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

Case for a New Plan – Air Quality Modelling Report

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1 Introduction

Purpose of Report

1.1.1 This report sets out the results of modelling carried out in Summer 2022 to forecast air quality in Greater Manchester (GM) in future years, taking into account the impacts of Covid-19 on vehicle fleet renewals and new investment in the bus fleet in GM.

1.1.2 The report documents minor refinements that have been reflected within the modelling methodology to reflect the impacts of the Covid-19 pandemic on air quality, and other changes that have been made to reflect the newest evidence on investment in ultra-low emission buses, as well as any other methodological changes that have been made to the 'Do Minimum' modelling methodology. These changes to the modelling apply the assumptions and methodology developed in agreement with JAQU (in Spring 2021) and the TIRP, based on the extant JAQU guidance for assessing the impact of Covid-19 provided to GM in 2021.

1.1.3 The report sets out how the relevant methodological changes have been reflected within the modelling to forecast the air quality without the GM CAP in place. The modelling has been conducted for 2025.

Background

1.1.4 The Government has instructed many local authorities across the UK to take quick action to reduce harmful roadside levels of Nitrogen Dioxide (NO_2) following the Secretary of State (SoS) for Environment, Food and Rural Affairs issuing a Direction under the Environment Act 1995 in 2017 requiring them 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) are working together to develop a Clean Air Plan to tackle NO_2 exceedances at the roadside, herein known as Greater Manchester Clean Air Plan (GM CAP).

1.1.5 In March 2019 the GM Authorities agreed the submission of the Outline Business Case (OBC) that proposed a package of measures that was considered would deliver compliance in Greater Manchester in the shortest possible time, at the lowest cost, least risk and with the least negative impacts. This involved a Charging Clean Air Zone Class C with additional measures.

1.1.6 In July 2019 the SoS issued a Direction under section 85 of the Environment Act 1995 requiring the 10 Greater Manchester local authorities to implement the local plan for NO_2 compliance for the areas for which they were responsible, including a Charging Clean Air Zone Class C with additional measures, but with an obligation to provide further options appraisal information to demonstrate the applicable class of Charging Clean Air Zone and other matters to provide assurance that the local plan would deliver compliance in the shortest possible time and by 2024 at the latest.

1.1.7 The SoS subsequently issued a Direction to the ten Greater Manchester local authorities in March 2020 that required them to take steps to implement the local plan for NO_2 compliance so that compliance with the legal limit for NO_2 is achieved in the shortest possible time, and by 2024 at the latest, and so that exposure to levels above the legal limit for NO_2 is reduced as quickly as possible.

1.1.8 A statutory consultation on the proposals took place in Autumn 2020.

1.1.9 The GMCA – Clean Air Final Plan report on 25 June 2021[1] endorsed Greater Manchester's Final CAP and policy following a review of all of the information gathered through the GM CAP consultation and wider data, evidence and modelling work. Throughout the development of the previous Plan, JAQU reviewed and approved all technical and delivery submissions. The Plan was agreed by the ten Greater Manchester local authorities. Within this document, this is referred to as the Previous GM CAP.

1.1.10 On 20 January 2022 the Air Quality Administration Committee considered the findings of an initial review of conditions within the supply chain of Light Good Vehicles (LGVs) in particular which were impacting the availability of compliant vehicles. The Committee agreed that a request should be made to the SoS to pause opening of the next phase of Clean Air Funds to enable an urgent and fundamental joint policy review with Government to identify how a revised policy can be agreed to deal with the supply issues and local businesses' ability to comply with the GM CAP.

1.1.11 On the 8th February 2022, a new Direction was issued by the SoS[2] which confirmed that the March 2020 Direction to implement a Class C charging Clean Air Zone (CAZ) had been revoked and required that a new plan be submitted to the SoS by 1st July 2022 which should:[3]

- review the measures specified in the local plan for NO_2 compliance and associated mitigation measures; and
- determine whether to propose any changes to the detailed design of those measures, or any additional measures.

1.1.12 The Direction also requires that compliance with the legal limit value for nitrogen dioxide is achieved in the shortest possible time and no later than 2026 and that exposure to levels above the legal limit for nitrogen dioxide is reduced as quickly as possible.

[1] Also considered by the Greater Manchester authorities through their own constitutional decision-making arrangements.
[2] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1054931/Environment_Act_1995_Greater_Manchester_Air_Quality_Direction_2022.pdf
[3] In addition to recommendations about interim arrangements for changes to delivery arrangements for the CAZ in the meantime, including signage, funding and discount/exemption applications.

1.1.13 Within this document, this new plan, and any subsequent further development of the new plan, is referred to as the New GM CAP.

Structure of the Note

1.1.14 Following this introductory chapter, the remaining sections of this report comprise:

- Chapter 2 provides details of methodology updates together with detail relating to the scenarios that have been modelled;
- Chapter 3 discusses the updated Do Minimum emissions modelling results;
- Chapter 4 Presents the updated Do Minimum Air Quality modelling results; and
- Chapter 5: provides the key summary and conclusions of the updated modelling, together with details of the proposed next steps.

1.1.15 In addition, **Appendix A**, set out the key data, approach and considerations for reflecting the latest position regarding delays to the natural turnover of the vehicle fleet.

2 Methodology

Overview of the Modelling Process

2.1.1 Air quality in Greater Manchester has been modelled as part of the GM CAP, and areas of exceedance of the Limit Values identified. This modelling has been updated at relevant stages throughout the development of the plan for a number of reasons; for example, to reflect changes to the key phasing dates, to revise underpinning assumptions such as vehicle fleet age (due to Covid-19), or as a response to policy refinements as a result of the public ‘conversation’ or consultations.

2.1.2 The core goal of the GM CAP is to address the legal requirement to achieve compliance with the legal Limit Value (40 µg/m^3) for NO_2.

2.1.3 Air quality is expected to gradually improve over time as a result of the ongoing cycle of newly purchased vehicles replacing older more polluting equivalents. The Government has required that the GM CAP delivers compliant air quality, using modelling to forecast future concentrations and showing how potential measures might reduce concentrations.

2.1.4 The air quality problem for Greater Manchester is assessed by reference to the “Do Minimum” scenario, which sets out air quality as forecast if no action is taken by the GM CAP. The forecast takes into account other investment/interventions that are planned, funded and committed, where they have an impact on travel, traffic or the road network. The forecast appraisal years were developed for the original planned scheme commencement date for the GM CAP (2021 – not updated), the current expected scheme commencement date (2023) and a further year to inform the trajectory of improvement to compliance with the Limit Values (2025).

2.1.5 The GM CAP is underpinned by an evidence base derived from data collection, research, analysis and modelling. Throughout the technical development process from 2017 to date, Greater Manchester has used best practice methodology and assumptions and worked closely with Government including, for example, by delivering updates to incorporate the impacts of Covid-19 to the GM CAP in accordance with national guidance.

2.1.6 The modelling approach has been updated to reflect the impacts of Covid-19 in line with JAQU guidance and changes to the GM CAP Policy following public consultation and now in respect to changing market conditions and further Covid-19 related impacts.

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

2.1.8 The modelling for the study is being undertaken using the CAP modelling suite as illustrated below in **Figure 1**.

Figure 1 CAP Modelling Suite

2.1.9 The modelling system consists of five components:

- The demand sifting tool, which has been developed to allow measures to be tested in a quick and efficient way prior to detailed assessments being undertaken using the highway and air quality models. The sifting tool uses fleet specific Cost Response models to determine behavioural responses to the CAP proposals (pay charge, upgrade vehicle, change mode, cancel trip etc.) The outputs comprise demand change factors which are applied to the do-minimum Saturn matrices to create do-something demands for assignment.
- The highway (Saturn) model, which uses information about the road network and travel demands for different years and growth scenarios to estimate traffic flows and speeds for input to the emissions model and forecasts of travel times, distances and flows for input to the economic appraisal.
- The emissions model, which uses TfGM's EMIGMA (Emissions Inventory for Greater Manchester) software to combine information about traffic speeds and flows from the Saturn model with road traffic emission factors and fleet composition data from the Emission Factor Toolkit (EFT) to provide estimates of annual mass emissions for a range of pollutants including oxides of nitrogen (NOx), primary-NO_2, particulate matter (PM_{10} and $PM_{2.5}$) and CO_2.
- The dispersion model, which uses ADMS-Urban software to combine information about mass emissions of pollution (from EMIGMA) with dispersion parameters such as meteorological data and topography to produce pollutant concentrations.
- Finally, the outputs of the dispersion model are processed to convert them to the verified air quality concentrations, using Defra tools and national background maps.

2.1.10 The modelling suite has remained consistent with that used for the development of the Option for Consultation, updates to these tools to represent the revised Do Minimum scenarios are discussed within the later chapters of this report.

<u>Refined Delayed Fleet Assumptions</u>

2.1.11 The Do Minimum forecast has been updated because the evidence presented to the Government in February 2022 showed that business as usual (BAU) car sales were lower than expected in 2021, meaning that the fleet was older than forecast, and that this was likely to delay compliance with legal limits of NO_2 with the scheme as planned. Therefore, in order to update the Do Minimum forecast, the underpinning assumptions have been reviewed to ensure they remain up-to-date. These changes are set out in **Table 1**.

Table 1 Overview of Delayed Fleet Assumptions Applied in Do Minimum 2025 Scenario Modelling

Vehicle Type	Criteria	Changes
HGV	Fleet age	No changes made in 2021 version as evidence did not suggest HGV purchases had been affected by the pandemic in 2020 (given impact of regulatory change in 2019 which had distorted purchase patterns such that lower than normal purchases were expected in 2020 anyway) - No changes made in latest forecast
LGV	Fleet age	Delay (c1 month) applied in 2021 version. Evidence suggests sales in 2021 were similar to Greater Manchester's forecast and therefore no additional changes are proposed.
Car	Fleet age	Delay (c11 months) applied in 2021 version to reflect loss of sales in 2020 and SMMT forecast of gradual Covid recovery. New evidence suggests that car purchases were lower than expected in 2021 and therefore this additional delay has been reflected in this forecast version, with a delay of one year applied.
Taxi	Fleet age	Evidence in 2021 suggested that upgrades had been delayed but could not quantify impact, therefore a delay of one year was applied as a cautious estimate in that version. - No changes made in latest forecast.
Bus	Funding	Electric bus funding was represented in the model includes the removal of ULEB funding from Vantage and Free Bus routes, and addition of ZEBRA funding for Stockport. CRSTS funding not yet assigned so cannot be represented in Do Minimum scenario, but is considered separately.

2.1.12 Further details and background data that have been used to determine the identified modelled impacts for representing the delays to the natural turnover of the vehicle fleet is discussed in Appendix A, together with the changes that were applied within the modelling.

Updated Position Regarding Electric Bus

2.1.13 GM has reviewed the assumptions underpinning the highway assignment modelling including bus services and fleet, taxi upgrade assumptions, traffic volumes and composition and future schemes.

2.1.14 Since the previous review of bus services, a fleet of zero emission buses has been deployed on routes into the city centre and further zero emission buses are funded and planned to be in operation from 2024. The highway model was updated to reflect these new buses, operating on the following services:

- 111, 43 (Chorlton to Manchester City Centre, Manchester Airport to Manchester City Centre) – from 2020. [Included in previous modelling]
- Full electrification of all services operating out of the Stagecoach Sharston depot, in Stockport as part of GM's successful ZEBRA[4] funding award, from 2024. [Updated from previous modelling]

2.1.15 The Stockport depot ZEBRA funded buses are not expected to be fully deployed until 2024. To enable the extrapolation of modelled concentrations for 2026, using the available 2023 and 2025 forecast models, the Stockport ZEBRA electric buses have been applied in the 2023 model as well as the 2025 model. This means that the emissions and concentration predictions along these bus routes, which are predominantly on the corridors from central Stockport towards the Manchester regional centre, will be under-predicted in 2023 because many buses would still be diesel variants at that time.

2.1.16 However, some previously expected electrification of bus services based on Ultra Low Emission Bus funds (ULEB), as represented in the Post-Consultation modelling scenario are no longer available following the expiry of the relevant funds. The services below are now modelled as continuing with the projected diesel / hybrid fleets, in the Do Minimum scenario:

- Manchester Metroshuttle Free Bus Services (within the City Centre) – previously planned from 2023.
- Vantage services (operating through Salford to Manchester City Centre, including along the A34 Bridge St/John Dalton St) – previously planned from 2023.

The locations of these services are shown in **Figure 2, Figure 3** and **Figure 4**.

[4] Zero Emission Bus Regional Areas (ZEBRA) scheme - GOV.UK (www.gov.uk)

Figure 2: ULEB-funded Electric Bus Routes (Vantage [now diesel buses], 111 & 43 [retained as electric buses])

