T006

Chelmsford Local Plan Review

Transport Impact Appraisal of Local Plan Review Pre-Submission

December 2024

Safer, greener, healthier

Document Control Sheet

Essex Highways

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Project Number	B3553RA3
Status	Final
Revision	2
Control Date	18/12/2024

Record of Issue

Issue	Status	Author	Date	Check	Date	Review	Date
1	Draft	KS/LP	18-11-24	JW	18-11-24	MS	18-11-24
2	Draft	KS/LP	11-12-24	JW	11-12-24	MS	12-12-24
3	Final	KS/LP	18-12-24	JW	18-12-24	JW	18-12-24

Approved for Issue By	Date
CF	18-12-24

Distribution

Organisation	Contact	Number of Copies
Essex County Council	HN	Electronic
Chelmsford City Council	LP	Electronic

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Executive Summary

- Chelmsford City Council (CCC) are undertaking a review of their Local Plan adopted in May 2020, extending the Plan period by five years from 2036 to 2041. As of November 2024, the review anticipates accommodating a further 4,233 homes and 111,445 sqm of employment over that period. More detail is provided in Table 3-1 in this report.

- CCC have requested that Essex Highways (EH) undertake further traffic modelling to support the Plan review evidence base - consistent with, and following on from, the modelling undertaken for the 2020 adopted Local Plan.

- This report documents the modelling methodology, results, and findings of the traffic impact appraisal of development identified in Chelmsford's Local Plan Review Pre-Submission (LPRPS) – specifically, the new development allocated *in addition* to that in the adopted Local Plan. Work contained within this report follows-on from the findings from the assessment of the Preferred Spatial Approach in early 2024 and documented within the following evidence base report: *"Chelmsford Local Plan Review: Transport Impact Appraisal of Preferred Spatial Approach Technical Report, 5th March 2024"* issued by EH on behalf of CCC.

- This study specifically looks at the following:

    1) The relative impact of additional development traffic on the future capacity of links and junctions on the strategic and local road network, at key junctions and across neighbouring authority boundaries.

    2) The effectiveness of mitigation measures proposed by developers of large, proposed development sites in Chelmsford – specifically SGS6 – North-East Chelmsford (Chelmsford Garden Community) and SGS16a – East Chelmsford Garden Community (Hammonds Farm).

    3) The impact of forecast traffic flows on the accessibility of passenger transport services and the network of bus priority infrastructure in Chelmsford.

- Modelling to-date has incorporated National Highways' proposals for the widening of the A12 carriageway between Chelmsford (Junction 19) and the A120 interchange near Colchester (Junction 25), including capacity improvements at A12 Junction 19 Boreham Interchange. Whilst a Development Consent Order (DCO) has been granted, funding for the scheme is subject to government review. The LPRPS modelling therefore includes an assessment of development impact with and without the A12 widening DCO proposals modelled.

Pre-Submission Modelling Approach

- With development associated with the adopted Local Plan already accounted for in the baseline, CCC's Local Plan Pre-Submission focuses the majority of additional development in Growth Area 3 located to the south and east of Chelmsford, and on sites along the A12 corridor. Approximately three quarters of the total quantum of additional new housing allocations are proposed at the Hammonds Farm site (SGS16a), and around three quarters of the additional employment space is allocated across Hammonds Farm (SGS16a) and Land adjacent to A12 Junction 18 (SGS16b).

- For the adopted Local Plan within the baseline modelling, the Pre-Submission also incorporates around 12,000 sqm of additional employment on SGS6 - Chelmsford Garden Community in North-East Chelmsford, which is the predominant development site in the adopted Local Plan.

Key Modelling Assumptions

- Modelling has been undertaken at a strategic scale using the latest version of the Chelmsford VISUM Forecast Model. In contrast to the earlier stages of the Plan appraisal, Variable Demand Modelling (VDM) has been incorporated into the Pre-Submission modelling work, given particular interest in the development impact along the A12 corridor.

- It is considered that use of VDM will present a more realistic representation of forecast traffic flow volumes along the A12 corridor and throughout the rest of the modelled network. However, care has been taken to account

for VDM adjustments in the overall appraisal of Local Plan development impact.

- The 2041 forecast modelling incorporates recent proposed infrastructure in Chelmsford, including the Army and Navy Sustainable Transport Package (with a redesigned 'hamburger' layout at the Army & Navy Roundabout, along with bus priority measures and cycling and pedestrian improvements at and in the vicinity of the roundabout). The package, which also includes a redesign of Sandon and Chelmer Valley P&R, was granted permission on 22nd November 2024.

- The forecast modelling also includes the latest National Highways long-term design proposals for the Boreham Interchange as per the Development Consent Order (DCO) granted in January 2024.

- The layout of the proposed Chelmsford North-East Bypass in the forecast model has been updated to reflect the latest position on scheme delivery timescales. Specifically, only the southern section of the bypass (Section 1a) between the proposed Northern Radial Distributor Road and Beaulieu Parkway has been modelled for the appraisal of the Local Plan Pre-Submission.

Summary of Strategic Network Impact

- In the 2041 baseline modelling (without the new allocations set out in the LPRPS, but including the development in the adopted Local Plan) the following key locations on Chelmsford's transport network are expected to experience notable congestion in the peak hours.

Modelled Queueing 2041 Key Locations
City Centre junctions along Parkway between A1016 Waterhouse Lane and Odeon Roundabout
Army & Navy Roundabout approaches (inc. A1114, A138, Baddow Road etc)*
A12 J17 (Howe Green)
Princes Road (Miami) Roundabout through to Widford Road Roundabout
Writtle Road junction with A1016 Waterhouse Lane
A1016 Chelmer Valley Road between Nabbotts Farm and Valley Bridge Roundabouts
A138 Chelmer Road southbound in vicinity of New Dukes Way

Modelled Queueing 2041 Key Locations
Valley Bridge Road at junction with B1008 Broomfield Road and A1016 Chelmer Valley Road
A1060 Roxwell Road westbound on approach to junction with Lordship Road
B1008 Main Road, Broomfield

*Modelled congestion would be expected to be worse with the existing (2023) roundabout layout.

- Of the Local Plan development allocated in the Pre-Submission on greenfield sites outside of the city centre, only Hammonds Farm and the employment site Land adjacent to the A12 J18 are shown in the modelling to generate vehicle flows of sufficient volume to impact traffic conditions significantly on the surrounding road network.

- Network capacity issues are modelled in the 2041 baseline along the A12 between Junction 17 and 19. Proposed new development along the A12 corridor has the potential to route a significant proportion of trips via the A12 - both northbound and southbound - from Junction 18, thereby exacerbating congestion along the trunk road. Modelling suggests this will also increase the likelihood of traffic re-routing along rural roads to the east of the A12, impacting the villages of Boreham and Little Baddow.

- At the same time, LPRPS development trips will likely have a direct impact on the link capacity of the A414 east of A12 Junction 18, and this is shown in the modelling to result in the displacement of background traffic flows from the A414 and onto alternative rural routes through Danbury and Sandon.

- The A12 Junction 17 at Howe Green is modelled with significant congestion in the 2041 baseline with queues on the southbound off-slip extending back along the A12 carriageway. Whilst a relatively small proportion of LPRPS development trips are shown in the modelling to access the junction, queues extending back along the A12 carriageway would likely heighten the impact of new development trips routing along the A12.

- A12 carriageway widening between Junctions 15-19 is not considered in National Highways' Road Investment Strategy (RIS3) pipeline for the period 2025-2030, and it is not clear whether National Highways are considering carriageway improvements beyond this period.

- The A12 Junction 17 at Howe Green has been the subject of Essex Highways studies in the past, looking at possible capacity improvements to accommodate future growth in traffic. There are recognised restrictions on space at the junction that prevent carriageway widening sufficient to provide the capacity to accommodate long-term traffic flows. A redesign of Junction 17 would therefore require coordination with proposals to widen the A12 carriageway at the location. Funding for such a scheme would also be significant and require an appropriate large scale funding bid opportunity.

- Recent modelling has been undertaken in Autumn 2024 by National Highways' consultants AECOM to assess the impact of the proposed Chelmsford Garden Community development in North-East Chelmsford on the A12 J19 Boreham Interchange - should DCO improvements at the junction not be forthcoming. Their preliminary findings suggest that the delivery of Boreham Interchange improvements associated with the A12 widening DCO proposals is required as a minimum to ensure that the junction has the capacity to accommodate proposed development across Chelmsford.

Cross-Boundary Impact

- Analysis shows that cross-boundary connections via the B1007 towards Basildon/Billericay are most affected by the latest proposed LPRPS development, with the highest modelled increase shown in the AM peak of around 4% from 2041 baseline flows – although in absolute terms, this is only a change of 30 vehicle trips.

- Findings from the cross-boundary impact analysis of the LPRPS, demonstrate that the use of VDM in the strategic modelling is limiting development impact on the strategic road network by effectively removing background traffic flows from the modelled peak hour, noticeably along the A12 corridor, to accommodate new development trips.

- Model outputs suggest that with the addition of LPRPS development focused in the vicinity of the A414 (and with site accesses directly onto the route) there will be a small reduction in trips along the A414 corridor

caused by VDM background traffic flow reductions and displacement onto alternative local routes.

- Just under 10% of residential trips from Pre-Submission development sites along the A12 corridor, totalling around 50 vehicles, are modelled routing towards Maldon District in the AM peak. Just under 5% of employment trips, totalling around 20 vehicles, are modelled arriving from Maldon District in the PM peak. These numbers are marginally smaller in the PM peak.

- Modelling suggests that the addition of LPRPS development trips routing via the A414 is likely to have a small impact on overall journey times along the corridor. Congestion is likely to be experienced at A12 Junction 18, but the severity could be managed by driver's making changes to their time of travel (inter-peak spreading) or mode of travel. The use of alternative local routes through Sandon (for example), though undesirable, will also likely limit the overall traffic impact along the strategic route.

- To alleviate the cross-boundary impact of development along the A12 corridor, policy requirements will be put in place at Hammonds Farm (SGS16a) and Chelmsford Garden Community (SGS6) , setting a target of 60% modal shift to maximise the internalisation of trips and encourage the provision of active and sustainable travel schemes; including sustainable corridors to/from Beaulieu Park Station and Chelmsford Park and Ride sites in north and east Chelmsford, as well as connections over and below the A12 linking with existing and planned interventions; and improvements to the east of Hammonds Farm towards Danbury.

A12 Merge / Diverge Assessment

- Modelling suggests that several on and off-slips at A12 junctions in Chelmsford are likely to be sub-standard in the 2041 Baseline scenario. It is understood that development trips associated with LPRPS sites account for an increased proportion of traffic flows on the A12 on and off-slips – particularly at Junctions 18 and 19, following the displacement of background traffic volumes and the suppression of overall traffic growth. With potential merge and diverge issues at the junctions in the future, it is therefore suggested that localised on-slip improvement measures are considered by developers to mitigate potential safety concerns.

Developer Mitigation and Recommendations

- The relative level of sustainable accessibility calculated across sites in the LPRPS is summarised in the table below.

	Average Sustainable Accessibility Score	% of dwellings	% of employment floorspace
Chelmsford Urban Area (Residential)	3.00	27.54%	
Chelmsford Urban Area (Employment)	3.00		3.59%
Ford End	1.57	0.46%	
Boreham	2.14		3.14%
Little Boyton Hall Farm	1.43		5.38%
North East Chelmsford	2.57		10.72%
South and East of Chelmsford	2.21	68.68%	77.17%
Bicknacre	1.64	2.61%	
East Hanningfield	1.50	0.71%	

**Blue cells indicate sites with over 15% of total allocated development*

- With development focused on, or in the vicinity of Hammonds Farm, a significant proportion of the overall LPRPS allocations are located in an area with a potentially good level of sustainable accessibility – subject to the provision of local amenities and sustainable travel infrastructure by developers. Just over 5% of employment floorspace has been allocated on Little Boyton Hall Farm. Whilst this site is expected to be accessed predominantly by private vehicle, the quantum of peak hour trips generated is calculated to be small and unlikely to impact the surrounding road network.

- The Hammonds Farm development is already required to provide substantive improvements connecting the site across the A12 and linking and enhancing the planned sustainable links being provided by the SGS3 East Chelmsford developments; Army and Navy Sustainable Transport Package improvements and outcomes from the Chelmsford Local Cycling and Walking Infrastructure Plans (LCWIPs).

- Central to these proposals are the provision of a bus, walking and cycle-only bridge link over the A12 connecting the development to the western side of the A12 to where Sandon Park and Ride, East Chelmsford site allocations, schools, leisure facilities and the city centre are located. Provision is also made for an Eastern Orbital Route serving as a bus

corridor enabling access for proposed new bus services to Beaulieu Park Station.

- The proposed bus, walking and cycle-only bridge link over the A12 is necessary to help deliver the required 60% mode shift away from the car and towards more active and sustainable modes of travel. This, in turn, would likely help reduce the impact of car trips on the surrounding road network – particularly the modelled pinch-point on the A414 on the approach to the A12 Junction 18.

- It is recommended that bus accessibility is monitored and potentially improved along the following routes where baseline congestion has the potential to be exacerbated by LPRPS development:
    - A414 westbound approach to A12 Junction 18 (Sandon Interchange)
    - A1060 Parkway between Odeon and Market Roundabouts

- To mitigate the impact of congestion along the A414 on the approach to Junction 18 consideration should also be given to the provision of a bus lane on the westbound approach to the Hammonds Farm access junction, supported by priority signals to accommodate buses into and out of the site and beyond into Chelmsford City Centre. The bus lane might then be extended up to the A12 Junction 18, with the provision of a bus gate to help bypass queue extents on the approach.

- Critical to the planning application process for Hammonds Farm and Land adjacent to A12 J18, should be a requirement to ensure that background traffic flows along the A414 and at Junction 18 of the A12 are not unreasonably delayed by the addition of new development trips. This may well require significant highway measures in the vicinity of the site accesses.

- Analysis of model outputs forecast a potential capacity issue with the Beaulieu Parkway bridge link over the rail line between the Boreham Interchange and the Beaulieu Park Station access junction. It is recommended that delays along the route are monitored over time to determine the long-term viability of the route serving as a bus access link between the Hammonds Farm development and Beaulieu Park Station.

- Should future journey times from Hammonds Farm to Beaulieu Park Station via the Boreham Interchange increase substantially, additional focus will be required on enhancing the provision of active and sustainable transport links between Hammonds Farm and Chelmsford rail station in the City Centre.

- With PM peak traffic congestion along Parkway in the City Centre shown to worsen with LPRPS development trips added, it would therefore be appropriate for all developers to contribute towards public transport measures to mitigate the impact on the City Centre.

- Discussion, under the duty to co-operate will continue with National Highways to keep them aware of the impact of development sites along the A12 and to work collaboratively to inform the scope of active and sustainable mitigation required to best manage the impact of traffic flows and limit the volume of LPRPS development trips routing via the A12.

- A12 Junction 17 at Howe Green is an existing recognised congestion hotspot and is an existing long-term issue to be considered by ECC in partnership with National Highways outside of the Local Plan and Local Plan Review process.

Conclusion

- With a focus on development along the A12 corridor, the modelled traffic impact of the LPRPS is largely limited to the A12 trunk road, the junctions along it and, to a lesser extent, the A414 east of the A12, and the A1114 and A138 corridors into Chelmsford City Centre. The minor quantum of development allocated in rural areas of Chelmsford is of insufficient size to likely impact the local road network.

- Overall, the allocation of development in the LPRPS provides the opportunity to make good use of existing and potential active and sustainable modes of transport to and from proposed sites. However, this will be dependent on the delivery of the bus, cycling and walking infrastructure proposed by developers, as well as additional measures required to provide the necessary connectivity to the wider sustainable transport network to achieve 60% modal shift targets. This will be crucial

to ensure that the growth in trips associated with the proposed development is managed and does not have a significant impact on the surrounding local area.

- With PM peak traffic congestion along Parkway in the City Centre shown to worsen with LPRPS development trips added, it would therefore be appropriate for all developers to contribute towards public transport measures to mitigate the impact on the City Centre.

- Trips from proposed development in the vicinity of A12 Junctions 18 (Sandon) and 19 (Boreham Interchange) are modelled to have a direct impact on the capacity of these junctions, and it should be expected that developers of sites including; Chelmsford Garden Community, Hammonds Farm and Land Adjacent to A12 Junction 18, identify and make provision for the potential funding and delivery of necessary junction capacity improvements alongside provision of sustainable and active mode infrastructure and services. Junction capacity improvements will be required in the event that development impact cannot be reasonably mitigated through bus, cycling and walking measures alone. The design and delivery of such capacity improvements would require collaboration with National Highways from an early planning stage.

- Modelling suggests that the delivery of Boreham Interchange improvements associated with the A12 widening DCO proposals is required as a minimum to help ensure that the junction has the capacity to accommodate proposed development across Chelmsford. Should funding for the DCO proposals be withheld following central government review in Spring 2025, modelling suggests that capacity improvements will require funding by alternative means and ECC and CCC will jointly lobby for funding for the provision of necessary infrastructure at the junction.

- Forecast modelling suggests that the impact of traffic flows associated with the LPRPS will have a minor impact along the A12 trunk road – relative to background traffic growth. At the same time however, the volume of development trips modelled on A12 junction on and off-slips may exacerbate potential safety issues in the future associated with carriageway merging.

- With forecast-year modelling suggesting that sections of the A414 east of the A12 will operate close to, or at capacity; developers of LPRPS sites located off the A414 should be required to consider journey time impact along the route in the vicinity of A12 Junction 18, and through Danbury, and ensure that traffic conditions are sufficiently managed with the addition of development trips.

- By maximising the potential for sustainable accessibility to and from the sites along the A12 corridor, the impact on the strategic highway network should not be considered severe. However, continued discussions with National Highways will be necessary to best ensure that future development growth in Chelmsford can be supported by the strategic highway network over the long-term.

1 Glossary of Terms

AM and PM peaks	The AM and PM peaks represent the two single hours with the largest volume of traffic observed across the AM period (before 11am) and the PM period (after 1pm), respectively. The AM and PM peaks used in this study are defined below: • AM peak hour (07:30-08:30) • PM peak hour (17:00-18:00)
ARCADY	TRL (Transport Research Laboratory) modelling software used to design and assess roundabouts
Baseline	(For the purpose of this study) The forecast modelled scenario in 2041 without the new development set out in the LPRPS, but including the development in the adopted Local Plan.
Connectors	An accessory used in traffic models to connect zones to specific points on the road network where vehicle trips enter or exit the model.
Cordons	In the context of model calibration/validation, a cordon represents a partitioned area of the model. Modelled flows along strategic routes passing through the cordon are subject to calibration/validation against observed traffic count data.
Donor Zones	Zones in the model that have been used to represent the trip distribution for a new development zone.
Fixed Demand	Demand for peak hour travel that does not change to take account of congestion on the road network.
Level of Service (LOS)	A measure by which the capacity of junctions can be categorised.
LinSig	UK industry standard software by JCT consultancy which enables the modelling of signalised junctions and their effect on traffic capacities and queuing
Local Model Validation Report (LMVR)	An LMVR documents the base-year traffic model build covering: network and development assumptions, build methodology and model calibration/validation statistics.
Model Calibration	In the development of base-year traffic models, calibration involves making adjustments to modelled demand (typically) in order to reduce the differences between modelled flows and observed data at cordon and/or screenline locations.
Model Matrices	A two-dimensional array where the rows and columns represent the origin and destination model zones respectively and the cell values are the vehicle trips between them. Matrices are created for different trip purposes and vehicular modes. Model matrices in this study represent vehicle rather than person trips.

Model Validation	This is the process of checking the robustness of the base-year traffic model by demonstrating its ability to replicate similar patterns to those observed. The data used for validation is separate from data used for calibration.
Model Zones	Zones are defined areas within the model that represent the origins and destinations of trips.
NTEM	National Trip End Model (NTEM) – produced by the Department for Transport, it uses a number of forecasts for population, employment and households by car ownership to forecast changes in trip ends (trips by origin and by destination). The results are viewed in software called TEMPro (Trip End Model Presentation Program).
PTV VISUM	An area-wide assignment modelling package used in this study to assess the impact of development traffic on the wider 'strategic' road network in and around Chelmsford.
Relative Queue Length	The queue of traffic on a junction approach calculated as a percentage of the length of the approach link in the model.
Screenlines	In the context of model calibration/validation, a screenline represents a line through an area of the model. Modelled flows along strategic routes passing across the screenline are subject to calibration/validation against observed traffic count data.
Strategic Modelling	The process of using a transport model to forecast transport demand and the assignment of traffic flows – typically across a wide-area modelled network at a 'strategic' or high level.
Transport Analysis Guidance (TAG)	TAG is guidance released by DfT which provides information on the role of transport modelling and appraisal.
TRICS	TRICS is the system of trip generation analysis for the UK and Ireland. The TRICS database contains over 8,000 transport surveys which can be filtered to help users establish potential levels of trip generation (trip rates) which are reflective of the size, location, and type of development they are proposing.
Trip End Model Presentation Program (TEMPro)	The TEMPro software allows users to view the National Trip End Model (NTEM) dataset and provides forecasts of the growth in background trips for use in modelling.
Variable Demand	Demand for peak hour travel that is adjusted to take account of congestion on the road network.
VISSIM	Microsimulation modelling package used to reproduce traffic patterns of all road users at a local scale (junctions)
Volume/Capacity Ratio	A measure of the volume of trips across an hour on a road in relation to its available capacity.

2 Introduction

2.1 Study Context

Chelmsford City Council (CCC) are undertaking a review of their Local Plan adopted in May 2020, extending the Plan period by five years from 2036 to 2041. As of November 2024, the review anticipates accommodating a further 4,233 homes and 111,445 sqm of employment over that period.

CCC have requested that Essex Highways (EH) undertake further traffic modelling to support the Plan review evidence base - consistent with, and following on from, the modelling undertaken for the 2020 adopted Local Plan. This report documents the modelling methodology, results and findings of the traffic impact appraisal of Chelmsford's Local Plan Review Pre-Submission (LPRPS), following on from consultation and subsequent adjustments made to development allocations within the Preferred Spatial Approach.

Section 4 of this report provides detail on the development allocation within the LPRPS. This specifically covers the development allocated *in addition* to that in the adopted Local Plan. Figure 2-1 on the following page illustrates where this latest study fits within the development of the Local Plan transport evidence base.

With reference to Figure 2-1 overleaf, it is intended for the findings of this modelling study to be considered alongside the documented findings from the earlier evidence base reports, including:

- Chelmsford Local Plan Review: Sustainable Accessibility Mapping & Appraisal Technical Note – Essex Highways, 15th July 2022.
- Chelmsford Local Plan Review: Transport Impact Appraisal of Spatial Approaches Technical Report – Essex Highways, 21st December 2023
- Chelmsford Local Plan Review: Transport Impact Appraisal of Preferred Spatial Approach Technical Report – Essex Highways, 5th March 2024
- Chelmsford Local Plan Review: Preferred Spatial Approach Local Junction Modelling Technical Note – Essex Highways, 3rd May 2024

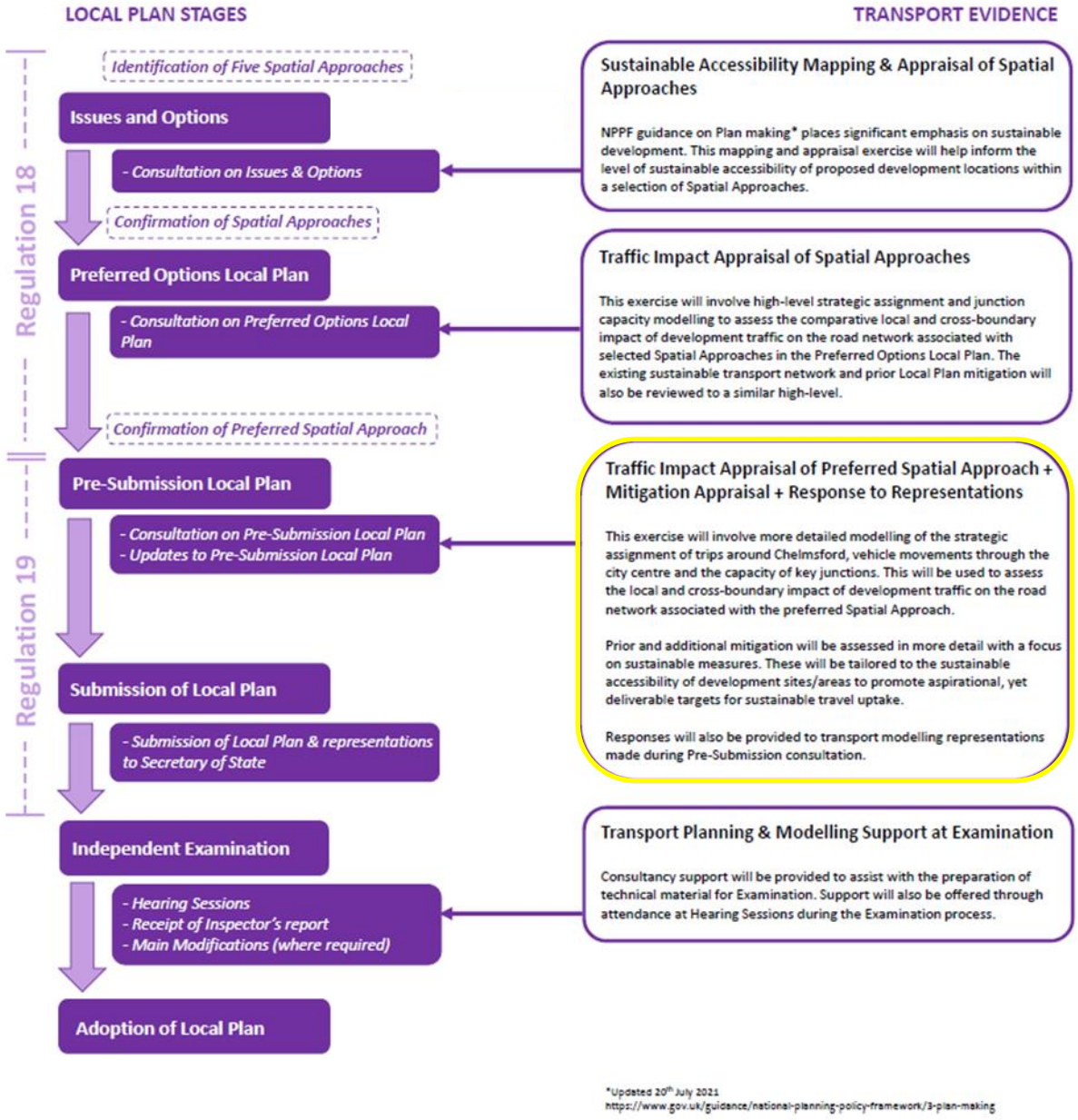


Figure 2-1: Transport evidence to support the various stages of the Local Plan Review

2.1.1 Objectives

As summarised in Figure 2-1, the objective of this study is to provide sufficient transport modelling evidence with which to inform CCC of the potential traffic impact of their LPRPS proposals and insight into the likely effectiveness of proposed infrastructure and/or active and sustainable measures to mitigate the

impact of development traffic growth. Findings from the modelling will be a key component of the Local Plan submission to the Secretary of State.

The study specifically looks at the following:

- The impact of additional LPRPS development traffic on the future capacity of links and junctions on the strategic and local road network, at key junctions and across neighbouring authority boundaries.

- The effectiveness of mitigation measures proposed by developers of large, proposed development sites in Chelmsford – specifically SGS6 – North-East Chelmsford (Chelmsford Garden Community) and SGS16a – East Chelmsford Garden Community (Hammonds Farm).

- The impact of forecast traffic flows on the accessibility of passenger transport services and the network of bus priority infrastructure in Chelmsford.

2.1.2 Status of National Highways' A12 Widening DCO Proposals

Documented in Section 3.4 of this report, modelling to-date has incorporated National Highways' proposals for the widening of the A12 carriageway between Chelmsford (Junction 19) and the A120 interchange near Colchester (Junction 25), including capacity improvements at A12 Junction 19 Boreham Interchange[1]. Whilst a Development Consent Order (DCO) was granted in January 2024, funding for the scheme is now subject to government review following the recent General Election, with a decision not expected until Spring 2025.

With uncertainty surrounding the A12 proposals, National Highways have requested that the LPRPS modelling includes a sensitivity test assessment of development impact with and without the A12 widening DCO proposals modelled.

[1] https://nationalhighways.co.uk/our-roads/east/a12-chelmsford-to-a120-widening-scheme/

3 Modelling Approach

3.1 Strategic Modelling

The traffic impact appraisal has been undertaken at a strategic scale using the latest 2019 version of the Chelmsford VISUM Forecast Model. This has recently been updated and adheres to strict Department for Transport (DfT) standards for use in the appraisal of design options for the Army & Navy Sustainable Transport Package project.

Two key documents have been produced which detail the latest model build:

- ***'Local Model Validation Report (LMVR) – Chelmsford Model Update – Essex Highways, April 2021'***. This report documents the improvements made to the 2019 base model and the subsequent recalibration and validation process. The document has been finalised and is available from Essex Highways.

- ***'Army & Navy Sustainable Transport Package: Stage 2 Forecasting Report – Essex Highways, September 2022'***. This report documents the development and infrastructure assumptions for Chelmsford included in a 2026 and 2041 forecast year for the purposes of assessing the future-year performance of the Army & Navy junction proposals.

Section 3.2 and 3.3 below provide a high-level summary of the Chelmsford VISUM Model base and forecast year builds. For a more comprehensive awareness and understanding of the model development process; including calibration/validation and matrix/network build assumptions, the documents highlighted above should be referenced.

3.2 Chelmsford VISUM Base Model Overview

3.2.1 Model Overview

The Chelmsford model has been built using the latest PTV VISUM software version 2020 (this is an upgraded version of the same software as used in the previous versions of the Chelmsford Model build) and utilises the Intersection Capacity Analysis (ICA) module to enable detailed evaluation of junction performance and represent blocking back and queuing.

3.2.2 Study Area & Network Coverage

The Chelmsford VISUM base model 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 movements in traffic flows approaching Chelmsford. The model focuses on car-based travel, which includes P&R, but also considers the impact of development and infrastructure proposals on passenger transport (bus and rail) generalised costs and mode share.

The geographic coverage of the model includes the following:

- The Fully Modelled Area, made up of:
  - The Area of Detailed Modelling (AoDM) - consisting of the Chelmsford administrative area.
  - The 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.
- The External Area, including all of mainland UK outside of the Fully Modelled Area.

The Fully Modelled Area of the Chelmsford VISUM Model is shown in Figure 3-1 overleaf.

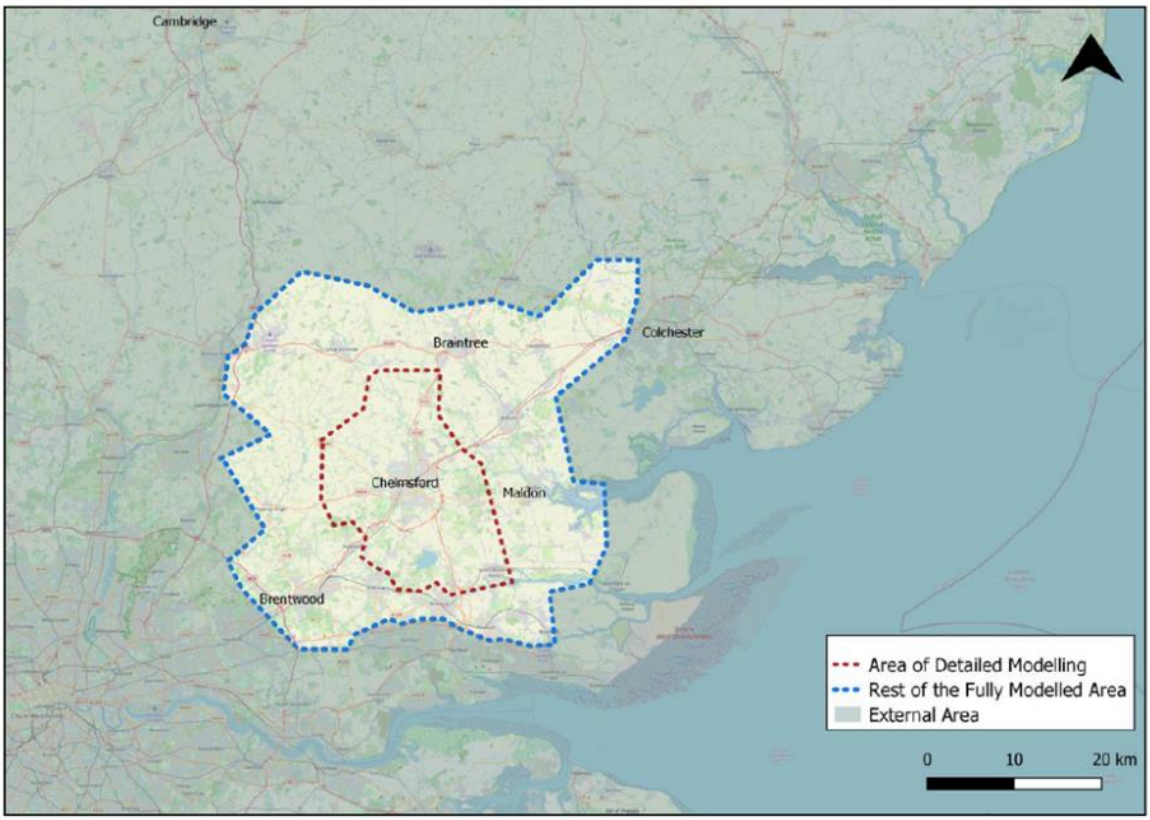


Figure 3-1: Chelmsford VISUM Model – Fully Modelled Area

As shown in Figure 3-1, the Chelmsford administrative area is located within the AoDM, which means that road links and junctions are modelled in more detail in terms of geometry and capacity, and with more granularity / depth of coverage. This detail increases further within the Chelmsford urban area. At the same time, the zone system used is increasingly detailed / granular when closer to the Chelmsford urban area, meaning that traffic is loaded onto the road network with greater precision.

In terms of model calibration and validation, the model is robustly representative of traffic flows and journey times in the Chelmsford urban area and on key strategic routes into the city. Figure 3-2 below illustrates the traffic flow screenlines and cordons used in the calibration and validation of the base model.

A separate calibration cordon can also be seen in north-east Chelmsford. This was introduced at the time of the Chelmsford North-East Bypass (CNEB) modelling appraisal in 2019 to ensure that alternative routes to the bypass were

modelled accurately to provide a robust assessment of trip reassignment to the proposed new route.

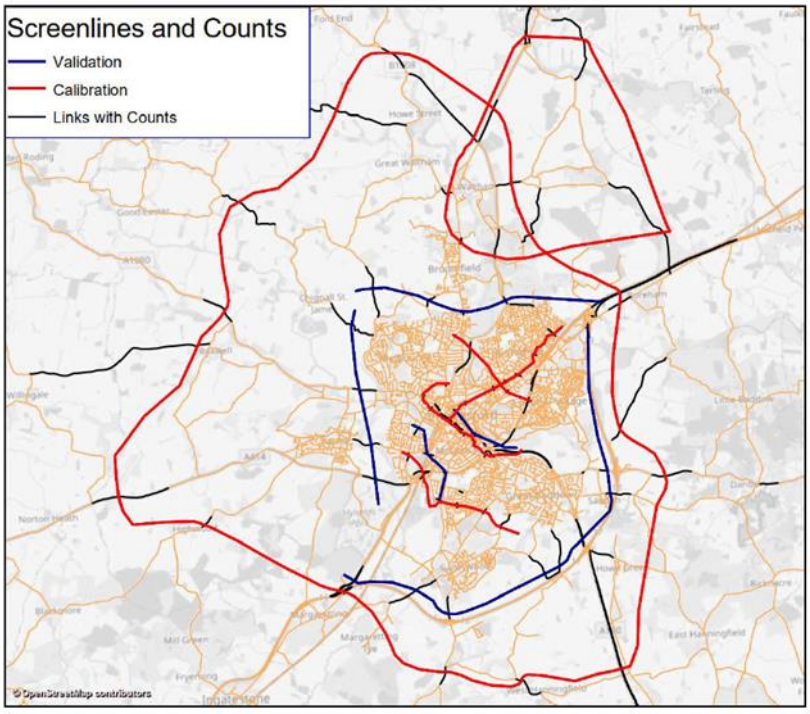


Figure 3-2: Cordons and screenlines used in 2019 base model calibration / validation

It should be noted that any assessment of development impact on the road network outside of the calibrated area of the model will need to be caveated or adapted to accommodate the limitations of the strategic model in these outer areas.

Furthermore, as is typical of large-scale strategic models, the Chelmsford VISUM Model is not validated to turning movements at junctions.

3.2.3 Time Periods

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)

Peak hours were determined prior to model development, through a review of 24hr traffic flows recorded at continuous count sites distributed across strategic routes in and around Chelmsford.

3.2.4 Variable Demand Modelling

An updated Variable Demand Model (VDM) was developed and tested as part of work to update the Chelmsford VISUM model to a 2019 base year. The VDM accounts for changes in travel behaviour – specifically the route taken, destination, and/or mode of travel choice due to a change in travel cost, through traffic intervention or changes in travel demand, often a result of network congestion.

The development and testing of the VDM is covered in detail in both the LMVR and Forecasting Report.

An assessment of VDM impact on forecast flows was undertaken earlier this year and included in the March 2024 reporting of the Preferred Spatial Approach. Findings revealed little overall change in peak hour traffic volumes across Chelmsford. However, owing to link capacity constraints along the A12, VDM was shown to reduce flows along the A12 by up to 250 vehicles southbound in the PM peak between Junctions 17 and 19.

Whilst VDM was not used in earlier stages of the Local Plan Review appraisal, a decision was made to incorporate it into the LPRPS modelling, given growing interest around development impact along the A12 corridor from National Highways with uncertainty around A12 widening proposals, and from other representations made by Parish Councils during consultation on the Preferred Spatial Approach.

It is considered that use of VDM will present a more realistic representation of traffic flow volumes along the A12 corridor and throughout the rest of the modelled network in the forecast modelling. However, care has been taken in the reported analysis to account for VDM adjustments in the overall appraisal of LPRPS development impact.

3.2.5 Park & Ride

A bespoke choice model has been developed to assess how future changes in car-based journey times impact on P&R demand. The validated base year P&R model (2019) – covering both Sandon and Chelmer Valley Park and Ride sites - is not linked to any wider transport model but rather developed as a standalone

model based on observed journey times and demand. However, the model is designed such that its structure and the calibrated model parameters can be nested within the Chelmsford VISUM Model.

The proposed P&Rs to serve the west of Chelmsford (Widford P&R) and north-east of Chelmsford (Boreham P&R) are not included within the model as funding has not been identified. However, these remain a key part of ECC's P&R strategy and a broad location for each has been identified in CCC's 'Strategic Policy S9 – Infrastructure Requirements'.

For the purposes of this study, the P&R model has been run for the pre-submission modelling of the Local Plan Review.

3.2.6 Notable changes since 2014 Base Model (used to model the adopted Local Plan)

A multi-modal strategic transport model for Chelmsford with a base year of 2014 was previously developed by Essex Highways to support the Local Plan process and Local Enterprise Partnerships (LEP) funding bids (Chelmsford City Growth Package, and the Chelmsford to Maldon Route Based Strategy). This was subsequently used in the Chelmsford North-East Bypass (CNEB) Housing Infrastructure Fund (HIF) bid support for ECC which was successfully awarded funds. The model was developed, calibrated, and validated following Transport Analysis Guidance (TAG).

However, it was identified that the model would need refinements in the context of the future Army and Navy Sustainable Transport Package project (including the current layout arrangements of the roundabout) business case work for the DfT, and the CNEB planning application for ECC. In particular, these refinements pertain to the age of data used within all stages of model development, the extent of the model network, and network changes that have taken place since original validation, in particular the permanent closure/removal of the Army and Navy flyover.

The model update was of particular relevance to the Army and Navy junction, to enable representation of the junction with the flyover closed (the existing model was developed with the flyover open), and to CNEB, to extend the detailed model area further to the north and east of Chelmsford.

To provide the evidence base for a Planning Application for the CNEB and a potential outline business case for a scheme to improve the Army and Navy junction therefore required an update to the existing Chelmsford Model. This also

provided an opportunity to feed any critical updates from past local studies (related to observed data or networks information) back to the Chelmsford Model in order to keep it up to date and increase its utility and quality in each subsequent application.

The latest Chelmsford VISUM Model has now been revalidated to 2019 traffic flows, representing average neutral weekday conditions during the period September to November of that year. A supplementary assessment has been developed, detailing the decision to continue using 2019 flows for the Chelmsford Local Plan Review. See section 3.3 below for more detail. The model has been updated to align with the latest DfT Databook (v1.23), with improvements made to both the robustness of model assignment and the representation of junction capacity across the wider network.

Further details on the base 2019 model calibration and validation can be found in the April 2021 LMVR.

3.3 Supplementary Technical Assessments

To support the modelling undertaken for Local Plan appraisal Evidence Base, three short technical notes have been included in Appendix A of this report documenting the methodology and findings from a series of desktop modelling studies, as follows:

- ***Appendix A1: TEMPro V7.2 and V8.0 Background Growth Comparisons***
    - Provides justification for the use of TEMPro V7.2 over the latest V8.0 datasets for the calculation of background growth in this study.

- ***Appendix A2: Pre and Post Covid-19 Traffic Flow Comparison***
    - Provides justification for the use of a 2019 validated base-year VISUM model as a platform for the forecast modelling in this study.

- ***Appendix A3: Low, Core and High Growth Scenarios***
    - Provides context around the potential variability in forecast model projections with which to view the findings of this study, and a justification for using a standard core growth scenario for the LPRPS modelling.

3.4 Chelmsford VISUM Forecast Model Overview

Two forecast years: 2026 and 2041 were modelled for the Army & Navy study. For the purpose of the Chelmsford Local Plan Review modelling, a single 2041 forecast year has been used– representing the end of the updated Local Plan review period.

The following section outlines the assumptions made in the modelling around the future layout of the road network in a 2041 assessment year, incorporating all known development and infrastructure changes proposed (outside of the LPRPS).

3.4.1 2041 Forecast Model – Army & Navy Redesign and Other Infrastructure Assumptions

This study uses a version of the Chelmsford VISUM forecast model that includes the preferred 'hamburger' roundabout design at the Army & Navy junction following public consultation in August 2021. The Army and Navy Sustainable Transport Package (including expansion of Sandon and Chelmer Valley P&R) was granted permission on 22nd November 2024.

Figure 3-3: Concept image of the Army & Navy Roundabout proposed 'hamburger' layout[2]

[2] Source: https://www.essexhighways.org/highway-schemes-and-developments/highway-schemes/chelmsford-schemes/army-and-navy-taskforce

Alongside this key infrastructure proposal, the following additional infrastructure assumptions presented in the Army & Navy Sustainable Transport Package modelling study form the basis of the main future year scenarios for the Chelmsford Local Plan Review modelling:

- *A12 Chelmsford to A120 widening scheme (as detailed in the July 2021 public consultation sponsored by National Highways)
- Lower Thames Crossing (sponsored by National Highways)
- Sheepcotes Roundabout A130-A131 left-turn filter (opened since 2019 base model) as part of the A131 Route Based Strategy
- *Boreham Interchange (A12 J19) improvements (as detailed in June 2023 consultation with signal timings from National Highways modelling)
- Radial Distributor Road (RDR) & Northern Radial Distributor Road (NRDR)
- Chelmsford North-East Bypass (CNEB) Section 1a
- Beaulieu Park Rail Station
- Expansion of Sandon P&R site by 350 spaces
- Expansion of Chelmer Valley P&R site by 500 spaces

* Sensitivity testing has also been undertaken as part of the LPRPS to assess the impact of development proposals without the A12 widening scheme and capacity improvements at the Boreham Interchange. Full details of all the scenarios modelled can be found in Section 4-4.

More detail on the specifics of the modelled schemes can be found in the September 2022 forecasting report and the following sections below.

3.4.2 Boreham Interchange (A12 Junction 19)

Latest Boreham Interchange designs and signal timings produced by National Highways and published as part of the A12 Chelmsford to A120 widening scheme Development Consent Order (DCO) June 2023, were incorporated into the latest Chelmsford VISUM forecast model. The proposed layout is shown in Figure 3-4 overleaf.

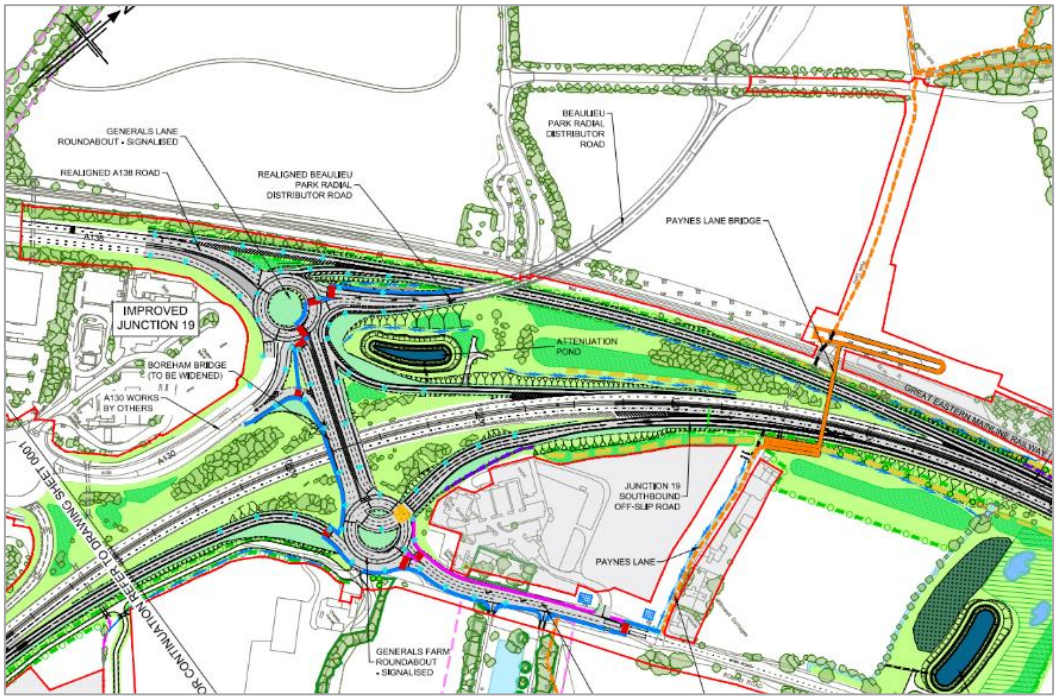


Figure 3-4: Latest National Highways proposals for the Boreham Interchange[3]

The proposed changes include:

- Controlled crossings at both Generals Lane Roundabout and Drover's Way Roundabout
- Signalisation of Generals Lane Roundabout.
- Widening of the A12 overbridge.
- Realignment of Beaulieu Parkway (RDR) and the A138.

3.4.3 Chelmsford North-East Bypass

The proposed layout of the CNEB is shown in Figure 3-5 overleaf. When fully built, the expectation is that the scheme will include a single-lane carriageway connecting the RDR to a new junction on the A131 Braintree Road at Chatham Green. An at-grade roundabout will provide a connection to the Northern RDR

[3] Source: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010060/TR010060-002612-National%20Highways%20-%202.9%20General%20Arrangement%20Plans%20-%20Part%202.pdf

(NRDR). The section of the A131 between the Chatham Green junction and Deres Bridge junction will also be dualled.

As of December 2023, proposals for the CNEB have been revised such that only Section 1A of the route with linkage to the NRDR is likely to be constructed by 2041. These latest scheme proposals have therefore been incorporated into the modelling of the LPRPS. The modelled extent of the CNEB and NRDR is highlighted in blue in Figure 3-5.

It is anticipated that provision of Section 1B of the CNEB scheme will help to reduce capacity pressures at the A131/B1008 Sheepcotes Roundabout, helping to facilitate long-term additional development to the north of Chelmsford, whilst encouraging use of the existing A131 route as a sustainable transport corridor. Section 8.2.1 of this report summarises the junction capacity modelling of Sheepcotes Roundabout with Section 1A of the CNEB in place, and demonstrates that delivery of Section 1b in the longer-term is unlikely to leave the junction operating significantly over-capacity in the interim.

3.4.4 Howe Green

With a focus on junctions along the A12 corridor, the existing layout of Howe Green (A12 J17) – as well as Sandon (A12 J18) – has been reviewed as part of this study. Through this, it has been noted that the A12 southbound off-slip at Howe Green was redesigned in 2022 with a reduction in the number of approach lanes from three to two. This change has been incorporated into the latest modelling.

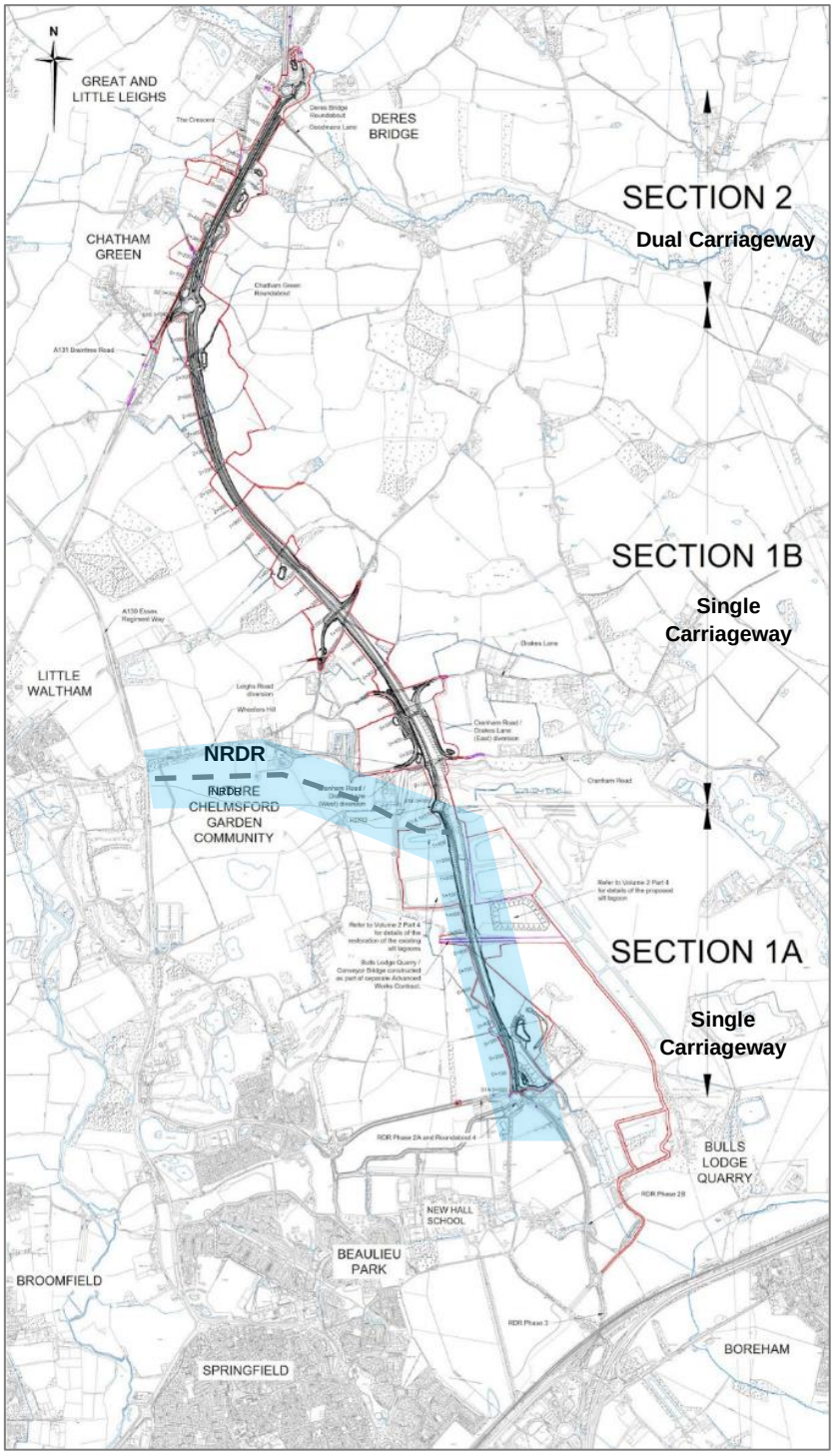


Figure 3-5: Chelmsford North-East Bypass proposed design[4] - Section 1A & NRDR shown in blue

[4] Source: https://www.essexhighways.org/highway-schemes-and-developments/highway-schemes/chelmsford-schemes/chelmsford-north-east-bypass

3.4.5 Original Planning and Growth Assumptions in Chelmsford Forecast Model

Housing and employment data within the Chelmsford Administrative Area in the original forecast model was based on planning data (applications and permissions) confirmed by Chelmsford City Council in summer 2020. As part of this, 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. 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 within the Chelmsford Administrative Area.

The majority of the housing and jobs allocated during the Local Plan period was located in the specific growth areas as identified under Strategic Policy S7 The Spatial Strategy in the adopted Chelmsford Local Plan[5].

3.4.6 Changes to Adopted Local Plan Development Assumptions – Sept '24 Update

Along with the latest development allocations for the LPRPS, CCC also provided an update (as of September 2024) on development allocations for existing Local Plan sites to be included in the 2041 baseline modelling. These are shown in Table 3-1 below.

