

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

## Note 9: GM CAP: Updating behavioural responses for LGVs



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<b>Version Status:</b>	APPROVED	<b>Prepared by:</b>	Transport for Greater Manchester on behalf of the 10 Local Authorities of Greater Manchester
<b>Authorised by:</b> <b>Date:</b>	Ian Palmer 1 <sup>st</sup> November 2019		

## **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.

This note contains early work on revised behavioural response estimates which is superseded by later work – see Note 37 and Report T4 for the latest assumptions.

## 1 Introduction

1.1 This Technical Note provides details of updates to the behavioural responses for LGVs applied within the Demand Sifting Tool (DST) for the Greater Manchester Clean Air Plan (GM-CAP) since the Outline Business Case (OBC) submission. Note that the DST was initially created to inform the early ‘sifting’ of options, and has subsequently been developed into a demand model tool to allow forecasting and appraisal.

1.2 The purpose of this note is to:

- Provide a summary on the behavioural responses applied at OBC stage;
- Discuss revised behavioural responses based on new available information;
- Explain recent updates to the DST capturing revised behavioural responses and resultant changes in compliance levels; and
- Report ongoing assessments to further refine LGV assumptions to take account of emerging information.

## 2 Background to OBC Behavioural Assumptions

2.1 The behavioural responses for LGVs that were applied within the OBC were based on Stated Preference (SP) surveys undertaken for Bristol, which were amended to reflect the application within Greater Manchester (GM). **Table 2-1** shows the behavioural responses applied within the DST at OBC.

**Table 2-1 OBC Behavioural Responses Greater Manchester LGV (2023)**

Modelled Response	LGV Response
Pay Charge	9.64%
Change Mode	7.54%
Cancel Trip	7.45%
Upgrade	75.37%

**Source:** Bristol Behavioural Responses adjusted to GM, includes freight fund adjustments. Note change mode impact at OBC reduces the overall matrices totals, though has not reallocated demand to other modes within the DST. This is being refined in the updates for FBC.

### 3 Updated Behavioural Responses (July 2019)

3.1 Since the completion of the OBC, a review of the behavioural responses was undertaken in May / June 2019 to take account of additional available information and to derive a method for identifying evidence-based behavioural response assumptions for LGVs. The review, including a consideration of the possible inclusion of behavioural responses from a recent Sheffield study, was discussed in the Technical Note – ‘GM-CAP: Behavioural Response Assumptions’, which was provided to JAQU on 20<sup>th</sup> May 2019. In addition, a cost response model for LGVs was also developed to better understand the GM fleet.

#### 3.2 Sheffield Responses

3.2.1 Details of the Sheffield based behavioural responses for LGVs are shown in **Table 3-1**. This shows the various charging levels considered by the Sheffield study.

**Table 3-1 Summary of Sheffield Behavioural Responses for LGV**

Scenario	Use same vehicle & pay the charge	Convert vehicle to run on LPG	Change to petrol-based vehicle	Change to Euro 6 diesel vehicle	Change to electric vehicle	Work/drive to different town/city
GM Equivalent Response	(Pay Charge)	Upgrade				(Cancel Trip)
LGV						
£5	51%	9%	1%	14%	5%	19%
£10	43%	5%	0%	17%	6%	29%
£10+Sub	38%	8%	0%	12%	18%	25%
£20	31%	4%	0%	16%	3%	45%

Source: Sheffield Behavioural Responses Survey Findings

3.2.2 The values above have been adjusted to reflect the proposed GM charge of £7.50 (at OBC) by interpolation.

3.2.3 It is noted that the responses above includes a change to upgrade to an electric vehicle in response to the CAZ. At the time of assessing, this response was captured within the regular upgrade response, though it should be noted that the upgrade to an electric vehicle would have a different impact on emissions than simply upgrading to a compliant vehicle.

3.2.4 The Sheffield study shows potential in further informing GM CAP than the use of the Bristol data for LGVs (which was used at OBC). The key reasons for this include:

- The analysis of trip frequency must be based on a sufficiently long period of data gathering in order to give a fair understanding of low-frequency trips. The Sheffield survey demonstrated distinct responses for trips with a frequency of less than once per month, requiring at least a month of data;
- There were concerns that the Bristol SP data did not actually target vans and that car based business trip results were used;
- The diversity of income within GM must be taken from a sufficiently large sample in order to capture distinct minorities. The use of Sheffield related responses are likely to be more relevant in this case than the Bristol survey; and
- The range of charges considered in the GM and Bristol CAP research was varied, whereas the Sheffield survey only assessed responses relating to £5, £10 and £20 charges for all vehicles. However, due to Bristol splitting their responses into income as opposed to vehicle type like Sheffield, their data was not as suitable for GMCAP.

