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

Note 32: Option for Consultation – Incremental Measures Modelling Note

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COVID-19 Pandemic Statement

This work has not considered the impact of the COVID-19 pandemic. Whilst we are continuing, where possible, to develop the Greater Manchester Clean Air Plan, the pandemic has already had an impact on our ability to keep to the timescales previously indicated and there may be further impacts on timescales as the impact of the pandemic becomes clearer.

We are also mindful of the significant changes that could result from these exceptional times. We know that the transport sector has already been impacted by the pandemic, and government policies to stem its spread. The sector's ability to recover from revenue loss, whilst also being expected to respond to pre-pandemic clean air policy priorities by upgrading to a cleaner fleet, will clearly require further thought and consideration.

The groups most affected by our Clean Air Plan may require different levels of financial assistance than we had anticipated at the time of writing our previous submission to Government.

More broadly, we anticipate that there may be wider traffic and economic impacts that could significantly change the assumptions that sit behind our plans. We have begun to consider the impacts, and have committed to updating the government as the picture becomes clearer over time.

We remain committed to cleaning up Greater Manchester's air. However, given the extraordinary circumstances that will remain for some time, this piece of work remains unfinished until the impact of the COVID-19 pandemic has been fully considered by the Greater Manchester Authorities.

Since the modelling contained in this report was completed, the Government have supplied GM with £41m of funding towards the retrofit and purchase of compliant buses, coaches, HGVs, minibuses and PHVs (includes Government-estimated delivery costs at 5%). The Government have also confirmed that they do not support the proposed Sustainable Journeys measure and a new Ministerial Direction was issued in March 2020. As the impact of the Government's decisions on the results and conclusions contained in this report was considered likely to be minor, the modelling has not yet been updated. Updated modelling will be carried out post-consultation to reflect any changes to the policy and proposals arising from the consultation and to reflect feedback from the Government and the Technical Independent Review Panel (TIRP) received since the modelling described in this report was completed.

1 Introduction

1.1 Overview

GM submitted the Clean Air Plan (GM CAP) Outline Business Case (OBC) to JAQU in March 2019. The methodology applied to modelling of conditions with and without action was set out in the supplementary Air Quality reports (AQ1/2/3) and Transport reports (T1/2/3/4), and the Economic Appraisal Methodology Report, set alongside a discussion of the limitations, uncertainties and risks of the evidence base in the Analytical Assurance Statement (AAS). A series of sensitivity tests were undertaken, supplied as appendices to the aforementioned reports.

Following OBC submission, various updates to the modelling process were implemented and these were reported in a series of Notes supplied to JAQU in July, August and November 2019, with revised results summarised in "Note 29: Option for Consultation Modelling Summary Note" supplied to JAQU in October 2019.

JAQU have requested evidence of the impact of each implementation fund measure on compliance and supporting evidence for any CAF measures in line with the JAQU guidance. This note has been prepared in response to that request.

1.2 Structure of this Note

Following this introduction, the rest of the note is set out as follows:

- Section 2 – Recap of the proposed Measures;
- Section 3 – Incremental and Isolation Testing Approach;
- Section 4 – Modelling Results; and
- Section 5 – Conclusions.

2 Recap of the proposed Measures

2.1 Overview

The components of the implementation package are set out below, which have been modelled incrementally in these test scenarios:

- M1 – Sustainable Journeys;
- M2 – Clean Bus Fund and GM wide CAZ A for buses and coaches;
- M3 – GM wide CAZ A for taxis and private hire vehicles (PHVs);
- M4 – GM wide CAZ B for HGVs; and
- M5 – GM wide CAZ C for LGVs and minibuses.

The additional Clean Air Fun (CAF) measures are set out below, and these have been modelled individually with the full suite of Implementation measures as listed above, to isolate the specific impacts of each measure:

- M6 – Taxi Fund, including investment in electric charging infrastructure for taxis;
- M7 – Commercial Vehicles (HGV & LGV) Fund; and
- *M8 – Loan Finance (note that this measure was not modelled in the Consultation Option as described in Note 29 and has not been modelled here, but may be included in future modelling so is listed for completeness).*

The Consultation Option includes all the measures set out above. The Consultation Option also includes proposals for investment in electric charging infrastructure across Greater Manchester, which has not been incorporated in the modelling.