[5] Source: https://www.chelmsford.gov.uk/media/fvfjkf0i/chelmsford-adopted-local-plan-may-2020-text-only.pdf#page=52

Location	Site Name	Total Allocation (No. of dwellings)
Growth Area 1		
City Centre	Chelmer Waterside Allocations	880
	Former St Peter's College Fox Crescent	185
	Riverside Ice and Leisure Land Victoria Road Chelmsford	150
	Civic Centre Land Fairfield Road Chelmsford	100
	Land West of Eastwood House Glebe Road Chelmsford	197
	Ashby House Car Parks New Street Chelmsford	80
	Chelmsford Social Club	29
	Rectory Lane Car Park West Rectory Lane Chelmsford	75
	Former Chelmsford Electrical and Car Wash Brook Street	41
	BT Telephone Exchange Cottage Place Chelmsford	30
	Rectory Lane Car Park East Rectory Lane Chelmsford	23
	Waterhouse Lane Depot and Nursery Chelmsford	20
	Site at Play Area Woodhall Road Chelmsford	12
	British Legion New London Road Chelmsford	15
	Land rear Of 17-37 Beach's Drive Chelmsford	18
	Garage Site St Nazaire Road Chelmsford	12
	Garage Site and Land Medway Close Chelmsford	6
	Car Park R/O Bellamy Court Broomfield Road Chelmsford	10
	Rivermead, Bishop Hall Lane	315
Writtle	Land Surrounding Telephone Exchange Ongar Road Writtle	25
West Chelmsford	West Chelmsford	880
East of Chelmsford	East of Chelmsford - Manor Farm	360
	East of Chelmsford - Land South of Maldon Road	65
	East of Chelmsford - Land North of Maldon Road	109
Galleywood	Land north of Galleywood Reservoir Beehive Lane Galleywood	24
Growth Area 2		
North East Chelmsford	Chelmsford Garden Community	5569
Great Leighs	Great Leighs - Land at Moulsham Hall	750
	Great Leighs - Land East of London Road	250
	Great Leighs - Land North and South of Banters Lane	100
North of Broomfield	North of Broomfield	512
Growth Area 3		
North of South Woodham Ferrers	Land North West of Hamberts Farm Bunham Road South Woodham Ferrers Chelmsford	1020
	Land North of South Woodham Ferrers Burnham Road South Woodham Ferrers Chelmsford	200
Bicknacre	South of Bicknacre	42
	St Giles Bicknacre	32
Danbury	Danbury	100

Location	Site Name	Total Allocation (floorspace m2)
Growth Area 1		
Great Baddow	East of Chelmsford - Land north of Maldon Road	5,000
Growth Area 2		
North East Chelmsford	North East Chelmsford	45,000
Growth Area 3		
South Woodham Ferrers	North of South Woodham Ferrers	1,200
Committed Development (separate to growth areas)		
Springfield	Greater Beaulieu Park White Hart Lane Springfield Chelmsford	9,969

Table 3-1: Revised development allocations on adopted Local Plan sites included in the modelled baseline scenario

The sites highlighted in grey in the table above are small residential developments, under 50 dwellings, that have not been modelled at specific locations but instead have been distributed across representative loading points across the network.

3.4.7 Constraining Trip-End Growth to TEMPro

In a departure from previous-stage modelling, a decision was made to not constrain development growth in the model to TEMPro trip-end assumptions. Whilst widely accepted as appropriate in the appraisal of infrastructure schemes, constraining to TEMPro is less robust as a means of modelling Local Plan impact, as it effectively replaces latest development numbers proposed with historic projections.

By adopting this new approach, it has not been possible to model latest windfall allowances in the LPRPS. Nevertheless, had windfall sites been modelled and evenly spread across the Chelmsford area, the impact of associated development trips would have been negligible.

3.4.8 Beaulieu Park Rail Station

Beaulieu Park Station is expected to generate what is described either as rail-heading or rail-based Park & Ride behaviour, characterised by trips which use private transport for the home to station legs and rail for the station to destination legs. The additional mixed mode trips expected as well as the change in rail station usage cannot be modelled directly in the Chelmsford VISUM model and is therefore estimated independently using a bespoke external rail mode, specifically:

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.

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 Park & Ride model matrices to be used in the final VISUM model assignment runs.

For the purposes of this study, the rail model was run for each assessed spatial approach and the fixed demand matrices adjusted accordingly.

4 Local Plan Review Pre-Submission Modelling 2036-2041

4.1 Proposed Development Allocations

Following consultation on the Local Plan Review Preferred Spatial Approach in June 2024, development allocations have been refined by CCC in September 2024 for the LPRPS and are shown in Table 4-1 below. These are sites in addition to those already allocated in the adopted Local Plan.

Location Name	Site Name	Residential (units)	Employment (sqm)			
			Office E(g)(i)	Research and Industrial E(g)(ii)	General Industrial B2	Storage or distribution (Warehousing) B8
Growth Area 1						
Chelmsford Urban Area	Meadows Shopping Centre and Meadows Surface Car Park	757	-	-	-	-
	Land between Hoffmans Way and Brook Street (Marriages Mill)	100	-	-	-	-
	Granary Car Park	50	-	-	-	-
	Coval Lane Car Park	40	-	-	-	-
	Glebe Road Car Park	12	-	-	-	-
	Andrews Place, Waterhouse Lane	183				
	Additional Employment (Unallocated) Site 1 - Victoria Road	-	1333	-	-	-
	Additional Employment (Unallocated) Site 2 - Glebe Road	-	1333	-	-	-
	Additional Employment (Unallocated) Site 3 - Navigation Road	-	1333	-	-	-
Growth Area 1 - Total (Review)		**1,142**	**3999**	**0**	**0**	**0**
Growth Area 2						
Ford End	Land South of Ford End Primary School, Ford End	20	-	-	-	-
Boreham	Boreham, Waltham Road	-	-	-	1750	1750
North West Chelmsford	Little Boyton Hall Farm	-	-	-	3000	3000
North East Chelmsford	Chelmsford Garden Community	-	302	3265	-	8379
Growth Area 2 - Total (Review)		**20**	**302**	**3265**	**4750**	**13129**
Growth Area 3						
South East Chelmsford	East Chelmsford Garden Community (Hammonds Farm)	3000	3841	13053	13053	13053
	Land adjacent to A12, Junction 18	-	4669	12777	12777	12777
Bicknacre	Land at Kingsgate, Bicknacre	20	-	-	-	-
	Lane west of Barbrook Way, Bicknacre	20	-	-	-	-
East Hanningfield	Land north of Abbey Fields, East Hanningfield	11	-	-	-	-
	Land east of Highfields Mead, East Hanningfield	20	-	-	-	-
Growth Area 3 - Total (Review)		**3,071**	**8,510**	**25,830**	**25,830**	**25,830**
Review LP Total		**4,233**	**12,811**	**29,095**	**30,580**	**38,959**
			111,445			

Table 4-1: Housing and employment allocations modelled for the LPRPS Scenario

Key changes to the Pre-Submission modelling since the initial modelling of the Preferred Spatial Approach (March 2024), include:

Site Changes

- Addition of new residential site at Andrews Place, Waterhouse Lane
- Removal of E2V Teledyne employment site
- Removal of Kay Metzler employment site
- Removal of Land West of Back Lane, Ford End residential site

Allocation Changes:

- Increasing the residential units at Meadows Shopping Centre (Site 1w)
- Amending site capacities for some allocations to reflect new information and further assessment including 'Granary Car Park, Victoria Road' and 'Land north of Abbey Fields, East Hanningfield'
- 681 units removed from North-East Chelmsford Garden Community residential site, to reflect the total allocation to be built up to 2041.

4.1.1 Forecast Model Zone Updates

Where appropriate, the LPRPS development sites have been modelled using existing zones within the 2019 Chelmsford base model. In the case where appropriate model zones did not already exist, new zones have been added. A list of new zones has been included in Appendix B of this report.

4.1.2 Forecast Model Zone Connector Updates

Appendix B of this report documents the assumed development access points to the local road network and, where multiple access points were identified, the proportional split of development trips assigned to the access points. Assumptions were confirmed with CCC Officers prior to the updating of the forecast model network.

Where development sites were located near to key impacted junctions, zone connectors were attached to access road 'stubs' served by dedicated development access junctions. For development located in more outer, rural locations where network capacity was not expected to be of concern, zone connectors were loaded directly onto main road links.

4.1.3 Development Trip Generation

Trips associated with the specific LPRPS housing and employment development over the period 2036-2041 were included in the 2041 forecast year Chelmsford Model, replacing generalised TEMPro based growth assumptions used for the recent Army & Navy modelling.

Trip rates used in the calculation of development trips were largely kept consistent with the peak period average hour rates used in previous Chelmsford forecast modelling. However, B2 industrial trip rates and C2 Student Accommodation trip rates were added for this study, calculated from data in TRICS version 7.10. Trip rates used can be found in Table 4-2 overleaf.

		Arrivals Trip Rates			Departures Trip Rates		
Land Use Type	**Unit**	**AM**	**IP**	**PM**	**AM**	**IP**	**PM**
C3 Residential Mixed Private / Affordable Houses	Per Dwelling	0.094	0.115	0.215	0.216	0.12	0.117
C2 Student Accommodation	Per Dwelling	0.002	0.004	0.003	0.001	0.005	0.004
E(g) Office / Research and Industrial (formerly B1a)	Per 100sqm	0.553	0.113	0.082	0.096	0.121	0.702
B8 Storage or Distribution	Per 100sqm	0.501	0.195	0.237	0.114	0.201	0.733
B2 General Industrial	Per 100sqm	0.211	0.153	0.080	0.105	0.173	0.145

Table 4-2: Development trip rate assumptions

It should be noted that the trip rates used in the Chelmsford forecast modelling are comparatively 'low', and account for a reasonable level of trip-internalisation (i.e. trips made *within* larger development sites) and a good level of sustainable and active travel mode-share.

It is recognised that the trip rates used are representative of an aspirational approach to development planning and the levels of trip generation that could be achieved with the successful implementation and uptake of sustainable and active mode infrastructure. In this regard, the modelled trip rates are considered to be well aligned with latest NPPF guidelines for Local Plan development.

Detail of the calculated development trips for the LPRPS modelling can be found in Appendix C of this report, whilst a summary can be found in Table 4-3 overleaf.

Location Name	Development Name	AM		PM	
		Destinations	Origins	Destinations	Origins
Chelmsford Local Plan Review Pre-Submission Sites					
Growth Area 1					
Chelmsford Urban Area	Meadows Shopping Centre and Meadows Surface Car Park	71	163	163	89
	Land between Hoffmans Way and Brook Street (Marriages Mill)	9	22	22	12
	Granary Car Park	5	11	11	6
	Coval Lane Car Park	4	9	9	5
	Glebe Road Car Park	1	3	3	1
	Andrews Place, Waterhouse Lane	17	39	39	21
	Additional Employment (Unallocated) Site 1 - Victoria Road	7	1	1	9
	Additional Employment (Unallocated) Site 2 - Glebe Road	7	1	1	9
	Additional Employment (Unallocated) Site 3 - Navigation Road	7	1	1	9
Growth Area 2					
Ford End	Land South of Ford End Primary School, Ford End	2	4	4	2
Boreham	Boreham, Waltham Road	9	2	4	13
		4	2	1	3
North West Chelmsford	Little Boyton Hall Farm	15	3	7	22
		6	3	2	4
North East Chelmsford	Chelmsford Garden Community	20	3	3	25
		42	10	20	61
Growth Area 3					
South East Chelmsford	East Chelmsford Garden Community (Hammonds Farm)	282	647	645	351
		93	16	14	119
		28	14	10	19
		42	10	20	61
	Land adjacent to A12, Junction 18	96	17	14	122
		27	13	10	19
		64	15	30	94
Bicknacre	Land at Kingsgate, Bicknacre	4	9	9	5
	Lane west of Barbrook Way, Bicknacre				
East Hanningfield	Land north of Abbey Fields, East Hanningfield	3	7	7	4
	Land east of Highfields Mead, East Hanningfield				
TOTAL TRIPS GENERATED		866	1024	1050	1085

Table 4-3: Summary of calculated development trips for the LPRPS

4.1.4 City Centre Brownfield Sites + Change in Land-Use

Table 4-4 below details the brownfield sites identified by CCC for inclusion in the modelling for the Chelmsford Urban Area. Unallocated employment was split evenly across sites in Chelmsford known to be focus areas for recent and upcoming redevelopment.

Location	Site Name	Residential No. of Dwellings	Employment Floorspace (sqm)
Chelmsford Urban Area (Residential Sites) - Previously developed sites in Chelmsford Urban Area	Meadows Shopping Centre and Meadows Surface Car Park	757	-
	Land between Hoffmans Way and Brook Street (Marriages Mill)	100	-
	Granary Car Park	50	-
	Coval Lane Car Park	40	-
	Glebe Road Car Park	12	-
	Andrews Place, Waterhouse Lane	183	
Additional Employment Allocation (4,000sqm) - To be allocated at sites across the city centre	Additional Employment (Unallocated) Site 1 - Victoria Road	-	1333
	Additional Employment (Unallocated) Site 2 - Glebe Road	-	1333
	Additional Employment (Unallocated) Site 3 - Navigation Road	-	1333

Table 4-4: Brownfield LPRPS development in Chelmsford Urban Area

Trips associated with existing land-uses on brownfield sites in Chelmsford were removed from the baseline forecast matrices by estimating the gross floor area of the existing land use and determining existing trip generation via use of the trip rates shown in Table 4-2. This process has been applied to the following sites to reflect the change in land use:

- Civic Centre Land Fairfield Road, Chelmsford
- Land West of Eastwood House
- Ashby House Car Parks
- Travis Perkins
- Land between Hoffmans Way and Brook Street (Marriages Mill)

4.2 Development Trip Distributions

4.2.1 Donor Zones

The trip distributions for new development zones modelled for either adopted Local Plan sites or proposed LPRPS sites, were taken from nearby 'donor zones'. 'Donor zones' are zones already present in the model that have been used to represent the trip distribution for a new development zone. Care was taken to ensure that selected donor zones were in reasonable geographic proximity to the corresponding new Local Plan zones, and that the quantum of development and make-up of land-uses in the donor zone were reasonably representative.

Following a review of modelling assumptions since the previous assessment of selected spatial approaches, the donor zones used for the preferred spatial approach have been updated. Appendix B provides more detail on the donor zones used.

4.2.2 Trip Distribution Analysis

The selection of plots below demonstrate the modelled distribution of trips to and from a few selected donor zones used in the pre-submission modelling of the LPRPS. All donor zones used are outlined in Appendix B.

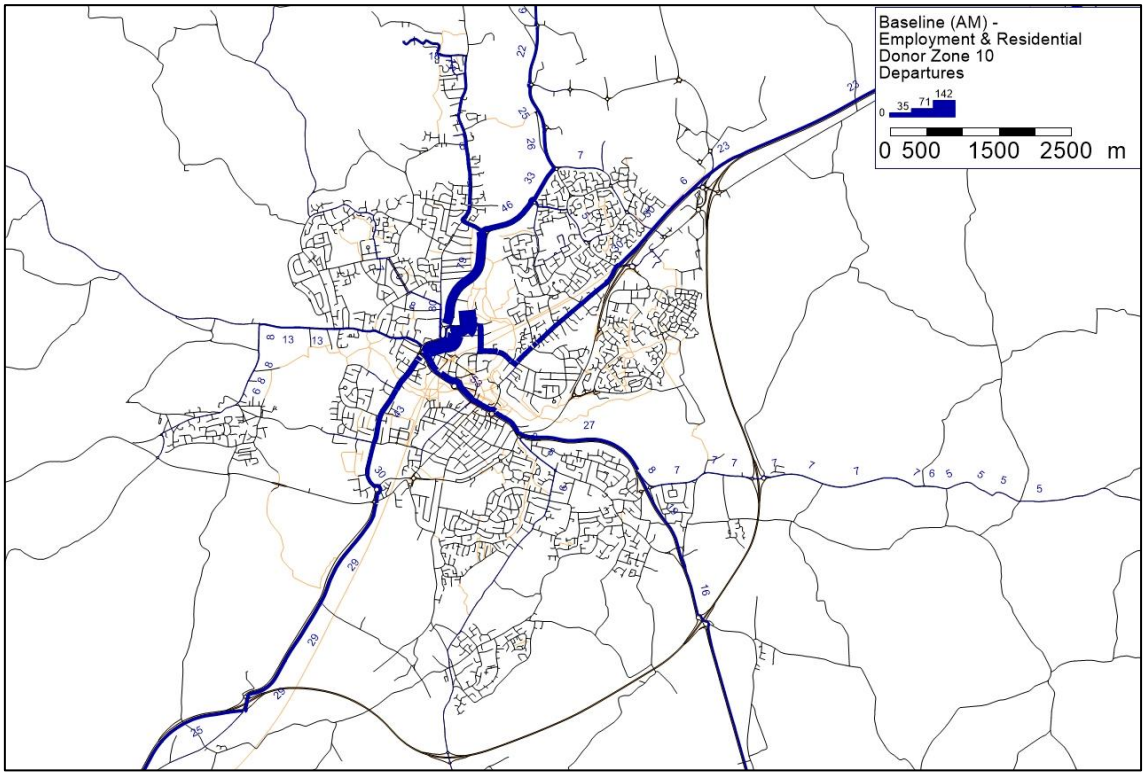


Figure 4-1: Distribution of AM Peak departure trips from ARU and Rectory Lane (Donor Zone 10)

Figure 4-1 illustrates the AM Peak modelled assignment of trips from the Anglian Ruskin University (ARU) campus and Rectory Lane housing – serving as a donor zone for the distribution of high-density urban housing trips to/from Local Plan development in the city centre. Arrivals in the PM peak have a matching distribution (in reverse).

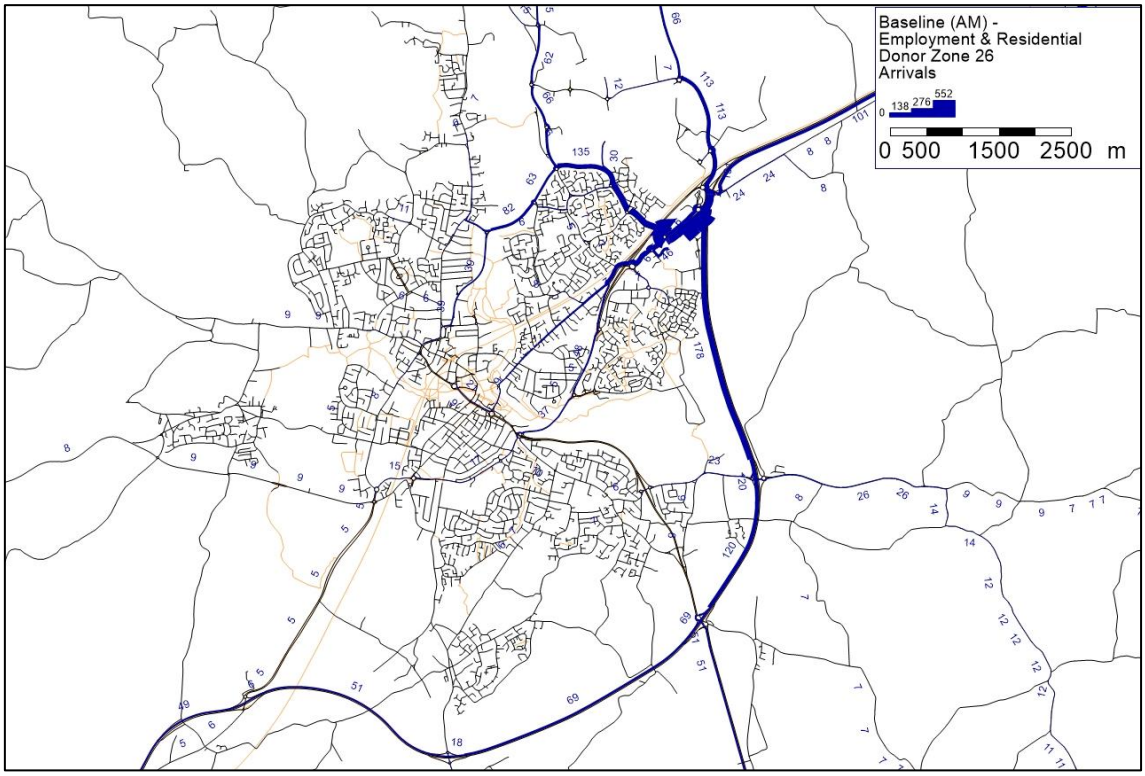


Figure 4-2: Distribution of AM Peak employment arrival trips to Springfield Business Park (Donor Zone 26)

Figure 4-2 illustrates the AM Peak modelled assignment of employment trip arrivals to the Springfield Business Park - serving as a donor zone for the distribution of employment trips to/from Local Plan development in north-east Chelmsford and along the A12 corridor. Departures in the PM peak have a matching distribution (in reverse).

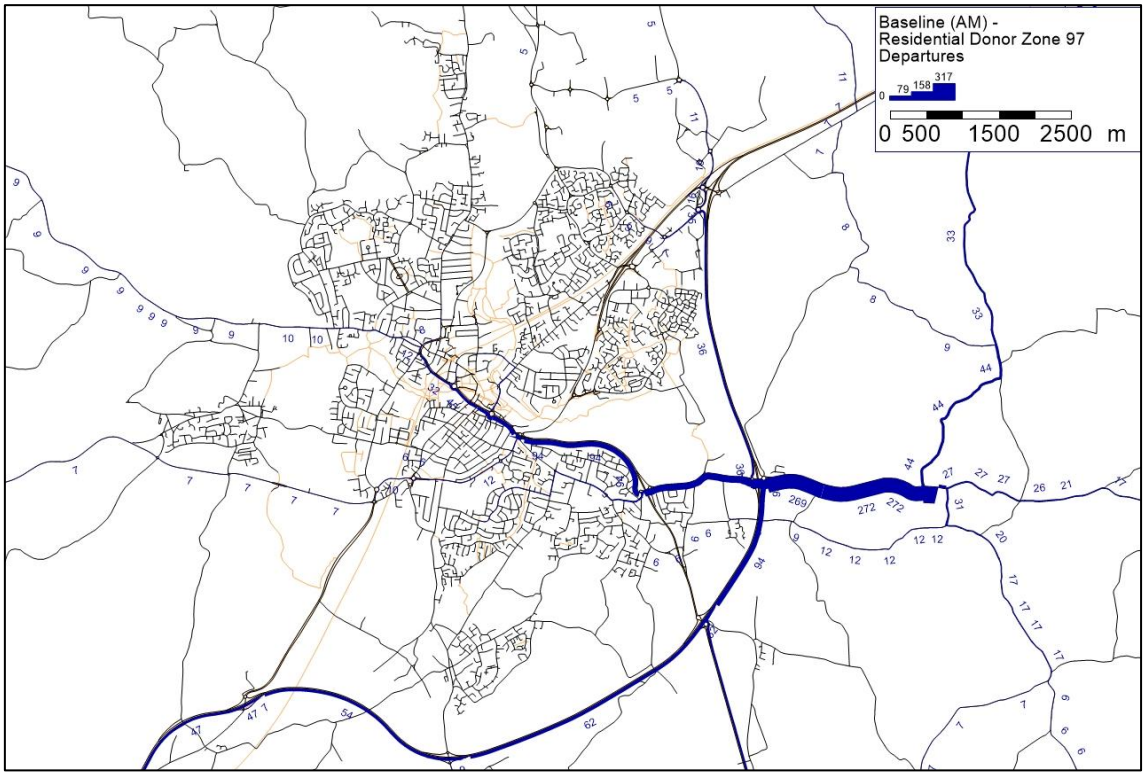


Figure 4-3: Distribution of AM Peak residential departure trips from Danbury (Donor Zone 97)

Figure 4-3 illustrates the AM peak modelled assignment of residential trip departures from Danbury – serving as a donor zone for the distribution of residential trips from the Hammonds Farm development. Arrivals in the PM peak have a matching distribution (in reverse).

Overall, the selected donor zones in the Chelmsford VISUM model can be seen to provide a reasonable and broadly representative distribution pattern of trips for both arrivals and departures to/from residential and employment zones in Chelmsford.

4.3 Proposed Development Access Assumptions Modelled

Section 4.1.2 and Appendix B of this report document the access assumptions modelled for the new LPRPS sites, based around the use of zone connectors. The following sections of this report provide further detail on the specific access assumptions modelled for two of the larger proposed development sites – Hammonds Farm and Chelmsford Garden Community.

4.3.1 Hammonds Farm Access

Current proposals for the Hammonds Farm site include a spine road through the development between a site access from the A414 Maldon Road to the south and Generals Farm Roundabout at the Boreham Interchange to the north. The street layout will be designed to discourage through trips and be unattractive as an alternative route for travelling on the A12, with the potential for a bus only link to support sustainable transport movements from this garden community to locations such as Beaulieu Park Station. Taking this into account, the spine road was not specifically modelled. However, to ensure the operation of Generals Farm Roundabout was modelled as accurately as possible, a further roundabout arm was added, serving exclusively as a development access point, based on an early-stage technical drawing provided by consultants Motion on behalf of Hammonds Farm developers in September 2024 and shown in Figure 4-4 below.

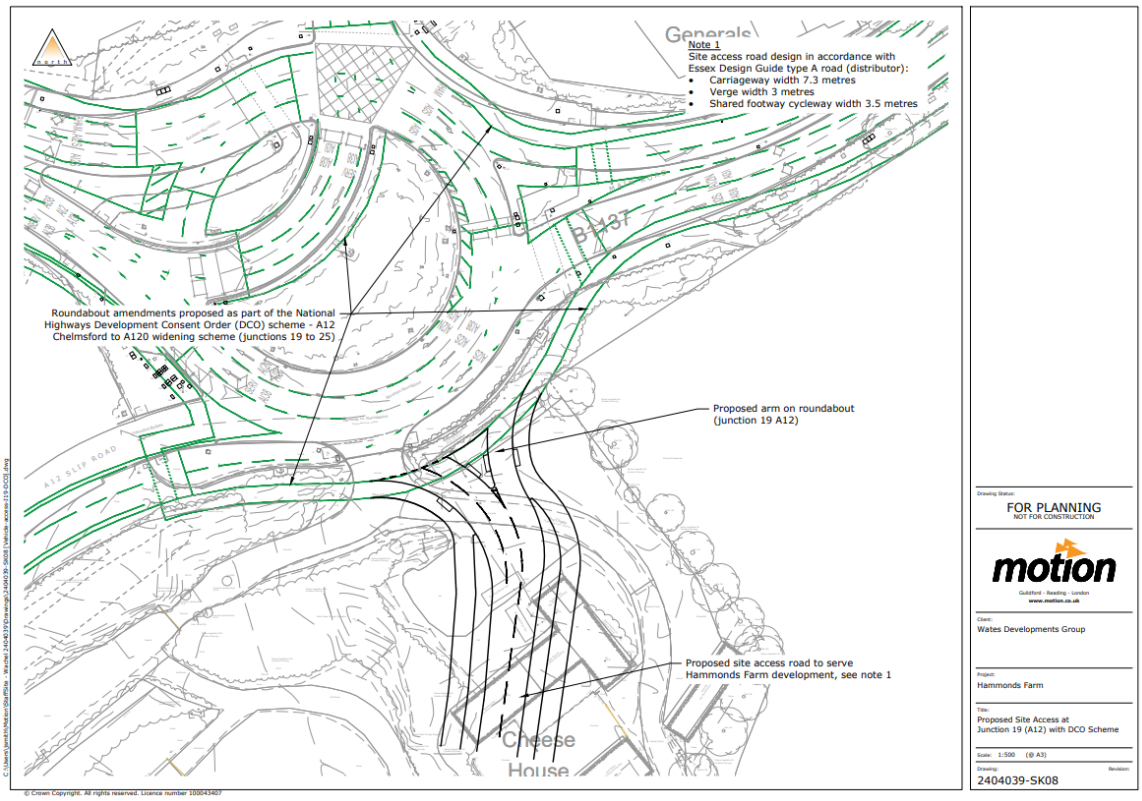


Figure 4-4: Proposed Hammonds Farm development access at A12 J19 Boreham Interchange

To the south of the development, access to the site has been modelled via the existing Hammonds Road arm on the A12 J18 Sandon Interchange eastern roundabout, as per latest site access proposals shown in Figure 4-5 overleaf.

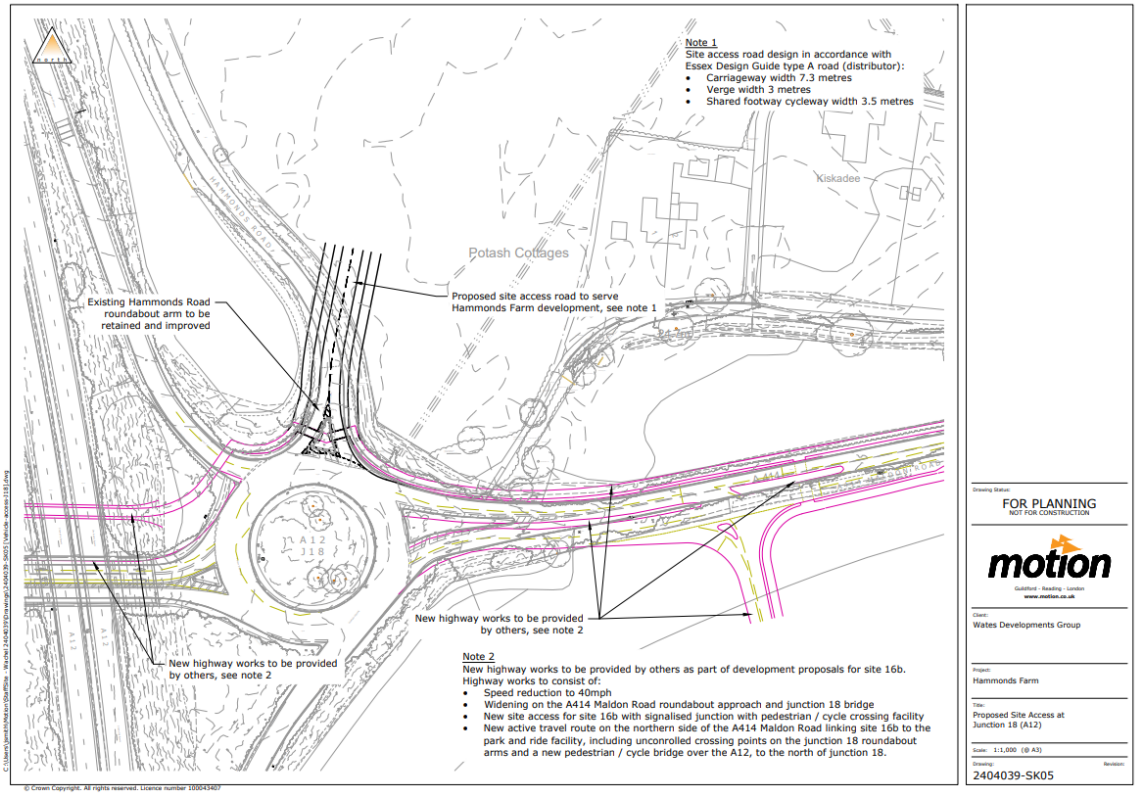


Figure 4-5: Proposed Hammonds Farm development access at A12 J18 Sandon Interchange

Additional access to/from the Hammonds Farm development site has been modelled via a new junction on the A414 Maldon Road as shown in the latest developer drawing in Figure 4-6.

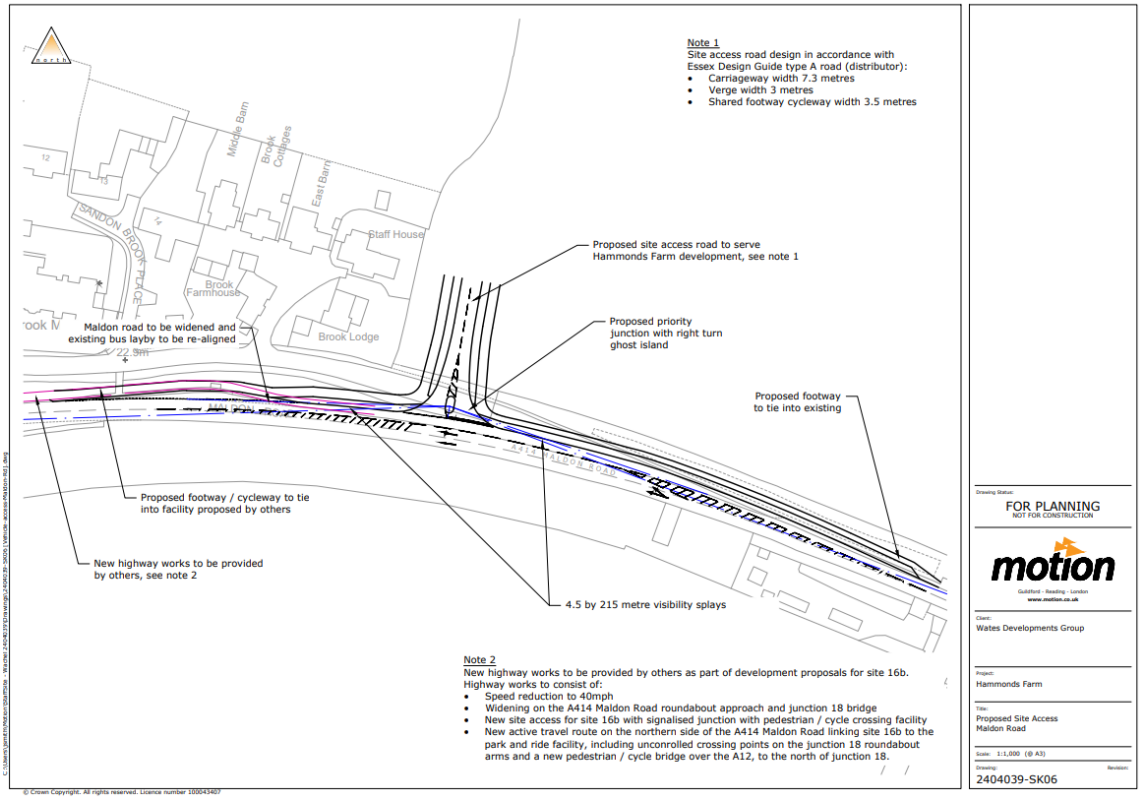


Figure 4-6: Proposed Hammonds Farm development access on A414 Maldon Road

The percentage of total Hammonds Farm development trips modelled at each of the proposed access points was a follows:

- 30% of trips to the north access point
- 70% of trips to the south access points (allowing the model to decide the split between access via the roundabout and via the A414)

It is understood that current access proposals to/from the Hammonds Farm development site are from a pre-application stage and have yet to be assessed in detail as part of a full planning application. The designs are expected to change or be refined throughout the planning process.

There are also developer proposals for a new bridge link over the A12 providing alternative access to the development from Maldon Road on the west side of the A12. It has been agreed with ECC/CCC that this should serve as a walking, cycling and bus-only access link and has therefore not been included in the modelling as an access route for cars/private vehicles.

4.3.2 Chelmsford Garden Community Access

The developer consortium for the Chelmsford Garden Community (CGC) have provided detail on access and infrastructure proposals for the development in their Development Framework Document agreed by CCC Cabinet as of January 2023[6] with further detail subsequently provided in their outline planning applications, which are currently under consideration.

The development makes use of the RDR and NRDR as well as the CNEB – which are both present in the Chelmsford Forecast Model - and also includes a network of local access roads and junctions. Given the strategic nature of the modelling, and an expectation that developer access junctions will be built on robust designs and with sufficient capacity, the local roads associated with the development have been represented in the model with zone connectors alone.

The latest version of the Chelmsford Forecast Model used for this study includes the detailed access arrangements proposed by developers for the CGC as well as an agreed distribution of development trips to/from each access point onto the existing and proposed road network in north-east Chelmsford.

Although public transport demand has not been specifically modelled, the VISUM forecast model also includes the proposed bus services and priority measures installed along the A1016 corridor to accommodate sustainable travel to/from the Chelmsford Garden Community development.

Figure 4-7 shows the development zones comprising the CGC as well as the proposed access points and road infrastructure to help accommodate the development trips.

[6] https://www.chelmsford.gov.uk/media/vsxh3m1i/chelmsford-garden-community-development-framework-document-january-2023.pdf

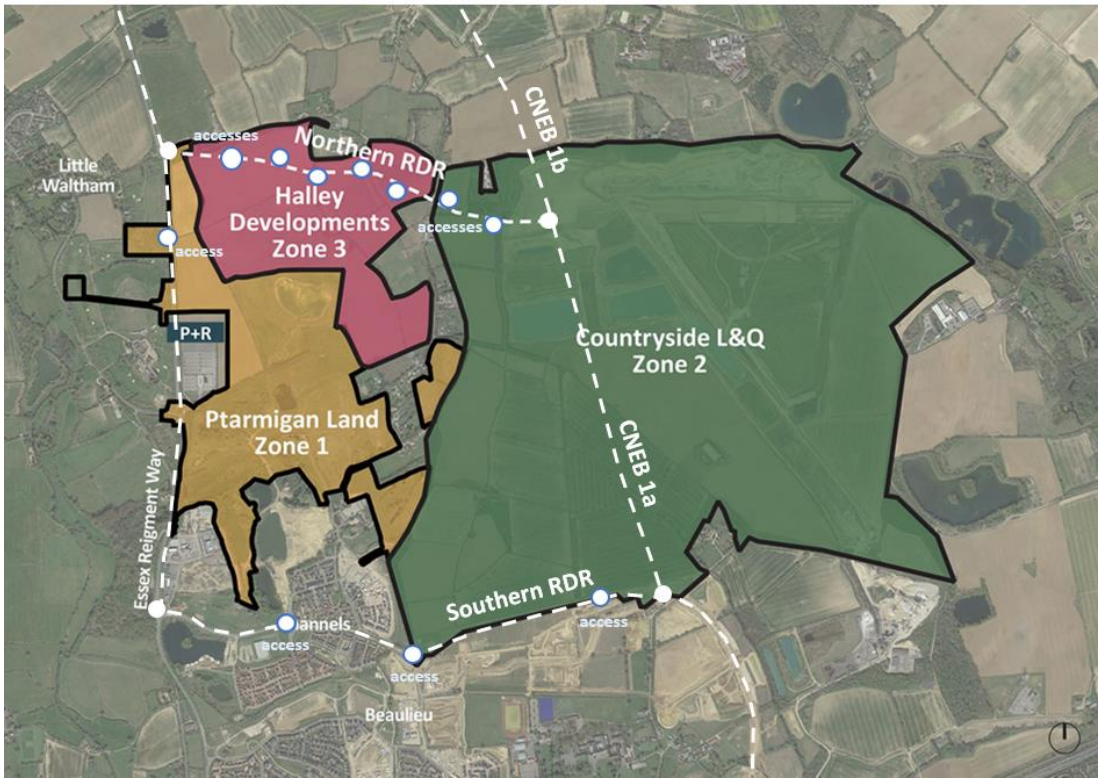


Figure 4-7: Chelmsford Garden Community modelled access points (latest modelling no longer includes CNEB 1b)

4.4 Local Plan Review Pre-Submission Modelled Scenarios

The main scenarios that have been modelled for the Pre-Submission stage of the Chelmsford Local Plan Review include the following:

Table 4-5: Main Scenarios Modelled

Main Scenarios	Summary
Baseline	Baseline with A12 widening. Modelled using forecast traffic flows comprising adjusted Adopted Local Plan development only in a 2041 assessment year.
LPRPS	Local Plan Review Pre-Submission scenario, with A12 widening. Modelled using flows from the baseline scenario **and** trips associated with the LPRPS development in a 2041 assessment year.

In addition to the above, several sensitivity tests have been carried out, as outlined below.

Table 4-6: Sensitivity Test Scenarios Modelled

Sensitivity Tests	Modelled Scenarios
Sensitivity Test 1: Network impact without A12 widening DCO proposals	Baseline without A12 widening DCO
	Local Plan Review Pre-Submission without A12 widening DCO
Sensitivity Test 2: Network impact with further mode shift to sustainable travel alternatives	Local Plan Review Pre-Submission with Essex Public Transport Accessibility Level (EPTAL) adjustments

Sensitivity Test 1 scenarios without A12 widening DCO proposals have been undertaken as part of the LPRPS modelling following Duty to Cooperate discussions between CCC, ECC and National Highways and concerns around the funding of the trunk road and junction improvements. Results and analysis are covered in Section 6 of this report.

The Sensitivity Test 2 scenario has been undertaken to consider the potential network impact of a greater mode shift to active and sustainable alternatives from the LPRPS developments. Further information on the methodology, results and analysis of this sensitivity test are covered in Section 7 of this report.

5 Main Scenarios: Model Outputs and Analysis

The following section provides analysis of the model outputs produced for the appraisal of the LPRPS Development. This includes the presentation of outputs for the Baseline and LPRPS scenarios as referenced in Table 4-5.

Whilst not all outputs produced have been included for analysis, for reasons outlined within each sub-section below, those shown illustrate the key findings of the modelling work undertaken.

5.1 Assignment of Development Trips

Figures 5-1 to 5-6 show the assignment of trips across the road network to/from the main development sites in the LPRPS scenario in the AM peak. For this analysis, plots have only been shown for the AM peak, as the distribution follows the same pattern in the PM peak - but in the opposite direction.

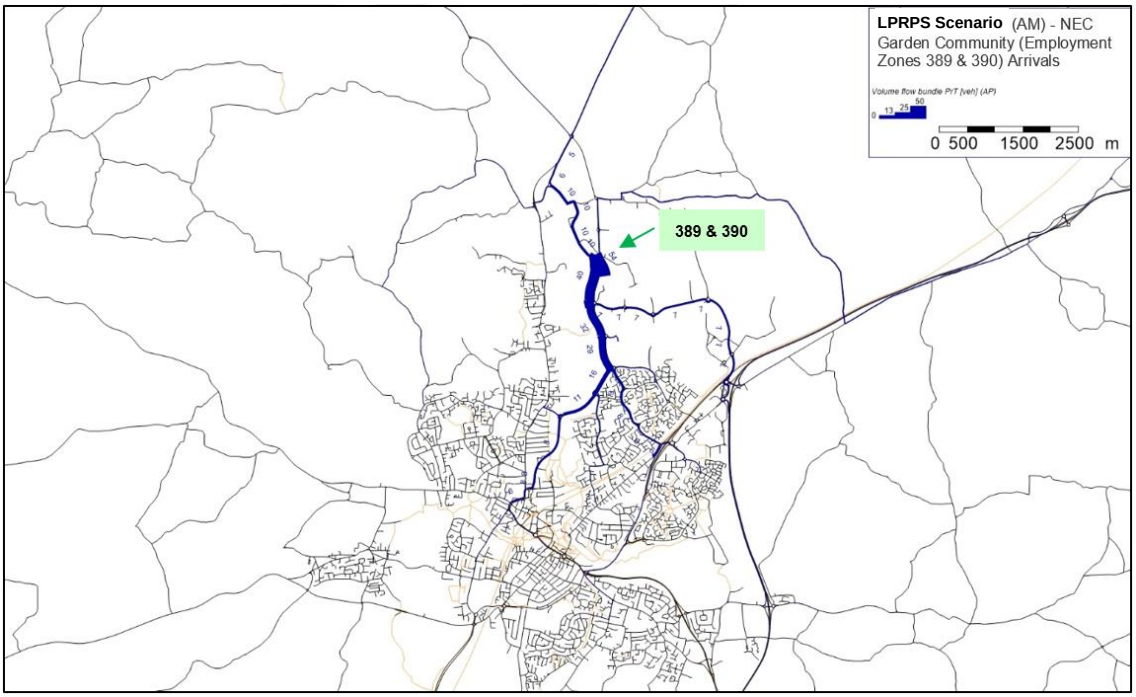


Figure 5-1: Development Trip Assignment for Chelmsford Garden Community (Employment) - AM Arrivals (zone location and ID shown in green)

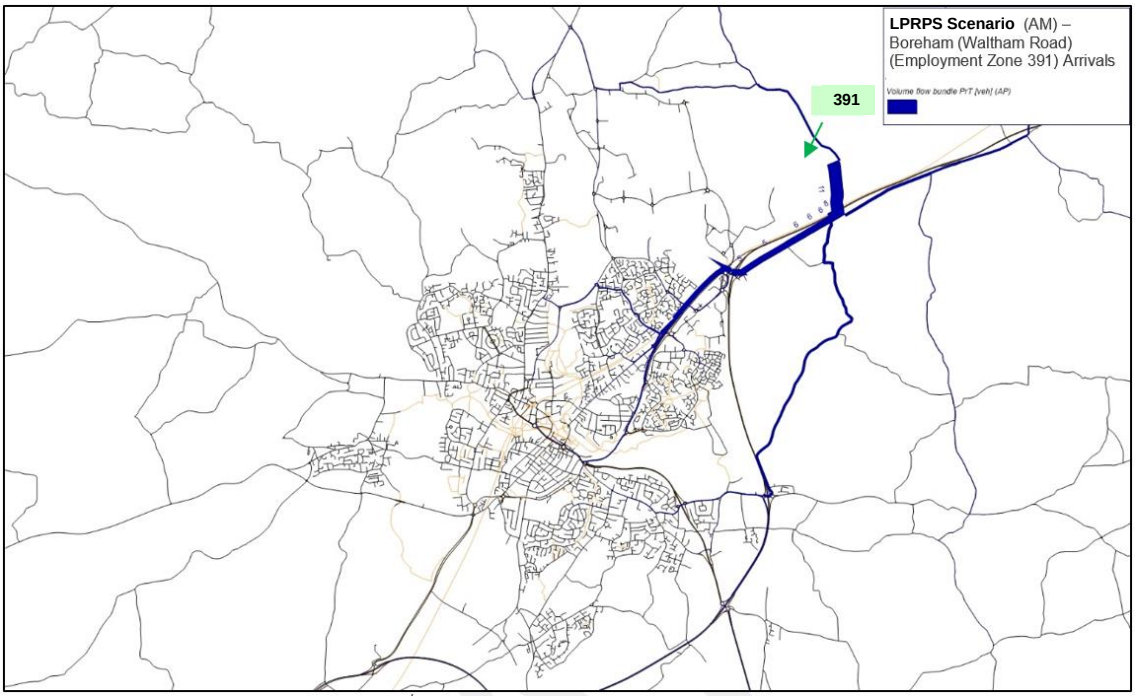


Figure 5-2: Development Trip Assignment for Boreham Employment Area - AM Arrivals (zone location and ID shown in green)

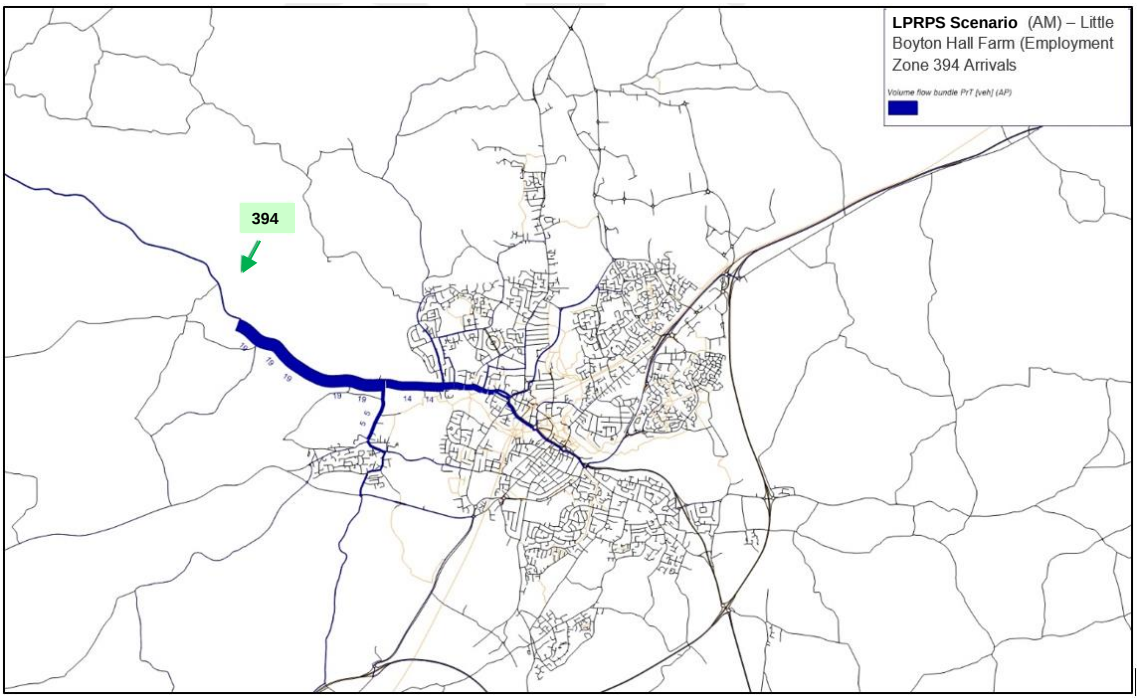


Figure 5-3: Development Trip Assignment for Little Boyton Hall Farm (Employment) - AM Arrivals (zone location and ID shown in green)

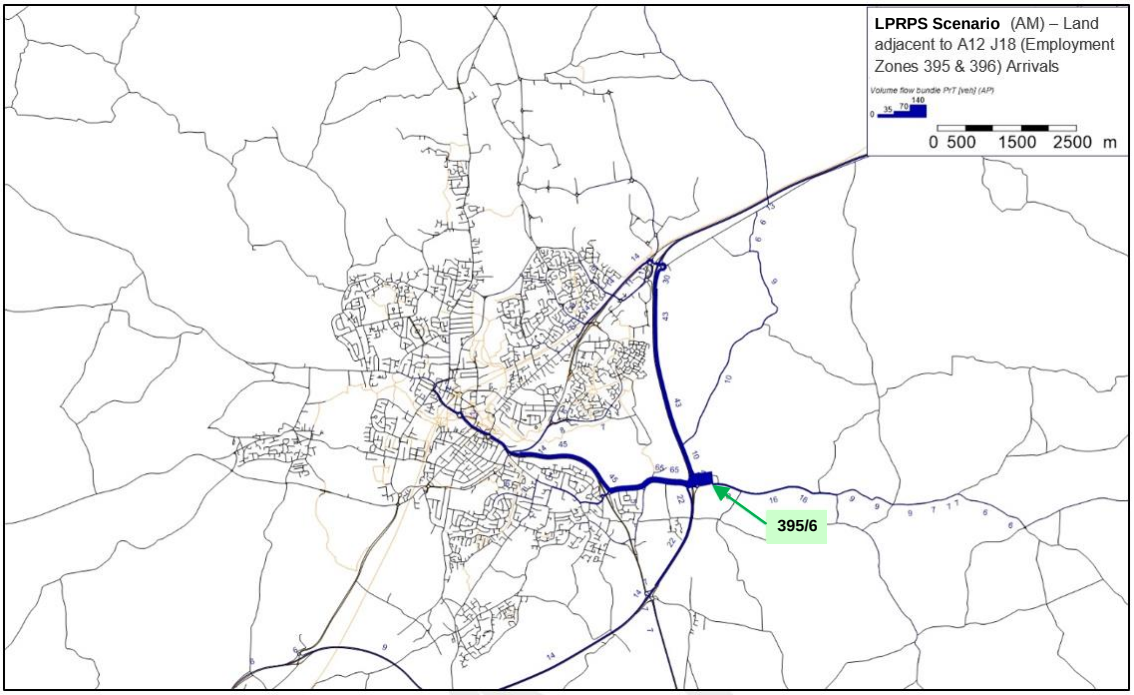


Figure 5-4: Development Trip Assignment for Land Adjacent to the A12 J18 (Employment) - AM Arrivals (zone location and ID shown in green)

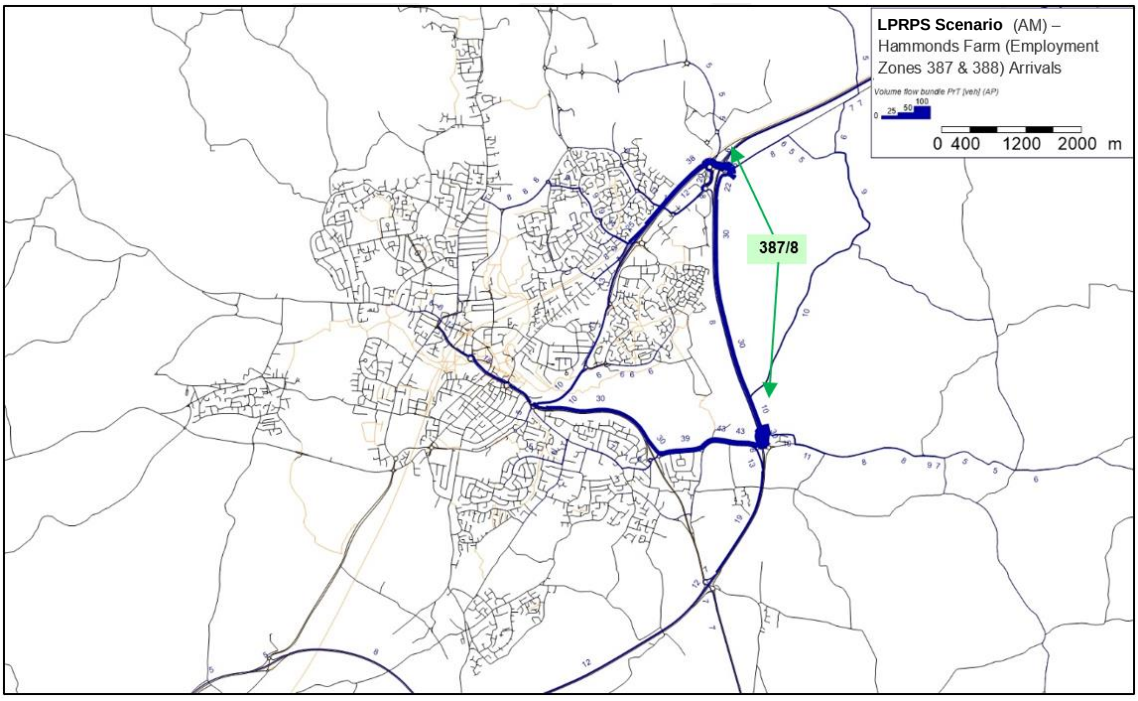


Figure 5-5: Development Trip Assignment for Hammonds Farm (Employment) - AM Arrivals (zone location and ID shown in green)

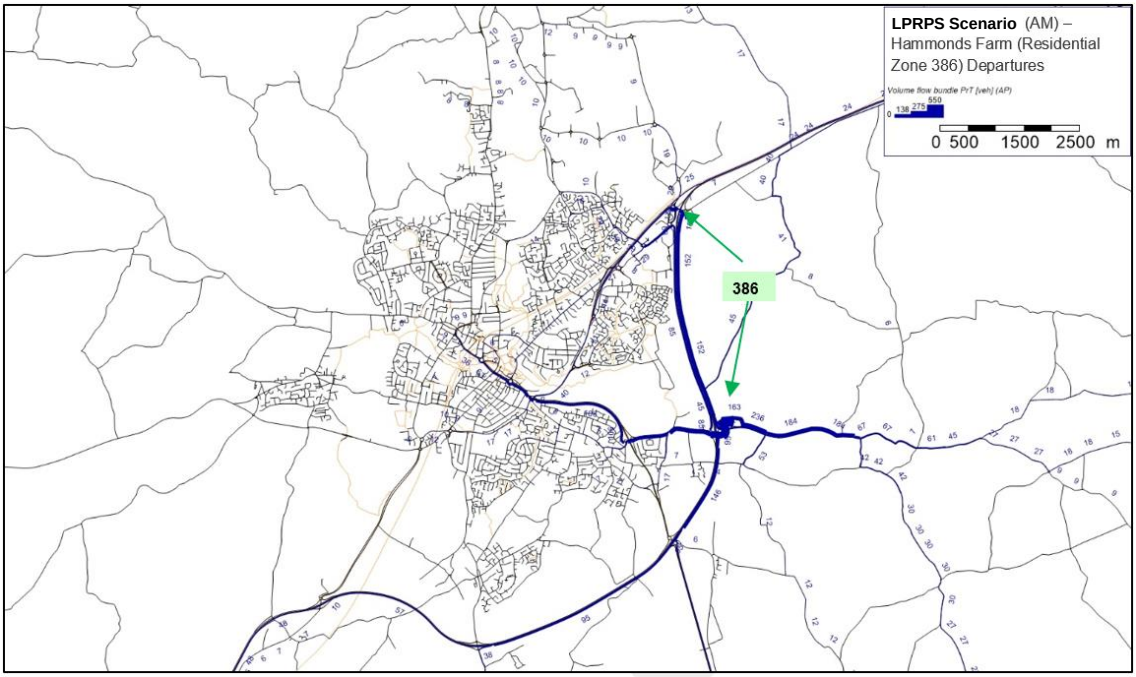


Figure 5-6: Development Trip Assignment for Hammonds Farm (Residential) - AM Departures (zone location and ID shown in green)

Assignment of Development Trips	Key Commentary
Residential Sites	
Hammonds Farm (Zone 386)	Trips from Hammonds Farm are assigned to the road network with a 70/30 split via A12 Junction 18 / A414 (south) and Junction 19 (north) respectively. Once on the network, trips are then modelled with an even distribution to end destinations via the main strategic routes in the vicinity of the development including the A12 and A414.
Employment Sites	
Hammonds Farm (Zone 387/388)	For employment at Hammonds Farm, the assignment of trips is similar to those for residential trips, with a somewhat greater focus on trips from the city centre via the A1114 Essex Yeomanry Way and from Springfield and areas north of Chelmsford via the A12.
Land Adjacent to A12 J18 (Zone 395/396)	Arrivals to the 'Land adjacent to A12 Junction 18' employment site, originate predominantly from Chelmsford city centre via the A1114 Essex Yeomanry Way and areas to the north along the A12 corridor.
Chelmsford Garden Community (Zone 390)	Arrivals to the Chelmsford Garden Community employment site are largely focused from the city centre via the A1016 Chelmer Valley Road and via A12 corridor, with a proportion using rural routes from satellite villages including Broomfield/Little Waltham and Boreham/Hatfield Peverel.
Boreham (Zone 391)	Modelled trips to the Boreham employment site originate predominantly from central Chelmsford and Springfield and route

	via the A138 Chelmer Road and through the Boreham Interchange. It is noted that trips with origins from the south, route via A12 J18 and Hammonds Road to avoid congestion along the A12.
Little Boyton Hall (Zone 394)	Trips to Little Boyton Hall route via the A1060 Roxwell Road, with the majority originating or routing through Chelmsford city centre.