### 3.3 LGV Cost Response Model

3.3.1 A cost response model to better understand the LGV responses to the GM-CAP was developed by assembling available data on the known LGV fleet and movements within GM.

3.3.2 This included a detailed review of the LGV fleet serving GM which was split into a series of 'commodity types' based on the types of vehicles used, including age of vehicles kept, and typical mileage travelled for that commodity type. This identified key commodity types which would be most highly impacted by the CAZ (such as the construction sector, which typically operates older LGVs which are more likely to be non-compliant).

3.3.3 Behavioural responses and costs for commodity types were amalgamated to derive a total LGV-weighted behavioural response for the GM LGV fleet. In addition to 'pay charge' and 'upgrade vehicle', the response model also identified a 'change mode' response which allows for the downgrade of vehicle to a compliant vehicle, e.g. the purchase of an estate car instead of an LGV in response to the CAZ which would have a different impact on air quality. An upsize response to HGV was also included too. At the time of the July update to the responses, the DST did not include the functionality to include this response.

3.3.4 Further details of the development of this cost response model is discussed within the accompanying note (Note 7) '*Freight Cost Model, October 2019*'.

### 3.4 Revised Responses

3.4.1 The revised behavioural responses identified from the Sheffield SP survey and new cost response model are shown in **Table 3-2**.

3.4.2 The Sheffield survey included a number of responses that equate to ‘cancel trip’; relating to LGVs operating outside the area (which is more likely in the Sheffield context of a relatively small CAZ area) and where drivers / operators could choose to work elsewhere from their home. Given the size of the GM CAZ boundary, the likelihood of operating in a different town is considered to be very small. This is because as most drivers will be a resident within the CAZ, they would therefore have to comply or pay to drive to an alternative destination anyway. If the Sheffield SP response was to be progressed for Full Business Case (FBC), further assessment of the cancel trip response would be recommended. Noting that the cost response model currently identifies a zero response to cancel trip.

**Table 3-2 Updated Behavioural Response**

Modelled Response	LGV Response (Sheffield SP)	LGV Response (GM cost model)
Pay Charge	47.4%	53.5%
Change Mode	0.0%	4.2%
Cancel Trip	23.8%	0.0%
Upgrade	28.8%	42.3%

Source: LGV Cost model.

**Note:** Change mode response currently being refined within the DST to reflect response to change mode to either a HGV or a car – therefore values are re-proportioned to prevent a loss of highway trips – this is being reviewed and updated for FBC

### 3.5 Impact on Compliance

3.5.1 The DST was run with the updated responses based on both the Sheffield SP and the new cost model responses to determine the impacts on compliance. The results are shown in **Table 3-3**. The inclusion of either the Sheffield responses directly (DS1) or the new cost response model (DS2) has a notable impact on the level of compliance identified. It is therefore important to note the following:

- The Sheffield SP responses indicate a sizable volume of cancel trip impacts resulting in an overall reduction in demand for LGVs. This is not the case for the cost response model which, in the context of the much larger GM CAZ area, identified no LGVs cancelling journeys, though the model does identify a proportion of demand changing mode (e.g. downgrading to a car) which would have a resultant impact on air quality; (This could result in more vehicles on the road, as small businesses could purchase a non-compliant diesel estate and avoid the charge);
- The overall level of non-compliant vehicles remains much higher in both the Sheffield SP and cost response model alternative responses, though still reflects a sizable reduction in non-compliant vehicles from the do minimum; and

- It should be noted that this would be considered worst case, as this test takes account of the impact of the CAZ Only, and does not consider the potential benefits offered by other proposals in the GM CAP affecting LGVs.

**Table 3-3 Impact on Compliance – 2023 Option 8**

<b>Scenario</b>	<b>Do Minimum</b>	<b>OBC (March 2019)</b>	<b>[DS1] (Sheffield SP)</b>	<b>[DS2] (Cost Model)</b>
<b>AM Peak</b>				
Compliant	36,294	48,985	41,273	43,670
Non-Compliant	17,876	2,705	8,953	10,499
<b>Total</b>	<b>54,170</b>	<b>51,690</b>	<b>50,226</b>	<b>54,169</b>
<b>Interpeak</b>				
Compliant	35,439	47,690	40,248	42,559
Non-Compliant	17,455	2,811	8,840	10,335
<b>Total</b>	<b>52,894</b>	<b>50,501</b>	<b>49,088</b>	<b>52,893</b>
<b>PM Peak</b>				
Compliant	30,757	41,353	34,916	36,915
Non-Compliant	15,149	2,483	7,699	8,990
<b>Total</b>	<b>45,906</b>	<b>43,836</b>	<b>42,615</b>	<b>45,906</b>

Source: DST – Trip volumes by compliance type

3.5.2 Following a review of both approaches to calculating behavioural responses, the cost response model has been recommended for inclusion due to the more robust understanding of the vehicle fleet and operations within Greater Manchester.

