T005

Essex Highways

Army & Navy Sustainable Transport Package:

Stage 2 Forecasting Report

Highways / Transport Planning

December 2022

Safer, greener, healthier

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Document Control Sheet

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Contents

Tables

Figures

Appendices

1 Introduction

1.1 Background

The city of Chelmsford is a regional centre located in the county of Essex and lying within the London commuter belt to the north-east of London. Chelmsford is the seat of Essex County Council and is a regional centre for services and employment with a population of about 180,000 people and home to about 100,000 jobs.

The Army and Navy junction is the key gateway to the city from the south and east, with around 70,000 vehicles per day travelling through the junction. The junction is situated to the south-east of Chelmsford city centre and is currently a five-arm part-signalised roundabout that, until recently, had a tidal single lane flyover connecting the primary movements from the southeast to the city centre. This flyover, which previously connected the movements between Parkway (A1060) in the city centre to the Strategic Road Network (SRN) at the A12 via Essex Yeomanry Way (A1114), was closed permanently in September 2019 as the functional life of the structure came to an end. The other connecting arms at the junction are Chelmer Road (A138), Baddow Road (B1009) and Van Diemans Road (A1114).

The city is also served by two Park & Ride services: the Sandon P&R site that provides services to the city centre via the A&N junction and the Chelmer Valley P&R site connecting the growth area to the north of Chelmsford for the city centre.

The location of the Army & Navy junction and the P&R sites is illustrated in the figures below.

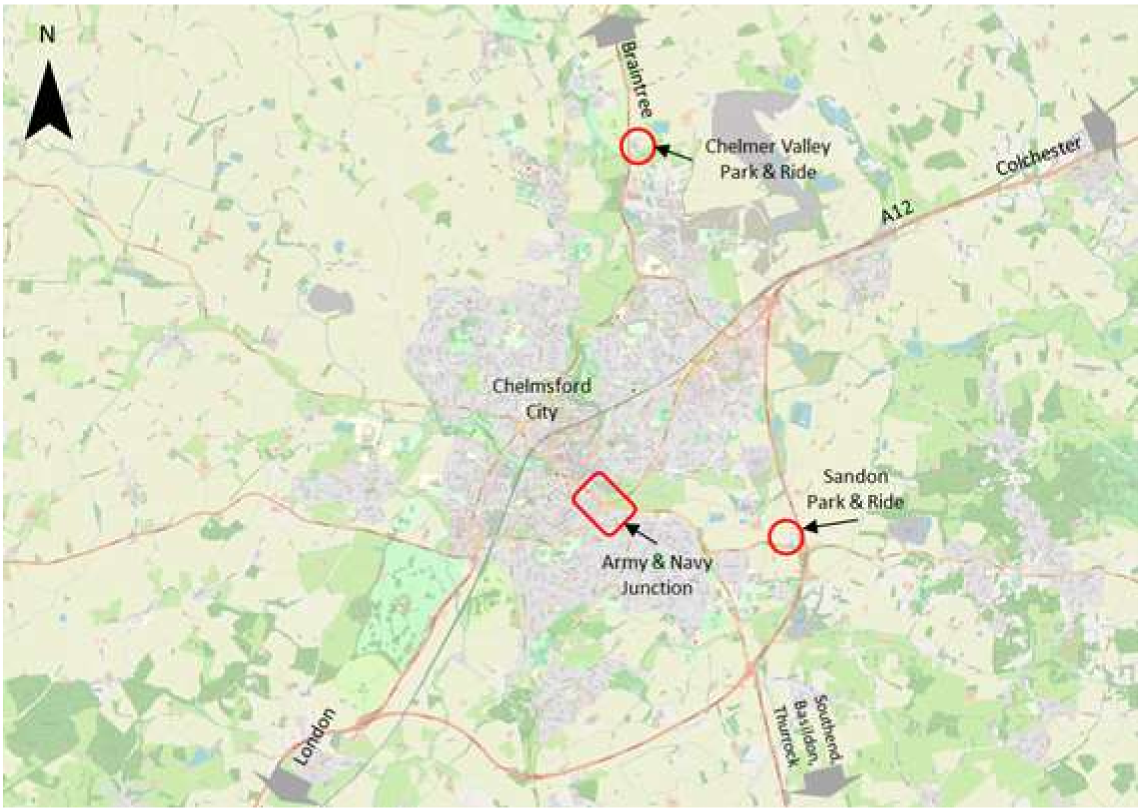

Figure 1-1: Chelmsford Transport Network and Scheme Location

Figure 1-2: Army and Navy Junction Location

Travel by residents of Chelmsford District is characterised by the commuter link to London via mainline rail (15% of commuter trips) and, although other modes such as bus (5%), walking (11%) and cycling (3%) play a role (based on 2011 Census Data), local and regional travel is still largely car-based for movements travelling to and from the city centre at 64% of commuter trips. In addition, given the status of Chelmsford City as a regional centre, there is a significant amount of commuting into and out of Chelmsford District, with the main external commuter flows being between London, Braintree, Basildon, Maldon and Colchester in that order[1].

The impact of car-based travel is mitigated to some extend by two successful P&R services run by ECC. These sites are located on key car-based travel corridors, with Sandon P&R located on the corridor serving the east (Maldon) and southeast (Basildon/Southend/Thurrock) and Chelmer Valley P&R located on the corridor serving the north (Braintree). The Sandon P&R served about 1,650 passengers per day in late 2019 while the Chelmer Valley site served about 800 passengers per day.

Despite this, the road network around the centre of Chelmsford is characterised by high traffic volumes and congestion during both weekday and weekend peak times, with an area in the vicinity of the A&N junction being designated as an air quality management area (AQMA). This congestion, at both the A&N junction itself and across the wider Chelmsford network, has been significantly exacerbated by the permanent closure of the flyover in September 2019 at the junction that connected EYW with Parkway and the centre of Chelmsford as the structure came to the end of its usable life.

A key significant change since the submission of the SOBC has been the impact of the COVID-19 pandemic on travel. While the pandemic had a profound impact on travel demand by all modes in 2020, and is continuing to affect conditions in 2022, it is not yet clear (at the time of writing) how it will affect longer term trends. The figure below shows the development of demand for travel by different modes in Great Britain since the start of the pandemic compared with the corresponding period in 2019[2].

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[1] Chelmsford City Council, 27 May 2020: *Chelmsford Local Plan quoting ONS 2010*
[2] Source: Jacobs analysis of DfT data from https://www.gov.uk/government/statistics/transport-use-during-the-coronavirus-covid-19-pandemic retrieved 21 April 2022

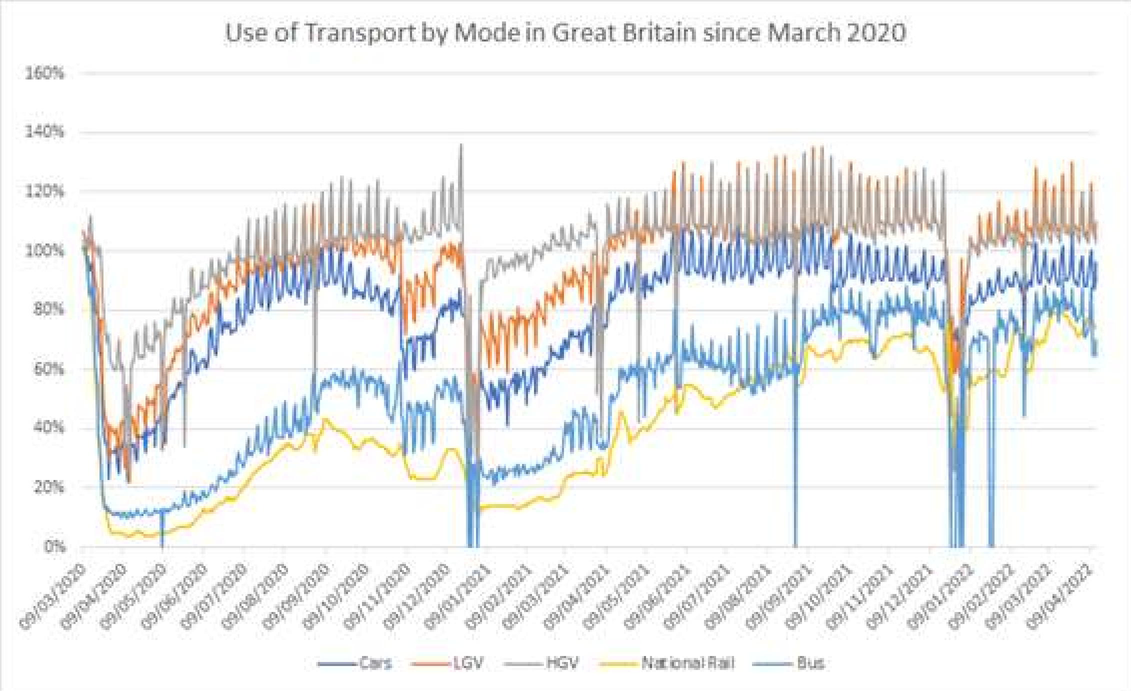

Figure 1-3: Use of Transport by Mode in Great Britain since March 2020

The above figure shows a significant downturn in demand for all modes during periods of national lockdown after March 2020 and again in January 2021. However, the data also suggests that highway demand has largely recovered to pre-pandemic levels while rail and bus demand continues to lie significantly below normal levels (at around 80% of pre-COVID levels).

The long-term trend, particularly with respect to public transport, is still uncertain. However, the forecast year modelling outlined in this document has been developed in accordance with the latest DfT guidance on how to address this uncertainty. The treatment of uncertainty is discussed in detail in section 2.10.

1.2 Purpose of this Report

This Report documents the methodology, findings and conclusions of the future-year scenario modelling undertaken in support of the Outline Business Case (OBC) for a MRN funding application to DfT, to be submitted in 2022.

The modelling covers the development of a strategic model in VISUM, including both assignment and variable demand models, a VISSIM microsimulation model and LINSIG models for developing signal timings for the models.

It should also be noted that this Report covers the methodology and results for all phases of the modelling carried out during Stage 2 of the Transport Appraisal Process (TAP) as follows:

- Phase 1: Revised modelling of options coming forward from TAP Stage 1 using an updated suite of modelling tools (DfT Databook v1.13.1 with sensitivity testing using v1.14):
    - Modelling and appraisal of four options from TAP Stage 1 (options B, C, D and E)
    - Review of option performance
    - Option B discarded by Task Force
- Phase 2: LTN 1/20 design revision (DfT Databook v.1.13.1 with sensitivity testing using v1.14):
    - Update of junction option design to be compliant with new DfT guidance with respect to walking and cycling infrastructure (LTN 1/20)
    - Modelling and appraisal of remaining three options with LTN compliant design
    - Review of option performance resulting in Option D being discarded, leaving Option C and Option E to go Public Consultation
- Phase 3: Finalisation of options design and appraisal prior to public consultation (DfT Databook v1.13.1) and the subsequent inclusion of public consultation outcomes in the Decision Framework, culminating in the identification of the preferred junction option:
    - Update of Option E design in response to a review of the operational safety of the layout
    - Revised modelling and appraisal of Option E
    - Completion of additional appraisal items for both options including noise, local air quality, walking and cycling impact (AMAT) and journey time reliability
    - Review of public consultation outcomes for inclusion in the Decision Framework
    - Review of option performance via the updated Decision Framework to identify preferred junction option
- Phase 4: Final design, modelling and appraisal for OBC (DfT Databook v1.15)
    - Revision of preferred junction option to incorporate detailed feedback from public consultation
    - Identification of the preferred sustainability package

  - Modelling and appraisal for preferred scheme package for OBC

Full detailed results are outlined in this report for the modelling and appraisal of the preferred option described in the OBC. Results for the phases 1 to 3 are discussed in the TAP Stage 2 Options Assessment Report (OAR) and summarised in the OBC.

1.3 Related Documents

This report is accompanied by the following related supporting documents:

- Chelmsford Model Update: Data Collection Report (DCR), August 2020;
- Chelmsford Model Update: Local Model Validation Report (LMVR), April 2021;
- Vissim Local Model Validation and Forecasting Report, August 2022; and
- Chelmsford Park & Ride 2019 Base Model Report, June 2021.

These documents are referred to throughout this report.

1.4 Report Structure

Following this introduction, the report is structured as follows:

- Chapter 2: Approach to Forecasting;
- Chapter 3: Forecast Model Network Development;
- Chapter 4: Forecast Model Matrix Development;
- Chapter 5: Variable Demand Model;
- Chapter 6: Treatment of Park & Ride;
- Chapter 7: Treatment of Beaulieu Park Rail Station
- Chapter 8: Strategic Model Results; and
- Chapter 9: Assignment Results for Appraisal.

2 Approach to Forecasting

2.1 Introduction

This section describes the general approach to forecasting and key design considerations for the model specification as well as the context within which the model was developed. Note that the development of the key model elements of networks and demand are described in detail in sections 3 and 4 respectively.

2.2 Context

The proposed schemes being assessed include improvements at the A&N junction, which is currently a partially signalised 5-arm roundabout, expansion of P&R services in Chelmsford and significant walking and cycling infrastructure improvements. The spatial impacts of these measures vary from local city centre impacts for all modes (car-based, bus, walking and cycling) to regional impacts for car-based travel. This provides a complex set of problems for transport modelling and has necessitated a suite of modelling tools to appropriately model the scheme at different spatial levels and with varying levels of complexity.

The Chelmsford Strategic Model largely captures the performance of DM and DS forecast year scenarios in a strategic context while attempting to adequately model a complex junction within an urban context. As described in the LMVR, this has necessitated a relatively detailed model network in the urban centre of Chelmsford but also sufficient detail at the regional level to capture more strategic shifts in travel approaching Chelmsford. At the same time and given the nature of the scheme, the model focuses more on car-based travel, which includes P&R, while still considering the impact of the scheme on public transport (bus and rail) generalised costs and mode share.

A further complication is the inclusion of vastly improved walking and cycling infrastructure at the A&N junction. Given the detailed nature of the interactions between road-based transport and walking and cycling at the junction, a microsimulation model has been developed to aid in scheme design and assess the impacts on operating performance for all modes in the immediate vicinity of the A&N junction.

These modelling tools have been developed to be as consistent as possible within the constraints of the differing methodologies and data requirements inherent in each. For example, the forecast year demand for the microsimulation models is derived directly from the strategic model forecasts and in this way includes the impacts of variable demand responses and the explicit P&R modelling included in the strategic model. In the other direction, the VISSIM model helps to inform the forecast year signal timings adopted within the strategic model.

Within this context, each modelling tool has a different purpose, with the Chelmsford Strategic Model providing the basis for all monetised appraisal informing the business case and the A&N microsimulation model informing junction design and the assessment of operational performance.

This report covers the Chelmsford Strategic Model. For a detailed description of the A&N microsimulation model, refer to the report *Vissim Local Model Validation and Forecasting Report*.

2.3 Geographical Scope

The updated base year Chelmsford Strategic Model was used as the basis for the development of the forecasting models to provide the evidence base for the OBC. The geographic coverage of the model was defined as part of the development of the Chelmsford Base Model and is described in detail in the LMVR. The resulting model coverage, established in line with TAG unit M3.1 section 2.2.1, can be summarised as follows:

- Fully Modelled Area, made up of:
  - Area of Detailed Modelling (AoDM), consisting of the Chelmsford District administrative area and, in places, its periphery, and
  - Rest of the Fully Modelled Area, consisting of the area surrounding the AoDM including Braintree to the north, the M11/A120 junction to the northwest, the A12/A120 junction to the northeast, Basildon to the south and Brentwood and the A12/M25 junction to the southwest.
- External Area, including all of mainland UK outside of the Fully Modelled Area.

These areas are illustrated in the figure below.

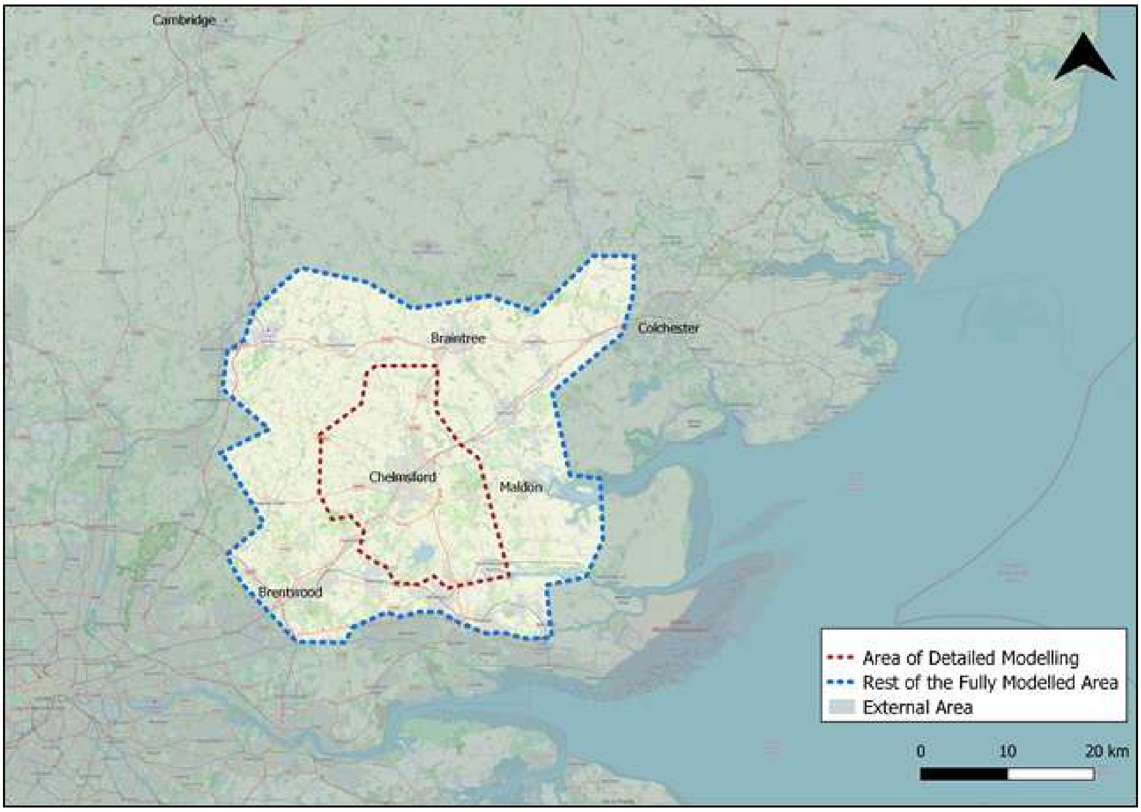

Figure 2-1:Chelmsford Model Geographic Coverage

It is noted that the full demand for all origin-destination pairs is captured for the fully modelled area. In addition, some of the Chelmsford Model External Area also includes the full demand with only external demand peripheral to Essex and not passing through Essex excluded.

2.4 Base Year

The Chelmsford Strategic Model was developed for a base year of 2019 representing average neutral weekday conditions during the period September to November of that year. Crucially for the A&N study, this represents the period after the permanent closure of the A&N flyover and prior to the impact of COVID19.

2.5 Time Periods

The demand modelling is undertaken at the 24-hour level while the assignment model was built to represent three weekday time periods as follows:

- AM peak hour (07:30-08:30);
- PM peak hour (17:00-18:00); and
- Average hour in the interpeak (10:00-16:00).

Continuous and ATC count data from in and around the Chelmsford administrative area was used to define the AM and PM peak hours while the inter-peak average hour is based on an average of the 10:00 to 16:00 time period. See the Chelmsford Model Update – Data Collection Report (DCR) (August 2020) for more information on the derivation of these time periods.

2.6 Forecast Years

For the A&N scheme, two forecast years were modelled as follows:

- 2026, the estimated scheme opening year; and
- 2041 future year.

These forecast years are based on the opening year and 15-year after that, which includes the end of the Chelmsford LP period of 2036 plus 5 years of additional background growth.

It was not considered necessary to model any intermediate years between the opening year and 2041 since there are not expected to be any significant step changes in demand or supply during that period that would significantly affect the profile of benefits for this scheme. It is worth noting that additional model years would add significantly to total modelling time and would have a significant impact on the project programme. Model run times are in excess of 24 hours for many scenarios (greater than 48 hours for some). While additional model years could be tested to confirm their level of impact on benefits, it was not considered proportional to do so at this stage. This will be reassessed in TAP Stage 3 following an update of the uncertainty log at that time.

It should also be noted that no additional forecast years post-2041 were considered likely to provide any proportionally significant benefits. Although TAG Unit M4 1.2 identifies the potential use of a forecast year "as far into the future as possible", such as a 2051 forecast to align with the final year in NTEM forecasts, this was not undertaken as, i) there were no changes in supply side or local demand identified for the period after 2041, ii) model run times for an additional forecast year for multiple scheme options would impact disproportionately on project programme, and iii) this provides a conservatively low estimate of benefits since a higher demand 2051 scenario would provide higher benefits as the impact of higher demand on the DM journey times would be larger than under the DS scenario. In addition, for the purposes of the operational performance of the scheme under higher demand, the High Growth scenario undertaken will provide evidence in this respect. This approach is therefore considered appropriate and proportionate for this stage of the scheme and will be reassessed for TAP Stage 3.

2.7 Demand Segments

Demand segments refer to the type of trips modelled by mode and purpose and for the demand model by car availability. Segmentation varies by demand and assignment models, are consistent with the recommendations set out for demand modelling in TAG Unit M2-1 and are outlined in the following table.

Table 2-1: Strategic Model Demand Segments

<table>
<tr><th>High Level</th><th>Vehicle Class (VC)</th><th>Assignment User Class (UC)</th><th>Demand Model Trip Purpose</th></tr>
<tr><td rowspan="10">Private transport</td><td rowspan="8">Car (VC1)</td><td>Car Commuter (UC1)</td><td>Home Based Work (HBW)</td></tr>
<tr><td rowspan="2">Car Employer’s Business (UC2)</td><td>Home Based Employer’s Business (HBEB)</td></tr>
<tr><td>Non-Home-Based Employer’s Business (NHBEB)</td></tr>
<tr><td rowspan="4">Car Other (UC3)</td><td>Home Based Education (HBE)</td></tr>
<tr><td>Home Based Shopping (HBS)</td></tr>
<tr><td>Home Based Other (HBO)</td></tr>
<tr><td>Non-Home-Based Other (NBHO)</td></tr>
<tr><td>LGV (VC2)</td><td>LGV (UC4)</td><td>-</td></tr>
<tr><td>HGV (VC3)</td><td>HGV (UC5)</td><td>-</td></tr>
<tr><td rowspan="9">Public Transport (Bus, Rail, London Underground)</td><td rowspan="9">n/a</td><td rowspan="2">Commuter</td><td>Car Available - Home Based Work (HBW)</td></tr>
<tr><td>No Car Available - Home Based Work (HBW)</td></tr>
<tr><td rowspan="4">Employer’s Business</td><td>Car Available - Home Based Employer’s Business (HBEB)</td></tr>
<tr><td>No Car Available - Home Based Employer’s Business (HBEB)</td></tr>
<tr><td>Car Available - Non-Home-Based Employer’s Business (NHBEB)</td></tr>
<tr><td>No Car Available - Non-Home-Based Employer’s Business (NHBEB)</td></tr>
<tr><td rowspan="3">Other</td><td>Car Available - Home Based Education (HBE)</td></tr>
<tr><td>No Car Available - Home Based Education (HBE)</td></tr>
<tr><td>Car Available - Home Based Shopping (HBS)</td></tr>
</table>

High Level	Vehicle Class (VC)	Assignment User Class (UC)	Demand Model Trip Purpose
			No Car Available - Home Based Shopping (HBS)
			Car Available - Home Based Other (HBO)
			No Car Available - Home Based Other (HBO)
			Car Available - Non-Home Based Other (NHBO)
			No Car Available - Non-Home Based Other (NHBO)

As mentioned in section 2.1, given the strategic nature of the model and the complex nature of the walking and cycling measures being introduced at the A&N junction, these modes are not considered in the strategic model but are rather treated within the local VISSIM microsimulation model. This is described in detail in the report *Vissim Local Model Validation and Forecasting Report*.

2.8 Treatment of Growth

The general treatment of demand growth varies by mode.

Car-based and PT demand is developed within the context of a Variable Demand Model (VDM), as described in detail in sections 4 and 5. In summary, car-based and PT demand is based initially on reference case demand, which is independent of network generalised costs, at the 24-hour level on a production attractive (PA) basis. For car- based demand, the reference case demand combines national estimates of growth via the National Trip End Model (NTEM) with local estimates based on planning applications and developments identified in the adopted Chelmsford Local Plan (LP) as well as a number of sites in Braintree District. Total demand is constrained to NTEM values at District level for Chelmsford and Braintree with the remainder of the UK derived directly from NTEM. This demand is input into the VDM, where various demand response to changes in assignment model generalised costs are considered.

LGV and HGV demand growth is fixed (i.e., not subject to changes in generalised costs via the VDM) and is based on the latest Road Traffic Forecasts (RTF) (2018) Scenario 1[3] growth estimates for the East of England

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[3] This is the reference scenario based on central projections for GDP (OBR), for fuel prices, and for population (ONS)

published by DfT. This growth is applied at the assignment (peak hour) matrix level as goods vehicles are external to the variable demand model.

2.9 Variable Demand and Modelled Responses

A Variable Demand Model (VDM) has been developed and is described in detail in the LMVR and summarised in section 5 of this report. As described in the LMVR, the VDM addresses the following choice responses in hierarchical order:

- Mode choice, i.e., car (including P&R) versus public transport (bus and rail);
- Destination choice (trip distribution); and
- Route choice (assignment)

This is illustrated in the following figure.

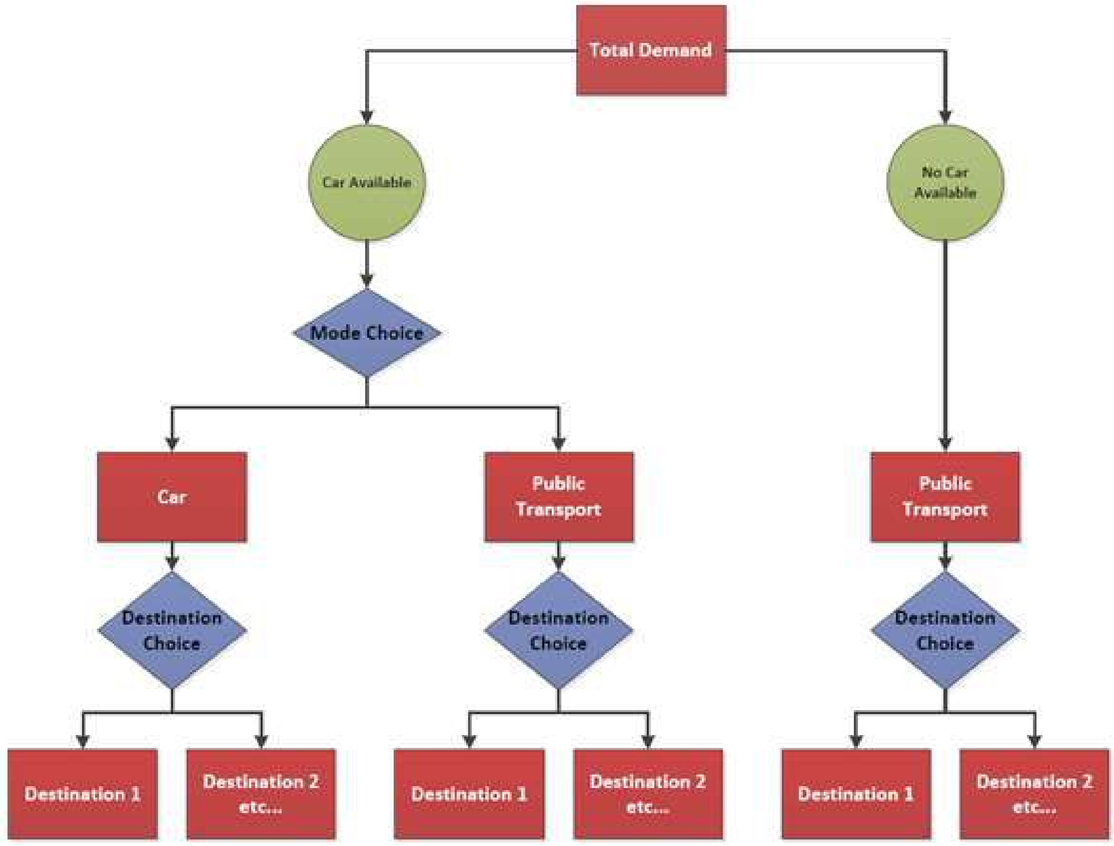

Figure 2-2: Chelmsford VDM Choice Structure

The demand model is designed to take account of future strategic and local growth in population and employment and to be capable of predicting likely travel behaviour in terms of mode choice and trip distribution of trips with one or both trip-ends within Chelmsford District and its periphery. The trip distribution response considers the attractiveness of alternative destinations whereas the mode choice response considers demand switching between car and public transport. Since mode choice depends on whether a traveller has a car available for the journey, the model distinguishes between households that have a car available and those that do not.

Due to the nature of the scheme being assessed and based on the objectives of the Chelmsford Model update, the public transport (PT) modelling adopted a 'light-touch' approach in that it largely incorporated the validated Essex Countywide Model VDM structure and data (see LMVR for detail). This was considered proportionate since the schemes do not address public transport in a significant way (apart from local dedicated bus lanes at the A&N junction) and are not expected to significantly impact on bus or rail generalised costs. As such, the primary objective of the PT component of the model is to provide reasonable PT generalised costs as inputs to the VDM process.

However, it should be noted that P&R is explicitly modelled externally to the VDM. Given the importance of P&R in Chelmsford and the expectation that changes to P&R will be included as part of the proposed scheme, a bespoke choice model was developed to assess how changes in car-based journey times impact on P&R demand. P&R is not considered as PT (bus and rail) but rather as a choice that effectively sits underneath the car branch in the above figure, that is, P&R is considered a choice of car park location (city centre long-stay versus P&R) after the decision is made to choose car. The implied assumption is that P&R does not significantly compete with bus or rail, that is, the choice is considered to be between PT and car and then, for car travel to the city centre, between city centre car parks and P&R. The rationale for this is based on the geographic corridors that are serviced by P&R, which are characterised by very low PT service and therefore very high car-based travel demand. Evidence to support this rationale consists of an estimate of the generalised cost of travel for PT versus P&R in the key corridors served by the P&R system and is outlined in section 6.2.3.

The treatment of P&R is summarised in section 6 of this report and outlined in detail in the *Chelmsford P&R 2019 Base Model Report*.

It is also noted that the above structure excludes the trip frequency and time period responses. Regarding trip frequency, TAG Unit M2.1[4] indicates that, "*Where the active modes of walk and cycle are not explicitly included in the demand model, trip frequency may be thought of as, mainly, the transfer between the active modes and the mechanised modes. Otherwise, overall trip rates will be fairly stable and there will often be no need to model the response of trip frequency to changes in travel cost since the effect of trip frequency is likely to be small. It may therefore be proportional to omit this response, particularly since the frequency effect is markedly less important than the other choices and there is little evidence to justify the scale of frequency parameters and elasticities by purpose.*" While census data and historic survey at the A&N junction indicates that base numbers of active mode users are relatively low, improvements to active modes have been prioritised at the junction as part of the scheme in line with DfT and ECC policy. The appraisal of this impact has been undertaken outside the strategic model in a more geographically focused manner using a microsimulation model and DfT's AMAT tool (see the Stage 2 EAR and AMAT Technical Note). It should also be noted that the improvements to active modes are very similar for all options and as such not likely to assist in distinguishing between options in an economic sense although operational performance is assessed and compared using the VISSIM microsimulation models. Given that trip frequency was not part of the original VDM set up adopted from the Countywide Model, it was not considered proportionate to invest in this functionality at this time.

Regarding time of day choice, TAG Unit M2.1[5] states that, "*macro time period choice should be considered when strong cost differentials between time periods are expected to develop or change. This is obviously the case where different charges are introduced for use of a road, rail or bus service in the peak and inter peak or off-peak, or where different levels of access to road capacity are being contemplated, or perhaps where peak surcharges are introduced for parking in a way which affects a large proportion of traffic.*" The proposed schemes for this project do not introduce changes in charges or road pricing and given that this response was not part of the original VDM set up adopted from the Countywide Model, it was not considered proportional to invest in this functionality at this time. Similarly with micro time period choice (peak spreading), since the peak periods in Chelmsford are relatively flat, leaving little

[4] Department for Transport, May 2020: *TAG Unit M2.1 Variable Demand Modelling paragraph 4.6.3*
[5] Department for Transport, May 2020: *TAG Unit M2.1 Variable Demand Modelling paragraph 4.8.5*

scope for further peak spreading, it was not considered proportionate to add this response at this time.

It is deemed that cycle and walk modes do not provide a realistic alternative for journeys across the wider study area of this size and so they are not modelled in the strategic VISUM model but were analysed as part of the VISSIM microsimulation modelling as outlined in section 2.2.

Road based goods vehicle trips are assumed to be non-responsive to changes in travel costs (with their trip making influenced by other, external, economic factors) and therefore remain fixed within the variable demand model.

2.10 Treatment of Uncertainty

The treatment of uncertainty considered DfT guidance outlined in *TAG Unit M4 Forecasting and Uncertainty* (May 2019) as well as newly released supplementary guidance in the *Uncertainty Toolkit* (May 2021). It is also acknowledged that this guidance is currently being reviewed and updated to incorporate Common Analytical Scenarios (CAS) that address different potential future scenarios with respect to key variables that build on the current High and Low growth scenarios.

As described in this guidance, most sources of forecasting uncertainty in transport modelling and appraisal can be classified into one of the following five categories:

- Model parameter errors;
- National uncertainty in travel demand, due to uncertainty in demographic projections and traveller’s behaviour and tastes;
- National uncertainty in travel cost, typically due to uncertainty in fuel prices or government policy;
- Local uncertainty in travel demand, the most common cause being uncertainty surrounding whether proposed developments (for example housing, employment, schools, or retail) are built; and
- Local uncertainty in travel supply/cost, potential sources of uncertainty include whether other transport construction projects materialise.

The main uncertainties identified for this scheme with respect to modelling and appraisal, including risks and opportunities to the project and how they are to be addressed, are presented below in the form of an uncertainty log.

Table 2-2: Army & Navy Sustainable Transport Package Uncertainty Log

Input/Item	Forecast Year	Description of Model Central Assumptions	Uncertainty Assumption / Status	Comments/Narrative
Model Parameter Uncertainty				
Sensitivity of P&R model lambda	2026 / 2041	Lambda parameters calibrated on local data by purpose: • Commuter 1.06840 • Business 0.70513	+25% of calibrated lambda values by purpose	See section 6.
National Uncertainty				
Growth in demand	2026 / 2041	NTEM plus approved planning applications and Chelmsford Local Plan developments (constrained to NTEM at District level)	High Growth	DfT is currently revising its guidance related to the treatment of national uncertainty, in part to provide guidance in the post-COVID context. Recent discussions and information sessions hosted by DfT indicate that the revised guidance and associated datasets were not likely to be issued in time for use for the Stage 2 appraisal of this scheme. As such, it has been agreed with DfT to follow the preliminary guidance issued in the Uncertainty Toolkit in May 2021 and to undertake TAG M4 Low Growth and High Growth scenarios to address national level uncertainty. It is noted that DfT indicated that these scenarios are likely to capture the majority of the range of uncertainty that the forthcoming Common Analytical Scenarios (CAS) will capture. It is noted that this captures the impact on forecast flows and journey time as well as P&R demand.
			Low Growth	

Input/Item	Forecast Year	Description of Model Central Assumptions	Uncertainty Assumption / Status	Comments/Narrative
Local Uncertainty: Factors affecting underlying demand				
Growth in Demand – Location of housing and jobs from development applications and Chelmsford Local Plan	2026	9,811 houses	The scenario represented by these local developments – the core scenario - is consider the most likely and consistent scenario given the philosophy and content of the approved Chelmsford LP. The majority of this housing is located in north Chelmsford plus some in central Chelmsford, with this general philosophy of the growth areas clearly stated in the LP. Since this local data impacts on the distribution of trips rather than the overall quantity, which is constrained to NTEM, no alternative scenario based on local data is therefore considered necessary.	The local area with respect to uncertainty has been defined as the area covered by the approved Chelmsford District LP plus some large sites just north of Chelmsford in Braintree District. All sites included here are considered *near certain* (approved planning application) or *more than likely* (PPA and in approved LP) and fulfil a criteria based on size, type and location. All other sites (small or considered only reasonably foreseeable or hypothetical) were not explicitly modelled. See section 4.2.1 for details of all individual sites.
	2041	16,850 houses		
	2026	2,476 jobs		
	2041	5,325 jobs		
Local Uncertainty: Factors affecting supply of transport				
A12 Chelmsford to A120 widening RIS 1 Committed Scheme	2026	Included in DM and DS	Same as Core	This scheme has a PRA and is considered *near certain* and is therefore included in the Core scenario.
	2041		Same as Core	
Lower Thames Crossing RIS 1 Committed Scheme	2026	Not included in DM or DS	Same as Core	This scheme is considered *more than likely* and is therefore included in the Core scenario.
	2041	Included in DM and DS	Same as Core	
A120 Braintree to A12 scheme, RIS2 pipeline project	2026	Not included in DM or DS	Same as Core	This scheme does not have a PRA and is a pipeline project and is therefore considered *reasonably foreseeable* and not included in the DM scenario. In addition, due to the nature and location of the scheme, it

Input/Item	Forecast Year	Description of Model Central Assumptions	Uncertainty Assumption / Status	Comments/Narrative
	2041	Not included in DM or DS	Same as Core	is not considered likely that it would have any significant impact on the A&N scheme appraisal and is not included in any sensitivity test.
Sheepcotes Roundabout	2026	Included in DM and DS	Same as Core	This scheme was constructed in 2020.
	2041		Same as Core	
Boreham Interchange improvements	2026	Included in DM and DS	Same as Core	This scheme is considered *near certain* as it is currently under construction.
	2041		Same as Core	
Radial Distributor Road (RDR) 1	2026	Included in DM and DS	Same as Core	This scheme forms part of the Chelmsford LP *Strategic Growth Site Policy 6 – North East Chelmsford*. It is currently under construction and is therefore considered *near certain*.
	2041		Same as Core	
Chelmsford North East Bypass (CNEB) and A131 dualling: ECC project with committed funding	2026	Included in DM and DS	Same as Core	This scheme forms part of the Chelmsford LP *Strategic Growth Site Policy 6 – North East Chelmsford*. It is considered *more than likely*, with the planning application imminent, funding committed and a safeguarded corridor.
	2041		Same as Core	
New Beaulieu Park Rail Station and access	2026	Included in DM and DS	Same as Core	The new rail station is part of the CNEB scheme granted HIF and SELEP funding and planning for opening in 2025/26. It is therefore considered *more than likely*.
	2041		Same as Core	
Radial Distributor Road (RDR) 2	2026	Not included in DM or DS	Same as Core	This scheme forms part of the Chelmsford LP *Strategic Growth Site Policy 6 – North East Chelmsford* including

Input/Item	Forecast Year	Description of Model Central Assumptions	Uncertainty Assumption / Status	Comments/Narrative
	2041	Included in DM and DS	Same as Core	RDR1 and CNEB and is therefore also considered *more than likely.*
Essex Regiment Way – related to CNEB	2026	Included in DM and DS	Same as Core	Essex Regiment Way will become a sustainable transport corridor as part of the CNEB scheme, with a speed limit reduced to 40mph south of Wheelers Hill. This has been included within all scenarios.
	2041		Same as Core	

Sensitivity testing around P&R model parameters is outlined in section 6.

As previously noted, it is acknowledged that DfT is currently revising its guidance related to the treatment of national uncertainty, in part to provide guidance in the post-COVID context. Recent discussions and information sessions hosted by DfT indicate that the revised guidance and associated datasets were not likely to be issued in time for use for the Stage 2 appraisal of this scheme. As such, it has been agreed with DfT to follow the preliminary guidance issued in the Uncertainty Toolkit in May 2021 and to undertake TAG M4 Low Growth and High Growth scenarios to address national level uncertainty. It is noted that DfT indicated that these scenarios are likely to capture the majority of the range of uncertainty that the forthcoming Common Analytical Scenarios (CAS) will capture. The results of the high and low growth scenarios with respect to modelled flows as well as the impact on P&R demand are outlined in section 8.8.

The selection process of individual development sites and the details of each individual site are described in section 4 together with the details of each site.

Local supply uncertainty highlights that there are no significant infrastructure projects that are considered *reasonably foreseeable* or *hypothetical* that are likely to impact on the Army & Navy scheme. The individual schemes included in the DM scenario are described in section 3.2.1.

The treatment of uncertainty as outlined in the uncertainty log provides the basis for reporting the results of the modelling and appraisal with respect to:

- A statement on the quality of the analysis;
- Scenario / sensitivities providing a range of benefit-cost ratios (BCR) and switching values analysis; and
- A value for money category and statement based on the range of BCRs developed.

In line with the guidance outlined in the Uncertainty Toolkit, forecasting and the resulting appraisal therefore make use of ranges when presenting forecasts in this report[6].

2.11 Model Parameters

Generalised cost parameters for the assignment model consist of the Value of Time (VoT) and Vehicle Operating Cost parameters (VOC). These are set for

[6] Department for Transport, May 2021: *TAG Supplementary Guidance – Uncertainty Toolkit*

each forecast year and are based on the latest DfT Databook at the time (November 2021 v1.17). The values used are contained in the following tables for the 2026 and 2041 forecast years. The values for VoT are in pence per minute (ppm) and for VOC pence per kilometre (ppk). Within VISUM however, the units of the parameters are in pence per second and pence per metre, with the VoT set relative to the VOC, which is normalised to 1. These values as entered into VISUM are also presented.

Table 2-3: Generalised Cost Parameters 2026

Time Period	User Class	VoT pence per minute	VOC pence per km	VOC (relative to VoT =1)
AM	Car employer's business	32.87	12.62	0.0230
	Car commuter	22.04	5.86	0.0160
	Car other	15.21	5.86	0.0231
	LGV	23.82	13.66	0.0344
	HGV	47.45	38.58	0.0488
IP	Car employer's business	33.68	12.62	0.0225
	Car commuter	22.40	5.86	0.0157
	Car other	16.20	5.86	0.0217
	LGV	23.49	13.66	0.0349
	HGV	47.45	38.58	0.0488
PM	Car employer's business	33.34	12.62	0.0227
	Car commuter	22.12	5.86	0.0159
	Car other	15.93	5.86	0.0221
	LGV	23.49	13.66	0.0349
	HGV	47.45	38.58	0.0488

Table 2-4: Generalised Cost Parameters 2041

Time Period	User Class	VoT pence per minute	VOC pence per km	VOC (relative to VoT =1)
AM	Car employer's business	40.67	11.25	0.0166
	Car commuter	27.27	4.51	0.0099
	Car other	18.82	4.51	0.0144
	LGV	29.47	13.01	0.0265
	HGV	58.70	38.46	0.0393
IP	Car employer's business	41.67	11.25	0.0162
	Car commuter	27.72	4.51	0.0098
	Car other	20.04	4.51	0.0135
	LGV	29.06	13.01	0.0269
	HGV	58.70	38.46	0.0393
PM	Car employer's business	41.25	11.25	0.0164
	Car commuter	27.37	4.51	0.0099
	Car other	19.70	4.51	0.0137
	LGV	29.06	13.01	0.0269
	HGV	58.70	38.46	0.0393

The model parameters for the P&R model are outlined in section 6.

Note that PT generalised costs are based on base year bus and rail timetable data. For bus, this implies that future year highways congestion in not included in the future year bus journey times. However, this simplification is considered reasonable and proportionate given that the scheme is not a PT scheme, with only additional local bus lanes provided at the A&N junction to bypass queueing traffic at the junction itself. It is not considered that this simplification would have any significant impact on appraisal since it would result in slightly lower bus generalised costs relative to car in the forecast years and so slightly higher bus mode share. Given the results of the VDM below, it can be seen that the change in PT mode share is minimal and not considered to play any significant role in appraisal.

2.12 Software

The model is built using the latest PTV VISUM software version 2020 (this is an upgraded version of the same software as used in the previous version of the Chelmsford Model) platform and utilised the Intersection Capacity Analysis (ICA) module to enable detailed evaluation of junction performance and represent blocking back and queuing (also known as flow metering).

3 Forecast Model Network Development

3.1 Overview

For the purpose of economic and environmental appraisal, a comparison is made between the transport network performance with and without the proposed scheme. Thus, Do-Minimum (DM) and Do-Something (DS) scheme networks are prepared for each modelled forecast year.

The DM scenario includes all existing and committed transport infrastructure schemes and services. These were collated and agreed in consultation with ECC in accordance with the definitions in TAG unit *M4 Forecasting and Uncertainty*[7]. Paragraph 3.2.4 of this unit states that forecast scenarios should contain "supply side" (network) infrastructure changes that are categorised as "near certain" or "more than likely" (by the date of the modelled forecast year) but those categorised as "reasonably foreseeable" or "hypothetical" are usually excluded. The identified infrastructure schemes and policies are outlined in the uncertainty log in section 2.10 and described in more detail in the following section. This includes all relevant schemes outlined in the DfT and Highways England *Roads Investment Strategy* as well as local ECC schemes.

The DS network then includes the proposed scheme option in addition to the DM schemes. A description of the proposed scheme options is also outlined in the following section.

3.2 Forecast Year Schemes

The following sections describe the schemes included in the DM and DS networks. The scheme included in the DM and DS by forecast year are listed in the following table with their locations identified in the figure below.

[7] Department for Transport, May 2019: *TAG Unit M4 Forecasting and Uncertainty*

Table 3-1: Forecast Network Infrastructure Schemes

Infrastructure Scheme	2026 DM	2026 DS	2041 DM	2041 DS
Sheepcotes Roundabout	✓	✓	✓	✓
Essex Regiment Way	✓	✓	✓	✓
Boreham Interchange	✓	✓	✓	✓
Beaulieu Park RDR	✓	✓	✓	✓
Beaulieu Rail Station Access	✓	✓	✓	✓
RDR 2			✓	✓
A12	✓	✓	✓	✓
Lower Thames Crossing			✓	✓
Chelmsford North East Bypass	✓	✓	✓	✓
A131 Dualling	✓	✓	✓	✓
A&N STP junction improvement		✓		✓
A&N STP P&R expansions		✓		✓
NE Chelmsford Garden Community Access			✓	✓
Broomfield Access			✓	✓

Note that the last two items in the above list are new development access points only.

The location of each of the above schemes is identified in the following figure (excluding the Lower Thames Gateway scheme, located in South Essex).

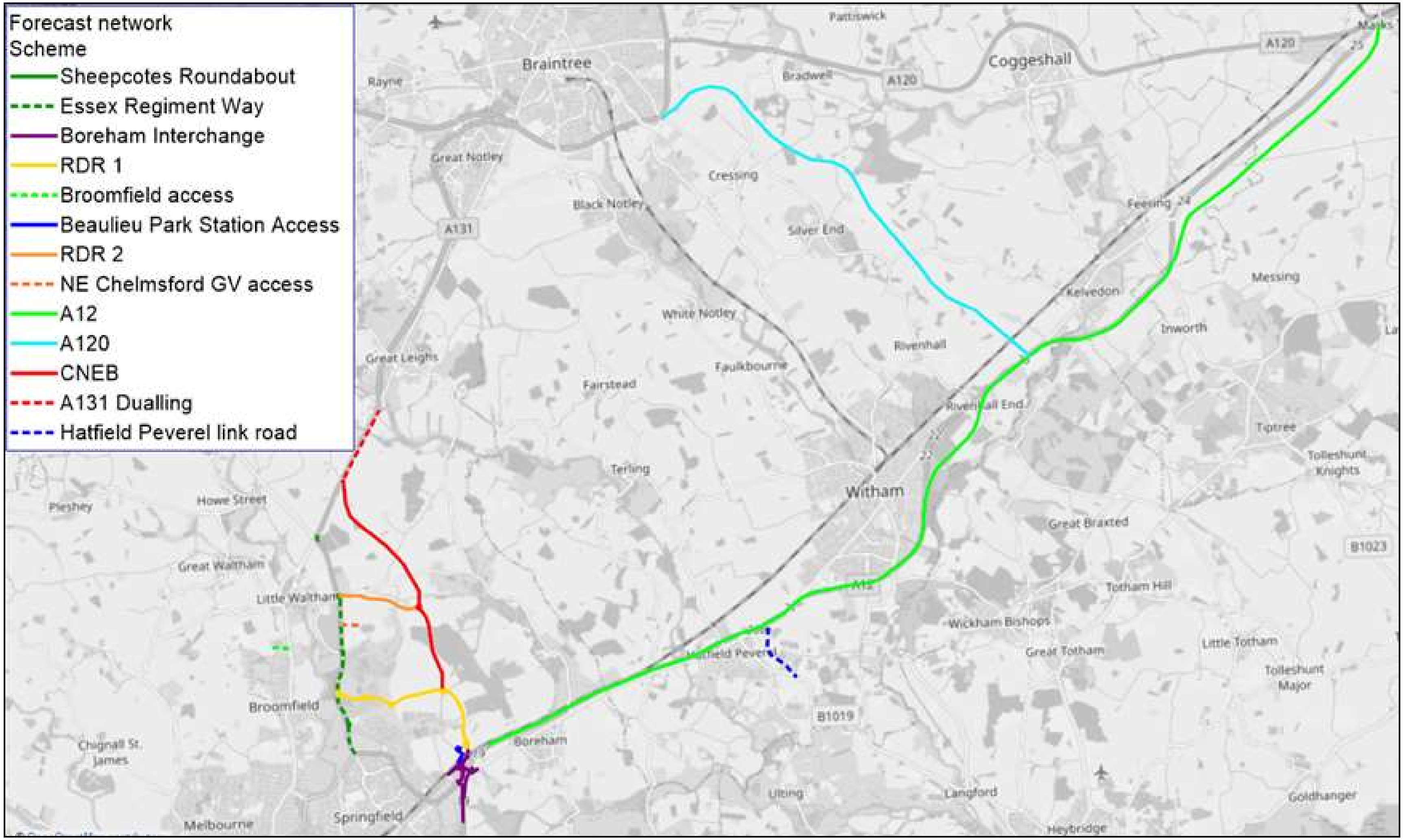

Figure 3-1: Location of DM Infrastructure Schemes

Note that, although initially considered for inclusion in the DM networks, the A120 and Hatfield Peverel schemes identified in the above figure were not included in the final DM scenario after changes in their status during model development.

3.2.1 Do-Minimum Schemes

Each of the schemes identified above is described in more detail in the following section.

A12 Chelmsford to A120 widening scheme

The A12 Chelmsford to A120 widening scheme is a committed scheme on Highways England's *2015-2020 Road Investment Strategy* (RIS1*)* programme, with the Preferred Route Announcement (PRA) made in August 2020. This major scheme involves the upgrade and widening of the A12 to three lanes from J19 to a point just west of the existing J25, where the new J25 would be located. Consultation on the PRA is currently open prior to the application of a Development Consent Order (DCO) in spring/summer 2022 with construction currently expected to start in 2023/24 with the road expected to open in 2027/28. However, at the time of coding the scheme in the model network, less detailed information was available. As a result, the current alignment as outlined in the July 2021 public consultation (21PC) information by Highways England differs slightly from what was assumed at the time of coding the junction. It is considered that the difference is sufficiently minor in relation to the area of interest to allow the currently modelled layout to be used. The scheme assumptions as modelled are as follows:

- Widening to three lanes in both directions between Hatfield Peverel and Marks Tey (same as 21PC).
- A new three-lane bypass at Rivenhall End between J22 and J23 (same as 21PC).
- A bypass between J24 and J25 (very similar to 21PC).
- A new J21 to replace the existing J21 as well as J20a and J20b, which will be closed (same as 21PC);
- A new junction to replace J24, with a connection to Inworth Road (very similar to 21PC).
- A new junction to replace J23. This is different from the 21PC scheme, which removes J23. At the time of modelling, RIS2 work on the A120 scheme was considered likely to result in a new junction being provided at this location as part of the A120 scheme. This difference is not considered likely to impact on the traffic flow

with respect to the A&N scheme and so the model network remains as originally coded.
- Improvements to J19 (as per 21PC).
- Improvements to the existing J25 similar to the 21PC layout.

This scheme is included in the DM scenario in both 2026 and 2041, although it is recognised that the latest estimates indicate that the actual opening year may be slightly later. However, an additional forecast year was not considered proportional given that it is a minor change and the limited impact the A12 is expected to have on the proposed scheme.

Lower Thames Crossing

The Lower Thames Crossing (LTC) is a new cross-Thames link 10km east of the Dartford Crossing that appears in Highways England’s RIS1 programme. This scheme provides a more direct route from Kent and the Medway Administrative Area to Essex and the M25 northbound (and vice versa). While this scheme would be of major strategic significance, it is located sufficiently far out from the Chelmsford detailed modelled area to mean that the exact details of the layout are not likely to impact on model assessments. However, in combination with other north-south DM network improvements (A12 and CNEB), there may be some scope for strategic reassignment that impacts on transport movements through Chelmsford. The scheme is therefore included in the DM network for 2041 with the layout is taken from the latest plans available from Highways England. The links affected are shown if the figure below.

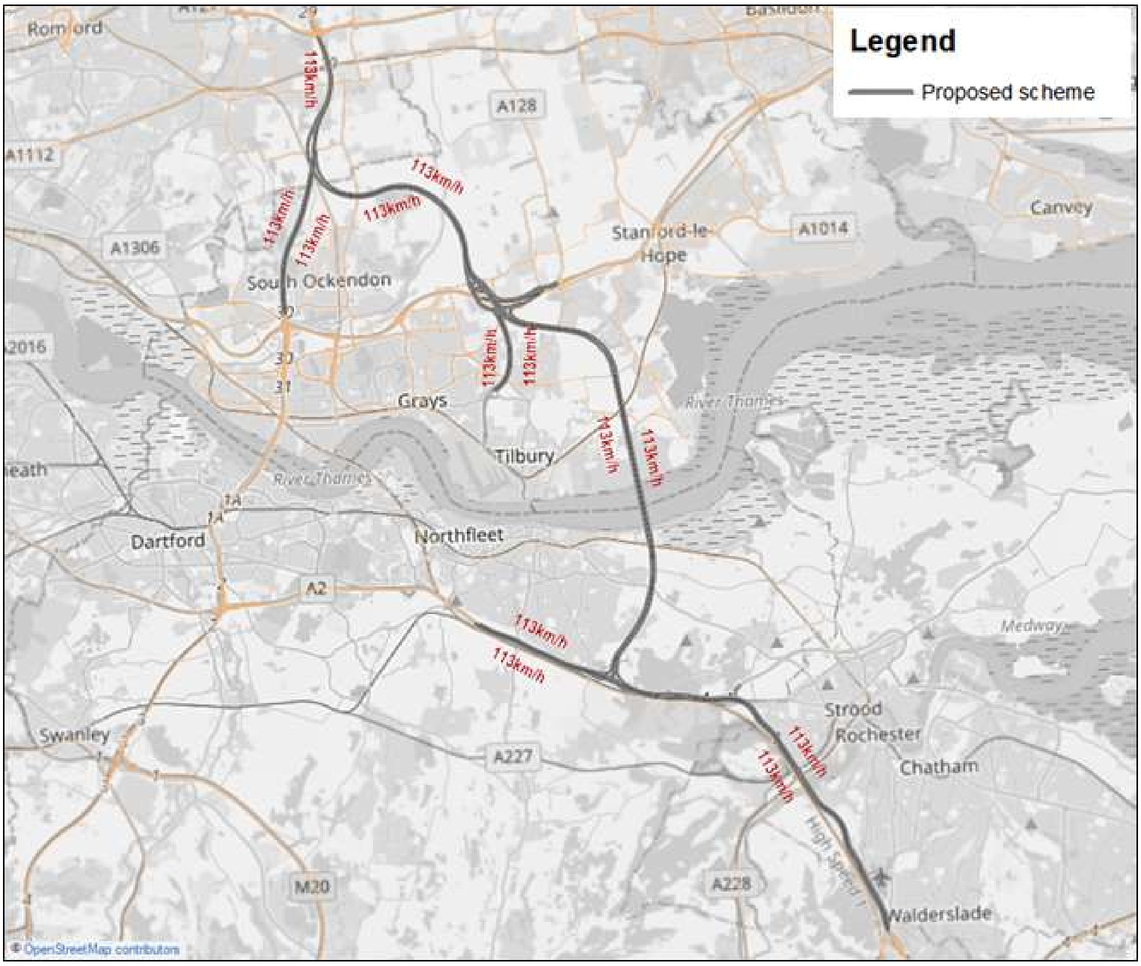

Figure 3-2: Lower Thames Crossing Network Coding

Sheepcotes Roundabout

In the time since the 2019 base model was calibrated and validated, a new left turn bypass for the northeast to southeast movement at the Sheepcotes Roundabout (the junction of the A130 and A131) has opened. As this exists, it has been included in all scenarios and it has been modelled to match the layout on the ground.

Boreham Interchange

The improvements to the A12 Junction 19 (Boreham Interchange) are in line with 21PC work described above. This scheme is currently in the early stages of construction. It is expected to be completed by 2026 and, as such, is included in all model network scenarios.

Radial Distributor Road (RDR) 1

Beaulieu Park RDR is the initial access road for the Chelmsford Garden Community Development and has been included within all scenarios. The western section of Beaulieu Park RDR has already been constructed. The location of the eastern section was based on plans that were prepared by Jacobs as part of the Phase 1 CNEB design work. Detailed design work is in progress; thus, the coded layout is depicted in Figure 3-4 below. The road is coded as good quality of a 40mph type with two lanes on approaches and on the circulatory for the roundabouts. Modelled zone access points are also shown in Figure 3-4:

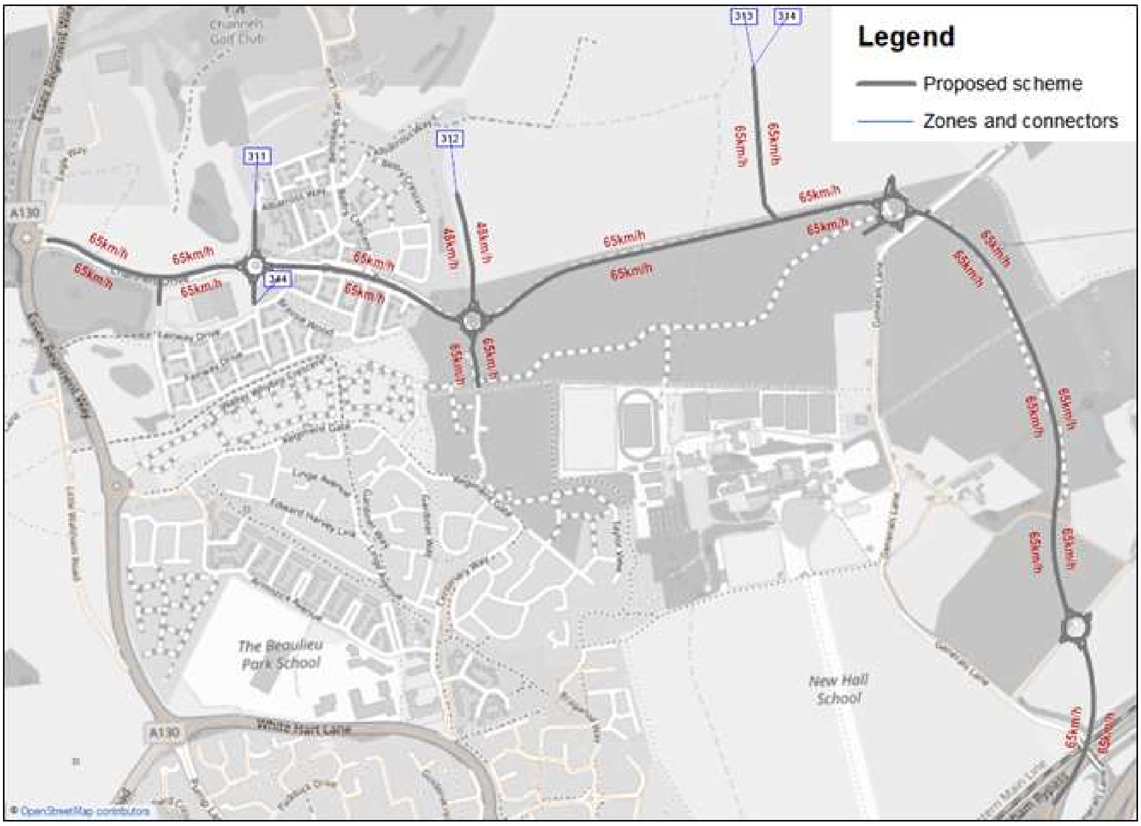

Figure 3-3: Radial Distributor Road 1 Layout

This scheme is expected to be completed by 2026 and as such is included in all model network scenarios.

Chelmsford Northeast Bypass (CNEB) and A131 Dualling

The Chelmsford North East Bypass (CNEB) and A131 dualling is an ECC project with committed funding from HIF and SELEP. The scheme consists of the following elements:

- Online dualling of the existing A131 Braintree Road between Deres Bridge and a new roundabout at Chatham Green.
- A new 8km single carriageway bypass connecting to the Beaulieu Park Radial Distributor Road (RDR1), which is currently under construction.
- Intermediate roundabout for future connection into the Chelmsford Garden Community (CGC) and second distributor road (RDR2).

The layout for the section between the A131 and the RDR2 is outlined in the following figure.

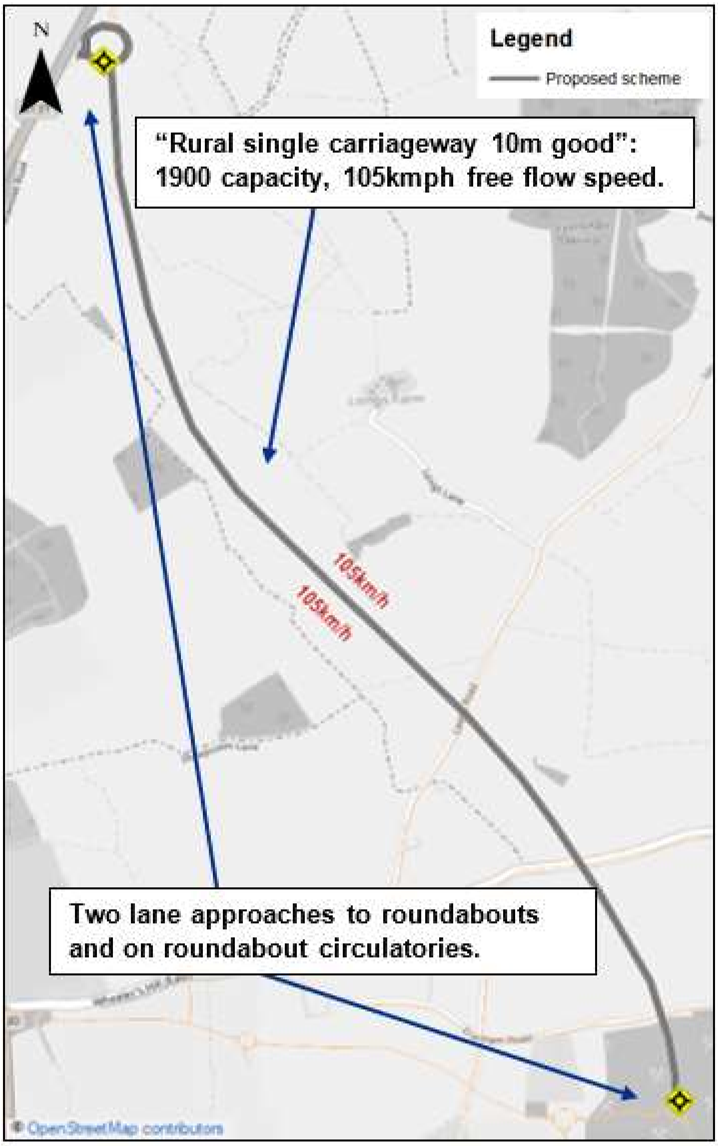

Figure 3-4: CNEB Layout (Northern Section)

The layout of the A131 dualling is illustrated in Figure 3-5. The section between RDR2 and RDR1 is illustrated in Figure 3-6.

Figure 3-5: A131 Dualling Layout

This combined scheme is expected to open in 2024 and is therefore included in all model network scenarios.

Radial Distributor Road (RDR) 2

This scheme is related to the RDR1 and CNEB schemes as well as the housing developments in Northeast Chelmsford including Beaulieu Park and the Chelmsford Garden Community. There are no detailed plans for RDR2, but the approximate layout is taken from the masterplan documents associated with the Chelmsford Garden Community Development planning process. As ECC has indicated that RDR2 will be provided to the same level of standard as Beaulieu Park RDR, it is assumed that the major access point junctions would be roundabouts with two lane approaches and two lanes on the circulatory. The road is assumed to be a good quality 40mph road. Plans for Domsey Lane are uncertain, and it has been assumed to cross RDR2 without joining it anywhere. In the figure below, the RDR2 consists of the east-west section of road, which links the A130 to the CNEB scheme (the northern section of which is was shown in Figure 3-4).

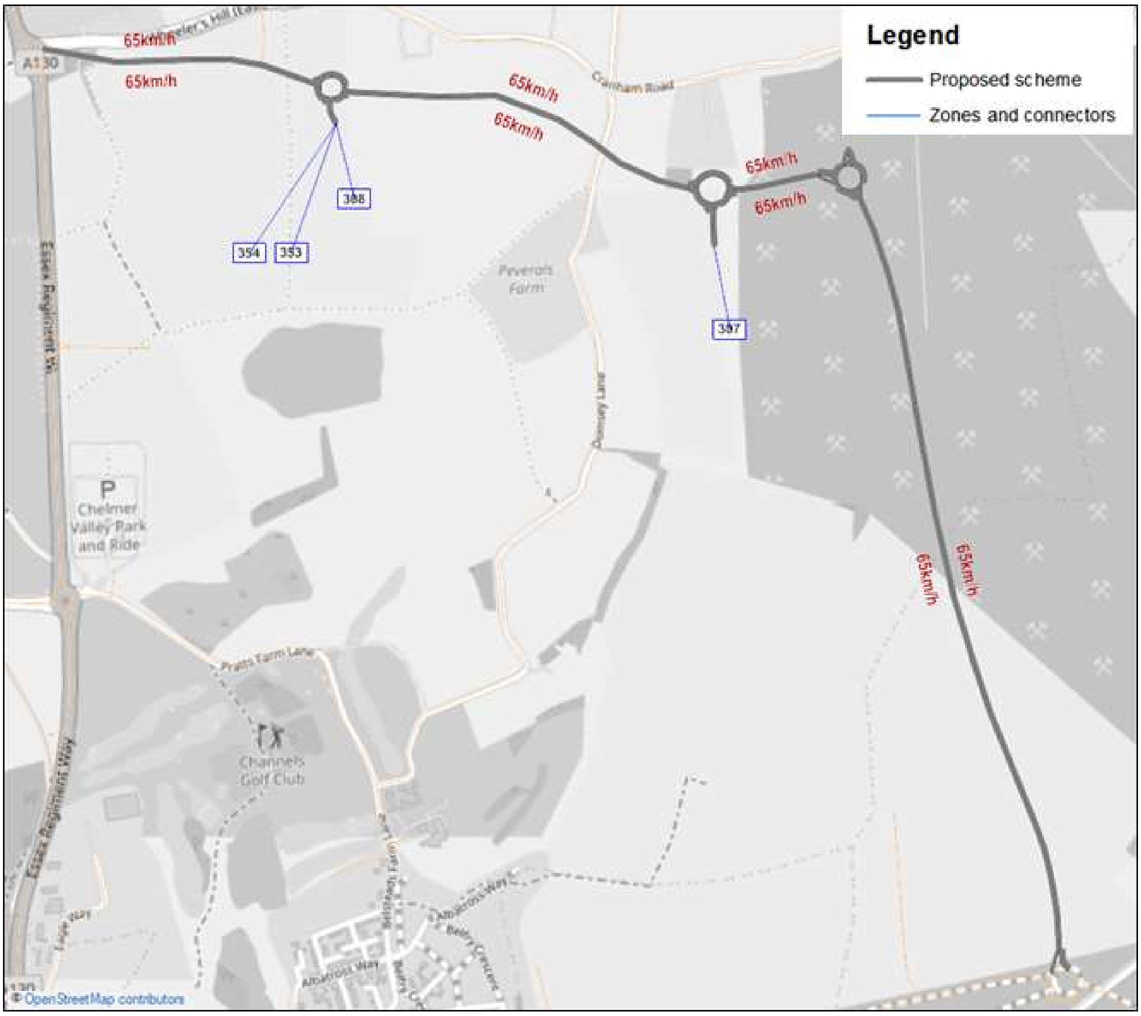

Figure 3-6: Radial Distributor Road (RDR) 2 Layout

This scheme is expected to open between 2026 and 2041 and so is include in the 2041 DM and DS networks.

Beaulieu Park Rail Station

The provision of a new rail station at Beaulieu Park was also included as part of the HIF funding grant together with the CNEB scheme. The new rail station is expected to open in 2025/26 and as such in included in all model network scenarios.

Army & Navy Junction

No specific schemes are identified at the A&N junction without the proposed project and so no structural changes to the DM network were made at the junction. However, the signal timings at the junction for the DM 2026 model were based on the most appropriate plan from existing timing options from the

Essex traffic control centre. DM 2041 timings were based on optimised signal timings developed using LINSIG and based on the forecast year flows at the junction.

3.2.2 Do-Something Schemes

Four options were brought forward for further appraisal from TAP Stage 1 based on a robust options development and sifting process as described in the SOBC and Stage 1 OAR, which started with over 100 options and resulted in the following four options continuing to TAP Stage 2:

- Option B: Two-Way Flyover;
- Option C: Hamburger Roundabout;
- Option D: Enlarged Roundabout; and
- Option E: Separated T-junctions.

Signal timings for all options were developed in LINSIG using an iterative process with forecast demand passed to LINSIG from VISUM and updated signal timings then passed back to VISUM.

In addition, a package of measures promoting sustainable transport was included with each of the above junction scheme options as follows:

- Provision of a new Park & Ride site at Widford (1,000 spaces);
- Improvement and expansion of the existing Sandon Park & Ride site by around 350 spaces;
- Two new strategic cycle routes;
- Improved walking and cycling facilities at the junction; and
- Improved bus priority on Parkway (excluding Option B).

Through several iterations of design and assessment, options B and D were discarded leaving options C and E to go to non-statutory public consultation. Following public consultation, the Option C Hamburger junction layout was identified as the preferred junction option with some design changes made on the Van Diemans Road approach in response to feedback during the consultation process. The preferred junction option layout is illustrated in the following figure.

Figure 3-7: A&N Preferred Junction Layout - Option C Hamburger

In addition, a change was made to the sustainable measures package with the P&R improvements included in the scheme during TAP Stage 2 up until and including public consultation (phases 1 to 3) altered for the final preferred scheme. The change involved discarding the proposed new P&R site at Widford and replacing it with the expansion of the existing P&R site at Chelmer Valley from 1,000 spaces to 1,500 spaces. The expansion of the Sandon site remains part of the scheme, unchanged from that presented at public consultation. The rationale for this change relates to the financial risk to ECC associated with opening and operating a new P&R site in the context of the uncertainty surrounding forecast future patronage following the COVID-19 pandemic. Operational cost and revenue analysis (see section 4 of the OBC) indicated that the opening of a new P&R site would mean a significant increase in operating costs for ECC, which, combined with the potential risk of demand for P&R not returning to pre-COVID levels, was considered to imply too much financial risk for the ECC budget and the taxpayer. It was therefore considered that this risk could be reduced significantly by expanding the P&R site at Chelmer Valley instead of opening a new site near Widford. This change would imply a much lower increase in operational costs while still expanding P&R capacity at a location identified in the adopted Chelmsford LP for the largest share of new housing development in the district. The final package of measures can therefore be summarised as follows:

- Improvements to the A&N junction for all users – car-based, pedestrians, cyclists and buses – through design changes including a Hamburger junction layout, LTN 1/20 compliant walking and cycling infrastructure and an additional 844 metres of dedicated bus lane on the Parkway, EYW and Princes Road approaches.
- Expansion of Sandon P&R site by 350 spaces.
- Expansion of Chelmer Valley P&R site by 500 spaces.

4 Forecast Model Matrix Development

4.1 Overview

Demand matrices are a key input into the VDM setup. Demand matrices are produced for each scenario starting with a Core scenario, for each forecast year and for each segment of demand at 24-hour Production-Attraction (PA) level. These matrices are referred to as *reference forecasts.* For car-based demand these are developed from a combination of background growth factors by spatial area, year and purpose as well as estimates of trip end totals for explicitly modelled developments. These growth factors are applied to the base year matrices. The combined matrices are then controlled to National Trip End Model (NTEM) growth at District level, in accordance with TAG guidance[8]. The reference forecasts do not take account of network costs, but rather represent growth related to housing and jobs growth that is unconstrainted or unaffected by network costs such as congestion. PT reference matrices do not include the impact of local developments (see section 5) and LGV and HGV matrices are fixed based on specific growth factors (see section 4.2.5).

These reference forecast matrices provide the key input into the VDM, which then modifies the matrices based on a hierarchy of responses, including mode choice and destination choice, which are based largely on the impact of network costs relative to the base year.

Finally, the impact of P&R and the new Beaulieu Park Station on demand are then considered outside of and after the VDM.

The development of the reference forecasts is outlined in section 4.2 while the development and outcomes of the VDM are outlined in section 5. The treatment of P&R is described in section 6 and Beaulieu Park station in section 7.

4.2 Core Scenario Demand

The Core scenario is a scenario based on the most unbiased and realistic set of assumptions that will form the central case that is presented in the appraisal. In accordance with DfT guidance, this is based on Core NTEM background growth and local developments that are more likely to occur than not. The process for producing the Core scenario reference forecast matrices and the data used is

[8] Department for Transport, May 2019: *TAG Unit M4 Forecasting and Uncertainty*

outlined in the following sections. The methodology employed for car demand can be summarised as follows:

- Identification and quantification of sources of local uncertainty, that is, explicitly model local developments as follows:
    - Identify the location, size, nature and status of local developments and filter the identified developments to include only those that meet an established criteria for inclusion in the Core scenario,
    - Establish trip generation factors on a 24-hour Origin-Destination (OD) basis for each site based on a Transport Assessment (TA) if available or TRICS factors if not,
    - Calculate trip end totals for each site by year and purpose,
    - Convert OD trips end totals to PA,
    - Allocate a Transport Model (TM) zone to each development,
    - Assume a trip distribution for each development site based on an identified donor zone from the base year transport model.
- Develop background growth matrices on a 24-hour PA basis by year and purpose using TEMPro v7.2 and the alternative planning assumptions functionality, thus controlling trip end totals to NTEM levels.
- Combine background growth with explicitly modelled developments using Furness procedure.

These steps are outlined in detail in the following sections.

The methodology for developing forecast demand for goods vehicles follows in section 4.2.5.

4.2.1 Identification of Local Planning Data

Housing and employment data within the Chelmsford Administrative Area was based on planning data (applications and permissions) confirmed by Chelmsford City Council in summer 2020. Additional sites were added from the approved Chelmsford Local Plan (May 2020).

Housing numbers and employment land use data (e.g. gross floor areas by type), were collated for the model forecast years of 2026 and 2041. Where build-out projections for developments (e.g. Great Notley and Braintree) were not available, a linear trajectory for housing and employment delivery was assumed. This also included brownfield sites and windfall development within the Chelmsford administrative area.

Due to the number of sites, search criteria were used to identify a list of developments to potentially include in the transport model. The following search criteria was considered during the Uncertainty Log development:

- Housing developments of 10 dwellings or more;
- B1 use class ‘Office Development’ with 10,000m2 Gross Floor Area (GFA) or more;
- B2 use class ‘Industrial Estate’ with 1,500m2 Gross Floor Area or more;
- B8 use class ‘Warehousing’ with 5,000m2 Gross Floor Area or more;
- Status of planning applications, permissions, allocations and safeguarded areas for future development;
- Nature of the development, i.e. land use;
- Phasing of development;
- Access points of the areas identified; and
- Any transport scheme associated with the development.

The resulting list of sites is described in the table below. These sites are defined based on a minimum development size of 10 houses with details by type, size (dwellings and jobs/floor area) and year (2026 and 2041).

Table 4-1: Explicitly Modelled Development Sites

Map ID	Area	Development Name	TM Zone	Type	Houses		Jobs GFA sqm)		Application Ref/Status
					2026	2041	2026	2041	
1	Chelmsford, Essex	Greater Beaulieu Park White Hart Lane Springfield - Phase 1 - Zone E	307	HH	170	170			09/01314/EIA approved 07/03/2014
	Chelmsford, Essex	Greater Beaulieu Park White Hart Lane Springfield - Phase 1 - Zone C1	308	HH	73	73			09/01314/EIA approved 07/03/2014
	Chelmsford, Essex	Greater Beaulieu Park White Hart Lane Springfield - Phase 1 - Zone C2		HH	122	122			09/01314/EIA approved 07/03/2014
	Chelmsford, Essex	Greater Beaulieu Park White Hart Lane Springfield - Phase 2 - Zone F & I	309	HH	206	206			09/01314/EIA approved 07/03/2015
	Chelmsford, Essex	Greater Beaulieu Park White Hart Lane Springfield - Phase 2 - Zone K and L	310	HH	300	300			09/01314/EIA approved 07/03/2015
	Chelmsford, Essex	Greater Beaulieu Park White Hart Lane Springfield - Phase 2 - Zone M, N & Q	311	HH	263	271			09/01314/EIA approved 07/03/2015
	Chelmsford, Essex	Greater Beaulieu Park White Hart Lane Springfield - Phase 2- Zone J	312	HH	82	82			09/01314/EIA
	Chelmsford, Essex	Greater Beaulieu Park White Hart Lane Springfield - Remainder of phase 2-4	313	HH	244	1764			09/01314/EIA approved 07/03/2015
	Chelmsford, Essex	NE Chelmsford - Beaulieu	314	Jobs (Business Park)			333 (18,000)	889 (40,000)	LDF commitment outlined in approved Chelmsford LP with outline planning permission.

Map ID	Area	Development Name	TM Zone	Type	Houses		Jobs GFA sqm)		Application Ref/Status
					2026	2041	2026	2041	
2	Chelmsford, Essex	North of Broomfield	315	HH	122	450			This scheme forms part of the approved Chelmsford LP *Strategic Growth Site Policy 8* and the approved Masterplan.
3	Chelmsford, Essex	Great Leighs - Land at Moulsham Hall	316	HH	180	750			This scheme forms part of the approved Chelmsford LP *Strategic Growth Site Policy 7*.
	Chelmsford, Essex	Great Leighs - Land East of London Road		HH	250	250			
	Chelmsford, Essex	Great Leighs - Land North and South of Banters Lane		HH	100	100			
4	Chelmsford, Essex	Land East of Plantation Road Boreham	317	HH	145	145			14/01552/OUT (18/00687/FUL, 18/00682/REM)
5	Chelmsford, Essex	Land North East of 158 Main Road Great Leighs	318	HH	100	100			14/01791/OUT (17/01949/REM)
6	Chelmsford, Essex	Peninsular Site Chelmer Waterside Development Wharf Road	319	HH	421	421			16/01630/FUL
7	Chelmsford, Essex	Site at Temple Farm Ship Road West Hanningfield	320 / 321	HH / Jobs (class B)	661	997	535	535	19/01488/REM, 14/01971/FUL / 14/01971/OUT,
8	Chelmsford, Essex	University Campus Part of Central Park and Land At Park Road Chelmsford	322 / 323	HH / Jobs (mixed)	386	386	134	134	14/01470/FUL
9	Chelmsford, Essex	Land at Mid Essex Gravel Pits Little	324	Jobs (B1, B2, B8)			24 (1,100)	24 (1,100)	14/01401/OUT
10	Chelmsford, Essex	Land North of Cranham Road Little Waltham Chelmsford Essex	325	Jobs (B2)			103	103	16/01394/OUT

Map ID	Area	Development Name	TM Zone	Type	Houses		Jobs GFA sqm)		Application Ref/Status
					2026	2041	2026	2041	
11	Chelmsford, Essex	Site at 30 Victoria Road	326	HH	203	203			18/00840/FUL
12	Chelmsford, Essex	Former Marconi Works	327 / 328	HH / Jobs (mixed)	437	437	56	334 (16,591)	12/01789/FUL
13	Chelmsford, Essex	Eastern Parcel Land North of Copperfield Road	329	HH	198	198			14/01672/OUT 14/01672/FUL
14	Chelmsford, Essex	Western Parcel Land North of Copperfield Road	330	HH	60	60			14/00976/FUL
15	Great Notley, Braintree	Land North Of A131 Seybourne Park Avenue East Skyline	331	Jobs	0	0	113	113	16/02095/FUL
16	Witham, Essex	Phase 2 Land at Forest Road	332	HH	163	163			17/01092/FUL
17	Witham, Essex	Land at North East Witham Forest Road	333	HH	247	370			15/00799/OUT
18	Cressing, Essex	Land Adjacent to Braintree Road	334	HH	225	225			16/02144/OUT
19	Hatfield Peverel, Essex	Land at Station Road	335	HH	145	145			16/02096/OUT
20	Hatfield Peverel, Essex	Land South of Stonepath Drive	336	HH	23	140			16/01813/OUT
21	Hatfield Road Witham	Land Adjacent to Lodge Farm	337	HH	750	750			15/00430/OUT
22	Hatfield Road Witham	Land North of Woodend Farm	338 / 339	HH	75	450	10	60	19/01896/OUT
23	Hatfield Bury	Bury Farm Lane	340	HH	8	50			19/01803/FUL
24	Hatfield Bury	Sorrell Farm	341	HH	50	50			17/00973/FUL
25	Great Notley, Braintree	Horizon 120 Land West of A131	342	Jobs	0	0	221	1326	19/00001/LDO
26	Chelmsford, Essex	Land north west of Essex County Cricket Ground New Writtle Street Chelmsford	343	HH	59	295			13/00690/ETL approved 17/09/2013

Map ID	Area	Development Name	TM Zone	Type	Houses		Jobs GFA sqm)		Application Ref/Status
					2026	2041	2026	2041	
27	Chelmsford, Essex	Land north south and east of Belsteads Farm Lane Broomfield (Channels) -	344 / 345	HH / Jobs	207	207	310	310	10/01976/OUT approved 31/10/2012
	Chelmsford, Essex	Land north south and east of Belsteads Farm Lane Broomfield (Channels) -		HH	27	27			10/01976/OUT approved 31/10/2012
	Chelmsford, Essex	Land north south and east of Belsteads Farm Lane Broomfield (Channels) -		HH	128	128			10/01976/OUT approved 31/10/2012
28	Chelmsford, Essex	Land north of Copperfield Road (East portion) Chelmsford	346	HH	198	198			14/01672/OUT approved 8/11/2016
29	Chelmsford, Essex	Former Gas Works Wharf Road Chelmsford	347	HH	10	250			This scheme forms part of the approved Chelmsford LP *Strategic Growth Site Policy 1a*.
30	Chelmsford, Essex	Baddow Road Car Park and Land to the East	348	HH	0	190			
31	Chelmsford, Essex	Former St Peter's College Fox Crescent	349	HH	185	185			This scheme forms part of the approved Chelmsford LP *Strategic Growth Site Policy 1b* and the approved Masterplan.
32	Chelmsford, Essex	Former Royal Mail Premises Victoria Road Chelmsford		HH	203	203			18/00840/FUL approved 18/02/2019
34	Chelmsford, Essex	West Chelmsford	350	HH	544	800			This scheme forms part of the approved Chelmsford LP *Strategic Growth Site Policy 2* and the approved Masterplan.
35	Chelmsford, Essex	East Chelmsford - Manor Farm	351 / 352	HH	210	250			This scheme forms part of the approved Chelmsford LP *Strategic Growth Site*
	Chelmsford, Essex	East Chelmsford - Land South of Maldon Road		HH	100	100			

Map ID	Area	Development Name	TM Zone	Type	Houses		Jobs GFA sqm)		Application Ref/Status
					2026	2041	2026	2041	
	Chelmsford, Essex	East Chelmsford - Land North of Maldon Road		HH / Jobs (B1)	50	50	65 (2,917)	111 (5,000)	*Policy 3* and the approved Masterplan.
33	Chelmsford, Essex	North East Chelmsford	353 / 354	HH / Jobs (Office, Business Park)	742	3000	259 (11,667)	1000 (45,000)	This scheme forms part of the approved Chelmsford LP *Strategic Growth Site Policy 6* including associated infrastructure (CNEB, RDR1, RDR2 and Beaulieu Park Station).
36	Chelmsford, Essex	North of South Woodham Ferrers	355 / 356	HH / Jobs (B1, A1a)	600	1000	28 (483)	131 (2,900)	This scheme forms part of the approved Chelmsford LP *Strategic Growth Site Policy 10* and the approved Masterplan.
37	Chelmsford, Essex	Rivermead	357	Jobs (mixed B)			80 (2,208)	255 (7,000)	This scheme forms part of the approved Chelmsford LP *Strategic Growth Site Policy 1u*.
38	Chelmsford, Essex	Rail Sidings, Brook Street	358	Jobs			80 (2,208)	255 (7,000)	This scheme forms part of the approved Chelmsford LP *Strategic Growth Site Policy 1v*.
39	Chelmsford, Essex	Land east of North Court Road and north of Hospital Approach Broomfield	359	HH	91	91			13/00409/FUL approved 28/05/2014
	Chelmsford, Essex	Land east of North Court Road and north of Hospital Approach Broomfield (Care		HH	48	48			13/00409/FUL approved 28/05/2014

Map ID	Area	Development Name	TM Zone	Type	Houses		Jobs GFA sqm)		Application Ref/Status
					2026	2041	2026	2041	
40	Chelmsford, Essex	Springfield Business Park, Winsford Way	360	Jobs	0	0	379 (17,072)	379 (17,072)	LDF commitment outlined in approved Chelmsford LP.

The majority of the new housing and jobs allocated during the LP period is located in the specific growth areas as identified under *Strategic Policy S7 The Spatial Strategy* in the adopted Chelmsford LP, those being North Chelmsford, with 4,793 houses (Growth Area 2) and in the central urban area of Chelmsford, with 2,381 houses (Growth Area 1 site 1), making up 75% of all new housing allocations.

4.2.2 Methodology for Developing Matrices for Explicitly Modelled Developments

Following on from the identification of local development sites to be explicitly modelled, the development of 24-hour PA matrices for each site was undertaken in four steps as follows:

- Identification/calculation of appropriate trip generation rates on OD basis by peak periods (AM, inter-peak and PM peak periods);
- Calculation of trip end totals on 24-hour OD basis;
- Conversion of 24-hour OD trip ends to 24-hour PA trip ends; and
- Determine distribution for each explicitly modelled development.

For calculating trip generation for the site-specific developments, available Transport Assessment (TA) trip generation was used where possible. For the developments where a TA was not available, TRICS trip rates were derived from a recent version of the TRICS database (version 7.7.1) which includes surveys up to the end of September 2019. For all trip rate calculations, only sites in England, Wales and Scotland were included. London sites were not immediately removed by default, as some areas in outer London may be considered representative. Only sites with surveys on weekdays were included. Unless otherwise stated, only sites with surveys post 1st January 2012 (the default 8 year cut off in TRICS) have been used. The TRICS rates used are summarised the following table.

Table 4-2: TRICS Rates for Local Developments

Type	Unit	Arrivals			Departures		
		AM (7-10am)	IP (10am-4pm)	PM (7-10am)	AM (7-10am)	IP (10am-4pm)	PM (7-10am)
C3 Residential Privately Owned Houses	Per dwelling	0.091	0.140	0.351	0.276	0.129	0.152
C3 Residential Mixed Private / Affordable Houses	Per dwelling	0.094	0.115	0.215	0.216	0.120	0.117
B1a Office	Per 100sqm	0.553	0.113	0.082	0.096	0.121	0.702
B1a Business Park	Per 100sqm	0.907	0.183	0.105	0.118	0.230	1.236

Annual Average Daily Traffic (AADT) factors derived from continuous Automatic Traffic Count (ATC) data were applied to calculate the daily trip generation from the peak period trip ends for each development. The AADT factors used, which are based on ECC continuous count data, are outlined in the following table.

Table 4-3: Factors to Calculate Daily Trip End Totals

Factor type	Neutral Day Factor
3-hour AM peak period: AM peak hour (8-9am)	2.65
6-hour inter-peak period: inter-peak hour (12am-1pm)	6
3-hour PM peak period: PM peak hour (5-6pm)	2.77
Weekday 24-hour: Weekday 12-hour	1.25
AADT:AAWT	0.92

Trip end totals on a 24-hour OD basis were then calculated for each local development site based on the planning data (housing and jobs) and trip rates outlined above. These were then converted to 24-hour PA trip end totals. The main difference between these is that a PA trip is non-directional, whereas an OD trip is directional, hence, indicating the number of trips going from an origin to a destination. The PA format indicates the direction of travelling from home-end of the trip (production) to non-home end of the trip (attraction). Trips to/from housing developments were treated as productions, and for employment locations, trips were treated as attractions. The 24-hour average of originating and terminating trips was used as the number of daily trips for the development zone.

Explicitly modelled development sites were represented in the transport model as new independent zones. This enables trips from the new development to be modelled differently from the existing locations. This could be, for example, the access and egress to/from the new development or the distribution pattern of trips. As such, each explicitly modelled development was allocated to a new transport model zone.

For each development zone, a parent zone/donor zone was chosen to represent its trip distribution pattern. As far as possible, the selected donor zone was the one that shared the same land use as the development zone and was located in reasonable proximity to the zone. This process was undertaken in order to accurately replicate the trip distribution of the developments' zones. This also enables future land use of zones to be robustly modelled, once matrix Furnessing had been applied.

The list of donor zone correspondence is available in Appendix A. The 24hr development PA trip developments were divided between purposes based on the donor zone purpose proportion. Also, the matrices were converted from vehicle to person trips using TAG Databook car occupancy factors by purpose.

4.2.3 Treatment of Background Growth

TEMPro v7.2 datasets were used to calculate the background growth for 2026 and 2041 assessment years. TAG Unit M4 states that estimates of growth in demand should be constrained to NTEM. Constraining to NTEM was achieved by limiting growth in households and jobs at the district level to those forecast in NTEM. To do this, the number of households and jobs associated with explicitly modelled developments was subtracted from NTEM using the 'alternative planning assumptions' functionality within TEMPro to avoid double-counting. TEMPro was then used to derive 24-hour PA factors for the NTEM-based background growth in trip ends. These factors were applied to the 24-hour base year PA demand matrices to calculate the background growth excluding the explicitly modelled developments. However, NHB (non-home-based) trips grow by the full TEMPro factor without application of alternative planning assumptions, as the home-based trip modelling for developments that are related to direct trips from productions to attractions, do not add on to the NHB trips in the study area.

The planning data used to calculate background growth together with the data for the explicitly modelled developments is outlined in the table below with the resulting growth factors outlined in the following table.

Table 4-4: Planning Data by Year Chelmsford and Braintree Districts

Item	Year	Type	Braintree	Chelmsford
Default Tempro v7.2	2019	HH	66,176	77,815
		Jobs	65,067	93,112
	2026	HH	70,974	85,804
		Jobs	66,720	95,506
	2041	HH	80,201	101,615
		Jobs	69,594	99,621
Explicitly modelled developments	2026	HH	1,686	7,302
		Jobs	344	1,943
	2041	HH	1,686	9,770
		Jobs	565	3,354
Alternative Scenario (TEMPro minus explicitly modelled developments)	2026	HH	69,288	78,502
		Jobs	66,376	93,563
	2041	HH	78,523	91,845
		Jobs	69,029	96,267
Combined change from base year (matches TEMPro)	**2026**	**HH**	**4,798**	**7,989**
		Jobs	**1,653**	**2,394**
	2041	**HH**	**14,033**	**23,800**
		Jobs	**4,527**	**6,509**

Table 4-5: Background Growth Factors from TEMPro and Adjusted TEMPro by year by purpose for Braintree and Chelmsford Districts

Year	Purpose	P/A	Growth tempro		Growth adjusted	
			Braintree	Chelmsford	Braintree	Chelmsford
2026	HBEB	P	1.018	1.047	0.994	0.958
		A	1.041	1.043	1.036	1.021
	HBW	P	1.009	1.035	0.985	0.947
		A	1.030	1.032	1.025	1.011
	HBO	P	1.076	1.099	1.051	1.005
		A	1.087	1.098	1.075	1.058
	HBE	P	1.033	1.071	1.009	0.980
		A	1.064	1.066	1.059	1.044
	HBS	P	1.084	1.104	1.059	1.011
		A	1.096	1.096	1.090	1.074
	NHBEB	P	1.043	1.044	1.043	1.044
		A	1.043	1.044	1.043	1.044
	NHBO	P	1.072	1.073	1.072	1.073
		A	1.075	1.075	1.075	1.075
2041	HBEB	P	1.063	1.145	1.031	0.992
		A	1.125	1.128	1.100	1.086
	HBW	P	1.033	1.108	1.002	0.960
		A	1.091	1.095	1.067	1.054
	HBO	P	1.206	1.264	1.169	1.095
		A	1.229	1.261	1.200	1.184
	HBE	P	1.109	1.208	1.076	1.047
		A	1.184	1.186	1.158	1.142
	HBS	P	1.222	1.270	1.185	1.100
		A	1.251	1.253	1.224	1.206
	NHBEB	P	1.126	1.128	1.126	1.128
		A	1.127	1.129	1.127	1.129
	NHBO	P	1.197	1.200	1.197	1.200
		A	1.202	1.204	1.202	1.204

4.2.4 Combination of Local Uncertainty and Background Growth

The final matrices combined the adjusted background growth from the NTEM with the explicitly modelled developments through a Furness process to obtain a pivot-point demand matrix for the two forecast years. The matrix totals at each stage of the process for each forecast year by purpose are presented in the table below with the final matrix totals compared to the 2019 base year are outlined in the following table.

