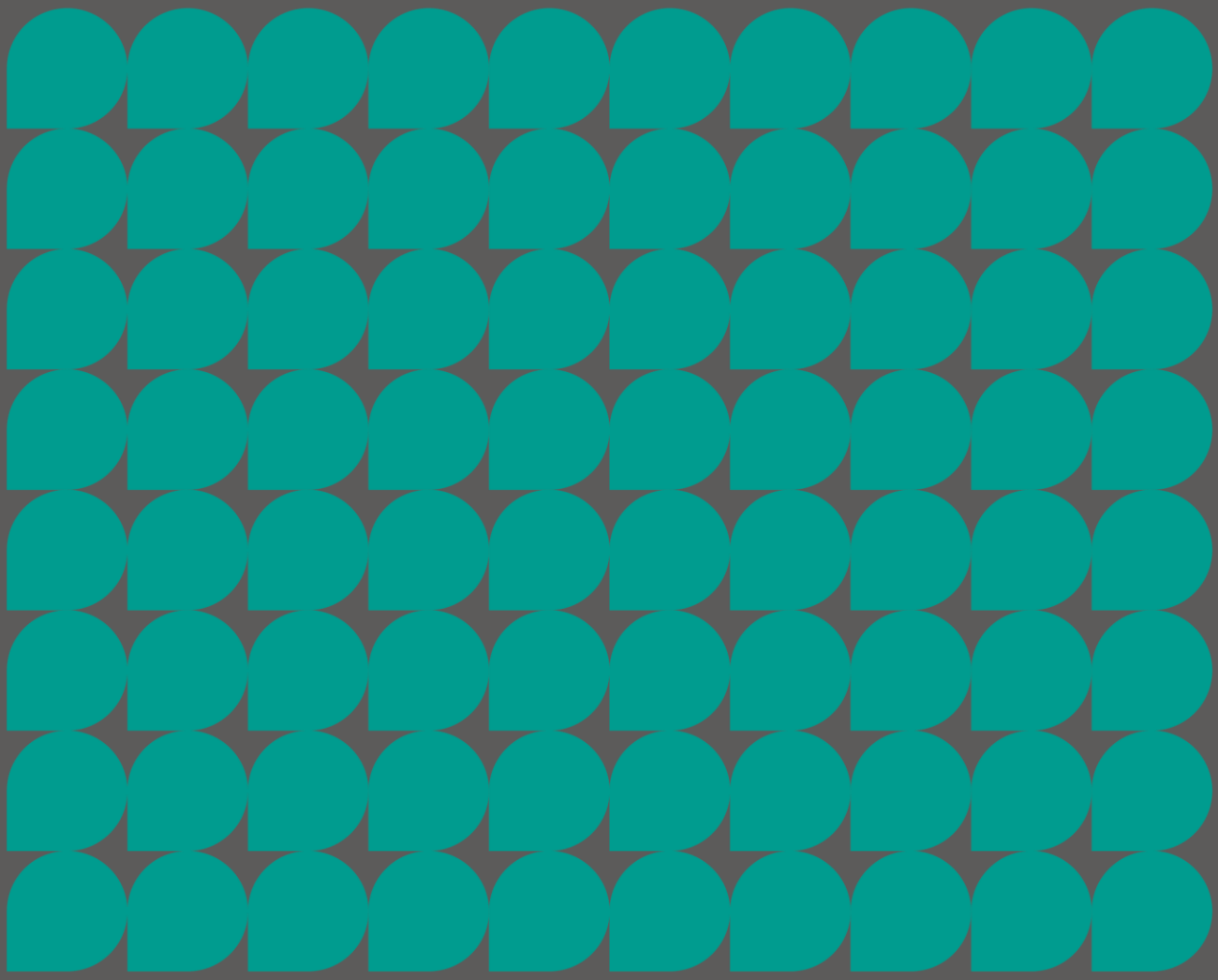
GREATER MANCHESTER
DOING THINGS DIFFERENTLY

Transport Strategic Modelling Technical Note

Places for Everyone – July 2021

Version 2.0



Version	Date	Author	Purpose	Reviewer
2.0	8 July 2021	TfGM, SYSTRA	Update of report (June 2021 modelling update)	POG, TSG, HE

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1 Executive Summary

Introduction

1.1 Following the withdrawal of Stockport Council from the original Greater Manchester Spatial Framework 2020 (GMSF 2020) Joint Development Plan Document (Joint DPD) preparations, the nine remaining Local Authorities have agreed to use the GMSF as the basis for a new Places for Everyone Plan Joint DPD. This new plan been prepared on the basis that it will have 'substantially the same effect' as the PfE. Full details of the processes, dates of consultations and key decision meetings are set out in the Topic Papers.

1.2 The information within this strategic modelling technical note is a complete update of an earlier note prepared for the GMSF 2020. This update supersedes the original GMSF 2020 version.

1.3 This update reflects a number of significant changes since the previous round of strategic modelling was undertaken in early 2020. These included the removal of all of the Stockport allocations and the associated reduction in transport demand, changes in the status of major transport infrastructure and some allocation-specific changes (such as changes in development quantum or associated interventions). These changes are incorporated into the latest round of strategic modelling.

1.4 This technical note describes the impacts on key transport metrics of incorporating the PfE land use proposals into the Greater Manchester strategic modelling framework. In particular, the tests look at the implications for travel across Greater Manchester of future population and employment growth being focused in the specific locations identified within the PfE Joint DPD.

1.5 The results of the updated modelling are substantially the same as the original report which was used to inform the GMSF 2020 and subsequently the Autumn 2021 consultation version of the Places for Everyone Plan Joint DPD.

The PfE Dataset: Existing Land Supply and Allocations

1.6 It is important to understand that forecast growth in Greater Manchester has been separated into two distinct parts:

i. Reference Scenario - Existing land supply; and

ii. Allocations.

1.7 The first part is the future year Reference Scenario which accounts for "existing land supply" – these are sites across Greater Manchester that have been identified through the "Strategic Housing Land Availability Assessment" (SHLAA) and the employment land availability assessment processes within each local planning authority across Greater Manchester. Representation of these existing land supply sites is included in the Reference Scenario. Factors have been applied in this reference scenario to ensure overall trip growth across the county matches DfT National Trip End Model (NTEM) assumptions for trip growth. DfT assumptions are broadly similar to the population projections incorporated into the Greater Manchester Forecast Model (GMFM) and so have been considered suitable for this scenario.

1.8 The second part of the forecast growth is the PfE allocation sites. These allocations have been included in an additional standalone incremental test. Representation of the allocations, as outlined in the Draft PfE Plan, have been added on top of the background or Reference Scenario growth.

1.9 The sequence in which the growth elements have been added is purely for modelling purposes, to demonstrate the maximum impacts from the allocations. In reality, both growth elements will happen simultaneously.

1.10 Using these assumptions, from a 2017 baseline, the assumed growth by the year 2040 (as a result of both the ELS and Allocations and assuming full take up of the allocations) would result in:

- 11% of the total population increase of 13% occurring in the areas of the existing land supply and 2.4% in the PfE allocations;
- 6% of the overall employment growth of 10% occurring in the areas of the existing land supply and 4% in the PfE allocations; and
- A forecast increase in car and PT trips within Greater Manchester of 14%, 12% of which is due to existing land supply and 2% due to PfE allocations.

Future Transport Intervention Schemes

1.11 The future year Reference Scenario forecasts, which include representation of the existing land supply and are reported in this technical note, do not include the representation of any transport interventions over and above already committed and funded interventions, nor the introduction of the policy proposals and mode shift proposals set out in Greater Manchester's 2040 Transport Strategy (https://tfgm.com/2040). Hence the tests here reported in this TN are referred to as "Policy Off" tests. Results from possible future tests that include these policy and mode shift proposals would be referred to as "Policy On" tests.

1.12 The allocations forecasts reported in this note do include representation of the majority of the local transport interventions that have been identified and developed through the Locality Assessment programme of work. Essentially, wherever it is possible to represent the proposed interventions in the strategic model this has been done. In a small number of cases e.g. minor localised road widening, localised cycle improvements, the strategic nature of the model means that this is not possible.

1.13 The key question this report addresses is how well does Greater Manchester's existing plus committed transport infrastructure, plus the local mitigation schemes identified for the allocations sites, accommodate the 2% increase in Greater Manchester wide trips above the Reference Scenario growth (approximately 120,000 daily trips) that will arise from the allocation sites.

Approach to Strategic Modelling

1.14 TfGM's strategic models have been used extensively for forecasting the impacts of transport and land use decisions in Greater Manchester for many years. The transport models provide estimates of future year transport demand, estimates of travel behaviour change and new patterns that schemes or land use changes, such as the PfE allocations, are likely to produce. The choices represented include routes, travel mode, time of travel and changes in journey destinations for some activities such as work and shopping. Resultant changes in highway congestion (and therefore journey time) and public transport crowding can then be reported.

1.15 The approach to forecasting at TfGM generally follows the Department for Transport TAG guidance. The forecasting for the PfE allocations is not significantly different: trips associated with new developments are obtained by applying trip rates observed from similar land uses to proposed site floor space or the number of dwellings. These trips are then added to the Reference Scenario as an incremental test. This test methodology can be regarded as a standard Transport Assessment approach, but applied across the full Greater Manchester geography for the combined impact of the allocations.

1.16 However, in order to assess the impact of the full PfE allocations (that are still at an early stage and are not included in national forecasts), trips associated with the allocations are added 'on top' of existing land supply without constraining to the DfT forecasts used to create the Reference Scenario, known as NTEM.

1.17 In terms of the transport supply networks, the Reference Scenario forecasts, i.e. those including representation of the existing land supply, incorporate just the committed highway and public transport schemes beyond the base year of 2017, and so exclude, for example, HS2 and all the highway schemes that may be considered part of that scheme. Details of the assumed committed schemes in the forecasts are included in this report (Section 4).

1.18 No allowance has been made within the forecasts reported in this note to reflect the potential longer term future impacts of the covid-19 virus – either economic or behavioural.

1.19 As described more fully in the paragraphs below, the PfE allocation Scenario to be tested against the Reference Scenario includes representation of the transport intervention schemes required to mitigate the primary congestion impacts of the proposed developments. More schemes are included in the 2040 forecast than at 2025, reflecting the likely phasing of the development related to the allocations.

Scenarios Tested

1.20 Seven key model scenarios are referred to in this report. The key characteristics and names of these scenarios are outlined in Table 1.1 below. It should be noted that scenario 1 has not been repeated with the most recent strategic model updates.

1.21 As stated above, the Policy Off scenarios do not include the forecast impacts of Greater Manchester's 2040 Transport Strategy, including Bus Reform, the growth of the Rapid Transit network and the active mode changes brought about by Streets For All and the Bee Cycle Network. As such, they do not capture the likely impacts of the land use policies and transport interventions intended to result in reduced trip lengths, as trips increasingly redistribute to local neighbourhood destinations. Nor do they take account of the expected increase in the use of public transport or active modes resulting from improved provision of facilities, which is expected to result in one million more trips each day using sustainable modes by 2040, as set out in the "Our Vision for 2040: the Right Mix" report.

Table 1.1 Model Scenarios Referred to in this Report

Scenario	Year(s)	Growth	Transport Supply
Base	2017	N/A	As at 2017
Scenario 1 NTEM	2025 & 2040	NTEM trips and distribution	Existing and committed schemes only
Scenario 2 Policy Off Reference	2025 & 2040	NTEM trips applied to existing land supply	Existing and committed schemes only
Scenario 2 Policy Off Allocations with Mitigation	2025 & 2040	Reference scenario plus allocations	Existing and committed schemes only associated with Reference, new proposed mitigation schemes associated with Allocations

Summary of Impacts

1.22 The analysis presented in this report concentrates on the cumulative strategic impact of the existing land supply and incrementally on top of that the PfE allocations. Site-specific observations are not the focus of this note as the outcomes associated with each individual development have been extensively reported within the Locality Assessment Reports.

1.23 It is also important to recognise the role of following NTEM trends (at this stage) which may not always align with Greater Manchester trends.

PfE Impacts on Travel Demand and Mode Share

1.24 Table 1.2 below summarises the strategic impacts for the PfE allocations:

- The PfE allocations contribute 2% of the 12% forecast overall Greater Manchester travel demand increase by all modes between 2017 and 2040. It is this addition of

trips to the strategic network that has an impact on journey times, highway congestion and public transport crowding particularly during the peaks;

- In terms of car travel demand, adding the PfE allocations would make up 2% of the projected 18% overall highway growth. For the existing land supply only, car travel demand growth is 16%, which is driven mainly by population increases and increase in car ownership;
- Public transport demand declines by around 5% by 2040 from 2017 levels with the existing land supply. This is mainly due to a continuing decline in bus travel, though both rail and Metrolink demand demonstrate expected increases to 2040. Again, note that only committed transport interventions are accounted for, so potential schemes to address this decline, such as bus reform, have not been considered. The decline in public transport demand reduces in the PfE allocations forecast to 4% by 2040 from 2017 as it includes mitigation schemes associated with the developments;
- Walk and cycle demand increases modestly. This does not, of course, take account of impacts of the current drive to improve walking and cycling across Greater Manchester or the impact of the role of TfGM's Streets for All approach [and the development of the Bee Network] which will see road space re-allocation for cycling and walking and a greater emphasis on 'place' in densely populated residential areas;
- In terms of mode share, these forecasts can be considered on the high end of highway demand (and the low end of public transport use) since no interventions beyond those committed have been considered in the reference scenario;
- PfE allocations, including local mitigations, are forecast to have a relatively low proportion of sustainable travel trips overall in this "policy-off" test. This, together with a declining NTEM trend for public transport, reduces the proportion of sustainable trips to 36% from the current 39%. There is variability across the

allocations; some will have a higher proportion of sustainable trips than this average figure.

Table 1.2 Summary of PfE Existing Land Supply and Allocation Impacts

Greater Manchester Metric	2017 Base	2040 S1 NTEM	2040 S2 Reference	2040 S2 Allocations with mitigation	2040 Reference to Allocations Difference
24hr Car Trips (000s)	5,955	7,101	6,916	7,045	+129 (+2%)
24hr Public Transport Trips (000s)	824	779	782	795	+13 (+2%)
24hr Walk & Cycle Trips (000s)	3,048	3,110	3,090	3,145	+55 (+2%)
Sustainable Mode Share	39%	35%	36%	36%	0%
CO_2 aggregate Emissions (2017=100)	100	104	91	94	+3 (+3%)
NOx aggregate Emissions (2017=100)	100	80	70	72	+2 (+3%)
24 hr Vehicle km	41,655	52,174	53,902	55,080	+1178 (+2%)
24 hr PT Passenger km	7,949	7,497	8,448	8,629	+181 (+2%)
AM peak Delay (secs/veh km)	67	89	96	100	+4 (+4%)
% of Metrolink & Rail trips standing	29%	22%	27%	27%	+0%

Difference to 2017 Metric	2040 S1 NTEM	2040 S2 Reference	2040 S2 Allocations
24hr Car Trips (000s)	19%	16%	18%
24hr Public Transport Trips (000s)	-5%	-5%	-4%
24hr Walk & Cycle Trips (000s)	2%	1%	3%
24 hr Vehicle km	25%	29%	32%
24 hr PT Passenger km	-6%	6%	9%
AM peak Delay (secs per veh km)	33%	43%	49%

PfE Impacts on Traffic Congestion and Bus Speeds

1.25 Traffic congestion is measured by the level of delays experienced across Greater Manchester. This has been measured as average delay per kilometre in the AM peak. This shows that:

- The PfE allocations increase average delays across Greater Manchester by 6% over and above that experienced from existing land allocations alone for 2040.
- While the overall network delay is 49% higher in 2040 than in 2017 for PfE allocations and 43% higher for existing land supply PfE, the average network speeds reduce to 49 km/hr (30 miles/hr). Bus speeds broadly follow the same decline in highway speeds.

1.26 Table 1.3 below shows what the changes in congestion mean for some sample routes into Manchester City Centre and for the M60. By 2040 in the reference scenario (i.e. without the allocation sites), the routes report a change in journey times ranging from 6 minutes on a 33 minute journey time between Bury and Manchester (a 6% increase) to 26 minutes on a 42 minute journey time clockwise part way around the M60 (a 62% increase). While the journey times vary in how they are affected, all journey times taken are forecast to increase.

1.27 When the allocation sites are added, almost all sample routes are forecast to either stay stable or increase in journey time. This is expected due to the fact the test increases the number of cars on the highway without allowing for the expected changes in travel patterns as a result of the delivery of Greater Manchester's 2040 Transport Strategy or its Right Mix approach. The journey time changes range from a 3 minute increase on the 36 minute journey time between Bury and Manchester and a 25 minute increase on the 42 minute journey time clockwise part way around the M60 (a 25% increase).

Table 1.3 Forecast Highway AM Peak Journey Time Changes for Selected Routes

Highway Journey Time Change by Route	2017 Base	2040 S2 Policy Off Reference	2040 S2 Policy Off Allocations with mitigation
Hazel Grove to Manchester	45 mins	51 mins (+6, +13%)	52 mins (+7, +16%)
Hyde to Manchester	28 mins	36 mins (+8, +29%)	36 mins (+8, +29%)
Mossley to Manchester	40 mins	50 mins (+10, +25%)	51 mins (+11, +28%)
Delph to Manchester	49 mins	53 mins (+4, +8%)	53 mins (+4, +8%)
Rochdale to Manchester	48 mins	54 mins (+6, +13%)	58 mins (+10, +21%)
Bury to Manchester	33 mins	35 mins (+2, +6%)	36 mins (+3, +9%)
Golborne to Manchester	38 mins	50 mins (+12, +32%)	51 mins (+13, +34%)
Altrincham to Manchester	38 mins	45 mins (+7, +18%)	43 mins (+5, +13%)
Manchester Airport to Manchester	21 mins	26 mins (+5, +24%)	27 mins (+6, +29%)
M60 Clockwise	42 mins	68 mins (+26, +62%)	67 mins (+25, +60%)

PfE Impacts on Rapid Transit and Rail

1.28 The demand reference forecast for public transport is a reduction of 5% from 2017 for all public transport modes combined. When the PfE allocations are included in the forecast the reduction is only 3%. This is a reflection of the current trend of decline in the bus market, although offset by an increase in both rail and Metrolink patronage for the future.

1.29 The overall impacts from 2017 to 2040 with PfE allocations include:

- Bus patronage declining by 18% from current (2017) levels;
- Metrolink patronage increasing by 43%, taking account of new trips on the Trafford Park Line and the extra capacity offered by the new trams on order; and
- rail patronage within Greater Manchester to increase by 26%, which takes account of extra capacity and new routes offered by the revised operator franchises in place pre-COVID.

1.30 Due to the large size of the bus market relative to metro and rail within Greater Manchester, it does mean that the overall net trend for public transport patronage is still downwards. It should be noted that Greater Manchester does have plans to address these issues and put together a comprehensive investment package that would significantly change this scenario, but it has not been considered in this series of tests as at the time of writing those interventions are still technically regarded as uncommitted and unfunded.

PfE Impacts on Transport Related Green House Gas Emissions

1.31 Impacts on pollution have been measured by the quantity of CO_2 and NOx emissions due to transport across Greater Manchester. As with all the other

metrics, emissions are presented for the whole of Greater Manchester as well as for each District and for defined sectors of Greater Manchester.

1.32 The assumptions include an assumed change in vehicle mix (although not efficiency of that fleet) that is published by DfT.

1.33 Across Greater Manchester this simplified forecast shows that by 2040 CO_2 emissions would decrease by 9% for existing land supply from 2017 levels. This changes to be only a 6% decrease when allocations are included. The reasons for this change relative to highway trips (highway trips are forecast to increase by 2%) is two-fold:

- The allocations generate longer distance car trips than average Greater Manchester trips due to their location; and
- Delay is additional to that caused in the reference scenario, and delay relationships are not linear, but increase as each unit is added.

1.34 NOx emissions are forecast to fall between the 2017 base and 2040 reference scenario by 30% due to the change in vehicle mix and impacts of improved car efficiency and increased prevalence of electric cars. This reduction falls to 28% when the allocation sites are considered.