## 4 Further Refinement of Behavioural Responses

4.1 The preceding sections contain details on the recent updates to the treatment of LGVs within the DST which were included for the July 2019 evidence submission to JAQU. There are however, several additional enhancements to the treatment of LGVs within the overall modelling process which have been included. These relate specifically to an enhanced understanding of the vehicle fleet and the nature of LGV operations, plus further enhancement to the modelling tools. These updates are discussed further below.

### 4.2 Data Collection

4.2.1 Since the completion of the OBC, additional LGV data was gathered, which provides a more thorough understanding of the freight market. The information includes:

- An up-to-date ANPR survey, providing wider understanding of LGVs within the wider vehicle fleet;
- Specialised Goods Survey, reviewing the types of freight vehicles and commodities operating at key sites within Greater Manchester; and
- A survey of businesses operating LGVs within Greater Manchester is underway to better understand how LGV drivers would respond to the introduction of a CAZ C, and how LGV owners may respond to potential upgrades on offer as part of GM-CAP. This survey is currently in progress and the results are not yet available to enable further refinements to the modelling tools at this time.

4.2.2 Furthermore, a public conversation was undertaken. The conversation closed on the 30th June and analysis of the results has been completed. These results were used, where appropriate, to inform our understanding of possible behavioural responses.

4.2.3 A separate independent survey was undertaken by the Federation of Small Businesses to investigate the response of their members to the CAP proposals. The outputs of this have been reviewed by TfGM and was used to add to the evidence base.

### 4.3 Enhancements to the DST

4.3.1 To support the ongoing development of the modelling tools, a number of assumptions and functionality within the DST have been reviewed and updated. In particular, an area that was reviewed was how the 'change mode' response could be built in and capture how LGV change mode responses might include LGV owners switching to car (e.g. a compliant estate car).



## 5 Updated Behavioural Responses (October 2019)

### 5.1 Revised Responses

5.1.1 Since the development of the behavioural responses results provided in July 2019, the models have been refined in order to provide a greater understanding of the possible responses. This section provides updates to the outputs following these refinements.

5.1.2 The refinements to the responses allow for the impacts of the:

- CAZ Only Impacts; and
- CAZ, plus financial assistance via funds which could be made available to certain categories of LGV owner.

5.1.3 A further refinement for LGVs is a higher CAZ charge, increasing from £7.50 (at OBC) to £10. It is also noted that LGVs are still assumed to be exempt until 2023 in this refinement.

5.1.4

5.1.5 **Table 5-1** below shows the updated behavioural responses for the CAZ Only result.

**Table 5-1 CAZ Only (£10): Refined Behavioural Responses**

Modelled Response	2021	2023	2025
Pay Charge	Not Applicable	30.1%	26.8%
Change Mode	Not Applicable	4.6%	0.0%
Cancel Trip	Not Applicable	0.0%	0.0%
Upgrade	Not Applicable	65.3%	73.2%

*Source: Cost Response Model*

5.1.6 For CAZ plus funds, the funding available for LGV upgrades is as follows:

- £3,500 Fund level for all eligible LGVs and requires vehicle scrappage to access the funds.

5.1.7 **Table 5-2** below provides the findings from the CAZ plus funds model run.

**Table 5-2 CAZ plus funds: Refined Behavioural Responses**

Modelled Response	2021	2023	2025
Pay Charge	Not Applicable	12.2%	13.6%

Change Mode	Not Applicable	3.4%	0.0%
Cancel Trip	Not Applicable	0.0%	0.0%
Upgrade	Not Applicable	84.5%	86.4%

Source: Operating Cost Model

## 5.2 Summary of other Modelling Refinements

5.2.1 Following the July submission of Note 9 to JAQU, plus the additional refinements of the behavioural responses, several further refinements to the modelling tools have been undertaken. This has been to reflect the latest modelling assumptions and the enhanced capabilities of the modelling tools. These updates are discussed in the note '*Updates to the Do Minimum*' which accompanies this submission.