Table 4-6: Total P/A Reference Case Trips (24-hour, vehicles) by year by purpose

Stage	Year	Type	HBW	HBEB	HBO	HBShop	HBEdu	NHBEB	NHBO
Base Year	2019	P/A	716,977	131,095	977,313	382,842	100,567	512,994	873,422
Explicitly Modelled Development Trips	2026	P	7,266	1,092	9,446	5,479	3,256	0	0
		A	4,911	323	217	123	108	0	0
	2041	P	11,535	1,734	14,996	8,699	5,169	0	0
		A	9,691	637	428	243	213	0	0
Adjusted TEMPRO Trips	2026	P	771,379	142,644	1,108,015	434,696	110,619	563,641	983,579
		A	777,775	143,549	1,114,352	439,089	113,106	563,559	984,121
	2041	P	859,208	161,724	1,322,002	519,929	127,077	642,692	1,156,957
		A	862,126	163,025	1,337,755	529,487	132,922	642,682	1,157,016
Total Trips	2026	P	778,645	143,736	1,117,461	440,175	113,875	563,641	983,579
		A	782,687	143,872	1,114,569	439,212	113,214	563,559	984,121
	2041	P	870,743	163,458	1,336,998	528,628	132,246	642,692	1,156,957
		A	871,817	163,662	1,338,183	529,730	133,135	642,682	1,157,016
Total Trips post-Furness	2026		778,645	143,736	1,117,461	440,175	113,875	563,600	983,850
	2041		870,743	163,458	1,336,998	528,628	132,246	642,687	1,156,987

Table 4-7: Reference Case Matrix Totals compared to Base Year

Purpose	Matrix Totals (vehicles)			Difference to Base Year		% Difference to Base Year	
	Base 2019	2026	2041	2026	2041	2026	2041
HBW	716,977	778,645	870,743	61,668	153,766	8.6%	21.4%
HBEB	131,095	143,736	163,458	12,641	32,363	9.6%	24.7%
HBO	977,313	1,117,461	1,336,998	140,148	359,685	14.3%	36.8%
HBS	382,842	440,175	528,628	57,333	145,786	15.0%	38.1%
HBE	100,567	113,875	132,246	13,308	31,679	13.2%	31.5%
NHBEB	512,994	563,600	642,687	50,606	129,693	9.9%	25.3%
NHBO	873,422	983,850	1,156,987	110,428	283,565	12.6%	32.5%

A comparison of the growth rates implied by the above data against national averages is described for both pre- and post-VDM in section 5.4.

4.2.5 Treatment of Goods Vehicles

As previously noted, LGV and HGV were based on the latest version of DfT's Road Traffic Forecasts (RTF 2018) Scenario 1[9] growth estimates for the East of England. The factors used are outlined in the following table.

Table 4-8: RTF18 Growth Factors for LGV and HGV

Year	LGV	HGV
2019	1.000	1.000
2026	1.0780	1.0230
2041	1.2915	1.1101

This growth is applied at the assignment (peak hour) matrix level as goods vehicles are external to the variable demand model.

[9] This is the reference scenario based on central projections for GDP (OBR), for fuel prices, and for population (ONS)

5 Variable Demand Model

5.1 Introduction

The premise of variable demand modelling is that any change in travel cost, through traffic intervention or changes in travel demand, may modify travel behaviour. The responses considered in the VDM for this scheme are a change of route, a change in destination and a change in mode.

The choice of route is within the scope of the highway assignment model, but to take account of the remaining two, a variable demand model (VDM) was required. More details on the VDM can be found in the accompanying Chelmsford Model LMVR. The VDM is a set up as an incremental logit model based on 24-hour production/attraction (PA) reference case demand. The input generalised costs are estimated by the assignment models and then converted to daily weighted average costs taking account of the time period and direction of journey. These costs are used to adjust the input (pivot) demand matrices. The resulting demand matrices require conversion to AM, IP and PM single peak hour origin / destination (OD) matrices for re-assignment. This process is repeated until the VDM converges, i.e. when the changes in demands and costs between iterations are regarded as sufficiently small.

5.2 VDM Specification

The specification of the VDM is described in detail in the LMVR. In addition, many elements of the VDM with respect to forecasting are the same as for the overall model and have been described in previous sections of this report. The VDM specification and where more detailed information can be found can be summarised as follows:

- The base year model represents the period from September to November 2019, which is after the permanent closure of the flyover at the A&N junction but prior to COVID19 with data used and model calibration and validation described in detail in the LMVR.
- The VDM has been developed in the same software used for the base model, that is, the latest PTV VISUM software version 2020.
- The demand responses modelled are mode choice i.e., car (including P&R) versus public transport (bus and rail) and destination choice (trip distribution) as described in section 2.9.
- The demand segments used are described in section 2.7, with LGV and HGV fixed as per standard guidance.

- The zone system is consistent across the highways assignment, PT and demand models as described in the LMVR. However, the zone system has been sectored into three parts – internal (Chelmsford District plus its periphery, that is, border zones in the surrounding districts), intermediate (rest of Essex plus border zones of Greater London and East of England) and external – for the purpose of defining the spatial areas subject to VDM response. Areas subject to the VDM are internal-internal and internal-intermediate, which covers all trips within Chelmsford District and its periphery plus all trips between the rest of Essex (and periphery) and Chelmsford District (and periphery). This excludes all trips with an origin/destination outside of Essex and its periphery, which are considered beyond the distance where VD responses are typically considered to be observed. Since the longer distance trips are fixed, cost damping was not used.
- The networks are the same as outlined in section 3.
- The data used to develop the reference case 24-hour PA demand matrices is described in section 4.
- The calibrated demand model parameters for destination and mode choice lie within +25% of the TAG median illustrative values and are described in the LMVR.
- The generalised cost parameters are outlined in section 2.11.

5.3 VDM Performance

Similar to the VDM specification, the model performance with respect to base model calibration, validation and convergence as well as the standard realism and sensitivity testing is described in detail in the LMVR.

The forecast year VDM convergence is outlined together with the assignment model convergence in section 8.1.

5.4 VDM Results

The impacts of the VDM are typically assessed in terms the following changes:

- Total trips by time period, mode and purpose;
- Trip distribution by time period by spatial sector; and
- Trip length by time period, mode and purpose.

The overall impact of the VDM at the 24-hour P/A level in terms a comparison between pre- and post-VDM matrix totals by purpose as well as the implied growth rates by purpose compared to national data (NTEM via TEMPro) are described in the tables below.

The impacts of the entire demand modelling process, including the VDM plus those associated with the P&R modelling and Beaulieu Park station, are described in more detail including total trips, trip distribution and trip length compared to national average in section 8.2.

Table 5-1: Impact of VDM on 2026 Matrix Totals by Scenario, Forecast Year and Purpose – 24-hour P/A in person trips

Purpose	Pre-VDM		Do-Minimum				Do-Something				Post-VDM	
			Post-VDM		Post minus Pre		Post-VDM		Post minus Pre		DS minus DM	
	Car	PT	Car	PT	Car	PT	Car	PT	Car	PT	Car	PT
HBW	778,645	413,950	779,370	413,225	725	-725	779,511	413,085	865	-865	141	-141
HBEb	143,736	58,925	143,564	59,096	-172	172	143,573	59,087	-163	163	9	-9
HBO	1,117,461	179,747	1,117,494	179,714	33	-33	1,117,526	179,682	65	-65	32	-32
HBShop	440,175	52,430	440,232	52,373	56	-56	440,250	52,354	75	-75	19	-19
HBEdu	113,875	9,591	113,898	9,567	23	-23	113,920	9,546	45	-45	22	-22
NHBEb	563,600	114,186	563,227	114,559	-373	373	563,238	114,548	-362	362	11	-11
NHBO	983,850	115,321	983,885	115,286	35	-35	983,907	115,264	57	-57	22	-22
Total	**4,141,342**	**944,149**	**4,141,671**	**943,821**	**329**	**-329**	**4,141,926**	**943,566**	**583**	**-583**	**255**	**-255**

Table 5-2: Impact of VDM on 2041 Matrix Totals by Scenario, Forecast Year and Purpose – 24-hour P/A in person trips

Purpose	Pre-VDM		Do-Minimum				Do-Something				Post-VDM	
			Post-VDM		Post minus Pre		Post-VDM		Post minus Pre		DS minus DM	
	Car	PT	Car	PT	Car	PT	Car	PT	Car	PT	Car	PT
HBW	870,743	413,950	872,106	412,588	1,363	-1,363	872,278	412,416	1,534	-1,534	172	-172
HBEb	163,458	58,925	163,366	59,017	-92	92	163,377	59,006	-81	81	11	-11
HBO	1,336,998	179,747	1,337,596	179,150	597	-597	1,337,642	179,103	644	-644	47	-47
HBShop	528,628	52,430	528,989	52,069	361	-361	529,016	52,041	388	-388	28	-28
HBEdu	132,246	9,591	132,225	9,611	-21	21	132,260	9,576	15	-15	35	-35
NHBEb	642,687	114,186	642,511	114,362	-176	176	642,521	114,352	-166	166	10	-10
NHBO	1,156,987	115,321	1,157,609	114,699	622	-622	1,157,632	114,676	645	-645	23	-23
Total	**4,831,747**	**944,149**	**4,834,401**	**941,495**	**2,654**	**-2,654**	**4,834,726**	**941,170**	**2,979**	**-2,979**	**325**	**-325**

The tables above highlight the following key impacts with respect to the VDM:

- Overall, there is a small (less than 0.1%) increase in highways demand in both DM and DS scenarios and both forecast years, with a commensurate reduction in PT demand due to the VDM. This is in line with expectation given the increase in highways capacity in the DM and DS scenarios (in particular the DM A12 improvements and CNEB) with no change in PT provision.
- By purpose, there is a small increase in all purposes post-VDM except employer's business, which is likely to be due to the distribution of EB trips being more London-centric and not benefitting from the increased highways capacity in the north of Chelmsford in the DM (A12 and CNEB schemes).
- A comparison of the impact between the DM and DS scenarios indicates that there is a larger increase in post-VDM trips in the DS compared to the DM of 255 trips in 2026 and 325 trips in 2041. This highlights the impact of the increase in highways capacity due to the A&N scheme and is again in line with expectation.

The growth rates compared to the 2019 base year implied by the above data are outlined in the following table with a comparison against national data from the NTEM for East of England, Essex and Chelmsford.

Table 5-3: Forecast growth factors pre- and post-VDM - Core 2026 24-hr P/A

Purpose	Pre-VDM	Post-VDM		National Growth Factor (NTEM)		
		DM	DS	East	Essex	Chelmsford
HBW	1.0860	1.0870	1.0872	1.0799	1.0696	1.0883
HBEB	1.0964	1.0951	1.0952	1.0909	1.0804	1.1010
HBO	1.1434	1.1434	1.1435	1.1492	1.1383	1.1551
HBS	1.1498	1.1499	1.1500	1.1560	1.1447	1.1609
HBE	1.1323	1.1326	1.1328	1.1207	1.1111	1.1256
NHBEB	1.0986	1.0979	1.0979	1.1007	1.0995	1.0970
NHBO	1.1264	1.1265	1.1265	1.1333	1.1291	1.1282
Total	**1.1207**	**1.1208**	**1.1209**	**1.1284**	**1.1218**	**1.1295**

Table 5-4: Forecast growth factors pre- and post-VDM - Core 2041 24-hr P/A

Purpose	Pre-VDM	Post-VDM		National Growth Factor (NTEM)		
		DM	DS	East	Essex	Chelmsford
HBW	1.2145	1.2164	1.2166	1.2060	1.1853	1.2436
HBEB	1.2469	1.2462	1.2462	1.2401	1.2178	1.2848
HBO	1.3680	1.3686	1.3687	1.3912	1.3704	1.4181
HBS	1.3808	1.3817	1.3818	1.4056	1.3846	1.4250
HBE	1.3150	1.3148	1.3152	1.3121	1.2946	1.3561
NHBEB	1.2528	1.2525	1.2525	1.2701	1.2679	1.2662
NHBO	1.3247	1.3254	1.3254	1.3536	1.3457	1.3468
Total	**1.3076**	**1.3083**	**1.3084**	**1.3379**	**1.3248**	**1.3505**

The data in the above tables indicates that the growth factors resulting from the demand modelling process almost identical pre- and post-demand modelling and are in line with national data for the study area.

6 Treatment of Park & Ride

6.1 Introduction

Park and Ride (P&R) is an integral part of the transport system in Chelmsford, with the two current P&R sites at Sandon and Chelmer Valley operating 18 services in the peak hour between them, carrying in excess of 2,300 passengers per day to the city centre on an average weekday. The location of these two P&R sites is illustrated in the figure below.

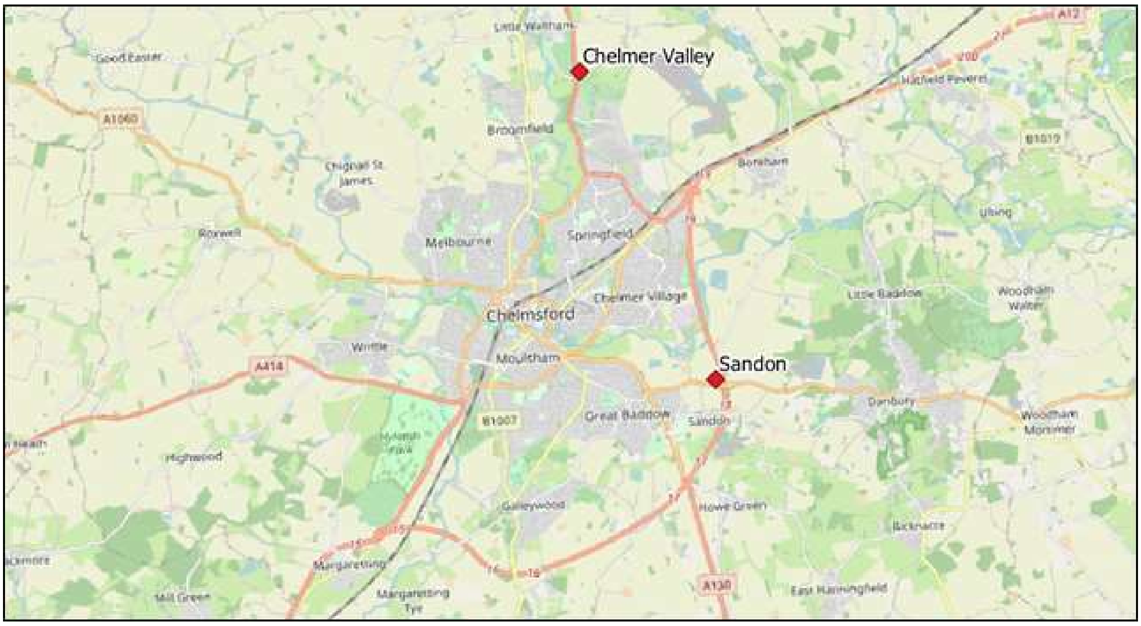

Figure 6-1: Chelmsford Park & Ride Location Map

In order to support various applications for funding in Chelmsford by ECC including the Army & Navy Sustainable Transport Package and recognising the importance of P&R in the city, an updated Park & Ride base year model was developed. This update builds on previous P&R models developed for Chelmsford and represents September to November 2019 traffic and patronage conditions. This included the impact of the permanent closure of the flyover at the A&N junction in August 2019, which was a key junction in Chelmsford with impacts on wider transport network performance as well as direct impacts on P&R bus routes from Sandon.

The 2019 base year P&R model provided the basis for a forecasting model in support of the A&N Sustainable Transport Package MRN funding application. The base year model development, calibration and validation is outlined in detail in the *Chelmsford Park & Ride 2019 Base Model Report* (June 2019), which is summarised in the following section and then goes on to describe the development of the forecast year P&R model, which links the base year P&R model to the VISUM transport model described in previously in this report.

6.2 Summary of Base Year Park & Ride Model

6.2.1 Context

Previously, Park & Ride models for Chelmsford and elsewhere in Essex have been successfully developed as multinomial logit choice models. This version of the P&R model follows the same basic structure with updates in terms of observed P&R demand and journey times to better represent the period following the closure of the flyover at the A&N. In addition, following requests from ECC, this version of the Chelmsford P&R model includes the two existing current P&R sites as well as financial modelling of the P&R operation.

The purpose of this base year P&R model was to:

- Model the choice between city centre parking and the two current P&R sites at Sandon and Chelmer Valley;
- Provide a sound basis for forecasting changes in P&R demand, primarily with respect to changes in future car-based travel demand and journey times but also, to a less degree, changes in city centre parking supply and cost as well as P&R fares; and
- Provide a sound basis for forecasting demand for new P&R sites in Chelmsford.

The validated base year P&R model was not linked to any wider transport model but was rather developed as a standalone model based on observed journey times and demand. However, the model was designed such that its structure and the calibrated model parameters were suitable for nesting within a wider transport model structure. In this case, the model was integrated into the Chelmsford VISUM Model for the purposes of forecasting for the A&N Sustainable Transport Package funding application.

6.2.2 Data Sources and Key Inputs

A key requirement for the updated Chelmsford P&R model was that it would represent the transport situation following the permanent closure of the A&N flyover in August 2019, which has been defined for this model as September to November 2019. While some new surveys were undertaken during this period, the scope for additional survey was curtailed by COVID-19. As such, the best use of existing data was made, where necessary.

The data required for the Park & Ride model consisted of three key types:

- Demand data in terms of the number of journeys using Park & Ride and long-stay city centre car parks;
- Journey cost data for the calculation of the generalised cost in terms of in-vehicle journey time, parking charges, bus fares, waiting times, car park access times and walk time to final destination; and
- Financial model data in terms of the Park & Ride operating cost and revenue streams.

The data sources used can be summarised as follows:

- Park & Ride on-board survey, 28th June 2018: This survey provided information on the journey characteristics of those using the Sandon and Chelmer Valley Park & Ride services, such as origin, purpose, ticket type and walking times to final destination and was considered valid for the representation of the model period;
- Chelmer Valley P&R passenger count, 28th June 2018: This survey provided information on the total number of passengers using the Chelmer Valley P&R by time period. Ideally, this survey would have been updated, but it was considered to be the best available data;
- Sandon P&R car park count, 18th October 2019: This survey provided information on the total number of vehicles entering and exiting the Sandon P&R site by time period for the model period directly;
- City centre car park counts, 28th June 2018: This survey provided information on the total number of vehicles entering and exiting 16 city centre car parks by time period. Ideally, this data would have been updated and enhanced to include additional journey data such as duration, purpose and some socio-economic information. Again, this was considered to be the best data available at that point in time;
- City centre long-stay car park journey purpose: In the absence of any direct survey data for city centre car parks, estimates of purpose type were based on the proportions observed at the Park & Ride sites (note that these values were compared to DfT TAG data to assess their suitability);
- Teletrac journey time data, September to November 2019: This data provided current average journey time information for car journeys to the city centre and to Sandon and Chelmer Valley P&R sites;

- Park & Ride timetables: This up-to-date data from the ECC website[10] provided journey times for Park & Ride services from the site car park to the city centre;
- City centre long stay parking charges: This up to date data from the Chelmsford City Council (CCC) website[11] provided full day car parking fees;
- Park & Ride fares: Average fare were calculated based on up to date published fares from the ECC website[12] and observed ticket types from on-board survey; and
- Financial Model data: Data from ECC on annual operating and site maintenance costs as well as revenue data for 2019/20 and more detailed revenue data by day and journey type for 2017/18.

The above data sources are described in detail in the *Chelmsford Park & Ride 2019 Base Model Report* (June 2019).

6.2.3 Model Structure

TAG Unit M5.1 Modelling Parking and Park & Ride (January 2014), outlines guidance for P&R modelling in terms of the comprehensive treatment of P&R and parking and then describes approaches that remove some of the level of detail in a proportionate manner for given circumstances. The choice model developed here adopted some of these simplifications, in most cases due to constraints imposed by the available data and is consistent with the approach successfully employed for previous P&R models in Essex.

The first simplification was that the model was based on trips, as the behavioural unit, as opposed to tours (that is, trips from an origin to a destination as opposed to tours from origin to destination and back to the origin). While it was recognised that there are benefits to modelling journeys as tours, the available data and in particular the lack of any duration data for city centre parking, did not support tour-based modelling. This was considered an acceptable simplification since, as the guidance notes, modelling of tours is an overhead that is generally avoided in transport modelling when there are no plans for policies that have significant time of day impacts, such as peak period road pricing. This also implied that time periods were modelled independently, meaning there was no time period response to changes in costs.

[10] https://www.essexhighways.org/transport-and-roads/getting-around/bus/park-and-ride.aspx
[11] https://www.chelmsford.gov.uk/parking-and-travel/find-a-car-park/
[12] https://www.essexhighways.org/transport-and-roads/getting-around/bus/park-and-ride.aspx

The second simplification was that the choice set was limited to car travel to city centre long-stay parking and the two P&R sites. This arises, in part, from the observation that the P&R services were providing for long-stay type journeys as opposed short-stay. In addition, it was observed that P&R demand in Chelmsford was almost entirely drawn from car-based travel as opposed to public transport, with limited scope for any competition with rail or bus. The rationale for this is based on the geographic corridors that are serviced by P&R, which are characterised by very low PT service and therefore very high car-based travel demand. Evidence to support this rationale consists of an estimate of the generalised cost of travel for PT versus P&R in the key corridors served by the P&R system as outlined in the following paragraphs.

With respect to the key Sandon corridors of Maldon and Danbury, there is no rail and the bus services do not provide a realistic alternative to P&R as demonstrated by the following comparison:

- Maldon to Chelmsford via bus: 5 bus services in peak hour (routes 31/331/332), taking 37 minutes in vehicle plus 6 minutes average wait for 43 minutes total (excluding walking and any factors applied to wait time) at a fare of £6 (4-week ticket) or £9.20 for a daily ticket.
- Maldon to Chelmsford via P&R: 11 services in peak hour, taking 19 minutes by car to the P&R plus 2.7 minutes average wait plus 9.5 minutes on the bus for a total of 31.2 minutes at a fare of £3.60. This means that P&R is about 12 minutes faster and at least £2.40 cheaper than bus.
- Danbury to Chelmsford via bus: 5 buses in peak hour (routes 31/331/332 plus one that is much slower), taking 20 minutes plus 6 minutes average wait time for 26 minutes in total at a fare of £6 (4-week ticket).
- Danbury to Chelmsford via P&R: 11 services in peak hour, taking 7.5 minutes by car to the P&R plus 2.7 minutes average wait plus 9.5 minutes on the bus for a total of about 20 minutes at a fare of £3.60. This means that P&R is about 6 minutes faster and at least £2.40 cheaper than bus.

The use of wait time factors to calculate the generalised cost would only increase the attractiveness of P&R given the longer wait times by bus. In addition, bus travel is also likely to have a larger penalty than P&R with respect to the alternative specific constant, that is, the general preference for the mode is likely to be lower for bus than P&R.

Given the above, PT is not considered an alternative likely to compete in any significant way with P&R from Maldon and Danbury to the centre of Chelmsford.

With respect to the key Chelmer Valley P&R corridor for travel from Braintree to Chelmsford the comparison is as follows:

- Braintree to Chelmsford via rail: 1 service in peak hour, taking 25 minutes in train time plus say 10 minutes wait for 35 minutes total (excluding any drive/walking time to the rail station and any factors applied to wait time) at return fare of £13.00.
- Braintree to Chelmsford via bus: 4 services in peak hour, taking about 52 minutes plus 7.5 minutes wait time for a total time of about an hour, at a fare of £6 (4-week ticket).
- Braintree to Chelmsford via P&R: 6 services in peak hour, taking about 20 minutes to drive to station, 5 minutes wait time, 15 minutes in bus time for a total 40 minutes at a fare of £3.60.

In summary, with only one service an hour and not likely to be faster than P&R (5 minutes faster but that excludes any time to walk/drive to the rail station) at a fare of £13 compared to £3.60, rail is not likely to significantly compete with P&R from Braintree. Similarly, bus travel takes about 20 minutes longer with a higher fare and again is therefore not likely to compete in any significant way with P&R.

The third simplification is that city centre long-stay car parks have been treated in aggregate terms and have not been modelled individually. As such, the choice set in this model is purely between city centre long-stay car parks (in aggregate terms) and each individual P&R. This reduced the choice set and ensured that the property of independence of irrelevant alternatives (IIA) was holding. Modelling each city centre car park individually, however, would likely have implied a more sophisticated model structure (nested logit) to avoid the problem of IIA and more detailed disaggregate data, which was not considered proportionate given the focus on Park & Ride for this work.

The model form is that of a multinomial logit choice model, which, as conventionally specified, is based on the behavioural principle that a decision-maker would choose the travel mode that yields greatest satisfaction or utility. A multinomial logit choice model is based on the utility of making a choice relative to the utility of some other choice. In the case of a mode choice model, the observable utility is a disutility represented by the total perceived cost of travel for a particular choice. This total perceived cost, known as the generalised cost of travel (GC), includes items such as in-vehicle journey times, car park fees, P&R bus fares, walking times, waiting times and car park access times, and is described in detail in the P&R base year model report[13].

As per standard practice and outlined in the guidance[14], an alternative-specific constant (ASC) was included in the utility function for all, but one choice alternative. An ASC can be interpreted as representing the net average effect of omitted variables (relative to the base). The inclusion of ASCs ensures that, when estimated by maximum likelihood, logit is able to replicate the aggregate choice shares. In this case, the ASC has been applied to city centre parking and omitted for P&R, but the results are identical should be ASC be applied to P&R.

The zone system used is based on 17 origin corridors/areas and three choices (city centre long stay car parks, Sandon Park & Ride and Chelmer Valley Park & Ride).

Five time periods were modelled in the base year P&R model as follows:

- 06:30 to 07:30;
- 07:30 to 08:30;
- 08:30 to 09:00;
- 09:00 to 10:00; and
- 10:00 to 13:00.

As previously mentioned, the return trip was not modelled, only the trip inbound towards the city centre. As such, the demand represented by the above time periods covers almost all inbound journeys.

In the base year, the P&R logit model explicitly addresses the choice between long-stay city centre car parks and P&R for commuter and business journeys only. Other purpose trips were not addressed by the logit model since during the peak periods they were made up largely of education trips and journeys to Broomfield Hospital, that is, they were not subject to the choice between city centre long-stay car parks and P&R.

Outside of the peak hours, the other purpose trips largely consisted of free concession journeys. Again, these were not considered to be a choice between long-stay city centre car parks and P&R with no available data on the number of

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[13] Essex Highways/Ringway Jacobs, June 2019: *Chelmsford Park & Ride 2019 Base Model Report*
[14] Department for Transport, January 2014: *Supplementary Guidance Bespoke Mode Choice Models*

concession holders using city centre parking. In addition, concession journeys on P&R may indeed to trips induced by the presence of the P&R service itself.

As such, other purpose trips have been modelled based on the simplifying assumption that demand for each other purpose type – education, hospital, drop-off, concession and remaining other – was proportionate to the observed total of commuter plus business trips.

6.2.4 Calibration and Validation

Model Estimation

The logit model was estimated by maximum likelihood (ML), which estimates the parameters for which the observed sample is most likely to have occurred. The parameters estimated by the model were the model scaling parameter (λ) and the ASC for city centre car parks. These parameters were estimated separately for commuter and business purposes. The estimation was undertaken based on a calculation of the observed generalised cost of travel for a combination of each origin corridor, each mode (city centre car parks and each P&R site) and each time period, as well as the observed proportion, choosing each alternative. Utility, based initially on seed values, was calculated with the proportions using each mode implied by this utility, also calculated. The log likelihood function was calculated for each combination and the SOLVER Excel module used to estimate the model by maximising the sum of the log likelihood function. The model converged, and the resulting parameters are outlined in the table below.

Table 6-1: Estimated Model Parameters by Purpose

Parameter	Commuter	Business
Model scaling factor (lambda λ)	1.06840	0.70513
Alternative-Specific Constant (ASC)	-£2.87	-£3.45

The ASC can be interpreted as representing the net average effect of omitted variables relative to the base, which in this case means that using the private car and parking in city centre car parks reduced the perceived generalised cost by £2.87 for commuters and by £3.45 for business users. Or to put another way, there was a penalty equivalent of £2.87 and £3.45 to use the P&R relative to city centre car parks. This penalty could have been said to represent a general preference for using the car and parking in city centre car parks relative to P&R.

In this way, this penalty also included the interchange penalty often included in the generalised cost when there are changes in mode, with TAG Unit M3.2[15] suggesting values of 5 to 10 minutes of in-vehicle time for each interchange. To put this in context, the ASC values above represent 13.4 minutes and 10.8 minutes for commuter and business trips respectively, covering this interchange penalty plus other omitted variables such as general preference for the car. This indicated that the ASC values were reasonable and in line with expectation.

The scaling parameter (λ) defines the shape of the logit curve, with lower values of λ resulting in a flatter curve. The calibrated curves for commuter and business purposes are illustrated in figures below, together with a representation of the observed proportion choosing each P&R compared to the difference in the average observed generalised cost of P&R relative to city centre car parks.

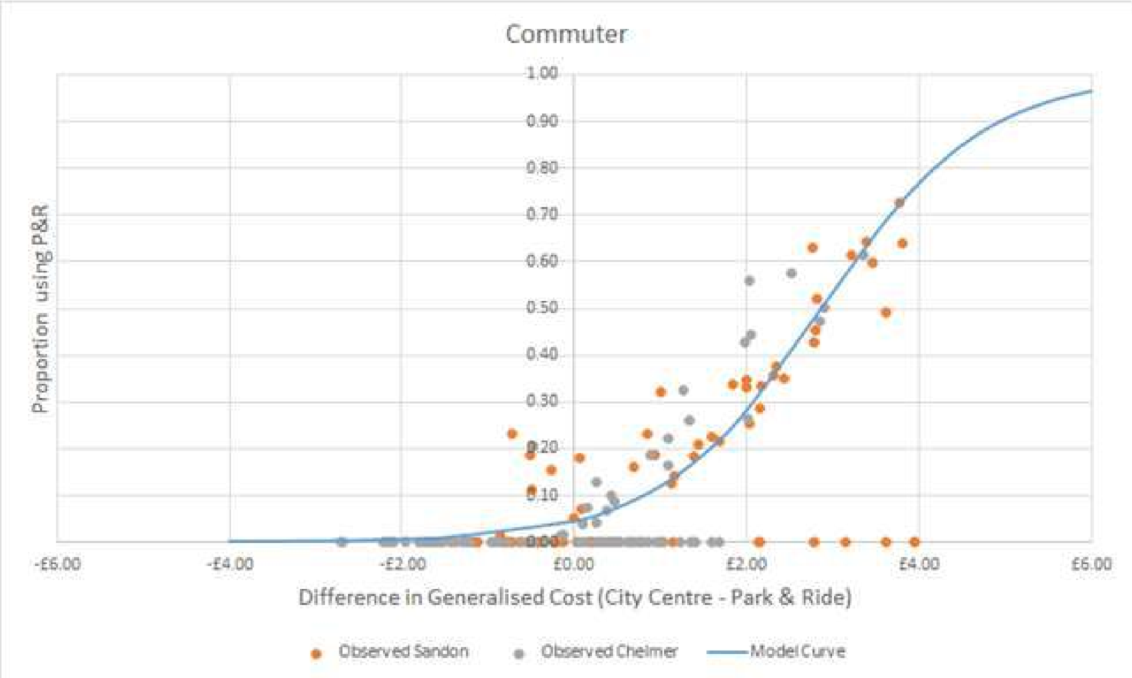


Figure 6-2: Modelled Curve and Observed Data for Commuter Trips

[15] Department for Transport, January 2014: *TAG Unit M3.2 Public Transport Assignment, paragraph 3.1.5*

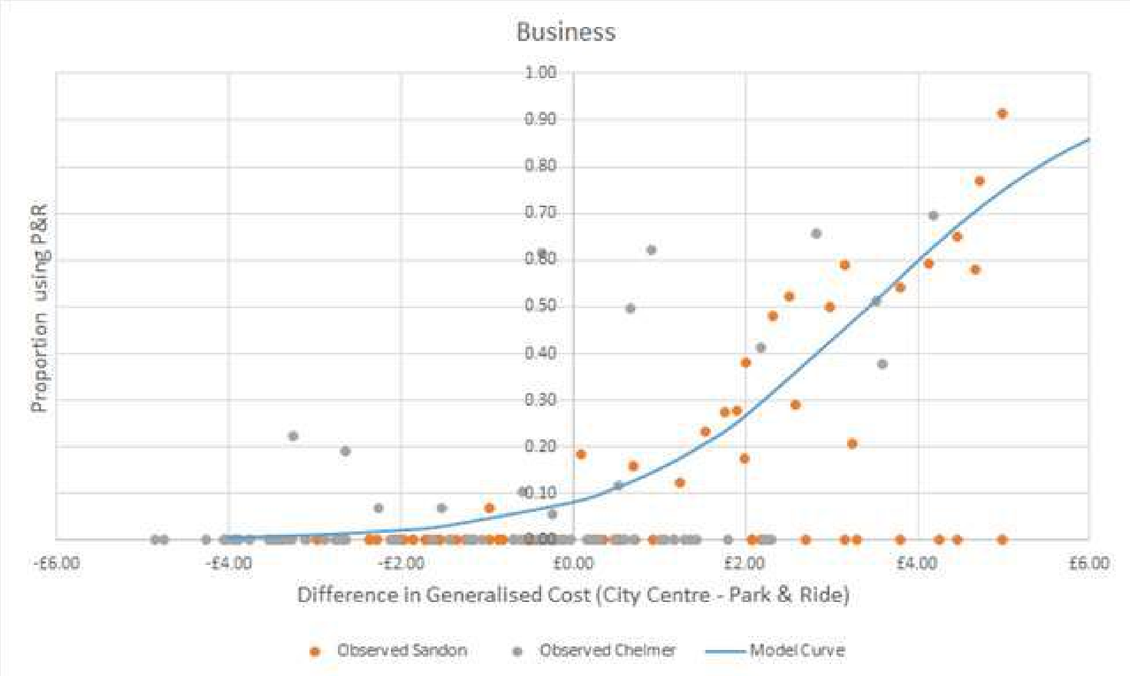


Figure 6-3: Modelled Curve and Observed Data for Business Trips

The modelled curves can be interpreted as follows:

- If the GC for P&R was the same as city centre car parks (£0.00 on the x-axis), it would be expected that about 4% of commuters and 8% of business trips would used P&R;
- If P&R usage was £4 cheaper than city centre parking in terms of the total GC, about 77% of commuters and 60% of business trips would use P&R. This indicates that for foreseeable differences in GC between city centre parking and P&R, there was a fixed level of travel that would always have used city centre parking; and
- Very little P&R patronage would be expected, if it was more expensive in total GC terms than parking in the city centre.

Validation

The DfT guidance on P&R models is outlined TAG Unit M5.1. With respect to model validation, this guidance indicates that, "*The park-and-ride choice model should be validated by comparing base year forecasts of park-and-ride patronage with counts of cars parked at existing park-and-ride sites*[16]". As such, the demand model was validated based on observed passenger volumes

[16] Department for Transport, January 2014: *TAG Unit M5.1 Modelling Parking and Park and Ride*, paragraph 3.2.6.

across all demand segments, that is, by time period and purpose for each Park & Ride site as well as at more aggregate levels. In addition, the model was validated by time period for vehicle arrivals and car park occupancy. Given the validation by a combination of all demand segments, this validation methodology is considered very robust.

The validation was carried out for both the difference in observed and modelled flows as well as using the GEH statistic. While no specific guidance was available for the acceptable level of these statistics for a mode choice model, the general criteria for the validation of assignment model flows, as outlined in TAG Unit M3.1 section 3.2, was used to provide a guide to the quality of the model validation. The values adopted as a guide were:

- Flow differences should be less than 5% as per screenlines in highways assignment for overall daily flows;
- Flows differences within 100 vehicle/hour of counts for flows less than 700 vehicles/hour for segmented demand; and
- All GEH values should be less than 5.0.

In addition, realism testing was undertaken in line with guidance for variable demand models[17], which states that, "*It is essential to apply realism testing to check that the model responds rationally and with acceptable elasticities*". In line with the guidance for assessing the mode choice response in variable demand models, elasticities for a change in P&R fares were examined.

Finally, in line with TAG Unit M2.1, sensitivity testing to determine the variation in the results of the assessment against the uncertainty in the input parameters was undertaken. For this mode choice model, the calibrated Lambda parameters were tested.

The following table provides a high-level but comprehensive overview of the model validation of daily passenger demand, vehicle arrivals and maximum car park occupancy at the two P&R sites.

[17] Department for Transport, May 2020: *TAG Unit M2.1 Variable Demand Modelling*

Table 6-2: Park & Ride Base Model Headline Validation Results

Site	Modelled	Observed	Diff	%Diff	GEH
Daily Passengers					
Sandon	1,645	1,650	-5	-0.3%	0.1
Chelmer Valley	814	796	18	2.2%	0.6
Total P&R	**2,459**	**2,446**	**13**	**0.5%**	**0.3**
Daily Vehicle Arrivals					
Sandon	1,397	1,389	8	0.6%	0.2
Chelmer Valley	677	659	17	2.6%	0.7
Total P&R	**2,073**	**2,048**	**25**	**1.2%**	**0.6**
Maximum Car Park Occupancy					
Sandon	1,203	1,196	7	0.6%	0.2
Chelmer Valley	677	655	21	3.3%	0.8
Total P&R	**1,879**	**1,851**	**28**	**1.5%**	**0.7**

The results in the above table indicate that:

- The model was validated extremely well at the level of daily passengers, vehicle arrivals and maximum car park occupancy for each P&R site;
- All percentage difference values were less than 4% and all GEH values less than 1.0, which are well within the established criteria; and
- For daily passenger flows, the highest difference was for Chelmer Valley P&R at 2.2% in flows or a GEH of 0.6, which were far lower than any validation criteria set for model validation.

The validation was generally slightly better for daily passengers than vehicle arrivals or occupancy, which is in line with expectation since the model calculations were carried out at the passenger level with a conversion to vehicle flows introducing minor errors due to the different vehicle occupancy values used for city centre car parks relative to Park & Ride.

Overall, the model validated extremely well for both Park & Ride sites. The model validation by purpose and time period was outlined in P&R base model report[18], which clearly demonstrated that the overall validation was not simply the result of poor positive and negative validation by segment cancelling each other out. In addition, the results of the realism testing and sensitivity testing were also outlined in the base model report. In summary, the model validated very well against observed data. The evidence provided in the proceeding sections and the base model report indicated that:

- Modelled daily passenger demand as well as demand segmented by time period and purpose all had a GEH less than 3;
- Realism testing of the model indicated that fare and car journey time elasticities respond in accordance with TAG guidance; and
- Sensitivity testing of the calibrated Lambda parameters provided evidence that the model was relatively insensitive to a sensible variation in the estimated Lambda parameter, providing confidence in the model as the basis for forecasts.

6.3 Forecast Year Park & Ride Model

6.3.1 Methodology

The forecast year P&R model was based on the base year P&R model but was linked to the VISUM forecast year transport models. This involved adopting the basic structure of the base year P&R model, including the calibrated model parameters, combined with key inputs from the forecast year VISUM models in terms of future year journey times and travel demand. The forecast year P&R model was developed in EXCEL as per the base year model and was effectively an add-on to the VISUM model at the end of the process following VDM as described in previous sections. The main reason for not nesting the P&R model within the VDM loops was impractical model run times. The P&R model was included in the process post-VDM as opposed to pre-VDM in order to include the impacts of the VDM in the P&R model inputs for demand and journey times, which is considered the appropriate place within the nested structure, that is, as a sub-choice under car following the choice between car and PT.

The key difference between the base year P&R model and the forecast year P&R model was the spatial representation of demand and in particular the city centre car parks. As mentioned, in the base year P&R model city centre car

[18] Essex Highways/Ringway Jacobs, June 2019: *Chelmsford Park & Ride 2019 Base Model Report*

parks were treated in aggregate terms. In the VISUM model, many of the long-stay car parks were explicitly modelled as individual zones. In order to be compatible with the base year P&R model, the VISUM car park zones, plus a proportion of other city centre zones that contain long-stay parking, were aggregated in terms of demand with demand weighted average costs used to calculate a representative generalised cost.

The methodology for adapting the base year P&R model to forecasting with the VISUM model included the following key steps:

- Import demand and time skim matrices from VISUM into the P&R model;
- Calculate the proportion of demand considered in-scope for the identified VISUM long-stay car park zones based on observed arrivals data (100% for explicitly modelled car parks);
- Convert demand in vehicles to demand in person trips;
- Calculate the total generalised costs for travel between every VISUM model origin zone to the city centre car park zones and P&R site zones for commuter and business trips for the AM peak and inter-peak VISUM model time periods, including car journey time, charges (car park or P&R fare), car park access time, walk time, wait time and bus travel time;
- Calculate a demand weighted average generalised cost to an aggregate representative city centre car park for each origin, time period and purpose;
- Calculate the modelled demand using the logit function as per the base year P&R model for the choice between aggregate city long-stay car parking and one of the two Park & Ride sites;
- Convert the modelled demand back to vehicle trips and then disaggregate the city centre car park demand into the individual city centre VISUM zones based on the pre-P&R model proportions;
- Calculate final demand matrices for VISUM for AM and IP commuter and employer’s business trips based on an incremental approach pivoting off the observed base year demand;
- Estimate AM and IP other purpose demand matrices for VISUM based on observed base year other trips and the modelled growth in commuter and business trips;
- Estimate PM peak demand matrices for VISUM based on a proportion (observed at 68%) of the reverse of the AM peak change

in demand, that is, with city centre car parks and P&R as the origin; and
- Export the revised demand matrices for assignment in VISUM.

The P&R model parameters are the same as those described in the base model report except for the Value of Time (VoT). The forecast year VoT values, as taken from the May 2020 Data Book (v1.17), used in the model are outlined in the following table.

Table 6-3: P&R Model Value of Time values per person by purpose by year (£ per hr)

Year	Commuter	Business	Other
2026	£11.68	£17.44	£5.33
2041	£14.45	£21.58	£6.60

6.3.2 Key Assumptions

A key assumption in the forecast year P&R demand modelling, which is common to the VDM, is that future demand follows similar trends to those observed in late 2019 prior to COVID-19. The uncertainty surround this is common to the whole modelling process and is addressed in the same way through the Low Growth scenario as described in section 2.10. The post-VDM demand and associated journey times from Low Growth were also passed through the P&R model and in this way attempt to capture the potential impact of lower than expected future transport demand. However, this does not address the potential impact on the calibrated base year model parameters. As such, sensitivity testing around the calibrated parameters was undertaken to assess the sensitivity of the model results to variations in the calibrated parameters. The results of this sensitivity test are also outlined in the following sections.

A second assumption, which is particular to the P&R model, is that the base year assumption that concession demand is a simple proportion of commuter plus business demand remains valid in the forecast years. A key issue around this assumption ECC introduced a concession fare of £1.50 in early 2020 to replace free concession travel after 09:00. The impact of this change has not been quantified due to impact of COVID19, but it is expected to result in a reduction in concession travel on the P&R. A survey and P&R concession users was undertaken by ECC prior to the introduction of the concession fare, which indicated that up to 65% may cease to use the service, although it is not known if, where or how they would travel instead. While it is not considered likely that this would impact significantly on scheme user benefit appraisal, as it is still a relatively low number of inter-peak period users, there may be an impact on the operational revenues and costs of the service. As such, sensitivity has been undertaken based on the results of the ECC survey to understand in the potential impact on the operational cost analysis. The revised passenger demand under this sensitivity test scenario is outlined in the following sections.

A third assumption is that future service provision will match future demand and as such, crowding has not been modelled. ECC has historically provided sufficient services to meet demand and this is expected to continue. The service requirements are calculated based on the forecast demand and current bus capacities with the resulting headways monitored. These values are outlined in section 6.3.4 below.

6.3.3 Model Performance

A validation exercise of the forecast year P&R model was undertaken using the base year VISUM journey time and demand inputs against observed data to assess the performance of this version of the model. The results are outlined in Table 7 3 for passenger demand by modelled time period.

Table 6-4: Forecast P&R Model Base Year Validation Check Results

Site	Modelled	Observed	Diff	%Diff	GEH
AM peak passengers (07:30 to 08:30)					
Sandon	446	449	-2	-0.5%	0.1
Chelmer Valley	172	272	-100	-36.7%	6.7
Total P&R	**618**	**721**	**-102**	**-14.2%**	**4.0**
Inter-peak passengers (average hour 10:00 to 16:00)					
Sandon	70	54	16	30.4%	2.1
Chelmer Valley	37	30	6	20.8%	1.1
Total P&R	**107**	**84**	**23**	**27.0%**	**2.3**

The results, of the validation check on the forecast year P&R model set-up using base year VISUM demand and journey time data, indicate a reasonable fit with observed data. The validation is considered excellent for the Sandon site in the AM peak and both Sandon and Chelmer Valley in the inter-peak, with GEH values no higher than 2.1. Modelled demand at the Chelmer Valley site is low in the AM peak period relative to observed data. Investigation highlighted that this was due to relatively fast modelled journey times on the Essex Regiment Way corridor in the VISUM base year model validation, indicating that the issue is with the strategic model on this corridor rather than the P&R model set-up. Having said that, the GEH of 6.7 still indicates a reasonable fit with the observed data and although the validation was not as good as in the base year P&R model, which was based on Teletrac observed journey time data, this was to be expected given that the key input in this case is modelled journey times in a strategic model.

It should be noted that the impact of these differences is mitigated by the incremental methodology adopted, in that forecast year demand is calculated based on a pivot off base year demand, that is, it is the change in modelled demand relative to the base that matters rather than the absolute value.

6.3.4 Model Results

The impact of the P&R model on demand is illustrated by the change in total car trips matrices as well as at a spatial level. This is illustrated firstly by higher level District or greater sectors and then with more detailed sub-sectors within Chelmsford District, using the DM 2026 AM peak total car matrices as an example.

Table 6-5: P&R Model change in Car Vehicle Trips by sector (P&R minus post-VDM) - DM 2026 AM peak

Sector	Chelmsford	Braintree	Colchester / Tendring	Maldon	South Essex	Epping / Harlow	Uttlesford	Other East of England	Greater London	External	ALL
ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
1	5	0	0	0	0	0	0	0	0	0	**5**
2	3	0	0	0	0	0	0	0	0	0	**3**
3	0	0	0	0	0	0	0	0	0	0	**0**
4	0	0	0	0	0	0	0	0	0	0	**0**
5	2	0	0	0	0	0	0	0	0	0	**2**
6	0	0	0	0	0	0	0	0	0	0	**0**
7	1	0	0	0	0	0	0	0	0	0	**1**
8	0	0	0	0	0	0	0	0	0	0	**0**
9	0	0	0	0	0	0	0	0	0	0	**0**
10	0	0	0	0	0	0	0	0	0	0	**0**
Total	**12**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**12**

Table 6-6: P&R Model changes in Car Vehicle Trips by sub-sector (P&R minus post-VDM) - DM 2026 AM peak

ID	Description	1	9	10	11	12	Total
1	Central South (Baddow, Moulsham)	-1	-1	3	0	1	**2**
2	Chelmer, Springfield	-2	-4	-3	6	3	**0**
3	NE Central (Melbourne)	0	-1	0	1	0	**0**
4	South (Galleywood)	0	0	1	0	0	**1**
5	Northwest (Broomfield)	-2	-2	-3	7	1	**2**
6	Northeast (Beaulieu)	-4	-6	-1	10	1	**0**
7	Chelmsford District West (Writtle)	0	0	0	0	0	**0**
8	Chelmsford District South/East	-6	-4	-5	3	13	**0**
9	City Centre	0	-1	0	0	0	**0**
10	City Centre Parking	0	0	0	0	0	**0**
11	Chelmer Valley P&R	0	0	0	0	0	**0**
12	Sandon P&R	0	0	0	0	0	**0**
20	Braintree District	-11	-7	-14	30	5	**3**
21	Colchester/Tendring Districts	-3	-2	-2	2	5	**0**
22	Maldon District	-5	-3	-4	4	9	**0**
23	South Essex	-7	-2	-8	3	17	**2**
24	Epping Forest/Harlow	0	0	0	0	0	**0**
25	Uttlesford	-2	-1	-3	6	2	**1**
26	East of England other	-1	-1	-1	2	1	**0**
27	Greater London	0	0	0	0	1	**0**
28	External	0	0	0	0	0	**0**
Total		**-47**	**-35**	**-41**	**74**	**60**	**12**

The data in the above tables highlights the following key points:

- The first table indicates that there is a negligible impact of the P&R model on total demand, with a change in the matrix total of 12 trips in the 2026 DM AM peak scenario (0.003%). This change in total demand represents small, accumulated model errors, mostly due to the conversion between passenger and vehicle trips in different parts of the model using different vehicle occupancies. This is a known inconsistency in the model that has been monitored and shown to result in acceptably small changes in total demand.

- There is almost no change in demand between sectors due to the P&R modelling, which is in line with expectation since the model is not changing the home origin of trips, only the choice of parking location (city centre versus P&R site), all on which are within Chelmsford District.
- The second table illustrates the change in trips with Chelmsford District divided into sub-sectors, showing the change between P&R and city centre parking locations and the origin of those journeys.
- In the 2026 DM AM peak, there is an increase in P&R usage at the two sites compared to the base year of 60 vehicles at Sandon and 74 vehicles at Chelmer Valley. There is a commensurate reduction in vehicles parking in the city centre long-stay sites around central Chelmsford.
- The largest increase in P&R usage of the Chelmer Valley site is for journey's starting in Braintree District (30 trips), which is in line with expectation given the location of the P&R site in northern Chelmsford.
- The largest increase in usage of the P&R site at Sandon is from South Essex (17 trips) and from the southern and eastern parts of Chelmsford District (13 trips). Again, this is in line with expectation given the location of the Sandon site to the east of Chelmsford.

The pattern of changes of the P&R model on demand is similar for all time periods and forecast years with the total impact of demand modelling for all time periods and year illustrated in 8.2.

In addition, outputs from the P&R were used to inform scheme design in terms of the need and scale of expansion as well as the operational cost analysis. Data for the modelled occupancy of the two P&R sites is outlined in the following table. Note that for this purpose, unconstrained site capacity was used to understand the total demand for P&R.

Table 6-7: Estimated Core Scenario P&R Site Occupancy

Site	Occupancy			%Occupancy		
	BY	DM	DS	BY	DM	DS
2026						
Sandon	1,183	1,393	1,146	84%	99%	65%
Chelmer Valley	659	943	816	66%	94%	54%
Total P&R	**1,842**	**2,336**	**1,962**	**76%**	**97%**	**60%**
City Centre	2,289	2,316	2,626	89%	90%	103%
2041						
Sandon	1,183	1,861	1,516	84%	132%	86%
Chelmer Valley	659	1,446	1,349	66%	145%	90%
Total P&R	**1,842**	**3,307**	**2,864**	**76%**	**137%**	**88%**
City Centre	2,289	2,140	2,537	89%	84%	99%

The data in the table above highlights that both P&R sites are expected to operate near capacity (over 90% occupancy) by 2026 without the scheme in place and would be well over-capacity by 2041. The sites would then be operating with 10%-14% spare capacity (on an average September-November day) by 2041.

Passenger data, split by standard fare paying passengers and concession passengers, was also extracted from the P&R model to inform the operational cost analysis. This data is summarised in the following table for the Core scenario. Note that unlike the data for occupancy presented above, this data includes the impact of the actual site capacity and the constraint this puts on the demand that can be accommodated.

Table 6-8: Estimated Core Scenario P&R Passenger Demand

Site	BY	DM			DS		
	Total	Standard	Con.	Total	Standard	Con.	Total
2026							
Sandon	1,650	1,410	578	1,989	1,142	573	1,714
Chelmer Valley	796	916	252	1,168	785	246	1,031
Total P&R	**2,446**	**2,327**	**830**	**3,157**	**1,927**	**818**	**2,745**
2041							
Sandon	1,650	1,605	223	1,828	1,520	705	2,225
Chelmer Valley	796	1,054	25	1,080	1,309	365	1,675
Total P&R	**2,446**	**2,659**	**249**	**2,908**	**2,829**	**1,070**	**3,900**

The data in the above table indicates that:

- Passenger demand is expected to increase over time due to both background growth related to increased overall demand for travel as well as increased congestion on the corridors served by the P&R services.
- P&R demand is higher in the DM scenario compared to the DS scenario in 2026. This is due to the impact of the scheme junction improvements at the A&N, which reduce journey times for car travel to the city centre and therefore also reduce demand for P&R.
- However, this is reversed by 2041 with higher demand for P&R under the 2041 scenario as the P&R sites are constrained by insufficient capacity under the DM scenario. It is noted that it is concession travel in particular that is lower under the DM scenario as it makes up a large proportion of inter-peak travel when the sites become full.

As previously mentioned in section 6.3.2, the impact of the forecast P&R demand on the level of service was monitored in terms the headway, that is, the time between buses, required to meet the forecast demand based on an operational design capacity of 56 passengers (41 seats plus 15 standing). The resulting values are outlined in the following table.

Table 6-9: Forecast Year Level of Service (headway minutes)

Site	Service Headway (minutes)				
	BY	2026		2041	
		DM	DS	DM	DS
AM peak hour					
Sandon	5.0	5.5	7.5	4.0	5.5
Chelmer Valley	10.0	7.5	10.0	5.0	5.5
Inter-peak					
Sandon	10.0	10.0	10.0	10.0	10.0
Chelmer Valley	10.0	10.0	10.0	10.0	10.0

The results in the above table indicate that:

- The required service frequencies at Sandon are similar to the base year values, being similar or lower in the DM and a little high in the DS. The highest frequency service required is with 4 minutes between buses in DM 2041, which is 1 minutes lower than in the base year, but is considered viable given the existing and proposed infrastructure.
- It is expected that more frequent services will be required in the future at Chelmer Valley with the gap between buses of as low as 5 minutes in 2041 from the current 10 minutes, although this is comparable with the current service frequency at Sandon.
- Inter-peak services currently operate at 10 minutes between buses as a matter of policy. In the future, it is not expected that this will change except that in the DM there would be less passengers per bus in this periods as the sites are largely full and in the DS there would be more passengers per bus than currently.

Overall, the information indicates that there is no reason to include crowding in the P&R model as the required service frequencies can be delivered by ECC.

6.3.5 Sensitivity Tests

A number of sensitivity test have been carried out to understand the impact of key assumptions in the P&R model on forecast demand and appraisal as follows:

- Sensitivity of forecast demand to the calibrated model parameters;
- Sensitivity of forecast demand to High and Low growth scenarios; and
- Sensitivity of the forecast demand to a reduction in concession travel due to the introduction of a £1.50 fares.

The results of these sensitivity tests are outlined below.

Model Parameters

As previously mentioned, sensitivity testing was undertaken to assess the impact of a variation in the calibrated P&R model *lambda* parameters on estimated patronage. The purpose of the sensitivity test is two-fold, i) to assess the potential impact on the design of the P&R expansion, and ii) to assess the potential impact on value for money. The test follows guidance from DfT TAG Unit M2.1[19] with a range of lambda values tested at +/25% of the calibrated values. The results from this test in terms of the estimated maximum (unconstrained) occupancy of the P&R sites in the 2041 forecast year are outlined in the following table.

Table 6-10: Park & Ride Model Sensitivity Testing (Lambda parameter) - Maximum Occupancy Results 2041 Forecast Year

Site	P&R Car Park Maximum Occupancy (vehicles)			% Difference from Core	
	+25%	Core	-25%	+25%	-25%
DM					
Sandon	1,780	1,861	1,988	-4.4%	6.8%
Chelmer Valley	1,397	1,446	1,564	-3.4%	8.2%
Total	3,177	3,307	3,552	-3.9%	7.4%
DS					
Sandon	1,352	1,516	1,751	-10.8%	15.5%
Chelmer Valley	1,310	1,349	1,462	-2.9%	8.4%
Total	2,662	2,864	3,214	-7.1%	12.2%

In terms of scheme design, the key questions to be answered by the sensitivity test are whether a variation in the model parameters changes i) the need for the

[19] Department for Transport, May 2020: *TAG Unit M2.1 Variable Demand Modelling*

expansion of the P&R sites (are there too many spaces?), and ii) does it change the design with respect to the expanded capacity (are there enough spaces?).

The sensitivity test results indicate that both Sandon and Chelmer Valley sites cannot accommodate the demand for P&R under the DM by 2041 under any scenario with the lower bound of the range of the estimated maximum occupancy at Sandon of 1,780 (current capacity 1,411 spaces) and at Chelmer Valley of 1,397 (current capacity of 1,000 spaces). Under the DS scenario the improvements to the A&N junction and the associated reductions in journey times for car travel to the city centre result in a reduction in P&R patronage when optimising the signal timings for car travel (within the constraint of the required crossing times for pedestrians and cyclists). This reduction in journey times implies that the lower bound of maximum occupancy in 2041 at Sandon (1,352 spaces) is lower than the current capacity. However, a few points should be noted in this regard as follows:

- Firstly, the lower bound is still at 96% of total capacity, i.e., it is almost full.
- Secondly, the model results are for an average day in the September to November period, with data[20] indicating that about 28% of the operational days of the year would have higher usage than that modelled, with the highest day about 27% higher than the September to November average. Clearly, additional spaces would be required at the site to accommodate demand on most of the 28% of days that are higher than average.
- Thirdly, the modelling assumes that there is no policy in place with respect to encouraging P&R usage, such as a reduction to city centre long-stay parking supply, changes to parking tariffs or P&R fares or reducing signal timing priorities for cars on EYW at the A&N junction. Any policy intervention to promote P&R would require the expansion.

At the Chelmer Valley site, the lower bound under the DS scenario is still significantly higher than current capacity (1,310 versus the capacity of 1,000 spaces). As such, it is considered that the sensitivity test does not imply any significant risk to the design of the P&R expansion as currently envisaged.

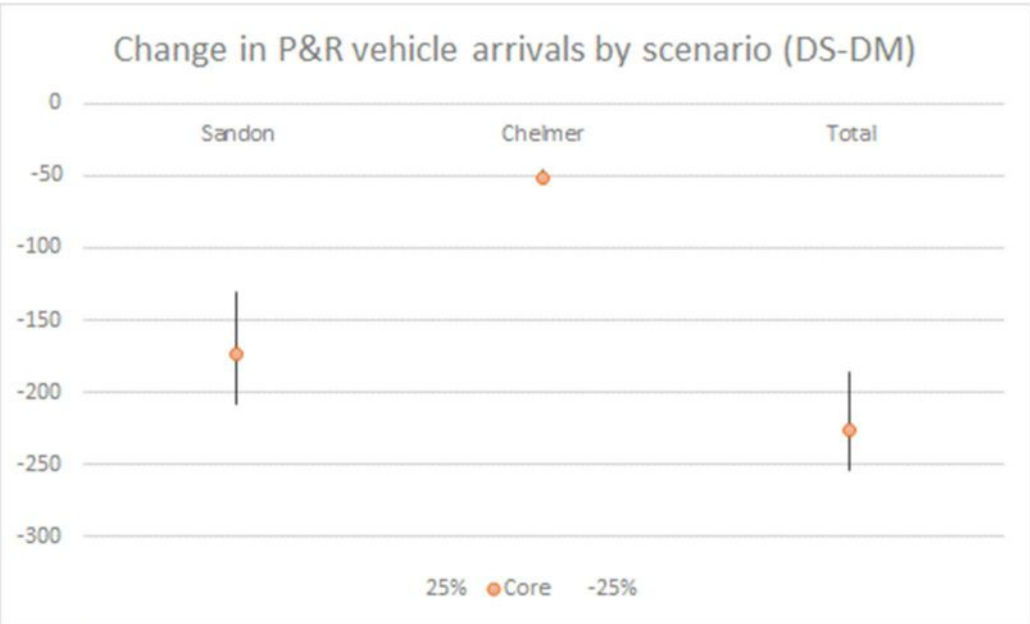
With respect to the implications on value for money, the time of day of the changes, and in particular the peak periods, is also important and not just the

[20] EH calculations based on Essex County Council data, 2020: *Park and Ride STATS 17-18*

total estimated occupancy. The estimated vehicle arrivals at the P&R sites for the morning peak hour is outlined in the following table and figure for the core and sensitivity test scenarios in the 2041 forecast year.

Table 6-11: Park & Ride Model Sensitivity Testing (Lambda parameter) – AM Peak Hour Arrivals 2041 Forecast Year

Scenario/Site	AM Peak Vehicle Arrivals			Difference from Core	
	+25%	Core	-25%	+25%	-25%
DM					
Sandon	741	737	734	4	-4
Chelmer Valley	581	586	610	-5	25
Total	1,322	1,323	1,344	-1	21
DS					
Sandon	533	563	604	-30	40
Chelmer Valley	535	534	554	1	20
Total	1,068	1,097	1,158	-29	61
DS-DM					
Sandon	-208	-174	-130	34	-44
Chelmer Valley	-46	-52	-56	-6	4
Total	-254	-226	-186	28	-40



The results of the sensitivity test on forecast vehicle arrivals during the AM peak hour indicate that:

- The model results are much less sensitive to changes in the calibrated lambda parameter during the AM peak compared to the impact on the daily values (and they are more sensitive during the inter-peak period).
- The change in the AM peak hour arrivals at Sandon is negligible in the DM (+/-4 vehicles), with a small change of -5 to +25 vehicle arrivals in the DS. However, the important change with respect to value for money is the change in the difference between DM and DS. As indicated in the figure, the difference between DM and DS in the core scenario is a drop of about 226 vehicles for the two P&R sites together (Sandon plus Chelmer Valley) in DS. The range provided by the sensitivity test around the core values is 186 to 254 vehicles, that is, a difference of between -28 to +40 vehicle arrivals. This means that if the lambda parameter is 25% higher than calibrated, then there would be 1 less vehicle forecast to use P&R in the DM and 29 more in the DS for a difference (DS-DM) of 28 less vehicles in the AM peak hour, implying 28 more travelling to central Chelmsford by car. This difference is not considered likely to impact significantly on the appraisal.

Low / High Growth

High and Low Growth scenarios were developed in line with guidance in DfT TAG Unit M4 and are outlined in more detail in section 8.8 of this report. Since the P&R model is integrated with the VISUM strategic model the impact of Low and High growth scenarios also alters P&R demand. The impact of the Low Growth scenario in particular is of interest with respect to the potential impact of COVID related travel and behavioural change on forecast P&R demand. The results of the Low and High Growth scenarios on forecast P&R demand are outlined in the following table.

Table 6-12: Forecast P&R Passenger Demand - Low Growth

Site	BY	DM			DS		
		Core	Low	%Diff to Core	Core	Low	%Diff to Core
2026							
Sandon	1,650	1,989	1,644	-17.3%	1,714	1,480	-13.7%
Chelmer Valley	796	1,168	953	-18.4%	1,031	856	-16.9%
Total P&R	**2,446**	**3,157**	**2,597**	**-17.7%**	**2,745**	**2,336**	**-14.9%**
2041							
Sandon	1,650	1,828	1,839	0.6%	2,225	1,692	-23.9%
Chelmer Valley	796	1,080	1,208	11.9%	1,675	1,276	-23.8%
Total P&R	**2,446**	**2,908**	**3,047**	**4.8%**	**3,900**	**2,968**	**-23.9%**

Table 6-13: Forecast P&R Passenger Demand - High Growth

Site	BY	DM			DS		
		Core	High	%Diff to Core	Core	High	%Diff to Core
2026							
Sandon	1,650	1,989	2,001	0.6%	1,714	1,970	14.9%
Chelmer Valley	796	1,168	1,213	3.8%	1,031	1,232	19.5%
Total P&R	**2,446**	**3,157**	**3,214**	**1.8%**	**2,745**	**3,202**	**16.7%**
2041							
Sandon	1,650	1,828	1,875	2.6%	2,225	2,384	7.1%
Chelmer Valley	796	1,080	1,085	0.5%	1,675	1,823	8.9%
Total P&R	**2,446**	**2,908**	**2,960**	**1.8%**	**3,900**	**4,207**	**7.9%**

The data in the above tables highlights that:

- Under the Low Growth scenario in 2026, which results in an overall reduction in demand compared to the Core scenario of 5.9% (see section 8.8.1), the forecast P&R demand reduced by 17.7% in the

DM and 14.9% in the DS scenarios. That is, the impact on P&R demand is higher than the impact of general background growth.

- In 2041, the Low Growth scenario results in a reduction in background growth of 9.0% compared to a reduction in P&R demand of 23.9% in the DS.
- In the 2041 DM scenario under Low Growth, there is (somewhat counterintuitively) an increase in passenger demand at both sites. The reason for this is that while both sites reach capacity by 2041 under both Core and Low Growth scenarios, the sites reach capacity earlier in the day under Core (between 9am and 10am) compared to Low (after 10am) due to the higher level of growth. The observed vehicle occupancy of P&R users earlier in the day is significantly lower than during the off-peak and should periods. This results in a higher number of passengers under Low Growth, since more off-peak (higher vehicle occupancy) users are able to access the site.
- Under High Growth in the DM scenario, both the Sandon and Chelmer Valley P&R sites would not be expected to accommodate all demand in 2026 or 2041, resulting in very low increases in passenger demand. This does not follow the same rationale as for Low Growth since the sites reach capacity in the same time period (between 9am and 10am), and so the differences are a function of arrival/departure patterns.
- Under High Growth in the DS scenario, both Sandon and Chelmer Valley P&R sites would be expected to accommodate all demand in 2026 but not by 2041. Again, this results in lower increases in demand in 2041 High relative to the reductions in demand under Low growth.

The impact of these forecasts is built into all appraisal.

Concession Fare

As previously mentioned in section 6.3.1, ECC introduced a concession fare to replace free concession travel in early 2020, subsequent to the development and validation of the P&R base model. To test the potential impact of this on total passenger demand and in particular the impact of the operational cost analysis, a sensitivity test was carried out assuming a 65% reduction in concession demand in line with the user survey undertaken by ECC prior to the introduction of the concession fare. These results are outlined in the following table.

Table 6-14: Estimated P&R Passenger Demand Concession Travel Sensitivity Test

Site	BY	DM			DS		
	Total	Standard	Con.	Total	Standard	Con.	Total
2026							
Sandon	1,650	1,410	202	1,613	1,142	200	1,342
Chelmer Valley	796	916	88	1,005	785	86	871
Total P&R	**2,446**	**2,327**	**291**	**2,617**	**1,927**	**286**	**2,213**
2041							
Sandon	1,650	1,667	92	1,760	1,520	247	1,767
Chelmer Valley	796	1,069	9	1,079	1,309	128	1,437
Total P&R	**2,446**	**2,737**	**102**	**2,838**	**2,829**	**375**	**3,204**

The above results highlight that the reduction in concession demand is highest for the DS scenario as the DM could not accommodate this demand by 2041. The results of this sensitivity test were used to undertake an operational cost analysis to fully understand their impact on the system financial viability as outlined in the Stage 2 EAR and OBC.

7 Treatment of Beaulieu Park Rail Station

Beaulieu Rail Station was expected to generate what is variously described either as rail-heading or rail-based Park & Ride behaviour, characterised by trips which use private transport for the home/station legs and rail for the station/destination legs. Therefore, within the model, while walk + rail and bus + rail trips were generated normally by the VDM/assignment loop, the additional mixed mode trips expected as well as the change in rail station used could not be modelled directly. To correct for this, the change in demand was estimated independently of the strategic VISUM model.

The external rail model determines:

- The number of newly generated trips (which did not previously use other stations); and
- The number of trips which are abstracted from other stations.

There are three strands to this modelling:

- Direct demand modelling – a means of calculating the demand between station pairs using the population in the catchment and generalised cost. This considers only London destinations, including Stratford and uses the functional form of the "Revised Parkway Access Model" described in the Passenger Demand Forecasting Handbook (PDFH) v.4.1 Section B6.6.1;
- MOIRA modelling – that estimates changes in demand at stations upstream of Beaulieu Station and affected by the additional travel time added by the additional stop; and
- Trip Rate Analysis – this provides a means of estimating non-London based demand on the basis of London-Based demand.

The combination of these three elements allows the estimation of demand at the new station and the reduction in demand at other affected stations. The scenario used is that referred to as Medium D[21] in the station studies and assumes a parking fee of £8.00. There are also some small adjustments to ignore trips originating very close the new station which are likely to be walk + rail trips and will be picked up by the mode split in the normal way.

[21] Four trains per hour at peak times and two trains per hour at other times.

Due to the small numbers involved and minimal impact on the road network, changes in demand have only been considered at Chelmsford and Braintree Stations. The outputs from the Rail Model are in the form of a matrix of annual passenger demand for all modes and purposes using the TEMPro zone system for without Beaulieu Park Station and with Beaulieu Park Station scenarios. These outputs are then converted for use in the Chelmsford VISUM model by creating adjustment matrices (the difference between the scenarios with and without Beaulieu Park station) by time period (AM, IP and PM) and purpose (commuter, employer's business and other). The assumptions for converting total annual passenger demand data to the Chelmsford VISUM model matrices by time periods and purpose are as follows:

- Annual passenger demand is converted to a typical weekday based upon MOIRA 2017/18 base data and 364.25 operating days per year (factor = 310);
- The total typical weekday passenger demand then then split for each direction by dividing by two to represent arrivals and departures at stations;
- The proportion of the total demand that uses a car and parks at or near the station is then calculated based on factors from the National Rail Travel Survey (NRTS – DfT, 2010) by rail station (Beaulieu Park, Chelmsford and Braintree) with the Beaulieu Park factor based on an average of Witham, Kelvedon, Hatfield Peverel and Ingatestone stations with the factors used as follows:
    - Beaulieu Park Station: 50.5%;
    - Chelmsford Station: 32.2%; and
    - Braintree Station: 27.8%.
- Passenger demand is then converted to car trip demand using a vehicle occupancy factor (factor = 1.13) resulting in daily vehicle trips arriving and departing each station;
- The daily vehicle demand is then used as the basis for calculating the car demand in each VISUM model time period. The factors used for converting from daily to peak hour demand are based on the observed arrival and departure profile at Townfield Street car park (June 2018), which is the main car park used for rail journeys in Chelmsford. The resulting factors, as a percentage of daily arrivals and departures, for each time period are outlined in the following table.

Table 7-1: Peak Hour Factors from Townfield Car Park, Chelmsford (June 2018)

Time Period	Peak Hour Factor (%)	
	Arrivals	Departures
AM peak hour (0730 to 0830)	27.7%	0.5%
Inter-peak average hour (1000 to 1600)	1.6%	2.9%
PM peak hour (1700 to 1800)	9.7%	32.6%

The peak hour factors in the above table indicate that, for example, 27.7% of arrivals to the station car park occur between 07:30 and 08:30 in the morning. Note that over half of arrivals enter the car park prior to 07:30 in the morning.

A summary of the input demand and factors and the resulting daily and peak hour arrivals and departures for each rail station for the with and without Beaulieu Park Station scenarios are outlined in the following table.

Table 7-2: Rail Model Factors and Results

Item	Beaulieu Park Station (BP)		Chelmsford Station				Braintree Station			
			w/o BP	with BP	w/o BP	with BP	w/o BP	with BP	w/o BP	with BP
Inputs										
Total annual Beaulieu Park Station demand	984,218		6,734,406		6,157,176		464,911		429,526	
Mode share "car (parked at or near the station)"	50.5%		32.2%				27.8%			
Annualisation	310									
Two-way to one-way	2									
Vehicle occupancy	1.13									
Results	Arrivals	Depart.	Arrivals	Depart.	Arrivals	Depart.	Arrivals	Depart.	Arrivals	Depart.
Daily weekday	709		3,098		2,832		185		171	
AM peak (07:30 to 08:30)	196	4	858	17	785	16	51	1	47	1
Inter-peak (avg 10:00 to 16:00)	7	231	29	1,010	27	923	2	60	2	56
PM peak (17:00 to 18:00)	11	21	50	91	46	83	3	5	3	5

The above table illustrates that the Rail Model forecasts daily demand of 709 vehicles at the Beaulieu Park station car park and reductions in demand at Chelmsford and Braintree stations with Beaulieu Park station in place.

The spatial distribution of demand from the Rail Model is based on the Tempro zones system, which has been converted to the Chelmsford VISUM Model zone system. From the stations, Beaulieu Station demand is split between Chelmsford Model zones 305 and 306 on the basis of the expected relative balance of usage of the two car park sites based on the location of short-stay/long-stay spaces. Braintree Station demand falls into a single zone and demand at Chelmsford Station is split between three potential zones (4, 76 and 300) again based on the number of short-stay/long-stay spaces available to station users.

The final output from this process is a series of adjustment matrices by purpose and time period that represent the change in demand between the with and without Beaulieu Park station scenarios. These adjustment matrices are applied to the post-Park & Ride model matrices to produce matrices for the final assignment. Note that following the latest advice from ECC regarding the likely capacity of the car park at Beaulieu Park station, it is estimated that the car would be almost full by 2026 and as such the adjustment matrices produced are applied to both the 2026 and 2041 forecast years in the VISSUM model. The matrix totals for these adjustment matrices by time period and purpose for each station are outlined in the following table.

Table 7-3: Rail Model Adjustment Matrix Totals by Station (vehicles)

Station	O/D	Car commuter	Car business	Car other	Car ALL
AM peak hour (07:30 to 08:30)					
Chelmsford station	Origin	-1.0	-0.1	-0.3	-1.5
	Dest.	-49.8	-6.4	-17.4	-73.6
Braintree station	Origin	-0.1	0.0	0.0	-0.1
	Dest.	-2.9	-0.3	-0.7	-3.9
Beaulieu Park station	Origin	2.6	0.3	1.0	3.9
	Dest.	129.0	17.6	48.1	194.7
Total		**77.8**	**11.2**	**30.6**	**119.6**
Inter-peak average hour (10:00 to 16:00)					
Chelmsford station	Origin	-5.3	-0.7	-1.8	-7.8
	Dest.	-2.9	-0.4	-1.0	-4.3
Braintree station	Origin	-0.3	0.0	-0.1	-0.4
	Dest.	-0.2	0.0	0.0	-0.2
Beaulieu Park station	Origin	13.7	1.9	5.1	20.6
	Dest.	7.5	1.0	2.8	11.4
Total		**12.5**	**1.8**	**4.9**	**19.3**
PM peak hour (17:00 to 18:00)					
Chelmsford station	Origin	-58.6	-7.5	-20.5	-86.6
	Dest.	-1.7	-0.2	-0.6	-2.5
Braintree station	Origin	-3.4	-0.3	-0.8	-4.6
	Dest.	-0.1	0.0	0.0	-0.1
Beaulieu Park station	Origin	151.9	20.7	56.6	229.2
	Dest.	4.4	0.6	1.6	6.6
Total		**92.3**	**13.3**	**36.4**	**142.0**

The data in the above table indicates, for example, that car commuter arrivals (destination) at Beaulieu Park are estimated at 129 trips in the morning peak hour with a reduction of 50 at Chelmsford station and 3 at Braintree station.

Final matrix totals including the rail adjustment are outlined in section 8.2.

8 Strategic Model Results

8.1 Model Convergence

TAG Unit M2.1[22] states that "*It is of crucial importance to demonstrate that the whole model system converges to a satisfactory degree, in order to have confidence that the model results are as free from error and 'noise' as possible*". Convergence is monitored for both the assignment model and VDM.

As recommended in the same TAG unit, convergence is measured through the relative demand / supply %GAP. The %GAP is a measure of how far the current flow is from the equilibrium point. It would be zero in a perfectly converged model, but values less than 0.2%, preferably 0.1%, are considered acceptable and the pattern of values achieved after each model loop is an additional useful indicator of stability as they can usually be seen to be declining asymptotically towards zero.

In addition, for the assignment models, stability indicators were monitored, which demonstrate the level of change in flow and delays on links between iterations.

The criteria used, as stated in TAG Unit M3.1, are described in the following table.

Table 8-1: Model Convergence Criteria

Measure	Base Model Acceptable Values
%GAP	<0.1% or at least stable with convergence fully documented and all other criteria met
Percentage of links with cost change (P2)<1%	Four consecutive iterations greater than 98%

For the VDM, the %GAP is used as the convergence as per the guidance. Both criteria from the above table are used to assess the convergence of the assignment models. Note that an additional criterion that appears in TAG relating to the percentage of links with a flow change less than 1% has not been adopted as VISUM does not use it as an internal criterion. The convergence of the VDM and assignment models is outlined in the following tables.

[22] Department for Transport, May 2020: *TAG Unit M2.1 Variable Demand Modelling*

Table 8-2: Core VDM Convergence

Scenario	Iteration	Loop	%GAP
Do-Minimum			
2026	F-3	-	-
	F-2	1	0.699%
	F-1	2	0.196%
	Final (F)	3	0.076%
2041	F-3	2	0.503%
	F-2	3	0.238%
	F-1	4	0.143%
	Final (F)	5	0.070%
Do-Something			
2026	F-3	-	-
	F-2	1	0.341%
	F-1	2	0.134%
	Final (F)	3	0.055%
2041	F-3	1	1.049%
	F-2	2	0.377%
	F-1	3	0.159%
	Final (F)	4	0.091%

Table 8-3: Assignment Model Convergence – Core Do-Minimum

Scenario	Time Period	Iteration	Loop	%GAP	Stability Indicator: %Delay	
					Links	Turns
2026	AM	F-3	9	0.0519%	98.67%	99.79%
		F-2	10	0.0447%	98.84%	99.81%
		F-1	11	0.0425%	99.20%	99.87%
		Final (F)	12	0.0417%	99.39%	99.93%
	IP	F-3	5	0.0048%	99.56%	99.93%
		F-2	6	0.0043%	99.72%	99.96%
		F-1	7	0.0036%	99.69%	99.93%
		Final (F)	8	0.0036%	99.79%	99.94%
	PM	F-3	12	0.0479%	99.15%	99.87%
		F-2	13	0.0431%	99.12%	99.88%
		F-1	14	0.0411%	99.31%	99.91%
		Final (F)	15	0.0395%	99.44%	99.95%
2041	AM	F-3	11	0.0664%	98.80%	99.86%
		F-2	12	0.0703%	98.68%	99.84%
		F-1	13	0.0672%	98.50%	99.79%
		Final (F)	14	0.0644%	99.04%	99.86%
	IP	F-3	6	0.0202%	99.05%	99.85%
		F-2	7	0.0110%	99.33%	99.89%
		F-1	8	0.0097%	99.61%	99.95%
		Final (F)	9	0.0090%	99.62%	99.97%
	PM	F-3	13	0.0822%	98.28%	99.82%
		F-2	14	0.0821%	98.65%	99.85%
		F-1	15	0.0775%	98.63%	99.84%
		Final (F)	16	0.0760%	98.59%	99.80%

Table 8-4: Assignment Model Convergence – Core Do-Something

Scenario	Time Period	Iteration	Loop	%GAP	Stability Indicator: %Delay	
					Links	Turns
2026	AM	F-3	10	0.0312%	98.06%	99.67%
		F-2	11	0.0284%	98.73%	99.81%
		F-1	12	0.0262%	99.00%	99.83%
		Final (F)	13	0.0237%	99.09%	99.84%
	IP	F-3	5	0.0006%	99.34%	99.88%
		F-2	6	0.0005%	99.78%	99.97%
		F-1	7	0.0005%	99.90%	99.98%
		Final (F)	8	0.0004%	99.94%	99.99%
	PM	F-3	7	0.0223%	99.10%	99.89%
		F-2	8	0.0221%	99.35%	99.89%
		F-1	9	0.0214%	99.45%	99.92%
		Final (F)	10	0.0207%	99.52%	99.93%
2041	AM	F-3	17	0.0510%	98.76%	99.84%
		F-2	18	0.0502%	99.08%	99.87%
		F-1	19	0.0480%	99.03%	99.87%
		Final (F)	20	0.0467%	99.13%	99.88%
	IP	F-3	7	0.0072%	99.26%	99.87%
		F-2	8	0.0067%	99.37%	99.91%
		F-1	9	0.0061%	99.63%	99.94%
		Final (F)	10	0.0059%	99.77%	99.98%
	PM	F-3	11	0.0583%	98.62%	99.76%
		F-2	12	0.0561%	98.32%	99.77%
		F-1	13	0.0537%	98.91%	99.86%
		Final (F)	14	0.0532%	99.07%	99.88%

The model convergence statistics in the above tables highlight that:

- The %GAP for the VDM is below the 0.1% preferred criteria for all models, that is, both DM and DS for both forecast years.
- For the final assignment models, the %GAP is less than 0.1% for all scenarios, time periods and final four iterations, with the highest value being 0.08%.
- The stability indicator is above 98% for four consecutive iterations.

The above convergence statistics indicate the models are sufficiently converged to provide a robust basis for appraisal.

8.2 Network Summary Statistics

Overall model network summary statistics provide a high-level indication of the impact of the difference scenarios on total network time and distance. These statistics are output from the final model assignments by scenario, forecast year and time period and are outlined in the following table.

Table 8-5: Overall Model Network Statistics

Time Period	AM peak			Inter-peak			PM Peak		
Scenario	**DM**	**DS**	**Diff.**	**DM**	**DS**	**Diff.**	**DM**	**DS**	**Diff.**
2026									
Time (hours)	296,448	296,411	-37	256,536	256,532	-4	257,225	257,179	-45
Distance (km)	22,507,916	22,516,605	8,689	20,345,844	20,349,727	3,884	19,523,670	19,532,245	8,575
Average Speed kph	75.9	76.0	0.0	79.3	79.3	0.0	75.9	75.9	0.0
Average Speed mph	47.5	47.5	0.0	49.6	49.6	0.0	47.4	47.5	0.0
2041									
Time (hours)	337,120	337,038	-81	294,225	294,204	-21	296,258	296,183	-75
Distance (km)	25,873,681	25,876,668	2,987	23,530,721	23,532,710	1,990	22,748,831	22,757,896	9,065
Average Speed kph	76.7	76.8	0.0	80.0	80.0	0.0	76.8	76.8	0.1
Average Speed mph	48.0	48.0	0.0	50.0	50.0	0.0	48.0	48.0	0.0
2041 minus 2026									
Time (hours)	40,672	40,627	-44	37,689	37,672	-17	39,033	39,003	-30
Distance (km)	3,365,765	3,360,063	-5,702	3,184,877	3,182,983	-1,894	3,225,161	3,225,651	490
Average Speed kph	0.8	0.8	0.0	0.7	0.7	0.0	0.9	0.9	0.0
Average Speed mph	0.5	0.5	0.0	0.4	0.4	0.0	0.6	0.6	0.0

The above table highlights the following key points:

- For all forecast years and time periods the total network time falls in the DS scenario compared to the DM scenario, which is in line with expectation given the scheme is designed to improve journey times.
- For all forecast years and time periods the total network distance increases in the DS scenario compared to the DM scenario. This suggests that, in general, users are travelling further to take advantage of the improvements in journey times through the A&N junction.

8.3 Forecast Demand

The combined impacts of the demand modelling – VDM, P&R model and Beaulieu Park station adjustments – relative to reference case demand are described in this section in terms of the following:

- Total trips by time period, mode and purpose;
- Trip distribution by time period by spatial sector; and
- Trip length by time period, mode and purpose.

Each of these impacts are described in the following sections, together with comparisons with National Data where available.

8.3.1 Trip Matrix Totals by time period

The impact of the demand modelling on trip matrix totals for the core DM and DS scenarios by forecast year by time period is outlined in the following tables.

Table 8-6: Pre- and Post-Demand Modelling Highways Matrix Totals - 2026

Scenario	Pre-VDM	Post-VDM	P&R	Beaulieu Park Stn	Diff.	% Diff.
AM Peak						
DM	589,105	589,226	589,239	589,396	292	0.0%
DS	589,105	589,267	589,284	589,438	334	0.1%
Inter-Peak						
DM	468,749	468,771	468,772	468,793	44	0.0%
DS	468,749	468,787	468,788	468,809	61	0.0%
PM Peak						
DM	557,465	557,549	557,558	557,745	280	0.1%
DS	557,465	557,586	557,598	557,782	317	0.1%

Table 8-7: Pre- and Post-Demand Modelling Highways Matrix Totals - 2041

Scenario	Pre-VDM	Post-VDM	P&R	Beaulieu Park Stn	Diff.	% Diff.
AM Peak						
DM	677,084	677,557	677,599	677,766	682	0.1%
DS	677,084	677,608	677,641	677,806	722	0.1%
Inter-Peak						
DM	546,903	547,121	547,122	547,144	241	0.0%
DS	546,903	547,142	547,142	547,164	261	0.0%
PM Peak						
DM	647,228	647,475	647,510	647,702	475	0.1%
DS	647,228	647,521	647,548	647,739	511	0.1%

The data in the above tables highlights that:

- The overall impact of the demand modelling on the reference case demand is minimal, with a small increase in overall demand, which is slightly larger for the DS compared to the DM.
- With respect to the VDM, this indicates that, overall, there is not a large difference in forecast year generalised costs compared to base year costs. Further, the increase in demand indicates that forecast year generalised costs are, on balance, actually lower than the base year. This is due to the large impact of the DM scheme, in particular the A12 improvements, and has been observed in other Essex models. The increase in DS scheme demand is slightly higher than the DM scenario, which is in line with expectation as the DS introduces additional highways capacity that attracts slightly more PT demand.
- The change in matrix totals from the P&R model is largely due to an issue converting people to vehicle trips in the model and represents a small error.
- The change in matrix totals due to the Beaulieu Park station is due to induced demand as additional car trips a generated through the introduction of the new station. (See section 7).

8.3.2 Trip Matrix Totals by time period by purpose

A comparison of the pre-VDM and final trip matrix totals by time period by purpose is outlined in the following tables.

Table 8-8: Pre- and Post-Demand Modelling Highways Matrix Totals – DM Core

User Class	2026				2041			
	Pre-VDM	Final	Diff	%Diff	Pre-VDM	Final	Diff.	% Diff
AM Peak								
Car commuter	170,414	170,679	265	0.2%	190,047	190,476	429	0.2%
Car EB	64,832	64,790	-42	-0.1%	73,410	73,414	4	0.0%
Car other	141,097	141,165	68	0.0%	167,043	167,292	250	0.1%
LGV	139,105	139,105	0	0.0%	166,655	166,655	0	0.0%
HGV	73,657	73,657	0	0.0%	79,929	79,929	0	0.0%
Total	**589,105**	**589,396**	**292**	**0.0%**	**677,084**	**677,766**	**682**	**0.1%**
Inter-Peak								
Car commuter	39,238	39,292	54	0.1%	43,932	44,016	84	0.2%
Car EB	42,869	42,836	-33	-0.1%	49,336	49,321	-15	0.0%
Car other	179,508	179,532	23	0.0%	214,650	214,822	171	0.1%
LGV	125,897	125,897	0	0.0%	150,832	150,832	0	0.0%
HGV	81,236	81,236	0	0.0%	88,153	88,153	0	0.0%
Total	**468,749**	**468,793**	**44**	**0.0%**	**546,903**	**547,144**	**241**	**0.0%**
PM Peak								
Car commuter	144,794	145,052	258	0.2%	162,100	162,505	406	0.3%
Car EB	59,561	59,534	-27	0.0%	67,590	67,588	-2	0.0%
Car other	203,692	203,741	49	0.0%	243,064	243,135	70	0.0%
LGV	109,247	109,247	0	0.0%	130,884	130,884	0	0.0%
HGV	40,170	40,170	0	0.0%	43,590	43,590	0	0.0%
Total	**557,465**	**557,745**	**280**	**0.1%**	**647,228**	**647,702**	**475**	**0.1%**

Table 8-9: Pre- and Post-Demand Modelling Highways Matrix Totals - DS Core

User Class	2026				2041			
	Pre-VDM	Final	Diff	%Diff	Pre-VDM	Final	Diff.	% Diff
AM Peak								
Car commuter	170,414	170,715	301	0.2%	190,047	190,509	463	0.2%
Car EB	64,832	64,790	-42	-0.1%	73,410	73,410	0	0.0%
Car other	141,097	141,172	75	0.1%	167,043	167,302	260	0.2%
LGV	139,105	139,105	0	0.0%	166,655	166,655	0	0.0%
HGV	73,657	73,657	0	0.0%	79,929	79,929	0	0.0%
Total	**589,105**	**589,438**	**334**	**0.1%**	**677,084**	**677,806**	**722**	**0.1%**
Inter-Peak								
Car commuter	39,238	39,300	62	0.2%	43,932	44,026	94	0.2%
Car EB	42,869	42,837	-32	-0.1%	49,336	49,323	-13	0.0%
Car other	179,508	179,539	30	0.0%	214,650	214,831	180	0.1%
LGV	125,897	125,897	0	0.0%	150,832	150,832	0	0.0%
HGV	81,236	81,236	0	0.0%	88,153	88,153	0	0.0%
Total	**468,749**	**468,809**	**61**	**0.0%**	**546,903**	**547,164**	**261**	**0.0%**
PM Peak								
Car commuter	144,794	145,081	287	0.2%	162,100	162,533	433	0.3%
Car EB	59,561	59,535	-27	0.0%	67,590	67,586	-4	0.0%
Car other	203,692	203,749	57	0.0%	243,064	243,146	82	0.0%
LGV	109,247	109,247	0	0.0%	130,884	130,884	0	0.0%
HGV	40,170	40,170	0	0.0%	43,590	43,590	0	0.0%
Total	**557,465**	**557,782**	**317**	**0.1%**	**647,228**	**647,739**	**511**	**0.1%**

The data in the above tables highlights that the minimal overall impact is consistent across all car-based purposes, being highest for commuter trips and lowest for employer's business. In line with the model specification, the variable demand modelling has no impact on LGV or HGV demand.

8.3.3 Trip Matrix Distribution

The change in the spatial distribution of trips pre- and post-VDM has also been assessed by sector, with the change in trips by time period for the total car matrices illustrated in the following figures.