1.35 Emission increases are noted to be highest for the Regional Centre and Town Centres around Greater Manchester. This is in line with forecast increased car and freight travel in these congested areas due to existing land supply.

Accessibility and Connectivity of PfE Allocations

1.36 The interaction between population, jobs and travel mode is a complex one. Overall reductions in journeys cost increase accessibility to jobs. Accessibility of jobs within Greater Manchester has been measured as the number of jobs within 45 minutes of public transport travel time.

1.37 This shows that:

- The current accessibility to jobs within Greater Manchester is 220,990 (the average number of jobs reachable within 45 min of PT from a location within Greater Manchester); and
- PfE allocations increase the accessibility to 222,110 – a modest increase of 0.5%

1.38 Although improvements of accessibility by public transport are only part of the picture, some focus on future public transport system accessibility helps identify opportunities for improving the proportion of sustainable mode journeys in future.

Strategic Road Network

1.39 A separate, parallel exercise is also underway in conjunction with Highways England to examine wider impacts on the strategic road network (SRN). This ongoing parallel exercise is investigating cumulative PfE impacts on the SRN mainline links and is expected to deliver key findings in late Summer 2021.

1.40 Further reporting will be provided to document the findings of this workstream.

Conclusions

1.41 In summary, it is clear that the existing land supply and the PfE allocations will present significant transport challenges that need to be planned for. The overall forecasts for congestion, crowding and emissions that are evident at the strategic level may require significant strategic interventions to mitigate negative impacts caused by the existing land supply and allocation sites.

1.42 Considering the existing land supply growth in the Reference scenario, this stage of work has not tested any proposed interventions beyond those

already committed and funded. It is unlikely that these schemes would be the sum effect of all transport interventions needed to provide for that growth, but the nature of those schemes is at present undetermined and therefore not available for inclusion in these scenarios. The impact of those transport interventions is likely to provide for a lower highway, more sustainable focussed future, and so some of the levels of congestion and delay reported may be considered as a high or worst case rather than a central expected forecast.

1.43 It is also important to note the difference in scale of demand change through time when comparing the PfE Existing Land Supply (NTEM based Reference scenario) to the additional demand created by the PfE allocations. PfE allocations contribute 2% of the total 18% car trip growth included in the forecasts covering a 23 year time period, with the other 16% being considered “business as usual” and accommodated within the existing land supply sites.

1.44 When considering the allocations test, these factors need to be kept in mind – noting that demand in the test is incremental to the “business as usual” existing land supply growth. Issues seen in the test may not necessarily be caused by the introduction of the PfE allocation sites, although in some cases exacerbating effects are likely to be observed.

1.45 The extent to which traffic increases caused by the introduction of the demand on allocation sites should be mitigated is for site promoters, districts and responsible agencies to decide, including whether the cost of those interventions is affordable and proportionate to their impact. The mitigations included in this test are considered to be essential, but further iterations may amend or add to this transport supply. Locality assessments are intended to assist in the documentation and resolution of these issues

based on these modelling scenarios and are considered in the Locality Assessment reporting.

1.46 No fixed thresholds have been set for what would describe tolerable impacts on the highway or public transport networks. The locality assessments have used a combination of industry best practice and professional judgement to determine which transport impacts are tolerable or otherwise.

1.47 That said, the forecasts reported in this document have been deliberately contextualised as high impact on the highway network in order to consider them a robust, or a worst case, scenario in the event of there being no transport mitigations being provided in advance of the assumed sites.

1.48 History suggests that Greater Manchester has provided options for sustainable modes of travel that prove to provide trip making on sustainable modes well above those suggested in previous central government forecasts. At this stage however, the potential interventions that would provide those solutions are not planned to a funding stage and are not pre-conditions for the release of allocation sites. Understanding the impacts of the allocation sites noted in this report will underpin the evidence that will bring those mitigations forward and in due course, further iterations of this report will include those revised assumptions. Until that point, the results presented in this report should be considered advisory.

2 Overview

Introduction and Background

2.1 Following the withdrawal of Stockport Council from the original Greater Manchester Spatial Framework 2020 (GMSF 2020) Joint Development Plan Document (Joint DPD) preparations, the nine remaining Local Authorities have agreed to use the GMSF as the basis for a new Places for Everyone Plan Joint DPD. This new plan been prepared on the basis that it will have 'substantially the same effect' as the PfE. Full details of the processes, dates of consultations and key decision meetings are set out in the Topic Papers.

2.2 The information within this strategic modelling technical note is a complete update of an earlier note prepared for the GMSF 2020. This update supersedes the original GMSF 2020 version.

2.3 This report discusses the likely impacts of the PfE Plan on the Greater Manchester transport system and the assumptions made to arrive at the forecast future travel demand, journey times and mode choices made within Greater Manchester. The key answer sought is whether the existing and proposed infrastructure could accommodate the proposed allocations.

2.4 The future year forecasts have been created using the Greater Manchester Variable Demand Model (GMVDM) – a multi-modal transport model built following the Department for Transport guidance set out in TAG Units M2, M3 and M4. This transport model provides estimates of future year transport demand as well as the estimates of travel behaviour changes and new patterns that the Plan is likely to produce. These include changes in choices of routes, travel mode, time of travel and changes in journey destinations for some activities such as work and shopping.

2.5 Details of the construction of the GMVDM (Greater Manchester Variable Demand Model) are contained in a separate document, this report focuses on testing impacts of the Plan, and on explaining evidence used, data sources and methodologies that have been applied to arrive at the forecasts that are based on both existing land supply and PfE allocations.

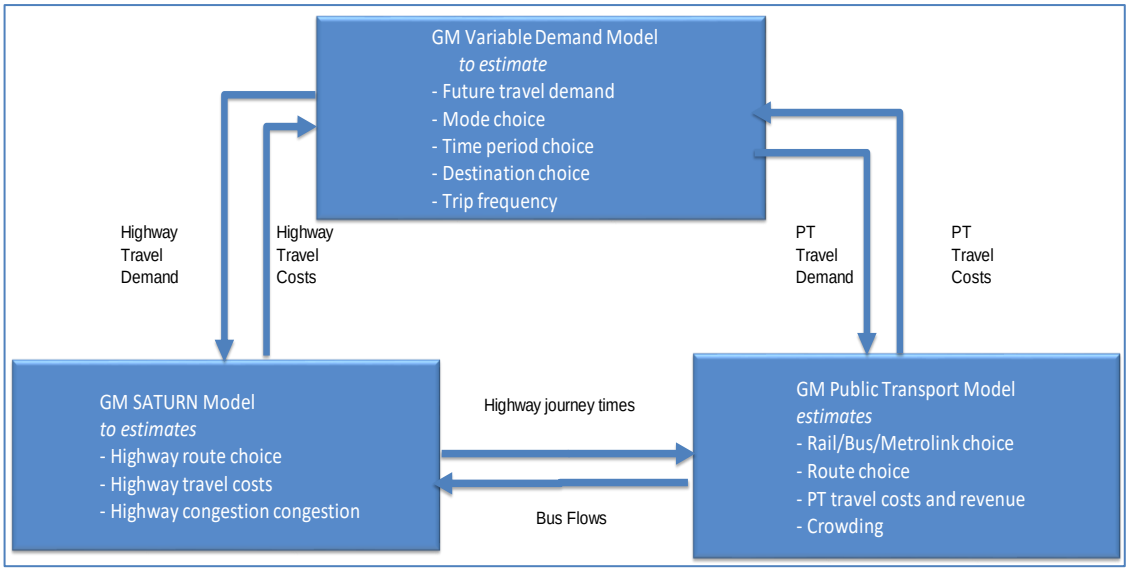
2.6 The report presents outcomes for two sets of forecasts: the first for existing land supply and the second includes allocations on top of existing land supply. The housing and commercial developments are countywide, and for existing land supply, travel demand growth is constrained to NTEM 7.2 projections, the nationally recognised growth estimates. Land allocations and developments in neighbouring counties are loosely represented within the NTEM factors used.

The Model Suite

2.7 As mentioned above, forecasting of travel demand for Greater Manchester is undertaken using the GMVDM that links a Voyager public transport assignment model (GMPTM), a SATURN highway model (GMSM), and bespoke application modules for demand model calculations.

2.8 Both GMSM and GMPTM can be used either in stand-alone mode (i.e. PT-only assignment setup or GMSM highway assignments) often useful in early stages of scheme development or for schemes with only local influence. However, for schemes whose impacts across Greater Manchester are more significant, the assignment models are then linked as part of the modelling system shown in Figure 2.1 below.

Figure 2.1 The Greater Manchester Modelling System



2.9 The transport models have a base year of 2017 and the variable demand model is constructed from GMPTM and GMSM assignment models that have been validated to data observed in 2017. The assignment models represent travel demand as origin-destination (OD) movements while the demand model works at production-attraction (PA) level and at 24hr level generally.

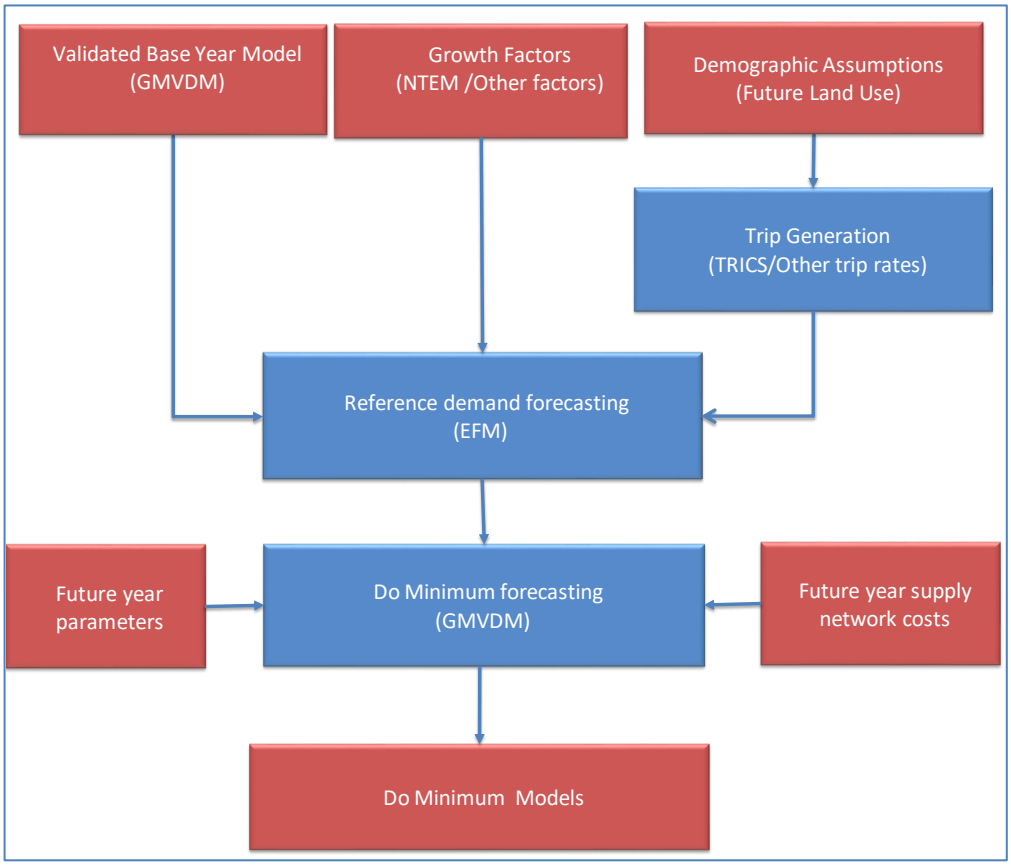
2.10 Therefore, carefully constructed processes are used to convert these data from OD format to a tour-based representation for home-based purposes. The forecast year models are for 2025 and 2040 and are constructed from the 2017 base year models with appropriate representation of expected changes in demand and supply over time applied. Details of these demand model processes are given in a separate GMVDM04 demand model report. In order to demonstrate that the starting point of the forecasts is robust, we present in Section 3 the level of validation in broad terms for the base year models.

TfGM's Approach to Strategic Modelling

2.11 The approach to forecasting at TfGM generally follows the Department for Transport guidance set out in TAG Unit M4 (May 2017) and is shown in

Figure 2.2 below. Trips associated with new developments are obtained by applying trip rates to floor space or number of dwellings. The process of adding these trips to validated base year demand to create forecasts can take one of several forms.

Figure 2.2 Outline Method for Producing Reference Forecasts and DMs



2.12 The approach normally selected for Greater Manchester forecasting is to add development trips to base year matrices and then apply background growth to the resulting matrix in a way that ensures that the resulting growth matches NTEM 7.2 growth forecasts. This means that trips associated with a particular development will be increased or reduced in the same manner as the rest demand in the forecasting sector. However, in order to assess the impact of the Plan (whose developments may not be included in national

forecasts), we have created a scenario where the PfE allocations are not constrained to NTEM.

2.13 In terms of future year interventions, we have included only schemes that satisfy DfT guidance conditions within the reference forecasts – near certain or more than likely.

The PfE Allocations Impact Model Test

2.14 An incremental two-stage approach has been adopted for forecasting the PfE impacts across Greater Manchester. As will be discussed in more detail later in this document, there are two future year scenarios that have been modelled in the context of providing evidence for the Plan – one builds on the other.

2.15 In addition, a standard NTEM 7.2 scenario has been carried out as this forms a useful comparator to understand some of the impacts of Scenario 2. The scenarios reported in this document are:

- Scenario 1 NTEM;
- Scenario 2 Policy Off Reference; and
- Scenario 2 Policy Off Allocations and with mitigation.

2.16 Scenario 2 Policy Off Reference provides an understanding of future transport conditions and contains land supply that is regarded as "Near Certain" or "More Than Likely" and transport intervention that are regarded as committed as per TAG Guidance (Section M4 "Forecasting and Uncertainty" https://www.gov.uk/government/publications/tag-unit-m4-forecasting-and-uncertainty). The "Policy" in this context refers to GM's 2040 Transport Strategy (https://tfgm.com/2040) - the fact it is referred to as "Off" indicates the interventions and subsequent assumed behavioural

change associated with the 2040 Transport Strategy is not assumed in these forecasts.

2.17 Scenario 2 Policy Off Reference is produced by adding trips generated by existing land supply to the base model and applying factors to the result in order to bring the overall growth in trips to levels projected in NTEM 7.2 at a sector level (see paragraph 4.22). This consequently forces compliance to NTEM trends, mode shares for example, which are not always in line with observed trends for some parts of Greater Manchester.

2.18 The Scenario 2 Policy Off Reference demand, together with future committed transport interventions, forms the input to the variable demand model which, in turn, adjusts the demand to take account of network congestion and crowding. Therefore, trip totals and mode splits that we start with are modified to those that the supply network will actually accommodate. This outturn of the Scenario 2 Policy Off Reference run will be called the **"Do Minimum"** in the sections that follow.

2.19 The Scenario 2 Policy Off Allocations With Mitigation scenario adds the allocation site development trips on top of the Reference trips – the assumption being that PfE allocations are not actually included in national growth forecasts because of their very early stage of development. It is an incremental test.

2.20 In order to understand the maximum transport capacity demands of these allocation developments, the associated trips are only constrained by network supply and not demand growth factors. Once the additional trips associated with the PfE allocations have been added to the outturn Do Minimum matrices, GMVDM is used to allow the demand to respond to any changes in travel costs associated with these additional trips and/or the associated additional transport supply. We will often refer to the Scenario 2

Policy Off Allocation With Mitigation incremental test outturn as the **"Do Something"**.

2.21 The strategic outputs from the Do Something have also been used for further assessment of each allocation within the Plan (as per the Locality Assessment process, described later in Chapter 7) and to provide input to pipeline intervention business cases that are required to support the allocations.

2.22 The Do Something With Mitigation scenario incorporates the various transport interventions and mitigation measures considered necessary to bring the allocations forward. (Further details of this scenario can also be found in Chapter 7).

2.23 For the forecasting processes to deliver robust results, a well-validated base year model is essential. In the section that follows we present some evidence to confirm that this is the case and that forecasts developed from the Greater Manchester validated base models can be relied upon.

2.24 The initial Do Something runs contained only the minimum highway and public transport provision to include the allocations within the model. The results of this first iteration were used to inform a list of essential interventions that were needed for the allocation to be delivered. These essential interventions were then included in the model. Results from this set of model runs was then used to check for the need for further mitigation schemes with flows being extracted from the strategic model and used in more detailed local junction models. The local junction models were used to devise and test highway mitigation schemes, with these schemes then being included in the next iteration of the strategic model. This process allowed the wider impacts of mitigation measures to be captured in the strategic model, so that checks could be done to ensure that the schemes did not create a need for further mitigation measures in other parts of the network. In reality

we would expect these runs to overstate the traffic impacts of the Allocations as they do not take account of the introduction of Greater Manchester's policy proposals set out in the 2040 Transport Strategy.

2.25 The strategic modelling took place over the course of a year. During this time various assumptions relating to different allocations and their mitigation measures were changed and refined. In order to make efficient progress across all allocations, different model runs were used at various stages. It should be noted that the different allocations and other interested parties, such as Highways England, have been provided with data from the earliest, most appropriate model runs available. Where significant differences between model runs have arisen, efforts have been made, and will continue to be made, to ensure that the most appropriate model run data is used to assess impacts on the transport network across the different areas of Greater Manchester.

3 Calibration and Validation of Base Models

Introduction

3.1 This section summarises the base year highway and public transport model validation to provide confidence that these models are a valid position from which to pivot in forecasting.

Overview

3.2 The base transport models broadly reflect movements within Greater Manchester made by Greater Manchester residents and those within the neighbouring counties; and movements for freight. Table 3.1 below shows the total population, household and jobs that currently act as productions and attractions for journeys within Greater Manchester. The existing land supply assumptions together with allocations suggest significant changes to households and employment growth which will, in turn, impact the number of trips made with Greater Manchester.

Table 3.1 The Greater Manchester 2017 Base Model Summary Metrics

Metric	2017 Base
Population	2.7m
Households	1.15m
Employment	1.32m
Daily car trips	5.95m
Daily public transport trips	0.87m
Walk and cycle trips	3.05m
Average car trip length	11.70km

3.3 The base model represents a validated 2017 base for supply and demand and shows a good match between observed and modelled metrics such a trip volumes and journey times. LMVRs (Local Model Validation Reports) exist for

GMSM and GMPTM that outline this level of validation and may be presented as part of the final evidence material.

3.4 The base modelling system includes GMSM and GMPTM together with GMVDM, the demand model. In terms of travel demand for the components of the modelling system we have the following:

- Public transport demand matrices that were developed in 2017 for the Manchester Airport Terminal 2 Metrolink business case from the most current data sources including county wide ticket sales data for rail and Metrolink, and the bus continuous passenger sampling survey;
- Highway matrices that were updated for the Manchester Airport Terminal 2 Metrolink business case, but were revalidated across the county to represent the 2017 base year;
- Walk and cycle matrices in the demand model prepared during Trafford Park Metrolink Line business case. These are PA matrices, and currently the model does not generate origin to destination flows from these matrices, but are there to ensure that the overall trip totals in the transport model are broadly consistent with NTEM.

Assignment

3.5 The base model assignments reflect assumptions made in GMSM and GMPTM where route choice is based on the relative generalised costs in the network.

3.6 Highway route choice in the highway network model, GMSM, is decided by generalised cost between origins and destinations based on the highway route options available. These routes and their relative attractiveness are influenced by factors such as capacity and flow where busier routes offer

higher generalised costs. There are five user classes in the highway demand assignments that represent:

- Car commute;
- Car employer's business;
- Car other purpose;
- Light goods vehicles; and
- Other goods vehicles (including heavy goods vehicles).

3.7 Each user class is assigned with their own demand matrix with characteristics unique to that class that represent their impact on the highway network and their relative priorities between speed and distance to reach their destination.

