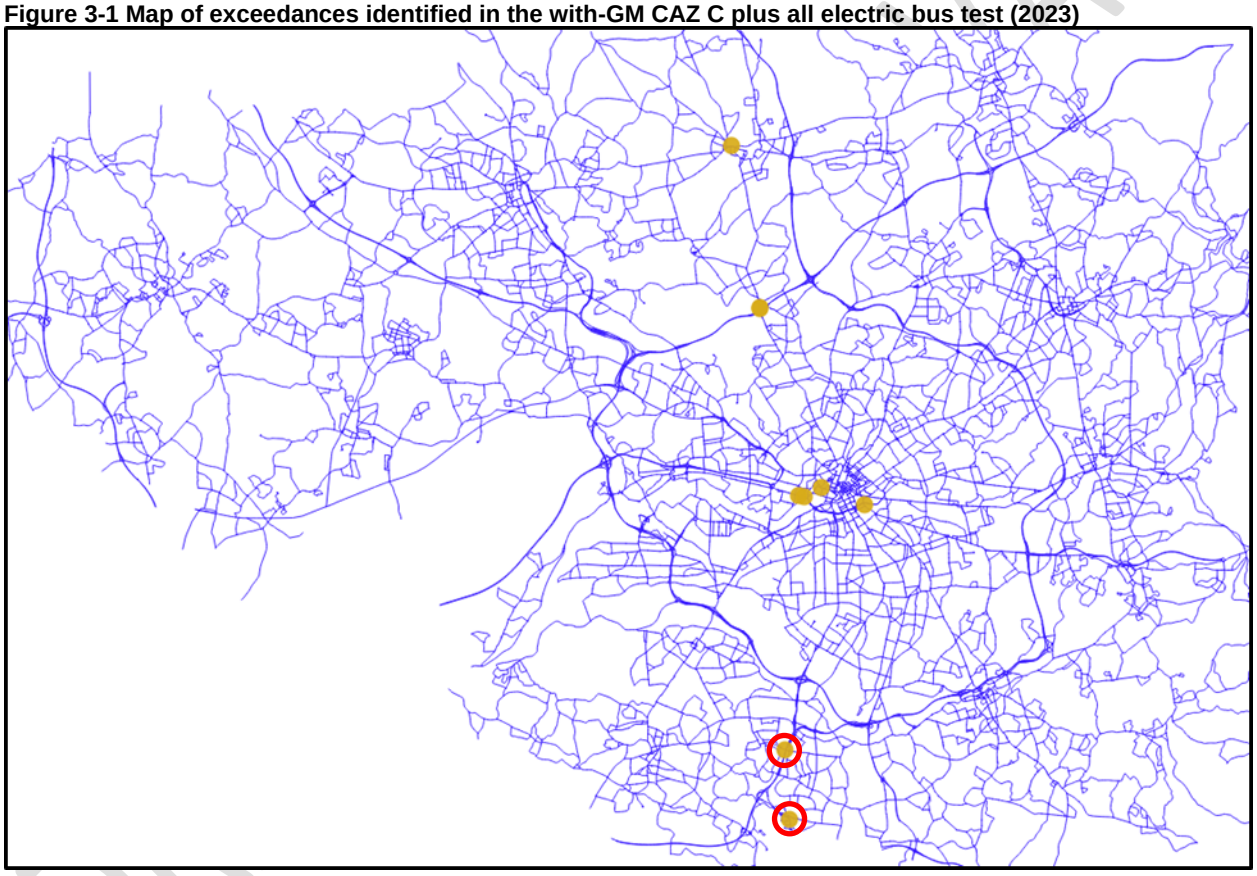


Figure 3-2 Map of exceedances identified in the with-GM CAZ C plus all electric bus test, city centre (2023)

3.13 The air quality and source apportionment data at key sites of exceedance are provided in **Table 3-4**.

3.14 The key points reported herein are those that would eventually come to define compliance within GM and each district in the OBC. These sites have been selected based on the maximum predicted concentrations and last points of compliance in each district in the best performing options, plus where there are several points with high concentrations, and those which display notably different source apportionment by vehicle type were added. The locations of these points are shown in Figure 3.

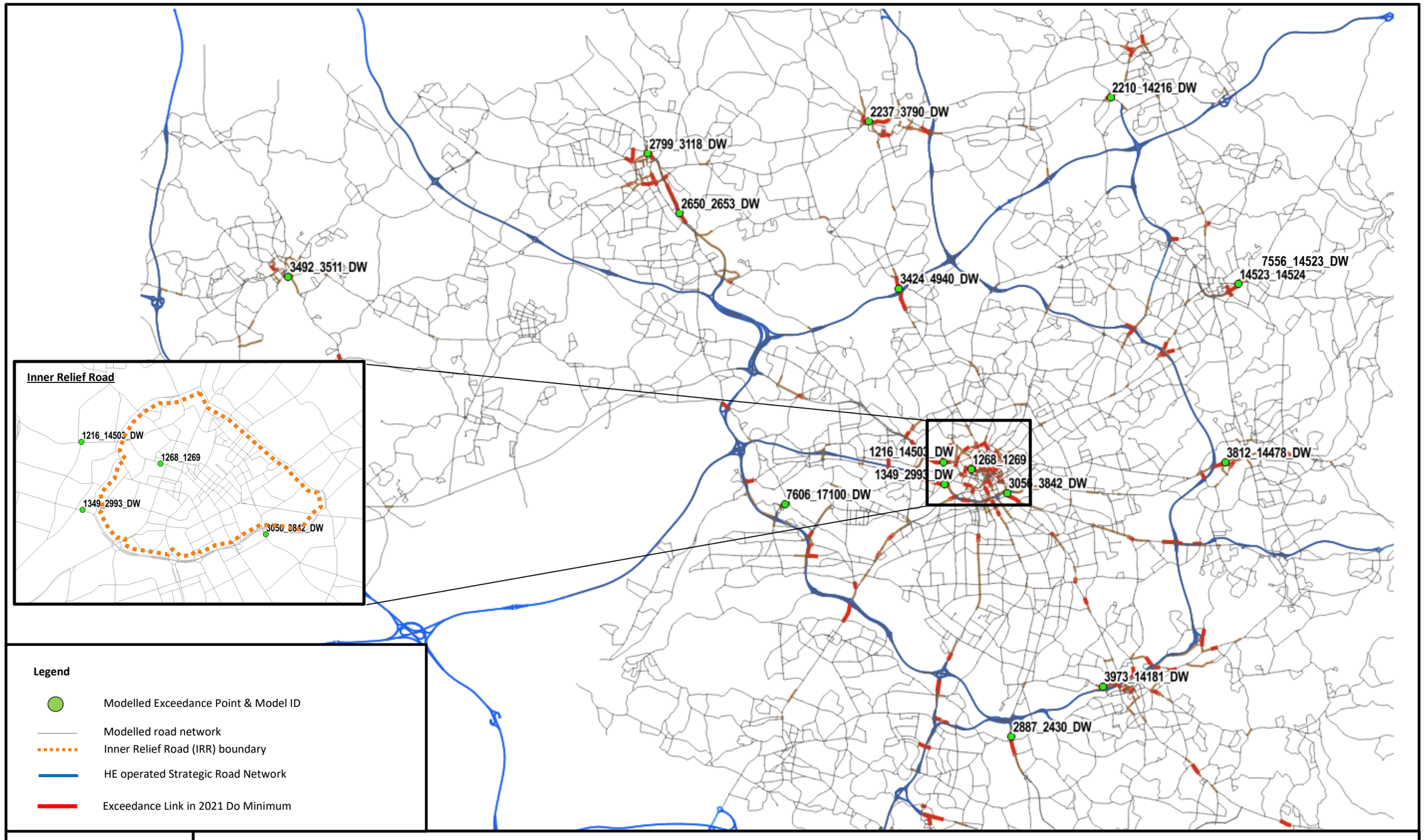
3.15 The analysis in the OBC showed that there are very diverse factors affecting vehicle emissions across Greater Manchester, with emissions from each vehicle type often differing between roads in close proximity to each other. The GM wide CAZ C sensitivity test imposes a penalty charge on all vehicle types except private cars, and therefore reduces the emissions contribution from these vehicles compared to the Do Minimum scenario, with all buses assumed to upgrade to Euro VI. However, whilst Euro VI buses are proven to provide significant reductions in NOx emissions over earlier standards, they do still emit NOx from their exhaust. Thus, an all-electric bus fleet test reduces the NOx emissions from the exhaust to zero, going beyond the Government's requirements in the Clean Air Zone Framework.