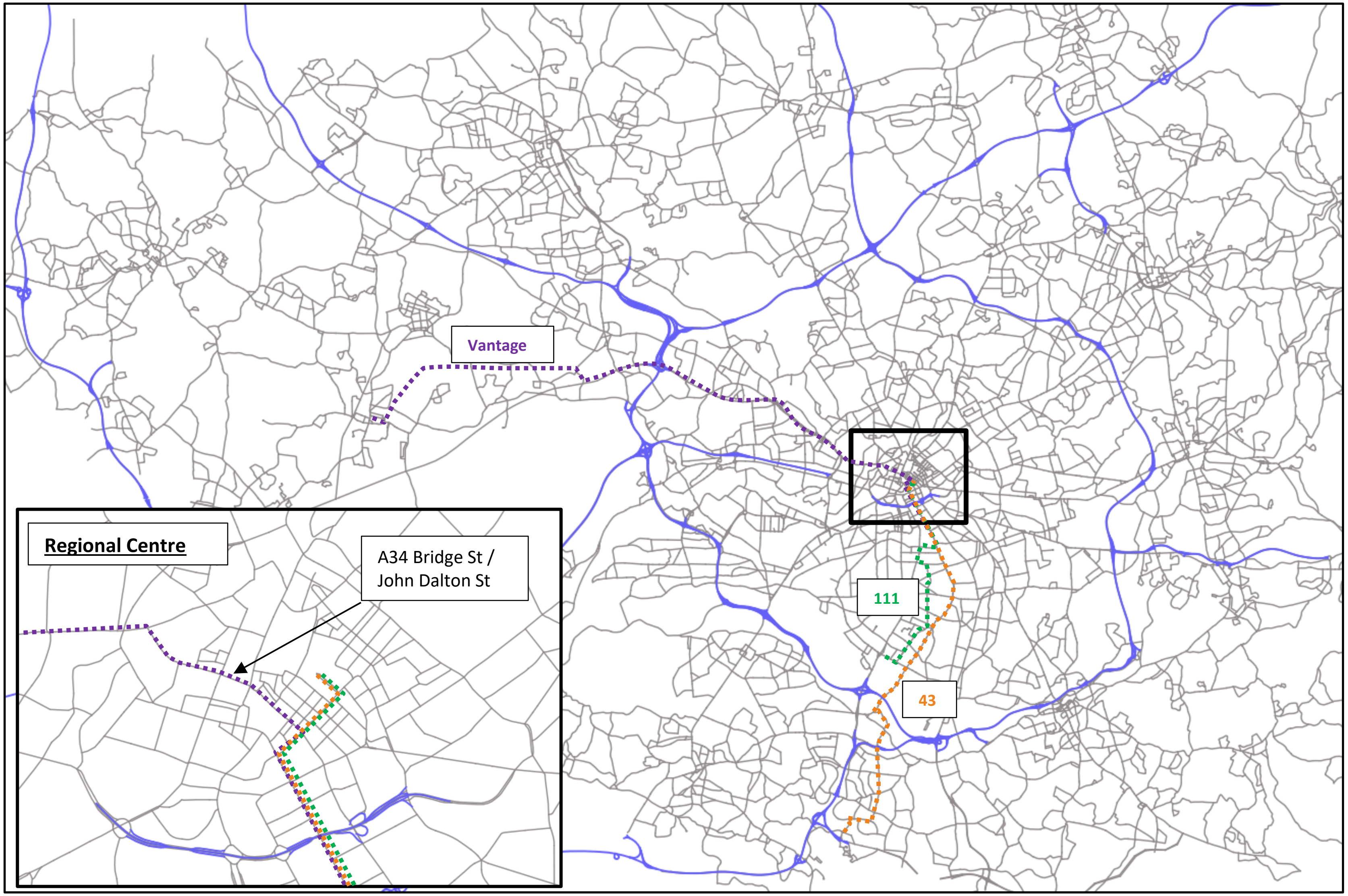


Figure 3: ULEB-funded Metroshuttle Free Bus Routes in the Regional Centre

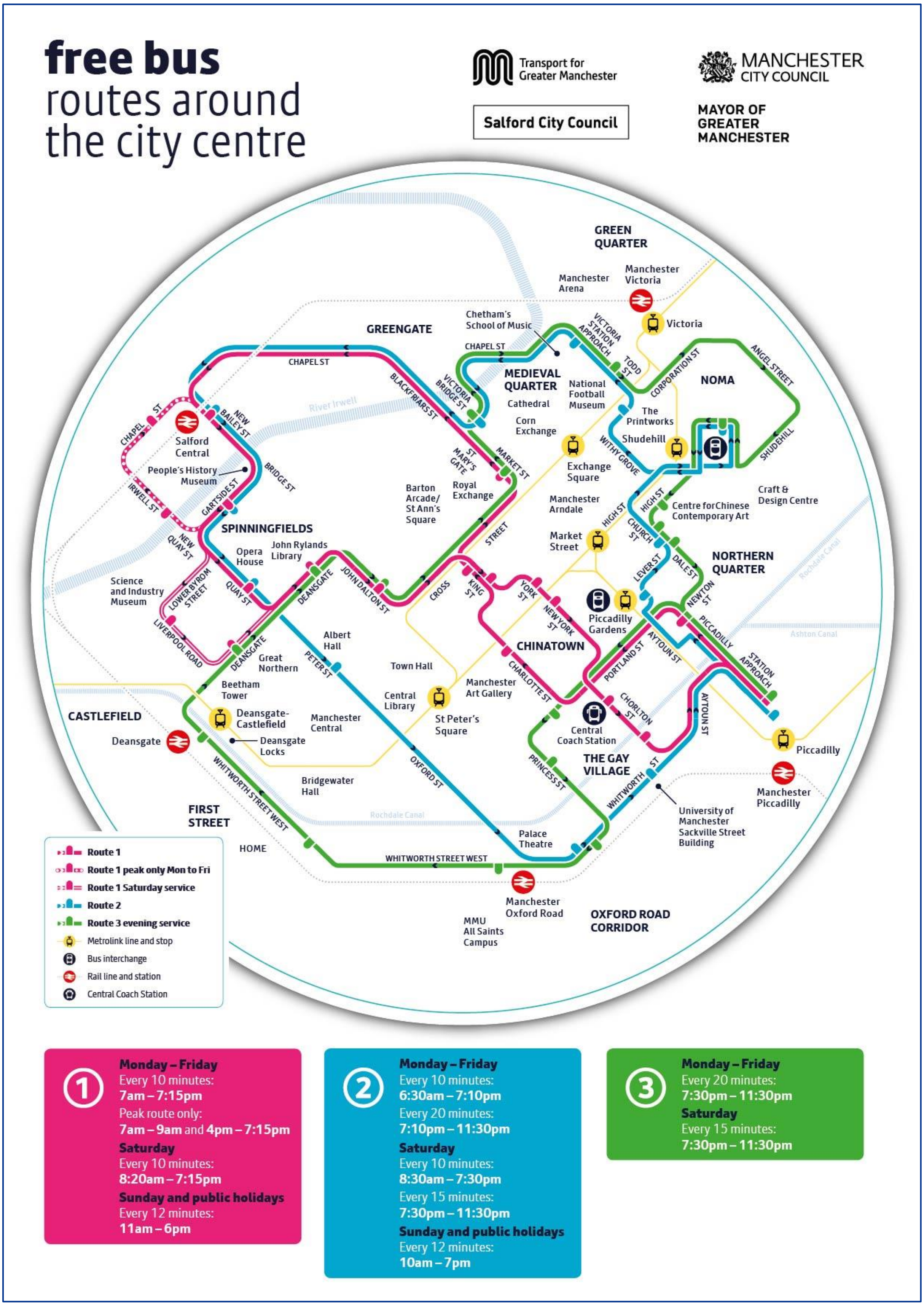
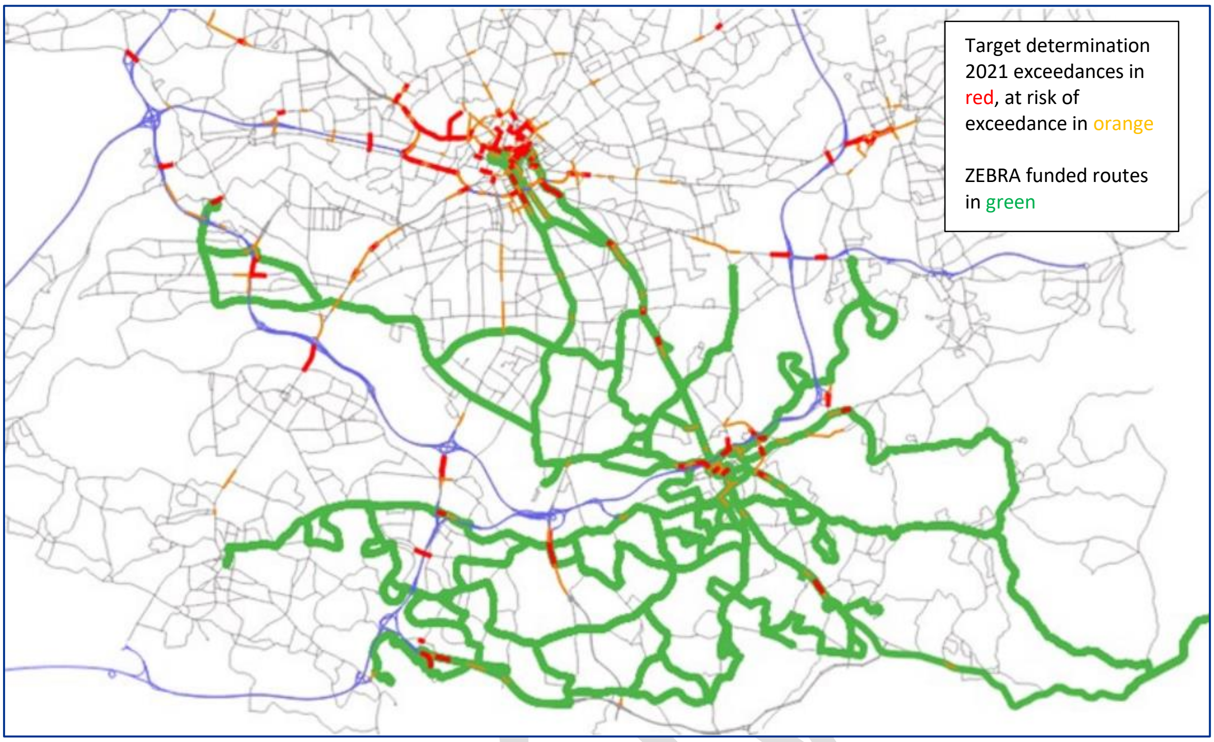


Figure 4: ZEBRA Funded Bus Routes, from the Stockport depot



Definition of Modelled Scenarios

2.1.17 Modelling has been undertaken for the following scenarios:

- **Do Minimum (i.e. No GM CAP) -** represents what would be forecast to happen in the absence of all GM CAP proposals. In reality this is overly pessimistic because funds for buses and HGVs have been available and successfully applied since these aspects of the GM CAP opened in 2021. This scenario is used to enable appraisal of the full impact of the GM CAP itself.
- **Do Minimum with CBF Grants** – represents what is forecast to happen with incorporation of approved GM CAP Clean Bus Fund (CBF) grants. The test is based upon the number of buses in each Greater Manchester operator's fleet where grants have been approved as of March 2022 (around 1,000 buses have been approved for retrofit or replacement funding, with 500 already on the road). The test was implemented in EMIGMA, with adjustments made to each specific operator's fleet mix to represent an increased proportion of newer (Euro VI) compliant buses running their service routes, so reducing forecast emissions.

- For those buses in an operator’s fleet where no upgrade support funding had been allocated (to either replace or retrofit), these buses were locked at their existing Euro standard age, because under the CAP there is no longer a proposed disincentive CAZ charge to encourage upgrade. This is 387 vehicles, out of the GM operator bus parc of 2,313 buses. This is considered a pessimistic approach. These older non-compliant buses are more likely to be used on less profitable or lower frequent routes, which would be less likely to run along the last key links of compliance.
- Under this CBF grants scenario, the percentage of GM route mileage operated by Euro VI compliant buses increased by approximately 30% relative to the •Do Minimum (i.e. No GM CAP) scenario.
- Whilst it is not certain that all operators would now utilise an approved grant in the absence of a CAZ charge to penalise use of their non-compliant buses, many buses have already been upgraded and are on the road. Therefore, it is expected that given known on-going CBF investment into bus fleets and the transition to bus franchising in Greater Manchester which can set emissions standards at service level, it is considered that this test is the most likely scenario representing the nature of the air quality problem in GM for the CAP to tackle.
- **Full electric bus fleet test** – Electric buses can be very effective at reducing road traffic emissions, especially at sites with high bus flows. The purpose of this test was to investigate the air quality impacts that investments in electric buses could deliver on key routes, beyond Euro VI diesel models. The City Region Sustainable Transport Fund Settlement (CRSTS) has provided confirmed funding to enable the investment into electric bus provision rapidly and at scale in GM. This test identifies where electric bus fleet would further bring forward compliance on persistent locations of exceedance. The results have been used to define the deployment strategy of electric buses within the wider programme, to services crossing exceedance locations, to deliver earliest compliance in support of the GM CAP. The test was implemented in the modelling by assuming that the whole bus fleet would be fully electric, without making any changes to service patterns or frequencies in the forecasts.

2.1.18 In addition to those scenarios set out above, work is ongoing to carry out a sensitivity test representing the impact of key schemes affecting the road network in Manchester and Salford, as part of the City Centre Transport Strategy (CCTS), which are expected to have been opened by 2025. Further testing of the Do Minimum scenario is underway to better reflect the possible impact of these schemes and is discussed within the next steps section of the report.

3 Road Traffic Emissions in the Do Minimum and Test Scenarios

3.1.1 Summary results from the EMIGMA modelling for the tests are presented in **Table 2**, which shows modelled mass NOx emission totals for 2023 and 2025 for Greater Manchester as a whole, disaggregated by vehicle type. The percentages in the table show changes in emissions for the test scenarios relative to the updated Do Minimum.

3.1.2 Total NOx emissions for the updated Do Minimum are approximately 2% greater than in the previous Do Minimum modelling, in both 2023 and 2025. This is mainly a result of the increased age of the private car fleet, due to Covid-19 impacts leading to reduced new (cleaner) vehicle sales, with private car fleet emissions increasing by 5% in both years. The total change in the mass emissions also include a reduction in emissions associated with new electric buses, but these improvements are confined to specific bus route corridors, whereas the private car fleet delay leads to a more geographically even spread of increased vehicle emissions.

3.1.3 The NOx totals in **Table 3** show that road traffic emissions within Greater Manchester are generated from a mixture of vehicle types, with private cars releasing most, followed by commercial vehicles (HGVs, LGVs) and then buses and taxis. The vehicle composition varies significantly across road types, however, and further detailed site-specific breakdowns of the sources at the most persistent exceedances are provided in the next section. It can be seen, though, that aggregate emissions for the updated Do Minimum are reducing into the future, with a reduction from 6,427T to 5,273T (18%) forecast from 2023 to 2025 as a result of the natural cycle of vehicle replacement and renewal with cleaner newer models.

3.1.4 The modelling for the CBF grant test indicates that bus emissions are forecast to reduce by 60% in 2023 (if the upgrades have been fully delivered by then) and 44% in 2025 compared to the updated Do Minimum forecasts for those years, delivering localised improvements along bus routes. This equates to potential reductions in total road vehicle NOx emissions over Greater Manchester of approximately 4% relative to the new Do Minimum in 2023 and 3% in 2025. It needs to be borne in mind however, that the bus emission forecasts for 2023 are likely to be under-estimated, (as described in Section 2), as the Stockport ZEBRA funded buses are not expected to be fully deployed until 2024. (This was a simplifying assumption to allow the interpolation of modelled concentrations for 2024, using the available 2023 and 2025 models.)

3.1.5 The EMIGMA modelling for the Do Minimum plus electric bus scenario indicates that total NOx road traffic emissions within the County are forecast to reduce by 7% in 2023 and 6% in 2025 compared to the updated Do Minimum forecasts for those years. The impacts will vary significantly by site, however, and will be greatest in corridors with high bus flows, but less marked at sites where emissions from other vehicle types predominate.

Table 2 Mass NOx Emission Totals from EMIGMA Modelling (Greater Manchester, Tonnes per Year (T), with Percentage Changes Relative to the Updated Do Minimum)

2023						
Scenario	**Car**	**LGV**	**HGV**	**Taxi**	**Bus**	**Total**
Updated Do Min.	2,938	1,888	796	357	449	6,427
Updated Do Min. with CBF	2,938	1,888	796	357	179	6,157
%Change (from Updated Do Min.)	0%	0%	0%	0%	-60%	-4%
Full Electric Bus Test	2,938	1,888	796	357	0	5,978
%Change (from Updated Do Min.)	0%	0%	0%	0%	-100%	-7%
2025						
Scenario	**Car**	**LGV**	**HGV**	**Taxi**	**Bus**	**Total**
Updated Do Min.	2,526	1,610	523	294	320	5,273
Updated Do Min. with CBF	2,526	1,610	523	294	179	5,133
%Change (from Updated Do Min.)	0%	0%	0%	0%	-44%	-3%
Full Electric Bus Test	2,526	1,610	523	294	0	4,954
%Change (from Updated Do Min.)	0%	0%	0%	0%	-100%	-6%
Notes: Taxis comprise Private Hire Vehicles and Hackney Carriages combined Totals may not sum due to rounding						

4 Air Quality Results in the Do Minimum and Test Scenarios

Do Minimum (i.e. no GM CAP)

4.1.1 **Table 3** summarises the updated Do Minimum scenario modelling results, which incorporate the current understanding of the impacts of Covid-19 on vehicle fleets, for the Do Minimum years of 2023 and 2025. It shows the distribution of non-compliant sites across Greater Manchester, both by spatial type and also in terms of how close they are to compliance. These results are then reported as the number of exceedances by each district in **Table 8**.

4.1.2 The location of the predicted exceedances in 2024 and 2025 are shown in **Figure 5** with the spatial pattern continuing to resemble that in the 'Option for Consultation' and 'Previous GM CAP' modelling iterations.

4.1.3 As shown in **Table 3**, there is an increase in the number of points of exceedance in 2023 from the Previous GM CAP model Do Minimum as modelled in spring/summer 2021 (from 71 to 79). This is primarily associated with the wider road network outside of the regional centre where private car emissions have increased due to an older fleet profile due to Covid-19, leading to increases in NO_2 concentrations of typically 0.5 µg/m^3 up to 1.0 µg/m3. However, on the route corridors where the new electric buses will operate there are improvements, with a reduction in exceedances inside the Inner Relief Route (IRR) on these routes. Conversely, on the Vantage and FreeBus routes where the ULEB funding will no longer be available it is assumed that diesel variants would still be operating, with associated increases in NO_2 concentrations.

4.1.4 By 2025, the number of exceedances reduces due to the natural upgrade of the vehicle fleet, which is expected to continue despite the depressive effect of Covid-19 on some markets, and which has been accounted for where relevant. Compared with the Previous GM CAP Do Minimum scenario, there has been an increase in the overall number of exceedances (from 11 to 13).

4.1.5 There are predicted to be exceedances in all districts with the exception of Wigan in the Do Minimum scenario for 2023. By 2025, exceedances are only predicted in Manchester, Salford, and Bury, which is consistent with the Consultation and Previous GM CAP modelling scenarios.

4.1.6 The updated modelling shows results are consistent with the methodological modelling alterations described previously. The locations where car flows are greatest have an increased number of exceedances, typically sites classed as 'Other Locations'. The last points of exceedance (13 in total) in 2025 still remain at:

- Inside the IRR, including the A34 Bridge St /John Dalton St, Lever St and the A56 Deansgate;
- A57 Regent Rd, Salford;
- A6 Chapel St, Salford; and

- A58 Bolton Road, Bury.

4.1.7 The modelling indicates that exceedances would remain in 2026 at 5 sites: 4 inside the IRR and on the A57 Regent Road. However, the A6 Chapel Street and the A58 Bolton Road would by this point have become compliant. All sites are predicted to be compliant by 2027 in the Do Minimum scenario.

4.1.8 Note that this does not include representation of the CCTS schemes which are expected to have been opened by 2025. A further sensitivity test of the Do Minimum modelling is underway to incorporate the CCTS schemes which are expected to be in place in the relevant forecast years.