3.8 As there are no user class matrices for bus, rail and Metrolink in the public transport network model, GMPTM. Public transport sub-mode choice is carried out by available options for each trip as represented within GMPTM. Each sub-mode has individual characteristics based on observed use that reflect their relative level of attractiveness to each other. The primary modal parameters are in-vehicle time weighting and a boarding penalty applied to bus trips. These elements determine the representation of PT mode choice.

3.9 More detail of the assignment methods and parameters are given in the highway and public transport local model validation reports.

Boarding and Alighting validation

3.10 In terms of annual patronage for the PT sub-modes Table 3.2 below shows comparisons against observed values.

Table 3.2 2017 Base Model Comparison to Annual Patronage

Mode	Modelled Annual Boardings within Greater Manchester (millions)	Observed Annual Values (millions)	% Difference
Bus	192	197	-3%
Rail	62	54	15%
Metrolink	40	41	12%
All Public Transport	300	292	3%

3.11 More detailed validation data for the base model can be found in the respective supply model validation reports and we do not intend to provide further details in this document.

3.12 The broad comparisons in Table 3.2 together with the base model statistics presented in the PT and highway LMVR confirm that the base model is a suitable basis for forecasting – that the model suite represents an accurate reflection of the transport network at a strategic level.

4 Future Year Scenarios – Scenario Definition

Introduction

4.1 This section summarises the input assumptions and techniques used to generate the future year scenarios modelled in GMVDM.

4.2 As already indicated in Section 2 above, there are three future year scenarios that have been modelled in the context of providing evidence for the Plan. These include:

- Scenario 1 NTEM;
- Scenario 2 Policy Off Reference; and
- Scenario 2 Policy Off Allocations with mitigation.

4.3 It is not intended to report on Scenario 1 NTEM in any detail in this report as it is not the focus of the model tests. Details and metrics have been provided solely to provide context for the Scenario 2 Policy Off Reference data.

4.4 Internally, this latest round of modelling is referred to as the "fifth round" of GMSF / PfE strategic modelling.

Forecast years

4.5 The base year for the model is 2017. Two forecast years were agreed for development of evidence for the allocations. The forecast years are 2025 and 2040. Land use within the existing land supply and PfE allocations are profiled into the two forecast years as per their respective trajectories as defined in the dataset received by TfGM from the GMCA on the 16th of April 2019 for the existing land supply and 3rd March 2021 for the PfE allocations.

4.6 Growth is implicit between 2037 and 2040 in the NTEM forecasts that the model is constrained to, but that growth is applied only to the existing land

supply and allocations to 2037. Land use trajectories beyond 2037 are not considered in these forecasts.

Assignment parameters

4.7 Assignment parameters, including values of time and vehicle operating costs, were created according to the future years to take account of changes in overall perceived costs. These parameters are given in Appendix B. The parameters were calculated using the DfT's Transport Analysis Guidance (TAG) databook.

Trip Generation and Trip Rates

4.8 Key inputs to the GMVDM (Greater Manchester Variable Demand Model) are estimates of future year travel matrices that reflect proposed trip generation at individual allocations and are constrained to exogenous growth forecasts, e.g. from the DfT National Trip End Model (NTEM), in the absence of future changes in travel cost. It is the function of the GMVDM to adjust those initial estimates of future year travel matrices to reflect changes in travel cost such as increased traffic congestion, changes in vehicle operating costs or public transport fares. The initial estimates of future year travel matrices are derived in the component of the model referred to in Figure 2.2 as "Reference Demand Forecasting (EFM)". EFM stands for External Forecasting Model or Exogenous Forecasting Model. Estimates of trip generation at the home and employment end of trips are derived for the new individual allocations by applying trip rates associated with the developments particular land use type, its size or quantum and location (town centre or non town centre). These trip generation estimates are specified by mode, purpose and time period. The model applies purpose splits to the trip generation based on the land use type.

4.9 The following levels of segmentation apply for time period and mode:

- Morning peak (0700hrs to 1000hrs); Inter-peak (1000hrs to 1600hrs); Evening peak (1600hrs to 1900hrs); and Off-peak (1900hrs to 2300hrs). The trip rates determine time period split for trips.
- Car occupant; public transport; and walk/cycle (no differentiation is made between walk and cycle).
- The mode split for development trips is fixed by the trip rates used and informed by whether the site is located in the urban area or not.

4.10 It is important to note that although trip rates fix the mode split, time period and purpose splits for generated trips, the reference matrix is adjusted by the demand model based on the change in the costs of travel between the base year and future year. For example, where access to a certain zone is particularly congested, demand will be reduced due to the increase in travel costs.

4.11 The adopted trip rates have been independently verified as being fit for purpose as part of the locality assessment process. Future consideration of the "Policy On" scenario will require a further review of these trip rates and, potentially, significant alterations to these. The TRICS Guidance Note "Changes in Travel Behaviour" issued in July 2019 responds to the fact that a range of evidence sources suggest that there has been a substantial change in travel behaviour, with increases in online shopping, rail travel and levels of cycling and walking, and decreases in private car trips, commuting trips and socio-economic conditions affecting travel choices. It recognises that these factors are likely to mean that there is a change in travel behaviour at a local level and these changes need to be reflected in the analysis of trip generation for local development proposals. Such an approach supports the 'vision and validate' approach to planning adopted by the 2040 Transport

Strategy and is likely to mean that the adoption of the trip rates adopted as part of the locality assessment process may overstate the actual travel demand likely to be experienced on Greater Manchester's highway network.

Trip Distribution

4.12 Site trips are generated without any indication of the corresponding origins/destinations. In practical terms, there are three methods for determining the trip distribution for new sites. These include:

- Application of gravitation models – a purely mathematical "best guess" that is based on generalised costs to the new development from across the model area;
- Cloning the distribution from nearby model zones with similar land use characteristics. This is best used where an existing land use is being extended, for example. The patterns of origins and destinations for the existing land use would then be most relevant;
- Applying district/sector trip distributions. Larger areas in which a new development lies may be used to determine where new trips originate or end up for each of the time periods.

4.13 For both the Do Minimum and Do Something scenarios, we have assumed that new trips adopt trip distributions that characterise the Greater Manchester sectors in which the developments lie. A description of the 12 sectors is given at paragraph 4.22, but it suffices to point out that the size of the sectors is large enough to provide sensible trip distributions for new trips across Greater Manchester. It is important to note that the trip distributions are cloned separately for each purpose, so for example only the distribution of existing commute trips is used to distribute commute trips associated with a new residential development. This ensures that those commute trips

generated are distributed to zones to which people currently travel to for work.

Treatment of Freight within the scenarios

4.14 Future year freight matrices for the Do Minimum are derived by applying factors to the base year freight matrices. The factors are taken from DfT's National Road Traffic Forecasts (NRTF) and reflect differential growth rates for light and other goods vehicles. Additional trips have been added to the matrices in Do Something scenarios to reflect trips that will be made to and from warehousing associated with new allocations. These additional trip ends are derived using a similar method to that used for estimating new person trips associated with new allocations, by applying appropriate trip rates to the proposed quantum of floorspace.

Public Transport Fares

4.15 Public Transport fares have been assumed to increase at 1% above inflation for all years between 2017 and 2040 in line with central and local policy. Inflation is set at the Retail Price Index (RPI).

The Land Use Dataset and the Treatment of Certainty

4.16 The future year land use dataset was received by TfGM on 16 April 2019. It is important to understand that it consists of two definitions of land use that relate to certainty of implementation: "existing land supply" and "allocations".

4.17 The sites referred to as existing land supply have been identified through the "Strategic Housing Land Availability Assessment" (SHLAA) process within each local planning authority across Greater Manchester. For this reason, they are considered to be either "near certain" or "more than likely" as relates to TAG certainty definitions and so are included in the Do Minimum forecast. There are over 5,000 sites across Greater Manchester identified

under this definition, including the existing land supply data for Stockport which was included to ensure that Stockport existing land supply was represented in the model.

4.18 The sites referred to as allocations are sites brought forward by districts for consideration under the Draft PfE and are added to the "Do Minimum" to become the "Do Something" test. There were 38 allocations identified under this definition which were expected to be developed, either in full or in part, prior to 2037.

4.19 It is the difference between the "Do Minimum" and "Do Something" that represents the impact of the addition of these sites to the Greater Manchester transport network.

4.20 DfT categorisation for certainty is given in Appendix B. The locations of existing and PfE allocations is given in Figure 4.1 below. Existing land supply sites are spread across the existing urban areas in Greater Manchester, including in the Regional Centre and town centres. As the PfE allocations have been identified to meet housing and employment need which can't be accommodated within the available existing land supply, these sites tend to be on the periphery of the existing urban area. Further details on the spatial options and site selection process is available in the "Places for Everyone 2021 Growth and Spatial Options Paper" and "Places for Everyone 2021 Site Selection Background Paper" https://www.greatermanchester-ca.gov.uk/placesforeveryone

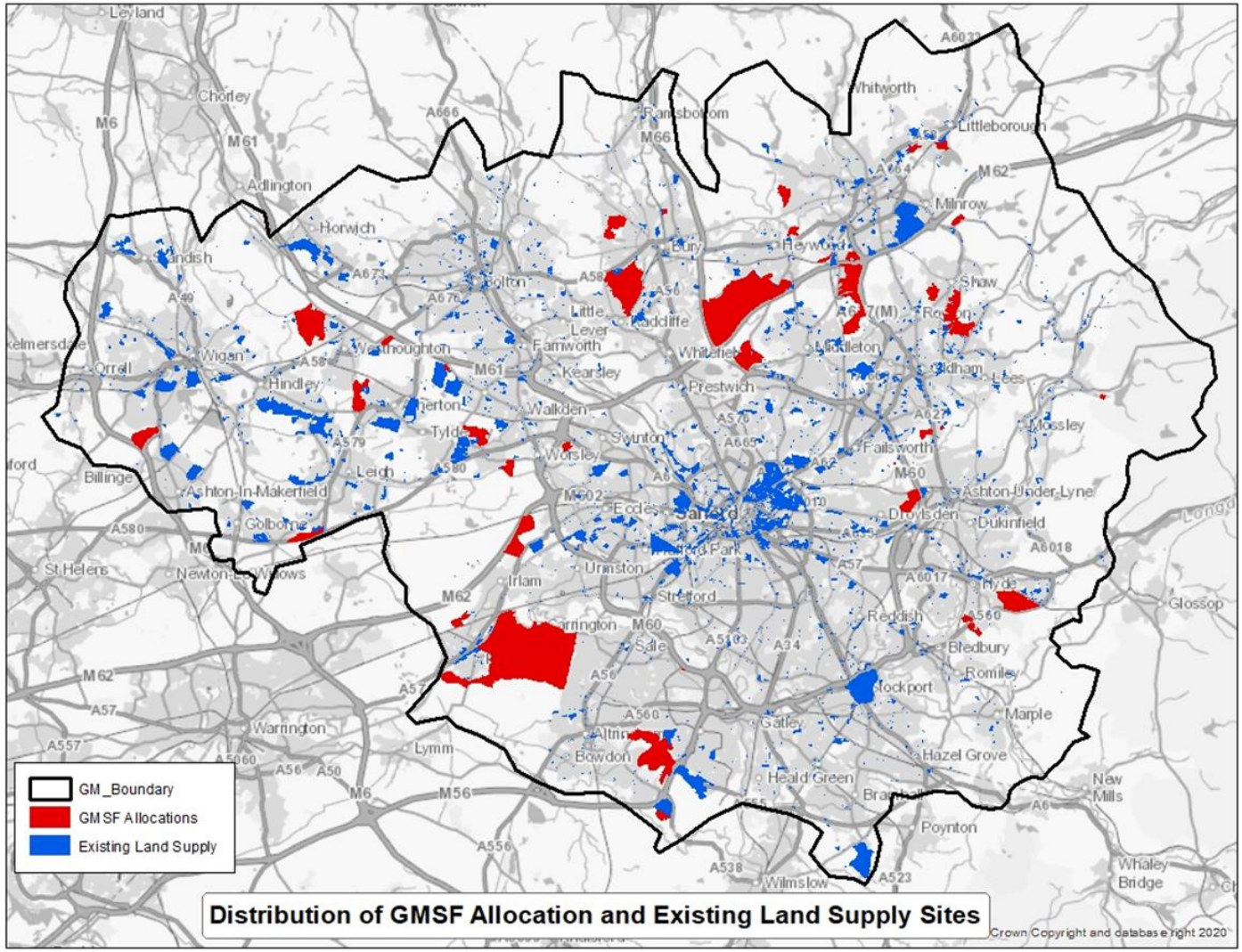
4.21 The following 38 allocations were included in the strategic modelling:

PFE 2021 Policy number	PfE 2021 Allocations
JPA1.1	Heywood / Pilsworth (Northern Gateway)

PFE 2021 Policy number	PfE 2021 Allocations
JPA1.2	Simister and Bowlee (Northern Gateway)
JPA2	Stakehill
JPA3.1	Medipark
JPA3.2	Timperley Wedge
JPA4	Bewshill Farm
JPA5	Chequerbent North
JPA6	West of Wingates / M61 Junction 6
JPA7	Elton Resevoir
JPA9	Walshaw
JPA10	Global Logistics
JPA11	Southwick Park
JPA12	Beal Valley
JPA13	Bottom Field Farm (Woodhouses)
JPA14	Broadbent Moss
JPA15	Chew Brook Vale (Robert Fletchers)
JPA16	Cowlishaw
JPA17	Land south of Coal Pit Lane (Ashton Road)
JPA18	South of Rosary Road
JPA19	Bamford / Norden
JPA20	Castleton Sidings
JPA21	Crimble Mill
JPA22	Land north of Smithy Bridge
JPA23	Newhey Quarry
JPA24	Roch Valley

PFE 2021 Policy number	PfE 2021 Allocations
JPA25	Trows Farm
JPA26	Land at Hazelhurst Farm
JPA27	East of Boothstown
JPA28	North of Irlam Station
JPA29	Port Salford Extension
JPA31	Ashton Moss West
JPA32	Godley Green Garden Village
JPA33	South of Hyde
JPA34	New Carrington
JPA35	M6 Junction 25
JPA36	North of Mosley Common
JPA37	Pocket Nook
JPA38	West of Gibfield

Figure 4.1 The locations of existing and PfE allocations*



*for final allocation boundaries refer to the PfE allocations map and policy documents.

Forecasting Sector System

4.22 The model area has been divided into 12 sectors that reflect common economic characteristics within them. See Figure 4.2 below. The Regional Centre, a rapidly growing employment area, is one of those sectors and covers the area from Etihad Campus to Salford Quays with probably the most variation in land use of all the sectors. The PfE Sectors are defined in the GM VDM 378 zone system.

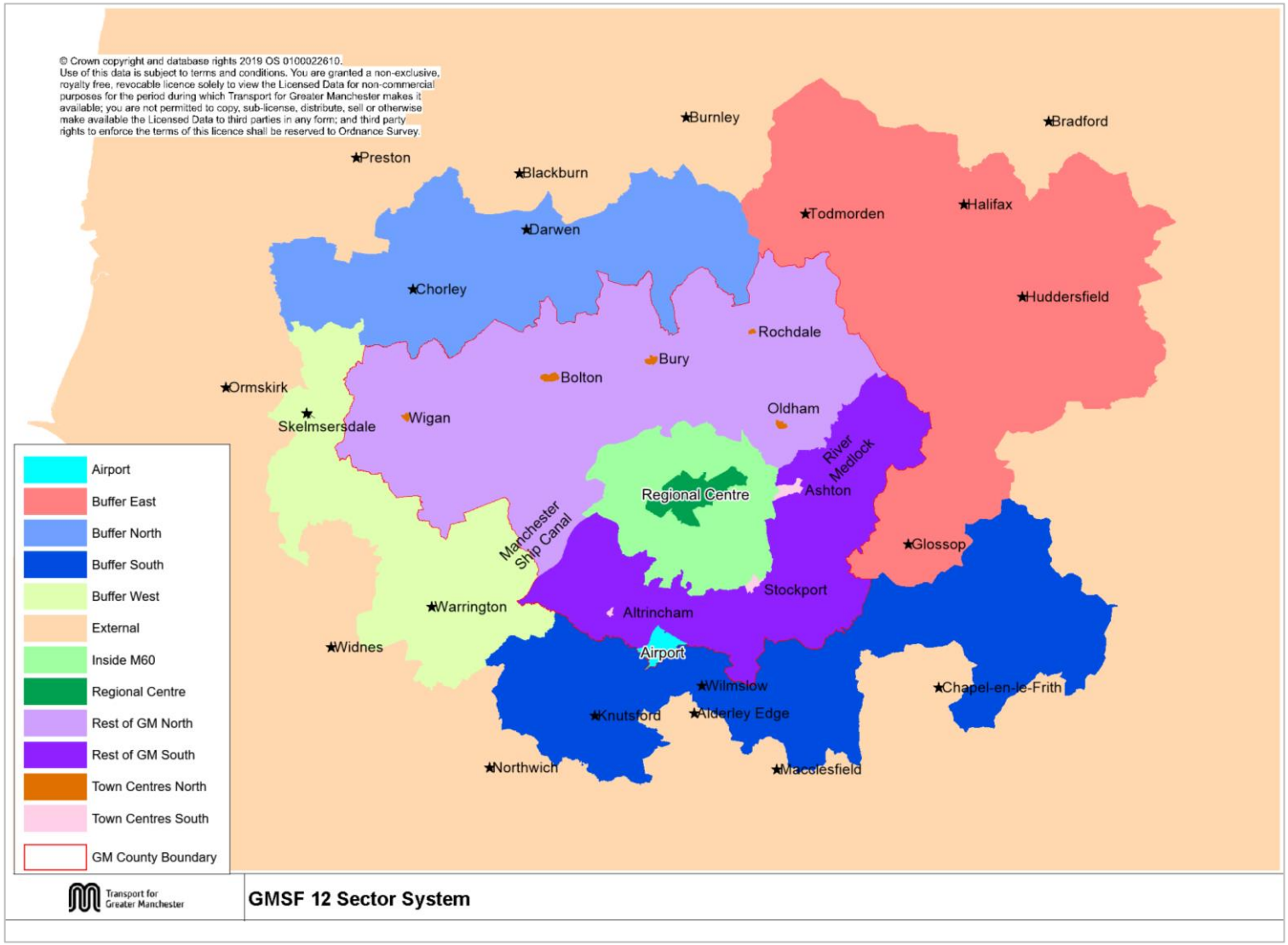
4.23 The 12 sectors are:

- Regional Centre (matched as closely as possible within the GMVDM zone system to the Greater Manchester Strategy definition);
- Town Centres North (a single sector consisting of Wigan, Bolton, Bury, Oldham, and Rochdale);
- Town Centres South (a single sector consisting of Ashton, Stockport, and Altrincham);
- Manchester International Airport (including developments in the immediate vicinity such as Airport City);
- All other areas inside the M60;
- Rest of Greater Manchester North (any area outside the M60 and not in Town Centres North);
- Rest of Greater Manchester South (any area outside the M60 and not in Town Centres South or Airport);
- Outside Greater Manchester Buffer East;
- Outside Greater Manchester Buffer South;
- Outside Greater Manchester Buffer West;

- Outside Greater Manchester Buffer North; and
- External (all areas in Great Britain outside the other 11 sectors).

4.24 The external buffer areas extend approximately 30km from the Greater Manchester county boundary.

Figure 4.2 The GMVDM 12-Sector System



The National Trip End Model (NTEM)

4.25 NTEM (otherwise referred to as TEMPRO, the Trip End Model Presentation Program) is a national forecast that ensures that measures of population, jobs and trips made by various mode are consistent across the whole of Great Britain. Data is currently provided at MSOA level and does allow for local comparison and validation. Data sources and forecasting methods in NTEM are well established, and the DfT always advise that in transport forecasting there should always be a scenario that is constrained to NTEM growth rates.

4.26 NTEM uses forecasts of population, employment, GDP and car ownership to forecast trip ends by mode, purpose, time of day and household car availability. These forecasts are used to calculate growth rates from base year to future year which can then be used to control the growth in the matrices used in GMVDM.