3.16 The results show that the modelled impacts of an all-electric bus fleet in addition to GM wide CAZ C leads to reductions in NO2 concentrations at typical worst-case locations of between 0 to -9 ug/m3. This essentially reflects the frequency of bus services at a given location, and their relative contribution to total NOx emissions from all vehicle traffic.

Table 3-4 Maximum Predicted annual mean NO2 concentrations and source apportionment at key compliance points on the Greater Manchester road network – GM wide CAZ C plus all electric bus sensitivity test 2023

Point ID	Census ID	Road name	Local Authority	Annual mean NO_2 conc ($\mu g/m^3$)	BG NOx conc ($\mu g/m^3$)	BG NO_2 conc ($\mu g/m^3$)	Road NOx contribution ($\mu g/m^3$)	Road NO_2 contribution ($\mu g/m^3$)	AADT	NOx contribution by vehicle type (%)					Change in Annual mean NO_2 conc ($\mu g/m^3$)
										Bus	Taxi	HGV	LGV	Car	
2799_3118_DW	58048	A673	Bolton	37.0	26.0	18.1	40.1	18.9	27,820	0%	5%	24%	25%	46%	-0.3
2650_2653_DW	7431	A666	Bolton	38.1	24.8	17.3	41.9	20.8	69,895	0%	5%	2%	43%	49%	-0.1
2237_3790_DW	38354	A58	Bury	41.8	21.4	15.2	57.4	26.6	79,499	0%	6%	16%	26%	52%	-1.3
3424_4940_DW	17924	A56	Bury	40.2	17.0	12.4	59.3	27.8	19,939	0%	6%	21%	24%	50%	-0.3
3056_3842_DW	26157	A6	Manchester	41.8	32.2	21.6	43.1	20.2	38,857	0%	6%	14%	29%	51%	-2.4
1268_1269	27974	A34	Manchester	33.5	35.6	23.4	21.8	10.1	9,320	0%	7%	7%	27%	59%	-8.8
7556_14523_DW	36632	A62	Oldham	37.0	24.5	17.1	40.6	19.9	24,933	0%	6%	9%	28%	57%	-0.1
2210_14216_DW	17322	A664	Rochdale	39.6	17.9	13.0	60.6	26.6	34,464	0%	4%	35%	25%	36%	-0.2
1349_2993_DW	73792	A57	Salford	42.7	24.7	17.2	54.1	25.5	57,604	0%	6%	9%	33%	52%	-0.2
1216_14503_DW	17926	A6	Salford	35.9	25.2	17.6	38.8	18.3	31,601	0%	6%	24%	24%	46%	-3.9
3973_14181_DW	58034	A5145	Stockport	38.6	20.9	14.9	49.5	23.7	26,336	0%	5%	18%	28%	48%	-1.1
2887_2430_DW	26352	A34	Stockport	39.7	19.0	13.8	53.2	25.9	40,340	0%	6%	6%	28%	61%	0.0
3812_14478_DW	99618	A635	Tameside	38.9	25.5	17.7	44.5	21.3	41,270	0%	6%	14%	35%	46%	-0.6
7606_17100_DW	N/A	B5214	Trafford	31.7	19.6	14.1	36.0	17.6	28,960	0%	6%	18%	21%	55%	-2.9
3492_3511_DW	8566	A577	Wigan	33.0	29.1	19.7	26.9	13.3	22,508	0%	6%	13%	29%	52%	-0.3

Figure 3-3 Map of key exceedances points across Greater Manchester



Transport for Greater Manchester	**Key Exceedance Points across GM**			
	Drawn by: NB	**Scale: NTS**	**Date: 1-8-19**	**Figure 3**

4 Summary and Conclusion

4.1 This note presents the results of sensitivity testing carried out to investigate the impact of an all-electric bus fleet applied in addition to the revised behavioural responses used in the GM wide CAZ C scenario in 2023.

4.2 Further information on these behavioural responses and the GM wide CAZ C sensitivity tests are available separately as part of the suite of reports provided to JAQU in July 2019.