To place the development trip assignment into context, of the sites highlighted in the table above, only Hammonds Farm and Land Adjacent to the A12 J18 are shown in the modelling to generate traffic flows of sufficient volume to impact traffic conditions significantly along the routes presented in the assignment plots.

Focusing on the A12 corridor sites, development trips might be expected to add to existing traffic flows along the A12 itself as well as the A414 to/from Maldon and the A1114 Essex Yeomanry Way route to/from the city centre.

Development flows from Hammonds Farm are also shown to route via the Boreham Interchange and the A138 Chelmer Road into the City Centre from the north, and via local access routes in north Chelmsford including the A130 Colchester Road / White Hart Lane.

5.2 Queue Length Analysis

Relative queue length plots are a useful tool to identify junctions in the strategic model with indicative congestion in the future. It is important to note that the queues illustrated in the plots highlight the full length of modelled links along which queues extend. They do not necessarily represent the absolute length of a modelled queue but are nevertheless sufficient in indicating the broad extent of modelled congestion in a particular location.

Queues modelled at signalised junctions are a reflection of the timings included in the strategic model. These will necessarily be less accurate than is possible with a local junction model and this should be considered when reviewing strategic modelling results.

Figure 5-7 to Figure 5-10 show the relative queue length plots for the Baseline and LPRPS Scenario for both the AM and PM peaks.

5.2.1 Relative Queue Lengths: 2041 AM Peak

Figure 5-7: Relative queue length plot – Baseline – 2041 AM Peak

Figure 5-7 illustrates the relative queue lengths modelled for the 2041 baseline (without additional Local Plan development) in the AM peak, and shows modelled queuing in the following key locations in Chelmsford:

Modelled Queueing 2041 AM Peak - Key Locations
Army & Navy Roundabout - Baddow Road, Van Diemans Road*
A12 J17 (Howe Green)
Princes Road (Miami) Roundabout through to Widford Road Roundabout
Writtle Road junction with A1016 Waterhouse Lane
A1016 Chelmer Valley Road between Nabbotts Farm and Valley Bridge Roundabouts
A138 Chelmer Road southbound in vicinity of New Dukes Way
A1060 Roxwell Road westbound on approach to junction with Lordship Road
B1008 Main Road, Broomfield

*Modelled congestion would be expected to be worse with the existing (2023) roundabout layout.

The A12 Junction 17 at Howe Green is modelled with significant congestion in the 2041 baseline with queues on the southbound off-slip extending back along the A12 carriageway. Whilst a relatively small proportion of Local Plan development trips are shown in the modelling to route through the junction, queues extending back along the A12 carriageway would likely heighten the impact of development trips routing along the A12.

Modelled queue extents along the A138 Chelmer Road in the vicinity of New Dukes Way, Springfield are likely linked to the extent of congestion modelled along the alternative A1016 Chelmer Valley Road route into Chelmsford from the north - resulting in traffic routing via the CNEB and A138 Chelmer Road to access the City Centre.

It should also be noted that queues shown on approaches to the Army and Navy Roundabout would likely be significantly worse without the Sustainable Transport Package in place which includes the redesign of the junction and Park and Ride expansion included in the modelling.

Figure 5-8: Relative queue length plot – LPRPS scenario – 2041 AM Peak

Figure 5-8 illustrates the relative queue lengths modelled for the 2041 LPRPS scenario in the AM peak, and shows modelled queuing in the following key locations in Chelmsford:

Queue Length Analysis - AM Peak	Key Commentary
A12	Moderate increase in queuing along A12 southbound carriageway caused by congestion at A12 J17 (Howe Green)
A1114 Essex Yeomanry Way / Southend Road	Slight increases in queues on approaches to the A12 J17

Army & Navy Roundabout	Small increases in queue extents modelled along Baddow Road.
A1016 Essex Regiment Way + Chelmer Valley Road	Small increases in queueing along southbound corridor into city centre.
City Centre	Small increases in queue extents at junctions along A1060 Parkway - specifically at Odeon and Market Roundabouts, on approach to Nabbotts Farm Roundabout from the north and on Eastern Approach, joining the A138 Chelmer Road
Eve's Corner, Danbury	Increase in queuing on approach to Eve's Corner from Maldon.

The pattern of queuing in the AM peak under the LPRPS scenario is consistent with the patterns modelled in the Baseline scenario, but with increases in extents in queues in particular locations.

Traffic flows along the A12, on the approach to the Junction 17 off-slip at Howe Green are shown to increase with the addition of Local Plan development traffic.

In the City Centre, there are some increases in queue extents at junctions along the A1060 Parkway – particularly on High Bridge Road on approach to the Odeon roundabout. At the Odeon Roundabout, queues extend along High Bridge Road and onto Springfield Road with the addition of Local Plan development. This is understood to be a result of increased flows along the A1060 Parkway corridor and is indicative of the impact that development traffic might be expected to have on City Centre routes.

To the north of the City Centre, there is also an increase in modelled queues on Essex Regiment Way, approaching Nabbotts Farm Roundabout and along Chelmer Valley Road in the AM Peak as a result of Local Plan development, suggesting an increase in re-routing away from the Boreham Interchange to alternative routes into the city centre when the Local Plan development trips are added to the network.

There is an increase in modelled queue extents at Eve's Corner, Danbury in the AM peak, between the Baseline and LPRPS scenarios – likely attributable to the Hammonds Farm development. It should, however, be noted that the part-time signals at the junction have not been modelled at the junction (as they are currently in operation for a few minutes in the peak hours). In reality, the expectation would be for the part-time signals to regulate flows along the A414 for longer periods during the peak hours in order to accommodate Local Plan development traffic through Danbury.

5.2.2 Relative Queue Lengths: 2041 PM Peak

Figure 5-9: Relative queue length plot – Baseline – 2041 PM Peak

Figure 5-9 illustrates the relative queue lengths modelled for the 2041 baseline (without additional Local Plan development) in the PM peak, and shows modelled queuing in the following key locations in Chelmsford:

Modelled Queueing 2041 PM Peak - Key Locations
City Centre junctions along Parkway between A1016 Waterhouse Lane and Odeon Roundabout
Army & Navy Roundabout* - A138 Chelmer Road
A12 J17 (Howe Green)
Princes Road (Miami) Roundabout and A1016 Westway Roundabout
Writtle Road junction with A1016 Waterhouse Lane
A1016 Chelmer Valley Road between Nabbotts Farm and Lawn Lane Roundabouts
Valley Bridge Road at junction with B1008 Broomfield Road and with A1016 Chelmer Valley Road

**Modelled congestion would be expected to be worse with the existing (2023) roundabout layout.*

Queues are also shown in the baseline model exiting Writtle south along Margaretting Road at the junction with the A414. This should perhaps be seen as indicative of queuing at junctions through Writtle in general, caused by through-routing between north and south/west Chelmsford via the A414.

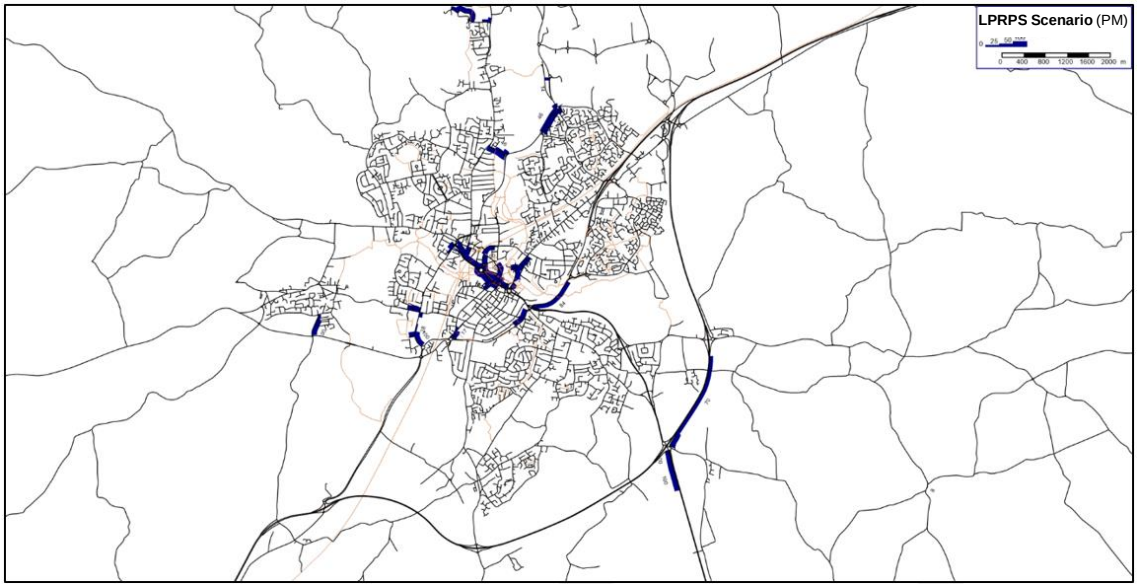


Figure 5-10: Relative queue length plot – LPRPS scenario – 2041 PM Peak

Figure 5-10 illustrates the relative queue lengths modelled for the 2041 Local Plan development in the PM peak, and shows modelled queuing in the following key locations in Chelmsford:

Queue Length Analysis - PM Peak	Key Commentary
A12	Increase in queuing along A12 southbound carriageway caused by congestion at A12 J17 (Howe Green)
Army & Navy Roundabout	Small increase in queue extents modelled along A138 Chelmer Road
A1016 Chelmer Valley Road	Small increase in queuing shown between Nabbotts Farm and Lawn Lane Roundabouts (and along Lawn Lane itself)
City Centre	Small increase in queue extents modelled on and around A1060 Parkway and on Victora Road. Significant increase in queues along A138 Chelmer Road bridge on approach to Army & Navy junction

Similar to the AM peak, modelled queues are shown along the A12, tracking back from the Junction 17 off-slip at Howe Green in the PM peak hour forecast Baseline scenario, and this is shown to increase with the addition of Local Plan development traffic.

In the city centre, queues along the A138 Chelmer Road approach to the Army & Navy Roundabout increase notably in the PM peak – although are not shown to

reach back to the junction with Chelmer Village Way. This could suggest a re-routing away from the Boreham Interchange to alternative routes into the city centre when the Local Plan development trips are added to the network.

Similar to the AM peak, modelled queues at the Odeon Roundabout and along High Bridge Road are shown to worsen and extend further onto Springfield Road. This is understood to be a result of increased flows along the A1060 Parkway corridor and is indicative of the impact that development traffic might be expected to have on city centre routes. Queues are also modelled to worse along Victoria Road, extending almost back to the junction with New Street.

Overall findings from an appraisal of queue length patterns with/without LPRPS development are consistent and comparable with those from the previous stage modelling of the Local Plan Review Preferred Approach.

5.3 Link Capacity Analysis

Volume/Capacity (V/C) ratio plots are presented in this report to identify links across the strategic modelled network with limited or no spare capacity in the future.

Links with a V/C ratio between 80 and 89 are shown in the model (highlighted in yellow) to be operating with limited spare capacity. It is likely that traffic will be affected by somewhat unstable journey times and an absence of free-flowing traffic conditions.

Links with a V/C ratio between 90 and 99 are shown in the model (highlighted in amber) to be operating with very limited spare capacity. It is likely that concentrated traffic volumes on these links will experience some journey time delay and speed limitations.

Links with a V/C ratio of 100 are shown in the model (highlighted in red) to be operating with no spare capacity, whilst those with a V/C ratio exceeding 100 are shown to have a demand flow that exceeds the available practical capacity. It is likely that heavily concentrated traffic volumes on these links will experience notable journey time delay and highly restricted speeds.

5.3.1 Volume/Capacity Stats: 2041 Baseline

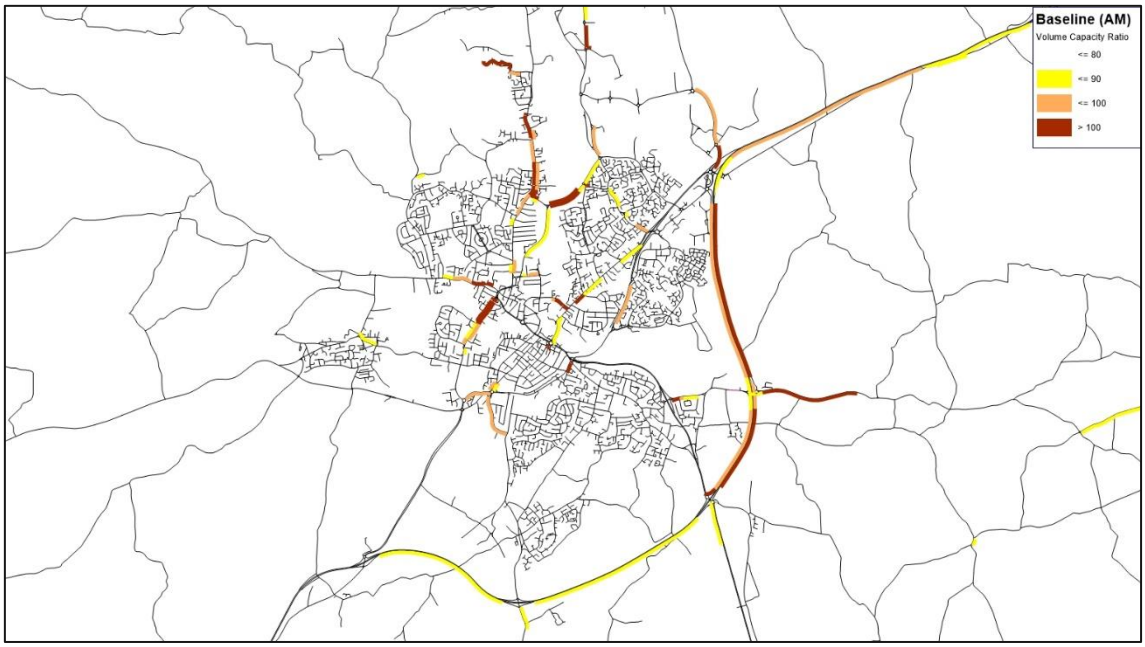


Figure 5-11: Volume/Capacity plot – Baseline – 2041 AM Peak

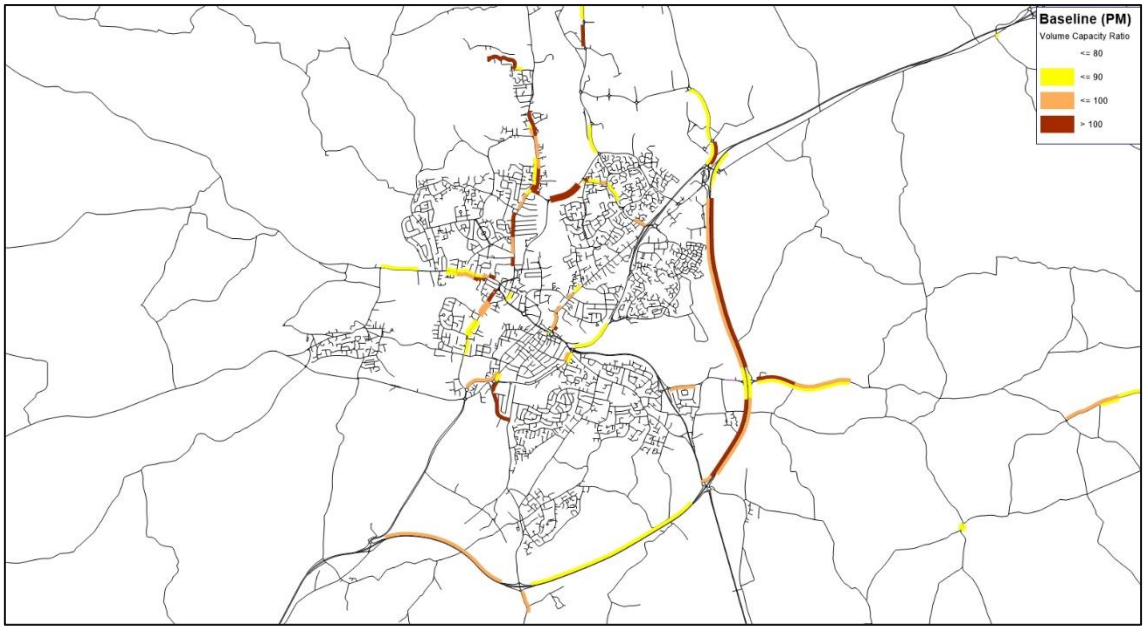


Figure 5-12: Volume/Capacity plot – Baseline – 2041 PM Peak

The 2041 baseline (without additional Local Plan development) shows modelled links with no spare capacity along the following key routes in Chelmsford across the AM and PM peaks:

Modelled Capacity Limitations 2041 Baseline - Key Locations
A12 between J19 Boreham Interchange and J17 Howe Green
A414 westbound between Danbury and Sandon
A131 Essex Regiment Way south of Sheepcotes Roundabout
A1016 Chelmer Valley Road between Lawn Lane and Valley Bridge Roundabouts
RDR/Beaulieu Parkway between CNEB and Boreham Interchange
A138 Chelmer Road southbound, north of junction with New Dukes Way
A1016 Waterhouse Lane / Rainsford Lane
B1008 Main Road, Broomfield

In addition, City Centre corridor routes including Rainsford Road, Springfield Road, Victoria Road and Van Diemans Road all contain short, modelled sections of route with V/C ratios exceeding 100.

The baseline volume/capacity statistics highlight the significant capacity pressures modelled along strategic corridor routes such as the A12 and A1016 Chelmer Valley Road in 2041. Both routes would be expected to accommodate a proportion of development trips associated with the LPRPS development sites.

With neither route modelled with spare capacity, traffic flows are shown to spread across nearby alternative routes. This is explored further in the traffic flow analysis in the following section of the report.

The volume over capacity plots also illustrate a potential capacity issue with the Beaulieu Parkway bridge link over the rail line between the Boreham Interchange and the Beaulieu Park Station access junction in the baseline AM and PM peak hours.

Of particular relevance to LPRPS development, the A414 in the vicinity of the proposed Hammonds Farm site is shown to function with no spare capacity in the 2041 AM peak baseline modelling.

Rural links in the vicinity of Broomfield Hospital are also shown with capacity limitations in the Baseline scenario However, it is important to acknowledge that the road network and zone coverage in the model is less granular in these outlying areas, and that the level of precision attached to traffic flows at specific locations on minor rural links is consequently reduced. It is therefore advised that

any observations made concerning network impact in outer areas of the strategic model are caveated as being subject to more detailed modelling being undertaken as part of future planning applications.

5.3.2 Link Capacity Impact of Local Plan Review Pre-Submission Development

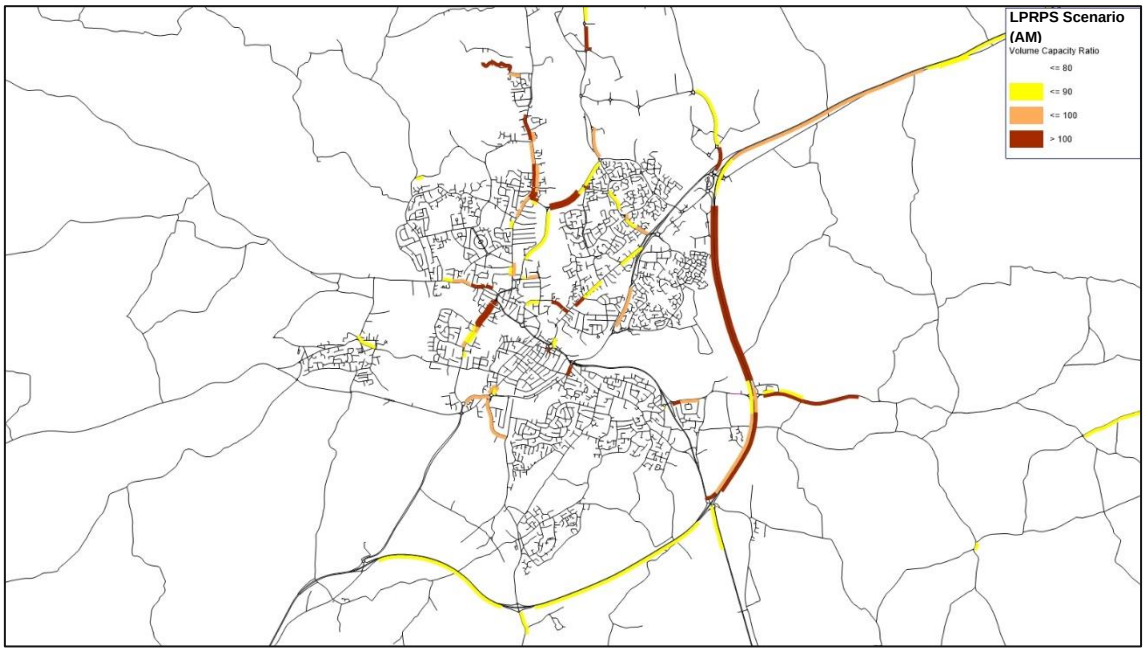


Figure 5-13: Volume/Capacity plot – LPRPS scenario – 2041 AM Peak

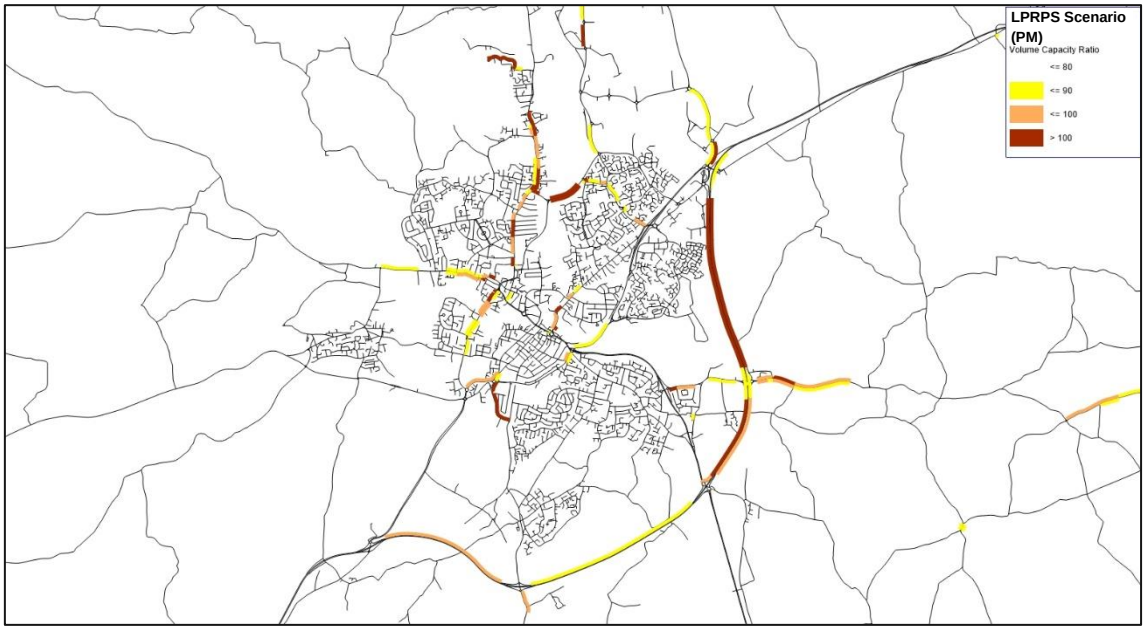


Figure 5-14: Volume/Capacity plot – LPRPS scenario – 2041 PM Peak

There is little in the way of observable differences between model outputs with and without LPRPS development – albeit with increases in the V/C ratio modelled on links in the vicinity of development along the A12 corridor. This is as a result of many of the key strategic corridors in the City Centre, such as along the A1016 Chelmer Valley Road, and the A12 corridor, already being at capacity in the Baseline 2041 scenario. Both routes would be expected to accommodate a proportion of development trips associated with the LPRPS development.

However, these outputs should not be viewed in isolation and should be considered alongside the reported queue length and flow difference plots, in particular, to gain a more holistic understanding of the modelled impact of the LPRPS development.

5.4 Traffic Flow Analysis

The following plots taken from the Chelmsford Forecast Model illustrate the change in traffic flow patterns across the local and strategic road network following the addition of development trips associated with the LPRPS development sites.

Traffic flow increases are shown in red, whilst traffic flow decreases are shown in green.

When viewed in isolation, an increase in traffic flow (whilst undesirable) is not necessarily problematic – so long as there is sufficient network capacity (on links and at junctions) to accommodate the increase. Therefore, the flow difference plots should be viewed alongside the queue length and volume/capacity plots shown earlier in the report to develop a more rounded appraisal of LPRPS development impact.

An increase in modelled traffic flow is understood to be the combined result of the direct introduction of new development trips, and the indirect impact of traffic re-routing to avoid areas of worsening congestion on the road network.

A reduction in modelled traffic flow is likely the result of traffic re-routing away from congestion 'pinch-points', thereby reducing the volume of upstream and/or downstream traffic along impacted routes in the model.

Summary analysis/commentary is provided for the AM peak and PM peaks combined.

Figure 5-15: 2041 Baseline vs LPRPS Development flow difference plot – 2041 AM Peak

Figure 5-16: 2041 Baseline vs LPRPS Development flow difference plot – 2041 PM Peak

Flow Difference Analysis	Key Commentary
A12	Greatest flow increase shown along the A12 carriageway between Junctions 18 and 19 in both peak hours, but particularly in the PM peak. Notable flow increases also modelled on the A12 north of Junction 19 in both peaks, and south of Junction 18 in the PM peak only
A138 Chelmer Road	Increase in flows shown along the A138 in the AM Peak along the entire length of route between the Boreham Interchange (A12 J19) and the Army and Navy Roundabout. Similar increase shown between the Boreham Interchange and New Dukes Way, as well on the approach to the Chelmer Road / Chelmer Village Way roundabout in the PM Peak.
A1114 Essex Yeomanry Way	Increase in flow modelled along A1114 Essex Yeomanry Way and through the Army & Navy roundabout, particularly in the AM peak
A414	An increase in peak hour traffic flow modelled along the A414, either side of J18 (both west and east)
City Centre	Increase in traffic flow modelled along Parkway, particularly in the PM peak
Rural Routes	Increase in modelled flows noted along routes to the east of the A12 including Hammonds Road and North Hill (through Little Baddow). Increase in flows also shown along Woodhill Road running parallel to the south of the A414 between Sandon and Danbury.

The peak hour flow difference plots effectively show the impact of development trips associated with Hammonds Farm and the employment land adjacent to A12 J18 on traffic flow patterns across the surrounding road network.

As can be seen from the queue length and volume/capacity analysis in earlier sections of this report, network capacity issues are modelled along the A12 between Junction 17 and 19. A significant proportion of development trips might be expected to route along the A12 - both northbound and southbound - from Junction 18, thereby exacerbating congestion along the trunk road. The link flow difference plots show that this will increase the likelihood of traffic re-routing along rural roads to the east of the A12, impacting the villages of Boreham and Little Baddow.

At the same time, development trips will likely have a direct impact on queuing along the A414 on the westbound approach to the A12 Junction 18, which has already been shown to have network capacity issues in the previous analysis shown. This results in the dispersal of background traffic flows from the A414 onto alternative rural routes through Danbury and Sandon to accommodate Local Plan development trips.

In the City Centre, traffic volumes are also shown to increase along A138 Chelmer Road and A1114 Essex Yeomanry Way and along A1060 Parkway, particularly in the PM peak. These routes are shown to accommodate additional trips from the largest LPRPS site modelled at Hammonds Farm in the vicinity of A12 Junction 18.

It is, however, apparent that overall flow change across the modelled network associated with LPRPS development is not significant. This is understood to be as a result of the application of VDM in the latest strategic modelling appraisal of the Pre-Submission. Use of VDM is shown to limit Local Plan development impact on the strategic road network as it effectively removes background traffic flows from the modelled peak hour, noticeably along the A12 corridor, to accommodate new development trips. This is apparent in the VDM comparison plots shown in Appendix D of this report.

5.5 Journey Time Analysis

Journey times for 14 routes have been extracted for both the 2041 baseline scenario and LPRPS scenario, for both the AM and PM peaks. The locations of the identified routes are illustrated in Figure 5-17 below.

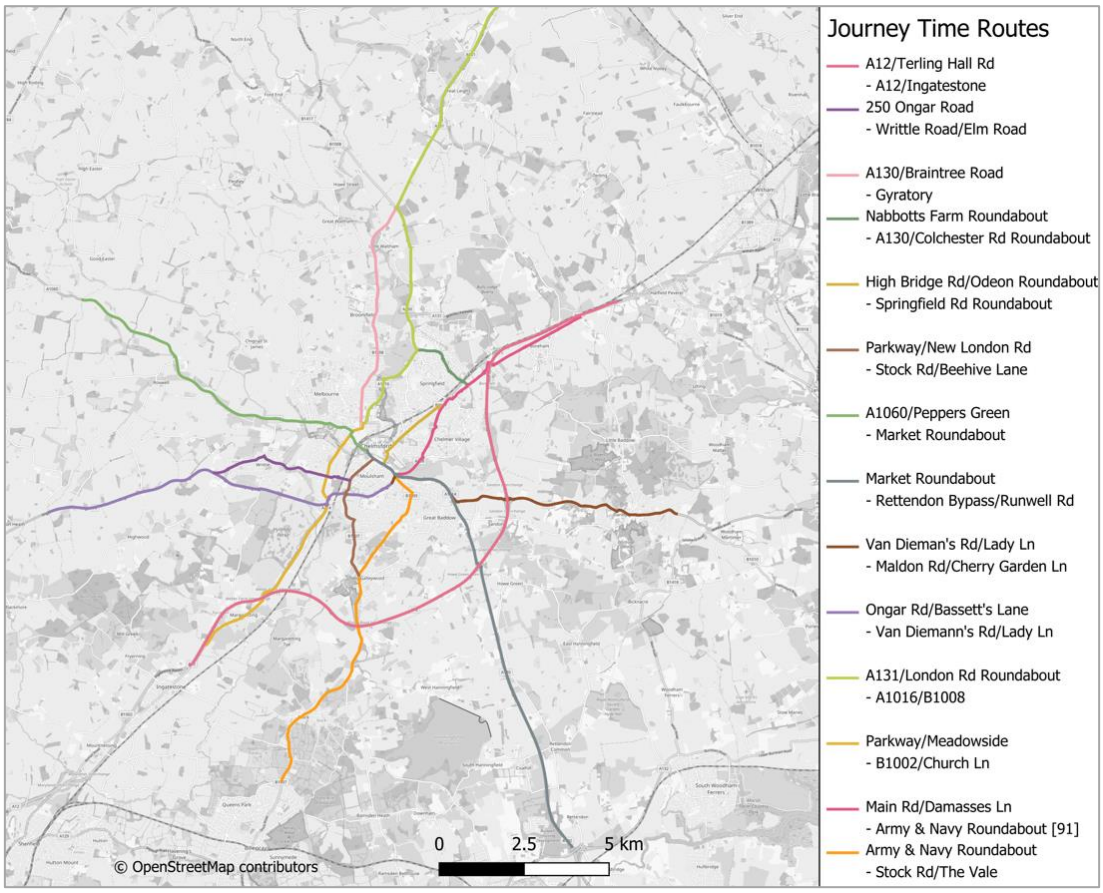


Figure 5-17: Key corridor routes in Chelmsford selected for journey time analysis

Directional journey times for the assessed routes are summarised in AM and PM peak tables found in Appendix E.

Journey time plots and commentary are also included in this section of the report for selected journey time routes expected to be most impacted by LPRPS development traffic - specifically:

- A12 Corridor - Hatfield Peverel to Ingatestone (and reverse)
- A414 corridor – Danbury to City Centre (and reverse)
- A130/A1114/A1060 corridor - Rettendon to Chelmsford
- Boreham to Army and Navy, via A138, Chelmer Road (and reverse)

- Springfield Road and High Bridge Road in the SE direction
- White Hart Lane in both directions

For each journey time plot, key points along each route have been highlighted to assist with interpretation.

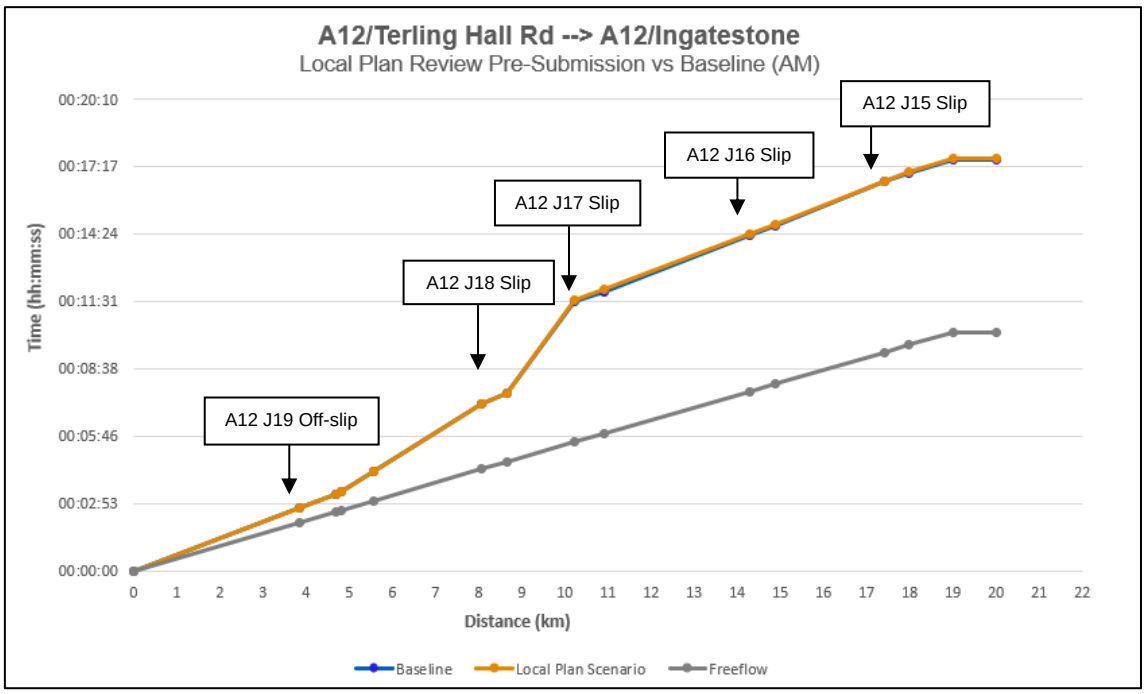


Figure 5-18: Journey Time plot for the A12 Corridor in the SB direction (Hatfield Peverel to Ingatestone), (AM Peak).

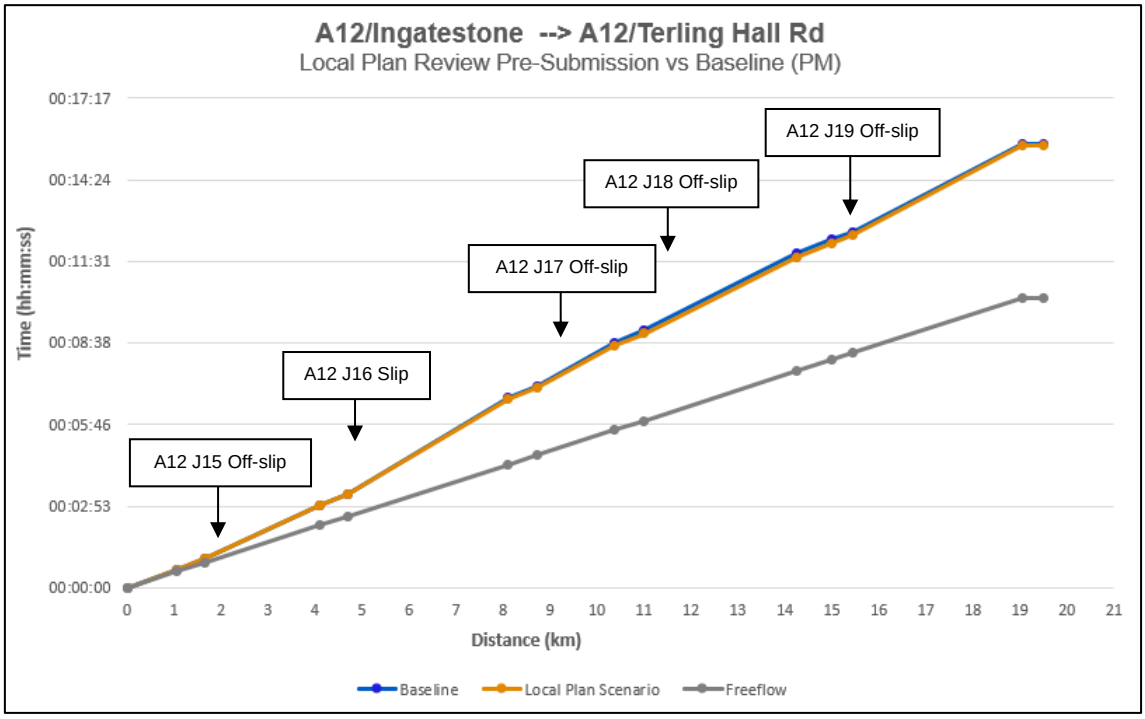


Figure 5-19: Journey Time plot for the A12 Corridor in the NB direction (Ingatestone to Hatfield Peverel), (PM Peak).

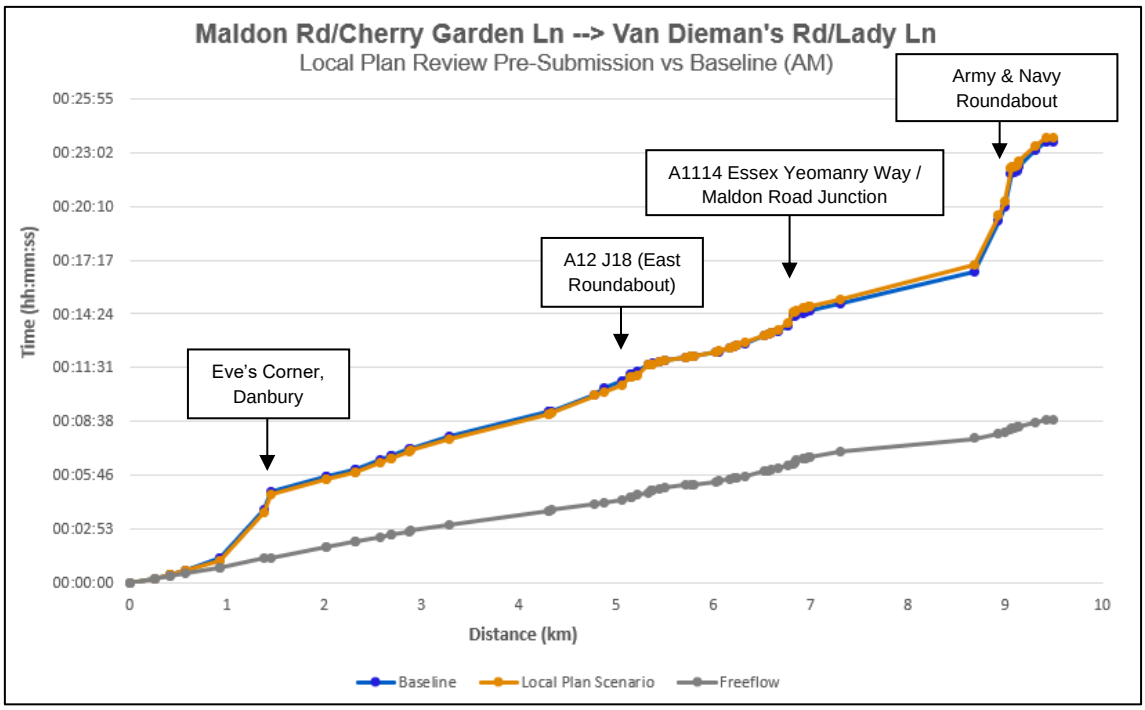


Figure 5-20: Journey Time plot for the A414 in the WB direction (Danbury to City Centre), (AM Peak).

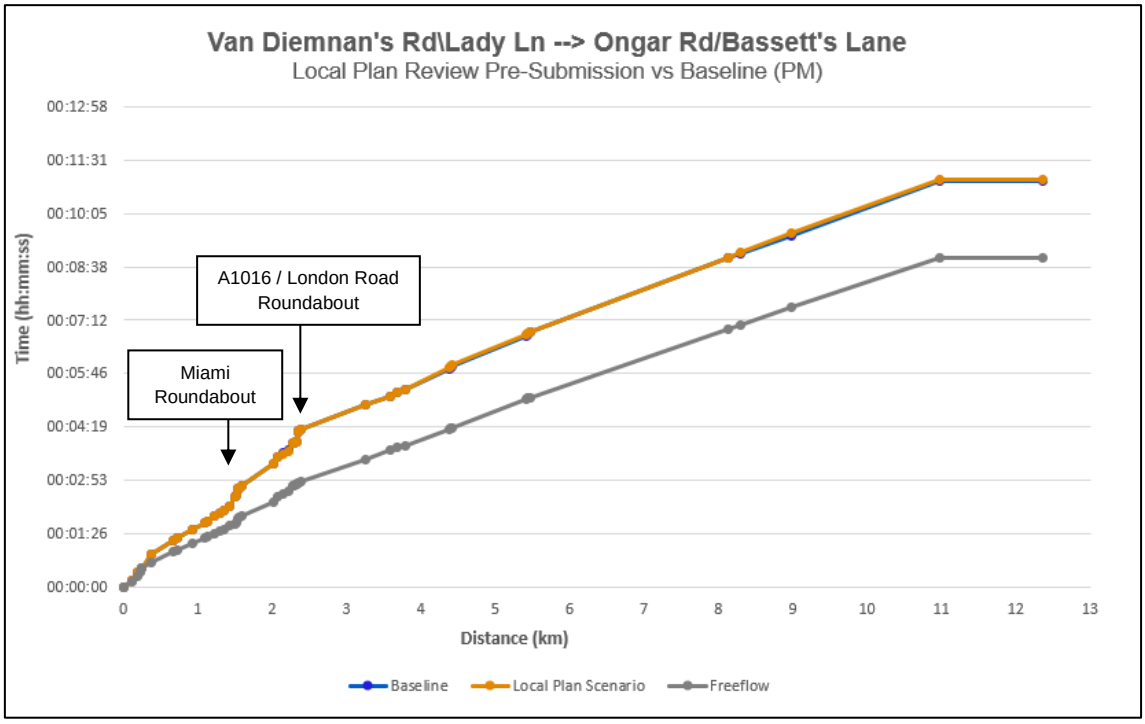


Figure 5-21: Journey Time plot for the A414 in the EB direction (City Centre to Danbury), (PM Peak).

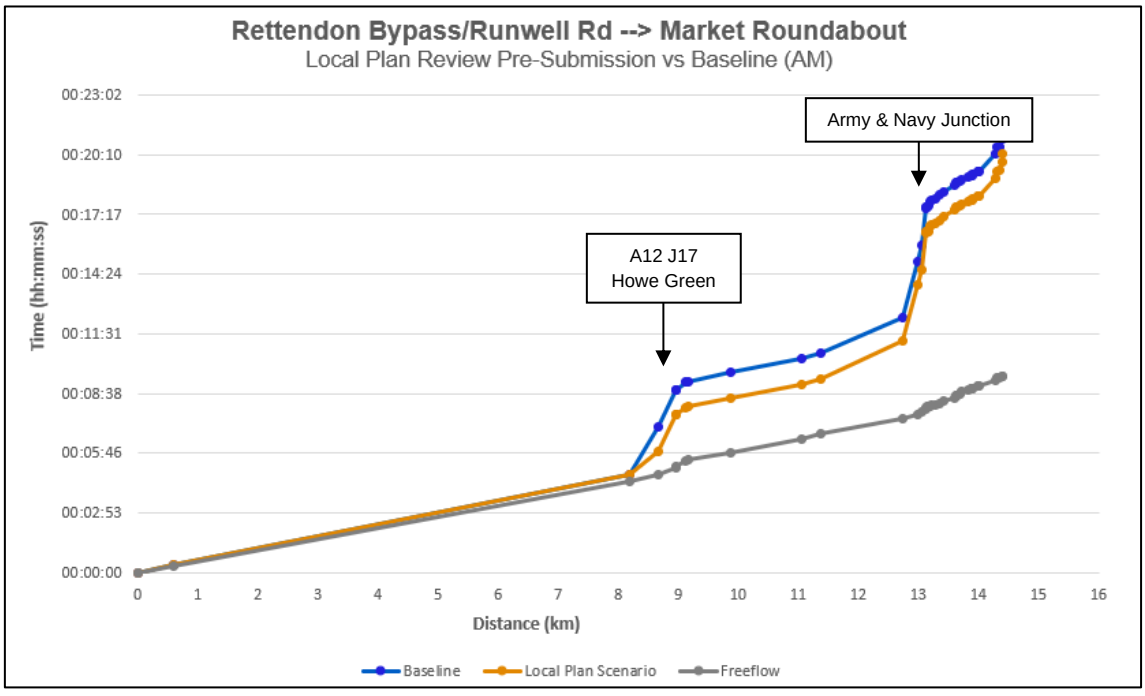


Figure 5-22: Journey Time Plot for the A130 / A1114 / A1060 in the NB direction (Rettendon to City Centre) (AM Peak).

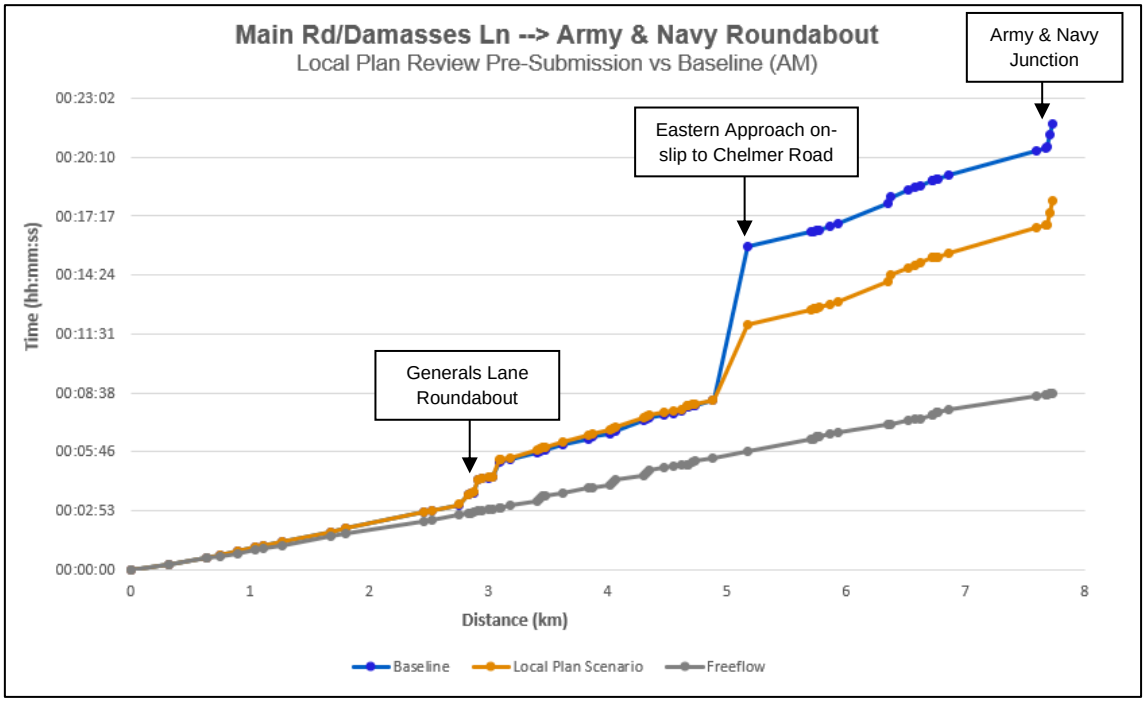


Figure 5-23: Journey Time Plot for SB route, between Boreham and the Army and Navy Roundabout, via Chelmer Road, in the SW direction (AM Peak).