2.2 Components of each Measure and Modelling Approach

The assumptions around each component and the way in which they have been modelled are summarised in Table 1.

Table 1 Summary of Measure Test

ID	Description	Assumptions	Measure Modelling Process	How Tested in this Report
M1	Sustainable Journeys	Reduction in vehicle km	Applied within the highway model as a reduction in vehicle trips as drivers transfer to other modes. Mass emissions and concentrations calculated using EMIGMA and the dispersion model.	Incremental Implementation Measure (M1 only)
M2	Clean Bus Fund and GM wide CAZ A for buses	100% upgrade bus fleet to compliant vehicles Implemented from 2021 onwards	Applied post highway model in EMIGMA	Incremental Implementation Measure (M1, M2)
M3	GM wide CAZ A for taxis (Hackney carriages) and private hire vehicles (PHVs)	Charge level of £7.50 per day, with a discounted weekly charge of £50 for owner-driver PHVs, assumed for modelling purposes to apply to all PHVs Implemented from 2021 onwards WAV exemption to 2023, assumed for modelling purposes to apply to all Hackneys and no PHVs	Behavioural response determined from bespoke Taxi Cost Model Implemented within Demand Sifting Tool (DST), assignment model (SATURN) and EMIGMA	Incremental Implementation Measure (M1, M2, M3)
M4	GM wide CAZ B for HGVs	Charge level of £60 per day Implemented from 2021 onwards	Behavioural response determined from bespoke cost model Implemented within DST, assignment model (SATURN) and EMIGMA	Incremental Implementation Measure (M1, M2, M3, M4)
M5	GM wide CAZ C for LGVs (Full Implementation Package)	Charge level of £10 per day Implemented from 2021 onwards, with full exemption assumed to 2023 (so for modelling purposes implemented from 2023)	Behavioural response determined from bespoke cost model Implemented within DST, assignment model (SATURN), EMIGMA and the dispersion model	Incremental Implementation Measure (M1, M2, M3, M4, M5) (Full Implementation Package)

M6	Clean Taxi Fund	PHV Fund: (working assumption all PHVs are non-WAV). Funding values per vehicle assumed to be: — All PHV = £3,000 Hackney Fund: (working assumption that all Hackneys are WAV) Note: as majority of Hackneys are already WAV funds are not introduced until 2023. Funding values per vehicle assumed as: — Zero Emission WAV Hackney = £10,000 — Retrofit = £5,000	Behavioural response determined from bespoke Commercial Vehicles Cost Model Implemented within DST, assignment model (SATURN), EMIGMA and the dispersion Model	CAF Measure Isolation Test (M1, M2, M3, M4, M5, M6) NB: excludes M7
M7	Commercial Vehicles Fund	HGV Fund: varies by weight category (scrappage required) assumed to be: — 7.5t = £2,500 — 18t = £3,500 — 26t = £4,500 — 32t = £5,500 — 44t = £4,500 LGV Fund assumed to be: (scrappage required) — £3,500 Fund level for all eligible LGVs	Behavioural response determined from bespoke cost model Implemented within DST, assignment model (SATURN), EMIGMA and the dispersion model	CAF Measure Isolation Test (M1, M2, M3, M4, M5, M7) NB: excludes M6
M8	Loan Finance	Not modelled in current iteration		
-	GM CAP Consultation Option	Includes all assumptions as set out above for Implementation and CAF proposals	As per methodology for each measure set out above	Full Implementation Package plus Clean Taxi Fund and Commercial Vehicles Fund as CAF measures

3 Incremental Testing Approach

3.1 Requirements

JAQU have requested that we assess:

- the impact of each implementation fund measure on emissions and exceedances to demonstrate that they contribute to compliance; and
- demonstrate that all CAF measures have a neutral or positive impact on emissions and compliance – via modelling where appropriate or off model analysis where impacts are minimal.

We have adopted an incremental modelling approach to the Implementation Fund Measures, modelling each individual measure in turn building up to the full suite. The rationale for adopting this order is that JAQU guidance states that authorities should seek to identify a package of measures and then test these against a benchmark CAZ, with a requirement to implement a CAZ if other measures cannot be shown to be as effective within the same time period. This suggests that non-CAZ measures should be considered first.