4.3 The key comments and conclusions relating to this test are detailed below:

- This test is purely hypothetical. The behavioural assumptions used in the CAZ C modelling are not finalised, and a wider package of other supporting measures would also be included in any future package.
- The use of an all-electric bus fleet delivered an additional 9% reduction in mass NOx emissions, inside the Inner Ring Road (IRR) compared with the GM-wide CAZ C scenario.
- Seven districts are fully compliant in this test: Bolton, Oldham, Rochdale, Stockport, Tameside, Trafford and Wigan. However, these are not brought into compliance due to the impact of electric buses, but were already compliant in the GM wide CAZ C scenario.
- The number of non-compliant sites falls from 16 in the Do Minimum to nine, located in three districts (Bury, Manchester and Salford):
    - The majority of these are already identified as the last remaining exceedances under OBC Option 7 (a GM-wide CAZ B with supporting measures) and are included in the current Local Exceedances project, which seeks to identify local interventions that could be effective in bringing forward compliance at the last points of exceedance.
    - The measure is most effective in the regional centre. The majority of the removed exceedances are located in Manchester city centre, with five removed inside the IRR and the sixth on the A6 south of the IRR. Only one exceedance remains inside the IRR.
    - Two additional exceedance locations have been predicted in the updated modelling for the GM wide CAZ using the revised behavioural responses. These are on the approach to Manchester Airport, and on Hollyhedge Road crossing the M56. There are some concerns as to the validity of these exceedances and analysis indicates that these are likely to be overestimates and not representative of exceedance.
- Overall, maximum concentrations are lower in all districts than the GM wide CAZ C scenario, with the exception of Stockport.

- Further work is required to refine the behavioural response assumptions to be applied to the testing of a GM CAZ. Nevertheless, the results of this test suggest that a CAZ C with an all-electric bus fleet, as defined here and implemented without further supporting measures may not be sufficient to achieve compliance in the shortest possible time and that further interventions will be necessary to tackle exceedances in Bury, Manchester and Salford.
- The feasibility of delivery of an all-electric bus fleet in GM has not been considered. There would be significant practical constraints relating to procurement, supply and lead times. Additionally, fully electric buses may not have the range to operate all of the routes and the scale of provision of suitable charging infrastructure would also need to be understood.

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

Note 22: Addendum to Note 3: GM Comparative Statistics

Post-OBC approach

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Authorised by: **Date:**	Ian Palmer 5th August 2019		

1 Introduction

1.1 This technical note provides an addendum to the report HGV Commercial Research (LGVs & HGVs), AECOM 2019 [submitted to JAQU 12th July 2019]. The note provides analysis of socio-economic data to support the Commercial Vehicles Research. It presents a series of data comparing Greater Manchester to the rest of England, demonstrating in many cases that Greater Manchester is typical to the country as a whole.

1.2 The note provides a review of data relating to:

- Population and Migration;
- Employment;
- Income;
- Education; and
- Economic Inactivity and Health;

.

2 Population and Migration

2.1 Greater Manchester currently has a total population of over 2.8 million people[1]. As illustrated in **Table 2-1**, over a 10 year period (2008-2018) the population of Greater Manchester has increased by 7.3%, alongside a national increase of 8.0%. This includes natural change in the population and net migration into the area.

Table 2-1 Population growth in Greater Manchester and England (2008-2018)

	Population (Mid-2008)	Population (Mid-2018)	Population Change over 10 years	Percentage Change (%)
Greater Manchester	2,620,007	2,812,569	192,562	7.34
England	51,815,853	55,977,178	4,161,325	8.03

Source: ONS (2018) Population estimates for the UK, England and Wales, Scotland and Northern Ireland: mid-2018[2]

[1] ONS Population Estimates by Local Authority based by five year age band, 2018 [online]- Available from: https://www.nomisweb.co.uk/reports/lmp/la/1967128590/report.aspx

[2] ONS Population estimates for the UK, England and Wales, Scotland and Northern Ireland: mid-2018 [online]- Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/annualmidyearpopulationestimates/mid2018

2.2 Projections for future population growth over the next 20 years are shown in **Table 2-2** for Greater Manchester, the North West and England. This highlights the expectation of a positive natural change in Greater Manchester, as well as the positive influence of net migration into the region. This positive natural change trend is also projected nationally. However, in Oxford's Economics forecasts for Greater Manchester, from early-to-mid 2020's migration will be reduced due to a stricter immigration policy being introduced and the UK / England being less attractive for migrants. This trend is also anticipated to be experienced across the rest of the UK[3].

Table 2-2 Population projections for Greater Manchester, North West and England, 2016-2036

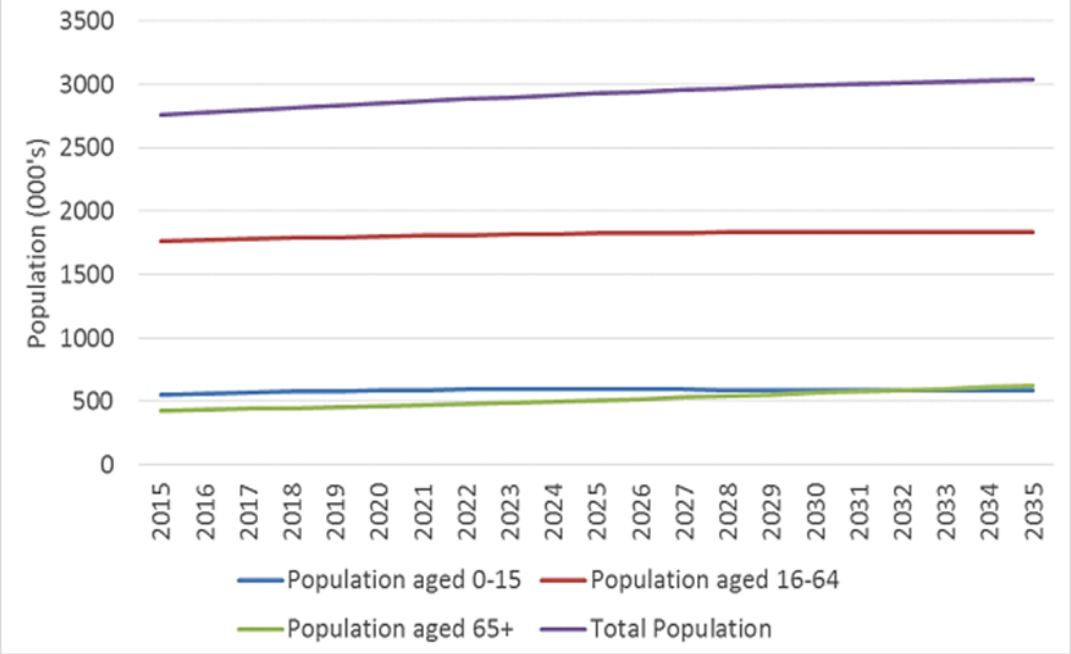
Area	Population Change (000s)	Net Migration (000s)	Natural Change (000s)
Bolton	15.2	-3	18.7
Bury	9.3	1.7	7.4
Manchester	77.2	-19.8	97.7
Oldham	19.1	-1.7	20.4
Rochdale	11.7	-2.4	13.8
Salford	37.3	9	28.2
Stockport	24.6	13.4	11
Tameside	10.7	2.4	8.1
Trafford	25.3	12.4	13
Wigan	9.8	11.6	-1.6
Greater Manchester	**240.2**	**23.5**	**216.4**
North West	403	215	187.4
England	**5,637**	**3,100**	**2,540**

Source: Greater Manchester Strategic Housing Market Assessment: (January 2019). Data Source: ONS 2016 - based subnational population projections for local authorities and higher administrative areas in England ONS[4].