## 5.3 Impact on Compliance

5.3.1 The DST was run with the refined behavioural responses to discover the impact on the quantity of complaint vehicles. The results for the various models are shown in, **Table Table 5-3** and **Table**

5.3.2 **Table 5-34**. The revised LGV response including the CAZ plus funds does show an increase in compliant vehicles when compared to the CAZ only. It is therefore important to note the following:

- 2021 impacts are excluded as the LGV charges are not introduced until 2023;
- Overall, there is a small reduction in the number of LGVs from the do minimum (2023 only). This is due to the change mode functionality; and
- The funds have a notable impact on compliance, further reducing the number of non-compliant vehicles.

**Table 5-3 Impact on Compliance (£10 charge) - 2023**

<b>Scenario</b>	<b>Do Minimum</b>	<b>CAZ Only</b>	<b>CAZ plus funds</b>
<b>AM Peak</b>			
Compliant	35,089	45,248	48,235
Non-Compliant	16,589	5,714	2,929
<b>Total</b>	<b>51,678</b>	<b>50,962</b>	<b>51,164</b>
<b>Interpeak</b>			
Compliant	34,263	44,068	46,951
Non-Compliant	16,198	5,701	3,013
<b>Total</b>	<b>50,460</b>	<b>49,770</b>	<b>49,965</b>
<b>PM Peak</b>			
Compliant	29,736	38,223	40,718
Non-Compliant	14,058	4,974	2,647
<b>Total</b>	<b>43,794</b>	<b>43,196</b>	<b>43,365</b>

Source: DST – Trip volumes by compliance type

**Table 5-3 Impact on Compliance - 2025**

<b>Scenario</b>	<b>Do Minimum</b>	<b>CAZ Only</b>	<b>CAZ plus funds</b>
<b>AM Peak</b>			
Compliant	42,664	50,465	51,872
Non-Compliant	11,409	3,608	2,201
<b>Total</b>	<b>54,073</b>	<b>54,073</b>	<b>54,073</b>
<b>Interpeak</b>			
Compliant	41,649	49,186	50,545
Non-Compliant	11,138	3,601	2,242
<b>Total</b>	<b>52,787</b>	<b>52,787</b>	<b>52,787</b>
<b>PM Peak</b>			
Compliant	36,147	42,661	43,835
Non-Compliant	9,667	3,153	1,978
<b>Total</b>	<b>45,813</b>	<b>45,813</b>	<b>45,813</b>

## 6 Conclusion

6.1 The inclusion of updated responses, based on the recently developed and refined cost response model for freight (HGV and LGV) have been applied to the DST for the latest October 2019 package modelling runs. The key changes included:

- Previous behavioural responses have been updated to reflect new data from the developed cost response model;
- The response included a 'change mode' response of 3.4% in 2023 (i.e. change to a car or HGV). The DST was recently updated to include this functionality, and as a result of this response a small change to the car and HGV matrices were considered;
- Latest position with regard to vehicle charges have been represented within the responses, including a change in LGV charge to £10. Behavioural responses also vary by forecast year;
- The review of the LGV fleet mix to include the use of new data, will provide a more detailed representation of LGVs operating within GM; and
- The cost response model has been updated to provide a more robust method for capturing the impacts of the funds.

6.2 The updated runs (October 2019) of the DST have shown a similar, though slightly higher volume of non-compliant values to the OBC version, when including the impacts of the funds (2023).

6.3 There are some further minor refinements proposed for FBC which could potentially improve the number of compliant LGVs. Due to the availability of data, these have not yet been fully incorporated into the modelling process. These include:

- Evidence from the survey of businesses operating LGVs within Greater Manchester will provide a better understand how LGV drivers would respond to the introduction of a CAZ C, and how LGV owners may respond to potential upgrades on offer as part of GM-CAP. This will enable some refinements of data used to inform / confirm the estimation of behavioural responses.
- The design of Loan Finance measures is currently being reviewed and updated. New tools are being developed to assess the impacts of these measures, with the intention that these outputs can be fed into the final Package Modelling process for FBC; and
- The upgrade response to an electric vehicle is currently merged within the wider response to upgrade to a compliant vehicle. As upgrade to an electric vehicle will have a much greater impact on air quality than simply upgrading to a compliant vehicle, this will be an aspect of further investigation to support the FBC submission and the results will be captured in the EMIGMA model, post highway assignment model.

6.4 Evidence from the conversation and other research will be used to inform the development of sensitivity tests to better understand the uncertainty around the assumed responses.