This approach was reflected in the identification of packages for testing at the Options Development phase, where Option 1 was a package of non-charging incentive-type measures, and each further package applied charging-based measures in addition to these measures. The approach taken to the incremental modelling is therefore consistent with that taken at Options appraisal.

The CAF measures have then been added to this, and isolated, because they do not necessarily apply in a given order and separate funding decisions will be made. The CAF funds would only be available with a charging CAZ in place, to mitigate the impacts and assist and encourage vehicle owners to upgrade.

The measures are built up in the order set out in Table 1.

Further information has been provided with regard to the disaggregation of the behavioural responses for the LGVs. These are discussed in **Appendix A** and includes details of how the behavioural responses differ by:

- Vehicle size;
- Business size; and
- Commodity type.

4 Modelling Results

4.1 Overview

The impacts of the measures have been assessed using the CAP modelling suite for a forecast year of 2023, as illustrated below:

The modelling system consists of five components:

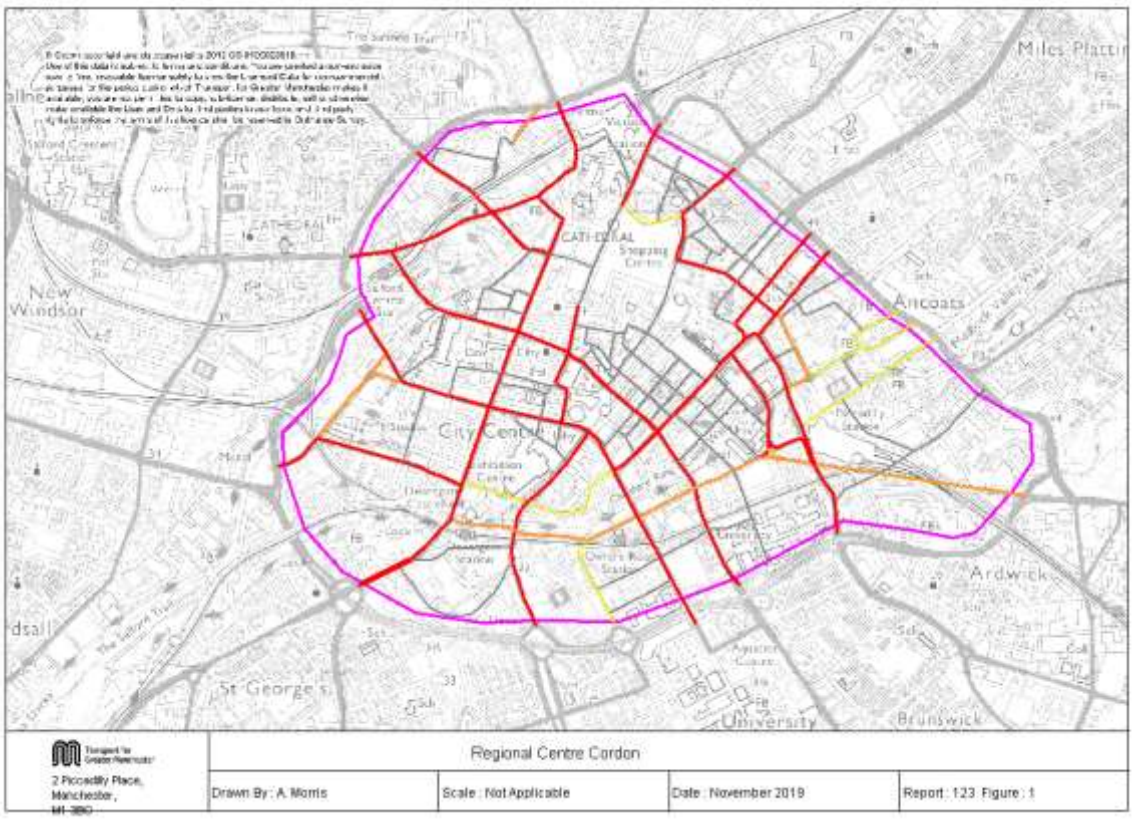
- The Demand Sifting Tool (DST), which models behavioral responses to the CAP measures and creates do-something assignment matrices for input to the Saturn model;
- The Saturn model, which provides details of traffic speeds and flows for input to the emissions model and forecasts of travel times, distances 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 form 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; and
- 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.