4.27 The version of NTEM used for these model runs is 7.2 and was published in March 2017 by DfT. It is the most recent version of NTEM available at the time of publication.

4.28 Greater Manchester NTEM 7.2 population and employment projections are given in Table 4.3 below. Inevitably local observations and projections, such as those in the Greater Manchester Forecasting Model (GMFM), may differ to some extent as they tend to use more recent data. However, NTEM projections link and balance with other areas outside of Greater Manchester and allow consistency across GB.

4.29 The DfT's TAG guidance indicates that when modelling for business cases for submission to the Department for Transport, scenarios assuming central growth in demand such as our Scenario 2 Policy Off Reference must be

controlled to the growth in travel demand in the NTEM dataset at an appropriate spatial area.

4.30 In order to arrive at factors that uplift base year demand to future years, NTEM growth expressed at MSOA level, has been aggregated up to the 12-sector level described above, allowing NTEM growth factors to be developed for each sector. Trips generated by existing land supply and allocations that are added to the base demand, are then scaled to match NTEM growth factors for each forecasting sector to produce the input matrices for the Do Minimum.

4.31 It should be noted that comparisons between NTEM 7.2 and GMFM Reference cases have shown that population projections are very similar, but that GMFM employment projections are noticeably higher. Should a forecast be generated based on a GMFM reference case, it is expected that a different pattern of trip making would be observed than that presented in the forecasts reported in this document.

4.32 It should also be noted that NTEM forecasts (to 2040):

- An 11% increase in population but an 18% increase in the number of households, leading to a reduction in the average household size;
- A 9% increase in workers, implying an increase in workers broadly in line with the population increase over time;
- An increase in jobs in the Regional Centre in line with that of the rest of the county – both observed local trends and forecast land supply indicate this is unrealistic and will underestimate trips to the Regional Centre;
- A growth rate at the airport significantly lower than its own published forecasts;

- That car ownership is expected to increase significantly, which implies a much higher trip rate in cars than at present; local and national trends indicate that license holding may actually be decreasing, especially amongst the young.

4.33 Therefore, it should be understood that tested scenarios that broadly follow NTEM projections for Greater Manchester have their weaknesses in terms of local detail. However, NTEM forecasts have been used for consistency with current TAG guidance.

Table 4.1 NTEM 7.2 Projections for Greater Manchester

Metric	2017	2025	% Change from 2017	2040	% Change from 2017
Total Population (000s)	2,709	2,820	4%	3,003	11%
Total Households (000s)	1,180	1,255	6%	1,391	18%
Average Household Size	2.30	2.25	-2%	2.16	-6%
Total workers (000s)	1,286	1,328	3%	1,405	9%
Total jobs (000s)	1,356	1,382	2%	1,441	6%
Regional Centre - jobs (000s)	190	193	2%	202	6%
% of GM jobs in Regional Centre	14%	14%	0%	14%	0%
Number of jobs Town Centres North (000s)	18	18	2%	19	6%
% of Greater Manchester jobs in Town Centres North	1%	1%	0%	1%	0%
Number of jobs Town Centres South (000s)	20	21	2%	22	6%
% of Greater Manchester jobs in Town Centres South	1.5%	1.5%	0%	1.5%	0%
Number of jobs for Airport (000s)	37	38	2%	38	3%
% of Greater Manchester jobs at Manchester Airport	2.7%	2.7%	0%	2.6%	-4%
Daily trip attractions to Manchester Airport (000s)	60	63	5%	67	13%
Jobs / worker in Greater Manchester	1.05	1.04	-1%	1.03	-2%
Car Ownership / Number of cars in Greater Manchester (000s)	1,262	1,393	10%	1,661	32%

Controlling Forecast Demand to NTEM

4.34 For the two ”Do Minimum” scenarios (i.e. Scenario 1 NTEM and Scenario 2 Policy Off Reference), demand growth for each of the future years has been constrained to NTEM 7.2 at PfE forecasting sector level.

4.35 For the “Do Something” scenario, this is an incremental test from the Scenario 2 Policy Off Reference and the PfE land allocation trips are additional to the reference scenario and are not constrained directly to NTEM.

4.36 Summaries of the developments that make up the two scenarios are presented below together with the total number of trips that are generated for each District. For more details of the Uncertainty Logs for each of the scenarios, the relevant technical notes should be consulted.

Existing land supply by District

4.37 The Scenario 2 Policy Off Reference is a forecast that applies growth to the sites specified in the existing land supply dataset. A summary by district of the developments in the existing land supply dataset is shown in Tables 4.4 and 4.5 below.

Table 4.4 Summary of existing land supply by District (2017 to 2025)

District	Dwellings	% by District	Office, Industrial & Warehousing (sqm)	% by District
Bolton	5,856	6%	287,048	11%
Bury	2,618	3%	45,961	2%
Manchester	30,607	32%	1,096,659	41%
Oldham	4,363	5%	220,188	8%
Rochdale	6,177	7%	281,787	11%
Salford	20,639	22%	269,642	10%
Stockport	5,031	5%	110,739	4%
Tameside	3,583	4%	58,737	2%
Trafford	6,285	7%	224,552	8%
Wigan	9,702	10%	74,352	3%
Total GM	94,859	100%	2,669,666	100%

Table 4.5 Summary of existing land supply by District (2017 to 2040)

District	Dwellings	% by District	Office, Industrial & Warehousing (sqm)	% by District
Bolton	12,321	7%	415,545	8%
Bury	4,417	2%	84,589	2%
Manchester	56,474	31%	1,896,163	35%
Oldham	10,765	6%	220,188	4%
Rochdale	10,047	6%	521,306	10%
Salford	35,914	20%	750,217	14%
Stockport	11,078	6%	171,185	3%
Tameside	7,139	4%	167,445	3%
Trafford	12,923	7%	903,325	17%
Wigan	20,058	11%	301,942	6%
Total GM	181,135	100%	5,431,905	100%

Existing land supply Trips by District

In terms of trips, housing sites are trip producers and employment sites are trip attractors. Different trip rates are applied to the dwellings and floorspace figures based on the land use type and location of the development, to generate departure and arrival trips for each site by time of day. These totals are presented by district in Table 4.6. As would be expected, there is correlation between the two tables, i.e. the districts with more dwellings and floorspace have higher levels of new trips.

Table 4.6 Scenario 2 Policy Off Reference: existing land supply generated trips (all modes)

District	New Trips 2025	% by District	New Trips 2040	% by District
Bolton	39,660	7%	75,746	7%
Bury	14,195	2%	26,652	2%
Manchester	259,831	43%	455,623	40%
Oldham	34,924	6%	59,658	5%
Rochdale	40,677	7%	71,050	6%
Salford	89,766	15%	184,371	16%
Stockport	28,884	5%	55,153	5%
Tameside	18,518	3%	38,826	3%
Trafford	29,278	5%	80,076	7%
Wigan	44,725	7%	98,214	9%
Total GM	600,459	100%	1,145,369	100%

4.38 As can be seen in Table 4.7 below, for Scenario 2 Policy Off Reference, around 30% of new trips are walk/cycle trips; 9% are public transport trips and 60% are car trips. The largest trip generators are developments in Manchester, Salford and Wigan for Policy-Off Reference, and from these, we have a high level of sustainable trips generated (around 40%). See Table 4.7 below. As will be seen later, the same is not true for PfE allocations that make up the Plan. This is due to the difference in locations, with a significant

number of the ELS sites being in town centres or the regional centre, which have lower car trip rates. This is evident from Figure 4.1.

Table 4.7 Existing land supply mode splits (departures)

	Highway	Public Transport	Walk/ Cycle	Total Trips	% Sustainable
Existing land supply trips at 2025	358,699	57,241	192,481	608,422	41%
Existing land supply trips at 2040	703,815	104,794	351,953	1,160,561	39%

Sustainable modes in this context means non-car trips, as referenced in the 2040 Transport Strategy.

Allocations by District

4.39 Tables 4.8 and 4.9 below show the size and type of developments proposed in the 38 allocations that are tested in Scenario 2 Policy Off Allocations. Allocations for 2025 that are shown in Table 4.8 were developed from trajectory information provided with the 2021 consultation dataset.

Table 4.8 PfE Allocations by District 2025

District	Dwellings	% by District	Office, Industrial & Warehousing (sqm)	% by District
Bolton	0	0%	187,666	77%
Bury	20	2%	-	0%
Manchester	16	2%	-	0%
Oldham	143	15%	27,720	11%
Rochdale	407	43%	-	0%
Salford	80	8%	-	0%
Stockport	0	0%	-	0%
Tameside	0	0%	-	0%
Trafford	279	30%	-	0%
Wigan	0	0%	27,871	11%
Total GM	945	100%	243,257	100%

Table 4.9 PfE Allocations by District 2040

District	Dwellings	% by District	Office, Industrial & Warehousing (sqm)	% by District
Bolton	0	0%	486,000	22%
Bury	4,025	19%	350,000	16%
Manchester	24	0%	111,000	5%
Oldham	2,337	11%	27,720	1%
Rochdale	4,681	21%	500,000	22%
Salford	1,500	7%	320,000	14%
Stockport	0	0%	-	0%
Tameside	1,558	7%	160,000	7%
Trafford	5,677	26%	92,160	4%
Wigan	1,600	7%	200,500	9%
Total GM	22,142	100%	2,247,380	100%

Table 4.10 Scenario 2 Policy Off Allocations: allocation generated trips (departures only)

District	New Trips 2025	% by District	New Trips 2040	% by District
Bolton	8,430	59%	21,507	12%
Bury	93	1%	25,069	14%
Manchester	74	1%	12,602	7%
Oldham	1,921	14%	11,827	7%
Rochdale	1,850	13%	35,032	19%
Salford	372	3%	21,038	12%
Stockport	0	0%	0	0%
Tameside	0	0%	14,141	8%
Trafford	1,206	8%	27,627	15%
Wigan	254	2%	12,272	7%
Total GM	14,201	100%	181,116	100%

4.40 Table 4.10 shows that the majority (92%) of generated trips occur between 2025 and 2040 rather than before 2025.

4.41 Input mode splits for trips generated by PfE land allocations are reported in Table 4.11 below.

Table 4.11 PfE Allocations Trip Generation by Mode (departures only)

Year	Highway	Public transport	Walk/cycle	Total trips	Sustainable %
2025	12,805	132	1,263	14,201	10%
2040	152,838	4,100	24,177	181,116	16%

Sustainable modes in this context means non-car trips, as referenced in the 2040 Transport Strategy.

4.42 Around 13% of allocation trips are walk/cycle trips; 2% are public transport trips and 85% are car trips. The low level of sustainable trips generated (around 15%) reflects the nature and location of the PfE allocations where public transport provision is lower than in established higher density urban areas.

4.43 Any schemes intended to facilitate the allocations will of course need to consider the nature of location of individual sites and the preference of mode for trips to such sites. As the PfE allocations have been identified to meet housing and employment need which can't be satisfied within the existing land supply in the existing urban area, the allocation sites tend to be on the periphery of the existing urban area where the public transport and active mode trip rates used are lower and lead to the lower sustainable mode share.

Committed Network Supply

4.44 Tables 4.12 and 4.14 below show major transport interventions that are regarded as funded and committed at the time of specifying the model runs, around summer 2020. These lists are not comprehensive.

4.45 In the interest of clarity, Tables 4.13 and 4.15 are included to show some proposed transport interventions that TfGM regarded as not committed at the time of reporting. These lists are not comprehensive.

4.46 Modelled supply changes between scenarios and forecast years to reflect that different schemes are assumed to be delivered by 2025 and 2040. Schemes considered necessary to enable the development of an allocation or to mitigate its impacts have been included in the Allocation scenarios only.

Table 4.12 Major Committed Highway Schemes

Scheme	2017 Base	2025 Reference forecasts	2040 Reference forecasts	2025 with Allocations	2040 with Allocations
A556 Knutsford to Bowdon Improvement	✓	✓	✓	✓	✓
Metrolink Second City Crossing	✓	✓	✓	✓	✓
Bus Priority Packages (Cross City, A580, Oxford Rd and Rochdale Rd)	✓	✓	✓	✓	✓
Manchester Airport Rainbow Works	✗	✓	✓	✓	✓
M60 Junction 8 to M62 Junction 20 Managed Motorways (variable speed limits M60 Jn 8-18)	✗	✓	✓	✓	✓
MSIRR Regent Road/Water Street improvements	✗	✓	✓	✓	✓
Stockport Town Centre Access Plan	✗	✓	✓	✓	✓

Scheme	2017 Base	2025 Reference forecasts	2040 Reference forecasts	2025 with Allocations	2040 with Allocations
A6 to Manchester Airport Relief Road, including Airport City Infrastructure and Poynton Bypass	✘	✓	✓	✓	✓
Metrolink to Trafford Centre	✘	✓	✓	✓	✓
Barton Dock Road Pedestrian Accessibility	✘	✓	✓	✓	✓
Bus lanes on Barton Dock Road	✘	✓	✓	✓	✓
New bus lane on A56 at Sir Matt Busby Way	✘	✓	✓	✓	✓
Altrincham Bus/Metrolink Interchange	✘	✓	✓	✓	✓
A49 Wigan Gateway	✘	✓	✓	✓	✓
A58 Wigan Gateway	✘	✓	✓	✓	✓
Salford-Bolton Network Improvements	✘	✓	✓	✓	✓
MSIRR Great Ancoats Street improvements	✘	✓	✓	✓	✓
M62 Junction 19 improvements (South Heywood)	✘	✓	✓	✓	✓

Scheme	2017 Base	2025 Reference forecasts	2040 Reference forecasts	2025 with Allocations	2040 with Allocations
South Heywood Link Road	✗	✓	✓	✓	✓
M56 Junction 6 to 8 Smart Motorway improvement	✗	✓	✓	✓	✓
M62 Junction 10-12 Smart Motorway improvement	✗	✓	✓	✓	✓
Carrington A1 Link	✗	✓	✓	✓	✓
Trafford Rd improvements	✗	✓	✓	✓	✓
Mottram Moor Link and A57T-A57 Link	✗	✓	✓	✓	✓
M60 J13 and A572 Leigh Rd improvements	✗	✓	✓	✓	✓
Western Gateway Infrastructure Scheme (Super WGIS)	✗	✓	✓	✓	✓
Simister Island interchange upgrade (M60 J18)	✗	✗	✓	✗	✓

4.47 Table 4.13 shows selected major highway schemes which are not regarded as committed in the modelling.

Table 4.13 Proposed Highway Schemes not yet regarded as Committed

M6 J21A to J26 Smart Motorways
M60 Junction 24-27 and Junction 1-4 Managed Motorway
Trafford Park Road Safety Scheme
Trafford Centre Bus Station Access Improvements
M62 J20 to J25 Smart
Denton Island

Table 4.14 Major Committed Public Transport Schemes

Scheme	2017 Base	2025 forecasts	2040 forecasts
2017 Metrolink Network including 2CC and Airport	✓	✓	✓
Leigh/Salford/Manchester Guided Busway including Cross City Package	✓	✓	✓
Trafford Park Metrolink	✗	✓	✓
New trams (2021 capacity enhancements – 27 new trams)	✗	✓	✓
New Metrolink zonal fare system (implemented 2019)	✗	✓	✓
Northern Hub rail services (specification CS7) including Ordsall Curve and new platforms 15/16 at Manchester Piccadilly	✗	✓	✓

Table 4.15 Proposed Public Transport Schemes not yet regarded as Committed

High Speed Rail (HS2)
Northern Powerhouse Rail (NPR)
Bus reform
Greater Manchester's 2040 Transport Strategy

4.48 Summary:

- Forecast years of 2025 and 2040 were developed
- Departure and arrival trips for each site were calculated by applying trip rates depending on the land use type, size and location of each development.
- Trips to and from developments were distributed by cloning the distribution of trips of the same purpose from other zones in the model sector that the development is located within.
- The input demand to GMVDM was controlled to growth in line with NTEM forecasts for the Reference or Do Minimum forecast – this represents a "policy-off" scenario that doesn't meet TfGM's Right Mix targets and can therefore be considered a worst case in terms of highway congestion.
- Additional growth associated with PfE allocations was added on top of the output from the Reference or Do Minimum forecast.
- The future existing land supply and transport schemes were included in the forecast years in line with the "Near certain" and "More than likely" definitions of certainty contained within TAG guidance.
- The 2040 Reference scenarios assumes 181,138 new dwellings and 5,431,905 sqm of Office, Industrial and Warehousing. The sustainable mode share generated by these sites is 39%. The total growth in trip making is controlled to NTEM at a sector level.
- The 2040 Allocations adds a further 21,402 new dwellings and 2,247,380 sqm of Office, Industrial and Warehousing. The sustainable mode share of which is 17%.

5 Model Reporting

Introduction

5.1 This section summarises the outcomes from both the Reference or Do Minimum forecasts, and the with PfE or Do Something forecasts. The figures presented therefore include the demand response associated with changes in travel costs predicted by GMVDM. For the Reference, this is the change in travel costs over time from the base year. For the PfE forecasts, which pivot from the Reference, this includes the response to changes in travel costs due to the addition of the PfE developments themselves.

5.2 The objectives of this modelling exercise and of this report is, given a set of assumed input assumptions as outlined in the previous sections, to objectively report the impact of the PfE allocations on the Greater Manchester transport network. It is not the purpose of this report to specify if those impacts are tolerable, as tolerance levels have not been specified and so would be subjective dependent on the audience.

5.3 It has been necessary to define the criteria on which the performance of the transport network shall be judged. The five agreed criteria are:

- Trip growth;
- Mode share;
- Transport emissions;
- Congestion on the highway and public transport network; and
- Accessibility to employment by public transport.

5.4 This section reports the outcomes from the model against these criteria. In order to place the PfE allocation test in the correct context, this section also illustrates the change from the modelled base year of 2017 to the forecast

years of 2025 and 2040 due to existing land supply sites and committed transport interventions, known as the Reference Case or Do Minimum. The PfE allocations are an incremental test to those forecast year Reference Cases.

High Level Metrics Reporting

5.5 The forecast year of 2025 represents the first 5 years of the allocations being released where the changes to the transport network are relatively certain, as it is a reasonable assumption that any strategic schemes that would be built by 2025 would already be funded at the time of reporting.

5.6 The forecast year of 2040 represents a point in time when the full extent of the allocations and associated interventions have been introduced.

5.7 This section reports a set of "high level metrics" from the transport models presented from the 2017 Base and for both forecast years for Scenario 2 Policy Off Reference and Scenario 2 Policy Off Allocations with mitigation.

5.8 In order to demonstrate the impact of the changes to land use and transport supply through time, the high level metrics tables that follow in this section and Appendix A cover 10 measures of highway and public transport performance. These include:

- Total car trips (origin based);
- Total PT trips (origin based);
- Total walk and cycle trips (origin based);
- Percentage of trips made by sustainable modes (a sustainable mode is defined as a non-car trip);
- CO2 aggregate emissions (assumes fleet composition is fixed in forecast years, this is a link based calculation);

- NOx aggregate emissions (assumes fleet composition is fixed in forecast years, link based calculation);
- Vehicle km (link based calculation);
- Passenger km (link based calculation);
- Traffic congestion (link based delay per km calculation); and
- PT crowding (link based loading calculation).

5.9 Note that for production based trip reporting, it is the home end that generates both outbound and return trips. For example, a return home-based commute trip will be allocated to the home end for both the trip to and from work.

5.10 Link based calculations are solely based on the location of the link regardless of the production or origin of the trip.

Greater Manchester-wide performance of the transport system

5.11 Table 5.1 below details the high level metrics across the entire Greater Manchester area. Where a metric is production based, then the location of that production must be within Greater Manchester. Where the metric is a link based calculation, the location of that link must be within Greater Manchester.

5.12 These metrics tables are repeated in Appendix A disaggregated by district and sector (the sector system is described in paragraph 4.22).

5.13 Scenario 1 (NTEM) is included in this table for reference, however this test has not been repeated using the latest set of supply side assumptions including the updates made to the Strategic Road Network.

5.14 In addition, Table 5.2 illustrates the changes by reporting journey time changes on the highway network on selected key routes. These routes are a subset of those reported in the highway model validation report.