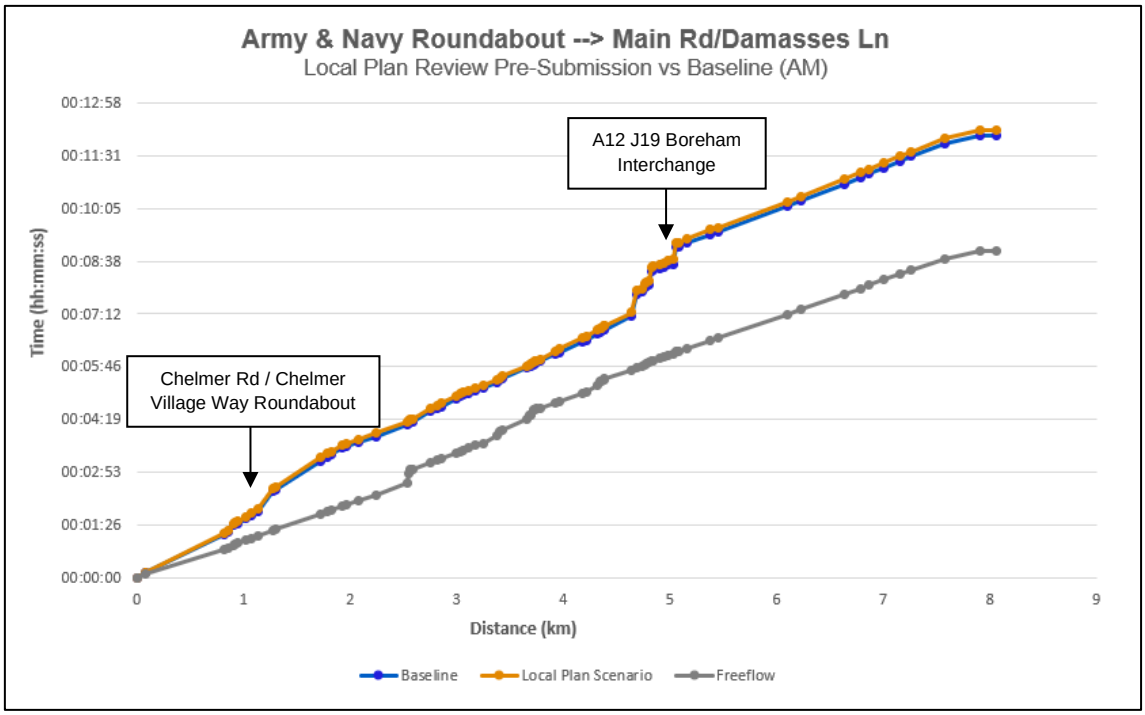


Figure 5-24: Journey Time Plot for the NB route between the Army and Navy Roundabout and Boreham, via Chelmer Road, in the NE direction (AM Peak).

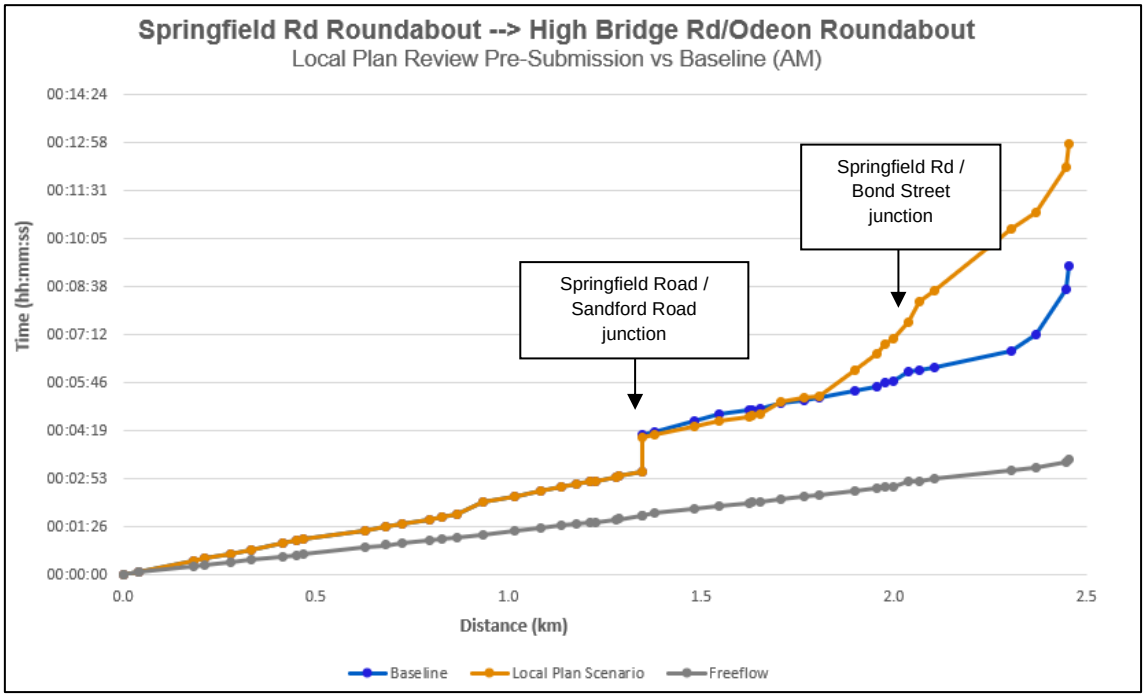


Figure 5-25: Journey Time Plot for Springfield Road and High Bridge Road, in the SE direction (AM Peak).

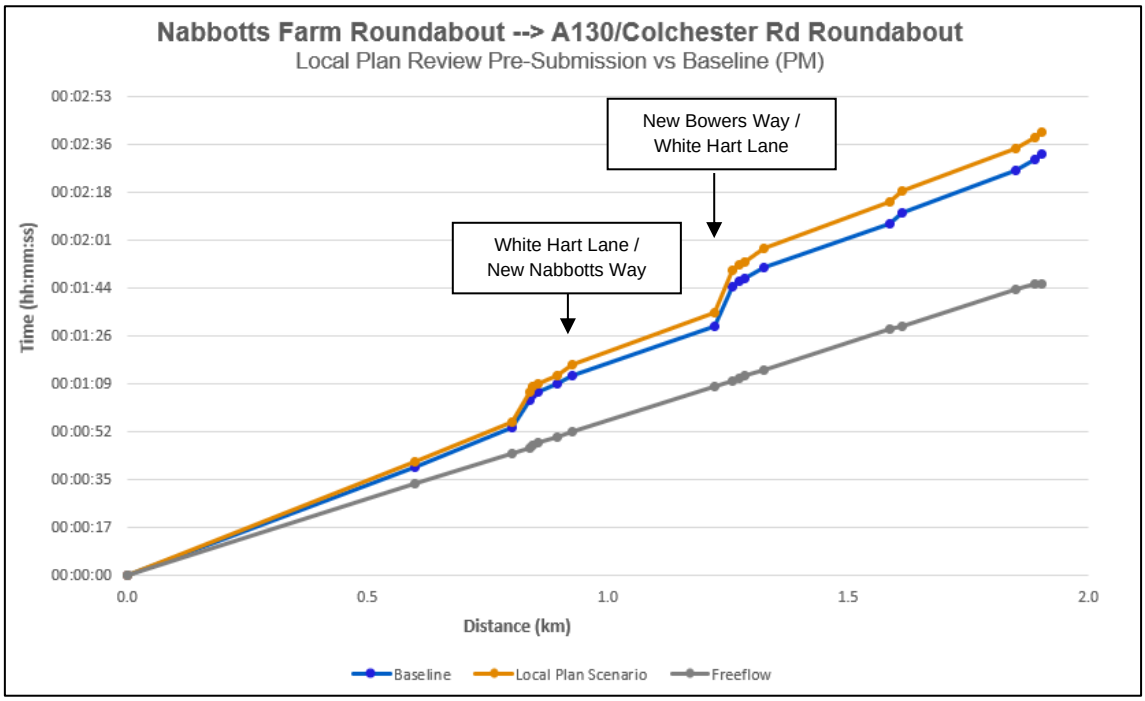


Figure 5-26: Journey Time Plot for White Hart Lane, in the SE direction (PM Peak).

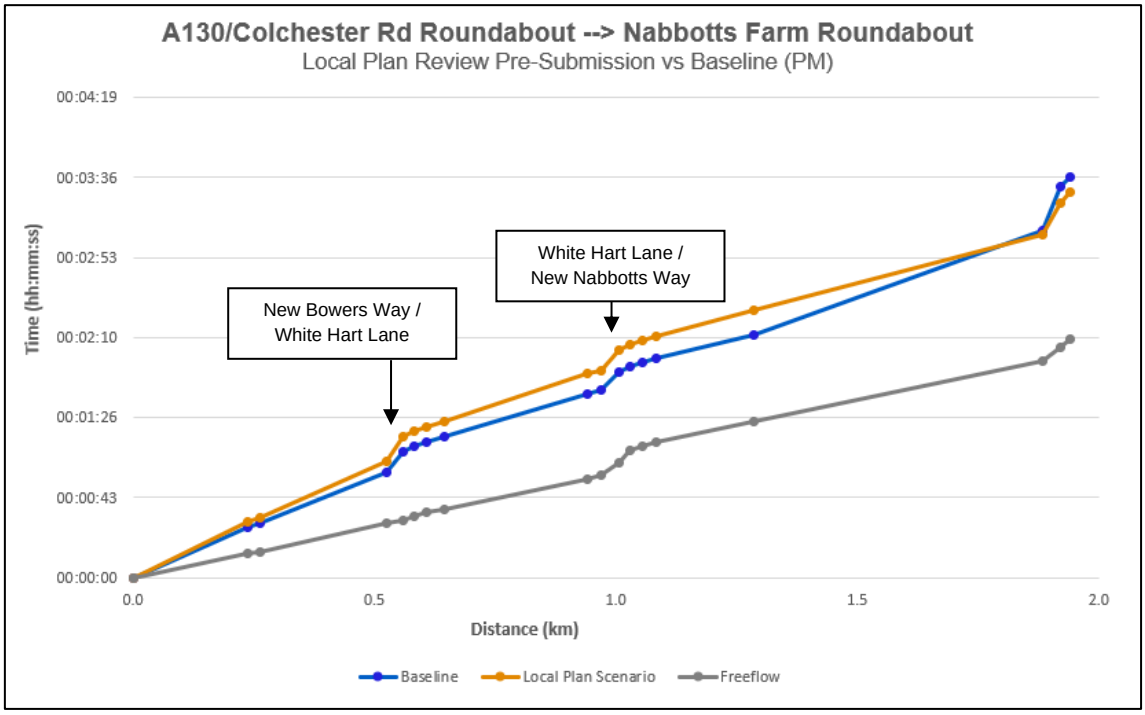


Figure 5-27: Journey Time Plot for White Hart Lane, in the NW direction (PM Peak).

Journey Time Analysis	Key Commentary
A12 Corridor	With significantly higher travel times for journeys along the route in the baseline compared with free-flow conditions, the application of VDM is understood to reduce the volume of background traffic along the congested A12 corridor to accommodate development trips in the LPRPS scenario. This results in a very small overall change in vehicle flows, and therefore little overall change in peak hour journey times along the A12 in either direction.
A414 Corridor	The addition of development in the LPRPS scenario results in a small increase in journey times along the A414 in both the westbound (AM) and eastbound (PM) direction, with the exception of a slight increase on the approach to the A12 and Essex Yeomanry Way, in both peaks.
A130/A1114 Corridor	With the addition of LPRPS development trips, northbound journey times along the A130/A1114 corridor towards Chelmsford City Centre are shown to increase by over a minute in the AM peak on the approach to A12 J17 at Howe Green.
A1060, Parkway	Similar to the A12 corridor, a significant increase in baseline journey times over free-flow on the approach to the Army & Navy Roundabout and along A1060 Parkway, suggest that the network is congested in the baseline. The application of VDM effectively limits the overall impact of new development trips on journey times along the route.
A138 Corridor	Journey times along the A138 corridor are largely unchanged between the baseline and LPRPS Scenario, with the exception of

	the most western section of route. Between the approach to the A138 Chelmer Road/New Dukes Way Roundabout and the Army and Navy Roundabout, journey times decrease by approximately four minutes, compared against the Baseline.
Springfield Road / High Bridge Road	The addition of development in the LPRPS scenario results in an increase in journey times at the southwest end of Springfield Road and onto High Bridge Road. Starting at the junction with Victoria Road, journey times continue to increase towards the city centre with a difference of 4 minutes between the Baseline and LPRPS Scenarios, on the approach to the Odeon Roundabout.
White Hart Lane	Journey times increase in the PM peak along White Hart Lane, in both directions under the LPRPS Scenario.

In summary:

- The LPRPS development is shown to have a minimal impact on journey times along the A12 corridor which is likely a result of the network already operating over capacity in the Baseline. In addition, the impact of applying the VDM process will result in a redistribution of trips away from the A12 corridor in the peak periods, further minimising the impact the Local Plan has on journey times. This helps to explain why an increase in journey times was reported for the A12, as part of the previous, Preferred Spatial Approach modelling (March 2024), which didn't make use of VDM.

- The addition of trips in the LPRPS scenario makes very little difference to journey times along the A414, with the exception of a slight increase on the approach to the A12 and Essex Yeomanry Way (A1114), in both peaks.

- Increases in journey times have been shown on key routes in the city centre as a result of LPRPS development, particularly on routes approaching key junctions such as the Odeon Roundabout and along Springfield Road.

- The journey time plots illustrate the impact of a variability in route assignment which can result in baseline journey times exceeding those for the LPRPS scenario on certain routes under congested network conditions. This effect is also demonstrated in the flow difference plots in Section 5.4 which show little overall change in City Centre traffic flow – likely caused by a broad displacement of background traffic across City Centre routes to accommodate additional development flows, as well as

the impact of using VDM, which results in reduced peak hour background traffic flows.

5.6 Summary of Cross-Boundary Impact

To assess the comparative cross-boundary impact of the LPRPS development, a review has been undertaken of the forecast flows on key routes travelling in and out of neighbouring Districts and Boroughs.

To carry out this review, inbound and outbound 2041 forecast traffic flows have been extracted from eight key routes at the point the route crosses the Chelmsford administrative boundary. Figure 5-28 shows the points at which data has been extracted.

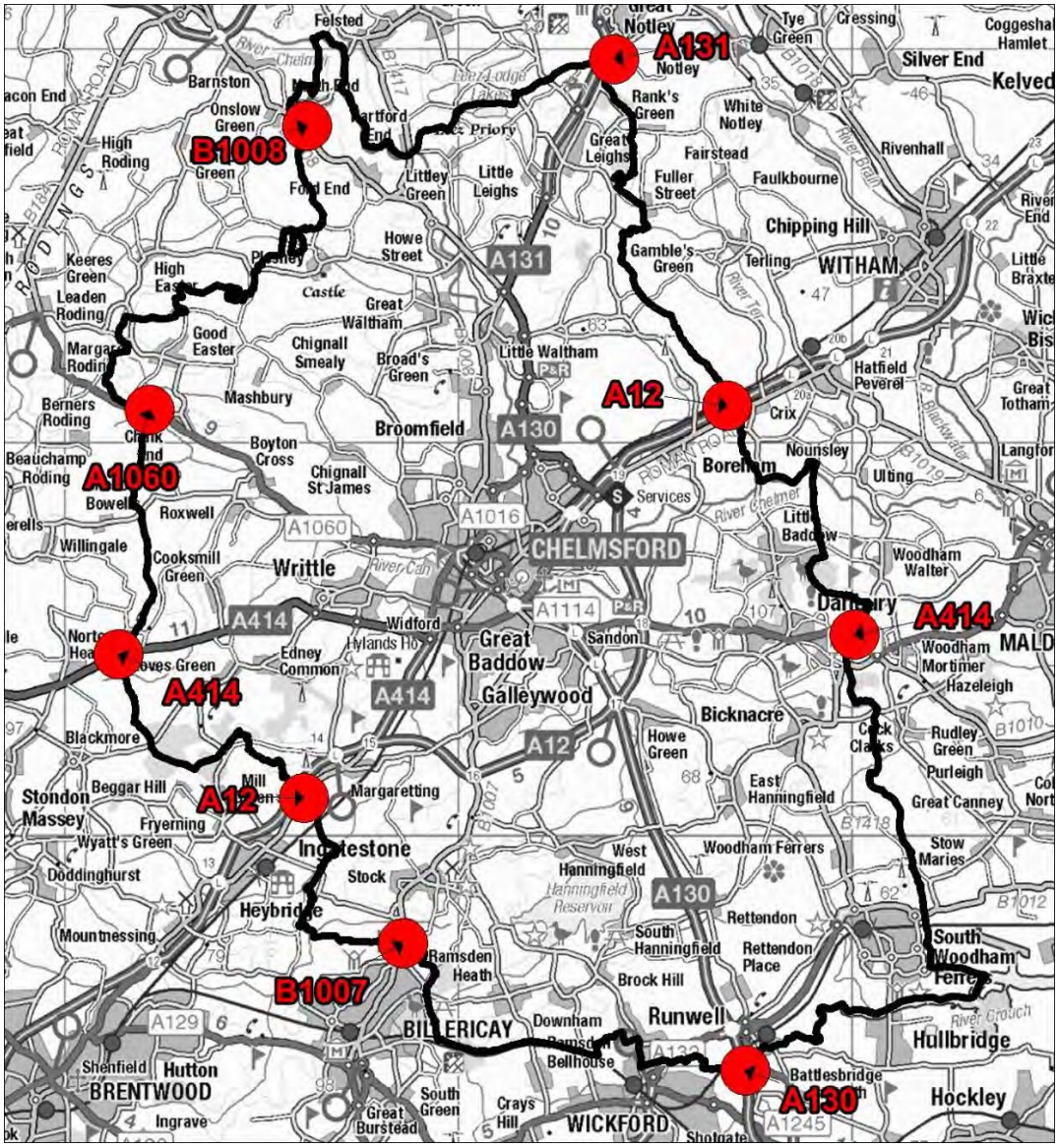


Figure 5-28: Location of cross boundary flow comparisons on key routes between Chelmsford and neighbouring authorities

Whilst the administrative boundary of Chelmsford is located a distance away from the main validated area of the Chelmsford VISUM model, traffic flows along key corridors passing into neighbouring authorities have been largely calibrated to observed count data in the base model. The model can therefore be considered sufficiently robust for forecasting traffic flows at these outer locations to compare the relative cross-boundary impact of the three spatial approaches.

Table 5-1 overleaf details the directional vehicle flows on these key corridor routes crossing the Chelmsford administrative boundary in the 2041 Baseline scenario. Table 5-2 shows the modelled flow differences between the 2041 baseline and the 2041 LPRPS scenario.

'Inbound' refers to flows travelling from neighbouring areas into the Chelmsford administrative boundary, and 'Outbound' refers to flows travelling out of the Chelmsford administrative boundary into neighbouring areas.

Table 5-1: Modelled flows in Baseline Scenario on key routes crossing the Chelmsford administrative boundary

Road	Neighbouring Authority	Baseline			
		AM Directional Flow		PM Directional Flow	
		IB Flow	OB Flow	IB Flow	OB Flow
A131	Braintree	1361	1095	1109	1305
A12 (north)	Braintree	5428	4454	4362	4445
A414 (east)	Maldon	722	550	621	726
A130 (south)	Basildon	2402	2285	2581	2050
B1007	Basildon	958	692	993	688
A12 (south)	Brentwood	3556	4187	4150	3577
A414 (west)	Epping Forest	529	709	766	537
A1060	Uttlesford	387	424	421	403
B1008	Uttlesford	581	684	621	674

Table 5-2: Modelled flow comparisons and % change between the LPRPS Scenario and Baseline Scenario on key routes crossing the Chelmsford administrative boundary

		Local Plan Review Pre-Submission Scenario							
		AM Directional Flow				PM Directional Flow			
Road	Neighbouring authority	IB Flow	% change	OB Flow	% change	IB Flow	% change	OB Flow	% change
A131	Braintree	1403	3.1%	1074	-1.9%	1093	-1.4%	1328	1.8%
A12 (north)	Braintree	5370	-1.1%	4515	1.4%	4410	1.1%	4448	0.1%
A414 (east)	Maldon	728	0.8%	554	0.7%	628	1.1%	713	-1.8%
A130 (south)	Basildon	2383	-0.8%	2283	-0.1%	2587	0.2%	2029	-1.0%
B1007	Basildon	966	0.8%	722	4.3%	1010	1.7%	678	-1.5%
A12 (south)	Brentwood	3558	0.1%	4175	-0.3%	4191	1.0%	3538	-1.1%
A414 (west)	Epping Forest	522	-1.3%	715	0.8%	776	1.3%	525	-2.2%
A1060	Uttlesford	391	1.0%	419	-1.2%	432	2.6%	398	-1.2%
B1008	Uttlesford	580	-0.2%	669	-2.2%	633	1.9%	669	-0.7%

Note: Colour scale indicates level of change from Baseline

Analysis of the impact of the LPRPS scenario on cross-boundary locations show that in the AM peak, increases in outbound flows are expected into Braintree (via A12 north), Maldon (via the A414 east), Basildon (via the B1007) and Epping Forest (via the A414 west). Outbound flows into Basildon via the B1007 in the AM peak are shown to see the largest change as a result of Local Plan development impact, with a 4.3% increase compared to the Baseline – although in absolute terms, this is only a change of 30 vehicle trips.

As shown in the outputs and analysis from the main scenarios earlier in this report, congestion at the A12 J17 Howe Green may be causing further trips to continue on the A12 and use the B1007 to access Basildon, as opposed to the A130.

Findings from the cross-boundary impact analysis of the LPRPS development, further demonstrate that the use of VDM in the strategic modelling is limiting Local Plan development impact on the strategic road network by effectively removing background traffic flows from the modelled peak hour, noticeably along the A12 corridor, to accommodate new development trips.

The biggest change in inbound flows in the AM peak is modelled between Braintree and Chelmsford, via the A131, with a 3.1% increase in modelled flows in the LPRPS scenario compared to the baseline, which is likely associated with trips to additional employment locations in Chelmsford from Braintree.

In the PM peak, the modelling indicates a 1.8% increase in outbound flows into Braintree via the A131 compared to the baseline. All other key routes show a decrease in outbound flows to neighbouring areas under the LPRPS scenario.

Under the LPRPS scenario, inbound flows into Chelmsford from neighbouring areas show an increase on all key routes in the PM peak, apart from the A131 from Braintree, which shows a -1.4% change in inbound PM flows compared to the baseline.

Whilst it might be expected that flows along the A414 to/from Maldon District would increase significantly as a result of development at, and to the south of, Hammonds Farm, model outputs suggest there will be only a minor increase in inbound and outbound flows in the AM, and inbound flows in the PM, and when VDM is applied, even suggests a reduction in outbound flows in the PM caused by background traffic flow reductions and displacement onto alternative local routes.

Table 5-3 below shows the number of trips in the forecast model travelling between the development sites along the A12 corridor (Hammonds Farm and the proposed employment site Land Adjacent to the A12 J18) and Maldon District. The plots presented in Section 5.1 of this report provide a further illustration of the distribution of development flows routing to/from Maldon District.

Table 5-3: Modelled trips between A12 corridor development sites and Maldon District in the LPRPS Scenario

		AM		PM	
		No. of Trips	% of total trips generated by development(s)	No. of trips	% of total trips generated
Residential Trips	To Maldon	54	8.3%	25	6.9%
	From Maldon	8	2.8%	49	7.6%
Employment Trips	To Maldon	2	2.2%	15	3.2%
	From Maldon	17	4.6%	2	1.8%

To alleviate the cross-boundary impact of development along the A12 corridor, policy requirements will be put in place at Hammonds Farm (SGS16a) and Chelmsford Garden Community (SGS6), setting a target of 60% modal shift to maximise the internalisation of trips and encourage the provision of active and sustainable travel schemes; including sustainable corridors to/from Beaulieu Park Station and Park and Ride sites in north and east Chelmsford, as well as connections over and below the A12 linking with existing and planned interventions; and improvements to the east of Hammonds Farm towards Danbury.

5.7 Forecast Impact on Rural Villages

A small quantum of development contained within the LPRPS scenario has been modelled in the villages of Boreham, Bicknacre, East Hanningfield, Ford End and Boyton Cross. Observations from model outputs suggests that development in these areas is unlikely to have an adverse impact on the road network in Bicknacre, East Hanningfield, Ford End and Boyton Cross to the extent that localised peak hour congestion is experienced within the villages.

Modelling does, however, demonstrate the likelihood of development along the A12 corridor causing a small increase in traffic volumes along rural routes through villages including Boreham, Little Baddow and Sandon, as a result of a displacement of trips.

It should be noted that the network and zone coverage in the Chelmsford VISUM model across the rural areas of the Chelmsford administrative area is not as detailed as in and around the urban area of Chelmsford itself, and the detailed impact of development traffic at local junctions in rural villages has not been possible to model as part of the broader LPRPS assessment.

There will therefore be a requirement for more detailed local traffic impact modelling to be undertaken by developers of LPRPS sites as part of future development planning applications alongside a commitment to the delivery of active and sustainable travel policy requirements.

5.8 Hammonds Farm Full Build Out Review

The quantum of housing proposed on Hammonds Farm by the end of the 2041 Plan review period has been set at 3,000 dwellings. However, it is acknowledged that the allocated site is able to provide a further 1,500 dwellings in the period beyond 2041, giving a total of up to 4,500 dwellings.

Whilst it would be beneficial to model the impact of the full build out of housing on the Hammonds Farm site to evaluate the longer-term development impact on the road network and the scale of potential mitigation required, there are significant challenges in modelling significantly beyond the 2041 Local Plan Review period.

As highlighted in the supplementary papers presented in Appendix A of this report, it is difficult to make a robust prediction on longer-term traffic growth given uncertainties around longer-term economic performance and/or the uptake of new technologies that will govern the way we travel in the future – such as electric vehicles.

At the same time, there are current uncertainties around the iterations of National Highways' Road Investment Strategy, and the sources of funding for larger infrastructure projects (e.g. the Housing Infrastructure Fund). This limits the ability to model robust assumptions around the long-term position on potential infrastructure across the strategic road network in Chelmsford (along the A12 and A130/A131 corridors in particular).

Alongside the challenges of forecasting background levels of demand and road infrastructure 20+ years into the future and beyond the current Local Plan period, an assessment of the full build out at Hammonds Farm would require an assumption to be made on the mitigation already in place to support a 3,000-

dwelling development by 2041. The scope and delivery timeframes for this mitigation have yet to be agreed between developers and ECC/CCC.

Observations from the strategic modelling suggest that without capacity improvements, additional development traffic added to the A12 corridor would result in a wider dispersal of background traffic and/or reductions in peak hour trips being modelled. Therefore, the scale of impact from a further 1,500 dwellings, and the mitigation required, would be difficult to assess using the modelling methodology adopted for the Local Plan Review evidence base.

It is, however, expected that any capacity improvement measures identified as part of the planning application process would be tested with a full 4,500 dwelling build-out, with assumptions to be agreed with developers on the volume of background growth to be applied.

5.9 A12 Merge / Diverge Assessment

Following discussions with National Highways regarding the impact of development on the A12 Corridor, merge and diverge assessments have been carried out for all on and off-slips at Junctions 15-19 on the A12, for the Baseline and LPRPS Scenario. The assessment was also undertaken for the Local Plan Scenario without A12 DCO, which can be found in Appendix H: A12 Merge / Diverge Assessment for LPRPS without A12 DCO Scenario.

Modelled flows for the on and off slips have been compared against the Design Manual for Roads and Bridges (DMRB) standards[7] to help identify where improvements to the merge / diverge layouts and number of lanes upstream and downstream of the merge / diverge may be required.

Table 5-4 outlines the recommended layouts and number of lanes for each of the A12 on and off-slips (J15-J19), under both the 2041 Baseline and LPRPS scenario. Where the recommended junction layout and number of lanes is different to the existing layout across the AM and PM peaks, this has been highlighted in yellow.

[7] Design Manual for Roads and Bridges, 2022. CD 122 – Geometric design of grade separated junctions. Available at: < 3ab9ef31-9880-4e8e-a7eb-f3d218e74ffd >

Table 5-4: Merge / Diverge Assessment of A12 Junctions 15-19

A12 Junction	Slip Rd	Baseline Scenario			Local Plan Review Pre-Submission Scenario			Change from Baseline Assessment
		Recommended Layout	Recommended No. of Lanes		Recommended Layout	Recommended No. of Lanes		
			Upstream	Downstream		Upstream	Downstream	
J15	NB On slip	D*	2	3*	D*	2	3*	No change
	NB Off slip	C	3	2	C	3	2	No change
	SB On slip	E	2	3	E	2	3	No change
	SB Off slip	A	2	2	A	2	2	No change
J16	NB On slip	A	2	2	A	2	2	No change
	NB Off slip	C**	3**	2	C**	3**	2	No change
	SB On slip	A	2	2	A	2	2	No change
	SB Off slip	A	2	2	A	2	2	No change
J17	NB On slip	E	2	3	E	2	3	No change
	NB Off slip	A	2	2	A	2	2	No change
	SB On slip	A	2	2	A	2	2	No change
	SB Off slip	D	3	2	D	3	2	No change
J18	NB On slip	D	2	3	D	2	3	No change
	NB Off slip	C	3	2	C	3	2	No change
	SB On slip	A	3	3	A	3	3	No change
	SB Off slip	A	3	3	A	3	3	No change
J19	NB On slip - Short	A	2	2	A	2	2	No change
	NB On-slip - Long	E	2	3	E	2	3	No change
	NB Off slip	C**	3**	2	C	3	2	No change
	SB On slip	D	2	3	D	2	3	No change
	SB Off slip	E***	4***	2	E***	4***	2	No change

**Borderline B (2 lanes downstream)*
***Borderline A (2 lanes upstream)*
****Borderline D (3 lanes upstream)*

Assessment of the flows on the A12 on and off-slips in both the Baseline and LPRPS scenarios using the DMRB guidance shows that there is no change in the recommended merge / diverge layouts following the addition of LPRPS development trips. This aligns with the results of the Traffic Flow Analysis (shown in Section 5.4), which suggest only small increases in overall A12 traffic volumes between the Baseline and LPRPS scenarios. However, modelling suggests that several on and off-slips at A12 junctions in Chelmsford are likely to be substandard in the 2041 Baseline scenario.

It is understood that development trips associated with LPRPS sites account for an increased proportion of traffic flows on the A12 on and off-slips – particularly at Junctions 18 and 19, following the displacement of background traffic volumes and the suppression of overall traffic growth. With potential merge and diverge issues at the junctions in the future, it is therefore suggested that localised on-slip improvement measures are considered by developers to mitigate potential safety concerns.

Based on DMRB recommendations, the optimal merge / diverge design layouts for the A12 on and off-slips in the 2041 forecast scenario has been identified as follows:

Junction 15
Recommended Layout Changes: • NB On-slip to change from layout A to layout D. Lane Changes: • NB On-Slip downstream lanes to change from 2 to 3.
Junction 16
Recommended Layout Changes: • NB Off-slip to change from layout A to layout C. Lane Changes: • NB Off-Slip upstream lanes to change from 2 to 3.
Junction 17
Recommended Layout Changes: • NB On-slip to change from layout A to layout E. • SB Off-slip to change from layout A to layout D. Lane Changes: • NB On-Slip downstream lanes to change from 2 to 3. • SB Off-slip upstream lanes to change from 2 to 3.
Junction 18
Recommended Layout Changes: • NB On-Slip to change from layout A to layout D. • NB Off-Slip to change from layout A to layout C. Lane Changes:

- NB On-slip downstream lanes to change from 2 to 3.
- NB Off-slip upstream lanes to change from 2 to 3.
- SB On-slip upstream and downstream lanes to both change from 2 to 3.
- SB Off-slip upstream and downstream lanes to both change from 2 to 3.

Junction 19

Recommended Layout Changes:

- NB Off-slip to change from layout A to layout C.
- SB On-slip to change from layout A to layout D.
- SB Off-slip to change from layout C to layout D.

Lane Changes:

- NB Off-Slip upstream lanes to change from 2 to 3.
- SB On-Slip downstream lanes to change from 2 to 3.

6 Without A12 Widening DCO Sensitivity Test

This section of the report documents the strategic modelling outputs and analysis undertaken for a sensitivity test of LPRPS development impact without the A12 DCO widening scheme and associated improvements at the A12 Junction 19 Boreham Interchange.

6.1 Purpose of 'Without A12 Widening DCO' Sensitivity Test

This sensitivity test has been undertaken to provide a high-level assessment of the network impact of the Local Plan Review development, without the A12 widening and Boreham Interchange capacity improvements.

6.1.1 Compatibility with other studies

Recent modelling has been undertaken in Autumn 2024 by National Highways' consultants AECOM to assess the impact of the proposed Chelmsford Garden Community development in North-East Chelmsford on the A12 J19 Boreham Interchange - should DCO improvements at the junction not come forward. A VISSIM microsimulation model of the junction was built by AECOM specifically for the capacity assessment.

It is important to emphasise that strategic VISUM model outputs presented for the LPRPS assessment cannot be compared directly with the VISSIM outputs produced by AECOM. The interchange has been coded to a greater level of detail in AECOM's microsimulation model, which is therefore better able to represent nuanced queuing behaviour and co-ordination of traffic signal times (for example).

Whilst the extent of queuing is likely to be understated in the LPRPS modelling analysis given its strategic nature (and for the reasons stated above), the VISUM model outputs shown in the following section of this report confirm that there would be increased queuing on key approaches to the junction without the A12 DCO scheme, which is in line with AECOM's current findings.

6.1.2 Scope of 'Without Widening DCO' Sensitivity Test

Preliminary findings from AECOM's modelling suggests that the delivery of Boreham Interchange improvements associated with the A12 widening DCO proposals is required as a minimum to ensure that Junction 19 has the capacity to accommodate proposed development across Chelmsford identified in the Adopted Local Plan and the LPRPS. Should funding for the DCO proposals be withheld following central government review in Spring 2025, modelling suggests that these capacity improvements would require funding by alternative means.

AECOM's findings therefore suggest that a scenario whereby Local Plan development could be delivered without capacity improvements at the Boreham Interchange, is unrealistic. With that in mind, sensitivity test model outputs and analysis have been

limited in the report to queue lengths, link capacities and flow differences. Journey time plots, cross boundary flow change tables and merge/diverge assessments for the sensitivity test can be found in the appendices.

6.2 'Without A12 Widening DCO' Modelling Approach

The modelling approach for the 'Without A12 Widening SCO' Sensitivity Test is consistent with the strategic modelling approach used for the main scenarios, which is outlined in Section 4, with the exception of a network change to remove the widening of the A12 carriageway and capacity improvements to the Boreham Interchange associated with the DCO. More detail about the A12 DCO proposals are outlined in Section 3.4.2.

6.3 'Without A12 Widening DCO' Sensitivity Test Outputs

6.3.1 Queue Lengths

Figure 6-1 to Figure 6-4 show the relative queue length plots for the Baseline and LPRPS Scenario for both the AM and PM peaks.

6.3.1.1 Relative Queue Lengths: 2041 AM Peak

Figure 6-1: Relative queue length plot – Baseline without A12 DCO – 2041 AM Peak

Figure 6-1 illustrates the relative queue lengths modelled for the 2041 baseline (without additional Local Plan development) in the AM peak, and shows modelled queuing in the following key locations in Chelmsford:

Modelled Queueing 2041 AM Peak - Key Locations
Army & Navy Roundabout - Baddow Road, Van Diemans Road*
A12 J19 Boreham Interchange – A12 SB off-slip & A131 Beaulieu Parkway link
A12 J17 (Howe Green)
Princes Road (Miami) Roundabout through to Widford Road Roundabout
Writtle Road junction with A1016 Waterhouse Lane
A1016 Chelmer Valley Road between Nabbotts Farm and Valley Bridge Roundabouts
A138 Chelmer Road southbound in vicinity of New Dukes Way
A1060 Roxwell Road westbound on approach to junction with Lordship Road
B1008 Main Road, Broomfield

*Modelled congestion would be expected to be worse with the existing (2023) roundabout layout.

Queues are shown at the Boreham Interchange on the A12 southbound off-slip and the new A131 Beaulieu Parkway link from the north. This is in contrast to the modelling of the main scenarios and suggests that without the National Highways DCO capacity improvements proposed at the junction, significant congestion is likely in 2041 before the addition of Local Plan development trips.

Figure 6-2: Relative queue length plot – LPRPS Development without A12 DCO – 2041 AM Peak

Figure 6-2 illustrates the relative queue lengths modelled for the 2041 Local Plan scenario in the AM peak, and shows modelled queuing in the following key locations in Chelmsford:

Queue Length Analysis - AM Peak	Key Commentary
A12	Small reduction in queuing along A12 southbound carriageway on approach to J17 caused by congestion at A12 J19.
A12 J18 Sandon	Queuing introduced along new access arm at A12 Junction 18 in the vicinity of the Hammonds Farm site.
Army & Navy Roundabout	Small increases in queue extents modelled along Baddow Road.
A1016 Essex Regiment Way + Chelmer Valley Road	Small increases in queueing along southbound corridor into city centre.
City Centre	Small increase in queue extents at junctions along A1060 Parkway - specifically at Odeon and Market Roundabouts.
Eve's Corner, Danbury	Increase in queuing on approach to Eve's Corner

The pattern of queuing in the AM peak under the LPRPS scenario is broadly consistent with the patterns modelled in the Baseline scenario, but with small changes in queue extents in particular locations.

The addition of Local Plan development trips is shown to extend queues further along the A12 southbound off-slip and new A131 approach to the Boreham Interchange. Queue increases are, however, limited by background trip redistribution and VDM trip removal from the peak hour modelling.

The reduction in A12 carriageway capacity on the A12 north of the Boreham Interchange is shown in the modelling to act as an upstream 'bottleneck' which results in small reductions in queue extents back along the A12 carriageway from Junction 17 at Howe Green.

Similarly, a modelled pinch-point at the Boreham Interchange results in marginally reduced queue lengths at junctions downstream on the A138 Chelmer Road.

The addition of Hammonds Farm and, to a lesser extent, Land Adjacent to A12 Junction 18 development trips results in modelled queues developing along the new development access arm at A12 Junction 18.

6.3.1.2 Relative Queue Lengths: 2041 PM Peak

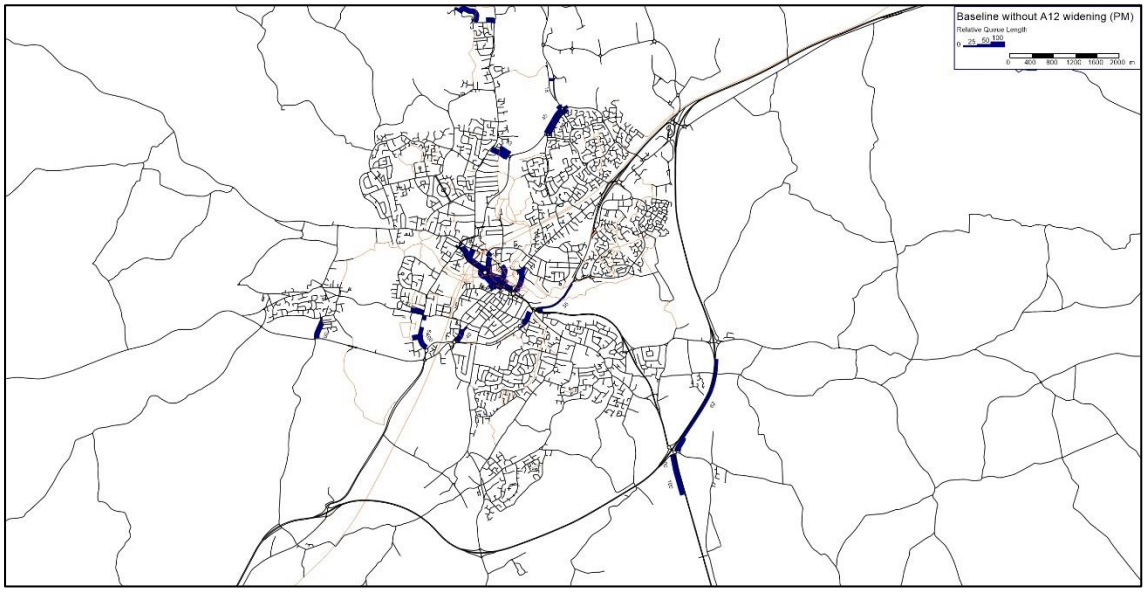


Figure 6-3: Relative queue length plot – Baseline without A12 DCO – 2041 PM Peak

Figure 6-3 illustrates the relative queue lengths modelled for the 2041 baseline (without additional Local Plan development) in the PM peak, and shows modelled queuing in the following key locations in Chelmsford:

Modelled Queueing 2041 PM Peak - Key Locations
City Centre junctions along Parkway between A1016 Waterhouse Lane and Odeon Roundabout
Army & Navy Roundabout - A138 Chelmer Road
A12 J17 (Howe Green)
Princes Road (Miami) Roundabout and A1016 Westway Roundabout
Writtle Road junction with A1016 Waterhouse Lane
A1016 Chelmer Valley Road between Nabbotts Farm and Lawn Lane Roundabouts
Valley Bridge Road at junction with B1008 Broomfield Road and with A1016 Chelmer Valley Road

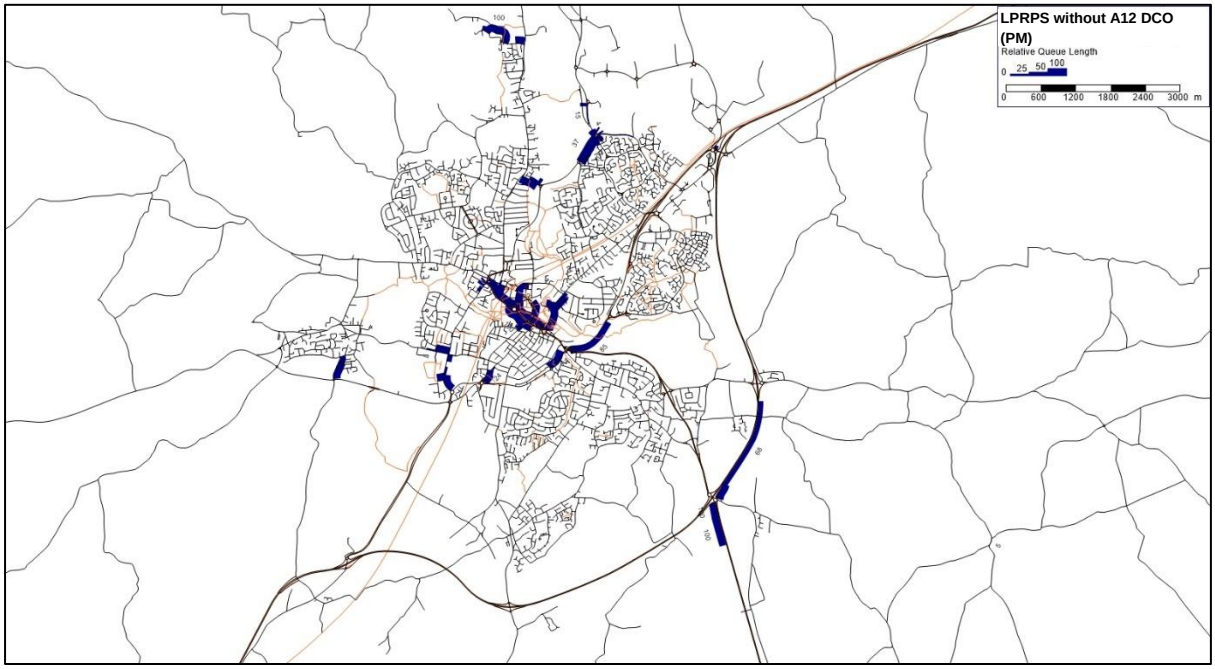


Figure 6-4: Relative queue length plot – LPRPS Development without A12 DCO – 2041 PM Peak

Queue Length Analysis - PM Peak	Key Commentary
Army & Navy Roundabout	Increase in queue extents modelled along A138 Chelmer Road
City Centre	Small increase in queue extents modelled on and around A1060 Parkway and on Victora Road. Significant increase in queues along A138 Chelmer Road bridge on approach to Army & Navy junction

Similar to the AM peak, modelled upstream bottlenecks along the A12 result in no modelled increase in queueing back from A12 Junction 17 at Howe Green with Local Plan development trips added.

6.3.2 Link Capacity Analysis

Volume/Capacity (V/C) ratio plots are presented in this sensitivity test to identify links across the strategic modelled network with limited or no spare capacity in the future.

6.3.2.1 Volume/Capacity Stats: 2041 Baseline

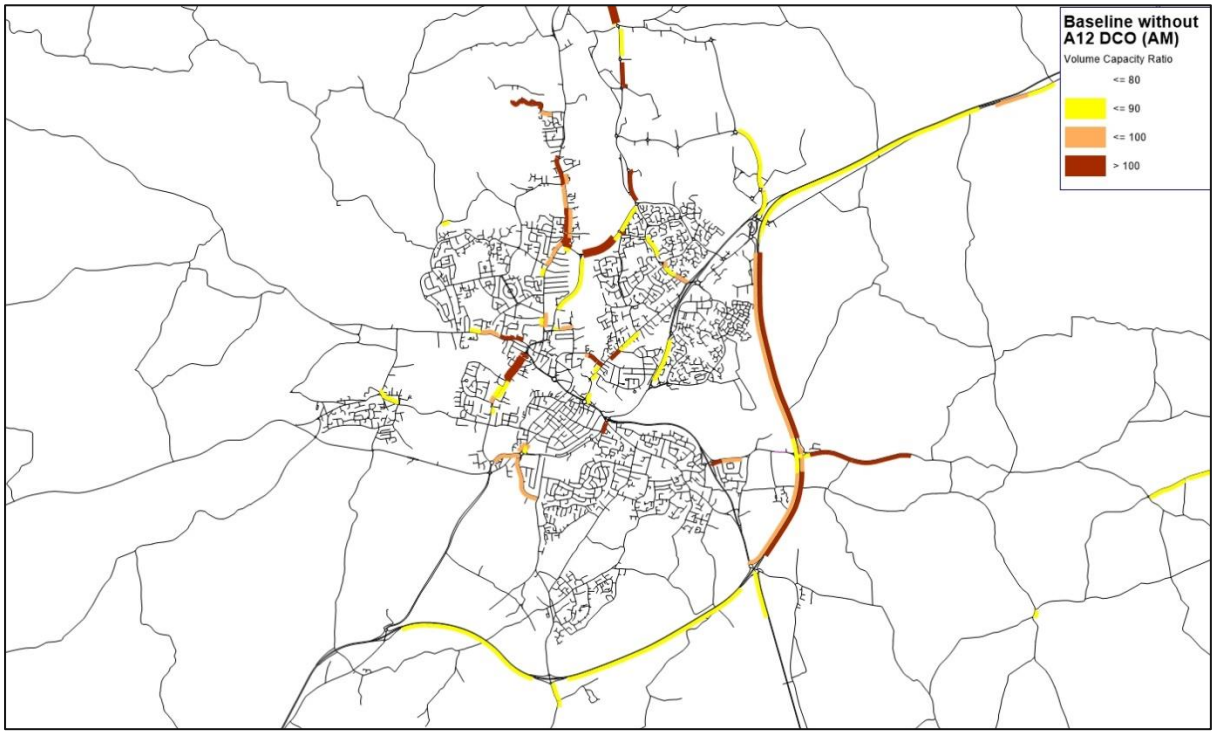


Figure 6-5: Volume/Capacity plot – Baseline without A12 DCO – 2041 AM Peak

Figure 6-6: Volume/Capacity plot – Baseline without A12 DCO – 2041 PM Peak

The 2041 baseline (without additional Local Plan development) shows modelled links with no spare capacity along the following key routes in Chelmsford across the AM and PM peaks:

Modelled Capacity Limitations 2041 Baseline without A12 DCO - Key Locations
A12 between J19 Boreham Interchange and J17 Howe Green
A414 westbound between Danbury and Sandon
A131 Essex Regiment Way south of Sheepcotes Roundabout
A1016 Chelmer Valley Road between Lawn Lane and Valley Bridge Roundabouts
RDR/Beaulieu Parkway between CNEB and Boreham Interchange
A1016 Waterhouse Lane / Rainsford Lane
B1008 Main Road, Broomfield

Overall link V/C values remain broadly consistent across the strategic road network between the main baseline scenario and the 'without A12 widening DCO' sensitivity test.

It is however, noted that both the A131 Beaulieu Parkway (between the Beaulieu Park Station access and Generals Lane roundabout) and A138 Chelmer Road (north of the junction with New Dukes Way) appear to have a lower V/C value in the sensitivity test, likely due to congestion at the Boreham Interchange causing a bottle-neck effect at the junction. These reductions are reflective of both the trip displacement modelled in the local area and the removal of peak hour trips due to the application of VDM.

6.3.2.2 Link Capacity Impact of LPRPS Development

Figure 6-7: Volume/Capacity plot – LPRPS Development without A12 DCO – 2041 AM Peak

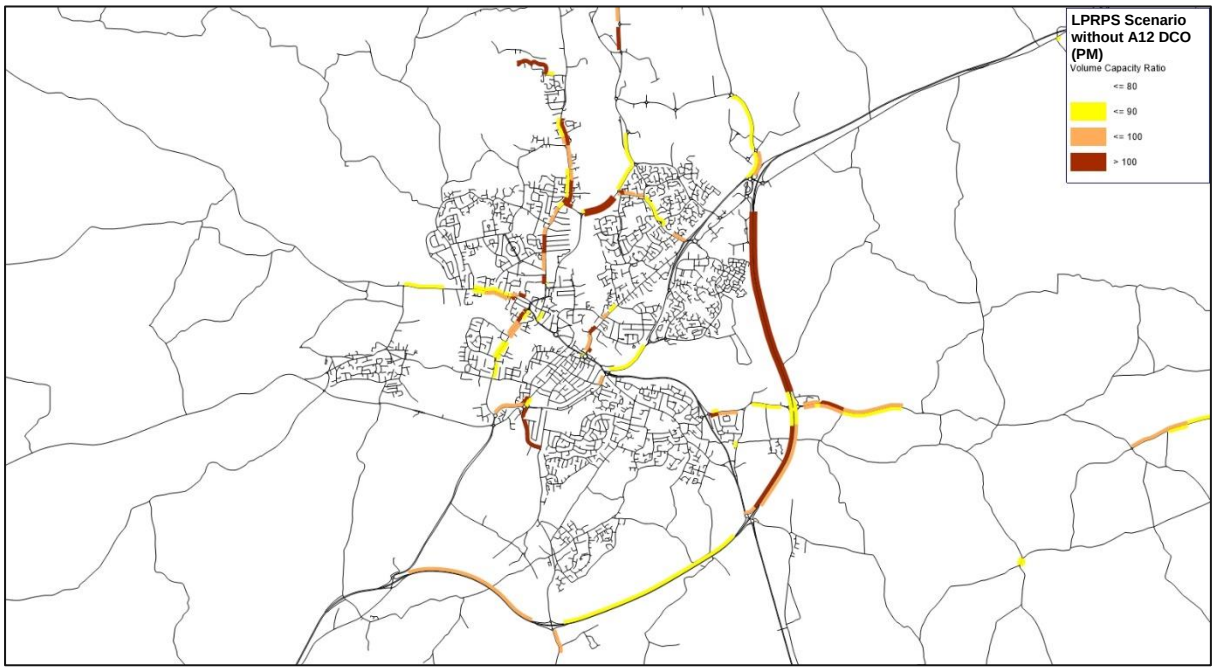


Figure 6-8: Volume/Capacity plot – LPRPS Development without A12 DCO – 2041 PM Peak

There is little in the way of observable differences between model outputs with and without Local Plan development in the sensitivity test – albeit with increases in the V/C ratio modelled on links in the vicinity of development along the A12 corridor. This is as a result of many of the key strategic corridors in the City Centre, such as along the A1016 Chelmer Valley Road, and the A12 corridor, already being at capacity in the Baseline 2041 scenario. Both routes would be expected to accommodate a proportion of development trips associated with the Local Plan development.

However, these outputs should not be viewed in isolation and should be considered alongside the reported queue length and flow difference plots, in particular, to gain a more holistic understanding of the modelled impact of the Local Plan development.

6.3.3 Traffic Flow Analysis

The following plots taken from the Chelmsford Forecast Model illustrate the change in traffic flow patterns across the local and strategic road network following the addition of development trips associated with the LPRPS scenario.

Traffic flow increases are shown in red, whilst traffic flow decreases are shown in green. A summary commentary is provided for the AM peak and PM peaks combined.

Figure 6-9: 2041 Baseline vs LPRPS Development without A12 DCO flow difference plot – 2041 AM Peak

Figure 6-10: 2041 Baseline vs LPRPS Development without A12 DCO flow difference plot – 2041 PM Peak

Flow Difference Analysis	Key Commentary
A12	Greatest flow increase shown along the A12 carriageway between Junctions 18 and 19 in the PM peak. However, significant flow reductions along the A12 north of Junction 19 Boreham Interchange.
B1019 Main Road, Boreham	Partial transfer of trips from the A12 to B1019 Main Road, through Boreham, resulting in noticeable flow increases along the local route.
A1114 Essex Yeomanry Way	Increase in flow modelled along A1114 Essex Yeomanry Way and through the Army & Navy roundabout.
A138 Chelmer Road	Increase in flows shown along the A138 between the Boreham Interchange (A12 J19) and the Army and Navy Roundabout – most notable in the PM peak.
A414	An increase in peak hour traffic flow modelled along the A414, either side of J18 (both west and east). Greater increase modelled in the AM peak between the Hammonds Farm development access and Danbury.
City Centre	Increase in traffic flow modelled along Parkway, particularly in the PM peak
Rural Routes	Increase in modelled flows noted along routes to the east of the A12 including Hammonds Road and North Hill (through Little Baddow). Increase in flows also shown along Woodhill Road running parallel to the south of the A414 between Sandon and Danbury.

The peak hour flow difference plots effectively show the impact of development trips associated with Hammonds Farm and the employment land adjacent to A12 J18 on traffic flow patterns across the surrounding road network.

As can be seen from the queue length and volume/capacity analysis in earlier sections of this report, network capacity issues are modelled along the A12 between Junction 17 and 19. A significant proportion of development trips might be expected to route along the A12 - both northbound and southbound - from Junction 18, thereby exacerbating congestion along the trunk road. The link flow difference plots show that this will increase the likelihood of traffic re-routing along rural roads to the east of the A12, impacting the villages of Boreham and Little Baddow.