All of the measures have been tested using the EMIGMA software as part of the analysis, to understand the impact on emissions. The M1, M5 (test of measures M1-5), M6 (test of measures M1-6) and M7 (test of measures M1-5 + M7) measures have also been assessed using the dispersion model to investigate the air quality impacts for these proposals.

4.2 EMIGMA Results

Changes in NOx emissions are reported for roads inside the Regional Centre and for Greater Manchester as a whole, for all vehicles combined. The location of the Regional Centre cordon is shown in Figure 1, and has been defined as within the Inner Relief Road.

Figure 1 Regional Centre Cordon

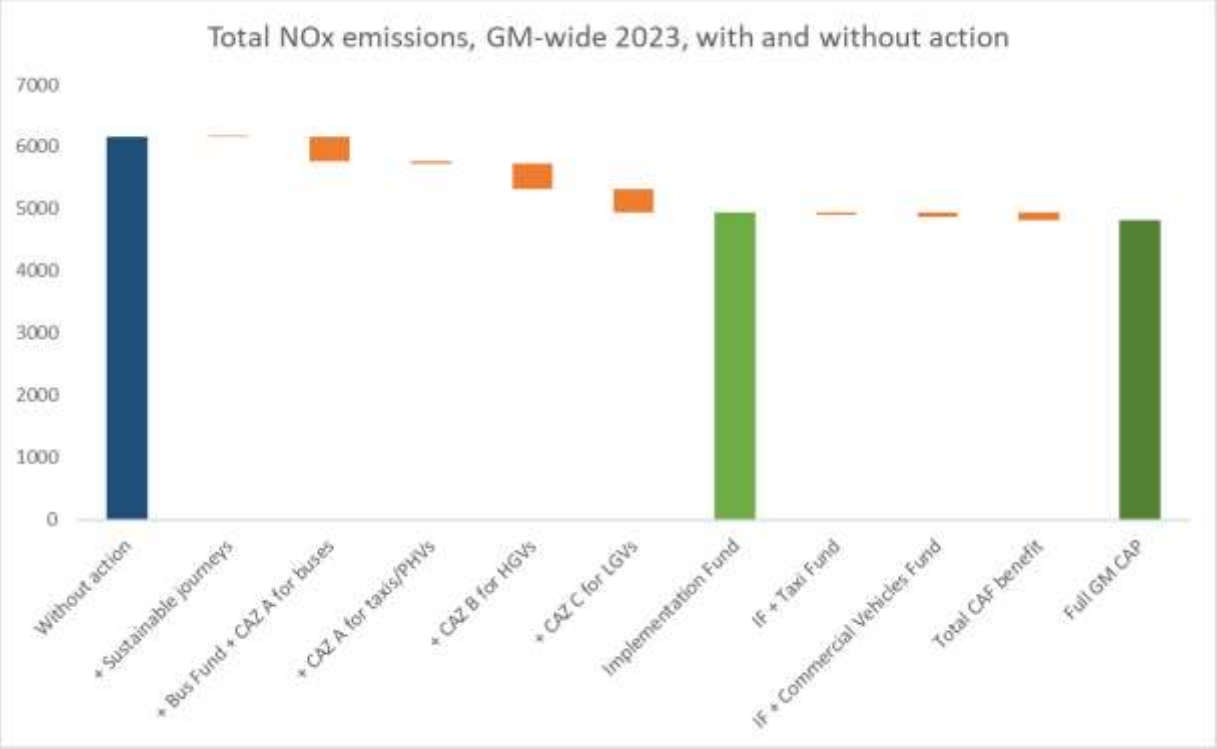


The results of the EMIGMA modelling are presented in Table 2, which shows modelled changes in annual mass NOx emission totals for 2023 for each of the measure tests relative to the Do-Minimum. Figure 2 shows the cumulative impacts as a waterfall diagram.