Table 5.1 Greater Manchester High Level Metrics

Greater Manchester Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	2040 Ref - New All Diff
24hr Car Trips (000s)	5,955	6,432	6,364	6,377	7,101	6,916	7,045	+129 (+2%)
24hr Public Transport Trips (000s)	824	769	769	773	779	782	795	+13 (+2%)
24hr Walk & Cycle Trips (000s)	3,048	3,055	3,038	3,037	3,110	3,090	3,145	+55 (+2%)
Sustainable Mode Share	39%	37%	37%	37%	35%	36%	36%	0%
CO2 aggregate Emissions (2017=100)	100	114	98	98	104	91	94	+3 (+3%)
NOx aggregate Emissions (2017=100)	100	94	80	80	80	70	72	+2 (+3%)
24 hr Vehicle km	41,655	46,205	47,875	48,079	52,174	53,902	55,080	+1178 (+2%)
24 hr PT Passenger km	7,949	7,345	8,047	8,091	7,497	8,448	8,629	+181 (+2%)
AM peak Delay (secs per veh km)	67	77	79	79	89	96	100	+4 (+4%)
% of Metrolink & Rail trips standing	29%	21%	23%	23%	22%	27%	27%	+0%

Difference to 2017 Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc
24hr Car Trips (000s)	5,955	8%	7%	7%	19%	16%	18%
24hr Public Transport Trips (000s)	824	-7%	-7%	-6%	-5%	-5%	-4%
24hr Walk & Cycle Trips (000s)	3,048	0%	0%	0%	2%	1%	3%
24 hr Vehicle km	41,655	11%	15%	15%	25%	29%	32%
24 hr PT Passenger km	7,949	-8%	1%	2%	-6%	6%	9%
AM peak Delay (secs per veh km)	67	14%	17%	17%	33%	43%	49%

Table 5.2 Changes in journey times from 2017 Base Year (AM Peak)

Highway Journey Time Change Route	2025 S2 Policy Off Reference	2025 S2 Policy Off Allocations with mitigation	2040 S2 Policy Off Reference	2040 S2 Policy Off Allocations with mitigation
Hazel Grove to Manchester	4%	4%	13%	16%
Hyde to Manchester	11%	11%	29%	29%
Mossley to Manchester	10%	8%	25%	28%
Delph to Manchester	2%	2%	8%	8%
Rochdale to Manchester	4%	6%	13%	21%
Bury to Manchester	0%	0%	6%	9%
Golborne to Manchester	13%	13%	32%	34%
Altrincham to Manchester	8%	3%	18%	13%
Manchester Airport to Manchester	5%	5%	24%	29%
M60 Clockwise	12%	12%	62%	60%

Overall existing land supply impacts

5.15 Observations from Tables 5.1 and 5.2 indicate that the impact due to the introduction of existing land supply and committed schemes (2017 Base to 2040 Scenario 2 Reference) include:

- A significant increase in highway trips (+16%), combined with a reduction in public transport trips (-5%), leading to a reduction in mode share on sustainable modes (39% to 36%);
- A decrease in CO2 and NOx emissions (-9% and -30% respectively). Variations in fleet composition over time were factored into the calculation of emissions and are responsible for these decreases;
- An increase in highway delay across the network (67 to 96 seconds per km). Trips entirely within Greater Manchester are 7km on average (longer for commute trips). This means an increase of just over 3 minutes on average from base year.

Overall allocation impacts

5.16 Observations from Tables 5.1 and 5.2 indicate that the impact due to the addition of allocations to the reference (i.e. 2025 and 2040 Scenario 2 Policy Off Reference to Scenario 2 Policy Off Allocations with mitigation) include:

- An increase in highway trips (+2%), public transport trips (+2%) and Walk & Cycle trips (+2%), resulting in mode share on sustainable modes remaining at 36%;
- An increase in CO2 and NOx emissions (+3% and +3% respectively);
- An increase in average highway delay across the network (96 to 100 seconds per km). This represents an average increase of less than a minute for journeys made entirely within Greater Manchester.

5.17 These observations show a trend over time that leads to increased reliance on car travel and reduced public transport patronage as a whole (note that not all PT sub modes decrease). The highway network would bear the majority of trips induced by growth for both the existing land supply and allocations dataset. This does not take into account the impact of Bus Reform or the implementation of any of the interventions in the 2040 Transport Strategy that will help Greater Manchester achieve its "Right Mix" targets to reduce motor vehicle traffic's daily share of trips to no more than 50%, with the remaining 50% made by public transport, walking and cycling. More details on the Right Mix is available in the "Greater Manchester Transport Strategy 2040 – Appendix 1: Right Mix Technical Note" GMTS_2040_Refresh_Appendix_Right_Mix_Jan_2021_Final.pdf (ctfassets.net)

5.18 Figure 5.3 below shows the change in trips by mode for the reported scenarios.

5.19 Figure 5.4 shows the change in trips kilometres by main mode.

5.20 Figure 5.5 reports the forecast emissions, accounting for external influences such as changes in vehicle type (electric cars for example) and efficiencies in combustion engines, as has occurred in recent years.

Figure 5.3 Daily Trips by Main Mode

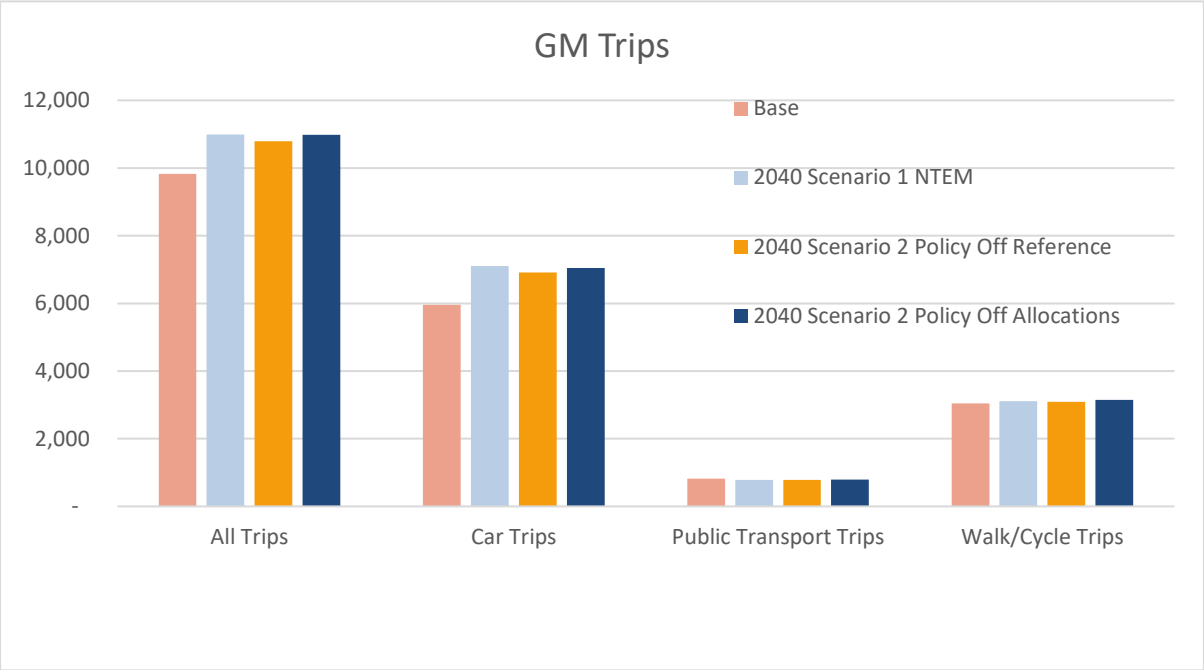


Figure 5.4 Journey KMs by Main mode

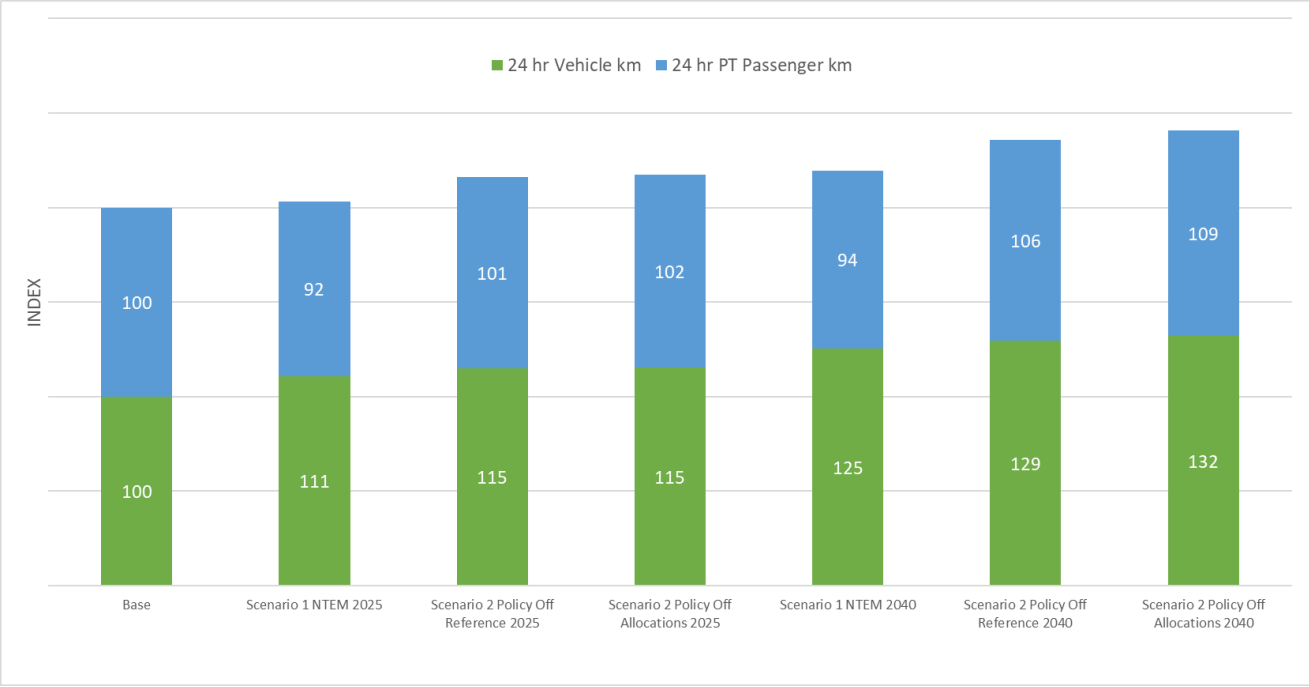
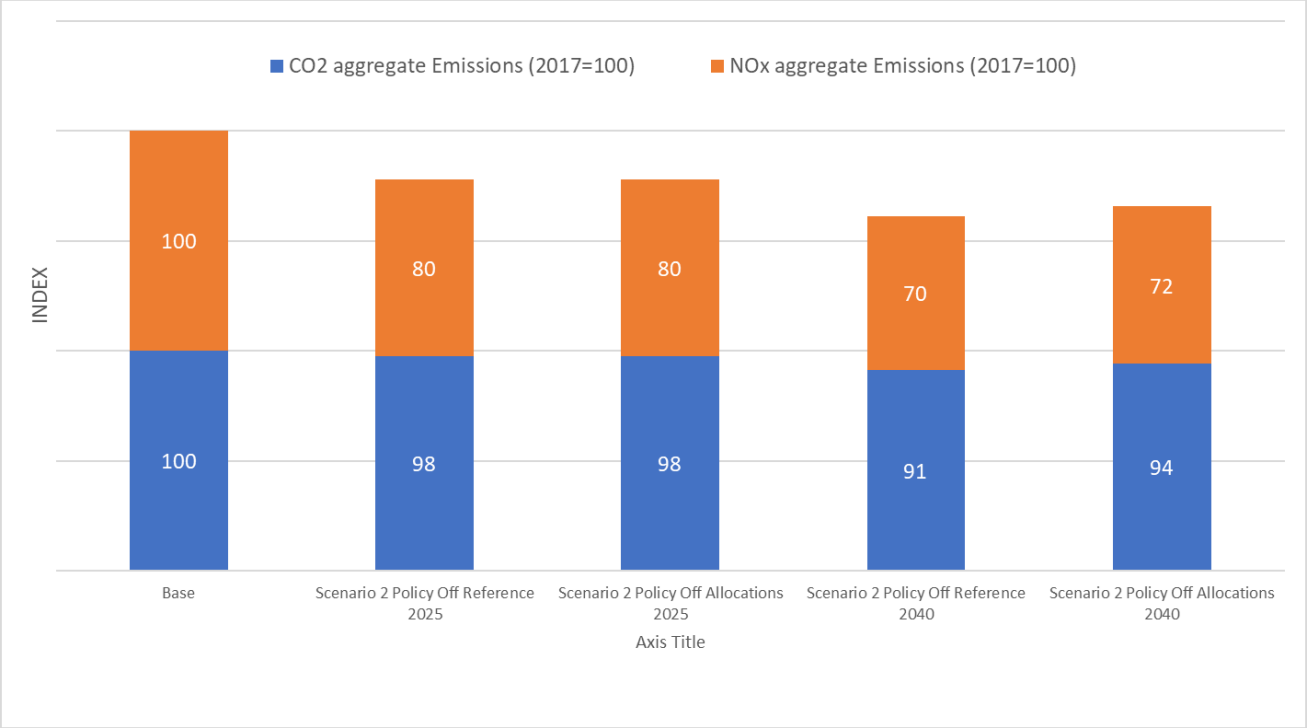


Figure 5.5: Transport Carbon Dioxide and Nitrous Oxide Emissions

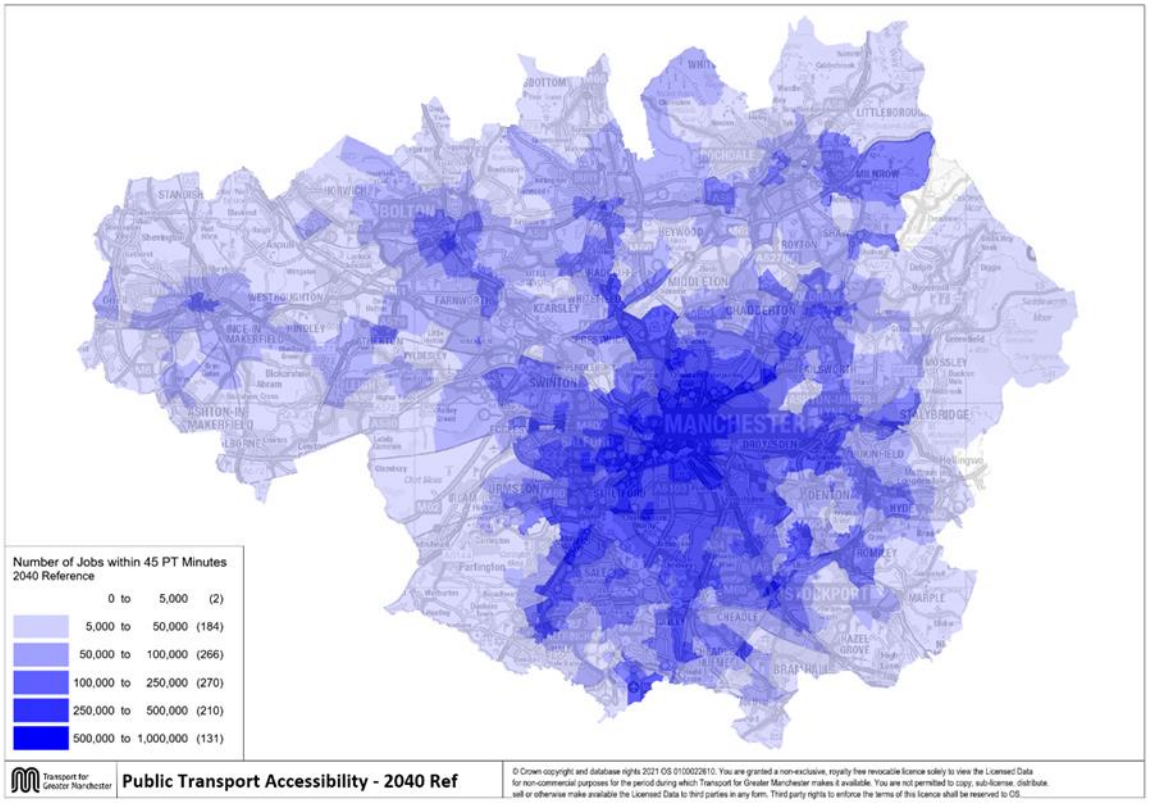


Employment Accessibility by Public Transport

5.21 The interaction between populations, jobs and travel mode is a complex one. Overall reductions in journey costs naturally increases accessibility to jobs, as do increases in employment density. Although improvements of accessibility by public transport are only part of the picture, some focus on future public transport system accessibility helps identify opportunities for improving the proportion of sustainable mode journeys in future.

5.22 The following maps show the accessibility of jobs, calculated as the number of Greater Manchester jobs within 45 minutes PT travel time. The test carried out will add to the number of jobs available but also reflects any change in accessibility due to increasing journey times (due to increased congestion) or improvements in PT provision. Figure 5.10 provides an indication of accessibility in the 2040 Reference Case.

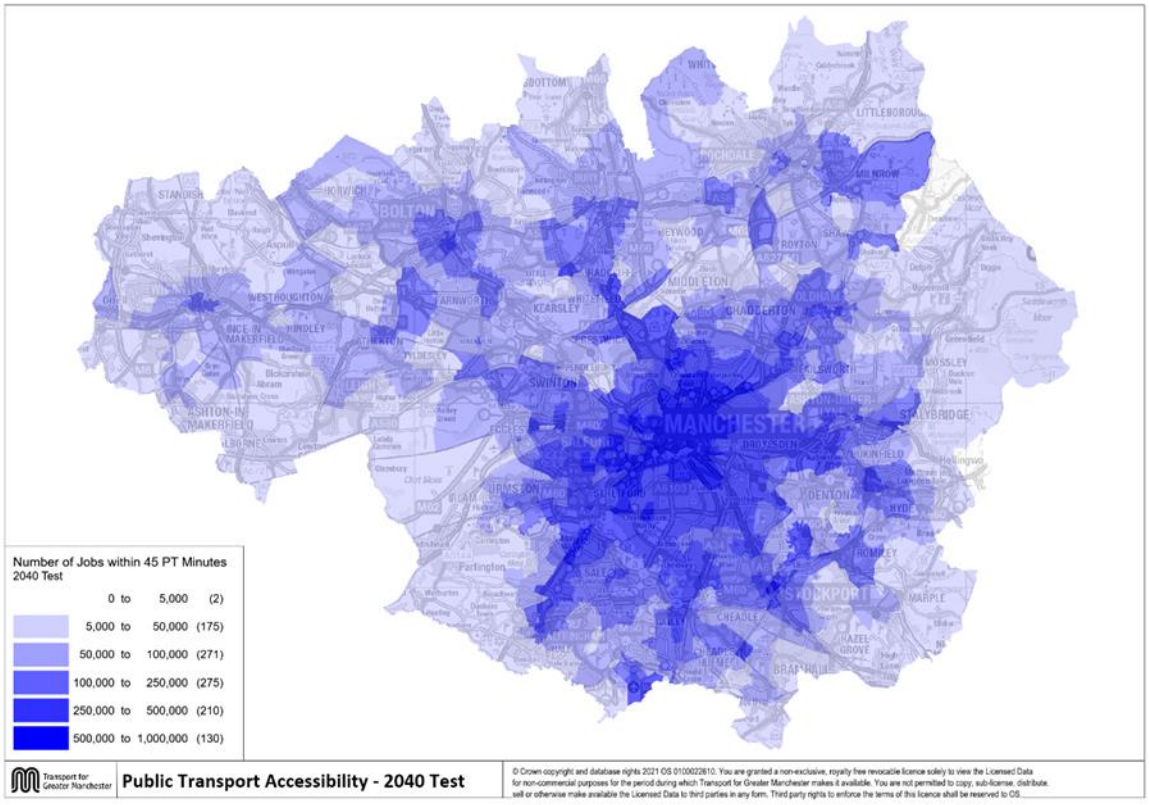
Figure 5.10: 2040 Reference Case Job Accessibility



5.23 This shows that those populations that are within 45 minutes of the largest numbers of jobs within Greater Manchester are those with good access to rail or Metrolink, or with only a *short-distance* bus travel to work - mostly people within a short distance of the Regional Centre and those along Metrolink and rail.