[3] Economic Forecasts for Greater Manchester, (January 2019), p.10 [online] - Available from: https://www.greatermanchester-ca.gov.uk/media/1731/final_gmfm2018_forecast_paper_web.pdf
[4] ONS Based Subnational Population Projections for local authorities and higher administrative areas in England, p.52 [online]- Available from: https://www.greatermanchester-ca.gov.uk/media/1733/gm-shma-jan-19.pdf

2.3 This decline in net migration, as well as an ageing population is projected to affect Greater Manchester's population growth in the next 15+years, as well as in England and the UK. Over a 10 year period (2016-2026), Greater Manchester's population will increase by 5%[5]. **Figure 2-1** illustrates forecast growth in population for Greater Manchester between 2015 and 2035. This includes consistent population of 0-15 year olds, a levelling out of those aged 16-64 and a steady increase of those aged 65+. This will result in Greater Manchester having an ageing population, as the number of people aged 65+ will grow by 53% by 2039[6]. This will also increase the Old Age dependency ratio in Greater Manchester.

Figure 2-1 Forecast population in Greater Manchester (2015-2035)



Source: Greater Manchester Transport Strategy 2040 Evidence Base: 2018 Update. Data Source: Greater Manchester Forecasting Model: Accelerated Growth Scenario, Oxford Economics (2017)[7]

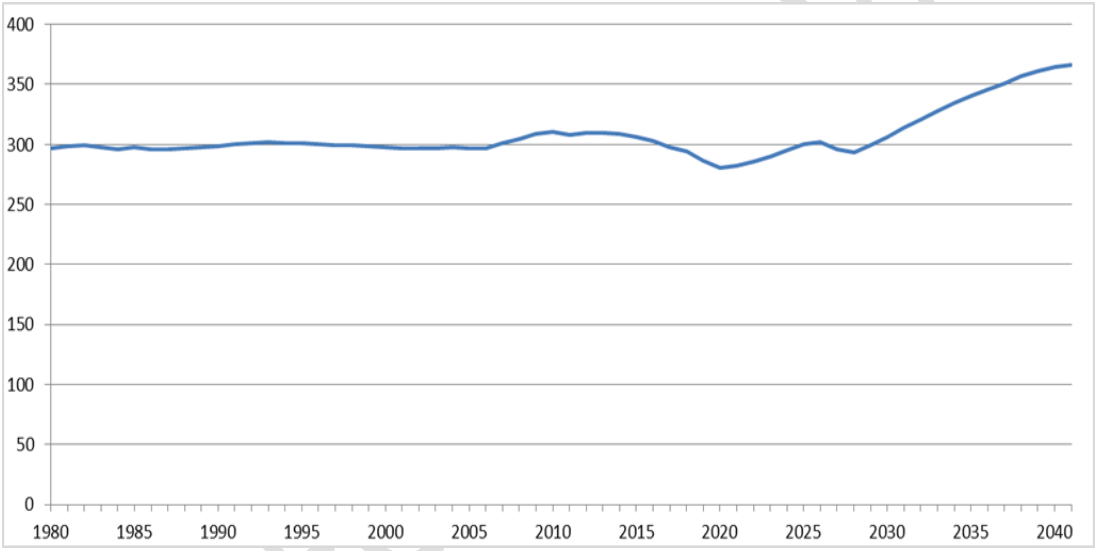
[5] ONS Population projections for local authorities: 2016 based. [online] Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/localauthoritiesinenglandtable2

[6] ONS National Population Projections: 2014 based Statistical Bulletin [online] Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/bulletins/nationalpopulationprojections/2015-10-29

[7] Greater Manchester Transport Strategy 2040, Evidence Base: 2018 Update, page S5, Data source: Greater Manchester Forecasting Model: Accelerated Growth Scenario, Oxford Economics (2017) [Online] Available from: http://www.neweconomymanchester.com/publications/greater-manchester-forecasting-model

2.4 In England, the projected average change in population over a 10 year period (2016-2026) will be an increase of 3.2 million people (a 5.9% increase) and the North West will have a slightly slower growth at 3.4%[8]. In comparison to the 2008 to 2018 period, where the population increased by 8% (nationally), this is a projected reduction in population growth. This will impact the economy due to the increasing ageing population and decline in those of working age. With regards to the Old Age dependency ratio, **Figure 2-2** demonstrates that it is predicted to exponentially grow from 280 in 2020 to 366 by 2041. These changes may increase the productive capacity of the workforce; however, it will place increasing pressure to provide social services, for example healthcare and housing, which will be the same situation in Greater Manchester.

Figure 2-2 Old Age dependency ratio in England (1980-2041)



Source: ONS (2018)[9]

3 Employment

3.1 As outlined in **Table 3-1**, the proportion that are economically active in Greater Manchester (aged 16-64) is marginally lower compared to the rest of the country. In Greater Manchester 76.0% of the population are economically active, compared to 79.4% in England. However, in 2017 there were over 890,000 (68.6%) people in Greater Manchester working full-time, which was slightly higher than the national average of 67.5%. [10]Unemployment in Greater Manchester is only marginally higher than the rest of England by 0.5%; this is also higher than whole of the North West which is currently below the national average (3.9%).