Table 2 EMIGMA Mass NOx Emission Totals (2023, Tonnes per Year)

	All GM			Regional Centre		
Test ID	NOx emissions	% Change from Do Min.	% Incremental benefit from previous Measure	NOx emissions	% Change from Do Min.	% Incremental benefit from previous Measure
Do Min	6,163	-	n/a	67.9	-	n/a
M1	6,157	-0.1%	-0.1%	67.7	-0.2%	-0.2%
M2	5,768	-6.4%	-6.3%	39.4	-41.9%	-41.8%
M3	5,732	-7.0%	-0.6%	39.2	-42.2%	-0.6%
M4	5,313	-13.8%	-7.3%	37.7	-44.4%	-3.8%
M5	4,952	-19.6%	-6.8%	36.1	-46.8%	-4.4%
M6 (exc. M7)	4,913	-20.3%	-0.8% (vs M5)	35.9	-47.1%	-0.6% (vs M5)
M7 (exc. M6)	4,867	-21.0%	-1.7% (vs M5)	35.8	-47.3%	-0.8% (vs M5)
Consultation Option (M1-7)	4,826	-21.7%	n/a	35.5	-47.8%	n/a

Figure 1 Total NOx emissions, GM-wide, by measure (2023, Tonnes per Year)



4.3 Commentary on emissions reductions

All Implementation Fund measures are forecast to lead to a reduction in mass emissions and thus contribute to the certainty of achieving compliance in the forecast year (2024). Due to the nature of the CAF measures proposed (which further incentivise upgrade to a compliant vehicle), they all have a positive impact on emissions.

The greatest impacts result from funding bus upgrades and the charging CAZ measures, with upgrades to the bus, HGV and LGV fleets (M2, M4 & M5, respectively) all having a similar level of impact at the GM scale at minus six to seven percent.

In the regional centre, the effect of the bus measure (M2) is approximately an order of magnitude greater than HGV and LGV charging (-42% compared to -4%), because bus movements comprise a greater proportion of overall emissions. As yet, buses are assumed to upgrade to compliant diesel and no account has been taken of the possibility of further upgrade to electric. It is evident however that further reducing bus emissions could be highly effective particularly in the Regional Centre.

The impact of the charging CAZ for taxis and Taxi Funds as modelled (M3 and M6, respectively) is the same within the Regional Centre as elsewhere at around -1% each, but it is likely that taxi movements within the Regional Centre are under-represented in the modelling. The Funds are forecast to have only a limited impact on upgrade to a compliant vehicle overall, but the inclusion of the Funds doubles the benefits. This is because the benefits of the Taxi Fund largely come from the increase in uptake of electric (or Zero Emission Capable) taxis (instead of upgrade to compliant diesel vehicles) facilitated by the Funds and investment in charging infrastructure.

The Commercial Vehicles Fund (M7) lead to a further 2% reduction in total vehicle emissions across GM, largely derived from additional upgrade of LGVs to compliant diesel vans. The Commercial Vehicles Fund (M7) increases the effectiveness of the GM CAP from delivering a 20% reduction in LGV emissions to a 24% reduction.

The changes in NOx emissions show how each measure performs at a regional scale, but it should be noted that this masks the more localised effect on NO_2 concentrations at the worst-case locations. The year of assessment used is 2023 when the full scheme including removal of exemptions for LGVs and WAV taxis is proposed to commence. However, measures M1 to M4 plus M6 are likely have a greater impact in the first year of opening when vehicle emissions are greater due to a less compliant fleet mix in the Do Minimum.

4.4 Dispersion Modelling Results

In order to understand the impact of the Measures on NO_2 concentrations, and their effect on compliance with the Limit Values, dispersion modelling has been undertaken for each type of measure, i.e.:

- Sustainable Journeys (M1)
- Charging CAZ (including the Bus Fund) (M2-5)
- Clean Taxi Funds (M6)
- Clean Commercial Vehicle Funds (M7).

The results on the number of exceedances, set out by concentration band are provided in Table 3.

Table 3 Number of sites by scale of exceedance, for each Measure Test (2023)

Measure Test	Compliant sites		Non-compliant sites				Change from Do Min.
	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							
Do Minimum	2287	209	55	13	1	69	n/a
M1	2285	186	56	11	1	68	-1
M2 - M5	2478	56	5	0	0	5	-64
M2 - M6 (exc. M7)	2480	54	5	0	0	5	-64
M2 – M5 and M7 (exc. M6)	2484	50	5	0	0	5	-64
Consultation Option	2485	51	3	0	0	3	-66

4.5 Commentary on impact on air quality

Without additional action, there are predicted to be 69 locations remaining in exceedance across Greater Manchester in 2023.