Without A12 widening and capacity improvements at the Boreham Interchange, the overall reduction in modelled A12 trips north of the junction is due to the application of VDM trip adjustments and a reassignment of traffic flows onto the B1137 Main Road through Boreham to avoid significant queues on the A12 southbound off-slip at the junction.

The impact of trip displacement and VDM reductions is shown in the limited overall increase in A12 traffic volumes modelled in the AM peak between Junction 17 and 19 – despite the addition of Local Plan development trips.

Development trips are nevertheless shown to have a direct impact on flow increases along the A414 in the vicinity of the A12 Junction 18, which has already been shown

to have network capacity issues in the main scenarios analysis. This results in the dispersal of background traffic flows from the A414 onto alternative rural routes through Danbury and Sandon to accommodate Local Plan development trips.

In the City Centre, traffic volumes are also shown to increase along A138 Chelmer Road and A1114 Essex Yeomanry Way and along A1060 Parkway, particularly in the PM peak. These routes are shown to accommodate additional trips from the largest LPRPS sites modelled at Hammonds Farm, and the employment allocation at Land Adjacent A12 Junction 18, in the vicinity of the A12 Junction 18.

7 Mode Shift Sensitivity Test

This section of the report documents the strategic modelling methodology, outputs and analysis undertaken for a sensitivity test of the Local Plan Review with a greater level of mode shift to active and sustainable alternatives.

7.1 Purpose of Mode Shift Sensitivity Test

A sensitivity test has been undertaken to consider the potential network impact of a greater mode shift to active and sustainable alternatives from the Local Plan Review development sites.

It is understood that a policy requirement to achieve a 60% active and sustainable mode share target has been set out for the Hammonds Farm site, as well as for the North East Chelmsford Garden Community (NECGC) site, within the Local Plan (Policy SGS16a and Policy SGS6 respectively). Whilst a 60% active and sustainable travel mode share of trips from Hammonds and the NECGC site hasn't specifically been modelled, this sensitivity test considers the potential network impact of a greater mode shift more generally, across all the Local Plan Review development sites.

This has been modelled by using reduced trip rates for both the Local Plan Review residential and employment sites to generate a reduced number of development trips, commensurate with more urban development and a greater provision of passenger transport services. The subsequent reduction in trips has been modelled as an aspirational target, potentially achievable through the provision of robust and attractive active and sustainable transport infrastructure and services - and their successful uptake.

The sensitivity test has been undertaken with an understanding that trip rates for proposed development within the Chelmsford forecast modelling are already representative of a good level of sustainable and active travel mode uptake. Thus, to achieve the trip reductions modelled for this sensitivity test, the provision and use of additional passenger transport services would need to be significantly higher than typically expected. The outputs presented should therefore be viewed in this context.

7.2 Mode Shift Modelling Approach

Development trip reductions have been calculated using EPTAL (Essex Passenger Transport Accessibility Level) which is a bespoke tool created by Essex Highways and loosely based on the DfT's PTAL process, used to derive trip rates around aspirational targets for sustainable transport provision.

EPTAL contains a database of TRICS surveyed development trip rates grouped by location classification: Rural, Edge of Town, Suburban, Edge of Town Centre and Town/City Centre.

The tool then calculates average trip rates across all surveyed sites for each land-use type within each location classification and determines the associated quantum of local rail and/or bus services required to achieve these trip rates – based on passenger transport provision data from the TRICS surveys.

Using EPTAL, it has been possible to determine average trip rates and a typical level of passenger transport provision for housing and employment sites in a Suburban location. This classification was seen as representative of the location and level of passenger transport provision currently proposed for Chelmsford Local Plan developments in North-East Chelmsford and along the A12 corridor.

Average trip rates and a typical level of bus/rail provision were then determined for housing and employment sites in an Edge of Town Centre location. These values were viewed as a suitable aspirational target for Local Plan development as part of the sensitivity test.

7.3 Mode Shift Sensitivity Test Outputs

Table 7-1 below shows the trip rates generated by EPTAL for the employment and residential developments for both Suburban and Edge of Town Centre sites and the percentage difference between them.

A 13% decrease in residential trip rates and 6% decrease in employment trip rates was identified by calculating the percentage decrease between the existing and desired land classifications. These factors were then applied to the total number of trips generated by the Local Plan development as part of the Sensitivity Test.

Type	Suburban Trip Rates	Edge of Town Trip Rates	% Reduction from Suburban to Edge of Town
Residential Houses: Privately Owned	0.121	0.105	13%
Employment (office)	1.239	1.168	6%

Table 7-1: EPTAL Trip Rates

Figure 7-1 and Figure 7-2 illustrate the traffic flow impact of the Local Plan scenario with reduced levels of demand calculated through EPTAL, compared against the 2041 baseline.

Figure 7-3 and Figure 7-4 illustrate the impact of EPTAL, by comparing the EPTAL adjusted Local Plan scenario, with the non-adjusted demand in the Local Plan scenario.

Traffic flow increases are shown in red, whilst traffic flow decreases are shown in green. Section 5.4 provides more detail on the traffic flow plots and an analysis of traffic flows.

Please note that the modelled outputs for the sensitivity test represent a best-case scenario and are dependent on there being a shift in travel behaviour in line with additional service provision. Nevertheless, they provide a preliminary insight into the potential effectiveness of sustainable transport options in mitigating the impact of Local Plan development.

Figure 7-1: LPRPS Development with EPTAL vs Baseline - flow difference plot – 2041 AM Peak

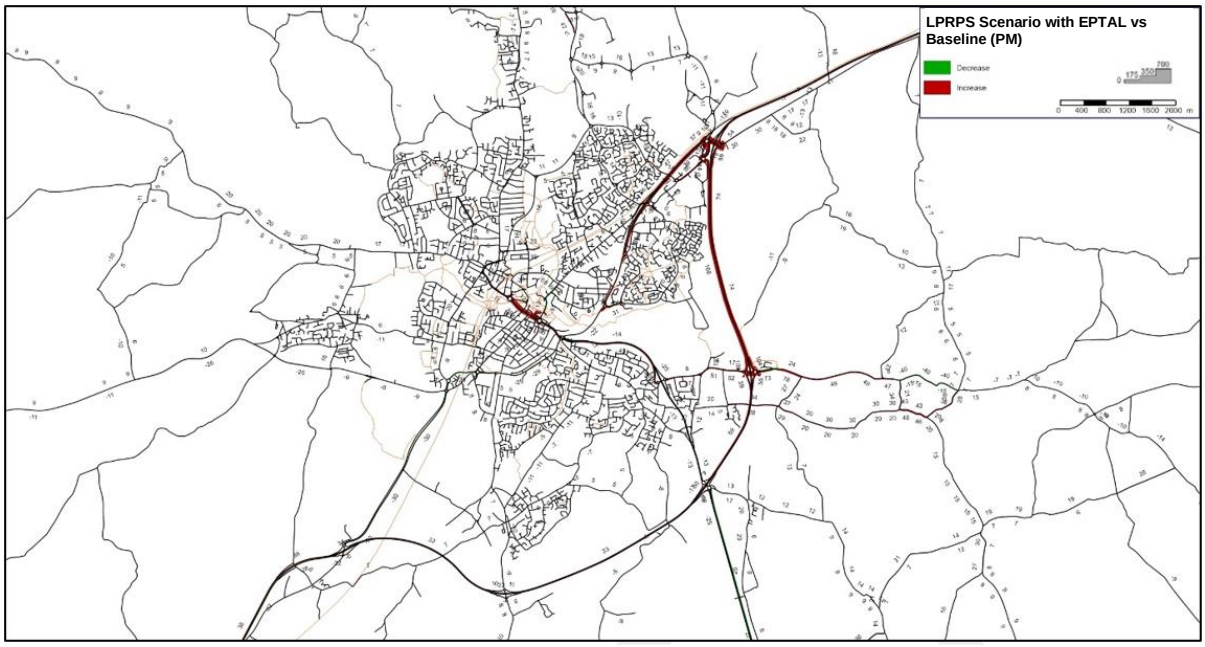


Figure 7-2: LPRPS Development with EPTAL vs Baseline - flow difference plot - 2041 PM Peak

Figure 7-3: EPTAL vs non-adjusted LPRPS scenario – 2041 AM Peak

Figure 7-4: EPTAL vs non-adjusted LPRPS scenario – 2041 PM Peak

Figure 7-3 and Figure 7-4 show that vehicle flow reductions as a result of the EPTAL adjusted scenario are largely focused along the A12 corridor and local routes through Boreham, Little Baddow and Danbury. On some routes, the impact of the adjusted trip rates results in a slight increase in flows on some routes, likely as a result of the reassignment of trips across the network.

Despite the reduction of flows (of 13% for residential sites and 6% for employment sites), the overall impact of the LPRPS Development with reduced levels of car/private vehicle demand is only minimal at a strategic level, and traffic flows and patterns of queuing remain relatively consistent with the impact of the unadjusted scenario (shown in Section 5-4).

However, the spread of the impact across the wider road network – particularly across rural routes, suggests that the assignment of traffic in the forecast modelling is particularly responsive to congestion along strategic routes.

Should Local Plan development be successfully delivered with a higher proportion of trips being made via active and sustainable modes, then it is most likely that benefits will be seen through small reductions in traffic volumes travelling along rural routes and through villages such as Little Baddow, Sandon and Boreham.

There will be policy requirements at Hammonds Farm (SGS16a) and Chelmsford Garden Community (SGS6), setting a target of 60% modal shift to maximise the internalisation of trips and encourage the provision of active and sustainable travel schemes. For Hammonds Farm this includes sustainable corridors to/from Beaulieu Park Station and Chelmsford Park and Ride sites in north and east Chelmsford, as

well as connections over and below the A12 linking with existing and planned interventions; and improvements to the east of Hammonds Farm towards Danbury.

8 Junction Modelling

This section details the local junction modelling undertaken as part of the transport impact appraisal of Chelmsford City Council (CCC)'s LPRPS.

The outputs presented and summary of findings contained within this section depict the extent of junction capacity issues as a result of the growth in background traffic flows as well as the addition of Local Plan development trips, resulting from the growth to 2041 set out in the LPRPS.

Junction infrastructure proposals in North-East Chelmsford that are presented in this report have been identified to mitigate the impact of background traffic associated with the Chelmsford Garden Community (Strategic Growth Site 6) development to 2041. Discussion around further LPRPS mitigation is outlined in Section 9.

8.1 Local Junction Modelling Methodology

8.1.1 Local Junction Modelling Scope

Capacity assessments have been undertaken at 17 junctions on the strategic and local road network in Chelmsford. Junctions were selected for assessment based on expected LPRPS impact as a result of:

a) Their location in proximity to larger development sites proposed as part of CCC's pre-submission spatial approach, and/or
b) Their location on key corridors into Chelmsford City Centre expected to accommodate a significant proportion of overall forecast trips to/from proposed development sites.

The list of junctions identified for capacity modelling, along with the software/ package used to model each is shown in Table 8-1 overleaf. Figure 8-1 shows the location of these junctions in relation to the LPRPS development site areas.

Table 8-1: Junctions identified for capacity modelling and the software packages used.

GROUPING	JUNCTION	MODEL PACKAGE
Chelmsford North-East area	1) Sheepcotes Roundabout	Junctions 10
	2) Wheelers Hill Roundabout	
	3) Pratts Farm Roundabout	
	4) Belsteads Farm Roundabout	
	5) Armistice Way Roundabout	
	6) Nabbotts Farm Roundabout	
	7) Beaulieu Parkway/CNEB Roundabout	
	8) Beaulieu Parkway/Rail Station Access Roundabout	
	9) Waltham Road / Main Road - Boreham	
A12 Corridor	10) A12 J15 Margaretting	Junctions 10
	11) A12 16 Galleywood	Junctions 10
	12) A12 J17 Howe Green	LinSig
	13) A12 J18 Sandon	Junctions 10 / LinSig
	14) A12 J19 Boreham Interchange	VISSIM
City Centre	15) Army & Navy Roundabout	LinSig
	16) Odeon Roundabout	Junctions 10
Outer	17) Eves Corner, Danbury	Junctions 10

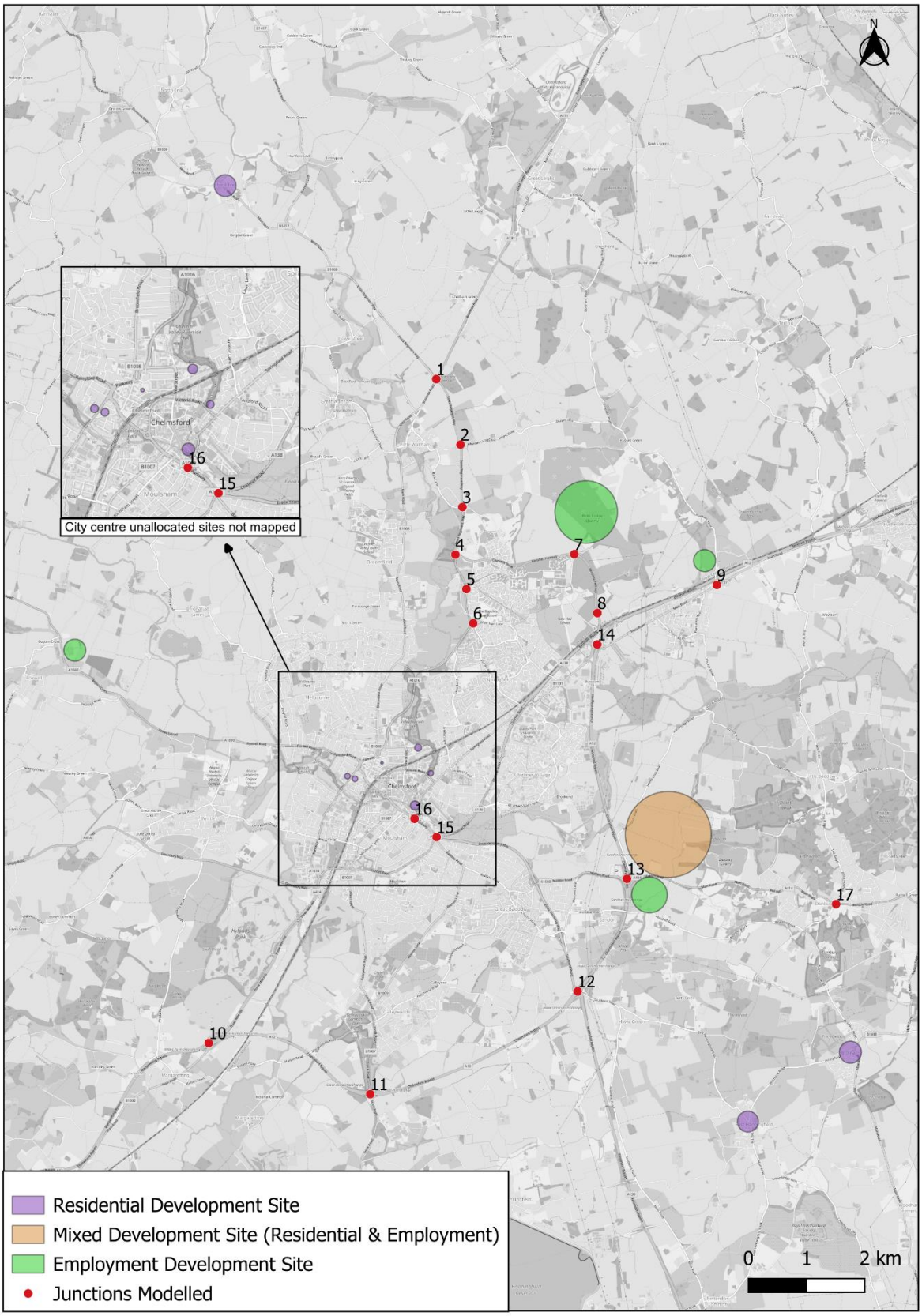


Figure 8-1: Location of modelled junctions in relation to the LPRPS development sites.

8.1.2 Modelling Approach

8.1.2.1 Peak Hours Modelled

Consistent with the VISUM strategic network modelling, peak hours for the local junction modelling are as follows:

- AM Peak (07:30 – 08:30)
- PM Peak (17:00 – 18:00)

8.1.2.2 Assessment Years Modelled

To assess the local junction impact of trips associated with the LPRPS development, a 2041 forecast year has been used. This matches the assessment year for the VISUM strategic network modelling and ties in with the end of the Local Plan Review period.

Base year junction models have been calibrated using 2022 journey time data, as detailed below.

8.1.2.3 Junction Modelling Software Used

Junctions 10/ARCADY models have been built for fourteen of the assessed junctions and LinSig models have been developed for the two signalised junctions – A12 J17 at Howe Green, and the Army & Navy Roundabout.

Eves Corner in Danbury has been modelled using Junctions 10 software despite part-time signals being installed on the minor arms at the junction. A review of signal data from 2023 showed that the signals were only in operation, typically, for around 5 minutes in both the AM and PM peak hours. A decision was therefore made to model the junction without signal controls.

8.1.2.3.1 National Highways' 2022 VISSIM model of A12 J19 Boreham Interchange – proposed DCO layout

To assess LPRPS development impact on the A12 Junction 19 Boreham Interchange, the chosen approach has been to reference outputs and findings documented in National Highways' published A12 DCO modelling report[8] and qualitatively assess the potential change in the reported junction impact when utilising demand flows taken from the strategic modelling appraisal of the LPRPS.

8.1.2.3.2 National Highways' 2024 VISSIM model of A12 J19 Boreham Interchange – without DCO improvements

Recent modelling has been undertaken in Autumn 2024 by National Highways' consultants AECOM to assess the impact of the proposed Chelmsford Garden Community development in North-East Chelmsford on the A12 J19 Boreham Interchange - should DCO improvements at the junction not come forward. A VISSIM

[8] 'A12 Chelmsford to A120 Widening Scheme TR010060 7.2 Transport Assessment – Appendix F: Junction Modelling Technical Notes – A12 Junctions', National Highways, August 2022

microsimulation model of the junction was built by AECOM specifically for the capacity assessment.

Preliminary findings, which are yet to be finalised, strongly indicate that the current layout of the junction would have insufficient capacity to accommodate forecast development up to 2041 - the current horizon year of the Local Plan Review. The expected conclusion is that capacity improvements at the junction proposed as part of the A12 widening DCO would be required, *as a minimum*, to support delivery of future housing and employment in Chelmsford.

The AECOM study did not account for the impact of Local Plan Review development trips from the proposed Hammonds Farm site accessing the Boreham Interchange directly via a new access arm on Generals Farm Roundabout. However, by incorporating a greater concentration of development trips through the Boreham Interchange to/from Hammonds Farm, it would be reasonable to expect junction performance to further worsen. At the very least, there would be no change in the overall conclusions determined in AECOM's study.

For this reason, a decision has been made to not model the capacity performance of the Boreham Interchange for the Local Plan Pre-Submission sensitivity test scenarios without capacity improvements associated with the A12 widening DCO.

8.1.2.4 Base Year Model Build

Models for thirteen of the assessed junctions were built for a 2022 base year, using existing layouts and geometries and by calibrating to existing traffic conditions.

Base year models for the Beaulieu Parkway Roundabout and Beaulieu Station Roundabout were not developed, as the required journey time data for model calibration was unavailable in the period since the opening of the Beaulieu Parkway bridge link over the Great Eastern Mainline on October 30th 2023.

Base year models were also not built for the Army & Navy junction, with the Local Plan modelling appraisal making use of existing forecast-year LinSig models built and approved for the appraisal of design options for the redevelopment of the junction (see Section 8.1.2.6.2). As mentioned earlier, the A12 J19 Boreham Interchange was modelled using National Highways' VISSIM microsimulation model.

8.1.2.4.1 Turning Count Data

Manual classified turning counts (MCCs) from March 2023 were provided by Essex Highways for eight of the assessed junctions (1-8 in Table 8-1). Recent survey data was not available for Waltham Road/Main Road junction, Boreham. In this instance, calibrated base model flows from the 2019 Chelmsford VISUM model were used as an alternative.

Latest traffic data available for the Odeon Roundabout in the city centre was taken from 2017 counts. Given the age of the survey data, factors derived from TEMPro v7.2 and 2022 NTM forecasts were applied to the count data to growth the flows up to 2022 levels – consistent with the base year used for model calibration.

For A12 Junctions 15-18, base year matrices were developed using turning count data collected in September 2024.

8.1.2.4.2 Base Matrices Build

Passenger Car Unit (PCU) factors were applied to the classified vehicle count data obtained/derived for each assessed junction to produce PCU turning movement matrices for the junction models.

The PCU conversion factors used are presented in Table 8-2 below.

Table 8-2: Calculation of Vehicles to PCU Factors

	CARS	LGV	HGV
Vehicle Count to PCU Conversion Factor	1	1	2

All base year ARCADY junction models used a One-Hour demand profile type, which represents a peak within the hour. Where junctions were shown to significantly exceed capacity, additional model runs were undertaken using a flat demand profile to better represent the potential impact of inter-peak spreading.

8.1.2.4.3 Base Network Build

Geometric information was based on OS mapping obtained by Essex Highways. This information was used to calculate the saturation flow, lane widths, lane allocation, and turning radii, as well as any specific geometric features for each junction.

8.1.2.5 Base Year Model Calibration

Base year ARCADY and LinSig models were calibrated using DfT (Teletrac) GPS journey time data from 2022. This data was used to calculate observed delay on junction approach arms, with which to directly compare against modelled delay outputs.

GPS journey data was obtained for the following times:

- AM Peak (07:30 – 08:30)
- PM Peak (17:00 – 18:00)
- Off-Peak to represent free-flow traffic (23:00 – 24:00)

Observed peak hour delay at the assessed junctions was calculated from the difference between free-flow off-peak journey times and AM/PM peak journey times.

Adjustments were then made, where necessary, to the base year modelled capacity of junctions so that modelled delay best represented observed delay on approach arms – as described below.

8.1.2.5.1 Lane Utilisation

A significant issue when employing ARCADY models pertains to accommodating variations in lane utilisation. By default, the ARCADY model assumes that all approaching traffic can fully occupy the entire entry width of the approach. However, in practical scenarios, this assumption doesn't hold true for many multi-lane roundabout entrances. In situations where there is an imbalance in the expected traffic flow arriving in each lane, it often leads to substantially higher delays and queues in specific lanes compared to what the model predicts.

To address uneven lane utilisation capacity adjustments were made on certain modelled approach arms at the following junctions in alignment with established best practices and industry guidelines:

- Wheelers Hill Roundabout
- Pratts Farm Roundabout
- Belsteads Farm Roundabout
- Armistice Way Roundabout
- Nabbotts Farm Roundabout
- Beaulieu Parkway/CNEB Roundabout
- Beaulieu Parkway/Rail Station Access Rbt
- A12 Junction 18 Sandon
- Odeon Roundabout

The method employed to determine Intercept corrections/capacity adjustments for uneven lane usage follows the Barbara Chard method, as outlined in the paper titled "ARCADY Health Warning: Account for Lane Usage or Risk Damaging the Public Purse." The recommended steps for accounting and adjusting for this imbalance are as follows:

1. Calculate the Intercept for the whole approach
2. Determine which lane(s) will be the most heavily used
3. Calculate the Intercept using the geometry of the busiest lane(s) only
4. Multiply the answer from (3) by the total traffic flow on the entry, then divide this by the traffic flow using the busiest lane(s)
5. If the result from (4) is lower than (1), then (4) is the Intercept to be used by ARCADY
6. Given that ARCADY will contain the geometry of the full entry, and therefore calculate (1) as the Intercept, a negative adjustment is required so that (4) is used instead.
7. If the result from (4) is higher than (1), then no adjustment is required.

8.1.2.5.2 Journey Time Calibration Statistics

Table 8-3 overleaf summarises the observed and modelled delay on junction approach arms following model calibration. Where no observed data is available cells have been greyed out.

Table 8-3: Observed Delay Comparison against Modelled.

ARM	AM Delay (s)		PM Delay (s)	
	Observed	Modelled	Observed	Modelled
SHEEPCOTES ROUNDABOUT				
Braintree Road (N)	4	5	1	3
Essex Regiment Way (S)	39	39	1	3
Braintree Road (s)	9	7	18	18
B1008	10	11	134	133
WHEELERS HILL ROUNDABOUT				
Essex Regiment Way (N)	33	33	5	4
Wheelers Hill	17	17	5	4
Essex Regiment Way (S)	31	32	8	8
PRATTS FARM ROUNDABOUT				
Essex Regiment Way (N)	149	148	12	11
Pratts Farm Lane	5	4	n/a	4
Essex Regiment Way (S)	11	10	8	5
Back Lane	2	6	5	6
BELSTEADS ROUNDABOUT				
Essex Regiment Way (N)	130	130	16	16
Retail Access	27	27	13	12
Channels Drive	19	18	2	3
Essex Regiment Way (S)	3	5	1	4
ARMISTICE AVENUE ROUNDABOUT				
Essex Regiment Way (N)	31	32	10	12
Housing Development	n/a	0	n/a	4
Armistice Avenue	8	9	3	6
Essex Regiment Way (S)	8	9	10	12
NABBOTTS FARM ROUNDABOUT				
Essex Regiment Way (N)	12	12	7	8
White Hart Lane	63	62	62	64
Essex Regiment Way (S)	10	11	9	9
Chelmer Valley Road	14	13	36	35
WALTHAM RD PRIORITY JCT				
Waltham Road	18	15	9	8
Main Road	13	8	4	9
A12 J18 SANDON INTERCHANGE				
Hammonds Road	4	6	8	6
Maldon Road (E)	5	7	4	3
Maldon Road (W)	11	5	12	17
NB Slip	26	26	10	9
SB Slip	8	5	8	8
ODEON ROUNDABOUT				
A1099 High Bridge Road	3	4	35	36
A1060 Parkway (E)	9	7	6	6
A1060 Parkway (W)	1	2	9	10
EVES CORNER MINI DOUBLE ROUNDABOUT				
Little Baddow Road	3	23	7	43
Main Road (E)	16	98	5	12
Mayes Lane	15	27	5	13
Main Road (W)	10	21	24	385

JUNCTION 15 – NORTH ROUNDABOUT				
Three Mile Hill	-1	2	2	2
A414	1	3	1	3
A12 NB Off-Slip	4	2	3	1
Golf Club		4		4
JUNCTION 15 – SOUTH ROUNDABOUT				
A414	3	2	0	2
A12 NB Off-Slip	2	3	3	2
B1002	2	3	0	3
JUNCTION 16 – NORTH ROUNDABOUT				
B1007 (N)	1	4	1	4
B1007 (S)	1	4	0	5
A12 Off-Slip	3	2	6	2
JUNCTION 16 – SOUTH ROUNDABOUT				
B1007 (N)	0	4	0	3
A12 SB Off-Slip	4	2	12	2
B1007 (S)	9	3	4	3
A12 J17 HOWE GREEN				
A12 SB off-slip	7	19	6	25
Southend Road	176	46	55	89
A130	79	314	61	3
A12 NB off-slip	72	36	82	10
A1114	27	27	13	35
SANDON P&R ACCESS JUNCTION				
Sandon P&R Access		29		29
Maldon Road (E)		6		2
Maldon Road (W)		11		12

Owing to recognised difficulties with making capacity adjustments at linked roundabout junctions using ARCADY software, it was not possible to fully calibrate all junction approaches to observed journey time delays at Eves Corner in Danbury. At the same time, it was recognised that the omission of the pre-signals for the modelling of the junction would create challenges in obtaining an accurate representation of delays along the A414.

It was also not possible to model an accurate representation of journey time delay at A12 J17 Howe Green in the base year LinSig models, as the modelling software was unable to accurately represent the impact of peak hour queuing on the A12 northbound on-slip extending back through the junction as shown in the Google Maps screenshot overleaf.

Figure 8-2: Google Maps screenshot of peak hour queuing on A12 northbound on-slip from J17 Howe Green

With challenges presented in the robust modelling of observed delays at both Howe Green and Eves Corner, 2041 forecast junction model results and analysis of Local Plan development impact at the two junctions will require caveating. Nevertheless, the expectation is that overall findings will support those highlighted previously in earlier Local Plan reporting.

8.1.2.6 Forecast Year Junction Layout Assumptions

This section details the assumed forecast-year layout of junctions modelled for this study for scenarios both with and without Local Plan development.

Revised junction layouts have been modelled at seven junctions in North-East Chelmsford based on mitigation identified as part of the planning application for the Chelmsford Garden Community (Strategic Growth Site 6). A summary description of proposals at each of these junctions is provided below (see Section 8.1.2.6.1), with illustrations included alongside the junction modelling results in the following chapter.

The forecast-year junction modelling also incorporates latest junction design proposals for the Army & Navy Roundabout and A12 J19 Boreham Interchange which are shown in the following sections of this report.

8.1.2.6.1 Future Junction Layouts – North-East Chelmsford

Sheepcotes Roundabout - No specific proposals have been modelled at this junction.

Wheelers Hill Roundabout - To address the challenges at this junction, several adjustments have been proposed, involving the realignment of all three approach arms to accommodate the Northern Radial Distributor Road (NRDR). In addition, flared approaches have been proposed on the Wheelers Hill junction arms to enhance capacity.

Pratts Farm Roundabout - Proposed mitigation involves comprehensive realignment of all four approach arms, with an additional arm introduced to accommodate the Pratts Farm Lane approach. Additionally, there are proposals to increase the Inscribed Circle Diameter (ICD) of the roundabout to boost capacity.

Belsteads Roundabout - For mitigation at this junction, proposals include the realignment of the Essex Regiment Way south approach arm to accommodate a cycle lane and improve overall capacity. The remaining approaches have not changed from the existing layout.

Armistice Avenue Roundabout - Mitigation focuses on the addition of a second lane flare on the Essex Regiment Way northern approach arm. The configuration of the other approaches remains unchanged.

Nabbotts Farm Roundabout – Current proposals consider the realignment of the bus lane and all-vehicle lanes on the Essex Regiment Way approach arm. The existing configuration remains on the other junction approaches.

Beaulieu Parkway / Chelmsford North-East Bypass (CNEB) Roundabout - At present, there are plans to realign the CNEB and eastern Beaulieu Parkway approach arms and lengthening the two-lane approaches, with both exit arms increased to two lanes. No changes are proposed on the minor access arms.

Beaulieu Parkway / Rail Station Access Roundabout - At present, there are plans to realign and widen the exit arms to two lanes on Beaulieu Parkway (n and s), with Loverose Way (w), also being realigned.

Waltham Road / Main Road, Boreham - No specific proposals have been modelled at this junction.

8.1.2.6.2 Army and Navy Roundabout Future Layout

Figure 8-3: Concept image of the Army and Navy Roundabout proposed 'hamburger' layout.

The forecast junction model built for the Army and Navy Roundabout in Chelmsford city centre incorporates the latest Essex County Council preferred 'hamburger' roundabout design[9] as shown in Figure 8-3 above. A LinSig model of the junction developed and approved for use on the Army and Navy modelling study was repurposed for the Local Plan junction modelling appraisal.

8.1.2.6.3 Boreham Interchange (A12 Junction 19) Future Layout

The Local Plan Review strategic forecast modelling incorporates the latest Boreham Interchange designs and signal timings produced by National Highways and published as part of the A12 Chelmsford to A120 widening scheme Development Consent Order (DCO) June 2023 into the Chelmsford Forecast VISUM Model. The proposed layout is shown in Figure 8-4 overleaf.

[9] Source: https://www.essexhighways.org/highway-schemes-and-developments/highway-schemes/chelmsford-schemes/army-and-navy-taskforce

Figure 8-4: Latest National Highways proposals for the Boreham Interchange[10]

The proposed changes include:

- Controlled crossings at both Generals Lane Roundabout and Boreham Roundabout
- Signalisation of Generals Lane Roundabout
- Widening of Boreham Bridge
- Realignment of Beaulieu Park RDR and the A138

8.1.2.7 Future Junction Demand Matrices

With the exception of Eves Corner, Danbury, forecast demand matrices were built using modelled demand flows taken directly from the 2041 Chelmsford VISUM forecast model at each of the assessed junctions – for scenarios with and without the assigned LPRPS development trips.

8.1.2.7.1 Eves Corner Demand Flows

A separate approach was adopted for Eves Corner to accommodate the limitations of the Chelmsford VISUM Model in this area. As shown in Figure 8-5 overleaf, Eves Corner is located outside of the calibrated area of the strategic model. VISUM output flows in this location were therefore not considered robust enough to be used directly for producing the forecast demand matrices.

[10] Source: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010060/TR010060-002612-National%20Highways%20-%202.9%20General%20Arrangement%20Plans%20-%20Part%202.pdf

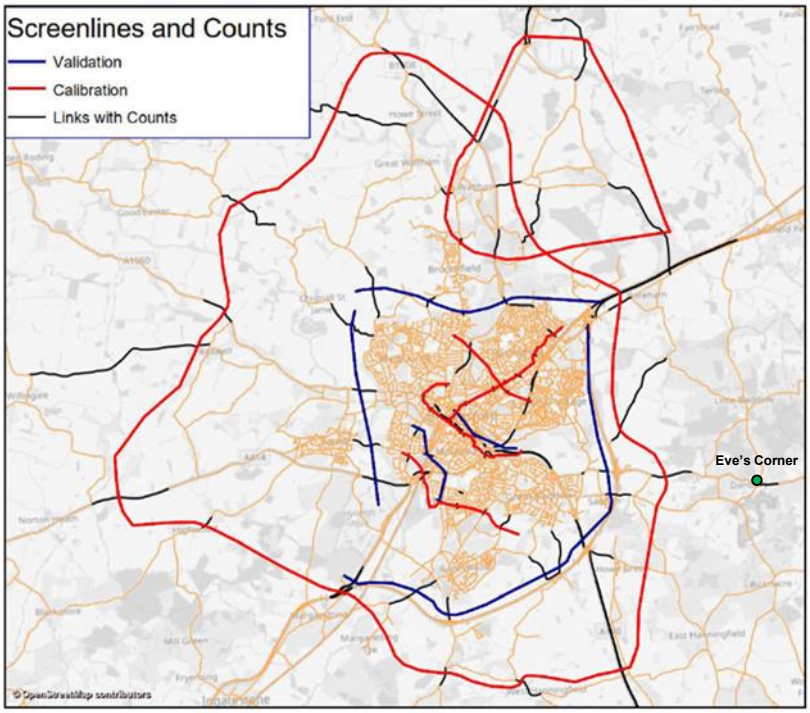


Figure 8-5: Cordons and Screenlines used in 2019 base model calibration/validation

Instead, a factor derived from the growth in traffic movements at Eves Corner in the Chelmsford VISUM model between the 2019 base and 2041 forecast year modelled scenarios, was applied to the observed counts at the junction in order to produce the forecast junction matrices (with and without LPRPS development trips).

To do this, observed vehicle counts from a 2022 junction survey were factored down to a 2019 'base' year using a reduction factor (0.97) generated from TEMPro growth figures, as shown in Table 8-4 below, to create a matching base with the 2019 Chelmsford VISUM model.

Table 8-4: Calculation of reduction factor for factoring back 2022 observed flows to a 2019 base year

	2019 - 2022 Growth in Origins (TEMPro)	2019 - 2022 Growth in Destinations (TEMPro)	2019 - 2022 Average Growth (Combined O-Ds)	2019 - 2022 Growth Factor	2022 - 2019 Reduction Factor
AM	1.0307	1.0295	1.0301	0.03	0.97
PM	1.0295	1.0308	1.03015	0.03	0.97

8.1.2.8 Metrics Used in Forecast Modelling

The metrics upon which the traffic conditions at junctions have been calculated and assessed are explained below:

- RFC (Ratio of Flow to Capacity) or DoS (Degree of Saturation): provides a measure of the utilised capacity of each junction arm. Arms exceeding 0.85 indicate 85% of the capacity of the arm is used and is approaching capacity. Arms with a ratio of 1.00 indicates the full capacity of the relevant arm has been used. Arms exceeding a ratio of 1.00 are overcapacity and high volumes of traffic queues occur;
- Practical Capacity: is a point beyond which delays and queues on a junction link begin to increase significantly. For 'give-way' roundabouts, the practical capacity limit is 0.85 RFC. This is generally seen as an acceptable threshold for a new junction in the opening year;
- Delay (in seconds): is the average delay in seconds per Passenger Car Unit (PCU) on each approach across the peak hour;
- Queue (in PCUs): is the average maximum queue length in Passenger Car Units (PCUs) on each approach across the peak hour.

8.2 Local Junction Modelling Outputs

This section presents the outputs of the local junction modelling for the main 2041 'Baseline' and 'With LPRPS' scenarios.

The outputs presented are based on the default use of a *One-Hour* demand profile for the junction modelling. This assumes a peaked profile with higher flows in the middle of the peak hour and proportionally lower flows towards the beginning and end of the peak hour.

For junctions operating with no spare capacity and with noticeable congestion experienced along approach arms, it may be reasonable to expect a flatter demand profile to occur in reality - with drivers shifting their travel times to avoid the busiest times within the peak hour.

To account for this potential intra-peak spreading, sensitivity tests using a *FLAT* demand profile were carried out for the non-signalised junctions modelled operating over capacity on any approach arm. The sensitivity test outputs are presented in the summary tables below (indicated by blue text) for junction arms with RFC values exceeding 1.0.

It should also be noted that output values for junction approach arms modelled with RFC/DoS values in excess of 1.0 have been shown to be increasingly

unrepresentative as conditions worsen and should therefore be considered with caution.

8.2.1 Junctions 10 Modelling (ARCADY and PICADY) Outputs

8.2.1.1 Sheepcotes Roundabout

As shown in Figure 8-6 below, Sheepcotes Roundabout comprises four arms with a filter-lane directed southbound from Braintree Road (A131) to Essex Regiment Way (A131). Currently there are no proposals to revise the layout of this junction as part of developer-led proposals in north-east Chelmsford.

Table 8-5 overleaf shows that the addition of LPRPS development trips through the junction would likely have a very minor impact on capacity performance. Nevertheless, it is noted that the Essex Regiment Way (S) arm does reach capacity in the PM peak, whilst background traffic flows along the B1008 arm exceed its capacity in both peak hours modelled.

It should be noted that delivery of the northern section of the Chelmsford North-East Bypass (CNEB) connecting into the A131 Braintree Road at Chatham Green, would reduce flows routing through Sheepcotes Roundabout and alleviate capacity stresses modelled in the 2041 forecast scenarios.

Figure 8-6: Sheepcotes Roundabout Existing Layout

Table 8-5: Sheepcotes Roundabout Local Junction Modelling Outputs - Existing Layout

Existing Layout	AM			PM		
	Queue (PCUs)	Delay (s)	RFC	Queue (PCUs)	Delay (s)	RFC
2041 Forecast - Baseline						
1 – Braintree Rd (N)	1	4.9	**0.48**	1	3.2	**0.34**
2 – Essex Regiment Way (S)	16	39.3	**0.96**	3	5.5	**0.71**
3 – Braintree Rd (S)	3	11.3	**0.70**	2	12.0	**0.66**
4 – B1008	4	21.2	**0.80**	56	262.3	**1.17**
				14	*79.4*	***0.94***
2041 Forecast - 'With LPRPS' Scenario						
1 – Braintree Rd (N)	1	5.0	**0.49**	1	3.2	**0.34**
2 – Essex Regiment Way (S)	19	45.3	**0.97**	3	5.6	**0.71**
3 – Braintree Rd (S)	3	12.4	**0.73**	2	12.3	**0.66**
4 – B1008	4	22.5	**0.81**	63	293.4	**1.19**
				18	*103.0*	***0.96***

** Outputs in italics have been modelled using a FLAT demand profile*

Within Capacity Approaching Capacity Over Capacity

8.2.1.2 Wheelers Hill Roundabout

The existing layout of the three-arm Wheelers Hill roundabout is shown in Figure 8-7 overleaf. Several adjustments have been proposed at the junction to help accommodate development associated with the CGC. These involve the realignment of all three arms to accommodate the proposed Northern Radial Distributor Road and flared lane approaches to the junction to help enhance capacity.

Modelling results have been presented for the future layout of this junction only, as it is understood that the proposed reconfiguration will necessarily be built to accommodate the Northern Radial Distributor Road, which will provide access to the Chelmsford Garden Community development and connectivity with the CNEB. As the proposed changes will be implemented independently of any potential capacity concerns with the existing roundabout, a comparison of network performance against the current layout is considered unnecessary.

Figure 8-7: Wheelers Hill Roundabout Existing Layout

The results in Table 8-6 again show that the addition of development trips from the LPRPS might be expected to have a very small impact on overall junction capacity performance. The revised junction layout is expected to operate sufficiently within capacity in both the AM and PM peaks hours in scenarios both with and without the additional Local Plan development.

Table 8-6: Wheelers Hill Roundabout Local Junction Modelling Outputs - Future Layout

Future Layout	AM			PM		
	Queue (PCUs)	Delay (s)	RFC	Queue (PCUs)	Delay (s)	RFC
2041 Forecast – Baseline						
1 – Essex Regiment Way (N)	8	20.0	**0.89**	5	14.5	**0.81**
2 – Wheelers Hill	5	14.6	**0.82**	2	4.9	**0.55**
3 – Essex Regiment Way (S)	2	6.0	**0.54**	2	6.0	**0.66**
2041 Forecast - 'With LPRPS' ' Scenario						
1 – Essex Regiment Way (N)	8	20.0	**0.89**	5	14.6	**0.81**
2 – Wheelers Hill	6	16.7	**0.85**	2	4.9	**0.55**
3 – Essex Regiment Way (S)	2	6.1	**0.53**	2	6.0	**0.67**

Within Capacity Approaching Capacity Over Capacity

8.2.1.3 Pratts Farm Roundabout

Pratts Farm Roundabout is a four-arm junction. The Essex Regiment Way (N) arm includes a left-turn filter lane into the Park and Ride site as illustrated in Figure 8-8 below.

Several improvements have been proposed for this junction, including the realignment of all four approach arms with an additional arm introduced to accommodate Pratts Farm Lane. Additionally, there are proposals to increase the Inscribed Circle Diameter (ICD) of the roundabout to boost capacity.

Summary model outputs presented in Table 8-7 and Table 8-8 demonstrate very little difference between the Baseline and LPRPS modelled scenarios, suggesting that trips associated with the Pre-Submission will likely have little impact on the performance of the junction.

Nevertheless, the proposed layout is expected to help significantly reduce the levels of queuing and delay along Essex Regiment Way (N) caused by background traffic growth in the AM peak.

Figure 8-8: Pratts Farm Roundabout Existing Layout

Table 8-7: Pratts Farm Roundabout Local Junction Modelling Outputs - Existing Layout

Existing Layout	AM			PM		
	Queue (PCUs)	Delay (s)	RFC	Queue (PCUs)	Delay (s)	RFC
2041 Forecast - Baseline						
1 – Essex Regiment Way (N)	99	414.1	**1.21**	2	8.7	**0.63**
	**116*	*474.8*	***1.08***			
2 – Pratts Farm Lane	0	3.4	**0.04**	1	6.4	**0.43**
3 – Essex Regiment Way (S)	3	7.3	**0.72**	2	4.1	**0.58**
4 – Back Lane	1	5.3	**0.29**	20	98.2	**1.01**
				5	*28.4*	***0.84***
2041 Forecast - 'With LPRPS' ' Scenario						
1 – Essex Regiment Way (N)	96	396.3	**1.21**	2	8.8	**0.63**
	108	*443.4*	***1.08***			
2 – Pratts Farm Lane	0	3.4	**0.04**	1	6.6	**0.44**
3 – Essex Regiment Way (S)	3	8.0	**0.75**	2	4.1	**0.58**
4 – Back Lane	0	5.3	**0.28**	37	160.0	**1.08**
				8	*42.6*	***0.89***

● Within Capacity ● Approaching Capacity ● Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

Table 8-8: Pratts Farm Roundabout Local Junction Modelling Outputs - Future Layout

Future Layout	AM			PM		
	Queue (PCUs)	Delay (s)	RFC	Queue (PCUs)	Delay (s)	RFC
2041 Forecast - Baseline						
1 – Essex Regiment Way (N)	2	4.3	**0.54**	1	3.3	**0.39**
2 – P&R	0	0.0	**0.0**	1	5.9	**0.32**
3 – Pratts Farm Lane	1	4.3	**0.05**	1	5.8	**0.17**
4 – Essex Regiment Way (S)	13	37.8	**0.94**	63	169.8	**1.09**
				**28*	*94.2*	***0.98***
5 – Back Lane	1	5.1	**0.28**	8	38.6	**0.90**
				4	*21.8*	***0.80***
2041 Forecast - 'With LPRPS' ' Scenario						
1 – Essex Regiment Way (N)	2	4.3	**0.54**	1	3.4	**0.40**
2 – P&R	0	0.0	**0.0**	1	6.0	**0.34**
3 – Pratts Farm Lane	1	4.3	**0.05**	1	6.0	**0.18**
4 – Essex Regiment Way (S)	20	53.7	**0.98**	67	178.6	**1.10**
				28	*94.2*	***0.98***
5 – Back Lane	1	5.0	**0.28**	13	60.2	**0.96**

● Within Capacity ● Approaching Capacity ● Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

8.2.1.4 Belsteads Farm Roundabout

As shown in Figure 8-9 below, Belsteads Farm Roundabout is a four-arm junction. Essex Regiment Way (N) includes a left-turn filter lane into the retail area, whilst Essex Regiment Way (S) includes a straight-ahead filter-lane.

The revised junction layout modelled involves the realignment of Essex Regiment Way (S) to accommodate a cycle lane and improve overall capacity.

The modelled results, shown in Table 8-9 and Table 8-10 indicate that the LPRPS development impact at the junction is likely to be negligible, whilst the proposed improvements at the junction would help to address capacity issues caused by background growth in traffic along Essex Regiment Way (N) and Channels Drive in the AM peak. With design proposals in place, the junction is anticipated to perform within capacity across all arms in both the AM and PM peaks.

Figure 8-9: Belsteads Farm Roundabout Existing Layout

Table 8-9: Belsteads Farm Local Junction Modelling Outputs - Existing Layout

Existing Layout	AM			PM		
	Queue (PCUs)	Delay (s)	RFC	Queue (PCUs)	Delay (s)	RFC
2041 Forecast – Baseline						
1 – Essex Regiment Way (N)	2	5.5	0.64	6	16.8	0.86
2 – Retail Access	0	0.0	0.0	0	8.4	0.01
3 – Channels Drive (Offside Ln)	35	177.1	1.08	2	15.0	0.63
	11	*63.9*	*0.92*			
4 – Channels Drive (Nearside Ln)	2	20.2	0.67	1	8.9	0.41
5 – Essex Regiment Way (S)	1	3.6	0.07	1	4.0	0.27
2041 Forecast - 'With LPRPS' ' Scenario						
1 – Essex Regiment Way (N)	2	5.4	0.63	7	19.6	0.88
2 – Retail Access	0	0.0	0.0	0	8.8	0.01
3 – Channels Drive (nearside)	40	197.6	1.10	2	16.0	0.65
	13	*76.3*	*0.94*			
4 – Channels Drive (offside)	2	20.9	0.68	1	9.2	0.42
4 – Essex Regiment Way (s)	1	3.6	0.14	1	4.1	0.29

● Within Capacity ● Approaching Capacity ● Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

Table 8-10: Belsteads Farm Roundabout Local Junction Modelling Outputs – Future Layout

Future Layout	AM			PM		
	Queue (PCUs)	Delay (s)	RFC	Queue (PCUs)	Delay (s)	RFC
2041 Forecast – Baseline						
1 – Essex Regiment Way (N)	2	5.9	0.65	7	17.7	0.87
2 – Retail Access	0	0.0	0.0	0	8.4	0.01
3 – Channels Drive (offside)	35	177.0	1.08	2	14.9	0.63
	11	*63.9*	*0.92*			
4 – Channels Drive (nearside)	2	20.2	0.67	1	8.9	0.41
4 – Essex Regiment Way (S)	1	1.6	0.07	1	1.6	0.13
2041 Forecast - 'With LPRPS' ' Scenario						
1 – Essex Regiment Way (N)	2	5.8	0.65	8	20.7	0.89
2 – Retail Access	0	0.0	0.0	0	8.8	0.01
3 – Channels Drive (offside)	40	197.4	1.10	2	16.0	0.65
	13	*76.3*	*0.94*			
4 – Channels Drive (nearside)	2	21.0	0.68	1	9.2	0.42
5 – Essex Regiment Way (S)	1	1.6	0.07	1	1.7	0.14

● Within Capacity ● Approaching Capacity ● Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

8.2.1.5 Armistice Avenue Roundabout

Armistice Avenue Roundabout operates as a four-arm junction as illustrated in Figure 8-10 below.

Minor capacity improvement measures proposed include the addition of a second lane flare on the Essex Regiment Way northern approach arm. The configuration of the other approaches remains unchanged.

The modelled results presented in Table 8-11 and Table 8-12 again show a negligible impact from LPRPS development trips routing through the junction. Capacity improvement measures at this junction would help to significantly reduce levels of queuing and delay for background traffic flows along both Essex Regiment Way (N) and Armistice Avenue in the AM peak. With capacity improvements in place, the junction is anticipated to perform within capacity across all arms in both the AM and PM peaks.

Figure 8-10: Armistice Avenue Junction Existing Layout

Table 8-11: Armistice Avenue Roundabout Local Junction Modelling Outputs - Existing Layout

Existing Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast – Baseline						
1 – Essex Regiment Way (N)	50	118.1	**1.05**	4	10.5	**0.78**
	*17	*49.9*	*0.95*			
2 – Development Access	0.0	0.0	**0.0**	0	0.0	**0.0**
3 – Armistice Avenue	12	63.7	**0.96**	1	4.8	**0.20**
4 – Essex Regiment Way (S)	2	4.0	**0.54**	4	8.2	**0.78**
2041 Forecast - 'With LPRPS' ' Scenario						
1 – Essex Regiment Way (N)	46	110.3	**1.04**	4	11.3	**0.80**
	16	*45.2*	*0.95*			
2 – Development Access	0	0.0	**0.0**	0	0.0	**0.0**
3 – Armistice Avenue	12	62.7	**0.95**	1	4.9	**0.20**
4 – Essex Regiment Way (S)	2	4.2	**0.55**	4	8.5	**0.79**

● Within Capacity ● Approaching Capacity ● Over Capacity * *Outputs in italics have been modelled using a FLAT demand profile*

Table 8-12: Armistice Avenue Roundabout Local Junction Modelling Outputs - Future Layout

Future Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast – Baseline						
1 – Essex Regiment Way (N)	2	3.9	**0.58**	2	4.0	**0.58**
2 – Development Access	0	0.0	**0.0**	0	0.0	**0.0**
3 – Armistice Avenue	1	6.9	**0.45**	1	4.0	**0.05**
4 – Essex Regiment Way (S)	1	3.0	**0.09**	1	3.0	**0.14**
2041 Forecast - 'With LPRPS' Scenario						
1 – Essex Regiment Way (N)	2	3.9	**0.58**	2	4.0	**0.58**
2 – Development Access	0	0.0	**0.0**	0	0.0	**0.0**
3 – Armistice Avenue	1	6.9	**0.45**	1	3.8	**0.05**
4 – Essex Regiment Way (S)	1	3.0	**0.09**	1	3.1	**0.15**

● Within Capacity ● Approaching Capacity ● Over Capacity

8.2.1.6 Nabbotts Farm Roundabout

Nabbotts Farm Roundabout is a four-arm junction, with a bus lane provide along both the Essex Regiment Way (N) and Chelmer Valley Road approach arms – as illustrated in Figure 8-11 overleaf.

Current developer proposals consider the realignment of the bus lane and all-vehicle lanes on the Essex Regiment Way approach arm. The existing configuration remains on the other junction approaches.

Table 8-13 and Table 8-14 show very little change between the baseline and Local Plan modelled scenarios – suggesting that the impact of Local Plan Pre-Submission development trips at this junction is likely to be very small.

Whilst the addition of LPRPS development does not have a notable impact on Essex Regiment Way (N), the results indicate that the proposed measures would be expected to help to reduce queues and delays caused by background traffic growth.

Figure 8-11: Nabbotts Farm Roundabout Existing Layout

Table 8-13: Nabbotts Farm Roundabout Local Junction Modelling Outputs - Existing Layout

Existing Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast - Baseline						
1 – Essex Regiment Way (n)	16	31.7	0.95	2	4.7	0.61
2 – White Hart Lane	2	10.4	0.58	7	27.5	0.87
3 – Pump Lane	1	3.8	0.24	1	4.9	0.38
4 – Chelmer Valley Road	2	5.0	0.54	5	17.0	0.84
2041 Forecast - 'With LPRPS' Scenario						
1 – Essex Regiment Way (n)	14	28.7	0.94	2	4.8	0.62
2 – White Hart Lane	2	10.2	0.58	7	30.8	0.89
3 – Pump Lane	1	3.8	0.25	1	5.1	0.39
4 – Chelmer Valley Road	1	5.0	0.55	6	19.7	0.86

● Within Capacity ● Approaching Capacity ● Over Capacity

Table 8-14: Nabbotts Farm Roundabout Local Junction Modelling Outputs - Future Layout

Future Layout	AM			PM		
	Queue (PCUs)	Delay (s)	RFC	Queue (PCUs)	Delay (s)	RFC
2041 Forecast - Baseline						
1 – Essex Regiment Way (n)	6	11.0	**0.85**	2	3.5	**0.54**
2 – White Hart Lane	2	10.4	**0.59**	7	27.5	**0.87**
3 – Pump Lane	1	3.8	**0.24**	1	4.9	**0.38**
4 – Chelmer Valley Road	2	5.0	**0.54**	5	17.0	**0.84**
2041 Forecast - 'With LPRPS' Scenario						
1 – Essex Regiment Way (n)	6	10.5	**0.84**	2	3.6	**0.55**
2 – White Hart Lane	2	10.3	**0.58**	7	30.8	**0.89**
3 – Pump Lane	1	3.9	**0.25**	1	5.1	**0.39**
4 – Chelmer Valley Road	2	5.1	**0.55**	6	19.7	**0.86**

● Within Capacity ● Approaching Capacity ● Over Capacity

8.2.1.7 Beaulieu Parkway / CNEB Roundabout

Beaulieu Parkway roundabout consists of six arms, with the northern arm (providing future connectivity for the CNEB) and the Generals Lane (S) arm not yet fully developed, as depicted in Figure 8-12 overleaf.