Table 8-10: Change in Car Vehicle Trips (final minus pre-VDM) - DM 2026 AM peak

Sector	Chelmsford	Braintree	Colchester / Tendring	Maldon	South Essex	Epping / Harlow	Uttlesford	Other East of England	Greater London	External	ALL
ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
1	308	32	14	-37	-147	-31	-9	-12	-50	0	**69**
2	116	34	-41	4	28	-7	-15	-2	6	0	**123**
3	47	-83	4	22	23	0	-1	0	1	0	**11**
4	-32	3	35	6	1	-3	4	1	1	0	**17**
5	-182	34	19	-9	135	13	15	3	28	0	**56**
6	-21	-2	0	-2	4	3	15	3	4	0	**5**
7	-9	-6	-2	1	12	12	-25	12	14	0	**11**
8	-7	-2	0	0	2	2	8	0	0	0	**4**
9	-42	7	0	-1	9	4	23	0	0	0	**0**
10	0	0	0	0	0	0	0	0	0	0	**0**
Total	**178**	**19**	**29**	**-16**	**66**	**-6**	**15**	**5**	**4**	**0**	**294**

Table 8-11: % Change in Car Vehicle Trips - DM 2026 AM peak

ID	1	2	3	4	5	6	7	8	9	10	Total
1	1.9%	2.3%	2.4%	-4.6%	-4.1%	-6.4%	-1.8%	-2.1%	-4.6%	0.0%	**0.3%**
2	5.1%	0.4%	-2.4%	0.6%	5.1%	-3.1%	-1.8%	-0.2%	1.3%	0.0%	**0.7%**
3	6.4%	-5.3%	0.0%	2.8%	5.8%	-0.5%	-0.6%	0.0%	0.2%	0.0%	**0.0%**
4	-2.3%	0.5%	4.4%	0.2%	0.1%	-5.6%	7.6%	0.8%	0.5%	0.0%	**0.2%**
5	-4.7%	8.2%	5.2%	-1.2%	0.2%	1.4%	7.0%	0.4%	0.3%	0.0%	**0.1%**
6	-5.6%	-1.5%	-0.2%	-12.8%	0.6%	0.0%	2.8%	0.1%	0.1%	0.0%	**0.0%**
7	-1.8%	-0.9%	-1.7%	6.7%	6.4%	1.6%	-0.6%	0.4%	2.3%	0.0%	**0.1%**
8	-1.4%	-0.1%	0.0%	0.2%	0.2%	0.1%	0.3%	0.0%	0.0%	0.0%	**0.0%**
9	-5.6%	2.8%	0.0%	-1.6%	0.1%	0.1%	3.2%	0.0%	0.0%	0.0%	**0.0%**
10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Total	**0.7%**	**0.1%**	**0.1%**	**-0.3%**	**0.1%**	**0.0%**	**0.1%**	**0.0%**	**0.0%**	**0.0%**	**0.1%**

Table 8-12: Change in Car Vehicle Trips (final minus pre-VDM) - DS 2026 AM peak

Sector	Chelmsford	Braintree	Colchester / Tendring	Maldon	South Essex	Epping / Harlow	Uttlesford	Other East of England	Greater London	External	ALL
ID	1	2	3	4	5	6	7	8	9	10	Total
1	318	30	12	-33	-141	-22	-11	-12	-47	0	**93**
2	135	27	-43	2	25	-4	-18	-3	5	0	**125**
3	58	-84	3	21	22	2	-1	0	1	0	**20**
4	-4	-1	32	-5	-10	3	3	1	-1	0	**18**
5	-110	30	18	-14	83	9	15	4	24	0	**60**
6	-14	1	2	2	1	-4	12	3	3	0	**6**
7	-12	-4	-1	2	12	9	-23	12	14	0	**9**
8	-7	-1	0	0	2	2	9	0	0	0	**4**
9	-36	7	0	-2	6	3	22	0	0	0	**1**
10	0	0	0	0	0	0	0	0	0	0	**0**
Total	**329**	**3**	**22**	**-26**	**1**	**-2**	**8**	**4**	**-2**	**0**	336

Table 8-13: % Change in Car Vehicle Trips - DS 2026 AM peak

ID	1	2	3	4	5	6	7	8	9	10	Total
1	2.0%	2.1%	2.0%	-4.0%	-3.9%	-4.6%	-2.2%	-2.2%	-4.4%	0.0%	**0.4%**
2	5.9%	0.3%	-2.5%	0.4%	4.6%	-1.8%	-2.1%	-0.2%	1.0%	0.0%	**0.7%**
3	7.9%	-5.4%	0.0%	2.7%	5.7%	1.9%	-0.9%	0.0%	0.2%	0.0%	**0.1%**
4	-0.3%	-0.2%	4.0%	-0.2%	-1.0%	6.4%	6.7%	0.6%	-0.6%	0.0%	**0.3%**
5	-2.9%	7.4%	4.9%	-1.7%	0.1%	1.0%	6.8%	0.5%	0.3%	0.0%	**0.1%**
6	-3.7%	0.8%	5.0%	12.9%	0.2%	0.0%	2.3%	0.1%	0.1%	0.0%	**0.0%**
7	-2.4%	-0.7%	-1.6%	7.4%	6.6%	1.2%	-0.5%	0.4%	2.3%	0.0%	**0.1%**
8	-1.4%	-0.1%	0.0%	0.2%	0.2%	0.1%	0.3%	0.0%	0.0%	0.0%	**0.0%**
9	-4.8%	2.7%	0.0%	-2.5%	0.1%	0.1%	3.1%	0.0%	0.0%	0.0%	**0.0%**
10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Total	**1.2%**	**0.0%**	**0.1%**	**-0.4%**	**0.0%**	**0.0%**	**0.1%**	**0.0%**	**0.0%**	**0.0%**	0.1%

Table 8-14: Change in Car Vehicle Trips (final minus pre-VDM) - DM 2026 inter-peak

Sector	Chelmsford	Braintree	Colchester / Tendring	Maldon	South Essex	Epping / Harlow	Uttlesford	Other East of England	Greater London	External	ALL
ID	1	2	3	4	5	6	7	8	9	10	Total
1	63	47	29	-21	-62	-11	2	-1	-17	0	**30**
2	46	-40	-24	2	38	-1	-4	1	8	0	**26**
3	34	-62	-2	18	22	0	0	0	0	0	**10**
4	-27	4	22	-14	-1	-2	2	1	0	0	**-14**
5	-83	33	17	-3	-4	7	11	3	-3	0	**-21**
6	-12	1	0	-2	4	-3	9	2	2	0	**2**
7	-3	-2	-1	2	11	7	-38	7	14	0	**-2**
8	-3	2	0	0	2	2	7	0	0	0	**11**
9	-16	7	0	1	-4	2	15	0	0	0	**5**
10	0	0	0	0	0	0	0	0	0	0	**0**
Total	**-1**	**-9**	**42**	**-18**	**6**	**3**	**5**	**12**	**5**	**0**	**47**

Table 8-15: % Change in Car Vehicle Trips - DM 2026 inter-peak

ID	1	2	3	4	5	6	7	8	9	10	Total
1	0.5%	3.8%	6.4%	-2.9%	-2.5%	-4.3%	0.8%	-0.4%	-3.0%	0.0%	**0.2%**
2	4.2%	-0.6%	-2.0%	0.4%	11.8%	-0.6%	-0.8%	0.2%	4.0%	0.0%	**0.2%**
3	9.9%	-5.4%	0.0%	3.1%	7.4%	0.2%	-0.4%	0.0%	0.2%	0.0%	**0.0%**
4	-4.0%	0.8%	3.9%	-0.7%	-0.1%	-7.7%	11.6%	0.6%	0.5%	0.0%	**-0.3%**
5	-3.4%	11.6%	6.7%	-0.5%	0.0%	1.2%	9.7%	0.5%	-0.1%	0.0%	**0.0%**
6	-4.8%	0.7%	0.5%	-8.9%	0.7%	0.0%	2.0%	0.1%	0.1%	0.0%	**0.0%**
7	-0.9%	-0.4%	-0.9%	10.3%	9.0%	1.5%	-1.2%	0.4%	2.9%	0.0%	**0.0%**
8	-1.1%	0.2%	0.0%	0.6%	0.4%	0.1%	0.4%	0.0%	0.0%	0.0%	**0.0%**
9	-3.6%	3.6%	0.1%	0.9%	-0.1%	0.1%	3.0%	0.0%	0.0%	0.0%	**0.0%**
10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Total	**0.0%**	**-0.1%**	**0.2%**	**-0.4%**	**0.0%**	**0.0%**	**0.1%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**

Table 8-16: Change in Car Vehicle Trips (final minus pre-VDM) - DS 2026 inter-peak

Sector	Chelmsford	Braintree	Colchester / Tendring	Maldon	South Essex	Epping / Harlow	Uttlesford	Other East of England	Greater London	External	ALL
ID	1	2	3	4	5	6	7	8	9	10	Total
1	92	49	29	-15	-61	-7	1	-2	-18	0	**69**
2	50	-46	-25	1	36	1	-5	1	8	0	**21**
3	36	-64	-3	16	21	1	0	0	0	0	**8**
4	-11	1	20	-25	-7	2	2	0	0	0	**-17**
5	-32	30	16	-8	-53	5	11	3	-6	0	**-34**
6	-4	3	2	3	0	-8	6	2	1	0	**5**
7	-3	-2	-1	2	11	6	-37	7	14	0	**-4**
8	-3	2	0	0	2	2	7	0	0	0	**11**
9	-9	7	0	0	-9	2	15	0	0	0	**4**
10	0	0	0	0	0	0	0	0	0	0	**0**
Total	**116**	**-20**	**38**	**-26**	**-59**	**3**	**0**	**11**	**-1**	**0**	**63**

Table 8-17: % Change in Car Vehicle Trips - DS 2026 inter-peak

ID	1	2	3	4	5	6	7	8	9	10	Total
1	0.5%	3.8%	6.4%	-2.9%	-2.5%	-4.3%	0.8%	-0.4%	-3.0%	0.0%	**0.2%**
2	4.2%	-0.6%	-2.0%	0.4%	11.8%	-0.6%	-0.8%	0.2%	4.0%	0.0%	**0.2%**
3	9.9%	-5.4%	0.0%	3.1%	7.4%	0.2%	-0.4%	0.0%	0.2%	0.0%	**0.0%**
4	-4.0%	0.8%	3.9%	-0.7%	-0.1%	-7.7%	11.6%	0.6%	0.5%	0.0%	**-0.3%**
5	-3.4%	11.6%	6.7%	-0.5%	0.0%	1.2%	9.7%	0.5%	-0.1%	0.0%	**0.0%**
6	-4.8%	0.7%	0.5%	-8.9%	0.7%	0.0%	2.0%	0.1%	0.1%	0.0%	**0.0%**
7	-0.9%	-0.4%	-0.9%	10.3%	9.0%	1.5%	-1.2%	0.4%	2.9%	0.0%	**0.0%**
8	-1.1%	0.2%	0.0%	0.6%	0.4%	0.1%	0.4%	0.0%	0.0%	0.0%	**0.0%**
9	-3.6%	3.6%	0.1%	0.9%	-0.1%	0.1%	3.0%	0.0%	0.0%	0.0%	**0.0%**
10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Total	**0.0%**	**-0.1%**	**0.2%**	**-0.4%**	**0.0%**	**0.0%**	**0.1%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**

Table 8-18: Change in Car Vehicle Trips (final minus pre-VDM) - DM 2026 PM peak

Sector	Chelmsford	Braintree	Colchester / Tendring	Maldon	South Essex	Epping / Harlow	Uttlesford	Other East of England	Greater London	External	ALL
ID	1	2	3	4	5	6	7	8	9	10	Total
1	291	133	42	-27	-149	-21	-4	-5	-40	0	**221**
2	40	13	-53	3	42	-2	-7	0	10	0	**45**
3	29	-78	1	31	26	0	-1	0	0	0	**8**
4	-43	7	29	-9	-4	-2	3	1	0	0	**-20**
5	-154	32	21	-2	76	9	15	3	9	0	**10**
6	-27	-3	0	-3	11	-1	15	3	4	0	**-1**
7	-10	-10	-1	3	16	13	-47	11	22	0	**-2**
8	-11	0	0	1	4	3	11	0	0	0	**8**
9	-42	8	1	2	21	4	20	0	0	0	**13**
10	0	0	0	0	0	0	0	0	0	0	**0**
Total	**72**	**101**	**38**	**0**	**43**	**4**	**5**	**14**	**5**	**0**	**282**

Table 8-19: % Change in Car Vehicle Trips - DM 2026 PM peak

ID	1	2	3	4	5	6	7	8	9	10	Total
1	1.8%	5.6%	6.4%	-2.0%	-3.7%	-6.0%	-0.7%	-1.0%	-5.1%	0.0%	**0.8%**
2	2.4%	0.1%	-3.1%	0.4%	9.1%	-1.5%	-0.9%	0.0%	3.6%	0.0%	**0.3%**
3	6.0%	-4.5%	0.0%	3.7%	6.5%	-0.2%	-0.7%	0.0%	0.1%	0.0%	**0.0%**
4	-4.8%	0.8%	3.4%	-0.3%	-0.4%	-10.5%	8.2%	0.5%	-0.2%	0.0%	**-0.3%**
5	-4.2%	7.6%	7.6%	-0.2%	0.1%	1.1%	8.6%	0.5%	0.1%	0.0%	**0.0%**
6	-5.6%	-1.6%	-0.2%	-8.5%	1.2%	0.0%	1.9%	0.1%	0.1%	0.0%	**0.0%**
7	-2.1%	-1.1%	-0.9%	7.5%	8.2%	2.1%	-1.1%	0.4%	3.3%	0.0%	**0.0%**
8	-2.1%	0.0%	0.0%	0.7%	0.5%	0.1%	0.4%	0.0%	0.0%	0.0%	**0.0%**
9	-4.5%	2.1%	0.2%	0.9%	0.2%	0.1%	2.9%	0.0%	0.0%	0.0%	**0.0%**
10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Total	**0.3%**	**0.6%**	**0.1%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.1%**

Table 8-20: Change in Car Vehicle Trips (final minus pre-VDM) - DS 2026 PM peak

Sector	Chelmsford	Braintree	Colchester / Tendring	Maldon	South Essex	Epping / Harlow	Uttlesford	Other East of England	Greater London	External	ALL
ID	1	2	3	4	5	6	7	8	9	10	Total
1	311	144	48	-10	-126	-16	-7	-6	-42	0	**298**
2	41	5	-55	0	40	0	-6	0	9	0	**34**
3	29	-81	0	29	26	2	-1	0	0	0	**4**
4	-27	3	27	-24	-10	2	3	1	-1	0	**-27**
5	-96	29	20	-11	14	8	15	3	7	0	**-11**
6	-15	0	2	4	6	-9	10	3	3	0	**5**
7	-12	-12	-1	3	15	12	-45	12	22	0	**-6**
8	-10	-1	0	1	4	3	12	0	0	0	**8**
9	-31	7	0	0	15	3	19	0	0	0	**14**
10	0	0	0	0	0	0	0	0	0	0	**0**
Total	**191**	**94**	**41**	**-8**	**-17**	**6**	**0**	**13**	**-1**	**0**	**319**

Table 8-21: % Change in Car Vehicle Trips - DS 2026 PM peak

ID	1	2	3	4	5	6	7	8	9	10	Total
1	1.9%	6.1%	7.4%	-0.7%	-3.1%	-4.6%	-1.3%	-1.1%	-5.3%	0.0%	**1.1%**
2	2.5%	0.0%	-3.2%	0.0%	8.6%	0.4%	-0.9%	0.0%	3.5%	0.0%	**0.2%**
3	6.0%	-4.6%	0.0%	3.4%	6.3%	4.1%	-0.7%	0.0%	0.1%	0.0%	**0.0%**
4	-2.9%	0.4%	3.2%	-0.8%	-1.2%	10.1%	8.3%	0.4%	-1.2%	0.0%	**-0.4%**
5	-2.6%	6.7%	7.2%	-1.1%	0.0%	0.9%	8.7%	0.5%	0.1%	0.0%	**0.0%**
6	-3.0%	0.2%	4.8%	14.1%	0.6%	-0.1%	1.3%	0.1%	0.1%	0.0%	**0.0%**
7	-2.5%	-1.4%	-1.2%	6.8%	8.0%	1.9%	-1.0%	0.4%	3.3%	0.0%	**-0.1%**
8	-2.0%	-0.1%	0.0%	0.6%	0.5%	0.1%	0.4%	0.0%	0.0%	0.0%	**0.0%**
9	-3.3%	1.7%	0.2%	0.1%	0.2%	0.1%	2.8%	0.0%	0.0%	0.0%	**0.0%**
10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Total	**0.7%**	**0.5%**	**0.1%**	**-0.1%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.1%**

Table 8-22: Change in Car Vehicle Trips (final minus pre-VDM) - DM 2041 AM peak

Sector	Chelmsford	Braintree	Colchester / Tendring	Maldon	South Essex	Epping / Harlow	Uttlesford	Other East of England	Greater London	External	ALL
ID	1	2	3	4	5	6	7	8	9	10	Total
1	180	77	89	-36	-266	-6	7	19	16	0	**79**
2	92	-133	8	17	21	32	28	38	70	0	**172**
3	79	-87	-33	48	47	3	9	2	5	0	**72**
4	-72	17	96	-61	8	2	12	6	19	0	**27**
5	-479	15	62	9	202	56	42	42	198	0	**147**
6	-26	18	3	-1	16	-40	33	11	17	0	**30**
7	-10	12	9	5	35	32	-153	39	79	0	**48**
8	-1	13	0	3	16	3	-5	0	0	0	**30**
9	-50	40	3	10	-32	7	102	0	0	0	**80**
10	0	0	0	0	0	0	0	0	0	0	**0**
Total	**-288**	**-29**	**236**	**-6**	**46**	**89**	**74**	**157**	**404**	**0**	**684**

Table 8-23: % Change in Car Vehicle Trips - DM 2041 AM peak

ID	1	2	3	4	5	6	7	8	9	10	Total
1	1.0%	4.5%	12.0%	-3.8%	-6.4%	-1.2%	1.1%	3.0%	1.4%	0.0%	**0.3%**
2	3.6%	-1.3%	0.4%	2.1%	3.5%	13.6%	3.0%	2.6%	14.5%	0.0%	**0.9%**
3	9.4%	-5.0%	-0.1%	5.5%	10.8%	3.4%	6.6%	0.0%	1.0%	0.0%	**0.2%**
4	-4.6%	2.3%	10.5%	-2.0%	0.7%	4.1%	20.7%	4.1%	10.6%	0.0%	**0.3%**
5	-10.8%	3.1%	14.5%	1.0%	0.3%	5.5%	17.5%	4.7%	2.1%	0.0%	**0.2%**
6	-6.0%	14.4%	5.4%	-5.5%	1.9%	-0.3%	5.1%	0.3%	0.3%	0.0%	**0.1%**
7	-1.8%	1.7%	8.2%	19.6%	16.8%	3.8%	-3.0%	1.2%	11.5%	0.0%	**0.4%**
8	-0.1%	1.1%	0.0%	2.2%	1.9%	0.1%	-0.2%	0.0%	0.0%	0.0%	**0.0%**
9	-5.3%	13.3%	0.6%	11.1%	-0.3%	0.1%	12.0%	0.0%	0.0%	0.0%	**0.1%**
10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Total	**-0.9%**	**-0.2%**	**0.6%**	**-0.1%**	**0.0%**	**0.3%**	**0.6%**	**0.2%**	**0.4%**	**0.0%**	**0.2%**

Table 8-24: Change in Car Vehicle Trips (final minus pre-VDM) - DS 2041 AM peak

Sector	Chelmsford	Braintree	Colchester / Tendring	Maldon	South Essex	Epping / Harlow	Uttlesford	Other East of England	Greater London	External	ALL
ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
1	231	75	86	-27	-291	1	2	18	13	0	**108**
2	90	-135	7	15	25	34	27	37	70	0	**172**
3	83	-87	-32	48	49	5	9	2	5	0	**80**
4	-31	10	91	-74	-7	8	10	6	16	0	**28**
5	-381	9	59	1	129	53	41	42	196	0	**148**
6	-23	20	5	5	16	-48	29	11	16	0	**31**
7	-16	13	9	5	36	30	-150	41	80	0	**47**
8	-1	13	0	3	16	3	-4	0	0	0	**30**
9	-50	40	3	9	-29	7	101	0	0	0	**81**
10	0	0	0	0	0	0	0	0	0	0	**0**
Total	**-98**	**-43**	**228**	**-15**	**-56**	**92**	**65**	**156**	**396**	**0**	**724**

Table 8-25: % Change in Car Vehicle Trips - DS 2041 AM peak

ID	1	2	3	4	5	6	7	8	9	10	Total
1	1.2%	4.4%	11.7%	-2.9%	-7.0%	0.1%	0.3%	2.8%	1.1%	0.0%	**0.4%**
2	3.5%	-1.4%	0.4%	2.0%	4.3%	14.6%	2.9%	2.6%	14.5%	0.0%	**0.9%**
3	9.9%	-5.0%	-0.1%	5.4%	11.2%	5.4%	6.6%	0.0%	1.0%	0.0%	**0.2%**
4	-2.0%	1.4%	9.9%	-2.5%	-0.6%	16.0%	17.6%	3.7%	9.0%	0.0%	**0.4%**
5	-8.6%	1.8%	13.9%	0.1%	0.2%	5.2%	16.9%	4.7%	2.1%	0.0%	**0.2%**
6	-5.2%	16.0%	11.4%	23.7%	1.9%	-0.3%	4.6%	0.3%	0.3%	0.0%	**0.1%**
7	-2.8%	1.9%	8.3%	19.3%	17.1%	3.6%	-3.0%	1.2%	11.5%	0.0%	**0.4%**
8	-0.2%	1.1%	0.0%	2.1%	1.9%	0.1%	-0.1%	0.0%	0.0%	0.0%	**0.0%**
9	-5.3%	13.3%	0.6%	10.0%	-0.3%	0.1%	11.9%	0.0%	0.0%	0.0%	**0.1%**
10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Total	**-0.3%**	**-0.2%**	**0.6%**	**-0.2%**	**-0.1%**	**0.3%**	**0.5%**	**0.2%**	**0.4%**	**0.0%**	**0.2%**

Table 8-26: Change in Car Vehicle Trips (final minus pre-VDM) - DM 2041inter-peak

Sector	Chelmsford	Braintree	Colchester / Tendring	Maldon	South Essex	Epping / Harlow	Uttlesford	Other East of England	Greater London	External	ALL
ID	1	2	3	4	5	6	7	8	9	10	Total
1	-319	79	134	-17	-102	19	21	29	37	0	**-120**
2	42	-289	32	15	57	29	29	33	51	0	**0**
3	88	-48	-43	53	61	4	9	1	3	0	**128**
4	-49	18	77	-116	18	3	9	5	15	0	**-22**
5	-238	32	65	22	-109	44	37	29	58	0	**-60**
6	-4	26	4	1	15	-42	27	9	9	0	**44**
7	-5	20	10	7	36	25	-188	29	75	0	**9**
8	13	26	1	4	22	7	15	0	0	0	**88**
9	14	47	2	13	18	7	73	0	0	0	**175**
10	0	0	0	0	0	0	0	0	0	0	**0**
Total	**-458**	**-90**	**281**	**-18**	**17**	**96**	**32**	**136**	**248**	**0**	**243**

Table 8-27: % Change in Car Vehicle Trips - DM 2041 inter-peak

ID	1	2	3	4	5	6	7	8	9	10	Total
1	-2.2%	5.4%	25.5%	-2.0%	-3.5%	6.4%	5.9%	7.4%	5.7%	0.0%	**-0.5%**
2	3.2%	-3.8%	2.3%	2.6%	15.5%	26.3%	5.0%	3.4%	22.1%	0.0%	**0.0%**
3	20.2%	-3.6%	-0.2%	7.9%	17.7%	7.3%	10.0%	0.0%	1.4%	0.0%	**0.4%**
4	-6.1%	3.0%	11.6%	-4.6%	2.5%	12.6%	35.0%	4.4%	16.2%	0.0%	**-0.4%**
5	-8.4%	9.5%	21.5%	3.1%	-0.2%	6.9%	27.1%	4.8%	1.0%	0.0%	**-0.1%**
6	-1.5%	22.2%	7.0%	3.8%	2.4%	-0.4%	4.9%	0.4%	0.3%	0.0%	**0.2%**
7	-1.3%	3.4%	11.5%	29.5%	24.9%	4.6%	-5.2%	1.4%	13.2%	0.0%	**0.1%**
8	3.6%	2.7%	0.0%	3.4%	3.3%	0.3%	0.7%	0.0%	0.0%	0.0%	**0.1%**
9	2.5%	20.0%	1.1%	14.5%	0.3%	0.2%	12.3%	0.0%	0.0%	0.0%	**0.3%**
10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Total	**-2.1%**	**-0.7%**	**0.9%**	**-0.3%**	**0.0%**	**0.5%**	**0.4%**	**0.2%**	**0.4%**	**0.0%**	**0.1%**

Table 8-28: Change in Car Vehicle Trips (final minus pre-VDM) - DS 2041 inter-peak

Sector	Chelmsford	Braintree	Colchester / Tendring	Maldon	South Essex	Epping / Harlow	Uttlesford	Other East of England	Greater London	External	ALL
ID	1	2	3	4	5	6	7	8	9	10	Total
1	-245	78	133	-6	-121	21	18	29	31	0	**-62**
2	40	-292	30	13	57	31	29	33	52	0	**-7**
3	86	-50	-42	51	61	5	9	1	3	0	**124**
4	-26	14	73	-128	9	7	8	4	13	0	**-27**
5	-180	29	63	15	-173	44	37	30	57	0	**-79**
6	3	28	7	7	11	-49	23	9	8	0	**47**
7	-7	20	9	6	36	24	-187	30	75	0	**6**
8	13	26	1	3	23	7	15	0	0	0	**88**
9	18	47	2	12	15	7	72	0	0	0	**174**
10	0	0	0	0	0	0	0	0	0	0	**0**
Total	**-297**	**-101**	**275**	**-27**	**-83**	**96**	**25**	**135**	**240**	**0**	**263**

Table 8-29: % Change in Car Vehicle Trips - DS 2041 inter-peak

ID	1	2	3	4	5	6	7	8	9	10	Total
1	-1.7%	5.4%	25.3%	-0.7%	-4.2%	7.0%	5.2%	7.3%	4.9%	0.0%	**-0.3%**
2	3.1%	-3.8%	2.1%	2.2%	15.6%	27.3%	5.0%	3.4%	22.3%	0.0%	**-0.1%**
3	19.7%	-3.7%	-0.2%	7.6%	17.8%	10.1%	10.0%	0.0%	1.4%	0.0%	**0.4%**
4	-3.3%	2.4%	11.0%	-5.1%	1.2%	27.4%	32.4%	4.1%	14.6%	0.0%	**-0.5%**
5	-6.3%	8.8%	21.0%	2.0%	-0.3%	6.8%	26.8%	4.8%	1.0%	0.0%	**-0.1%**
6	1.1%	24.0%	13.0%	29.3%	1.8%	-0.4%	4.2%	0.3%	0.2%	0.0%	**0.2%**
7	-2.0%	3.4%	11.3%	27.4%	24.6%	4.5%	-5.1%	1.4%	13.2%	0.0%	**0.1%**
8	3.6%	2.6%	0.0%	3.2%	3.3%	0.3%	0.7%	0.0%	0.0%	0.0%	**0.1%**
9	3.4%	19.9%	1.1%	13.1%	0.3%	0.2%	12.2%	0.0%	0.0%	0.0%	**0.3%**
10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Total	**-1.4%**	**-0.7%**	**0.9%**	**-0.5%**	**-0.1%**	**0.5%**	**0.3%**	**0.2%**	**0.4%**	**0.0%**	**0.1%**

Table 8-30: Change in Car Vehicle Trips (final minus pre-VDM) - DM 2041 PM peak

Sector	Chelmsford	Braintree	Colchester / Tendring	Maldon	South Essex	Epping / Harlow	Uttlesford	Other East of England	Greater London	External	ALL
ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
1	-32	158	137	-36	-315	5	16	22	-1	0	**-46**
2	51	-278	-5	21	48	32	34	32	60	0	**-5**
3	81	-51	-45	85	70	4	10	1	4	0	**158**
4	-66	25	88	-131	17	2	10	5	17	0	**-32**
5	-375	17	62	19	-2	54	44	32	57	0	**-93**
6	-17	34	3	1	38	-56	38	10	12	0	**65**
7	-9	27	10	11	47	36	-243	23	107	0	**10**
8	6	31	1	5	33	8	18	0	0	0	**103**
9	1	68	3	19	120	15	92	0	0	0	**318**
10	0	0	0	0	0	0	0	0	0	0	**0**
Total	**-360**	**31**	**255**	**-5**	**53**	**100**	**20**	**125**	**257**	**0**	**476**

Table 8-31: % Change in Car Vehicle Trips - DM 2041 PM peak

ID	1	2	3	4	5	6	7	8	9	10	Total
1	-0.2%	5.9%	18.2%	-2.4%	-6.8%	1.3%	2.6%	3.5%	-0.1%	0.0%	**-0.1%**
2	2.6%	-2.6%	-0.3%	2.4%	9.1%	23.2%	4.1%	2.1%	18.9%	0.0%	**0.0%**
3	13.4%	-2.5%	-0.1%	8.6%	15.0%	7.4%	8.9%	0.0%	1.1%	0.0%	**0.4%**
4	-6.1%	2.7%	9.1%	-3.6%	1.7%	9.6%	25.3%	3.1%	14.2%	0.0%	**-0.4%**
5	-8.8%	3.4%	19.3%	1.7%	0.0%	5.7%	22.4%	3.7%	0.6%	0.0%	**-0.1%**
6	-3.1%	16.8%	5.9%	4.4%	3.6%	-0.4%	4.5%	0.2%	0.2%	0.0%	**0.2%**
7	-1.7%	2.9%	8.3%	20.9%	21.2%	4.9%	-4.7%	0.7%	13.2%	0.0%	**0.1%**
8	1.0%	2.0%	0.0%	3.1%	3.3%	0.2%	0.5%	0.0%	0.0%	0.0%	**0.1%**
9	0.1%	16.1%	1.1%	10.3%	1.2%	0.3%	11.8%	0.0%	0.0%	0.0%	**0.3%**
10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Total	**-1.2%**	**0.2%**	**0.6%**	**-0.1%**	**0.1%**	**0.4%**	**0.2%**	**0.1%**	**0.2%**	**0.0%**	**0.1%**

Table 8-32: Change in Car Vehicle Trips (final minus pre-VDM) - DS 2041 PM peak

Sector	Chelmsford	Braintree	Colchester / Tendring	Maldon	South Essex	Epping / Harlow	Uttlesford	Other East of England	Greater London	External	ALL
ID	1	2	3	4	5	6	7	8	9	10	Total
1	42	155	139	-11	-300	7	10	21	-10	0	**53**
2	46	-280	-6	17	45	34	35	32	61	0	**-18**
3	78	-53	-44	81	69	6	10	1	4	0	**151**
4	-41	21	84	-148	5	8	9	5	16	0	**-41**
5	-318	17	62	6	-87	55	44	32	61	0	**-128**
6	-5	38	7	9	33	-64	34	9	11	0	**71**
7	-14	27	10	9	46	35	-240	24	108	0	**5**
8	6	31	1	5	33	8	19	0	0	0	**103**
9	8	67	3	17	115	14	92	0	0	0	**318**
10	0	0	0	0	0	0	0	0	0	0	**0**
Total	**-199**	**23**	**256**	**-13**	**-41**	**101**	**13**	**124**	**249**	**0**	**513**

Table 8-33: % Change in Car Vehicle Trips - DS 2041 PM peak

ID	1	2	3	4	5	6	7	8	9	10	Total
1	0.2%	5.8%	18.6%	-0.7%	-6.4%	1.6%	1.7%	3.3%	-1.1%	0.0%	**0.2%**
2	2.3%	-2.6%	-0.3%	1.9%	8.6%	24.5%	4.2%	2.1%	19.0%	0.0%	**-0.1%**
3	12.8%	-2.6%	-0.1%	8.3%	14.9%	11.3%	9.0%	0.0%	1.1%	0.0%	**0.3%**
4	-3.8%	2.3%	8.7%	-4.1%	0.5%	30.9%	24.0%	2.9%	12.9%	0.0%	**-0.5%**
5	-7.5%	3.5%	19.2%	0.6%	-0.1%	5.9%	22.6%	3.8%	0.6%	0.0%	**-0.1%**
6	-0.9%	18.3%	11.6%	28.5%	3.2%	-0.4%	4.0%	0.2%	0.2%	0.0%	**0.2%**
7	-2.4%	2.8%	8.3%	18.4%	20.7%	4.8%	-4.6%	0.7%	13.2%	0.0%	**0.0%**
8	1.0%	2.0%	0.0%	2.8%	3.3%	0.2%	0.5%	0.0%	0.0%	0.0%	**0.1%**
9	0.8%	16.0%	1.1%	8.9%	1.2%	0.2%	11.8%	0.0%	0.0%	0.0%	**0.3%**
10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Total	**-0.7%**	**0.1%**	**0.6%**	**-0.2%**	**0.0%**	**0.4%**	**0.1%**	**0.1%**	**0.2%**	**0.0%**	**0.1%**

The data in the tables above highlights that:

- In general, at the trip end total level, there is relatively small increase in demand across almost all sectors, with the largest changes relative to travel in Chelmsford District.
- In 2026, the largest increases are related to travel with a destination in Chelmsford District in the morning with 178 more trips in the DM (0.7%) and 329 more trips in the DS (1.2%) and an origin in Chelmsford District in the afternoon with 221 more trips in the DM (0.8%) and 298 more trips in the DS (1.1%). This is followed by smaller changes in Braintree District and South Essex. The location of these changes is in line with expectation given the nature and location of the DM and DS network changes.
- In 2041, the nature of the impact of the demand modelling changes as congestion increases over time. This results in reductions in travel where there are no major increases in network capacity relative to the base year and increases where large-scale DM schemes have an influence, such as the A12 upgrade, CNEB and Lower Thames Crossing.
- The changes between Chelmsford and Braintree Districts are largely due to the impact of the new Beaulieu Park rail station (see section 7) as well as the CNEB scheme increasing capacity between the two districts.
- There are increases in travel within Chelmsford District and South Essex and reductions between Chelmsford and South Essex, which are related to the VDM as the generalised costs of travel between these areas increases over time. It is noted that the decrease between Chelmsford and South Essex is smaller in the DS due to the impact of the A&N scheme (see tables below).
- There is zero change in the external sector as per the model specification. The changes in Greater London and other East of England are due to zones that are included in the intermediate area but are the peripheral zones outside Essex.

With regards to appraisal, the key issue is the difference in demand between the DM and DS scenarios. To better understand the impact of the demand modelling process on the appraisal, the differences in DM and DS demand at the sector level are presented in the following tables.

Table 8-34: Difference in Total Car Demand – DS minus DM 2026 AM peak (veh)

Sector	Chelmsford	Braintree	Colchester / Tendring	Maldon	South Essex	Epping / Harlow	Uttlesford	Other East of England	Greater London	External	ALL
ID	1	2	3	4	5	6	7	8	9	10	Total
1	10	-3	-2	4	6	9	-2	0	3	0	**24**
2	19	-8	-2	-2	-3	3	-3	-1	-1	0	**3**
3	11	-1	-1	-1	-1	2	0	0	0	0	**9**
4	28	-5	-3	-11	-11	6	0	0	-2	0	**1**
5	72	-3	-1	-4	-51	-4	-1	0	-4	0	**4**
6	7	2	2	5	-3	-7	-3	0	-1	0	**1**
7	-3	1	0	0	0	-3	2	0	0	0	**-1**
8	0	0	0	0	0	0	1	0	0	0	**0**
9	6	0	0	-1	-3	-1	0	0	0	0	**1**
10	0	0	0	0	0	0	0	0	0	0	**0**
Total	**151**	**-16**	**-7**	**-10**	**-65**	**4**	**-7**	**-1**	**-6**	**0**	**42**

Table 8-35: Difference in Total Car Demand – DS minus DM 2026 inter-peak (veh)

ID	1	2	3	4	5	6	7	8	9	10	Total
1	29	2	0	7	1	3	-1	0	-1	0	**39**
2	5	-6	-2	-2	-2	2	0	0	0	0	**-6**
3	2	-2	-1	-1	-1	1	0	0	0	0	**-2**
4	16	-3	-2	-11	-6	3	0	0	-1	0	**-4**
5	51	-3	-1	-5	-49	-2	0	0	-3	0	**-12**
6	8	2	2	4	-4	-6	-3	0	-1	0	**3**
7	-1	0	0	0	0	-1	1	0	0	0	**-2**
8	0	0	0	0	0	0	0	0	0	0	**0**
9	7	-1	0	-1	-5	0	-1	0	0	0	**0**
10	0	0	0	0	0	0	0	0	0	0	**0**
Total	**117**	**-10**	**-4**	**-9**	**-66**	**1**	**-5**	**-1**	**-6**	**0**	**16**

Table 8-36: Difference in Total Car Demand – DS minus DM 2026 PM peak (veh)

Sector	Chelmsford	Braintree	Colchester / Tendring	Maldon	South Essex	Epping / Harlow	Uttlesford	Other East of England	Greater London	External	ALL
ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
1	20	11	6	17	23	5	-3	-1	-2	0	**78**
2	1	-8	-2	-3	-2	2	1	0	0	0	**-11**
3	0	-2	-1	-2	-1	2	0	0	0	0	**-4**
4	17	-3	-2	-15	-7	4	0	0	-1	0	**-7**
5	58	-4	-1	-9	-62	-2	0	0	-2	0	**-21**
6	13	4	3	7	-5	-8	-5	-1	-1	0	**6**
7	-2	-2	0	0	0	-1	2	1	0	0	**-3**
8	0	-1	0	0	0	0	0	0	0	0	**0**
9	11	-1	0	-2	-6	-1	-1	0	0	0	**1**
10	0	0	0	0	0	0	0	0	0	0	**0**
Total	**118**	**-7**	**3**	**-8**	**-59**	**2**	**-5**	**0**	**-6**	**0**	37

Table 8-37: Difference in Total Car Demand – DS minus DM 2041 AM peak (veh)

Sector	Chelmsford	Braintree	Colchester / Tendring	Maldon	South Essex	Epping / Harlow	Uttlesford	Other East of England	Greater London	External	ALL
ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
1	51	-2	-3	9	-25	7	-4	-1	-3	0	**29**
2	-1	-2	-1	-1	4	2	-1	0	0	0	**0**
3	4	0	1	-1	2	2	0	0	0	0	**8**
4	40	-7	-5	-14	-14	6	-2	-1	-3	0	**1**
5	98	-6	-2	-8	-73	-3	-1	0	-3	0	**1**
6	3	2	3	6	0	-8	-4	-1	-1	0	**1**
7	-6	1	0	0	1	-2	3	1	0	0	**-1**
8	-1	0	0	0	0	0	1	0	0	0	**0**
9	0	0	0	-1	3	-1	0	0	0	0	**1**
10	0	0	0	0	0	0	0	0	0	0	**0**
Total	**189**	**-14**	**-7**	**-9**	**-102**	**3**	**-9**	**-1**	**-9**	**0**	**40**

Table 8-38: Difference in Total Car Demand – DS minus DM 2041 inter-peak (veh)

ID	1	2	3	4	5	6	7	8	9	10	Total
1	75	-1	-1	11	-20	2	-3	-1	-5	0	**58**
2	-2	-3	-2	-2	0	1	0	0	0	0	**-7**
3	-2	-2	0	-2	0	1	0	0	0	0	**-4**
4	23	-4	-4	-12	-10	4	-1	0	-1	0	**-5**
5	58	-2	-2	-8	-64	0	0	0	-1	0	**-20**
6	7	2	3	6	-4	-7	-4	-1	-1	0	**3**
7	-2	0	0	0	0	-1	1	0	0	0	**-3**
8	0	0	0	0	0	0	0	0	0	0	**0**
9	5	0	0	-1	-3	0	0	0	0	0	**-1**
10	0	0	0	0	0	0	0	0	0	0	**0**
Total	**161**	**-10**	**-5**	**-9**	**-100**	**0**	**-7**	**-1**	**-8**	**0**	**20**

Table 8-39: Difference in Total Car Demand – DS minus DM 2041 PM peak (veh)

Sector	Chelmsford	Braintree	Colchester / Tendring	Maldon	South Essex	Epping / Harlow	Uttlesford	Other East of England	Greater London	External	ALL
ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
1	74	-3	2	26	16	1	-6	-1	-10	0	**99**
2	-5	-2	-1	-5	-3	2	1	0	0	0	**-12**
3	-4	-2	1	-3	-1	2	0	0	0	0	**-7**
4	25	-4	-3	-17	-12	5	-1	0	-2	0	**-8**
5	57	1	0	-13	-85	1	0	1	4	0	**-35**
6	11	3	3	8	-5	-9	-4	-1	-1	0	**6**
7	-4	-1	0	-1	-1	-1	2	1	0	0	**-5**
8	0	0	0	-1	0	0	1	0	0	0	**-1**
9	7	0	0	-3	-4	0	0	0	0	0	**-1**
10	0	0	0	0	0	0	0	0	0	0	**0**
Total	**161**	**-9**	**1**	**-9**	**-94**	**1**	**-7**	**-1**	**-7**	**0**	**37**

In general, the impact of the demand modelling on the spatial distribution of demand between the DM and DS scenarios is relatively small, with an increase of up to only 42 trips across the entire matrix indicating that mode shift has minimal impact on appraisal. The results indicate that the changes identified in the individual sector matrices by DM and DS are largely associated with the background DM network changes rather than the scheme. As previously mentioned, this is in line with expectation given previous modelling in Essex and the large-scale nature of the DM schemes including the A12 upgrade, CNEB and Lower Thames Crossing.

The largest changes between the DM and DS scenarios are associated with increased demand between South Essex and Chelmsford in both forecast years and all time periods, which is related to the VDM as the increase in highways capacity due to the A&N junction improvements increases travel between South Essex and Chelmsford while decreasing internal South Essex travel relative to the DM. This is in line with expectation given that the capacity improvements at the A&N directly facilitate the movements between Chelmsford city centre and South Essex.

Overall, it can be said that the demand modelling results in relatively small, sensible changes in demand.

8.3.4 Trip Length

The overall impact of the demand modelling on the average trip length is outlined in the following table followed by a table with estimates of average trip length for England and East of England region from the National Travel Survey (NTS).

Table 8-40: Average Trip Length (km) for 2026 pre-VDM and Final Matrices

Scenario 2026	Pre-VDM	Post-VDM		% Diff	
		DM	DS	DM	DS
AM Peak					
Commuter	22.0	21.5	21.6	-2.6%	-2.0%
Employer's Business	32.8	32.3	32.2	-1.7%	-1.8%
Other	19.3	19.3	19.4	0.4%	0.6%
Inter-Peak					
Commuter	18.6	18.1	18.2	-2.7%	-2.1%
Employer's Business	28.4	28.0	27.9	-1.4%	-1.5%
Other	17.4	17.5	17.5	0.7%	0.9%
PM Peak					
Commuter	20.1	19.5	19.6	-3.0%	-2.3%
Employer's Business	28.8	28.2	28.2	-2.0%	-2.1%
Other	17.2	17.3	17.3	0.3%	0.6%

Table 8-41: Average Trip Length (km) for 2041 pre-VDM and Final Matrices

Scenario 2041	Pre-VDM	Post-VDM		% Diff	
		DM	DS	DM	DS
AM Peak					
Commuter	22.3	21.3	21.4	-4.6%	-4.1%
Employer's Business	33.0	33.0	32.9	-0.1%	-0.3%
Other	19.7	20.3	20.3	3.0%	3.0%
Inter-Peak					
Commuter	18.9	18.0	18.1	-4.8%	-4.4%
Employer's Business	28.7	28.9	28.8	0.8%	0.5%
Other	17.8	18.6	18.6	4.0%	4.0%
PM Peak					
Commuter	20.5	19.4	19.5	-5.1%	-4.5%
Employer's Business	29.0	28.9	28.9	-0.3%	-0.5%
Other	17.6	18.2	18.2	3.4%	3.5%

Table 8-42: Average Trip Length from published data (km)

Purpose	England	East of England
Commuter	16.6	22.0
Employer's Business	30.6	31.0
Other	7.2	8.3

The data in the above tables indicates that:

- The demand modelling process slightly reduces commuter and employer's business trip lengths by between 1.4% and 3.0% with very small increases to other purpose trip lengths (less than 1%) in 2026.
- In 2041, the demand modelling process reduces commuter trip lengths by a little more, up to 5.1%, with minimal change in employer's business trip lengths and 3% to 4% increases in other purpose trip lengths.

- The impact on trip lengths is similar for the DM and DS scenarios with differences no greater than 200 metres.
- The modelled trip lengths are very similar to estimated average daily trip lengths from the National Travel Survey (NTS)[23] for commuter and employer's business purposes although the average modelled other purpose trips lengths are longer. This perhaps highlights the known issue of a lack a short distance trips when Mobile Network Data is used as the basis for demand matrix development (see the LMVR for more detail).

The change in the trip length distribution by time period and purpose between the pre-VDM matrices and the final matrices for the Do-Minimum (DM) and Do-Something (DS) scenarios is illustrated in the following figures for the 2026 and 2041 forecast years.

[23] Department for Transport, August 2020: https://www.gov.uk/government/statistics/national-travel-survey-2019 tables NTS0409, NTS9906 and NTS9907.

Table 8-43: Trip Length Distribution by purpose – 2026 AM peak

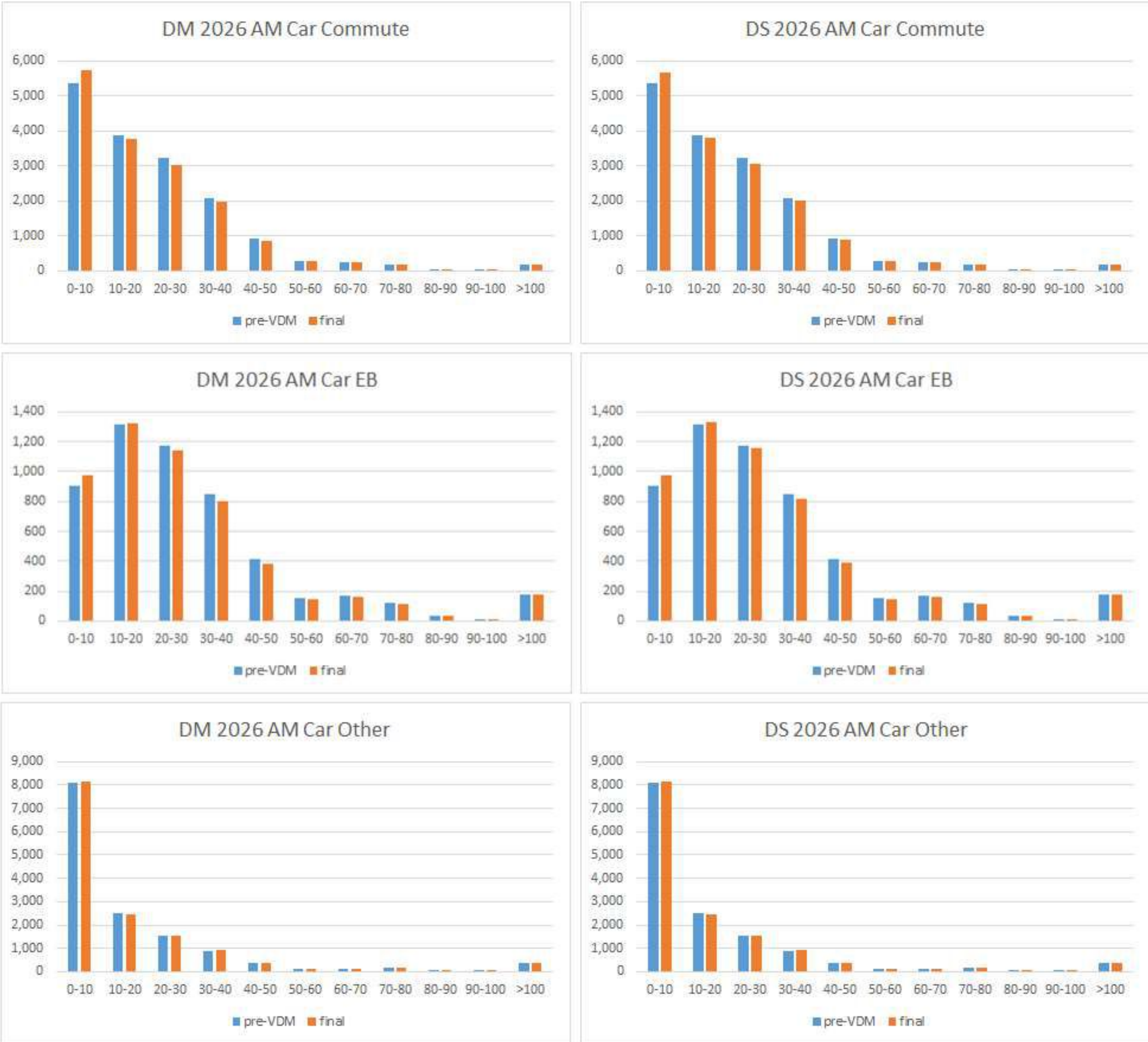


Table 8-44: Trip Length Distribution by purpose – 2026 IP peak

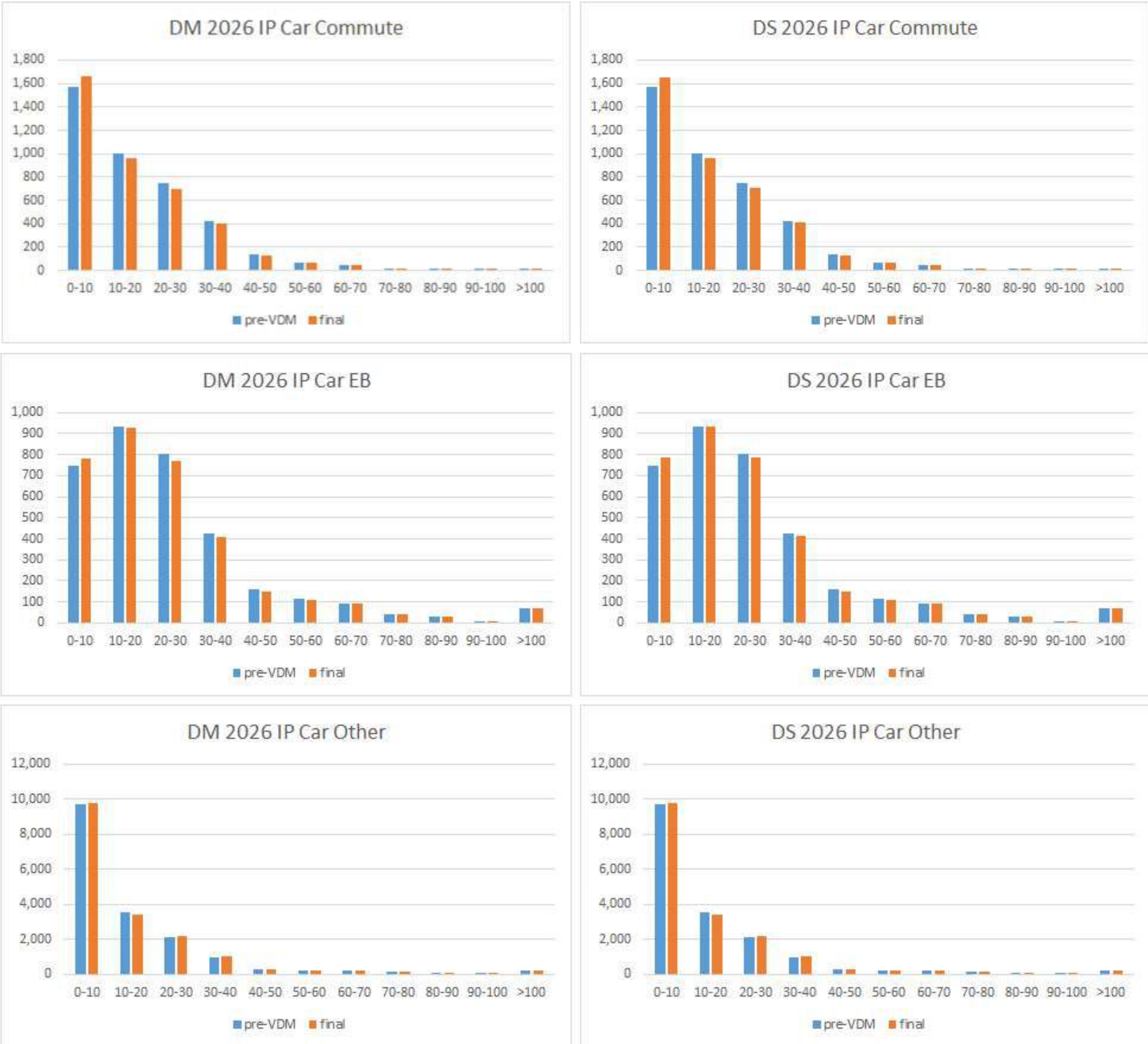
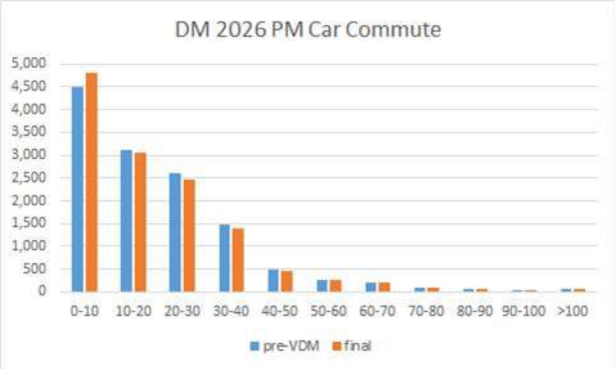
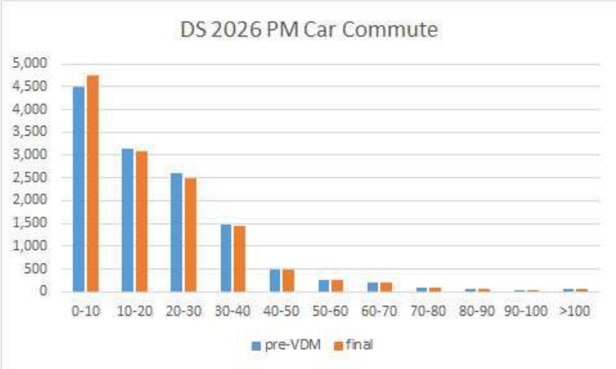
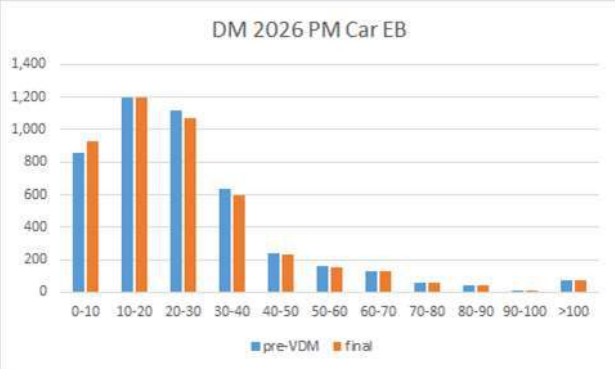
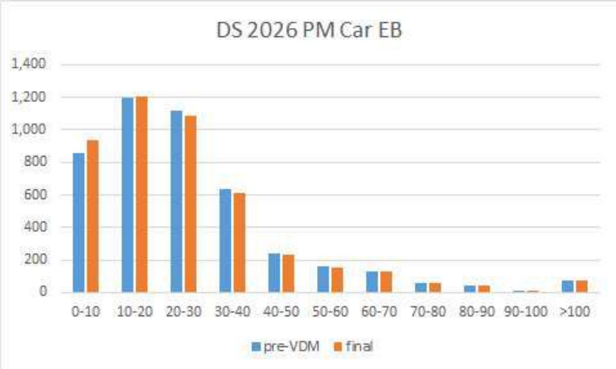


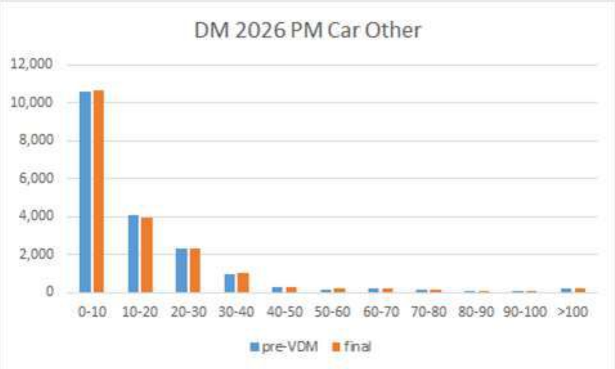
Table 8-45: Trip Length Distribution by purpose – 2026 PM peak











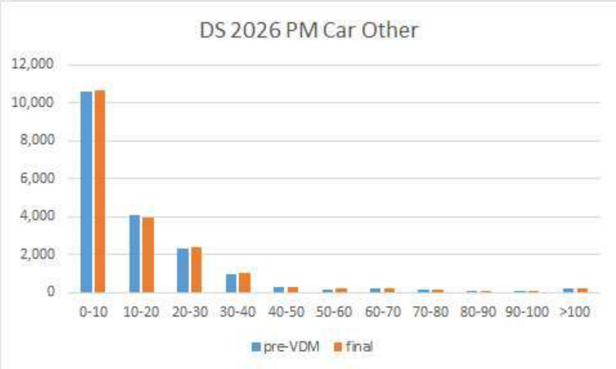


Table 8-46: Trip Length Distribution by purpose – 2041 AM peak

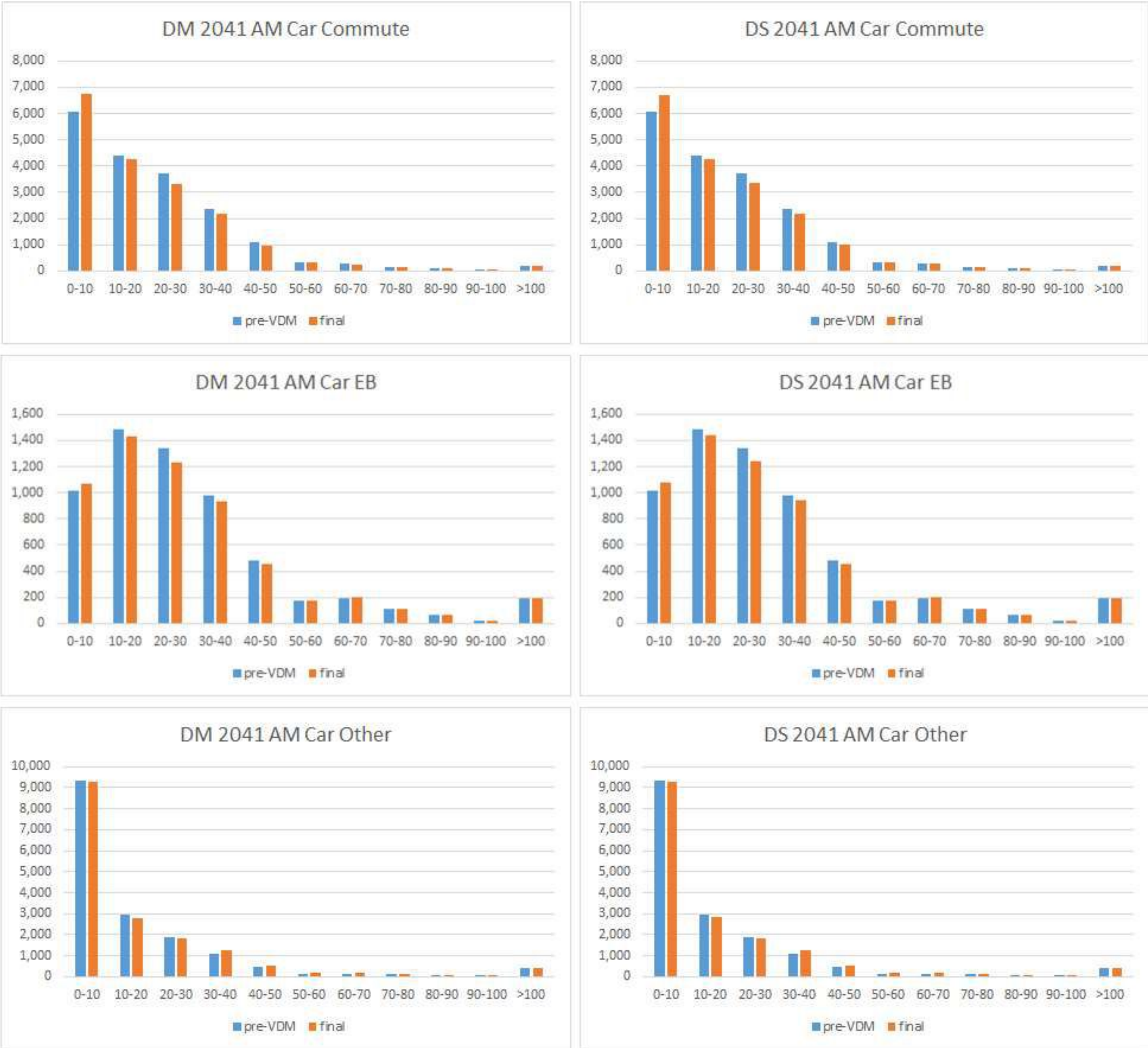


Table 8-47: Trip Length Distribution by purpose – 2041 inter-peak

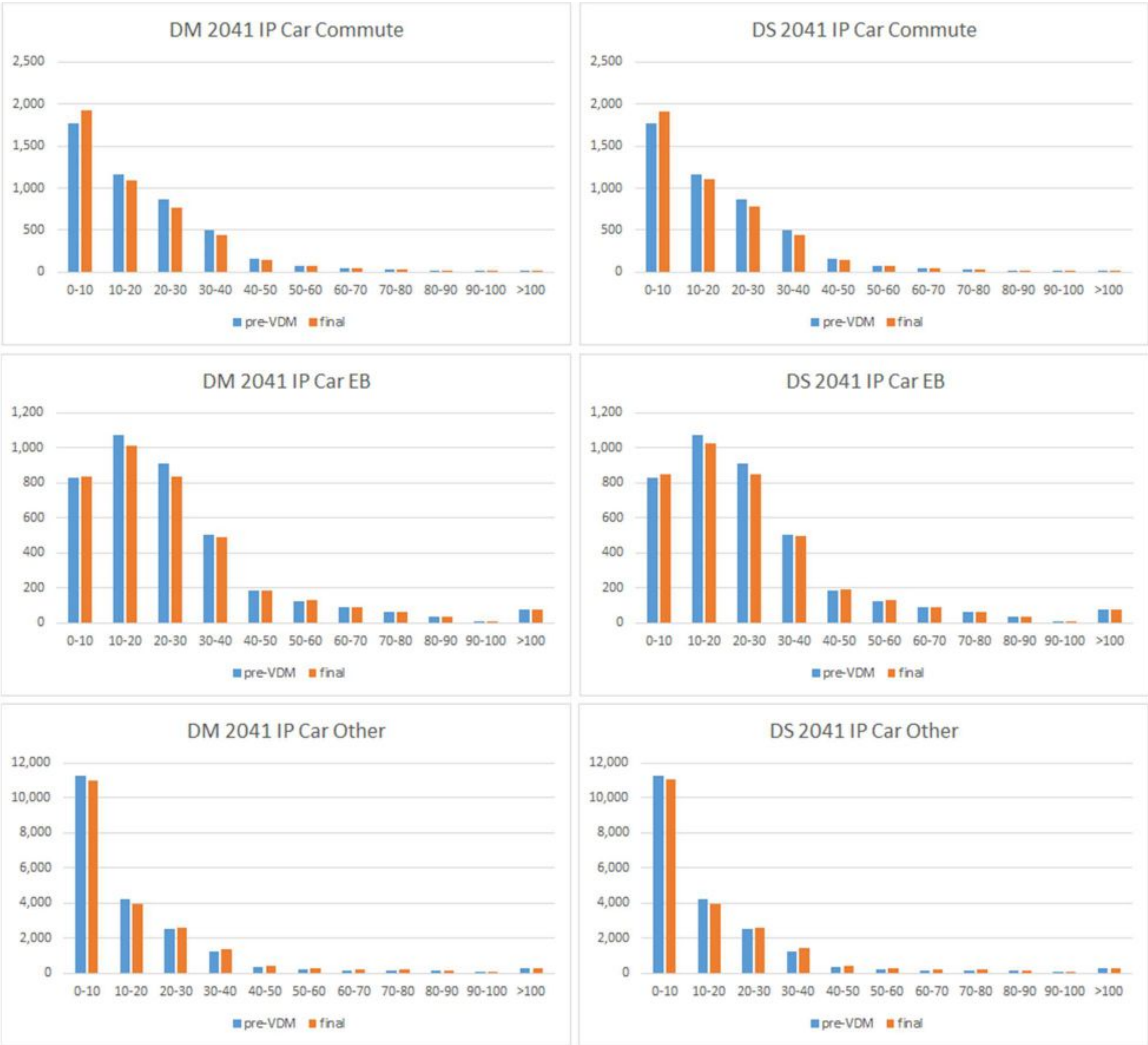
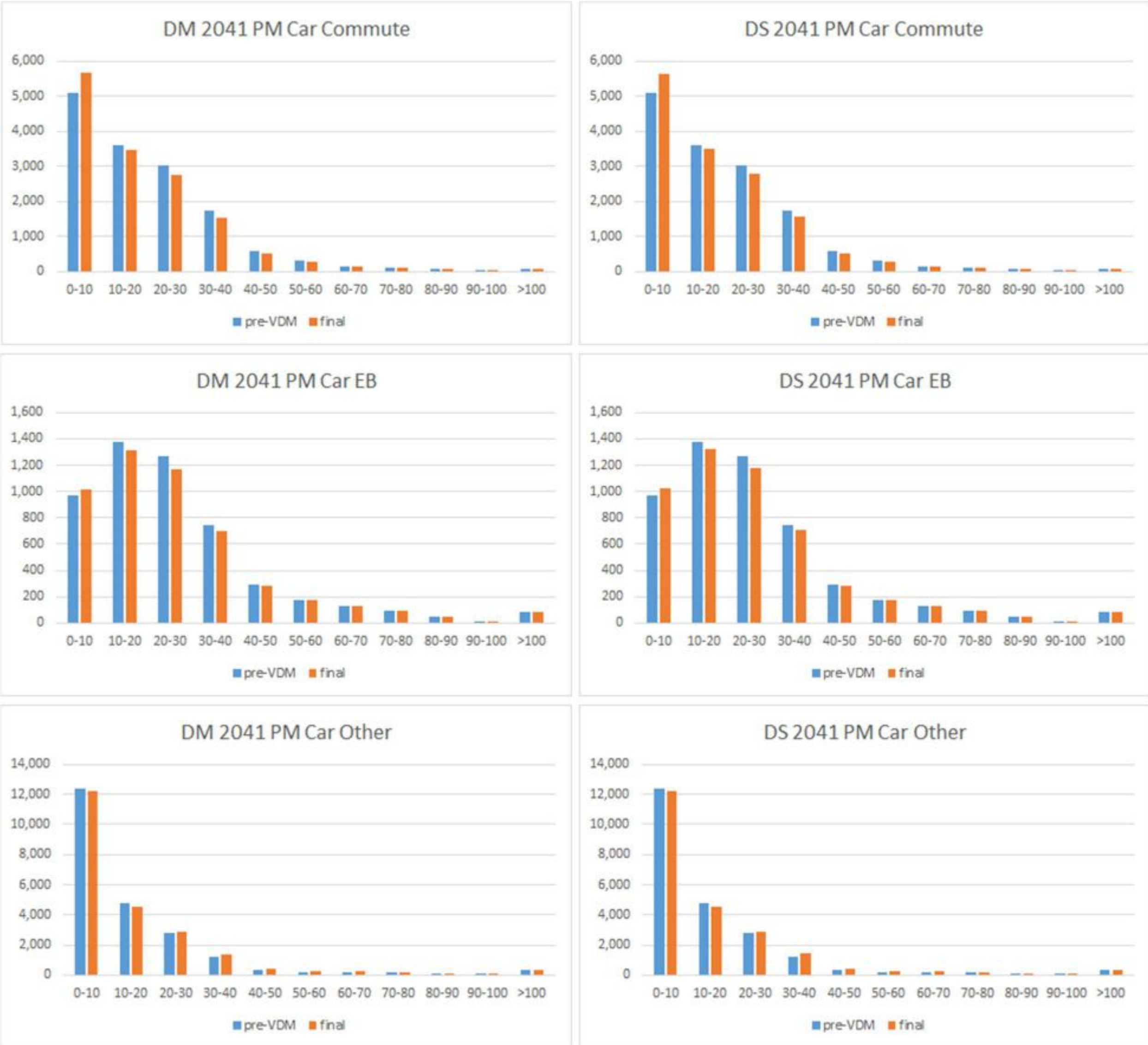


Table 8-48: Trip Length Distribution by purpose – 2041 PM peak



The above figures highlight that the pre-VDM and final matrices have very similar trip length distributions, which is in line with expectation.

The data also provides some indication of the potential causes of longer than expected average trip lengths for other purpose trips, with a number of trips of greater than 100 kilometres, especially in the AM peak. The reason for the presence of these longer trips in the AM peak dataset is not clear although there is the potential for a misallocation of rail trips with Mobile Network Data (MND). As a sensitivity test, the average trip length without trips greater that 100 km was calculated for the 2026 AM peak, which would reduce the average modelled trip length in the pre-VDM scenario from 19.3km to 13.9km. However, with the general profile of other purpose trips in line with expectation and given the still relatively small number of trips it is not considered that this would impact on appraisal.

8.4 Forecast Traffic Flows

The Core Scenario forecast traffic flows are outlined in the following tables for the Do-Minimum and the preferred Do-Something option (Option C Hamburger) for all forecast years, time periods, purposes and vehicle types. Separate tables with a figure illustrating the location of the sites used for reporting are outlined by different spatial areas including a table for impacts on the Strategic Road Network (SRN). Note that locations with a change between DM and DS of greater than 10% are shaded yellow and those with a change of less than -10% are shaded blue.

Bus and rail assigned flows are illustrated in Appendix B, which indicate that there is very little change in public transport flows in the model, in line with expectation.

Figure 8-1: Forecast Traffic Flows Location Map - Army & Navy junction

Table 8-49: Forecast Traffic Flows at Army & Navy Junction – Core Scenario 2026 AM Peak (vehicles)

ID_direction	Location	DM26				DS26				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
AN1.1_EB	A1060 Parkway	1,370	135	36	1,541	1,213	122	22	1,357	-157	-13	-14	-184	-11%	-10%	-39%	-12%
AN1.1_WB	A1060 Parkway	1,697	91	20	1,808	2,257	111	25	2,393	560	20	5	585	33%	22%	25%	32%
81038104_SB	A138 Chelmer Road	1,067	115	16	1,198	1,804	163	29	1,996	737	48	13	798	69%	42%	81%	67%
81038104_NB	A138 Chelmer Road	829	103	31	963	873	109	24	1,006	44	6	-7	43	5%	6%	-23%	4%
AN1.3_WB	A1114 EYW	1,180	62	13	1,255	1,441	71	16	1,528	261	9	3	273	22%	15%	23%	22%
AN1.3_EB	A1114 EYW	861	94	21	976	1,062	109	27	1,198	201	15	6	222	23%	16%	29%	23%
AN1.4_NWB	B1009 Baddow Road	516	42	7	565	627	41	6	674	111	-1	-1	109	22%	-2%	-14%	19%
AN1.4_SEB	B1009 Baddow Road	448	49	6	503	469	52	7	528	21	3	1	25	5%	6%	17%	5%
AN1.5_NB	A1114 Van Diemans Road	455	67	24	546	488	69	25	582	33	2	1	36	7%	3%	4%	7%
AN1.5_SB	A1114 Van Diemans Road	627	69	14	710	774	78	12	864	147	9	-2	154	23%	13%	-14%	22%
To junction	**Towards A&N**	**4,588**	**421**	**96**	**5,105**	**5,573**	**466**	**98**	**6,137**	**985**	**45**	**2**	**1,032**	**21%**	**11%**	**2%**	**20%**
From junction	**Away from A&N**	**4,462**	**406**	**92**	**4,960**	**5,435**	**459**	**95**	**5,989**	**973**	**53**	**3**	**1,029**	**22%**	**13%**	**3%**	**21%**
Total	**ALL**	**9,050**	**827**	**188**	**10,065**	**11,008**	**925**	**193**	**12,126**	**1,958**	**98**	**5**	**2,061**	**22%**	**12%**	**3%**	**20%**

Table 8-50: Forecast Traffic Flows at Army & Navy Junction – Core Scenario 2026 Inter-Peak (vehicles)

ID_direction	Location	DM26				DS26				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
AN1.1_EB	A1060 Parkway	1,472	121	40	1,633	1,334	95	30	1,459	-138	-26	-10	-174	-9%	-21%	-25%	-11%
AN1.1_WB	A1060 Parkway	1,245	119	36	1,400	1,395	124	32	1,551	150	5	-4	151	12%	4%	-11%	11%
81038104_SB	A138 Chelmer Road	944	112	25	1,081	985	115	25	1,125	41	3	0	44	4%	3%	0%	4%
81038104_NB	A138 Chelmer Road	973	113	24	1,110	999	108	22	1,129	26	-5	-2	19	3%	-4%	-8%	2%
AN1.3_WB	A1114 EYW	916	100	30	1,046	883	98	30	1,011	-33	-2	0	-35	-4%	-2%	0%	-3%
AN1.3_EB	A1114 EYW	927	100	31	1,058	958	104	36	1,098	31	4	5	40	3%	4%	16%	4%
AN1.4_NWB	B1009 Baddow Road	431	50	5	486	588	55	5	648	157	5	0	162	36%	10%	0%	33%
AN1.4_SEB	B1009 Baddow Road	564	53	5	622	528	45	5	578	-36	-8	0	-44	-6%	-15%	0%	-7%
AN1.5_NB	A1114 Van Diemans Road	585	73	17	675	705	85	20	810	120	12	3	135	21%	16%	18%	20%
AN1.5_SB	A1114 Van Diemans Road	596	66	20	682	617	67	16	700	21	1	-4	18	4%	2%	-20%	3%
To junction	**Towards A&N**	**4,348**	**456**	**117**	**4,921**	**4,495**	**448**	**110**	**5,053**	**147**	**-8**	**-7**	**132**	**3%**	**-2%**	**-6%**	**3%**
From junction	**Away from A&N**	**4,305**	**451**	**116**	**4,872**	**4,497**	**448**	**111**	**5,056**	**192**	**-3**	**-5**	**184**	**4%**	**-1%**	**-4%**	**4%**
Total	**ALL**	**8,653**	**907**	**233**	**9,793**	**8,992**	**896**	**221**	**10,109**	**339**	**-11**	**-12**	**316**	**4%**	**-1%**	**-5%**	**3%**

Table 8-51: Forecast Traffic Flows at Army & Navy Junction – Core Scenario 2026 PM Peak (vehicles)

ID_direction	Location	DM26				DS26				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
AN1.1_EB	A1060 Parkway	2,069	108	19	2,196	2,029	93	16	2,138	-40	-15	-3	-58	-2%	-14%	-16%	-3%
AN1.1_WB	A1060 Parkway	1,184	76	12	1,272	1,559	80	15	1,654	375	4	3	382	32%	5%	25%	30%
81038104_SB	A138 Chelmer Road	1,170	130	21	1,321	1,064	121	15	1,200	-106	-9	-6	-121	-9%	-7%	-29%	-9%
81038104_NB	A138 Chelmer Road	1,028	86	26	1,140	1,152	97	34	1,283	124	11	8	143	12%	13%	31%	13%
AN1.3_WB	A1114 EYW	761	41	10	812	1,237	64	15	1,316	476	23	5	504	63%	56%	50%	62%
AN1.3_EB	A1114 EYW	1,283	78	12	1,373	1,517	89	12	1,618	234	11	0	245	18%	14%	0%	18%
AN1.4_NWB	B1009 Baddow Road	416	43	5	464	559	48	5	612	143	5	0	148	34%	12%	0%	32%
AN1.4_SEB	B1009 Baddow Road	662	66	9	737	661	59	8	728	-1	-7	-1	-9	0%	-11%	-11%	-1%
AN1.5_NB	A1114 Van Diemans Road	412	58	23	493	660	77	31	768	248	19	8	275	60%	33%	35%	56%
AN1.5_SB	A1114 Van Diemans Road	496	65	17	578	628	71	13	712	132	6	-4	134	27%	9%	-24%	23%
To junction	**Towards A&N**	**4,828**	**380**	**78**	**5,286**	**5,549**	**403**	**82**	**6,034**	**721**	**23**	**4**	**748**	**15%**	**6%**	**5%**	**14%**
From junction	**Away from A&N**	**4,653**	**371**	**76**	**5,100**	**5,517**	**396**	**82**	**5,995**	**864**	**25**	**6**	**895**	**19%**	**7%**	**8%**	**18%**
Total	**ALL**	**9,481**	**751**	**154**	**10,386**	**11,066**	**799**	**164**	**12,029**	**1,585**	**48**	**10**	**1,643**	**17%**	**6%**	**6%**	**16%**

Table 8-52: Forecast Traffic Flows at Army & Navy Junction – Core Scenario 2041 AM Peak (vehicles)

ID_direction	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
AN1.1_EB	A1060 Parkway	1,475	167	38	1,680	1,312	146	31	1,489	-163	-21	-7	-191	-11%	-13%	-18%	-11%
AN1.1_WB	A1060 Parkway	1,648	107	22	1,777	2,186	120	27	2,333	538	13	5	556	33%	12%	23%	31%
81038104_SB	A138 Chelmer Road	1,525	146	22	1,693	2,117	179	29	2,325	592	33	7	632	39%	23%	32%	37%
81038104_NB	A138 Chelmer Road	928	125	24	1,077	1,015	125	18	1,158	87	0	-6	81	9%	0%	-25%	8%
AN1.3_WB	A1114 EYW	1,019	84	18	1,121	1,369	80	16	1,465	350	-4	-2	344	34%	-5%	-11%	31%
AN1.3_EB	A1114 EYW	1,065	141	31	1,237	1,249	138	35	1,422	184	-3	4	185	17%	-2%	13%	15%
AN1.4_NWB	B1009 Baddow Road	443	39	4	486	576	48	7	631	133	9	3	145	30%	23%	75%	30%
AN1.4_SEB	B1009 Baddow Road	436	48	7	491	502	57	7	566	66	9	0	75	15%	19%	0%	15%
AN1.5_NB	A1114 Van Diemans Road	455	64	18	537	513	66	16	595	58	2	-2	58	13%	3%	-11%	11%
AN1.5_SB	A1114 Van Diemans Road	699	73	12	784	781	72	9	862	82	-1	-3	78	12%	-1%	-25%	10%
To junction	**Towards A&N**	**4,917**	**500**	**100**	**5,517**	**5,887**	**519**	**99**	**6,505**	**970**	**19**	**-1**	**988**	**20%**	**4%**	**-1%**	**18%**
From junction	**Away from A&N**	**4,776**	**494**	**96**	**5,366**	**5,733**	**512**	**96**	**6,341**	**957**	**18**	**0**	**975**	**20%**	**4%**	**0%**	**18%**
Total	**ALL**	**9,693**	**994**	**196**	**10,883**	**11,620**	**1,031**	**195**	**12,846**	**1,927**	**37**	**-1**	**1,963**	**20%**	**4%**	**-1%**	**18%**

Table 8-53: Forecast Traffic Flows at Army & Navy Junction – Core Scenario 2041 Inter-Peak (vehicles)

ID_direction	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
AN1.1_EB	A1060 Parkway	1,572	144	43	1,759	1,503	118	33	1,654	-69	-26	-10	-105	-4%	-18%	-23%	-6%
AN1.1_WB	A1060 Parkway	1,229	136	37	1,402	1,405	143	33	1,581	176	7	-4	179	14%	5%	-11%	13%
81038104_SB	A138 Chelmer Road	1,077	134	30	1,241	1,112	131	23	1,266	35	-3	-7	25	3%	-2%	-23%	2%
81038104_NB	A138 Chelmer Road	1,064	118	21	1,203	1,110	104	18	1,232	46	-14	-3	29	4%	-12%	-14%	2%
AN1.3_WB	A1114 EYW	871	108	30	1,009	858	98	30	986	-13	-10	0	-23	-1%	-9%	0%	-2%
AN1.3_EB	A1114 EYW	1,014	133	43	1,190	1,070	132	40	1,242	56	-1	-3	52	6%	-1%	-7%	4%
AN1.4_NWB	B1009 Baddow Road	421	49	4	474	593	59	5	657	172	10	1	183	41%	20%	25%	39%
AN1.4_SEB	B1009 Baddow Road	566	60	5	631	568	53	5	626	2	-7	0	-5	0%	-12%	0%	-1%
AN1.5_NB	A1114 Van Diemans Road	576	76	14	666	728	86	17	831	152	10	3	165	26%	13%	21%	25%
AN1.5_SB	A1114 Van Diemans Road	603	60	15	678	635	59	9	703	32	-1	-6	25	5%	-2%	-40%	4%
To junction	**Towards A&N**	**4,517**	**511**	**121**	**5,149**	**4,794**	**492**	**108**	**5,394**	**277**	**-19**	**-13**	**245**	**6%**	**-4%**	**-11%**	**5%**
From junction	**Away from A&N**	**4,476**	**507**	**121**	**5,104**	**4,788**	**491**	**105**	**5,384**	**312**	**-16**	**-16**	**280**	**7%**	**-3%**	**-13%**	**5%**
Total	**ALL**	**8,993**	**1,018**	**242**	**10,253**	**9,582**	**983**	**213**	**10,778**	**589**	**-35**	**-29**	**525**	**7%**	**-3%**	**-12%**	**5%**

Table 8-54: Forecast Traffic Flows at Army & Navy Junction – Core Scenario 2041 PM Peak (vehicles)

ID_direction	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
AN1.1_EB	A1060 Parkway	1,856	125	25	2,006	2,045	113	20	2,178	189	-12	-5	172	10%	-10%	-20%	9%
AN1.1_WB	A1060 Parkway	1,163	87	16	1,266	1,581	102	18	1,701	418	15	2	435	36%	17%	13%	34%
81038104_SB	A138 Chelmer Road	1,294	151	23	1,468	1,190	133	20	1,343	-104	-18	-3	-125	-8%	-12%	-13%	-9%
81038104_NB	A138 Chelmer Road	1,063	94	19	1,176	1,312	112	21	1,445	249	18	2	269	23%	19%	11%	23%
AN1.3_WB	A1114 EYW	749	54	10	813	1,327	85	19	1,431	578	31	9	618	77%	57%	90%	76%
AN1.3_EB	A1114 EYW	1,181	109	20	1,310	1,507	119	23	1,649	326	10	3	339	28%	9%	15%	26%
AN1.4_NWB	B1009 Baddow Road	393	46	5	444	527	50	5	582	134	4	0	138	34%	9%	0%	31%
AN1.4_SEB	B1009 Baddow Road	597	76	10	683	647	63	9	719	50	-13	-1	36	8%	-17%	-10%	5%
AN1.5_NB	A1114 Van Diemans Road	432	62	13	507	692	78	17	787	260	16	4	280	60%	26%	31%	55%
AN1.5_SB	A1114 Van Diemans Road	556	60	10	626	694	63	10	767	138	3	0	141	25%	5%	0%	23%
To junction	**Towards A&N**	**4,724**	**438**	**76**	**5,238**	**5,781**	**459**	**81**	**6,321**	**1,057**	**21**	**5**	**1,083**	**22%**	**5%**	**7%**	**21%**
From junction	**Away from A&N**	**4,560**	**426**	**75**	**5,061**	**5,741**	**459**	**81**	**6,281**	**1,181**	**33**	**6**	**1,220**	**26%**	**8%**	**8%**	**24%**
Total	**ALL**	**9,284**	**864**	**151**	**10,299**	**11,522**	**918**	**162**	**12,602**	**2,238**	**54**	**11**	**2,303**	**24%**	**6%**	**7%**	**22%**

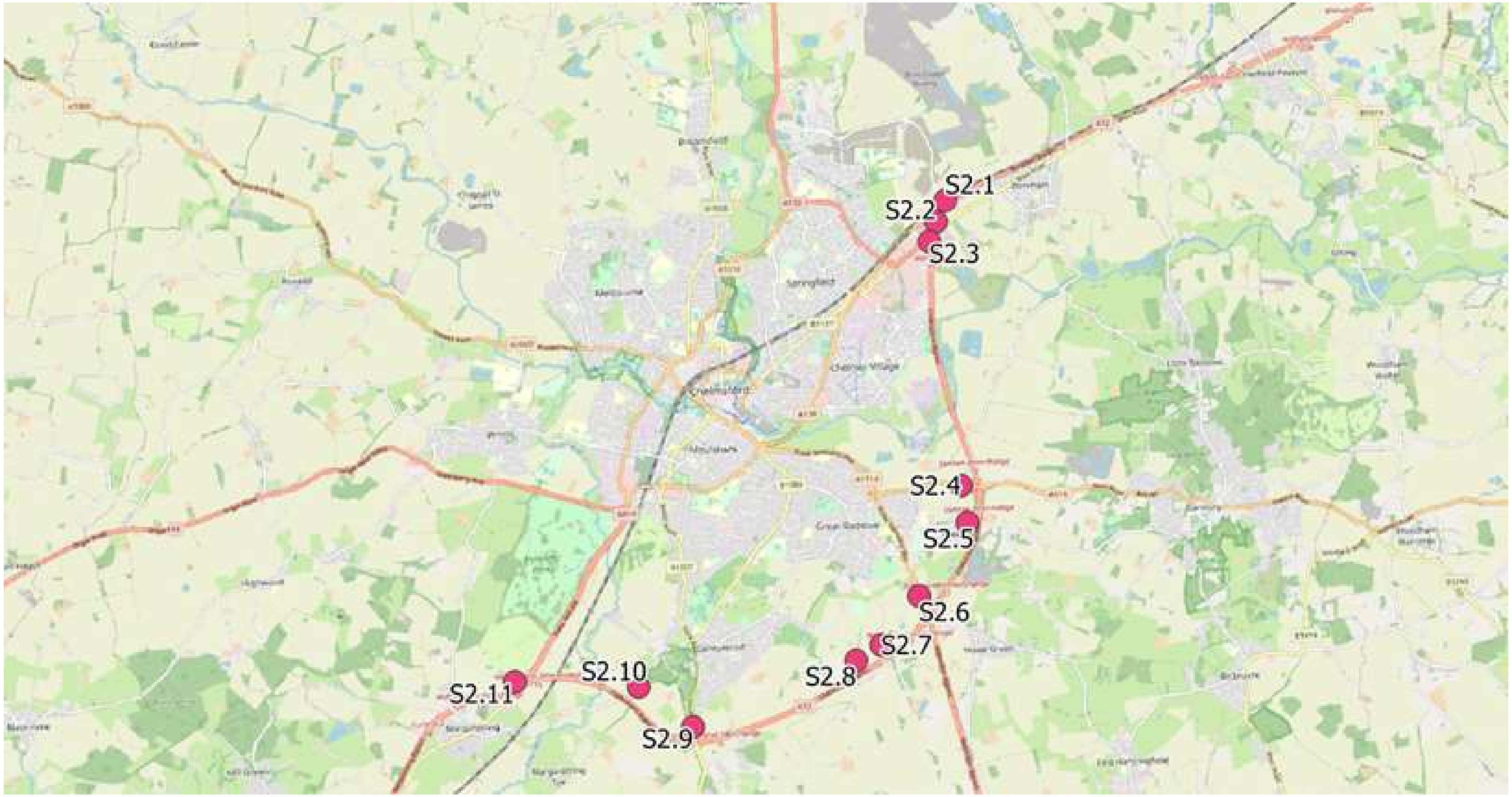


Figure 8-2: Forecast Traffic Flows Location Map - South, East and Northeast of Chelmsford

Table 8-55: Forecast Traffic Flows South, East and Northeast of Chelmsford – Core Scenario 2026 AM Peak (vehicles)

ID_dir	Location	DM26				DS26				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S2.1_EB	A138 /A12 NB on-slip	1,024	101	22	1,147	1,011	100	22	1,133	-13	-1	0	-14	-1%	-1%	0%	-1%
S2.2_WB	Bridge over A12, Boreham INT	2,018	136	55	2,209	2,102	137	56	2,295	84	1	1	86	4%	1%	2%	4%
S2.2_EB	Bridge over A12, Boreham INT	1,138	167	85	1,390	1,080	159	79	1,318	-58	-8	-6	-72	-5%	-5%	-7%	-5%
S2.3_NB	A12 off-slip, Drovers Roundabout	1,140	139	48	1,327	1,158	140	48	1,346	18	1	0	19	2%	1%	0%	1%
S2.4_WB	A414 Maldon Road	715	59	3	777	680	53	3	736	-35	-6	0	-41	-5%	-10%	0%	-5%
S2.4_EB	A414 Maldon Road	814	54	5	873	798	57	5	860	-16	3	0	-13	-2%	6%	0%	-1%
S2.5_WB	Woodhill Road	434	41	30	505	483	37	29	549	49	-4	-1	44	11%	-10%	-3%	9%
S2.5_EB	Woodhill Road	217	31	24	272	221	37	25	283	4	6	1	11	2%	19%	4%	4%
S2.6_NB	A1114 Southend Road N of Howe Green	1,089	136	40	1,265	1,133	134	39	1,306	44	-2	-1	41	4%	-1%	-3%	3%
S2.6_SB	A1114 Southend Road N of Howe Green	641	109	50	800	666	108	55	829	25	-1	5	29	4%	-1%	10%	4%
S2.7_NB	West Hanningfield Road	56	9	2	67	56	9	2	67	0	0	0	0	0%	0%	0%	0%
S2.7_SB	West Hanningfield Road	54	15	1	70	62	15	1	78	8	0	0	8	15%	0%	0%	11%
S2.8_NB	Brook Lane	19	4	1	24	19	4	1	24	0	0	0	0	0%	0%	0%	0%
S2.8_SB	Brook Lane	18	2	1	21	18	2	1	21	0	0	0	0	0%	0%	0%	0%

ID_dir	Location	DM26				DS26				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S2.9_NB	B1007 Stock Road	546	32	3	581	541	45	3	589	-5	13	0	8	-1%	41%	0%	1%
S2.9_SB	B1007 Stock Road	611	41	10	662	642	46	11	699	31	5	1	37	5%	12%	10%	6%
S2.10_EB	Margaretting Road, Chelmsford	42	21	9	72	61	9	9	79	19	-12	0	7	45%	-57%	0%	10%
S2.10_WB	Margaretting Road, Chelmsford	134	32	16	182	130	29	17	176	-4	-3	1	-6	-3%	-9%	6%	-3%
S2.11_EB	A414 Three Mile Hill	1,430	112	66	1,608	1,452	96	64	1,612	22	-16	-2	4	2%	-14%	-3%	0%
S2.11_WB	A414 Three Mile Hill	1,147	123	30	1,300	1,183	124	30	1,337	36	1	0	37	3%	1%	0%	3%
To city centre	**Towards City Centre**	**7,489**	**689**	**257**	**8,435**	**7,685**	**664**	**254**	**8,603**	**196**	**-25**	**-3**	**168**	**3%**	**-4%**	**-1%**	**2%**
From city centre	**Away from City Centre**	**5,798**	**675**	**244**	**6,717**	**5,811**	**677**	**246**	**6,734**	**13**	**2**	**2**	**17**	**0%**	**0%**	**1%**	**0%**
Total	**ALL**	**13,287**	**1,364**	**501**	**15,152**	**13,496**	**1,341**	**500**	**15,337**	**209**	**-23**	**-1**	**185**	**2%**	**-2%**	**0%**	**1%**

Table 8-56: Forecast Traffic Flows South, East and Northeast of Chelmsford – Core Scenario 2026 Inter-Peak (vehicles)

ID_dir	Location	DM26				DS26				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S2.1_EB	A138 /A12 NB on-slip	1,027	135	35	1,197	1,057	141	36	1,234	30	6	1	37	3%	4%	3%	3%
S2.2_WB	Bridge over A12, Boreham INT	907	94	49	1,050	916	94	49	1,059	9	0	0	9	1%	0%	0%	1%
S2.2_EB	Bridge over A12, Boreham INT	858	116	70	1,044	886	117	66	1,069	28	1	-4	25	3%	1%	-6%	2%
S2.3_NB	A12 off-slip, Drovers Roundabout	720	123	85	928	729	124	85	938	9	1	0	10	1%	1%	0%	1%
S2.4_WB	A414 Maldon Road	449	54	3	506	466	54	3	523	17	0	0	17	4%	0%	0%	3%
S2.4_EB	A414 Maldon Road	563	53	9	625	582	54	7	643	19	1	-2	18	3%	2%	-22%	3%
S2.5_WB	Woodhill Road	103	16	28	147	109	16	28	153	6	0	0	6	6%	0%	0%	4%
S2.5_EB	Woodhill Road	169	24	29	222	169	25	29	223	0	1	0	1	0%	4%	0%	0%
S2.6_NB	A1114 Southend Road N of Howe Green	671	110	53	834	691	109	53	853	20	-1	0	19	3%	-1%	0%	2%
S2.6_SB	A1114 Southend Road N of Howe Green	611	111	54	776	598	108	60	766	-13	-3	6	-10	-2%	-3%	11%	-1%
S2.7_NB	West Hanningfield Road	32	6	2	40	31	6	2	39	-1	0	0	-1	-3%	0%	0%	-3%
S2.7_SB	West Hanningfield Road	19	7	1	27	19	7	1	27	0	0	0	0	0%	0%	0%	0%
S2.8_NB	Brook Lane	11	3	1	15	12	3	1	16	1	0	0	1	9%	0%	0%	7%
S2.8_SB	Brook Lane	6	2	1	9	6	2	1	9	0	0	0	0	0%	0%	0%	0%

ID_dir	Location	DM26				DS26				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S2.9_NB	B1007 Stock Road	432	37	6	475	443	37	6	486	11	0	0	11	3%	0%	0%	2%
S2.9_SB	B1007 Stock Road	354	34	8	396	347	34	8	389	-7	0	0	-7	-2%	0%	0%	-2%
S2.10_EB	Margaretting Road, Chelmsford	32	4	12	48	32	4	12	48	0	0	0	0	0%	0%	0%	0%
S2.10_WB	Margaretting Road, Chelmsford	142	27	21	190	143	27	21	191	1	0	0	1	1%	0%	0%	1%
S2.11_EB	A414 Three Mile Hill	741	74	47	862	802	73	46	921	61	-1	-1	59	8%	-1%	-2%	7%
S2.11_WB	A414 Three Mile Hill	820	104	36	960	825	100	38	963	5	-4	2	3	1%	-4%	6%	0%
To city centre	**Towards City Centre**	**4,098**	**521**	**286**	**4,905**	**4,231**	**520**	**285**	**5,036**	**133**	**-1**	**-1**	**131**	**3%**	**0%**	**0%**	**3%**
From city centre	**Away from City Centre**	**4,569**	**613**	**264**	**5,446**	**4,632**	**615**	**267**	**5,514**	**63**	**2**	**3**	**68**	**1%**	**0%**	**1%**	**1%**
Total	**ALL**	**8,667**	**1,134**	**550**	**10,351**	**8,863**	**1,135**	**552**	**10,550**	**196**	**1**	**2**	**199**	**2%**	**0%**	**0%**	**2%**

Table 8-57: Forecast Traffic Flows South, East and Northeast of Chelmsford – Core Scenario 2026 PM Peak (vehicles)

ID_dir	Location	DM26				DS26				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S2.1_EB	A138 /A12 NB on-slip	1,466	145	13	1,624	1,513	148	13	1,674	47	3	0	50	3%	2%	0%	3%
S2.2_WB	Bridge over A12, Boreham INT	1,011	67	34	1,112	984	64	29	1,077	-27	-3	-5	-35	-3%	-4%	-15%	-3%
S2.2_EB	Bridge over A12, Boreham INT	1,389	115	66	1,570	1,446	116	67	1,629	57	1	1	59	4%	1%	2%	4%
S2.3_NB	A12 off-slip, Drovers Roundabout	1,078	112	76	1,266	980	107	75	1,162	-98	-5	-1	-104	-9%	-4%	-1%	-8%
S2.4_WB	A414 Maldon Road	630	47	2	679	730	48	2	780	100	1	0	101	16%	2%	0%	15%
S2.4_EB	A414 Maldon Road	642	66	3	711	696	68	3	767	54	2	0	56	8%	3%	0%	8%
S2.5_WB	Woodhill Road	167	16	18	201	178	17	3	198	11	1	-15	-3	7%	6%	-83%	-1%
S2.5_EB	Woodhill Road	433	27	16	476	453	27	16	496	20	0	0	20	5%	0%	0%	4%
S2.6_NB	A1114 Southend Road N of Howe Green	762	47	29	838	937	54	30	1,021	175	7	1	183	23%	15%	3%	22%
S2.6_SB	A1114 Southend Road N of Howe Green	859	88	31	978	933	88	16	1,037	74	0	-15	59	9%	0%	-48%	6%
S2.7_NB	West Hanningfield Road	47	6	1	54	41	5	0	46	-6	-1	-1	-8	-13%	-17%	-100%	-15%
S2.7_SB	West Hanningfield Road	48	17	1	66	50	17	1	68	2	0	0	2	4%	0%	0%	3%
S2.8_NB	Brook Lane	21	3	0	24	21	3	0	24	0	0	0	0	0%	0%	0%	0%
S2.8_SB	Brook Lane	10	2	0	12	10	2	0	12	0	0	0	0	0%	0%	0%	0%

ID_dir	Location	DM26				DS26				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S2.9_NB	B1007 Stock Road	707	28	7	742	683	30	7	720	-24	2	0	-22	-3%	7%	0%	-3%
S2.9_SB	B1007 Stock Road	454	44	9	507	441	45	9	495	-13	1	0	-12	-3%	2%	0%	-2%
S2.10_EB	Margaretting Road, Chelmsford	120	22	7	149	109	19	7	135	-11	-3	0	-14	-9%	-14%	0%	-9%
S2.10_WB	Margaretting Road, Chelmsford	156	26	10	192	157	26	9	192	1	0	-1	0	1%	0%	-10%	0%
S2.11_EB	A414 Three Mile Hill	1,004	64	46	1,114	1,060	70	49	1,179	56	6	3	65	6%	9%	7%	6%
S2.11_WB	A414 Three Mile Hill	1,126	135	27	1,288	1,130	136	29	1,295	4	1	2	7	0%	1%	7%	1%
To city centre	**Towards City Centre**	**5,547**	**412**	**220**	**6,179**	**5,723**	**417**	**202**	**6,342**	**176**	**5**	**-18**	**163**	**3%**	**1%**	**-8%**	**3%**
From city centre	**Away from City Centre**	**6,583**	**665**	**176**	**7,424**	**6,829**	**673**	**163**	**7,665**	**246**	**8**	**-13**	**241**	**4%**	**1%**	**-7%**	**3%**
Total	**ALL**	**12,130**	**1,077**	**396**	**13,603**	**12,552**	**1,090**	**365**	**14,007**	**422**	**13**	**-31**	**404**	**3%**	**1%**	**-8%**	**3%**

Table 8-58: Forecast Traffic Flows South, East and Northeast of Chelmsford – Core Scenario 2041 AM Peak (vehicles)

ID_dir	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S2.1_EB	A138 /A12 NB on-slip	1,238	117	24	1,379	1,269	120	24	1,413	31	3	0	34	3%	3%	0%	2%
S2.2_WB	Bridge over A12, Boreham INT	2,254	158	60	2,472	2,355	153	57	2,565	101	-5	-3	93	4%	-3%	-5%	4%
S2.2_EB	Bridge over A12, Boreham INT	1,156	189	90	1,435	1,058	186	87	1,331	-98	-3	-3	-104	-8%	-2%	-3%	-7%
S2.3_NB	A12 off-slip, Drovers Roundabout	1,014	125	49	1,188	1,043	134	55	1,232	29	9	6	44	3%	7%	12%	4%
S2.4_WB	A414 Maldon Road	682	68	4	754	694	66	3	763	12	-2	-1	9	2%	-3%	-25%	1%
S2.4_EB	A414 Maldon Road	940	61	6	1,007	899	64	6	969	-41	3	0	-38	-4%	5%	0%	-4%
S2.5_WB	Woodhill Road	425	42	15	482	455	41	23	519	30	-1	8	37	7%	-2%	53%	8%
S2.5_EB	Woodhill Road	293	41	24	358	318	42	24	384	25	1	0	26	9%	2%	0%	7%
S2.6_NB	A1114 Southend Road N of Howe Green	951	142	41	1,134	1,026	122	39	1,187	75	-20	-2	53	8%	-14%	-5%	5%
S2.6_SB	A1114 Southend Road N of Howe Green	655	140	46	841	656	124	52	832	1	-16	6	-9	0%	-11%	13%	-1%
S2.7_NB	West Hanningfield Road	139	32	3	174	148	33	3	184	9	1	0	10	6%	3%	0%	6%
S2.7_SB	West Hanningfield Road	75	19	1	95	81	21	1	103	6	2	0	8	8%	11%	0%	8%
S2.8_NB	Brook Lane	48	7	1	56	50	7	1	58	2	0	0	2	4%	0%	0%	4%
S2.8_SB	Brook Lane	24	3	0	27	23	3	0	26	-1	0	0	-1	-4%	0%	0%	-4%

