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

Evidence Submission for a new GM Clean Air Plan

T3 Appendix A: Technical Note 43 - Demand Response Modelling of Impacts of Recent and Planned Changes to the Regional Centre

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Version Status:	APPROVED	**Prepared by:**	Transport for Greater Manchester on behalf of the 10 Local Authorities of Greater Manchester
Date:	October 2024		

Contents

1 Purpose of this Report

1.1.1 As part of a wider initiative to reduce car use to, and within, the Regional Centre, a series of transport infrastructure interventions are planned. This wider initiative is known as the City Centre Transport Strategy (CCTS), as part of the GM Transport Strategy 2040.

1.1.2 The network impacts of these infrastructure interventions, such as rerouting, are reflected within the current GM CAP modelling. This note details the modelling approach to assess, through sensitivity testing, the potential demand response to these measures. This note also provides a summary of the outputs of the demand modelling tests.

1.1.3 This document is part of a suite of documents that have been produced to describe the transport and air quality modelling deliverables for the study. The documents in the series include:

- Local Plan Transport Modelling Tracking Table (T1), which demonstrates that the transport modelling requirements for the study are being met;
- Local Plan Transport Model Validation Report (T2), which explains in detail how the road traffic model was validated against real-world data;
- Local Plan Transport Modelling Methodology Report (T3), this document details the development of the future year without scheme model (Do Minimum);
- Local Plan Transport Model Forecasting Report (T4), which presents baseline and scenario forecasts for GM CAP;
- Local Plan Air Quality Modelling Tracking Table (AQ1), which demonstrates that the air quality modelling requirements for the study are being met;
- Local Plan Air Quality Modelling Methodology Report (AQ2), which provides an overview of the air quality modelling process;
- Local Plan Air Quality Modelling Report (AQ3), which provides details of modelled NOx and NO2 concentrations for the base and forecast years, including comparisons with measured concentrations for the base year;
- Sensitivity Testing Report, which provides a summary of the sensitivity tests carried out on the core scenarios to test areas of uncertainty, understand whether the tests result in a positive or negative benefit and the scale of benefit; and
- Analytical Assurance Statement, consider the limitations, uncertainties and risks in the evidence base, and the implications of these for decision makers.

2 Greater Manchester Clean Air Plan Overview

2.1 Background to the Clean Air Plan

2.1.1 In 2017 the Secretary of State (SoS) for Environment, Food and Rural Affairs issued directions under the Environment Act 1995 requiring many local authorities, to produce feasibility studies to identify the option which will deliver compliance with the requirement to meet legal limits for nitrogen dioxide (NO_2) in the shortest possible time. The legal limit being defined as the long-term annual mean legal limit of 40 µg/m^3.

2.1.2 In Greater Manchester (GM), the ten 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).

2.1.3 The development of the GM CAP is funded by government and is overseen by the Joint Air Quality Unit (JAQU), the joint Department for Environment, Food and Rural Affairs (DEFRA) and Department for Transport (DfT) unit established to deliver national plans to improve air quality and meet legal limits. The costs related to the business case, implementation and operation of the GM CAP are either directly funded or underwritten by government acting through JAQU and any net deficit over the life of the GM CAP will be covered by the New Burdens Doctrine, subject to a reasonableness test[1].

2.1.4 In March 2019, the ten GM Local Authorities collectively submitted an Outline Business Case (OBC)[2] for the GM CAP to JAQU outlining a package of measures to deliver regional compliance with legal limits for NO_2 emissions in the shortest possible time.

2.1.5 In July 2019, the Environment Act 1995 (Greater Manchester) Air Quality Direction 2019 was made, which required all ten of the GM local authorities to implement a charging Clean Air Zone Class C[3] with additional measures. There was also an obligation to provide further scenarios appraisal information to demonstrate the applicable Class of Charging CAZ and other matters to provide assurance that the local plan would deliver compliance in the shortest possible time and by 2024 at the latest.

2.1.6 In March 2020, the Environment Act 1995 (Greater Manchester) Air Quality Direction 2020 was made, which required the submission of an Interim FBC (along with confirmation that all public consultation activity has completed) as soon as possible and by no later than 30 October 2020. The 2020 direction confirmed that legal duty remains to ensure the GM CAP (Charging Clean Air Zone Class C with additional measures) is implemented so that NO_2 compliance is achieved in the shortest possible time and by 2024 at the latest and that human exposure is reduced as quickly as possible.The Ministerial letter accompanying the March 2020 direction confirmed that the minister was satisfied that the main evidence queries from the July 2019 direction had been addressed.

[1] The new burdens doctrine is part of a suite of measures to ensure Council Tax payers do not face excessive increases. New burdens doctrine: guidance for government departments - GOV.UK (www.gov.uk)
[2] https://cleanairgm.com/technical-documents/#outline-business-case
[3] https://www.gov.uk/government/publications/air-quality-clean-air-zone-framework-for-england/annex-a-clean-air-zone-minimum-classes-and-standards

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

2.1.8 The GMCA - Clean Air Final Plan report[4] on 25th June 2021[5] endorsed GM's Final CAP and policy in compliance with this direction, 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, the JAQU reviewed and approved all technical and delivery submissions. Within this document, this is referred to as the Previous GM CAP.

2.2 The Previous GM CAP and the impacts of Covid-19

2.2.1 Under the Previous GM CAP, GM was awarded £123 million by government for funds aimed at encouraging vehicle upgrades to secure compliance and mitigating the impacts of the GM-wide CAZ. The funds included £15.4 million for bus retrofit, £3.2 million for bus replacement, £10.2 million for Private Hire Vehicles (PHVs), £10.1 million for Hackney Carriages, £7.6 million for Heavy Goods Vehicles (HGVs), £4.4 million for coaches, £2.0 million for minibuses and £70.0 million for Light Goods Vehicles (LGVs).

2.2.2 The June 2021 Clean Air Final Plan report set out that the Air Quality Administration Committee (AQAC) had the authority to establish and distribute the funds set out in the agreed GM Clean Air Plan policy. On 21 September 2021 the AQAC approved the establishment and distribution of the agreed bus replacement funds.

2.2.3 On 13 October 2021 the AQAC agreed the distribution of Clean Air funds set out in the agreed GM Clean Air Plan policy as follows:

- From 30 November 2021 applications for funding would open for HGVs.
- From the end of January 2022 applications for funding would open for PHVs, Hackney Carriages, coaches, minibuses and LGVs.

2.2.4 On 20th January 2022, the AQAC considered the findings of an initial review of conditions within the supply chain of LGVs in particular following Covid-19 related impacts, which were impacting the availability of compliant vehicles and supply-side constraints resulting in price increases, particularly in the second-hand market[6]. The AQAC agreed that a request should be made to the SoS to pause the opening of the next phase of Clean Air Funds. This was to allow an urgent and fundamental joint policy review with government, to identify how a revised policy could be agreed to deal with the supply issues and local businesses' ability to comply with the GM CAP.

[4] https://democracy.greatermanchester-ca.gov.uk/documents/s15281/GMCA%20210621%20Report%20Clean%20Air%20Plan%20-%20FINAL%20FINAL.pdf
[5] Also considered by the GM authorities through their own constitutional decision-making arrangements.
[6] https://democracy.greatermanchester-ca.gov.uk/documents/s18685/ARUP%20Technical%20Note.pdf

2.2.5 On 8th February 2022, the AQAC noted the submission of a report "Issues Leading to Delayed Compliance Based on the Approved GM CAP Assumptions". The report concluded that on balance, the latest emerging evidence suggested that with the approved plan in place, it was no longer likely that compliance would be achieved in 2024. Members also requested that arrangements were put in place for those vehicles owners who had already placed orders pending funding opening at the end of January to ensure they are not detrimentally impacted by the decision to pause the opening of the funds. Government subsequently issued The Environment Act 1995 (Greater Manchester) Air Quality Direction 2022[7] which confirmed that the March 2020 Direction had been revoked and required that by 1st July 2022 the GM authorities 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.

2.2.6 This Direction ('the Direction') also stated that the local plan for NO_2 compliance, with any proposed changes, must ensure the achievement of NO_2 compliance in the shortest possible time and by 2026 at the latest. It should also ensure that human exposure to concentrations of NO_2 above the legal limit is reduced as quickly as possible.

2.3 The Case for a new GM CAP

2.3.1 On 1st July 2022, the AQAC noted that the 'Case for a new Greater Manchester Clean Air Plan[8] document and associated appendices would be submitted to the SoS as a draft document subject to any comments of GM Authorities.

2.3.2 On 17th August 2022, the AQAC agreed to submit the 'Case for a new Greater Manchester Clean Air Plan' to the SoS as a final version and approved the Case for a New Plan - Air Quality Modelling Report for submission to JAQU.

2.3.3 The 'Case for a new Greater Manchester Clean Air Plan' set out that challenging economic conditions, rising vehicle prices and ongoing pandemic impacts meant that the original plan of a GM-wide charging CAZ was no longer the right solution to achieve compliance, instead proposing an investment-led, non-charging GM CAP.

2.3.4 The primary focus of the 'Case for a new Greater Manchester Clean Air Plan' was to identify a plan to achieve compliance with the legal limit value for NO_2 in a way that considered the cost-of-living crisis and associated economic challenges faced by businesses and residents. This would be achieved through an investment-led approach combined with wider measures that the GM Authorities are implementing and aimed to reduce NO_2 emissions to within legal limits, in the shortest possible time and at the latest by 2026.

[7] The Environment Act 1995 (Greater Manchester) Air Quality Direction 2022 (publishing.service.gov.uk)
[8] https://assets.ctfassets.net/tlpgbvy1k6h2/7jtkDc5AODypDQlw0cYwsl/67091a85f26e7c503a19ec7aeb2e8137/Appendix_1_-_Case_for_a_new_Greater_Manchester_Clean_Air_Plan.pdf

2.3.5 The 'Case for a new Greater Manchester Clean Air Plan' proposed using the remaining funding that the government has awarded to GM for the Previous GM CAP to deliver an investment-led approach to invest in vehicle upgrades, rather than imposing daily charges, and deliver new Zero Emission Buses (ZEBs) as part of the Bee Network[9] (a London-style integrated transport network for GM). The new plan would ensure that the reduction of harmful emissions would be at the centre of GM's wider objectives. Within this document, this plan is referred to as the 'Investment-led Plan'.

2.3.6 The GM Authorities committed to a participatory approach to the development of the new plan to ensure that the GM Authorities' proposals would be well-grounded in evidence in terms of the circumstances of affected groups and possible impacts of the new plan on them, and therefore the deliverability and effectiveness of that plan.