At present, there are plans to realign the CNEB and Beaulieu Parkway (E) approach arms and lengthening the two-lane approaches, with both exit arms increased to two lanes. No changes are proposed on the minor access arms of the junction.

The modelled results, as shown in Table 8-15 and Table 8-16, suggest that LPRPS development impact is likely to be minimal at the junction. Regardless, the capacity improvement measures proposed at the junction to accommodate background traffic growth would likely help to reduce forecast congestion modelled along Beaulieu Parkway (E) and, to a lesser extent, along the CNEB approach.

Figure 8-12: Beaulieu Parkway / CNEB Roundabout Existing Layout

Table 8-15: Beaulieu Parkway / CNEB Roundabout Local Junction Modelling Outputs - Existing Layout

Existing Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast - Baseline						
1 – CNEB (N)	10	33.2	0.91	2	8.0	0.61
2 – Generals Lane (N)	0.0	0.0	0.0	0.0	0.0	0
3 – Beaulieu Parkway (E)	2	5.0	0.52	66	132.2	1.07
				*22	*56.2*	*0.97*
4 – Generals Lane (S)	1	4.3	0.18	1	5.7	0.12
5 – Remembrance Ave	1	4.7	0.20	1	5.3	0.11
6 – Beaulieu Parkway (W)	1	5.7	0.44	2	11.5	0.68
2041 Forecast - 'With LPRPS' Scenario						
1 – CNEB (N)	9	31.2	0.91	1.6	8.2	0.61
2 – Generals Lane (N)	0.0	0.0	0.0	0.0	0.0	0.0
3 – Beaulieu Parkway (E)	2	5.1	0.53	61.6	124.9	1.06
				20	*50.7*	*0.96*
4 – Generals Lane (S)	1	4.3	0.19	0.1	5.7	0.12
5 – Remembrance Ave	1	4.8	0.20	0.1	5.3	0.11
6 – Beaulieu Parkway (W)	1	5.7	0.43	2.3	12.0	0.70

● Within Capacity ● Approaching Capacity ● Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

Table 8-16: Beaulieu Parkway / CNEB Roundabout Local Junction Modelling Outputs - Future Layout

Future Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast - Baseline						
1 – CNEB (N)	8	25.7	0.89	2	7.4	0.59
2 – Generals Lane (N)	0	0.0	0.00	0	0.0	0.0
3 – Beaulieu Parkway (E)	1	3.2	0.41	6	11.8	0.84
4 – Generals Lane (S)	1	4.3	0.18	1	6.2	0.13
5 – Remembrance Ave	1	4.7	0.20	1	5.7	0.12
6 – Beaulieu Parkway (W)	1	5.7	0.44	3	12.9	0.71
2041 Forecast - 'With LPRPS' Scenario						
1 – CNEB (N)	7	24.4	0.88	2	7.6	0.59
2 – Generals Lane (N)	0.0	0.0	0.0	0	0.0	0.0
3 – Beaulieu Parkway (E)	1	3.3	0.42	5	11.5	0.84
4 – Generals Lane (S)	1	4.3	0.19	1	6.1	0.12
5 – Remembrance Ave	1	4.8	0.20	1	5.7	0.12
6 – Beaulieu Parkway (W)	1	5.7	0.43	3	13.4	0.72

● Within Capacity ● Approaching Capacity ● Over Capacity

8.2.1.8 Beaulieu Parkway / Railway Station Access Roundabout

The existing layout for the Beaulieu Station access roundabout consists of four arms as shown in Figure 8-13 below. The screenshot, taken from Google Maps, shows the Beaulieu Parkway (S) arm still under construction although the link has since been completed and opened.

At present, there are plans to realign and widen the exit arms to two lanes on Beaulieu Parkway (N and S), with Loverose Way (W), also being realigned.

With limited geometric data available for the new-build junction, only the redesign layout has been modelled. The results summarised in Table 8-17 again show the very minor impact that Local Plan development trips associated with the Pre-Submission will likely have on junctions in north-east Chelmsford.

With growth in background traffic flows alone, junction modelling indicates that the Beaulieu Parkway northern and southern arms will likely operate over-capacity in a 2041 baseline scenario. Assuming a FLAT demand profile, Beaulieu Parkway (N) would operate 'near capacity' (AM) but Beaulieu Parkway (S) would still operate over-capacity in the PM peak.

Figure 8-13: Beaulieu Parkway / Railway Station Access Roundabout - Existing Layout

Table 8-17: Beaulieu Parkway / Railway Station Access Roundabout Local Junction Modelling Outputs - Mitigation Layout

Future Layout	AM			PM		
	Queue (PCUs)	Delay (s)	RFC	Queue (PCUs)	Delay (s)	RFC
2041 Forecast - Baseline						
1 – Beaulieu Parkway (N)	60	116.3	**1.06**	3	8.8	**0.75**
	*14	*34.8*	*0.94*			
2 – Loverose Way (E)	1	9.0	**0.19**	3	22.5	**0.73**
3 – Beaulieu Parkway (S)	11	28.2	**0.93**	69	132.7	**1.07**
				23	*55.8*	*0.97*
4 – Loverose Way (W)	1	6.5	**0.40**	6	32.1	**0.86**
2041 Forecast - 'With LPRPS' Scenario						
1 – Beaulieu Parkway (N)	54	107.6	**1.05**	3	8.9	**0.75**
	13	*31.6*	*0.93*			
2 – Loverose Way (E)	1	9.0	**0.19**	3	22.7	**0.73**
3 – Beaulieu Parkway (S)	13	32.3	**0.94**	63	122.0	**1.06**
				20	*48.0*	*0.96*
4 – Loverose Way (W)	1	6.6	**0.40**	6	31.8	**0.86**

● Within Capacity ● Approaching Capacity ● Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

8.2.1.9 Waltham Road / Main Road Priority Junction, Boreham

The existing layout of the priority junction of Waltham Road with Main Road in Boreham, is shown in Figure 8-14 overleaf. Currently there are no plans in place to revise the layout of this junction.

The modelled results shown in Table 8-18 indicate that Waltham Road operates over-capacity in the AM peak in the forecast Baseline scenario. Waltham Road itself is a recognised alternative to the A131 for longer-distance trips between Great Leighs and the A12 and is modelled as a favoured route to avoid congestion on the A131 in the vicinity of the Boreham Interchange.

However, with LPRPS development traffic added to the Boreham Interchange particularly from the proposed Hammonds Farm development site located off Generals Farm Roundabout, fewer vehicle trips are modelled routing via Waltham Road and B1137 Main Road to access the Boreham Interchange.

As a result, the Waltham Road / Main Road junction is modelled with lower journey time delay and RFC values for Waltham Road, resulting in the approach arm operating within capacity.

Figure 8-14: Waltham Road / Main Road Priority Junction Existing Layout

Table 8-18: Waltham Road / Main Road Priority Junction, Boreham Local Junction Modelling Outputs - Existing Layout

Existing Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast – Baseline						
1 – Waltham Rd to Main Rd (e)	7	181.7	**1.00**	2	32.7	**0.63**
	2	*36.8*	***0.56***			
2 – Waltham Rd to Main Rd (w)	17	113.1	**1.01**	4	35.1	**0.80**
	6	*42.4*	***0.85***			
3 – Main Road	2	15.8	**0.59**	2	13.2	**0.49**
2041 Forecast - 'With LPRPS' Scenario						
1 – Waltham Rd to Main Rd (e)	6	148.6	**0.95**	3	45.0	**0.71**
2 – Waltham Rd to Main Rd (w)	13	90.5	**0.97**	5	44.2	**0.85**
3 – Main Road	2	19.3	**0.66**	2	12.9	**0.49**

** Outputs in italics have been modelled using a FLAT demand profile*

● Within Capacity ● Approaching Capacity ● Over Capacity

8.2.1.10 Eves Corner Double Mini Roundabout, Danbury

As shown in Figure 8-15 overleaf, Eves Corner features a pair of mini roundabouts. A pedestrian crossing can be found on the eastern approach arm of A414 Main Road, along with part-time signals on the north arm (Little Baddow Road) and south arm (Mayes Lane). However, as previously mentioned, these have not been modelled in Junctions 10 due to the limited time they are in use during the AM and PM peaks.

Table 8-19 shows that the A414 Main Road (E) and Little Baddow Road approach arms are both expected to operate over capacity in the Baseline scenario, with background growth from Chelmsford and Maldon, prior to the addition of Local Plan development trips associated with the Pre-Submission. The LPRPS modelled scenario exacerbates congestion issues at the junction to a small extent.

It should, however, be noted that the pre-signals at the junction have not been included in this modelling appraisal, and their increased use in the peak hours will help to manage queues and delays forecast along A414 Main Road (E). Additionally, model outputs along Little Baddow Road and Mayes Lane, in particular, should be treated with caution as they are likely to exaggerate the extent of queues and delays along the minor approach arms. This is because the accuracy of the forecast junction flows taken from the Chelmsford VISUM model will be impacted by the limited number of zones and connectors covering Danbury, and the concentration of vehicle trips at specific load-on points – such as along Little Baddow Road.

With this in mind, the outputs shown in Table 8-19 would be best used to consider the relative impact of LPRPS development trips at the junction, as opposed to focussing on absolute junction capacity values.

It is recommended that development impact at Eve's Corner junction will need to be a focus of future planning applications associated with proposed development sites off the A414. This will likely require liaison with ECC to re-evaluate the effectiveness of the current pre-signals at the junction, the extent to which their use will need to be extended through the peak hours, and the subsequent impact on queues along Little Baddow Road and Mayes Lane.

Figure 8-15: Eves Corner Roundabout Existing Layout

Table 8-19: Eves Corner Roundabout Existing Layout

Existing Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast - Baseline						
Mayes Lane Roundabout (E)						
1 - Mayes Lane	1	28.7	0.11	1	26.0	0.95
2 – A414 Main Road (W)	6	25.6	0.85	83	327.0	1.16
				*87	339.3	1.05
Little Baddow Road Roundabout (W)						
3 – A414 Main Road (E)	140	535.5	1.26	13	50.3	0.95
	188	685.5	1.14			
4 - Little Baddow Road	12	118.5	1.01	6	85.8	0.89
	3	27.5	0.69			
2041 Forecast - 'With LPRPS' Scenario						
Mayes Lane Roundabout (E)						
1 - Mayes Lane	1	28.7	0.11	1	28.9	0.31
2 – A414 Main Road (W)	5	23.2	0.83	42	152.5	1.07
				20	88.8	0.97
Little Baddow Road Roundabout (W)						
3 – A414 Main Road (E)	164	640.8	1.29	15	58.6	0.96
	248	932.6	1.19			
4 - Little Baddow Road	28	253.2	1.15	7	92.7	0.91
	10	100.0	0.96			

● Within Capacity ● Approaching Capacity ● Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

8.2.1.11 A12 Junction 15, Margaretting Interchange

As shown in Figure 8-16, Junction 15 on the A12 features a double roundabout bridging N-S over the A12. The north roundabout consists of 4 arms, including an access only arm to the north and an off slip (entry only arm) on the west side. The south roundabout consists of 4 arms including an off slip (entry only arm) on the east side and an on slip (exit only arm) on the west side. Currently there are no plans in place to revise the layout of this junction.

Table 8-20 suggests that the impact of the LPRPS development is likely to be minimal at the junction. Whilst the A12 southbound off-slip and B1002, approaching the South Roundabout are approaching capacity under the LPRPS Scenario, this is consistent with the Baseline.

Figure 8-16: A12 J15 Existing Layout

Table 8-20: A12 J15 ARCADY Outputs – Existing Layout

Existing Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast - Baseline						
J15 North Roundabout						
1 – Three Mile Hill	4	6.6	**0.76**	4	6.6	**0.76**
3 – A414	2	5.3	**0.57**	1	3.9	**0.44**
4 – A12 NB off-slip	2	3.8	**0.52**	1	2.9	**0.43**
5 – Golf Club	0.0	0.0	**0.00**	0	0.0	**0.00**
J15 South Roundabout						
1 – A414	3	7.3	**0.74**	2	4.8	**0.60**
2 – A12 SB off-slip	16	62.2	**0.97**	1	5.8	**0.44**
3 – B1002	6	52.1	**0.88**	2	10.1	**0.54**
2041 Forecast - 'With LPRPS' Scenario						
J15 North Roundabout						
1 – Three Mile Hill	4	7.1	**0.78**	3	6.5	**0.75**
3 – A414	2	5.5	**0.59**	1	4.0	**0.44**
4 – A12 NB off-slip	2	3.8	**0.52**	1	2.9	**0.44**
5 – Golf Club	0	0.0	**0.00**	0	0.0	**0.00**
J15 South Roundabout						
1 – A414	4	7.9	**0.76**	2	4.7	**0.60**
2 – A12 SB off-slip	18	71.8	**0.98**	1	5.8	**0.44**
3 – B1002	9	74.2	**0.94**	2	10.2	**0.54**

● Within Capacity ● Approaching Capacity ● Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

8.2.1.12 A12 Junction 16, Galleywood Interchange

As shown in Figure 8-17, Junction 16 on the A12 features a double roundabout bridging N-S over the A12. The north roundabout consists of 4 arms, including a on-slip (exit only arm) on the east side and an off-slip (entry only arm) on the west side. The south roundabout also consists of 4 arms including an off slip (entry only arm) on the east side and an on-slip (entry only arm) on the west side.

Table 8-21 suggests that the impact of the LPRPS development is likely to be minimal at the junction. Whilst the B1007 (N) on the north roundabout is operating over- capacity under the LPRPS Scenario in both the AM and PM peaks, this is consistent with the Baseline. In a similar way, the B1007 (N) access onto the South Roundabout is also over-capacity in the AM peak under the LPRPS Scenario, but again consistent with the Baseline.

Figure 8-17: A12 J16 Existing Layout

Table 8-21: A12 J16 ARCADY Outputs – Existing Layout

Existing Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast - Baseline						
J16 North Roundabout						
1 – B1007 (N)	14	542.4	**1.30**	27	139.0	**1.05**
	**170*	*696.5*	***1.13***	*8*	*45.3*	***0.88***
2 – B1007 (S)	2	10.3	**0.67**	6	22.4	**0.85**
3 – A12 NB off-slip	1	2.7	**0.29**	2	4.9	**0.57**
J16 South Roundabout						
1 – B1007 (N)	29	79.8	**1.01**	14	43.6	**0.95**
	11	*33.6*	***0.92***			
2 – B1007 (S)	1	4.2	**0.37**	1	4.0	**0.35**
3 – A12 SB off-slip	5	16.6	**0.83**	5	13.7	**0.81**

2041 Forecast - 'With LPRPS' Scenario						
J16 North Roundabout						
1 – B1007 (N)	144	596.3	**1.32**	30	154.3	**1.06**
	196	*795.8*	***1.15***	*8*	*50.0*	***0.89***
2 – B1007 (S)	2	10.0	**0.66**	6	24.0	**0.86**
3 – A12 NB off-slip	1	2.7	**0.29**	2	5.0	**0.59**
J15 South Roundabout						
1 – B1007 (N)	34	91.3	**1.02**	14	44.8	**0.96**
	12	*38.6*	***0.93***			
2 – B1007 (S)	1	4.4	**0.39**	1	4.1	**0.36**
3 – A12 SB off-slip	5	16.4	**0.82**	5	14.4	**0.82**

● Within Capacity ● Approaching Capacity ● Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

8.2.1.13 A12 Junction 18, Sandon Interchange

As shown in Figure 8-18 overleaf, the Sandon Interchange is a grade-separated 'dumbbell roundabout' junction on the A12.

The modelled results shown in Table 8-22 suggest that the junction, particularly the eastern roundabout, will be under increased pressure through a growth in background traffic from Danbury and Maldon by 2041 which can be seen in the Baseline. With the addition of LPRPS development at Hammonds Farm and the employment site located east of the A12 (south of the A414), outputs show that Maldon Road (E) and Hammonds Road, serving as the new development access, will be under increased pressure in both peak periods. This is indicated by Maldon Road (E) and Hammonds Road showing an RFC of over 1 in both peak periods.

A sensitivity test using a FLAT demand profile was shown to reduce overall RFC values at the junction, particularly along Maldon Road (East) in the PM peak. However, the Hammonds Farm approach arm continues to operate over-capacity in the PM peak even under a FLAT demand profile.

Proposals to mitigate the traffic impact of development at Hammonds Farm on this junction are contained within Section 9.3.2. These will be further refined through the ongoing Local Plan Review process, master planning and planning application process.

Figure 8-18: A12 Junction 18 Sandon Interchange Existing Layout

Table 8-22: A12 J18 ARCADY Outputs - Existing Layout

Existing Layout	AM			PM		
	Queue (PCUs)	Delay (s)	RFC	Queue (PCUs)	Delay (s)	RFC
2041 Forecast - Baseline						
A12 J18 East						
1 - A12 J18 SB off-slip	1.1	6.8	0.52	4.4	23.5	0.82
2 - Hammonds Road	2.7	15.6	0.73	1.4	14.4	0.58
3 - A414 Maldon Road E	5.8	14.0	0.86	1.6	5.0	0.61
4 - A414 Maldon Road bridge	1.1	3.6	0.51	3.3	7.7	0.77
A12 J18 West						
5 - A414 Maldon Rd bridge	11.6	29.4	0.93	4.1	11.6	0.81
6 - A12 J18 NB off-slip	1.1	7.1	0.53	2.4	10.0	0.70
7 - Maldon Road W	2.2	9.0	0.69	36.7	106.4	***1.04***
				*5.4**	*18.6*	***0.85***
2041 Forecast – With 'Local Plan Review Pre-Submission' Scenario						
A12 J18 East						
1 - A12 J18 SB off-slip	1.6	9.1	0.62	31.5	126.3	1.05
				6.5	*31.7*	***0.87***
2 - Hammonds Road	50.4	181.7	1.10	4.7	31.5	0.84
	12.3	*56.0*	***0.93***			
3 - A414 Maldon Road E	8.6	21.6	0.91	2.3	6.7	0.69
4 - A414 Maldon Road bridge	1.3	4.1	0.57	4.7	10.2	0.83
A12 J18 West						
5 - A414 Maldon Rd bridge	56.6	109.1	1.05	11.5	29.0	0.93
	17.7	*42.9*	***0.95***			
6 - A12 J18 NB off-slip	1.4	8.6	0.57	6.1	24.2	0.87
7 - Maldon Road W	3.5	13.1	0.78	106.3	294.7	1.20
				20.0	*69.5*	***0.96***

● Within Capacity ● Approaching Capacity ● Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

8.2.1.14 Odeon Roundabout

As shown in Figure 8-19 overleaf, the Odeon Roundabout currently consists of three approach arms. The southern arm, Manor Road, exits the roundabout via a slip road onto the A1060 Parkway west. Additionally, the A1060 Parkway west

has its own dedicated slip road that leads into Baddow Road. There are currently no plans in place to revise the layout of this junction.

Table 8-23 shows that there are minor differences between the modelled queueing and delay figures displayed for both the 'Baseline' and 'With Local Plan' scenarios, suggesting that the LPRPS development has little impact on the performance on this junction. The A1060 Parkway (both the eastern and western arms) is expected to operate over-capacity in a Baseline scenario as a result of background traffic growth. However, assuming a FLAT demand profile, the A1060 Parkway (East) would potentially operate near to capacity.

Figure 8-19: Odeon Roundabout Existing Layout

Table 8-23: Odeon Roundabout Local Junction Modelling Outputs - Existing Layout

Existing Layout	AM			PM		
	Queue (PCUs)	Delay (s)	RFC	Queue (PCUs)	Delay (s)	RFC
2041 Forecast - Baseline						
1 - A1099 High Bridge Road	3	12.9	0.75	4	14.5	0.77
2 - A1060 Parkway (E)	8	9.2	0.88	18	34.5	0.96
3 - Manor Road	0	0	0	0	0	0
4 - A1060 Parkway (W)	2	3.4	0.62	150	173.8	1.12
				*39	58.7	0.99
2041 Forecast - 'With LPRPS' Scenario						
1 - A1099 High Bridge Road	6	23.7	0.86	5	18.9	0.83
2 - A1060 Parkway (E)	9	11.4	0.90	53	86.6	1.03
				13	25.0	0.93
3 - Manor Road	0	0	0	0	0	0
4 - A1060 Parkway (W)	2	3.6	0.64	167	203.9	1.13
				74	107.0	1.01

** Outputs in italics have been modelled using a FLAT demand profile*

Within Capacity Approaching Capacity Over Capacity

8.2.2 LinSig Modelling Outputs

8.2.2.1 A12 Junction 17, Howe Green

As shown in Figure 8-20 overleaf, the A12 Junction 17 (Howe Green Interchange), comprises two grade-separated roundabouts in a dumbbell arrangement. Whilst a number of major infrastructure improvements at the junction have been investigated by Essex Highways in the recent past, there are currently no feasible plans in place to update the layout of this junction. Howe Green is a recognised existing congestion hotspot and is a long-term issue to be considered by ECC in partnership with National Highways as part of a more strategic solution to redesign the junction and the A12 carriageway at this location.

The modelled results shown in Table 8-24 demonstrate that the junction is expected to operate over capacity in both the AM and PM peak hours, across both Baseline and LPRPS scenarios. Modelled queues and delay times are significant across all arms of the junction.

LPRPS impact at the junction is relatively minor, with increases in flow limited by modelled congestion on the A12. Indeed, the wider redistribution of traffic flows away from the Howe Green junction - shown in the strategic forecast modelling

to be a consequence of congestion along the A12 corridor and at Junction 17 itself, result in a slight reduction in delay and queue lengths on certain approaches, despite the addition of LPRPS development trips.

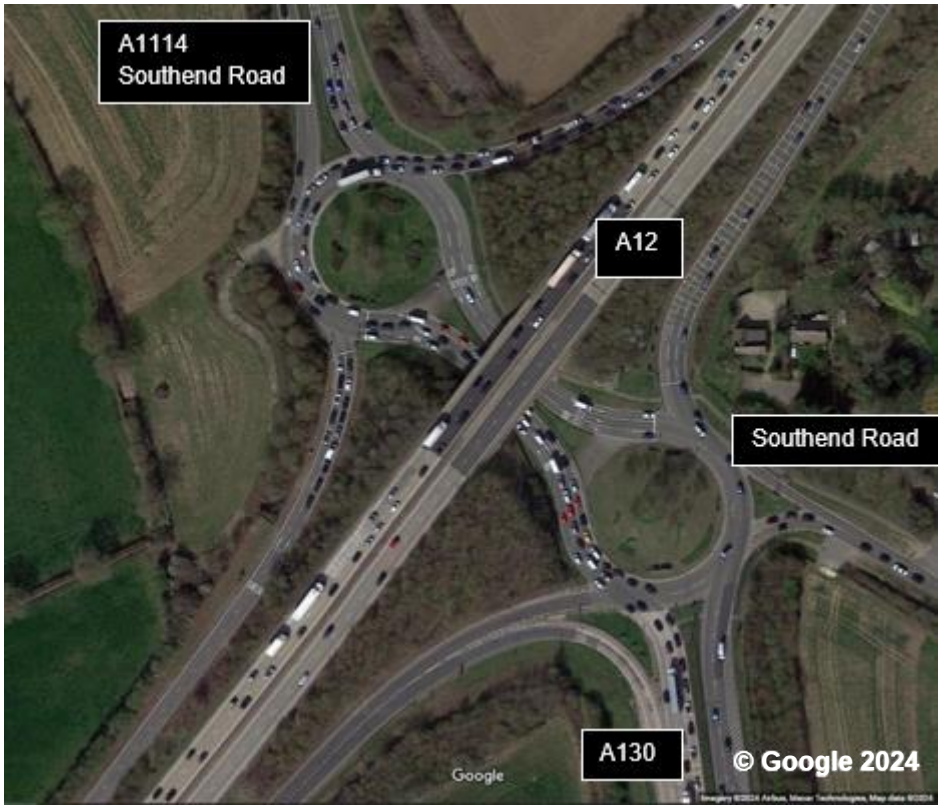


Figure 8-20: A12 Junction 17 Howe Green Interchange, Existing Layout

Table 8-24: A12 Junction 17, Howe Green Interchange Local Junction Modelling Outputs – Existing Layout

Existing Layout	AM				PM			
	Mean Max Queue (PCUs)	Average Delay (s/pcus)	DoS	Total Delay (pcu hrs)	Mean Max Queue (PCUs)	Average Delay (s/pcus)	DoS	Total Delay (pcu hrs)
2041 Forecast - Baseline								
1 - A12 (SB off-slip)	18	20.5	**0.82**	5.5	17	22.9	**0.80**	5.5
2 - Southend Rd (SE)	3	27.0	**0.64**	1.5	59	385.7	**1.23**	48.3
3 - A130	590	771.2	**1.66**	480.9	521	760.3	**1.64**	422.0
4 - A12 (NB off-Slip)	52	571.1	**1.37**	49.0	99	868.8	**1.75**	95.3
5 - A1114 Southend Rd (NW)	171	815.1	**1.69**	168.2	163	692.4	**1.52**	155.4
2041 Forecast - 'With LPRPS ' Scenario								
1 - A12 (SB off-slip)	19	21.1	**0.83**	5.8	17	23.1	**0.81**	5.6
2 - Southend Rd (E)	3	36.8	**0.72**	1.8	49	297.3	**1.25**	38.8
3 - A130	581	761.5	**1.64**	472.1	529	771.1	**1.66**	430.5
4 - A12 (NB off-Slip)	55	592.5	**1.39**	51.7	87	837.4	**1.70**	83.1
5 - A1114 Southend Rd (W)	188	862.0	**1.76**	178.9	144	683.3	**1.52**	159.3

● Within Capacity ● Approaching Capacity ● Over Capacity

8.2.2.2 Army and Navy Roundabout

The forecast junction model built for the Army and Navy Roundabout in Chelmsford city centre incorporates the latest Essex County Council preferred 'hamburger' roundabout design[11] as shown in Figure 8-21 overleaf. A LinSig model of the junction, developed and approved for use on the Army and Navy modelling study, was repurposed for the Local Plan junction modelling appraisal.

Table 8-25 shows that whilst Van Dieman's Road is expected to operate over-capacity within both peak periods, under the LPRPS Scenario, this remains consistent with the Baseline. Similarly, Baddow Road is also expected to operate over capacity in the AM peak, in both the Baseline and LPRPS scenario. Despite

[11] Source: https://www.essexhighways.org/highway-schemes-and-developments/highway-schemes/chelmsford-schemes/army-and-navy-taskforce

these arms operating over-capacity, it is expected that the proposed redesign of the roundabout, as modelled, offers notable congestion relief over the existing layout.

Figure 8-21: Concept image of the Army and Navy Roundabout proposed 'hamburger' layout.

Table 8-25: Army and Navy Roundabout Local Junction Modelling Outputs – Future Layout

Future Layout	AM				PM			
	Mean Max Queue (PCUs)	Average Delay (per PCUs)	DoS	Total Delay (pcu hrs)	Mean Max Queue (PCUs)	Average Delay (per PCUs)	DoS	Total Delay (pcu hrs)
2041 Forecast – Baseline								
1 – Parkway	10	33.0	0.91	4.5	13.8	40.1	0.89	10.5
2 - Chelmer Road	308	674.2	0.54	293.7	9.9	38.3	0.58	8.2
3 - Essex Yeomanry Way	7	18.2	0.76	2.1	7.7	42.3	0.93	7
4 - Baddow Road	120	613.6	1.43	114.5	10.5	30.3	0.78	4.6
5 - Van Diemans Road	56	93.9	1.01	19.7	111.7	295.2	1.16	71.5
2041 Forecast - 'With LPRPS ' Scenario								
1 – Parkway	11.3	33.1	0.90	5.6	10.5	38.6	0.94	7.3
2 - Chelmer Road	280.2	616.3	0.55	266.7	70.6	288.7	0.70	67.3
3 - Essex Yeomanry Way	6	29.5	0.85	3.6	8.2	45	0.94	7.4
4 - Baddow Road	135.1	694.2	1.52	130.2	11.5	32.8	0.82	5.2
5 - Van Diemans Road	53.6	82.9	1.00	17.2	120.2	330.2	1.19	80.5

● Within Capacity ● Approaching Capacity ● Over Capacity

8.2.2.3 Sandon Park and Ride Access Junction

As shown in Figure 8-22, the Sandon Park and Ride access junction on the A414 Maldon Road consists of three approach arms with the minor arm from the north serving as the Park and Ride access.

Table 8-26 suggests that the impact of the LPRPS development is likely to be minimal at the Sandon Park and Ride access junction as all arms are operating within capacity under both the Baseline and LPRPS Scenario.

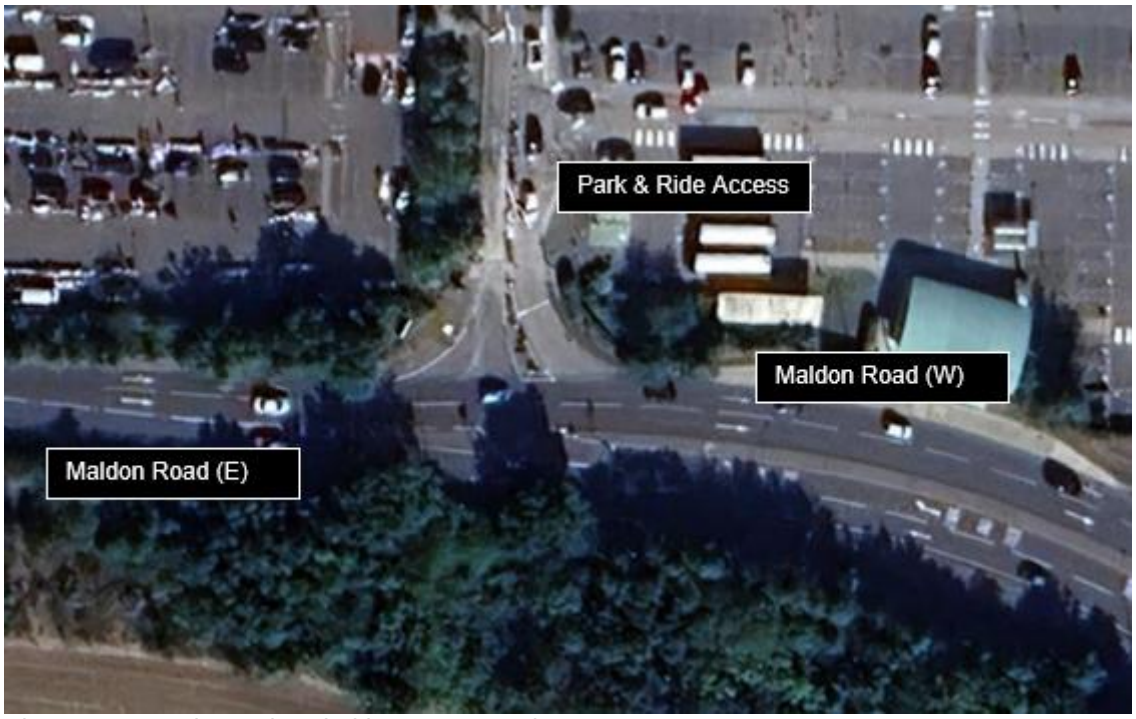


Figure 8-22: Sandon Park and Ride Access Junction Layout

Table 8-26: Sandon Park and Ride Access Local Junction Modelling Outputs – Future Layout

Future Layout	AM				PM			
	Mean Max Queue (PCUs)	Average Delay (per PCUs)	DoS	Total Delay (pcu hrs)	Mean Max Queue (PCUs)	Average Delay (per PCUs)	DoS	Total Delay (pcu hrs)
2041 Forecast – Baseline								
1 – Sandon P&R	0.0	0.00	**0.0**	0.00	5.4	30.0	**0.64**	2.5
2 – Maldon Road (E)	5.3	8.0	**0.69**	2.5	0.6	2.0	**0.54**	0.6
3 – Maldon Road (W)	6.7	15.8	**0.73**	4.1	6.0	15.9	**0.67**	3.6
2041 Forecast - 'With LPRPS' Scenario								
1 – Sandon P&R	0.0	0.00	**0.0**	0.00	5.6	30.7	**0.66**	2.7
2 – Maldon Road (E)	5.6	8.4	**0.78**	2.9	0.7	2.2	**0.57**	0.7
3 – Maldon Road (W)	7.4	15.4	**0.77**	4.4	6.2	16.3	**0.68**	3.8

8.2.3 VISSIM Modelling Outputs

8.2.3.1 A12 Junction 19, Boreham Interchange

To assess LPRPS development impact on the A12 Junction 19 Boreham Interchange, the chosen approach has been to reference outputs and findings documented in National Highways' published A12 DCO modelling report[12] and qualitatively assess the potential change in the reported junction impact when utilising demand flows taken from the strategic modelling appraisal of the LPRPS.

The A12 DCO study made use of a VISSIM microsimulation model of the Boreham Interchange to assess the impact of National Highway's proposed carriageway widening and junction capacity improvements. Whereas the DCO study incorporated Local Plan Review development trips into general background growth across Chelmsford, the LPRPS has modelled development trips specifically calculated and distributed to/from nearby proposed developments such as Chelmsford Garden Community and Hammonds Farm. This includes the development trips modelled directly from the proposed Hammonds Farm access onto the Boreham Interchange at Generals Farm Roundabout.

Although accepted by the DfT, the National Highways VISSIM model has yet to be approved by ECC, and as such, direct use of the model for the LPRPS appraisal has not been possible. Consequently, developer access proposals at the Boreham Interchange have not been assessed at a local junction level as part of this study. It is expected that this will instead be undertaken within Transport Assessments produced by developers of the Hammonds Farm site.

The reported Level of Service (LOS) for each approach arm at the Boreham Interchange, taken from the A12 DCO modelling of the junction with proposed capacity improvements, can be found in Table 8-28. The table also includes the entry and circulatory flows at each approach arm taken from the latest strategic VISUM modelling of the LPRPS scenario.

LOS is based upon average vehicle delay and can be used as a guide for how well the junction operates. Table 8-27 below shows the bands used in the LOS calculation.

[12] 'A12 Chelmsford to A120 Widening Scheme TR010060 7.2 Transport Assessment – Appendix F: Junction Modelling Technical Notes – A12 Junctions', National Highways, August 2022

Table 8-27: Bands used in the calculation of Level of Service (LOS)

LOS	Signalised Junction Delay (s/veh)	Priority Junction Delay (s/veh)	Description of Traffic Operation
A	≤10 sec	≤10 sec	Highly stable, free-flow condition with little or no congestion.
B	10–20 sec	10–15 sec	Stable, free-flow condition with little congestion.
C	20–35 sec	15–25 sec	Stable flow condition, with moderate congestion.
D	35–55 sec	25–35 sec	Less stable Approaching unstable condition with increasing congestion.
E	55–80 sec	35–50 sec	Unstable flow condition, volume at or slightly over capacity, considerable delays.
F	>80 sec	>50 sec	Forced flow condition, volumes exceed capacity; long delays with stop-and-go traffic.

Subsequent analysis of Table 8-28 highlights the approach arms that have been modelled with a notable increase in entry or circulatory flow in the latest strategic modelling between the baseline and LPRPS scenarios. Where these increases have been identified, a qualitative assessment has been undertaken to evaluate the possible impact on approach arm capacity based on an awareness of the LOS values previously reported from the A12 DCO microsimulation modelling.

Care has been taken in the analysis to acknowledge that the difference in strategic modelled flow between the baseline and Local Plan scenarios should not be considered as the extent of the LPRPS impact *over and above* that reported for the A12 DCO appraisal. This is because the application of background growth in the DCO modelling will have accounted for a proportion of future development trips through the junction.

Therefore, any likely increase in traffic flow at the Boreham Interchange associated with a larger concentration of LPRPS trips from development at Chelmsford Garden Community and Hammonds Farm (as examples), is likely to be smaller than the strategic VISUM modelled flow increases presented.

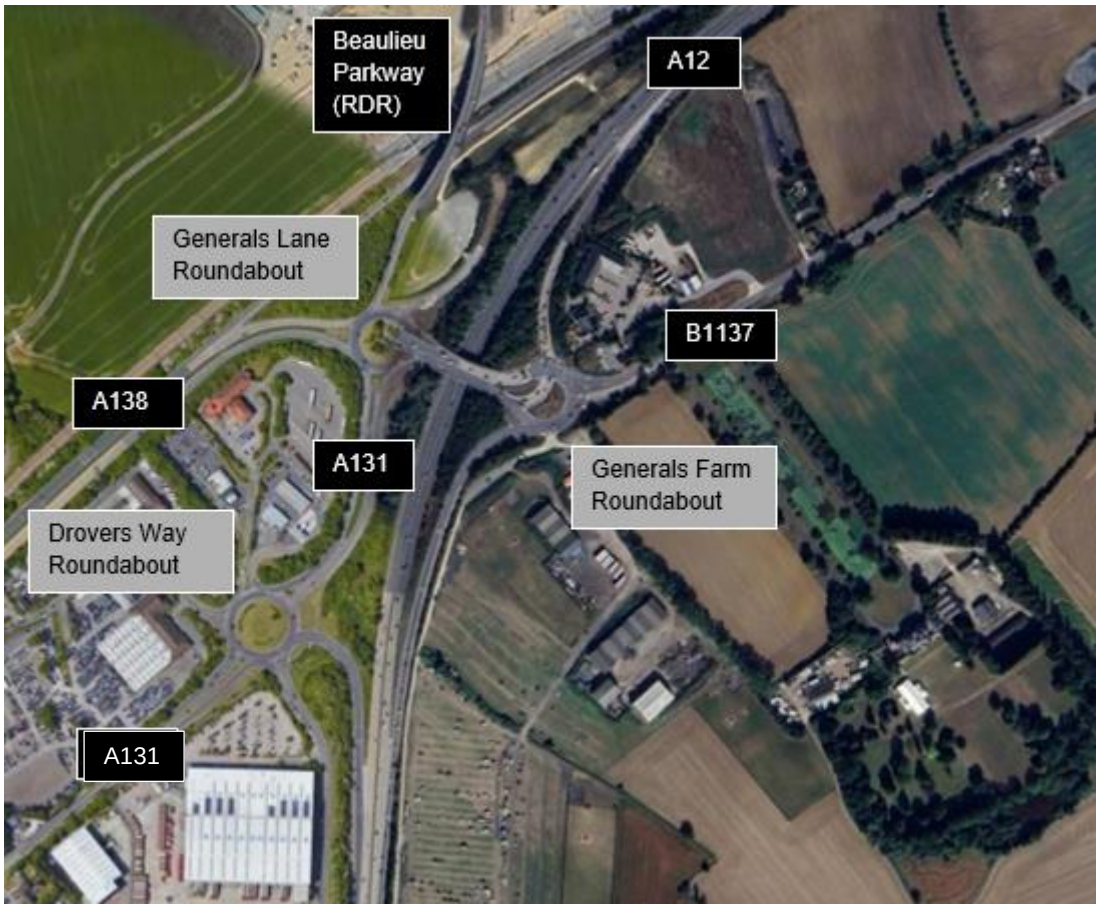


Figure 8-23: A12 Junction 19 – Boreham Interchange Junction Layout

Table 8-28: Assessment of A12 J19 Boreham Interchange - Impact of LPRPS Scenario

			A12 J19 VISSIM Outputs - 2042 Future Operation with Scheme (A12 DCO Modelling)				A12 J19 VISUM Outputs - 2041 Local Plan Review Pre-Submission Scenario							
			AM		PM		Approach arm flows				Circulatory flows infront of approach arms			
							Local Plan Review Scenario		Change from Baseline		Local Plan Review Scenario		Change in circulatory flows	
Junction	Approach Arms	Control	LOS	Vehicles	LOS	Vehicles	AM	PM	AM	PM	AM	PM	AM	PM
Generals Lane Roundabout	Beaulieu Parkway	Signalised	C	1418	C	1680	1647	1700	-13	1	553	775	84	233
	A12 overbridge	Signalised	C	1756	D	1102	2558	1459	150	188	926	713	17	18
	A131	Signalised	D	1487	D	1827	1004	1438	44	156	2570	1560	129	117
	A138	Signalised	D	501	D	587	655	799	39	41	1416	1638	90	182
	A138 slip (to A12 NB)	Signalised	A	1133	B	2012	1269	1239	37	9	not on circulatory	not on circulatory		
	A131 slip from bridge	Signalised	A	898	A	745	697	409	47	23	not on circulatory	not on circulatory		
	Total	**Signalised**	**C**	**7192**	**C**	**7953**	**7830**	**7044**						
Generals Farm Roundabout	A12 SB off-slip	Signalised	D	2170	D	1598	2119	1192	11	59	1103	1459	51	221
	B1137 Main Road	Signalised	D	710	D	299	587	407	54	37	763	906	17	219
	A12 overbridge	Signalised	C	1295	B	1713	1103	1459	51	221	0	0	0	0
	Hammonds Farm access	TBC	-	-	-	-	309	180	not in baseline	not in baseline	1249	1038	not in baseline	not in baseline
	Total	**Signalised**	**D**	**4174**	**C**	**3610**	**4118**	**3238**						
Drovers Way Roundabout	A131 (N)	Signalised	D	953	C	831	914	549	38	26	174	54	-2	0
	A12 NB off-slip	Signalised	C	1551	C	1409	987	1243	63	132	1088	600	37	24
	Winsford Way	Priority	C	137	D	323	27	91	0	1	1981	1817	100	155
	A131 Colchester Road	Priority	C	643	C	891	694	803	16	46	484	689	27	110
	Drovers Way	Priority	C	122	C	136	no flows	no flows			1178	1492	43	156
	Boreham Services	Priority	B	124	C	137	no flows	no flows			1178	1492	43	156
	Total	**Signalised**	**C**	**3530**	**C**	**3725**	**2622**	**2686**						

Findings from the high-level assessment of junction impact suggest that the **A131** and **A138** approach arms at **Generals Lane Roundabout** would likely be impacted by a greater concentration of development trips associated with the LPRPS.

PM peak hour traffic volumes on the A131 approach arm in the strategic modelling are noticeably higher in the LPRPS scenario than in the baseline, as well as showing an increase in circulatory flows at the approach arm stop line. The approach arm was identified as having a LOS of D in the A12 DCO VISSIM modelling, and it is therefore likely that further development trips would place additional pressure on this arm.

Whilst the A138 is shown to have a smaller increase in strategic PM peak hour entry flows, circulatory traffic volumes at the approach arm stop line have increased significantly in comparison. The approach arm was also identified as having a LOS of D in the A12 DCO VISSIM modelling, and it is therefore likely that further development trips would place additional pressure on this arm.

The **Beaulieu Parkway** approach arm could also be impacted – particularly in the PM peak, given the significant increase in circulatory flows in front of arm which could potentially push the LOS for this approach arm above the 'C' category reported.

Where signalised, it is likely that timings would require some adjustment to accommodate the change in the quantum and balance of entry and circulatory flows at each impacted approach arm. So as to ensure that further increases in circulatory flow can be accommodated within the available stacking capacity at the junction(s), it is likely that available green time for entry flows would need to be reduced, thereby increasing delay and queue extents along the approach arms.

At **Generals Farm Roundabout**, the **A12 southbound off-slip** and **B1127 Main Road** approaches have been modelled previously with a LOS of D, and it is likely that a greater concentration of LPRPS development trips through the junction will increase circulatory flows in the PM peak. It is again likely that adjustments would need to be made to signal timings to accommodate additional circulatory flows through the roundabout, resulting in a worsening of delays and queues for entry flows on the affected approach arms.

Whilst it has not been possible to quantify the impact of LPRPS development trips at the Boreham Interchange, the findings from this high-level assessment of junction impact – with A12 DCO capacity improvements included - helps to

identify the approach arms that would need to be assessed in more detail as part of future planning applications for nearby development in North-East Chelmsford and LPRPS development sites along the A12 corridor.

8.3 Summary of Findings

- The results of the local junction modelling are broadly aligned with the overall findings from the strategic impact assessment of the LPRPS and previous junction analysis carried out as part of the Preferred Spatial Approach modelling (March 2024).
- The small quantum of development allocated to the north of Chelmsford appears to have a negligible impact on junctions assessed in north-east Chelmsford.
- Capacity improvement measures have, however, been identified at several junctions along the A130/A131 corridor in north-east Chelmsford to help accommodate the significant growth in background traffic flows largely attributed to the proposed Chelmsford Garden Community (Strategic Growth Site 6) development. These improvement measures will help accommodate the small increase in trips modelled to/from the allocated LPRPS sites.
- The impact on City Centre junctions is similarly limited, with the exception of Parkway (East) where an increase in RFC can be seen between the Baseline and LPRPS Scenario, resulting in the arm operating over-capacity.
- With the largest LPRPS allocation of development at Hammonds Farm (Strategic Growth Site 16a) in the vicinity of A12 Junction 18, Sandon Interchange, the roundabout is therefore most impacted by LPRPS development trips. The A414 Maldon Road is shown in the modelling to exceed capacity in the AM peak with the potential for long queues and journey time delays. This supports the identified need for sustainable mitigation measures to be provided by the developers of Hammonds Farm to address this impact.
- Initial proposals to mitigate the traffic impact of development at Hammonds Farm on A12 Junction 18 are contained within Section 9.3.2 which will be further refined through the master planning and planning application process.
- LPRPS impact modelled at A12 Junction 17, Howe Green Interchange is relatively minor, with the application of VDM, resulting in trip reductions and a wider redistribution of traffic flows away from the junction due to background congestion along the A12 corridor. Howe Green is a recognised existing congestion hotspot and is a long-term issue to be

considered by ECC in partnership with National Highways as part of a more strategic solution to identify funding for a redesign of the junction and the A12 carriageway at this location.

- It is likely that LPRPS development trips will place additional pressure on several approach arms at the A12 J19 Boreham Interchange that have been modelled previously by National Highways to operate close to, or at, capacity with A12 widening DCO capacity improvements added at the junction. Current design proposals would need to be revisited as part of future planning applications for nearby development in North-East Chelmsford and LPRPS development sites along the A12 corridor – with particular attention paid to the layout of the approach arms identified to be impact most by a greater concentration of development trips at the junction.

9 Mitigation

9.1 Introduction

Baseline modelling suggests that by 2041, network congestion will likely worsen in key locations in and around Chelmsford. The addition of development traffic associated with the LPRPS, would likely exacerbate existing problems, particularly along the A12 and A414 corridors.

Modelling suggests that proposed LPRPS development may have only a minor impact on traffic conditions in the centre of Chelmsford, likely due to both network constraint modelled 'upstream' along key corridors into and out of the City Centre, and a wider dispersal of background traffic flows to accommodate development trips.

New junction infrastructure to mitigate the impact of development has not been assessed as part of this study. Instead, a review of developer proposals is presented in this report alongside recommendations for potential sustainable measures to help manage development flows.

To provide wider context, this section of the report first considers the sustainable accessibility of sites within the LPRPS, and then reviews the impact of forecast modelled traffic congestion on levels of accessibility to existing and proposed public transport services and bus priority infrastructure.

9.1 Sustainable Accessibility Appraisal

As part of the Issues and Options stage of the Chelmsford Local Plan Review, Essex Highways undertook a sustainable accessibility assessment of CCC's five initial spatial approaches. The methodology used and findings of this study are summarised in the 'Sustainable Accessibility Mapping & Appraisal Technical Note' issued in July 2022. Following confirmation of CCC's Pre-Submission, RAG scores for each development site were derived from the 'settlement areas' assessed previously.

Owing to a recognised difference in the accessibility criteria applicable to residential sites as opposed to employment sites, the RAG scores for Local Plan Review employment sites represent an average across employment-related criteria only - as shown in Table 9-1 overleaf.

Table 9-1: Criteria used for scoring of residential and employment sites

Criteria	Residential	Employment
Accessibility to urban centres	Y	Y
Accessibility to employment locations	Y	N
Accessibility to rail stations (walking & cycling)	Y	Y
Accessibility to rail stations (public transport)	Y	Y
Weekday bus services and frequency	Y	Y
Saturday bus services and frequency	Y	Y
Sunday and night (out of hours) frequency	Y	Y
Walking access to bus stops	Y	Y
UFBB internet connectivity	Y	N
Car driver mode share	Y	N
Accessibility to healthcare	Y	N
Accessibility to nurseries	Y	N
Accessibility to primary schools	Y	N
Accessibility to secondary schools	Y	N

Table 9-2 below summarises the updated average RAG scores for each development site alongside its size as a percentage of the total new Local Plan housing and employment allocations in the LPRPS. A more detailed breakdown of the scores given can be found in Appendix F.

Table 9-2: Average RAG scores for each development site

	Average Sustainable Accessibility Score	% of dwellings	% of employment floorspace
Chelmsford Urban Area (Residential)	3.00	27.54%	
Chelmsford Urban Area (Employment)	3.00		3.59%
Ford End	1.57	0.46%	
Boreham	2.14		3.14%
Little Boyton Hall Farm	1.43		5.38%
North East Chelmsford	2.57		10.72%
South and East of Chelmsford	2.21	68.68%	77.17%
Bicknacre	1.64	2.61%	
East Hanningfield	1.50	0.71%	

**Blue cells indicate sites with over 15% of total allocated development*

It is important to note that the RAG assessment of the South and East of Chelmsford (inc. Hammonds Farm) sites, has been updated to reflect the proposed developer-funded infrastructure at this location. A similar approach was adopted previously for the 'North-East Chelmsford' site, and it is assumed that both will be developed with active mode and bus infrastructure to offer high levels

of sustainable accessibility across walking, cycling and passenger transport modes in order to meet prescribed site policy modal shift targets.

With over three quarters of the total LPRPS allocation of housing and around three quarters of the allocated quantum of employment proposed to the east of Chelmsford, the LPRPS places a focus on development in an area with a potentially good level of sustainable accessibility – subject to the provision of local amenities and sustainable travel infrastructure by developers.

A significant proportion of housing and employment is also allocated on land in the central urban area of Chelmsford, which would be expected to benefit from high levels of sustainable accessibility.

Elsewhere, whilst a proportion of housing and employment is allocated in less sustainable rural locations, as a percentage of the total LPRPS allocation, the quantum of development proposed in these areas is small and as set out in section 5, development in these areas is unlikely to have an adverse impact on the road network.

Overall, the allocation of development in the LPRPS provides the opportunity to make good use of existing and potential sustainable accessibility to and from proposed sites.

9.2 Impact on Access to Public Transport

A mapping assessment has been undertaken as part of this study, involving the overlay of forecast queue extents modelled for the LPRPS onto a map of bus routes and bus priority measures (bus lanes etc.) in Chelmsford – both existing and proposed.

The purpose of this analysis is to highlight the potential impact of congestion on bus accessibility into, out of, and around the City Centre. This analysis can be cross referenced with the development trip assignment plots shown in section 5.1 to determine where Local Plan development trips are shown to directly impact bus accessibility.