[8] ONS Subnational Population Projections for England: 2016- based [online] Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/bulletins/subnationalpopulationprojectionsforengland/2016based

[9] ONS Old Age dependency ratio, England, 1980-2041. [online] Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/ageing/adhocs/008459oldagedependencyratioengland1980to2041

[10]

Table 3-1 Employment and unemployment in Greater Manchester, the North West and England (Apr 2018- Mar 2019)

All People	Greater Manchester (Met County) (Numbers)	Greater Manchester (Met County) (%)	North West (%)	England[11] (%)
Economically Active†	1,389,300	76.0	76.9	79.4
In Employment†	1,328,700	72.6	73.8	76.3
Employees†	1,143,600	62.9	64.4	-
Self Employed†	181,100	9.5	9.2	-
Unemployed§	60,600	4.4	3.9	3.9

Source: ONS Annual Population Survey. †= numbers are for those aged 16 and over, %= those aged 16-64, §= numbers and %= proportion of economically active [12]

3.2 In terms of occupations in Greater Manchester, **Table 3-2** illustrates there is a slightly higher proportion of the population aged 16-64 who work in the manufacturing (Process Plant & Machine Operatives) and in the service sector compared to the national level. A total of 19.0% work as Process Plant & Machine Operatives and Elementary Occupations in Greater Manchester, whereas 16.4% work in these roles nationally. Furthermore, there are higher proportions of those who work in Greater Manchester in the services sector, for example, in Caring, Leisure, Sales and Customer Service (17.8%) compared with the national level (16.2%). This trend is also shown in **Figure 3-1**; in 2016 the Greater Manchester GVA per employee was £29,100 in the health and social care sector, but in the UK it was only £28,000 GVA per employee.

[11] England data based on March-May 2019 NOMIS data
[12] NOMIS/ ONS Annual Population Survey- Labour Market Profile- Greater Manchester (Met County)- Available from: https://www.nomisweb.co.uk/reports/lmp/la/1967128590/report.aspx#tabempunemp

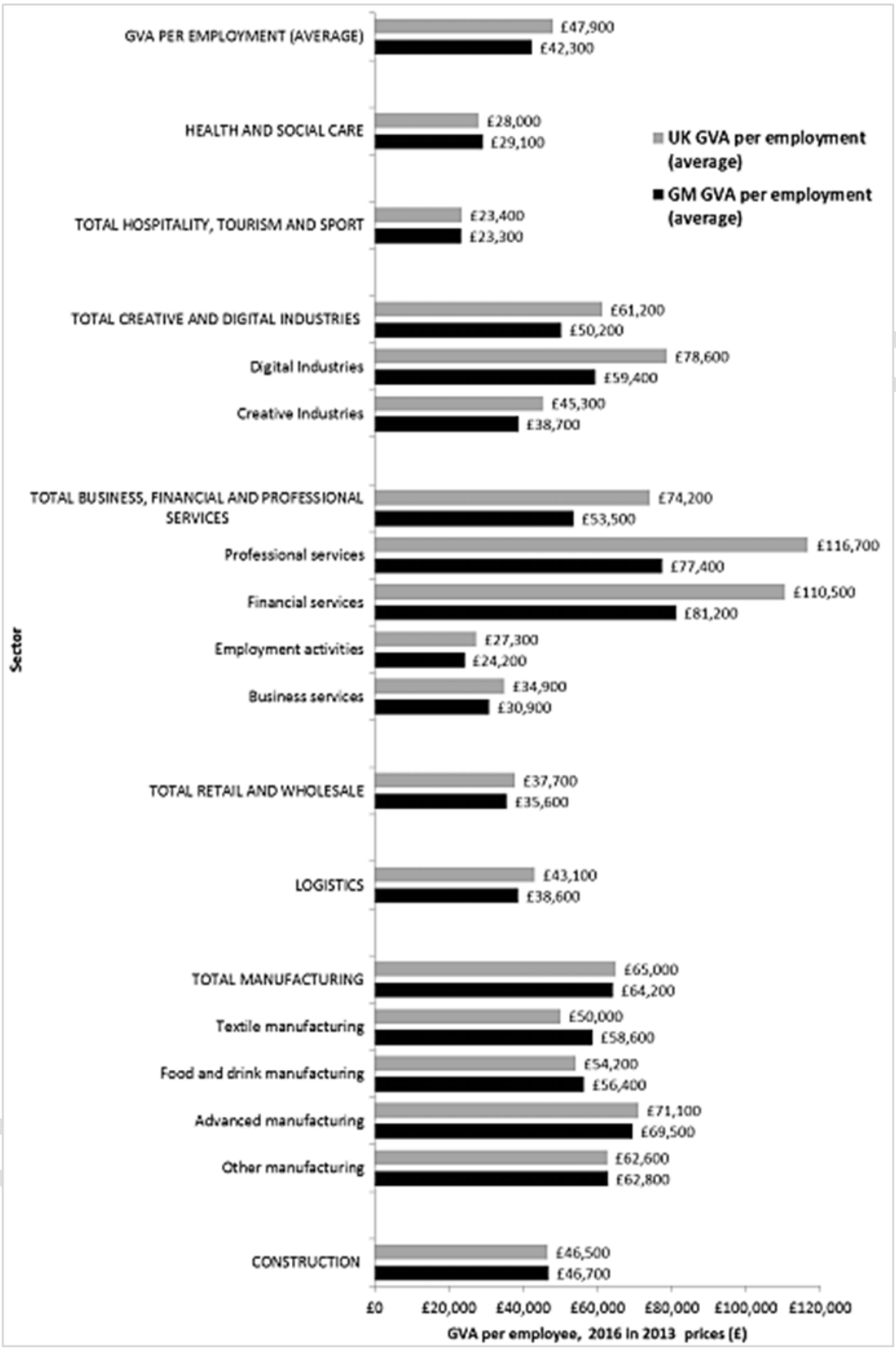
Table 3-2 Employment by occupation in Greater Manchester, the North West and England (Apr 2018-Mar 2019)

Occupations	Greater Manchester (Met County) (Numbers)	Greater Manchester (Met County) (%)	North West (%)	England (%)
Soc 2010 Major Group 1-3	583,300	44.1	44.2	47.4
1 Managers, Directors And Senior Officials	129,900	9.8	10.3	11.2
2 Professional Occupations	269,100	20.3	19.8	21.0
3 Associate Professional & Technical	184,200	13.9	13.9	15.0
Soc 2010 Major Group 4-5	252,700	19.1	20.1	19.9
4 Administrative & Secretarial	136,500	10.3	10.6	10.0
5 Skilled Trades Occupations	116,200	8.7	9.5	9.9
Soc 2010 Major Group 6-7	235,300	17.8	18.0	16.2
6 Caring, Leisure And Other Service Occupations	120,400	9.1	9.5	8.9
7 Sales And Customer Service Occs	114,900	8.6	8.5	7.3
Soc 2010 Major Group 8-9	251,100	19.0	17.7	16.4
8 Process Plant & Machine Operatives	97,700	7.4	7.0	6.2
9 Elementary Occupations	153,400	11.5	10.7	10.2