ID_dir	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S2.9_NB	B1007 Stock Road	527	51	5	583	527	52	5	584	0	1	0	1	0%	2%	0%	0%
S2.9_SB	B1007 Stock Road	763	55	13	831	797	58	14	869	34	3	1	38	4%	5%	8%	5%
S2.10_EB	Margaretting Road, Chelmsford	97	9	8	114	96	13	7	116	-1	4	-1	2	-1%	44%	-13%	2%
S2.10_WB	Margaretting Road, Chelmsford	110	26	13	149	98	27	14	139	-12	1	1	-10	-11%	4%	8%	-7%
S2.11_EB	A414 Three Mile Hill	1,499	104	68	1,671	1,513	101	62	1,676	14	-3	-6	5	1%	-3%	-9%	0%
S2.11_WB	A414 Three Mile Hill	1,173	120	24	1,317	1,201	122	23	1,346	28	2	-1	29	2%	2%	-4%	2%
To city centre	Towards City Centre	**7,636**	**738**	**254**	**8,628**	**7,907**	**722**	**255**	**8,884**	**271**	**-16**	**1**	**256**	**4%**	**-2%**	**0%**	**3%**
From city centre	Away from City Centre	**6,427**	**771**	**241**	**7,439**	**6,400**	**767**	**245**	**7,412**	**-27**	**-4**	**4**	**-27**	**0%**	**-1%**	**2%**	**0%**
Total	ALL	**14,063**	**1,509**	**495**	**16,067**	**14,307**	**1,489**	**500**	**16,296**	**244**	**-20**	**5**	**229**	**2%**	**-1%**	**1%**	**1%**

Table 8-59: Forecast Traffic Flows South, East and Northeast of Chelmsford – Core Scenario 2041 Inter-Peak (vehicles)

ID_dir	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S2.1_EB	A138 /A12 NB on-slip	1,219	157	36	1,412	1,257	158	38	1,453	38	1	2	41	3%	1%	6%	3%
S2.2_WB	Bridge over A12, Boreham INT	1,120	112	49	1,281	1,105	110	46	1,261	-15	-2	-3	-20	-1%	-2%	-6%	-2%
S2.2_EB	Bridge over A12, Boreham INT	1,023	143	72	1,238	1,038	146	72	1,256	15	3	0	18	1%	2%	0%	1%
S2.3_NB	A12 off-slip, Drovers Roundabout	801	126	84	1,011	803	127	84	1,014	2	1	0	3	0%	1%	0%	0%
S2.4_WB	A414 Maldon Road	486	61	3	550	514	59	3	576	28	-2	0	26	6%	-3%	0%	5%
S2.4_EB	A414 Maldon Road	639	61	12	712	679	64	11	754	40	3	-1	42	6%	5%	-8%	6%
S2.5_WB	Woodhill Road	164	25	25	214	165	30	13	208	1	5	-12	-6	1%	20%	-48%	-3%
S2.5_EB	Woodhill Road	205	37	29	271	207	38	29	274	2	1	0	3	1%	3%	0%	1%
S2.6_NB	A1114 Southend Road N of Howe Green	539	98	51	688	541	92	51	684	2	-6	0	-4	0%	-6%	0%	-1%
S2.6_SB	A1114 Southend Road N of Howe Green	672	143	64	879	653	131	50	834	-19	-12	-14	-45	-3%	-8%	-22%	-5%
S2.7_NB	West Hanningfield Road	57	14	4	75	57	14	4	75	0	0	0	0	0%	0%	0%	0%
S2.7_SB	West Hanningfield Road	27	15	1	43	26	15	1	42	-1	0	0	-1	-4%	0%	0%	-2%
S2.8_NB	Brook Lane	14	3	1	18	15	3	1	19	1	0	0	1	7%	0%	0%	6%
S2.8_SB	Brook Lane	6	2	1	9	6	2	1	9	0	0	0	0	0%	0%	0%	0%

ID_dir	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S2.9_NB	B1007 Stock Road	472	43	8	523	507	44	6	557	35	1	-2	34	7%	2%	-25%	7%
S2.9_SB	B1007 Stock Road	459	37	13	509	451	38	16	505	-8	1	3	-4	-2%	3%	23%	-1%
S2.10_EB	Margaretting Road, Chelmsford	45	5	11	61	39	5	12	56	-6	0	1	-5	-13%	0%	9%	-8%
S2.10_WB	Margaretting Road, Chelmsford	121	28	16	165	124	28	16	168	3	0	0	3	2%	0%	0%	2%
S2.11_EB	A414 Three Mile Hill	768	73	48	889	805	84	46	935	37	11	-2	46	5%	15%	-4%	5%
S2.11_WB	A414 Three Mile Hill	832	93	30	955	822	103	31	956	-10	10	1	1	-1%	11%	3%	0%
To city centre	**Towards City Centre**	**4,466**	**560**	**284**	**5,310**	**4,551**	**568**	**266**	**5,385**	**85**	**8**	**-18**	**75**	**2%**	**1%**	**-6%**	**1%**
From city centre	**Away from City Centre**	**5,203**	**716**	**274**	**6,193**	**5,263**	**723**	**265**	**6,251**	**60**	**7**	**-9**	**58**	**1%**	**1%**	**-3%**	**1%**
Total	**ALL**	**9,669**	**1,276**	**558**	**11,503**	**9,814**	**1,291**	**531**	**11,636**	**145**	**15**	**-27**	**133**	**1%**	**1%**	**-5%**	**1%**

Table 8-60: Forecast Traffic Flows South, East and Northeast of Chelmsford – Core Scenario 2041 PM Peak (vehicles)

ID_dir	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S2.1_EB	A138 /A12 NB on-slip	1,583	165	12	1,760	1,643	162	12	1,817	60	-3	0	57	4%	-2%	0%	3%
S2.2_WB	Bridge over A12, Boreham INT	1,205	80	34	1,319	1,188	75	32	1,295	-17	-5	-2	-24	-1%	-6%	-6%	-2%
S2.2_EB	Bridge over A12, Boreham INT	1,376	130	67	1,573	1,409	141	63	1,613	33	11	-4	40	2%	8%	-6%	3%
S2.3_NB	A12 off-slip, Drovers Roundabout	1,014	114	90	1,218	938	108	91	1,137	-76	-6	1	-81	-7%	-5%	1%	-7%
S2.4_WB	A414 Maldon Road	738	53	1	792	857	61	2	920	119	8	1	128	16%	15%	100%	16%
S2.4_EB	A414 Maldon Road	616	76	3	695	695	81	3	779	79	5	0	84	13%	7%	0%	12%
S2.5_WB	Woodhill Road	201	22	19	242	196	21	4	221	-5	-1	-15	-21	-2%	-5%	-79%	-9%
S2.5_EB	Woodhill Road	501	38	14	553	551	39	14	604	50	1	0	51	10%	3%	0%	9%
S2.6_NB	A1114 Southend Road N of Howe Green	704	63	27	794	870	74	34	978	166	11	7	184	24%	17%	26%	23%
S2.6_SB	A1114 Southend Road N of Howe Green	903	131	41	1,075	949	115	28	1,092	46	-16	-13	17	5%	-12%	-32%	2%
S2.7_NB	West Hanningfield Road	89	12	1	102	87	12	1	100	-2	0	0	-2	-2%	0%	0%	-2%
S2.7_SB	West Hanningfield Road	47	22	1	70	63	24	1	88	16	2	0	18	34%	9%	0%	26%
S2.8_NB	Brook Lane	34	3	0	37	33	3	0	36	-1	0	0	-1	-3%	0%	0%	-3%
S2.8_SB	Brook Lane	11	3	0	14	11	2	0	13	0	-1	0	-1	0%	-33%	0%	-7%

ID_dir	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S2.9_NB	B1007 Stock Road	805	30	8	843	765	27	7	799	-40	-3	-1	-44	-5%	-10%	-13%	-5%
S2.9_SB	B1007 Stock Road	511	51	10	572	520	54	11	585	9	3	1	13	2%	6%	10%	2%
S2.10_EB	Margaretting Road, Chelmsford	122	24	7	153	107	20	7	134	-15	-4	0	-19	-12%	-17%	0%	-12%
S2.10_WB	Margaretting Road, Chelmsford	147	23	8	178	152	23	8	183	5	0	0	5	3%	0%	0%	3%
S2.11_EB	A414 Three Mile Hill	1,047	62	36	1,145	1,141	69	36	1,246	94	7	0	101	9%	11%	0%	9%
S2.11_WB	A414 Three Mile Hill	1,222	133	24	1,379	1,242	142	24	1,408	20	9	0	29	2%	7%	0%	2%
To city centre	**Towards City Centre**	**5,959**	**463**	**223**	**6,645**	**6,182**	**470**	**214**	**6,866**	**223**	**7**	**-9**	**221**	**4%**	**2%**	**-4%**	**3%**
From city centre	**Away from City Centre**	**6,917**	**772**	**180**	**7,869**	**7,235**	**783**	**164**	**8,182**	**318**	**11**	**-16**	**313**	**5%**	**1%**	**-9%**	**4%**
Total	**ALL**	**12,876**	**1,235**	**403**	**14,514**	**13,417**	**1,253**	**378**	**15,048**	**541**	**18**	**-25**	**534**	**4%**	**1%**	**-6%**	**4%**

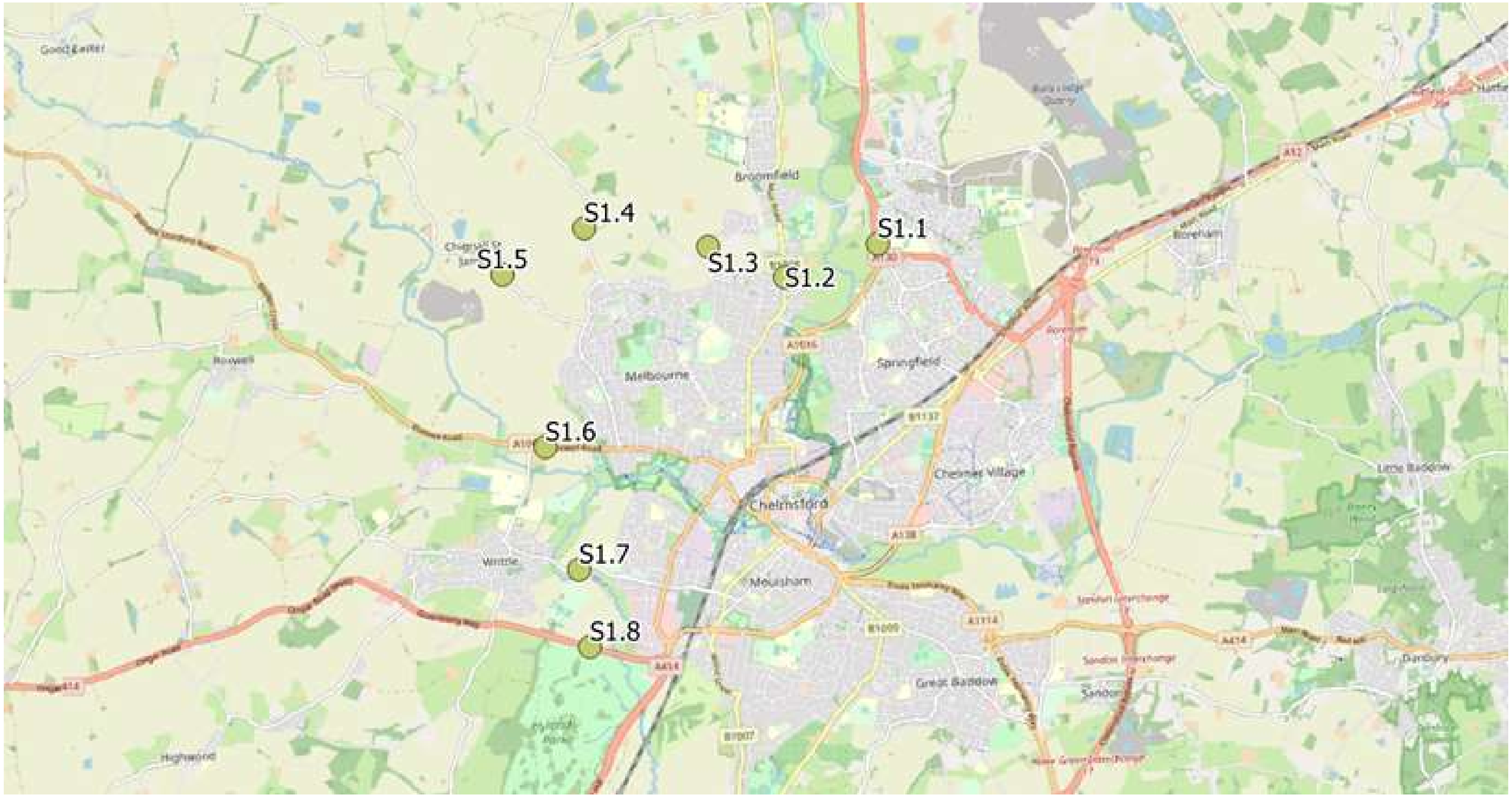


Figure 8-3: Forecast Traffic Flows Location Map – North and West of Chelmsford

Table 8-61:Forecast Traffic Flows North and West of Chelmsford – Core Scenario 2026 AM Peak (vehicles)

ID_dir	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S1.1_SB	Essex Regiment Way	1,311	52	14	1,377	1,326	52	13	1,391	15	0	-1	14	1%	0%	-7%	1%
S1.1_NB	Essex Regiment Way	836	74	33	943	826	74	33	933	-10	0	0	-10	-1%	0%	0%	-1%
S1.2_SB	B1008 Main Road, Broomfield	740	35	11	786	736	34	11	781	-4	-1	0	-5	-1%	-3%	0%	-1%
S1.2_NB	B1008 Main Road, Broomfield	805	41	9	855	819	41	10	870	14	0	1	15	2%	0%	11%	2%
S1.3_SB	School Lane, Parsonage Green	235	13	0	248	234	13	0	247	-1	0	0	-1	0%	0%	0%	0%
S1.3_NEB	School Lane, Parsonage Green	264	8	4	276	265	8	4	277	1	0	0	1	0%	0%	0%	0%
S1.4_SB	Chignal Road	221	30	5	256	214	29	4	247	-7	-1	-1	-9	-3%	-3%	-20%	-4%
S1.4_NB	Chignal Road	149	16	3	168	151	16	3	170	2	0	0	2	1%	0%	0%	1%
S1.5_SEB	Mashbury Road, Chignall	46	5	1	52	46	5	1	52	0	0	0	0	0%	0%	0%	0%
S1.5_NWB	Mashbury Road, Chignall	26	5	1	32	31	5	1	37	5	0	0	5	19%	0%	0%	16%
S1.6_EB	Roxwell Rd, Writtle	781	51	21	853	776	51	23	850	-5	0	2	-3	-1%	0%	10%	0%
S1.6_WB	Roxwell Rd, Writtle	782	85	24	891	782	87	24	893	0	2	0	2	0%	2%	0%	0%
S1.7_EB	Chelmsford Road, Writtle	396	28	4	428	374	23	3	400	-22	-5	-1	-28	-6%	-18%	-25%	-7%
S1.7_WB	Chelmsford Road, Writtle	269	42	8	319	293	41	8	342	24	-1	0	23	9%	-2%	0%	7%
S1.8_EB	A414 Greenbury Way	489	67	5	561	472	67	5	544	-17	0	0	-17	-3%	0%	0%	-3%

ID_dir	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S1.8_WB	A414 Greenbury Way	612	60	7	679	606	48	7	661	-6	-12	0	-18	-1%	-20%	0%	-3%
To city centre	**Towards City Centre**	**4,219**	**281**	**61**	**4,561**	**4,178**	**274**	**60**	**4,512**	**-41**	**-7**	**-1**	**-49**	**-1%**	**-2%**	**-2%**	**-1%**
From city centre	**Away from City Centre**	**3,743**	**331**	**89**	**4,163**	**3,773**	**320**	**90**	**4,183**	**30**	**-11**	**1**	**20**	**1%**	**-3%**	**1%**	**0%**
Total	**ALL**	**7,962**	**612**	**150**	**8,724**	**7,951**	**594**	**150**	**8,695**	**-11**	**-18**	**0**	**-29**	**0%**	**-3%**	**0%**	**0%**

Table 8-62: Forecast Traffic Flows North and West of Chelmsford – Core Scenario 2026 Inter-Peak (vehicles)

ID_dir	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S1.1_SB	Essex Regiment Way	657	46	12	715	667	45	12	724	10	-1	0	9	2%	-2%	0%	1%
S1.1_NB	Essex Regiment Way	738	66	30	834	744	67	29	840	6	1	-1	6	1%	2%	-3%	1%
S1.2_SB	B1008 Main Road, Broomfield	577	41	15	633	564	43	15	622	-13	2	0	-11	-2%	5%	0%	-2%
S1.2_NB	B1008 Main Road, Broomfield	473	41	9	523	474	42	9	525	1	1	0	2	0%	2%	0%	0%
S1.3_SB	School Lane, Parsonage Green	203	14	0	217	203	12	0	215	0	-2	0	-2	0%	-14%	0%	-1%
S1.3_NEB	School Lane, Parsonage Green	114	13	5	132	114	13	5	132	0	0	0	0	0%	0%	0%	0%
S1.4_SB	Chignal Road	54	12	4	70	54	11	4	69	0	-1	0	-1	0%	-8%	0%	-1%
S1.4_NB	Chignal Road	60	12	3	75	60	12	3	75	0	0	0	0	0%	0%	0%	0%
S1.5_SEB	Mashbury Road, Chignall	22	5	1	28	22	5	1	28	0	0	0	0	0%	0%	0%	0%
S1.5_NWB	Mashbury Road, Chignall	23	4	1	28	23	4	1	28	0	0	0	0	0%	0%	0%	0%
S1.6_EB	Roxwell Rd, Writtle	493	57	31	581	485	54	31	570	-8	-3	0	-11	-2%	-5%	0%	-2%
S1.6_WB	Roxwell Rd, Writtle	485	69	37	591	491	70	38	599	6	1	1	8	1%	1%	3%	1%
S1.7_EB	Chelmsford Road, Writtle	189	17	5	211	204	20	5	229	15	3	0	18	8%	18%	0%	9%
S1.7_WB	Chelmsford Road, Writtle	254	24	8	286	249	25	8	282	-5	1	0	-4	-2%	4%	0%	-1%
S1.8_EB	A414 Greenbury Way	427	73	10	510	431	67	9	507	4	-6	-1	-3	1%	-8%	-10%	-1%

ID_dir	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S1.8_WB	A414 Greenbury Way	336	39	15	390	372	41	12	425	36	2	-3	35	11%	5%	-20%	9%
To city centre	**Towards City Centre**	**2,622**	**265**	**78**	**2,965**	**2,630**	**257**	**77**	**2,964**	**8**	**-8**	**-1**	**-1**	**0%**	**-3%**	**-1%**	**0%**
From city centre	**Away from City Centre**	**2,483**	**268**	**108**	**2,859**	**2,527**	**274**	**105**	**2,906**	**44**	**6**	**-3**	**47**	**2%**	**2%**	**-3%**	**2%**
Total	**ALL**	**5,105**	**533**	**186**	**5,824**	**5,157**	**531**	**182**	**5,870**	**52**	**-2**	**-4**	**46**	**1%**	**0%**	**-2%**	**1%**

Table 8-63: Forecast Traffic Flows North and West of Chelmsford – Core Scenario 2026 PM Peak (vehicles)

ID_dir	Location	DM41				DS41				Diffrence				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S1.1_SB	Essex Regiment Way	868	33	3	904	858	31	3	892	-10	-2	0	-12	-1%	-6%	0%	-1%
S1.1_NB	Essex Regiment Way	1,184	72	16	1,272	1,191	73	16	1,280	7	1	0	8	1%	1%	0%	1%
S1.2_SB	B1008 Main Road, Broomfield	711	33	6	750	695	32	5	732	-16	-1	-1	-18	-2%	-3%	-17%	-2%
S1.2_NB	B1008 Main Road, Broomfield	537	35	8	580	549	36	8	593	12	1	0	13	2%	3%	0%	2%
S1.3_SB	School Lane, Parsonage Green	304	6	0	310	308	6	0	314	4	0	0	4	1%	0%	0%	1%
S1.3_NEB	School Lane, Parsonage Green	187	7	2	196	188	7	2	197	1	0	0	1	1%	0%	0%	1%
S1.4_SB	Chignal Road	159	16	2	177	157	15	2	174	-2	-1	0	-3	-1%	-6%	0%	-2%
S1.4_NB	Chignal Road	165	11	1	177	166	12	1	179	1	1	0	2	1%	9%	0%	1%
S1.5_SEB	Mashbury Road, Chignall	31	4	1	36	31	4	0	35	0	0	-1	-1	0%	0%	-100%	-3%
S1.5_NWB	Mashbury Road, Chignall	34	5	0	39	35	5	0	40	1	0	0	1	3%	0%	0%	3%
S1.6_EB	Roxwell Rd, Writtle	859	42	14	915	856	41	14	911	-3	-1	0	-4	0%	-2%	0%	0%
S1.6_WB	Roxwell Rd, Writtle	762	81	18	861	795	83	19	897	33	2	1	36	4%	2%	6%	4%
S1.7_EB	Chelmsford Road, Writtle	213	14	2	229	209	13	2	224	-4	-1	0	-5	-2%	-7%	0%	-2%
S1.7_WB	Chelmsford Road, Writtle	353	35	4	392	370	35	4	409	17	0	0	17	5%	0%	0%	4%
S1.8_EB	A414 Greenbury Way	656	102	10	768	666	100	6	772	10	-2	-4	4	2%	-2%	-40%	1%

ID_dir	Location	DM41				DS41				Diffreence				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S1.8_WB	A414 Greenbury Way	376	21	10	407	399	25	5	429	23	4	-5	22	6%	19%	-50%	5%
To city centre	**Towards City Centre**	**3,801**	**250**	**38**	**4,089**	**3,780**	**242**	**32**	**4,054**	**-21**	**-8**	**-6**	**-35**	**-1%**	**-3%**	**-16%**	**-1%**
From city centre	**Away from City Centre**	**3,598**	**267**	**59**	**3,924**	**3,693**	**276**	**55**	**4,024**	**95**	**9**	**-4**	**100**	**3%**	**3%**	**-7%**	**3%**
Total	**ALL**	**7,399**	**517**	**97**	**8,013**	**7,473**	**518**	**87**	**8,078**	**74**	**1**	**-10**	**65**	**1%**	**0%**	**-10%**	**1%**

Table 8-64: Forecast Traffic Flows North and West of Chelmsford – Core Scenario 2041 AM Peak (vehicles)

ID_dir	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S1.1_SB	Essex Regiment Way	1,611	58	10	1,679	1,557	62	13	1,632	-54	4	3	-47	-3%	7%	30%	-3%
S1.1_NB	Essex Regiment Way	1,028	64	17	1,109	990	64	29	1,083	-38	0	12	-26	-4%	0%	71%	-2%
S1.2_SB	B1008 Main Road, Broomfield	791	40	14	845	793	39	12	844	2	-1	-2	-1	0%	-3%	-14%	0%
S1.2_NB	B1008 Main Road, Broomfield	847	48	13	908	862	47	12	921	15	-1	-1	13	2%	-2%	-8%	1%
S1.3_SB	School Lane, Parsonage Green	255	15	0	270	253	15	0	268	-2	0	0	-2	-1%	0%	0%	-1%
S1.3_NEB	School Lane, Parsonage Green	285	8	5	298	291	9	5	305	6	1	0	7	2%	13%	0%	2%
S1.4_SB	Chignal Road	301	36	6	343	285	35	5	325	-16	-1	-1	-18	-5%	-3%	-17%	-5%
S1.4_NB	Chignal Road	223	21	3	247	238	21	3	262	15	0	0	15	7%	0%	0%	6%
S1.5_SEB	Mashbury Road, Chignall	45	7	1	53	45	6	1	52	0	-1	0	-1	0%	-14%	0%	-2%
S1.5_NWB	Mashbury Road, Chignall	38	6	1	45	38	6	1	45	0	0	0	0	0%	0%	0%	0%
S1.6_EB	Roxwell Rd, Writtle	870	55	21	946	869	56	21	946	-1	1	0	0	0%	2%	0%	0%
S1.6_WB	Roxwell Rd, Writtle	757	86	23	866	757	85	24	866	0	-1	1	0	0%	-1%	4%	0%
S1.7_EB	Chelmsford Road, Writtle	405	28	4	437	433	28	4	465	28	0	0	28	7%	0%	0%	6%
S1.7_WB	Chelmsford Road, Writtle	274	36	4	314	286	43	5	334	12	7	1	20	4%	19%	25%	6%
S1.8_EB	A414 Greenbury Way	455	73	3	531	455	68	2	525	0	-5	-1	-6	0%	-7%	-33%	-1%

ID_dir	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S1.8_WB	A414 Greenbury Way	603	62	10	675	589	58	10	657	-14	-4	0	-18	-2%	-6%	0%	-3%
To city centre	**Towards City Centre**	**4,733**	**312**	**59**	**5,104**	**4,690**	**309**	**58**	**5,057**	**-43**	**-3**	**-1**	**-47**	**-1%**	**-1%**	**-2%**	**-1%**
From city centre	**Away from City Centre**	**4,055**	**331**	**76**	**4,462**	**4,051**	**333**	**89**	**4,473**	**-4**	**2**	**13**	**11**	**0%**	**1%**	**17%**	**0%**
Total	**ALL**	**8,788**	**643**	**135**	**9,566**	**8,741**	**642**	**147**	**9,530**	**-47**	**-1**	**12**	**-36**	**-1%**	**0%**	**9%**	**0%**

Table 8-65: Forecast Traffic Flows North and West of Chelmsford – Core Scenario 2041 Inter-Peak (vehicles)

ID_dir	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S1.1_SB	Essex Regiment Way	891	50	19	960	877	48	15	940	-14	-2	-4	-20	-2%	-4%	-21%	-2%
S1.1_NB	Essex Regiment Way	943	73	27	1,043	928	64	27	1,019	-15	-9	0	-24	-2%	-12%	0%	-2%
S1.2_SB	B1008 Main Road, Broomfield	619	48	15	682	609	48	15	672	-10	0	0	-10	-2%	0%	0%	-1%
S1.2_NB	B1008 Main Road, Broomfield	506	49	11	566	503	59	11	573	-3	10	0	7	-1%	20%	0%	1%
S1.3_SB	School Lane, Parsonage Green	229	21	0	250	231	22	0	253	2	1	0	3	1%	5%	0%	1%
S1.3_NEB	School Lane, Parsonage Green	136	11	5	152	135	10	5	150	-1	-1	0	-2	-1%	-9%	0%	-1%
S1.4_SB	Chignal Road	106	12	4	122	101	11	4	116	-5	-1	0	-6	-5%	-8%	0%	-5%
S1.4_NB	Chignal Road	78	17	3	98	78	16	3	97	0	-1	0	-1	0%	-6%	0%	-1%
S1.5_SEB	Mashbury Road, Chignall	26	6	1	33	26	6	1	33	0	0	0	0	0%	0%	0%	0%
S1.5_NWB	Mashbury Road, Chignall	25	5	1	31	26	5	1	32	1	0	0	1	4%	0%	0%	3%
S1.6_EB	Roxwell Rd, Writtle	554	61	30	645	561	60	30	651	7	-1	0	6	1%	-2%	0%	1%
S1.6_WB	Roxwell Rd, Writtle	607	75	40	722	614	74	40	728	7	-1	0	6	1%	-1%	0%	1%
S1.7_EB	Chelmsford Road, Writtle	203	25	5	233	188	25	4	217	-15	0	-1	-16	-7%	0%	-20%	-7%
S1.7_WB	Chelmsford Road, Writtle	286	31	9	326	283	32	8	323	-3	1	-1	-3	-1%	3%	-11%	-1%
S1.8_EB	A414 Greenbury Way	514	79	9	602	523	76	7	606	9	-3	-2	4	2%	-4%	-22%	1%

ID_dir	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S1.8_WB	A414 Greenbury Way	399	40	12	451	429	47	11	487	30	7	-1	36	8%	18%	-8%	8%
To city centre	**Towards City Centre**	**3,142**	**302**	**83**	**3,527**	**3,116**	**296**	**76**	**3,488**	**-26**	**-6**	**-7**	**-39**	**-1%**	**-2%**	**-8%**	**-1%**
From city centre	**Away from City Centre**	**2,980**	**301**	**108**	**3,389**	**2,996**	**307**	**106**	**3,409**	**16**	**6**	**-2**	**20**	**1%**	**2%**	**-2%**	**1%**
Total	**ALL**	**6,122**	**603**	**191**	**6,916**	**6,112**	**603**	**182**	**6,897**	**-10**	**0**	**-9**	**-19**	**0%**	**0%**	**-5%**	**0%**

Table 8-66: Forecast Traffic Flows North and West of Chelmsford – Core Scenario 2041 PM Peak (vehicles)

ID_dir	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S1.1_SB	Essex Regiment Way	1,124	41	4	1,169	1,087	33	2	1,122	-37	-8	-2	-47	-3%	-20%	-50%	-4%
S1.1_NB	Essex Regiment Way	1,391	52	4	1,447	1,381	57	4	1,442	-10	5	0	-5	-1%	10%	0%	0%
S1.2_SB	B1008 Main Road, Broomfield	765	39	5	809	731	40	5	776	-34	1	0	-33	-4%	3%	0%	-4%
S1.2_NB	B1008 Main Road, Broomfield	607	47	12	666	610	49	13	672	3	2	1	6	0%	4%	8%	1%
S1.3_SB	School Lane, Parsonage Green	369	7	0	376	360	7	0	367	-9	0	0	-9	-2%	0%	0%	-2%
S1.3_NEB	School Lane, Parsonage Green	228	8	2	238	225	8	2	235	-3	0	0	-3	-1%	0%	0%	-1%
S1.4_SB	Chignal Road	231	19	2	252	231	18	2	251	0	-1	0	-1	0%	-5%	0%	0%
S1.4_NB	Chignal Road	215	13	2	230	220	14	2	236	5	1	0	6	2%	8%	0%	3%
S1.5_SEB	Mashbury Road, Chignall	27	5	1	33	27	4	1	32	0	-1	0	-1	0%	-20%	0%	-3%
S1.5_NWB	Mashbury Road, Chignall	31	5	0	36	35	5	0	40	4	0	0	4	13%	0%	0%	11%
S1.6_EB	Roxwell Rd, Writtle	964	49	14	1,027	958	47	14	1,019	-6	-2	0	-8	-1%	-4%	0%	-1%
S1.6_WB	Roxwell Rd, Writtle	873	94	18	985	892	95	19	1,006	19	1	1	21	2%	1%	6%	2%
S1.7_EB	Chelmsford Road, Writtle	250	26	2	278	237	23	2	262	-13	-3	0	-16	-5%	-12%	0%	-6%
S1.7_WB	Chelmsford Road, Writtle	438	43	5	486	421	38	5	464	-17	-5	0	-22	-4%	-12%	0%	-5%
S1.8_EB	A414 Greenbury Way	689	115	9	813	711	113	4	828	22	-2	-5	15	3%	-2%	-56%	2%

ID_dir	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
S1.8_WB	A414 Greenbury Way	424	23	4	451	474	35	4	513	50	12	0	62	12%	52%	0%	14%
To city centre	**Towards City Centre**	**4,419**	**301**	**37**	**4,757**	**4,342**	**285**	**30**	**4,657**	**-77**	**-16**	**-7**	**-100**	**-2%**	**-5%**	**-19%**	**-2%**
From city centre	**Away from City Centre**	**4,207**	**285**	**47**	**4,539**	**4,258**	**301**	**49**	**4,608**	**51**	**16**	**2**	**69**	**1%**	**6%**	**4%**	**2%**
Total	**ALL**	**8,626**	**586**	**84**	**9,296**	**8,600**	**586**	**79**	**9,265**	**-26**	**0**	**-5**	**-31**	**0%**	**0%**	**-6%**	**0%**

Table 8-67: Forecast Traffic Flows on SRN (A12) – Core Scenario 2026 AM Peak (vehicles)

ID_direction	Location	DM26				DS26				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
C1.1_WB	A12 north of J19	4,622	553	242	5,417	4,731	568	242	5,541	109	15	0	124	2%	3%	0%	2%
C1.1_EB	A12 north of J19	3,409	467	251	4,127	3,422	456	251	4,129	13	-11	0	2	0%	-2%	0%	0%
A12_6261_1_NB	A12 between J18 and J19	3,185	475	276	3,936	3,196	470	282	3,948	11	-5	6	12	0%	-1%	2%	0%
A12_6258_1_SB	A12 between J18 and J17	3,763	561	270	4,594	3,718	586	261	4,565	-45	25	-9	-29	-1%	4%	-3%	-1%
A12_6259_1_NB	A12 between J17 and J18	3,054	488	283	3,825	3,038	482	287	3,807	-16	-6	4	-18	-1%	-1%	1%	0%
A12_6256_1_SB	A12 between J17 and J16	2,929	320	175	3,424	2,894	339	172	3,405	-35	19	-3	-19	-1%	6%	-2%	-1%
A12_6257_1_NB	A12 between J16 and J17	2,195	279	209	2,683	2,235	277	212	2,724	40	-2	3	41	2%	-1%	1%	2%
A12_6255_1_NB	A12 between J15 and J16	2,301	306	211	2,818	2,353	299	214	2,866	52	-7	3	48	2%	-2%	1%	2%
A12_6254_2_SB	A12 south of J15	2,293	259	160	2,712	2,274	279	156	2,709	-19	20	-4	-3	-1%	8%	-3%	0%
A12_6253_2_NB	A12 south of J15	1,958	257	205	2,420	1,971	253	208	2,432	13	-4	3	12	1%	-2%	1%	0%
A12 SB / WB	**Towards London**	**13,607**	**1,693**	**847**	**16,147**	**13,617**	**1,772**	**831**	**16,220**	**10**	**79**	**-16**	**73**	**0%**	**5%**	**-2%**	**0%**
A12 NB / EB	**Towards Colchester**	**16,102**	**2,272**	**1,435**	**19,809**	**16,215**	**2,237**	**1,454**	**19,906**	**113**	**-35**	**19**	**97**	**1%**	**-2%**	**1%**	**0%**
Total	**ALL**	**29,709**	**3,965**	**2,282**	**35,956**	**29,832**	**4,009**	**2,285**	**36,126**	**123**	**44**	**3**	**170**	**0%**	**1%**	**0%**	**0%**

Table 8-68: Forecast Traffic Flows on SRN (A12) – Core Scenario 2026 Inter-Peak (vehicles)

ID_direction	Location	DM26				DS26				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
C1.1_WB	A12 north of J19	2,432	333	265	3,030	2,441	333	265	3,039	9	0	0	9	0%	0%	0%	0%
C1.1_EB	A12 north of J19	2,583	413	319	3,315	2,601	418	320	3,339	18	5	1	24	1%	1%	0%	1%
A12_6261_1_NB	A12 between J18 and J19	2,275	401	369	3,045	2,274	400	369	3,043	-1	-1	0	-2	0%	0%	0%	0%
A12_6258_1_SB	A12 between J18 and J17	2,493	368	310	3,171	2,510	372	304	3,186	17	4	-6	15	1%	1%	-2%	0%
A12_6259_1_NB	A12 between J17 and J18	2,149	402	377	2,928	2,145	402	377	2,924	-4	0	0	-4	0%	0%	0%	0%
A12_6256_1_SB	A12 between J17 and J16	1,872	260	264	2,396	1,896	260	264	2,420	24	0	0	24	1%	0%	0%	1%
A12_6257_1_NB	A12 between J16 and J17	1,748	281	325	2,354	1,753	281	325	2,359	5	0	0	5	0%	0%	0%	0%
A12_6255_1_NB	A12 between J15 and J16	1,865	271	323	2,459	1,866	270	325	2,461	1	-1	2	2	0%	0%	1%	0%
A12_6254_2_SB	A12 south of J15	1,669	230	258	2,157	1,665	231	258	2,154	-4	1	0	-3	0%	0%	0%	0%
A12_6253_2_NB	A12 south of J15	1,678	245	322	2,245	1,668	246	324	2,238	-10	1	2	-7	-1%	0%	1%	0%
A12 SB / WB	**Towards London**	**8,466**	**1,191**	**1,097**	**10,754**	**8,512**	**1,196**	**1,091**	**10,799**	**46**	**5**	**-6**	**45**	**1%**	**0%**	**-1%**	**0%**
A12 NB / EB	**Towards Colchester**	**12,298**	**2,013**	**2,035**	**16,346**	**12,307**	**2,017**	**2,040**	**16,364**	**9**	**4**	**5**	**18**	**0%**	**0%**	**0%**	**0%**
Total	**ALL**	**20,764**	**3,204**	**3,132**	**27,100**	**20,819**	**3,213**	**3,131**	**27,163**	**55**	**9**	**-1**	**63**	**0%**	**0%**	**0%**	**0%**

Table 8-69: Forecast Traffic Flows on SRN (A12) – Core Scenario 2026 PM Peak (vehicles)

ID_direction	Location	DM26				DS26				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
C1.1_WB	A12 north of J19	3,153	272	134	3,559	3,128	270	134	3,532	-25	-2	0	-27	-1%	-1%	0%	-1%
C1.1_EB	A12 north of J19	3,353	435	148	3,936	3,397	438	149	3,984	44	3	1	48	1%	1%	1%	1%
A12_6261_1_NB	A12 between J18 and J19	2,965	402	211	3,578	2,863	397	210	3,470	-102	-5	-1	-108	-3%	-1%	0%	-3%
A12_6258_1_SB	A12 between J18 and J17	3,449	301	173	3,923	3,449	306	193	3,948	0	5	20	25	0%	2%	12%	1%
A12_6259_1_NB	A12 between J17 and J18	2,925	421	233	3,579	2,869	416	233	3,518	-56	-5	0	-61	-2%	-1%	0%	-2%
A12_6256_1_SB	A12 between J17 and J16	2,538	256	166	2,960	2,530	256	171	2,957	-8	0	5	-3	0%	0%	3%	0%
A12_6257_1_NB	A12 between J16 and J17	2,381	326	227	2,934	2,377	325	228	2,930	-4	-1	1	-4	0%	0%	0%	0%
A12_6255_1_NB	A12 between J15 and J16	2,819	303	228	3,350	2,795	298	228	3,321	-24	-5	0	-29	-1%	-2%	0%	-1%
A12_6254_2_SB	A12 south of J15	2,057	223	168	2,448	2,061	223	172	2,456	4	0	4	8	0%	0%	2%	0%
A12_6253_2_NB	A12 south of J15	2,301	254	224	2,779	2,254	249	225	2,728	-47	-5	1	-51	-2%	-2%	0%	-2%
A12 SB / WB	**Towards London**	11,197	1,052	641	12,890	11,168	1,055	670	12,893	-29	3	29	3	0%	0%	5%	0%
A12 NB / EB	**Towards Colchester**	16,744	2,141	1,271	20,156	16,555	2,123	1,273	19,951	-189	-18	2	-205	-1%	-1%	0%	-1%
Total	**ALL**	27,941	3,193	1,912	33,046	27,723	3,178	1,943	32,844	-218	-15	31	-202	-1%	0%	2%	-1%

Table 8-70: Forecast Traffic Flows on SRN (A12) – Core Scenario 2041 AM Peak (vehicles)

ID_direction	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
C1.1_WB	A12 north of J19	4,622	553	242	5,417	4,731	568	242	5,541	109	15	0	124	2%	3%	0%	2%
C1.1_EB	A12 north of J19	3,409	467	251	4,127	3,422	456	251	4,129	13	-11	0	2	0%	-2%	0%	0%
A12_6261_1_NB	A12 between J18 and J19	3,185	475	276	3,936	3,196	470	282	3,948	11	-5	6	12	0%	-1%	2%	0%
A12_6258_1_SB	A12 between J18 and J17	3,763	561	270	4,594	3,718	586	261	4,565	-45	25	-9	-29	-1%	4%	-3%	-1%
A12_6259_1_NB	A12 between J17 and J18	3,054	488	283	3,825	3,038	482	287	3,807	-16	-6	4	-18	-1%	-1%	1%	0%
A12_6256_1_SB	A12 between J17 and J16	2,929	320	175	3,424	2,894	339	172	3,405	-35	19	-3	-19	-1%	6%	-2%	-1%
A12_6257_1_NB	A12 between J16 and J17	2,195	279	209	2,683	2,235	277	212	2,724	40	-2	3	41	2%	-1%	1%	2%
A12_6255_1_NB	A12 between J15 and J16	2,301	306	211	2,818	2,353	299	214	2,866	52	-7	3	48	2%	-2%	1%	2%
A12_6254_2_SB	A12 south of J15	2,293	259	160	2,712	2,274	279	156	2,709	-19	20	-4	-3	-1%	8%	-3%	0%
A12_6253_2_NB	A12 south of J15	1,958	257	205	2,420	1,971	253	208	2,432	13	-4	3	12	1%	-2%	1%	0%
A12 SB / WB	**Towards London**	**13,607**	**1,693**	**847**	**16,147**	**13,617**	**1,772**	**831**	**16,220**	**10**	**79**	**-16**	**73**	**0%**	**5%**	**-2%**	**0%**
A12 NB / EB	**Towards Colchester**	**16,102**	**2,272**	**1,435**	**19,809**	**16,215**	**2,237**	**1,454**	**19,906**	**113**	**-35**	**19**	**97**	**1%**	**-2%**	**1%**	**0%**
Total	**ALL**	**29,709**	**3,965**	**2,282**	**35,956**	**29,832**	**4,009**	**2,285**	**36,126**	**123**	**44**	**3**	**170**	**0%**	**1%**	**0%**	**0%**

Table 8-71: Forecast Traffic Flows on SRN (A12) – Core Scenario 2041 Inter-Peak (vehicles)

ID_direction	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
C1.1_WB	A12 north of J19	3,135	406	288	3,829	3,088	402	288	3,778	-47	-4	0	-51	-1%	-1%	0%	-1%
C1.1_EB	A12 north of J19	3,109	466	332	3,907	3,135	468	331	3,934	26	2	-1	27	1%	0%	0%	1%
A12_6261_1_NB	A12 between J18 and J19	2,691	436	380	3,507	2,680	438	377	3,495	-11	2	-3	-12	0%	0%	-1%	0%
A12_6258_1_SB	A12 between J18 and J17	3,129	442	343	3,914	3,129	443	356	3,928	0	1	13	14	0%	0%	4%	0%
A12_6259_1_NB	A12 between J17 and J18	2,519	416	386	3,321	2,511	417	383	3,311	-8	1	-3	-10	0%	0%	-1%	0%
A12_6256_1_SB	A12 between J17 and J16	2,069	195	231	2,495	2,068	196	234	2,498	-1	1	3	3	0%	1%	1%	0%
A12_6257_1_NB	A12 between J16 and J17	2,132	243	279	2,654	2,099	245	274	2,618	-33	2	-5	-36	-2%	1%	-2%	-1%
A12_6255_1_NB	A12 between J15 and J16	2,225	230	284	2,739	2,214	232	283	2,729	-11	2	-1	-10	0%	1%	0%	0%
A12_6254_2_SB	A12 south of J15	1,944	166	232	2,342	1,920	166	234	2,320	-24	0	2	-22	-1%	0%	1%	-1%
A12_6253_2_NB	A12 south of J15	1,964	201	282	2,447	1,955	203	281	2,439	-9	2	-1	-8	0%	1%	0%	0%
A12 SB / WB	**Towards London**	**10,277**	**1,209**	**1,094**	**12,580**	**10,205**	**1,207**	**1,112**	**12,524**	**-72**	**-2**	**18**	**-56**	**-1%**	**0%**	**2%**	**0%**
A12 NB / EB	**Towards Colchester**	**14,640**	**1,992**	**1,943**	**18,575**	**14,594**	**2,003**	**1,929**	**18,526**	**-46**	**11**	**-14**	**-49**	**0%**	**1%**	**-1%**	**0%**
Total	**ALL**	**24,917**	**3,201**	**3,037**	**31,155**	**24,799**	**3,210**	**3,041**	**31,050**	**-118**	**9**	**4**	**-105**	**0%**	**0%**	**0%**	**0%**

Table 8-72: Forecast Traffic Flows on SRN (A12) – Core Scenario 2041 PM Peak (vehicles)

ID_direction	Location	DM41				DS41				Diff				%Diff			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
C1.1_WB	A12 north of J19	3,888	325	143	4,356	3,879	324	143	4,346	-9	-1	0	-10	0%	0%	0%	0%
C1.1_EB	A12 north of J19	3,880	508	151	4,539	3,930	506	152	4,588	50	-2	1	49	1%	0%	1%	1%
A12_6261_1_NB	A12 between J18 and J19	3,312	457	230	3,999	3,226	451	231	3,908	-86	-6	1	-91	-3%	-1%	0%	-2%
A12_6258_1_SB	A12 between J18 and J17	3,914	341	186	4,441	3,890	344	197	4,431	-24	3	11	-10	-1%	1%	6%	0%
A12_6259_1_NB	A12 between J17 and J18	3,299	480	254	4,033	3,258	473	254	3,985	-41	-7	0	-48	-1%	-1%	0%	-1%
A12_6256_1_SB	A12 between J17 and J16	2,694	178	149	3,021	2,638	176	147	2,961	-56	-2	-2	-60	-2%	-1%	-1%	-2%
A12_6257_1_NB	A12 between J16 and J17	2,485	281	184	2,950	2,560	293	189	3,042	75	12	5	92	3%	4%	3%	3%
A12_6255_1_NB	A12 between J15 and J16	3,039	263	194	3,496	3,038	274	195	3,507	-1	11	1	11	0%	4%	1%	0%
A12_6254_2_SB	A12 south of J15	2,147	148	146	2,441	2,110	148	148	2,406	-37	0	2	-35	-2%	0%	1%	-1%
A12_6253_2_NB	A12 south of J15	2,467	200	190	2,857	2,420	200	191	2,811	-47	0	1	-46	-2%	0%	1%	-2%
A12 SB / WB	**Towards London**	**12,643**	**992**	**624**	**14,259**	**12,517**	**992**	**635**	**14,144**	**-126**	**0**	**11**	**-115**	**-1%**	**0%**	**2%**	**-1%**
A12 NB / EB	**Towards Colchester**	**18,482**	**2,189**	**1,203**	**21,874**	**18,432**	**2,197**	**1,212**	**21,841**	**-50**	**8**	**9**	**-33**	**0%**	**0%**	**1%**	**0%**
Total	**ALL**	**31,125**	**3,181**	**1,827**	**36,133**	**30,949**	**3,189**	**1,847**	**35,985**	**-176**	**8**	**20**	**-148**	**-1%**	**0%**	**1%**	**0%**

The forecast model traffic flows outlined in the above tables highlight the following key points:

- There is a significant increase in traffic volumes through the A&N junction as a result of the scheme due to the increase in car-based vehicle capacity, in the order of 20% in the AM peak and 16% in the PM peak in the 2026 opening year. In 2041, the increase is forecast to be 18% and 22% respectively.
- The largest increases occur inbound on Chelmer Road (37%), Essex Yeomanry Way (31%) and Baddow Road (30%) in the 2026 AM peak and inbound on Essex Yeomanry Way (76%) and Van Diemans Road (55%) in the 2026 PM peak. Results are similar in 2041.
- However, there is also a reduction in traffic on Parkway in the eastbound direction out of Chelmsford in the AM and IP time periods in the order of 6% to 12%. This is largely a consequence of two interrelated aspects of the scheme design. Firstly, the Parkway approach to A&N junction in the DM in the AM and IP time periods is priority controlled, which allows additional traffic to exit Parkway but also provides additional conflicting traffic on the roundabout causing delay to other approach arms, in particular Chelmer Road. Secondly, the design solution at the junction incorporates more signal control in order to prioritise both active travel measures at the junction as well as to provide the most efficient overall result for junction performance. The result of this is a reduction in capacity on the Parkway approach arm in the AM and IP periods, but better overall performance while prioritising active travel. It is in effect the necessary consequence of prioritising active travel within the physical constraints at the junction while providing the best possible overall junction performance for private vehicles.
- The forecast model results at locations along a screenline to the north and west of Chelmsford (ID S1) indicates minimal changes in traffic volumes, with a 0% change overall during all three time periods in 2026 and up to a 1% change in 2041.
- Across a screenline of locations east of Chelmsford that follow the A12, the overall forecast traffic flows increase 1% and 3% in 2026 and by 1% to 4% in 2041. The vast majority of the change across this screenline occurs on the two corridors passing through the A&N junction, i.e., the A414 from Maldon and Danbury and the

A130/A1114 corridor from South Essex with up to 16% and 23% increases respectively (PM 2041).

- The forecast model traffic flows on the A12, which is part of the SRN, indicate only a minimal impact of between -2% and 3% change.

In general, the forecast model results are in line with expectation in that the impacts are observed on corridors passing through the A&N junction, with minimal impacts elsewhere.

As such, it is considered that the forecast model results indicate that the model is performing sensibly and provides a suitable basis for appraisal.

8.5 Forecast Journey Times

Journey time for 14 routes (28 directional routes) have been extracted from the core scenario DM and DS models for the two forecast years of 2026 and 2041 and for each modelled time period (AM, IP and PM). These are the same routes used for the base model validation and cover routes that pass through the Army & Navy junction as well as more broadly across Chelmsford District. The locations of the routes are illustrated in the figure below followed by the journey times by year and time period. Key routes with respect to the scheme are:

- Route 1 identifies the impact on the SRN A12 around Chelmsford bypass;
- Route 5 is on Springfield Road and runs parallel to Chelmer Road, which is a key approach to the A&N junction;
- Route 8 is the key route from the A12 to the centre of Chelmsford via Essex Yeomanry Way and Parkway through the A&N junction;
- Route 9 is the key route from the east (Maldon/Danbury) to the centre of Chelmsford via the A414 and Essex Yeomanry Way through the A&N junction;
- Route 13 is the key route from the north to the A&N junction from Boreham via the A12 interchange and Chelmer Road; and
- Route 14 is a route from the southern Chelmsford to the A&N via Baddow Road.

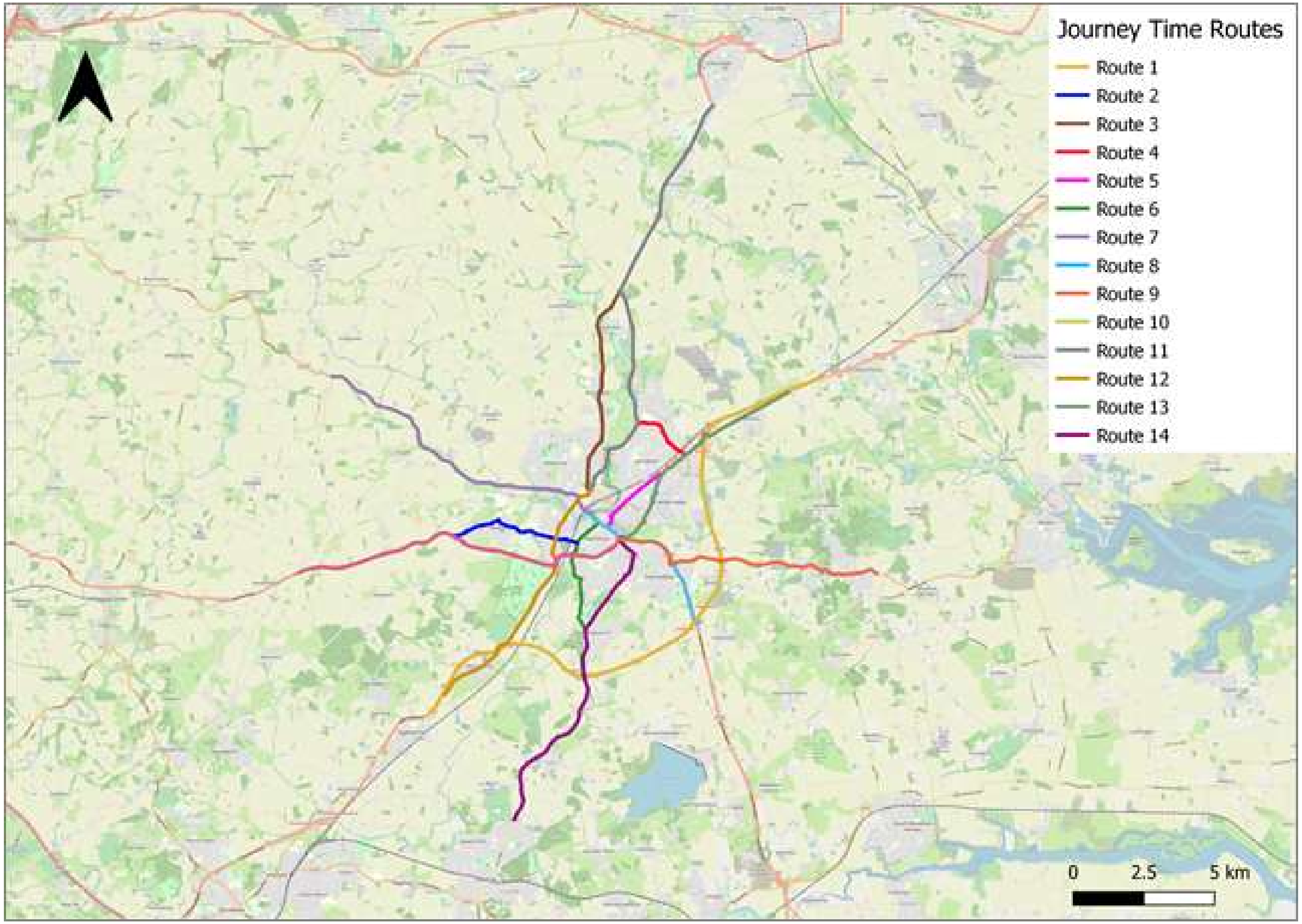


Figure 8-4: Journey Time Routes

Table 8-73: Forecast Journey Times – Core Scenario 2026 AM Peak (mm:ss)

Route	Route ID	Dir	Description	Length (km)	DM	DS	Diff.	%Diff.
1	101	WB	A12/Millfield Cottage North --> A12/Ingatestone	19.01	15:26	15:07	-00:19	-2.1%
1	102	EB	A12/Ingatestone --> A12/Millfield Cottage North	19.05	15:19	15:23	00:04	0.4%
2	201	EB	250 Ongar Road --> Writtle Road/Elm Road	3.89	14:32	14:51	00:19	2.2%
2	202	WB	Writtle Road/Elm Road --> 250 Ongar Road	3.86	09:16	10:16	01:00	10.8%
3	301	SB	A130/Braintree Road --> Parkway Roundabout	6.74	14:50	14:47	-00:03	-0.3%
3	302	NB	Parkway Roundabout --> A130/Braintree Road	6.68	13:10	13:26	00:16	2.0%
4	401	SB	A130/Nabbotts Farm Roundabout --> A130/1 White Hart Ln	1.89	02:32	02:34	00:02	1.3%
4	402	NB	A130/1 White Hart Ln --> A130/Nabbotts Farm Roundabout	1.92	03:15	03:13	-00:02	-1.0%
5	501	EB	High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.40	05:06	05:24	00:18	5.9%
5	502	WB	Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	07:37	06:53	-00:44	-9.6%
6	601	SB	Parkway/New London Rd --> Stock Rd/Beehive Lane	3.99	07:55	08:56	01:01	12.8%
6	602	NB	Stock Rd/Beehive Lane --> Parkway/New London Rd	4.00	10:31	10:31	00:00	0.0%
7	701	EB	Wooden Farm Newland Hall --> Market Roundabout	10.17	14:39	14:48	00:09	1.0%
7	702	WB	Market Roundabout --> Wooden Farm Newland Hall	10.18	12:36	12:50	00:14	1.9%
8	801	SB	Market Roundabout --> A12 J17	5.20	06:01	07:56	01:55	31.9%
8	802	NB	A12 J17 --> Market Roundabout	5.21	14:50	11:47	-03:03	-20.6%

Route	Route ID	Dir	Description	Length (km)	DM	DS	Diff.	%Diff.
9	901	EB	Van Dieman's Rd --> Maldon Rd/Cherry Garden Lane	9.21	14:01	13:29	-00:32	-3.8%
9	902	WB	Maldon Rd/Cherry Garden Lane --> Van Dieman's Rd	9.30	23:45	20:07	-03:38	-15.3%
10	1001	WB	Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	11.00	12:02	13:49	01:47	14.8%
10	1002	EB	Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	10.95	18:47	17:22	-01:25	-7.5%
11	1101	SB	A131/London Rd --> B1016/B1008	14.10	19:35	18:56	-00:39	-3.3%
11	1102	NB	B1016/B1008 --> A131/London Rd	13.99	14:16	14:27	00:11	1.3%
12	1201	SB	Rectory Ln/Meadowside --> B1002/Church Ln	8.66	14:02	14:33	00:31	3.7%
12	1202	NB	B1002/Church Ln --> Rectory Ln/Meadowside	8.67	15:18	15:24	00:06	0.7%
13	1301	WB	Main Rd/Damasses Ln --> Army and Navy Roundabout	7.71	19:59	13:30	-06:29	-32.4%
13	1302	EB	Army and Navy Roundabout --> Main Rd/Damasses Ln	7.90	11:46	11:44	-00:02	-0.3%
14	1401	SB	Army and Navy Roundabout --> Stock Rd/The Vale	7.03	12:10	13:15	01:05	8.9%
14	1402	NB	Stock Rd/The Vale --> Army and Navy Roundabout	7.10	21:38	21:25	-00:13	-1.0%

Table 8-74: Forecast Journey Times – Core Scenario 2026 Inter-Peak (mm:ss)

Route	Route ID	Dir	Description	Length (km)	DM	DS	Diff.	%Diff.
1	101	WB	A12/Millfield Cottage North --> A12/Ingatestone	19.01	11:59	12:02	00:03	0.4%
1	102	EB	A12/Ingatestone --> A12/Millfield Cottage North	19.05	12:46	12:46	00:00	0.0%
2	201	EB	250 Ongar Road --> Writtle Road/Elm Road	3.89	07:08	07:13	00:05	1.2%
2	202	WB	Writtle Road/Elm Road --> 250 Ongar Road	3.86	07:48	07:49	00:01	0.2%
3	301	SB	A130/Braintree Road --> Parkway Roundabout	6.74	11:02	10:57	-00:05	-0.8%
3	302	NB	Parkway Roundabout --> A130/Braintree Road	6.68	10:08	10:10	00:02	0.3%
4	401	SB	A130/Nabbotts Farm Roundabout --> A130/1 White Hart Ln	1.89	02:12	02:13	00:01	0.8%
4	402	NB	A130/1 White Hart Ln --> A130/Nabbotts Farm Roundabout	1.92	02:39	02:39	00:00	0.0%
5	501	EB	High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.40	05:22	05:38	00:16	5.0%
5	502	WB	Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	04:58	04:55	-00:03	-1.0%
6	601	SB	Parkway/New London Rd --> Stock Rd/Beehive Lane	3.99	07:26	07:48	00:22	4.9%
6	602	NB	Stock Rd/Beehive Lane --> Parkway/New London Rd	4.00	07:22	07:18	00:04	-0.9%
7	701	EB	Wooden Farm Newland Hall --> Market Roundabout	10.17	12:16	12:23	00:07	1.0%
7	702	WB	Market Roundabout --> Wooden Farm Newland Hall	10.18	11:06	11:09	00:03	0.5%
8	801	SB	Market Roundabout --> A12 J17	5.20	06:03	06:53	00:50	13.8%
8	802	NB	A12 J17 --> Market Roundabout	5.21	06:18	05:50	-00:28	-7.4%

Route	Route ID	Dir	Description	Length (km)	DM	DS	Diff.	%Diff.
9	901	EB	Van Dieman's Rd --> Maldon Rd/Cherry Garden Lane	9.21	13:28	11:55	-01:33	-11.5%
9	902	WB	Maldon Rd/Cherry Garden Lane --> Van Dieman's Rd	9.30	12:33	12:00	-00:33	-4.4%
10	1001	WB	Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	11.00	11:27	11:13	-00:14	-2.0%
10	1002	EB	Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	10.95	12:08	11:04	-01:04	-8.8%
11	1101	SB	A131/London Rd --> B1016/B1008	14.10	13:14	13:20	00:06	0.8%
11	1102	NB	B1016/B1008 --> A131/London Rd	13.99	13:06	13:12	00:06	0.8%
12	1201	SB	Rectory Ln/Meadowside --> B1002/Church Ln	8.66	13:48	14:01	00:13	1.6%
12	1202	NB	B1002/Church Ln --> Rectory Ln/Meadowside	8.67	13:21	12:40	-00:41	-5.1%
13	1301	WB	Main Rd/Damasses Ln --> Army and Navy Roundabout	7.71	10:20	10:30	00:10	1.6%
13	1302	EB	Army and Navy Roundabout --> Main Rd/Damasses Ln	7.90	11:35	11:35	00:00	0.0%
14	1401	SB	Army and Navy Roundabout --> Stock Rd/The Vale	7.03	09:04	08:58	-00:06	-1.1%
14	1402	NB	Stock Rd/The Vale --> Army and Navy Roundabout	7.10	10:55	10:29	-00:26	-4.0%

Table 8-75: Forecast Journey Times – Core Scenario 2026 PM Peak (mm:ss)

Route	Route ID	Dir	Description	Length (km)	DM	DS	Diff.	%Diff.
1	101	WB	A12/Millfield Cottage North --> A12/Ingatestone	19.01	12:49	12:52	00:03	0.4%
1	102	EB	A12/Ingatestone --> A12/Millfield Cottage North	19.05	14:37	14:32	-00:05	-0.6%
2	201	EB	250 Ongar Road --> Writtle Road/Elm Road	3.89	10:03	10:24	00:21	3.5%
2	202	WB	Writtle Road/Elm Road --> 250 Ongar Road	3.86	09:07	11:17	02:10	23.8%
3	301	SB	A130/Braintree Road --> Parkway Roundabout	6.74	12:12	12:06	-00:06	-0.8%
3	302	NB	Parkway Roundabout --> A130/Braintree Road	6.68	14:00	14:29	00:29	3.5%
4	401	SB	A130/Nabbotts Farm Roundabout --> A130/1 White Hart Ln	1.89	02:23	02:24	00:01	0.7%
4	402	NB	A130/1 White Hart Ln --> A130/Nabbotts Farm Roundabout	1.92	02:54	02:51	-00:03	-1.7%
5	501	EB	High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.40	06:59	07:35	00:36	8.6%
5	502	WB	Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	13:53	11:33	-02:20	-16.8%
6	601	SB	Parkway/New London Rd --> Stock Rd/Beehive Lane	3.99	10:13	11:54	01:41	16.5%
6	602	NB	Stock Rd/Beehive Lane --> Parkway/New London Rd	4.00	08:43	08:13	-00:30	-5.7%
7	701	EB	Wooden Farm Newland Hall --> Market Roundabout	10.17	14:39	15:29	00:50	5.7%
7	702	WB	Market Roundabout --> Wooden Farm Newland Hall	10.18	11:49	11:56	00:07	1.0%
8	801	SB	Market Roundabout --> A12 J17	5.20	10:42	10:48	00:06	0.9%
8	802	NB	A12 J17 --> Market Roundabout	5.21	12:07	08:20	-03:47	-31.2%

Route	Route ID	Dir	Description	Length (km)	DM	DS	Diff.	%Diff.
9	901	EB	Van Dieman's Rd --> Maldon Rd/Cherry Garden Lane	9.21	15:57	15:13	-00:44	-4.6%
9	902	WB	Maldon Rd/Cherry Garden Lane --> Van Dieman's Rd	9.30	19:14	12:39	-06:35	-34.2%
10	1001	WB	Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	11.00	13:28	11:06	-02:22	-17.6%
10	1002	EB	Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	10.95	20:28	12:50	-07:38	-37.3%
11	1101	SB	A131/London Rd --> B1016/B1008	14.10	15:18	15:26	00:08	0.9%
11	1102	NB	B1016/B1008 --> A131/London Rd	13.99	19:45	20:15	00:30	2.5%
12	1201	SB	Rectory Ln/Meadowside --> B1002/Church Ln	8.66	18:21	19:31	01:10	6.4%
12	1202	NB	B1002/Church Ln --> Rectory Ln/Meadowside	8.67	16:25	15:50	-00:35	-3.6%
13	1301	WB	Main Rd/Damasses Ln --> Army and Navy Roundabout	7.71	12:54	14:03	01:09	8.9%
13	1302	EB	Army and Navy Roundabout --> Main Rd/Damasses Ln	7.90	12:48	13:15	00:27	3.5%
14	1401	SB	Army and Navy Roundabout --> Stock Rd/The Vale	7.03	10:23	10:20	-00:03	-0.5%
14	1402	NB	Stock Rd/The Vale --> Army and Navy Roundabout	7.10	17:15	11:37	-05:38	-32.7%

Table 8-76: Forecast Journey Times – Core Scenario 2041 AM Peak (mm:ss)

Route	Route ID	Dir	Description	Length (km)	DM	DS	Diff.	%Diff.
1	101	WB	A12/Millfield Cottage North --> A12/Ingatestone	19.01	16:55	16:32	-00:23	-2.3%
1	102	EB	A12/Ingatestone --> A12/Millfield Cottage North	19.05	16:27	16:36	00:09	0.9%
2	201	EB	250 Ongar Road --> Writtle Road/Elm Road	3.89	18:31	17:44	-00:47	-4.2%
2	202	WB	Writtle Road/Elm Road --> 250 Ongar Road	3.86	09:55	10:21	00:26	4.4%
3	301	SB	A130/Braintree Road --> Parkway Roundabout	6.74	18:54	18:02	-00:52	-4.6%
3	302	NB	Parkway Roundabout --> A130/Braintree Road	6.68	14:17	14:41	00:24	2.8%
4	401	SB	A130/Nabbotts Farm Roundabout --> A130/1 White Hart Ln	1.89	02:40	02:40	00:00	0.0%
4	402	NB	A130/1 White Hart Ln --> A130/Nabbotts Farm Roundabout	1.92	03:34	03:16	-00:18	-8.4%
5	501	EB	High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.40	05:22	05:41	00:19	5.9%
5	502	WB	Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	08:48	07:15	-01:33	-17.6%
6	601	SB	Parkway/New London Rd --> Stock Rd/Beehive Lane	3.99	09:07	10:43	01:36	17.6%
6	602	NB	Stock Rd/Beehive Lane --> Parkway/New London Rd	4.00	10:22	10:32	00:10	1.6%
7	701	EB	Wooden Farm Newland Hall --> Market Roundabout	10.16	16:29	16:25	-00:04	-0.4%
7	702	WB	Market Roundabout --> Wooden Farm Newland Hall	10.18	14:24	15:22	00:58	6.7%
8	801	SB	Market Roundabout --> A12 J17	5.21	08:04	13:04	05:00	62.0%
8	802	NB	A12 J17 --> Market Roundabout	5.19	15:56	12:19	-03:37	-22.7%

Route	Route ID	Dir	Description	Length (km)	DM	DS	Diff.	%Diff.
9	901	EB	Van Dieman's Rd --> Maldon Rd/Cherry Garden Lane	9.21	14:37	14:05	-00:32	-3.6%
9	902	WB	Maldon Rd/Cherry Garden Lane --> Van Dieman's Rd	9.42	27:50	24:09	-03:41	-13.2%
10	1001	WB	Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	10.97	13:38	14:18	00:40	4.9%
10	1002	EB	Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	10.82	24:28	21:04	-03:24	-13.9%
11	1101	SB	A131/London Rd --> B1016/B1008	14.10	24:50	23:37	-01:13	-4.9%
11	1102	NB	B1016/B1008 --> A131/London Rd	13.99	15:54	16:06	00:12	1.3%
12	1201	SB	Rectory Ln/Meadowside --> B1002/Church Ln	8.66	15:48	16:44	00:56	5.9%
12	1202	NB	B1002/Church Ln --> Rectory Ln/Meadowside	8.67	16:53	17:08	00:15	1.5%
13	1301	WB	Main Rd/Damasses Ln --> Army and Navy Roundabout	7.71	21:07	18:33	-02:34	-12.2%
13	1302	EB	Army and Navy Roundabout --> Main Rd/Damasses Ln	7.90	12:17	12:15	-00:02	-0.3%
14	1401	SB	Army and Navy Roundabout --> Stock Rd/The Vale	7.03	13:50	13:51	00:01	0.1%
14	1402	NB	Stock Rd/The Vale --> Army and Navy Roundabout	7.13	26:16	22:40	-03:36	-13.7%

Table 8-77: Forecast Journey Times – Core Scenario 2041 Inter-Peak (mm:ss)

Route	Route ID	Dir	Description	Length (km)	DM	DS	Diff.	%Diff.
1	101	WB	A12/Millfield Cottage North --> A12/Ingatestone	19.01	13:04	13:05	00:01	0.1%
1	102	EB	A12/Ingatestone --> A12/Millfield Cottage North	19.05	13:40	13:39	-00:01	-0.1%
2	201	EB	250 Ongar Road --> Writtle Road/Elm Road	3.89	07:18	07:16	-00:02	-0.5%
2	202	WB	Writtle Road/Elm Road --> 250 Ongar Road	3.86	08:00	07:57	-00:03	-0.6%
3	301	SB	A130/Braintree Road --> Parkway Roundabout	6.74	11:28	11:27	-00:01	-0.1%
3	302	NB	Parkway Roundabout --> A130/Braintree Road	6.68	10:37	10:41	00:04	0.6%
4	401	SB	A130/Nabbotts Farm Roundabout --> A130/1 White Hart Ln	1.89	02:22	02:23	00:01	0.7%
4	402	NB	A130/1 White Hart Ln --> A130/Nabbotts Farm Roundabout	1.92	02:44	02:42	-00:02	-1.2%
5	501	EB	High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.40	05:29	05:56	00:27	8.2%
5	502	WB	Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	05:10	05:08	-00:02	-0.6%
6	601	SB	Parkway/New London Rd --> Stock Rd/Beehive Lane	3.99	07:41	08:07	00:26	5.6%
6	602	NB	Stock Rd/Beehive Lane --> Parkway/New London Rd	4.00	07:31	07:30	-00:01	-0.2%
7	701	EB	Wooden Farm Newland Hall --> Market Roundabout	10.16	12:43	12:59	00:16	2.1%
7	702	WB	Market Roundabout --> Wooden Farm Newland Hall	10.18	11:34	11:37	00:03	0.4%
8	801	SB	Market Roundabout --> A12 J17	5.21	07:05	08:26	01:21	19.1%
8	802	NB	A12 J17 --> Market Roundabout	5.19	06:17	05:45	-00:32	-8.5%

Route	Route ID	Dir	Description	Length (km)	DM	DS	Diff.	%Diff.
9	901	EB	Van Dieman's Rd --> Maldon Rd/Cherry Garden Lane	9.21	14:03	13:02	-01:01	-7.2%
9	902	WB	Maldon Rd/Cherry Garden Lane --> Van Dieman's Rd	9.42	13:06	12:33	-00:33	-4.2%
10	1001	WB	Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	10.97	11:55	11:42	-00:13	-1.8%
10	1002	EB	Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	10.82	13:35	11:15	-02:20	-17.2%
11	1101	SB	A131/London Rd --> B1016/B1008	14.10	14:31	14:35	00:04	0.5%
11	1102	NB	B1016/B1008 --> A131/London Rd	13.99	14:20	14:25	00:05	0.6%
12	1201	SB	Rectory Ln/Meadowside --> B1002/Church Ln	8.66	14:44	14:44	00:00	0.0%
12	1202	NB	B1002/Church Ln --> Rectory Ln/Meadowside	8.67	15:12	12:59	-02:13	-14.6%
13	1301	WB	Main Rd/Damasses Ln --> Army and Navy Roundabout	7.71	11:06	11:16	00:10	1.5%
13	1302	EB	Army and Navy Roundabout --> Main Rd/Damasses Ln	7.90	12:02	12:08	00:06	0.8%
14	1401	SB	Army and Navy Roundabout --> Stock Rd/The Vale	7.03	09:22	09:18	-00:04	-0.7%
14	1402	NB	Stock Rd/The Vale --> Army and Navy Roundabout	7.13	11:28	11:05	-00:23	-3.3%

Table 8-78: Forecast Journey Times – Core Scenario 2041 PM Peak (mm:ss)

Route	Route ID	Dir	Description	Length (km)	DM	DS	Diff.	%Diff.
1	101	WB	A12/Millfield Cottage North --> A12/Ingatestone	19.01	14:35	14:36	00:01	0.1%
1	102	EB	A12/Ingatestone --> A12/Millfield Cottage North	19.05	15:55	15:47	-00:08	-0.8%
2	201	EB	250 Ongar Road --> Writtle Road/Elm Road	3.89	13:29	13:07	-00:22	-2.7%
2	202	WB	Writtle Road/Elm Road --> 250 Ongar Road	3.86	09:48	12:23	02:35	26.4%
3	301	SB	A130/Braintree Road --> Parkway Roundabout	6.74	13:11	13:01	-00:10	-1.3%
3	302	NB	Parkway Roundabout --> A130/Braintree Road	6.68	17:13	17:23	00:10	1.0%
4	401	SB	A130/Nabbotts Farm Roundabout --> A130/1 White Hart Ln	1.89	02:34	02:32	-00:02	-1.3%
4	402	NB	A130/1 White Hart Ln --> A130/Nabbotts Farm Roundabout	1.92	03:03	03:24	00:21	11.5%
5	501	EB	High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.40	07:14	08:30	01:16	17.5%
5	502	WB	Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	15:19	13:20	-01:59	-12.9%
6	601	SB	Parkway/New London Rd --> Stock Rd/Beehive Lane	3.99	11:11	13:13	02:02	18.2%
6	602	NB	Stock Rd/Beehive Lane --> Parkway/New London Rd	4.00	10:26	10:03	-00:23	-3.7%
7	701	EB	Wooden Farm Newland Hall --> Market Roundabout	10.16	18:19	17:50	-00:29	-2.6%
7	702	WB	Market Roundabout --> Wooden Farm Newland Hall	10.18	12:11	12:31	00:20	2.7%
8	801	SB	Market Roundabout --> A12 J17	5.21	13:00	12:18	-00:42	-5.4%
8	802	NB	A12 J17 --> Market Roundabout	5.19	14:11	09:41	-04:30	-31.7%

Route	Route ID	Dir	Description	Length (km)	DM	DS	Diff.	%Diff.
9	901	EB	Van Dieman's Rd --> Maldon Rd/Cherry Garden Lane	9.21	16:29	16:04	-00:25	-2.5%
9	902	WB	Maldon Rd/Cherry Garden Lane --> Van Dieman's Rd	9.42	19:53	13:40	-06:13	-31.3%
10	1001	WB	Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	10.97	13:40	11:22	-02:18	-16.8%
10	1002	EB	Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	10.82	21:17	13:16	-08:01	-37.7%
11	1101	SB	A131/London Rd --> B1016/B1008	14.10	19:18	20:10	00:52	4.5%
11	1102	NB	B1016/B1008 --> A131/London Rd	13.99	22:05	22:28	00:23	1.7%
12	1201	SB	Rectory Ln/Meadowside --> B1002/Church Ln	8.66	20:34	21:46	01:12	5.8%
12	1202	NB	B1002/Church Ln --> Rectory Ln/Meadowside	8.67	18:39	16:20	-02:19	-12.4%
13	1301	WB	Main Rd/Damasses Ln --> Army and Navy Roundabout	7.71	16:14	17:07	00:53	5.4%
13	1302	EB	Army and Navy Roundabout --> Main Rd/Damasses Ln	7.90	14:31	16:10	01:39	11.4%
14	1401	SB	Army and Navy Roundabout --> Stock Rd/The Vale	7.03	11:00	11:00	00:00	0.0%
14	1402	NB	Stock Rd/The Vale --> Army and Navy Roundabout	7.13	19:45	12:30	-07:15	-36.7%

The following key points can be observed from the data in the tables above:

- Route 8 (802) is the key route into the centre of Chelmsford from South Essex, which travels along Essex Yeomanry Way and Parkway via the A&N junction. Journey times improve on this route inbound in the AM peak by 03min03sec in 2026 and 03min37sec in 2041 and in the PM peak by 03min47sec in 2026 and 04min30sec in 2041.
- For Route 8 (801) in the outbound direction, journey times are similar in the 2026 PM peak and improve in the 2041 PM peak (by 42 seconds). However, journey times are higher in the AM off-peak direction by about 2 minutes in 2026 and by about 5 minutes in 2041. Most of this extra delay is due additional pressure on the A1114 interchange with the A12 at Howe Green, which is the next junction along the route from the A&N and is caused by higher traffic flows travelling through the A&N junction. These results therefore highlight this location for potential improvement measures in the future and indicates that benefits are being reduced by the constraint at this roundabout.
- Route 9 (902) is a key route into the centre of Chelmsford from the A414 to East Essex (Maldon/Danbury) via Essex Yeomanry Way and the A&N. Results are similar to route 802 with improved journey times in the AM and PM peak periods of just over 3.5 minutes in the AM peak and about 6 minutes in the PM peak.
- Route 9 (901) outbound from Chelmsford city centre has improved journey times of between 25 and 44 seconds depending on the year and peak hour period. This demonstrates that travel through the A&N junction outbound improves since this route does not pass via Howe Green, where the outbound congestion is located on Route 801.
- Route 13 (1301) is one of the routes into central Chelmsford from the north (routes 5 and 9 are competing routes), which travel via the Chelmer Road approach to the A&N junction. Inbound journey times towards Chelmsford improve significantly on this route in AM peak hour (by 6min29sec in 2026 and 2min34sec in 2041) but are slower in the PM peak by about 1 minute.
- Route 13 (1302) outbound has similar or slower speeds by up to about 1min39sec in 2041 PM peak. Similar to route 801, this is due to the congestion create at downstream junctions from additional

traffic using the A&N junction to Chelmer Road and as such, warrants further investigation in the future.

- Route 5 (502) inbound runs parallel to Chelmer Road (Route 1301) and has lower journey times by between 44 seconds and 2min20sec as traffic has diverted to Chelmer Road. Journey times are slightly slower in the outbound direction.
- Route 14 (1402) inbound, which travels from southern Chelmsford to the city centre via Baddow Road through the A&N junction has significantly lower journey times of up to 7min15sec in the PM peak as congestion is reduced on Baddow Road. There is minimal change outbound.
- Route 1 covers the A12, which is part of the SRN, with results indicating only a minor impact of between a 23 second reduction and a 9 second increase in journey times.

Overall, it can be said that journey times are improved for route passing through the A&N junction, although the improvement also attracts additional traffic that is modelled to have impacts reduce these benefits during certain time periods.

The results appear in line with expectation indicating that the model is providing sensible results as the basis for scheme appraisal.

8.6 Forecast Travel Patterns Through Army & Navy Junction

An analysis of the travel patterns through the A&N junction has been undertaken for the 2041 forecast year models by AM and PM peak time period. The results are illustrated in the following figures.