2.3.7 Between August and November 2022, the GM Authorities carried out engagement and research with key stakeholders - vehicle-owning groups and representatives of other impacted individuals, such as community, business, environment and equality-based groups. This activity included targeted engagement sessions with all groups, and an online survey and supporting qualitative research activity with vehicle-owning groups.

2.3.8 Input from those engaged informed the ongoing policy development process as the GM Authorities developed the package of measures forming the Investment-led Plan.

2.4 The Investment-led Plan and the impact of bus retrofit issues

2.4.1 Having submitted the 'Case for a new Greater Manchester Clean Air Plan'[10] in July 2022, the GM Authorities were asked by government in January[11] 2023 to:

- *Provide modelling results for a benchmark CAZ to address the persistent exceedances identified in central Manchester and Salford, in order for these to be compared against your proposals.*
- *Identify a suitable approach to address persistent exceedances identified in your data on the A58 Bolton Road in Bury in 2025, and to propose a suitable benchmark.*
- *Set out how the measures you have proposed will be modelled and evidenced overall, and to ensure that they are modelled without any unnecessary delay.*

[9] The Bee Network is Greater Manchester integrated transport system joining together bus, Metrolink, rail and active travel https://tfgm.com/corporate/business-plan/case-studies/bee-network

[10] https://assets.ctfassets.net/tlpgbvy1k6h2/7jtkDc5AODypDQIw0cYwsl/67091a85f26e7c503a19ec7aeb2e8137/Appendix_1_-_Case_for_a_new_Greater_Manchester_Clean_Air_Plan.pdf

[11] https://democracy.greatermanchester-ca.gov.uk/documents/s24937/Appendix%201.%20Ministerial%20Letter%20to%20GM%20with%20attachment.pdf

2.4.2 The GM Authorities undertook the work required to supply this further evidence and on 8th March 2023 submitted the report 'Approach to Address Persistent Exceedances Identified on the A58 Bolton Road, Bury'[12]. GM Authorities also worked to address the remaining two requests from government by June 2023 on the basis of providing further information to support its Investment-led Plan and testing the proposal against a suitable benchmark CAZ, herein referred to as the 'CAZ Benchmark'.

2.4.3 In April 2023, government advised TfGM that it was to pause any new spending on bus retrofit as it had evidence that retrofitted buses have poor and highly variable performance in real-world conditions[13]. This new evidence followed a JAQU-funded study to quantify nitrogen oxide (NO_X) and NO_2 emissions from buses under real-world driving conditions in three cities across the UK, including Manchester (monitoring took place in Manchester City Centre between 21st November and 12th December 2022). The monitoring indicated that retrofitted buses were not reducing emissions as expected, with significant variation in performance between bus models with retrofit technologies. Furthermore, emissions of primary-NO_2 (as opposed to NO_X) were highly variable, potentially worsening roadside NO_2 concentrations despite an overall reduction in NO_X emissions.

2.4.4 Government therefore commenced a six-month focused research programme to quickly investigate the causes of this poor performance and scope how it could be improved, which was anticipated to be reported in Autumn 2023.

2.4.5 In the light of government's new evidence, JAQU issued revised general guidance[14] to authorities producing CAPs nationwide. In summary, this required that air quality modelling should no longer assume any air quality benefits from a retrofitted bus.

2.4.6 GM incorporated the revised guidance, as agreed with JAQU, into the modelling which underpins the development of its CAP to produce a report that appraises the ability of the Investment-led Plan and the CAZ Benchmark to deliver compliance with the legal limit value in the shortest possible time and by no later than 2026. The key findings from government's six-month focused research programme were not available at the time this work was undertaken.

2.4.7 The first version of the *Appraisal Report* and supporting documentation was submitted to government in December 2023. The *Appraisal Report* concluded that GM's Investment-led Plan can deliver compliance in 2025 and performs better than a CAZ Benchmark.

2.5 Key developments since December 2023 submission

2.5.1 Since the submission of evidence to JAQU in December 2023 there have been a number of key developments, resulting in a need to update the modelling, the *Appraisal Report* and supporting documentation.

[12] https://democracy.greatermanchester-ca.gov.uk/documents/s24939/Appendix%203.%20GM%20CAP%20A58%20Bury%20Measure%20Report%20DRAFT%20for%20AQAC%20Approval%20Feb%2023.pdf

[13] https://democracy.greatermanchester-ca.gov.uk/documents/s27699/Appendix%201.%20Letter%20from%20DfT%20to%20Greater%20Manchester%20regarding%20Bus%20Retrofit%20Update.pdf

[14] Bus Retrofit Update - Technical Guidance for Local Authorities, JAQU Guidance, May 2023

2.5.2 Further modelling was undertaken in Summer 2024 to consider and address the following key developments:

- Delay to Stockport all-electric bus depot;
- Changes to bus fleets (operational and planned); and
- Correction to Euro V retrofit bus modelling emission values.

2.5.3 Drafts of the *Appraisal Report* and supporting documentation were updated to take account of the key developments and the Summer 2024 modelling, in preparation for submission to government. These updates did not change GM's conclusion that the Investment-led, non-charging plan can deliver compliance in 2025 and performs better than a CAZ Benchmark.

2.6 Developments following Summer 2024 modelling

2.6.1 Following the substantial drafting to update the *Appraisal Report* and supporting material (to address the key developments since the December 2023 submission), two additional issues have arisen.

2.6.2 Firstly, a risk identified in the December 2023 submission "Delays to bus depot electrification" has materialised and there is now a delivery delay to the electrification of Queens Road depot. This was due to take place by January 2025, which was the assumed delivery date in the modelling of the Investment-led Plan.

2.6.3 This poses a significant challenge to achieving compliance in 2025, as 73 ZEBs are to be operated out of Queens Road depot. The issue affects 12 bus services, which run through 17 forecast 'Do Minimum' exceedance sites in 2025.

2.6.4 Secondly, in July 2024 National Highways also advised TfGM that the temporary speed limit on the M602 is to be removed, and the 70mph speed limit reinstated. The M602 temporary speed limit is assumed to be in place in the Investment-led Plan modelling assumptions.

2.6.5 The implications of these two issues are addressed in the *Supplementary Appraisal Report*, included as part of this evidence submission documentation. Therefore, the *Appraisal Report* and associated documentation, including this report, should be read in conjunction with the *Supplementary Appraisal Report*.

2.6.6 In addition, since the drafting of the *Appraisal Report* and supporting material, government published the 'Bus Retrofit Performance Report'[15] on the 12th September 2024. The key findings of this report include that the retrofit technology fitted onto retrofitted buses is not reducing NO_X emissions to the levels expected and retrofit performance is highly variable. These findings are consistent with the guidance issued in May 2023. Therefore, the publication of the study findings has no impact on the Investment-led Plan, the *Appraisal Report* and supporting material.

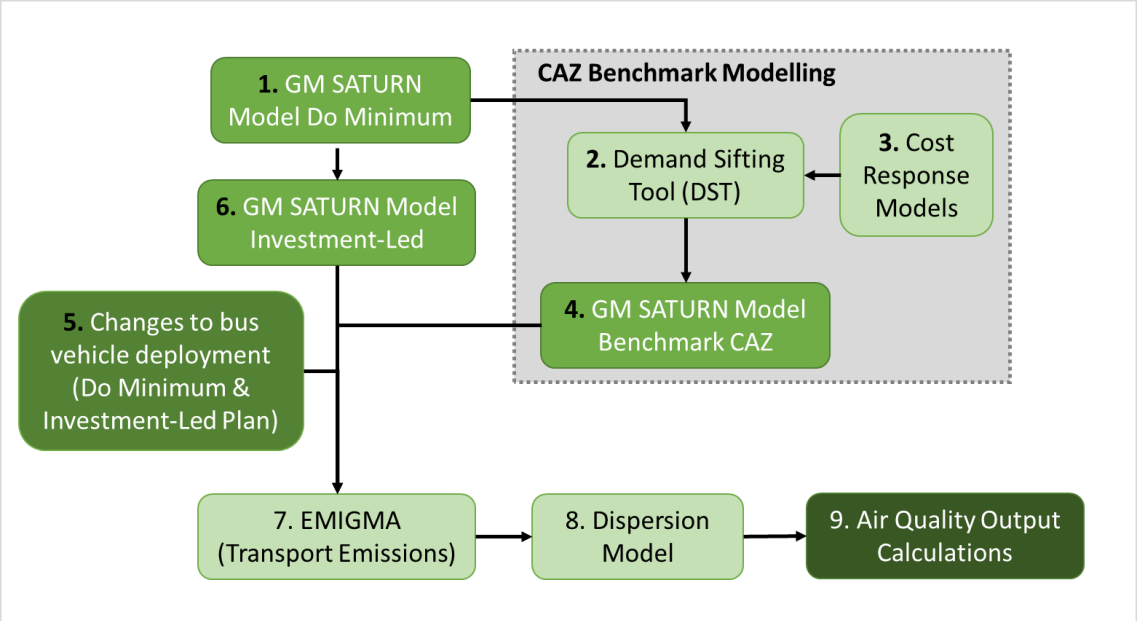
[15] https://assets.publishing.service.gov.uk/media/66e1ab11951c1776394a003c/bus-retrofit-performance-24.pdf

3 GM CAP Modelling Approach

3.1 GM CAP Model

3.1.1 The study is being undertaken using the GM CAP modelling suite, illustrated in **Figure 3-1**.

Figure 3-1: GM CAP Modelling Suite



3.1.2 The modelling system consists of the following components:

- **The Greater Manchester highway SATURN model (GMSM)**, which uses information about the road network and travel demand for different years and growth scenarios to estimate traffic flows and speeds for input to the emissions model. The SATURN model also outputs forecast for travel times, distances, and flows for input to the economic appraisal.
- **Cost Response models**, which are models developed to better understand commercial vehicle, taxi, and coach/minibus behavioural changes to the GM CAP. These have been developed by assembling available data on the known fleets and movements within GM (and have been primarily used to assess the impacts of GM CAP in the context of a CAZ Benchmark).
- **The demand sifting tool (DST),** 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 DST has primarily been used to assess the impacts of GM CAP in the context of a CAZ Benchmark).

- **The emissions model**, which uses TfGM's EMIGMA (Emissions Inventory for GM) software to combine information about traffic speeds and flows (from SATURN) with road traffic emission factors and fleet composition data from the Emission Factor Toolkit (EFT), providing 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 on mass emissions of pollution (from EMIGMA) with dispersion parameters such as meteorological data and topography to produce pollutant concentrations.
- **The outputs** of the dispersion model are processed to convert them to the verified air quality concentrations, using DEFRA tools and national background maps.