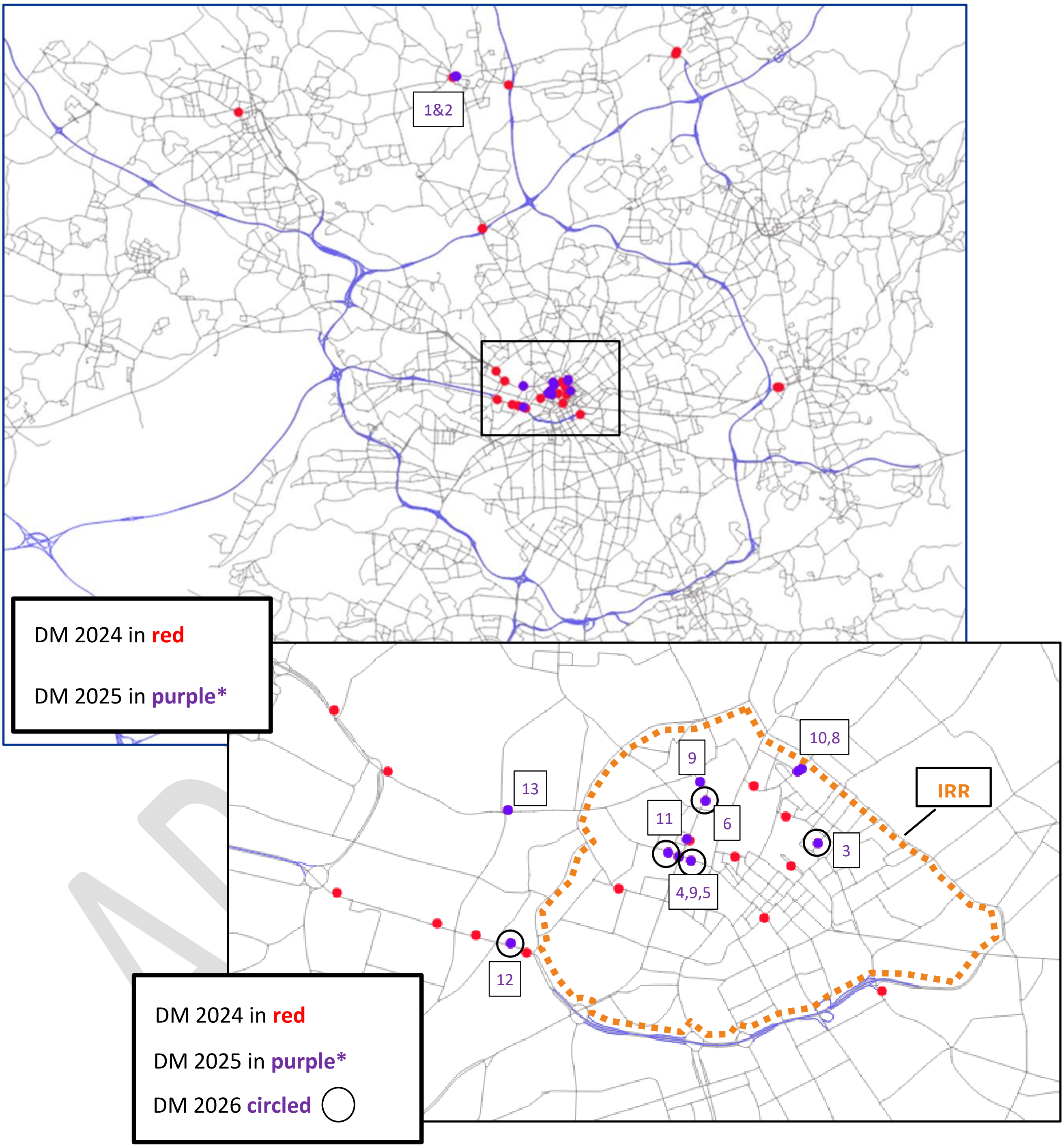
Table 1 Predicted annual mean NO_2 concentrations at points on the Greater Manchester road network – 2023 to 2026 without action ('Do Minimum')

Road classification[5]	Compliant sites		Non-compliant sites			
	Very compliant (below 35 µg/m³)	Compliant but marginal (35 to 40 µg/m³)	Non-compliant (>40 to 45 µg/m³)	Very non-compliant (>45 to 50 µg/m³)	Extremely non-compliant (>50 µg/m³)	Total non-compliant (>40 µg/m³)
2023						
Inside Manchester-Salford Inner Relief Route (IRR)	211	33	23	8	0	**31**
Urban centres	209	24	4	0	0	**4**
Other locations	1829	157	38	6	0	**44**
Total	**2249**	**214**	**65**	**14**	**0**	**79**
2024 (Interpolated)						
Inside IRR	227	32	11	5	0	**16**
Urban centres	223	12	2	0	0	**2**
Other locations	1936	75	18	1	0	**19**
Total	**2386**	**119**	**31**	**6**	**0**	**37**
2025						
Inside IRR	243	23	9	0	0	**9**
Urban centres	233	4	0	0	0	**0**
Other locations	1984	42	4	0	0	**4**
Total	**2460**	**69**	**13**	**0**	**0**	**13**
2026 (Extrapolated)						
Inside IRR	257	14	4	0	0	**4**

[5] "Inside Inner Relief Route" is the area encircled by the Inner Relief Route. "Urban centres" are areas that met a definition used for the purposes of air quality modelling for OBC Option testing. "Other locations" are roads outside of Urban centres and the Inner Relief Route.

Road classification[5]	Compliant sites		Non-compliant sites			
	Very compliant (below 35 µg/m^3)	**Compliant but marginal (35 to 40 µg/m^3)**	**Non-compliant (>40 to 45 µg/m^3)**	**Very non-compliant (>45 to 50 µg/m^3)**	**Extremely non-compliant (>50 µg/m^3)**	**Total non-compliant (>40 µg/m^3)**
Urban centres	235	2	0	0	0	**0**
Other locations	2008	21	1	0	0	**1**
Total	**2500**	**37**	**5**	**0**	**0**	**5**

Figure 5 Greater Manchester Do-Minimum Exceedance Points in 2024, 2025 and 2026



*Exceedances in the Do Minimum (i.e. No GM CAP) scenario for 2025 have marked with an ID number to reference against the detailed model results tables.

4.1.9 The air quality modelling data and emissions source apportionment is provided in **Table 4** for 2025, for all of the 13 sites predicted to be in exceedance. This table shows how each vehicle type contributes to the total road transport emissions on a given road link, and how this varies.

4.1.10 The exceedance site results are discussed based on their spatial cluster.

<u>Regional Centre / Within the IRR and Chapel St, Salford</u>

4.1.11 The majority of the last points of exceedance are located within Manchester City Centre and the IRR. The source apportionment indicates that bus emissions dominate the contributions to the predicted exceedances at almost all locations, typically 70% to 100% of vehicle emissions. This reflects the higher frequency of buses running on these routes compared with wider Greater Manchester, but also the slower traffic speeds inside the IRR where queuing and congestion occurs more frequently, and signalised junctions occur at a greater density. At low speeds, buses and HGV NOx emissions are elevated even for Euro VI models.

4.1.12 The maximum concentration of 45.2 ug/m^3 is located A62 Lever St which is a road that is restricted to buses only. The A34 Bridge St / John Dalton St sites with a concentration of 44.0 ug/m^3 are the next worst exceedances, again dominated by bus emissions.

4.1.13 The southern section A56 Deansgate and A6 Chapel Street show a different source pattern to the other exceedance locations, with a lower but still significant proportion of bus emissions (50% or less), and higher proportion of private car and LGV emissions.

<u>A58 Bolton Road, Bury</u>

4.1.14 The A58 Bolton Road, Bury, is a dual carriageway over the River Irwell, serving traffic from the confluence of the A58, B6196 & B6213 roads to and from the Bury town centre ring road. There are modelled exceedances on both of the carriageways but these essentially both represent the same traffic flows. The contribution from HGVs is low on this link, with the majority of emissions derived from private cars and LGVs. However, there is also a material proportion of emissions from diesel buses. Concentrations here are predicted to be 42.8 ug/m^3 in 2025.

<u>A57 Regent Road, Salford</u>

4.1.15 The A57 Regent Road is an important highway corridor providing an East-West connection through Manchester City Centre and joining the M602, part of the Strategic Road Network which is managed by National Highways.

4.1.16 This route contains a relatively high proportion of commercial vehicles, with emissions from HGVs & LGVs at c50% of total emissions, and the remainder primarily derived from private cars c40%. Emissions from buses are very low (just 2% of total), with very few bus services operating on this corridor. This reflects the nature of this route as a primary arterial route from the Strategic Road Network, serving traffic demands of the Regional Centre and surrounding area.

4.1.17 Concentrations here are predicted to be 42.8 ug/m^3 in 2025.

Table 4: Predicted annual mean NO_2 concentrations and source apportionment at key compliance points on the Greater Manchester road network - 2025 Do Minimum (i.e. No GM CAP)

Map ID	Point ID	x	y	Census ID	Road name	Location Type	Local Authority	PCM/ LA/ HE	Annual mean NO_2 conc (µg/m^3)	BG[6] NOx conc (µg/m^3)	BG NO_2 conc (µg/m^3)	Road NOx contrib (µg/m^3)	Road NO_2 contrib (µg/m^3)	Traffic Flow (veh per day)	NOx contribution by vehicle type (%)				
															Bus	Taxi	HGV	LGV	Car
1	2237_3790_DW	379830	410975	38354	A58 Bolton Road	Wider GM	Bury	PCM	42.8	20.1	14.4	66.3	28.4	80,272	16%	5%	17%	24%	38%
2	3790_3652	379874	410937	38354	A58 Bolton Road	Wider GM	Bury	PCM	41.2	20.1	14.4	63.1	26.8	80,272	16%	5%	17%	24%	38%
3	1242_1243	384483	398343	70154	A62 Lever St	Inside IRR	Manchester	PCM	45.2	33.2	22.1	90.8	23.0	1,444	100%	0%	0%	0%	0%
4	1268_1269	383558	398278	27974	A34 Bridge St	Inside IRR	Manchester	PCM	44.0	33.2	22.1	70.2	21.9	9,399	74%	2%	3%	7%	14%
5	1268_46301	383702	398229	7947	A34 John Dalton St	Inside IRR	Manchester	PCM	43.6	33.2	22.1	70.8	21.5	8,542	73%	1%	9%	7%	9%
6	2283_8544_DW	383791	398603	27992	A56 Deansgate	Inside IRR	Manchester	PCM	43.3	33.2	22.1	70.1	21.2	4,313	84%	1%	3%	7%	4%
7	NonPCM_207	383624	398258	N/A	A34 Bridge St / Deansgate	Inside IRR	Manchester	LA	42.8	33.2	22.1	64.8	20.7	14,035	14%	7%	8%	25%	46%
8	8546_14050	384384	398801	57427	A664 Shudehill	Inside IRR	Manchester	PCM	42.2	33.2	22.1	63.4	20.1	8,016	79%	2%	2%	4%	13%
9	1307_1317	383757	398717	36551	A6041 Blackfriar's Rd	Inside IRR	Manchester	PCM	41.2	33.2	22.1	61.9	19.1	4,313	90%	1%	1%	5%	3%
10	Jct285	384363	398784	N/A	A664 Shudehill	Inside IRR	Manchester	LA	41.2	33.2	22.1	59.1	19.1	8,016	79%	2%	2%	4%	13%
11	1267_1985	383672	398364	16536	A56 Deansgate	Inside IRR	Manchester	PCM	41.1	33.2	22.1	52.2	19.0	8,836	50%	3%	7%	15%	24%
12	1349_2993_DW	382580	397716	73792	A57 Regent Road	Access to IRR	Salford	PCM	42.8	23.2	16.3	59.6	26.5	57,844	2%	6%	20%	30%	42%
13	1216_14503_DW	382565	398546	17926	A6 Chapel St	Access to IRR	Salford	PCM	41.2	23.7	16.6	63.0	24.6	31,902	45%	3%	14%	15%	22%

[6] BG = Background

Air quality in the Do Minimum with CBF Grants scenario

4.1.18 The assumption is that when the CBF grants have been utilised by the relevant operators to upgrade non-compliant buses to Euro VI diesel, this will lead to an improvement in air quality across bus corridors, and a reduction in the number of predicted exceedances. Note that Greater Manchester is assuming that all CBF grants will be utilised as planned.

4.1.19 As shown in **Table 5**, under this scenario, there is a predicted decrease in the number of points of exceedance in 2023 from the Do Minimum from 79 to 44. This is primarily associated with the regional centre inside the IRR, where bus emissions comprise a greater proportion of total emissions, alongside the arterial routes that lead into the IRR on wider road network outside of the regional centre.

4.1.20 There are predicted to be exceedances in all districts with the exception of Wigan, Trafford and Oldham in the Do Minimum plus CBF scenario for 2023.

4.1.21 By 2025, the number of exceedances reduces due to the natural upgrade of the vehicle fleet. Compared with the Do Minimum scenario, there would be a decrease in the overall number of exceedances from 13 to 5 as a result of the CBF.

4.1.22 By 2025, whilst there are fewer exceedances predicted, the key locations remain as per the Do Minimum scenario at:

- Inside the IRR, including the A34 Bridge St /John Dalton St;
- A57 Regent Rd, Salford; and
- A58 Bolton Road, Bury.

4.1.23 The modelling indicates that exceedances would remain in 2026 at one site, on the A57 Regent Road. All sites are predicted to be compliant by 2027 in the Do Minimum plus CBF Grants scenario.

Table 5 Predicted annual mean NO_2 concentrations at points on the Greater Manchester road network – 2023 to 2026 Do Minimum with CBF Grants

Road classification[3]	Compliant sites		Non-compliant sites			
	Very compliant (below 35 μg/m^3)	Compliant but marginal (35 to 40 μg/m^3)	Non-compliant (>40 to 45 μg/m^3)	Very non-compliant (>45 to 50 μg/m^3)	Extremely non-compliant (>50 μg/m^3)	Total non-compliant (>40 μg/m^3)
2023						
Inside Manchester-Salford Inner Relief Route (IRR)	241	26	8	0	0	**8**
Urban centres	219	14	4	0	0	**4**
Other locations	1881	117	30	2	0	**32**
Total	**2341**	**157**	**42**	**2**	**0**	**44**
2024 (Interpolated)						
Inside IRR	250	19	6	0	0	**6**
Urban centres	228	8	1	0	0	**1**
Other locations	1952	66	12	0	0	**12**
Total	**2430**	**93**	**19**	**0**	**0**	**19**
2025						
Inside IRR	259	13	3	0	0	**3**
Urban centres	233	4	0	0	0	**0**
Other locations	1995	33	2	0	0	**2**
Total	**2487**	**50**	**5**	**0**	**0**	**5**
2026 (Extrapolated)						
Inside IRR	265	10	0	0	0	**0**
Urban centres	237	0	0	0	0	**0**
Other locations	2011	18	1	0	0	**1**
Total	**2513**	**28**	**1**	**0**	**0**	**1**

4.1.24 The air quality modelling data and emissions source apportionment is provided in Table 6 for 2025. The exceedance site results are discussed based on their spatial cluster.

Regional Centre / Within the IRR and Chapel St, Salford

4.1.25 The majority of the last points of exceedance are located within Manchester City Centre and the IRR, but are now only on the A34 Bridge Street and John Dalton, adjacent to the A56 Deansgate. The A34 Bridge St / John Dalton St sites with a maximum concentration of 41.7 ug/m^3, showing an improvement due to the CBF of -2.3 ug/m^3.

4.1.26 The maximum concentration in the Do Minimum (i.e. no GM CAP) A62 Lever St has decreased by -6.3 ug/m^3, and is no longer in exceedance. which a road that is restricted to buses only. All other sites have also improved and are no longer in exceedance.

A58 Bolton Road, Bury

4.1.27 The exceedance at the A58 Bolton Road, Bury is predicted to remain on the downwind side of the dual carriageway. The concentration is 41.6 ug/m^3, showing an improvement due to the CBF of -1.2 ug/m^3.

A57 Regent Road, Salford

4.1.28 The A57 Regent Road has very few bus services operating on this corridor. Therefore, the improvements associated with CBF are much lower at -0.2 ug/m^3. The concentration is predicted to be 42.6 ug/m^3 in 2025, which is the highest predicted across GM under this scenario.

Table 6: Predicted annual mean NO_2 concentrations and source apportionment at key compliance points on the Greater Manchester road network - 2025 Do Minimum with CBF Grants

Map ID	Point ID	x	y	Census ID	Road name	Location Type	Local Authority	PCM/ LA/ HE	Annual mean NO_2 conc (µg/m^3)	BG[7] NOx conc (µg/m^3)	BG NO_2 conc (µg/m^3)	Road NOx contrib (µg/m^3)	Road NO_2 contrib (µg/m^3)	Traffic Flow (veh per day)	NOx contribution by vehicle type (%)				
															Bus	Taxi	HGV	LGV	Car
1	2237_3790_DW	379830	410975	38354	A58 Bolton Road	Wider GM	Bury	PCM	**41.6**	20.1	14.4	61.8	27.2	80,272	9%	6%	19%	26%	41%
2	3790_3652	379874	410937	38354	A58 Bolton Road	Wider GM	Bury	PCM	40.1	20.1	14.4	59.0	25.7	80,272	9%	6%	19%	26%	41%
3	1242_1243	384483	398343	70154	A62 Lever St	Inside IRR	Manchester	PCM	38.9	33.2	22.1	56.8	16.7	1,444	100%	0%	0%	0%	0%
4	1268_1269	383558	398278	27974	A34 Bridge St	Inside IRR	Manchester	PCM	**41.7**	33.2	22.1	59.3	19.6	9,399	69%	2%	4%	8%	17%
5	1268_46301	383702	398229	7947	A34 John Dalton St	Inside IRR	Manchester	PCM	**41.6**	33.2	22.1	61.2	19.6	8,542	69%	2%	10%	8%	11%
6	2283_8544_DW	383791	398603	27992	A56 Deansgate	Inside IRR	Manchester	PCM	37.4	33.2	22.1	44.0	15.3	4,313	75%	2%	5%	12%	7%
7	NonPCM_207	383624	398258	N/A	A34 Bridge St / Deansgate	Inside IRR	Manchester	LA	**40.6**	33.2	22.1	54.8	18.5	14,035	16%	7%	8%	25%	45%
8	8546_14050	384384	398801	57427	A664 Shudehill	Inside IRR	Manchester	PCM	37.4	33.2	22.1	43.0	15.3	8,016	69%	3%	4%	6%	20%
9	1307_1317	383757	398717	36551	A6041 Blackfriar's Rd	Inside IRR	Manchester	PCM	35.3	33.2	22.1	37.1	13.2	4,313	82%	1%	2%	8%	6%
10	Jct285	384363	398784	N/A	A664 Shudehill	Inside IRR	Manchester	LA	36.5	33.2	22.1	40.0	14.4	8,016	69%	3%	4%	6%	20%
11	1267_1985	383672	398364	16536	A56 Deansgate	Inside IRR	Manchester	PCM	39.4	33.2	22.1	45.3	17.3	8,836	43%	4%	8%	17%	28%
12	1349_2993_DW	382580	397716	73792	A57 Regent Road	Access to IRR	Salford	PCM	**42.6**	23.2	16.3	58.6	26.3	57,844	1%	6%	21%	31%	42%
13	1216_14503_DW	382565	398546	17926	A6 Chapel St	Access to IRR	Salford	PCM	39.2	23.7	16.6	55.1	22.6	31,902	37%	4%	17%	17%	26%

[7] BG = Background

Air quality in the Full Electric Bus test scenario

4.1.29 This scenario investigates what the potential improvement to air quality would be if electric buses were in operation. This information can be used to prioiritise where the CRSTS funding would deploy buses to assist in delivering the maximum improvements to air quality and work towards compliance in the shortest possible time.

4.1.30 By 2025, compared with the Do Minimum with CBF Grants scenario, there could be a decrease in the overall number of exceedances from 5 to 1 as a result of prioritised electric bus deployment.

4.1.31 The only remaining exceedance is at:

- A57 Regent Rd, Salford.