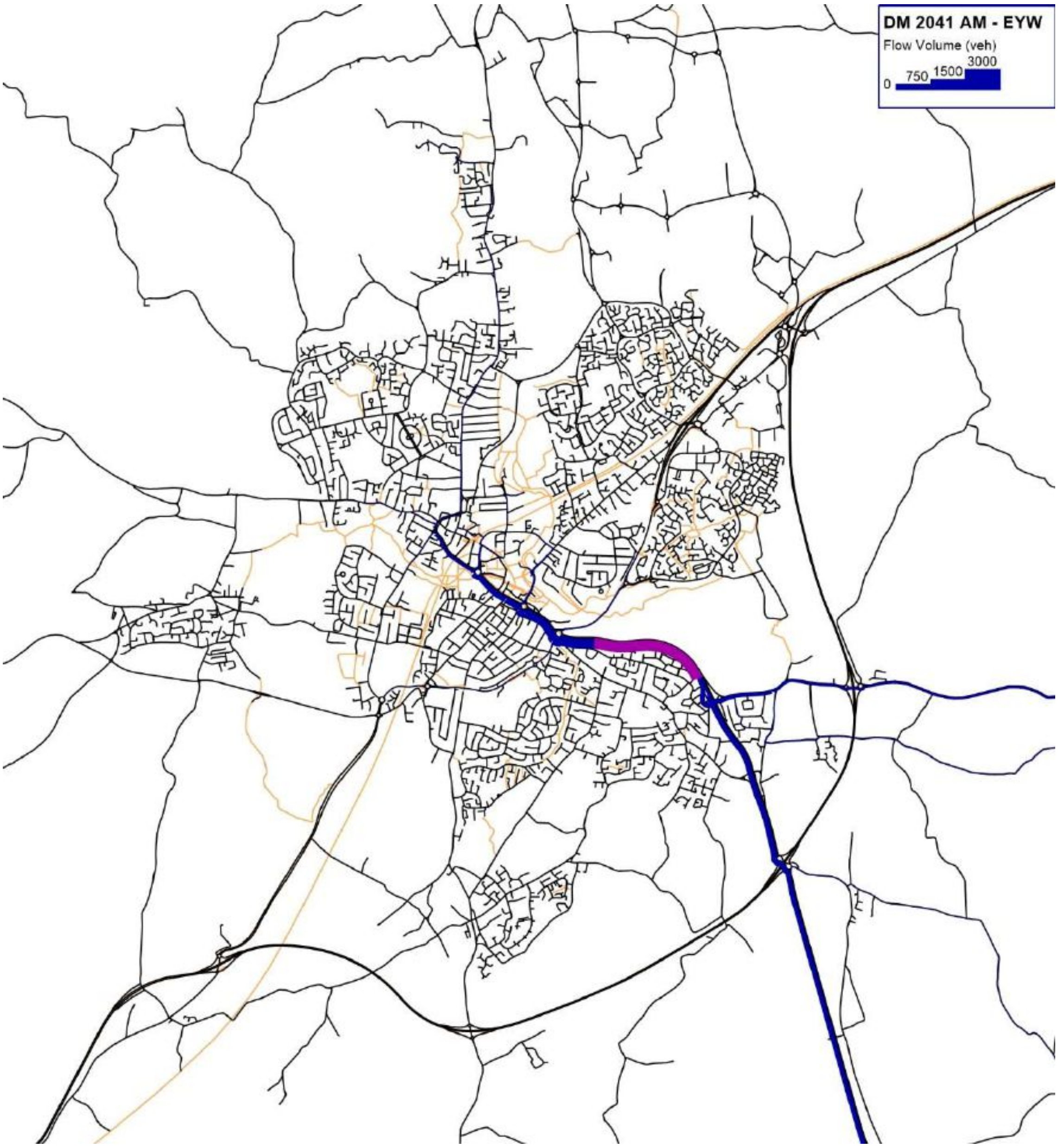


Figure 8-5: Select Link Analysis - Essex Yeomanry Way inbound, DM 2041 AM peak

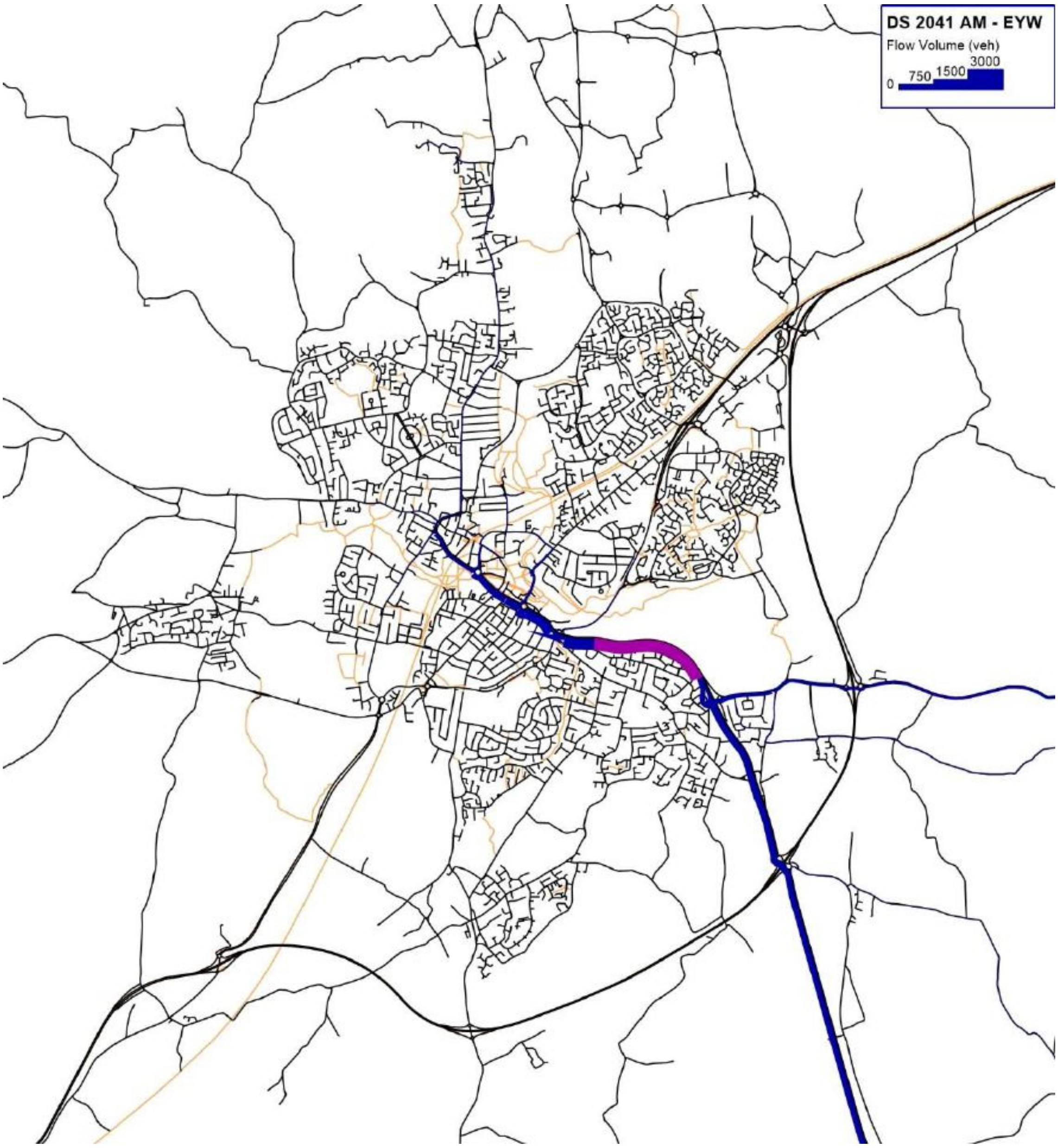


Figure 8-6: Select Link Analysis - Essex Yeomanry Way inbound, DS 2041 AM peak

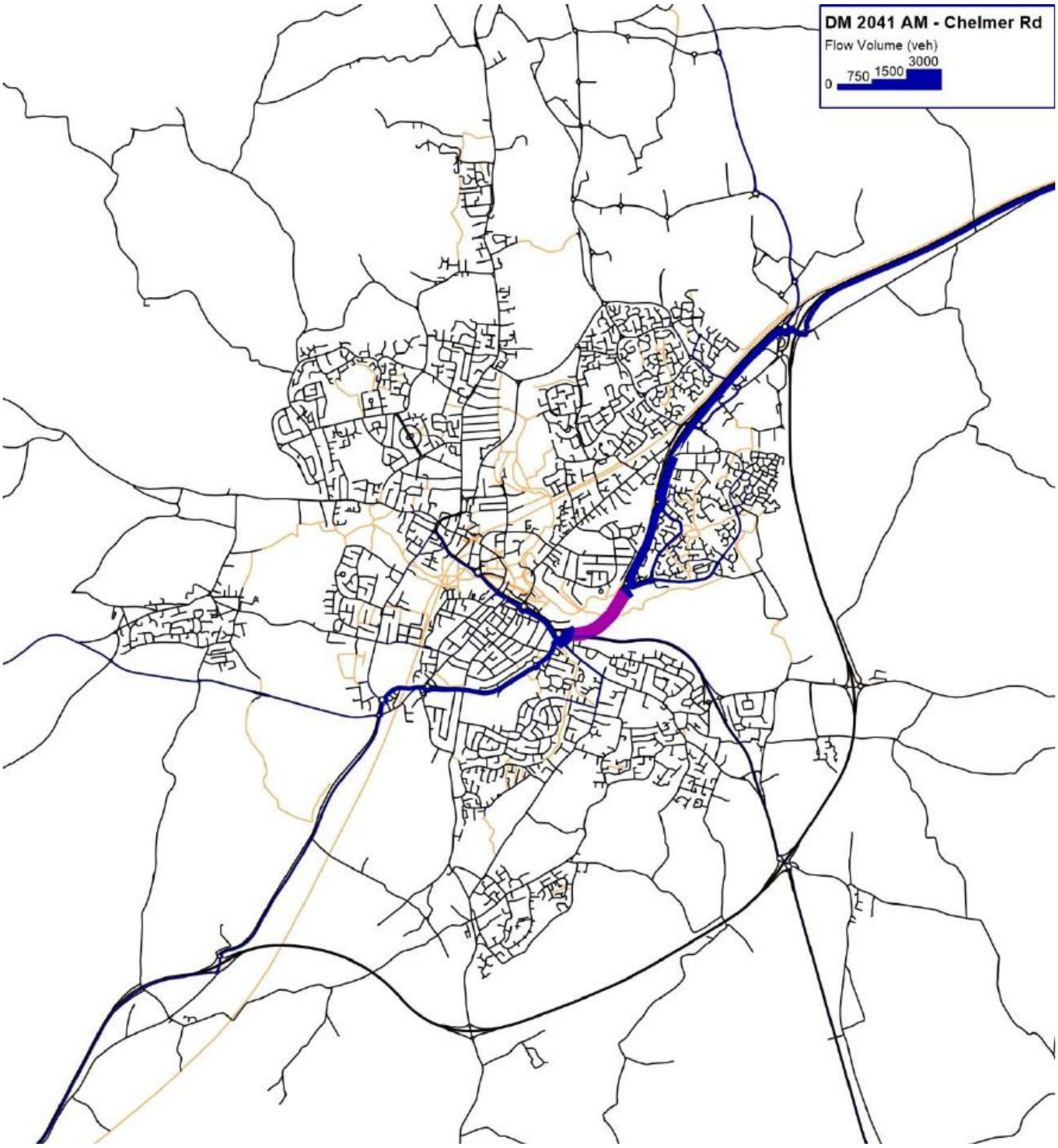


Figure 8-7: Select Link Analysis - Chelmer Road inbound, DM 2041 AM peak

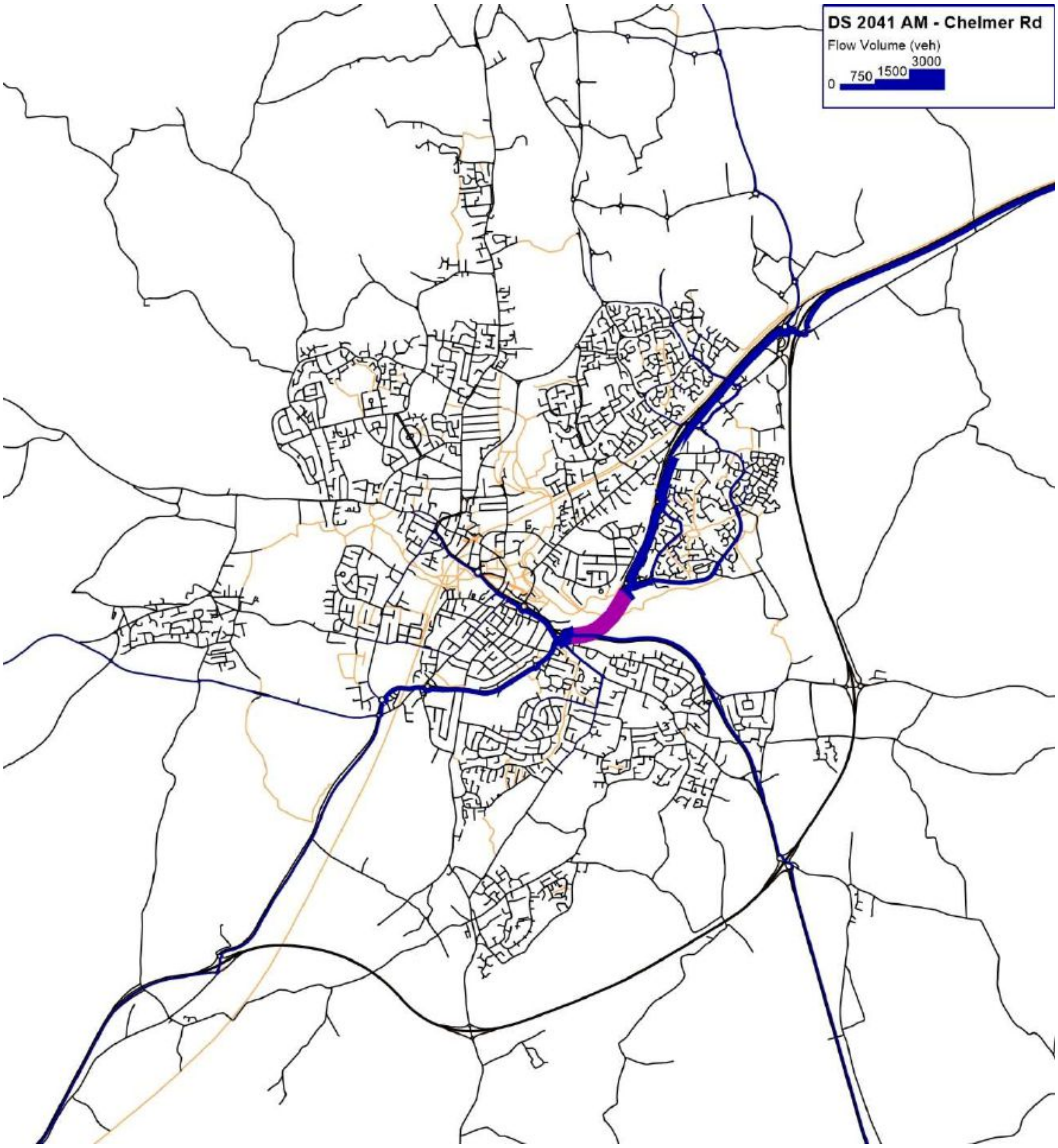


Figure 8-8: Select Link Analysis – Chelmer Road inbound, DS 2041 AM peak

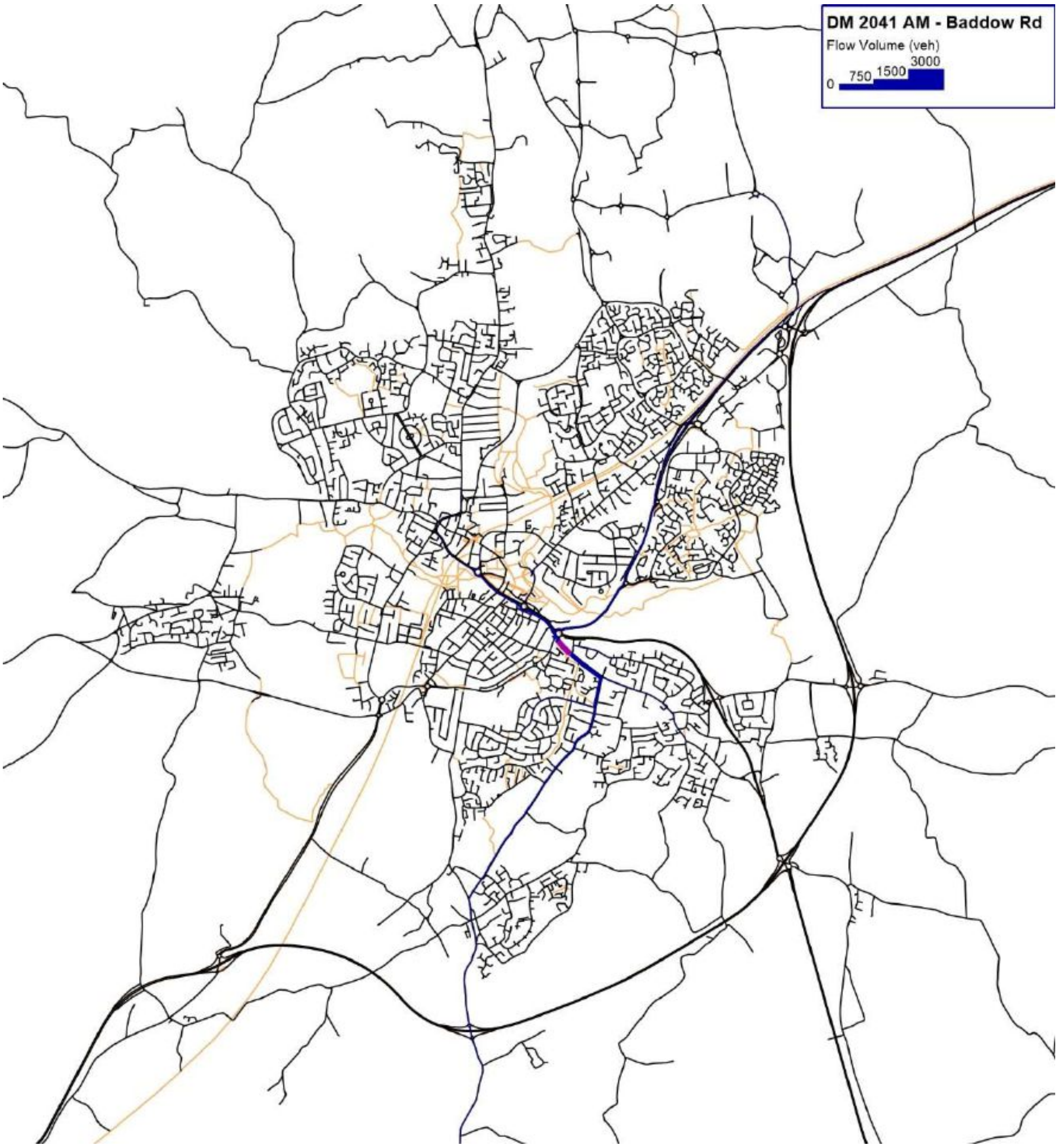


Figure 8-9: Select Link Analysis – Baddow Road inbound, DM 2041 AM peak

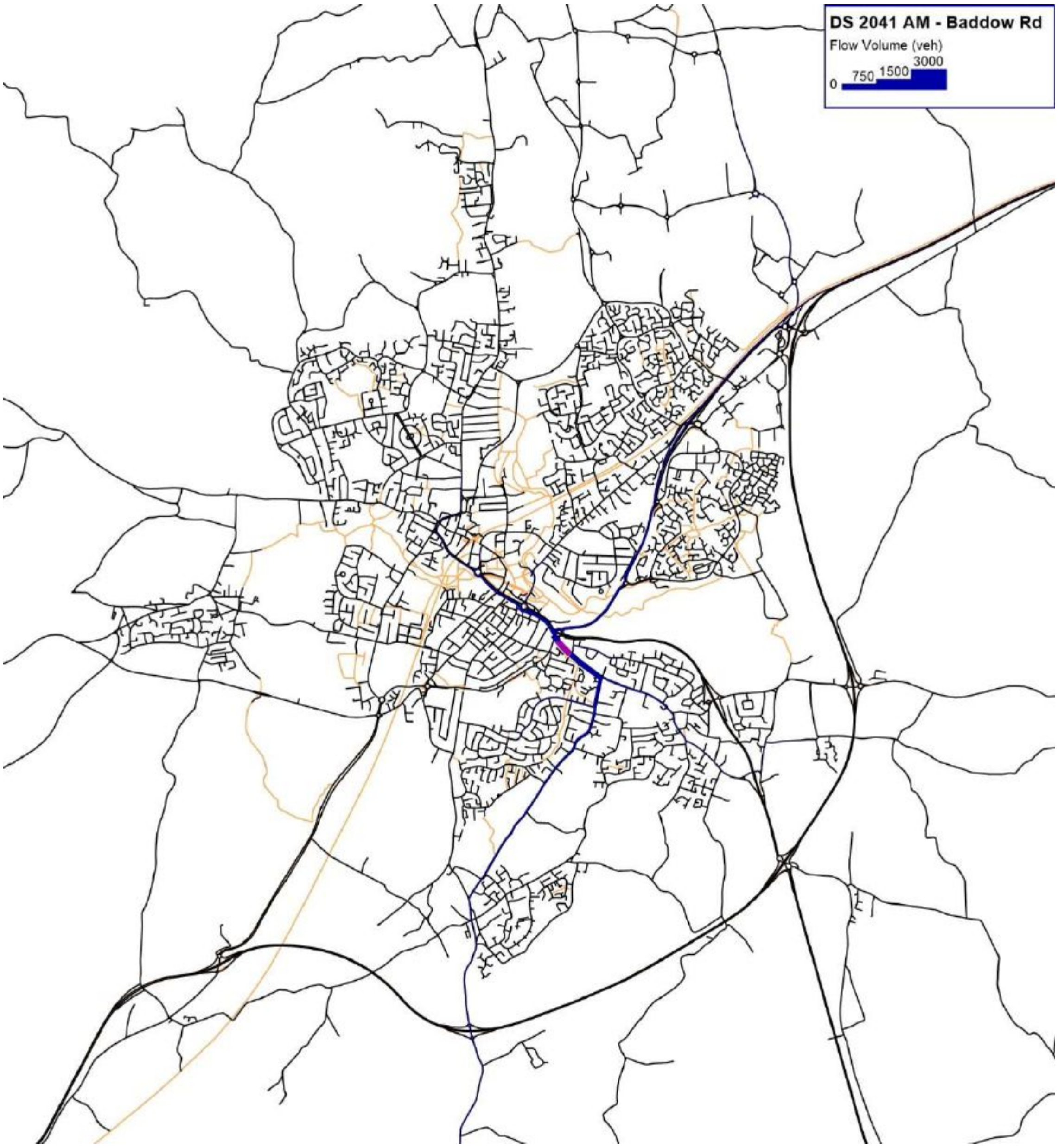


Figure 8-10: Select Link Analysis – Baddow Road inbound, DS 2041 AM peak

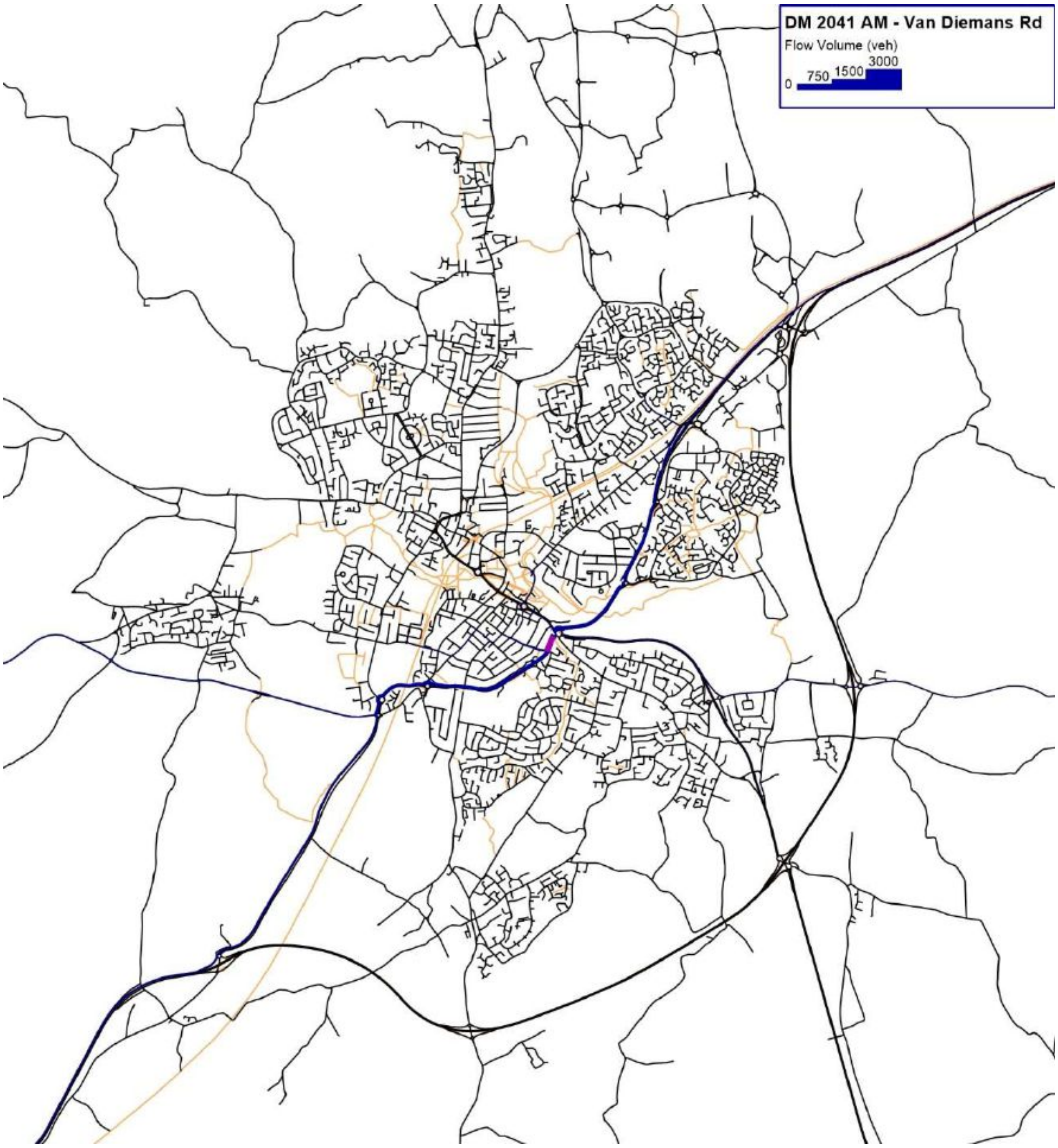


Figure 8-11: Select Link Analysis – Van Diemans Road inbound, DM 2041 AM peak

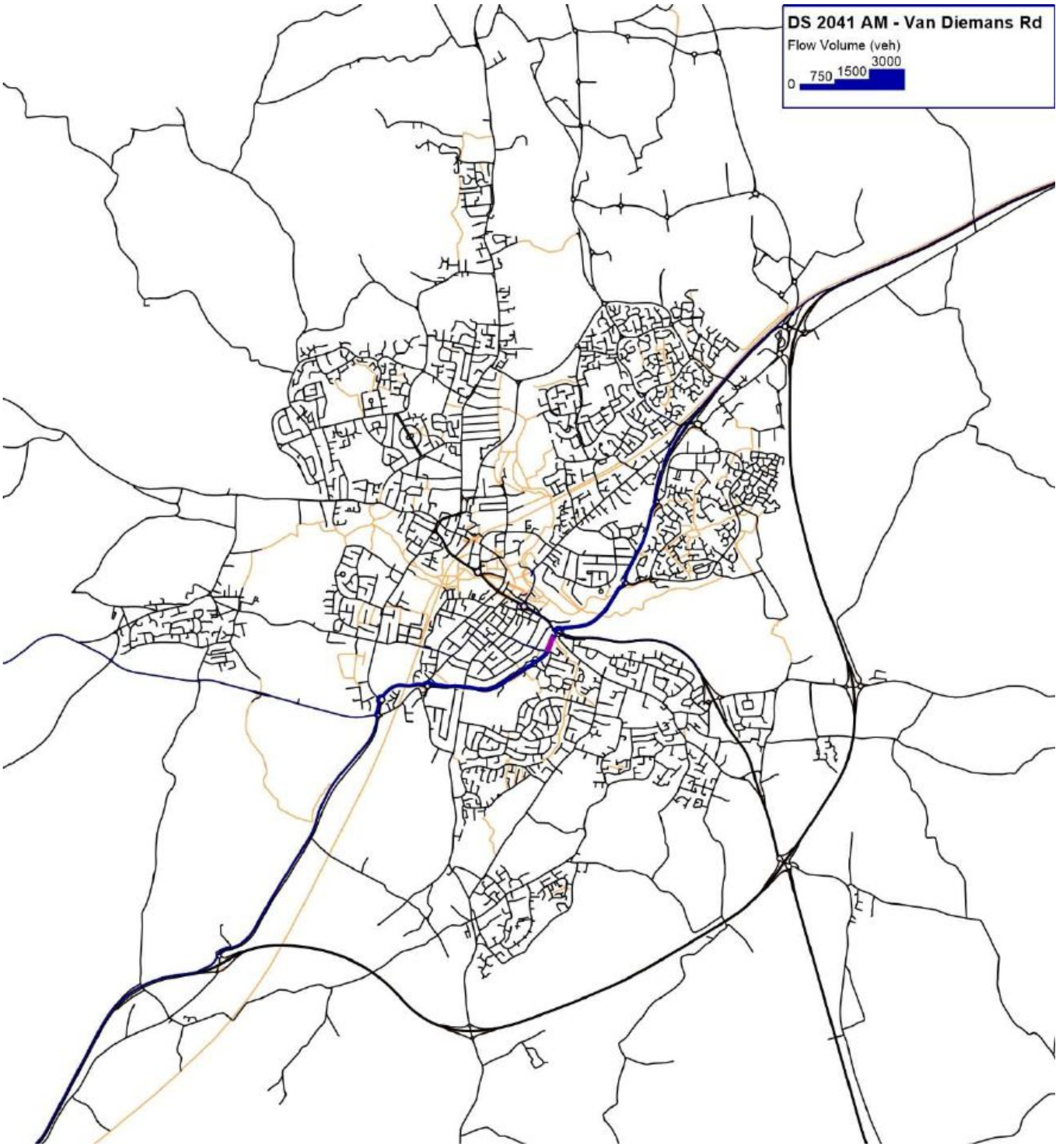


Figure 8-12: Select Link Analysis – Van Diemans Road inbound, DS 2041 AM peak

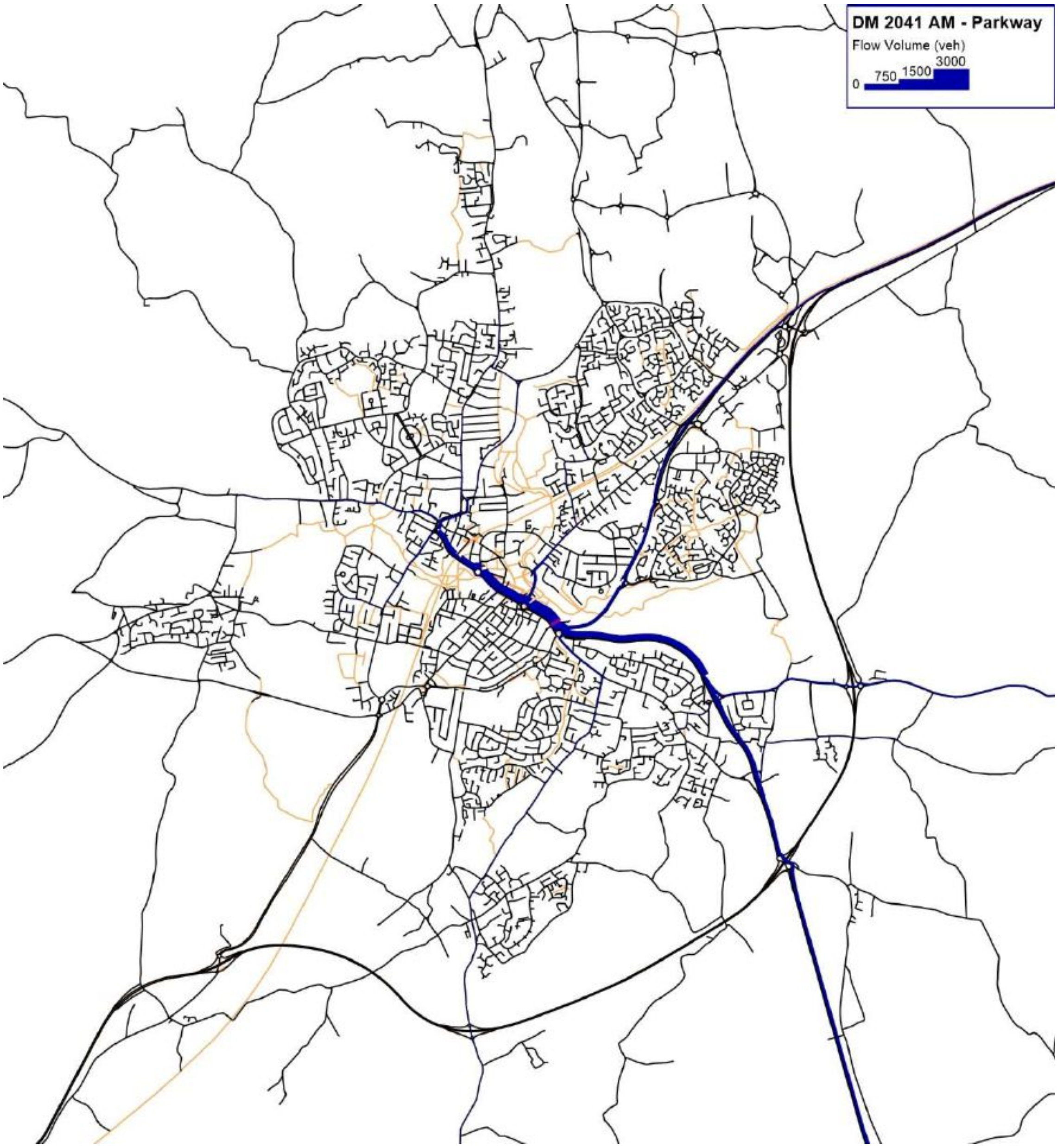


Figure 8-13: Select Link Analysis – Parkway outbound, DM 2041 AM peak

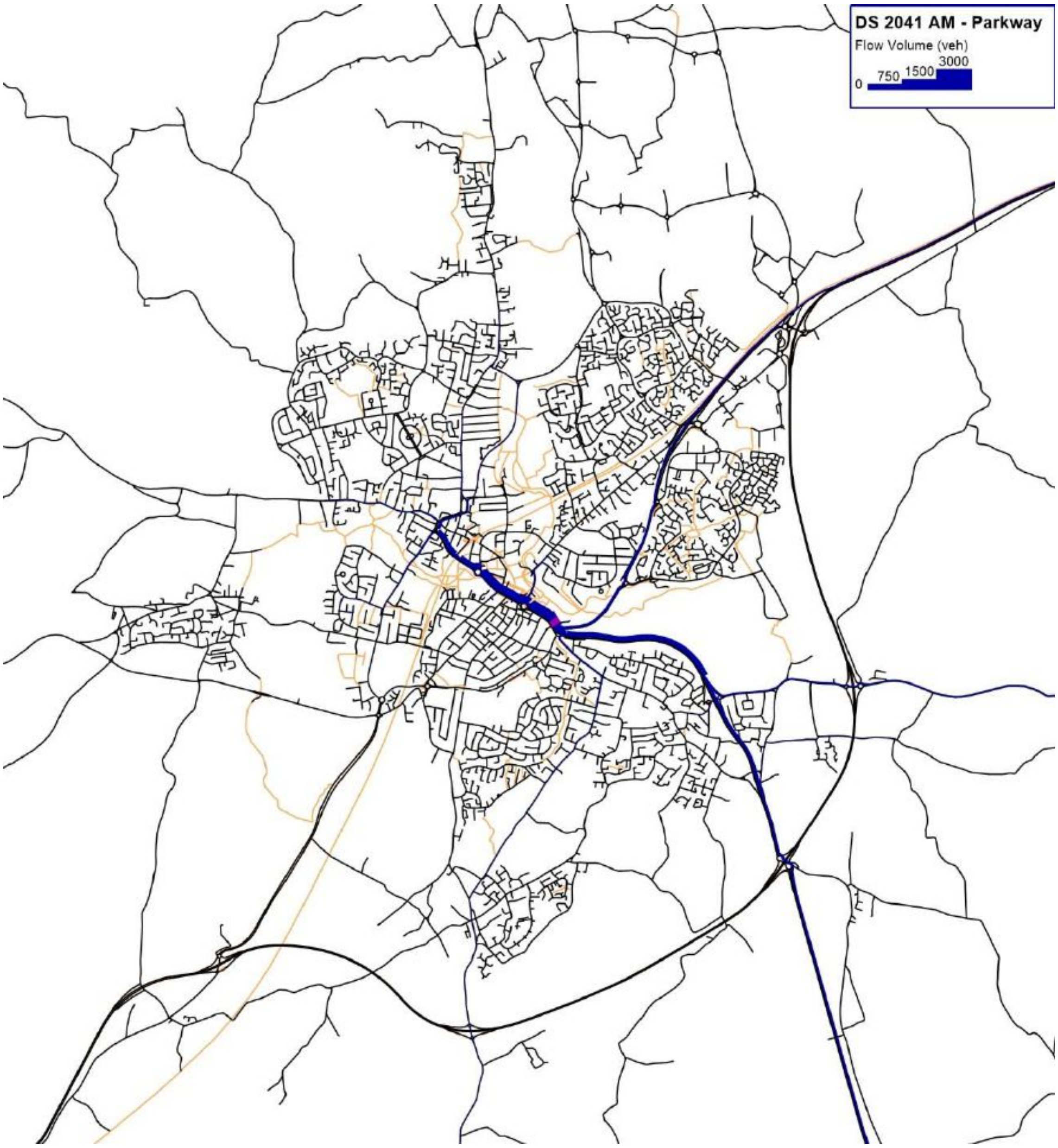


Figure 8-14: Select Link Analysis – Parkway outbound, DM 2041 AM peak

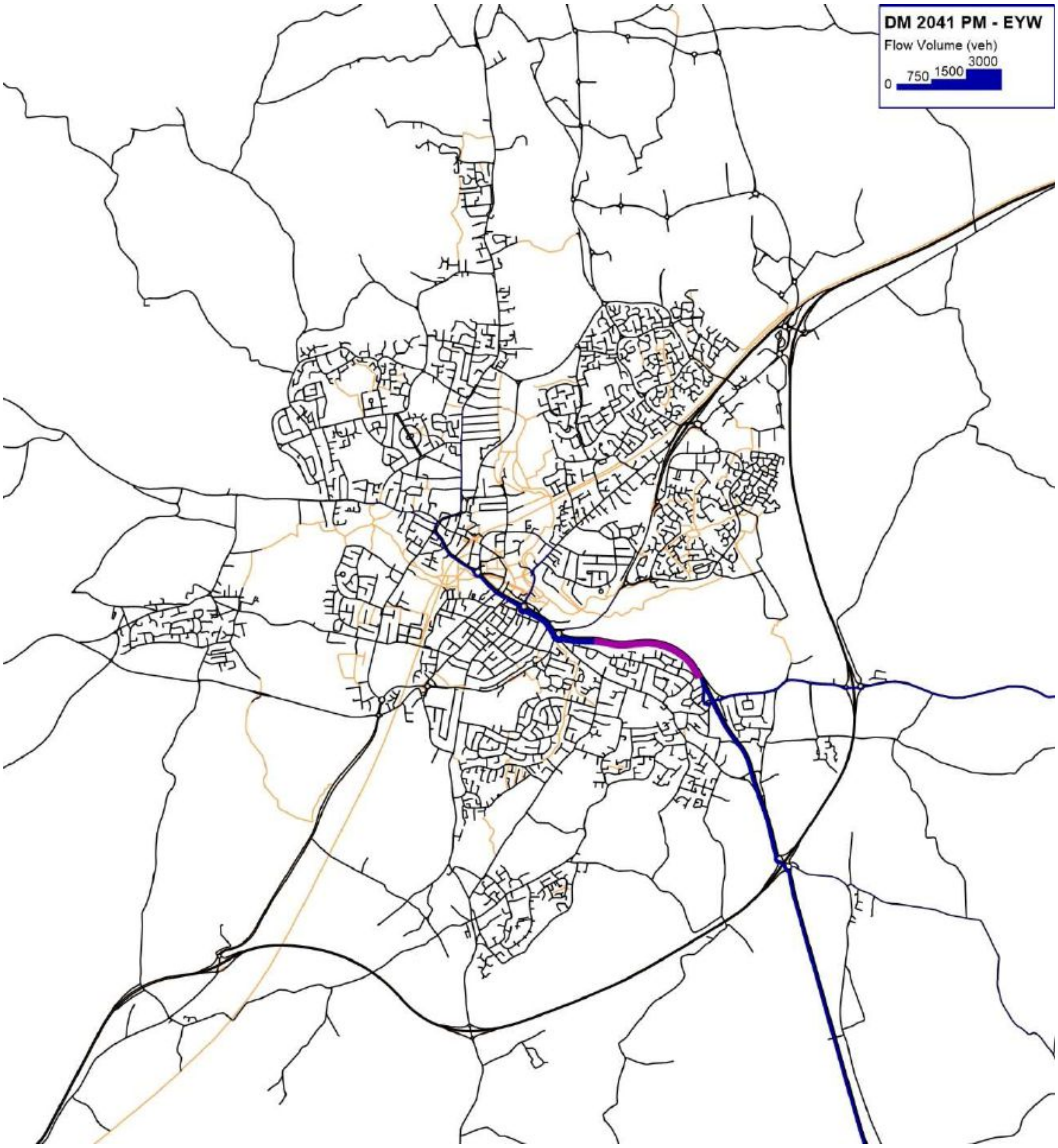


Figure 8-15: Select Link Analysis – Essex Yeomanry Way inbound, DM 2041 PM peak

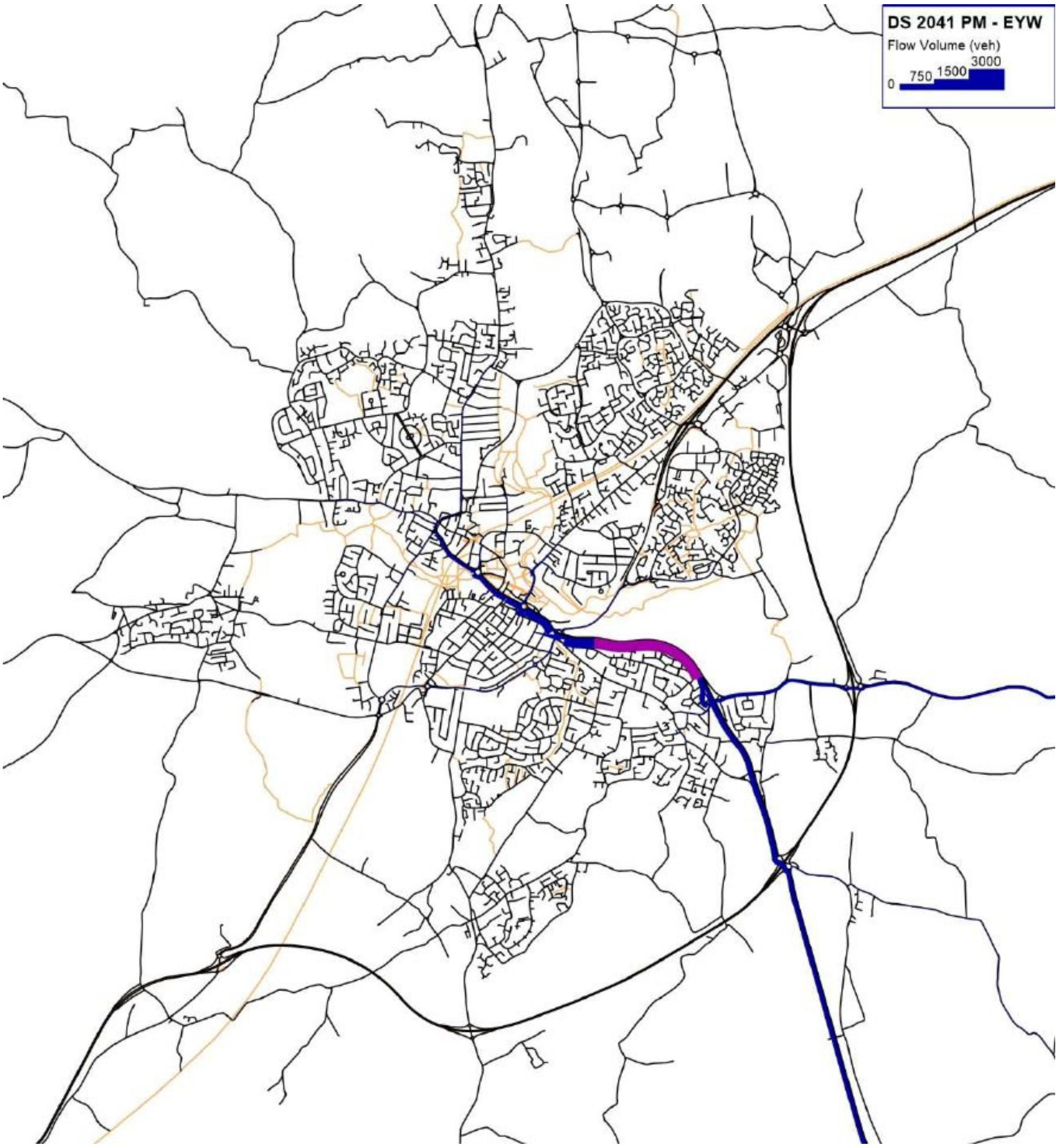


Figure 8-16: Select Link Analysis – Essex Yeomanry Way inbound, DS 2041 PM peak

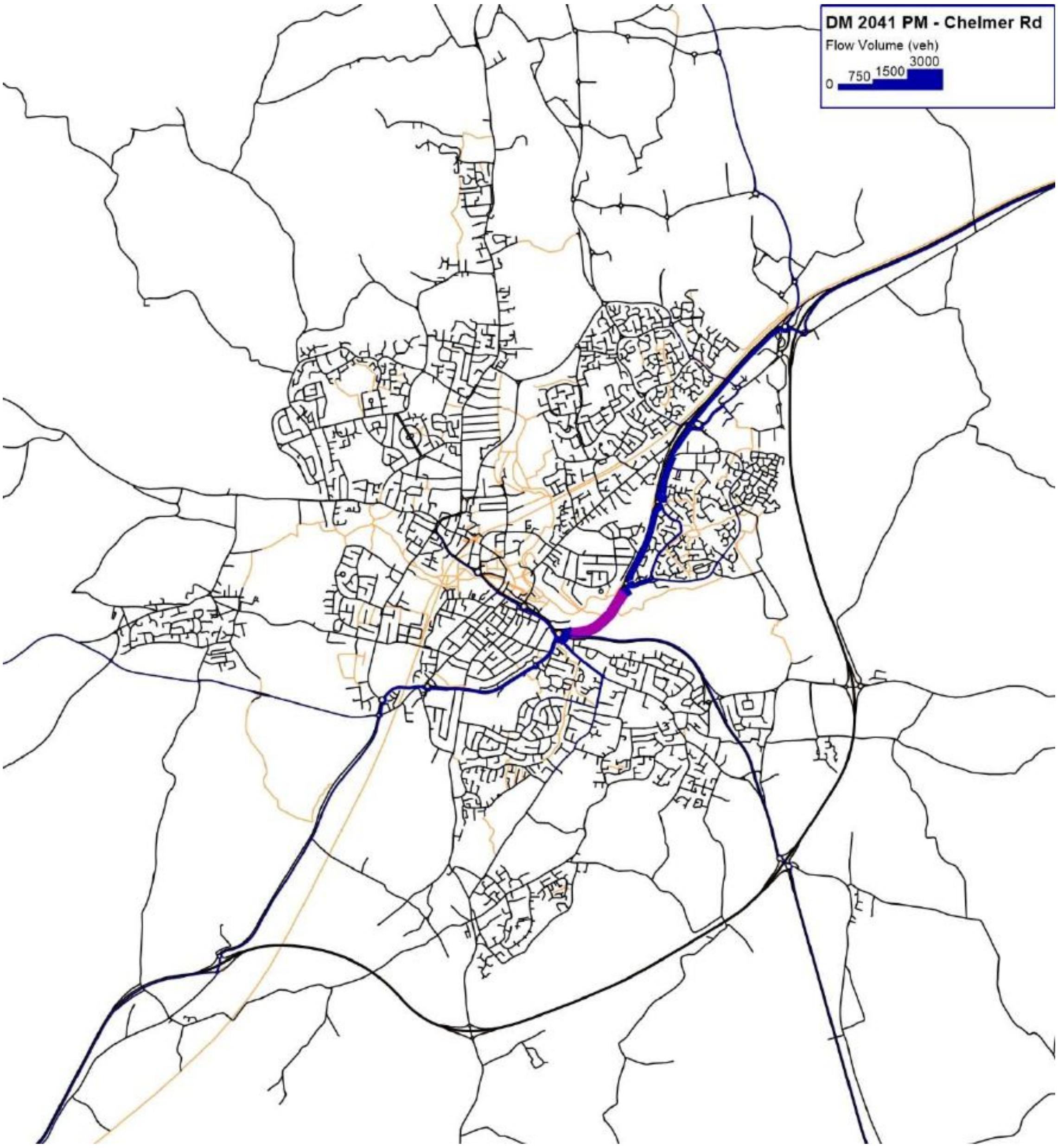


Figure 8-17: Select Link Analysis – Chelmer Road inbound, DM 2041 PM peak

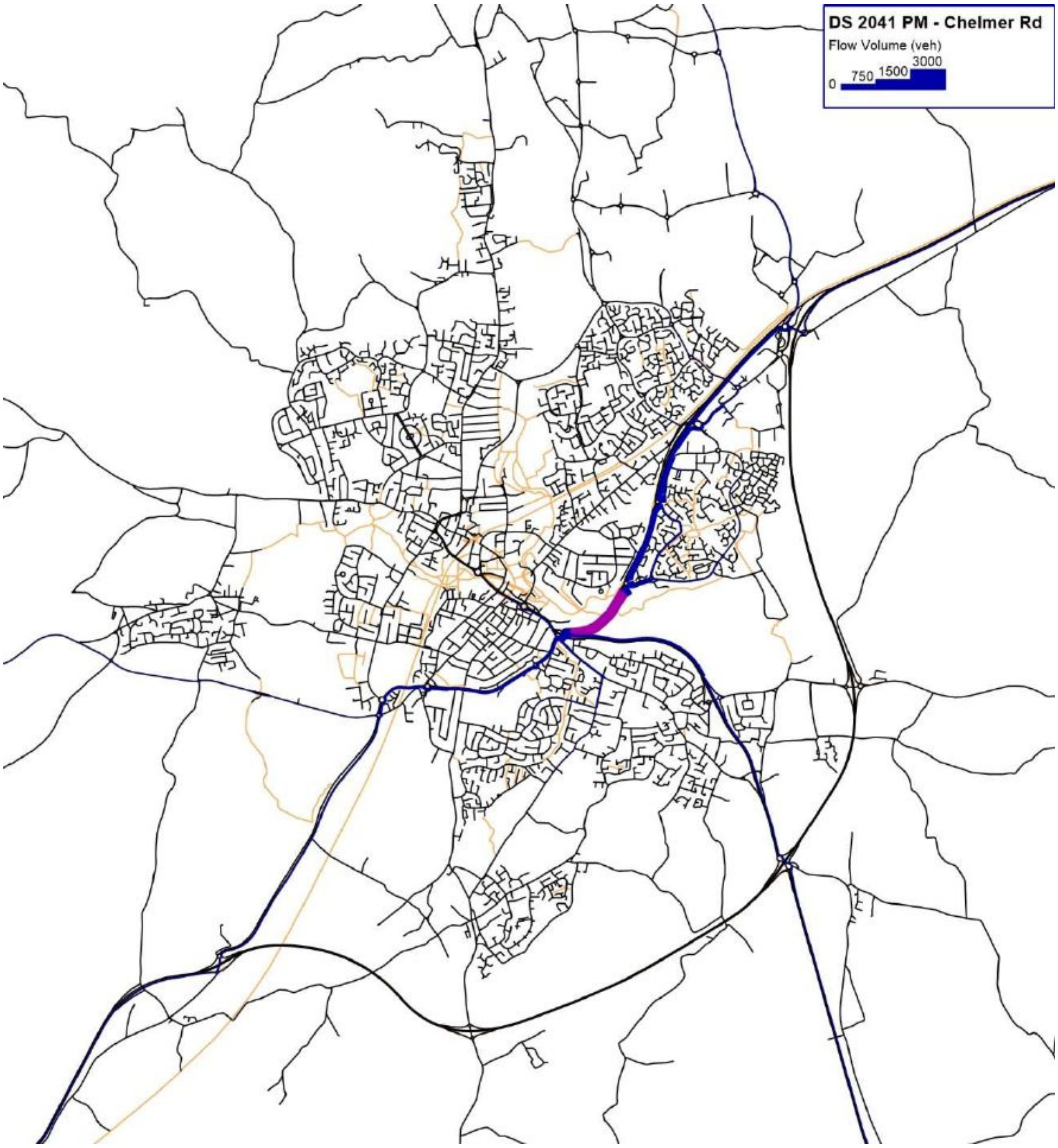


Figure 8-18: Select Link Analysis – Chelmer Road inbound, DS 2041 PM peak

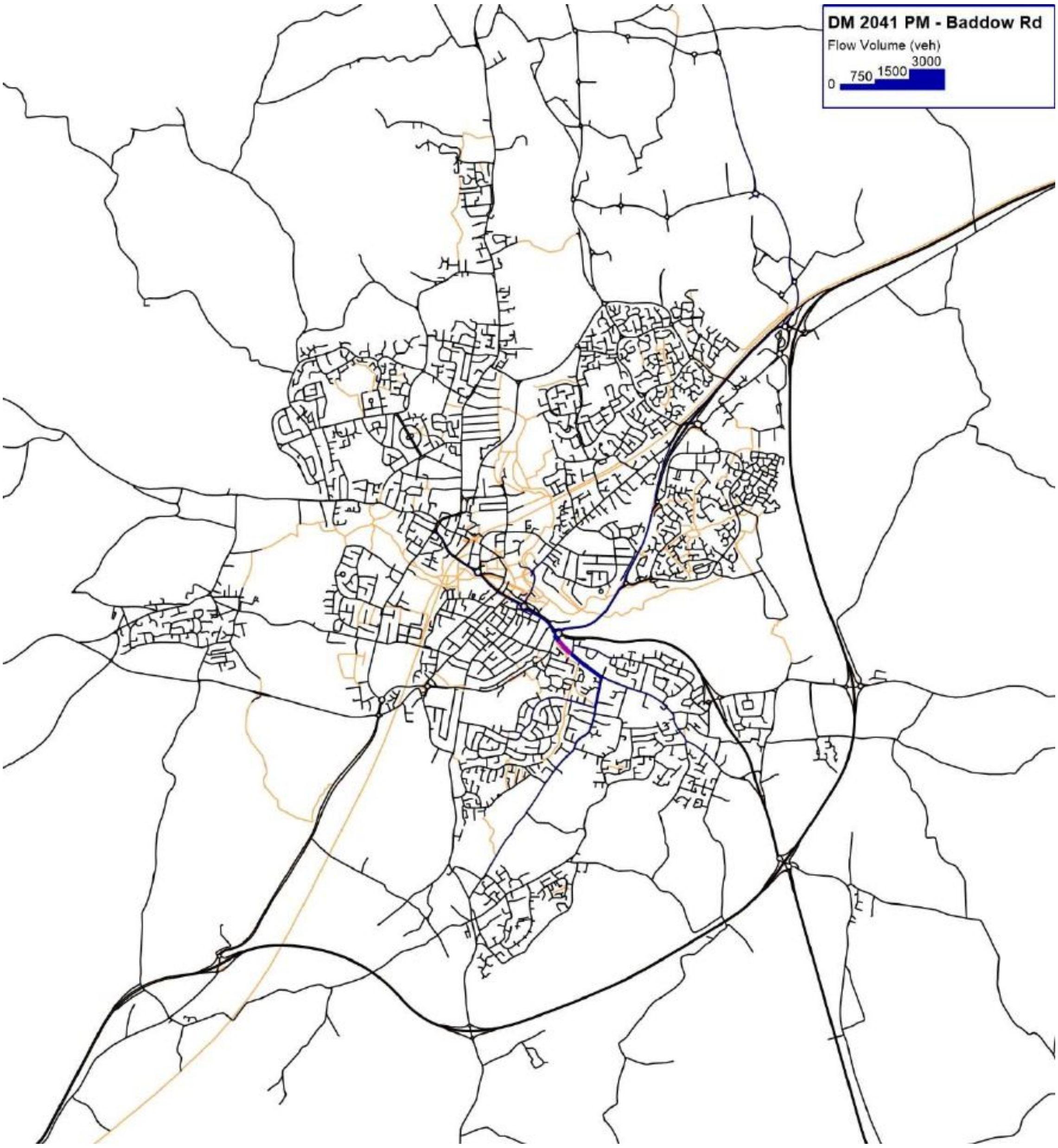


Figure 8-19: Select Link Analysis – Baddow Road inbound, DM 2041 PM peak

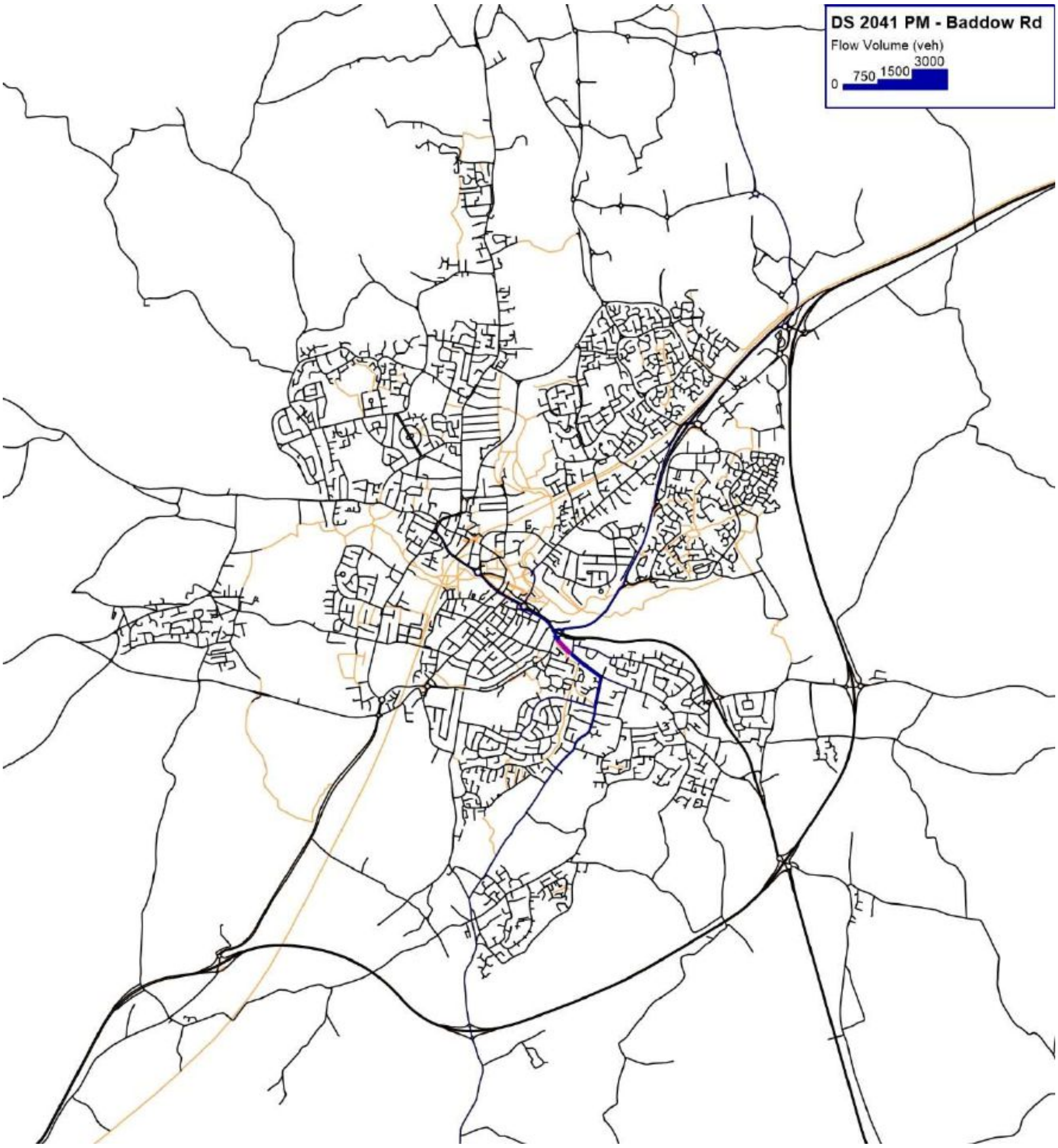


Figure 8-20: Select Link Analysis – Baddow Road inbound, DS 2041 PM peak

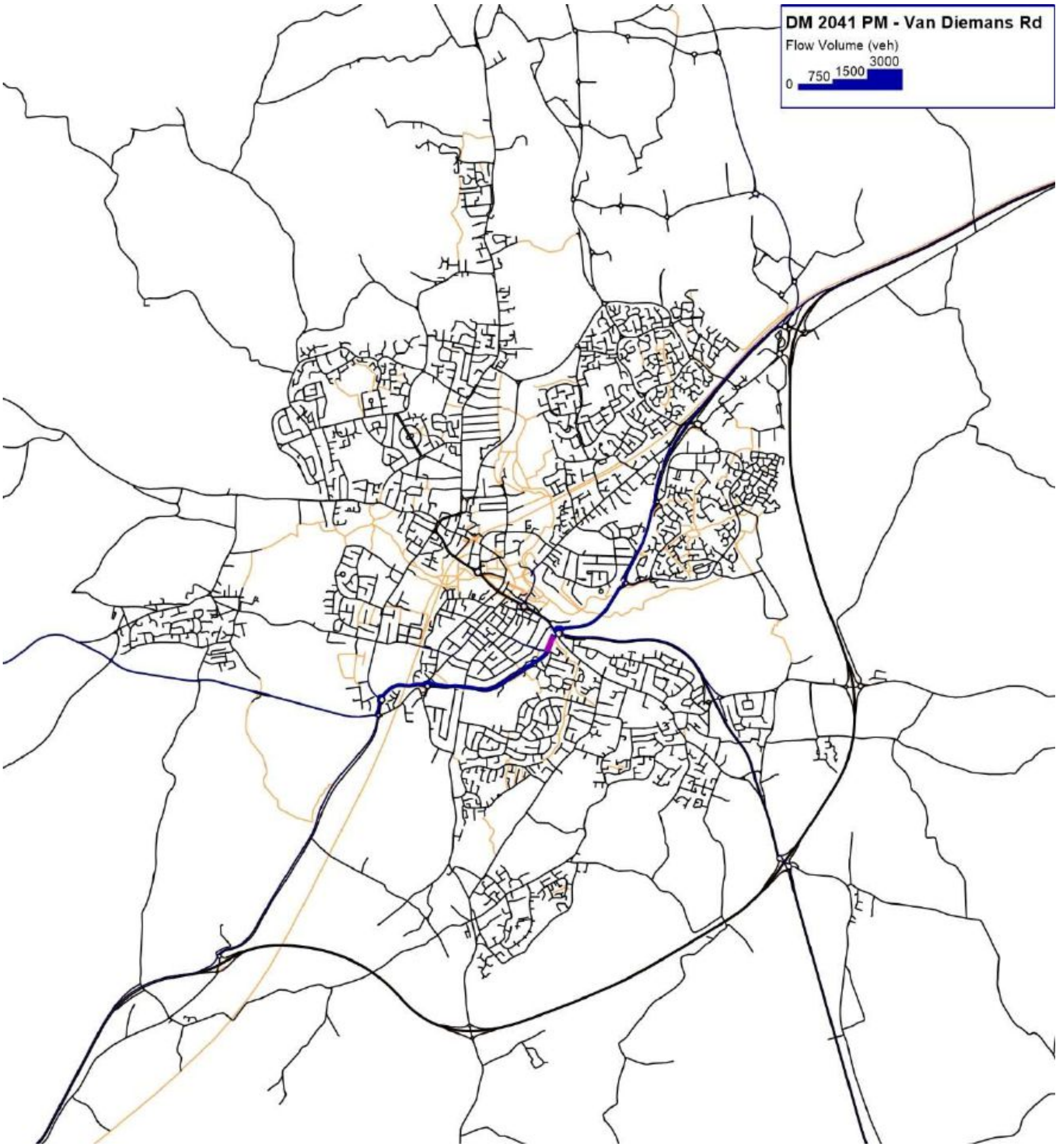


Figure 8-21: Select Link Analysis – Van Diemans Road inbound, DM 2041 PM peak

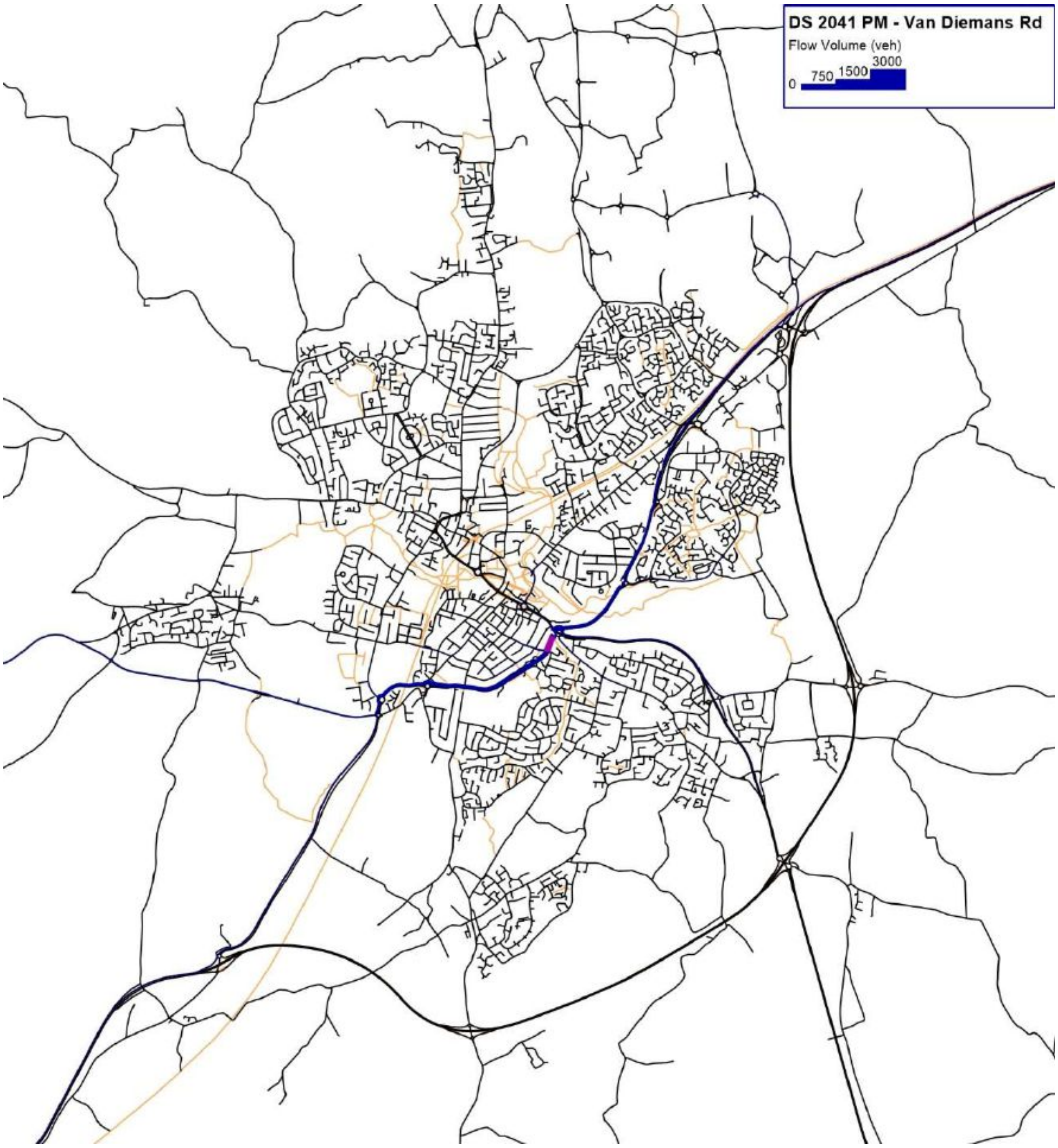


Figure 8-22: Select Link Analysis – Van Diemans Road inbound, DS 2041 PM peak

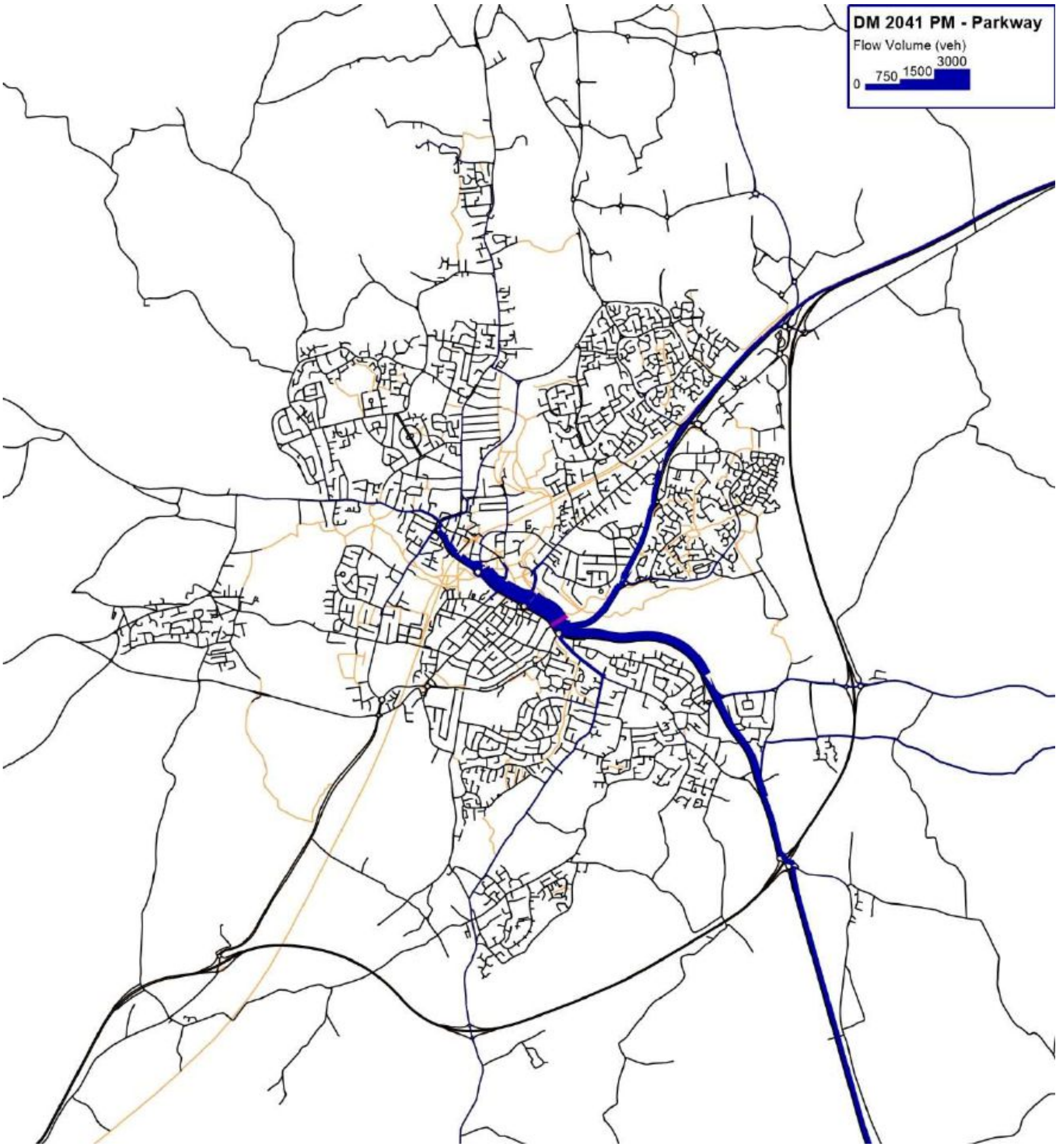


Figure 8-23: Select Link Analysis – Parkway outbound, DM 2041 PM peak

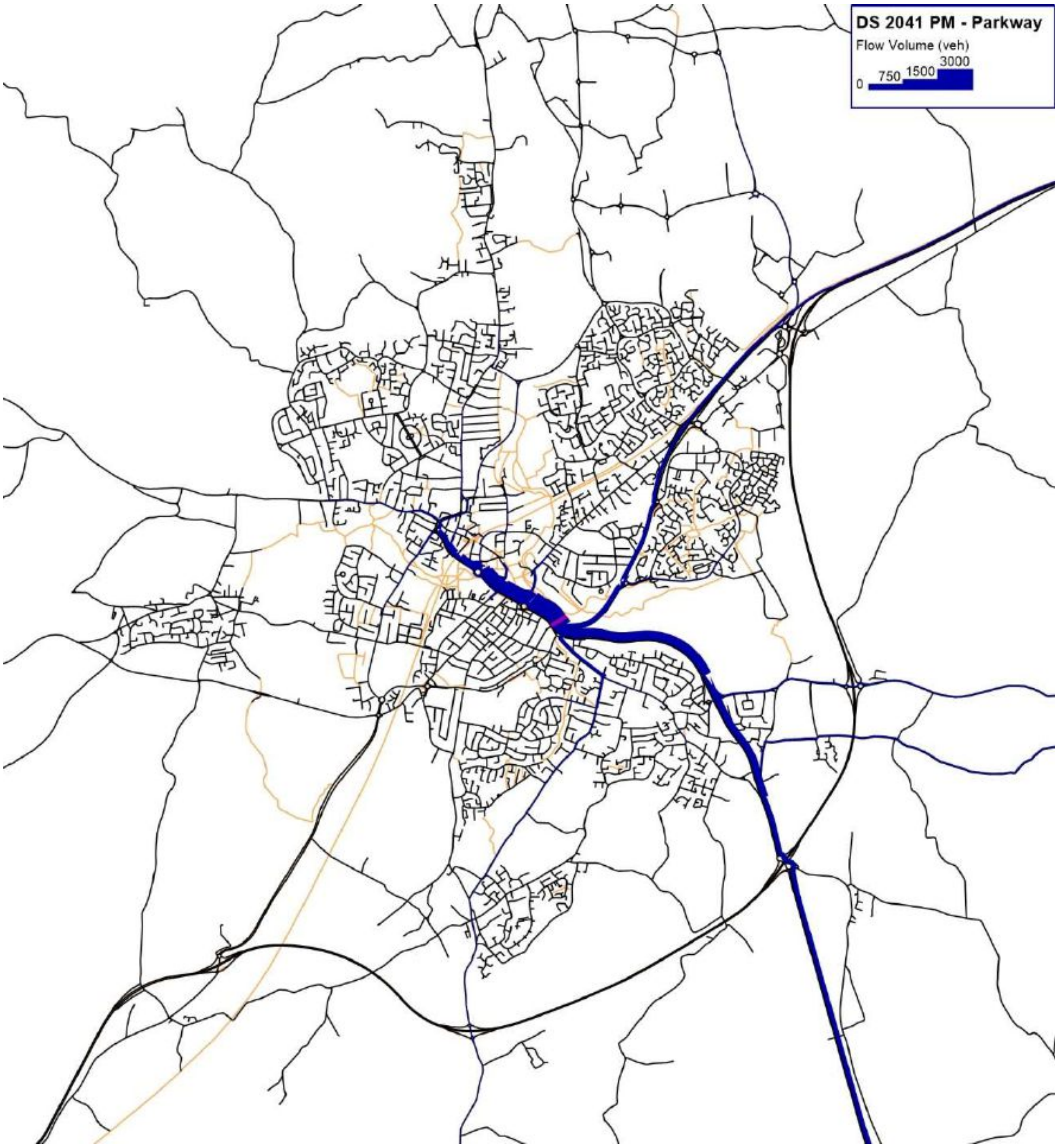


Figure 8-24: Select Link Analysis – Parkway outbound, DS 2041 PM peak

The figures above indicate that there is no significant change in travel patterns due to the scheme, but rather, as highlighted in the forecast traffic flows in section 8.4, there is generally an increase in the level of traffic through the Army & Navy junction due to the increase in capacity.

8.7 Model Speed and Capacity Checks

Three key checks have been undertaken to further assess the robustness of the model for appraisal as follows:

- Location and plausibility of links with very slow speeds;
- Identification and discussion of forecast flows that are above capacity; and
- Changes in junction V/C.

The results of these checks are discussed in the following sections.

8.7.1 Links with very slow speeds

The following figures highlight model links where the speed is below 10 kph and 5 kph by scenario, forecast year and time period as well as for the base year model for comparison.

Figure 8-25: Slow Model Speeds - Base Year 2019 AM

Figure 8-26: Slow Model Speeds - Base Year 2019 PM

Figure 8-27: Slow Model Speeds - DM 2026 AM

Figure 8-28: Slow Model Speeds - DS 2026 AM

Figure 8-29: Slow Model Speeds - DM 2026 PM

Figure 8-30: Slow Model Speeds - DS 2026 PM

Figure 8-31: Slow Model Speeds - DM 2041 AM

Figure 8-32: Slow Model Speeds - DS 2041 AM

Figure 8-33: Slow Model Speeds - DM 2041 PM

Figure 8-34: Slow Model Speeds - DS 2041 PM

The above figures highlight that:

- The Army & Navy junction is the key pinch point in the DM network with slow speeds on approach arms in 2026 in both time periods, with a similar pattern in 2041. This is in line with expectation given that the junction already suffers from high congestion and delay in the base year, with observed speeds on the EYW, Baddow Road and Van Diemans Road approaches of less than 10 kph in both AM and PM peak hours and on Chelmer Road in the AM peak hour.
- In the DS network, the A&N is still the main pinch point in the network with relatively slow speeds on the same approaches as the DM except Chelmer Road is no longer less than 10kph in the AM peak and EYW and Baddow Road in the PM peak. Other approaches and local connecting streets have improved, albeit with speeds still less than 10 kph. This is in line with expectation given the nature of the junction improvements, which, while providing some additional car-based capacity at the junction, also given extra priority to walking, cycling and bus infrastructure.
- Additional areas with localised slow speeds include the Parkway roundabouts in the PM peak in both DM and DS networks and the junction of Writtle Road and Waterhouse Lane in both time periods and both DM and DS. Again, these are congested junctions in the base year model and as such in line with expectation.

Overall, the locations with slow modelled speeds are associated with localised congestion at junctions that is also present in the base year model and as such in line with expectation for the forecast year models. Furthermore, the changes in speed in the DS relative to the DM are not considered extreme or out of place given the nature of the scheme improvements and as such, are considered sensible for the purposes of appraisal.

8.7.2 Links over capacity

A further check of the model robustness was to identify model links with flows higher than capacity. These are highlighted by scenario, forecast year and time period in the following figures as well as for the base year for comparison. Note that these figures represent an analysis of link capacities, not junction capacities, which are better reflected in the figures above depicting areas with slow speeds.

Figure 8-35: Over-capacity Model Links - Base Year 2019 AM

Figure 8-36: Over-capacity Model Links - Base Year 2019 PM

Figure 8-37: Over-capacity Model Links - DM 2026 AM

Figure 8-38: Over-capacity Model Links - DS 2026 AM

Figure 8-39: Over-capacity Model Links - DM 2026 PM

Figure 8-40: Over-capacity Model Links - DS 2026 PM

Figure 8-41: Over-capacity Model Links - DM 2041 AM

Figure 8-42: Over-capacity Model Links - DS 2041 AM

Figure 8-43: Over-capacity Model Links - DM 2041 PM

Figure 8-44: Over-capacity Model Links - DS 2041 PM

The above figures highlight that:

- Link capacities are generally not exceeded in the urban areas of Chelmsford, where junction capacities generally provide the capacity restraint (see the slow speeds figures in the previous section).
- The main location with over-capacity links is the A12 Chelmsford bypass under all scenarios, forecast years and time periods. This section of the A12 is over-capacity in the base year and as such in line with expectation and more importantly, is not related to the scheme. The exception in the figures is the section southbound between junction 18 and 17, which is slightly over-capacity in 2026 DS PM peak but not in the DM. However, this link operates only just below capacity in the DM with the difference in flow between DM and DS of only 25 vehicles.
- Other over-capacity links are localised and also common to all scenarios, forecast years and time periods.

8.7.3 Junction Volume to Capacity Ratios

The volume to capacity ratio for junctions across the network by scenario, forecast year and time period is outlined in the following figures.