3.1.3 The GM SATURN regional traffic model covers all of GM, the extent of which is shown in **Figure 3-2** with the regional centre coverage illustrated in **Figure 3-3**.

Figure 3-2: GM SATURN Traffic Model – GM Wide

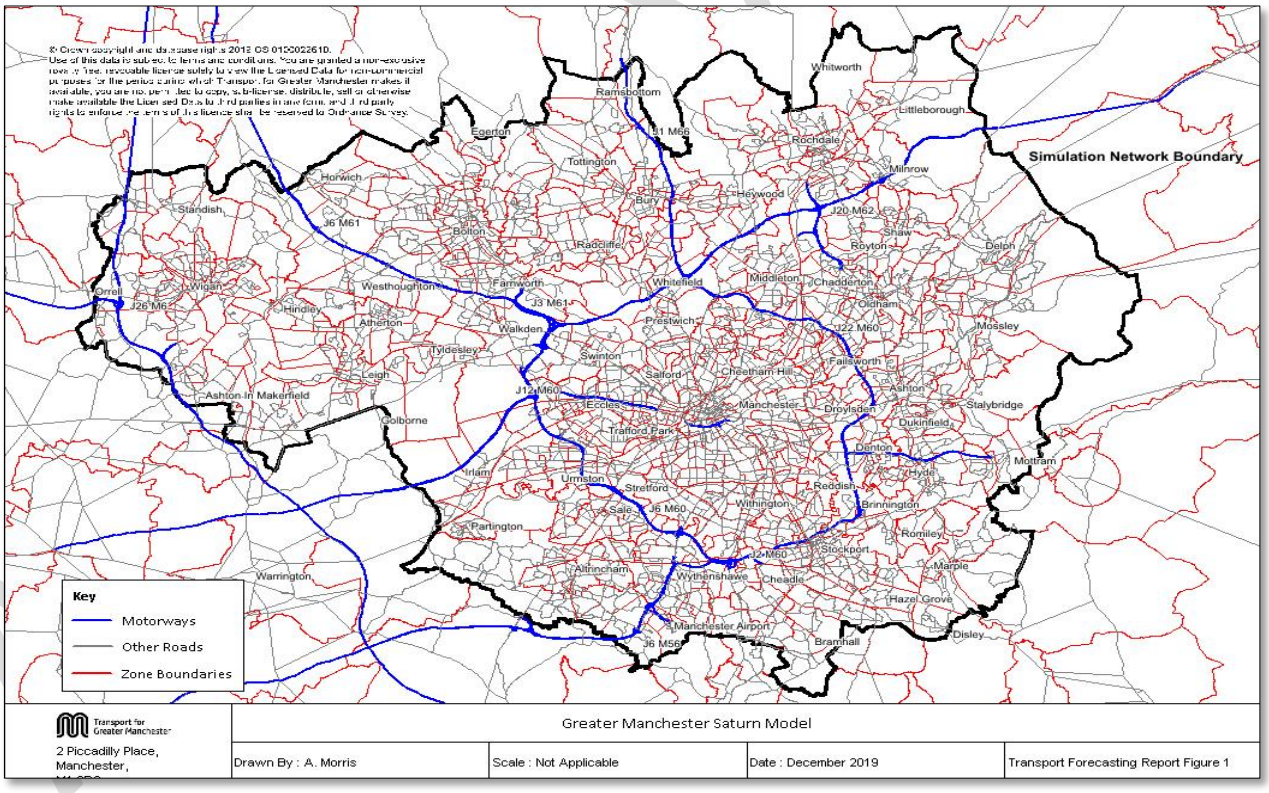
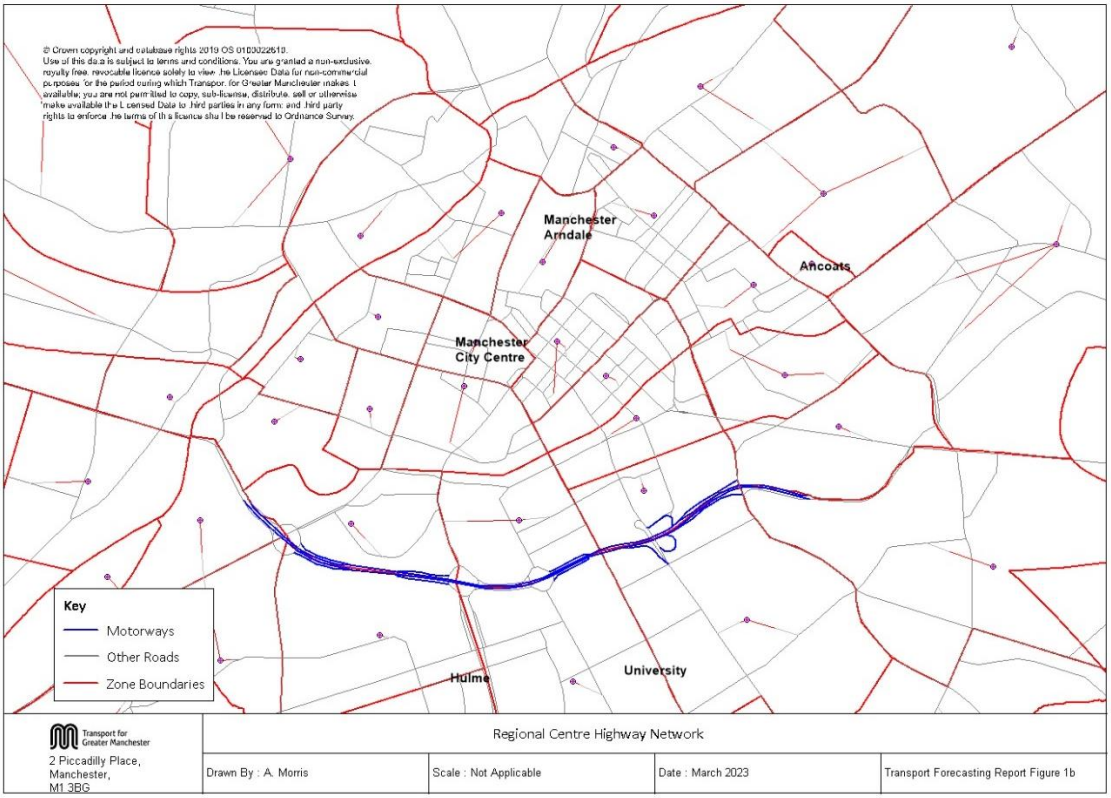


Figure 3-3: GM SATURN Traffic Model – Regional Centre



3.1.4 The model reflects morning (AM Peak 08:00 to 09:00), evening (PM Peak 17:00 to 18:00) and average inter peak (10:00 to 16:00 average hour) periods. Forecast year travel demand is derived from the higher tier GM variable demand model (GMVDM), which reflects land use and transport infrastructure cost changes (all modes) over time. This feeds into the GM SATURN model.

3.1.5 Growth within the GM SATURN model is adjusted to ensure consistency with the National Trip End Model (NTEM) at local authority district level. The NTEM is published by the Department for Transport (DfT), it forecasts growth in productions – attractions nationally up to 2051 for use in transport modelling.

3.1.6 Forecast assignments within GM SATURN reflect changes to relevant infrastructure and bus routes / frequencies. These also include delays in the natural turnover of the fleet in response to COVID-19, which impacts on the compliant/non-compliant levels for specific modes. Further details on the forecasting approach are set out in the *Local Plan Transport Modelling Methodology Report (T3)*.

3.2 Modelling impacts within GM CAP

3.2.1 The GM CAP traffic forecasts reflect:

- **Changes in fleet composition** (proportion of vehicle types) over time, although the differences between 'with' and 'without' GM CAP scenarios are not significant[16].
- **Changes in fleet age over time**, these vary between 'with' and 'without' GM CAP scenarios, according to the behavioural responses to costs or incentives around vehicle upgrade.

3.2.2 The quantum and distribution of traffic demand is maintained as constant across both 'with' and 'without' GM CAP scenarios. The traffic demand accounts for changes to the nature of the vehicle fleet, infrastructure impacts on flows and speeds and, therefore, air quality impacts.

[16] *When a charging CAZ was being assessed, some limited variation due to changes in goods vehicle behaviours (e.g. switching from multiple small vehicles to a single larger vehicle) was reflected in the approach.*

4 City Centre Transport Strategy (CCTS) Background

4.1 CCTS

4.1.0 The CCTS was published in March 2021, following consultation in 2020, and builds on the previous strategy adopted in 2010. The target is for GM to be net-zero carbon by 2038, with a need for urgent action over the next five years.

4.1.1 The vision for the CCTS includes a central aim of 90% of all morning peak trips to the Regional Centre to be made on foot, by cycle or using public transport before 2040, with walking to become the predominant mode of travel within the Regional Centre.

4.1.2 The aim is for public transport trips into the Regional Centre to increase by around 50% (Metrolink), over 50% (bus) and around 90% (rail) by 2040. The aim is to increase walking and cycling by around 70%. This will achieve a car mode share of 10% in 2040 (compared to 21% in 2019).

4.1.3 As part of the vision, there is a planned reduction in off-street car parking in the Regional Centre through the redevelopment of car parking sites. It is estimated that 12,500 spaces will be removed from the parking supply, which will free up space for other uses.

4.1.4 The CCTS has many components which have reached differing levels of maturity in terms of development and implementation. A significant number of infrastructure elements are aimed at reducing the capacity and therefore appeal of the Regional Centre for vehicular travel have already been implemented, some are currently under construction or confirmed to open soon.

4.2 Committed interventions

4.2.1 Manchester City Council (MCC), Salford City Council (SCC) and TfGM have identified the transport interventions for the Regional Centre, which will be delivered by the start of 2025 and contribute to achieving the CCTS vision. These projects have significant funding allocated and the case for change has already been made.

4.2.2 The transport interventions in the Regional Centre include:

- Bus fleet & Metrolink investment;
- Central Manchester rail network enhancements & Salford Central station upgrade;
- Infrastructure improvements, such as redevelopment of Albert Square & New Bailey St / Bridge St;
- New and enhanced city centre cycling routes as part of the Bee Network;
- Bus priority corridors;
- E-scooter pilots; and
- Integrated public transport ticketing.

4.2.3 Following the principles set out in the DfT's Transport Analysis Guidance (TAG) Unit M4 (Forecasting and Uncertainty), the transport interventions for the Regional Centre which are classified as near certain, and therefore included in our core scenario, are summarised in **Figure 4-1** and **Figure 4-2**. A full list is provided in **Annex A**.