Source: ONS Annual Population Survey. Numbers and % are for those of 16+, % is a proportion of all persons in employment[13]

[13] NOMIS/ ONS Annual Population Survey, Labour Market Profile- Greater Manchester (Met County) [online]-Available from; https://www.nomisweb.co.uk/reports/lmp/la/1967128590/report.aspx#tabempunemp

Figure 3-1 Productivity Average Gap in Employment Sector between Greater Manchester and the UK



Source: Greater Manchester Transport Strategy 2040, Evidence Base (2018), Data Source: Oxford Economics (2017)[14]

[14] Oxford Economics (2017), 'Greater Manchester Forecasting Model Dataset' in Greater Manchester Transport Strategy 2040, Evidence Base (2018) p, EC8. Available from: https://downloads.ctfassets.net/nv7y93idf4jq/3ryONeNzmuSAsPDzgtB3jt/489fbfefd35227ba4bad46c89f0e210a/2040_Evidence_Base_Update_Collated.pdf

4 Income

4.1 In Greater Manchester, the Gross Weekly and Hourly-Pay are below the national level. As illustrated in **Table 4-1**, in Greater Manchester the gross hourly pay for full-time workers in 2018 was £13.04, whereas in England it was £14.42. For the Gross Weekly pay, workers are paid nearly £60 less in Greater Manchester compared with the national amount (£574.90).

Table 4-1 Earning by place of residence in Greater Manchester, the North West and England (2018)

	Greater Manchester (Met County) (Pounds)	North West (Pounds)	England (Pounds)
Gross Weekly Pay			
Full-Time Workers	516.2	529.6	574.9
Male Full-Time Workers	552.0	571.9	614.5
Female Full-Time Workers	473.4	472.4	512.0
Hourly Pay-Excluding Overtime			
Full-Time Workers	13.04	13.35	14.42
Male Full-Time Workers	13.47	13.90	15.00
Female Full-Time Workers	12.44	12.55	13.58

Source: ONS annual survey of hours and earnings - resident analysis. Median earnings in pounds for employees living in the area[15]

5 Education

5.1 A major barrier to increasing the employment rate in Greater Manchester is residents having poor skills and/or accessibility to do the available jobs which affects Greater Manchester's economic performance in relation to the rest of England. As shown in **Table 5-1**, almost one in ten (9.8%) of 16-64 year olds in Greater Manchester have no qualifications compared with 7.6% in England. It is important that Greater Manchester provides more support and access for all residents to new jobs[16].

[15] NOMIS/ ONS Annual Survey of Hours and Earnings- resident analysis [online]- Available from: https://www.nomisweb.co.uk/reports/lmp/la/1967128590/report.aspx#tabearn

[16] Greater Manchester Transport Strategy 2040, Evidence Base (2018)- Update, p. EC12 [online]- Available from: https://downloads.ctfassets.net/nv7y93idf4jq/3ryONeNzmuSAsPDzgtB3jt/489fbfefd35227ba4bad46c89f0e210a/2040_Evidence_Base_Update_Collated.pdf

5.2 Furthermore, Greater Manchester has a large proportion of students living, studying and working in the region. **Table 5-2** outlines that there were nearly 123,000 (28.7%) students economically inactive in Greater Manchester, which is higher than the national level at 27%. This large student population will be having many positive effects on the economy of Greater Manchester, but might also be negatively affecting housing prices and availability.

Table 5-1 Qualifications in Greater Manchester, the North West and England (Jan 2018-Dec 2018)

	Greater Manchester (Met County) (Level)	Greater Manchester (Met County) (%)	North West (%)	England (%)
NVQ4 and Above	632,800	35.6	35.5	39.0
NVQ3 and Above	974,800	54.9	55.1	57.7
NVQ2 and Above	1,291,600	72.7	74.1	75.0
NVQ1 and Above	1,483,900	83.5	84.8	85.6
Other Qualifications	119,800	6.7	6.1	6.8
No Qualifications	173,400	9.8	9.1	7.6

Source: ONS Annual Population Survey. No Qualifications; No formal qualifications held, Other Qualifications; Includes foreign qualifications and some professional qualifications, NVQ 1 Equivalent; e.g. fewer than 5 GCSEs at grades A-C, foundation GNVQ, NVQ 1, intermediate 1 national qualification (Scotland) or equivalent, NVQ 2 Equivalent; e.g. 5 or more GCSEs at grades A-C, intermediate GNVQ, NVQ 2, intermediate 2 national qualification (Scotland) or equivalent, NVQ 3 Equivalent; e.g. 2 or more A levels, advanced GNVQ, NVQ 3, 2 or more higher or advanced higher national qualifications (Scotland) or equivalent, NVQ 4 Equivalent and Above; e.g. HND, Degree and Higher Degree level qualifications or equivalent[17].

[17] NOMIS/ ONS Annual Population Survey- Labour Market Profile- Greater Manchester (Met County)- [online]- Available from: https://www.nomisweb.co.uk/reports/lmp/la/1967128590/report.aspx#tabempunemp

6 Economic Inactivity and Health

6.1 Health is another major barrier in Greater Manchester to employment, as well as to residents' wellbeing. Over 680,000 Greater Manchester residents fall into the 10% most disadvantaged areas of the country, affecting their life expectancies[18]. As shown in **Table 5-2**, across Greater Manchester the proportion of those who are economically inactive due to long-term sickness (25.95) is considerably higher than the national level (22.1%). Over 110,000 people aged 16-64 are currently inactive due to long-term sickness, and 10,300 are temporary sick. Furthermore, in Greater Manchester 9.8% of adults stated they had a long-term condition or disability that limited their day-to-day activities a lot and 9.5% said that their day to-day activities were limited a little, compared with 8.3% and 9.3% respectively nationally.12 This does not only impact the individual's ability to support themselves financially, it also affects Greater Manchester's productivity.