Action to encourage a switch to sustainable modes of travel could reduce mass emissions by 0.1% and reduce the number of exceedances by one, to 68 in 2023. Furthermore, the number of sites classified as 'very non-compliant', with concentrations over 45 µg/m^3, reduces by two and the number of sites considered compliant but at risk of non-compliance reduces by 23.

The implementation of a Class C CAZ, including funding to support bus upgrade (as per the Clean Bus Fund), and forming the full Implementation Fund package, could substantially reduce emissions by a further 19.5% and reduce the number of locations in exceedance from 68 to 5. Furthermore, the number of sites classified as 'very non-compliant', with concentrations over 45 µg/m^3, reduces from eleven (with M1) to zero. The number of sites considered compliant but at risk of non-compliance reduces by 130.

The Clean Taxi Fund and Commercial Vehicles Fund do not reduce the number of non-compliant sites on their own, although they do deliver a reduction in mass emissions of 1% and 2% respectively. They also reduce the number of sites considered compliant but at risk of non-compliance by two and six respectively.

Nevertheless, the modelling shows that in combination, the inclusion of the CAF measures to form the Consultation Option lead to a further two sites becoming compliant in 2023.

It would also be reasonable to expect that the order of analysis, in terms of applying the Funds after the charging CAZ measure is also reducing the relative performance of these measures, because many vehicles have already chosen to upgrade as a response to the CAZ charge alone. In reality, the Funds will encourage early upgrade and therefore bring human exposure benefits in early years but this is not reflected in the modelling.

In order to better understand the effect of the measures on compliance at specific sites, the predicted NO_2 concentrations have been presented for the most persistent locations of poor air quality, where exceedances are still predicted in 2023 with the Implementation Fund only scenario (M5) in place, set out in Table 4.

At these locations, the Implementation Fund is relatively effective, but is still not sufficient to deliver compliance in 2024. The grant offers included in the CAF proposals have therefore been set to deliver compliance as efficiently as possible, and whilst only small incremental levels of improvement are shown at these worst case sites by M6 and M7 in isolation, their combined effect is critical to achieving delivering compliance.

Table 4 below shows that site 1268_1269 (A34 John Dalton St) is predicted to have the maximum NO_2 concentration in 2024, at 40.4 ug/m^3. This determines that the GM CAP is predicted to deliver compliance in 2024 by the narrowest possible margin. With the removal of the either the Clean Taxi Fund (M6) or the Clean Commercial Vehicle Fund (M7), the concentration at this site has been assessed and is predicted to increase by 0.1 ug/m^3. This would be deemed an exceedance, and the predicted first year of compliance within GM would be delayed until 2025.

Table 4 Modelled NO_2 Concentrations at sites predicted to exceed in 2023 with the Implementation Funds only scenario (M5), for each Measure Test (2023)

Site Details			**Modelled NO_2 Concentrations (ug/m^3)**					
Site ID	**LA**	**Road Name**	**Do Minimum**	**M1**	**M5**	**M6**	**M7**	**Consultation Option (2023)**
MAXIMUM CONCENTRATION IN EACH SCENARIO			**50.8**	**50.8**	**41.7**	**41.6**	**41.6**	**41.5**
2237_3790_DW	Bury	A58 Bury Bridge	46.9	46.9	41.5	41.3	41.1	40.9
1268_1269	Manchester	A34 John Dalton St	50.8	50.8	41.7	41.6	41.6	41.5
1349_2993_DW	Salford	A57 Regent Rd	45.7	45.7	40.9	40.7	40.5	40.3
1268_46301	Manchester	A34 Bridge St	49.0	49.0	41.3	41.3	41.2	41.1
NonPCM_207	Manchester	A34 Bridge St / A56 Deansgate	49.4	49.4	40.7	40.6	40.5	40.4

5 Conclusions

5.1 The approach to modelling has demonstrated the individual and collective impacts of all measures included in the GM CAP, and shown that all measures are required to deliver compliance with the EU Limit Value for NO_2 in 2024.