The mapping is presented in Figure 9-1 and Figure 9-2 on the following pages

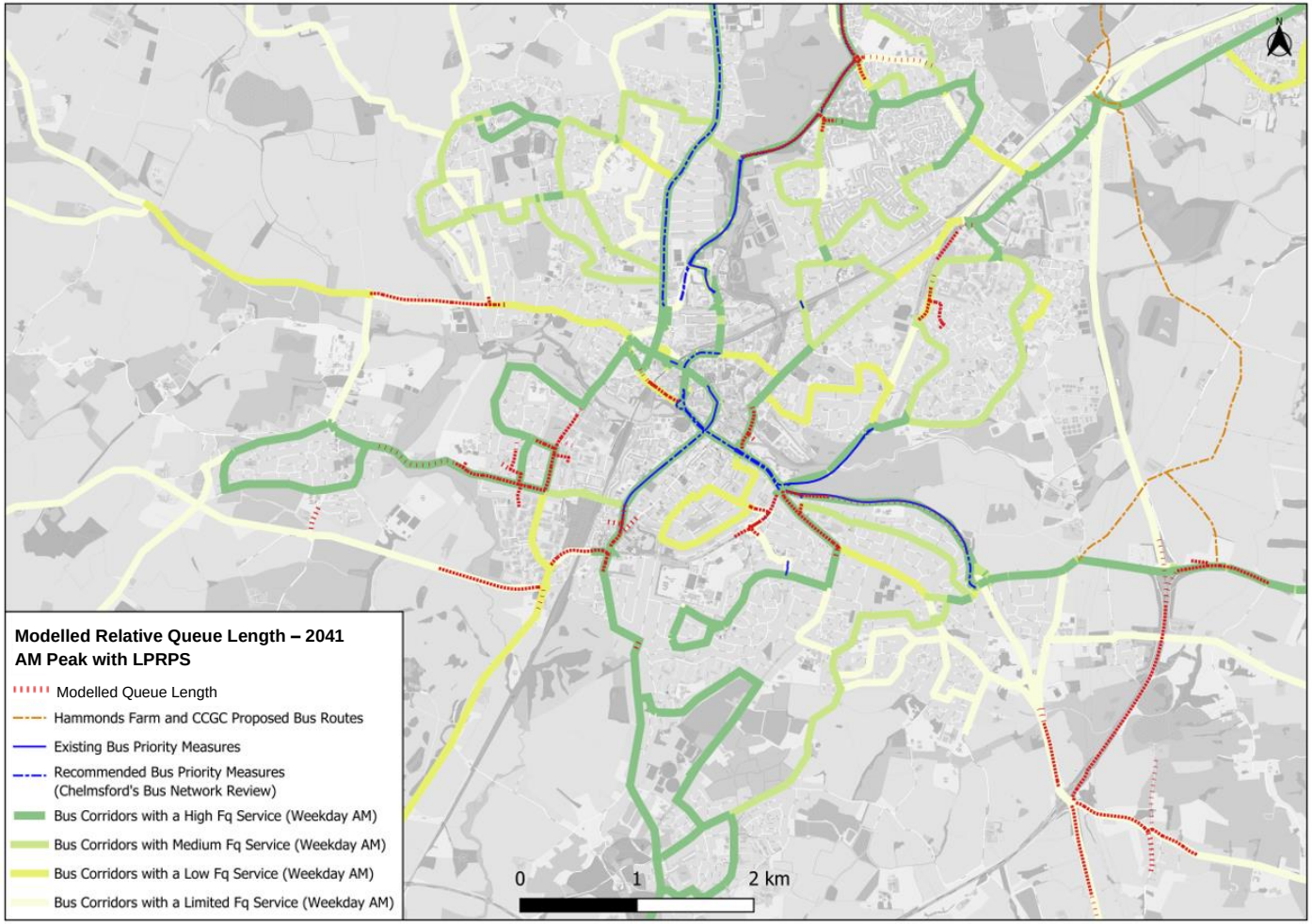


Figure 9-1: Modelled relative queue lengths – 2041 AM Peak with LPRPS – overlayed on bus routes and priority measures

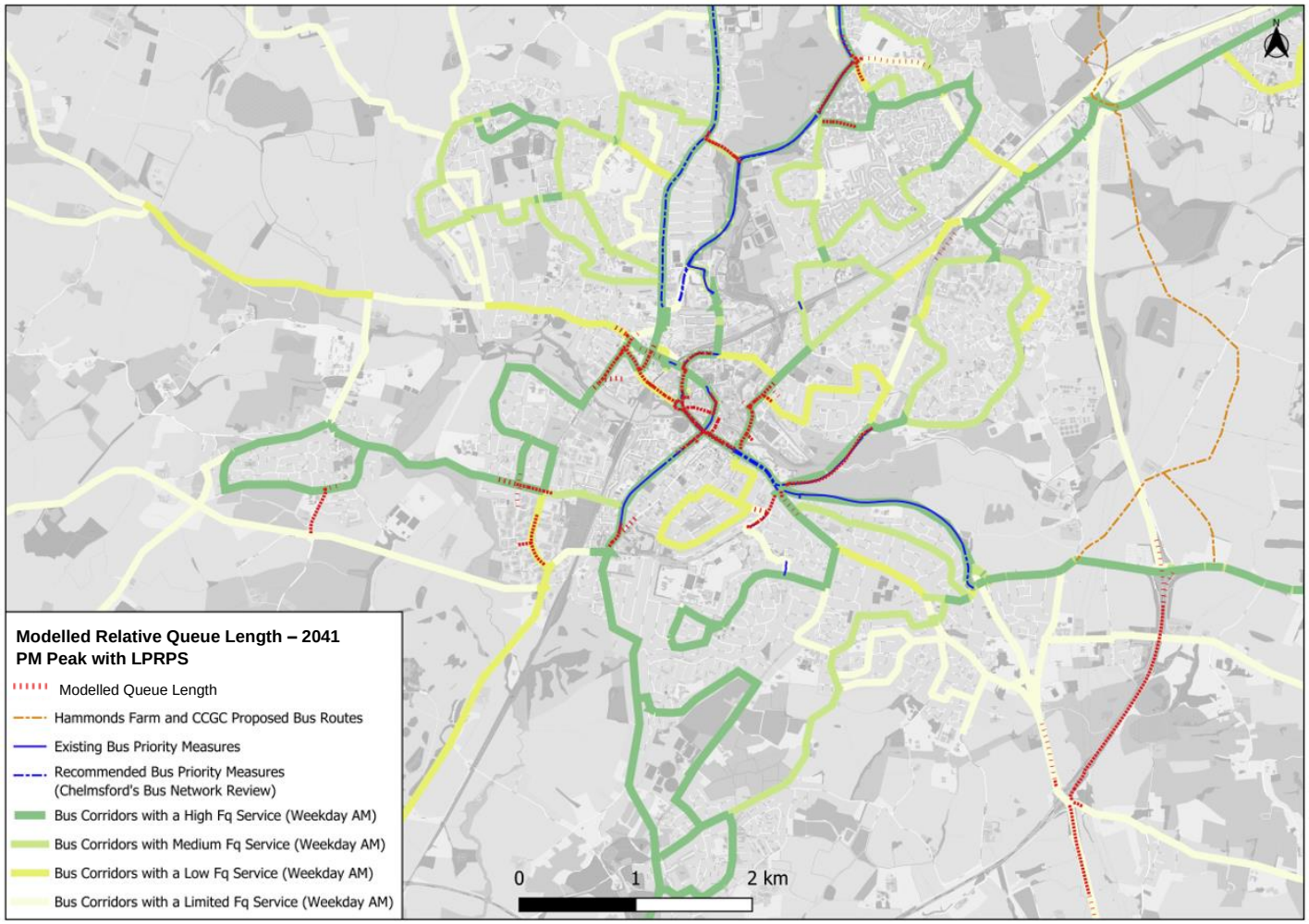


Figure 9-2: Modelled relative queue lengths – 2041 PM Peak with LPRPS – overlayed on bus routes and priority measures

Focusing exclusively on bus corridors in Chelmsford where congestion has the potential to be exacerbated by LPRPS development, the following routes are highlighted:

- A414 westbound approach to A12 Junction 18 (Sandon Interchange)
- A1060 Parkway between Odeon and Market Roundabouts

It is recommended that bus accessibility along these routes is considered as part of the masterplan and planning application process, with a focus on the delivery of bus priority measures - where there is reasonable highway land available. The new bus lanes and bus priority measures along the A1060 Parkway proposed as part of the Army and Navy Sustainable Transport Package will likely help to address this.

Potential bus priority infrastructure on the A414 in the vicinity of Hammonds Farm is discussed further in the following section of this report.

9.3 Review of Developer Proposed Mitigation + Recommendations

9.3.1 North-East Chelmsford - Chelmsford Garden Community

Whilst the impact of proposed employment on the CGC site as part of the LPRPS is unlikely to be of sufficient size to warrant site-specific mitigation, it is recommended that a link is maintained between the Local Plan Review evidence base and infrastructure proposals in north-east Chelmsford. It is highly likely that the infrastructure delivered to accommodate the CGC development, and the timescales for its delivery, will have a bearing on the capacity of the wider road network, as well as National Highways' long-term proposals for the A12 corridor.

As of Autumn 2024, discussions are ongoing between ECC and the developer consortium to agree on appropriate infrastructure to mitigate the impact of trips to/from the CGG.

Latest documents to support the planning application process for the CGC sites can be found online - https://chelmsfordgardencommunity.co.uk/library/.

9.3.2 Hammonds Farm

Initial proposals to mitigate the traffic impact of development at Hammonds Farm are contained within the Oct 2022 Stantec report 'Hammonds Farm Transport

Technical Report[13]' which will be further refined through the master planning and planning application process, to ensure any measures are deliverable and viable.

The Hammonds Farm development is already required to provide substantive improvements connecting the site across the A12 and linking and enhancing the planned sustainable links being provided by the East Chelmsford developments; Army and Navy improvements and outcomes from the Chelmsford Local Cycling and Walking Infrastructure Plans (LCWIPs).

Central to these proposals are the provision of a bus, walking and cycle-only bridge link over the A12 connecting the development to the western side of the A12 to where Sandon Park and Ride, East Chelmsford site allocations, schools, leisure facilities and the City Centre are located. Provision is also made for an Eastern Orbital Route serving as a bus corridor enabling access for proposed new bus services to Beaulieu Park Station.

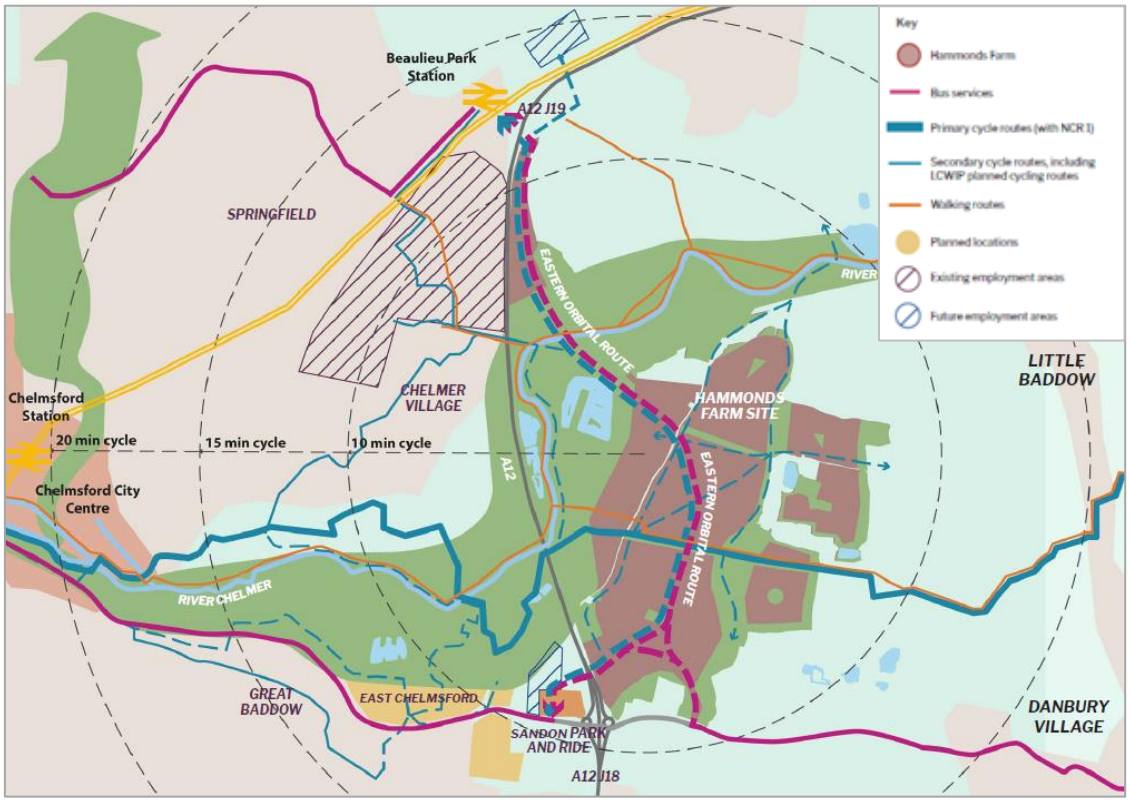


Figure 9-3: Hammonds Farm access strategy

13 https://consult.chelmsford.gov.uk/kseapi/public/submissions/198806/representations/3869302/attachments/772133/file

Access proposals outlined in the strategy via the A414 and A12 J19 are of insufficient detail to be modelled specifically and/or be reviewed as part of this study. The design detail around site access proposals is expected to be agreed between the developer and ECC as part of the planning application process.

Access via proposed bridge link and Sandon Park and Ride site

A range of potential options are being investigated to provide connectivity via a new bridge (walking, cycling and bus) between the Hammonds Farm site and the A414 close to Sandon Park and Ride. Any option will consider the potential to link in with emerging proposals regarding the strategic sites in East Chelmsford (Location 3) and improvements identified in the Army and Navy Sustainable Transport Package in order to provide onward connectivity benefits.

The proposed bus, walking and cycle-only bridge link over the A12 is necessary to help deliver the required mode shift away from the car and towards more sustainable modes of travel. This, in turn, would likely help reduce the impact of car trips on the surrounding road network – particularly the modelled pinch-point on the A414 on the approach to the A12 Junction 18.

Critical to the planning application process should be a requirement to ensure that background traffic flows along the A414 and at Junction 18 of the A12 are not unreasonably delayed by the addition of development trips. This may well require significant highway measures in the vicinity of the site access.

To mitigate the impact of congestion along the A414 on the approach to Junction 18, consideration should also be given to the provision of a bus lane on the westbound approach to the Hammonds Farm access junction, supported by priority signals to accommodate buses into and out of the site and beyond into Chelmsford City Centre. The bus lane might then be extended up to the A12 Junction 18, with the provision of a bus gate to help bypass queue extents on the approach.

Recommended mitigation for consideration in addition to developer proposals:
• Westbound bus lane on approach to site access with bus priority signals
• Extended westbound bus lane to A12 Junction 18 with bus gate

Bus Access to Beaulieu Park Station

Bus connectivity to Beaulieu Park Station would provide inter-connected passenger transport links facilitating longer-distance journeys to/from Hammonds Farm via sustainable modes of travel.

Modelling has, however, raised a potential concern with the capacity of the RDR south of the Beaulieu Park Station access junction (the exit from Boreham Interchange). With no scope for widening the bridge link over the rail line to provide additional capacity, or a bus lane, to expedite sustainable access to the rail station, usage of bus services between Hammonds Farm and Beaulieu Park Station may be limited if congestion causes significant journey time delay.

Options are currently being discussed with developers of CGC to help improve the flow of traffic on the approach to the Beaulieu Park Station access junction. Nevertheless, it is recommended that delays along the route are monitored over time to determine the long-term viability of the route as a bus access link between the Hammonds Farm development and Beaulieu Park Station.

Should future journey times from Hammonds Farm to Beaulieu Park Station via the Boreham Interchange increase substantially, additional focus will be required on enhancing the provision of active and sustainable transport links to the existing rail station in Chelmsford City Centre. Services could make use of the existing bus lane along the A1114 Essex Yeomanry Way (Baddow Bypass) and improved access through the redesigned Army and Navy Roundabout. PM peak traffic congestion along Parkway in the City Centre is shown to worsen with Local Plan development trips added, therefore it would be appropriate for developers to contribute towards measures to mitigate City Centre impact on public transport.

ECC, CCC and National Highways will continue to work with developers and their consultants to ensure that initial proposed public transport mitigation measures are further developed, refined and costed through the master planning and planning application process to ensure the right schemes are delivered by developers in a timely manner.

9.4 The A12 corridor and Junction 17 Howe Green

VISUM model outputs demonstrate that the A12 corridor between Junctions 17 and 19 will operate without spare capacity and will likely experience significant congestion by 2041 in a baseline scenario without additional LPRPS development trips.

The A12 Junction 17 at Howe Green is also modelled with significant congestion in the 2041 baseline. Queues on the southbound off-slip are shown in the modelling to extend back along the A12 carriageway. At the same time, northbound congestion along the A12 is observed in reality to contribute towards delays on the northbound on-slip, impeding movements exiting from the junction.

The addition of LPRPS traffic from proposed development at Hammonds Farm and the employment site adjacent to the A12 Junction 18, would be expected to exacerbate forecast congestion along the A12 and, to a lesser extent, through Junction 17 at Howe Green.

A12 carriageway widening between Junctions 15-19 is not considered in National Highways' Road Investment Strategy (RIS3) pipeline for the period 2025-2030, and it is not clear whether National Highways are considering carriageway improvements beyond this period.

Junction 17 at Howe Green has been the subject of Essex Highways studies in the past, looking at possible capacity improvements to accommodate future growth in traffic. There are recognised restrictions on space at the junction that prevent carriageway widening sufficient to provide the capacity to accommodate long-term traffic flows. A redesign of Junction 17 would therefore require coordination with proposals to widen the A12 carriageway at the location.

A12 Junction 17 at Howe Green is a recognised congestion hotspot and is an existing long-term issue to be considered by ECC in partnership with National Highways outside of the Local Plan Review process to identify and bid for future funding opportunities for improvements.

According to NPPF guidance, there is an expectation for local plans and spatial development strategies *"to be underpinned by a clear and transparent evidence base which informs the authority's preferred approach to land use and strategic transport options, and the formulation of policies and allocations that will be subject to public consultation. (National Highways) will expect this process to explore all options to reduce a reliance on the Strategic Road Network for local journeys including a reduction in the need to travel and integrating land use considerations with the need to maximise opportunities for walking, wheeling, cycling, public transport and shared travel*[14]".

[14] Policy paper: Strategic road network and the delivery of sustainable development https://www.gov.uk/government/publications/strategic-road-network-and-the-delivery-of-sustainable-development/strategic-road-network-and-the-delivery-of-sustainable-development

Discussion, under the duty to co-operate will continue with National Highways to keep them aware of the impact of development sites along the A12 and to work collaboratively to inform the scope of active and sustainable mitigation required to best manage the impact of traffic flows and limit the volume of LPRPS development trips routing via the A12.

10 Conclusion

With a focus on development along the A12 corridor, the modelled traffic impact of the LPRPS is largely limited to the A12 trunk road, the junctions along it and, to a lesser extent, the A414 east of the A12, and the A1114 and A138 corridors into Chelmsford City Centre. The minor quantum of development allocated in rural areas of Chelmsford is of insufficient size to likely impact the local road network.

Overall, the allocation of development in the LPRPS provides the opportunity to make good use of existing and potential active and sustainable modes of transport to and from proposed sites. However, this will be dependent on the delivery of the bus, cycling and walking infrastructure proposed by developers, as well as additional measures required to provide the necessary connectivity to the wider sustainable transport network and achieve 60% modal shift targets. This will be crucial to ensure that the growth in trips associated with the proposed development is managed and does not have a significant impact on the surrounding local area.

With PM peak traffic congestion along Parkway in the City Centre shown to worsen with LPRPS development trips added, it would therefore be appropriate for all developers to contribute towards public transport measures to mitigate the impact on the City Centre.

Trips from proposed development in the vicinity of A12 Junctions 18 (Sandon) and 19 (Boreham Interchange) are modelled to have a direct impact on the capacity of these junctions, and it should be expected that developers of sites including; Chelmsford Garden Community, Hammonds Farm and Land Adjacent to A12 Junction 18, identify and make provision for the potential funding and delivery of necessary junction capacity improvements alongside the provision of sustainable and active transport infrastructure and services. Junction capacity improvements will be required in the event that development impact cannot be reasonably mitigated through bus, cycling and walking measures alone. The design and delivery of such capacity improvements would require collaboration with National Highways from an early planning stage.

Modelling suggests that the delivery of Boreham Interchange improvements associated with the A12 widening DCO proposals is required as a minimum to help ensure that the junction has the capacity to accommodate proposed development across Chelmsford identified in the Adopted Local Plan and the LPRPS. Should funding for the DCO proposals be withheld following central

government review in Spring 2025, modelling suggests that these capacity improvements will require funding by alternative means and ECC and CCC will jointly lobby for funding for the provision of necessary infrastructure at the junction.

Forecast modelling suggests that the impact of traffic flows associated with the LPRPS will have a minor impact along the A12 trunk road – relative to background traffic growth. At the same time however, the volume of development trips modelled on A12 junction on and off-slips may exacerbate potential safety issues in the future associated with carriageway merging.

With forecast-year modelling suggesting that sections of the A414 east of the A12 will operate close to, or at capacity; developers of LPRPS sites located off the A414 should be required to consider journey time impact along the route in the vicinity of A12 Junction 18, and through Danbury, and ensure that traffic conditions are sufficiently managed with the addition of development trips.

By maximising the potential for sustainable accessibility to and from the sites along the A12 corridor, the impact on the strategic highway network should not be considered severe. However, continued discussions between CCC, ECC and National Highways will be necessary to best ensure that future development growth in Chelmsford can be supported by the strategic highway network over the long-term.

Appendices

11 Appendix A: Supporting Technical Notes

Below are three supplementary reports which should be read alongside this Appraisal. These are as follows:

- Appendix A1: TEMPro V7.2 and V8.0 Background Growth Comparison
- Appendix A2: Pre and Post Covid-19 Traffic Flow Comparison
- Appendix A3: Low, Core and High Growth Scenarios

These supplementary reports were produced alongside the Preferred Spatial Approach assessment in March 2024, but remain relevant to this later stage of modelling.

Appendix A1: TEMPro V7.2 and V8.0 Background Growth Comparisons Supplementary Report

1. Introduction

TEMPro (Trip End Model Presentation Program) enables users to access and analyse the datasets from the National Trip End Model (NTEM) in order to forecast traffic growth associated with future housing and employment. For the Chelmsford Local Plan Review modelling, TEMPro has been used to determine background traffic growth in the initial assessment of spatial approaches and the subsequent appraisal of the preferred approach.

The latest version of TEMPro (version 8.0) was released in 2022. Shortly after, Essex Highways undertook a study comparing v8.0 and v7.2 datasets and found that the latest version assumes a significantly lower core scenario growth in housing and development in Chelmsford and surrounding local authorities than previous iterations. The study concluded that v7.2 projections were more in-line with current planning assumptions in Essex over the next 15-20 years. As such, the study recommended that TEMPro v7.2 continue to be used on modelling projects in Essex until further guidance is issued by the DfT on the appropriate application of v8.0 datasets.

This technical note summarises the findings from this study to help support the decision to use v7.2 datasets for the Chelmsford Local Plan Review modelling.

2. Comparison of v7.2 and v8.0

A study was undertaken analysing v7.2 and v8.0 TEMPro data compared to housing requirements and build out in Essex, Southend, and Thurrock[15]. The table overleaf shows the difference in the number of houses in TEMPro v7.2 and v8.0 and how these figures compare to the number of homes required and built between 2018/19 – 2020/21.

[15] Housing requirements and build out totals sourced from: DLUHC, 2022: 'Housing Delivery Test: 2021 Measurement'

Table A1-1: TEMPro v7.2 and v8.0 housing growth forecasts compared to housing requirements and build out in Essex

ONS Code	Area Name	2018/19 to 2020/21 Period			
		Homes required	Homes Built	TEMPro v7.2	TEMPro v8.0
E07000066	Basildon	2,717	1,117	1,540	696
E07000067	Braintree	1,848	2,302	2,248	299
E07000068	Brentwood	1,169	774	474	174
E07000069	Castle Point	912	451	1,245	-18
E07000070	Chelmsford	2,082	2,917	3,214	704
E07000071	Colchester	2,375	3,173	2,957	1,292
E07000072	Epping Forest	2,436	847	651	471
E07000073	Harlow	933	1,936	956	356
E07000074	Maldon	791	1,217	1,100	183
E07000075	Rochford	933	958	1,088	292
E06000033	Southend-on-Sea	3,041	947	1,663	577
E07000076	Tendring	1,420	2,345	2,063	800
E06000034	Thurrock	3,001	1,459	4,029	865
E07000077	Uttlesford	1,848	1,830	1,610	811
ALL	**Essex**	**25,503**	**22,273**	**24,839**	**7,502**

Table A1-1 shows that TEMPro v8.0 consistently underestimated housing growth by a large margin, compared to v7.2, across all districts in Essex. In Chelmsford, v8.0 figures were reported to be 78% less than v7.2. TEMPro v8.0 also recorded an anomalous decline in the number of houses in Castle Point across the three-year period, raising further concerns about its accuracy.

Table A1-2 below shows a more detailed summary of the differences between TEMPro v8.0 and v7.2 figures and the number of homes required and built in Chelmsford district. TEMPro v8.0 figures for Chelmsford were roughly 76% less than what was actually built, whereas TEMPro v7.2 figures were only 10% more than what was built. The study concluded that TEMPro v8.0 could not be reliably used for the period up to 2020/21 as the number of houses were out of sync with observed house building and therefore traffic growth related to the number of households. As such, any growth factors calculated from a base year at, or before 2021 were not likely to provide a reliable estimate of growth.

Table A1-2: TEMPro v8.0 and TEMPro v7.2 forecasts compared to the number of homes required and homes built.

TEMpro version	TEMPro forecast	Homes Required	Homes Built	% Difference between TEMPro forecast and homes required	% Difference between TEMPro forecast and homes built
V7.2	3,214	2,082	2,917	54%	10%
V8.0	704			-66%	-76%

Figure A1-1 below shows TEMPro forecasts to 2046 for both v7.2 and v8.0.

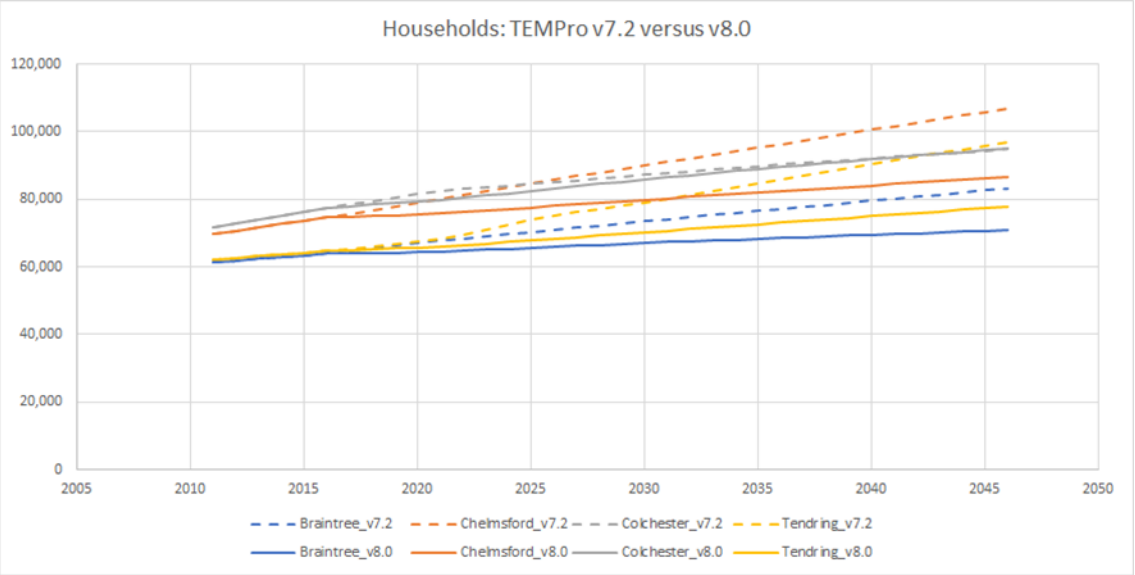


Figure A1-1: TEMPro v7.2 versus v8.0 forecasts for housing growth 2011 - 2046

The number of houses in v7.2 and v8.0 start to deviate from each other around 2017. Whilst v7.2 forecasts follow a straight upward trajectory that is a continuation from 2011, v8.0 forecasts appear to follow a much shallower trajectory from 2017.

Following the trajectories shown in Figure A1-1, the predicted growth in households and jobs in both TEMPro v7.2 and v8.0 over the extended Local Plan Review period 2036-2041 is summarised in Table A1-3 below. When compared with the housing and employment assumptions modelled for the Local Plan Review, v8.0 values are significantly lower.

Table A1-3: 2036-2041 Chelmsford housing and employment projections - Local Plan vs TEMPro v7.2 vs v8.0

	Chelmsford Local Plan Allocation (2036-2041)	TEMPro v7.2	TEMPro v8.0
Growth in Households	6500	5270	2041
Growth in Jobs	4303	1468	506

3. Conclusions

It is recommended that TEMPro v7.2 is used to determine background traffic growth for the local plan modelling appraisal due to the significantly low growth assumed in v8.0 and larger discrepancies between TEMPro v8.0, housing requirements and actual homes built compared to v7.2. This decision is in line with Essex Highways' previous recommendation to continue to use v7.2 datasets for all Chelmsford projects.

Appendix A2: Pre and Post Covid-19 Traffic Flow Comparison Supplementary Report

1. Introduction

The Chelmsford Local Plan Review modelling is underpinned by the Army and Navy VISUM model which is based on 2019 traffic flows. The decision has been made to continue using 2019 data as opposed to updating the base model to reflect current traffic. This decision follows a desktop study comparing pre and post Covid-19 traffic counts. This technical note summarises the outcomes of the desktop study and outlines the justifications for the continued use of 2019 trips for the Chelmsford Local Plan Review modelling.

2. Data Selection

Continuous counter data was extracted for the dates listed below to enable a comparison of pre and post Covid-19 traffic flows:

- Pre-Covid Dates: 1st September – 31st November 2019.
- Post-Covid Dates: 1st March – 30th June 2023.

The most recent data available was obtained for 2023 to represent post-pandemic flows. The year 2019 was used for pre-pandemic flows as this was consistent with the Chelmsford VISUM model base year. The months September to November were used for 2019 covering the period after the removal of the flyover at the Army and Navy roundabout and before the start of the Covid-19 pandemic. Data was extracted for neutral months for both scenarios to ensure consistency across the two samples and reduce the impact of seasonality.

Data was extracted from a total of 8 counters located on key routes in and out of Chelmsford, as shown in Figure A2-1 overleaf.

Figure A2-1: Chelmsford Counter sites selected for the pre/post Covid-19 Traffic Flow Comparison.

Pre and Post Covid-19 traffic flows were compared at each counter location for the three time periods defined below:

- AM Peak: 07:30 – 08:30
- IP: 10:00 – 16:00
- PM Peak: 17:00 – 18:00

These times are consistent with those used in the Army and Navy modelling.

A t-test analysis was carried out to determine whether there were any significant differences between the sampled, pre and post Covid-19 counts. The test considered the difference in the means and, the difference in the variation of the two samples.

Table A2-1 on page 93 shows the pre and post-Covid19 average daily flows (ADF) for each counter location for the times outlined above and, the results of the t-test. Section 3 below summarises the findings of this statistical analysis.

3. Pre and Post Covid-19 comparisons – Summary of Findings

Whilst Table A2-1 on the following page shows that there are statistical differences between pre and post Covid-19 traffic flows at individual count sites, at an aggregate level, there is no significant difference for both the AM and PM peaks. This supports DfT findings that overall volumes are still at pre-pandemic levels and have not yet stabilised. Given that the VISUM model uses count data at an aggregate level, 2019 data is still appropriate for use and provides a reliable, stable base for the modelling.

Updating the base VISUM model would also require new mobile phone origin-destination data to better reflect current travel patterns and behaviours. This would require a significant investment which could not be justified at this time, given the lack of certainty around the stability of traffic patterns.

	Weekday ADF - AM: 07:30 - 08:30				Weekday ADF -IP: 10:00 - 16:00				Weekday ADF -PM: 17:00 - 18:00			
Counter Location	Pre-Covid 19 (Sept - Nov 2019)	Post-Covid 19 (Feb - April 2023)	Statistically Significant Difference	% Difference	Pre-Covid 19 (Sept - Nov 2019)	Post-Covid 19 (Feb - April 2023)	Statistically Significant Difference	% Difference	Pre-Covid 19 (Sept - Nov 2019)	Post-Covid 19 (Feb - April 2023)	Statistically Significant Difference	% Difference
A - A1016 Chelmer Valley Rd	2291	2352	Y	2.6%	1459	1580	Y	8.3%	1924	2054	Y	6.7%
B - A414, Three Mile Hill	2655	2487	Y	-6.3%	1759	1722	Y	-2.1%	2449	14681	Y	499.5%
C - B1137, Springfield Rd	898	842	Y	-6.3%	677	638	Y	-5.8%	767	787	N	2.6%
D - B1008, Broomfield Rd	1443	1272	Y	-11.9%	1196	1151	Y	-3.8%	1491	1399	Y	-6.1%
E - A1060, Roxwell Rd	1583	1718	Y	8.5%	966	1090	Y	12.8%	1594	1628	N	2.1%
F - A1060, Parkway	3061	2993	Y	-2.2%	2717	2638	Y	-2.9%	3057	2853	Y	-6.7%
G - A1114, Gt Baddow By-Pass	2366	2224	Y	-6.0%	1902	1907	N	0.3%	2337	2246	Y	-3.9%
H - A138, Chelmer Rd	2432	2518	Y	3.6%	2325	2315	N	-0.4%	2685	2757	N	2.7%
All Sites	**16358**	**16379**	**N**	**0.1%**	**12766**	**13040**	**Y**	**2.1%**	**15946**	**16059**	**N**	**0.7%**
All Sites (Excluding Three Mile Hill)	**13872**	**13892**	**N**	**0.1%**	**11120**	**10943**	**Y**	**-1.6%**	**13653**	**13724**	**N**	**0.5%**

Table A2-1: Pre and post covid-19 comparison of traffic flows.

ADF – Average Daily Flow (Based on non-neutral month – excluding weekends and bank holiday

4. Conclusion

It is recommended that the 2019 VISUM Army and Navy base models continue to be used for the Chelmsford Local Plan Review Modelling. Whilst there are statistical differences between 2019 and 2023 traffic flows at individual count sites, at the aggregate level there is no significant difference in both the AM and PM peaks. 2019 therefore remains a more reliable base year for forecasting, given that current travel patterns have not yet stabilised and are subject to higher levels of uncertainty.

Appendix A3: Low, Core and High Growth Scenarios Supplementary Report

1. Introduction

(NB – The following refers to growth scenarios in DfT Transport Analysis Guidance, and is unrelated to modelled scenarios discussed in the main body of this report)

There is an increasing acceptance across the industry of the lack of certainty when predicting future traffic growth, influenced by the inherent unpredictability surrounding the uptake of new technologies and changes in future travel behaviour. It is not possible to robustly identify a 'most likely' or expected outcome with any certainty, and the further we forecast into the future, the accuracy of the modelling approach declines and uncertainty increases. Therefore the use of 'alternative' growth scenarios help to establish a range of likely outcomes.

This has led to a range of growth forecasts provided by the Department for Transport (DfT) for use in traffic modelling, which aims to both mitigate and reflect this uncertainty. However, forecasts are by nature uncertain, and even when using unbiased assumptions there is no guarantee that the outturn result of scheme implementation will match the forecast.

As outlined in TAG Unit M1, it is recommended that modifications to the transport network should be, where appropriate, tested under different growth assumptions (referred to as 'alternative scenarios') to highlight any risks to the benefits or impacts of a scheme, and to acknowledge this uncertainty around future traffic forecasts.

However, the guidance also recognises that the use of Alternative Growth Scenarios in modelling should be proportionate to the level of detail required. Therefore, in the case of the Chelmsford Local Plan Review, the decision has been taken to only model a single growth scenario, as this has been deemed sufficient for the modelling and commensurate with the level of detail required for the Local Plan review evidence base.

Whilst alternative growth scenarios won't be explicitly modelled as part of the Local Plan Review evidence base, a supplementary assessment has been undertaken to review the impact of the Alternative Growth Scenarios on traffic flows on key links across Chelmsford, recently modelled as part of the Army and Navy Strategic Outline Business Case.

The outcomes of the additional analysis are documented within this supplementary report.

2. Growth Scenarios

2.1 Core Growth Scenario

The Core Growth Scenario is based on a set of central assumptions. It includes only future land-use and transport network developments which have a high degree of certainty (usually based on existing Local Plan allocations, planning consents and committed transport schemes) and is consistent with TEMPro travel demand forecasts at the sub-regional / district level and DfT's Road Traffic Forecasts (RTF2018) as appropriate.

It is intended to provide a sensible, consistent basis for decision-making given current evidence, and provides a 'common comparator' to assess all projects and options against. The Core Growth Scenario is based on:

- NTEM growth in demand, at a suitable spatial area;
- Sources of local uncertainty that are more likely to occur than not; and
- Appropriate modelling assumptions

As outlined in TAG Unit M4, a core scenario appraisal should always be undertaken when assessing the impact a scheme, or of development, on a transport network.

However, as mentioned previously, there are significant and often unquantifiable uncertainties associated with forecasting travel demand, and therefore other scenarios should be considered in line with the guidance in TAG Unit M4, including Low/High Growth scenarios to reflect uncertainties in the national travel demand forecasts.

2.2 Alternative Growth Scenarios

Alternative growth scenarios are a set of background assumptions incorporating 'with scheme' and 'without scheme' forecasts that may have different supply and/or demand assumptions from the core scenario.

- High Growth – Assumes a greater increase in private transport usage over the Core Scenario due to (for example) advancements in technology that help reduce the relative financial and environmental cost of travel.

- Low Growth – Assumes a greater reduction in private transport usage over the Core Scenario due to (for example) increases in the cost of living and stricter environmental targets being set to manage vehicle emissions.

3. Comparison of Alternative Growth Scenario Outputs from A&N Modelling

As part of the strategic modelling carried out on the options for the Army and Navy junction in Chelmsford, national uncertainty in traffic growth was addressed using the standard TAG High and Low growth scenarios as outlined above.

The below sub-sections illustrate the impact of the alternative growth scenarios when compared with the Core Growth Scenario on traffic flows as observed in the Army and Navy forecast modelling.

3.1 Traffic Flow Difference Plots

The figures below provide an overview of the network differences in traffic flows between the Core Growth Scenario and the alternative (Low and High) growth scenarios in the 2021 Do Something model, across the AM, IP and PM periods.

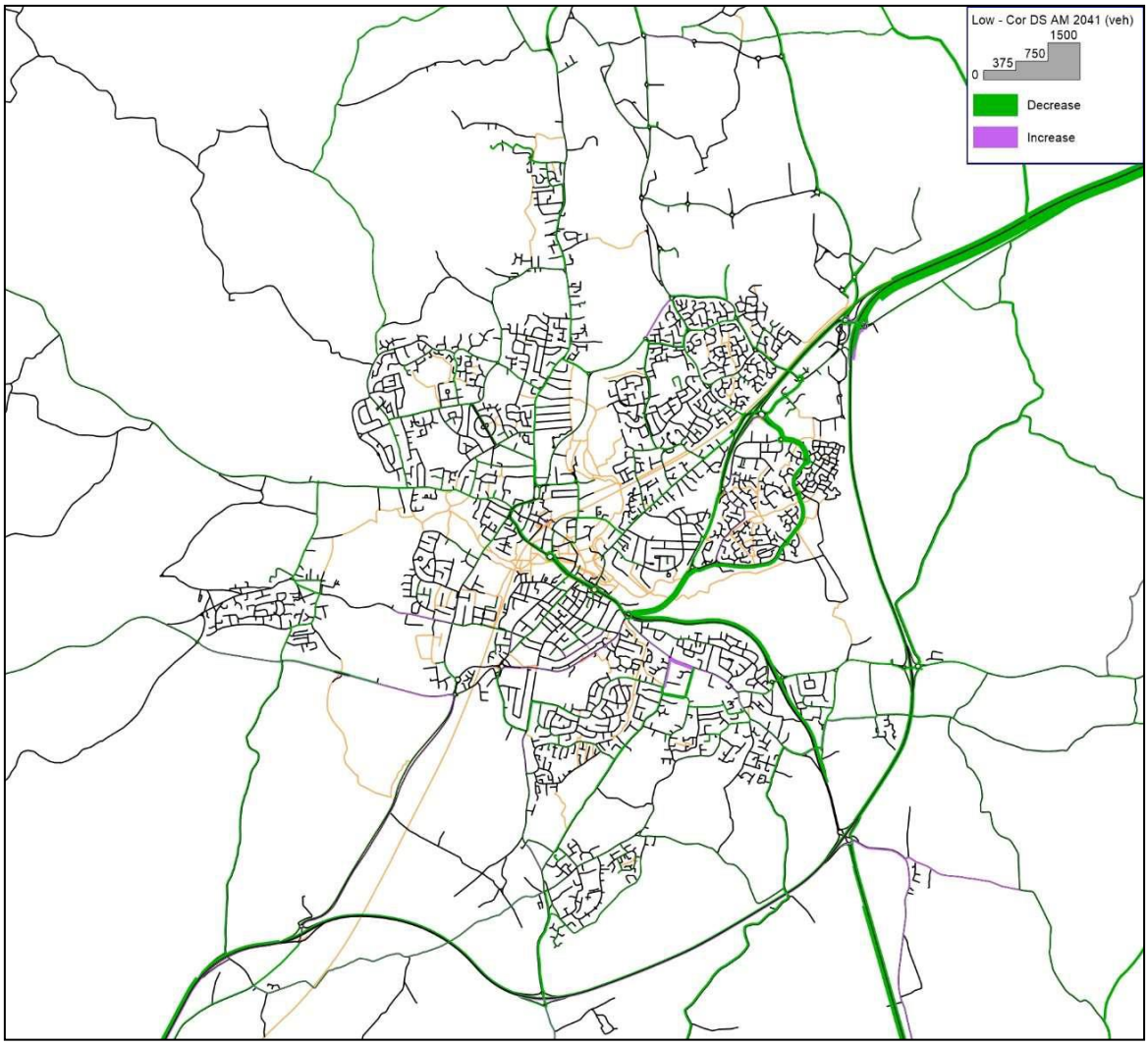


Figure A3-1: Traffic Flow Difference Plots Low Growth vs Core - DS 2041 AM Peak

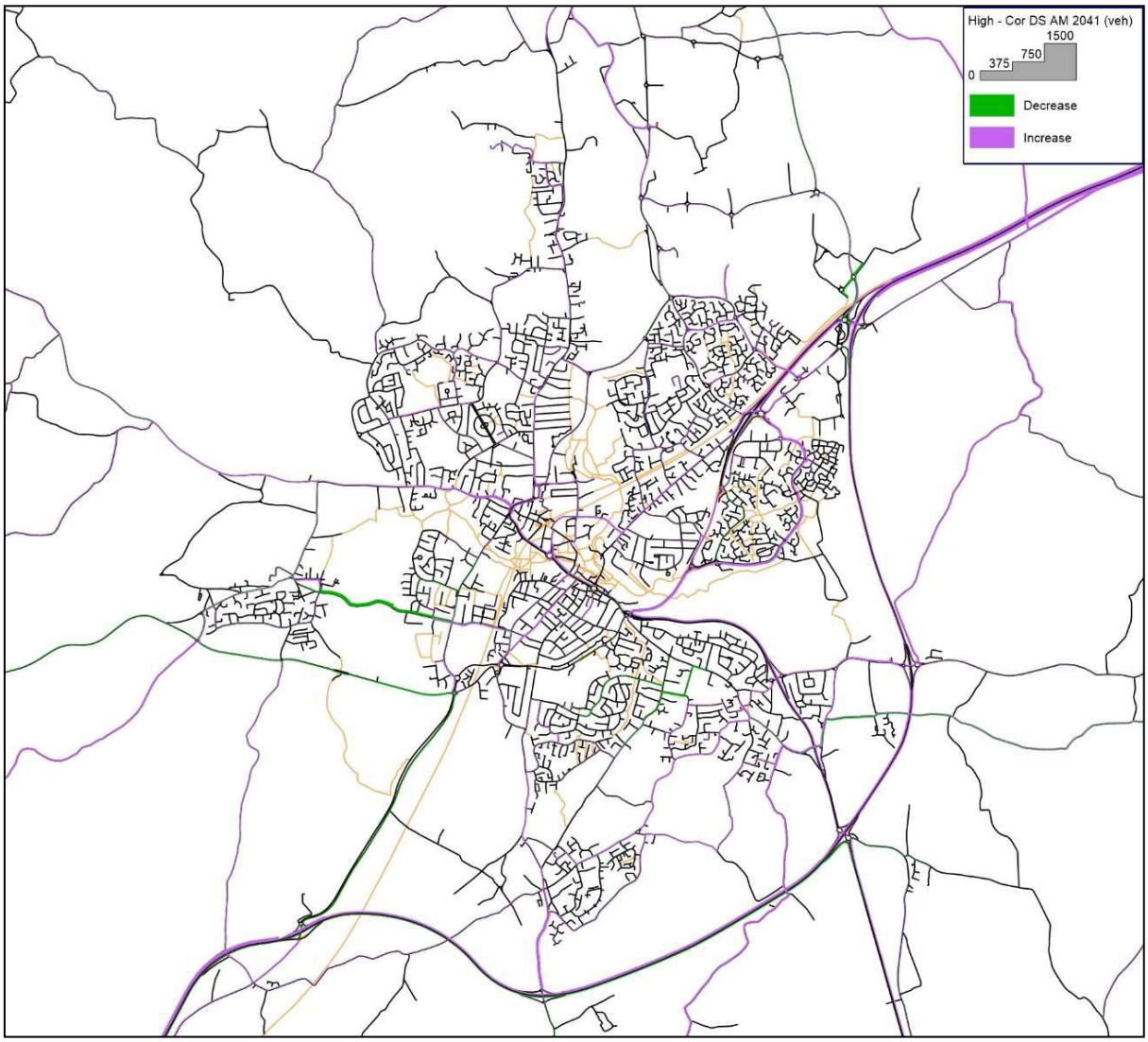


Figure A3-2: Traffic Flow Difference Plots High Growth vs Core - DS 2041 AM Peak

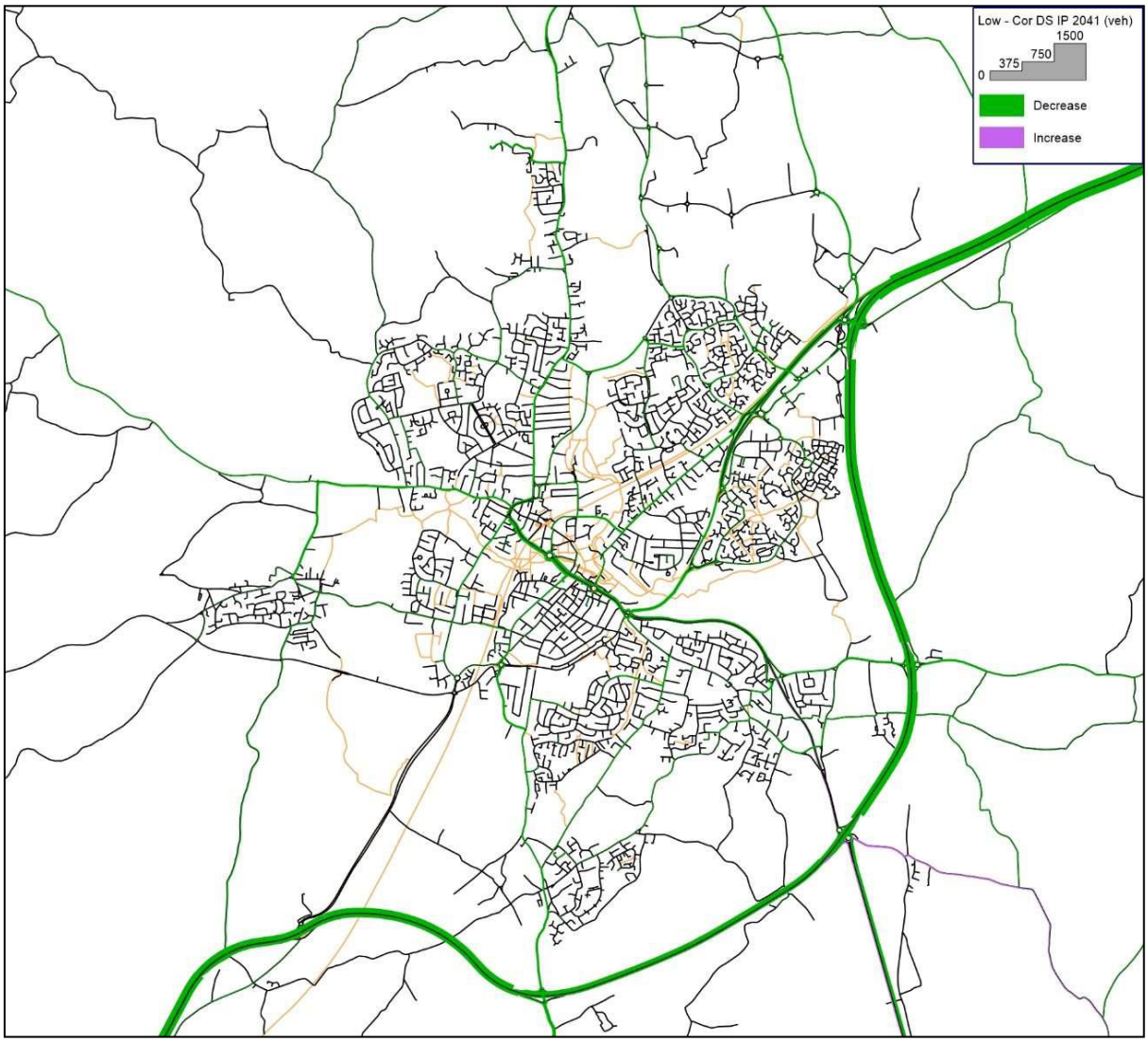


Figure A3-3: Traffic Flow Difference Plots Low Growth vs Core – DS 2041 Inter-peak

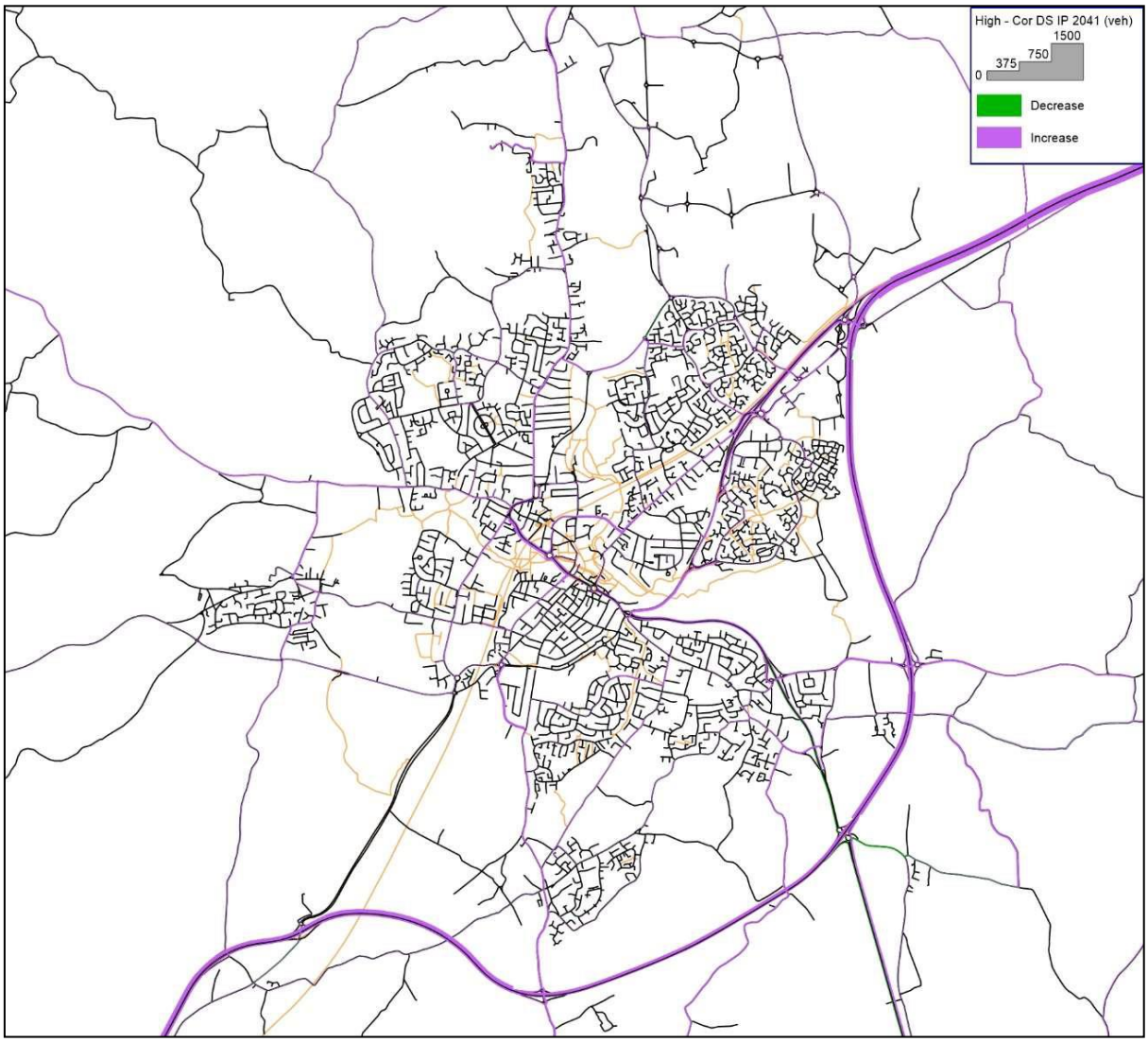


Figure A3-4: Traffic Flow Difference Plots High Growth vs Core - DS 2041 Inter-peak

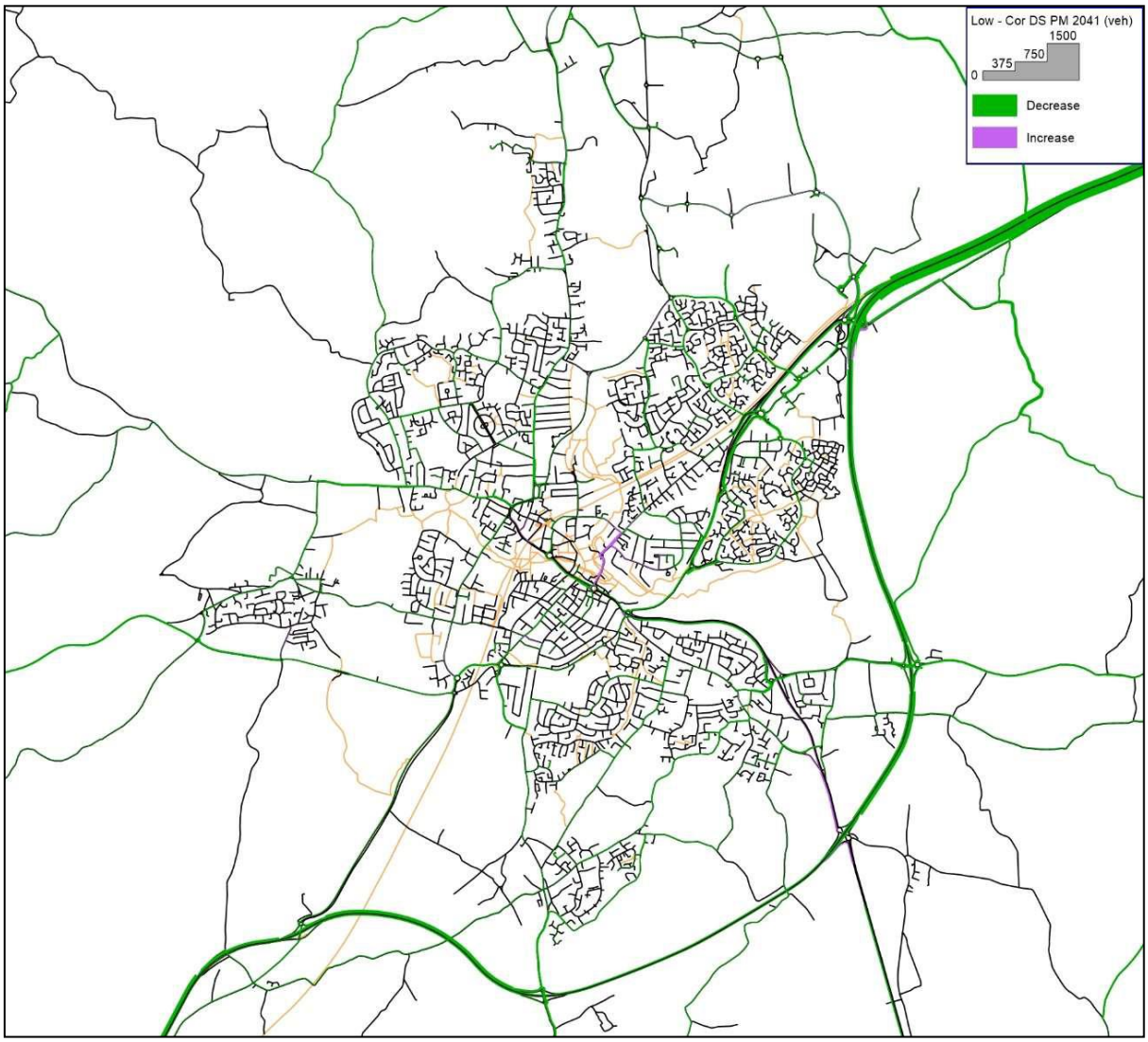


Figure A3-5: Traffic Flow Difference Plots Low Growth vs Core – DS 2041 PM peak

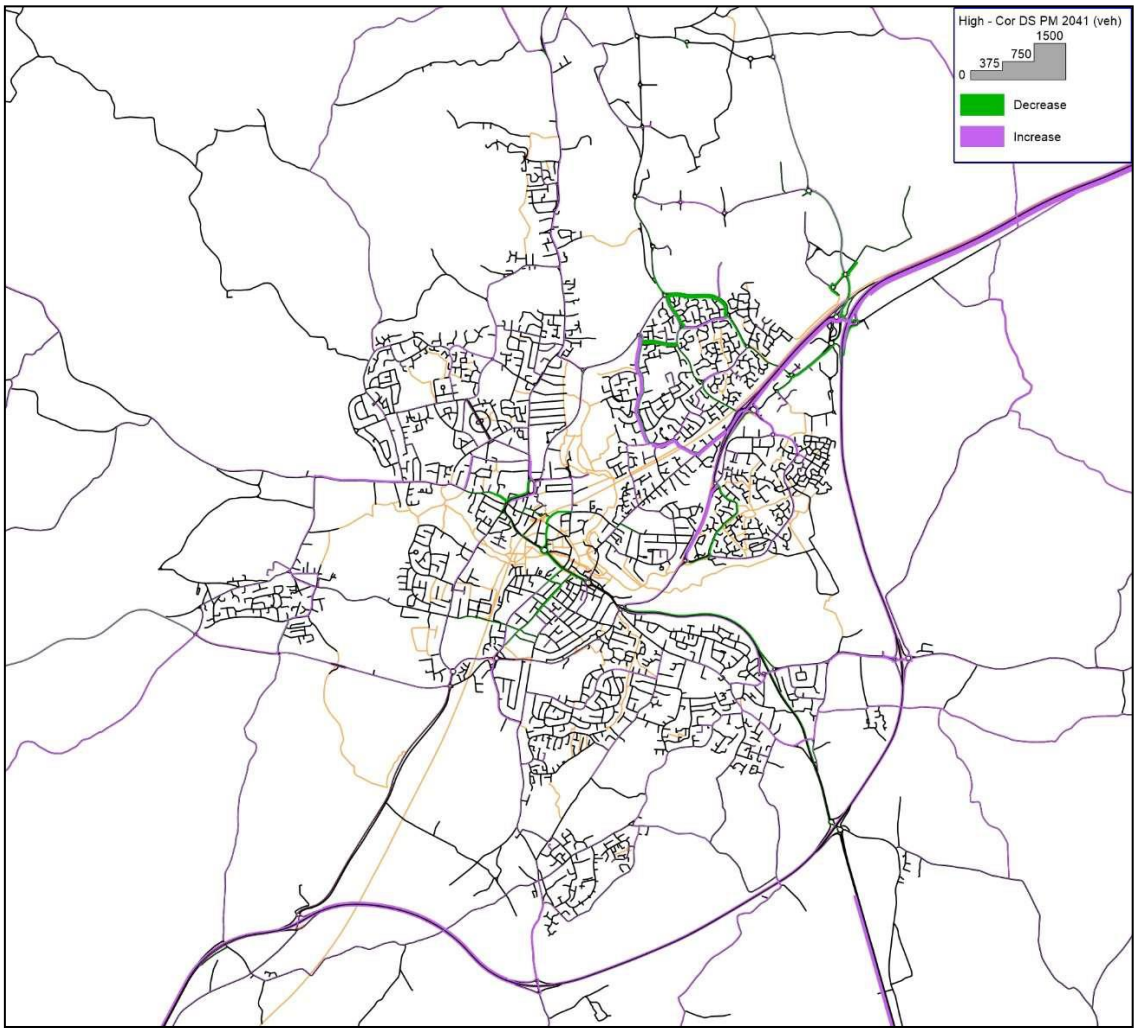


Figure A3-6: Traffic Flow Difference Plots High Growth vs Core – DS 2041 PM peak

The flow difference plots presented above illustrate the impact of both the alternative growth scenarios when compared to the Core Growth Scenario.