Table 5-2 . Economic inactivity in Greater Manchester, the North West and England (Apr 2018-Mar 2019)

	Greater Manchester (Met County) (Level)	Greater Manchester (Met County) (%)	North West (%)	England (%)
Student	122,600	28.7	26.0	27.0
Looking After Family/Home	104,700	24.5	23.1	24.4
Temporary Sick	10,300	2.4	2.0	1.9
Long-Term Sick	110,600	25.9	25.8	22.1
Discouraged	#	#	0.4	0.4
Retired	39,900	9.3	13.0	12.8
Other	38,000	8.9	9.7	11.4
Total	427,200	24	23.1	21.1
Wants A Job	87,500	20.5	18.6	20.5
Does Not Want A Job	339,700	79.5	81.4	79.5

Source: ONS annual population survey. # Sample size too small for reliable estimate. Numbers are for those aged 16-64. % is a proportion of those economically inactive, except total, which is a proportion of those aged 16-64[19]

[18] The Greater Manchester Population Health Plan 2017-2021, pp. 8-10 [online]- Available from: https://www.gmhsc.org.uk/wp-content/uploads/2018/05/Population-Health-Plan-2017-2021.pdf

[19] NOMIS/ ONS Annual Population Survey- Labour Market Profile- Greater Manchester (Met County) [online]- Available from: https://www.nomisweb.co.uk/reports/lmp/la/1967128590/report.aspx#tabempunemp

7 Conclusion

7.1 Overall, the data presented within this note has illustrated that the key socio economic metrics for Greater Manchester aligns closely to national trends for England, providing supporting information that Greater Manchester is 'typical' to England as a whole.

7.2 Given the main purpose of this analysis is to understand how typical Greater Manchester is when looking at freight demand and freight trips. The most relevant analysis relates to **Table 3-2**, which presents employment by occupation, and shows a close correlation between both Greater Manchester and England.

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

Note 24: Updates to the Modelling Tools post OBC Submission

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Version Status:	DRAFT FOR APPROVAL	**Prepared by:**	TfGM 29/10/2019
Authorised by: **Date:**	Ian Palmer 1st November 2019		

1 Introduction

1.1 This note documents the updates to the modelling tools since the OBC was submitted in Spring 2019.

1.2 The note covers updates to each of the elements of the modelling process including:

- Do Minimum SATURN Model;
- Demand Sifting Tool;
- Updates to EMIGMA;
- Dispersion model updates; and
- AQ Modelling DM Updates.

2 DM Updates to the strategic highway model (GM Saturn)

2.1 Overview of Updates

2.1.1 The updates to the forecast year Saturn models since the submission of the OBC in March 2019 comprise:

- Updates to the bus service data based on more recently available 2019 service patterns;
- Updates to the demand matrices in line with changes to the projected splits of petrol, diesel and electric cars\taxis in version 9.1a of the EFT and the latest DfT figures for the projected fleet split (by vkms);
- Updates to the values of time and distance, (PPM and PPK), used during the assignments using the latest values of time, GDP growth rates and vehicle operating costs derived from the WebTAG data book, May 2019.

2.2 Updates to the Bus Service Data

2.2.1 The bus services in the OBC Saturn model were based on 2016 service patterns and frequencies. The bus services in the updated models have been refreshed to include more recent 2019 data.

2.2.2 The updates to the bus routing data have resulted in an overall reduction in bus mileage across the County of approximately 11% compared with the OBC modelling, as operators have reduced services and stopped running some less profitable routes.

2.2.3 The bus services in the forecast year models for 2021, 2023 and 2025 are based on the 2019 services and patterns. The fleet mix, however, is projected forward using the OBC fleet roll-over methodology. This has resulted in an older bus fleet in future years than was projected in the OBC modelling, because bus operators have not invested in newer vehicles as frequently since 2016 as in preceding years. This has the effect of increasing future bus emissions on a per vehicle basis.

2.3 Updates to the Demand Matrices

2.3.1 The updates to demand matrices involved adjustments to the compliant and non-compliant car\taxi matrices to maintain consistency with the updated petrol\diesel splits in version 9.1.a of the EFT. The updated forecasts produced a small increase in the proportions of petrol vehicles and a corresponding reduction in the proportions of diesel vehicles compared to our earlier forecasts.

2.3.2 At the same time as adjusting the car demand matrices a correction was made to the traffic growth factors that were applied to the LGV matrices, which had incorrect growth applied in the OBC forecasts. This correction reduced the numbers of LGV trips by approximately 5% in each of the forecast years.

2.3.3 The reduction in LGV flows following the correction to the demand matrices reduced total NOx emissions from LGVs in the 2021 OBC do-minimum model by approximately 5% and total NOx emissions from all vehicle types approximately 1%.

2.4 Updates to the Values of Time and Distance

2.4.1 The future year generalised cost parameters for the updated models are shown in **Table 2.1**, below.

Table 2-1: Future Year Generalised Cost Parameters (2010 Prices)

Period	User Class	2021		2023		2025	
		PPM	PPK	PPM	PPK	PPM	PPK
AM Peak Hour	Compliant Cars	20.32	8.10	20.77	7.89	21.33	7.70
	Non-Compliant Cars	20.32	7.65	20.77	7.52	21.33	7.42
	Compliant LGV	22.09	15.29	22.44	15.15	22.91	15.03
	Non-Compliant LGV	22.09	15.29	22.44	15.15	22.91	15.03
	Compliant OGVs	22.68	50.30	23.18	50.93	23.81	51.47
	Non-Compliant OGVs	22.68	50.30	23.18	50.93	23.81	51.47
	Compliant Taxis	27.96	14.18	28.57	14.06	29.35	13.94
	Non-Compliant Taxis	27.96	14.13	28.57	14.02	29.35	13.90
Inter-Peak Hour	Compliant Cars	19.05	7.62	19.47	7.05	20.00	6.87
	Non-Compliant Cars	19.05	6.92	19.47	6.78	20.00	6.67
	Compliant LGV	22.09	14.24	22.44	14.11	22.91	14.00
	Non-Compliant LGV	22.09	14.24	22.44	14.11	22.91	14.00
	Compliant OGVs	22.68	44.41	23.18	44.97	23.81	45.45
	Non-Compliant OGVs	22.68	44.41	23.18	44.97	23.81	45.45
	Compliant Taxis	27.96	12.77	28.57	12.63	29.35	12.50
	Non-Compliant Taxis	27.96	12.73	28.57	12.60	29.35	12.47
PM Peak Hour	Compliant Cars	19.75	7.58	20.19	7.35	20.74	7.14
	Non-Compliant Cars	19.75	7.15	20.19	6.99	20.74	6.87
	Compliant LGV	22.09	15.11	22.44	14.97	22.91	14.86
	Non-Compliant LGV	22.09	15.11	22.44	14.97	22.91	14.86
	Compliant OGVs	22.68	49.30	23.18	49.91	23.81	50.45
	Non-Compliant OGVs	22.68	49.30	23.18	49.91	23.81	50.45
	Compliant Taxis	27.96	13.92	28.57	13.77	29.35	13.63
	Non-Compliant Taxis	27.96	13.86	28.57	13.73	29.35	13.60

3 DM Updates to Demand Sifting Tool

3.1 Overview of Updates

3.1.1 Since the submission of the OBC in March 2019, several updates and enhancements have been applied the Demand Sifting Tool (DST). These enhancements have improved the linkage with the wider modelling tools, whilst providing enhanced functionality. These include the following changes, which are discussed further below:

- Disaggregation of Taxi behavioural responses to apply separate responses to PHV and Hackneys;
- Enable the DST to assess the impacts of change mode behavioural responses;
- Enhanced linkages between the do minimum demand in the DST and GM SATURN model; and
- Update to DST demand to reflect refined Do Minimum matrices following GM SATURN do minimum model updates. This also included the update of PPM/PPK values which were updated during the SATURN model update.