4.1.32 The modelling indicates that by 2026 this location would have naturally improved such that all of GM is compliant in 2026.

4.1.33 The table of predicted annual mean NO_2 concentration bandings at all points on the Greater Manchester road network has not been produced, because the scenario has been modelled inform route prioritisation, and is not realistic at a full GM scale.

4.1.34 The air quality modelling data and emissions source apportionment is provided in **Table 2** for 2025. The exceedance site results are discussed based on their spatial cluster.

Regional Centre / Within the IRR and Chapel St, Salford

4.1.35 There are no exceedances located within Manchester City Centre and the IRR. The A34 Bridge St has a concentration of 31.5 ug/m^3, showing an improvement due to electric buses of -10.2 ug/m^3.

4.1.36 All of the modelled sites would have significant headroom below the Limit Value of 40 ug/m^3, meaning that only a relatively low proportion of the bus fleet serving the city centre would need to be electrified to deliver compliance, beyond the CBF upgrades.

A58 Bolton Road, Bury

4.1.37 The A58 Bolton Road, Bury is predicted to be in compliance with electric buses in operation. The concentration is 40.1 ug/m^3, showing an improvement due to electric buses of -1.5 ug/m^3. The majority of services would need to be electrified to deliver compliance, based on the modelling.

A57 Regent Road, Salford

4.1.38 The A57 Regent Road has very few bus services operating on this corridor. Therefore, the improvements associated with electric buses are much lower at -0.2 ug/m^3, beyond the CBF upgrades. The concentration is predicted to be 42.4 ug/m^3 in 2025. This is the last remaining exceedance in 2025, assuming electric bus deployment can be successfully delivered.

4.1.39 Whilst electric buses will be targeted for this location, GM is developing a additional package of measures aimed at further improving air quality at the A57 Regent Road, such that all of GM is predicted to be compliant in 2025.

Table 2: Predicted annual mean NO_2 concentrations and source apportionment at key compliance points on the Greater Manchester road network - 2025 Full Electric Bus Test

Map ID	Point ID	x	y	Census ID	Road name	Location Type	Local Authority	PCM/ LA/ HE	Annual mean NO_2 conc (µg/m^3)	BG[8] NOx conc (µg/m^3)	BG NO_2 conc (µg/m^3)	Road NOx contrib (µg/m^3)	Road NO_2 contrib (µg/m^3)	Traffic Flow (veh per day)	NOx contribution by vehicle type (%)				
															Bus	Taxi	HGV	LGV	Car
1	2237_3790_DW	379830	410975	38354	A58 Bolton Road	Wider GM	Bury	PCM	40.1	20.1	14.4	56.2	25.7	80,272	0%	6%	21%	28%	45%
2	3790_3652	379874	410937	38354	A58 Bolton Road	Wider GM	Bury	PCM	38.5	20.1	14.4	53.2	24.1	80,272	0%	6%	21%	28%	45%
3	1242_1243	384483	398343	70154	A62 Lever St	Inside IRR	Manchester	PCM	23.6	33.2	22.1	3.0	1.4	1,444	0%	0%	0%	0%	0%
4	1268_1269	383558	398278	27974	A34 Bridge St	Inside IRR	Manchester	PCM	31.5	33.2	22.1	20.6	9.4	9,399	0%	8%	12%	27%	54%
5	1268_46301	383702	398229	7947	A34 John Dalton St	Inside IRR	Manchester	PCM	31.1	33.2	22.1	20.6	9.0	8,542	0%	5%	33%	27%	35%
6	2283_8544_DW	383791	398603	27992	A56 Deansgate	Inside IRR	Manchester	PCM	28.1	33.2	22.1	13.0	6.0	4,313	0%	6%	20%	45%	29%
7	NonPCM_207	383624	398258	N/A	A34 Bridge St / Deansgate	Inside IRR	Manchester	LA	30.9	33.2	22.1	19.2	8.8	14,035	0%	8%	10%	29%	53%
8	8546_14050	384384	398801	57427	A664 Shudehill	Inside IRR	Manchester	PCM	29.2	33.2	22.1	15.2	7.0	8,016	0%	9%	11%	18%	63%
9	1307_1317	383757	398717	36551	A6041 Blackfriar's Rd	Inside IRR	Manchester	PCM	26.3	33.2	22.1	8.9	4.2	4,313	0%	7%	13%	47%	33%
10	Jct285	384363	398784	N/A	A664 Shudehill	Inside IRR	Manchester	LA	28.6	33.2	22.1	14.1	6.5	8,016	0%	9%	11%	18%	63%
11	1267_1985	383672	398364	16536	A56 Deansgate	Inside IRR	Manchester	PCM	34.0	33.2	22.1	26.5	11.9	8,836	0%	7%	14%	31%	49%
12	1349_2993_DW	382580	397716	73792	A57 Regent Road	Access to IRR	Salford	PCM	**42.4**	23.2	16.3	57.9	26.1	57,844	0%	6%	21%	31%	43%
13	1216_14503_DW	382565	398546	17926	A6 Chapel St	Access to IRR	Salford	PCM	34.3	23.7	16.6	37.9	17.7	31,902	0%	6%	27%	27%	41%

[8] BG = Background

Air Quality exceedances by local authority

4.1.40 The number of exceedances by local authority is presented for each scenario in **Table 8**. This shows that with the electric buses that are expected to be deliverable as part of the CRSTS funding, all of GM would be compliant by 2026.

4.1.41 It is not predicted that all of the electric bus test services could all be in place by 2023 or 2024, so the results in **Table 8** are only presented for this scenario for 2025 and 2026.

Table 8 Number of sites remaining in exceedance of legal limits for NO_2 concentrations by year, Greater Manchester, by local authority for the Do Minimum (i.e. No GM CAP), Do Minimum with CBF Grants Scenario and the Full Electric Bus Test

	2023		2024 (interpolated)		2025			2026 (extrapolated)		
District	**Do Min.**	**Do Min with CBF**	**Do Min.**	**Do Min. with CBF**	**Do Min.**	**Do Min with CBF**	**Electric Bus Test**	**Do Min.**	**Do Min. with CBF**	**Electric Bus Test**
Bolton	3	2	1	0	0	0	0	0	0	0
Bury	11	7	6	4	2	1	0	0	0	0
Manchester	40	16	18	7	9	3	0	4	0	0
Oldham	1	0	0	0	0	0	0	0	0	0
Rochdale	2	2	2	2	0	0	0	0	0	0
Salford	14	10	8	5	2	1	1	1	1	0
Stockport	3	3	0	0	0	0	0	0	0	0
Tameside	4	4	2	1	0	0	0	0	0	0
Trafford	1	0	0	0	0	0	0	0	0	0
Wigan	0	0	0	0	0	0	0	0	0	0
GM Total	**79**	**44**	**37**	**19**	**13**	**5**	**1**	**5**	**1**	**0**

Note: Calculation of 2024 and 2026 was undertaken using linear interpolation or extrapolation from 2023 and 2025 year's modelled NO_2 *results for each model output point.*

4.1.42 It is important to note that the modelled scenarios do not include representation of the CCTS schemes which are expected to have been opened by 2025. A further update to the Do Minimum modelling is underway. There are a number of schemes which could alter the nature of local traffic flows and routing, especially on the A34 Bridge St/John Dalton St, A56 Deansgate, A57 Regent Road and A6 Chapel St and these schemes have the potential to interact.

5 Summary, Conclusions and Next Steps

Summary & Conclusions

5.1.1 This report sets out the results of modelling carried out in Summer 2022 to forecast air quality in Greater Manchester (GM) in future years, taking into account the impacts of Covid-19 delaying vehicle fleet renewals and changes to the expected provision of electric buses. These changes are the removal of ULEB funded electric buses operating on certain routes serving the regional centre, and the inclusion of new ZEBRA funding of routes from Stockport.

5.1.2 As a result, there is an increase in the number of points of exceedance in from the Previous GM CAP model Do Minimum as modelled in spring/summer 2021 (from 71 to 79 in 2023, and from 11 to 13 in 2025).

5.1.3 However, this Do Minimum scenario is considered pessimistic, because the GM CAP has already delivered a significant amount of support funding to buses and HGVs to help them upgrade. Much of the approved funding in the Clean Bus Fund is already out on the GM network, with further funding still to be deployed. This is considered the most representative scenario of future air quality that the New Plan needs to tackle.

5.1.4 Under the Do Minimum with CBF Grants scenario, there is a predicted decrease in the number of points of exceedance in 2023 from the Do Minimum from 79 to 44. This is primarily associated with the regional centre inside the IRR, where bus emissions comprise a greater proportion of total emissions, alongside the arterial routes that lead into the IRR on wider road network outside of the regional centre.

5.1.5 By 2025, the number of exceedances reduces due to the natural upgrade of the vehicle fleet. Compared with the Do Minimum scenario, there would be a decrease in the overall number of exceedances from 13 to 5 as a result of the CBF.

5.1.6 By 2025, whilst there are fewer exceedances predicted, the key locations remain as per the Do Minimum scenario:

- Inside the IRR, including the A34 Bridge St /John Dalton St;
- A57 Regent Rd, Salford; and
- A58 Bolton Road, Bury.

5.1.7 The modelling indicates that exceedances would remain in 2026 at one site, on the A57 Regent Road. All sites are predicted to be compliant by 2027 in the Do Minimum with CBF Grants scenario.

5.1.8 A further scenario has been run to investigate what the potential improvement to air quality would be if electric buses were in operation. This information can be used to prioiritise where the CRSTS funding would deploy electric buses to assist in delivering the maximum improvements to air quality and work towards compliance in the shortest possible time.

5.1.9 By 2025, the number of exceedances reduces due to the natural upgrade of the vehicle fleet. Compared with the Do Minimum with CBF Grants scenario, there could be a decrease in the overall number of exceedances from 5 to 1 as a result of prioritised electric bus deployment, with the only remaining exceedance at the A57 Regent Road, Salford.

5.1.10 Whilst electric buses will be targeted for this location, GM is developing a additional package of measures aimed at further improving air quality at the A57 Regent Road, such that all of GM is predicted to be compliant in 2025.

<u>Next Steps</u>

5.1.11 A further note will be provided separately for the methodology for the next steps. A summary of the approach includes the following:

- Production of approved report summarising modelling submitted on 1st July (by early August) (this document is the unapproved draft version, shared in confidence);
- Modelling to represent impact of CCTS;
- Analysis of bus emissions and ZEB requirements, and modelling of ZEB proposition;
- Taxi data analysis, development of updated cost models, development of upgrade scenarios to test in cost models;
- Cost gap analysis and redevelopment of cost models into segmentation tools that can be used to develop/assess different upgrade scenarios;
- Analysis of air quality/traffic/congestion/fleet/travel patterns at Regent Road;
- Modelling and development of ‘target analysis tool’ for assessing different scenarios at Regent Road (and roll out to other locations if appropriate);
- Package modelling of revised package, when available, and benchmarking against Do Minimum and CAZ options;
- Sensitivity testing of revised package; and
- Production of Technical Reports, as per requirements to be agreed with JAQU.

<u>Indicative Timeline</u>

5.1.12 The below is a timeline of tasks which need to be completed:

- July 2022 – December 2022: Development of preferred scheme – Policy definition (though participatory approach) and agreeing parameters;
- December 2022 – January 2023: Consultation materials, evidence sign off, governance;
- February 2023 – July 2023: Consultation, analysis, and reporting; and
- August 2023: Scheme opening.

Appendix A: Technical Note: Review of Delayed Fleet Upgrade Projections

A1 Introduction

<u>Overview</u>

Greater Manchester (GM) local authorities have been mandated by the Government to take action to reduce harmful Nitrogen Dioxide (NO_2) levels, 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 GM, the 10 local authorities have worked together with the support of Transport for Greater Manchester (TfGM) to develop a Clean Air Plan (CAP) to tackle NO_2 exceedances at the roadside, referred to as GM CAP.

GM is reviewing its CAP with government and has been directed to submit, by 1st July 2022, a new plan for clean air in the city-region which should:

- review the measures specified in the local plan for NO_2 compliance and associated mitigation measures; and
- determine whether to propose any changes to the detailed design of those measures, or any additional measures.

The Direction also requires that compliance with the legal limit value for nitrogen dioxide is achieved in the shortest possible time and no later than 2026 and that exposure to levels above the legal limit for nitrogen dioxide is reduced as quickly as possible.

The GM CAP has been developed based upon the best evidence available at the time, whilst also following prescribed Government guidance. Since the GM CAP proposals were approved in Summer 2021, it has become increasingly clear that there have been pressures on the vehicle markets affecting the availability of sufficient suitable vehicles to meet demand. Feedback from users and the vehicle industry suggests limited vehicle availability is impacting the price of used vehicles, lead times for new ones and may be impacting the on-road vehicle age profile resulting in delays to the natural upgrade of vehicles.

The purpose of this technical note is to review the impacts of changes and possible delays to the natural turnover of the vehicle fleet, through analysis of the following data sets:

- Vehicle sales data and forecasts prepared by Society of Motor Manufacturers and Traders (SMMT); and

The purpose of this analysis is to review the impacts of changes and possible delays to eth natural turnover of the vehicle fleet, through analysis of the following datasets:

- Vehicle sales data and forecasts prepared by the Society of Motor Manufacturers and Traders (SMMT); and

- GM taxi licensing data for Hackneys and PHVs licensed to GM Local Authorities.

These datasets have been used to understand the current position regarding the natural upgrade of the fleet and the on-road fleet mix operating within GM. The data analysis has also supported the review of vehicle fleet assumptions in the context of any revisions required to the Do-Minimum modelling, updating assumptions previously developed by GM in Spring 2021.

Automatic Number Plate Recognition (ANPR) camera data held by Greater Manchester Police (GMP) has also been analysed in **Annex A**, of this appendix, to understand the changing fleet operating on the road. It is noted that this data is impacted by behavioural changes during the pandemic, which might be temporary and could skew the overall results. Therefore, the analysis is not used to directly inform the recommendation for delays to the fleet.

It should be noted that, within the remainder of this document, the term taxi is taken to refer to both Private Hire Vehicles (PHVs) and Hackney Cabs unless otherwise stated.

Structure of Appendix Note

The remaining sections of the report are structured as follows:

- Section 2 provides an overview of the fleet profile position used to inform the Option for Consultation (Pre-COVID-19), and the resulting delayed fleet upgrade assumptions that were current in Autumn 2021;
- Section 3 reviews COVID-19 impacts on the SMMT vehicle sales market in terms of the delay to the fleet;
- Section 4 describes the methodology and assumptions adopted for the review of the taxi licensing database to inform understanding of the taxi age profile; and presents the findings of the data review;
- Section 5 provides a summary of the key findings and recommendations for updates to the Do Minimum modelling regarding delayed fleet upgrade assumptions for each vehicle mode; and
- **Annex A** describes the methodology and assumptions adopted for the review of the new ANPR data and presents the findings of the data review.

A2 Position in Autumn 2021

In Autumn 2021, following a review of the impacts of COVID-19, and in agreement with JAQU, a delay to the natural turnover of the vehicle fleet was included within the core modelling of the Approved GM CAP. This was based on the reduction in actual and predicted new vehicle sales by the Society of Motor Manufacturers and Traders (SMMT) and on estimates of impacts on taxi based on licensing and ANPR data.

This included the following fleet turnover delays for the 2023 forecast year, with the delay period representing the proportion of a typical year of new vehicles sales entering the fleet, as shown in **Table A1**.

Table A1 Delayed Fleet Upgrade Assumptions Developed for Autumn 2021 Modelling

Vehicle Type	Delay to Fleet	Justification
Bus	No	Fleet mix assumptions will not be altered. Bus operators already responding to CAZ in terms of upgrading their fleet (retrofit funds have been made available already) and so it is not considered likely that bus fleet will age more than expected. Electric bus routes will be incorporated when funding is secured or the fleets are already in operation.
HGV	No	Purchases were disrupted in 2019 and 2020 by factors other than Covid. Analysis suggests that overall purchases across the two years were fairly typical of an average year.
LGV	Yes (3 months)	Purchases were depressed in 2020, with some recovery in early 2021. Analysis suggests that a delay of c.3 months is plausible, with the age of the fleet gradually converging to close to the Pre-Covid-19 Forecast by 2025 if sales recover over time.
Hackney	Yes (12 months)	Consider that significant impact likely – based on licensing data, propose applying a delay of one year to the upgrade of the Hackney & PHV fleet, to be maintained throughout the lifetime of the GM CAP i.e. to 2025.
PHV	Yes (12 months)	
Private Cars	Yes (7 months)	Although not in scope for a CAZ C, important contributor to background emissions. Evidence suggests a significant delay in fleet upgrade and that this is likely to be maintained in future years. Delay of c7 months proposed, to be maintained throughout the lifetime of the GM CAP i.e. to 2025.
Coach & Minibus	No	No changes to the transport and air quality modelling are applicable, because not directly represented in these tools.

Table A2 presents the number of vehicles by type that were in scope for the approved GM CAP in 2019 for both the Option for Consultation (August 2020) and work undertaken in Autumn 2021. As can be seen, most numbers are the same between the submissions apart from a slight update on Hackney numbers in Autumn 2021. This is because the key data source for Hackney was changed from the ANPR database to the Taxi Licensing database.