5.24 Figure 5.11 shows that job accessibility increases for most parts of Greater Manchester as a result of a changes to public transport provision and reduced proximity between employment sites and housing implied by the allocations.

Figure 5.11: Scenario 2 Policy Off Allocations (Test Scenario)



5.25 In summary, from the existing land supply and the PfE land allocations together, the following observations are apparent:

- The average number of accessible jobs within Greater Manchester is 220,990 (number of jobs reachable within 45 min of PT on average);
- PfE allocations increases the accessibility to 222,110 – a modest increase of 0.5%.

5.26 Overall, the improvement in employment accessibility is modest – new jobs added from the allocations together with new PT schemes that improve access are offset to a degree by increased congestion leading to higher bus journey times.

Summary

- Future scenarios see increases in vehicle trips combined with decreases in public transport trips. The result of which is a decrease in public transport's mode share. This is consistent with a policy off forecast as future trends indicate reduced public transport use if no interventions are made.
- Both NOX and CO2 emission decrease as a result of improvements in vehicle efficiency.
- With the inclusion of the allocations, highway, public transport and active travel trips all increase, resulting in the total sustainable mode share remaining unchanged.
- With the inclusion of the allocations both NOX and CO2 emissions increase in proportion to the increase in highway trips.
- Delays across the highway network increase as a result of the new highway trips from the allocations.

6 Strategic Road Network (SRN) Impacts

Overview

6.1 The transport modelling undertaken as part of the Locality Assessment process considers the Strategic Road Network (SRN) in terms of the points where the allocation traffic loads on to the SRN. Junction impacts at the interface between the Local Road Network (LRN) and the SRN have been considered; however, it does not consider impacts on the SRN mainline itself.

6.2 A separate, parallel exercise is underway in conjunction with Highways England to examine wider impacts on the strategic road network (SRN). This ongoing parallel exercise is investigating cumulative PfE impacts on the SRN mainline links and is expected to deliver key findings in late Summer 2021.

6.3 It is important to stress that all of the strategic modelling work done to date on the SRN represents a worst-case scenario for a number of reasons. Firstly, as discussed earlier in this Technical Note, the scenario used for testing is the "Policy Off" scenario. That is, policy interventions to encourage sustainable travel and behaviour change have not been included, so increases in home working as well as other behavioural shifts are not reflected.

6.4 Furthermore, in terms of employment uses, it is assumed that all Industry and Warehousing sites are filled, however the plan has an oversupply of these employment sites in order to offer flexibility and choice to the market. Total supply, including the allocations is around 4.5m sqm, but demand is expected to be closer to 4m sqm.

6.5 Further reporting will be provided to document the findings of this workstream.

Overall Scope of SRN Work

6.6 The key objective of this work is to inform a position of understanding between the PfE Local Authorities, Transport for Greater Manchester and Highways England on the likely implications of PfE on the SRN – both at key junctions and on the mainline. This will form an evidence base on which the parties can base their respective statutory responses to the PfE Plan.

6.7 The intended outcome of the assessment is to enable a position of agreement to be reached between the parties on what the cumulative transport issues may be in a "worst-case" traffic dominated future and the requirements that arise from the plan to set out the necessary infrastructure proposals required to support the plan at a concept level.

6.8 The evidence will consider the needs of the network arising out to the end of the plan horizon year (2037) as assessed in the future forecast year of 2040. This will be supplemented by additional assessment, where it is necessary, of the additional impacts of further land use promoted through PfE allocations that are currently forecast to arise beyond the plan period. This sensitivity assessment will give consideration to the potential that such development could come forward sooner, before the end of the plan period.

SRN Workstream – Strategic Modelling Scope

6.9 In strategic modelling terms, this workstream has incorporated a comprehensive review of the coding of the strategic road network within the model. Where, appropriate coding modifications have been made to improve the accuracy of the model's representation of the network.

6.10 The workstream also encompassed updates to reflect the latest Road Investment Strategy (RIS1/RIS2) schemes. Specifically, the following schemes were incorporated based on consultation with Highways England:

- **Improvement of M67 / A57 Hyde Road / A560 roundabout junction (Mottram Moor Link Road – MMLR):** Signalisation and the provision of both an additional circulating lane and an additional lane on the M67 (W) approach arm as part of the wider Mottram Moor Link Road (MMLR) proposal, which is committed by Highways England in order to deliver improvements along the A57 corridor (this scheme comprises a dual carriageway link from the M67 terminal roundabout to a junction at A57(T) west of Hadfield); For more detail visit the following website A57-Link-Roads
- **M60 / M62 / M66 Simister Island Interchange Improvements:** A comprehensive redesign of the existing Simister interchange which will introduce a free-flow grade separated link between the M62 (W) and the M60 (S), and other improvements. For more detail visit the following website Simister-Island
- **M56 Smart Motorway between Junctions 6 and 8**: The existing M56 is a rural dual three-lane motorway with a hard shoulder, with the exception of sections on both carriageways near junction 7 where the hard shoulder has been converted into additional running lanes. As part of this scheme, we will convert the hard shoulder into a running lane on the full stretch between junctions 6 and 7 and through junction 6 westbound.

6.11 These updates to the strategic model served as a consistent platform for both the updating of the locality assessment reports and the SRN mainline assessment.

SRN Workstream – Other Scope Components

6.12 The assessment will inform Highways England's understanding of the potential implications of PfE development on its network, including any mainline and junction issues that arise and will further identify associated 'Concept Feasibility' schemes, that may need to be considered, alongside

other future investments already arising in the Delivery Plan and as part of future RIS funding programmes.

6.13 Concept Feasibility scheme proposals will be developed as initial draft proposals commensurate with the needs of demonstration that a proportionate scheme option is feasible, however this does not imply that the proposed option solution would have any status as preferred option. The concept feasibility scheme would however be the starting point for further detailed discussions with developers (allocation promotors), or other funding partners, at the time of a further planning application or delivery of an infrastructure need.

6.14 The assessment will further identify locations where existing SRN programmes and studies are underway that will be looking at similar issues and help inform where studies should be coordinated to avoid duplication of investigations. The evidence developed will provide information to update existing SRN programmes and studies.

7 Modelling Outputs and Allocation Assessments

Introduction

7.1 The strategic modelling outputs described in the preceding chapters served as a starting point for the specific modelling work undertaken for each PfE allocation. The overall goal was to assess the individual and cumulative impacts of the PfE allocations on the adjoining transport networks.

7.2 This section describes the analysis undertaken using outputs from GMVDM to carry out more detailed assessments of the allocations.

Specific Use of Strategic Model for Locality Assessments

7.3 The GMVDM strategic model was primarily designed to assess regional and Greater Manchester-wide transport impacts. It is the best available tool to assess the cumulative impacts of the allocations on the network. SYSTRA updated the model in the following ways for the purposes of the locality assessment work:

- Modifying the network coding in the vicinity of the allocations to improve the accuracy with which the transport network is represented
- For the most recent round of forecasting, improving the representation of the Strategic Road Network in the highway assignment model (GMSM)
- Adjusting the model zoning system e.g. by adding new zones or splitting existing zones to better represent the allocations
- Developing new scenarios to permit comparison and evaluation (discussed in more detail below).

7.4 TfGM provided the Base Model to SYSTRA representing how the transport network operates at present (in 2017). SYSTRA made some refinements to

the Base Model to add detail in the vicinity of some allocations, as mentioned above.

7.5 SYSTRA then produced a Reference Scenario, including the "existing land supply" and committed transport infrastructure for two assessment years - 2025 and 2040, as described in sections 4 and 5. This facilitated an understanding of how the transport network was likely to operate in the future PfE.

7.6 In order to carry out further specific testing of the impact of the allocations on the network, two scenarios were set up, a '**constrained**' and '**high side**'.

7.7 The "**PfE constrained"** forecasts were those generated by GMVDM and reported in section 5 of this report. In these forecasts, the model adjusts the input demand based on how the cost of travel changes with the addition of the demand and supply associated with the PfE sites. For example, for a shopping trip undertaken by car which becomes more congested due to additional PfE traffic, changes might be:

- Travel via a different route;
- Travel via a different mode, e.g. walk/cycle, bus, Metrolink;
- Travel to some different shops;
- Travel at a different time of day; and
- Some combination of the above.

7.8 As explained above, GMVDM constrains the volume of future highway trips due to congestion on the highway network. This differs from the 'standard' development planning approach which would generally not assume that future highway trips are constrained by congestion on the highway network. Discussions during the course of the locality assessment work pointed

towards a need to also look at a 'high-side' unconstrained scenario alongside the constrained scenario. The two scenarios are defined below:

7.9 The "**PfE High-Side**" is the forecast case in which the model does not adjust the input demand based for trips to and from allocation sites based on how the cost of travel changes. Demand not associated with the allocations remains at the same level as the 'PfE Constrained' scenario. In this scenario, for allocations' demand, congestion does not lead to a change of mode or time of day for these trips. The result of this is that road traffic flows will generally be higher in the High-Side AM and PM peak periods compared to the Constrained scenario. In simple terms, this can be considered a worst-case assessment from the highway network perspective. A "PfE High-Side" scenario was only created for the AM and PM peaks as these are the periods where traffic flows and congestion are highest. The demand not associated with the Allocations was left at the constrained level. This was done as removing the constraints of the Highway network on all traffic in the model would lead to an unrealistically high level of highway demand that would be out of balance with the available capacity of the network.

7.10 The results presented in this Strategic Modelling Technical Note are for the "PfE Constrained" scenario. This scenario incorporates congestion on the highway network across the entire day and, as such, is considered most appropriate when considering the Greater Manchester-wide perspective. In contrast, the Locality Assessments, which consider more localised effects, utilise the "PfE High-Side" scenario to assess the AM and PM peaks.

7.11 One of the key goals of the locality assessment work undertaken by SYSTRA and others was to assess the need for transport mitigation measures to address forecast impacts on the network. These mitigations comprised a wide range of possible measures:

- New or improved public transport links and stations
- Infrastructure and facilities to support walking and cycling
- New or enhanced bus services
- New or improved road links and junctions

7.12 In the case of road improvement measures, the outputs from the "PfE High-Side Scenario" were further analysed using the previously devised local junction models. This was done because local junction modelling tools provide a greater degree of accuracy in modelling specific measures.

Limitations of the Strategic Modelling

7.13 GMVDM is a strategic model and, as such, does have limitations in terms of investigating localised transport issues. As described above, SYSTRA has made a number of changes to the model network coding and zoning system to improve its accuracy in this regard. In the case of certain allocations, multiple iterations of strategic modelling were undertaken to improve the accuracy of outputs since these problems only became apparent upon detailed scrutiny of the outputs of the local junction modelling exercise.

7.14 Notwithstanding this effort, there will be certain instances where the accuracy of the model may not provide sufficient certainty for the purposes of the locality assessments. Examples of this would include:

- Complex route choice permutations across a dense congested local network
- Complex variable network effects where traffic queuing / congestion at one location causes problems at another location
- Detailed traffic behaviours such as the way traffic moves through large roundabouts in a congested situation

- Large allocations with multiple connections to the existing transport network which have, by necessity, been simplified
- Bus stops shelters and real-time departure information
- Bus operator responses to new developments such as route diversions
- Improved walk and cycle accessibility through upgrade infrastructure or new links

7.15 In such cases, the locality assessment reports make clear that a definitive finding may not be possible due to these limitations. The level of certainty is made clear and, where applicable, recommendations for further, more detailed modelling work are made. These recommendations might include more detailed modelling of specific defined parts of the local transport network – potentially using traffic simulation tools – to provide a greater level of certainty regarding these findings.

7.16 Despite the limitations set out in the preceding paragraph, the Locality Assessments are considered sufficiently robust to inform the preparation of the Allocations Policies and viability assessments for the PfE. It is recognised that further detailed work will be required to identify detailed transport mitigation at the planning application stage.

Summary

- The strategic model supply was updated to add the required detail in the vicinity of the allocations.
- A High Side assignment was developed to produce a worst case set of highway flows for testing the impact of the allocations.
- The need for mitigation was assessed using flows from the strategic model as inputs to more detailed local junction models.

- The strategic model is considered the best tool available to provide a source of data to assess the transport impacts of the allocations, however it is acknowledged that there are limitations inherent with strategic level modelling.
- The Locality Assessments are considered sufficiently robust to inform the preparation of the Allocations Policies and viability assessments for the PfE

8 Conclusions and Recommendations

8.1 This report has presented assumptions and results for modelling of developments contained in the Places for Everyone Plan Joint DPD. Those developments are on top of existing land supply already in the planning process.

8.2 The results of the updated modelling are substantially the same as the original report which was used to inform the GMSF 2020 and subsequently the Autumn 2021 consultation version of the Places for Everyone Plan.

8.3 The allocations that make up this Plan generate a large number of trips; in aggregate these comprise a substantial increment in trips over and above the existing land supply. Across Greater Manchester this includes approximately:

- 22,000 housing units at 2040; and
- 2.2 million square metres of office/industrial/warehousing space at 2040.

8.4 In terms of new daily trips generated across Greater Manchester, the PfE allocations create approximately:

- 16,000 new trips by all modes by 2025 (13,000 by car); and
- 197,000 new trips by all modes by 2040 (129,000 by car), representing an increase of 2% from the 2017 base year.

8.5 As the model scenarios do not take into account the introduction of Greater Manchester's transport policies intended to support growth in public transport and active travel modes, the new trips are mostly highway traffic. The impact of these allocation trips over and above existing land supply trips include:

- Increases in average delays across Greater Manchester of around 4% on top of that created by existing land supply;
- Increases of around 2% in vehicle kilometres and 2% in public transport passenger kilometres; and
- Most highway trips to Manchester City Centre increase in journey time by around 5%.

8.6 The impacts of both the existing land allocations and the PfE allocations at District level are presented in Appendix A. The performance metrics are also presented at a sector level that identifies impacts for the Regional Centre and each of the districts.

8.7 Overall, it is clear that adding the PfE allocations to the existing land supply will present transport challenges that need to be planned for. The overall forecasts for congestion, crowding and emissions that are evident at the strategic level show that there is still a deterioration after the identified interventions are included. However, it is important to stress that the results presented in this Strategic Modelling Technical Note do not include the representation of any transport interventions over and above already committed and funded interventions, nor the introduction of the policy proposals and mode shift proposals set out in Greater Manchester's 2040 Transport Strategy.

8.8 It is also important to note that the scenarios presented in this Technical Note represent one ("worst-case") version of the future in relation to key parameters such as suitable trip rates to apply to the proposed allocations, what car ownership assumptions are plausible for Greater Manchester over the next 20 years and how observed local trends would impact on overall mode shares.

Appendix A: High Level metrics

The SYSTRA designations given to the specific model runs discussed in this study are shown in the table below.

Year Scenario	2017 Base	2025 S1 NTEM	2025 S2 Ref.	2025 S2 Alloc.	2040 S1 NTEM	2040 S2 Ref.	2040 S2 Alloc.
SYSTRA designation	FA_2017	N/A	GQ_2025	GS_2025	N/A	GR_2040	GT_2040

Data in the High Level metrics come from the model runs reported in this study. For the S2 Allocations model runs, these contain all of the PfE allocations. Consequently, the figures shown in these columns are for the cumulative impact of all of the Allocations contained within the model run. The figures presented for each district represent the combined impact, rather than just the impact of the Allocations within that district.

Table A.1 Regional Centre High Level Metrics

Regional Centre Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	New All. Ref - New All Diff
24hr Car Trips (000s)	349	378	368	367	420	396	392	-3 (-1%)
24hr Public Transport Trips (000s)	214	182	190	190	204	212	213	+1 (+0%)
24hr Walk & Cycle Trips (000s)	138	139	142	142	143	149	149	-1 (-1%)
Sustainable Mode Share	50%	46%	47%	47%	45%	48%	48%	+0%
CO_2 Emissions (2017=100)	100	108	98	98	98	91	92	+1 (+1%)
NOx Emissions (2017=100)	100	89	80	80	75	68	69	+0 (+0%)
24 hr Vehicle km	1,513	1,578	1,753	1,754	1,730	1,935	1,944	+9 (+0%)
24 hr PT Passenger km	1,283	937	1,338	1,342	990	1,478	1,501	+22 (+1%)
AM peak Delay (s/veh km)	130	142	152	153	156	176	176	0 (0%)
Standing % of Rapid Transit	30%	21%	23%	23%	26%	30%	31%	
Difference to 2017 Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	
24hr Car Trips (000s)	349	8%	5%	5%	20%	13%	12%	
24hr Public Transport Trips (000s)	214	-15%	-12%	-11%	-5%	-1%	-1%	
24hr Walk & Cycle Trips (000s)	138	0%	3%	3%	3%	8%	7%	
24 hr Vehicle km	1,513	4%	16%	16%	14%	28%	28%	
24 hr PT Passenger km	1,283	-27%	4%	5%	-23%	15%	17%	
AM peak Delay (secs per veh km)	130	9%	17%	18%	20%	36%	36%	

Table A.2 Inside M60 Metrics

Inside M60 Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	New All. Ref - New All Diff
24hr Car Trips (000s)	1,393	1,519	1,501	1,500	1,694	1,645	1,639	-6 (0%)
24hr Public Transport Trips (000s)	217	210	208	209	205	206	207	+1 (+0%)
24hr Walk & Cycle Trips (000s)	753	759	759	759	778	782	783	+1 (+0%)
Sustainable Mode Share	41%	39%	39%	39%	37%	38%	38%	+0%
CO2 aggregate Emissions (2017=100)	100	108	98	98	100	91	92	+1 (+1%)
NOx aggregate Emissions (2017=100)	100	88	80	80	76	69	70	+1 (+1%)
24 hr Vehicle km	8,847	10,127	9,985	9,995	11,323	11,099	11,163	+64 (+1%)
24 hr PT Passenger km	2,570	2,757	2,552	2,554	2,878	2,714	2,756	+41 (+2%)
AM peak Delay (secs per veh km)	76	86	88	89	101	110	111	+1 (+1%)
% of Metrolink & Rail trips standing	31%	25%	28%	28%	27%	32%	32%	+1%
Difference to 2017 Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	
24hr Car Trips (000s)	1,393	9%	8%	8%	22%	18%	18%	
24hr Public Transport Trips (000s)	217	-3%	-4%	-4%	-6%	-5%	-5%	
24hr Walk & Cycle Trips (000s)	753	1%	1%	1%	3%	4%	4%	
24 hr Vehicle km	8,847	14%	13%	13%	28%	25%	26%	
24 hr PT Passenger km	2,570	7%	-1%	-1%	12%	6%	7%	
AM peak Delay (secs per veh km)	76	13%	17%	17%	34%	46%	47%	

Table A.3 Town Centres North Metrics

Town Centres North Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	New All. Ref - New All Diff
24hr Car Trips (000s)	111	120	119	119	132	128	129	+1 (+1%)
24hr Public Transport Trips (000s)	52	50	49	49	48	47	48	+1 (+2%)
24hr Walk & Cycle Trips (000s)	44	44	44	44	45	45	46	+1 (+2%)
Sustainable Mode Share	46%	44%	44%	44%	41%	42%	42%	+0%
CO2 aggregate Emissions (2017=100)	100	145	98	98	123	87	90	+2 (+2%)
NOx aggregate Emissions (2017=100)	100	123	80	80	96	67	68	+2 (+3%)
24 hr Vehicle km	273	360	295	294	397	320	325	+5 (+2%)
24 hr PT Passenger km	172	71	176	163	67	176	164	-12 (-7%)
AM peak Delay (secs per veh km)	129	135	135	136	145	143	145	+2 (+1%)
% of Metrolink & Rail trips standing	12%	17%	13%	13%	17%	16%	16%	0%
Difference to 2017 Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	
24hr Car Trips (000s)	111	8%	7%	7%	18%	15%	16%	
24hr Public Transport Trips (000s)	52	-4%	-6%	-5%	-7%	-10%	-8%	
24hr Walk & Cycle Trips (000s)	44	0%	-1%	-1%	1%	0%	3%	
24 hr Vehicle km	273	32%	8%	8%	46%	17%	19%	
24 hr PT Passenger km	172	-59%	2%	-5%	-61%	2%	-5%	
AM peak Delay (secs per veh km)	129	5%	5%	5%	13%	11%	13%	