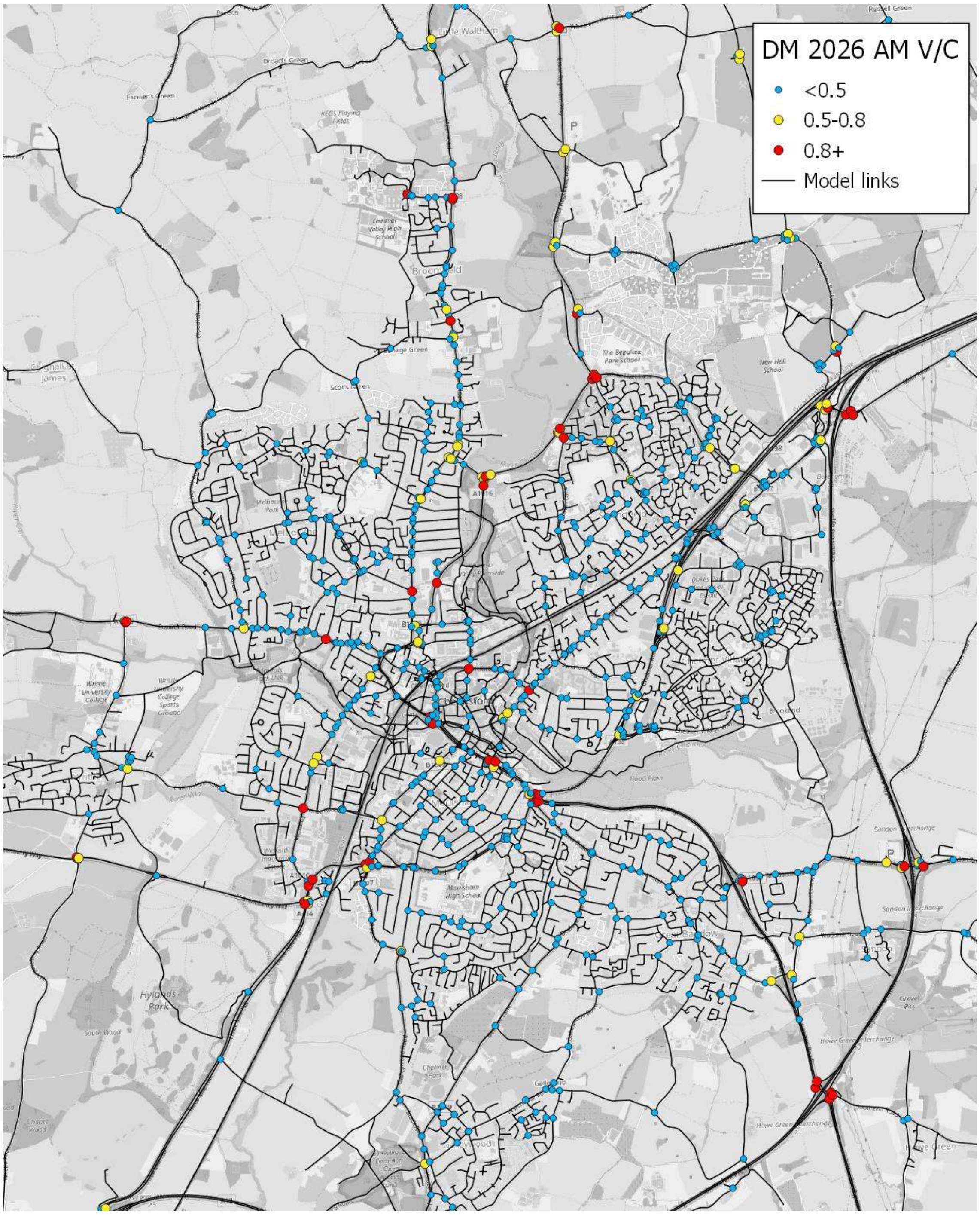


Figure 8-45: Volume to Capacity Ratio – 2026 DM AM peak

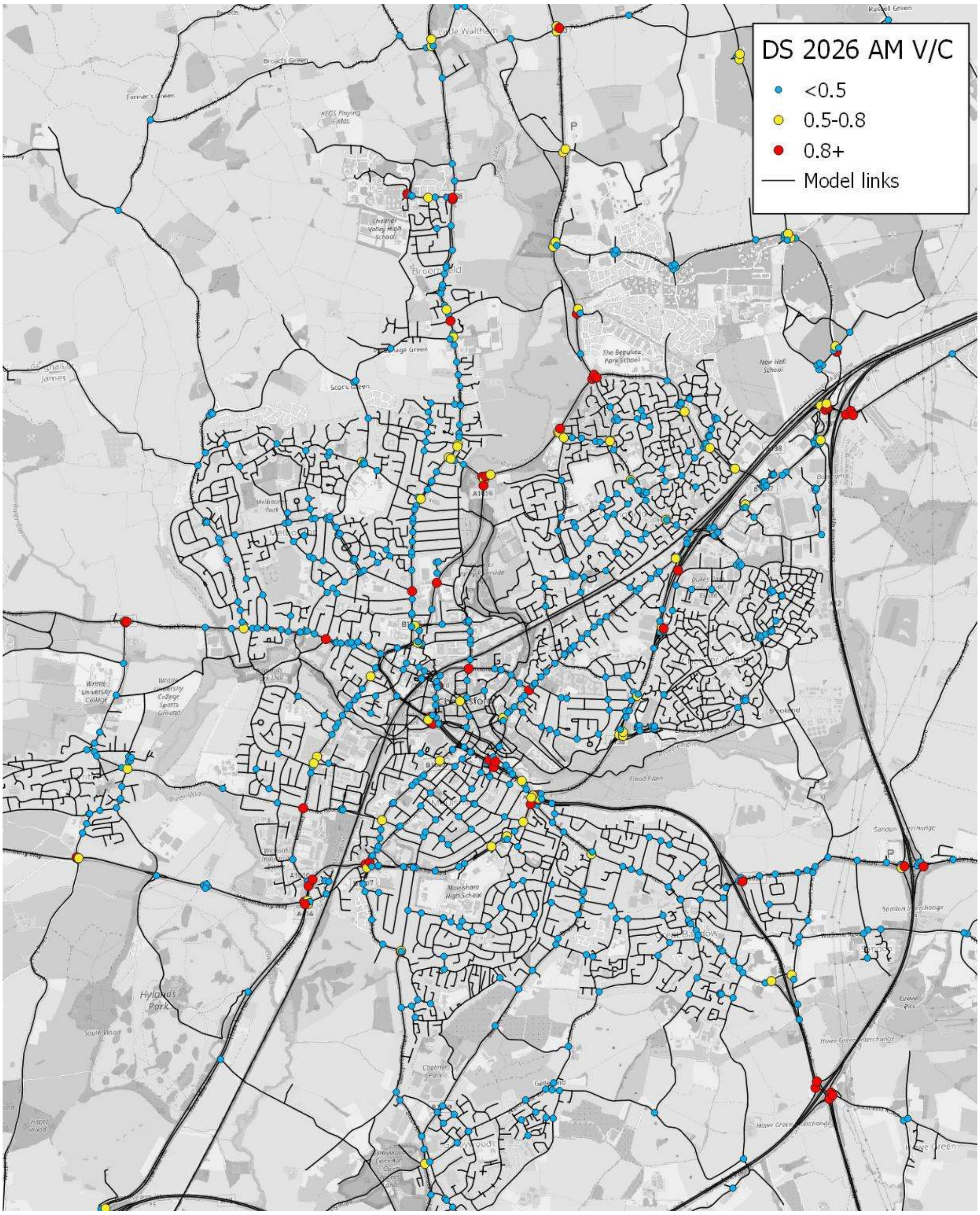


Figure 8-46: Volume to Capacity Ratio – 2026 DS AM peak

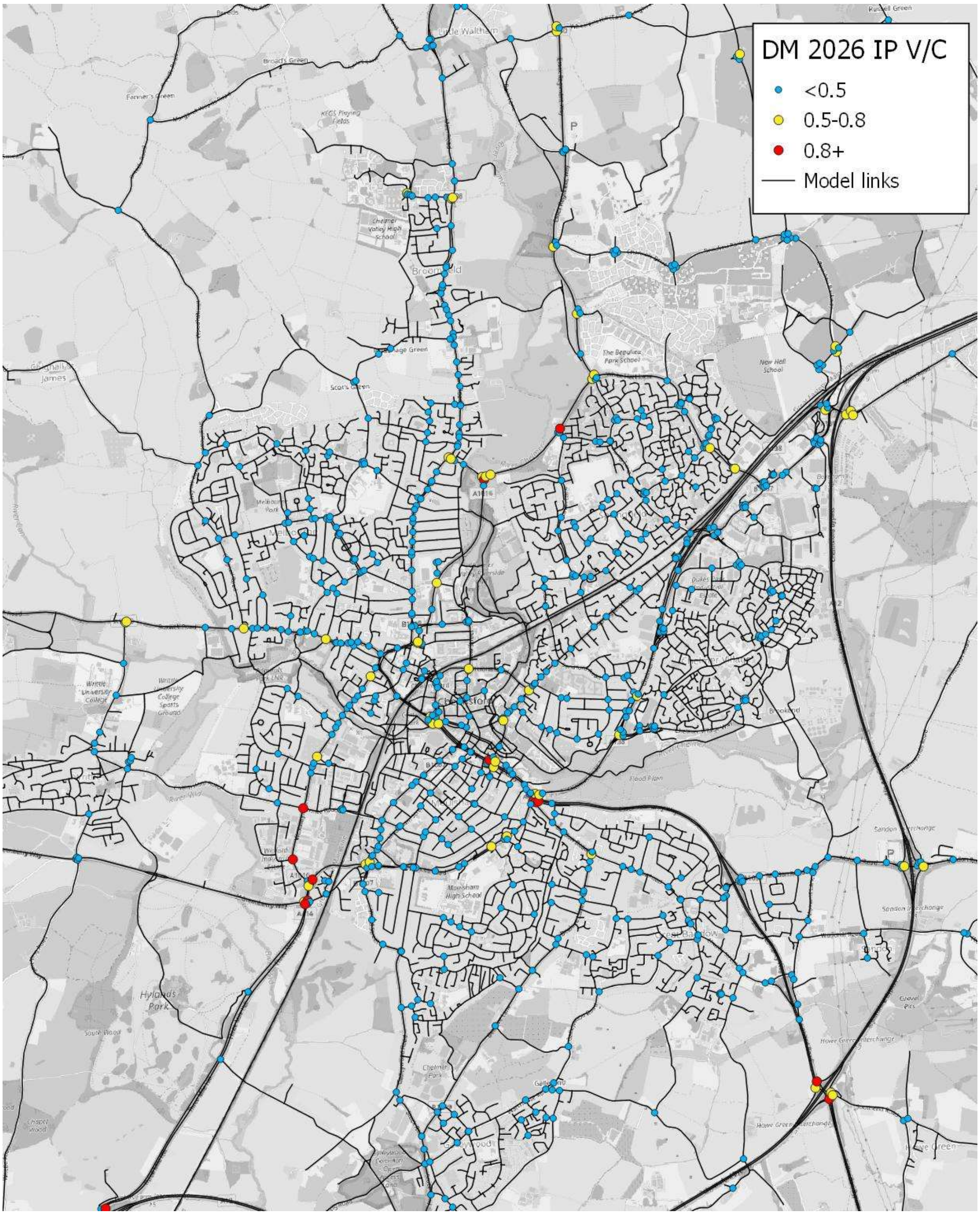


Figure 8-47: Volume to Capacity Ratio – 2026 DM inter-peak

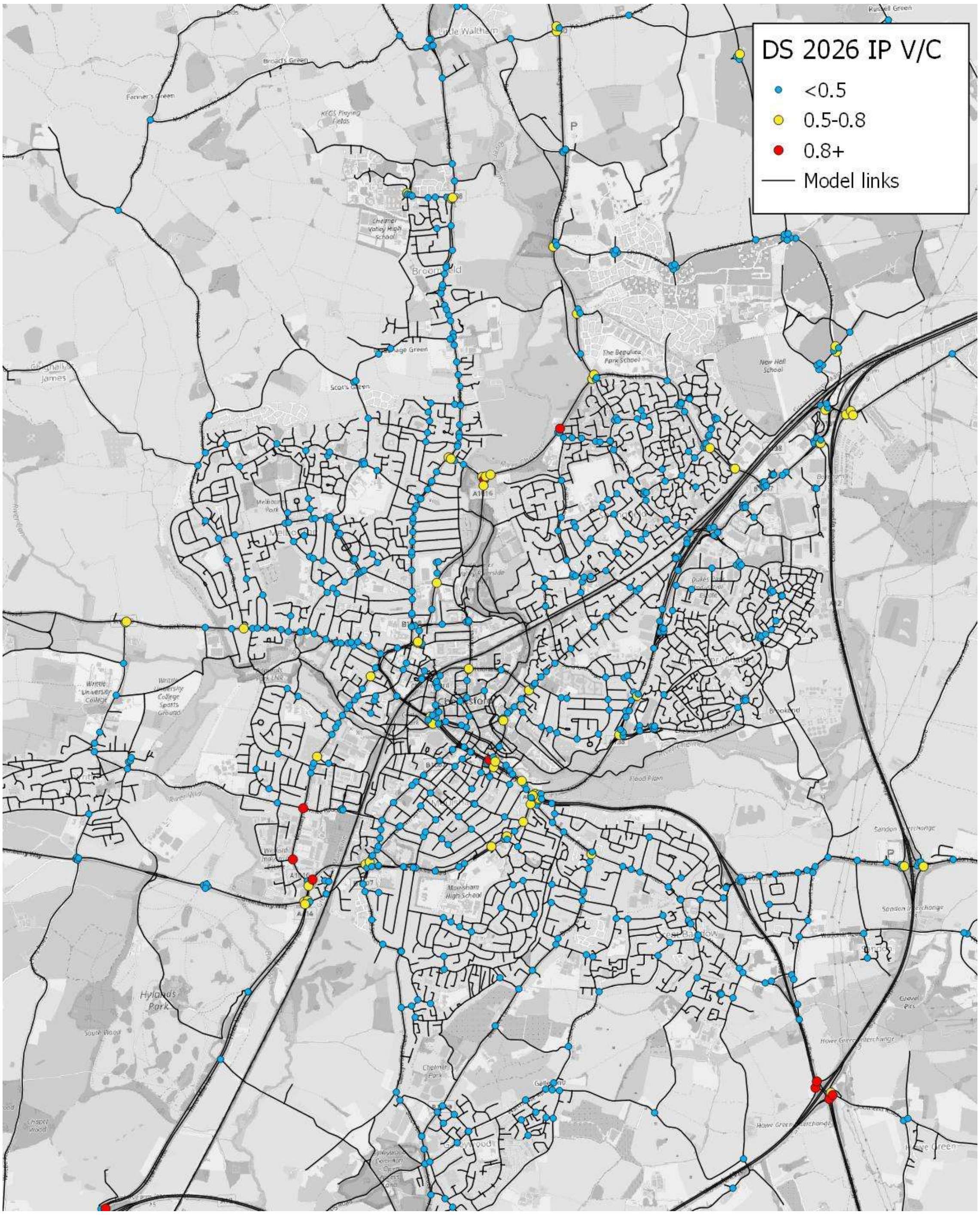


Figure 8-48: Volume to Capacity Ratio – 2026 DS inter-peak

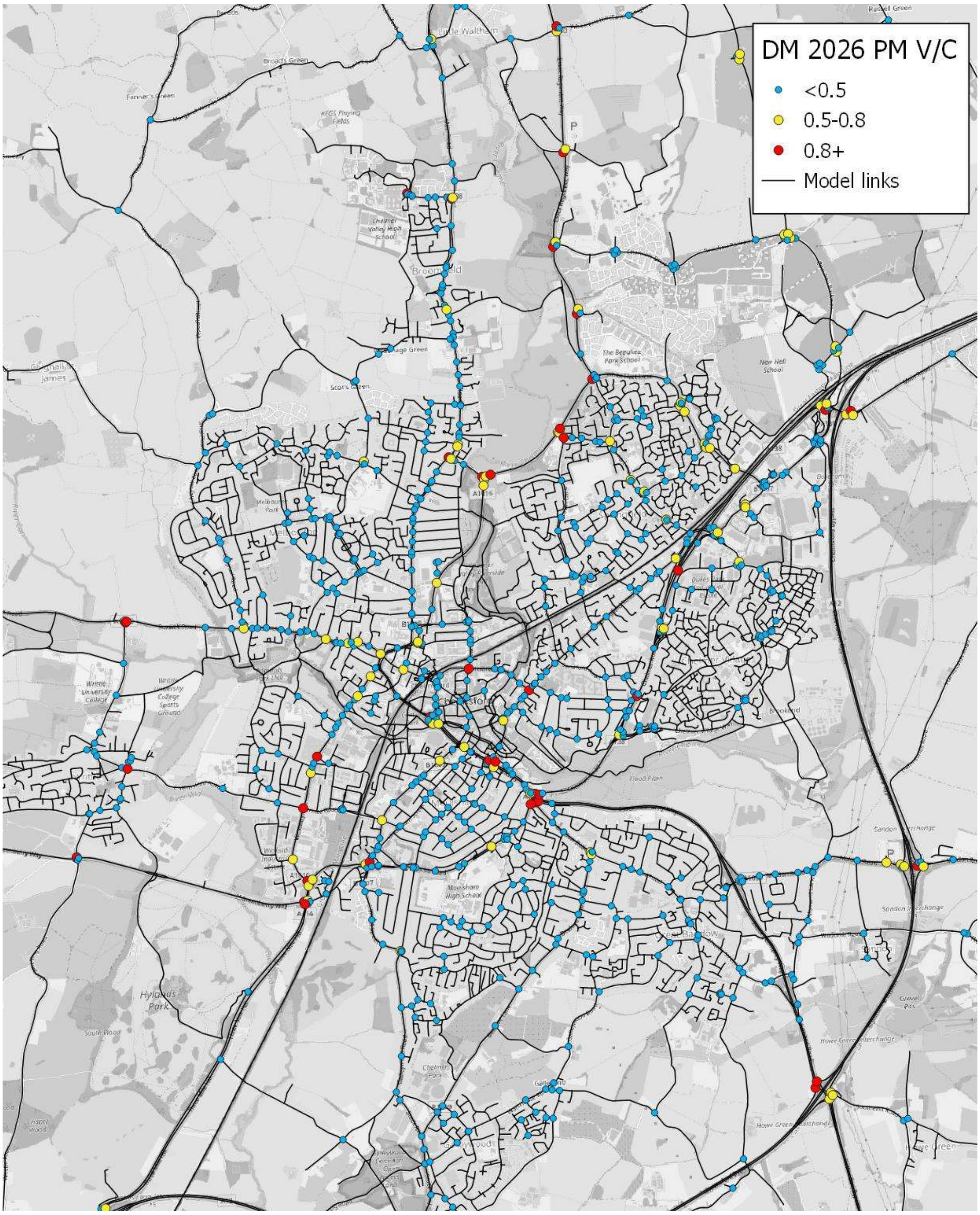


Figure 8-49: Volume to Capacity Ratio – 2026 DM PM peak

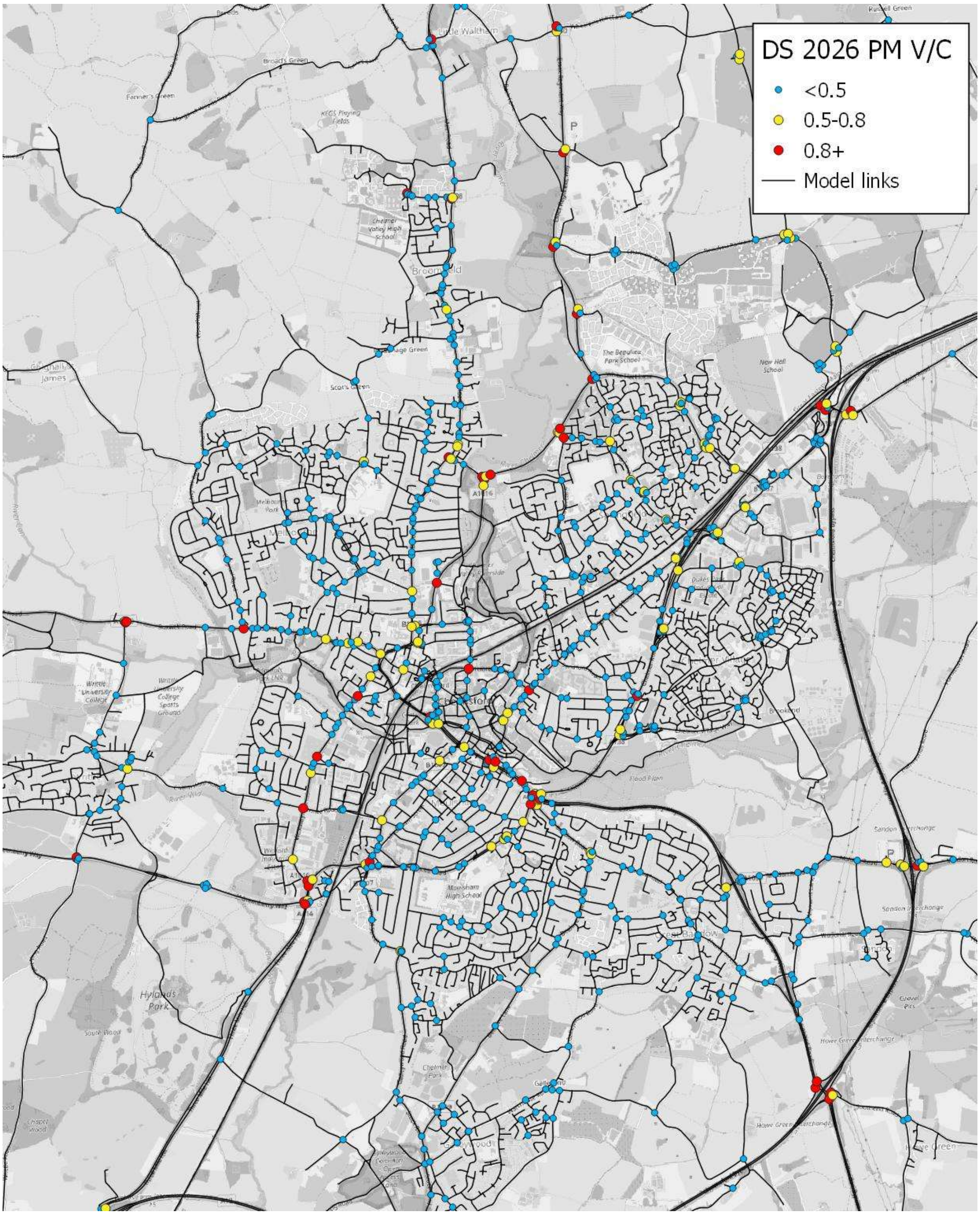


Figure 8-50: Volume to Capacity Ratio – 2026 DS PM peak

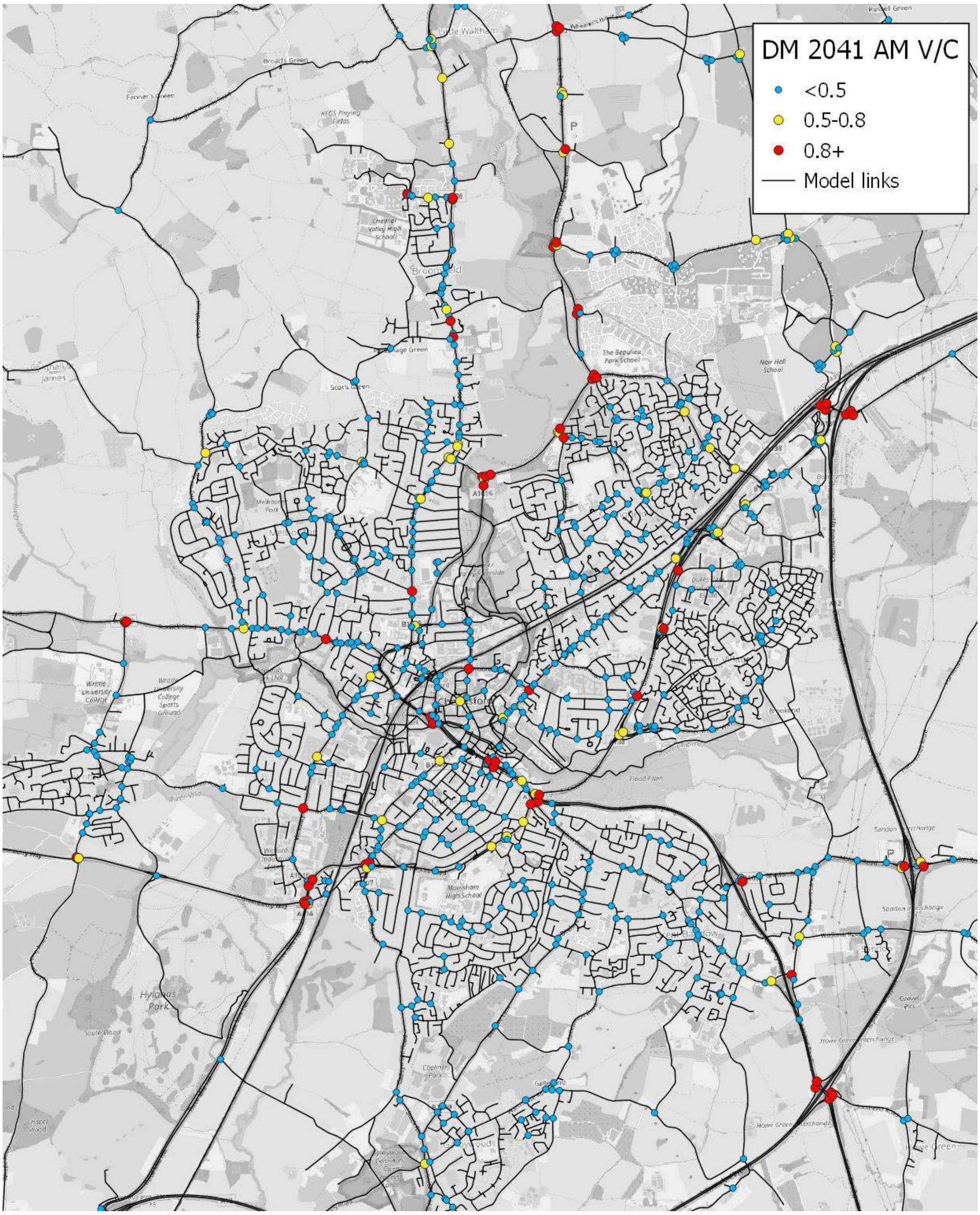


Figure 8-51: Volume to Capacity Ratio – 2041 DM AM peak

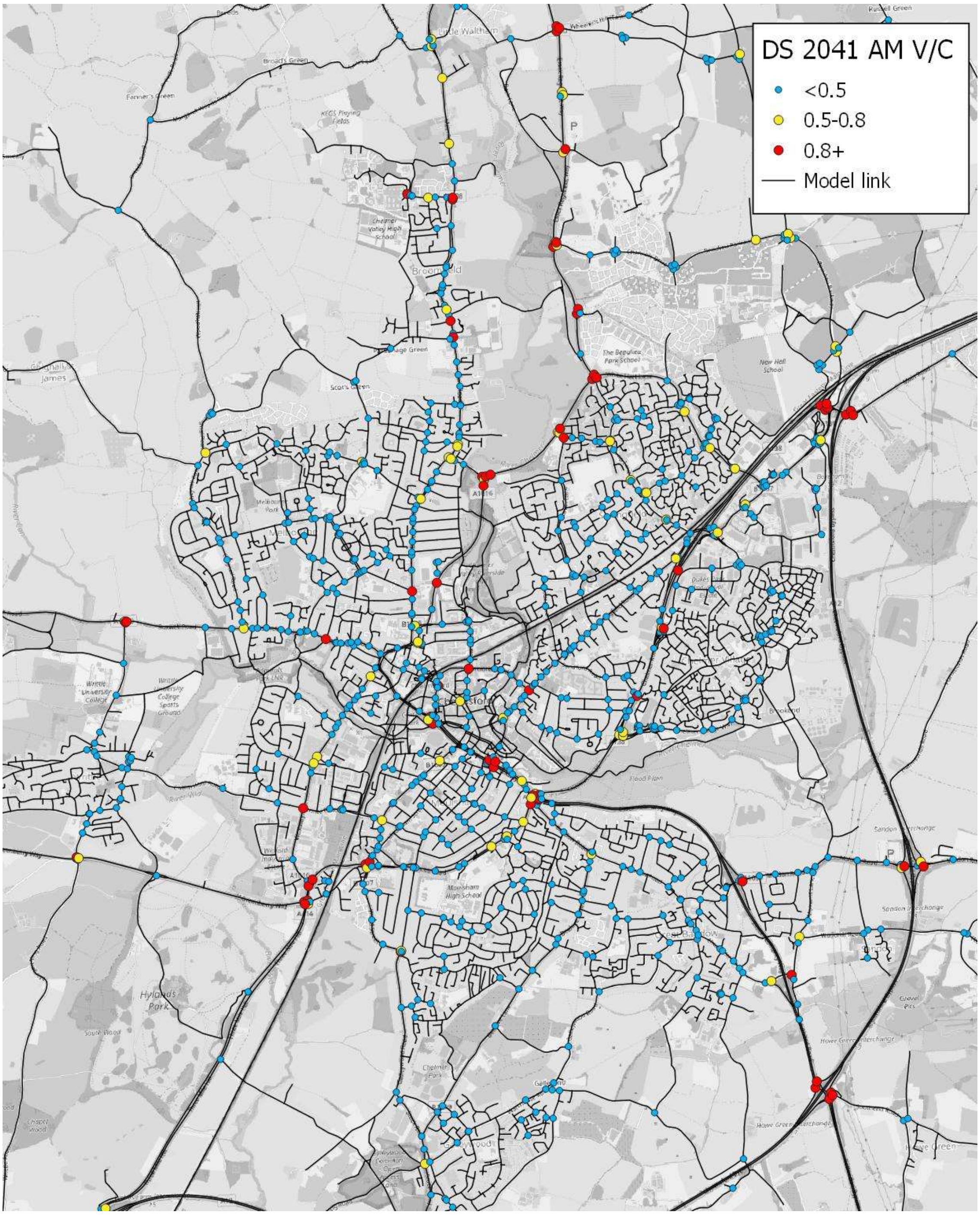


Figure 8-52: Volume to Capacity Ratio – 2041 DS AM peak

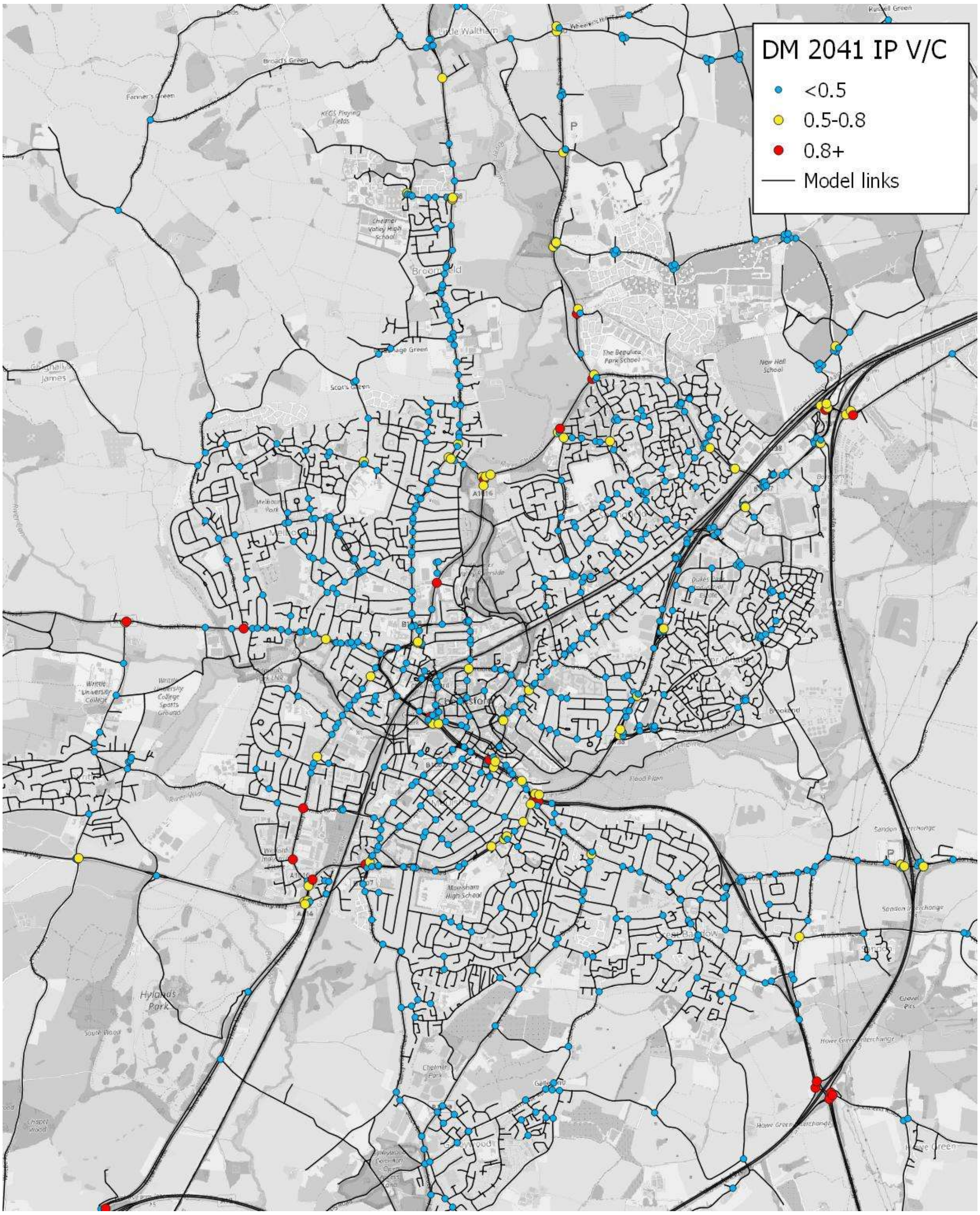


Figure 8-53: Volume to Capacity Ratio – 2041 DM inter-peak

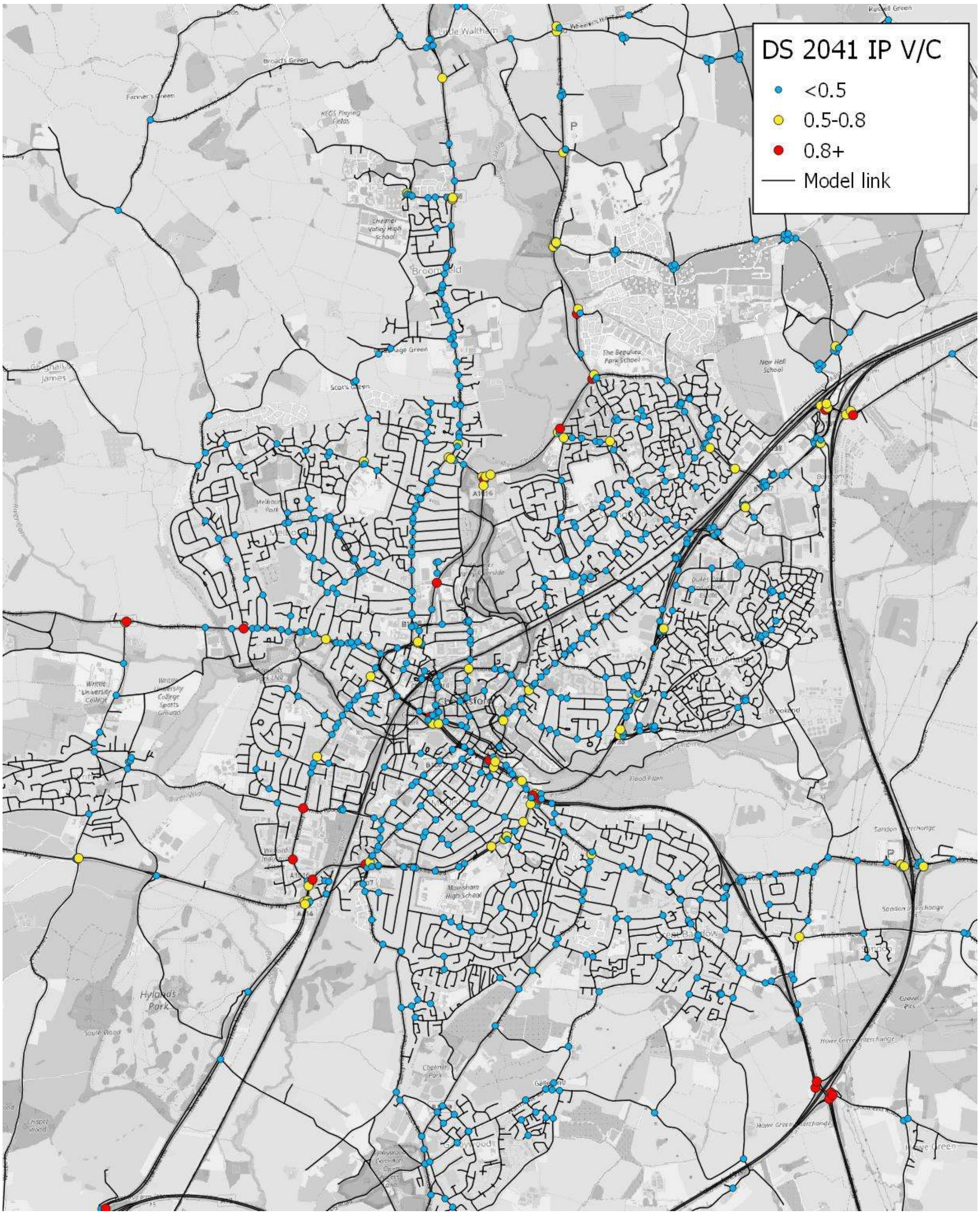


Figure 8-54: Volume to Capacity Ratio – 2041 DS inter-peak

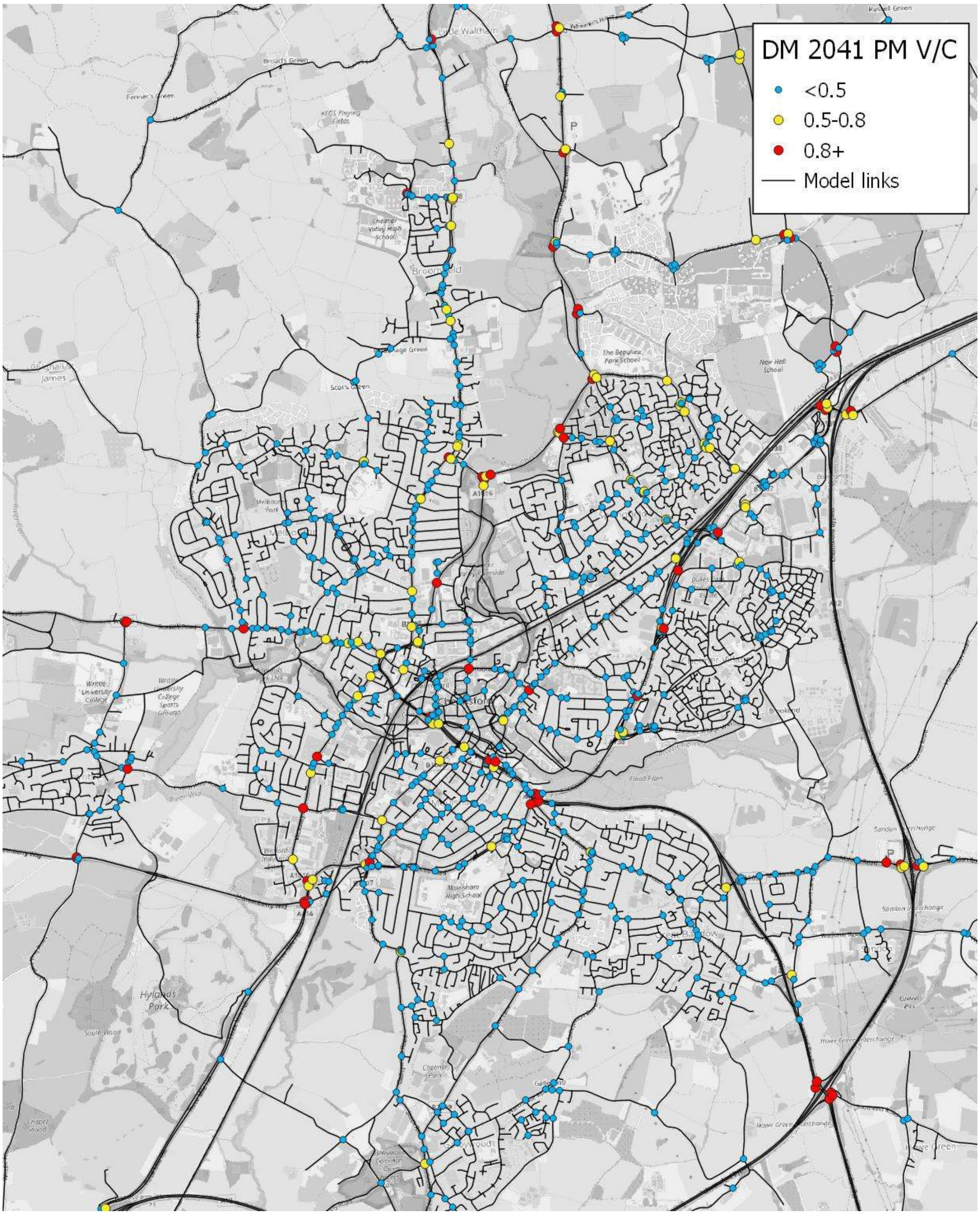


Figure 8-55: Volume to Capacity Ratio – 2041 DM PM peak

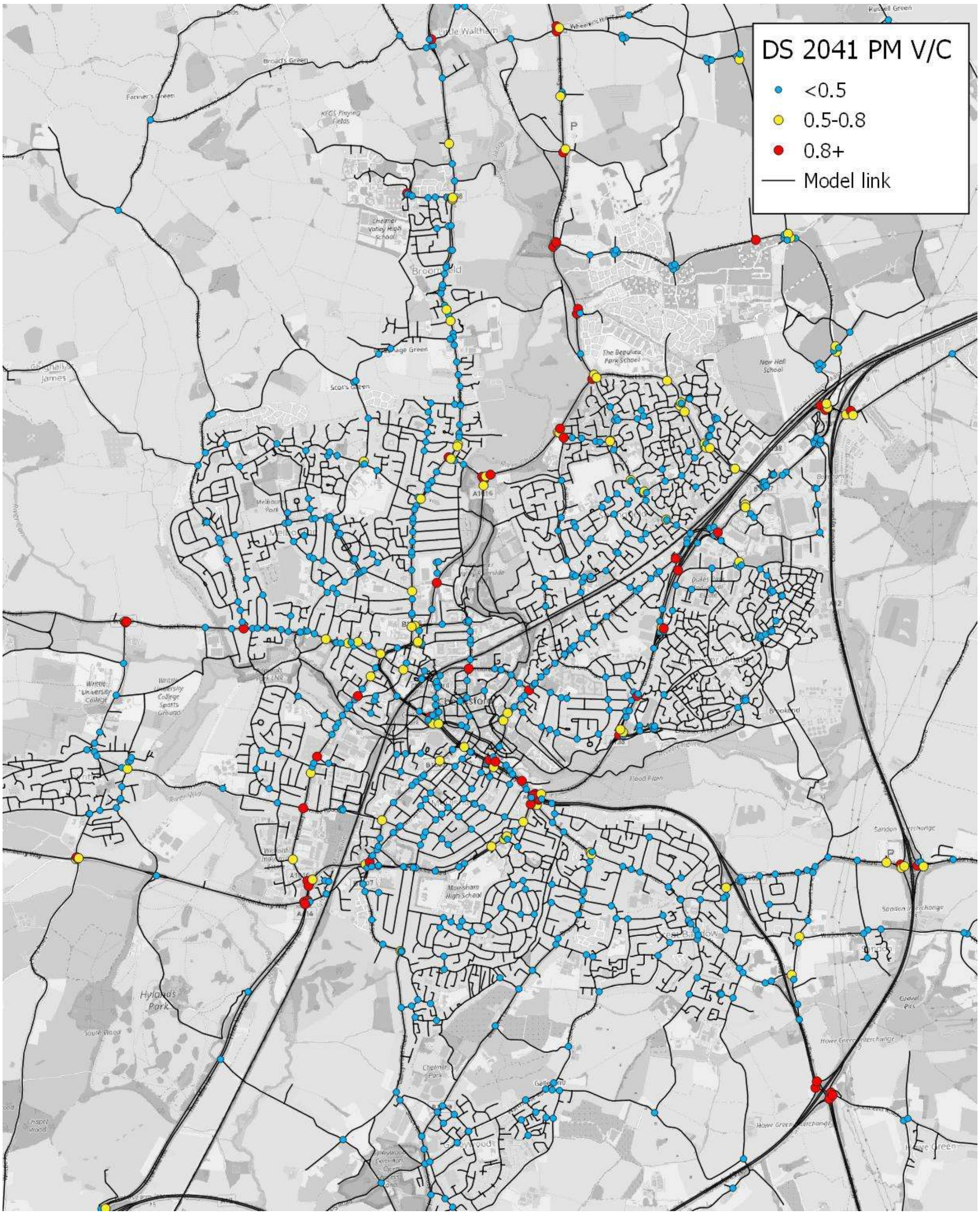


Figure 8-56: Volume to Capacity Ratio – 2041 DS PM peak

The data in the above figures highlights that there is no significant changes in the V/C at junctions around the wider network.

8.8 Alternative Scenario Results – High and Low Growth

As previously mentioned, national uncertainty has been addressed through the standard TAG high and low growth scenarios. These scenarios aim to address two key questions:

- Under high demand assumptions, is the intervention still effective in reducing congestion or crowding, or are there any adverse effects, e.g. on safety or the environment?
- Under low demand assumptions, is the intervention still economically viable?

The forecast year modelling aims to provide the data to address these questions as outlined in the OBC and EAR.

The methodology outlined in TAG Unit M4[24] for developing the high and low growth scenarios has been followed whereby forecast year reference matrices are based on a proportion of base year demand added to or subtracted from the demand from the core scenario.

The results of these sensitivity tests are summarised in the following sections with respect to impacts on reference case demand, post-demand model matrices, model convergence, forecast flows and forecast journey times.

8.8.1 Reference Case Demand

The reference case demand matrix totals by purpose (24-hour P/A in person trips) is outlined in the following tables for the Core, High and Low growth scenarios.

Table 8-79: Reference Matrix Total by purpose – 2026 Core, Low and High growth (person trips)

Purpose	Core		Low		%Diff to Core		High		%Diff to Core	
	Car	PT	Car	PT	Car	PT	Car	PT	Car	PT
HBW	778,645	413,950	731,313	392,348	-6.1%	-5.2%	825,977	435,552	6.1%	5.2%
HBEB	143,736	58,925	135,084	55,824	-6.0%	-5.3%	152,388	62,025	6.0%	5.3%
HBO	1,117,461	179,747	1,052,891	170,612	-5.8%	-5.1%	1,182,031	188,883	5.8%	5.1%

[24] Department for Transport, May 2019 and November 2022: *TAG Unit M4 Forecasting and Uncertainty*

HBS	440,175	52,430	414,895	50,044	-5.7%	-4.6%	465,456	54,815	5.7%	4.6%
HBE	113,875	9,591	107,202	9,210	-5.9%	-4.0%	120,547	9,971	5.9%	4.0%
NHBEB	563,600	114,186	529,706	108,188	-6.0%	-5.3%	597,494	120,184	6.0%	5.3%
NHBO	983,850	115,321	926,110	109,538	-5.9%	-5.0%	1,041,590	121,105	5.9%	5.0%
Total	**4,141,342**	**944,149**	**3,897,201**	**895,763**	**-5.9%**	**-5.1%**	**4,385,484**	**992,536**	**5.9%**	**5.1%**

Table 8-80: Reference Matrix Total by purpose – 2041 Core, Low and High growth (person trips)

Purpose	Core		Low		%Diff to Core		High		%Diff to Core	
	Car	PT	Car	PT	Car	PT	Car	PT	Car	PT
HBW	870,743	413,950	786,833	375,653	-9.6%	-9.3%	954,654	452,247	9.6%	9.3%
HBEB	163,458	58,925	148,120	53,427	-9.4%	-9.3%	178,796	64,422	9.4%	9.3%
HBO	1,336,998	179,747	1,222,528	163,552	-8.6%	-9.0%	1,451,469	195,943	8.6%	9.0%
HBS	528,628	52,430	483,810	48,200	-8.5%	-8.1%	573,446	56,659	8.5%	8.1%
HBE	132,246	9,591	120,417	8,916	-8.9%	-7.0%	144,075	10,265	8.9%	7.0%
NHBEB	642,687	114,186	582,600	103,552	-9.3%	-9.3%	702,775	124,819	9.3%	9.3%
NHBO	1,156,987	115,321	1,054,624	105,068	-8.8%	-8.9%	1,259,349	125,574	8.8%	8.9%
Total	**4,831,747**	**944,149**	**4,398,931**	**858,369**	**-9.0%**	**-9.1%**	**5,264,563**	**1,029,929**	**9.0%**	**9.1%**

8.8.2 Post-Demand Modelling Matrix Total

The assignment matrix totals for the pre- and post-demand modelling by scenario, forecast year and purpose are outlined in the following tables.

Table 8-81: Pre- and Post-Demand Modelling Highways Matrix Totals – DM Low Growth

User Class	2026				2041			
	Pre-VDM	Final	Diff	%Diff	Pre-VDM	Final	Diff.	% Diff
AM Peak								
Car commuter	160,371	160,622	250	0.2%	172,243	172,695	452	0.3%
Car EB	61,126	61,082	-45	-0.1%	66,841	66,844	3	0.0%
Car other	133,033	133,089	55	0.0%	152,748	149,556	-3,193	-2.1%
LGV	130,570	130,570	0	0.0%	151,524	151,524	0	0.0%
HGV	68,895	68,895	0	0.0%	71,486	71,486	0	0.0%
Total	**553,996**	**554,257**	**261**	**0.0%**	**614,842**	**612,105**	**-2,737**	**-0.4%**
Inter-Peak								
Car commuter	36,816	36,877	61	0.2%	39,638	39,746	108	0.3%
Car EB	40,082	40,056	-25	-0.1%	44,395	44,397	1	0.0%
Car other	168,839	168,887	48	0.0%	195,736	194,868	-868	-0.4%
LGV	118,173	118,173	0	0.0%	137,137	137,137	0	0.0%
HGV	75,984	75,984	0	0.0%	78,841	78,841	0	0.0%
Total	**439,893**	**439,977**	**83**	**0.0%**	**495,748**	**494,989**	**-759**	**-0.2%**
PM Peak								
Car commuter	135,927	136,138	211	0.2%	146,379	146,769	389	0.3%
Car EB	56,087	56,053	-34	-0.1%	61,429	61,427	-2	0.0%
Car other	191,863	191,889	26	0.0%	222,094	221,161	-932	-0.4%
LGV	102,544	102,544	0	0.0%	119,000	119,000	0	0.0%
HGV	37,573	37,573	0	0.0%	38,986	38,986	0	0.0%
Total	**523,993**	**524,196**	**203**	**0.0%**	**587,889**	**587,343**	**-545**	**-0.1%**

Table 8-82: Pre- and Post-Demand Modelling Highways Matrix Totals – DS Low Growth

User Class	2026				2041			
	Pre-VDM	Final	Diff	%Diff	Pre-VDM	Final	Diff.	% Diff
AM Peak								
Car commuter	160,371	160,649	278	0.2%	172,243	172,725	482	0.3%
Car EB	61,126	61,084	-42	-0.1%	66,841	66,847	6	0.0%
Car other	133,033	133,096	62	0.0%	152,748	149,561	-3,187	-2.1%
LGV	130,570	130,570	0	0.0%	151,524	151,524	0	0.0%
HGV	68,895	68,895	0	0.0%	71,486	71,486	0	0.0%
Total	**553,996**	**554,294**	**298**	**0.1%**	**614,842**	**612,143**	**-2,699**	**-0.4%**
Inter-Peak								
Car commuter	36,816	36,884	68	0.2%	39,638	39,753	115	0.3%
Car EB	40,082	40,058	-24	-0.1%	44,395	44,399	3	0.0%
Car other	168,839	168,893	54	0.0%	195,736	194,875	-861	-0.4%
LGV	118,173	118,173	0	0.0%	137,137	137,137	0	0.0%
HGV	75,984	75,984	0	0.0%	78,841	78,841	0	0.0%
Total	**439,893**	**439,991**	**97**	**0.0%**	**495,748**	**495,005**	**-742**	**-0.1%**
PM Peak								
Car commuter	135,927	136,161	235	0.2%	146,379	146,794	414	0.3%
Car EB	56,087	56,055	-32	-0.1%	61,429	61,430	0	0.0%
Car other	191,863	191,896	33	0.0%	222,094	221,171	-923	-0.4%
LGV	102,544	102,544	0	0.0%	119,000	119,000	0	0.0%
HGV	37,573	37,573	0	0.0%	38,986	38,986	0	0.0%
Total	**523,993**	**524,229**	**236**	**0.0%**	**587,889**	**587,380**	**-508**	**-0.1%**

Table 8-83: Pre- and Post-Demand Modelling Highways Matrix Totals – DM High Growth

User Class	2026				2041			
	Pre-VDM	Final	Diff	%Diff	Pre-VDM	Final	Diff.	% Diff
AM Peak								
Car commuter	180,457	180,505	48	0.0%	207,850	207,973	122	0.1%
Car EB	68,537	68,454	-84	-0.1%	79,979	79,916	-64	-0.1%
Car other	149,160	149,146	-13	0.0%	181,337	181,484	147	0.1%
LGV	147,640	147,640	0	0.0%	181,787	181,787	0	0.0%
HGV	78,420	78,420	0	0.0%	88,371	88,371	0	0.0%
Total	**624,214**	**624,165**	**-49**	**0.0%**	**739,325**	**739,531**	**206**	**0.0%**
Inter-Peak								
Car commuter	41,660	41,672	12	0.0%	48,226	48,252	26	0.1%
Car EB	45,656	45,610	-46	-0.1%	54,277	54,242	-35	-0.1%
Car other	190,177	190,158	-20	0.0%	233,565	233,669	105	0.0%
LGV	133,622	133,622	0	0.0%	164,526	164,526	0	0.0%
HGV	86,489	86,489	0	0.0%	97,464	97,464	0	0.0%
Total	**497,604**	**497,551**	**-53**	**0.0%**	**598,058**	**598,153**	**95**	**0.0%**
PM Peak								
Car commuter	153,662	153,702	40	0.0%	177,820	177,933	113	0.1%
Car EB	63,036	62,969	-67	-0.1%	73,750	73,687	-63	-0.1%
Car other	215,521	215,488	-33	0.0%	264,035	263,996	-39	0.0%
LGV	115,950	115,950	0	0.0%	142,767	142,767	0	0.0%
HGV	42,767	42,767	0	0.0%	48,195	48,195	0	0.0%
Total	**590,937**	**590,877**	**-60**	**0.0%**	**706,567**	**706,578**	**11**	**0.0%**

Table 8-84: Pre- and Post-Demand Modelling Highways Matrix Totals – DS High Growth

User Class	2026				2041			
	Pre-VDM	Final	Diff	%Diff	Pre-VDM	Final	Diff.	% Diff
AM Peak								
Car commuter	180,457	180,540	83	0.0%	207,850	208,011	160	0.1%
Car EB	68,537	68,456	-81	-0.1%	79,979	79,918	-62	-0.1%
Car other	149,160	149,156	-4	0.0%	181,337	181,492	155	0.1%
LGV	147,640	147,640	0	0.0%	181,787	181,787	0	0.0%
HGV	78,420	78,420	0	0.0%	88,371	88,371	0	0.0%
Total	**624,214**	**624,211**	**-3**	**0.0%**	**739,325**	**739,579**	**254**	**0.0%**
Inter-Peak								
Car commuter	41,660	41,681	21	0.1%	48,226	48,262	36	0.1%
Car EB	45,656	45,612	-44	-0.1%	54,277	54,243	-34	-0.1%
Car other	190,177	190,165	-12	0.0%	233,565	233,678	113	0.0%
LGV	133,622	133,622	0	0.0%	164,526	164,526	0	0.0%
HGV	86,489	86,489	0	0.0%	97,464	97,464	0	0.0%
Total	**497,604**	**497,569**	**-35**	**0.0%**	**598,058**	**598,173**	**115**	**0.0%**
PM Peak								
Car commuter	153,662	153,731	69	0.0%	177,820	177,965	145	0.1%
Car EB	63,036	62,972	-65	-0.1%	73,750	73,689	-61	-0.1%
Car other	215,521	215,498	-23	0.0%	264,035	264,008	-27	0.0%
LGV	115,950	115,950	0	0.0%	142,767	142,767	0	0.0%
HGV	42,767	42,767	0	0.0%	48,195	48,195	0	0.0%
Total	**590,937**	**590,918**	**-19**	**0.0%**	**706,567**	**706,624**	**57**	**0.0%**

The data in the above tables highlights that the demand modelling has only a minimal impact on total trips by purpose for the Low and High Growth scenario.

The impact of the alternative scenarios on P&R demand was outlined previously in section 6.3.5.

8.8.3 Model Convergence

The convergence of the VDM and assignment models for the High and Low growth scenarios is outlined in the following tables.

Table 8-85: Low and High Growth VDM Convergence

Scenario	Iteration	Low Growth		High Growth	
		Loop	%GAP	Loop	%GAP
Do-Minimum					
2026	F-3	-	-	1	1.224%
	F-2	1	0.286%	2	0.307%
	F-1	2	0.117%	3	0.113%
	Final (F)	3	0.049%	4	0.060%
2041	F-3	1	1.039%	3	0.330%
	F-2	2	0.334%	4	0.151%
	F-1	3	0.150%	5	0.108%
	Final (F)	4	0.072%	6	0.057%
Do-Something					
2026	F-3	-		-	-
	F-2	1	0.439%	1	0.670%
	F-1	2	0.167%	2	0.224%
	Final (F)	3	0.066%	3	0.093%
2041	F-3	1	0.713%	8	0.112%
	F-2	2	0.280%	9	0.108%
	F-1	3	0.116%	10	0.108%
	Final (F)	4	0.064%	11	0.104%

Table 8-86: Assignment Model Convergence – Low Growth Do-Minimum

Scenario	Time Period	Iteration	Loop	%GAP	Stability Indicator: %Delay	
					Links	Turns
2026	AM	F-3	8	0.0416%	98.83%	99.81%
		F-2	9	0.0387%	99.24%	99.89%
		F-1	10	0.0370%	99.38%	99.91%
		Final (F)	11	0.0368%	99.39%	99.89%
	IP	F-3	5	0.0043%	99.69%	99.93%
		F-2	6	0.0033%	99.82%	99.96%
		F-1	7	0.0030%	99.87%	99.98%
		Final (F)	8	0.0028%	99.88%	99.99%
	PM	F-3	12	0.0391%	99.29%	99.91%
		F-2	13	0.0350%	98.65%	99.83%
		F-1	14	0.0342%	98.73%	99.84%
		Final (F)	15	0.0300%	99.23%	99.91%
2041	AM	F-3	13	0.0426%	99.28%	99.89%
		F-2	14	0.0407%	99.25%	99.89%
		F-1	15	0.0414%	99.26%	99.89%
		Final (F)	16	0.0397%	99.31%	99.89%
	IP	F-3	6	0.0092%	99.39%	99.88%
		F-2	7	0.0112%	99.31%	99.90%
		F-1	8	0.0076%	99.59%	99.92%
		Final (F)	9	0.0070%	99.71%	99.96%
	PM	F-3	16	0.0602%	99.18%	99.90%
		F-2	17	0.0591%	99.09%	99.88%
		F-1	18	0.0579%	99.35%	99.93%
		Final (F)	19	0.0566%	99.42%	99.94%

Table 8-87: Assignment Model Convergence – Low Growth Do-Something

Scenario	Time Period	Iteration	Loop	%GAP	Stability Indicator: %Delay	
					Links	Turns
2026	AM	F-3	13	0.0141%	99.13%	99.85%
		F-2	14	0.0133%	99.13%	99.84%
		F-1	15	0.0109%	99.33%	99.88%
		Final (F)	16	0.0102%	99.43%	99.91%
	IP	F-3	5	0.0005%	99.77%	99.94%
		F-2	6	0.0005%	99.89%	99.98%
		F-1	7	0.0011%	99.74%	99.96%
		Final (F)	8	0.0004%	99.80%	99.96%
	PM	F-3	7	0.0130%	99.29%	99.91%
		F-2	8	0.0123%	99.47%	99.93%
		F-1	9	0.0113%	99.53%	99.90%
		Final (F)	10	0.0104%	99.60%	99.93%
2041	AM	F-3	16	0.0311%	98.91%	99.84%
		F-2	17	0.0287%	99.09%	99.86%
		F-1	18	0.0269%	99.21%	99.88%
		Final (F)	19	0.0273%	99.21%	99.89%
	IP	F-3	6	0.0076%	99.31%	99.90%
		F-2	7	0.0041%	99.69%	99.95%
		F-1	8	0.0040%	99.89%	99.99%
		Final (F)	9	0.0040%	99.91%	99.99%
	PM	F-3	9	0.0408%	98.53%	99.79%
		F-2	10	0.0383%	99.17%	99.88%
		F-1	11	0.0369%	99.25%	99.88%
		Final (F)	12	0.0351%	99.46%	99.91%

Table 8-88: Assignment Model Convergence – High Growth Do-Minimum

Scenario	Time Period	Iteration	Loop	%GAP	Stability Indicator: %Delay	
					Links	Turns
2026	AM	F-3	10	0.0596%	98.91%	99.82%
		F-2	11	0.0572%	98.91%	99.84%
		F-1	12	0.0560%	99.12%	99.90%
		Final (F)	13	0.0558%	99.20%	99.91%
	IP	F-3	6	0.0056%	99.73%	99.95%
		F-2	7	0.0052%	99.83%	99.97%
		F-1	8	0.0050%	99.88%	99.98%
		Final (F)	9	0.0050%	99.88%	99.99%
	PM	F-3	12	0.0567%	98.42%	99.81%
		F-2	13	0.0537%	98.96%	99.83%
		F-1	14	0.0510%	99.23%	99.92%
		Final (F)	15	0.0488%	99.07%	99.88%
2041	AM	F-3	13	0.0794%	98.47%	99.81%
		F-2	14	0.0774%	98.76%	99.83%
		F-1	15	0.0803%	98.77%	99.84%
		Final (F)	16	0.0775%	98.79%	99.87%
	IP	F-3	7	0.0133%	99.19%	99.92%
		F-2	8	0.0120%	99.41%	99.94%
		F-1	9	0.0116%	99.56%	99.96%
		Final (F)	10	0.0117%	99.59%	99.96%
	PM	F-3	23	0.0892%	98.80%	99.87%
		F-2	24	0.0883%	98.95%	99.88%
		F-1	25	0.0870%	99.00%	99.87%
		Final (F)	26	0.0863%	99.18%	99.90%

Table 8-89: Assignment Model Convergence – High Growth Do-Something

Scenario	Time Period	Iteration	Loop	%GAP	Stability Indicator: %Delay	
					Links	Turns
2026	AM	F-3	10	0.0344%	98.33%	99.75%
		F-2	11	0.0332%	98.24%	99.79%
		F-1	12	0.0313%	98.47%	99.80%
		Final (F)	13	0.0296%	98.78%	99.83%
	IP	F-3	5	0.0008%	99.28%	99.89%
		F-2	6	0.0005%	99.73%	99.95%
		F-1	7	0.0005%	99.75%	99.96%
		Final (F)	8	0.0005%	99.89%	99.98%
	PM	F-3	8	0.0341%	98.92%	99.85%
		F-2	9	0.0323%	99.14%	99.87%
		F-1	10	0.0317%	99.12%	99.89%
		Final (F)	11	0.0308%	99.11%	99.88%
2041	AM	F-3	21	0.0676%	98.70%	99.78%
		F-2	22	0.0668%	98.49%	99.80%
		F-1	23	0.0627%	98.47%	99.80%
		Final (F)	24	0.0612%	98.70%	99.78%
	IP	F-3	7	0.0089%	99.27%	99.89%
		F-2	8	0.0087%	99.50%	99.92%
		F-1	9	0.0086%	99.73%	99.95%
		Final (F)	10	0.0085%	99.79%	99.97%
	PM	F-3	12	0.0794%	98.22%	99.81%
		F-2	13	0.0786%	98.06%	99.71%
		F-1	14	0.0784%	98.38%	99.78%
		Final (F)	15	0.0747%	98.70%	99.84%

The model convergence statistics in the above tables highlight that:

- The %GAP for the VDM is below the 0.1% preferred criteria for all models, that is, both DM and DS for both forecast years and both High and Low growth.
- For the final assignment models, the %GAP is less than 0.1% for all scenarios, time periods and final four iterations, with the highest value being 0.086%.
- The stability indicator is above 98% for four consecutive iterations.

8.8.4 Forecast Traffic Flows

The High and Low Growth Scenario forecast traffic flows are outlined in the following tables for the Do-Minimum and the preferred Do-Something option (Option C Hamburger) for all forecast years, time periods, purposes and vehicle types.

Figure 8-57: Forecast Traffic Flows Location Map - Army & Navy junction

Table 8-90: Forecast Traffic Flows at Army & Navy Junction – Low Growth 2026 AM Peak (vehicles)

ID_direction	Location	DM26				DS26				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
AN1.1_EB	A1060 Parkway	1,325	126	33	1,484	1,181	120	20	1,321	-144	-6	-13	-163	-11%	-5%	-39%	-11%
AN1.1_WB	A1060 Parkway	1,726	87	16	1,829	2,201	106	23	2,330	475	19	7	501	28%	22%	44%	27%
81038104_SB	A138 Chelmer Road	1,081	106	14	1,201	1,744	157	28	1,929	663	51	14	728	61%	48%	100%	61%
81038104_NB	A138 Chelmer Road	798	99	30	927	858	106	20	984	60	7	-10	57	8%	7%	-33%	6%
AN1.3_WB	A1114 EYW	1,189	58	13	1,260	1,427	67	14	1,508	238	9	1	248	20%	16%	8%	20%
AN1.3_EB	A1114 EYW	828	90	20	938	987	102	26	1,115	159	12	6	177	19%	13%	30%	19%
AN1.4_NWB	B1009 Baddow Road	517	40	6	563	640	40	6	686	123	0	0	123	24%	0%	0%	22%
AN1.4_SEB	B1009 Baddow Road	445	44	6	495	511	51	6	568	66	7	0	73	15%	16%	0%	15%
AN1.5_NB	A1114 Van Diemans Road	463	65	22	550	497	67	22	586	34	2	0	36	7%	3%	0%	7%
AN1.5_SB	A1114 Van Diemans Road	632	68	16	716	790	82	13	885	158	14	-3	169	25%	21%	-19%	24%
To junction	**Towards A&N**	**4,575**	**395**	**88**	**5,058**	**5,489**	**451**	**90**	**6,030**	**914**	**56**	**2**	**972**	**20%**	**14%**	**2%**	**19%**
From junction	**Away from A&N**	**4,429**	**388**	**88**	**4,905**	**5,347**	**447**	**88**	**5,882**	**918**	**59**	**0**	**977**	**21%**	**15%**	**0%**	**20%**
Total	**ALL**	**9,004**	**783**	**176**	**9,963**	**10,836**	**898**	**178**	**11,912**	**1,832**	**115**	**2**	**1,949**	**20%**	**15%**	**1%**	**20%**

Table 8-91: Forecast Traffic Flows at Army & Navy Junction – Low Growth Scenario 2026 PM Peak (vehicles)

ID_direction	Location	DM26				DS26				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
AN1.1_EB	A1060 Parkway	2,076	106	18	2,200	2,029	92	16	2,137	-47	-14	-2	-63	-2%	-13%	-11%	-3%
AN1.1_WB	A1060 Parkway	1,153	70	13	1,236	1,529	77	15	1,621	376	7	2	385	33%	10%	15%	31%
81038104_SB	A138 Chelmer Road	1,171	123	22	1,316	1,070	116	16	1,202	-101	-7	-6	-114	-9%	-6%	-27%	-9%
81038104_NB	A138 Chelmer Road	1,034	84	24	1,142	1,134	97	35	1,266	100	13	11	124	10%	15%	46%	11%
AN1.3_WB	A1114 EYW	781	38	9	828	1,178	60	15	1,253	397	22	6	425	51%	58%	67%	51%
AN1.3_EB	A1114 EYW	1,323	74	11	1,408	1,528	89	12	1,629	205	15	1	221	15%	20%	9%	16%
AN1.4_NWB	B1009 Baddow Road	416	43	5	464	557	45	4	606	141	2	-1	142	34%	5%	-20%	31%
AN1.4_SEB	B1009 Baddow Road	640	62	9	711	666	57	8	731	26	-5	-1	20	4%	-8%	-11%	3%
AN1.5_NB	A1114 Van Diemans Road	418	55	21	494	655	78	33	766	237	23	12	272	57%	42%	57%	55%
AN1.5_SB	A1114 Van Diemans Road	557	66	17	640	596	67	13	676	39	1	-4	36	7%	2%	-24%	6%
To junction	**Towards A&N**	**4,862**	**365**	**75**	**5,302**	**5,489**	**391**	**84**	**5,964**	**627**	**26**	**9**	**662**	**13%**	**7%**	**12%**	**12%**
From junction	**Away from A&N**	**4,707**	**356**	**74**	**5,137**	**5,453**	**387**	**83**	**5,923**	**746**	**31**	**9**	**786**	**16%**	**9%**	**12%**	**15%**
Total	**ALL**	**9,569**	**721**	**149**	**10,439**	**10,942**	**778**	**167**	**11,887**	**1,373**	**57**	**18**	**1,448**	**14%**	**8%**	**12%**	**14%**

Table 8-92: Forecast Traffic Flows at Army & Navy Junction – Low Growth Scenario 2041 AM Peak (vehicles)

ID_direction	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
AN1.1_EB	A1060 Parkway	1,408	154	40	1,602	1,254	138	26	1,418	-154	-16	-14	-184	-11%	-10%	-35%	-11%
AN1.1_WB	A1060 Parkway	1,705	102	20	1,827	2,151	116	24	2,291	446	14	4	464	26%	14%	20%	25%
81038104_SB	A138 Chelmer Road	1,526	146	21	1,693	1,951	169	26	2,146	425	23	5	453	28%	16%	24%	27%
81038104_NB	A138 Chelmer Road	881	107	28	1,016	955	118	14	1,087	74	11	-14	71	8%	10%	-50%	7%
AN1.3_WB	A1114 EYW	1,047	72	13	1,132	1,334	79	15	1,428	287	7	2	296	27%	10%	15%	26%
AN1.3_EB	A1114 EYW	1,034	131	30	1,195	1,124	128	32	1,284	90	-3	2	89	9%	-2%	7%	7%
AN1.4_NWB	B1009 Baddow Road	429	37	6	472	594	47	6	647	165	10	0	175	38%	27%	0%	37%
AN1.4_SEB	B1009 Baddow Road	400	42	6	448	493	51	6	550	93	9	0	102	23%	21%	0%	23%
AN1.5_NB	A1114 Van Diemans Road	461	62	18	541	519	64	13	596	58	2	-5	55	13%	3%	-28%	10%
AN1.5_SB	A1114 Van Diemans Road	723	73	11	807	795	75	10	880	72	2	-1	73	10%	3%	-9%	9%
To junction	**Towards A&N**	**4,871**	**471**	**98**	**5,440**	**5,652**	**497**	**86**	**6,235**	**781**	**26**	**-12**	**795**	**16%**	**6%**	**-12%**	**15%**
From junction	**Away from A&N**	**4,743**	**455**	**95**	**5,293**	**5,518**	**488**	**86**	**6,092**	**775**	**33**	**-9**	**799**	**16%**	**7%**	**-9%**	**15%**
Total	**ALL**	**9,614**	**926**	**193**	**10,733**	**11,170**	**985**	**172**	**12,327**	**1,556**	**59**	**-21**	**1,594**	**16%**	**6%**	**-11%**	**15%**

Table 8-93: Forecast Traffic Flows at Army & Navy Junction – Low Growth Scenario 2041 PM Peak (vehicles)

ID_direction	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
AN1.1_EB	A1060 Parkway	1,858	117	21	1,996	2,018	104	18	2,140	160	-13	-3	144	9%	-11%	-14%	7%
AN1.1_WB	A1060 Parkway	1,180	85	14	1,279	1,598	97	16	1,711	418	12	2	432	35%	14%	14%	34%
81038104_SB	A138 Chelmer Road	1,320	142	19	1,481	1,194	132	16	1,342	-126	-10	-3	-139	-10%	-7%	-16%	-9%
81038104_NB	A138 Chelmer Road	1,074	90	16	1,180	1,257	106	20	1,383	183	16	4	203	17%	18%	25%	17%
AN1.3_WB	A1114 EYW	768	49	10	827	1,267	79	18	1,364	499	30	8	537	65%	61%	80%	65%
AN1.3_EB	A1114 EYW	1,248	99	14	1,361	1,529	107	18	1,654	281	8	4	293	23%	8%	29%	22%
AN1.4_NWB	B1009 Baddow Road	392	44	5	441	545	50	4	599	153	6	-1	158	39%	14%	-20%	36%
AN1.4_SEB	B1009 Baddow Road	566	66	9	641	641	62	8	711	75	-4	-1	70	13%	-6%	-11%	11%
AN1.5_NB	A1114 Van Diemans Road	436	59	12	507	696	75	16	787	260	16	4	280	60%	27%	33%	55%
AN1.5_SB	A1114 Van Diemans Road	553	60	10	623	661	60	10	731	108	0	0	108	20%	0%	0%	17%
To junction	**Towards A&N**	**4,774**	**411**	**67**	**5,252**	**5,720**	**440**	**72**	**6,232**	**946**	**29**	**5**	**980**	**20%**	**7%**	**7%**	**19%**
From junction	**Away from A&N**	**4,621**	**400**	**63**	**5,084**	**5,686**	**432**	**72**	**6,190**	**1,065**	**32**	**9**	**1,106**	**23%**	**8%**	**14%**	**22%**
Total	**ALL**	**9,395**	**811**	**130**	**10,336**	**11,406**	**872**	**144**	**12,422**	**2,011**	**61**	**14**	**2,086**	**21%**	**8%**	**11%**	**20%**

Table 8-94: Forecast Traffic Flows at Army & Navy Junction – High Growth Scenario 2026 AM Peak (vehicles)

ID_direction	Location	DM26				DS26				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
AN1.1_EB	A1060 Parkway	1,436	141	38	1,615	1,316	135	24	1,475	-120	-6	-14	-140	-8%	-4%	-37%	-9%
AN1.1_WB	A1060 Parkway	1,696	92	21	1,809	2,251	111	26	2,388	555	19	5	579	33%	21%	24%	32%
81038104_SB	A138 Chelmer Road	1,057	116	20	1,193	1,725	163	30	1,918	668	47	10	725	63%	41%	50%	61%
81038104_NB	A138 Chelmer Road	836	105	36	977	884	112	24	1,020	48	7	-12	43	6%	7%	-33%	4%
AN1.3_WB	A1114 EYW	1,199	68	15	1,282	1,439	74	16	1,529	240	6	1	247	20%	9%	7%	19%
AN1.3_EB	A1114 EYW	977	96	22	1,095	1,013	110	27	1,150	36	14	5	55	4%	15%	23%	5%
AN1.4_NWB	B1009 Baddow Road	496	40	6	542	661	43	6	710	165	3	0	168	33%	8%	0%	31%
AN1.4_SEB	B1009 Baddow Road	355	51	6	412	554	57	8	619	199	6	2	207	56%	12%	33%	50%
AN1.5_NB	A1114 Van Diemans Road	443	70	27	540	493	68	23	584	50	-2	-4	44	11%	-3%	-15%	8%
AN1.5_SB	A1114 Van Diemans Road	642	69	17	728	746	81	12	839	104	12	-5	111	16%	17%	-29%	15%
To junction	**Towards A&N**	**4,631**	**435**	**106**	**5,172**	**5,634**	**483**	**99**	**6,216**	**1,003**	**48**	**-7**	**1,044**	**22%**	**11%**	**-7%**	**20%**
From junction	**Away from A&N**	**4,506**	**413**	**102**	**5,021**	**5,448**	**471**	**97**	**6,016**	**942**	**58**	**-5**	**995**	**21%**	**14%**	**-5%**	**20%**
Total	**ALL**	**9,137**	**848**	**208**	**10,193**	**11,082**	**954**	**196**	**12,232**	**1,945**	**106**	**-12**	**2,039**	**21%**	**13%**	**-6%**	**20%**

Table 8-95: Forecast Traffic Flows at Army & Navy Junction – High Growth 2026 PM Peak (vehicles)

ID_direction	Location	DM26				DS26				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
AN1.1_EB	A1060 Parkway	2,075	116	24	2,215	2,055	96	18	2,169	-20	-20	-6	-46	-1%	-17%	-25%	-2%
AN1.1_WB	A1060 Parkway	1,181	75	12	1,268	1,556	84	15	1,655	375	9	3	387	32%	12%	25%	31%
81038104_SB	A138 Chelmer Road	1,167	135	21	1,323	1,060	123	16	1,199	-107	-12	-5	-124	-9%	-9%	-24%	-9%
81038104_NB	A138 Chelmer Road	1,023	90	29	1,142	1,218	103	36	1,357	195	13	7	215	19%	14%	24%	19%
AN1.3_WB	A1114 EYW	753	43	9	805	1,297	68	16	1,381	544	25	7	576	72%	58%	78%	72%
AN1.3_EB	A1114 EYW	1,253	80	12	1,345	1,525	87	13	1,625	272	7	1	280	22%	9%	8%	21%
AN1.4_NWB	B1009 Baddow Road	416	43	6	465	560	48	5	613	144	5	-1	148	35%	12%	-17%	32%
AN1.4_SEB	B1009 Baddow Road	675	68	9	752	670	60	8	738	-5	-8	-1	-14	-1%	-12%	-11%	-2%
AN1.5_NB	A1114 Van Diemans Road	412	58	23	493	656	78	33	767	244	20	10	274	59%	34%	43%	56%
AN1.5_SB	A1114 Van Diemans Road	527	70	17	614	629	71	15	715	102	1	-2	101	19%	1%	-12%	16%
To junction	**Towards A&N**	**4,823**	**395**	**83**	**5,301**	**5,628**	**413**	**88**	**6,129**	**805**	**18**	**5**	**828**	**17%**	**5%**	**6%**	**16%**
From junction	**Away from A&N**	**4,659**	**383**	**79**	**5,121**	**5,598**	**405**	**87**	**6,090**	**939**	**22**	**8**	**969**	**20%**	**6%**	**10%**	**19%**
Total	**ALL**	**9,482**	**778**	**162**	**10,422**	**11,226**	**818**	**175**	**12,219**	**1,744**	**40**	**13**	**1,797**	**18%**	**5%**	**8%**	**17%**

Table 8-96: Forecast Traffic Flows at Army & Navy Junction – High Growth Scenario 2041 AM Peak (vehicles)

ID_direction	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
AN1.1_EB	A1060 Parkway	1,493	179	49	1,721	1,345	144	34	1,523	-148	-35	-15	-198	-10%	-20%	-31%	-12%
AN1.1_WB	A1060 Parkway	1,623	110	24	1,757	2,157	127	28	2,312	534	17	4	555	33%	15%	17%	32%
81038104_SB	A138 Chelmer Road	1,512	154	24	1,690	2,183	194	35	2,412	671	40	11	722	44%	26%	46%	43%
81038104_NB	A138 Chelmer Road	937	134	32	1,103	1,035	130	20	1,185	98	-4	-12	82	10%	-3%	-38%	7%
AN1.3_WB	A1114 EYW	994	96	21	1,111	1,330	106	20	1,456	336	10	-1	345	34%	10%	-5%	31%
AN1.3_EB	A1114 EYW	1,053	155	35	1,243	1,292	153	42	1,487	239	-2	7	244	23%	-1%	20%	20%
AN1.4_NWB	B1009 Baddow Road	435	38	3	476	566	47	7	620	131	9	4	144	30%	24%	133%	30%
AN1.4_SEB	B1009 Baddow Road	422	49	8	479	518	59	8	585	96	10	0	106	23%	20%	0%	22%
AN1.5_NB	A1114 Van Diemans Road	461	66	16	543	513	69	14	596	52	3	-2	53	11%	5%	-13%	10%
AN1.5_SB	A1114 Van Diemans Road	728	73	11	812	789	78	10	877	61	5	-1	65	8%	7%	-9%	8%
To junction	**Towards A&N**	**4,895**	**533**	**113**	**5,541**	**5,937**	**560**	**110**	**6,607**	**1,042**	**27**	**-3**	**1,066**	**21%**	**5%**	**-3%**	**19%**
From junction	**Away from A&N**	**4,763**	**521**	**110**	**5,394**	**5,791**	**547**	**108**	**6,446**	**1,028**	**26**	**-2**	**1,052**	**22%**	**5%**	**-2%**	**20%**
Total	**ALL**	**9,658**	**1,054**	**223**	**10,935**	**11,728**	**1,107**	**218**	**13,053**	**2,070**	**53**	**-5**	**2,118**	**21%**	**5%**	**-2%**	**19%**

Table 8-97: Forecast Traffic Flows at Army & Navy Junction – High Growth Scenario 2041 PM Peak (vehicles)

ID_direction	Location	DM41				DS41				Difference				%Difference			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total	Car	LGV	HGV	Total
AN1.1_EB	A1060 Parkway	1,867	130	27	2,024	2,029	119	24	2,172	162	-11	-3	148	9%	-8%	-11%	7%
AN1.1_WB	A1060 Parkway	1,154	88	15	1,257	1,575	111	23	1,709	421	23	8	452	36%	26%	53%	36%
81038104_SB	A138 Chelmer Road	1,296	157	26	1,479	1,174	136	22	1,332	-122	-21	-4	-147	-9%	-13%	-15%	-10%
81038104_NB	A138 Chelmer Road	1,082	95	18	1,195	1,363	110	22	1,495	281	15	4	300	26%	16%	22%	25%
AN1.3_WB	A1114 EYW	737	54	10	801	1,351	100	25	1,476	614	46	15	675	83%	85%	150%	84%
AN1.3_EB	A1114 EYW	1,153	108	21	1,282	1,449	122	25	1,596	296	14	4	314	26%	13%	19%	24%
AN1.4_NWB	B1009 Baddow Road	393	47	5	445	522	44	5	571	129	-3	0	126	33%	-6%	0%	28%
AN1.4_SEB	B1009 Baddow Road	615	75	10	700	635	65	9	709	20	-10	-1	9	3%	-13%	-10%	1%
AN1.5_NB	A1114 Van Diemans Road	441	55	11	507	692	76	18	786	251	21	7	279	57%	38%	64%	55%
AN1.5_SB	A1114 Van Diemans Road	584	61	13	658	706	67	14	787	122	6	1	129	21%	10%	8%	20%
To junction	**Towards A&N**	**4,734**	**443**	**79**	**5,256**	**5,768**	**475**	**94**	**6,337**	**1,034**	**32**	**15**	**1,081**	**22%**	**7%**	**19%**	**21%**
From junction	**Away from A&N**	**4,588**	**427**	**77**	**5,092**	**5,728**	**475**	**93**	**6,296**	**1,140**	**48**	**16**	**1,204**	**25%**	**11%**	**21%**	**24%**
Total	**ALL**	**9,322**	**870**	**156**	**10,348**	**11,496**	**950**	**187**	**12,633**	**2,174**	**80**	**31**	**2,285**	**23%**	**9%**	**20%**	**22%**

The following table summarises the total junction traffic flow at the A&N for all model scenario, forecast year and for AM and PM peak hours.

Table 8-98: Total Junction Flows at A&N for all scenarios, forecast years and AM and PM peak (vehicles)

Scenario	DM	DS	Diff	%Diff
2026 AM				
Low	9,963	11,912	1,949	19.6%
Core	10,065	12,126	2,061	20.5%
High	10,193	12,232	2,039	20.0%
2026 PM				
Low	10,439	11,887	1,448	13.9%
Core	10,386	12,029	1,643	15.8%
High	10,422	12,219	1,797	17.2%
2041 AM				
Low	10,733	12,327	1,594	14.9%
Core	10,883	12,846	1,963	18.0%
High	10,935	13,053	2,118	19.4%
2041 PM				
Low	10,336	12,422	2,086	20.2%
Core	10,299	12,602	2,303	22.4%
High	10,348	12,633	2,285	22.1%

The forecast model traffic flows outlined in the above tables highlight the following key points:

- Traffic flows through the A&N junction in the Core scenario are a little higher than the Low growth scenario and a little lower than the High growth scenario as expected; and
- The A&N scheme accommodates more traffic than the DM in all scenarios, forecast years and peak time periods, with up to 22% more traffic (2041 PM core and high).

8.8.5 Traffic Flow Difference Plots – Low Growth

The wider network differences in traffic flows between the Low growth scenario compared to the Core scenario are illustrated in the following figures.

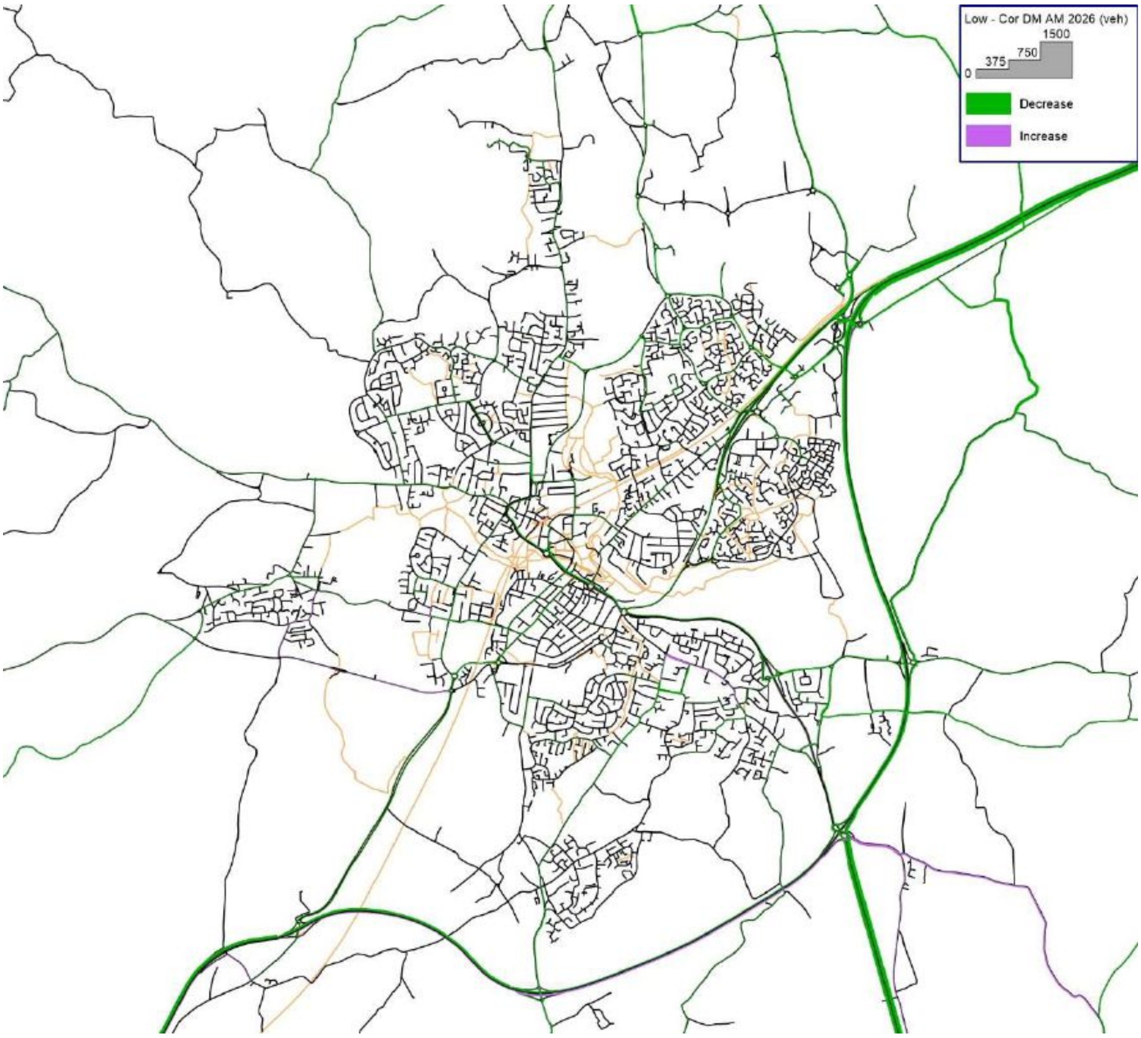


Figure 8-58: Traffic Flow Difference Plots Low Growth vs Core – DM 2026 AM peak

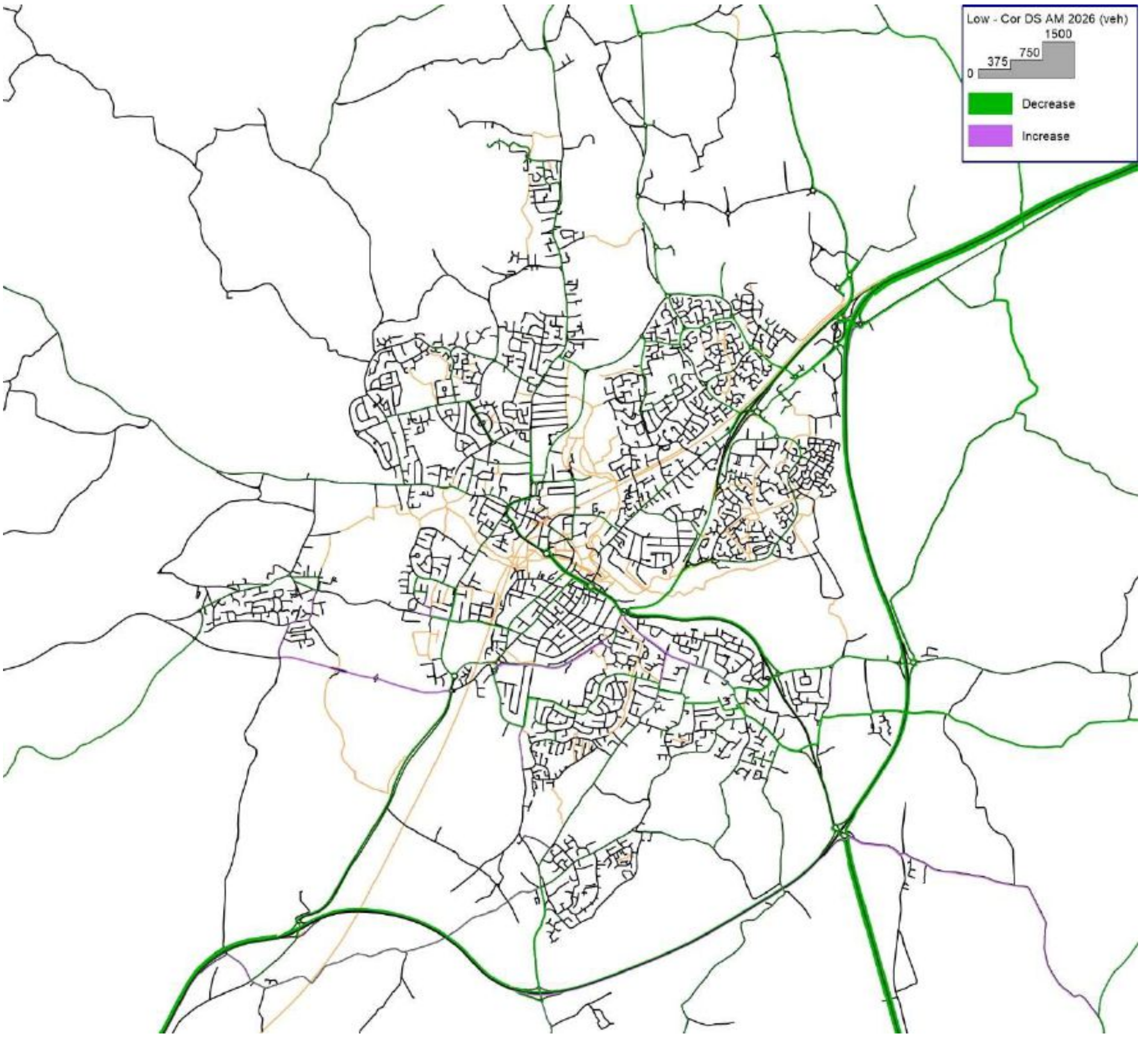


Figure 8-59: Traffic Flow Difference Plots Low Growth vs Core – DS 2026 AM peak

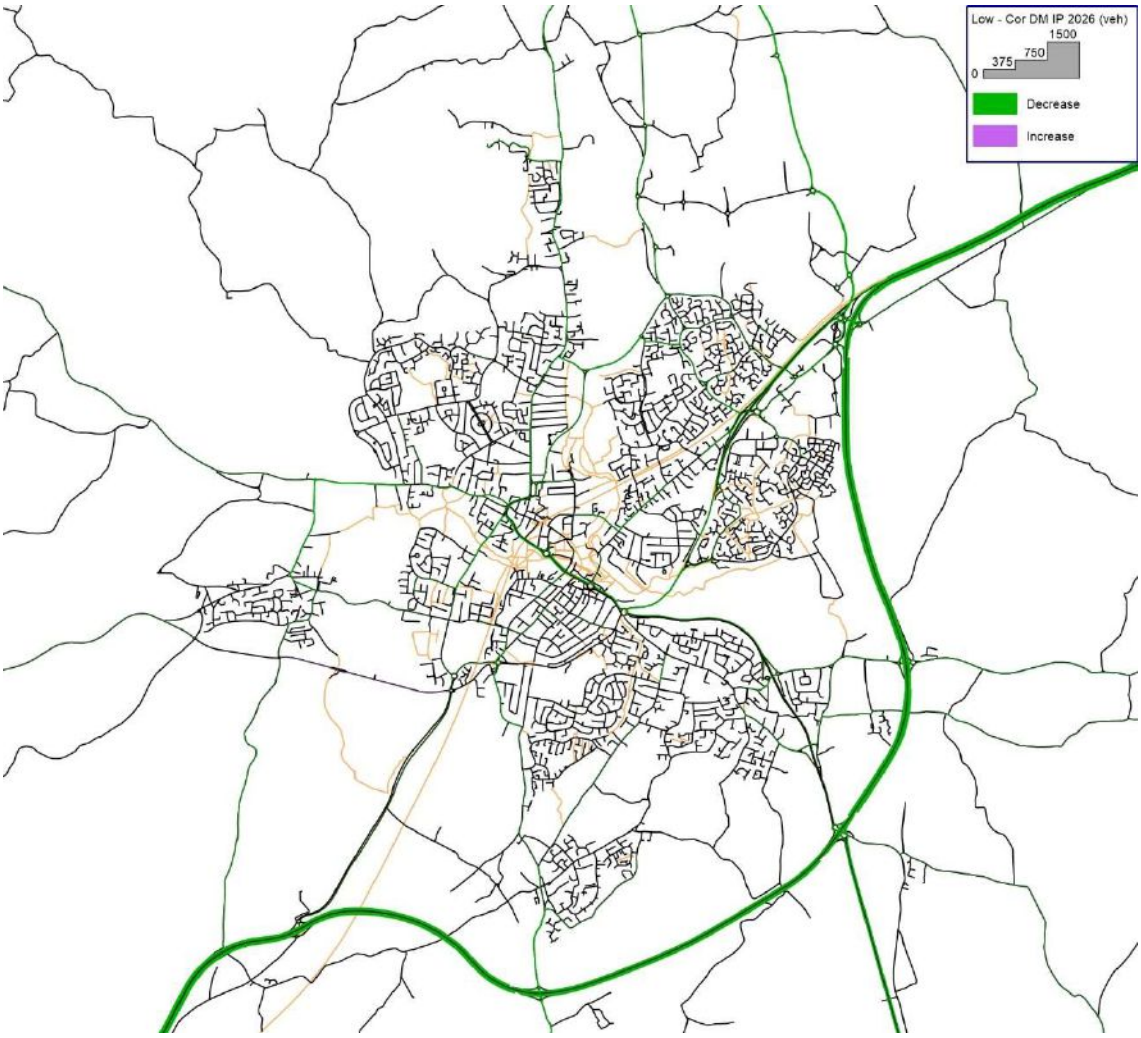


Figure 8-60: Traffic Flow Difference Plots Low Growth vs Core – DM 2026 Inter-peak

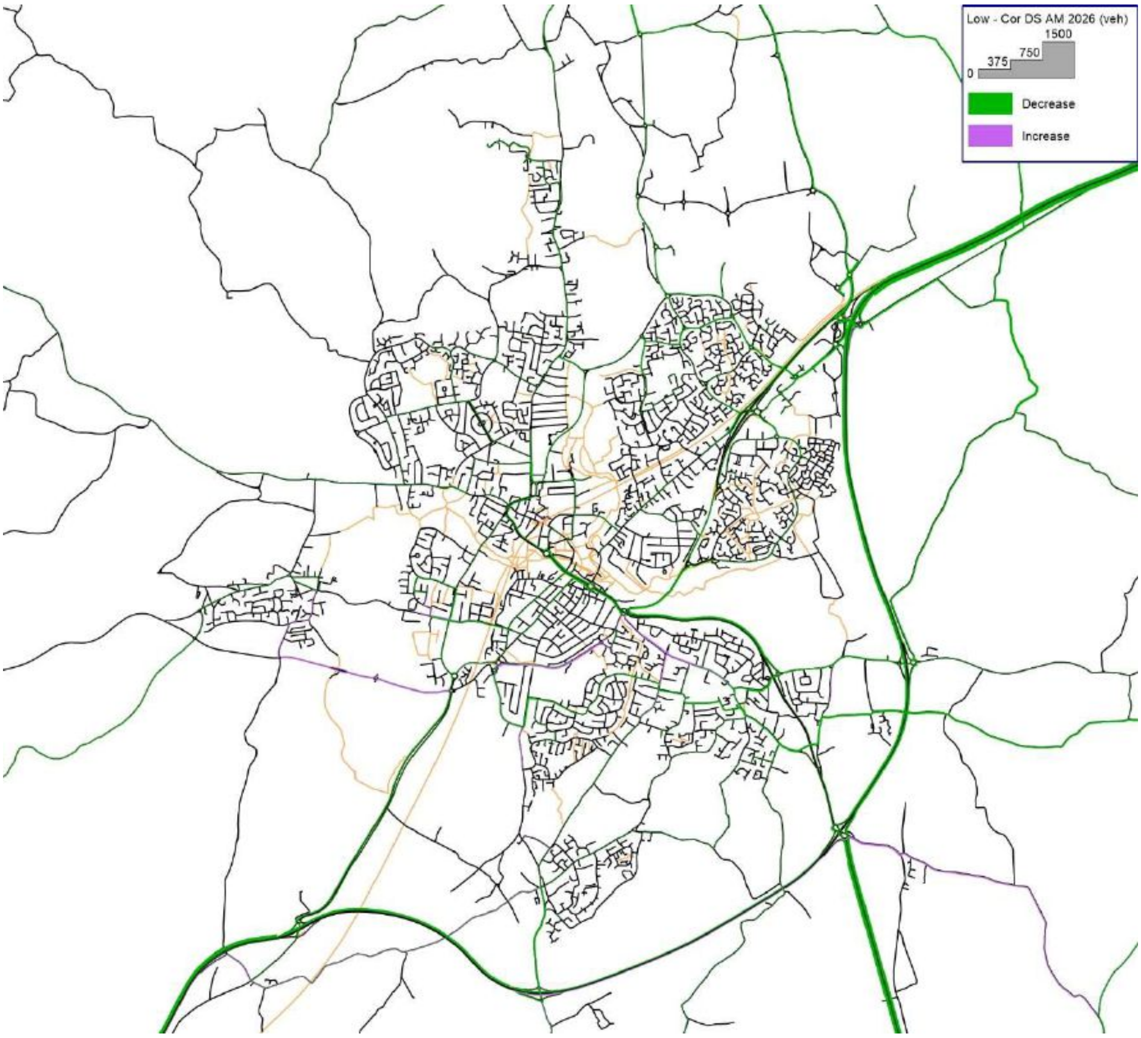


Figure 8-61: Traffic Flow Difference Plots Low Growth vs Core – DS 2026 Inter-peak

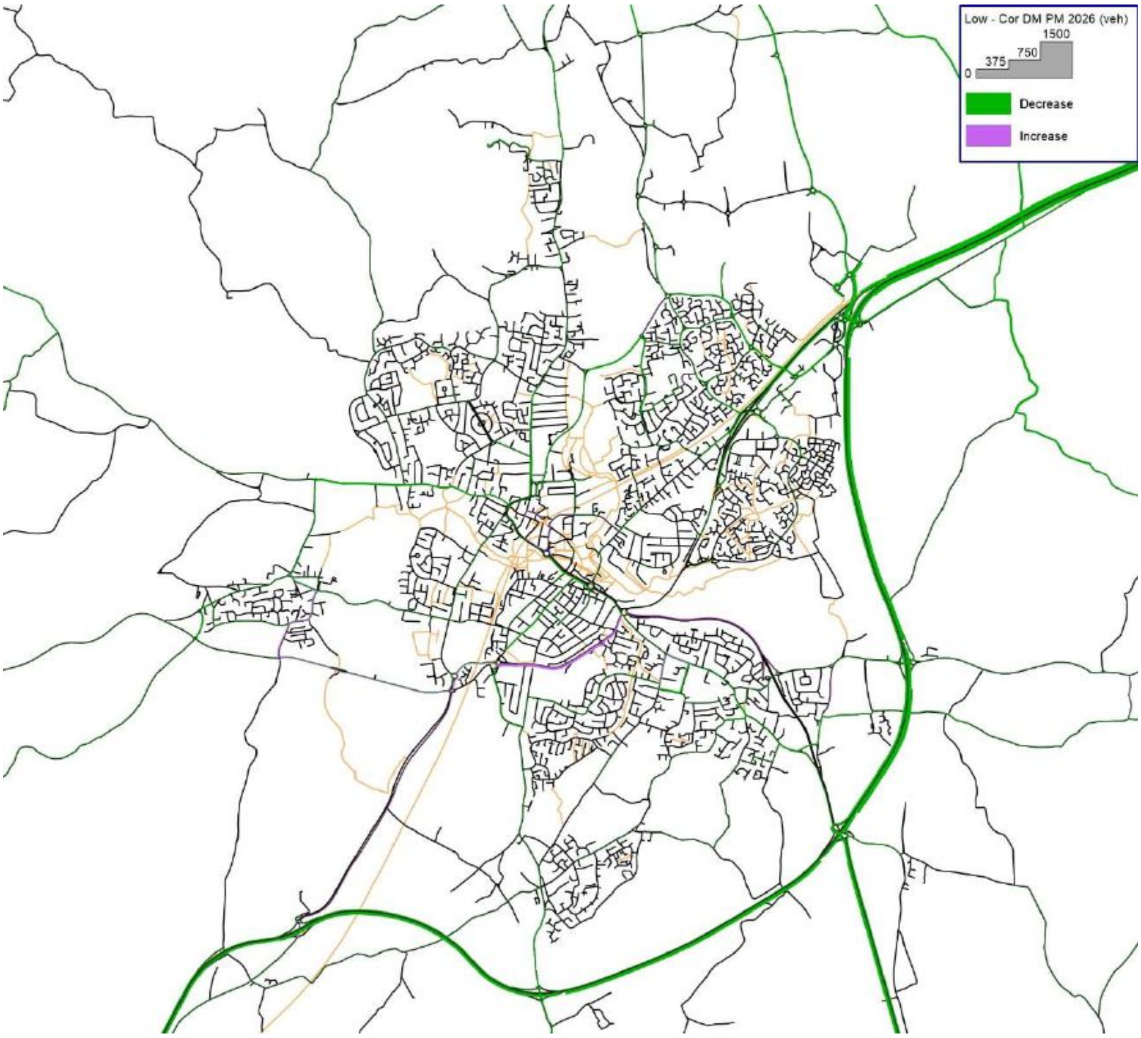


Figure 8-62: Traffic Flow Difference Plots Low Growth vs Core – DM 2026 PM peak

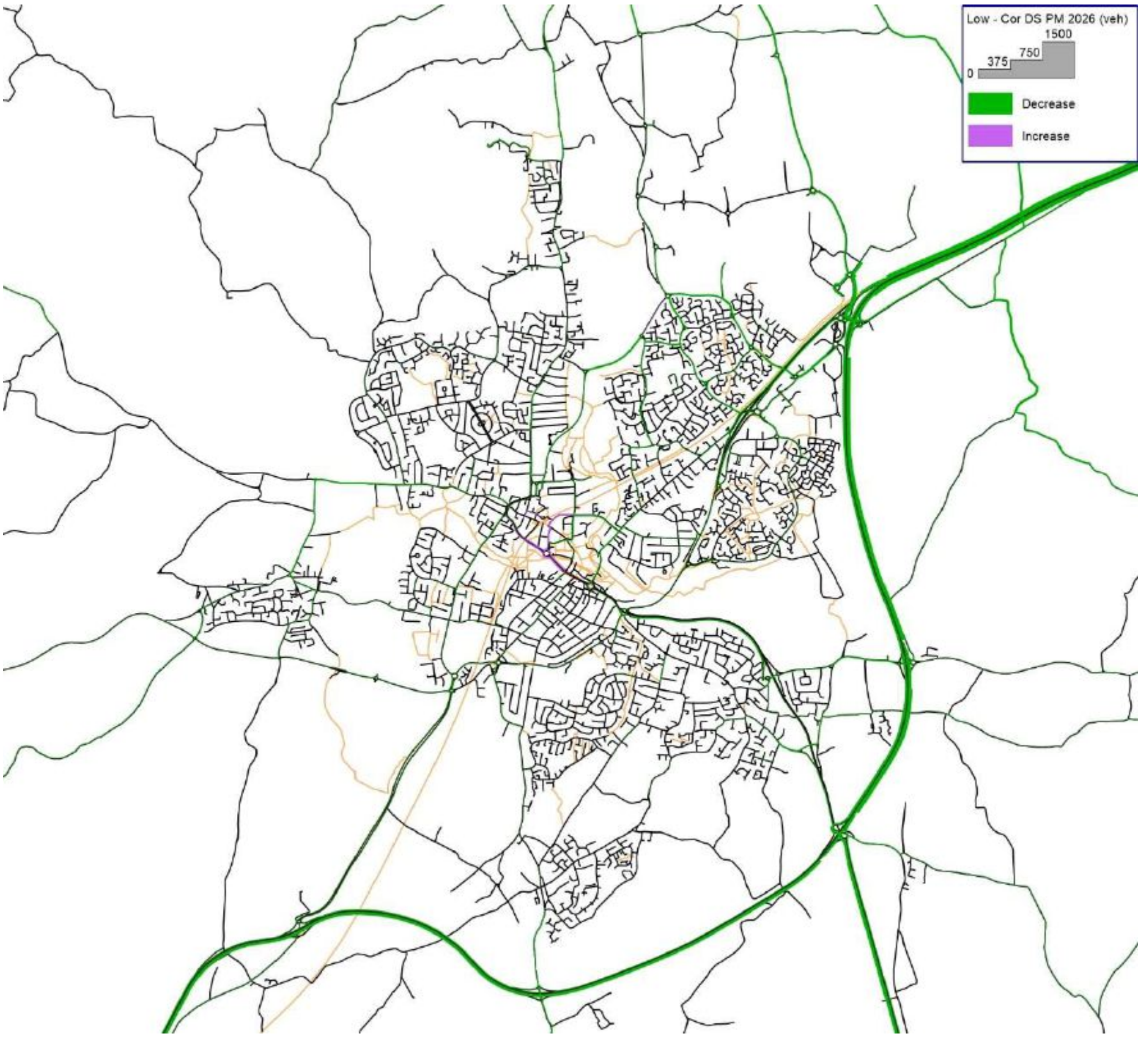


Figure 8-63: Traffic Flow Difference Plots Low Growth vs Core – DS 2026 PM peak

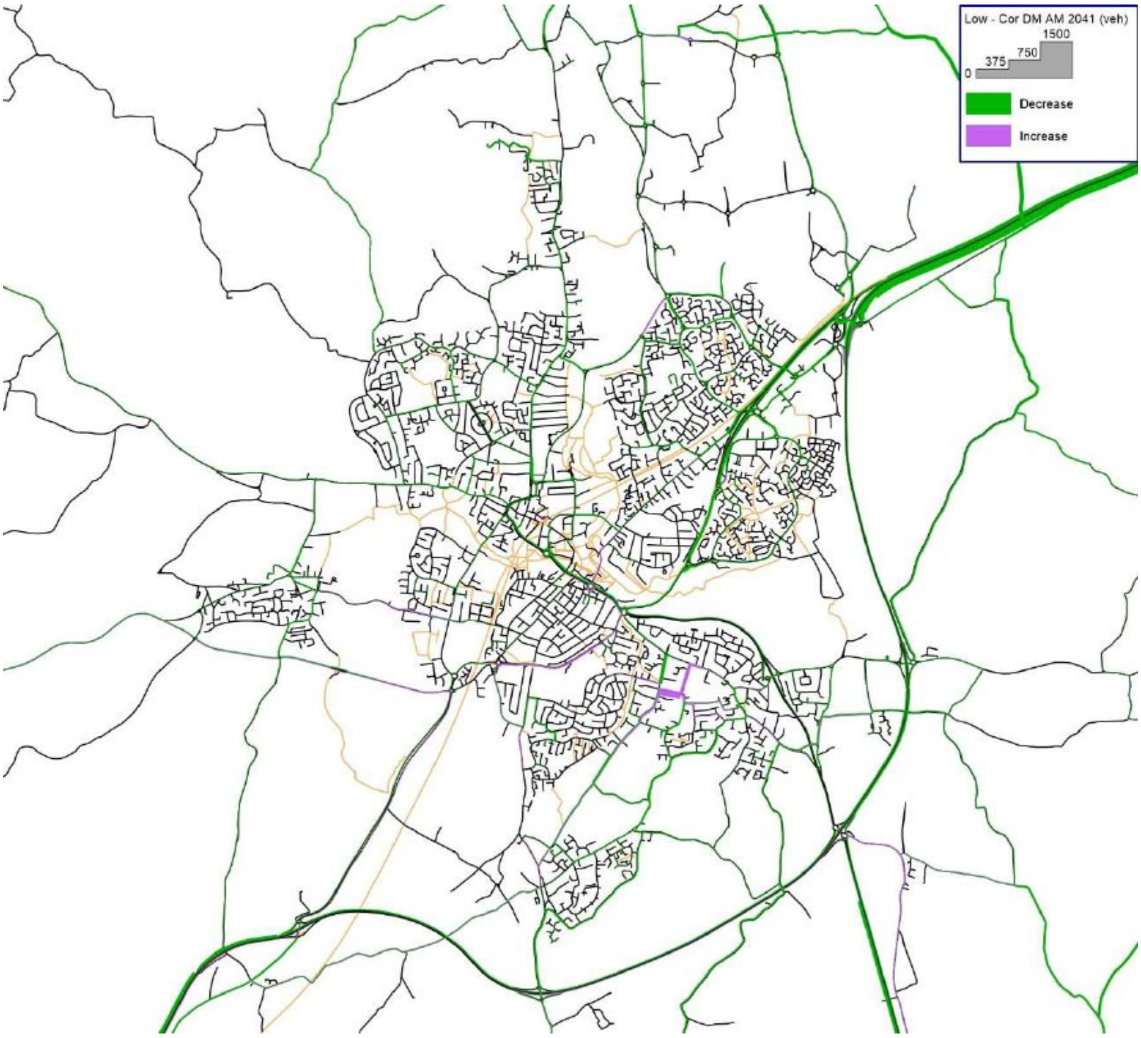


Figure 8-64: Traffic Flow Difference Plots Low Growth vs Core – DM 2041 AM peak

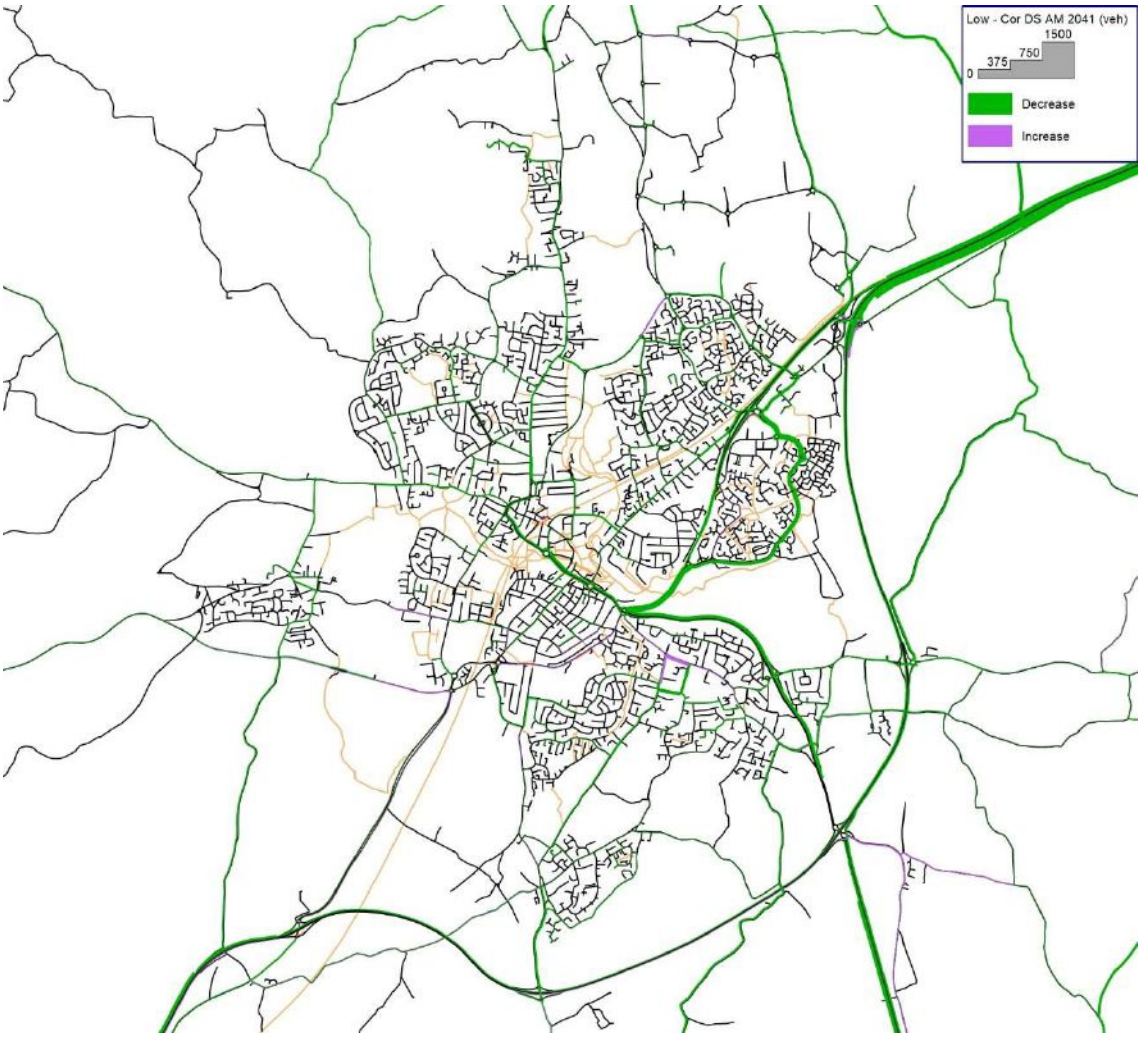


Figure 8-65: Traffic Flow Difference Plots Low Growth vs Core – DS 2041 AM peak

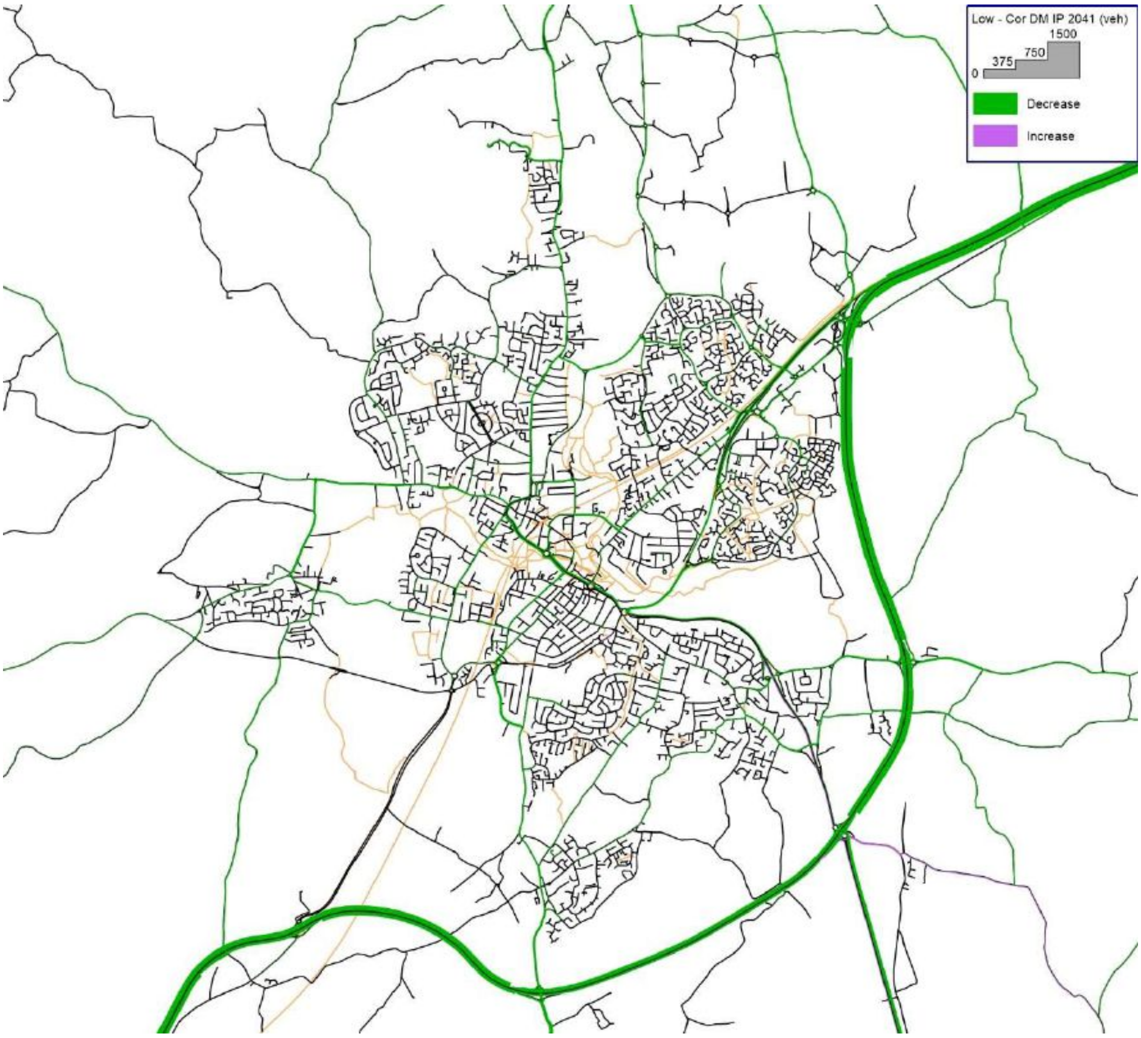


Figure 8-66: Traffic Flow Difference Plots Low Growth vs Core – DM 2041 Inter-peak

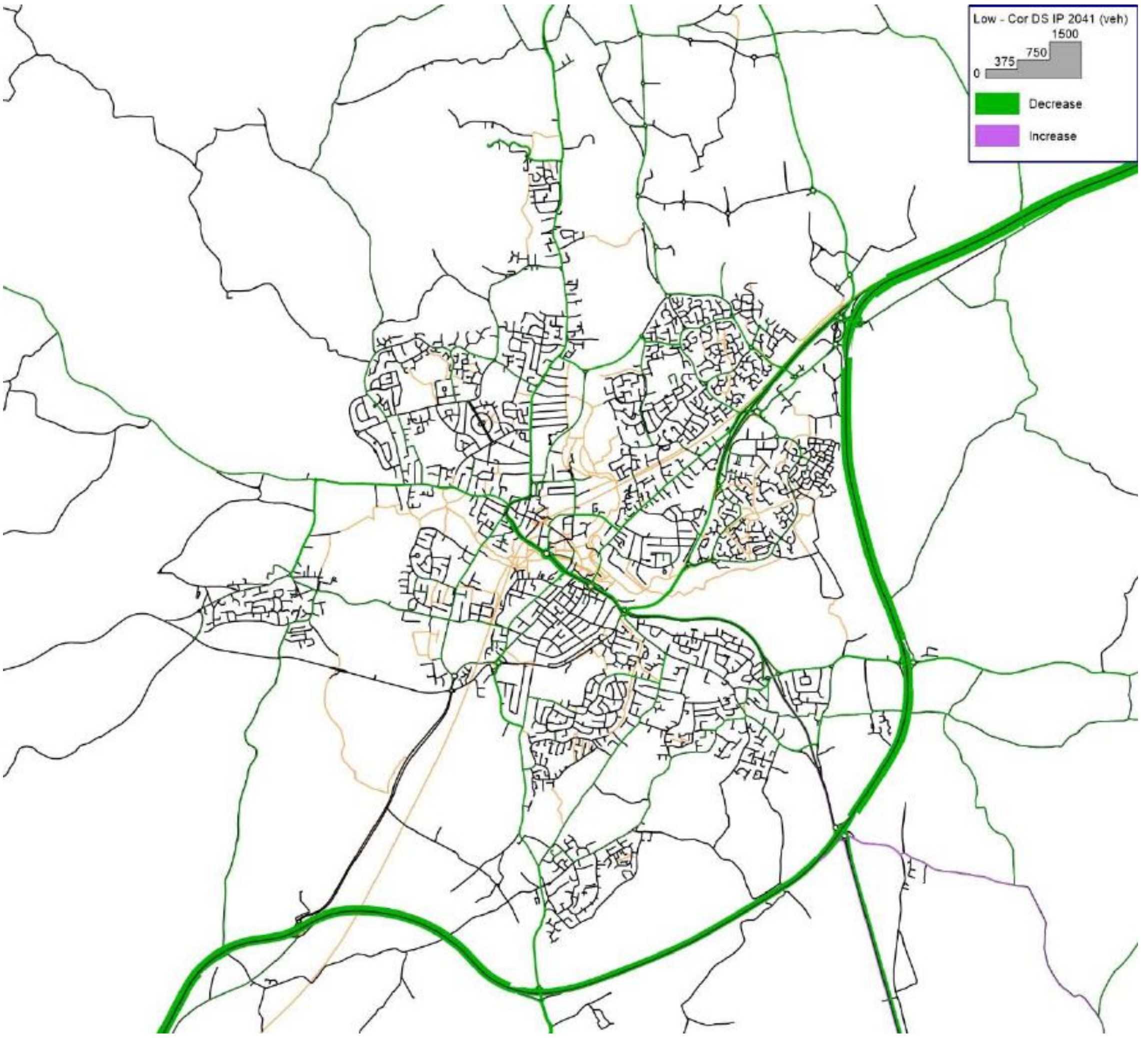


Figure 8-67: Traffic Flow Difference Plots Low Growth vs Core – DS 2041 Inter-peak

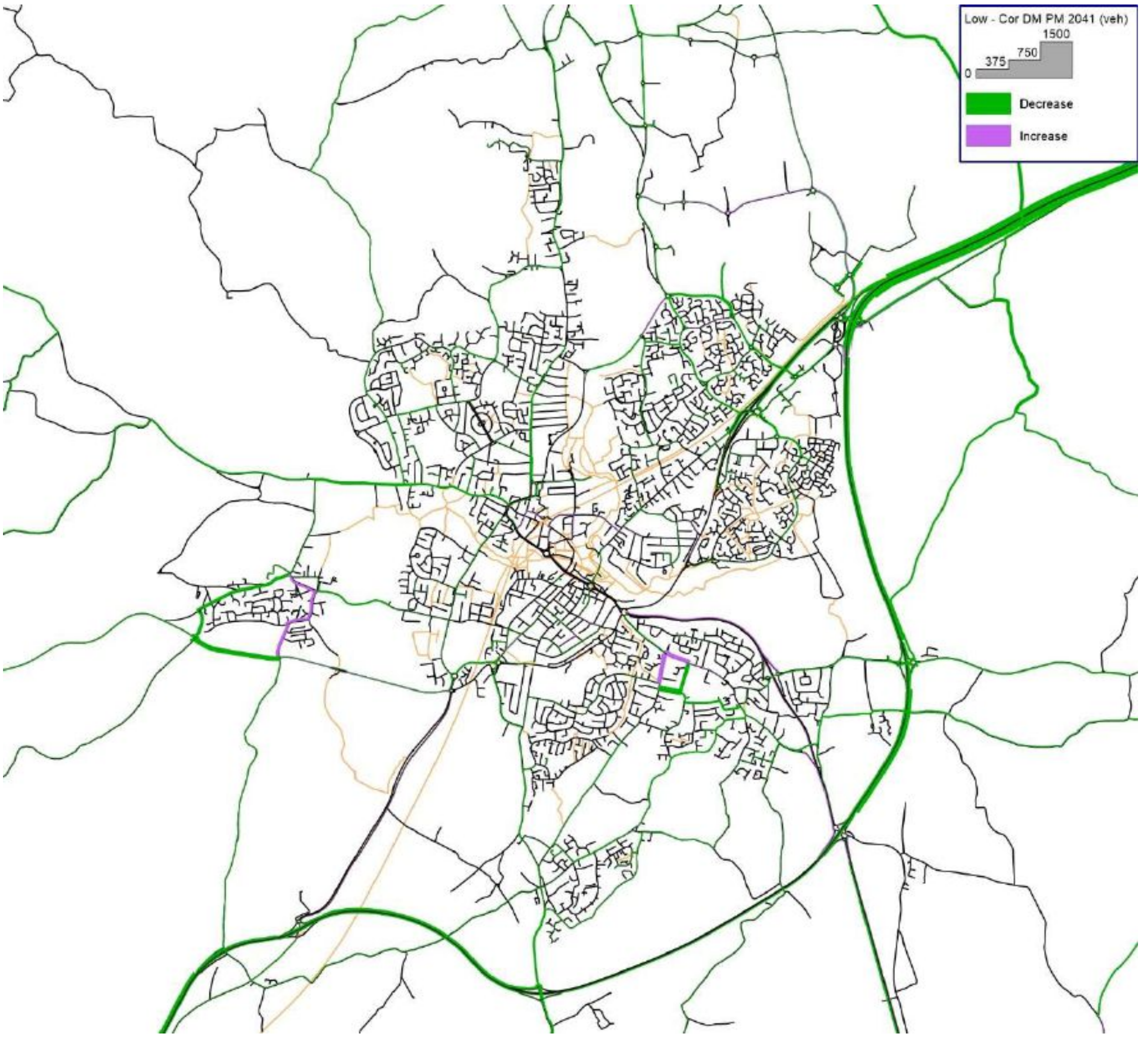


Figure 8-68: Traffic Flow Difference Plots Low Growth vs Core – DM 2041 PM peak

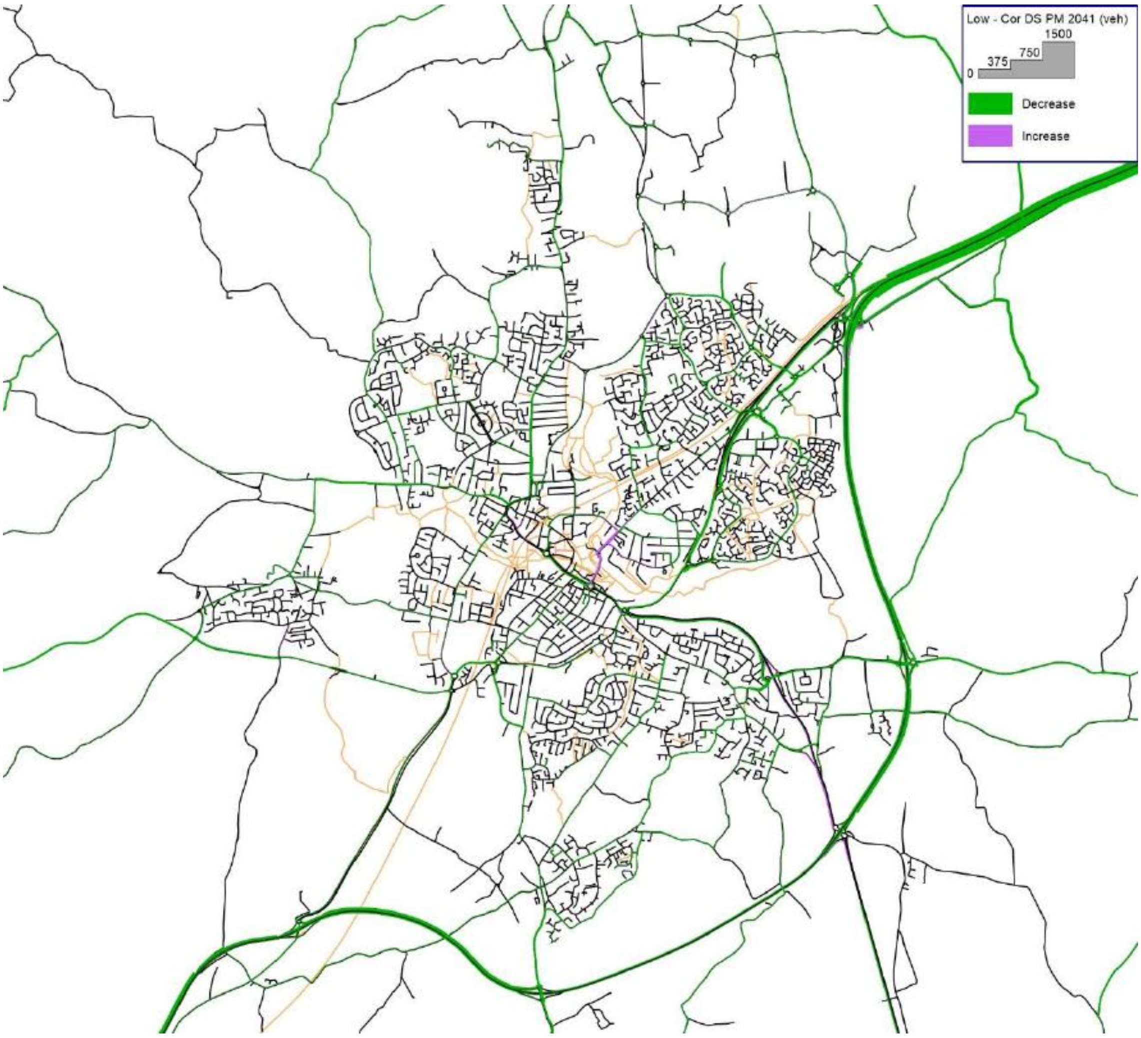


Figure 8-69: Traffic Flow Difference Plots Low Growth vs Core – DS 2041 PM peak

The difference plots for Low growth compared to the Core scenario indicate similar patterns of change between the DM and DS scenarios. The most notable change is the larger reduction in traffic through the A&N junction in the 2041 AM peak DS compared to DM, indicating that traffic is actually getting through the junction in the DS Core scenario (and not getting through in DM) and is therefore reduced under Low growth.