Table A2 Do-Minimum vehicle numbers serving GM 2019

Year	Mode	Compliance	Option for Consultation (Pre-COVID-19)		Autumn 2021	
			Total Serving GM	% Compliant	Total Serving GM	% Compliant
2019	LGV	Compliant	101,437	37%	101,437	37%
		Non-Compliant	175,991		175,991	
		Total	277,428		277,428	
	HGV	Compliant	42,064	59%	42,064	59%
		Non-Compliant	28,728		28,728	
		Total	70,792		70,792	
	Hackney	Compliant	237	10%	296	12%
		Non-Compliant	2,139		2,080	
		Total	2,376		2,376	
	PHV	Compliant	4,979	29%	4,978	29%
		Non-Compliant	12,196		12,196	
		Total	17,174		17,174	

Technical Note 37: Vehicle Population Estimates[9]

Local Plan Transport Model Forecasting Report (T4) - (Updated at FBC Draft for Approval) Appendix C: Vehicle Population Estimates

[9] https://assets.ctfassets.net/tlpgbvy1k6h2/3fR4HEB016Z572elRIs8wx/ddfa01e92fb972d2d5297e04c78f046a/37_-_GM_CAP_Vehicle_population_estimates.pdf

5.1.13 Projection of the estimated vehicle numbers, as set out in **Table A2**, was undertaken to forecast the natural change in compliant vehicles into the future, without any interventions applied (Do-Minimum – No GM CAP measures). This was undertaken to understand the market's proportion of natural upgrades. Natural upgrades have been incorporated into the key forecast years (2022, 2023 and 2025). **Table A3** summarises the vehicle number projections of all modes in 2023, as per the Option for Consultation and Autumn 2021 analysis. As would be expected, the proportion of compliant vehicles serving GM increases between 2019 and 2023 through natural churn, as vehicle owners upgrade their vehicles and the oldest vehicles are scrapped out of the fleet.

Compared to the Option for Consultation, the Autumn 2021 forecast more non-compliant vehicles for certain vehicle types which were severely impacted by the COVID-19 pandemic, with a noticeable delay in the normal cycle of purchasing new and second-hand vehicles.

Table A3 Projection of Do Minimum vehicle numbers serving GM 2023

Year	Mode	Compliance	Option for Consultation (Pre-COVID-19)		Autumn 2021	
			Total Serving GM	% Compliant	Total Serving GM	% Compliant
2023	LGV	Compliant	147,067	53%	145,056	52%
		Non-Compliant	130,360		132,371	
		Total	277,428		277,428	
	HGV	Compliant	57,191	81%	57,272	81%
		Non-Compliant	13,600		13,520	
		Total	70,792		70,792	
	Hackney	Compliant	1,013	43%	844	36%
		Non-Compliant	1,363		1,532	
		Total	2,376		2,376	
	PHV	Compliant	13,004	76%	11,668	68%
		Non-Compliant	4,170		5,506	
		Total	17,174		17,174	

Technical Note 37: Vehicle Population Estimates[10]

Local Plan Transport Model Forecasting Report (T4) - (Updated at FBC Draft for Approval) Appendix C: Vehicle Population Estimates

[10] https://assets.ctfassets.net/tlpgbvy1k6h2/3fR4HEB016Z572elRIs8wx/ddfa01e92fb972d2d5297e04c78f046a/37_-_GM_CAP_Vehicle_population_estimates.pdf

A3 Review of COVID-19 impacts on the vehicle sales market

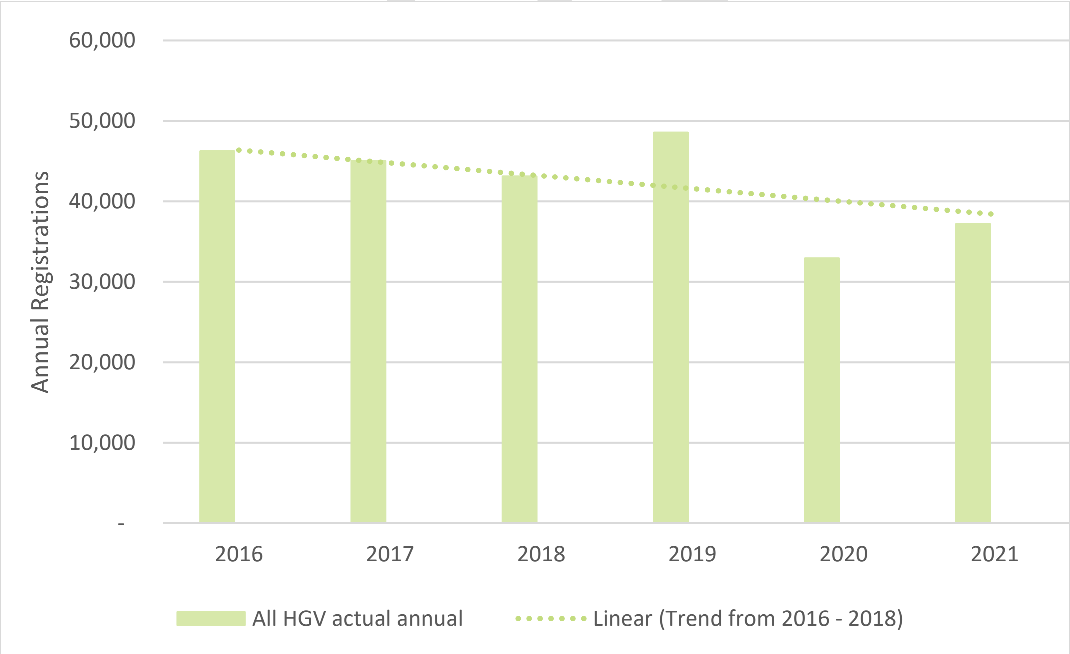
Overview

This section provides an update on the changes in the latest vehicle sales based on figures published by SMMT as a result of the COVID-19 global pandemic.

Figure A1 shows the annual UK HGV registrations between 2016 and 2021. It should be noted that HGV sales was brought forward to 2019 due to a change in regulation in 2020, which led to atypical high registrations in year 2019 when compared to previous years as shown in the figure below. Consequently, the sales in 2020 would have been expected to be atypically low regardless of the pandemic, which makes it more difficult to assess the impact of Covid on HGV sales.

Typical annual registrations from the pre-existing 2016-2018 have been projected from 2019 to 2021 as shown in the dotted line in **Figure A1**, where HGV registrations were recovering but still slightly below the projected registration level in 2021.

Figure A1 UK HGV Registrations (Annual and Cumulative) 2016 – 2021



Source: https://www.smmt.co.uk/vehicle-data/heavy-goods-vehicle-registrations/

The global shortage of semi-conductors began in the first quarter of 2021 due to the impact of COVID-19. Conversations with SMMT in 2021 & 2022 indicate that:

- The semi-conductor shortage has had a significant impact on vehicle production, with the typical vehicle comprising of 1,500 semi-conductor chips;

- Due to COVID-19 restrictions in South-east Asia, approximately 19 semi-conductor plants have been closed, affecting supply. In addition, due to ‘stay-at-home’ restrictions, demand from other sectors such as the gaming industry has risen, further reducing supply; and
- Car producers have been hit hardest as it is more difficult for high volume manufacturers to source chips. HGV manufacturers have more specialist providers which means they can source chips more easily and overall volumes are much lower.

The evidence presented in GM CAP- Impact of COVID Report demonstrates that, as a result of the pandemic, vehicle owners will not be starting from the same position as had been previously assumed in terms of their fleets or their ability to upgrade for the following reasons:

- It is evident that businesses overall have lost revenue, used up reserves and are more indebted and less able to borrow than prior to the pandemic.
- Capital investment in replacement vehicles has been delayed and as a result the fleet on GM’s roads is older. This, along with potential constraints on the supply of compliant vehicles, means that vehicle owners may be less able to upgrade their vehicles in response to the CAZ
- Covid-19 appears to have had the greatest impact on passenger vehicles – Hackney Cabs, PHVs and coaches – who have faced a major drop in passenger demand and long periods of low or no operations.
- Hackney Cabs and coaches in particular entered the pandemic with a highly non-compliant fleet and face high costs to upgrade. Vehicle upgrades have been further delayed during the pandemic
- Some LGV sectors have also been badly affected by the pandemic with extensive periods of closure, whilst others have experienced shorter periods of shutdown and reduced turnover.

<u>HGVs</u>

New HGV Registrations

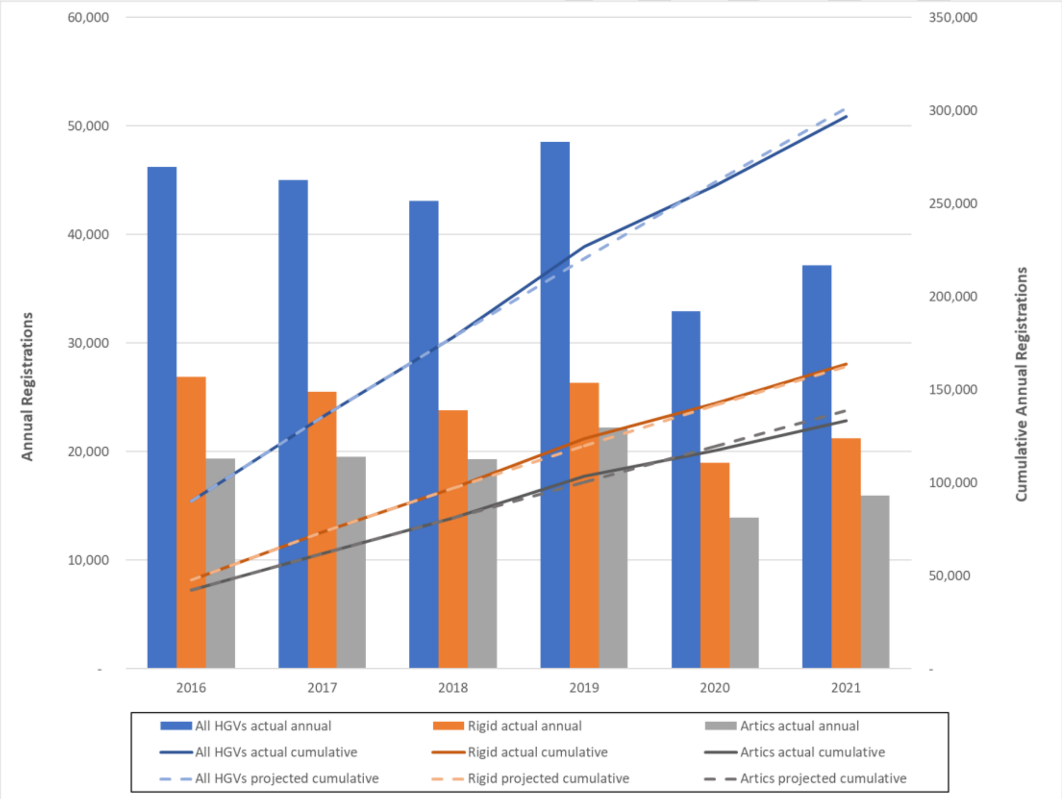
Data produced by SMMT shows that despite an initial decrease in HGV registrations, particularly noticeable in quarter two of 2020, HGV registrations are recovering but still not at the same levels as pre-pandemic. Figure 3 2 shows annual and cumulative UK HGV registrations between 2016 and 2021.

A review of HGV sales shows that whilst there has been a reduction in 2020, this was in part a consequence of increased sales in 2019 due to regulatory changes coming into effect the following year, leading to hauliers bringing forward vehicle purchases.

This effect would be expected to produce a knock-on impact of reduced 2020 sales irrespective of the impacts of COVID-19.

To understand trends in HGV registrations without the distortion of 2019, typical annual registrations from 2019 to 2021 have been projected from the pre-existing 2016-2018 trends out to 2021 (dotted lines). The cumulative actual sales over 2019 to 2021, which account for a 3-year structural sales shift altering investment cycles associated with bringing forward of purchases into 2019 and reduced sales over 2020 and 2021 when COVID-19 impacts are in effect, show that total HGV registrations are 4% below pre-existing 2016-2018 trends. Registrations of rigids (which would be most relevant to air quality in urban centres) are 2% above pre-existing trends, whereas articulated HGVs (which operate more frequently on the more strategic road network) are 10% as shown in **Figure A2**.

Figure A2 UK HGV Registrations (Annual and Cumulative) 2016 – 2021



Source: https://www.smmt.co.uk/vehicle-data/heavy-goods-vehicle-registrations/

Analysis of traffic count data for HGVs from March 2020 onwards indicates that this vehicle group were less impacted compared to cars and vans, with movements returning to Pre-COVID-19 levels by late summer 2020. This would also suggest that the HGV market may have been less severely impacted than cars and vans, although it is recognised that distribution patterns within different industry or commodity sectors may have varied.

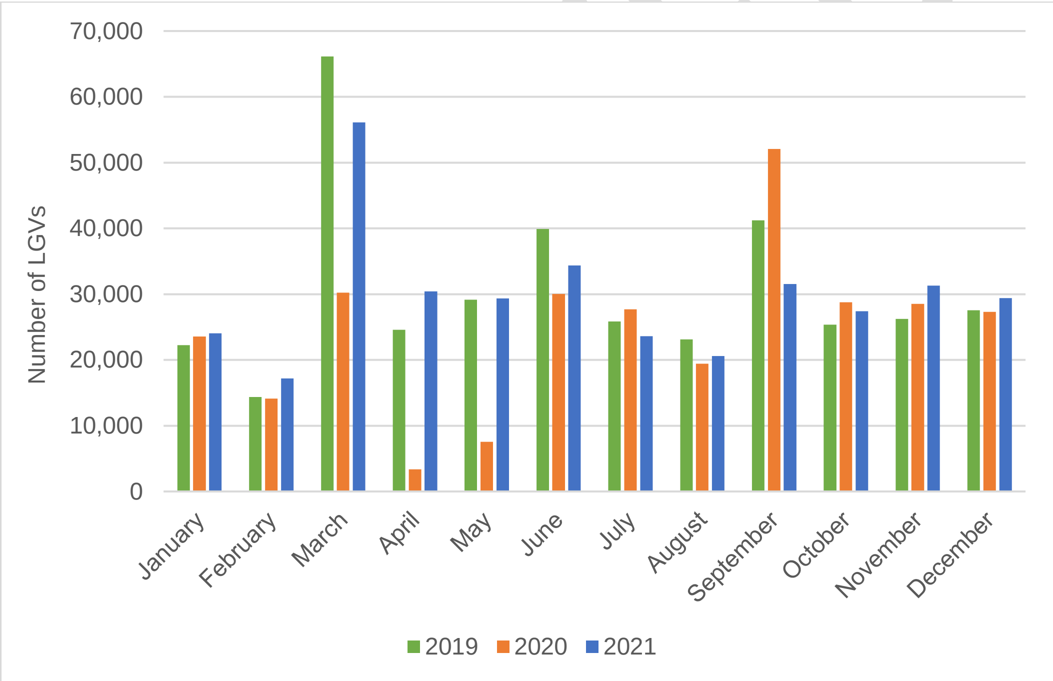
Forecast future sales estimates for HGVs are not published by SMMT and given the relatively low divergence of HGV registrations over the 2019-2021 period, it is not possible to distinguish how COVID-19 has impacted on the longer-term pattern of HGV investment cycles.

LGVs

New Vehicle Registrations

To review the impact of COVID-19 on national van sales, new vehicle registration data from 2019 to 2021 has been reviewed from SMMT. As shown in **Figure A3**, van sales have been impacted by pressures associated with COVID-19. SMMT data shows April and May 2020 being particularly poor months for new van registrations.

Figure A3 Registration of New Vans from 2019 to 2021



Source: SMMT

Table A4 Total number of new vans registered in 2019-2021

Year	Total	% Change from 2019
2019	365,778	-
2020	292,657	-20%
2021	355,380	-3%

Source: SMMT

Table A4 displays the total number of vans registered in 2020 and 2021 compared to the pre-pandemic year of 2019. Annual sales of new vans have been stable from 2016 up to the pandemic, and sales in 2019 were very similar to the previous 4-year average of 366,000, and 2019 is therefore a reasonable comparator to Pre-COVID-19 sales. In 2020 there were significantly fewer new sales with the total registered down 20%. There was a strong recovery in 2021, although sales remained 3% below pre-pandemic levels. The net effect is a reduction of over 80,000 new vans in circulation compared to what would have been expected based on pre-pandemic sales.

However, it can also be inferred that despite the constraints in place, manufacturing in 2021 has broadly managed to deliver at previous levels of supply, and owners purchasing new vehicles have been able to afford them. This indicates that there is strong and resilient demand in some sectors, at least for those companies able to purchase new vehicles. Furthermore, sales in several months of 2021 were greater than those recorded historically and it is therefore considered reasonable that vehicles sales per year could be forecast to exceed those in the Pre-COVID-19 reference level.

Alongside historic new vehicle sales data, SMMT publishes sales projections two years ahead. Using this data, the following approach to incorporate the impacts of COVID-19 into the modelling has been undertaken, as set out in **Table A5.**

This approach aligns to the previous modelling methodology undertaken to support both the Option for Consultation and Autumn 2021 modelling which has been updated using more recently available data and includes the following approach:

- The typical Pre-COVID-19 sales have been set at those recorded in 2019.
- Evidence of reduced vehicle sales for 2020/21 and projections of sales recovery have been published recently by the SMMT for vehicles in 2022/23. These were used to calculate the number of cumulative lost sales between 2020 and the forecast years of 2021, 2023 and 2025 by vehicle type, which is then applied to GM's existing OBC fleet-rollover method used for vehicle fleet projection.
- The SMMT predictions for 2022/23 have then been extrapolated forward to 2025. The number of vans sold per year has been limited to the maximum rate suggested by the SMMT in 2023. The difference between the predicted annual sales (or actual for 2020/21) and typical Pre-COVID-19 levels (2019) have been summed cumulatively, and are reported as the equivalent of lost typical sales each year.
- For vans, the rate of lost vehicle sales is equivalent to 18% of a year's worth of renewal in 2023, reducing to 7% in 2025, because future sales have been extrapolated to levels above those in 2019 allowing lost sales in 2020 to 2022 to be recovered.

- These lost renewal rates are then be applied into the existing fleet roll over model, for each year, creating a slightly older fleet profile for use in the behavioural response and emissions modelling.