Figure 4-1: Completed and Built schemes included in the Core Scenario for 2025

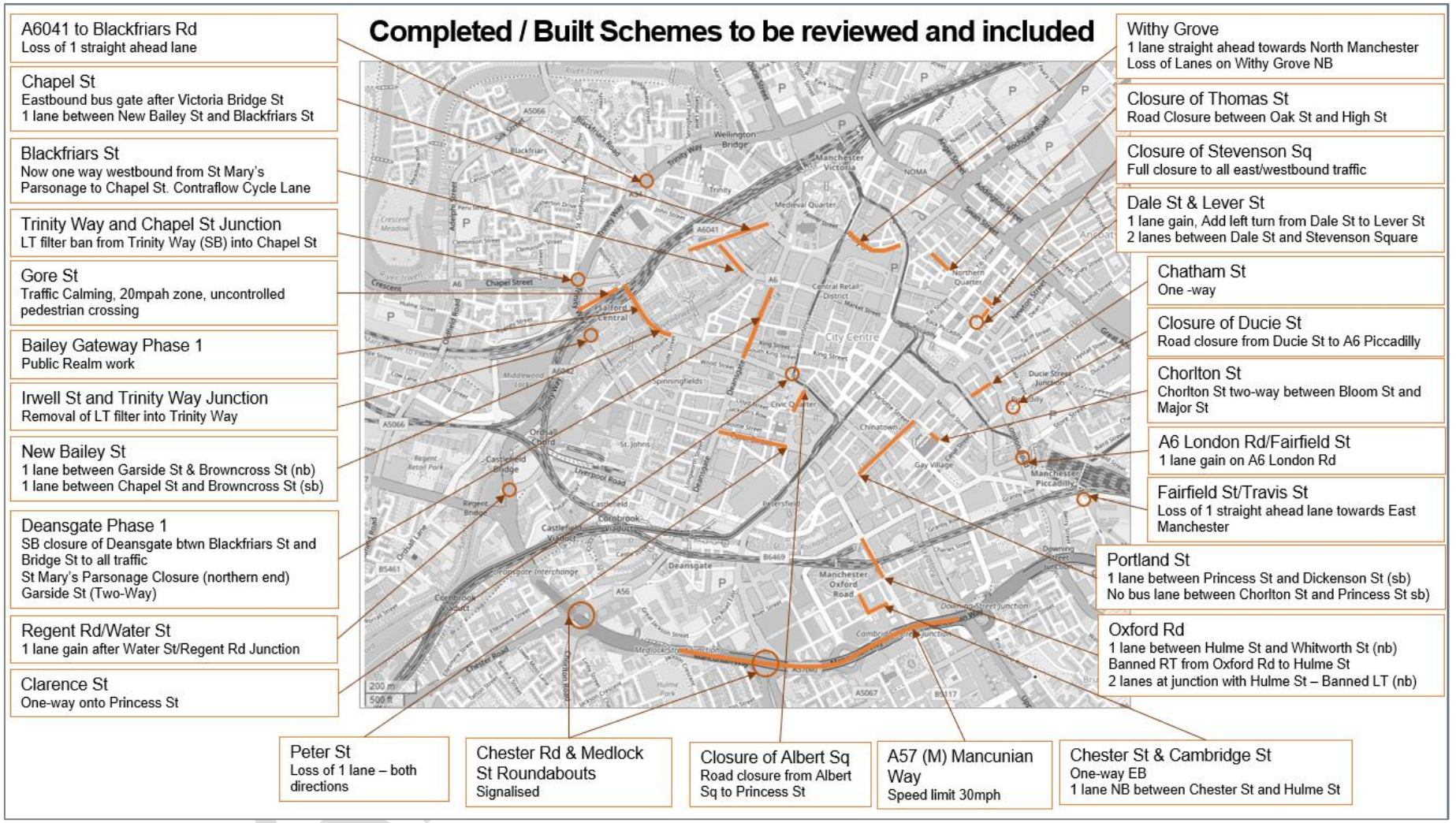
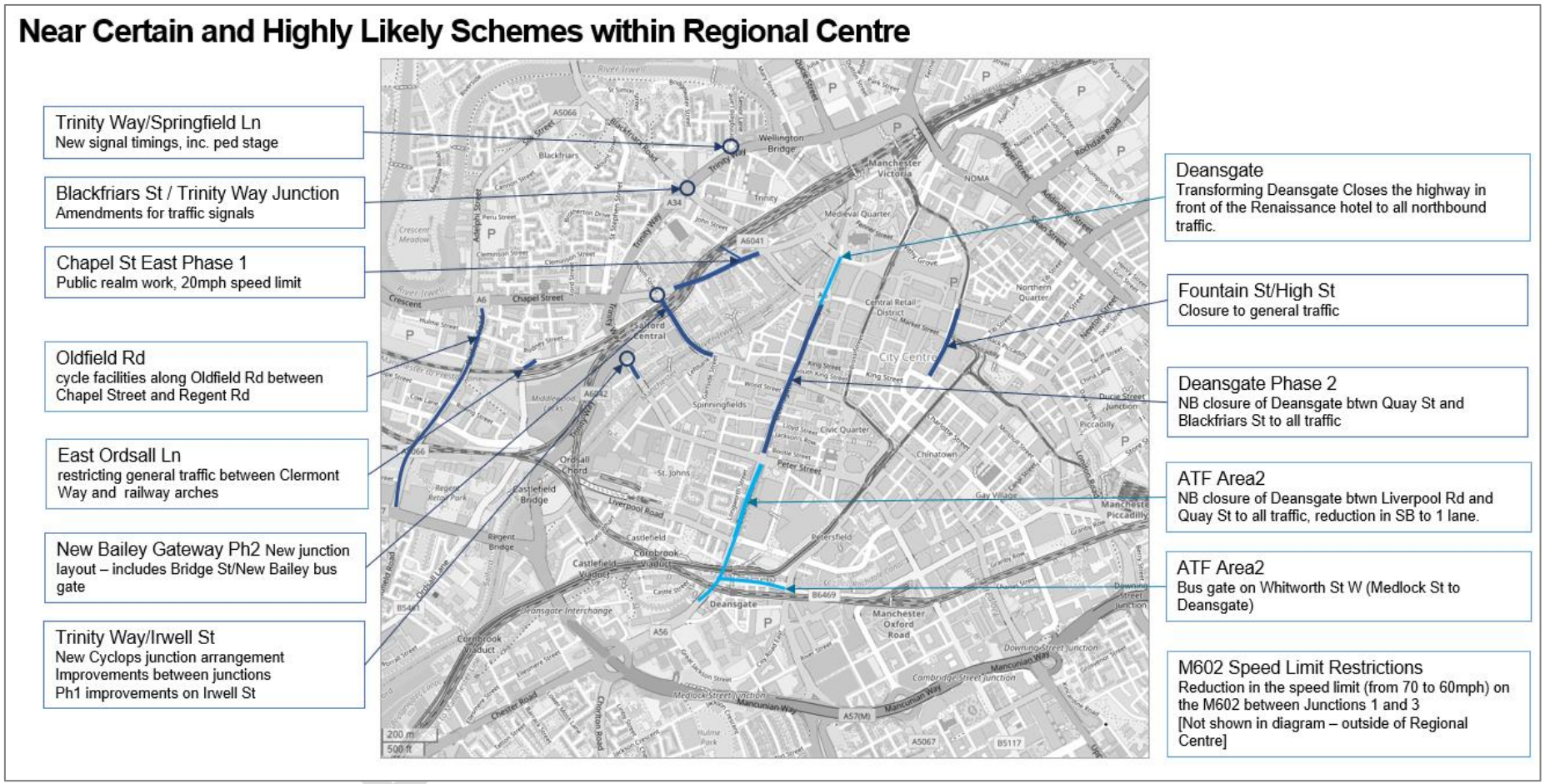


Figure 4-2: Committed and Planned Schemes for delivery by 2025 included in the Core Scenario for 2025



5 Modelling Methodology

5.1.1 This section details the methodology used in modelling the potential demand response within the Regional Centre of the CCTS related measures to be delivered by 2025.

5.2 Summary of Position

- The CCTS is designed to reduce the level of vehicular demand into the Regional Centre;
- Some elements of the CCTS have already been implemented, with others due for completion before the GM CAP goes live;
- Changes to parking supply (quantum and location) are likely to take longer to implement as they are linked to wider development proposals; and
- The GM CAP modelling to date has not reduced the nature or quantum of demand into the Regional Centre as a consequence of the CCTS.

5.3 Reflecting CCTS – Model Considerations

5.3.1 The CCTS is designed to influence change in a number of ways:

- Modal shift to increase the share of trips by active modes and public transport;
- Reduce the quantum of parking spaces within the city centre; and
- Restrict the ability of traffic to use the city centre as a 'through route'.

5.3.2 These influences will likely result in both changes to route choices and changes to demand.

5.3.3 Route choice is already considered within the SATURN modelling by reflecting relevant (i.e. near certain) schemes in the network coding. The model considered the network coding updates when assigning routes.

5.3.4 The demand aspects are not modelled presently, as the demand matrices within the model are fixed. However likely demand changes could include:

- Changes in the overall level of transport demand for trips to the Regional Centre;
- Changes in the mode share with a consequent reduction in vehicular traffic; or
- Redistribution of trips as car parking availability is reduced or made less attractive in certain locations (likely to happen later than network based changes).

5.4 Options for Reflecting CCTS demand influences

5.4.1 The CCTS is a 'work-in-progress' which will have evolved further by the time the GM CAP goes 'live' – therefore the modelling has assessed the likely impacts of CCTS and other Regional Centre schemes up to 2025. The full impacts of the overall CCTS strategy are not expected to be realised until 2040.

5.4.2 There are a number of ways to reflect the potential demand changes within the GM CAP modelling and these can be broadly grouped in to four levels:

1. Full variable demand modelling (VDM) using the GMVDM tool;
2. A simplified approach based on the cost elasticity functionality within GM SATURN;
3. A matrix-based elasticity approach undertaken externally to GM SATURN; and
4. Manual adjustments to the Regional Centre demand in the model based on externally derived estimates and / or professional judgement.