Table A.4 Town Centres South Metrics

Town Centres South Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	New All. Ref - New All Diff
24hr Car Trips (000s)	110	118	116	116	130	126	126	0 (0%)
24hr Public Transport Trips (000s)	29	28	27	27	27	26	27	+0 (+0%)
24hr Walk & Cycle Trips (000s)	36	36	36	36	37	37	38	+1 (+3%)
Sustainable Mode Share	37%	35%	35%	35%	33%	34%	34%	+0%
CO2 aggregate Emissions (2017=100)	100	113	98	98	102	88	89	+1 (+1%)
NOx aggregate Emissions (2017=100)	100	94	80	80	78	69	69	+0 (+0%)
24 hr Vehicle km	707	375	782	783	417	871	874	+3 (+0%)
24 hr PT Passenger km	125	56	151	152	52	151	155	+4 (+3%)
AM peak Delay (secs per veh km)	108	112	112	111	120	123	122	-1 (-1%)
% of Metrolink & Rail trips standing	20%	0%	0%	0%	0%	0%	0%	+0%
Difference to 2017 Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	
24hr Car Trips (000s)	110	8%	6%	6%	19%	15%	15%	
24hr Public Transport Trips (000s)	29	-3%	-5%	-5%	-7%	-8%	-7%	
24hr Walk & Cycle Trips (000s)	36	0%	0%	0%	2%	2%	4%	
24 hr Vehicle km	707	-47%	11%	11%	-41%	23%	24%	
24 hr PT Passenger km	125	-55%	20%	21%	-59%	20%	23%	
AM peak Delay (secs per veh km)	108	4%	3%	3%	11%	13%	13%	

Table A.5 Rest of Greater Manchester North High Level Metrics

Rest of GM North Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	New All. Ref - New All Diff
24hr Car Trips (000s)	2,568	2,762	2,734	2,747	3,022	2,947	3,053	+105 (+4%)
24hr Public Transport Trips (000s)	172	164	162	164	158	155	160	+5 (+3%)
24hr Walk & Cycle Trips (000s)	1,388	1,382	1,371	1,373	1,393	1,381	1,418	+37 (+3%)
Sustainable Mode Share	38%	36%	36%	36%	34%	34%	34%	0%
CO2 aggregate Emissions (2017=100)	100	118	98	98	107	91	95	+4 (+4%)
NOx aggregate Emissions (2017=100)	100	98	80	80	83	70	73	+2 (+3%)
24 hr Vehicle km	20,803	23,703	24,333	24,473	27,012	27,508	28,298	+790 (+3%)
24 hr PT Passenger km	1,818	2,062	1,843	1,885	2,035	1,837	1,908	+71 (+4%)
AM peak Delay (secs per veh km)	55	63	67	67	76	83	90	+6 (+7%)
% of Metrolink & Rail trips standing	17%	8%	10%	10%	9%	13%	13%	+0%
Difference to 2017 Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	
24hr Car Trips (000s)	2,568	8%	6%	7%	18%	15%	19%	
24hr Public Transport Trips (000s)	172	-5%	-6%	-5%	-8%	-10%	-7%	
24hr Walk & Cycle Trips (000s)	1,388	0%	-1%	-1%	0%	-1%	2%	
24 hr Vehicle km	20,803	14%	17%	18%	30%	32%	36%	
24 hr PT Passenger km	1,818	13%	1%	4%	12%	1%	5%	
AM peak Delay (secs per veh km)	55	14%	22%	23%	39%	52%	64%	

Table A.6 Rest of Greater Manchester South High Level Metrics

Rest of GM South Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	New All. Ref - New All Diff
24hr Car Trips (000s)	1,383	1,488	1,478	1,480	1,637	1,610	1,639	+29 (+2%)
24hr Public Transport Trips (000s)	131	126	124	125	123	121	126	+5 (+4%)
24hr Walk & Cycle Trips (000s)	679	685	675	673	701	681	696	+15 (+2%)
Sustainable Mode Share	37%	35%	35%	35%	33%	33%	33%	+0%
CO2 aggregate Emissions (2017=100)	100	113	98	98	103	92	94	+3 (+3%)
NOx aggregate Emissions (2017=100)	100	92	80	80	79	70	72	+2 (+3%)
24 hr Vehicle km	8,738	9,476	9,824	9,887	10,630	11,154	11,445	+291 (+3%)
24 hr PT Passenger km	1,954	1,450	1,961	1,968	1,463	2,052	2,105	+53 (+3%)
AM peak Delay (secs per veh km)	53	63	59	58	69	71	74	+3 (+4%)
% of Metrolink & Rail trips standing	34%	22%	26%	25%	21%	27%	27%	+0%
Difference to 2017 Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	
24hr Car Trips (000s)	1,383	8%	7%	7%	18%	16%	19%	
24hr Public Transport Trips (000s)	131	-4%	-5%	-5%	-6%	-7%	-4%	
24hr Walk & Cycle Trips (000s)	679	1%	-1%	-1%	3%	0%	3%	
24 hr Vehicle km	8,738	8%	12%	13%	22%	28%	31%	
24 hr PT Passenger km	1,954	-26%	0%	1%	-25%	5%	8%	
AM peak Delay (secs per veh km)	53	20%	11%	10%	30%	35%	41%	

Table A.7 Bolton District High Level Metrics

Bolton Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	New All. Ref - New All Diff
24hr Car Trips (000s)	599	645	639	646	706	690	709	+19 (+3%)
24hr Public Transport Trips (000s)	51	49	48	49	47	46	47	+1 (+2%)
24hr Walk & Cycle Trips (000s)	316	314	312	313	317	313	320	+6 (+2%)
Sustainable Mode Share	38%	36%	36%	36%	34%	34%	34%	0%
CO2 aggregate Emissions (2017=100)	100	121	98	98	107	92	95	+3 (+3%)
NOx aggregate Emissions (2017=100)	100	101	80	80	84	70	73	+2 (+3%)
24 hr Vehicle km	4,456	4,770	5,146	5,204	5,330	5,882	6,092	+210 (+4%)
24 hr PT Passenger km	607	519	585	594	518	604	619	+15 (+2%)
AM peak Delay (secs per veh km)	60	69	72	72	81	86	91	+5 (+6%)
% of Metrolink & Rail trips standing	20%	3%	6%	6%	5%	9%	9%	+0%
Difference to 2017 Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	
24hr Car Trips (000s)	599	8%	7%	8%	18%	15%	18%	
24hr Public Transport Trips (000s)	51	-4%	-6%	-4%	-8%	-11%	-8%	
24hr Walk & Cycle Trips (000s)	316	-1%	-1%	-1%	0%	-1%	1%	
24 hr Vehicle km	4,456	7%	15%	17%	20%	32%	37%	
24 hr PT Passenger km	607	-14%	-4%	-2%	-15%	0%	2%	
AM peak Delay (secs per veh km)	60	15%	20%	20%	35%	43%	51%	

Table A.8 Bury District High Level Metrics

Bury Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	New All. Ref - New All Diff
24hr Car Trips (000s)	423	456	441	442	501	465	481	+16 (+3%)
24hr Public Transport Trips (000s)	44	42	42	43	40	41	43	+2 (+5%)
24hr Walk & Cycle Trips (000s)	213	212	208	208	215	208	216	+7 (+3%)
Sustainable Mode Share	38%	36%	36%	36%	34%	35%	35%	+0%
CO2 aggregate Emissions (2017=100)	100	117	98	98	110	96	101	+5 (+5%)
NOx aggregate Emissions (2017=100)	100	97	80	80	85	74	77	+4 (+5%)
24 hr Vehicle km	3,629	4,251	4,371	4,424	4,943	5,254	5,435	+182 (+3%)
24 hr PT Passenger km	358	325	347	352	313	347	361	+14 (+4%)
AM peak Delay (secs per veh km)	61	65	73	74	77	97	105	+8 (+8%)
% of Metrolink & Rail trips standing	30%	12%	17%	17%	14%	21%	21%	+1%
Difference to 2017 Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	
24hr Car Trips (000s)	423	8%	4%	4%	18%	10%	14%	
24hr Public Transport Trips (000s)	44	-4%	-4%	-2%	-8%	-6%	-2%	
24hr Walk & Cycle Trips (000s)	213	0%	-2%	-2%	1%	-2%	1%	
24 hr Vehicle km	3,629	17%	20%	22%	36%	45%	50%	
24 hr PT Passenger km	358	-9%	-3%	-2%	-13%	-3%	1%	
AM peak Delay (secs per veh km)	61	7%	19%	23%	27%	59%	72%	

Table A.9 Manchester District High Level Metrics (including Manchester Airport)

Manchester Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	New All. Ref - New All Diff
24hr Car Trips (000s)	1,030	1,120	1,107	1,105	1,259	1,203	1,201	-2 (0%)
24hr Public Transport Trips (000s)	348	315	316	316	336	335	338	+3 (+1%)
24hr Walk & Cycle Trips (000s)	541	547	560	559	565	584	588	+4 (+1%)
Sustainable Mode Share	46%	43%	44%	44%	42%	43%	44%	+0%
CO2 aggregate Emissions (2017=100)	100	108	98	98	99	90	92	+2 (+2%)
NOx aggregate Emissions (2017=100)	100	88	80	80	75	69	70	+1 (+1%)
24 hr Vehicle km	6,451	6,451	7,262	7,242	7,148	8,029	8,062	+33 (+0%)
24 hr PT Passenger km	2,438	2,288	2,448	2,456	2,443	2,675	2,740	+65 (+2%)
AM peak Delay (secs per veh km)	89	107	103	104	113	120	124	+4 (+3%)
% of Metrolink & Rail trips standing	29%	23%	25%	25%	26%	31%	31%	+1%
Difference to 2017 Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	
24hr Car Trips (000s)	1,030	9%	7%	7%	22%	17%	17%	
24hr Public Transport Trips (000s)	348	-10%	-9%	-9%	-3%	-4%	-3%	
24hr Walk & Cycle Trips (000s)	541	1%	3%	3%	4%	8%	9%	
24 hr Vehicle km	6,451	0%	13%	12%	11%	24%	25%	
24 hr PT Passenger km	2,438	-6%	0%	1%	0%	10%	12%	
AM peak Delay (secs per veh km)	89	20%	16%	17%	28%	35%	39%	

Table A.10 Oldham District High Level Metrics

Oldham Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	New All. Ref - New All Diff
24hr Car Trips (000s)	467	503	503	505	552	544	555	+12 (+2%)
24hr Public Transport Trips (000s)	45	43	43	43	41	42	43	+1 (+2%)
24hr Walk & Cycle Trips (000s)	273	272	271	271	275	273	280	+6 (+2%)
Sustainable Mode Share	40%	38%	38%	38%	36%	37%	37%	+0%
CO2 aggregate Emissions (2017=100)	100	121	98	98	108	90	93	+3 (+3%)
NOx aggregate Emissions (2017=100)	100	99	80	80	83	69	71	+2 (+3%)
24 hr Vehicle km	2,656	3,021	3,002	3,013	3,453	3,385	3,462	+77 (+2%)
24 hr PT Passenger km	491	312	518	520	306	546	556	+9 (+2%)
AM peak Delay (secs per veh km)	57	64	63	64	82	84	88	+4 (+5%)
% of Metrolink & Rail trips standing	24%	17%	19%	19%	18%	24%	25%	+1%
Difference to 2017 Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	
24hr Car Trips (000s)	467	8%	8%	8%	18%	16%	19%	
24hr Public Transport Trips (000s)	45	-4%	-3%	-3%	-8%	-6%	-4%	
24hr Walk & Cycle Trips (000s)	273	0%	-1%	0%	1%	0%	3%	
24 hr Vehicle km	2,656	14%	13%	13%	30%	27%	30%	
24 hr PT Passenger km	491	-37%	5%	6%	-38%	11%	13%	
AM peak Delay (secs per veh km)	57	12%	10%	11%	43%	47%	54%	

Table A.11 Rochdale District High Level Metrics

Rochdale Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	New All. Ref - New All Diff
24hr Car Trips (000s)	467	502	506	507	549	546	579	+33 (+6%)
24hr Public Transport Trips (000s)	41	39	38	39	38	36	38	+1 (+3%)
24hr Walk & Cycle Trips (000s)	251	250	250	251	252	251	262	+11 (+4%)
Sustainable Mode Share	38%	37%	36%	36%	35%	34%	34%	0%
CO2 aggregate Emissions (2017=100)	100	117	98	98	107	92	97	+5 (+5%)
NOx aggregate Emissions (2017=100)	100	97	80	80	84	71	74	+3 (+4%)
24 hr Vehicle km	3,845	4,896	4,604	4,597	5,650	5,290	5,481	+191 (+4%)
24 hr PT Passenger km	323	266	321	326	254	310	320	+10 (+3%)
AM peak Delay (secs per veh km)	53	56	63	64	67	74	89	+14 (+19%)
% of Metrolink & Rail trips standing	13%	5%	7%	6%	4%	7%	7%	-1%
Difference to 2017 Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	
24hr Car Trips (000s)	467	7%	8%	8%	17%	17%	24%	
24hr Public Transport Trips (000s)	41	-5%	-7%	-6%	-8%	-11%	-8%	
24hr Walk & Cycle Trips (000s)	251	0%	-1%	0%	0%	0%	4%	
24 hr Vehicle km	3,845	27%	20%	20%	47%	38%	43%	
24 hr PT Passenger km	323	-18%	-1%	1%	-21%	-4%	-1%	
AM peak Delay (secs per veh km)	53	7%	19%	22%	28%	42%	69%	

Table A.12 Salford District High Level Metrics

Salford Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	New All. Ref - New All Diff
24hr Car Trips (000s)	559	606	597	597	672	656	668	+12 (+2%)
24hr Public Transport Trips (000s)	61	57	60	60	58	63	64	+0 (+0%)
24hr Walk & Cycle Trips (000s)	277	278	275	275	284	283	287	+4 (+1%)
Sustainable Mode Share	38%	36%	36%	36%	34%	35%	34%	0%
CO2 aggregate Emissions (2017=100)	100	109	98	98	101	90	92	+2 (+2%)
NOx aggregate Emissions (2017=100)	100	92	80	80	80	68	69	+1 (+1%)
24 hr Vehicle km	5,058	6,065	5,949	5,954	6,839	6,261	6,307	+46 (+1%)
24 hr PT Passenger km	872	877	882	882	900	915	924	+9 (+1%)
AM peak Delay (secs per veh km)	72	82	88	89	100	117	120	+3 (+3%)
% of Metrolink & Rail trips standing	18%	12%	14%	13%	15%	19%	19%	0%
Difference to 2017 Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	
24hr Car Trips (000s)	559	8%	7%	7%	20%	17%	19%	
24hr Public Transport Trips (000s)	61	-8%	-3%	-3%	-6%	3%	4%	
24hr Walk & Cycle Trips (000s)	277	0%	-1%	-1%	2%	2%	3%	
24 hr Vehicle km	5,058	20%	18%	18%	35%	24%	25%	
24 hr PT Passenger km	872	0%	1%	1%	3%	5%	6%	
AM peak Delay (secs per veh km)	72	14%	22%	23%	39%	62%	66%	

Table A.13 Stockport District High Level Metrics

Stockport Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	New All. Ref - New All Diff
24hr Car Trips (000s)	697	752	739	737	830	795	791	-4 (-1%)
24hr Public Transport Trips (000s)	64	61	60	60	60	58	59	+1 (+2%)
24hr Walk & Cycle Trips (000s)	320	322	313	313	329	314	316	+3 (+1%)
Sustainable Mode Share	35%	34%	34%	34%	32%	32%	32%	+0%
CO2 aggregate Emissions (2017=100)	100	109	98	98	100	91	92	+1 (+1%)
NOx aggregate Emissions (2017=100)	100	89	80	80	77	70	71	+1 (+1%)
24 hr Vehicle km	4,425	4,747	4,987	4,978	5,301	5,576	5,614	+38 (+1%)
24 hr PT Passenger km	1,221	1,019	1,232	1,233	1,017	1,285	1,300	+14 (+1%)
AM peak Delay (secs per veh km)	70	76	77	77	89	94	96	+2 (+2%)
% of Metrolink & Rail trips standing	40%	30%	35%	35%	29%	35%	34%	0%
Difference to 2017 Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	
24hr Car Trips (000s)	697	8%	6%	6%	19%	14%	14%	
24hr Public Transport Trips (000s)	64	-4%	-6%	-6%	-6%	-9%	-8%	
24hr Walk & Cycle Trips (000s)	320	1%	-2%	-2%	3%	-2%	-1%	
24 hr Vehicle km	4,425	7%	13%	12%	20%	26%	27%	
24 hr PT Passenger km	1,221	-17%	1%	1%	-17%	5%	6%	
AM peak Delay (secs per veh km)	70	9%	10%	11%	28%	35%	38%	

Table A.14 Tameside District High Level Metrics

Tameside Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	New All. Ref - New All Diff
24hr Car Trips (000s)	449	484	481	481	534	525	536	+11 (+2%)
24hr Public Transport Trips (000s)	60	58	57	57	56	55	56	+1 (+2%)
24hr Walk & Cycle Trips (000s)	266	268	260	260	273	261	264	+4 (+2%)
Sustainable Mode Share	42%	40%	40%	40%	38%	38%	37%	0%
CO2 aggregate Emissions (2017=100)	100	122	98	98	111	92	94	+2 (+2%)
NOx aggregate Emissions (2017=100)	100	99	80	80	84	71	72	+1 (+1%)
24 hr Vehicle km	2,856	2,924	3,205	3,210	3,317	3,699	3,763	+64 (+2%)
24 hr PT Passenger km	590	519	608	614	524	634	648	+14 (+2%)
AM peak Delay (secs per veh km)	64	71	72	71	86	85	87	+2 (+2%)
% of Metrolink & Rail trips standing	18%	6%	10%	10%	8%	13%	14%	+1%
Difference to 2017 Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	
24hr Car Trips (000s)	449	8%	7%	7%	19%	17%	20%	
24hr Public Transport Trips (000s)	60	-4%	-6%	-5%	-6%	-9%	-7%	
24hr Walk & Cycle Trips (000s)	266	1%	-2%	-2%	3%	-2%	0%	
24 hr Vehicle km	2,856	2%	12%	12%	16%	30%	32%	
24 hr PT Passenger km	590	-12%	3%	4%	-11%	7%	10%	
AM peak Delay (secs per veh km)	64	12%	12%	11%	34%	32%	36%	

Table A.15 Trafford District High Level Metrics

Trafford Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	New All. Ref - New All Diff
24hr Car Trips (000s)	597	645	644	647	713	720	740	+20 (+3%)
24hr Public Transport Trips (000s)	61	59	61	60	57	63	64	+1 (+2%)
24hr Walk & Cycle Trips (000s)	229	231	232	231	237	242	246	+5 (+2%)
Sustainable Mode Share	33%	31%	31%	31%	29%	30%	30%	0%
CO2 aggregate Emissions (2017=100)	100	109	98	98	99	91	94	+3 (+3%)
NOx aggregate Emissions (2017=100)	100	89	80	80	76	70	72	+2 (+3%)
24 hr Vehicle km	3,300	3,779	3,694	3,770	4,226	4,204	4,414	+211 (+5%)
24 hr PT Passenger km	603	658	611	610	672	651	668	+17 (+3%)
AM peak Delay (secs per veh km)	56	61	64	62	70	76	76	-1 (-1%)
% of Metrolink & Rail trips standing	40%	29%	31%	30%	32%	35%	36%	+0%
Difference to 2017 Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	
24hr Car Trips (000s)	597	8%	8%	8%	19%	21%	24%	
24hr Public Transport Trips (000s)	61	-4%	0%	-1%	-6%	3%	5%	
24hr Walk & Cycle Trips (000s)	229	1%	1%	1%	3%	5%	7%	
24 hr Vehicle km	3,300	15%	12%	14%	28%	27%	34%	
24 hr PT Passenger km	603	9%	1%	1%	11%	8%	11%	
AM peak Delay (secs per veh km)	56	9%	14%	11%	25%	36%	35%	