8.8.6 Traffic Flow Difference Plots – High Growth

The differences in traffic flows between the High growth scenario compared to the Core scenario are illustrated in the following figures.

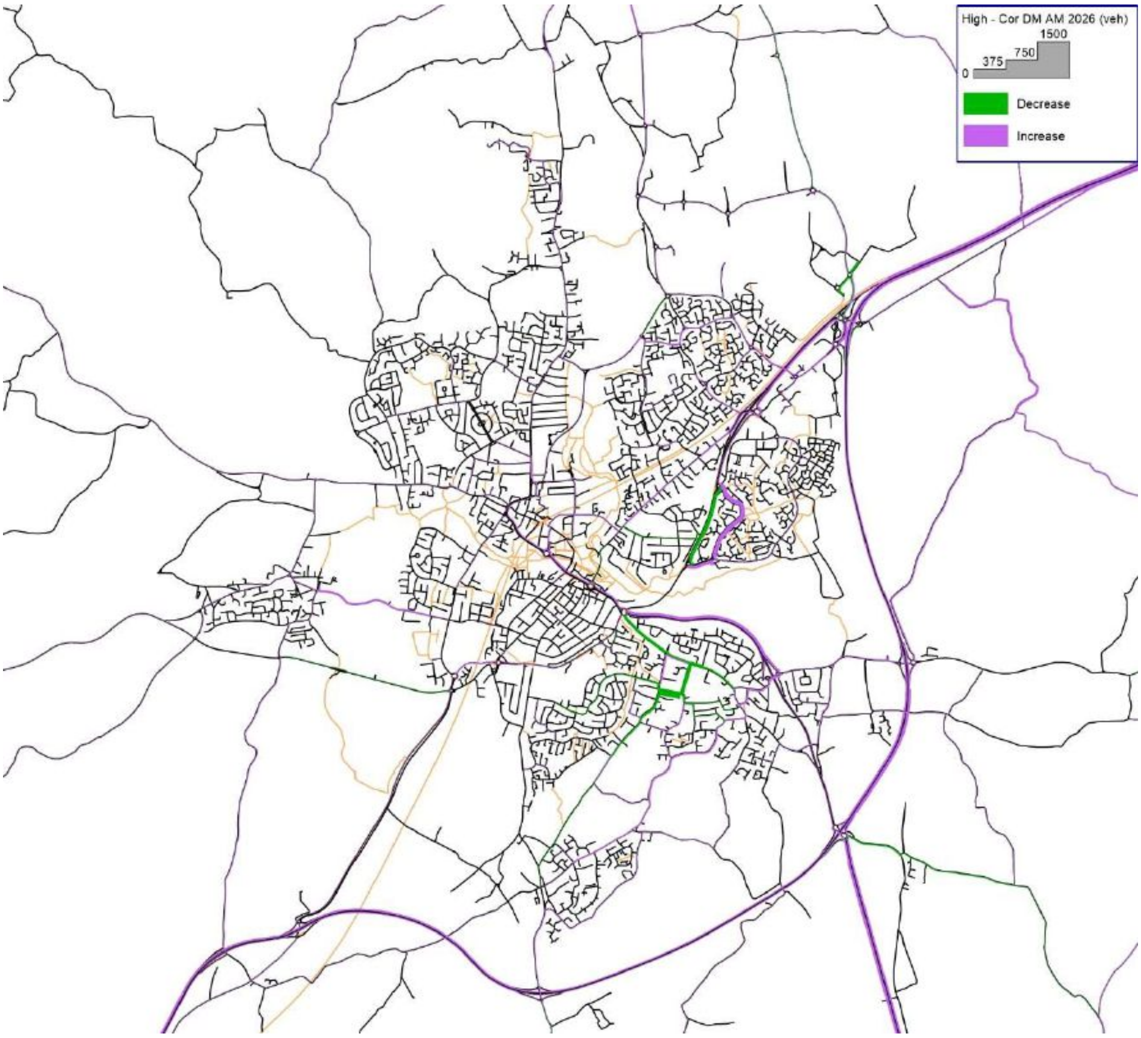


Figure 8-70: Traffic Flow Difference Plots High Growth vs Core – DM 2026 AM peak

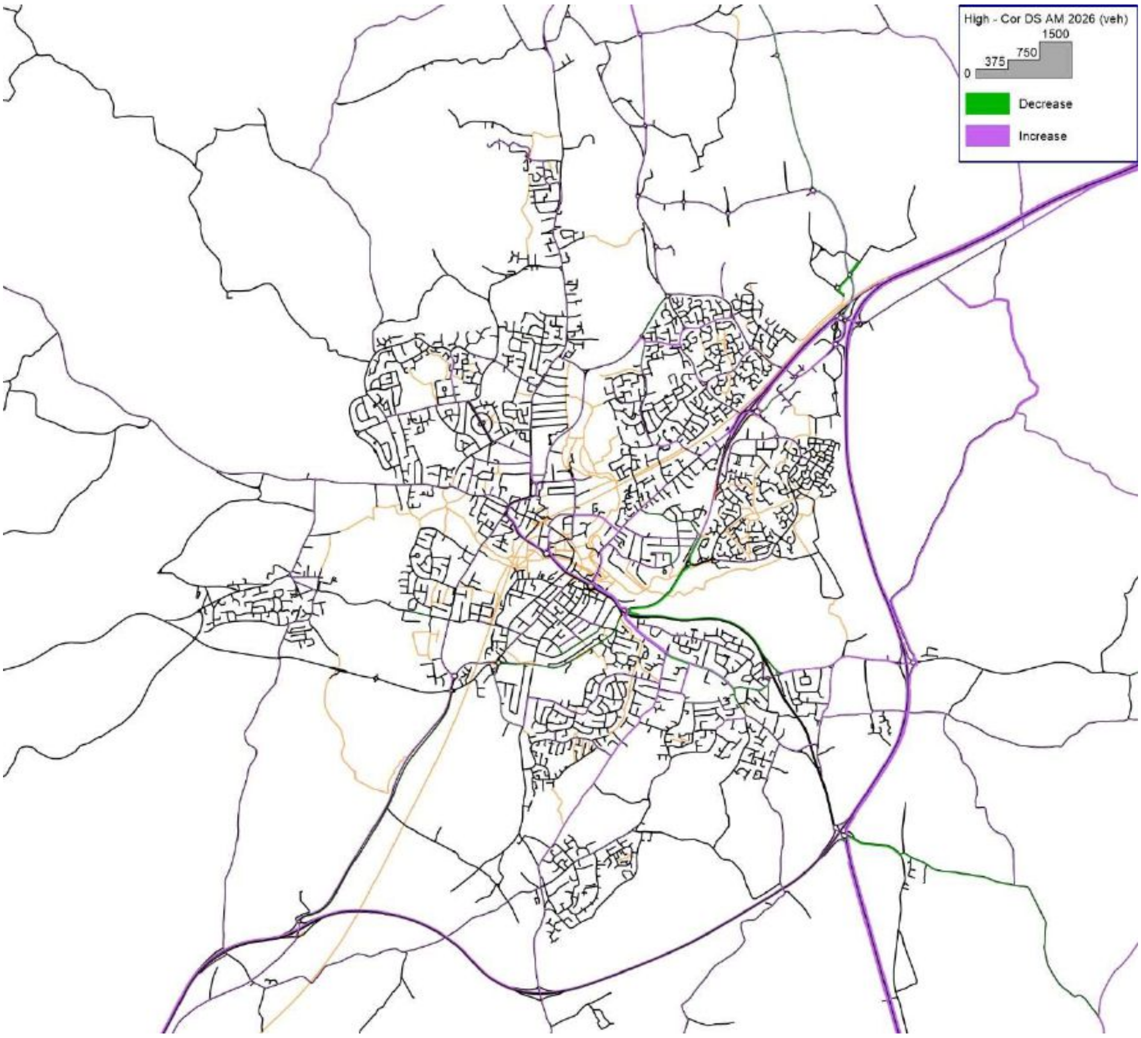


Figure 8-71: Traffic Flow Difference Plots High Growth vs Core – DS 2026 AM peak

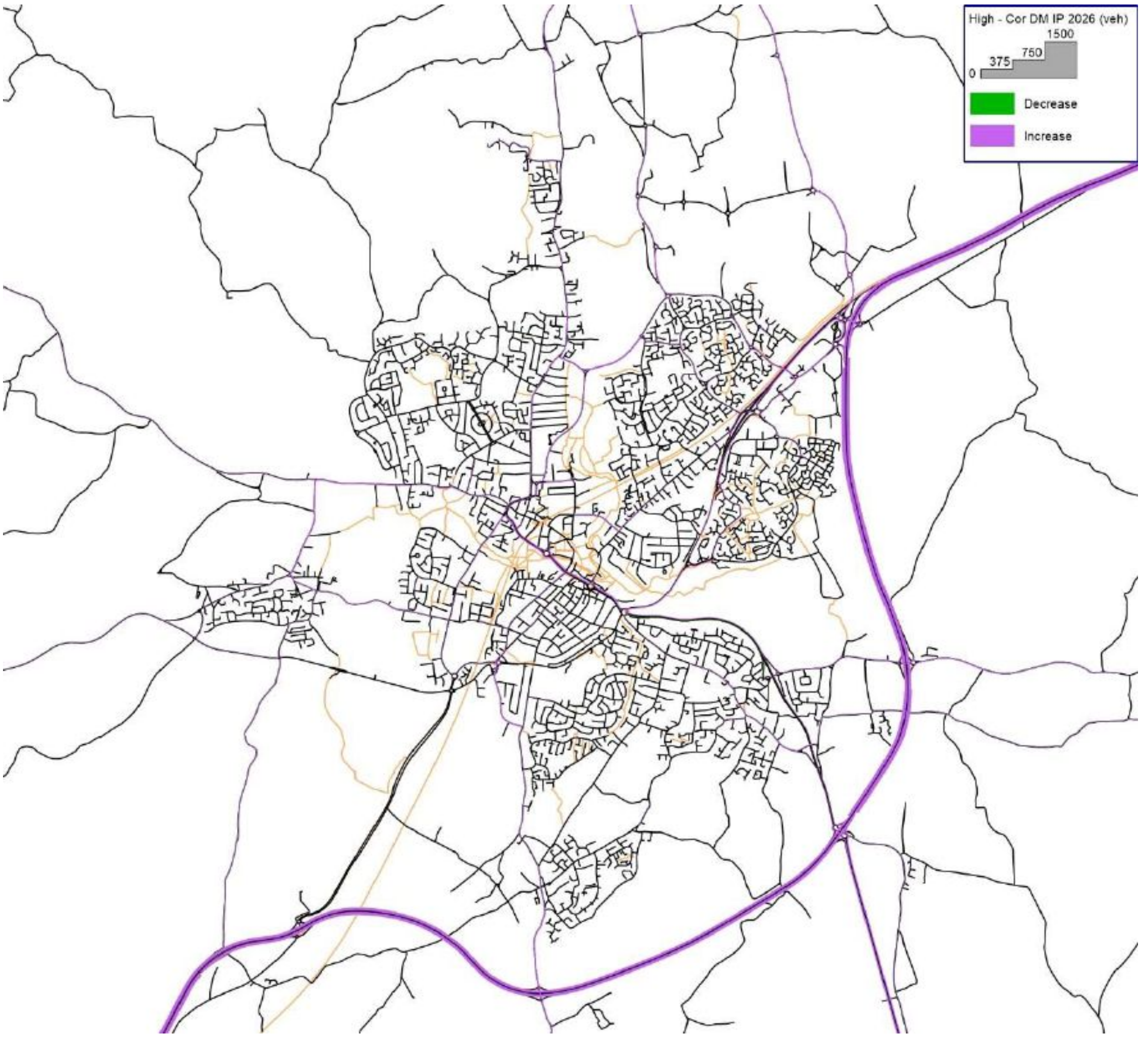


Figure 8-72: Traffic Flow Difference Plots High Growth vs Core – DM 2026 Inter-peak

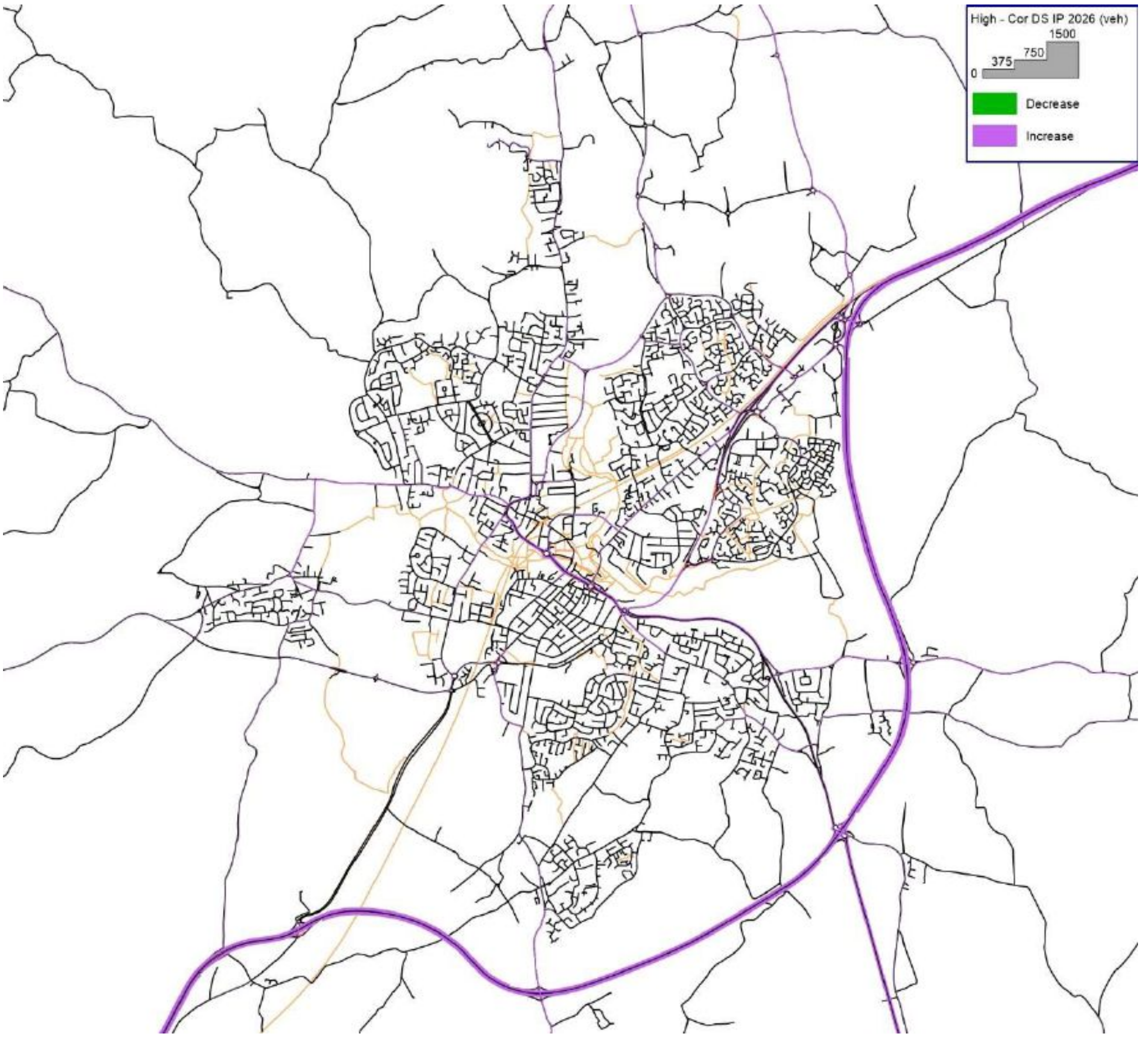


Figure 8-73: Traffic Flow Difference Plots High Growth vs Core – DS 2026 Inter-peak

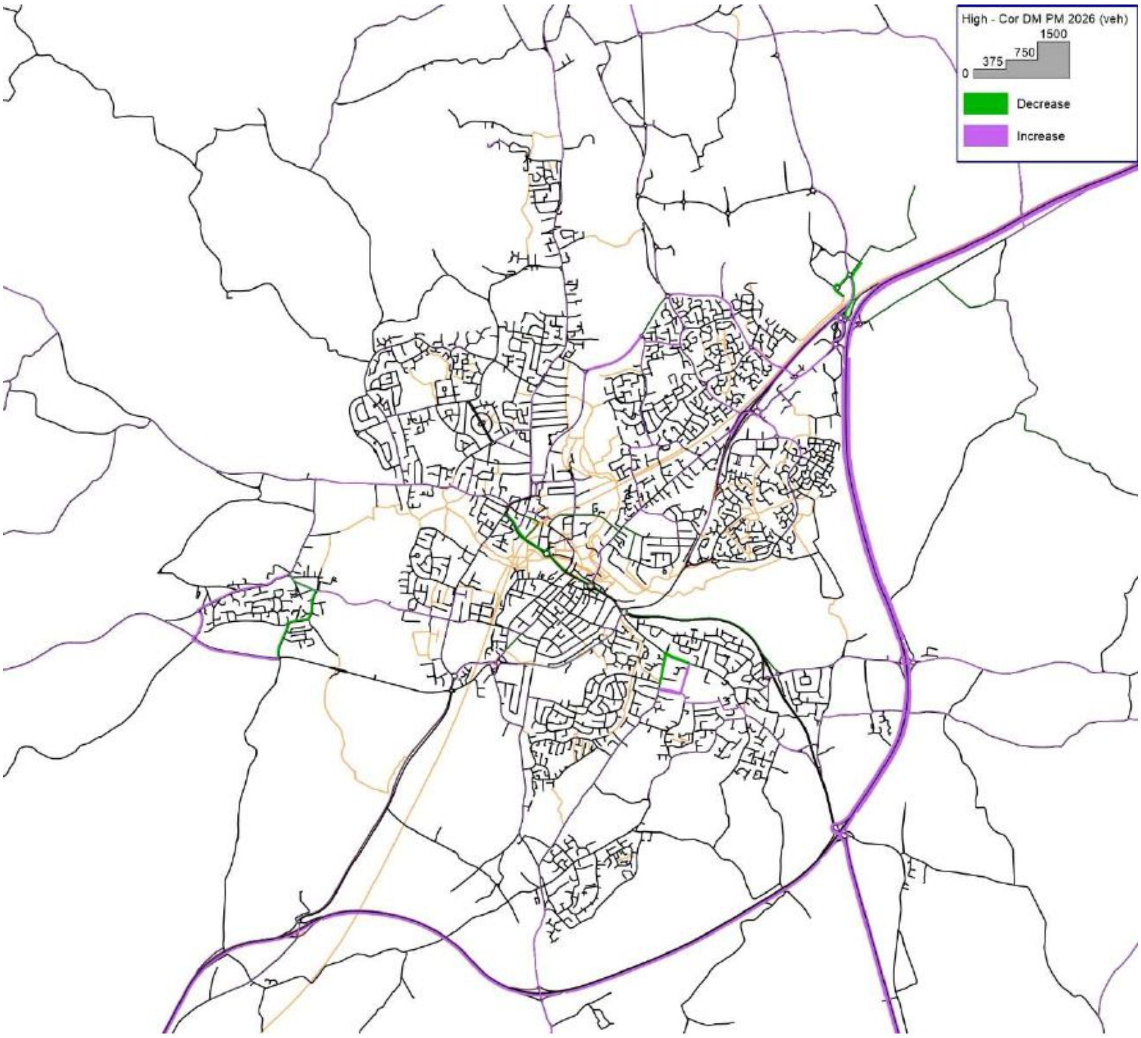


Figure 8-74: Traffic Flow Difference Plots High Growth vs Core – DM 2026 PM peak

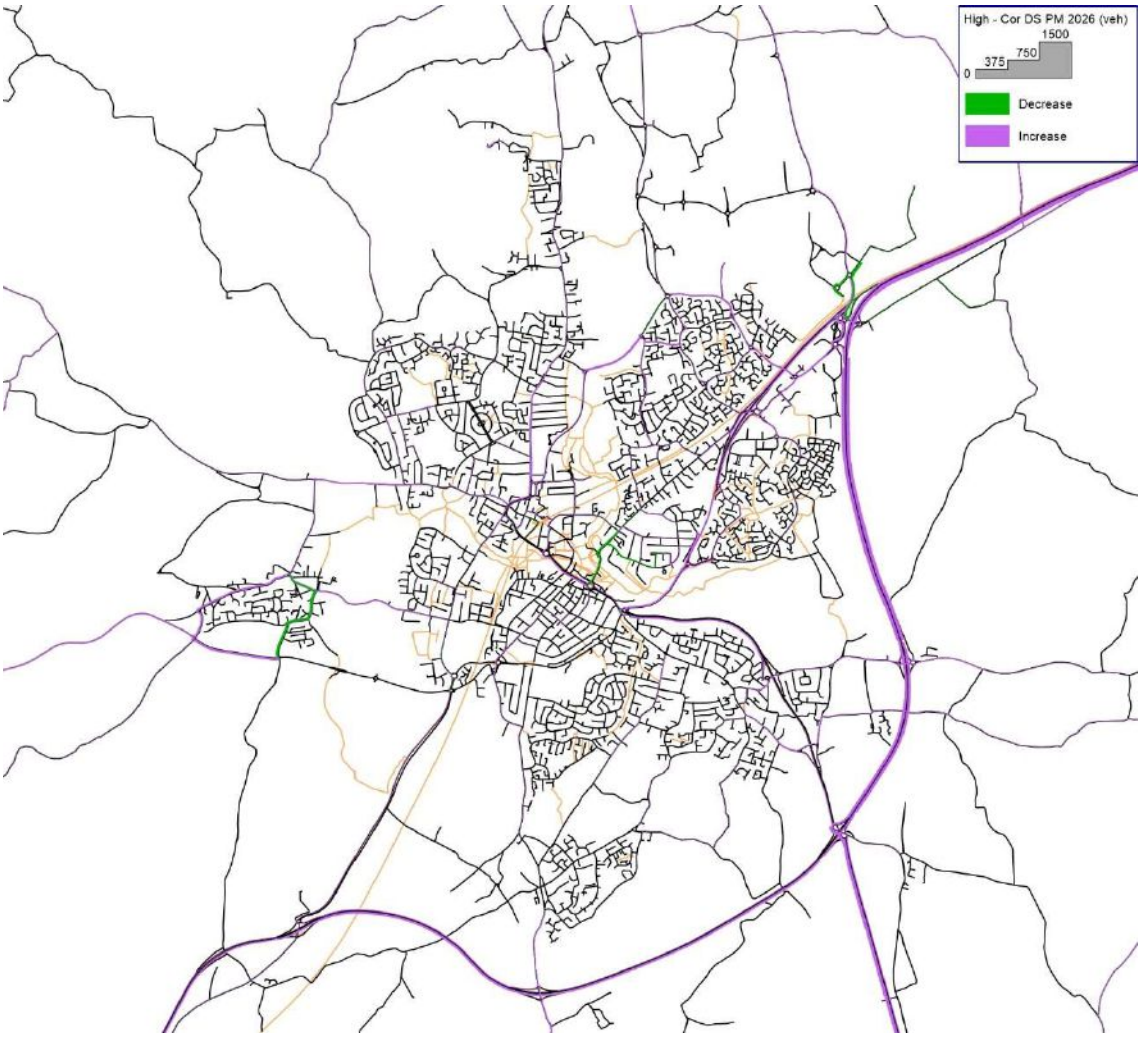


Figure 8-75: Traffic Flow Difference Plots High Growth vs Core – DS 2026 PM peak

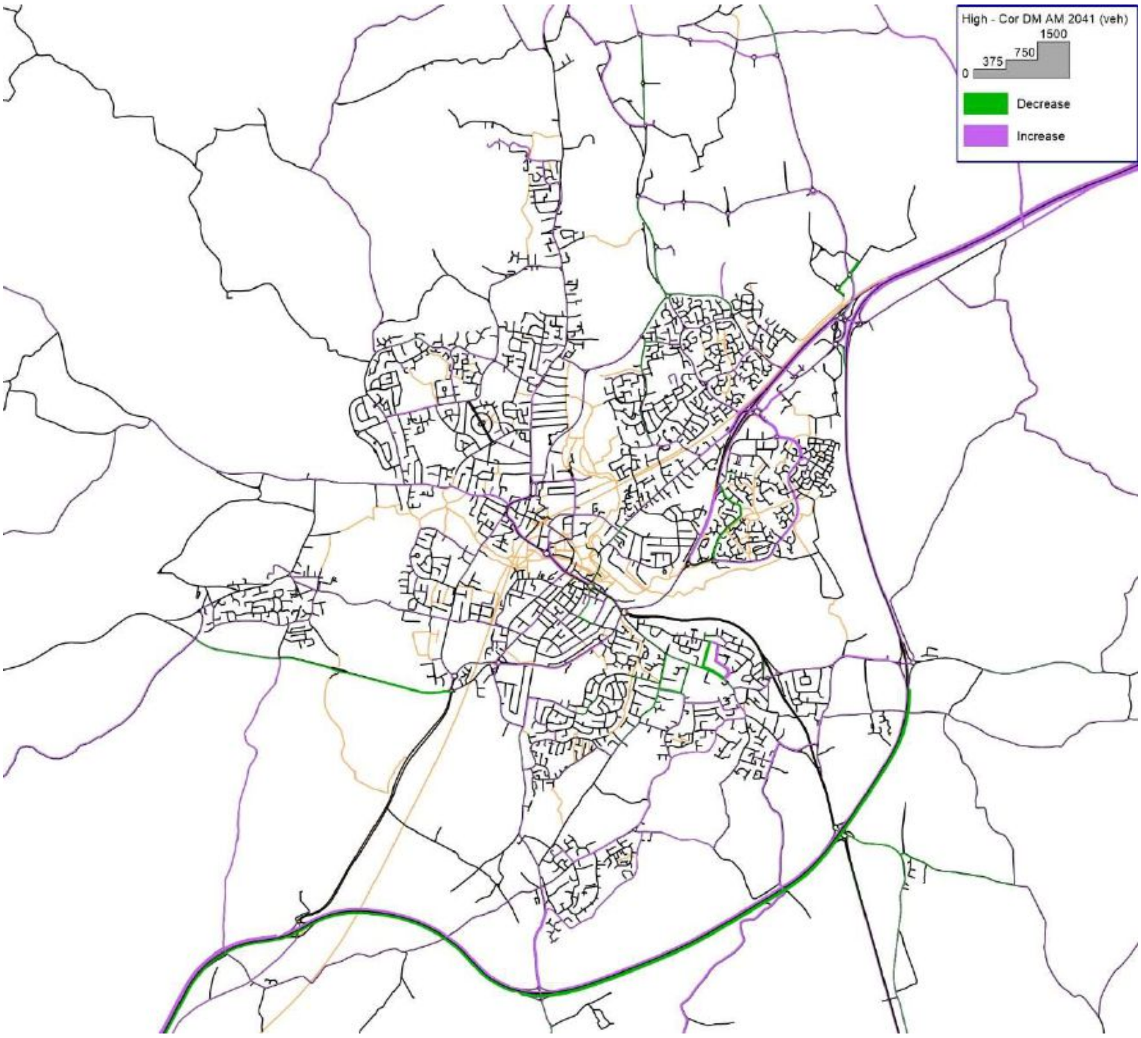


Figure 8-76: Traffic Flow Difference Plots High Growth vs Core – DM 2041 AM peak

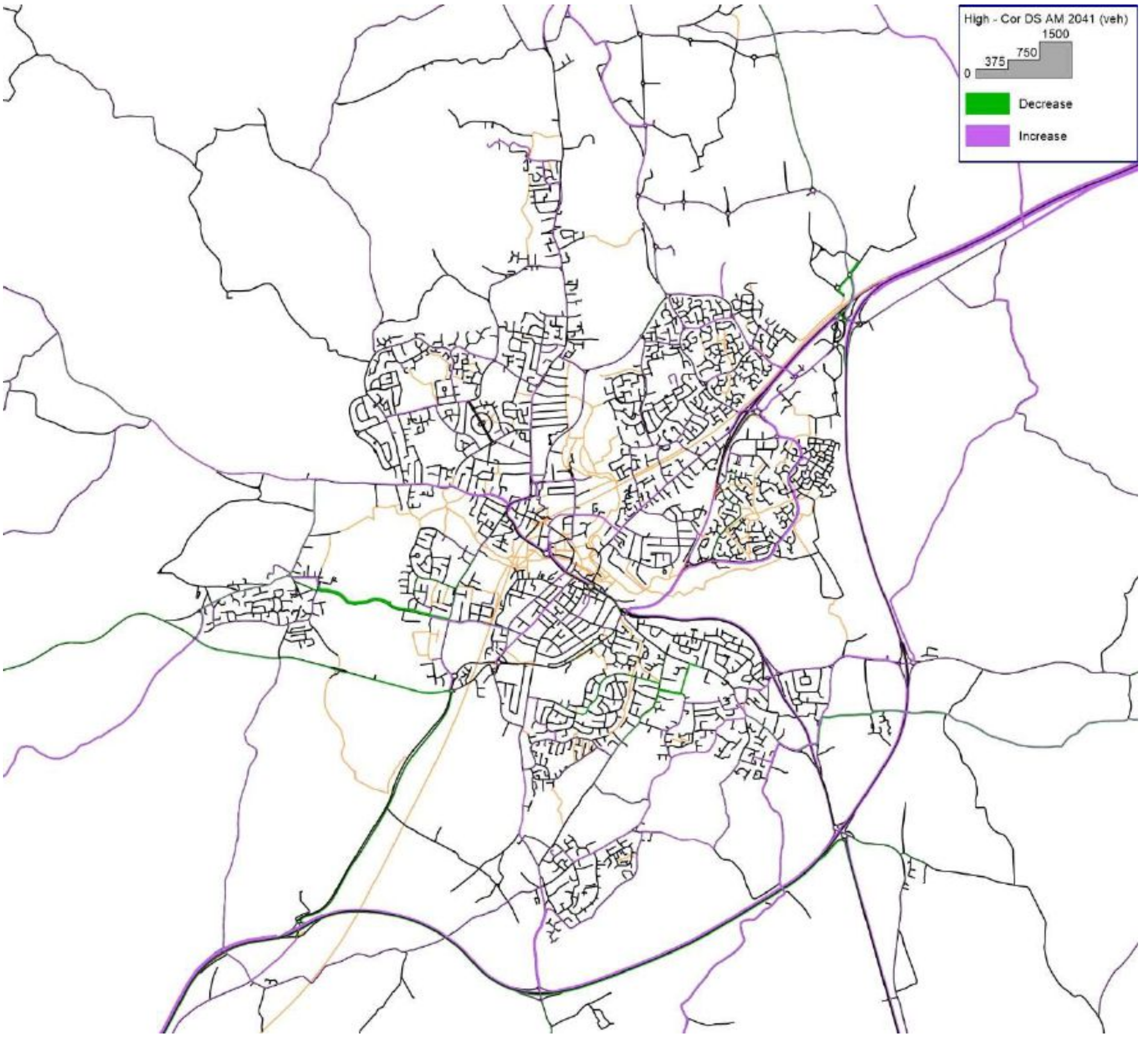


Figure 8-77: Traffic Flow Difference Plots High Growth vs Core – DS 2041 AM peak

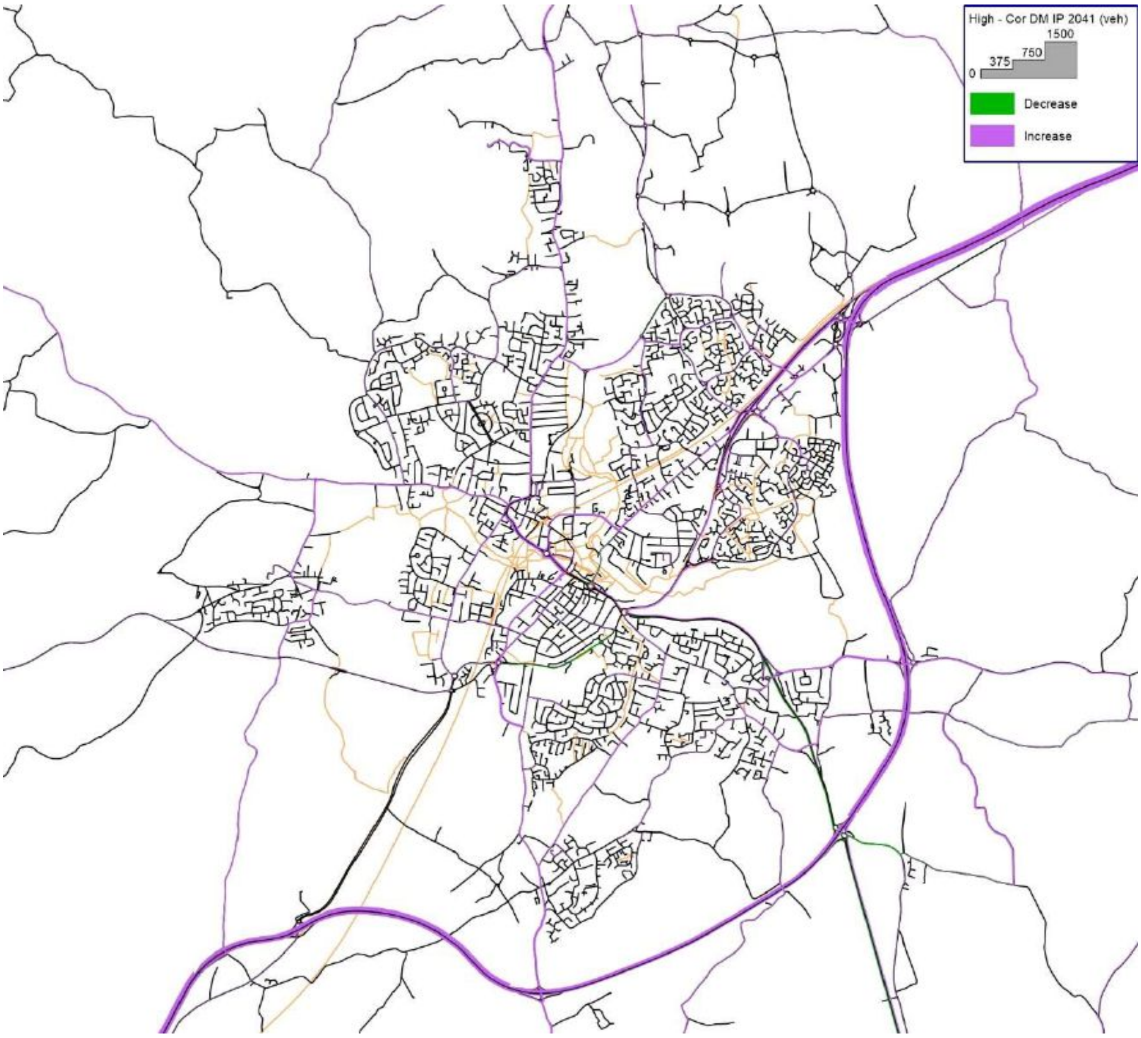


Figure 8-78: Traffic Flow Difference Plots High Growth vs Core – DM 2041 Inter-peak

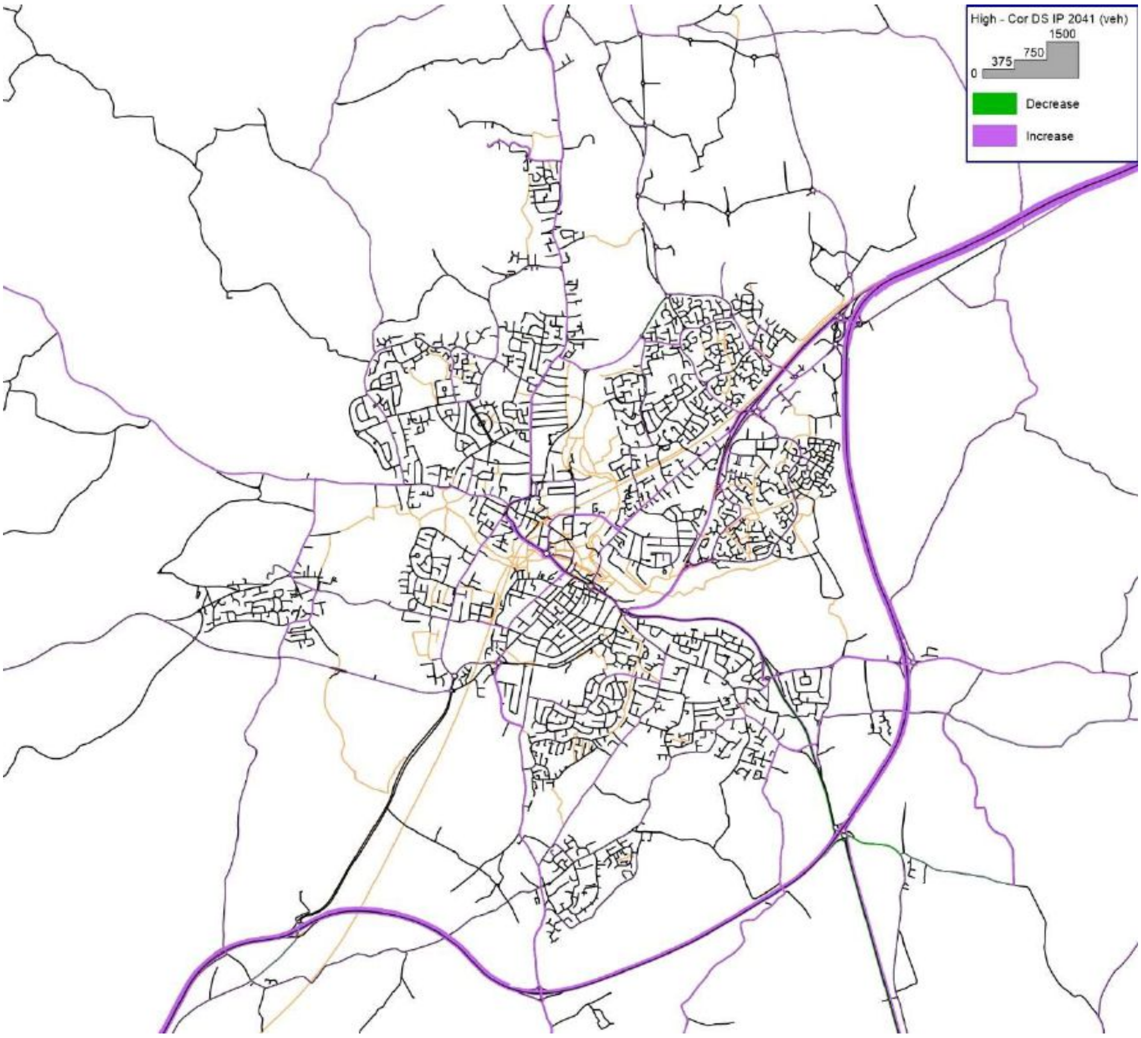


Figure 8-79: Traffic Flow Difference Plots High Growth vs Core – DS 2041 Inter-peak

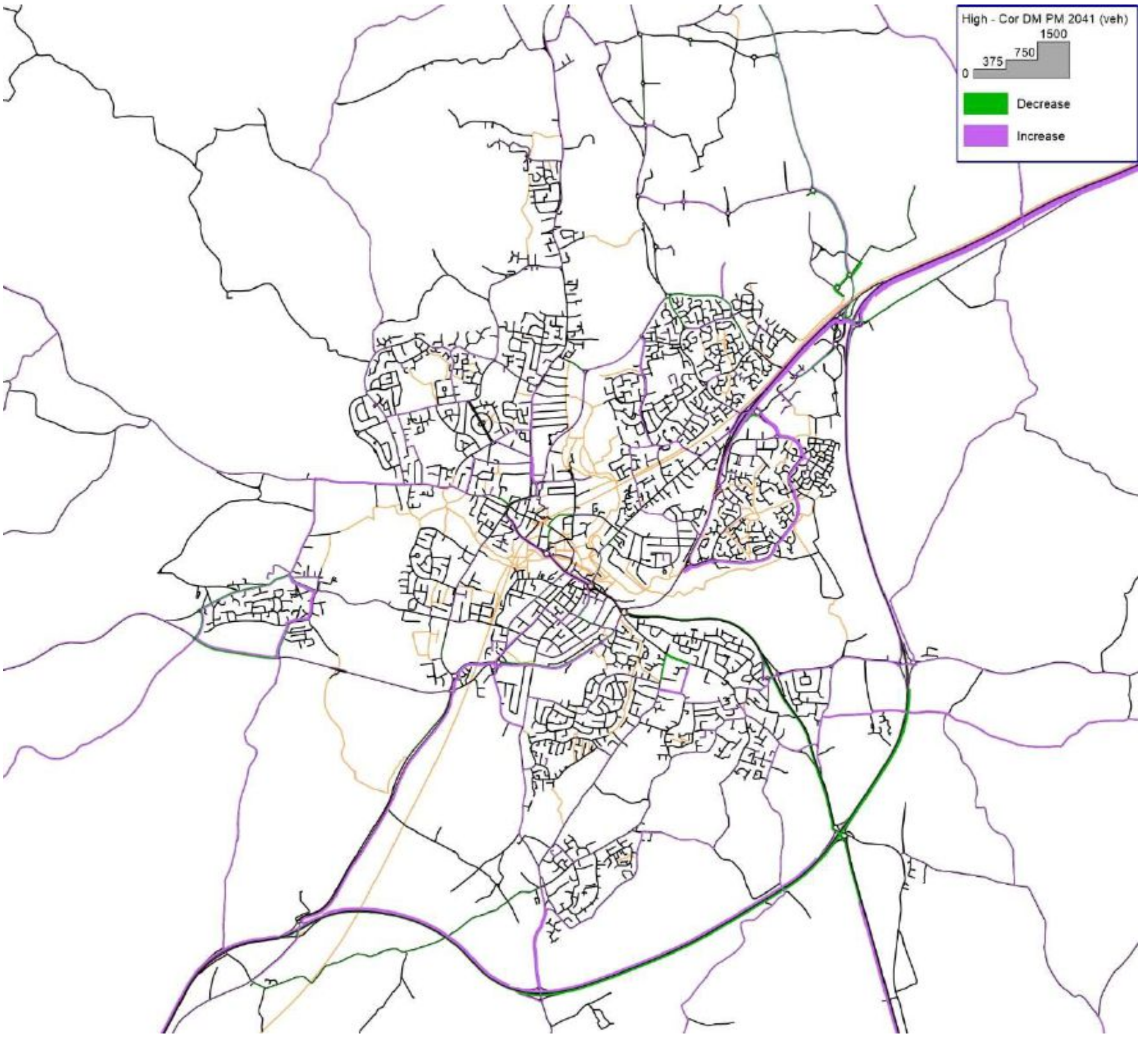


Figure 8-80: Traffic Flow Difference Plots High Growth vs Core – DM 2041 PM peak

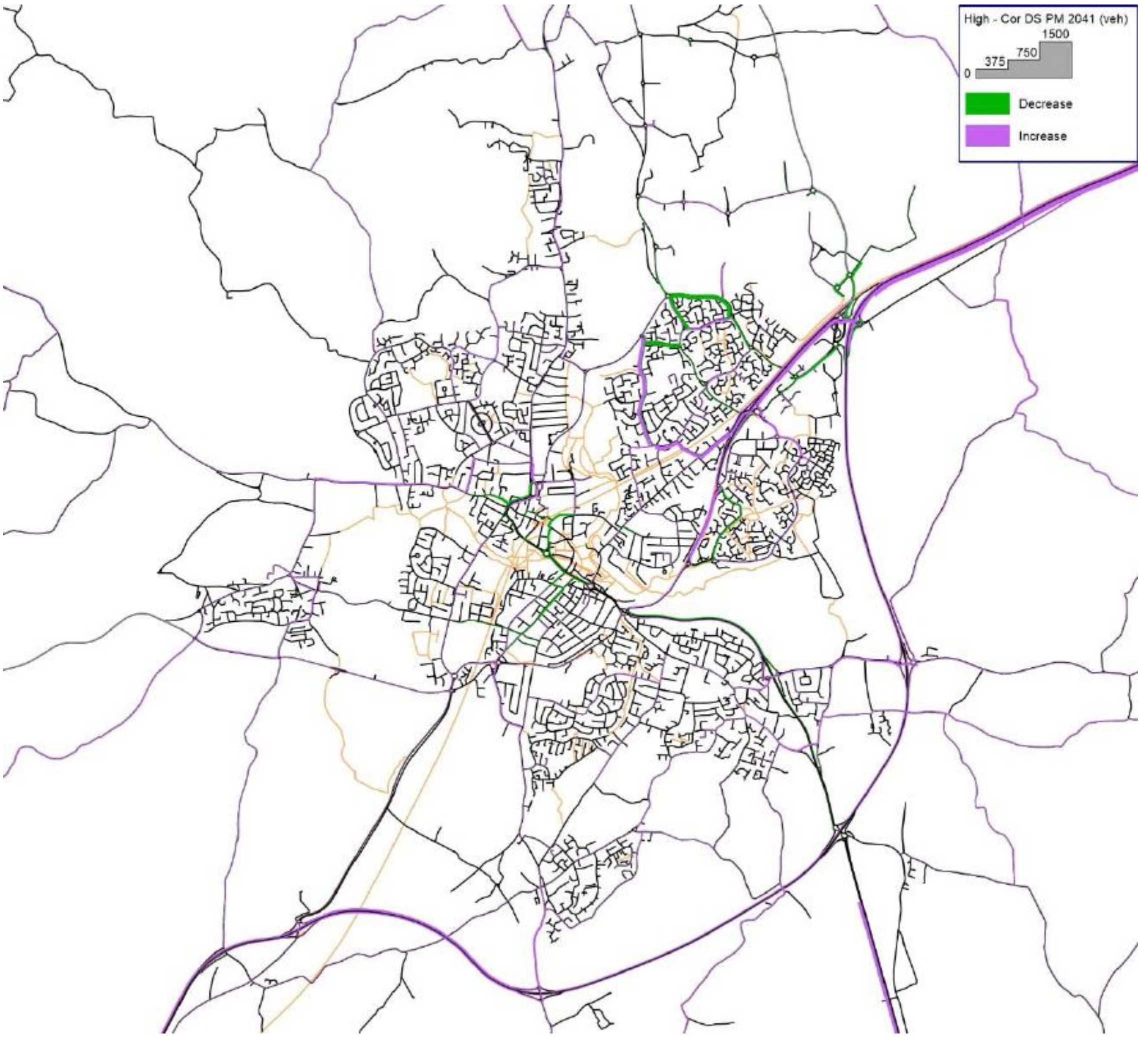


Figure 8-81: Traffic Flow Difference Plots High Growth vs Core – DS 2041 PM peak

The flow difference plots presented above comparing High growth with the Core scenario firstly highlight that there is relatively little change, particularly in the peak hours. This indicates that the network is generally already at or close to capacity and cannot accommodate additional traffic under the High growth scenario (note that the flows presented are “actual” flows rather than “demand” flows, meaning that only traffic that can pass through the network is included).

The most notable change, albeit still relatively low, that is highlighted by the plots is an increase in traffic through the A&N junction via Chelmer Road in the AM peak as vehicles take advantage of the additional capacity and are not constrained either upstream or downstream on their route.

8.8.7 Forecast Journey Times

Journey times for 14 routes (28 directional routes) have been extracted from the High and Low growth scenario DM and DS models for the two forecast years of 2026 and 2041 and for each modelled time period (AM, IP and PM). These are the same routes used for the base model validation and Core scenario and cover routes that pass through the Army & Navy junction as well as more broadly across Chelmsford District. The locations of the routes are illustrated in the figure below followed by the journey times by year and time period.

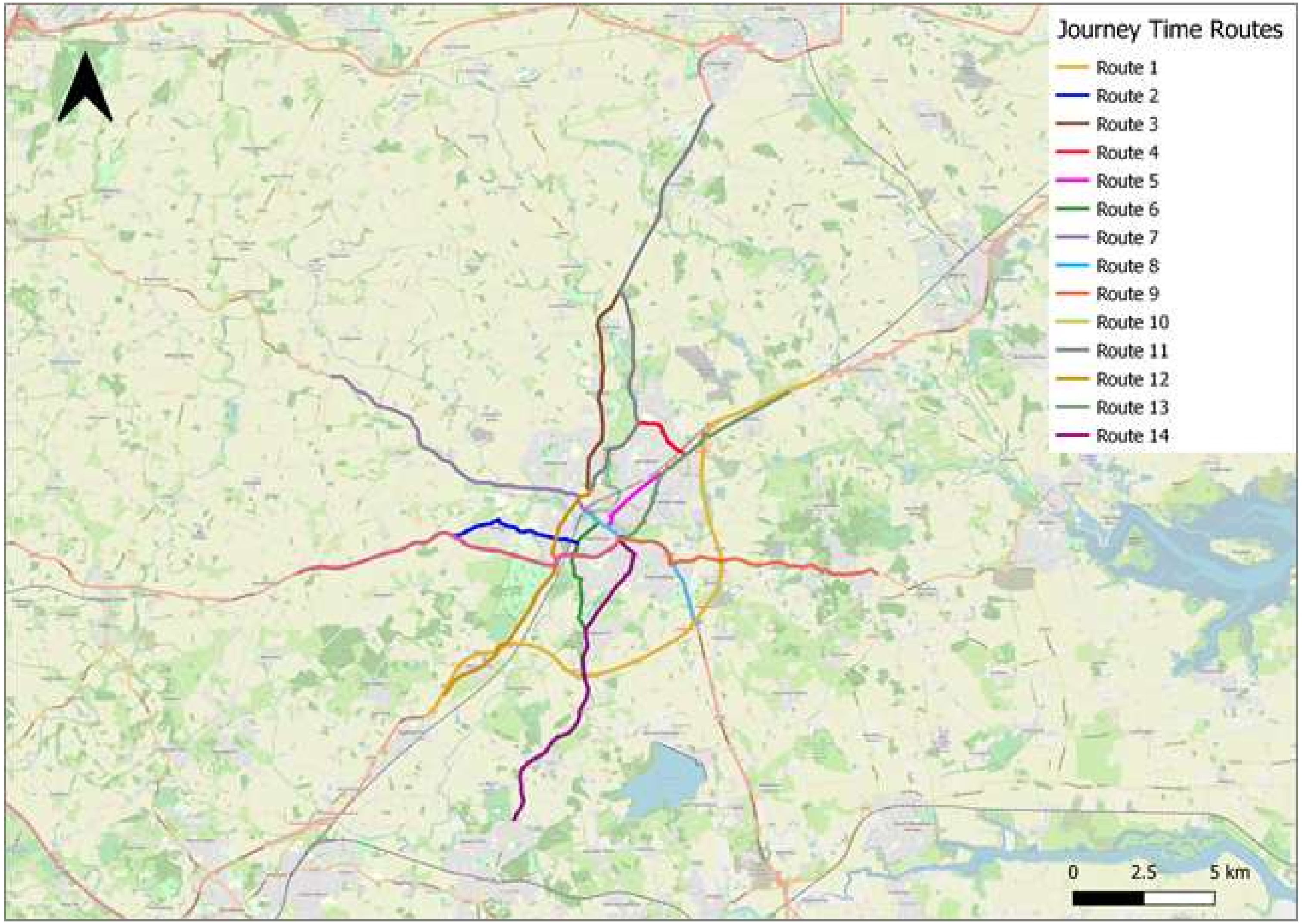


Figure 8-82: Journey Time Routes

Table 8-99: Forecast Journey Times – Low Growth Scenario 2026 AM Peak (mm:ss)

Route	Route ID	Dir	Description	Length (km)	Journey Times (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
1	101	WB	A12/Millfield Cottage North --> A12/Ingatestone	19.01	14:59	14:41	-2.9%	-2.9%
1	102	EB	A12/Ingatestone --> A12/Millfield Cottage North	19.05	14:54	14:56	-2.7%	-2.9%
2	201	EB	250 Ongar Road --> Writtle Road/Elm Road	3.89	11:55	09:28	-18.0%	-36.3%
2	202	WB	Writtle Road/Elm Road --> 250 Ongar Road	3.86	08:22	09:49	-9.7%	-4.4%
3	301	SB	A130/Braintree Road --> Parkway Roundabout	6.74	13:55	13:55	-6.2%	-5.9%
3	302	NB	Parkway Roundabout --> A130/Braintree Road	6.68	12:47	12:52	-2.9%	-4.2%
4	401	SB	A130/Nabbotts Farm Roundabout --> A130/1 White Hart Ln	1.89	02:31	02:32	-0.7%	-1.3%
4	402	NB	A130/1 White Hart Ln --> A130/Nabbotts Farm Roundabout	1.92	03:11	03:10	-2.1%	-1.6%
5	501	EB	High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.40	05:07	05:18	0.3%	-1.9%
5	502	WB	Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	07:21	06:38	-3.5%	-3.6%
6	601	SB	Parkway/New London Rd --> Stock Rd/Beehive Lane	3.99	07:42	08:13	-2.7%	-8.0%
6	602	NB	Stock Rd/Beehive Lane --> Parkway/New London Rd	4.00	10:21	09:57	-1.6%	-5.4%
7	701	EB	Wooden Farm Newland Hall --> Market Roundabout	10.17	14:01	13:58	-4.3%	-5.6%
7	702	WB	Market Roundabout --> Wooden Farm Newland Hall	10.18	12:01	12:29	-4.6%	-2.7%
8	801	SB	Market Roundabout --> A12 J17	5.20	05:46	06:50	-4.2%	-13.9%

Route	Route ID	Dir	Description	Length (km)	Journey Times (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
8	802	NB	A12 J17 --> Market Roundabout	5.21	13:53	12:12	-6.4%	3.5%
9	901	EB	Van Dieman's Rd --> Maldon Rd/Cherry Garden Lane	9.21	13:55	13:23	-0.7%	-0.7%
9	902	WB	Maldon Rd/Cherry Garden Lane --> Van Dieman's Rd	9.30	22:00	20:13	-7.4%	0.5%
10	1001	WB	Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	11.00	11:43	12:27	-2.6%	-9.9%
10	1002	EB	Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	10.95	16:49	14:46	-10.5%	-15.0%
11	1101	SB	A131/London Rd --> B1016/B1008	14.10	18:30	18:09	-5.5%	-4.1%
11	1102	NB	B1016/B1008 --> A131/London Rd	13.99	13:55	14:09	-2.5%	-2.1%
12	1201	SB	Rectory Ln/Meadowside --> B1002/Church Ln	8.66	13:38	13:52	-2.9%	-4.7%
12	1202	NB	B1002/Church Ln --> Rectory Ln/Meadowside	8.67	14:53	15:06	-2.7%	-1.9%
13	1301	WB	Main Rd/Damasses Ln --> Army and Navy Roundabout	7.71	18:57	12:16	-5.2%	-9.1%
13	1302	EB	Army and Navy Roundabout --> Main Rd/Damasses Ln	7.90	11:38	11:39	-1.1%	-0.7%
14	1401	SB	Army and Navy Roundabout --> Stock Rd/The Vale	7.03	11:59	10:56	-1.5%	-17.5%
14	1402	NB	Stock Rd/The Vale --> Army and Navy Roundabout	7.10	20:48	18:04	-3.9%	-15.6%

Table 8-100: Forecast Journey Times – Low Growth Scenario 2026 Inter-Peak (mm:ss)

Route	Route ID	Dir	Description	Length (km)	Journey Times (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
1	101	WB	A12/Millfield Cottage North --> A12/Ingatestone	19.01	11:43	11:45	-2.2%	-2.4%
1	102	EB	A12/Ingatestone --> A12/Millfield Cottage North	19.05	12:26	12:26	-2.6%	-2.6%
2	201	EB	250 Ongar Road --> Writtle Road/Elm Road	3.89	07:04	07:09	-0.9%	-0.9%
2	202	WB	Writtle Road/Elm Road --> 250 Ongar Road	3.86	07:38	07:41	-2.1%	-1.7%
3	301	SB	A130/Braintree Road --> Parkway Roundabout	6.74	10:46	10:44	-2.4%	-2.0%
3	302	NB	Parkway Roundabout --> A130/Braintree Road	6.68	10:02	10:02	-1.0%	-1.3%
4	401	SB	A130/Nabbotts Farm Roundabout --> A130/1 White Hart Ln	1.89	02:16	02:12	3.0%	-0.8%
4	402	NB	A130/1 White Hart Ln --> A130/Nabbotts Farm Roundabout	1.92	02:35	02:36	-2.5%	-1.9%
5	501	EB	High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.40	05:20	05:34	-0.6%	-1.2%
5	502	WB	Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	04:51	04:48	-2.3%	-2.4%
6	601	SB	Parkway/New London Rd --> Stock Rd/Beehive Lane	3.99	07:22	07:41	-0.9%	-1.5%
6	602	NB	Stock Rd/Beehive Lane --> Parkway/New London Rd	4.00	07:16	07:15	-1.4%	-0.7%
7	701	EB	Wooden Farm Newland Hall --> Market Roundabout	10.17	12:11	12:07	-0.7%	-2.2%
7	702	WB	Market Roundabout --> Wooden Farm Newland Hall	10.18	10:58	10:59	-1.2%	-1.5%
8	801	SB	Market Roundabout --> A12 J17	5.20	05:51	06:43	-3.3%	-2.4%

Route	Route ID	Dir	Description	Length (km)	Journey Times (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
8	802	NB	A12 J17 --> Market Roundabout	5.21	05:23	05:44	-14.6%	-1.7%
9	901	EB	Van Dieman's Rd --> Maldon Rd/Cherry Garden Lane	9.21	13:22	11:39	-0.7%	-2.2%
9	902	WB	Maldon Rd/Cherry Garden Lane --> Van Dieman's Rd	9.30	11:27	11:45	-8.8%	-2.1%
10	1001	WB	Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	11.00	11:08	11:06	-2.8%	-1.0%
10	1002	EB	Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	10.95	11:29	11:08	-5.4%	0.6%
11	1101	SB	A131/London Rd --> B1016/B1008	14.10	13:10	13:09	-0.5%	-1.4%
11	1102	NB	B1016/B1008 --> A131/London Rd	13.99	12:53	12:59	-1.7%	-1.6%
12	1201	SB	Rectory Ln/Meadowside --> B1002/Church Ln	8.66	13:33	13:40	-1.8%	-2.5%
12	1202	NB	B1002/Church Ln --> Rectory Ln/Meadowside	8.67	13:01	12:35	-2.5%	-0.7%
13	1301	WB	Main Rd/Damasses Ln --> Army and Navy Roundabout	7.71	10:15	10:26	-0.8%	-0.6%
13	1302	EB	Army and Navy Roundabout --> Main Rd/Damasses Ln	7.90	11:25	11:25	-1.4%	-1.4%
14	1401	SB	Army and Navy Roundabout --> Stock Rd/The Vale	7.03	08:57	08:48	-1.3%	-1.9%
14	1402	NB	Stock Rd/The Vale --> Army and Navy Roundabout	7.10	10:36	10:19	-2.9%	-1.6%

Table 8-101: Forecast Journey Times – Low Growth Scenario 2026 PM Peak (mm:ss)

Route	Route ID	Dir	Description	Length (km)	Journey Times (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
1	101	WB	A12/Millfield Cottage North --> A12/Ingatestone	19.01	12:27	12:29	-2.9%	-3.0%
1	102	EB	A12/Ingatestone --> A12/Millfield Cottage North	19.05	14:15	14:10	-2.5%	-2.5%
2	201	EB	250 Ongar Road --> Writtle Road/Elm Road	3.89	09:39	09:36	-4.0%	-7.7%
2	202	WB	Writtle Road/Elm Road --> 250 Ongar Road	3.86	08:50	09:20	-3.1%	-17.3%
3	301	SB	A130/Braintree Road --> Parkway Roundabout	6.74	11:53	11:50	-2.6%	-2.2%
3	302	NB	Parkway Roundabout --> A130/Braintree Road	6.68	12:30	12:32	-10.7%	-13.5%
4	401	SB	A130/Nabbotts Farm Roundabout --> A130/1 White Hart Ln	1.89	02:21	02:23	-1.4%	-0.7%
4	402	NB	A130/1 White Hart Ln --> A130/Nabbotts Farm Roundabout	1.92	02:47	02:46	-4.0%	-2.9%
5	501	EB	High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.40	06:55	06:57	-1.0%	-8.4%
5	502	WB	Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	12:45	09:39	-8.2%	-16.5%
6	601	SB	Parkway/New London Rd --> Stock Rd/Beehive Lane	3.99	09:24	10:58	-8.0%	-7.8%
6	602	NB	Stock Rd/Beehive Lane --> Parkway/New London Rd	4.00	08:26	07:55	-3.3%	-3.7%
7	701	EB	Wooden Farm Newland Hall --> Market Roundabout	10.17	13:37	13:41	-7.1%	-11.6%
7	702	WB	Market Roundabout --> Wooden Farm Newland Hall	10.18	11:35	11:52	-2.0%	-0.6%
8	801	SB	Market Roundabout --> A12 J17	5.20	10:41	10:45	-0.2%	-0.5%

Route	Route ID	Dir	Description	Length (km)	Journey Times (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
8	802	NB	A12 J17 --> Market Roundabout	5.21	11:27	06:59	-5.5%	-16.2%
9	901	EB	Van Dieman's Rd --> Maldon Rd/Cherry Garden Lane	9.21	15:43	14:50	-1.5%	-2.5%
9	902	WB	Maldon Rd/Cherry Garden Lane --> Van Dieman's Rd	9.30	17:50	12:22	-7.3%	-2.2%
10	1001	WB	Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	11.00	10:38	11:04	-21.0%	-0.3%
10	1002	EB	Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	10.95	19:42	12:08	-3.7%	-5.5%
11	1101	SB	A131/London Rd --> B1016/B1008	14.10	15:01	15:05	-1.9%	-2.3%
11	1102	NB	B1016/B1008 --> A131/London Rd	13.99	18:58	19:20	-4.0%	-4.5%
12	1201	SB	Rectory Ln/Meadowside --> B1002/Church Ln	8.66	16:54	18:24	-7.9%	-5.7%
12	1202	NB	B1002/Church Ln --> Rectory Ln/Meadowside	8.67	15:49	15:27	-3.7%	-2.4%
13	1301	WB	Main Rd/Damasses Ln --> Army and Navy Roundabout	7.71	12:35	13:18	-2.5%	-5.3%
13	1302	EB	Army and Navy Roundabout --> Main Rd/Damasses Ln	7.90	12:34	12:57	-1.8%	-2.3%
14	1401	SB	Army and Navy Roundabout --> Stock Rd/The Vale	7.03	10:06	10:11	-2.7%	-1.5%
14	1402	NB	Stock Rd/The Vale --> Army and Navy Roundabout	7.10	14:59	11:29	-13.1%	-1.1%

Table 8-102: Forecast Journey Times – Low Growth Scenario 2041 AM Peak (mm:ss)

Route	Route ID	Dir	Description	Length (km)	Journey Time (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
1	101	WB	A12/Millfield Cottage North --> A12/Ingatestone	19.01	16:11	15:56	-4.3%	-3.6%
1	102	EB	A12/Ingatestone --> A12/Millfield Cottage North	19.05	15:48	15:46	-4.0%	-5.0%
2	201	EB	250 Ongar Road --> Writtle Road/Elm Road	3.89	13:47	14:48	-25.6%	-16.5%
2	202	WB	Writtle Road/Elm Road --> 250 Ongar Road	3.86	09:42	09:51	-2.2%	-4.8%
3	301	SB	A130/Braintree Road --> Parkway Roundabout	6.74	17:00	16:02	-10.1%	-11.1%
3	302	NB	Parkway Roundabout --> A130/Braintree Road	6.68	13:44	13:53	-3.9%	-5.4%
4	401	SB	A130/Nabbotts Farm Roundabout --> A130/1 White Hart Ln	1.89	02:32	02:33	-5.0%	-4.4%
4	402	NB	A130/1 White Hart Ln --> A130/Nabbotts Farm Roundabout	1.92	03:29	03:15	-2.3%	-0.5%
5	501	EB	High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.40	05:11	05:34	-3.4%	-2.1%
5	502	WB	Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	07:39	06:56	-13.1%	-4.4%
6	601	SB	Parkway/New London Rd --> Stock Rd/Beehive Lane	3.99	08:00	09:33	-12.2%	-10.9%
6	602	NB	Stock Rd/Beehive Lane --> Parkway/New London Rd	4.00	10:13	10:04	-1.4%	-4.4%
7	701	EB	Wooden Farm Newland Hall --> Market Roundabout	10.16	15:25	15:13	-6.5%	-7.3%
7	702	WB	Market Roundabout --> Wooden Farm Newland Hall	10.18	13:06	13:19	-9.0%	-13.3%
8	801	SB	Market Roundabout --> A12 J17	5.21	07:33	08:43	-6.4%	-33.3%

Route	Route ID	Dir	Description	Length (km)	Journey Time (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
8	802	NB	A12 J17 --> Market Roundabout	5.19	14:08	12:15	-11.3%	-0.5%
9	901	EB	Van Dieman's Rd --> Maldon Rd/Cherry Garden Lane	9.21	14:28	13:50	-1.0%	-1.8%
9	902	WB	Maldon Rd/Cherry Garden Lane --> Van Dieman's Rd	9.42	23:42	21:39	-14.9%	-10.4%
10	1001	WB	Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	10.97	12:12	13:24	-10.5%	-6.3%
10	1002	EB	Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	10.82	19:24	16:50	-20.7%	-20.1%
11	1101	SB	A131/London Rd --> B1016/B1008	14.10	22:23	21:17	-9.9%	-9.9%
11	1102	NB	B1016/B1008 --> A131/London Rd	13.99	15:14	15:36	-4.2%	-3.1%
12	1201	SB	Rectory Ln/Meadowside --> B1002/Church Ln	8.66	14:22	15:00	-9.1%	-10.4%
12	1202	NB	B1002/Church Ln --> Rectory Ln/Meadowside	8.67	15:37	15:47	-7.5%	-7.9%
13	1301	WB	Main Rd/Damasses Ln --> Army and Navy Roundabout	7.71	15:13	15:03	-27.9%	-18.9%
13	1302	EB	Army and Navy Roundabout --> Main Rd/Damasses Ln	7.90	12:03	12:04	-1.9%	-1.5%
14	1401	SB	Army and Navy Roundabout --> Stock Rd/The Vale	7.03	13:17	11:17	-4.0%	-18.5%
14	1402	NB	Stock Rd/The Vale --> Army and Navy Roundabout	7.13	24:24	20:07	-7.1%	-11.3%

Table 8-103: Forecast Journey Times – Low Growth Scenario 2041 Inter-Peak (mm:ss)

Route	Route ID	Dir	Description	Length (km)	Jourey Time (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
1	101	WB	A12/Millfield Cottage North --> A12/Ingatestone	19.01	12:29	12:30	-4.5%	-4.5%
1	102	EB	A12/Ingatestone --> A12/Millfield Cottage North	19.05	13:07	13:06	-4.0%	-4.0%
2	201	EB	250 Ongar Road --> Writtle Road/Elm Road	3.89	07:09	07:10	-2.1%	-1.4%
2	202	WB	Writtle Road/Elm Road --> 250 Ongar Road	3.86	07:47	07:45	-2.7%	-2.5%
3	301	SB	A130/Braintree Road --> Parkway Roundabout	6.74	11:14	11:13	-2.0%	-2.0%
3	302	NB	Parkway Roundabout --> A130/Braintree Road	6.68	10:19	10:22	-2.8%	-3.0%
4	401	SB	A130/Nabbotts Farm Roundabout --> A130/1 White Hart Ln	1.89	02:16	02:16	-4.2%	-4.9%
4	402	NB	A130/1 White Hart Ln --> A130/Nabbotts Farm Roundabout	1.92	02:40	02:38	-2.4%	-2.5%
5	501	EB	High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.40	05:24	05:44	-1.5%	-3.4%
5	502	WB	Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	05:02	05:01	-2.6%	-2.3%
6	601	SB	Parkway/New London Rd --> Stock Rd/Beehive Lane	3.99	07:28	07:46	-2.8%	-4.3%
6	602	NB	Stock Rd/Beehive Lane --> Parkway/New London Rd	4.00	07:18	07:18	-2.9%	-2.7%
7	701	EB	Wooden Farm Newland Hall --> Market Roundabout	10.16	12:28	12:27	-2.0%	-4.1%
7	702	WB	Market Roundabout --> Wooden Farm Newland Hall	10.18	11:17	11:21	-2.4%	-2.3%
8	801	SB	Market Roundabout --> A12 J17	5.21	06:07	07:10	-13.6%	-15.0%

Route	Route ID	Dir	Description	Length (km)	Jourey Time (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
8	802	NB	A12 J17 --> Market Roundabout	5.19	05:34	05:44	-11.4%	-0.3%
9	901	EB	Van Dieman's Rd --> Maldon Rd/Cherry Garden Lane	9.21	13:46	12:17	-2.0%	-5.8%
9	902	WB	Maldon Rd/Cherry Garden Lane --> Van Dieman's Rd	9.42	12:06	12:16	-7.6%	-2.3%
10	1001	WB	Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	10.97	11:31	11:18	-3.4%	-3.4%
10	1002	EB	Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	10.82	12:12	11:08	-10.2%	-1.0%
11	1101	SB	A131/London Rd --> B1016/B1008	14.10	14:07	14:09	-2.8%	-3.0%
11	1102	NB	B1016/B1008 --> A131/London Rd	13.99	13:51	13:56	-3.4%	-3.4%
12	1201	SB	Rectory Ln/Meadowside --> B1002/Church Ln	8.66	14:02	14:12	-4.8%	-3.6%
12	1202	NB	B1002/Church Ln --> Rectory Ln/Meadowside	8.67	14:31	12:45	-4.5%	-1.8%
13	1301	WB	Main Rd/Damasses Ln --> Army and Navy Roundabout	7.71	10:57	11:08	-1.4%	-1.2%
13	1302	EB	Army and Navy Roundabout --> Main Rd/Damasses Ln	7.90	11:52	11:57	-1.4%	-1.5%
14	1401	SB	Army and Navy Roundabout --> Stock Rd/The Vale	7.03	09:07	09:05	-2.7%	-2.3%
14	1402	NB	Stock Rd/The Vale --> Army and Navy Roundabout	7.13	10:49	10:51	-5.7%	-2.1%

Table 8-104: Forecast Journey Times – Low Growth Scenario 2041 PM Peak (mm:ss)

Route	Route ID	Dir	Description	Length (km)	Journey Time (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
1	101	WB	A12/Millfield Cottage North --> A12/Ingatestone	19.01	13:41	13:47	-6.2%	-5.6%
1	102	EB	A12/Ingatestone --> A12/Millfield Cottage North	19.05	15:15	15:14	-4.2%	-3.5%
2	201	EB	250 Ongar Road --> Writtle Road/Elm Road	3.89	11:53	11:34	-11.9%	-11.8%
2	202	WB	Writtle Road/Elm Road --> 250 Ongar Road	3.86	09:17	11:04	-5.3%	-10.6%
3	301	SB	A130/Braintree Road --> Parkway Roundabout	6.74	12:55	12:48	-2.0%	-1.7%
3	302	NB	Parkway Roundabout --> A130/Braintree Road	6.68	16:47	16:58	-2.5%	-2.4%
4	401	SB	A130/Nabbotts Farm Roundabout --> A130/1 White Hart Ln	1.89	02:26	02:26	-5.2%	-3.9%
4	402	NB	A130/1 White Hart Ln --> A130/Nabbotts Farm Roundabout	1.92	02:56	02:56	-3.8%	-13.7%
5	501	EB	High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.40	07:00	07:25	-3.2%	-12.7%
5	502	WB	Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	13:23	10:56	-12.6%	-18.0%
6	601	SB	Parkway/New London Rd --> Stock Rd/Beehive Lane	3.99	09:18	11:39	-16.8%	-11.9%
6	602	NB	Stock Rd/Beehive Lane --> Parkway/New London Rd	4.00	08:51	08:33	-15.2%	-14.9%
7	701	EB	Wooden Farm Newland Hall --> Market Roundabout	10.16	16:29	15:51	-10.0%	-11.1%
7	702	WB	Market Roundabout --> Wooden Farm Newland Hall	10.18	12:01	12:15	-1.4%	-2.1%
8	801	SB	Market Roundabout --> A12 J17	5.21	12:08	11:53	-6.7%	-3.4%

Route	Route ID	Dir	Description	Length (km)	Journey Time (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
8	802	NB	A12 J17 --> Market Roundabout	5.19	13:18	08:44	-6.2%	-9.8%
9	901	EB	Van Dieman's Rd --> Maldon Rd/Cherry Garden Lane	9.21	16:05	15:13	-2.4%	-5.3%
9	902	WB	Maldon Rd/Cherry Garden Lane --> Van Dieman's Rd	9.42	18:27	13:02	-7.2%	-4.6%
10	1001	WB	Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	10.97	13:33	11:09	-0.9%	-1.9%
10	1002	EB	Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	10.82	18:52	12:02	-11.4%	-9.3%
11	1101	SB	A131/London Rd --> B1016/B1008	14.10	16:13	18:17	-16.0%	-9.3%
11	1102	NB	B1016/B1008 --> A131/London Rd	13.99	20:52	21:30	-5.5%	-4.3%
12	1201	SB	Rectory Ln/Meadowside --> B1002/Church Ln	8.66	18:36	20:09	-9.6%	-7.4%
12	1202	NB	B1002/Church Ln --> Rectory Ln/Meadowside	8.67	17:21	15:48	-7.0%	-3.3%
13	1301	WB	Main Rd/Damasses Ln --> Army and Navy Roundabout	7.71	13:25	14:10	-17.4%	-17.2%
13	1302	EB	Army and Navy Roundabout --> Main Rd/Damasses Ln	7.90	13:53	14:28	-4.4%	-10.5%
14	1401	SB	Army and Navy Roundabout --> Stock Rd/The Vale	7.03	10:24	10:33	-5.5%	-4.1%
14	1402	NB	Stock Rd/The Vale --> Army and Navy Roundabout	7.13	16:53	12:17	-14.5%	-1.7%

Table 8-105: Forecast Journey Times – High Growth Scenario 2026 AM Peak (mm:ss)

Route	Route ID	Dir	Description	Length (km)	Journey Times (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
1	101	WB	A12/Millfield Cottage North --> A12/Ingatestone	19.01	16:07	15:52	4.4%	5.0%
1	102	EB	A12/Ingatestone --> A12/Millfield Cottage North	19.05	15:38	15:45	2.1%	2.4%
2	201	EB	250 Ongar Road --> Writtle Road/Elm Road	3.89	14:22	16:46	-1.1%	12.9%
2	202	WB	Writtle Road/Elm Road --> 250 Ongar Road	3.86	09:33	10:06	3.1%	-1.6%
3	301	SB	A130/Braintree Road --> Parkway Roundabout	6.74	15:35	15:30	5.1%	4.8%
3	302	NB	Parkway Roundabout --> A130/Braintree Road	6.68	13:37	13:55	3.4%	3.6%
4	401	SB	A130/Nabbotts Farm Roundabout --> A130/1 White Hart Ln	1.89	02:34	02:36	1.3%	1.3%
4	402	NB	A130/1 White Hart Ln --> A130/Nabbotts Farm Roundabout	1.92	04:02	03:20	24.1%	3.6%
5	501	EB	High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.40	05:12	05:30	2.0%	1.9%
5	502	WB	Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	07:58	07:28	4.6%	8.5%
6	601	SB	Parkway/New London Rd --> Stock Rd/Beehive Lane	3.99	08:16	09:44	4.4%	9.0%
6	602	NB	Stock Rd/Beehive Lane --> Parkway/New London Rd	4.00	10:33	10:54	0.3%	3.6%
7	701	EB	Wooden Farm Newland Hall --> Market Roundabout	10.17	15:13	15:09	3.9%	2.4%
7	702	WB	Market Roundabout --> Wooden Farm Newland Hall	10.18	12:59	13:17	3.0%	3.5%
8	801	SB	Market Roundabout --> A12 J17	5.20	06:40	08:23	10.8%	5.7%

Route	Route ID	Dir	Description	Length (km)	Journey Times (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
8	802	NB	A12 J17 --> Market Roundabout	5.21	15:22	12:24	3.6%	5.2%
9	901	EB	Van Dieman's Rd --> Maldon Rd/Cherry Garden Lane	9.21	14:10	13:40	1.1%	1.4%
9	902	WB	Maldon Rd/Cherry Garden Lane --> Van Dieman's Rd	9.30	25:08	23:32	5.8%	17.0%
10	1001	WB	Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	11.00	12:19	14:01	2.4%	1.4%
10	1002	EB	Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	10.95	19:36	19:56	4.3%	14.8%
11	1101	SB	A131/London Rd --> B1016/B1008	14.10	20:55	21:07	6.8%	11.5%
11	1102	NB	B1016/B1008 --> A131/London Rd	13.99	14:31	14:48	1.8%	2.4%
12	1201	SB	Rectory Ln/Meadowside --> B1002/Church Ln	8.66	14:32	15:00	3.6%	3.1%
12	1202	NB	B1002/Church Ln --> Rectory Ln/Meadowside	8.67	15:43	16:13	2.7%	5.3%
13	1301	WB	Main Rd/Damasses Ln --> Army and Navy Roundabout	7.71	21:50	13:02	9.3%	-3.5%
13	1302	EB	Army and Navy Roundabout --> Main Rd/Damasses Ln	7.90	11:56	11:53	1.4%	1.3%
14	1401	SB	Army and Navy Roundabout --> Stock Rd/The Vale	7.03	13:08	12:58	7.9%	-2.1%
14	1402	NB	Stock Rd/The Vale --> Army and Navy Roundabout	7.10	24:09	21:41	11.6%	1.2%

Table 8-106: Forecast Journey Times – High Growth Scenario 2026 Inter-Peak (mm:ss)

Route	Route ID	Dir	Description	Length (km)	Journey Time (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
1	101	WB	A12/Millfield Cottage North --> A12/Ingatestone	19.01	12:15	12:16	2.2%	1.9%
1	102	EB	A12/Ingatestone --> A12/Millfield Cottage North	19.05	13:07	13:08	2.7%	2.9%
2	201	EB	250 Ongar Road --> Writtle Road/Elm Road	3.89	07:13	07:15	1.2%	0.5%
2	202	WB	Writtle Road/Elm Road --> 250 Ongar Road	3.86	08:01	07:57	2.8%	1.7%
3	301	SB	A130/Braintree Road --> Parkway Roundabout	6.74	11:09	11:07	1.1%	1.5%
3	302	NB	Parkway Roundabout --> A130/Braintree Road	6.68	10:17	10:18	1.5%	1.3%
4	401	SB	A130/Nabbotts Farm Roundabout --> A130/1 White Hart Ln	1.89	02:14	02:15	1.5%	1.5%
4	402	NB	A130/1 White Hart Ln --> A130/Nabbotts Farm Roundabout	1.92	02:42	02:42	1.9%	1.9%
5	501	EB	High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.40	05:22	05:45	0.0%	2.1%
5	502	WB	Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	05:03	04:59	1.7%	1.4%
6	601	SB	Parkway/New London Rd --> Stock Rd/Beehive Lane	3.99	07:35	08:00	2.0%	2.6%
6	602	NB	Stock Rd/Beehive Lane --> Parkway/New London Rd	4.00	07:30	07:23	1.8%	1.1%
7	701	EB	Wooden Farm Newland Hall --> Market Roundabout	10.17	12:23	12:20	1.0%	-0.4%
7	702	WB	Market Roundabout --> Wooden Farm Newland Hall	10.18	11:20	11:22	2.1%	1.9%
8	801	SB	Market Roundabout --> A12 J17	5.20	06:13	07:08	2.8%	3.6%

Route	Route ID	Dir	Description	Length (km)	Journey Time (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
8	802	NB	A12 J17 --> Market Roundabout	5.21	06:33	05:54	4.0%	1.1%
9	901	EB	Van Dieman's Rd --> Maldon Rd/Cherry Garden Lane	9.21	13:35	12:10	0.9%	2.1%
9	902	WB	Maldon Rd/Cherry Garden Lane --> Van Dieman's Rd	9.30	12:56	12:24	3.1%	3.3%
10	1001	WB	Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	11.00	11:38	11:33	1.6%	3.0%
10	1002	EB	Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	10.95	12:09	11:10	0.1%	0.9%
11	1101	SB	A131/London Rd --> B1016/B1008	14.10	13:29	13:30	1.9%	1.3%
11	1102	NB	B1016/B1008 --> A131/London Rd	13.99	13:20	13:33	1.8%	2.7%
12	1201	SB	Rectory Ln/Meadowside --> B1002/Church Ln	8.66	14:12	14:15	2.9%	1.7%
12	1202	NB	B1002/Church Ln --> Rectory Ln/Meadowside	8.67	13:48	12:46	3.4%	0.8%
13	1301	WB	Main Rd/Damasses Ln --> Army and Navy Roundabout	7.71	10:27	10:38	1.1%	1.3%
13	1302	EB	Army and Navy Roundabout --> Main Rd/Damasses Ln	7.90	11:42	11:44	1.0%	1.3%
14	1401	SB	Army and Navy Roundabout --> Stock Rd/The Vale	7.03	09:09	09:04	0.9%	1.1%
14	1402	NB	Stock Rd/The Vale --> Army and Navy Roundabout	7.10	12:22	10:38	13.3%	1.4%

Table 8-107: Forecast Journey Times – High Growth Scenario 2026 PM Peak (mm:ss)

Route	Route ID	Dir	Description	Length (km)	Journey Time (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
1	101	WB	A12/Millfield Cottage North --> A12/Ingatestone	19.01	13:12	13:15	3.0%	3.0%
1	102	EB	A12/Ingatestone --> A12/Millfield Cottage North	19.05	14:53	14:47	1.8%	1.7%
2	201	EB	250 Ongar Road --> Writtle Road/Elm Road	3.89	12:03	12:22	19.9%	18.9%
2	202	WB	Writtle Road/Elm Road --> 250 Ongar Road	3.86	09:42	12:47	6.4%	13.3%
3	301	SB	A130/Braintree Road --> Parkway Roundabout	6.74	12:25	12:22	1.8%	2.2%
3	302	NB	Parkway Roundabout --> A130/Braintree Road	6.68	16:05	16:16	14.9%	12.3%
4	401	SB	A130/Nabbotts Farm Roundabout --> A130/1 White Hart Ln	1.89	02:28	02:28	3.5%	2.8%
4	402	NB	A130/1 White Hart Ln --> A130/Nabbotts Farm Roundabout	1.92	02:57	02:56	1.7%	2.9%
5	501	EB	High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.40	07:06	08:26	1.7%	11.2%
5	502	WB	Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	15:11	13:13	9.4%	14.4%
6	601	SB	Parkway/New London Rd --> Stock Rd/Beehive Lane	3.99	11:04	12:43	8.3%	6.9%
6	602	NB	Stock Rd/Beehive Lane --> Parkway/New London Rd	4.00	08:55	09:01	2.3%	9.7%
7	701	EB	Wooden Farm Newland Hall --> Market Roundabout	10.17	16:10	16:17	10.4%	5.2%
7	702	WB	Market Roundabout --> Wooden Farm Newland Hall	10.18	11:54	12:08	0.7%	1.7%
8	801	SB	Market Roundabout --> A12 J17	5.20	10:21	10:53	-3.3%	0.8%

Route	Route ID	Dir	Description	Length (km)	Journey Time (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
8	802	NB	A12 J17 --> Market Roundabout	5.21	12:59	08:42	7.2%	4.4%
9	901	EB	Van Dieman's Rd --> Maldon Rd/Cherry Garden Lane	9.21	16:09	15:30	1.3%	1.9%
9	902	WB	Maldon Rd/Cherry Garden Lane --> Van Dieman's Rd	9.30	19:15	12:56	0.1%	2.2%
10	1001	WB	Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	11.00	13:23	11:10	-0.6%	0.6%
10	1002	EB	Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	10.95	20:21	13:22	-0.6%	4.2%
11	1101	SB	A131/London Rd --> B1016/B1008	14.10	15:47	15:43	3.2%	1.8%
11	1102	NB	B1016/B1008 --> A131/London Rd	13.99	19:50	20:27	0.4%	1.0%
12	1201	SB	Rectory Ln/Meadowside --> B1002/Church Ln	8.66	19:07	20:14	4.2%	3.7%
12	1202	NB	B1002/Church Ln --> Rectory Ln/Meadowside	8.67	17:34	16:20	7.0%	3.2%
13	1301	WB	Main Rd/Damasses Ln --> Army and Navy Roundabout	7.71	13:37	15:50	5.6%	12.7%
13	1302	EB	Army and Navy Roundabout --> Main Rd/Damasses Ln	7.90	12:59	13:27	1.4%	1.5%
14	1401	SB	Army and Navy Roundabout --> Stock Rd/The Vale	7.03	10:35	10:34	1.9%	2.3%
14	1402	NB	Stock Rd/The Vale --> Army and Navy Roundabout	7.10	18:35	12:07	7.7%	4.3%

Table 8-108: Forecast Journey Times – High Growth Scenario 2041 AM Peak (mm:ss)

Route	Route ID	Dir	Description	Length (km)	Journey Time (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
1	101	WB	A12/Millfield Cottage North --> A12/Ingatestone	19.01	17:43	17:10	4.7%	3.8%
1	102	EB	A12/Ingatestone --> A12/Millfield Cottage North	19.05	16:47	17:05	2.0%	2.9%
2	201	EB	250 Ongar Road --> Writtle Road/Elm Road	3.89	17:56	22:22	-3.2%	26.1%
2	202	WB	Writtle Road/Elm Road --> 250 Ongar Road	3.86	10:22	10:33	4.5%	1.9%
3	301	SB	A130/Braintree Road --> Parkway Roundabout	6.74	20:49	19:47	10.1%	9.7%
3	302	NB	Parkway Roundabout --> A130/Braintree Road	6.68	14:49	15:17	3.7%	4.1%
4	401	SB	A130/Nabbotts Farm Roundabout --> A130/1 White Hart Ln	1.89	02:40	02:43	0.0%	1.9%
4	402	NB	A130/1 White Hart Ln --> A130/Nabbotts Farm Roundabout	1.92	03:56	04:05	10.3%	25.0%
5	501	EB	High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.40	05:27	05:54	1.6%	3.8%
5	502	WB	Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	10:24	07:50	18.2%	8.0%
6	601	SB	Parkway/New London Rd --> Stock Rd/Beehive Lane	3.99	10:11	11:49	11.7%	10.3%
6	602	NB	Stock Rd/Beehive Lane --> Parkway/New London Rd	4.00	10:55	10:57	5.3%	4.0%
7	701	EB	Wooden Farm Newland Hall --> Market Roundabout	10.16	18:11	17:10	10.3%	4.6%
7	702	WB	Market Roundabout --> Wooden Farm Newland Hall	10.18	15:45	15:49	9.4%	2.9%
8	801	SB	Market Roundabout --> A12 J17	5.21	09:43	13:57	20.5%	6.8%

Route	Route ID	Dir	Description	Length (km)	Journey Time (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
8	802	NB	A12 J17 --> Market Roundabout	5.19	16:14	13:09	1.9%	6.8%
9	901	EB	Van Dieman's Rd --> Maldon Rd/Cherry Garden Lane	9.21	15:11	14:22	3.9%	2.0%
9	902	WB	Maldon Rd/Cherry Garden Lane --> Van Dieman's Rd	9.42	31:54	28:25	14.6%	17.7%
10	1001	WB	Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	10.97	13:34	14:20	-0.5%	0.2%
10	1002	EB	Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	10.82	28:21	24:00	15.9%	13.9%
11	1101	SB	A131/London Rd --> B1016/B1008	14.10	26:49	26:00	8.0%	10.1%
11	1102	NB	B1016/B1008 --> A131/London Rd	13.99	16:15	16:48	2.2%	4.3%
12	1201	SB	Rectory Ln/Meadowside --> B1002/Church Ln	8.66	17:38	17:49	11.6%	6.5%
12	1202	NB	B1002/Church Ln --> Rectory Ln/Meadowside	8.67	17:23	17:39	3.0%	3.0%
13	1301	WB	Main Rd/Damasses Ln --> Army and Navy Roundabout	7.71	22:04	18:57	4.5%	2.2%
13	1302	EB	Army and Navy Roundabout --> Main Rd/Damasses Ln	7.90	12:54	12:51	5.0%	4.9%
14	1401	SB	Army and Navy Roundabout --> Stock Rd/The Vale	7.03	15:21	15:18	11.0%	10.5%
14	1402	NB	Stock Rd/The Vale --> Army and Navy Roundabout	7.13	28:35	24:41	8.8%	8.9%

Table 8-109: Forecast Journey Times – High Growth Scenario 2041 Inter-Peak (mm:ss)

Route	Route ID	Dir	Description	Length (km)	Journey Time (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
1	101	WB	A12/Millfield Cottage North --> A12/Ingatestone	19.01	13:42	13:45	4.8%	5.1%
1	102	EB	A12/Ingatestone --> A12/Millfield Cottage North	19.05	14:12	14:07	3.9%	3.4%
2	201	EB	250 Ongar Road --> Writtle Road/Elm Road	3.89	07:28	07:21	2.3%	1.1%
2	202	WB	Writtle Road/Elm Road --> 250 Ongar Road	3.86	08:20	08:17	4.2%	4.2%
3	301	SB	A130/Braintree Road --> Parkway Roundabout	6.74	11:48	11:43	2.9%	2.3%
3	302	NB	Parkway Roundabout --> A130/Braintree Road	6.68	10:56	11:01	3.0%	3.1%
4	401	SB	A130/Nabbotts Farm Roundabout --> A130/1 White Hart Ln	1.89	02:23	02:23	0.7%	0.0%
4	402	NB	A130/1 White Hart Ln --> A130/Nabbotts Farm Roundabout	1.92	02:45	02:44	0.6%	1.2%
5	501	EB	High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.40	05:35	06:03	1.8%	2.0%
5	502	WB	Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	05:16	05:20	1.9%	3.9%
6	601	SB	Parkway/New London Rd --> Stock Rd/Beehive Lane	3.99	07:58	08:31	3.7%	4.9%
6	602	NB	Stock Rd/Beehive Lane --> Parkway/New London Rd	4.00	07:47	07:40	3.5%	2.2%
7	701	EB	Wooden Farm Newland Hall --> Market Roundabout	10.16	13:03	13:02	2.6%	0.4%
7	702	WB	Market Roundabout --> Wooden Farm Newland Hall	10.18	11:49	11:54	2.2%	2.4%
8	801	SB	Market Roundabout --> A12 J17	5.21	08:54	09:44	25.6%	15.4%

Route	Route ID	Dir	Description	Length (km)	Journey Time (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
8	802	NB	A12 J17 --> Market Roundabout	5.19	06:43	05:49	6.9%	1.2%
9	901	EB	Van Dieman's Rd --> Maldon Rd/Cherry Garden Lane	9.21	14:07	13:59	0.5%	7.3%
9	902	WB	Maldon Rd/Cherry Garden Lane --> Van Dieman's Rd	9.42	14:03	13:11	7.3%	5.0%
10	1001	WB	Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	10.97	13:11	12:02	10.6%	2.8%
10	1002	EB	Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	10.82	14:45	11:23	8.6%	1.2%
11	1101	SB	A131/London Rd --> B1016/B1008	14.10	14:53	14:56	2.5%	2.4%
11	1102	NB	B1016/B1008 --> A131/London Rd	13.99	14:57	15:08	4.3%	5.0%
12	1201	SB	Rectory Ln/Meadowside --> B1002/Church Ln	8.66	15:11	15:23	3.1%	4.4%
12	1202	NB	B1002/Church Ln --> Rectory Ln/Meadowside	8.67	15:35	13:15	2.5%	2.1%
13	1301	WB	Main Rd/Damasses Ln --> Army and Navy Roundabout	7.71	11:18	11:26	1.8%	1.5%
13	1302	EB	Army and Navy Roundabout --> Main Rd/Damasses Ln	7.90	12:12	12:19	1.4%	1.5%
14	1401	SB	Army and Navy Roundabout --> Stock Rd/The Vale	7.03	09:36	09:37	2.5%	3.4%
14	1402	NB	Stock Rd/The Vale --> Army and Navy Roundabout	7.13	13:31	11:34	17.9%	4.4%

Table 8-110: Forecast Journey Times – Core Scenario 2041 PM Peak (mm:ss)

Route	Route ID	Dir	Description	Length (km)	Journey Time (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
1	101	WB	A12/Millfield Cottage North --> A12/Ingatestone	19.01	15:32	15:28	6.5%	5.9%
1	102	EB	A12/Ingatestone --> A12/Millfield Cottage North	19.05	16:17	16:13	2.3%	2.7%
2	201	EB	250 Ongar Road --> Writtle Road/Elm Road	3.89	13:51	15:11	2.7%	15.8%
2	202	WB	Writtle Road/Elm Road --> 250 Ongar Road	3.86	10:25	10:00	6.3%	-19.2%
3	301	SB	A130/Braintree Road --> Parkway Roundabout	6.74	13:30	13:25	2.4%	3.1%
3	302	NB	Parkway Roundabout --> A130/Braintree Road	6.68	17:45	19:15	3.1%	10.7%
4	401	SB	A130/Nabbotts Farm Roundabout --> A130/1 White Hart Ln	1.89	02:36	02:31	1.3%	-0.7%
4	402	NB	A130/1 White Hart Ln --> A130/Nabbotts Farm Roundabout	1.92	03:37	04:07	18.6%	21.1%
5	501	EB	High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.40	07:30	09:18	3.7%	9.4%
5	502	WB	Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	16:53	15:18	10.2%	14.8%
6	601	SB	Parkway/New London Rd --> Stock Rd/Beehive Lane	3.99	11:36	13:26	3.7%	1.6%
6	602	NB	Stock Rd/Beehive Lane --> Parkway/New London Rd	4.00	11:00	11:59	5.4%	19.2%
7	701	EB	Wooden Farm Newland Hall --> Market Roundabout	10.16	20:12	20:34	10.3%	15.3%
7	702	WB	Market Roundabout --> Wooden Farm Newland Hall	10.18	12:29	13:01	2.5%	4.0%
8	801	SB	Market Roundabout --> A12 J17	5.21	13:10	12:42	1.3%	3.3%

Route	Route ID	Dir	Description	Length (km)	Journey Time (mm:ss)		% Difference to Core	
					DM	DS	DM	DS
8	802	NB	A12 J17 --> Market Roundabout	5.19	14:44	11:10	3.9%	15.3%
9	901	EB	Van Dieman's Rd --> Maldon Rd/Cherry Garden Lane	9.21	16:50	16:21	2.1%	1.8%
9	902	WB	Maldon Rd/Cherry Garden Lane --> Van Dieman's Rd	9.42	20:16	14:37	1.9%	7.0%
10	1001	WB	Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	10.97	11:11	11:30	-18.2%	1.2%
10	1002	EB	Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	10.82	21:06	14:35	-0.9%	9.9%
11	1101	SB	A131/London Rd --> B1016/B1008	14.10	20:32	21:43	6.4%	7.7%
11	1102	NB	B1016/B1008 --> A131/London Rd	13.99	22:09	22:35	0.3%	0.5%
12	1201	SB	Rectory Ln/Meadowside --> B1002/Church Ln	8.66	22:30	24:01	9.4%	10.3%
12	1202	NB	B1002/Church Ln --> Rectory Ln/Meadowside	8.67	20:04	18:32	7.6%	13.5%
13	1301	WB	Main Rd/Damasses Ln --> Army and Navy Roundabout	7.71	18:37	20:35	14.7%	20.3%
13	1302	EB	Army and Navy Roundabout --> Main Rd/Damasses Ln	7.90	17:29	18:06	20.4%	12.0%
14	1401	SB	Army and Navy Roundabout --> Stock Rd/The Vale	7.03	11:21	11:23	3.2%	3.5%
14	1402	NB	Stock Rd/The Vale --> Army and Navy Roundabout	7.13	21:23	14:13	8.3%	13.7%

The following key points can be observed from the data in the tables above:

- The change in journey time relative to the Core scenario is mostly consistent with the change in demand, that is, journey times generally fall under low growth (in 97% of routes) and increase under high growth (97% of routes).
- The change in forecast journey times on the A12 (route 1) increases slightly under high growth for both DM and DS (by about 3% to 6% depending on the direction and time period in 2041) and falls slightly under low growth (by about 2% to 6%).
- The journey times through the A&N via EYW and Parkway (Route 8) increase under high growth, in particular the outbound AM peak in the DM, which increases by about 20.5% in the AM peak as increased traffic has a larger impact on journey times in an already highly congested network. Under DS, the increase is about 6.8%. Under low growth, the journey times generally fall. It is worth noting that the pattern of benefits, that is, the difference between the DS and DM scenarios, is the same as Core. For example, the inbound journey has relatively high benefits in the AM peak while the outbound journey has a disbenefit (see section 8.5 for further discussion on this).
- The journey times to the A&N via the Chelmer Road approach (Route 13) also respond to changes in demand in line with expectation, with increases under high growth and reductions under low growth, with scheme journey time savings increasing under high growth and falling under low growth.
- The journey times to the A&N via the Baddow Road approach (Route 14) again respond to changes in demand in line with expectation, with increases under high growth, reductions under low growth and scheme journey time savings similar.