5.4.3 The strengths and weaknesses of each modelling approach are summarised in **Table 5-1**.

Table 5-1: Demand Modelling Approach

Approach	Strengths	Weaknesses
1. Full VDM	▪ Fully TAG compliant process	▪ Impact of CCTS (to date) may be masked by convergence issues given regional model extent ▪ Additional adjustment would be required to reflect parking supply changes ▪ Timescale to run and refine VDM do not align to planned submission timeline ▪ Results may be difficult to interpret
2. Elasticity Approach 1 *(Short term elasticity values)*	▪ Accepted TAG compliant process ▪ Uses the demand-responsive elastic assignment procedure within SATURN developed for this purpose ▪ Speed of implementation ▪ Can control area of impact	▪ Additional adjustment would be required to reflect parking supply changes ▪ Possible concerns regarding convergence issues of the SATURN Model

Approach	Strengths	Weaknesses
3. Elasticity Approach 2 *(Short term elasticity values)*	▪ Similar to Elasticity – 1 but a bespoke process outside of SATURN using elasticities applied to the change in generalised cost ▪ The revised demand is then reassigned within SATURN	▪ Additional adjustment would be required to reflect parking supply changes ▪ Although aligns with TAG guidance this approach is not strictly TAG compliant
4. Manual	▪ Full control over adjustments ▪ Transparent approach	▪ Not TAG compliant ▪ May be perceived as 'simplistic'

5.5 Identified Approach

5.5.1 The identified best approach to model the expected demand response within the Regional Centre, considering time, cost and suitability is to adopt a matrix-based elasticity approach (Option 3, Elasticity Approach 2). This approach will:

- Estimate demand impacts as a consequence of CCTS and Regional Centre network changes using the GM CAP 2025 model forecast year (note this does not represent the full CCTS);
- Utilise standard elasticity values using function parameters set out in TAG Unit M2.1;
- Apply to car trips only (all journey purposes combined). Taxis, LGVs and HGVs are excluded from the approach as demand for these modes is normally assumed fixed, however these journeys are susceptible to re-routing;
- Limit demand changes to solely trips with origins or destinations within the Regional Centre as these are most likely to be affected by the CCTS changes; and
- Use pre-CCTS modelling as a basis to pivot from to identify changes due to network impacts (this includes already built & completed schemes).

5.5.2 Where an elasticity model is appropriate the functional form and parameter values need to be selected. It is most appropriate to use short term elasticity given the overall short-term impacts of the CCTS and the 2025 future year assessment. Car journey time elasticity values have been derived using the values provided in Table A.1 of TAG Unit M2.1 (May 2020) Variable Demand Modelling. Short term elasticities are 28%, 8% & 5% less than the table values for HB Work, Employer's Business and Discretionary purposes respectively.

5.5.3 It is noted that the TAG Guidance Unit M2.1 was recently updated in May 2024, after the completion of the core modelling. Following review of this guidance it was identified that there were minor changes to recommended elasticity values, though these are not expected to result in a material impact on the demand changes forecast by values applied within the modelling process.

5.6 Details of Methodology

5.6.1 The methodology for the preferred demand Approach, Option 3 – Elasticity Approach 2 was as follows:

- The elasticity model considers the driver's response to changes in travel cost in terms of propensity to travel;
- The model applies a function to the change in travel costs, due to network changes, to forecast the change in demand due to changing travel costs; and
- The model is constrained to trips to and from the Regional Centre.

5.6.2 The methodology adopted an iterative process which was developed using SATURN software to:

- Assign the current matrix;
- Skim generalized costs from the assigned network; and
- Adjust the current matrix using the cost changes.

5.6.3 The process was run for a fixed number of iterations, after which a visual check was undertaken to check that flow changes between the final two iterations were minimal.

5.6.4 Matrix changes were restricted to trips with either an origin or destination within the Regional Centre.

5.6.5 Switching between time periods has not been included (e.g. delaying travel to coincide with a less congested time period), adjustments are retained within each time period of assessment.

5.6.6 The elasticity values used in the matrix adjustment process represent short term car journey time cost elasticities, derived using the elasticity values provided in Table A.1 of TAG Unit M2.1 titled 'Derived Long Term Car Journey Time cost Elasticities for Different Purposes' - short term elasticity factors were applied. The elasticities were treated as follows:

- disaggregated by user class and converted into journey time cost elasticities (Equivalent journey cost elasticities are calculated from **Table A.1** by dividing the elasticities by the proportion of the total generalised cost made up of journey time);
- Given the Regional Centre location, 'High Modal Competition' values were adopted;
- Note that the generalised costs in **Table A.1** are disaggregated by journey purpose (HB Work, Employer's Business, Essential Other and Discretionary Other). Values were calculated separately by purpose and combined to derive a weighted (all purpose) value; and
- Values are based on the use of the 'Discretionary Other' 'High Modal Competition' elasticity values for Cars.

5.6.7 The elasticity values used are shown in **Table 5-2**. Note that compliant vehicles are defined as Euro IV standards for petrol vehicles and Euro VI standard for diesel vehicles, in accordance with the CAZ Framework standards.

Table 5-2: Short Term Elasticity Values

Vehicle Class	AM Peak	PM Peak
Compliant car	-0.401	-0.401
Non-compliant car	-0.398	-0.398

5.6.8 The process used a power relationship to estimate the change in demand, in response to changes in travel costs taking the form defined in TAG Unit M2.1. The demand adjustment process was run in an iterative sequence until matrix stability was achieved and changes in trip totals between successive assignments were very small.

5.6.9 TAG Unit M2.1 describes this method as a ‘well-behaved formulation” that is base-dependent and will therefore provide consistent results when forecasting from one year to another, or via an intermediate year.

5.6.10 The model process was used to identify the potential demand change that might be realised due to an evolving set of options for demand management. The use of short-term elasticities is considered appropriate, as given the overall short-term impact of these schemes and 2025 future year of assessment, and initial impact of measures, short term values would be considered more appropriate.

5.6.11 When incorporating the CCTS demand impacts into the core modelling, in discussion with JAQU we have agreed the use of more cautious short-term elasticities which will represent the impacts of implementing a scheme and looking to forecast (almost) immediate impacts, as in the case of these measures, in the context of GM CAP.

5.7 Cross Price Elasticities

5.7.1 The demand response modelling has adopted a cautious approach and has not incorporated cross price elasticity impacts. The Regional Centre schemes, and CCTS measures to be delivered by 2025 are primarily focused on improvements to bus and active travel which will have a significant attraction to public transport modes (bus and Metrolink).

5.7.2 The measures are intended to facilitate improved bus journey times and reliability within the Regional Centre for those routes dominated by bus flows. This has included the inclusion of significant bus priority measures, including bus lanes, bus gates and restrictions on general traffic.

5.7.3 The schemes are listed below:

- New Bailey Gateway (Phase 2) - Bridge Street / New Bailey Bus Gate
- Deansgate Phase 1 - Southbound closure of Deansgate between Blackfriars Street and Bridge Street to general traffic (buses, taxis and cycles exempt).
- Chapel Street Bus Gate - Eastbound bus gate after Victoria Bridge Street (now permanent).

5.7.4 The cross-elasticities between vehicle types/ purposes are assumed to be zero. The application of cross price elasticities in the demand modelling approach, would encourage higher volumes of traffic to shift towards public transport due to the improvements. The GM approach to CCTS Demand Impacts by 2025 are therefore considered to be cautious. Importantly, this modelling approach only considers network cost changes and not the effect of restrictions on parking supply.

6 Results

6.1.1 The overall changes made in terms of demand to the matrices are shown in **Table 6-1** and **Table 6-2**.

6.1.2 The approach to assessing the demand impacts of Regional Centre and committed CCTS measures has adopted an elasticity-based approach. This assessment has considered the change in travel time between the highway network, prior to the inclusion of these measures and following the introduction of the Regional Centre Measures. The modelling approach has not precluded traffic volumes increasing if generalised travel times for road traffic falls.

6.1.3 The focus of Regional Centre and CCTS measures is to dissuade general traffic from accessing large proportions for the Regional Centre.

Table 6-1: AM Peak Hour Matrix Changes (Car based Demand)

	Regional Centre Origins					Regional Centre Destinations				
Vehicle Class	**2016 Base**	**2025 DM**	**2025 Test**	**Change**	**% Change**	**2016 Base**	**2025 DM**	**2025 Test**	**Change**	**% Change**
Compliant car	1,929	3,748	3,667	-81	-2.2%	4,649	8,584	8,271	-313	-3.6%
Non-compliant car	2,237	403	394	-9	-2.2%	5,392	922	889	-33	-3.6%
Compliant taxi	*26*	*260*	*260*	*n/a*	*n/a*	*63*	*597*	*597*	*n/a*	*n/a*
Non-compliant taxi	*278*	*42*	*42*	*n/a*	*n/a*	*670*	*97*	*97*	*n/a*	*n/a*
Total	4470	4,453	4,363	-90	**-2.2%**	10,774	10,200	9,854	-346	**-3.4%**

Table 6-2: PM Peak Hour Matrix Changes (Car based demand)

	Regional Centre Origins					Regional Centre Destinations				
Vehicle Class	**2016 Base**	**2025 DM**	**2025 Test**	**Change**	**% Change**	**2016 Base**	**2025 DM**	**2025 Test**	**Change**	**% Change**
Compliant car	4,656	8,587	7,975	-612	-7.1%	2,771	5,517	5,278	-239	-4.3%
Non-compliant car	5,400	922	857	-65	-7.0%	3,213	593	567	-26	-4.4%
Compliant taxi	63	597	597	n/a	*n/a*	38	383	383	n/a	*n/a*
Non-compliant taxi	671	97	97	n/a	*n/a*	399	62	62	n/a	*n/a*
Total	10,790	10,203	9,526	-677	**-6.6%**	6,421	6,555	6,290	-265	**-4.0%**

6.1.4 The total number of trips removed from the matrices as a result of the process is lower than the sum of the origin and destination totals since internal trips will appear in both columns. Overall, the total number of trips removed from the matrices was 433 (99 origin and 334 destination trips) in the AM Peak hour and 986 (712 origin and 474 destination trips) in the PM Peak hour. It is noted that the PM peak typically experiences higher levels of congestion, therefore a greater demand impact has been recorded in the PM Peak due to greater difference in generalised cost in the PM Peak. As the approach has adopted an origin / destination-based assessment, rather than a Production / Attraction approach, and given the commuter focused travel to the Regional Centre as given that 712 vehicles are removed in the PM, a similar level might be expected in the AM. This means that the model is likely to be slightly overstating congestion and traffic volumes in the AM Peak.

6.1.5 **Figure 6-1** shows the change in AM Peak hour traffic flows between the original demand and the revised demand following the application of the elasticity process. Link flow changes result from the reduction in assigned demand and also rerouting of remaining demand due to the change in junction delays. Figures are bandwidth plots of link flow differences, where the link widths are proportional to the size of the flow changes and where links coloured green identify locations where flows have increased, and links coloured blue identify flow reductions.