5.2 The measure-specific analysis shows that the greatest impacts are produced by the charging CAZ measures and funding for bus upgrades, although their effectiveness varies depending on their location and the fleet mix using specific roads. As would be expected, delivering improvements in air quality becomes progressively more difficult as each measure is applied and the remaining road component of NOx emissions of the final total NO_2 concentration is reduced. In this context, the effectiveness of the funds is critical to the delivery of the plan and compliance in 2024.

Appendix A – LGV Behavioural Responses

The vehicle cost model for LGV provides a disaggregation of behavioural response by various categories. These include disaggregation by:

- Weight type (1.6t and 3.5t);
- Business size (Sole/Micro/Small and Medium/Large business split); and
- Commodity type.

Key assumptions:

- Prevention of large organisation owned vans from downsizing to estate cars

The option for 1.6t vans owned by large organisations to choose to downsize to estate cars (a non-compliant option) is blocked, given it was determined that this would only be an option considered by Sole/Micro/Small's. The assumption is based on various reasons including access to capital, procurement processes, reputational impacts etc. It is unlikely that the large organisations would dramatically change the vehicle size of their fleets, therefore consequently change their operational model/frequency.

- Business size split

The behavioural responses splits by business sizes are provided, where SMiS represents Sole, Micro and Small business and where Non-SMiS (Medium and Large) represents the businesses larger than a Small business.

- Vehicle Trips Number

The vehicle trips numbers represent the daily vehicle numbers serving GM weighted by the trip frequency captured by ANPR camera surveys.

The behavioural responses for 2023 are shown below, along with the number of vehicles relevant to each category.

CAZ Only Responses

Table A.1 CAZ only Behavioural Response

Response	Vehicles Trips	2023
Pay Charge	27,419	30.1%
Change Mode	4,193	4.6%
Cancel Trip	0	0.0%
Upgrade Vehicle	59,362	65.3%
Total	**90,975**	**100%**

Table A.2 – Disaggregation by vehicle Size (2023)

	1.6t		3.5t	
Response	**Vehicles Trips**	**Response**	**Vehicles Trips**	**Response**
Pay Charge	5,137	25.6%	22,283	31.4%
Change Mode	4,193	21.0%	0	0.0%
Cancel Trip	0	0.0%	0	0.0%
Upgrade Vehicle	10,602	53.4%	48,760	68.6%
Total	19,932	**100%**	71,043	**100%**

Table A.3 – Disaggregation by business size

	SMiS		Non-SMiS	
Response	**Vehicles Trips**	**Response**	**Vehicles Trips**	**Response**
Pay Charge	24,857	36.7%	2,563	10.9%
Change Mode	4,193	6.2%	0	0.0%
Cancel Trip	0	0.0%	0	0.0%
Upgrade Vehicle	38,607	57.1%	20,756	89.1%
Total	67,656	**100%**	23,318	**100%**

Table A.4 – Behavioural Responses by Commodity Type

Sector		Pay Charge	Change Mode	Cancel Trip	Upgrade
Construction	Vehicles	12,991	2,486	0	11,156
	Response	48.81%	9.22%	0.00%	41.98%
Wholesale, retail & repair of motor vehicles	Vehicles	3,599	326	0	9,503
	Response	27.03%	2.70%	0.00%	70.27%
Manufacturing	Vehicles	2,971	269	0	7,843
	Response	27.05%	2.46%	0.00%	70.49%
Transport & storage	Vehicles	1,999	181	0	5,279
	Response	26.83%	2.44%	0.00%	70.73%
Accommodation & food services	Vehicles	555	6	0	6,454
	Response	7.79%	0.00%	0.00%	92.21%
Information & communication	Vehicles	492	4	0	4,662
	Response	8.93%	0.00%	0.00%	91.07%
Professional, scientific & technical activities	Vehicles	1,028	93	0	2,715
	Response	26.19%	2.38%	0.00%	71.43%
Mining, energy & water supply	Vehicles	281	83	0	3,046
	Response	8.11%	2.70%	0.00%	89.19%
Public admin. & defence; social security	Vehicles	1,078	231	0	2,011
	Response	32.43%	8.11%	0.00%	59.46%
Human health & social work activities	Vehicles	590	126	0	1,099
	Response	31.58%	5.26%	0.00%	63.16%
Other services	Vehicles	575	123	0	1,072
	Response	31.58%	5.26%	0.00%	63.16%
Financial & insurance activities	Vehicles	122	1	0	1,424
	Response	5.88%	0.00%	0.00%	94.12%
Administrative &support services	Vehicles	350	117	0	1,193
	Response	22.22%	5.56%	0.00%	72.22%
Agriculture, forestry & fishing	Vehicles	670	128	0	575
	Response	50.00%	7.14%	0.00%	42.86%
Real estate activities	Vehicles	57	1	0	664
	Response	12.50%	0.00%	0.00%	87.50%
Education	Vehicles	61	18	0	666
	Response	12.50%	0.00%	0.00%	87.50%