3.2 Disaggregation of Taxi Behavioural Responses

3.2.1 For the OBC, the behavioural responses for taxis assumed that all hackney carriages are upgraded to compliant, with a taxi behavioural response applied to determine the response for PHVs. Following review of more recent behavioural responses from the Sheffield SP surveys, plus the development of a cost response model, a more detailed set of responses were developed for Hackney Carriages, and PHVs separately.

3.2.2 As a result, additional changes to the DST were applied to disaggregate the do minimum taxi demand separately into PHV and Hackneys. This included the following:

- Do minimum taxi demand was split within the DST into Hackneys and PHVs. Also, separately splitting these by compliant and non-compliant;
- The assumption of 100% hackney upgrades was removed from the DST;
- The inclusion of separate behavioural responses for Hackneys and PHVs was applied within the DST; and
- The resultant changes in demand after application of the behavioural responses was then combined back into compliant and non-compliant taxi matrices (User class 7 and User class 8) for input back into the strategic highway model.

3.3 Capturing Change Mode Behavioural Responses

3.3.1 At OBC stage, the DST did not include the functionality to allow the changing of demand between modes as a result of the behavioural changes. Previously it was assumed that LGVs would change mode to active or PT i.e. walking or public transport, but due to the unrealistic nature of this action the DST was refined in order to allow for more accurate mode changes. The refined change mode are as follows:

- HGVs downgrading to LGVs;
- LGVs switching to either a car or a HGV trip
- Hackneys switching to PHVs
- PHVs switching to Hackneys; and
- Cars switching to active modes or public transport.

The DST underwent a number of structural changes to allow the switching between modes, which were then sense checked by checking the quantum of change in outturn flows by user class through to the SATURN model to review the impacts of the changes.

3.4 Electric Vehicle Upgrade Behavioural Response

3.4.1 For taxis (PHV/Hackneys), the behavioural responses include an upgrade to an electric vehicle (EV). Within the DST, this forecasts an upgrade to a compliant vehicle, which is then incorporated within the highway model. To account for the air quality impacts associated with this change to electric, the outputs of the DST were reviewed to identify the percentage of the compliant matrices that would become EV. This output was then provided as an input to the EMIGMA model.

3.5 Enhanced linkages between the SATURN model and DST

3.5.1 The original do minimum (DM) matrices used for the DST was recreated from the outputs from the SATURN model, following updates made to the SATURN model. This was to ensure the consistent representation of do minimum demand in both models.

3.5.2 Further updated assumptions include a refinement to the Pence Per Minute (PPM) and Pence Per Kilometre (PPK) to reflect a more realistic cost for vehicles. Other updated assumptions include the change to vehicle proportions as mentioned in the previous section.

4 Update to EMIGMA Model

4.1 Overview

4.1.1 Road traffic emissions for the Greater Manchester Clean Air Plan (GM CAP) have been calculated using TfGM's in-house EMIGMA software (EMissions Inventory for Greater MAnchester). The software uses information about traffic speeds and flows from the highway model in association with fleet-weighted emission rates (factors) derived from the EFT to calculate mass road traffic emissions in the County, broken down by vehicle type, as previously submitted to the T-IRP.

4.1.2 The road traffic emission factors (for input to EMIGMA) for the OBC were derived using EFT version 8.0 by selecting the 'Advanced/Euro Composition' options. The appropriate Euro fleet splits were then entered in the 'UserEuro' worksheet to obtain emission rates in g/km for motorway and non-motorway road types, for speeds between 5kph and 115kph (at 5kph intervals), for NOx and NO_2 to calculate f-NO_2, PM_{10} and $PM_{2.5}$.

4.1.3 The Euro fleet splits for the base year (2016) were derived using ANPR data supplied by Greater Manchester Police. The fleet mix for forecast years is estimated using a 'roll-over' model to adjust base year vehicle composition for the projected fleet. The approach keeps the vehicle age constant for any given future year (e.g. 2021), and then re-calculates the Euro standard at this point in time. The method conserves the age distribution of the vehicle population for each vehicle/fuel type, to produce the fleet mix for the future year based on this constant distribution the fleet mix. An ANPR survey taken during 2019 was used to cross-check the rate of fleet renewal which demonstrated that the approach used in 2016 and projected forwards was robust. Therefore, the 2016 GMP ANPR analysis has not been altered.

4.1.4 Petrol/diesel splits for forecast years were estimated using JAQU guidance, making use of information about the ratios of petrol and diesel powered vehicles in the base year (calculated from ANPR data) and assumptions that vehicle splits by fuel type would change at the same rate as the national fleet. (Further details of these procedures are available in Note 15: Implications of the EFT update for the GM CAP).

4.2 Updates to the Emission Factor Toolkit

4.2.1 The road traffic emission rates and petrol\diesel splits for input to EMIGMA have been updated using information from version 9.1.a of the EFT, released May 2019. This has primarily affected the split of petrol and diesel cars, increasing the petrol and EV/hybrid fleet in line with more recent sales trends. Overall, this has reduced NOx emissions compared with the 2023 do-minimum OBC forecast by approximately 2%. This varies, however, depending on the vehicle mix on each road. There is also a secondary effect as petrol cars have lower f-NO_2 than diesel cars, which further reduces final NO_2 concentrations.

5 Updates to Dispersion Model

5.1 There have been no alterations to the dispersion modelling process since OBC.

6 Update to AQ Modelling

6.1 There have been no alterations to the air quality modelling (Defra background maps or NOx to NO_2 tool or verification) process since the OBC, as previously agreed with JAQU (see Note 15 section 3).

7 Summary

7.1 Overall, these updates are considered to better reflect best practice and the more recent evidence which has evolved since the production of the OBC modelling process.

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