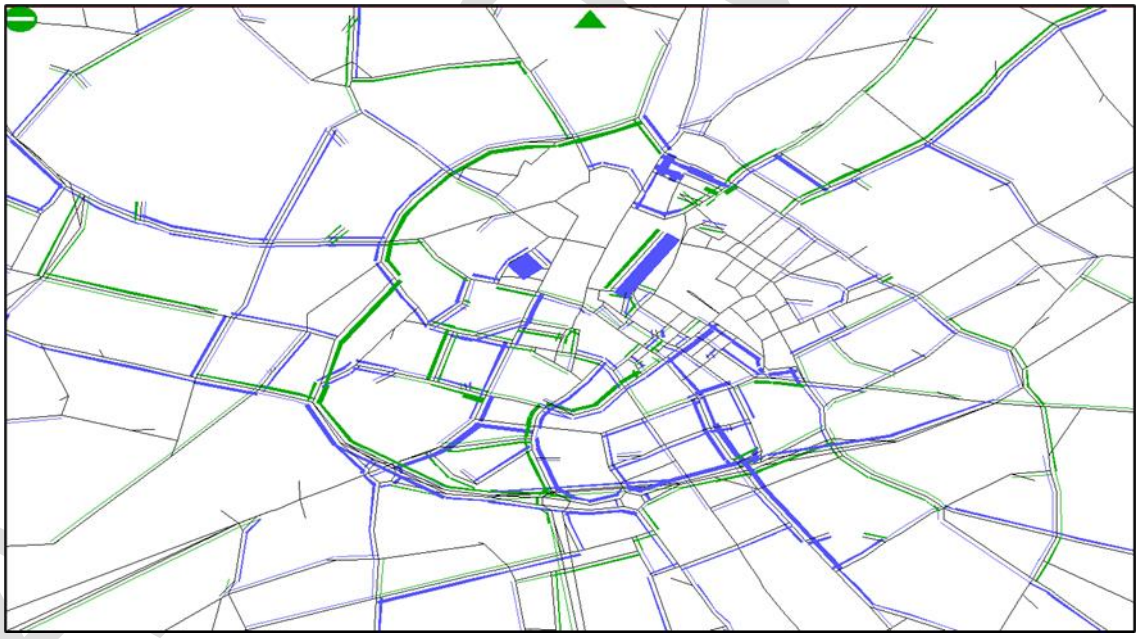
6.1.6 The key changes are an overall reduction of demand within the inner ring road with small decreases in demand on the radial routes into the Regional Centre. Ring road demand increases on Trinity Way to the north of Chapel Street.

6.1.7 **Figure 6-2** shows the corresponding changes in the PM Peak hour. Overall, the pattern of change is similar to the AM peak with a reduction in demand inside the ring road and on radials into the Regional Centre. As in the morning peak, a small increase in demand on Trinity Way north of Chapel Street is forecast.

6.1.8 Analysis from the previous GM CAP modelling indicates the eastern section of the A57 Regent Road, Salford is the last remaining location of air quality exceedance. The results of this sensitivity test indicate that traffic flows at this section see marginal overall change. In the AM peak there is a c.10 PCU (Passenger Car Unit) flow reduction, with an equivalent increase in the PM Peak. This change is marginal compared to the over 2,000 PCUs per hour on these links during peak periods. However, it should be noted that vehicle emissions vary both based on vehicle flow and also speed. It would be necessary to test any impact in more detail to fully understand if a material improvement may occur at this location.

Figure 6-1: Flow Change - Elasticity Based Approach 2 - AM Peak

Figure 6-2: Flow Change - Elasticity Based Approach 2 - PM Peak



6.1.9 As shown in these figures, the results of the demand sensitivity test appear sensible and intuitive. They show relatively modest changes which reflect the relevant timelines of the GM CAP and the CCTS. Importantly, this modelling approach only considers network cost changes and not the effect of restrictions on parking supply.

6.1.10 The overall origin and destination flow changes between the with and without elasticity runs for zones in the Regional Centre are shown in figures below.

Figure 6-3: Origin and Destination Flow Changes – AM Peak

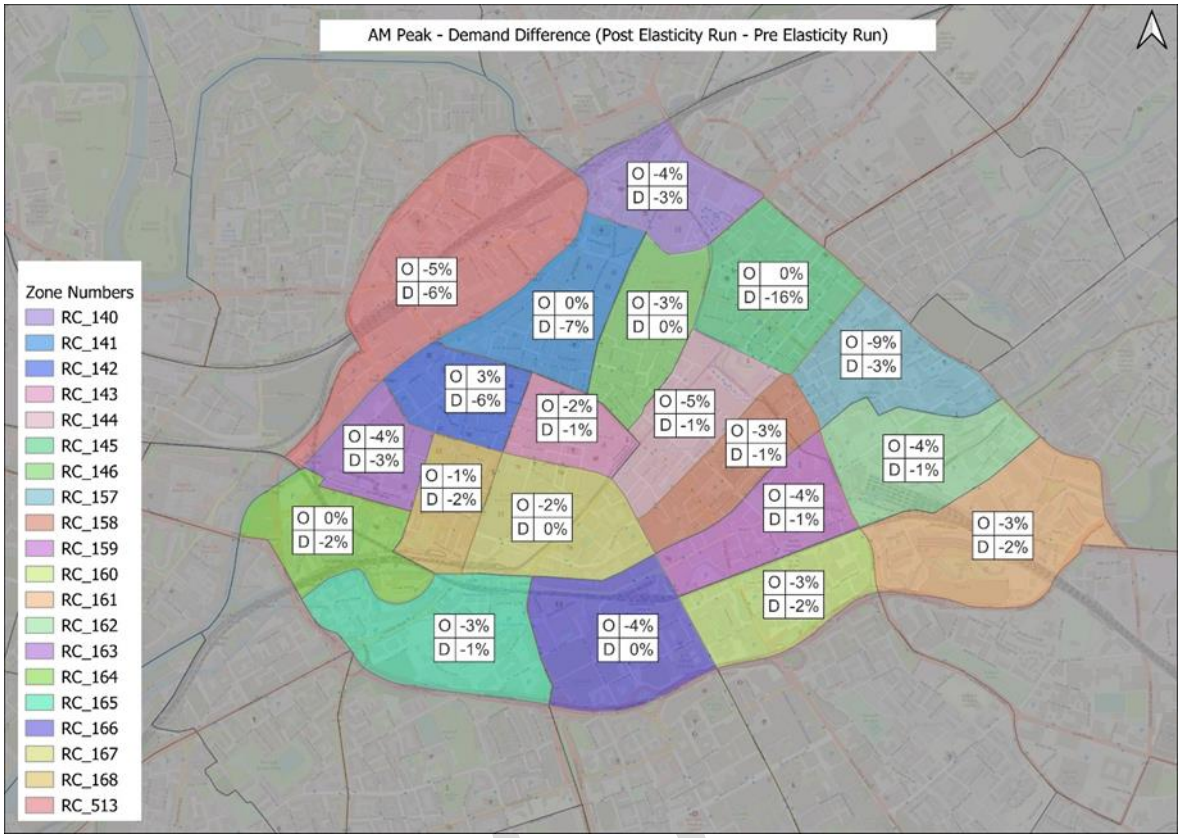
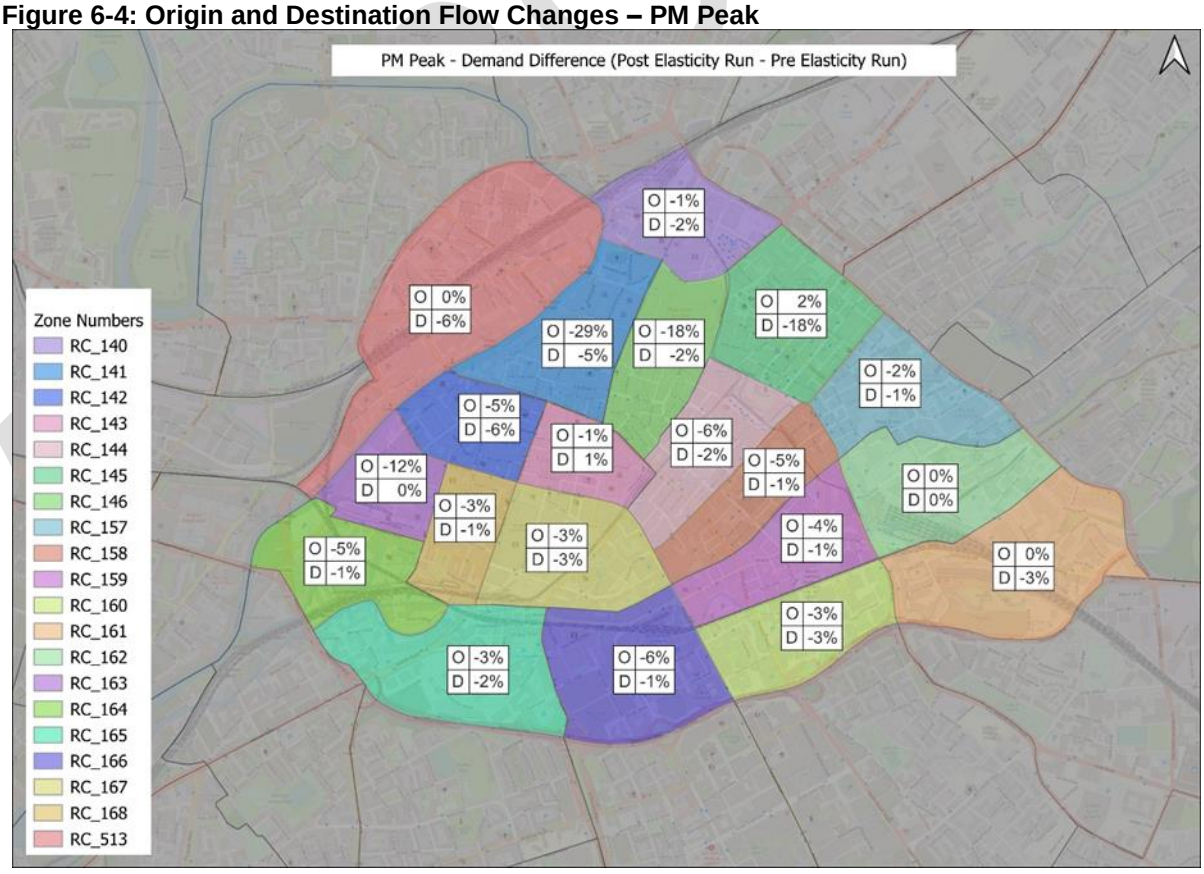


Figure 6-4: Origin and Destination Flow Changes – PM Peak



6.1.11 As shown in these figures most of the changes in demand in both the AM and PM are small reductions (less than 5%). In the AM peak, the highest reduction in flows is by 16% which is for trips to zone 145 (Northern Quarter). There is a 7% reduction in trips to Deansgate. There is also a 9% reduction in trips from Piccadilly Basin. There is however, a small increase in trips from Spinningfields area in the AM peak of 3%.