Table A5 Predicted Van Fleet Renewal Versus Pre-COVID-19 Rates (thousands)

Data Source	Year	Vans sold	Lost sales/yr	Cumulative lost sales	Lost % of annual sales
Actual	2016	376			
Actual	2017	362			
Actual	2018	357			
Actual	2019	366	typical sales per yr		
Actual (during pandemic)	2020	293	-73	-73	**-20%**
Actual (during pandemic)	2021	355	-11	-84	**-23%**
SMMT prediction	*2022*	*363*	*-3*	*-87*	***-24%***
SMMT prediction	*2023*	*387*	*21*	*-66*	***-18%***
Extrapolation	*2024*	*387*	*21*	*-45*	***-12%***
Extrapolation	*2025*	*387*	*21*	*-24*	***-7%***

Source: SMMT

This level of fleet age impact predicted for 2021/22 agrees with measured increase in average age of vans reported in the ANPR data for 2020 compared with 2019, and a smaller increase again in the 2021 dataset.

It should be noted that the available ANPR data was collated from slightly different periods of the year, therefore the forecast figures from the ANPR analysis should be treated with some caution as analysis outputs may be slightly skewed from actual fleet age delay due to variability in the month during which surveys were made. This is likely to have introduced variance to the relative proportion of newer vehicles in the overall fleet age.

Private Cars

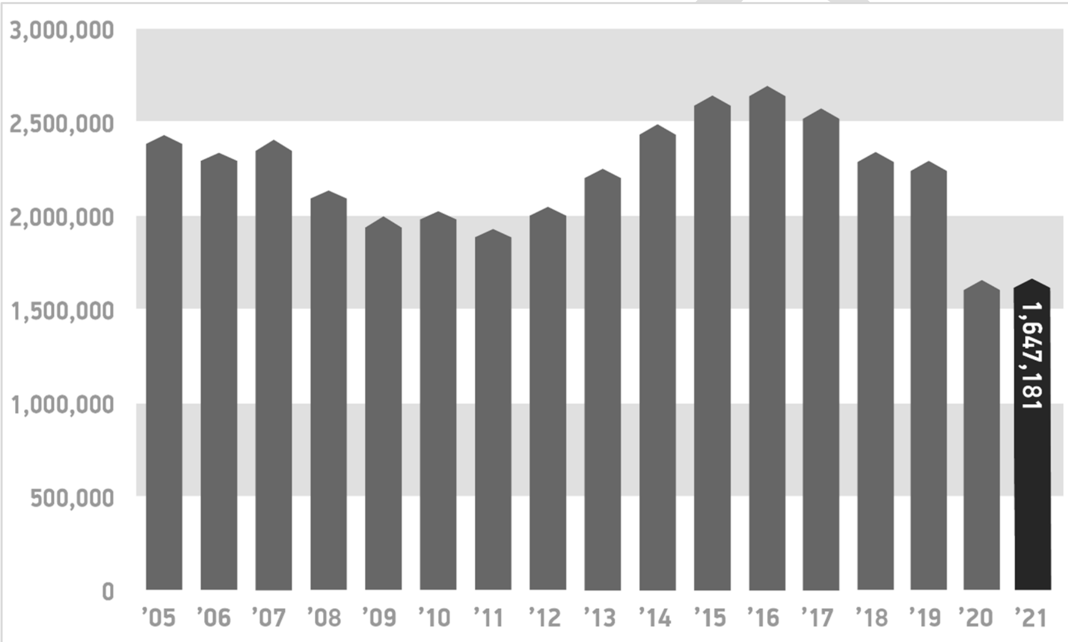
New Vehicle Registrations

Although cars are not impacted by the GM CAP, the age of the car fleet is important as it contributes to the emissions produced by general traffic. Car producers have been hit hardest as it is more difficult for high volume manufacturers to source semiconductor chips.

Applying the same methodology to review the impact of COVID-19 on national private car sales, data on the registration of new vans has been used from SMMT.

As the registration data demonstrates in **Figure A4**, car sales have been heavily impacted by pressures associated with COVID-19. Whilst the Pre-COVID-19 sales pattern for private cars shows that sales have been falling year-on-year since 2016, sales in 2020 and 2021 are both approximately 30% lower than those in 2019. Unlike the sales of vans, car sales did not recover in 2021 and continue to underperform.

Figure A4 Annual New Car Registrations from 2019 to 2021



Source: SMMT

Table A6 displays the total number of new cars registered in 2020 and 2021 compared to the last pre-pandemic year of 2019.

Using SMMT sales projection data, the following approach to incorporating the impacts of COVID-19 into the modelling has been undertaken, as set out in **Table A6**, consistent with the approach taken on LGVs. This approach aligns to the previous modelling methodology undertaken to support both the Option for Consultation and Autumn 2021 modelling which has been updated using more recently available data and includes the following approach:

- The typical Pre-COVID-19 sales have been set at those recorded in 2019.

- Evidence of reduced vehicle sales for 2020/21 and projections of a gradual sales recovery have been published recently by the SMMT for vehicles in 2022/23. These were used to calculate the number of cumulative lost sales between 2020 and the forecast years of 2021, 2023 and 2025 by vehicle type, which is then applied to GM's the existing OBC fleet-rollover method used for vehicle fleet projection.
- The SMMT predictions for 2022/23 have then been extrapolated forward to 2025. Given the Pre-COVID-19 trend of falling year-on-year car sales, the number of cars sold per year has been limited to the rate recorded by the SMMT in 2019. The difference between the predicted annual sales (or actual for 2020/21) and typical Pre-COVID-19 levels have been summed cumulatively, and are reported as the equivalent of lost typical sales each year.
- For cars, the rate of lost vehicle sales is equivalent to 96% of a year's worth of renewal in 2023, reaching 100% in 2025.
- These lost renewal rates will then be applied into the fleet roll over model, for each year, creating an older fleet profile for use in the behavioural response and emissions modelling.

Table A6 Predicted Car Fleet Renewal Versus Pre-COVID-19 Rates (thousands)

Data Source	Year	Car sold	Lost sales/yr	Cumulative lost sales	Lost % of annual sales
Actual	2016	2317			
Actual	2017	2179			
Actual	2018	2010			
Actual	2019	1945	typical sales per yr		
Actual (during pandemic)	2020	1338	-607	-607	**-31%**
Actual (during pandemic)	2021	1292	-653	-1260	**-65%**
SMMT prediction	*2022*	*1534*	*-411*	*-1671*	***-86%***
SMMT prediction	*2023*	*1740*	*-205*	*-1876*	***-96%***
Extrapolation	*2024*	*1874*	*-71*	*-1947*	***-100%***
Extrapolation	*2025*	*1945*	*0*	*-1947*	***-100%***

Source: SMMT

This level of fleet age impact predicted for 2021/22 agrees with measured larger increase in average age of cars reported in the ANPR data for 2020 compared with 2019.

However, it should be noted that the available ANPR data was collated from slightly different periods of the year, therefore the forecast figures from the ANPR analysis should be treated with some caution as analysis outputs may be slightly skewed from actual fleet age delay due to variability in the month during which surveys were made. This is likely to have introduced variance to the relative proportion of newer vehicles in the overall fleet age.

Separately, there are a range of compounding factors which affect how emissions would be altered, since the way that new vehicles are used on the road is not necessarily linearly related to sales themselves. For example, generally newer vehicles drive more miles per annum than older vehicles, as do vehicles purchased for primarily business use rather than private use. Range anxiety concerns with battery-electric vehicles (BEV) also mean that BEVs are often purchased as second cars or for shorter local trips. These effects cannot be quantified or represented in the modelling process.

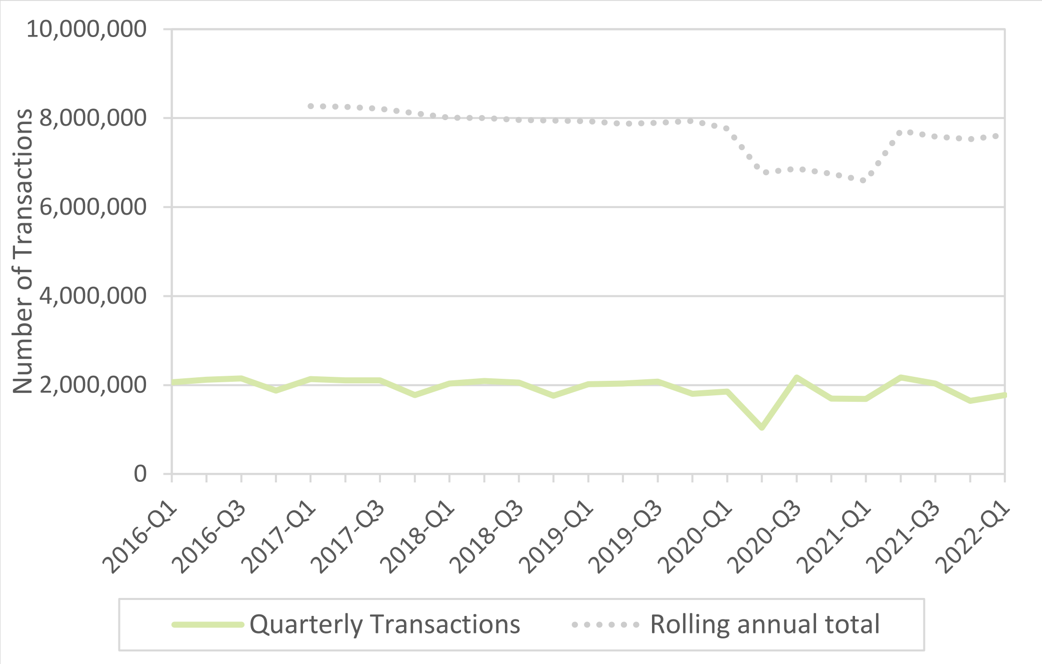
The current split between diesel, petrol and electric car mileage for each forecast year is based on projections from the Department for Transport. The trend in a switch from diesel cars towards petrol and electric powered vehicles is represented in this modelling process following JAQU guidance, and assumptions will be reviewed against available evidence. However, whilst the reduction in new and used vehicle sales is related to the impacts of COVID-19, the influence of COVID-19 altering projected rates of fuel switch is not clear or at this stage considered a first order impact.

Used Vehicle Registrations

Used car sales have also been heavily impacted by the pandemic, with an annual reduction of over 15% in the 12-month period from the start of the pandemic. Quarterly used car sales transactions reported by SMMT is presented in **Figure A5**, together with rolling annual totals.

The review of sales data has shown that sales in late 2021 and early 2022 have risen substantially from the major drop in 2020 and are close, although not fully recovered, to pre-pandemic levels. However, there is no evidence that the lost sales have been recovered.

Figure A5 Used Car Sales from 2016 to 2022



Source: SMMT

Taxis

The UK vehicle market has made a slow recovery due to a combination of manufacturing issues and lack of consumer purchasing. The vehicle market has seen a slow return to pre-pandemic manufacturing levels, experiencing supply chain interruptions, export disruption and the closure of manufacturing plants. In January 2021, commercial vehicle production, including the production of taxis, was 31.5% lower when compared to pre pandemic production in January 2020.

A lack of consumer purchasing could explain the reduction in the number of Hackney Carriages and PHVs registered between 2019 and 2022 shown in Figure 4 1 in taxi licensing analysis. According to PwC Research's QuantiBus survey, there has been a lack of vehicle purchasing as uncertainty has increased and the demand outlook has declined, this is likely due to financial constraints following the pandemic. The lack of vehicle upgrades resulted in a limited second-hand car market during the pandemic, as shown in **Figure 3 5**.

Due to the limited bespoke vehicles sales data on taxi, GM taxi licensing data is used as best source for estimating the fleet delays.

A4 Review of GM Taxi Licensing Data

<u>Overview</u>

The 10 local authorities (LAs) in GM provided their records of registered taxis and PHVs to TfGM for analysis.

Three datasets have been received; these represent data collated at the following points in time:

- July 2019 (Pre-COVID-19 pandemic);
- November 2020 (mid-pandemic, post easing of first lockdown restrictions); and
- January 2022 (post lifting of most legal limits on social contact).

Comparisons of vehicle profiles were made to review the changes over time. The information provided in the taxi licensing data for the profile analysis is shown in **Table A7**.

Table A7 Key Taxi licensing data

Data Points	Description
Registration Plate	Vehicle Registration Number (Number Plate)
Licensing LA	Local Authority where taxi is licensed to
License type	PHV or Hackney
Make	Brand of the vehicle
Model	Model of the vehicle
Fuel Types	Type of fuel used by vehicle
Date of 1st Registration	Date when the vehicle is first registered

From this, the data was processed and cleaned to remove any erroneous records. Following the cleaning process, the data was then analysed to provide a clearer picture of the fleet profiles based on these methodologies:

a) Total GM registered taxi volumes

i) Based on the identification of the unique number plate system – based on unique numbers and characters in VRN; and

ii) A number of taxis were found to be licensed to more than one LA, and those duplicates were removed to gain an accurate number of unique taxis operating within GM.

b) Identification of taxi type (Hackney or PHVs)

i) Based on taxi license type.

c) Fleet age profile

i) Vehicle ages in years are calculated based on the date of 1st registration and date when the dataset was obtained; and

ii) Consistent age categorising methodology was adopted across all datasets. E.g., vehicles are categorised as 0-years-old where the time gap between receiving date of dataset and the date of 1st registration of the vehicle is less than 12 months, and 1 year-old where the time gap is between 12 months and 24 months.

d) Identification of Euro Standards

i) Based on registration year and vehicle and fuel types.

e) Compliancy status

i) Based on vehicle/fuel types and Euro Standard;

ii) According to CAZ framework policies, Euro 6 diesel engines and Euro 4 and above petrol engines will be considered as compliant; and

iii) Note all Electric Vehicles (EVs) and hybrid-electric vehicles whose engines are Euro 4 or later are considered compliant for the purpose of this study.

f) Market natural churn

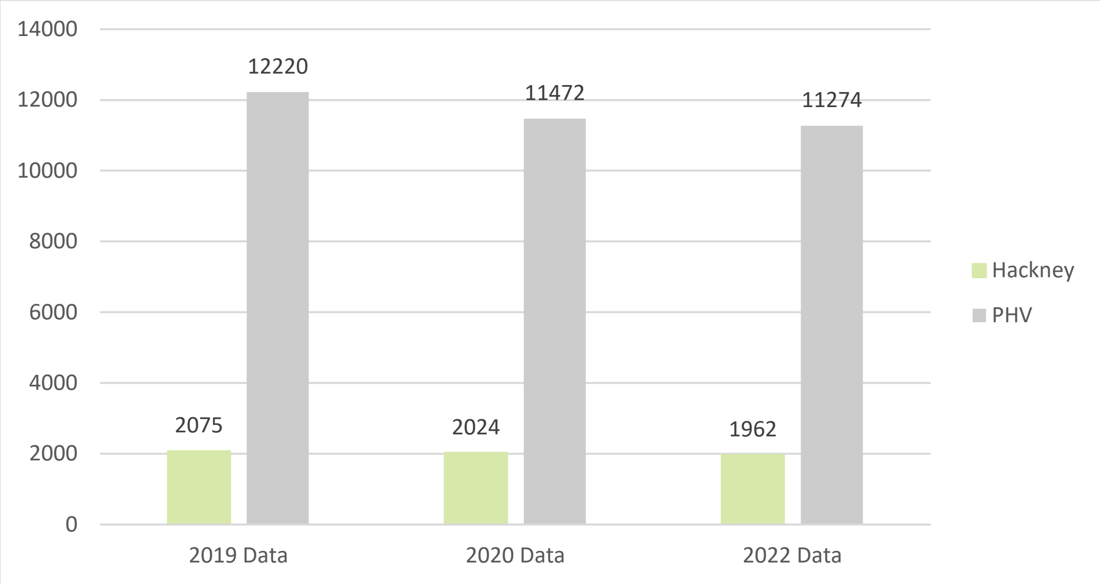
i) By identifying unique registration plate numbers across different data years.

<u>Taxi Licensing Data Analysis</u>

This section provides summary information about the current taxi sector based on the GM licensing datasets for both PHVs and Hackneys. The changes in vehicle age profiles from July 2019 (Pre-COVID-19) to January 2022 (Post-COVID-19) has also been further reviewed.

Figure A6 illustrates the total number of taxis registered in GM from 2019 to 2022. There have been reductions in the total number of taxis licensed in GM over that period. The total number of GM licensed Hackneys decreased by 113 (5.4%) from 2,075 in 2019 to 1,962 in 2022. The total number of GM licensed PHVs reduced by 964 (7.7.%) from 12,220 in 2019 to 11,274 in 2022. This trend of a fall in the number of licensed vehicles has also been seen nationally.

Figure A6 Total GM Registered Hackney and PHV Numbers



Hackney

Figure A7 provides an insight into the change of the GM-licensed Hackney age profile over time.

Only 12 brand-new Hackneys (0-year-old) were bought and licensed in GM within the year before November 2020 which is significantly lower than that for 2019 when 76 brand-new Hackneys were purchased and licensed. The significant reduction in purchasing new vehicles is suspected to be due to the COVID-19 lockdown implemented in March 2020.

The number of new Hackneys purchased recovered from 12 to 23 in January 2022. This seems to be due to the ease of lock-down in 2021-2022. Although it is still lower than the pre-COVID-19 numbers in 2019.

The Hackney age profile has slightly “shifted” to the right from 2019 to 2022, which indicates that fleet age has grown older, and fleet natural upgrade process had been delayed slightly due to the impact of COVID-19.

This can also be evidenced in **Table A8**, where the average Hackney age increased by 0.9 years from July 2019 to January 2022, and the peak of age profile shifted from 8-year-old in 2019 to 9-year-old in 2020 and further increased to 10-years-old in 2022.