Table A.16 Wigan District High Level Metrics

Wigan Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	New All. Ref - New All Diff
24hr Car Trips (000s)	667	717	709	711	785	771	784	+12 (+2%)
24hr Public Transport Trips (000s)	49	47	45	46	45	43	44	+1 (+2%)
24hr Walk & Cycle Trips (000s)	362	360	356	356	362	361	366	+5 (+1%)
Sustainable Mode Share	38%	36%	36%	36%	34%	34%	34%	0%
CO2 aggregate Emissions (2017=100)	100	120	98	98	107	90	92	+2 (+2%)
NOx aggregate Emissions (2017=100)	100	98	80	80	81	69	70	+1 (+1%)
24 hr Vehicle km	4,979	5,302	5,657	5,688	5,967	6,323	6,449	+126 (+2%)
24 hr PT Passenger km	444	562	496	504	550	481	493	+12 (+2%)
AM peak Delay (secs per veh km)	59	73	78	77	87	94	96	+2 (+2%)
% of Metrolink & Rail trips standing	1%	7%	11%	11%	8%	13%	13%	0%
Difference to 2017 Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	
24hr Car Trips (000s)	667	8%	6%	7%	18%	16%	18%	
24hr Public Transport Trips (000s)	49	-5%	-8%	-7%	-8%	-13%	-11%	
24hr Walk & Cycle Trips (000s)	362	-1%	-2%	-2%	0%	0%	1%	
24 hr Vehicle km	4,979	6%	14%	14%	20%	27%	30%	
24 hr PT Passenger km	444	26%	12%	13%	24%	8%	11%	
AM peak Delay (secs per veh km)	59	23%	31%	30%	47%	59%	62%	

Table A.17 SRN High Level Metrics

SRN Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	New All. Ref - New All Diff
CO2 aggregate Emissions (2017=100)	100	110	98	98	101	84	86	+2 (+2%)
NOx aggregate Emissions (2017=100)	100	92	80	80	81	67	69	+1 (+1%)
24 hr Vehicle km	15,886	25,775	18,458	18,531	29,468	19,595	19,838	+243 (+1%)
AM peak Delay (secs per veh km)	35	84	43	45	95	57	64	+6 (+10%)
Difference to 2017 Metric	2017 Base	2025 S1 NTEM	2025 S2 Ref	2025 S2 New Alloc	2040 S1 NTEM	2040 S2 Ref	2040 S2 New Alloc	
24 hr Vehicle km	15,886	62%	16%	17%	85%	23%	25%	
AM peak Delay (secs per veh km)	35	142%	25%	28%	172%	64%	82%	

Appendix B: Assignment Parameters and TAG Certainty Categories

Table B.1 Value of time (PPM, pence per minute) and vehicle operating costs (PPK, pence per kilometre) used in assignment

	2017 PPM	2017 PPK	2025 PPM	2025 PPK	2040 PPM	2040 PPK
Morning peak						
Commute	21	6.58	23.42	7.57	31.67	8.16
Business	31	14	35	14.55	47.3	14.88
Other	14.16	6.58	16.17	7.57	21.87	8.16
LGV	21.71	13.66	24.8	14.68	33.54	15.19
OGV	22	51.36	25.12	57.03	33.97	61.26
Inter peak						
Commute	20.87	6.58	23.83	7.57	32.23	8.16
Business	31.44	13.83	35.9	14.55	48.56	14.88
Other	15	6.58	17.21	7.57	23.28	8.16
LGV	22	14	25	14.68	33.54	15.19
OGV	21.99	51.36	25.12	57.03	33.97	61.26
Evening peak						
Commute	21	6.58	23.63	7.57	31.95	8.16
Business	31	14	36	14.55	48.14	14.88
Other	14.82	6.58	16.93	7.57	22.89	8.16
LGV	21.71	13.66	24.8	14.68	33.54	15.19
OGV	22	51.36	25.12	57.03	33.97	61.26

Table B.2 TAG Certainty Categories

Probability of the input	Status	Scenario Assumptions
Near certain: The outcome will happen or there is a high probability that it will happen.	Intent announced by proponent to regulatory agencies. Approved development proposals. Projects under construction.	This should form part of the NTEM Central core scenario.
More than likely: The outcome is likely to happen but there is some uncertainty.	Submission of planning or consent application imminent. Development application within the consent process.	This could form part of the core scenario.
Reasonably foreseeable: The outcome may happen, but there is significant uncertainty.	Identified within a development plan. Not directly associated with the transport strategy/scheme but may occur if the strategy/scheme is implemented. Development conditional upon the transport strategy/scheme proceeding. Or, a committed policy goal, subject to tests (e.g. of deliverability) whose outcomes are subject to significant uncertainty.	These should be excluded from the core scenario but may form part of the alternative scenarios.
Hypothetical: There is considerable uncertainty whether the outcome will ever happen.	Conjecture based upon currently available information. Discussed on a conceptual basis. One of a number of possible inputs in an initial consultation process. Or, a policy aspiration.	These should be excluded from the core scenario but may form part of the alternative scenarios.

Appendix C: Accessibility Analysis

Figure C.1: Base 2017

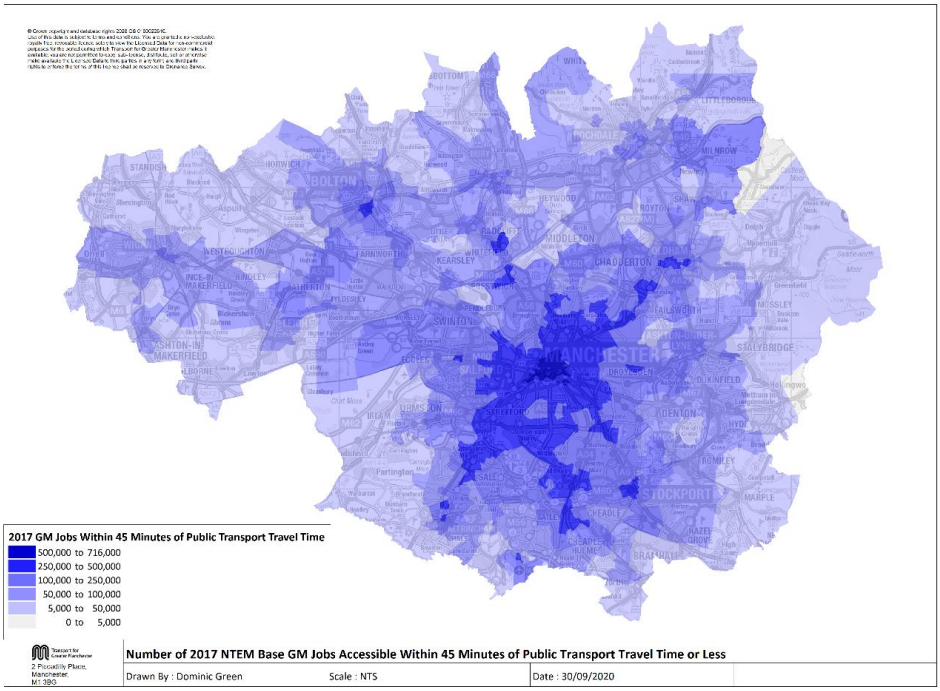


Figure C.4: Scenario 2 Policy Off Reference 2040

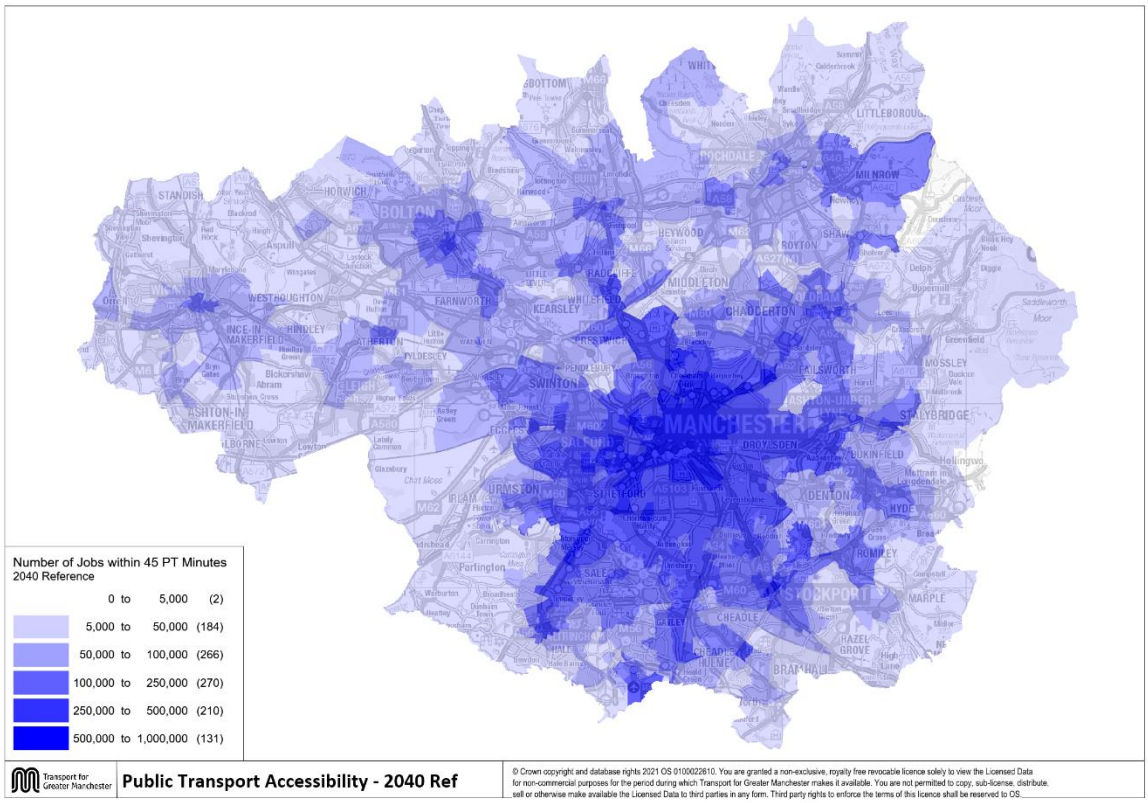
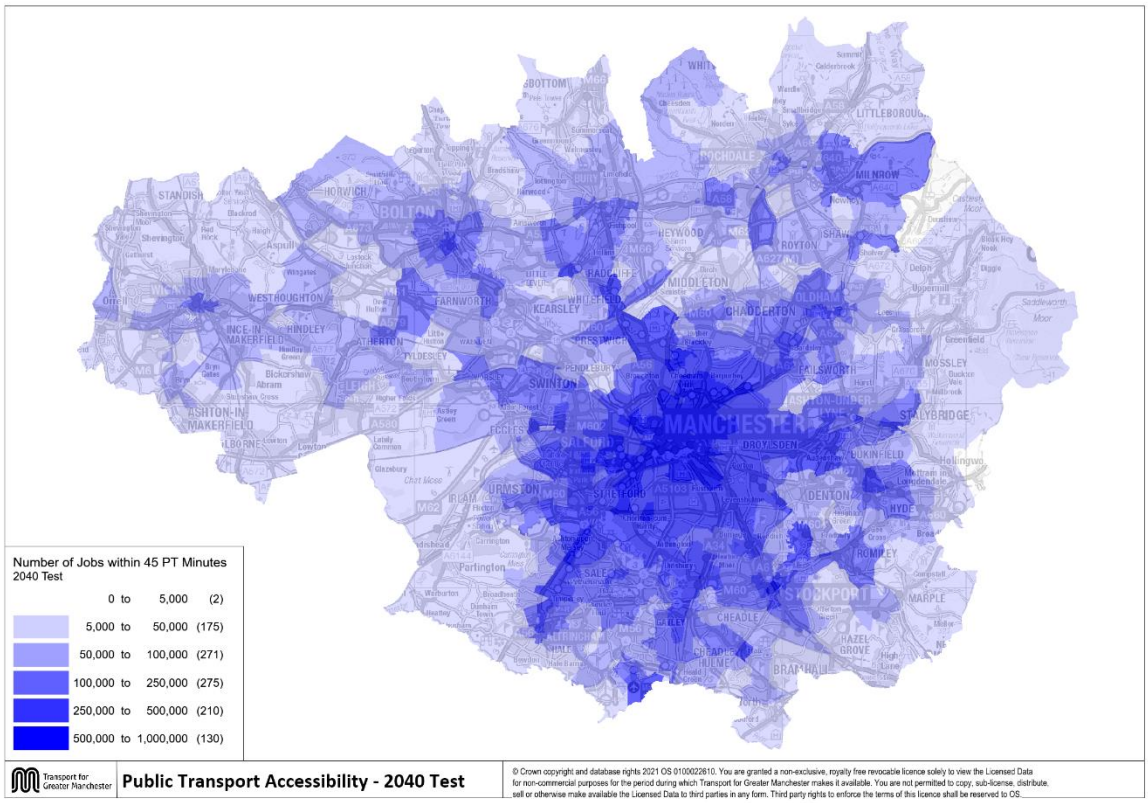


Figure C.5: 2040 Scenario 2 Policy Off Allocations 2040



Appendix D: Trip Rates, Job and Populations Densities

8.9 The Trips rates used are based on the Trafford Park Metrolink business case trips rates, which are based on TRICS. They are peak period (AM: 0700-1000, IP: 1000-1600, PM: 1600-1900) and are the number of person trips. There are separate rates for arrivals and departures.

8.10 Rates are split such that areas within town centres (TC) and outside town centres (non TC) use different rates.

8.11 The following areas have been defined as town centres: Wigan, Bolton, Bury, Oldham, Rochdale, Ashton, Stockport, Eccles, Altrincham, City Centre (the area within the Inner Ring Road), Airport.

8.12 The rates used are shown in the two tables below.

Arrival trips for period	Per	HW AM	HW IP	HW PM	PT AM	PT IP	PT PM	Active AM	Active IP	Active PM
Apartments/TC	1 dwelling	0.13	0.41	0.33	0.00	0.09	0.14	0.12	0.67	0.64
Houses/TC	1 dwelling	0.49	1.38	0.95	0.02	0.07	0.06	0.12	0.30	0.32
B1c/B2/B8/TC	100 sqm	1.17	1.74	0.40	0.01	0.00	0.00	0.10	0.14	0.04
B1a/TC	100 sqm	1.75	0.95	0.20	3.45	0.60	0.08	1.45	7.46	0.82
B1c/B8/TC	100 sqm	0.55	0.63	0.13	0.01	0.00	0.00	0.07	0.12	0.02
B8/TC	100 sqm	0.15	0.25	0.06	0.01	0.00	0.00	0.02	0.02	0.00
B1c/TC	100 sqm	0.96	1.00	0.20	0.02	0.01	0.00	0.11	0.21	0.04
B2/B8/TC	100 sqm	1.24	1.98	0.47	0.01	0.00	0.00	0.09	0.11	0.04
B2/TC	100 sqm	1.79	2.85	0.67	0.01	0.00	0.00	0.13	0.15	0.05
B1c/B2/TC	100 sqm	0.55	0.63	0.13	0.01	0.00	0.00	0.07	0.12	0.02
Apartments/NonTC	1 dwelling	0.23	0.82	0.90	0.00	0.04	0.05	0.06	0.26	0.24
Houses/NonTC	1 dwelling	0.47	1.56	1.31	0.01	0.04	0.04	0.13	0.38	0.25
B1c/B2/B8/NonTC	100 sqm	1.17	1.74	0.40	0.01	0.00	0.00	0.10	0.14	0.04
B1a/NonTC	100 sqm	4.17	3.66	0.91	1.12	0.37	0.09	0.82	1.78	0.19
B1c/B8/NonTC	100 sqm	0.55	0.63	0.13	0.01	0.00	0.00	0.07	0.12	0.02
B8/NonTC	100 sqm	0.15	0.25	0.06	0.01	0.00	0.00	0.02	0.02	0.00
B1c/NonTC	100 sqm	0.96	1.00	0.20	0.02	0.01	0.00	0.11	0.21	0.04
B2/B8/NonTC	100 sqm	1.24	1.98	0.47	0.01	0.00	0.00	0.09	0.11	0.04
B2/NonTC	100 sqm	1.79	2.85	0.67	0.01	0.00	0.00	0.13	0.15	0.05
B1c/B2/NonTC	100 sqm	0.55	0.63	0.13	0.01	0.00	0.00	0.07	0.12	0.02

Departure trips for period	Per	HW AM	HW IP	HW PM	PT AM	PT IP	PT PM	Active AM	Active IP	Active PM
Apartments/TC	1 dwelling	0.33	0.41	0.22	0.12	0.08	0.03	0.30	0.72	0.30
Houses/TC	1 dwelling	0.87	1.26	0.80	0.06	0.09	0.04	0.22	0.31	0.15
B1c/B2/B8/TC	100 sqm	0.61	1.85	0.96	0.00	0.01	0.01	0.02	0.15	0.09
B1a/TC	100 sqm	0.25	0.91	1.70	0.09	0.80	3.23	0.42	7.46	1.84
B1c/B8/TC	100 sqm	0.17	0.69	0.52	0.00	0.02	0.01	0.01	0.17	0.06
B8/TC	100 sqm	0.06	0.28	0.13	0.00	0.01	0.01	0.00	0.04	0.01
B1c/TC	100 sqm	0.28	1.10	0.90	0.00	0.04	0.02	0.02	0.30	0.10
B2/B8/TC	100 sqm	0.72	2.10	0.98	0.00	0.01	0.01	0.02	0.10	0.09
B2/TC	100 sqm	1.05	3.01	1.40	0.00	0.00	0.01	0.04	0.13	0.13
B1c/B2/TC	100 sqm	0.17	0.69	0.52	0.00	0.02	0.01	0.01	0.17	0.06
Apartments/NonTC	1 dwelling	0.75	0.86	0.57	0.06	0.02	0.01	0.16	0.29	0.13
Houses/NonTC	1 dwelling	1.19	1.47	0.90	0.04	0.04	0.01	0.25	0.34	0.18
B1c/B2/B8/NonTC	100 sqm	0.61	1.85	0.96	0.00	0.01	0.01	0.02	0.15	0.09
B1a/NonTC	100 sqm	1.08	3.70	3.78	0.04	0.68	0.88	0.21	1.82	0.78
B1c/B8/NonTC	100 sqm	0.17	0.69	0.52	0.00	0.02	0.01	0.01	0.17	0.06
B8/NonTC	100 sqm	0.06	0.28	0.13	0.00	0.01	0.01	0.00	0.04	0.01
B1c/NonTC	100 sqm	0.28	1.10	0.90	0.00	0.04	0.02	0.02	0.30	0.10
B2/B8/NonTC	100 sqm	0.72	2.10	0.98	0.00	0.01	0.01	0.02	0.10	0.09
B2/NonTC	100 sqm	1.05	3.01	1.40	0.00	0.00	0.01	0.04	0.13	0.13
B1c/B2/NonTC	100 sqm	0.17	0.69	0.52	0.00	0.02	0.01	0.01	0.17	0.06

Jobs density

8.13 Where Office or Industry and Warehouse floorspace has been converted to a number of jobs, densities have been derived from the Homes and Community Agency Employment Density Guide 2015. In some cases the density guide has more than one density per use class, and so an average has been used.

Unique Use Classes	Square metres per job
B1a (Office)	11
B1c (Light Industrial)	47
B2 (Industrial and Manufacturing)	36
B8 (Storage and Distribution)	81

Population density

8.14 Where a number of houses or apartments has been converted to population, average rates of occupancy have been derived from the 2011 Census. The assumed number of people per house is 2.454, and the assumed number of people per apartment is 1.409.