6.1.12 In the PM peak, the flows from zone 141 (Deansgate) are reduced by 29% which is the highest reduction. The flows from zone 146 (King Street / Manchester Arndale) are reduced by 18% and the demand from Liverpool Road is reduced by 12%. There is a reduction in trips from the Northern Quarter of 18%, similar to the AM peak. There is no change to demand at Piccadilly in the PM peak.

6.1.13 The flow reductions in the PM Peak are driven by high levels of congestion which exist in the central area (Deansgate / King Street) of the Regional Centre. The CCTS measures included within this part of the Regional Centre include enhancements to bus and active travel, though result in a more restrictive access to this part of the Regional Centre for general traffic, such as the introduction of bus only sections along Deansgate.

7 Historical Change in Regional Centre Demand

7.1 Overview

7.1.1 During a review of an earlier version of this report, JAQU requested from GM evidence of changing trip patterns to and from the Regional Centre by mode (including pre-pandemic). For example, data showing an increase in trips but a reduction or flat line for highway trips, as this would provide additional confidence in the assumptions of reduced highway trips into the centre. The following section provides a review of historical data in the context of access to/from the Regional Centre.

7.1.2 To understand the changing trip patterns in the Regional Centre historical data dating back to 2002 from the Highways Forecasting and Analytical Services (HFAS) reports[17] cordon counts have been reviewed.

7.1.3 Traffic and rail counts were first conducted on a cordon around Manchester in 1997. After that, the Regional Centre was surveyed in 1999, 2002, 2005, 2006 and then every year from 2009 onwards. Pedestrian surveys were added in 2002.

7.1.4 Between 1997 and 2005 Continuous Passenger Sampling (CPS) data was used to estimate bus trips. In 2006, 2009 and every year since 2009 counts of bus passengers crossing the cordon are being conducted.

7.1.5 Surveys of vehicles crossing the cordon into the Regional Centre are conducted in two time periods on a typical weekday:

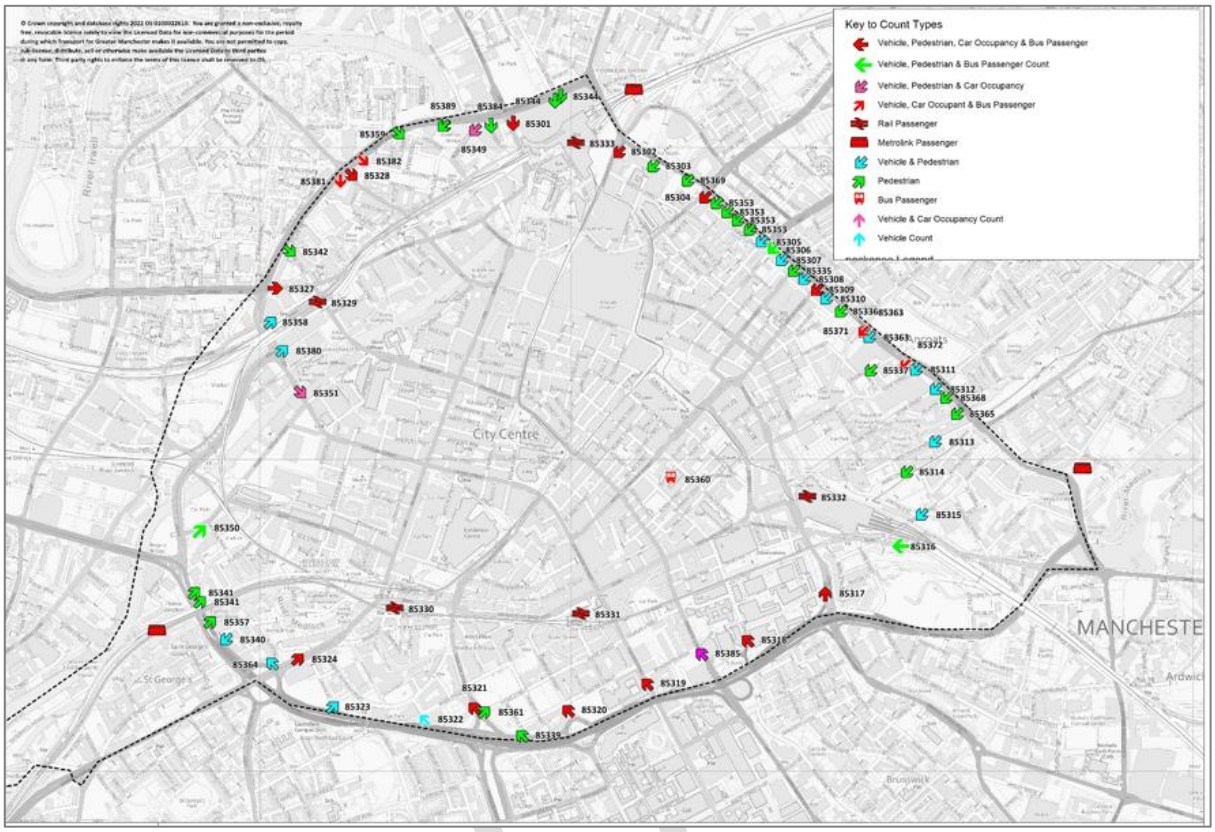
- 07:30 – 09:30; and
- 10:00 – 12:00.

7.1.6 For this analysis only data from 2002 between the 07:30 – 09:30 time period was analysed further, due to availability of data over the long term time horizon. The use of AM peak data is considered representative of peak time conditions within the Regional Centre.

7.1.7 **Figure 7-1** shows the location of survey sites and the key centre boundary.

[17] Highways Forecasting and Analytical Services - home page (gmtu.gov.uk)

Figure 7-1: Regional Centre Counts Cordon Area



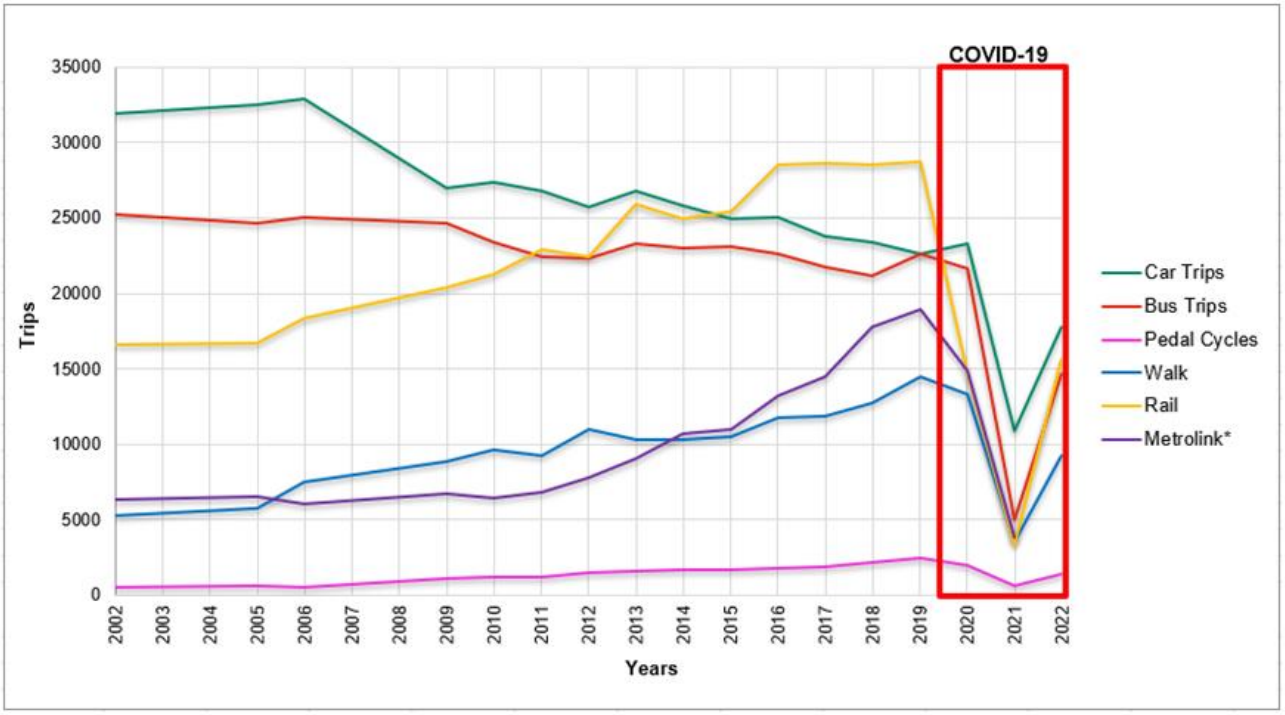
7.2 Data Analysis

7.2.1 The available Regional Centre survey data between 2002 and 2022 was analysed to understand the key trends in mode share including car trips, public transport trips (bus, rail and Metrolink) and active travel (pedal cycle and walk).

7.2.2 It is worth noting that the Regional Centre surveys for Manchester conducted in 2020 and 2021 were affected by COVID-19 measures implemented by the government, therefore mode share comparisons were made between 2002 and 2019 to provide evidence of changing trip patterns.

7.2.3 **Figure 7-2** shows an overview of the trips by mode between 2002 and 2021.

Figure 7-2: Trips by Mode between 2002 and 2022 (AM Peak)



** Note Metrolink data not included for 2022*

7.2.4 As illustrated in **Figure 7-2**, the number of car trips entering the Regional Centre have been slowly declining since 2002. However, public transport and active travel trips have been slowly increasing until 2019.

7.2.5 **Table 7-1** shows the percentage change between 2002 and 2019.