Figure A7 Change in Hackney Fleet Age Distribution

Table A8 Average Hackney Age

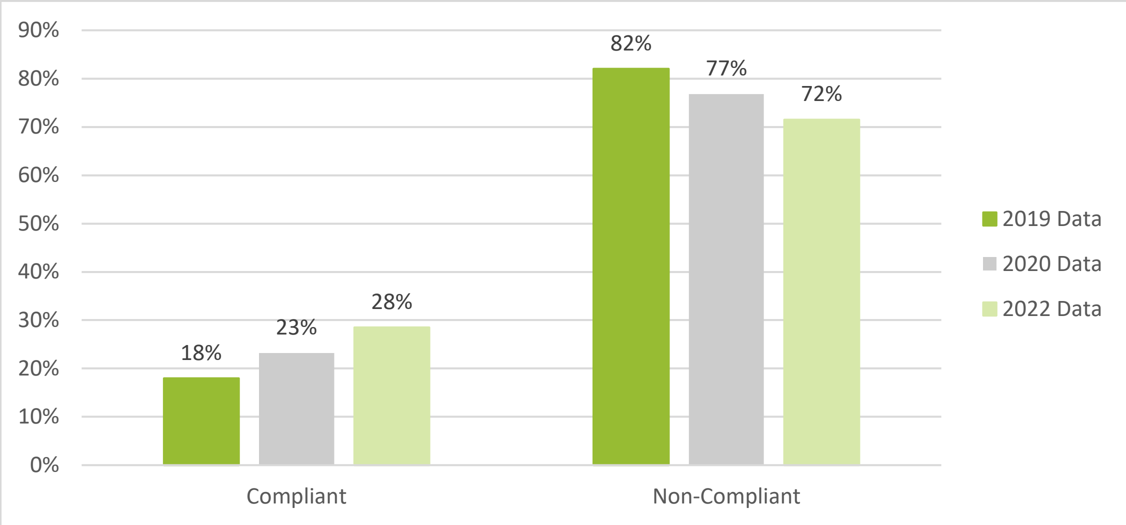
Taxi Type	Data year	2019	2020	2022
Hackney	Average Age	8.2	8.7	9.1
	Most common age group	8	9	10

Note: vehicles older than 20 years are excluded from calculation to avoid unreasonably skewing the average age

In relation to the GM CAZ, compliant vehicles are determined by fuel types and whether the engine standards comply with those set by the EU. Based on current GM CAP policies, Euro 6 diesel engines (2015) and Euro 4 and above petrol engines (2005) will be considered as compliant. It should be noted that all EVs and hybrid-electric vehicles whose engines are Euro 4 or later are considered compliant for the purpose of this study.

Figure A8 shows that the hackney compliance rate has increased from 18% in 2019 to 28% in 2022.

Figure A8 Hackney Compliance Rates



PHV

A similar story can be seen in PHVs as shown in **Figure A9**, with 147 brand-new PHVs purchased and licensed within GM in the year before November 2020, less than half of the number in 2019 (327). 181 brand-new PHVs were purchased and licensed in GM in 2022, a slight increase from 2020 due to the lift of lockdown in 2021, although still lower than the Pre-COVID-19 number (327).

As suggested in **Figure A9** and **Table A9,** the PHV fleet age profile had also grown older in 2020 and 2022 compared to 2019, which indicates that the rate of natural upgrades has also been delayed due to the impact of COVID-19. However, the upgrade delay seems to be less significant when compared to that of Hackney, with the average age increasing by 0.7 years from 2019 to 2022.

Figure A9 PHV fleet age distribution

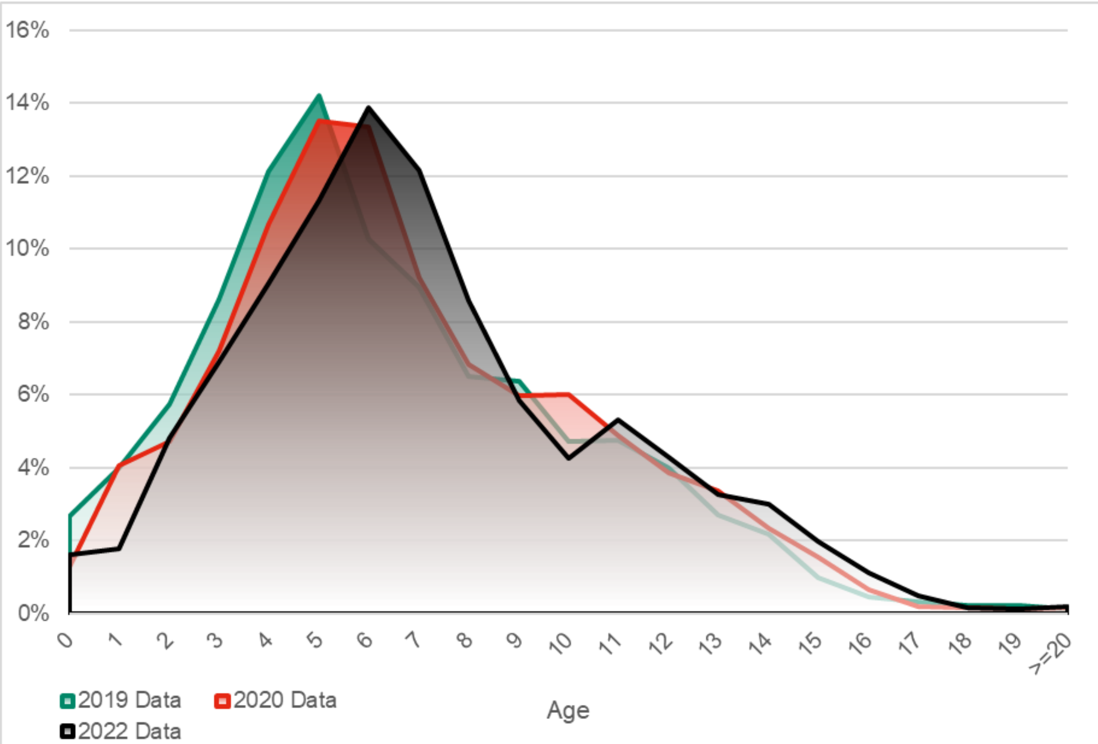


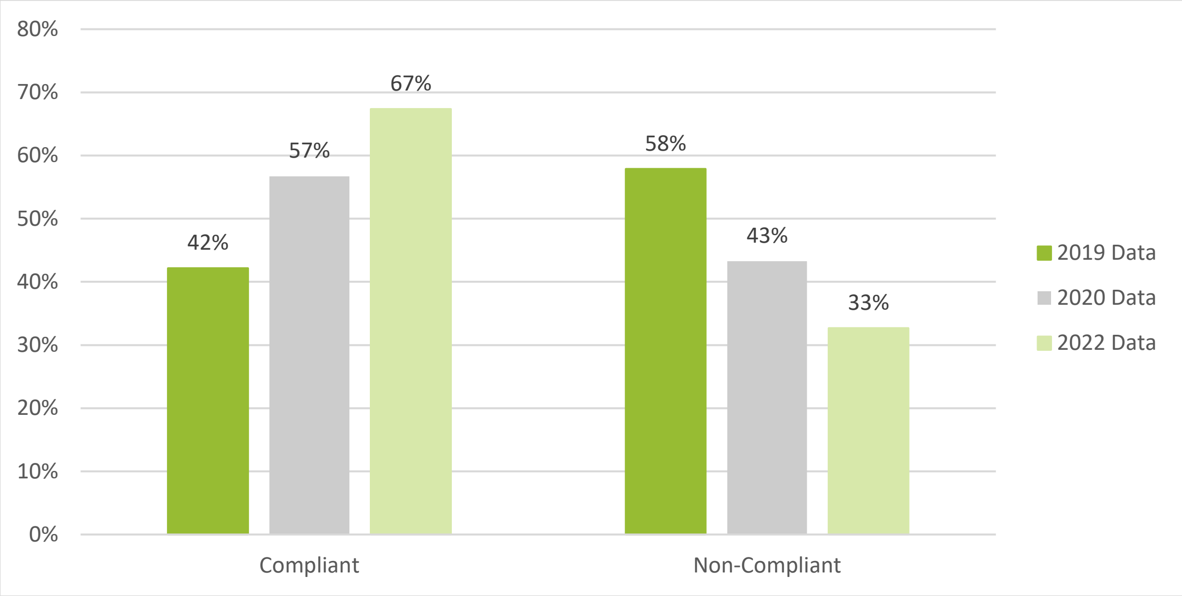
Table A9 Average PHV Age

Taxi Type	Data year	2019	2020	2022
PHV	Average Age	6.4	6.8	7.1
	Most common age group	5	5	6

Note: vehicles older than 20 years are excluded from calculation to avoid unreasonably skewing the average age

Figure A10 shows the change of PHV compliance between 2019 to 2022. The compliance has increased from 42% in July 2019 to 57% in November 2020, up by 15% and further increased to 67% in January 2022.

Figure A10 PHVs Compliance Rates



A5 Summary and Recommendations

<u>Summary</u>

This section provides a summary of the key findings from the review of SMMT vehicles sales data and GM taxi licensing data, to understand any delays to the natural turnover of the vehicle fleet serving GM, for each vehicle type. Recommendations, based on this data, are also provided identifying any updates to the Do- Minimum modelling regarding delayed fleet upgrade assumptions.

<u>SMMT Vehicle Sales market review</u>

HGVs:

- The latest figures from SMMT, as this document was produced, shows that HGV registrations are on the rise, but have still not reached the numbers seen prior to the pandemic; and
- Sales of new HGVs had been brought forward into 2019 by many hauliers. Given the relatively low divergence of HGV registrations over the 2019-2021 period, it is not yet possible to say with confidence how COVID-19 has impacted on the longer-term pattern of HGV investment cycles, though the 2021 HGVs sales data

Vans:

- The pandemic had a large impact on the number of new vans sold in the UK in 2020, but sales recovered to near Pre-COVID-19 levels in 2021; and
- Sales forecasts indicate that the majority of lost sales with be recovered by 2025.

5.1.14 Private Cars:

- The pandemic had a major impact on the number of new cars sold in the UK, initially due to the halting of production lines and local lockdowns around the world, with 2020 sales c.30% below 2019. New cars sales continue to be much lower than pre-pandemic levels in 2021; and
- Sales forecasts indicate that new car sales will gradually recover but the lost sales between 2020 and 2022 will not be recovered, leaving the equivalent of a full year of lost car sales by 2025.

5.1.15 Taxis (Hackney and PHVs):

- In January 2021, commercial vehicle production, including the production of taxis, was 31.5% lower when compared to pre pandemic production in January 2020.

GM Taxi Licensing data review

5.1.16 Hackney:

- The total number of GM licensed Hackneys decreased by 113 (5.4%) from July 2019 to January 2022.
- The number of newly registered hackneys decreased significantly (76 to 12) from 2019 to 2020 due COVID-19 impacts, although recovered slowly (23) at the beginning of 2022 following the easing of lockdown restrictions.
- The data source shows there has been delay in upgrade for hackneys with the peak of hackney age profile shifting from 8-year-old to 10-years-old between 2019 and 2022.
- Hackney compliance rate has increased from 18% in July 2019 to 28% in January 2022.

5.1.17 PHVs:

- The total number of GM licensed PHVs decreased by 964 (7.7.%) from July 2019 to January 2022.
- Similarly, the number of registered brand-new PHVs decreased significantly (327 to 147) from 2019 to 2020 due COVID-19 impacts, although recovered (181) in 2021 due to the easing of lockdown restrictions.
- There has been delay in upgrade for PHVs with the peak of the peak of PHV age profile shifting from 5-year-old to 6-years-old between 2019 and 2022.
- PHV compliance rate has increased from 42% in July 2019 to 67% in January 2022

Summary of Findings

Based on the review of SMMT sales market and GM Taxi Licensing data, the average fleet age delays, and fleet turnover delays (as a proportion of typical annual sales) are summarised in **Table A10**.

Table A10 Data Review Summary Table

Mode	SMMT delayed sales		Taxi Licensing Data
	2023	2025	
HGV	No delay	No delay	n/a
LGV	2 months	1 months	n/a
Hackneys	n/a	n/a	10.8 months
PHV	n/a	n/a	8.4 months
Private Cars	12 months	12 months	n/a

When developing recommendations for the do minimum modelling, the following approach was adopted:

- SMMT vehicle sales data, together with forecasts, where available, is recommended to determine changes to the natural turnover of the fleet due to the pandemic;
- The GM taxi licensing data provides a useful and reliable data source to understand the changing trend of taxi licensing within GM; and

Automatic Number Plate Recognition (ANPR) camera data held by Greater Manchester Police (GMP) has been analysed in Annex A to understand the changing fleet operating on the road. It is noted that this data is impacted by behavioural changes during the pandemic, which could change following COVID-19 and has therefore been used to support the analysis of delayed fleet upgrade assumptions, though has not been included within the recommendations for modelling.

Conclusions

Following review of the data discussed above, **Table A11** presents the delayed natural fleet upgrade assumptions which were developed to inform the Autumn 2021 modelling (see Table 2), together with the latest position regarding natural delays to the fleet. The recommended approach for the updated Do Minimum modelling, for each vehicle type, following the Spring 2022 data review is also noted within the table and where this has changed from assumptions developed to support the Autumn 2021modelling.

Table A11 Recommended delay of fleet upgrade

<table>
<tr><th rowspan="2">Mode</th><th rowspan="2">Option for Consultation (Pre-COVID-19)</th><th colspan="2">Delay as at Autumn 2021[11]</th><th colspan="2">Forecast Delay (Spring 2022)</th></tr>
<tr><th>2023</th><th>2025</th><th>2023</th><th>2025</th></tr>
<tr><td rowspan="2">HGV</td><td>No delay</td><td>No delay</td><td>No delay</td><td>No delay</td><td>No delay</td></tr>
<tr><td></td><td colspan="4">Purchases were disrupted in 2019 and 2020 by factors other than Covid. Analysis suggests that overall purchases across the two years were fairly typical of an average year. Retain Autumn 2021 Assumption No Delay</td></tr>
<tr><td rowspan="2">LGV</td><td>No delay</td><td>3 months</td><td>1 month</td><td>2 months(2)</td><td>1 month(3)</td></tr>
<tr><td></td><td colspan="4">Purchases were depressed in 2020, with some recovery in early 2021. Analysis suggests that a delay of c.2 to 3 months is plausible, with the age of the fleet gradually converging to close to the Pre-COVID-19 forecast by 2025 if sales recover over time.
Retain Autumn 2021 Assumption 3 months delay in 2023, no delay in 2025</td></tr>
<tr><td rowspan="2">Hackney</td><td>No delay</td><td>12 months</td><td>12 months</td><td>10.8 months(1)</td><td>10.8 months(1)</td></tr>
<tr><td></td><td colspan="4">Consider that significant impact likely – based on licensing data, propose maintaining a delay of one year to the upgrade of the Hackney & PHV fleet, to be maintained throughout the lifetime of the GM CAP i.e. to 2025. Retain Autumn assumption of 12 months given significant COVID-19 impact on the taxi sector</td></tr>
<tr><td rowspan="2">PHV</td><td>No delay</td><td>12 months</td><td>12 months</td><td>8.4 months(1)</td><td>8.4 months(1)</td></tr>
<tr><td></td><td colspan="4">Consider that significant impact likely – based on licensing data, propose maintaining a delay of one year to the upgrade of the Hackney & PHV fleet, to be maintained throughout the lifetime of the GM CAP i.e. to 2025. Retain Autumn 2021 assumption of 12 months given significant COVID-19 impact on the taxi sector</td></tr>
<tr><td rowspan="2">Private Car</td><td>No delay</td><td>7 months</td><td>7 months</td><td>12 months</td><td>12 months</td></tr>
<tr><td></td><td colspan="4">Although not in scope for GM CAP, private car is an important contributor to background emissions. Evidence suggests a significant delay in fleet upgrade and that this is likely to be maintained in future years. Delay of c12 months proposed, to be maintained throughout the lifetime of the GM CAP i.e. to2025, this has increased from the 7 months assumption assumed for Autumn 2021 following review of the new data</td></tr>
</table>

NB: (1) 12 months delayed fleet upgrade assumed within the modelling; (2) 3 months delayed fleet upgrade assumed within the modelling (3) no delayed fleet upgrade assumed within the modelling

[11] https://assets.ctfassets.net/tlpgbvy1k6h2/2vJXVuLxfXON7HexGli29Q/4726e8696145d9f10bd1b19c16bdc1dd/Appendix_5_Impacts_of_COVID-19_Report.pdf (Table 7.2).

Based on the recommendations identified above in **Table A11**, the following adjustments were applied in the GM SATURN model to reflect the latest position regarding delayed fleet upgrades, applied in May 2022 (see above).

The forecast delayed fleet upgrades discussed above, aligned closely to existing demand forecasts previously prepared to support the Autumn 2021 modelling and sensitivity testing associated with these model runs. Due to time constraints to develop the updated Do Minimum scenario, the nearest existing demand forecasts have been applied within the GM SATURN model, which have been rounded up to the nearest 3 months forecast delay, ensuring a more conservative approach to delayed fleet upgrades.

Annex A: ANPR Analysis

Overview

GMP has provided ANPR data for a representative week in each of the following three periods (Monday to Sunday):

- January 2019 (Pre-COVID-19 pandemic) – defined as GMP19 data;
- September 2020 (post easing of first lockdown restrictions) – GMP20 data; and
- November 2021 (post lifting of most legal limits on social contact) – GMP21 data.

Data was processed to identify the common camera locations available across the three datasets. A total of 15 camera locations were taken forward to the analysis. Only a general description of the camera locations is available due to confidentiality regarding exact locations. A total of 3 cameras are located within Manchester's Inner Ring Road (IRR), 9 are between the IRR and the M60, and 3 are located within GM, but outside the M60 boundary.