9 Assignment Results for Appraisal

Average peak hour flows, Annual Average Daily Traffic (AADT) flows, and 18hr Average Annual Weekday Traffic (AAWT) flows, percent HGVs and speeds have been calculated using the model outputs and have been made available for input into environmental (noise and air quality) and accident appraisal as well as for the distributional impact assessments (severance). The methodology and results of this process are outlined in the following sections.

9.1 Requirements

As described in section 2.5, the Chelmsford Strategic Model represents neutral weekday conditions for three time periods as follows:

- AM peak hour – 08:00 to 09:00;
- Average inter-peak hour – average hour representing 10:00 to 16:00; and
- PM peak hour – 17:00 to 18:00.

The modelling and appraisal of noise, air quality, severance and accident impacts require traffic flows, percent HGVs and estimated speeds for the following time periods:

- Noise assessment (directional flows):
  - Average AM peak hour (07:00 to 10:00);
  - Average inter-peak hour (10:00 to 16:00);
  - Average PM peak hour (16:00 to 19:00);
  - Average off-peak hour (19:00 to 07:00);
  - AAWT; and
  - AADT.
- Air quality (both two-way and directional flows):
  - AAWT for the 18-hour period 06:00 to midnight; and
  - AAWT night time 23:00 to 07:00.
- COBA-LT accident appraisal and severance (two-way flows):
  - AADT

The methodology for converting the model flows and speeds to the required time periods involved developing and applying appropriate conversion factors plus some key assumptions as outlined in the following sections.

9.2 Appraisal Flows

The factors for converting the modelled time periods were calculated based on Essex continuous count site data for the corresponding model period. The location of the sites is illustrated in the figure below.

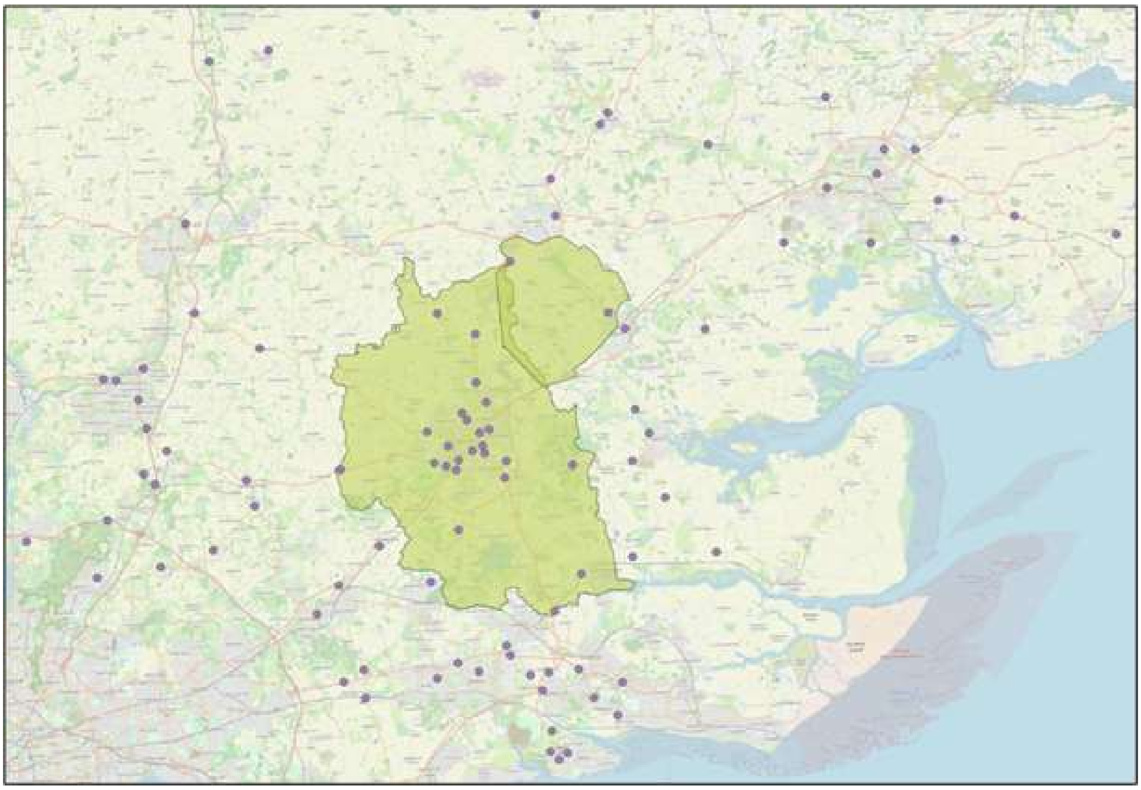


Figure 9-1: Continuous Count Site Locations for Conversion Factors

The factors required to convert the modelled flows to required time periods are outlined in the following table.

Table 9-1: Appraisal Flow Time Period Calculations and Factors

Appraisal Flow Type	Calculation	Factor
Average AM peak hour	= (AM modelled flow) x (Average AM peak factor) / 3	2.65
Average inter-peak hour	= (IP modelled flow)	n/a
Average PM peak hour	= (PM modelled flow) x (Average PM peak factor) / 3	2.77
12-hour AAWT	= 3 x (Average AM peak hour) + 6 x (Average inter-peak hour) + 3 x (Average PM Peak hour)	n/a
Average off-peak hour	= ((Average 12-hour AAWT) x ((AAWT factor) – 1)) / 12	1.17
AAWT	= (Average 12-hour AAWT) x (AAWT factor)	1.17
AAWT 18-hr	= (Average 12-hour AAWT) x (AAWT18 factor)	1.13
AAWT night	= (Average 12-hour AAWT) x (AAWT night factor)	0.10
AADT	= AAWT / (AADT factor)	1.08

All flows have been calculated as per the formulae and factors in the above table except for the off-peak hourly flow in the DS scenario. In this case, it has been assumed that the DS off-peak flow is the same as the DM off-peak flow where the links already existed in the DM scenario. The rationale for this assumption is that there is no reason to expect that the DS scheme would result in any change in traffic flows in the off-peak period since i) reassignment due to the scheme is based on changes in congestion at the A&N junction, which is not expected to exist in the off-peak and therefore no reason to expect any rerouting, and ii) the P&R elements of the scheme to not operate in the off-peak period. This is considered more accurate than the assumption that off-peak flows would change in the same proportion as the 12-hour peak period flows, where congestion does result in reassignment and P&R has an impact of flows. It is noted that if the link is new in the DS scenario, then the DM formula is applied.

9.3 Percent HGVs

The percentage of HGVs is also calculated for each of the above appraisal time periods based on the same methodology as outlined above to total vehicles but with specific HGV factors as per the table below.

Appraisal Flow Type	Factor
Average AM peak hour	2.93
Average inter-peak hour	n/a
Average PM peak hour	3.35
12-hour AAWT	n/a
Average off-peak hour	0.12
AAWT	1.12
AAWT 18-hr	1.04
AAWT night	0.14
AADT	1.08

9.4 Estimated Speeds

The noise and air quality appraisal also requires estimated speeds for each identified time period.

Guidance in IAN 185 provides a method for estimating speeds from traffic models as follows: "*using observed vehicle speeds from the base year. This allows for a comparison with the modelled base year speeds and provides an indication of the performance of the speeds from the traffic model. This information can then be used to adjust the individual base year link speeds output from the traffic model, where required. As it is not possible to measure forecast traffic speeds, the adjustments applied to the base year model are applied to the opening and design year forecasts in the same way.*"

Applying this method involved calculating appropriate pivot factors from the base model speeds compared to observed data. As such, a correspondence table was generated between the model network node and link structure and the Integrated Transport Network (ITN) GIS file network structure used to generate observed speeds across all links in the ITN where there is a sample of records. This process was undertaken for journey time routes for which observed data had been calculated during model validation. A complication however, it that in many cases there is no exact correspondence between links in the transport model and those in the ITN. In addition, many links in the transport model and ITN networks are very short, with aggregate sections often used to provide smoother results along routes while at the same time attempting to represent change in speeds at key locations such as the approach to junctions. As such, pivot factors have been calculated to attempt to provide factors that capture sensible variations in speeds in the network that match, in as much as possible, equivalent links in the transport model network.

The pivot factor is therefore a simple ratio of:

$$Speed\ Pivot\ Factor = \frac{Observed\ Speed}{Modelled\ Speed}$$

The calculated pivot factors by time period cover the main routes in the study area, with a total of 1,329 links covered. Where a pivot factor is not available, the model speed has been taken. These factors have been applied to the forecast year model speeds.

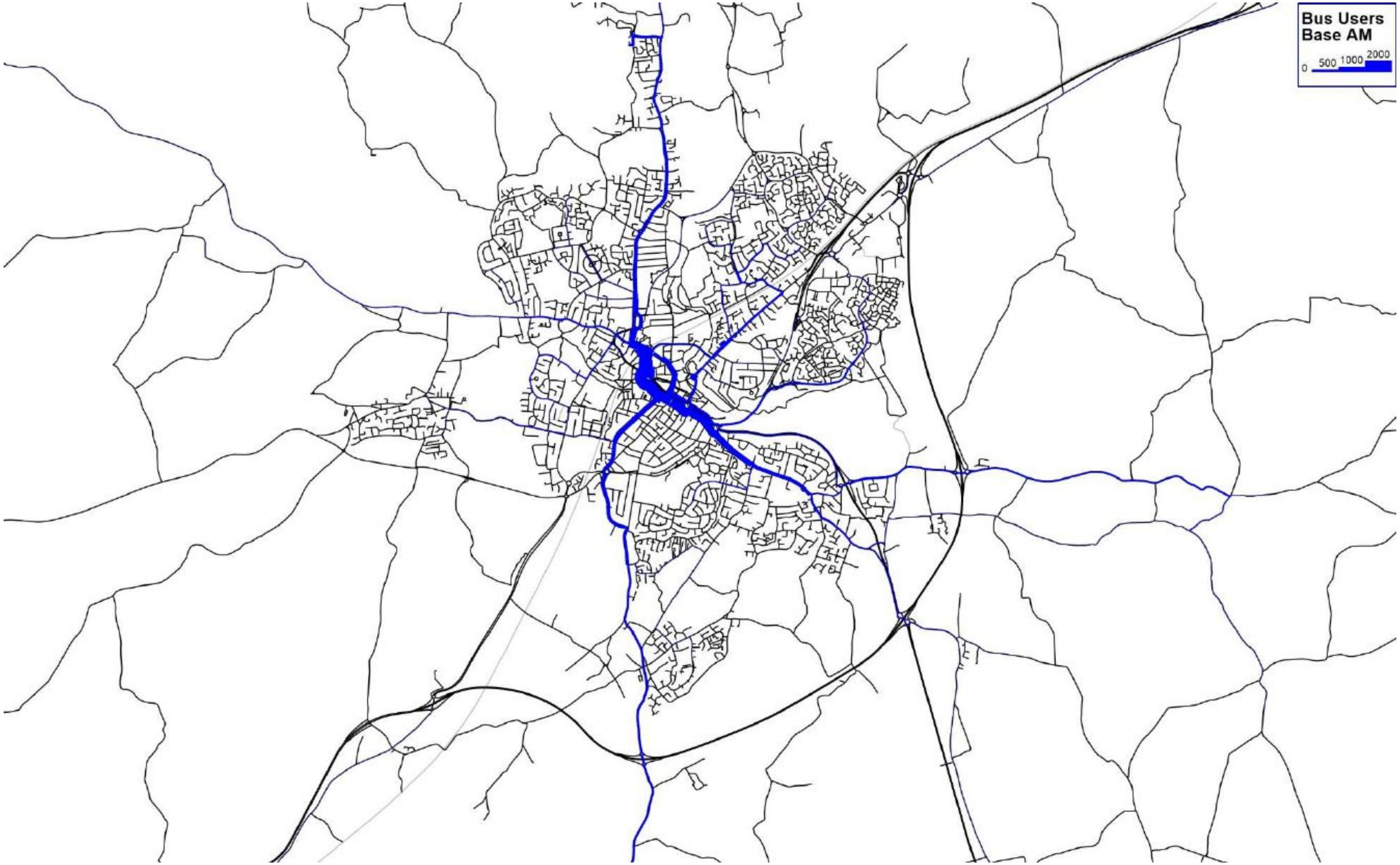
Speeds for average peak periods are based on the above method. Off peak speeds are based on model free flow speeds. More aggregate time periods of AAWT and AADT are based on a flow weighted average of the individual hourly time periods.

Appendices

Appendix A: Donor Zone Correspondence

New Model Zone ID	Donor Zone ID	New Model Zone ID	Donor Zone ID
307	87	337	194
308	87	338	194
309	87	339	193
310	87	340	190
311	87	341	190
312	87	342	188
313	87	343	56
314	17	344	87
315	135	345	85
316	92	346	127
317	94	347	6
318	92	348	6
319	6	349	51
320	114	350	50
321	110	351	132
324	85	352	64
325	85	353	87
326	7	354	85
329	127	355	105
330	127	356	101
331	188	357	36
332	195	358	9
333	195	359	135
334	189	360	26
335	190	361	87
336	190		

Appendix B: Bus and Rail Flows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500
1000
2000


Bus Users
Base AM
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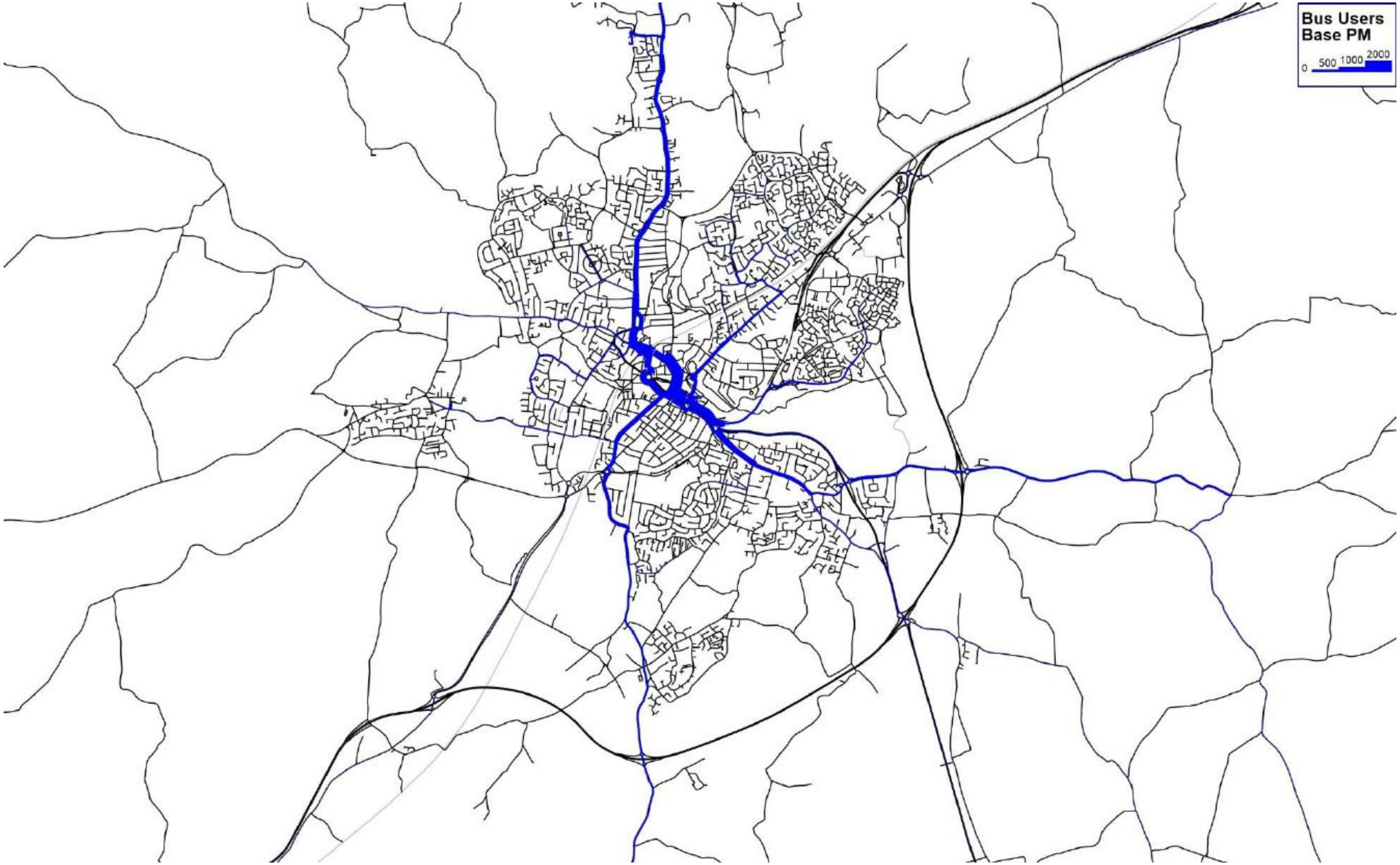
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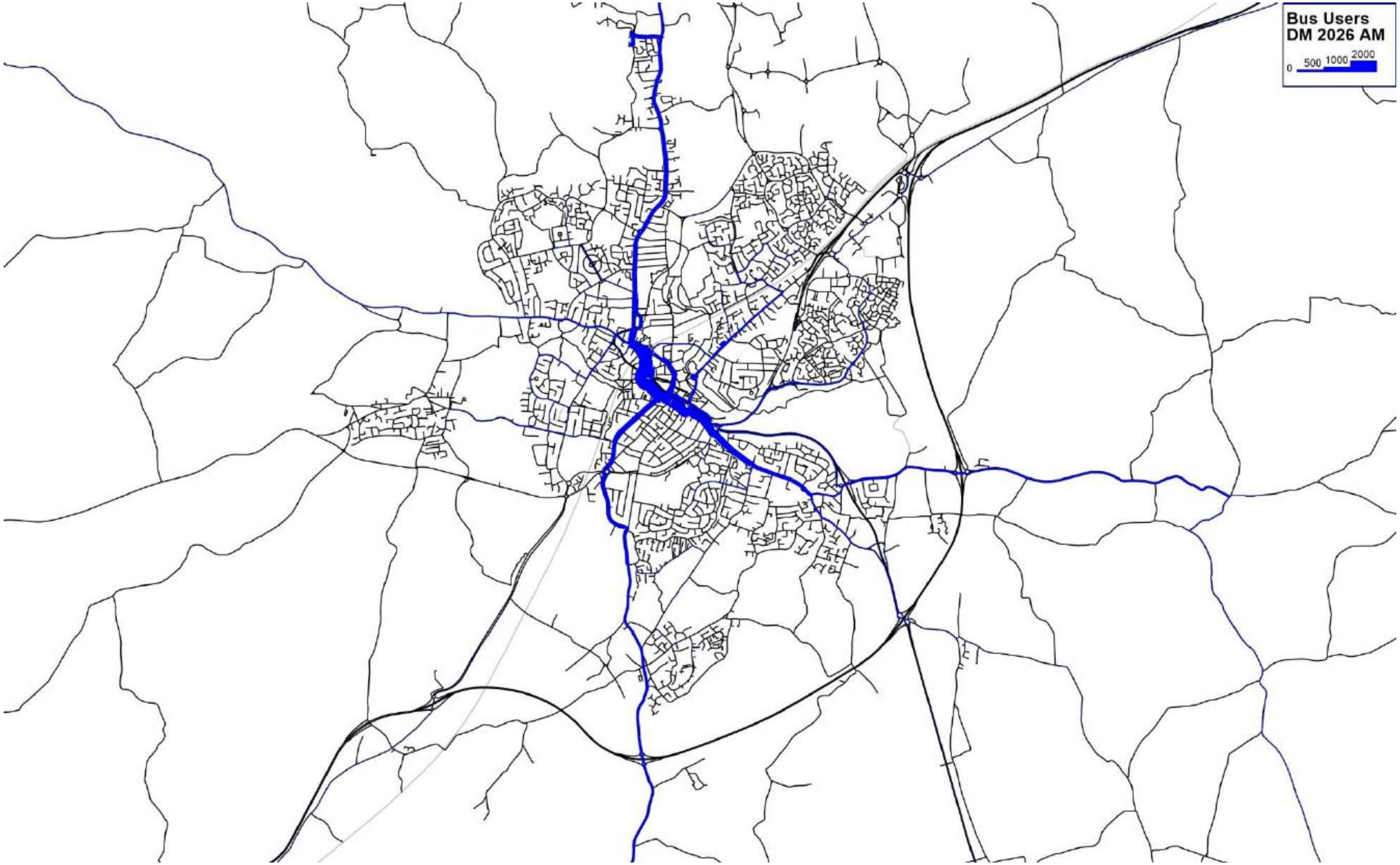
Bus Users
Base PM
0
500
1000
2000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500
1000
2000


Bus Users
DM 2026 AM
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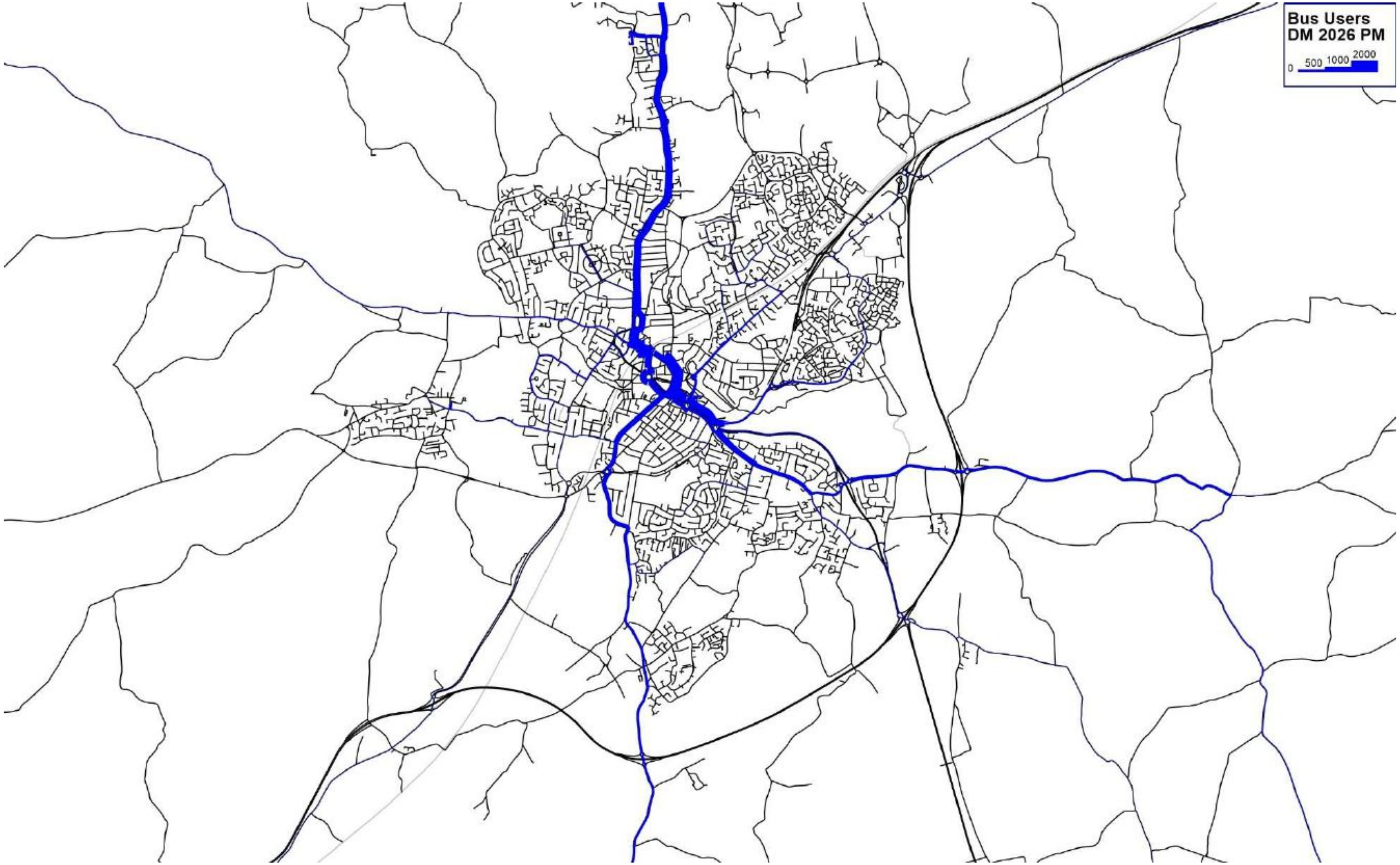
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500
1000
2000


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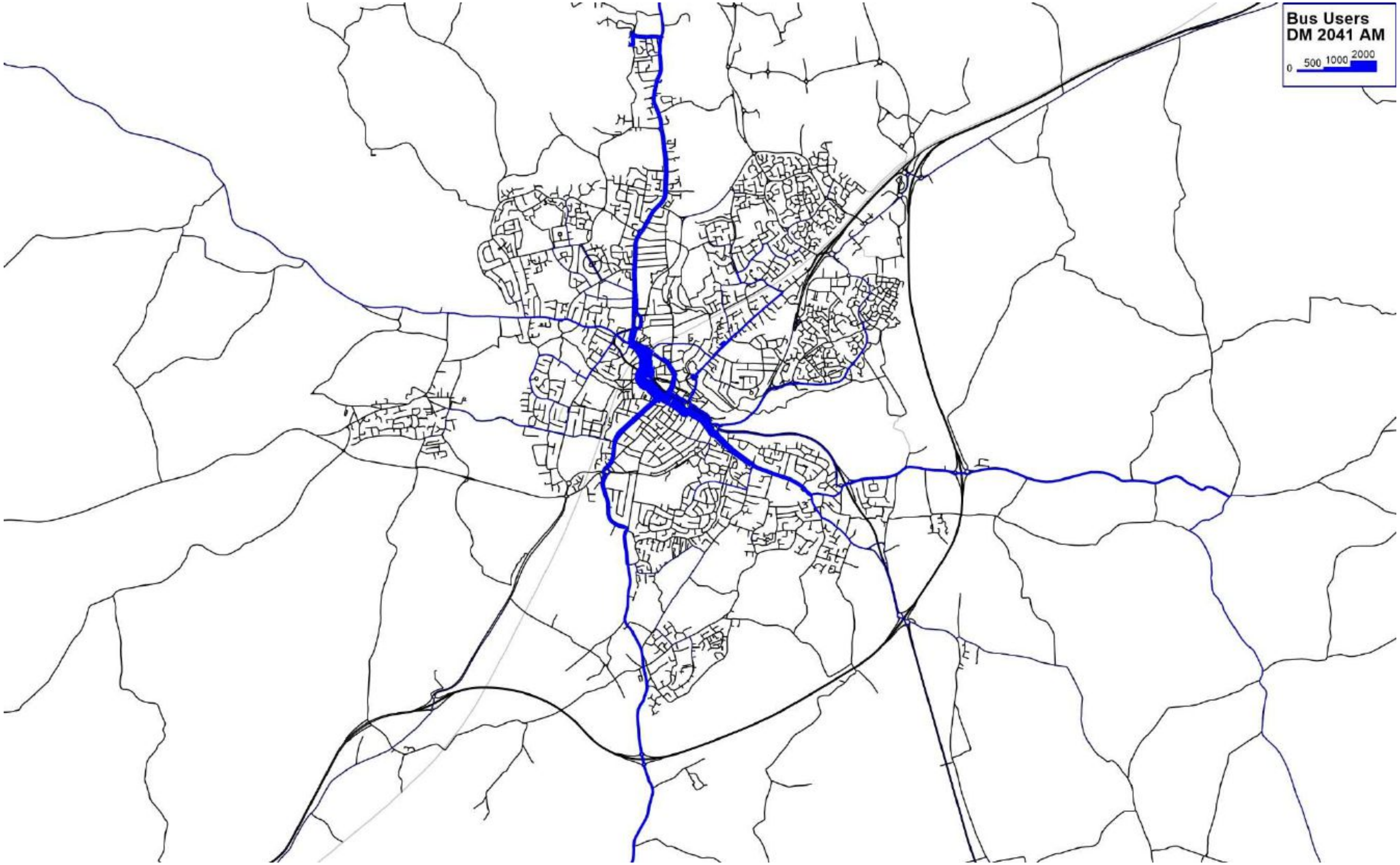
1000
2000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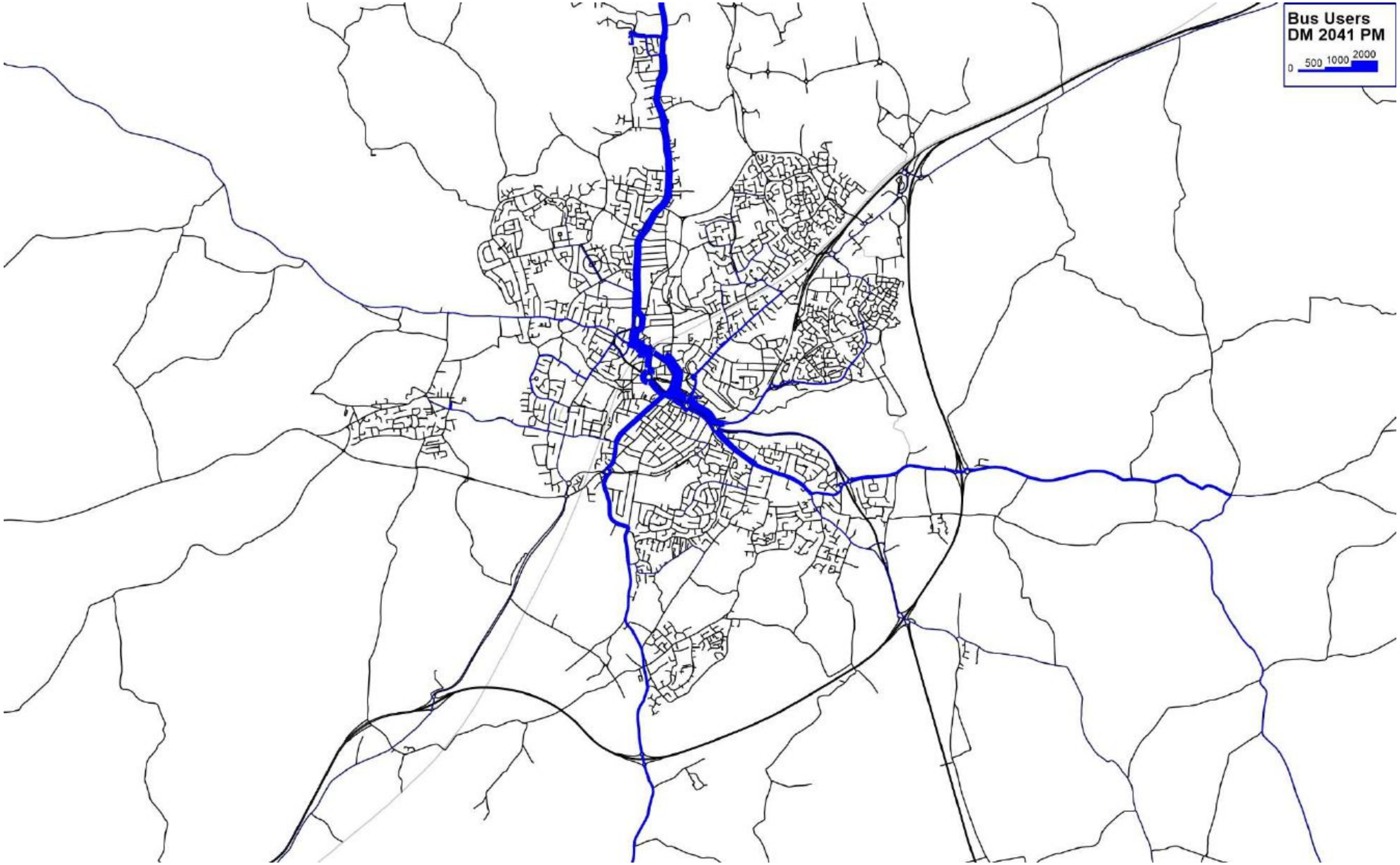
DM 2041 AM
0
500
1000
2000


Bus Users
DM 2041 AM
0 500 1000 2000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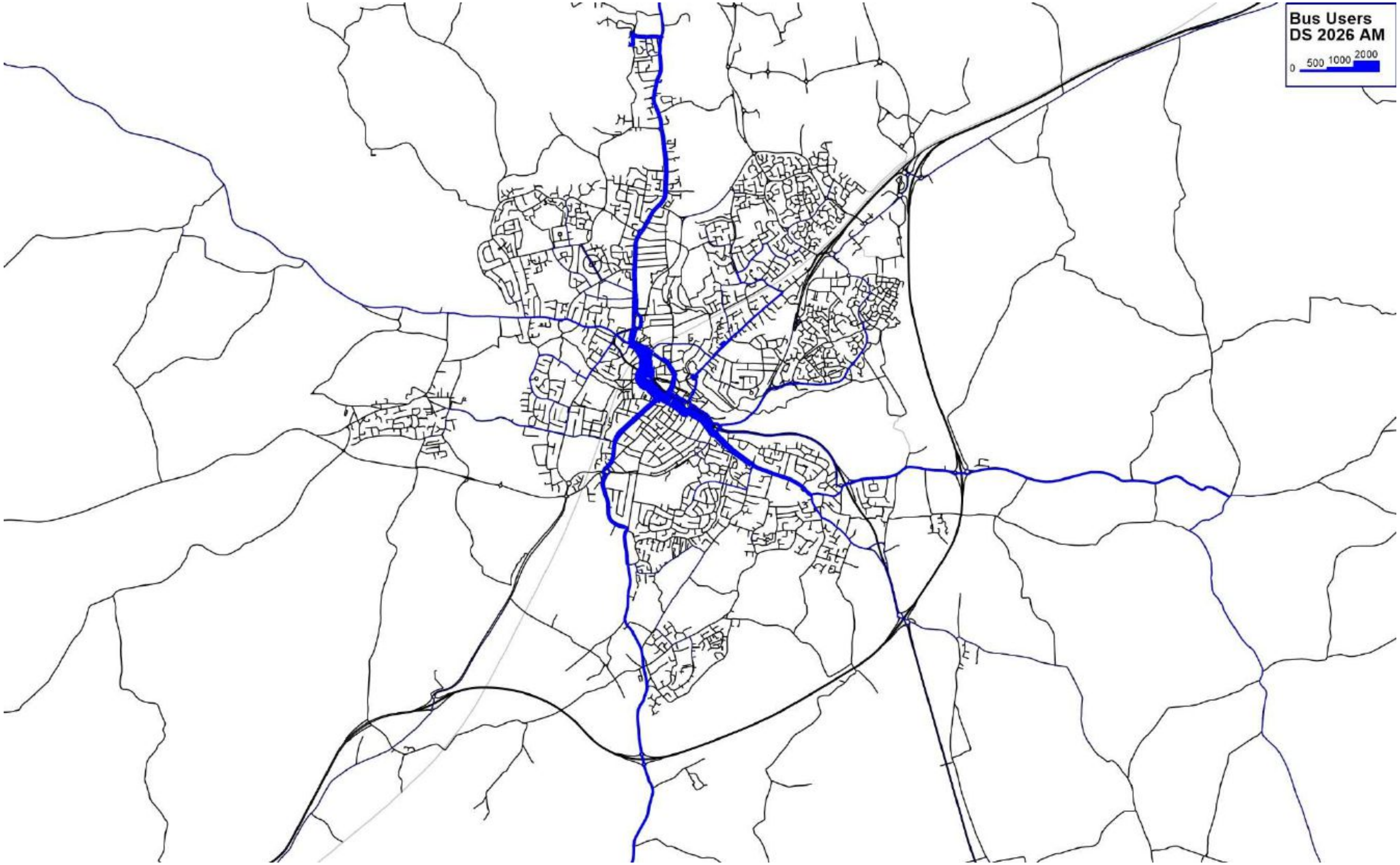
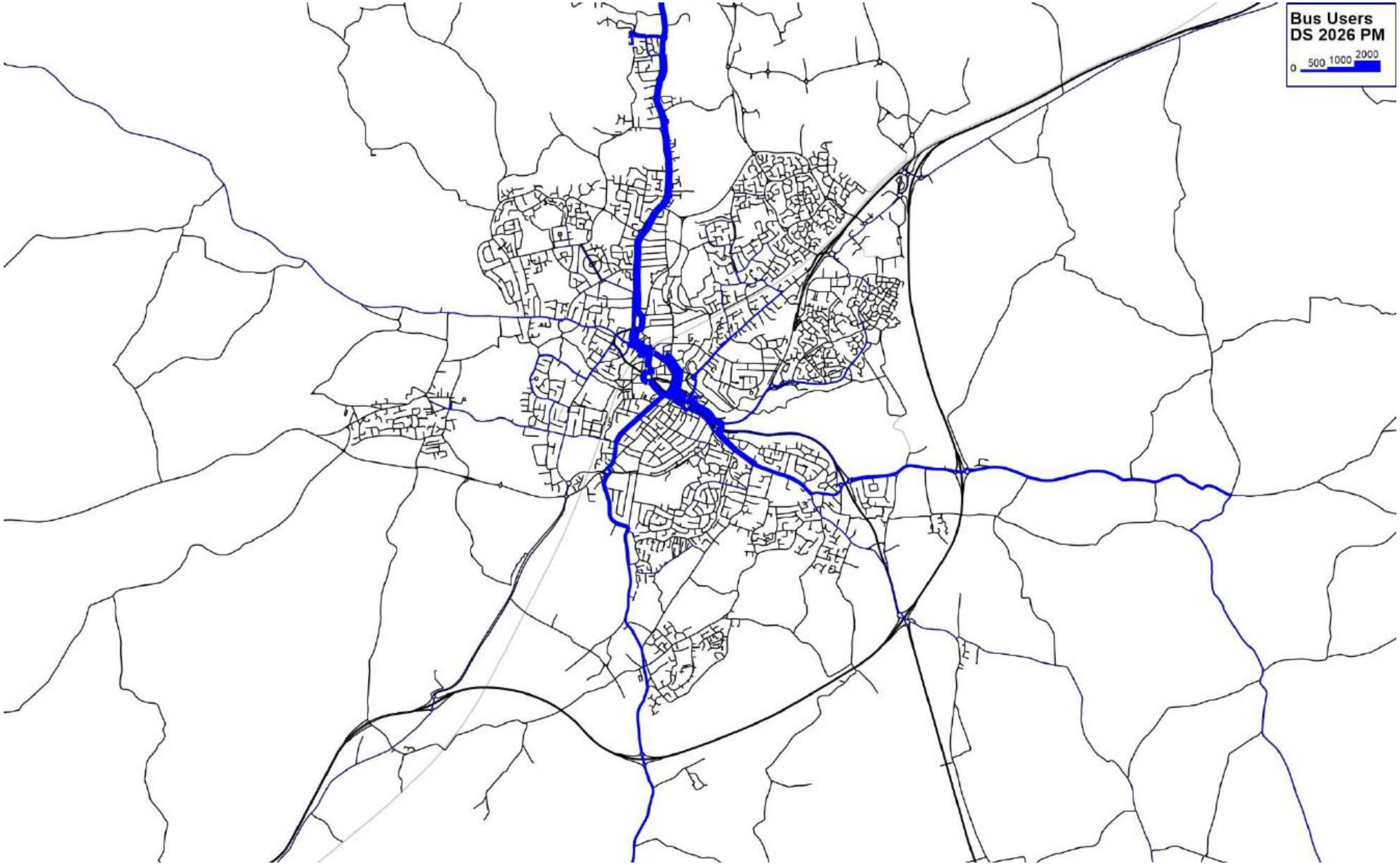
DM 2041 PM
0
500
1000
2000


Bus Users
DM 2041 PM
0 500 1000 2000


Bus Users
DS 2026 AM
0
500
1000
2000


Bus Users
DS 2026 AM
0 500 1000 2000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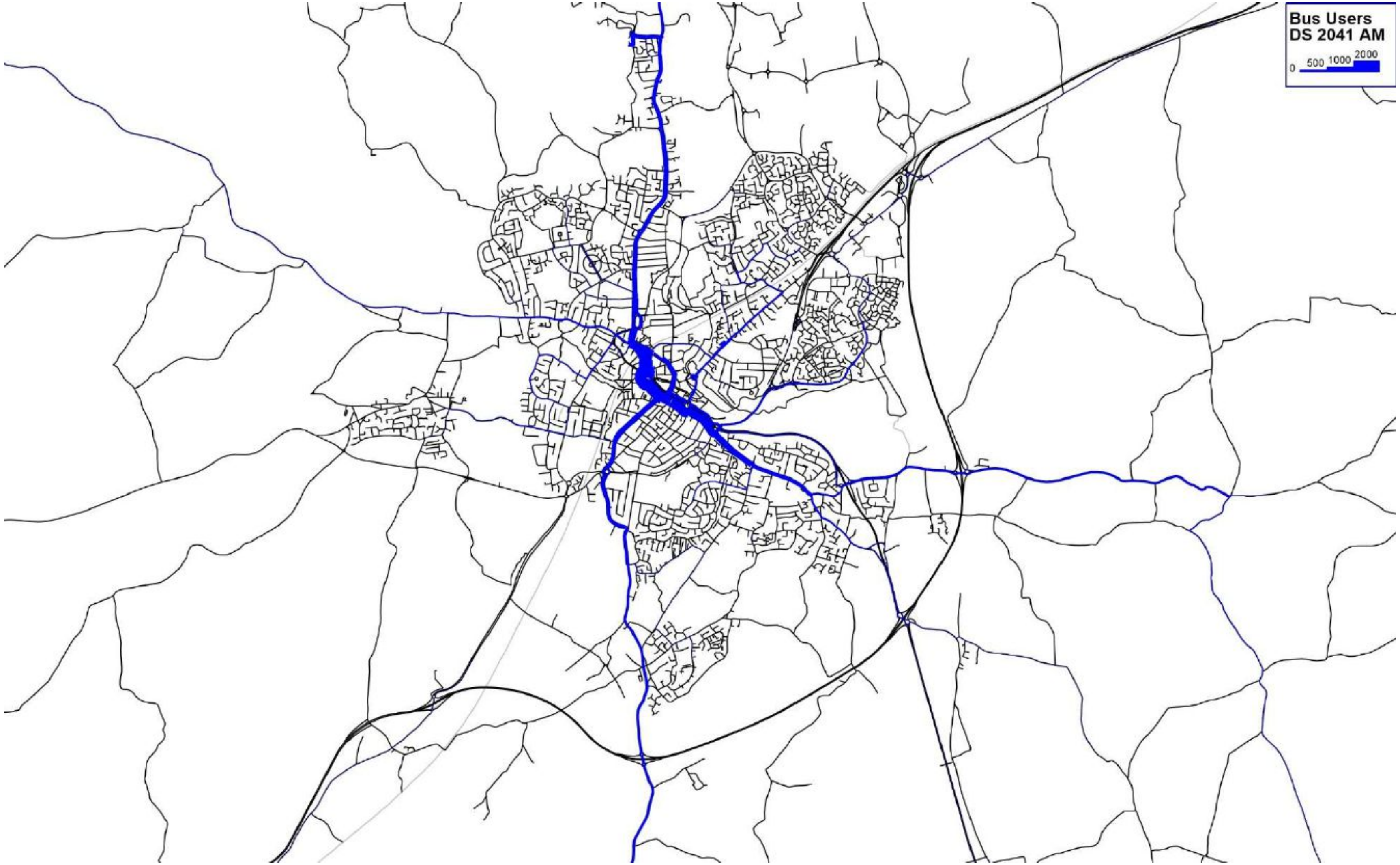
DS 2026 PM
0
500
1000
2000


Bus Users
DS 2026 PM
0 500 1000 2000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DS 2041 AM
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500
1000
2000


Bus Users
DS 2041 AM
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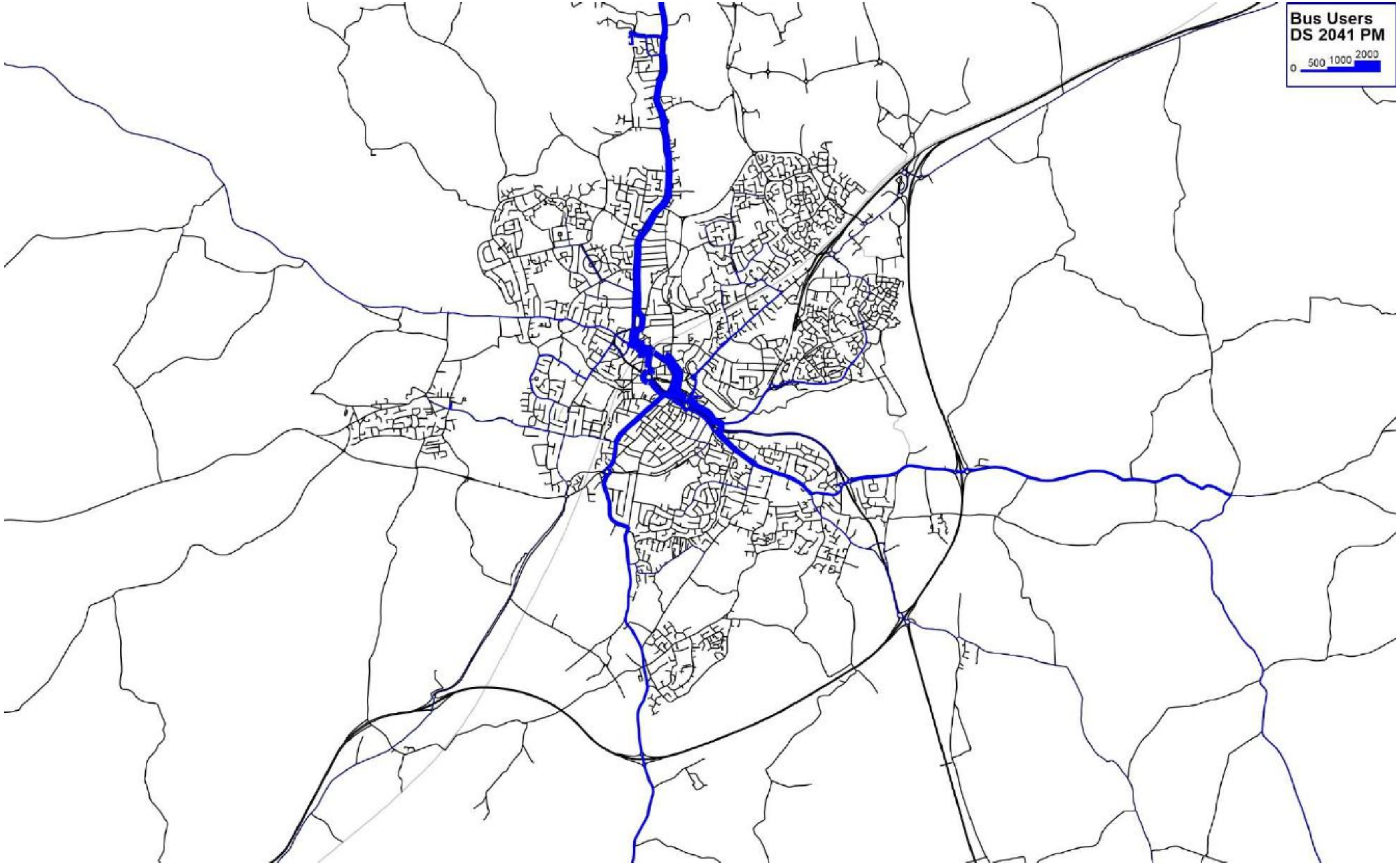
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500
1000
2000


Bus Users
DS 2041 PM
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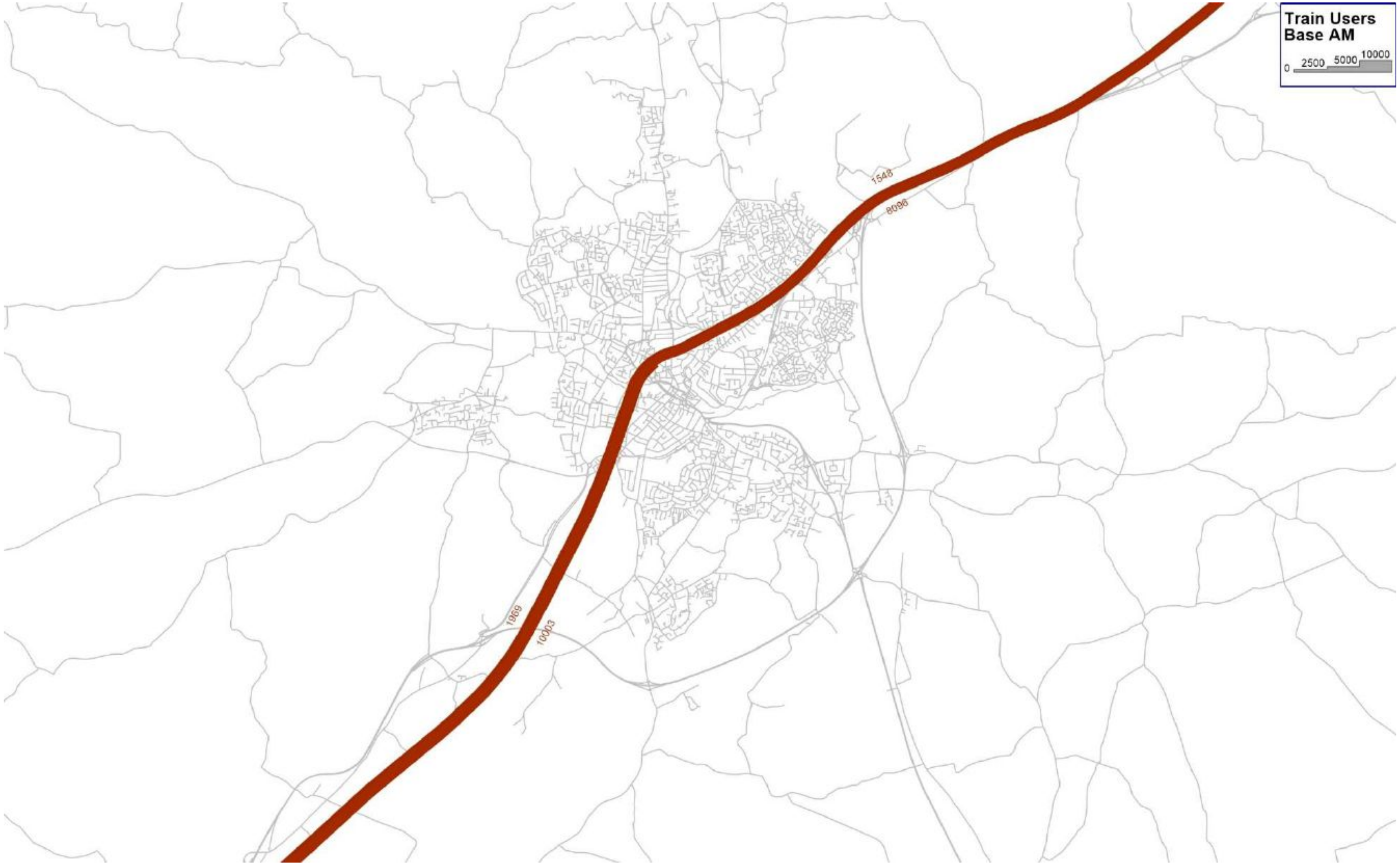
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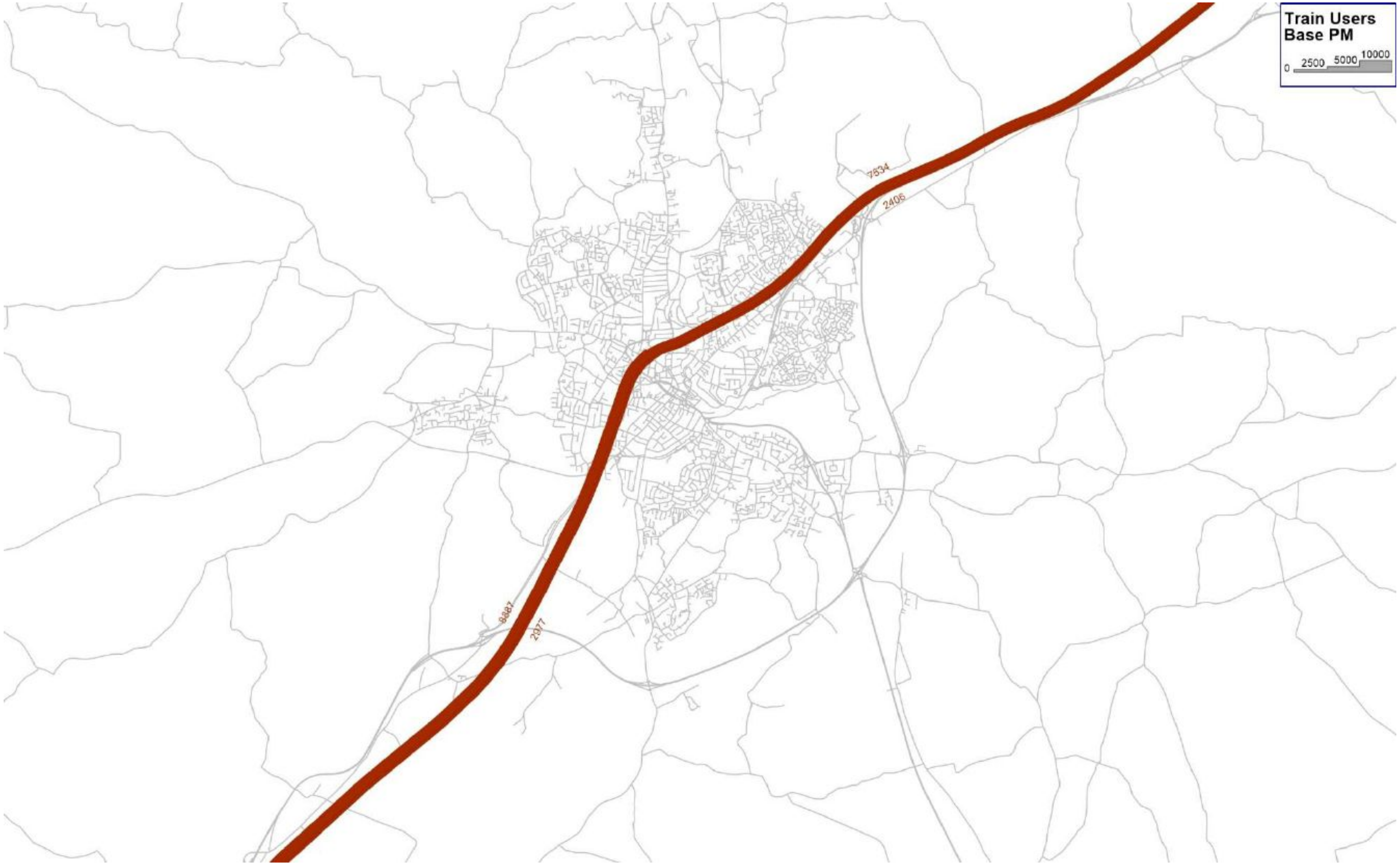
5000
10000
1548
8096
1969
10003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Base PM
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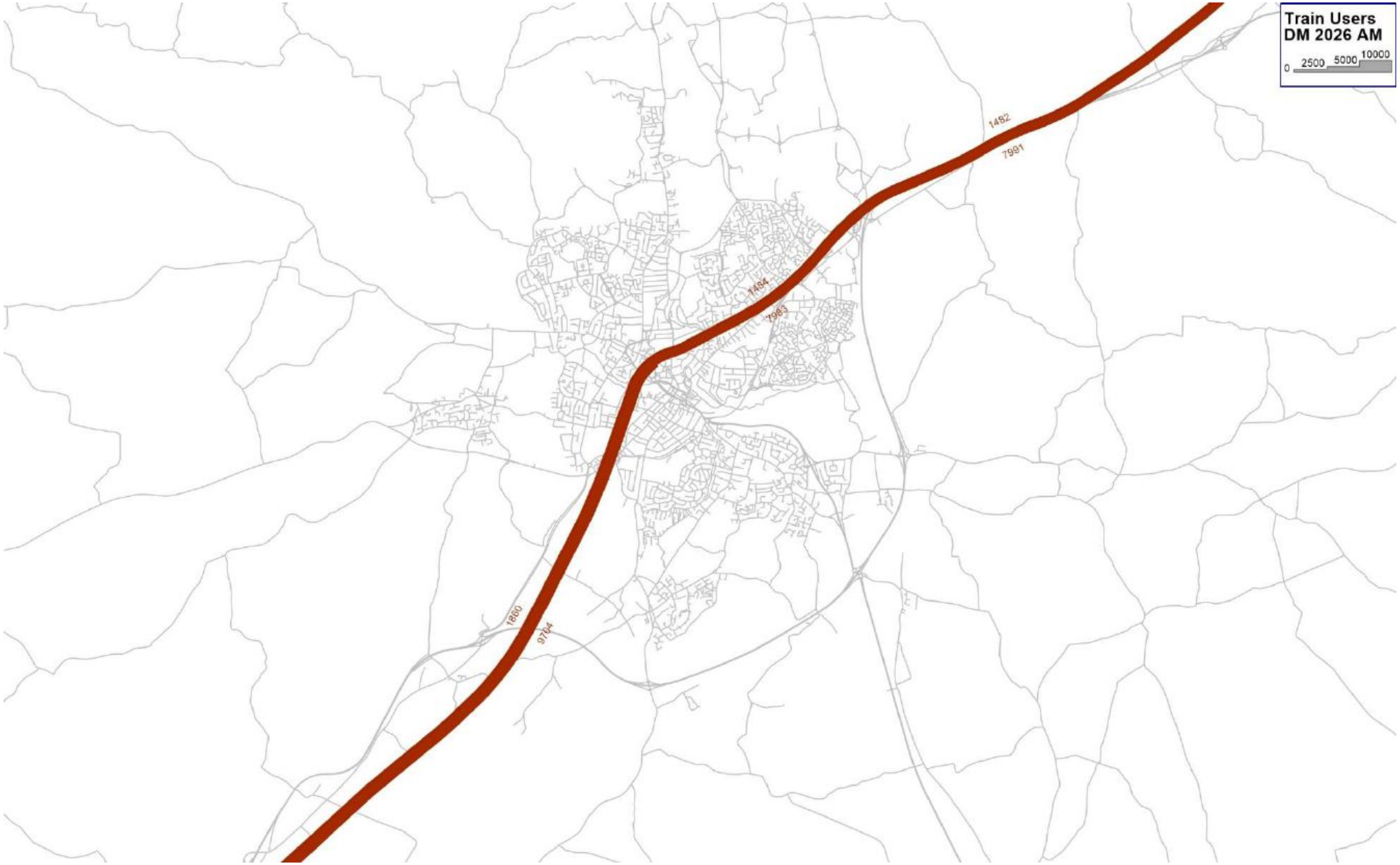
2500
5000
10000
7534
2406
8887
2977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DM 2026 AM
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5000
10000
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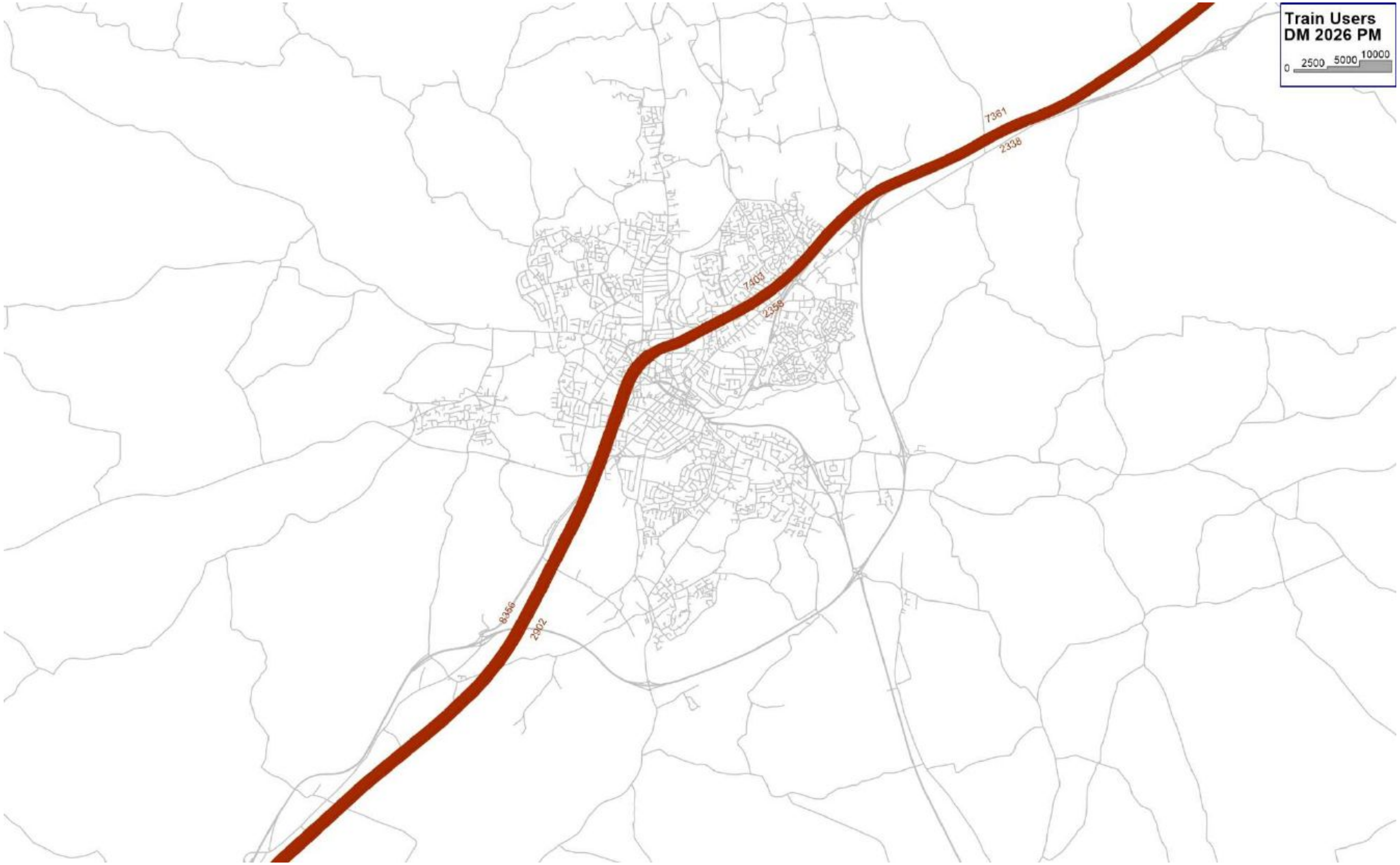
1464
7983
1860
9704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DM 2026 PM
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5000
10000
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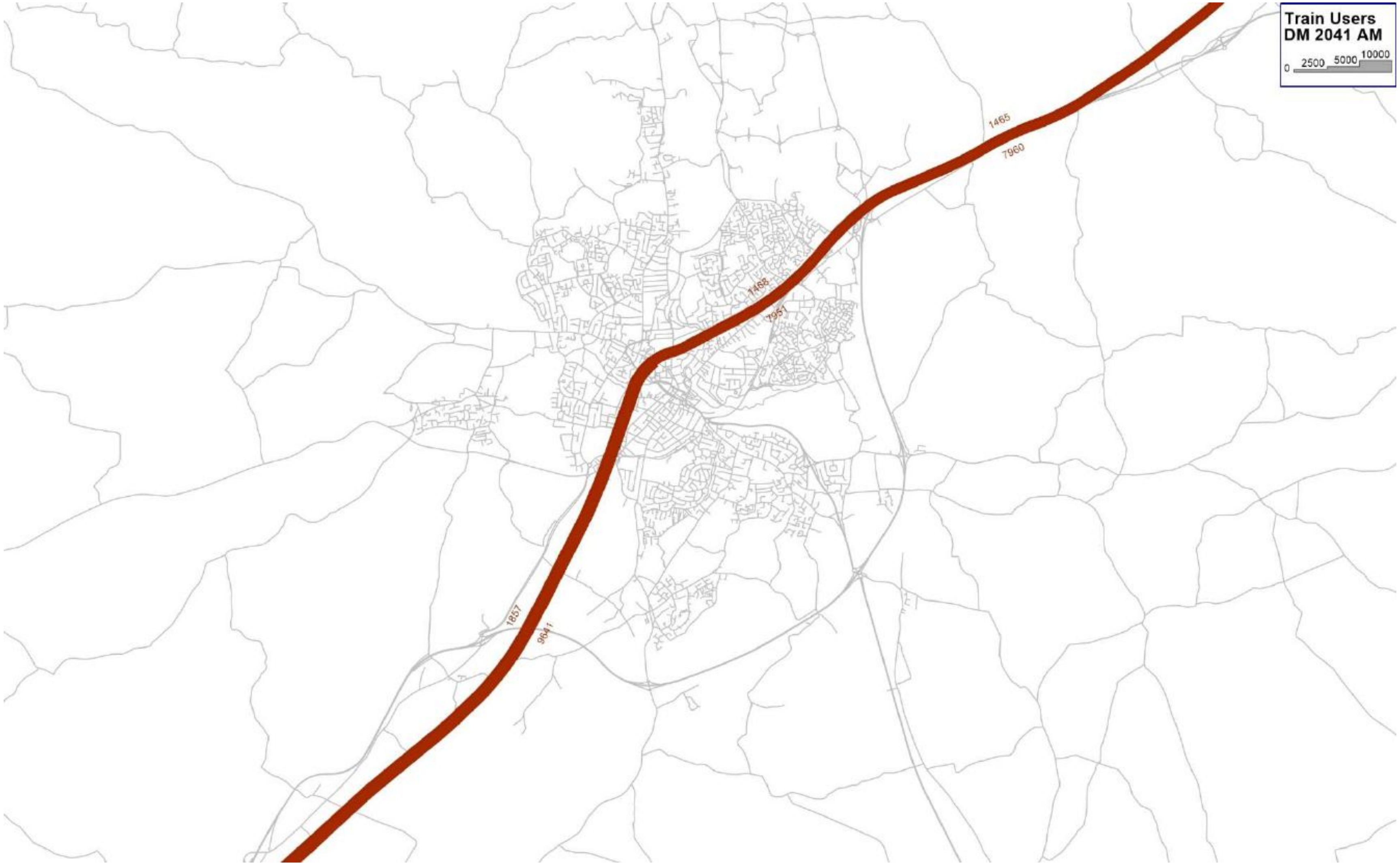
7403
2358
8356
2902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DM 2041 AM
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2500
5000
10000
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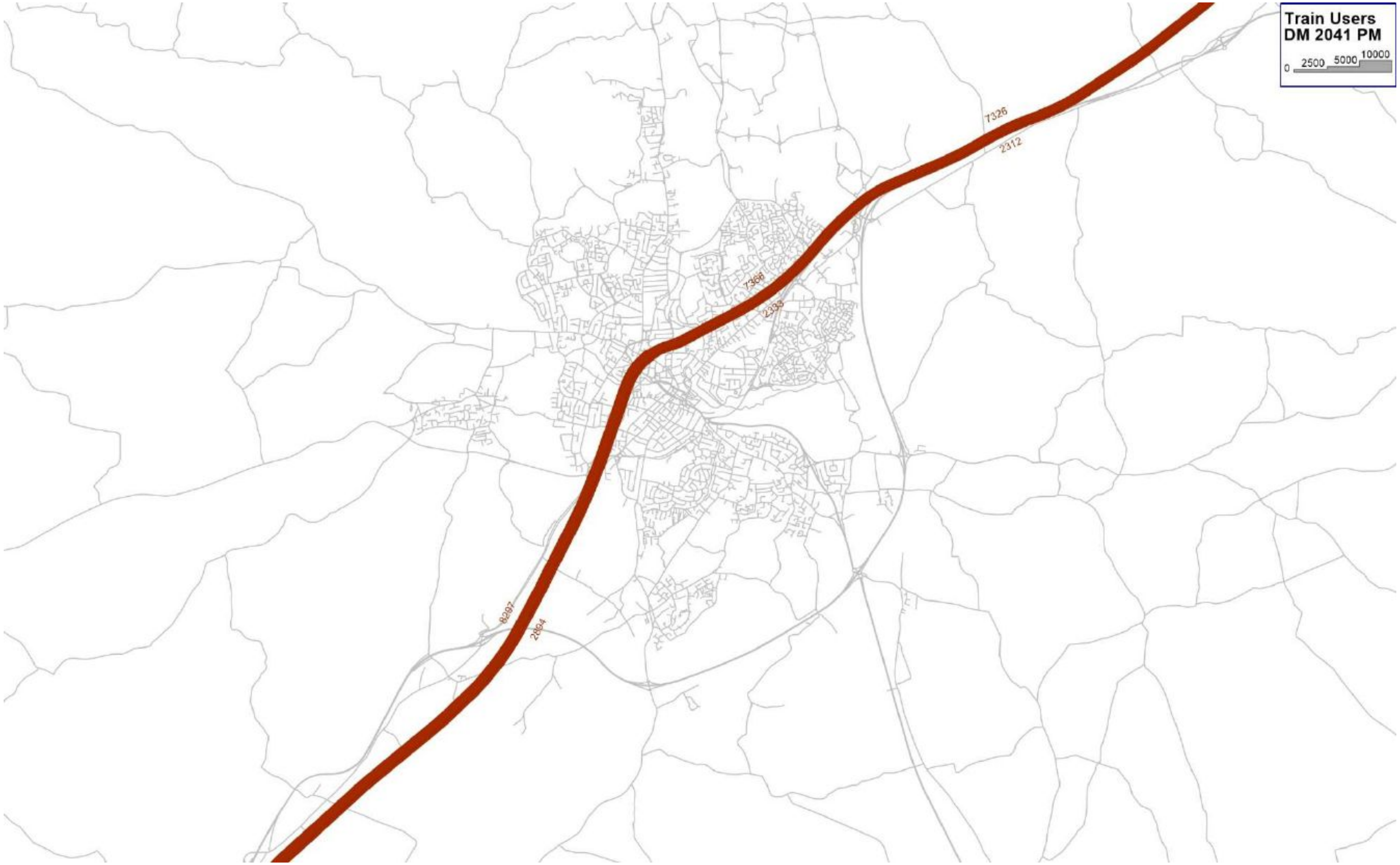
7960
1468
7951
1857
9641


Train Users
DM 2041 PM
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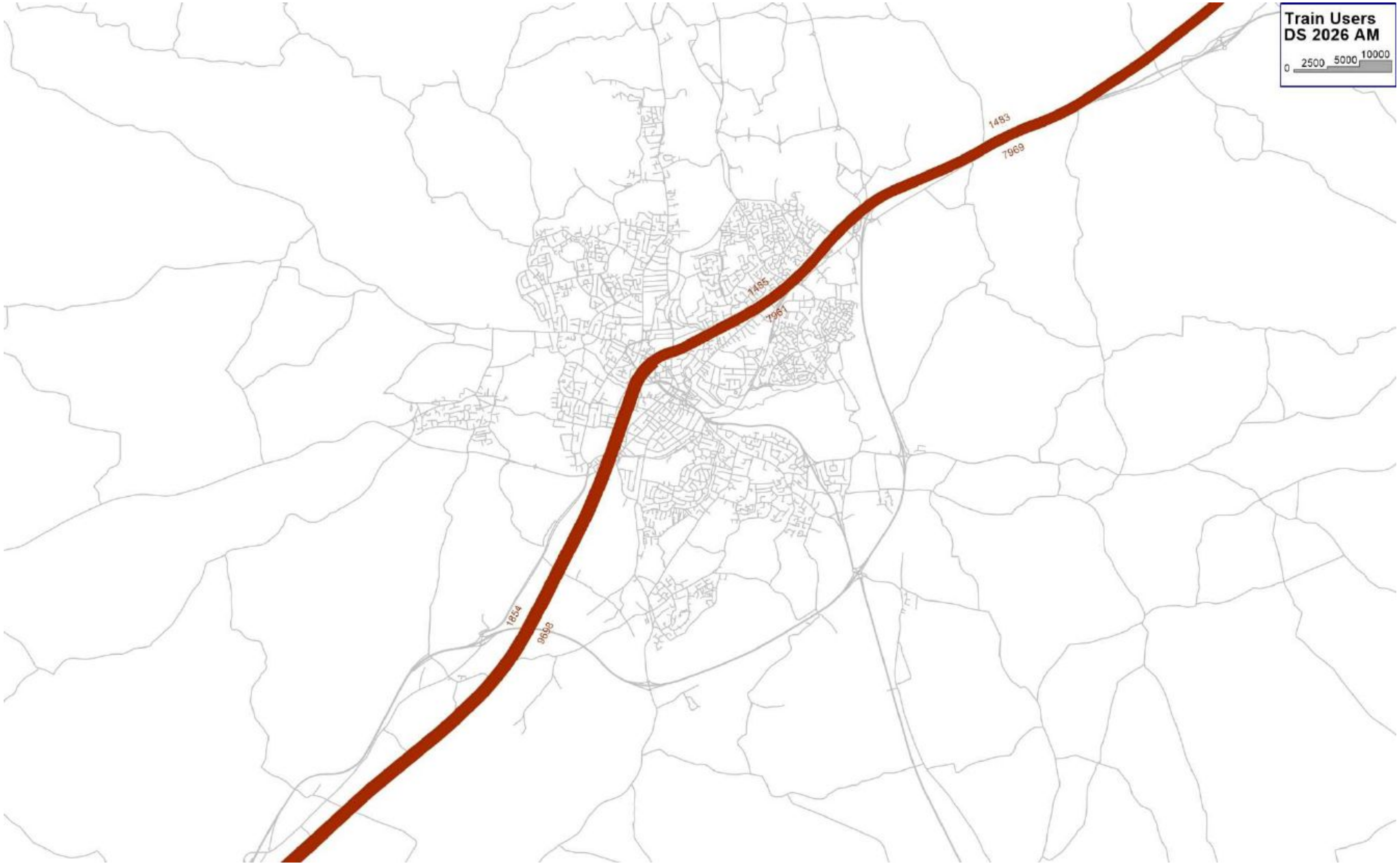
2500
5000
10000
7326
2312
7366
2333
8297
2894


Train Users
DS 2026 AM
0
2500
5000
10000
1483
7969
1465
7961
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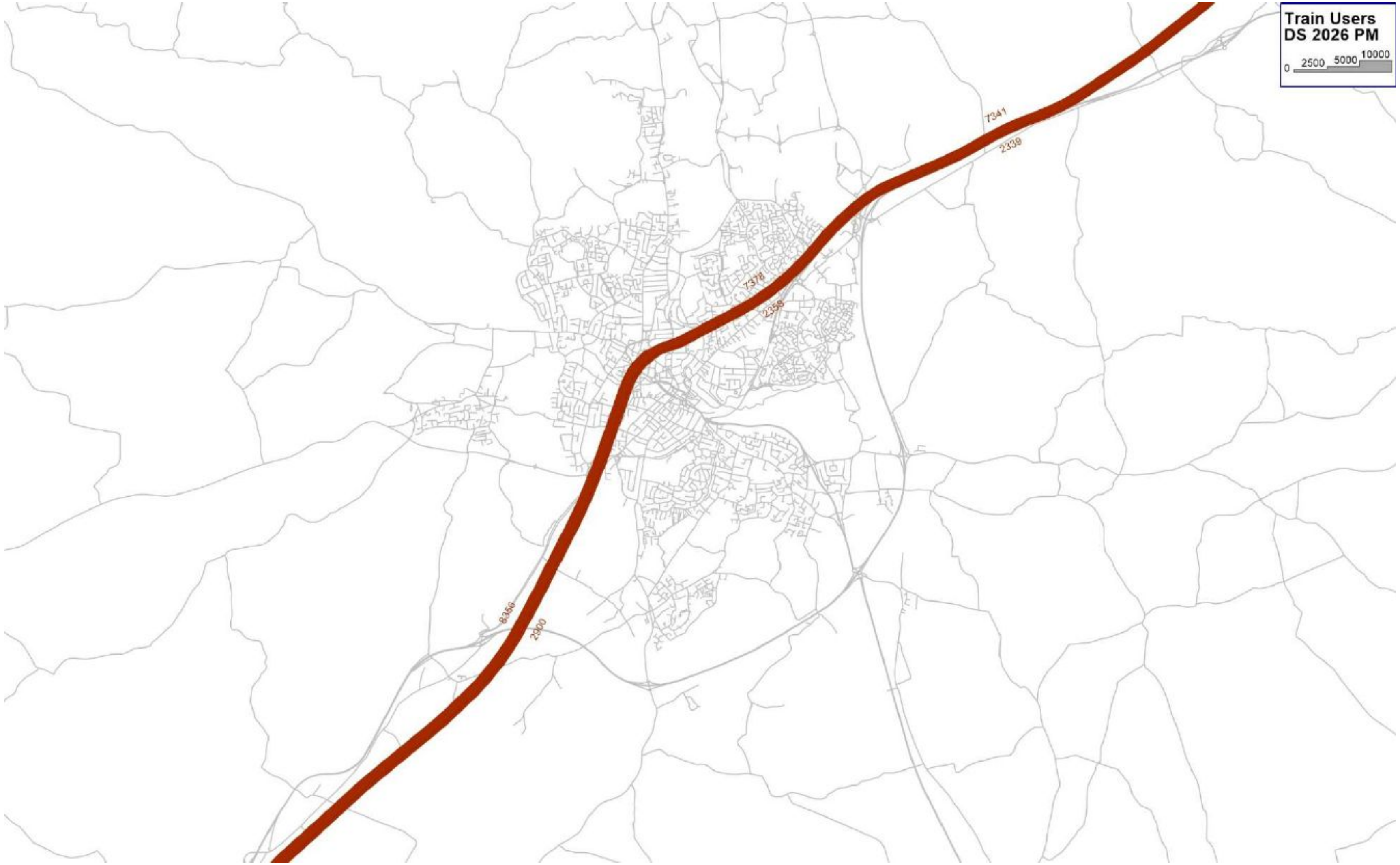
9698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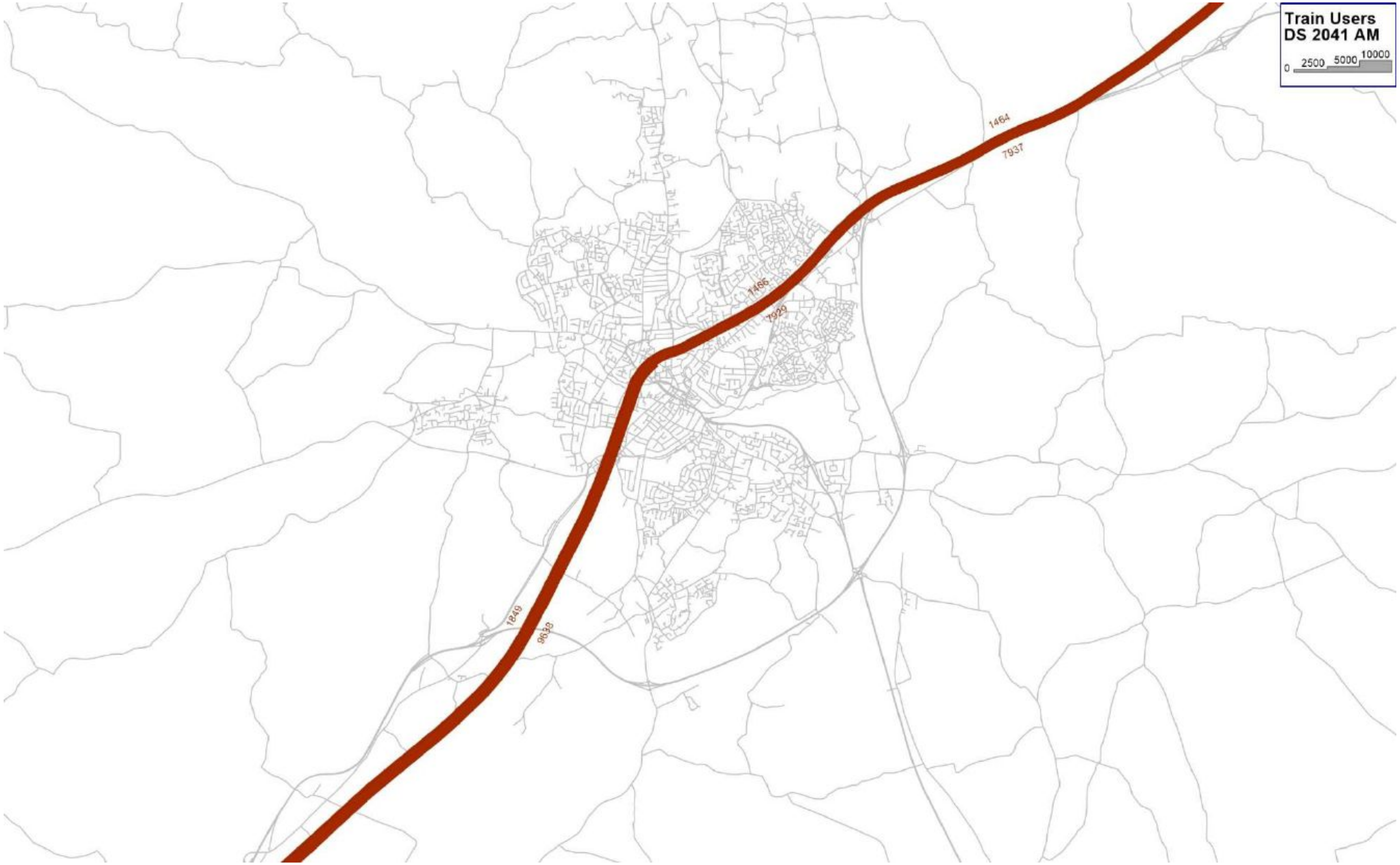
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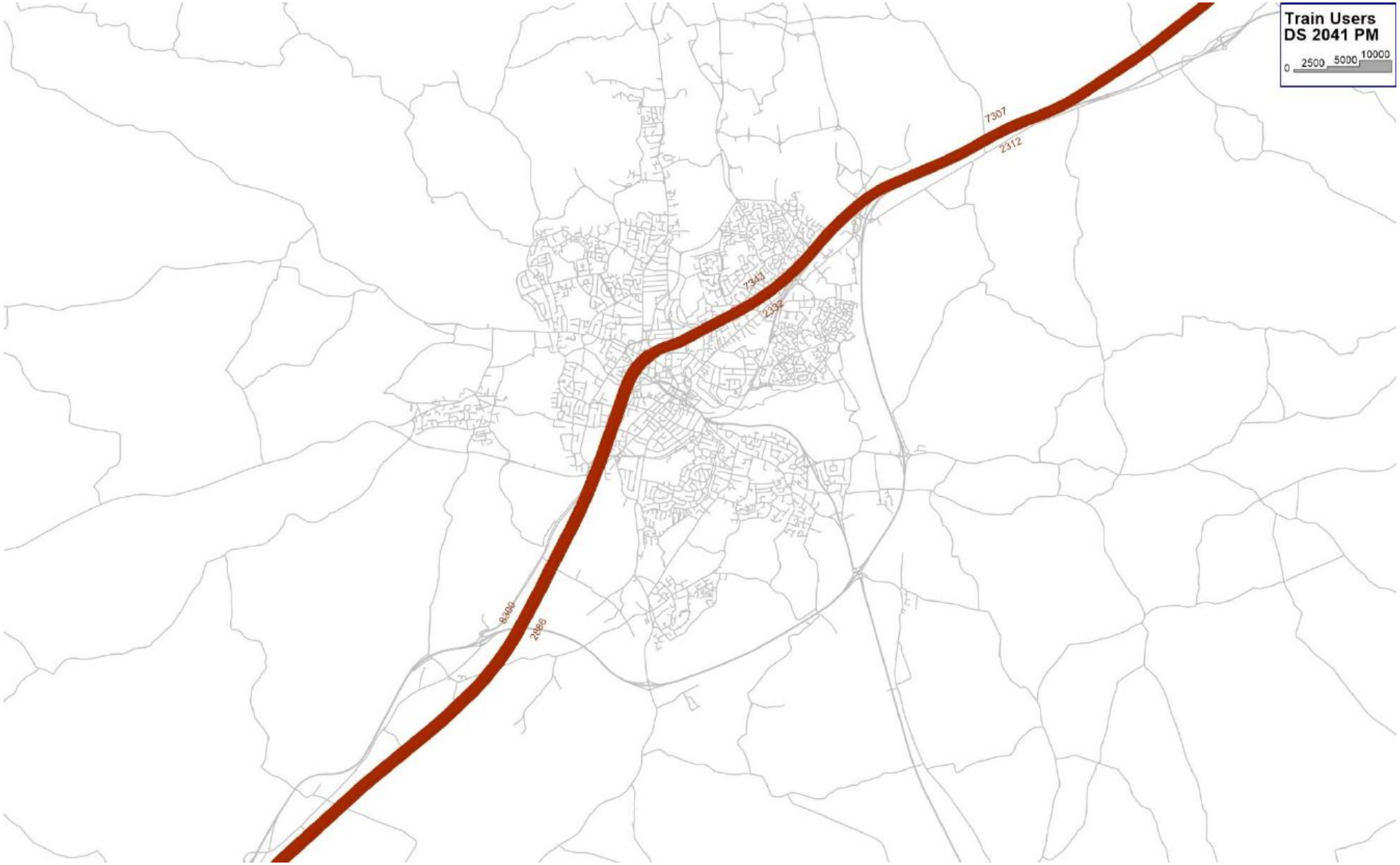
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