Table 7-1: % Change since 2002

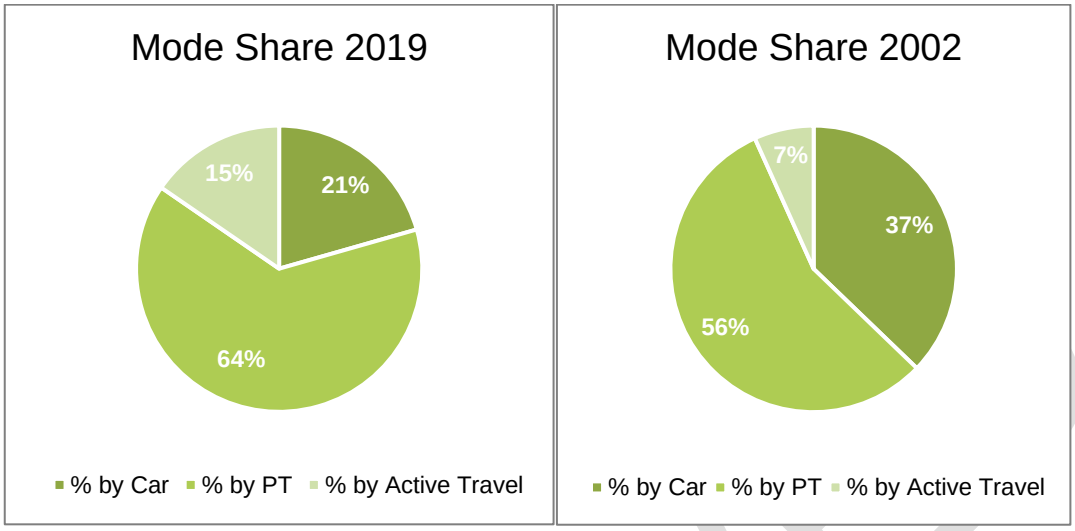
	2019	2002	Difference	% Change
Car Trips	22,623	31,955	-9,332	-29%
Bus Trips	22,669	25,254	-2,585	-10%
Rail	28,709	16,612	12,097	73%
Metrolink	18,983	6,301	12,682	201%
Walk	14,463	5,279	9,184	174%
Pedal Cycle	2,477	509	1,968	387%

7.2.6 Car trips and bus trips have decreased by 29% and 10% respectively in 2019 since 2002. Rail and Metrolink trips have increased by 73% and 201% respectively.

7.2.7 In terms of active travel, the number of pedestrians entering the Regional Centre increased by 174% and cycling has increased by 387% in 2019 when compared to the 2002 survey data.

7.2.8 Further mode share comparisons are shown in **Figure 7-3**.

Figure 7-3: Mode Share Comparison between 2002 and 2019 (AM)



7.2.9 Mode share comparison:

- Car trip share decreased from 37% to 21% in 2019;
- Public transport share increased from 56% to 64% in 2019; and
- Active travel share increased from 7% to 15% in 2019.

7.2.10 In summary, the number of car trips crossing the cordon decreased by 29% since 2002. The number of public transport trips increased by 46% since 2002 and active travel trips increased by 193%.

8 Summary

8.1.1 As part of a wider initiative to reduce car use to and within the Regional Centre, a series of transport infrastructure interventions are planned. This wider initiative is known as the CCTS. Several of these measures are expected to be delivered by 2025, within the lifespan of GM CAP and will influence the level of general vehicular traffic within the Regional Centre.

8.1.2 The network impacts of these infrastructure interventions, such as rerouting, are already reflected within the current GM CAP core modelling. This note has considered the modelling approach to assess, through sensitivity testing, the potential demand response to these measures.

8.1.3 A demand test has been undertaken, adopting an elasticity-based approach to consider the driver's response to changes in travel cost in terms of propensity to travel, for trips to and from the Regional Centre. The elasticity values were derived from Appendix A of TAG Unit M2.1 and adjusted to reflect the generalized cost parameters used in the assignment model.

8.1.4 The impacts of the test identified a 3% overall demand reduction for Regional Centre based trips in the AM Peak hour, with up to a 6% reduction identified within the PM peak hour. These show relatively modest changes which reflects the relevant timelines of the GM CAP and the delivery of the early parts of CCTS.

8.1.5 Analysis on the eastern section of the A57 Regent Road, Salford, the last remaining location of air quality exceedance, shows only a marginal overall change in traffic flows at this location.

8.1.6 As noted in **Section 5**, the modelling process was being used to identify the potential demand change that might be realised due to an evolving set of options for demand management. The analysis presented within this note was based on a set of short term elasticity values, as these represent the relative short term impacts that would occur as a result of the CCTS schemes and allow for the 2025 future year assessment.

8.1.7 Beyond 2025 further CCTS measures are proposed, which will continue to discourage general vehicular traffic from the Regional Centre, and would likely result in further demand reductions for traffic accessing the Regional Centre.

Annex A – Regional Centre and CCTS Interventions

Near certain Regional Centre and CCTS Measures included in 2025 and 2026 Do Minimum modelling.

Near Certain CCTS and Regional Centre Measures in 2025 core scenario

Scheme	Description
MCC: ATF Area 2	ATF 2 closes A56 Deansgate between Liverpool St and Quay St to all northbound traffic. The design also includes a reduction in southbound lanes from two to one along Deansgate/Bridgewater Viaduct between Liverpool St and U Deansgate.
MCC: ATF Area 2	Bus Gate on Whitworth Street West (Medlock St to Deansgate)
M602 Speed Limit Reduction	(National Highways) Reduction in the speed limit (from 70 to 60mph) on the M602 between Junctions 1 and 3.
SCC: Oldfield Rd	Segregated cycle facilities along Oldfield Rd between Chapel Street and Regent Rd. Includes CYCLOPS junction at Oldfield Rd and Liverpool St. https://oldfieldroadcorridor.commonplace.is/proposals/oldfield-road-corridor-improvement
SCC: East Ordsall Lane	Closure to general traffic to reduce rat running at point where EOL goes under railway.
SCC: Chapel St East (Phase 1)	Public realm work, 20mph speed limit, speed cushions & cycle lanes. No reduction in capacity.
SCC: New Bailey Gateway	(Phase 2) New junction layout at Chapel St/New Bailey St including westbound Cycle Gate – new signal timings. Includes Bridge Street / New Bailey Bus Gate.
SCC: Trinity Way/Irwell St	Phase 1 scheme for improvements on Irwell Street.
SCC: Trinity Way / Springfield Ln	New signal timings – pedestrian stage added.
SCC: Blackfriars St / Trinity Way Junction	Amendments to traffic signals
MCC: Fountain St/High St	Closure of Fountain St/High St to general traffic.
MCC: Deansgate Phase 2	Northbound closure of Deansgate between Quay St and Blackfriars St to all traffic. Allow left turn from St Mary's Parsonage to Bridge St. Allow right turn from Bridge St to Deansgate.
MCC: Deansgate:	Transforming Deansgate closes the highway in front of the Renaissance Hotel to all northbound traffic

Completed and Built Schemes by Autumn 2023 Core Do Minimum

Scheme	Description
MCC SCC: MSIRR	Improvement Scheme - Upgrade to six major junctions along Regent Road.
MCC: A57(M) Mancunian Way	Speed Limit 30 mph.
MCC: Closure of Ducie St	Road closure from Ducie St to A6 Piccadilly.
MCC: Closure of Stevenson Square	Full closure to all east/westbound traffic.
SCC: Chapel St Bus Gate	Eastbound bus gate after Victoria Bridge St (now permanent).
SCC: New Bailey Gateway	(Phase 1) Public Realm work (complete).
MCC: Closure of Thomas St	Road Closure between Oak St and High St.
MCC: Closure of Albert Sq	Road closure from Albert Square to Princess St.
MCC: Gt Ancoats St Improvement Works	Improvements to junctions and pavements to enable safer crossing to surrounding neighbourhoods.
MCC: Deansgate Phase 1	Southbound closure of Deansgate between Blackfriars St and Bridge St to general traffic (buses taxis and cycles exempt). St Mary's Parsonage Closure (northern end). Garside St (Two-Way).
MCC: A6041 Blackfriars Rd	Loss of 1 straight ahead lane.
MCC: Regent Rd/Water St	1 lane gain after Water St/Regent Rd Junction.
MCC: A6 London Rd/Fairfield St	1 lane gain on A6 London Rd.
MCC: Chatham St	One-way.
MCC: Fairfield St/Travis St	Loss of 1 straight ahead lane towards East Manchester.
MCC: Dale St	1 lane gain.
MCC: Dale St	Add left turn from Dale St to Lever St.
MCC: Lever St	2 lanes between Dale St and Stevenson Square.
MCC: Withy Grove	Only 1 lane straight ahead towards North Manchester.
MCC: Withy Grove	Loss of Lanes on Withy Grove NB.
MCC: Corporation St	Loss of 1 lane (Inbound).
MCC: St Johns/Factory	Network change (connected lost to Liverpool Rd).
MCC: Peter St	Loss of 1 lane – both directions.
MCC: Chester Rd Roundabout	Chester Rd/Chorlton Rd Signalised.
MCC: Medlock St Roundabout	Roundabout Signalised – Lane Changes.
MCC: Princess Street	1 lane at junction with Charles St.
MCC: Lower Mosley St	1 lane at junction with Albion St.
MCC: Whitworth St	1 lane at junction with Gloucester St (wb).
MCC: Oxford Rd	1 lane between Hulme St and Whitworth St (nb).
MCC: Oxford Rd	Banned RT from Oxford Rd to Hulme St.
MCC: Oxford Rd	2 lanes at junction with Hulme St – Banned LT (nb).
MCC: Chester St	One-way (eb).
MCC: Cambridge St	1 lane between Chester St and Hulme St (nb).
MCC: Princess St	2 lanes at junction with Whitworth St.
MCC: Whitworth St	1 lane only ahead at junction with Princess St (wb).
MCC: Princess St	1 lane at junction with Bloom St.
MCC: Chorlton St	Chorlton St two-way between Bloom St and Major St.
MCC: Oxford St	Allow RT from Oxford St to Chepstow St.
MCC: Portland St	1 lane between Princess St and Dickenson St (sb).
MCC: Princess St	1 lane at junction with Portland St.
MCC: Portland St	No bus lane between Chorlton St and Princess St (sb).
MCC: Oxford St	1 lane at junction with St Peters Square.
MCC. Oxford St	1 lane at junction with George St – RT Allowed.
MCC: Princess St	Remove bus lane between Portland St and George St for access only.
MCC: Clarence St	One-way onto Princess St.
MCC: King St	1 lane at junction with Brown St.

Scheme	Description
MCC: Booth St	1 lane at junction with Cooper St.
SCC: Blackfriars Rd	Mostly 1 lane between MSIRR and Chapel St in both directions.
SCC: East Ordsall Ln	1 lane at junction with Middlewood St.
SCC: East Ordsall Ln	1 lane at junction with MSIRR.
SCC: Chapel St	Chapel St at junction with Oldfield.
MCC: Aytoun St	3 lanes at junction with Auburn St.
SCC: New Bailey St	1 lane between Garside St and Browncross St (nb).
SCC: New Bailey St	1 lane between Chapel St and Browncross St (sb).
SCC: New Bailey St	Remove bus lane at junction with Garside St (sb).
SCC: Chapel St	1 lane between New Bailey St and Blackfriars St.
SCC: Chapel St	1 lane at junction with New Bailey St.
MCC: Deansgate	2 lanes at junction with Liverpool St (out of city).
MCC: Blackfriars St	1 lane at junction with Chapel St.