The GMP dataset was anonymised to comply with confidentiality requirements, with the year of registration determined from the age codifier in the Vehicle Registration Number (VRN). The dataset also comprised vehicle make and model, fuel type and vehicle tax class as listed in **Table A12**. These were used to filter through the dataset and derive key information required to summarise the GM fleet profile.

Table A12 GMP Data Content

Data Point	Description
Anonymised VRN	Vehicle Registration Number (Number Plate)
Date	Date of record
Time with seconds	Time of record
Camera Name	Road name
Make	Brand of the vehicle
Model	Model of the vehicle
Specification	Additional specific details of the vehicle (not always available)
Tax Class	Vehicle tax classification

A consistent approach was developed to apply several filters to the three GMP datasets. Briefly, key steps included:

- Identification of the number plate system – based on length / number of characters in VRN (7: current system (2002-today); 6: prefix system (1983-2001); 5: suffix system (1963-1983);
- Identification of registration year based on the VRN system and VRN (e.g. current system and 14 (or 64) = 2014);
- Identification of vehicle type (car, LGV, HGV, etc.) based on vehicle tax class, whitelists and/or on make/model/specification.
- Identification of fuel type (petrol, diesel, hybrid-electric, electric, other) based on vehicle tax class and/or vehicle specification (e.g., TDI = Diesel; PHEV = Hybrid Electric);
- Identification of Euro Standard based on registration year and vehicle type/fuel; and
- Compliancy status based on vehicle type, fuel and Euro Standard.

ANPR Review Findings

Data outputs from the ANPR data processing were subject to analysis to understand the evolution of the fleet profile of vehicles captured by the GMP cameras across the three distinct datasets. Data records for which no specific vehicle registration year and/or vehicle/fuel type could be defined have been excluded from the analysis.

HGV, LGV and car figures presented in this section all derive from the ANPR data analysis. Taxi (Hackney and PHV) figures have been taken directly from the analysis of the licensing data provided by the GM local authorities.

The ANPR data is analysed on both the number of unique vehicles captured by the ANPR cameras as well as the total frequency of records. Sample sizes vary between the three GMP data sets, mostly due to on-going impacts induced by the COVID-19 pandemic. However, it is also worth noting that other variables are likely to impact the sample size, such as the time of the year these surveys have been undertaken ranging from winter (GMP19) to late summer just after schools reopening (GMP20) and mid-autumn (GMP21).

HGV

Figure A11 presents the vehicle age profile of HGVs in each survey on both the number of unique vehicles as well as the total trips captured by the ANPR cameras during three specific weeks. The figure shows that the age distributions based on individual vehicles are very close to that based on total trips. **Table A13** shows that average ages of fleet on total trips are younger than that on unique vehicles for all three years, which indicates that younger HGVs tend to be used more frequently in GM than the older HGVs.

The analysis indicates that half of the HGVs captured by the cameras were 3 years old or less in the 2019 survey. The data shows that in both 2020 and 2021 this figure becomes 4 years old or less. This is the case for both unique vehicles as well as the total trips.

The average age of fleet for both individual vehicles and trips, as shown in **Figure A11**, has increased since 2019 suggesting a slower uptake of new vehicles compared to previous years. This is further supported by the much lower fraction of 0-year-old (brand-new) HGVs in 2020/21 compared with 2019, despite the month of the survey being later in the year. This match reported new HGV sales, which were above typical levels in 2019 due to forthcoming regulatory changes, such that 2020 levels were expected to be lower than average regardless of COVID-19.

However, given that compliant Euro VI HGVs were first available in 2013, this recent new vehicle sales trend will have a more limited impact on the HGV fleet mix of compliant versus non-compliant vehicles on the road.

Figure A11 HGV fleet age distribution

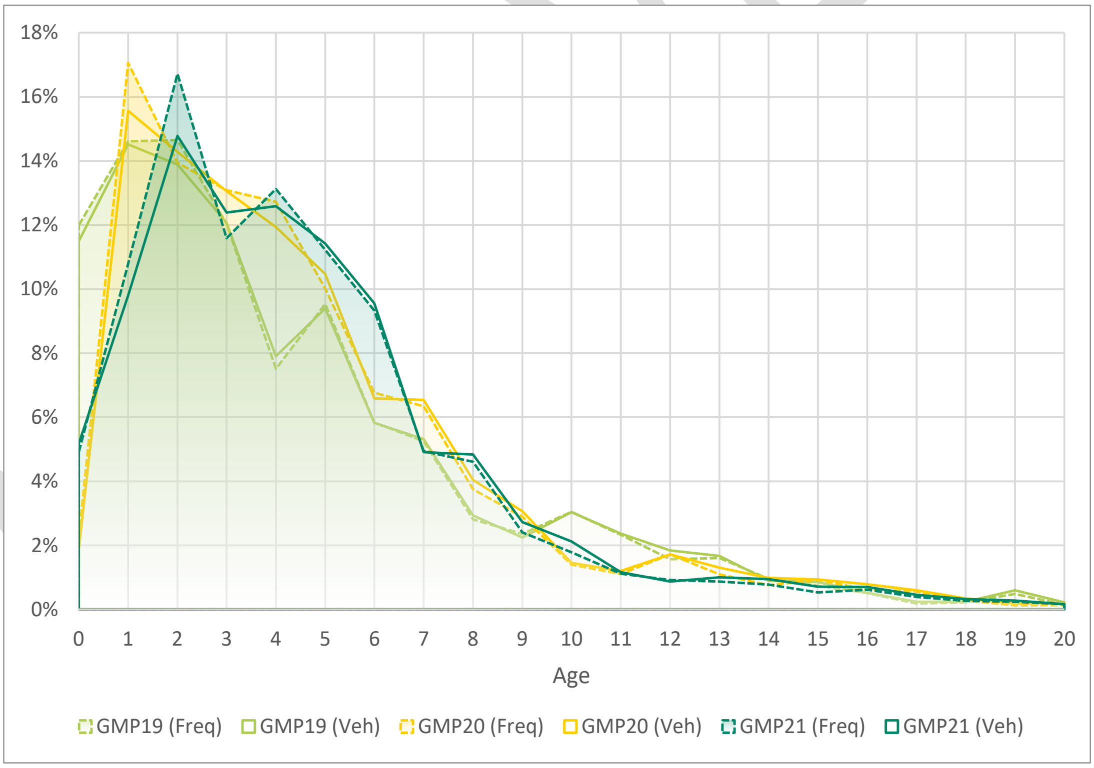


Table A13 Average HGV Age

Data set	GMP19	GMP20	GMP21
Frequency			
Average Age	4.6	5.0	5.0
Most common age group	2	1	2
Unique Vehicles			
Average Age	4.8	5.2	5.3
Most common age group	1	1	2

LGV

The LGV vehicle age profile change is presented in **Figure A12** on both the number of unique vehicles as well as the total trips captured by the ANPR cameras during three specific weeks. The figure shows that the age distributions based on individual vehicles are close to that based on total trips. However, **Table A14** shows that average vehicle ages based on total trips are younger than that based on unique vehicles for all three years, which indicates that younger vehicles tend to be used more frequently in GM than the older vehicles.

The data indicates that half of the valid ANPR records were 4 years old (or less) in the 2019 survey. The same figure changes to 5 years when considering the 2020 and 2021 datasets. This is the case for both unique vehicles as well as the total trips. The average ages of the fleet based on both individual vehicles and total trips, as shown in **Table A14**, have increased since 2019 suggesting a slower uptake of new vehicles compared to previous years.

It is noticeable that the vehicles aged 4-7 years as a proportion of the fleet had increased in 2020/21 compared to that in 2019, whereas the profile of older vehicles has remained more similar. This suggests that the biggest impacts in terms of fleet have been on those who would normally operate a fairly new vehicle, and who may have delayed their upgrade.

Figure A12 LGV fleet age distribution

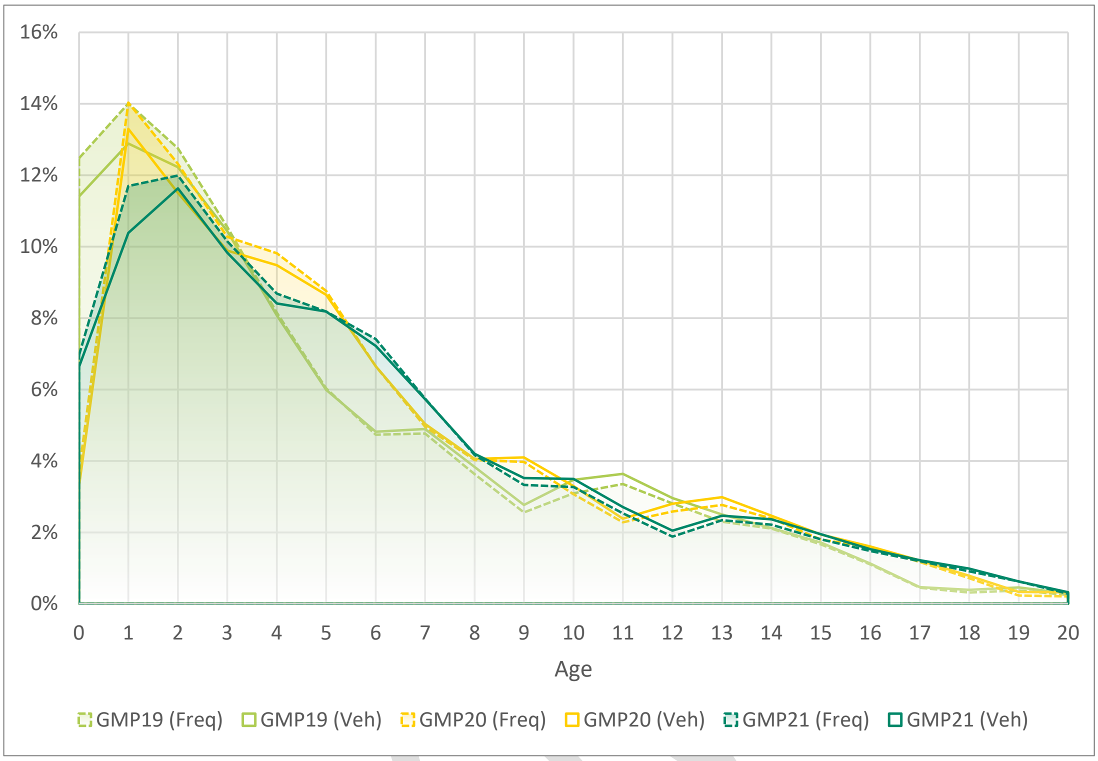


Table A14 Average LGV Age

Data set	GMP19	GMP20	GMP21
Frequency			
Average Age	5.3	6.0	6.1
Most common age group	1	1	2
Unique Vehicles			
Average Age	5.8	6.5	6.6
Most common age group	1	1	2

Private Car

Figure A13 presents the car fleet profile across the three GMP datasets (both in terms of trips and unique vehicles). The figure shows that the age distributions based on individual vehicles and total trips are consistent with each other.

Table A15 shows that average vehicle ages based on both total trips and vehicles. It is noticeable that the average vehicle ages based on total trips are younger than that based on unique vehicles across all three years, which indicates that younger vehicles tend to be used more frequently in GM than the older vehicles.

The data seems to confirm that the impact of recent events has slowed down the car market. The GMP20 and GMP21 data shows a notably reduced proportion of newer (less than 3-year-old) vehicles than the GMP19 equivalent. This is the case for both unique vehicles and the total trips. The data in **Table A15** shows the increased average age, for both unique vehicles and the total trips, since 2019, suggesting a slower uptake of new vehicles compared to previous years.

Unlike vans, the Covid impacts on cars appear to be sustained all the way down the fleet in terms of age – showing that it is not just new car sales that have been affected, but people upgrading to a newer second-hand car as well. This is likely to be as a result of both supply and demand issues (such as the semi-conductor shortage) but also people having done lower mileage than normal during the pandemic, or financial issues caused by the pandemic.

Figure A13 Car fleet age distribution

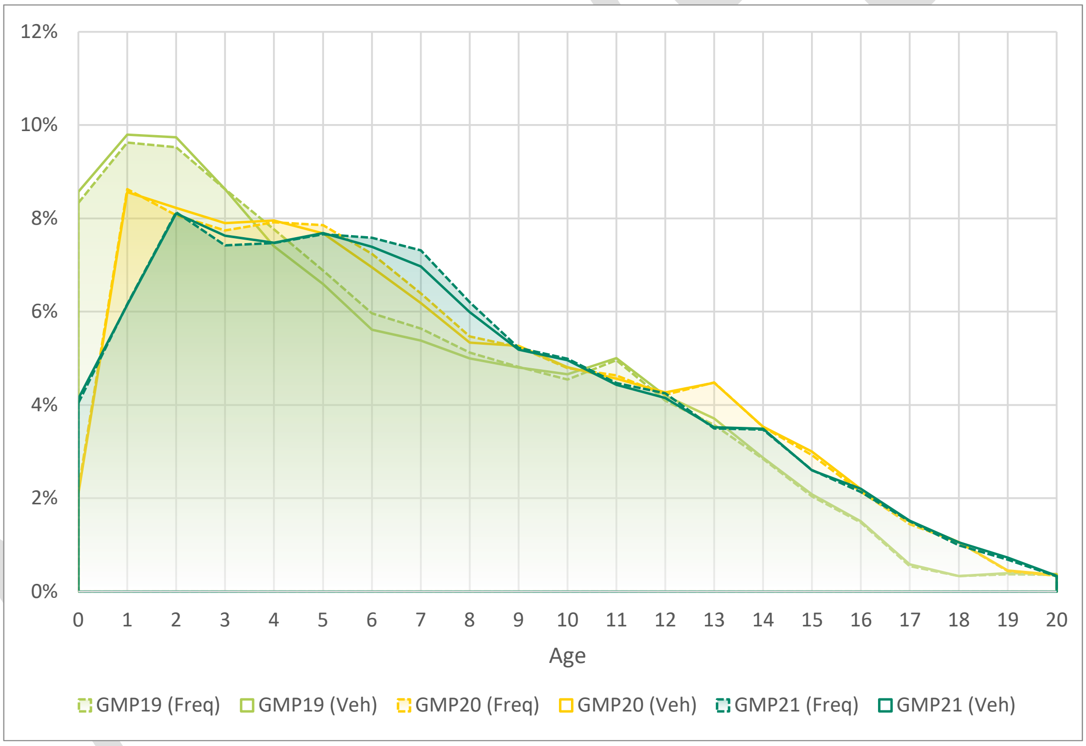


Table A15 Average Car Age

Data set	GMP19	GMP20	GMP21
Frequency			
Average Age	6.6	7.7	7.8
Most common age group	1	1	2
Unique Vehicles			
Average Age	6.7	7.8	7.9
Most common age group	1	1	2

Coach / Minibus

It was not possible to undertake a similar analysis for these vehicle types due to the very limited relevant data within the GMP datasets. Further data disaggregation would be required in order to provide further insights over the coach/minibus fleet profiles (e.g. using the DVLA data set to match with the number plate records).

Data Review Summary

Three sets of ANPR data were compared, covering the following time periods:

- GMP19 - January 2019 (pre COVID-19 pandemic);
- GMP20 - September 2020; and
- GMP21 - November 2021.

The available data was collated from slightly different periods of the year, therefore the forecast figures from the ANPR analysis should be treated with some caution as analysis outputs may be slightly skewed from actual fleet age delay due to variability in the month during which surveys were made. This is likely to have introduced variance to the relative proportion of newer vehicles in the overall fleet age.

Also the ANPR data, whilst accounting for delayed fleet impacts, is also impacted by trip making behaviour which may be temporary in nature due to changing government guidance and recovery of the economy following the lifting of restrictions. This may therefore impact the observed vehicles from the ANPR dataset.

Based on the above points, the ANPR data is being used as useful supporting information, though is not used to directly inform the recommendations for any changes to the natural turnover of the vehicle fleet serving GM. The key findings of the ANPR data analysis are discussed below.

HGVs:

- The analysis suggests that the average age of HGVs increased by 0.5 years from the beginning of 2019 to the end of 2021; and
- The proportion of newly purchased HGVs (i.e. less than 1 year-old) captured by ANPR cameras decreased from near 12% to 2% from 2019 to 2020[12] and recovered to close to 6% by the end of the 2021. These figures are likely to be slightly overestimated due to differences in the sample size (10 months' worth of 'new vehicles' captured in the January 2019 survey compared to 6 and 8 months captured in the September 2020 and November 2021 surveys).

LGVs:

- The analysis suggests that the average age of LGVs increased by 0.8 years from the beginning of 2019 to the end of 2021; and
- The proportion of newly purchased LGVs (i.e. less than 1 year-old) captured by ANPR cameras decreased from near 12% to 3% from 2019 to 2020[6] and recovered to close to 7% by the end of the 2021. It is noted that these figures are likely to be slightly overestimated due to differences in the sample size (10 months' worth of 'new vehicles' captured in the January 2019 survey compared to 6 and 8 months captured in the September 2020 and November 2021 surveys).

Private Cars:

- The analysis suggests that the average age of the car fleet increased by 1.2 years from the beginning of 2019 to the end of 2021; and
- The proportion of newly purchased cars (i.e. less than 1 year-old) captured by ANPR cameras decreased from near 9% to 2% from 2019 to 2020[6] and recovered slightly to 4% by the end of the 2021. These figures are likely to be slightly overestimated due to differences in the sample size (10 months' worth of 'new vehicles' captured in the January 2019 survey compared to 6 and 8 months captured in the September 2020 and November 2021 surveys).

[12] Acknowledging that 2020 is missing at least 3 months of data since the survey was taken in September.