CAZ Plus Funds Responses

Table A.5 CAZ only Behavioural Response

Response	Total Vehicle Trips	**2023**
Pay Charge	11,183	12.20%
Change Mode	3,050	3.40%
Cancel Trip	-	0.00%
Upgrade Vehicle	76,741	84.50%
Total	90,974	**100%**

Table A.6 – Disaggregation by vehicle Size (2023)

	1.6t		**3.5t**	
Response	**Vehicles Trips**	**Response**	**Vehicles Trips**	**Response**
Pay Charge	1,976	10.00%	9,207	12.93%
Change Mode	3,050	15.45%	-	0.00%
Cancel Trip	-	0.00%	-	0.00%
Upgrade Vehicle	14,906	74.55%	61,835	87.07%
Total	19,932	**100%**	71,042	**100%**

Table A.7 – Disaggregation by business size

	SMiS		**Non-SMiS**	
Response	**Vehicles Trips**	**Response**	**Vehicles Trips**	**Response**
Pay Charge	8,621	12.77%	2,563	10.94%
Change Mode	3,050	4.57%	0	0.00%
Cancel Trip	0	0.00%	0	0.00%
Upgrade Vehicle	55,985	82.66%	20,756	89.06%
Total	67,656	**100%**	23,318	**100%**

Table A.8 – Behavioural Responses by Commodity Type

Sector		Pay Charge	Change Mode	Cancel Trip	Upgrade
Construction	Vehicles	3,876	1,474	0	21,282
	Response	14.68%	5.46%	0.00%	79.86%
Wholesale, retail & repair of motor vehicles	Vehicles	1,706	326	0	11,395
	Response	12.84%	2.70%	0.00%	84.46%
Manufacturing	Vehicles	1,408	269	0	9,406
	Response	12.40%	2.48%	0.00%	85.12%
Transport & storage	Vehicles	948	181	0	6,331
	Response	12.20%	2.44%	0.00%	85.37%
Accommodation & food services	Vehicles	548	6	0	6,460
	Response	7.79%	0.00%	0.00%	92.21%
Information & communication	Vehicles	429	4	0	4,724
	Response	8.77%	0.00%	0.00%	91.23%
Professional, scientific & technical activities	Vehicles	487	93	0	3,256
	Response	11.90%	2.38%	0.00%	85.71%
Mining, energy & water supply	Vehicles	276	83	0	3,051
	Response	7.89%	2.63%	0.00%	89.47%
Public admin. & defence; social security	Vehicles	430	200	0	2,690
	Response	13.51%	5.41%	0.00%	81.08%
Human health & social work activities	Vehicles	235	110	0	1,470
	Response	15.00%	5.00%	0.00%	80.00%
Other services	Vehicles	229	107	0	1,435
	Response	15.00%	5.00%	0.00%	80.00%
Financial & insurance activities	Vehicles	121	1	0	1,425
	Response	5.88%	0.00%	0.00%	94.12%
Administrative &support services	Vehicles	172	102	0	1,386
	Response	11.11%	5.56%	0.00%	83.33%
Agriculture, forestry & fishing	Vehicles	200	76	0	1,097
	Response	13.33%	6.67%	0.00%	80.00%
Real estate activities	Vehicles	56	1	0	665
	Response	12.50%	0.00%	0.00%	87.50%
Education	Vehicles	60	18	0	668
	Response	12.50%	0.00%	0.00%	87.50%