When comparing the network impact of Low growth compared to the Core Growth Scenario, the impact on traffic flows is relatively stable, represented by a reduction in traffic flows in most areas of the network across all periods.

When comparing the network impact of High growth compared to the Core Growth Scenario, the traffic flow difference plots indicate that the impact on traffic flows is less significant, with relatively little change along key strategic routes in the peak hours. This indicates that the network is generally at or close to capacity in the peak periods in the 2041 Do Something scenario and that additional traffic under the High growth scenario cannot be accommodated. These car trips are either being reassigned in the model to alternative routes (to reflect traffic rerouting) or being removed from the network (to reflect a change in the time of travel or a shift to alternative modes) because of the variable demand modelled response to network congestion. The impact of trip reassignment caused by

network congestion in the High Growth Scenario can be seen in Figure A3-4 and A3-6, where trips are being rerouted away from the key corridors and onto alternative rural routes, such as Hammonds Road to the east of the A12 and Margaretting Road to the west of Hylands Park - both of which experience an increase in vehicle flow.

Under the High Growth Scenario, some sections of route are shown with a decrease in traffic flow, which can be explained by congestion modelled at locations upstream or downstream resulting in traffic being reassigned away from the route entirely.

3.2 Key Corridor Analysis

The tables below provide a more detailed comparison of modelled traffic flows on key corridors across Chelmsford, in the Low, Core and High growth scenarios, observed in the 2041 Do Something AM, IP and PM models.

Table A3-1: Comparison of modelled traffic flows across Low, Core & High growth scenarios – AM Peak

Corridor	AM Peak Period						
	Core Growth	Low Growth			High Growth		
	Flows	Flows	Diff from core	% diff from core	Flows	Diff from core	% diff from core
Essex Yeomanry Way (EB)	1,421	1,284	137	-11%	1,487	66	4%
Essex Yeomanry Way (WB)	1,465	1,428	37	-3%	1,456	-9	-1%
Chelmer Road (NE)	1,158	1,088	70	-6%	1,185	27	2%
Chelmer Road (EW)	2,325	2,147	178	-8%	2,411	86	4%
Parkway (NW)	2,335	2,291	44	-2%	2,312	-23	-1%
Parkway (SE)	1,609	1,531	78	-5%	1,647	38	2%
Broomfield Road (NB)	615	592	23	-4%	629	14	2%
Broomfield Road (SB)	543	515	28	-5%	568	25	4%
Roxwell Road (WB)	561	527	34	-6%	589	28	5%
Roxwell Road (EB)	777	758	19	-3%	824	47	6%
Three Mile Hill (NB)	1,667	1,648	19	-1%	1,657	-10	-1%
Three Mile Hill (SB)	1,346	1,368	-22	2%	1,306	-40	-3%
	Average difference from core:		54	-4%		21	2%

Table A3-1 illustrates the difference in AM traffic flows in the DS 2041 model under the alternative growth scenarios, when compared with the Core Growth Scenario. In the case of all but 1 of the 12 links presented, the Low Growth Scenario produces a reduction in traffic flows, with the largest reduction seen on Essex Yeomanry Way (EB). The range of impact of the Low Growth Scenario on observed traffic flows on the key corridors presented in the AM peak is between -11% and +2% difference from the Core Growth Scenario.

The impact of the High Growth Scenario on traffic flows in the AM peak is slightly more variable, with 8 of the 12 corridors seeing an increase in traffic flows as a result, and 4 corridors seeing a decrease in traffic flows. The range of impact of the High Growth Scenario on observed traffic flows on the key corridors presented in the AM peak is between -3% and +6% difference from the Core Growth Scenario.

The analysis shows that the overall impact of the Low Growth Scenario on traffic flows across the selected links is more significant than in the High Growth Scenario, and this can be explained by the redistribution of trips onto wider areas of the network under the High Growth Scenario. As a result, the impact of the High Growth Scenario is less visible when only looking at flow changes on key corridors.

Table A3-2: Comparison of modelled traffic flows across Low, Core & High growth scenarios – Inter-Peak

Corridor	Inter-Peak Period						
	Core Growth	Low Growth			High Growth		
	Flows	Flows	Diff from core	% diff from core	Flows	Diff from core	% diff from core
Essex Yeomanry Way (EB)	1,243	1,178	65	-6%	1,293	50	4%
Essex Yeomanry Way (WB)	987	962	25	-3%	1,029	42	4%
Chelmer Road (NE)	1,233	1,186	47	-4%	1,255	22	2%
Chelmer Road (EW)	1,266	1,187	79	-7%	1,354	88	6%
Parkway (NW)	1,582	1,535	47	-3%	1,625	43	3%
Parkway (SE)	1,743	1,652	91	-6%	1,774	31	2%
Broomfield Road (NB)	564	531	33	-6%	605	41	7%
Broomfield Road (SB)	490	462	28	-6%	512	22	4%
Roxwell Road (WB)	588	542	46	-8%	624	36	6%
Roxwell Road (EB)	523	498	25	-5%	536	13	2%
Three Mile Hill (NB)	935	940	-5	1%	945	10	1%
Three Mile Hill (SB)	979	979	0	0%	978	-1	0%
	Average difference from core:		40	-4%		33	3%

Table A3-2 illustrates the difference in Inter-peak traffic flows in the DS 2041 model under the alternative growth scenarios, when compared with the Core Growth Scenario. All corridors, with the exception of Three Mile Hill (both directions), see a reduction in traffic flows in the Low Growth Scenario in the Inter-peak period. The range of impact on observed traffic flows on the key corridors is between -8% and 0% difference from the Core Growth Scenario.

The corridor 'Three Mile Hill Southbound' saw no change in modelled traffic flows in the Inter-peak period under the High Growth Scenario. The range of impact of the High Growth Scenario on observed traffic flows on the key corridors presented in the Inter-peak period is between 0% and +7% difference from the Core Growth Scenario.

Compared to the AM peak period, the impact of the High Growth Scenario on traffic flows in the Inter-peak period is less varied, with all but one corridor seeing a modelled increase in traffic flows compared to the Core Growth Scenario. This is likely due to the overall network being less congested in the inter-peak period,

meaning the additional trips in the High Growth Scenario can be better accommodated on these key corridors, resulting in a greater increase in flows than in the congested peak periods.

Table A3-3: Comparison of modelled traffic flows across Low, Core & High growth scenarios – PM Peak

Corridor	PM Peak Period						
	Core Growth	Low Growth			High Growth		
	Flows	Flows	Diff from core	% diff from core	Flows	Diff from core	% diff from core
Essex Yeomanry Way (EB)	1,648	1,653	-5	0%	1,595	-53	-3%
Essex Yeomanry Way (WB)	1,431	1,363	68	-5%	1,475	44	3%
Chelmer Road (NE)	1,444	1,383	61	-4%	1,495	51	3%
Chelmer Road (EW)	1,344	1,343	1	0%	1,332	-12	-1%
Parkway (NW)	1,701	1,712	-11	1%	1,709	8	0%
Parkway (SE)	2,202	2,168	34	-2%	2,190	-12	-1%
Broomfield Road (NB)	757	727	30	-4%	745	-12	-2%
Broomfield Road (SB)	562	523	39	-7%	602	40	7%
Roxwell Road (WB)	795	787	8	-1%	805	10	1%
Roxwell Road (EB)	709	672	37	-6%	752	43	6%
Three Mile Hill (NB)	1,245	1,208	37	-3%	1,263	18	1%
Three Mile Hill (SB)	1,409	1,402	7	0%	1,413	4	0%
	Average difference from core:		26	-3%		11	1%

Table A3-3 illustrates the difference in PM peak traffic flows in the DS 2041 model under the alternative growth scenarios, when compared with the Core Growth Scenario. Most of the key corridors see a reduction in traffic flows in the Low growth scenario in the PM peak period, with two corridors observing no change in flows and one corridor (Parkway NW) experiencing a slight increase. The range of impact of the Low Growth Scenario on observed traffic flows on the key corridors presented in the PM peak period is between -7% and 1% difference from the Core Growth Scenario.

The impact of the High Growth Scenario on traffic flows in the PM period is similar to the impact in the AM peak, with 8 of the 12 links experiencing an increase in traffic flows compared to the Core Growth Scenario. Two of the links (Parkway NW and Three Mile Hill SB) experienced no impact compared to the Core Growth

Scenario as a result of the High Growth Scenario, and two links (Parkway SE and Broomfield Road NB) experienced a slight decrease in traffic flows. The range of difference in traffic flows in the High Growth Scenario compared to the Core Growth Scenario in the PM period is from -3% to +7%.

Again, similar to the AM peak, the impact of the wider distribution of trips across the network in the High Growth Scenario means that the overall increase in flows on these key corridors is less significant than the difference between the Low Growth and Core Growth scenarios in the PM peak.

The below table provides the range and average difference in observed traffic flows in the AM, Inter-peak and PM periods, in both the alterative growth scenarios when compared to the Core Growth Scenario.

Table A3-4: Range and average difference in observed traffic flows – alternative vs Core growth scenario

	Range of observed difference (%) in traffic flows from Core scenario		Average observed difference (%) in traffic flows from Core scenario	
	Low Growth	High Growth	Low Growth	High Growth
AM Peak	-11 to +2%	-3 to +6%	-4%	2%
Inter-peak	-8 to 0%	0 to +7%	-4%	3%
PM Peak	-7 to +1%	-3 to +7%	-3%	1%

In the AM peak, the average difference in traffic flows between the Low Growth Scenario and the Core Growth Scenario across the 6 key Chelmsford corridors is -4%, and between the High Growth Scenario and Core Growth Scenario is +2%.

In the Inter-peak period, the average difference in traffic flows between the Low Growth Scenario and the Core Growth Scenario across the 6 key Chelmsford corridors is -4%, and between the High Growth Scenario and Core Growth Scenario is +3%.

In the PM peak period, the average difference in traffic flows between the Low Growth Scenario and the Core Growth Scenario across the 6 key Chelmsford corridors is -3%, and between the High Growth Scenario and Core Growth Scenario is +1%.

4. Conclusion

In conclusion, analysis of the impact of the Alternative growth scenarios on modelled traffic flows in the Chelmsford Army and Navy model provides a high-level indication of the likely difference in modelled traffic flows that would be expected from the LPRPS testing, if modelled under both a Low and High Growth Scenario.

Based on the analysis presented above, under the Low Growth Scenario, it is possible that we could expect to see a -4% difference in traffic flows from the Core Growth Scenario outputs in the AM model, a +3% difference in the Inter-Peak model and a 1% difference in the PM model.

Based on the analysis presented above, under the High Growth Scenario, it is possible that we could expect to see a +2% difference in traffic flows from the Core Growth Scenario outputs in the AM model, a -4% difference in the Inter-Peak model and a -3% difference in the PM model. Due to the reassignment of trips onto the wider network under the High Growth Scenario, the change in flows from the Core Growth Scenario on the selected routes is less significant than in the Low Growth Scenario.

Alongside the modelled Core Growth Scenario outputs from the LPRPS testing, this information will be used to provide an inferred ‘range’ of traffic flow outputs, to address the challenges around forecast modelling and uncertainty, and the requirements outlined in TAG Unit M1.

12 Appendix B: New Development Zones

Where appropriate, development sites have been modelled using existing zones within the 2019 Chelmsford base model. However, where appropriate model zones did not exist, new zones have been added. These have been outlined in Table B-1 below.

Model Zone Number	Development Name	Development Type	Proposed Donor Zone	Proposed Donor Zone Description	Justification for donor zone use	Modelled Loading Point on Network
Adopted Local Plan Sites						
362	Civic Centre Land Fairfield Road Chelmsford	Housing	10	ARU Student Village and Land South of Rectory Ln	Kept consistent with A&N modelling	Fairfield Road
363	Land West of Eastwood House Glebe Road Chelmsford	Housing	10	ARU Student Village and Land South of Rectory Ln	Kept consistent with A&N modelling	Glebe Road
364	Riverside Ice and Leisure Land Victoria Road Chelmsford	Housing	10	ARU Student Village and Land South of Rectory Ln	Kept consistent with A&N modelling	Waterloo Lane
365	Ashby House Car Parks New Street Chelmsford	Housing	10	ARU Student Village and Land South of Rectory Ln	Kept consistent with A&N modelling	Hoffmans Way
366	Rectory Lane Car Park West Rectory Lane Chelmsford	Housing	10	ARU Student Village and Land South of Rectory Ln	Kept consistent with A&N modelling	Elms Drive
367	Lockside Navigation Road Chelmsford	Housing	6	Land south of Navigation Road	Kept consistent with A&N modelling	Navigation Road
	Travis Perkins, Navigation Road Chelmsford	Housing				
368	Rivermead	Student Accomodation	10	ARU Student Village and Land South of Rectory Ln	Appropriate donor zone for Student Accomodation. To maintain consistency with donor zones used for the Chelmsford Urban Area as part of the A&N modelling.	Ransomes Way
369	Danbury	Housing	99	Danbury, Land east of Gay Bowers Lane	Kept consistent with A&N modelling	Maldon Road
371	East of Chelmsford - Land North of Maldon Road	General Industrial	26	Chelmsford Business Park, Sheepcotes, Springfield	Kept consistent with A&N modelling	Sandford Mill Lane
		Warehousing				
		Office				
		Research and Industrial				
372	North of South Woodham Ferrers	General Industrial	103	North of South Woodham Ferrers	Kept consistent with A&N modelling	B1418
		Warehousing				
Chelmsford Local Plan Review Development Sites						
370	Andrews Place, Waterhouse Lane	Housing	10	ARU Student Village and Land South of Rectory Ln	To maintain consistency with donor zones used for the Chelmsford Urban Area as part of the A&N modelling	Rainsford Road, near Andrews Place
373	Glebe Road Car Park	Housing	10	ARU Student Village and Land South of Rectory Ln	Kept consistent with A&N modelling	Glebe Road
374	Granary Car Park	Housing	7	Springfield, Land east of Bunny Walks and west of Arbour Ln	Kept consistent with A&N modelling	Victoria Road
375	Land between Hoffmans Way and Brook Street (Marriages Mill)	Housing	10	ARU Student Village and Land South of Rectory Ln	Kept consistent with A&N modelling	Hoffmans Way
376	Coval Lane Car Park	Housing	54	Land east of Waterhouse Ln and north of Writtle Rd	Kept consistent with A&N modelling	Rainsford Lane junction with Coval Lane
377	Meadows Shopping Centre and Meadows Surface Car Park	Housing	7	Springfield, Land east of Bunny Walks and west of Arbour Ln	Kept consistent with A&N modelling	Stub connecting onto Highbridge Road
380	Additional Employment (Unallocated) - Site 1 (Victoria Road)	Office	2	Victoria Road	Kept consistent with A&N modelling	Victoria Road
381	Additional Employment (Unallocated) - Site 2 (Glebe Road)	Office	4	Glebe Road	Kept consistent with A&N modelling	Glebe Road
382	Additional Employment (Unallocated) - Site 3 (Navigation Road)	Office	5	Former Gas Works, Wharf Road	Kept consistent with A&N modelling	Stub connecting onto Navigation Road
383	Land at Kingsgate, Bicknacre	Housing	119	Bicknacre, Land north of Leighams Road	Kept consistent with A&N modelling	Priory Road, near Moor Hall Lane
	Land west of Barbrook Way, Bicknacre	Housing				
384	Land South of Ford End Primary School, Ford End	Housing	91	Main Road, Ford End	Kept consistent with A&N modelling	B1008 - Sandon Hill
385	Land north of Abbey Fields, East Hanningfield	Housing	108	East Hanningfield	Kept consistent with A&N modelling	The Tye
	Land east of Highfields Mead, East Hanningfield	Housing				
386	East Chelmsford Garden Community (Hammonds Farm)	Housing	97	Danbury, Land north and south of A414	Kept consistent with A&N modelling	Stub connecting onto J19 East Rdbt
						Maldon Road cul-de-sac coming off the A414
387		Office	26	Chelmsford Business Park, Sheepcotes, Springfield	Kept consistent with A&N modelling	Stub connecting onto J19 East Rdbt
		Research and Industrial				Connects into Maldon Road cul-de-sac coming off the A414
388		Warehousing	26	Chelmsford Business Park, Sheepcotes, Springfield	Kept consistent with A&N modelling	Stub connecting onto J19 East Rdbt
		General Industrial				Connects into Maldon Road cul-de-sac coming off the A414
389	NEC Garden Community	Warehousing	26	Chelmsford Business Park, Sheepcotes, Springfield	Kept consistent with A&N modelling	CGC Access 1 (West of Pratt's Farm roundabout)
390		Research and Industrial	26	Chelmsford Business Park, Sheepcotes, Springfield	Kept consistent with A&N modelling	CGC Access 1 (West of Pratt's Farm roundabout)
		Office				
391	Boreham, Waltham Road	Warehousing	26	Chelmsford Business Park, Sheepcotes, Springfield	Kept consistent with A&N modelling	Waltham Road
		General Industrial				
394	Little Boyton Hall Farm	Warehousing	85	Broomfield Hospital	Kept consistent with A&N modelling	Roxwell Road
		General Industrial				
395	Land adjacent to A12, Junction 18	Office	26	Chelmsford Business Park, Sheepcotes, Springfield	Kept consistent with A&N modelling	Maldon Road, opposite Hammonds Farm development access junction
		Research and Industrial				
396		General Industrial				Maldon Road, opposite Hammonds Farm development access junction
		Warehousing				

Table B-1: New development zones added to the 2019 Chelmsford base model for the purpose of the Chelmsford LPRPS – inc. proposed donor zones and network loading points

13 Appendix C: Development Trips

Location Name	Development Name	Development Type	Use Class	AM		IP		PM	
				Destinations	Origins	Destinations	Origins	Destinations	Origins
Adopted Local Plan Sites									
Growth Area 1									
Chelmsford Urban Area	Chelmer Waterside Allocations	Mixed / Affordable Housing	C3	173	417	359	375	412	220
	Former St Peter's College Fox Crescent	Mixed / Affordable Housing	C3	52	120	127	133	121	68
	Riverside Ice and Leisure Land Victoria Road Chelmsford	Mixed / Affordable Housing	C3	14	32	17	18	32	18
	Civic Centre Land Fairfield Road Chelmsford	Mixed / Affordable Housing	C3	9	22	11	12	22	12
	Land West of Eastwood House Glebe Road Chelmsford	Mixed / Affordable Housing	C3	19	42	23	24	42	23
	Ashby House Car Parks New Street Chelmsford	Mixed / Affordable Housing	C3	8	17	9	10	17	9
	Rectory Lane Car Park West Rectory Lane Chelmsford	Mixed / Affordable Housing	C3	7	16	9	9	16	9
	Rivermead, Bishop Hall Lane	Student Accomodation	C2	1	0	1	2	1	1
West Chelmsford	West Chelmsford	Mixed / Affordable Housing	C3	248	569	605	633	574	324
East of Chelmsford	East of Chelmsford - Manor Farm	Mixed / Affordable Housing	C3	102	233	248	259	235	132
	East of Chelmsford - Land South of Maldon Road	Mixed / Affordable Housing	C3	18	42	45	47	42	24
	East of Chelmsford - Land North of Maldon Road	Mixed / Affordable Housing	C3	31	71	75	78	71	40
		Office & Research/Industrial	E(g) - Formerly B1a	8	1	2	2	1	11
		General Industrial	B2	3	2	2	3	1	2
		Storage or Distribution	B8	4	2	3	3	2	3
Growth Area 2									
North East Chelmsford	Chelmsford Garden Community	Mixed / Affordable Housing	C3	1570	3603	3831	4004	3631	2049
		Office & Research/Industrial	E(g) - Formerly B1a	13	6	9	10	5	3
		General Industrial	B2	32	16	23	26	12	22
		Storage or Distribution	B8	218	28	44	55	25	297
Great Leighs	Great Leighs - Land at Moulsham Hall	Mixed / Affordable Housing	C3	212	485	516	539	489	276
	Great Leighs - Land East of London Road	Mixed / Affordable Housing	C3	71	162	172	180	163	92
	Great Leighs - Land North and South of Banters Lane	Mixed / Affordable Housing	C3	28	65	69	72	65	37
North of Broomfield	North of Broomfield	Mixed / Affordable Housing	C3	148	339	361	377	342	193
Growth Area 3									
North of South Woodham Ferrers	Land North West of Hamberts Farm Bunham Road South Woodham Ferrers Chelmsford	Mixed / Affordable Housing	C3	344	789	839	877	795	449
	Land North of South Woodham Ferrers Burnham Road South Woodham Ferrers Chelmsford	General Industrial	B2	1	0	1	1	0	1
		Storage or Distribution	B8	4	1	2	2	2	6
Danbury	Danbury	Mixed / Affordable Housing	C3	9	22	11	12	22	12
TOTAL TRIPS GENERATED BY ADOPTED LP SITES				**3346**	**7103**	**7414**	**7761**	**7140**	**4337**
Chelmsford Local Plan Review Pre-Submission Sites									
Growth Area 1									
Chelmsford Urban Area	Meadows Shopping Centre and Meadows Surface Car Park	Mixed / Affordable Housing	C3	71	163	87	91	163	89
	Land between Hoffmans Way and Brook Street (Marriages Mill)	Mixed / Affordable Housing	C3	9	22	11	12	22	12
	Granary Car Park	Mixed / Affordable Housing	C3	5	11	6	6	11	6
	Coval Lane Car Park	Mixed / Affordable Housing	C3	4	9	5	5	9	5
	Glebe Road Car Park	Mixed / Affordable Housing	C3	1	3	1	1	3	1
	Andrews Place, Waterhouse Lane	Mixed / Affordable Housing	C3	17	39	21	22	39	21
	Additional Employment (Unallocated) Site 1 - Victoria Road	Office	E(g) - Formerly B1a	7	1	2	2	1	9
	Additional Employment (Unallocated) Site 2 - Glebe Road	Office	E(g) - Formerly B1a	7	1	2	2	1	9
	Additional Employment (Unallocated) Site 3 - Navigation Road	Office	E(g) - Formerly B1a	7	1	2	2	1	9
Growth Area 2									
Ford End	Land South of Ford End Primary School, Ford End	Mixed / Affordable Housing	C3	2	4	2	2	4	2
Boreham	Boreham, Waltham Road	General Industrial	B2	9	2	3	4	4	13
		Storage or Distribution	B8	4	2	3	3	1	3
North West Chelmsford	Little Boyton Hall Farm	General Industrial	B2	15	3	6	6	7	22
		Storage or Distribution	B8	6	3	5	5	2	4
North East Chelmsford	Chelmsford Garden Community	Office & Research/Industrial	E(g) - Formerly B1a	20	3	4	4	3	25
		Storage or Distribution	B8	42	10	16	17	20	61
Growth Area 3									
South East Chelmsford	East Chelmsford Garden Community (Hammonds Farm)	Mixed / Affordable Housing	C3	282	647	344	359.5	645	351
		Office & Research/Industrial	E(g) - Formerly B1a	33	16	19	20	14	119
		General Industrial	B2	28	14	20	23	10	19
		Storage or Distribution	B8	42	10	16	17	20	61
	Land adjacent to A12, Junction 18	Office & Research/Industrial	E(g) - Formerly B1a	36	17	20	21	14	122
		General Industrial	B2	27	13	20	22	10	19
		Storage or Distribution	B8	64	15	25	26	30	34
Bicknacre	Land at Kingsgate, Bicknacre	Mixed / Affordable Housing	C3	4	9	5	5	9	5
	Lane west of Barbrook Way, Bicknacre								
East Hanningfield	Land north of Abbey Fields, East Hanningfield	Mixed / Affordable Housing	C3	3	7	4	4	7	4
	Land east of Highfields Mead, East Hanningfield								
TOTAL TRIPS GENERATED BY LP REVIEW SITES				**866**	**1024**	**647**	**680**	**1050**	**1085**
TOTAL TRIPS GENERATED BY ADOPTED LP SITES & LP REVIEW SITES (COMBINED TOTAL)				**4211**	**8128**	**8061**	**8441**	**8190**	**5422**

Appendix C-1: Volume of Origin and Destination trips calculated to/from additional development included in the assessment of the LPRPS

14 Appendix D: Variable Demand Model Comparison

Figure D-1: Impact of VDM Process on the LPRPS scenario (AM)

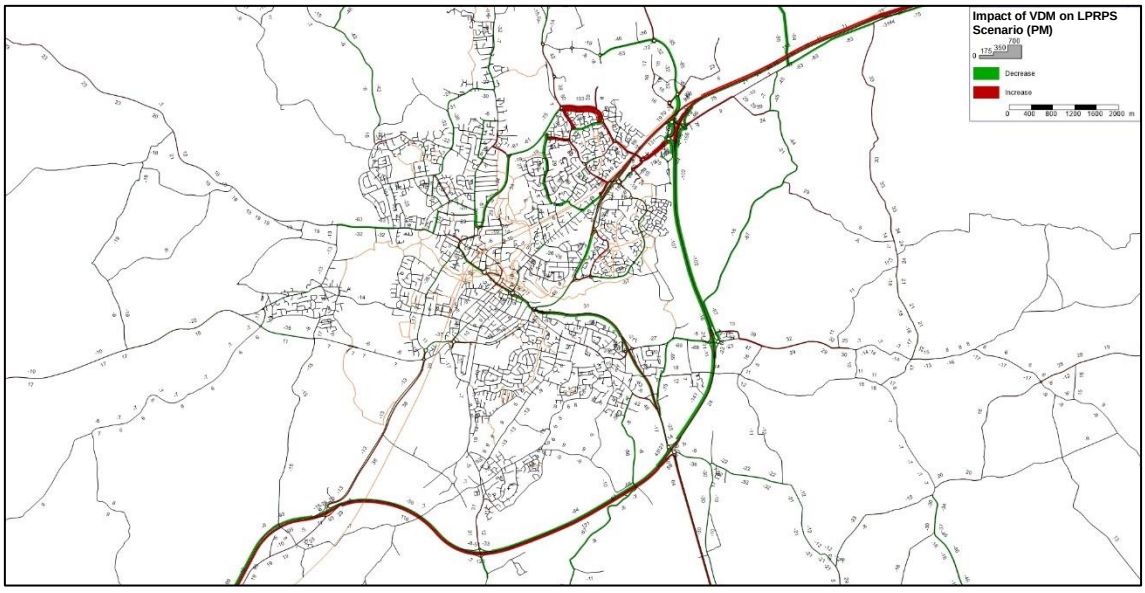


Figure D-2: Impact of VDM Process on the LPRPS scenario (PM)

Figure D1 and D2 show the impact of the Variable Demand Model (VDM) on the LPRPS scenario. The plots show that VDM reduces flows predominantly along the A12 corridor on the most congested section of the route between Junctions

17 and 19. It also reduces flows along Beaulieu Parkway which is shown to struggle with capacity on the approach to the Boreham Interchange.

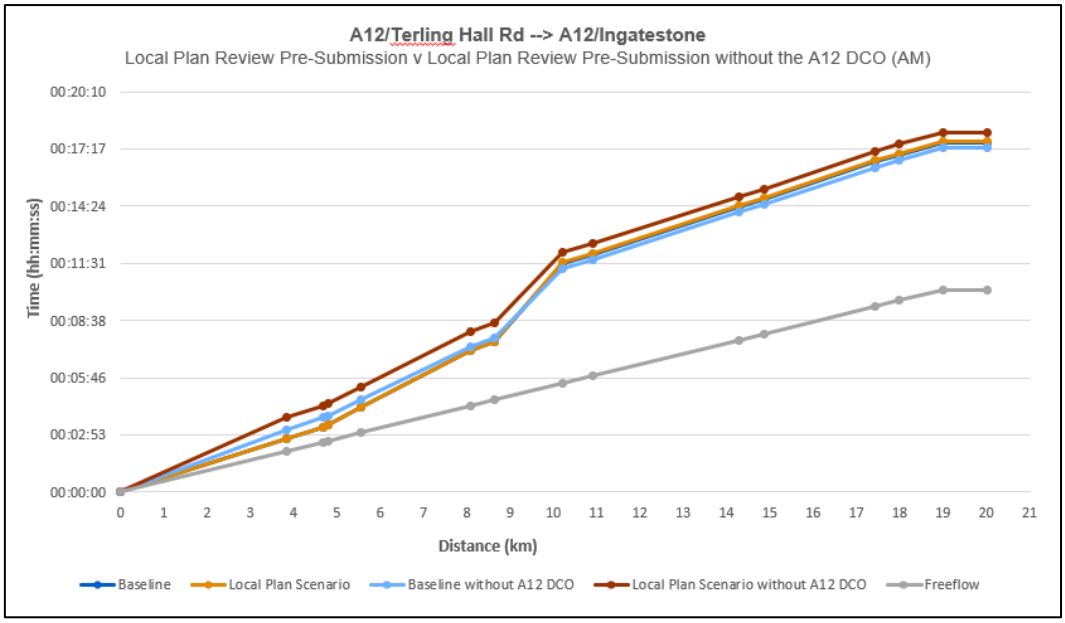
With targeted flow reductions across the modelled network, other areas of the road network downstream of bottlenecks show an increase in traffic flow, notably the A12 and A130 corridors south and east of Junction 17, as well as the A12 north of Junction 19. Traffic volumes along the 'old A130' route via White Hart Lane and Colchester Road are also shown to increase.

When considering the modelled impact of LPRPS development traffic on the local and strategic road network, with/without A12 widening, it is therefore important to acknowledge that VDM is removing peak hour trips from the modelled peak hours as a result of forecast network capacity constraint.

15 Appendix E: Sensitivity Test Journey Times

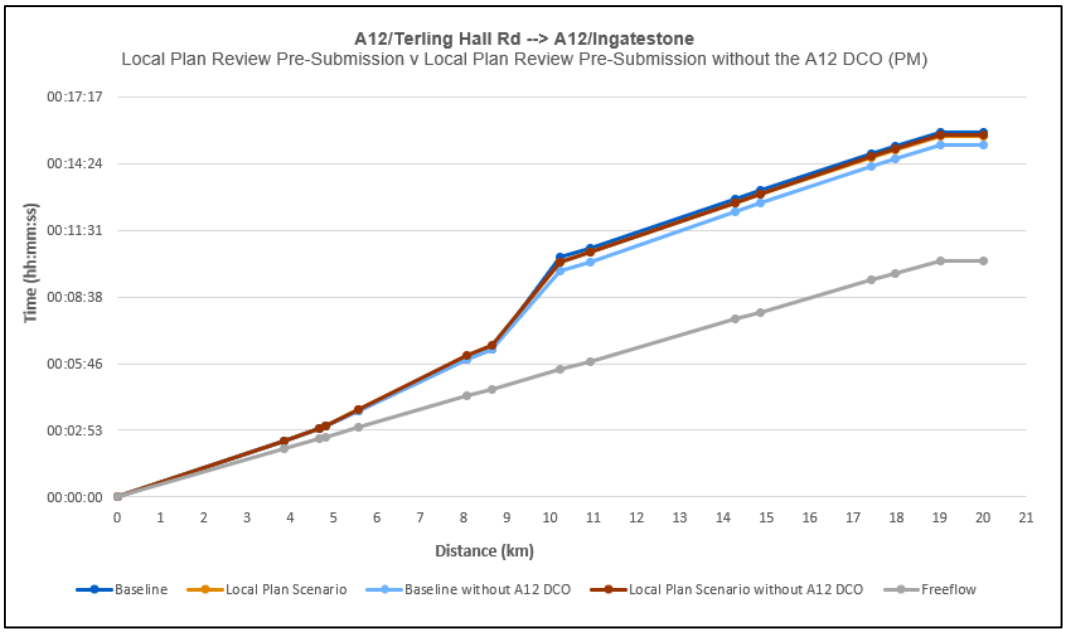
A12 / Terling Hall Road → A12 / Ingatestone

AM Peak



Appendix E 1: Journey Time Plot for A12/Terling Hall Road --> A12 / Ingatestone (AM Peak)

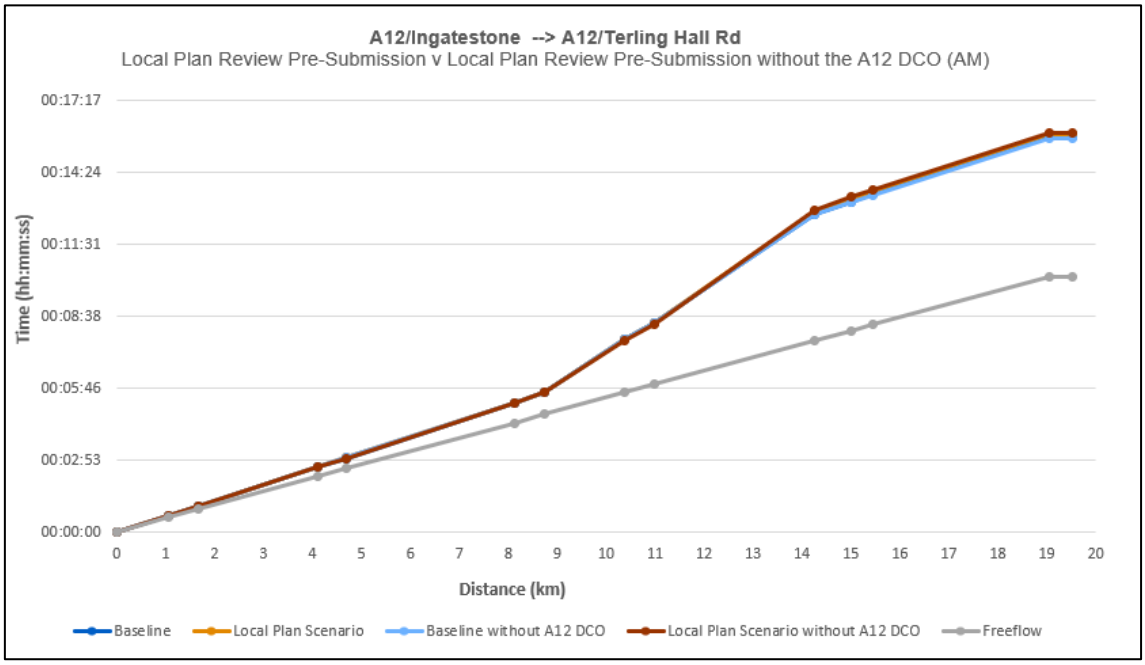
PM Peak



Appendix E 2: Journey Time Plot for A12/Terling Hall Road --> A12 / Ingatestone (PM Peak)

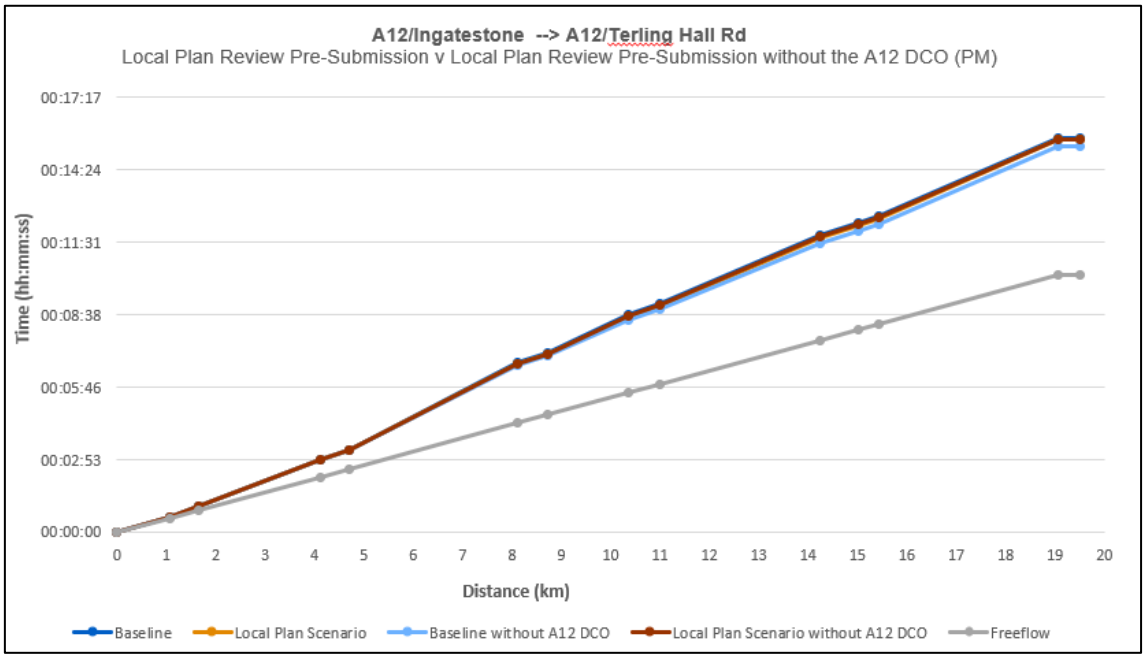
A12 / Ingatestone → A12 Terling Hall Road

AM Peak



Appendix E 3: Journey Time Plot for A12 / Ingatestone --> A12 / Terling Hall Road (AM Peak)

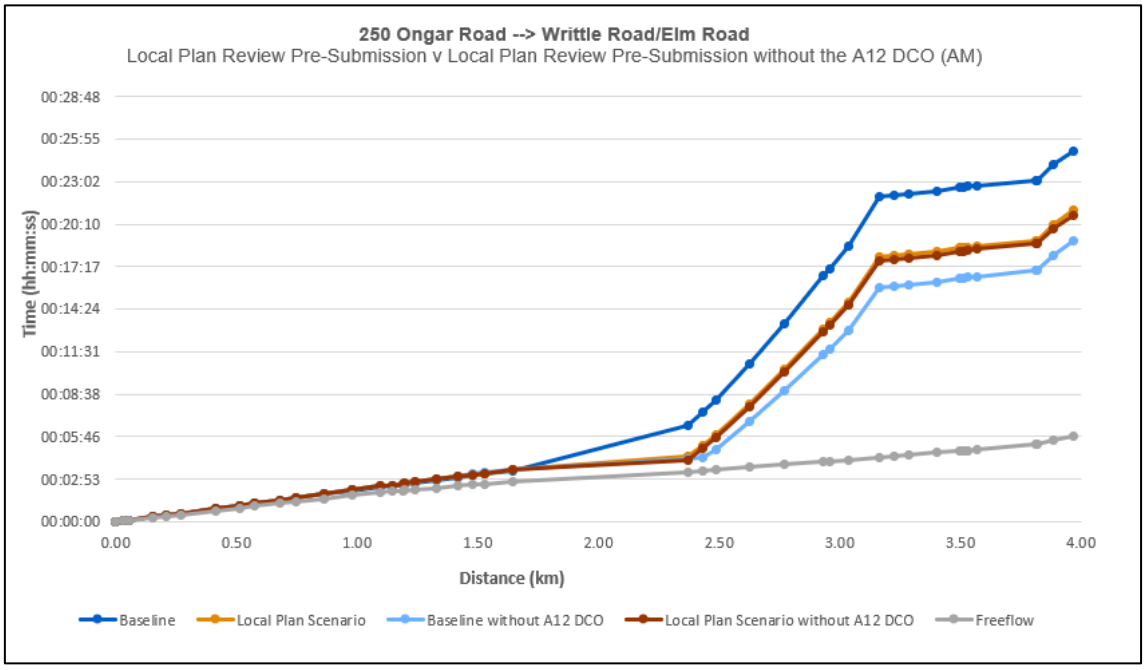
PM Peak



Appendix E 4: Journey Time Plot for A12 / Ingatestone --> A12 / Terling Hall Road (PM Peak)

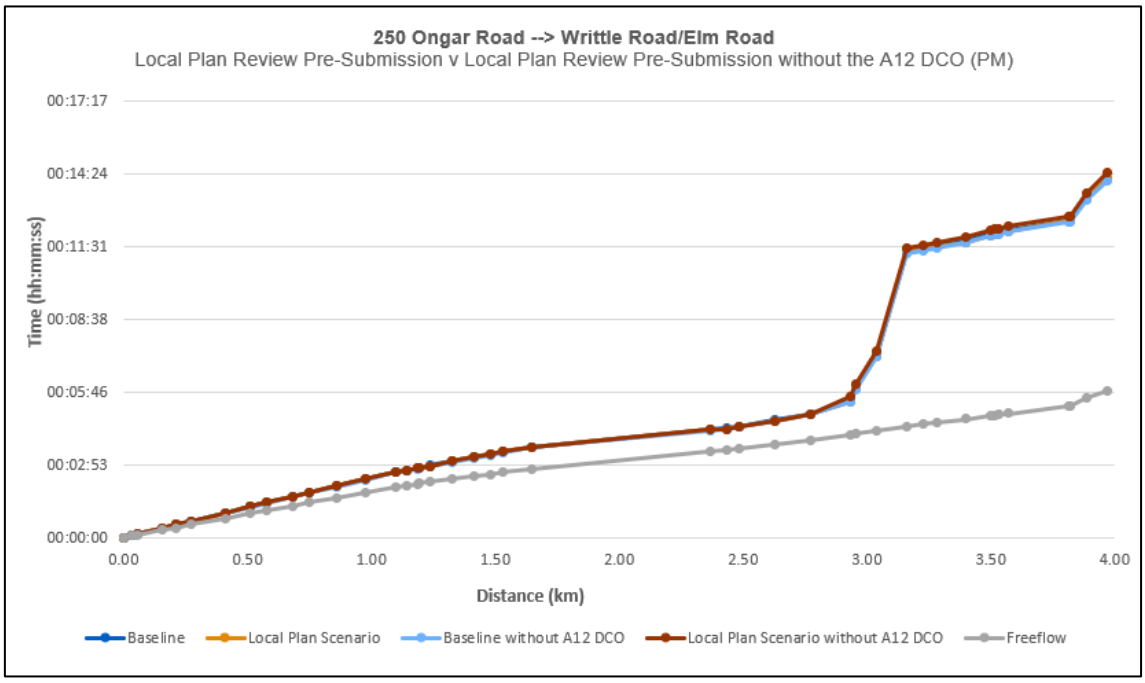
250 Ongar → Writtle Road / Elm Road

AM Peak



Appendix E 5: 250 Ongar --> Writtle Road / Elm Road (AM Peak)

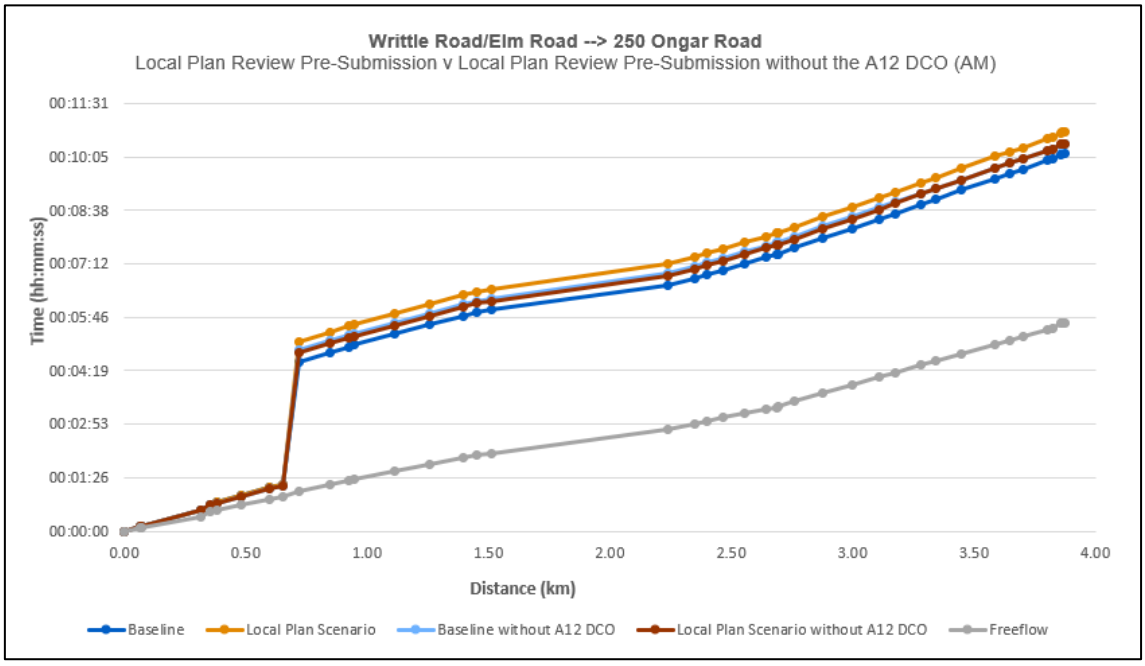
PM Peak



Appendix E 6: 250 Ongar --> Writtle Road / Elm Road (PM Peak)

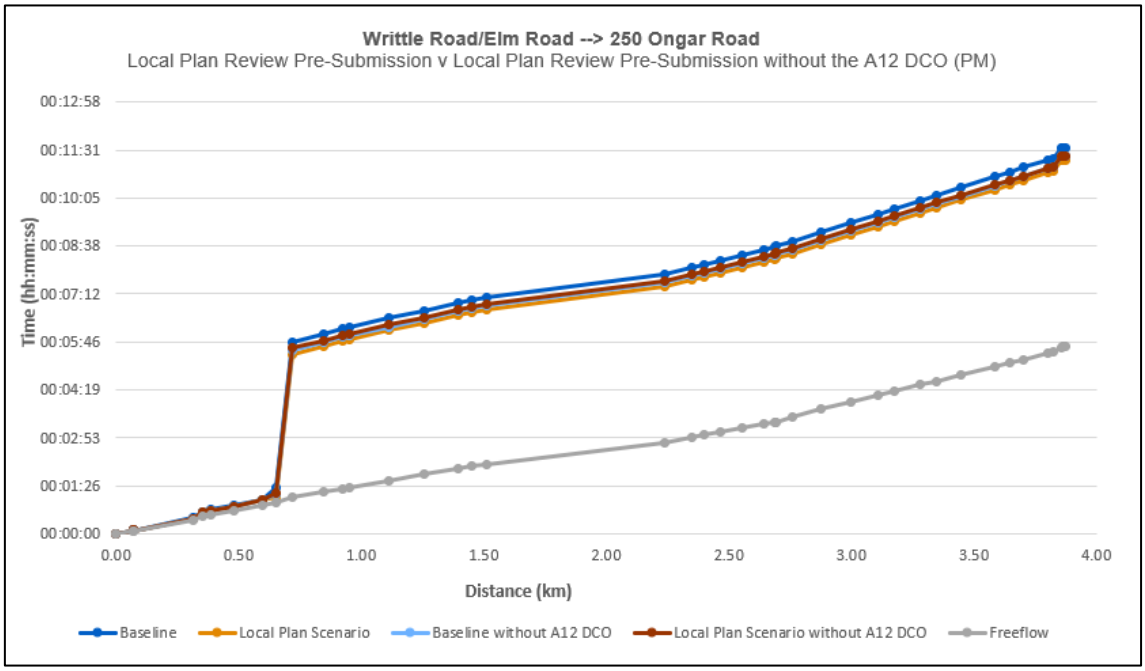
Writtle Road / Elm Road → 250 Ongar Road

AM Peak



Appendix E 7: Journey Time Plot for Writtle Road / Elm Road --> 250 Ongar Road (AM Peak)

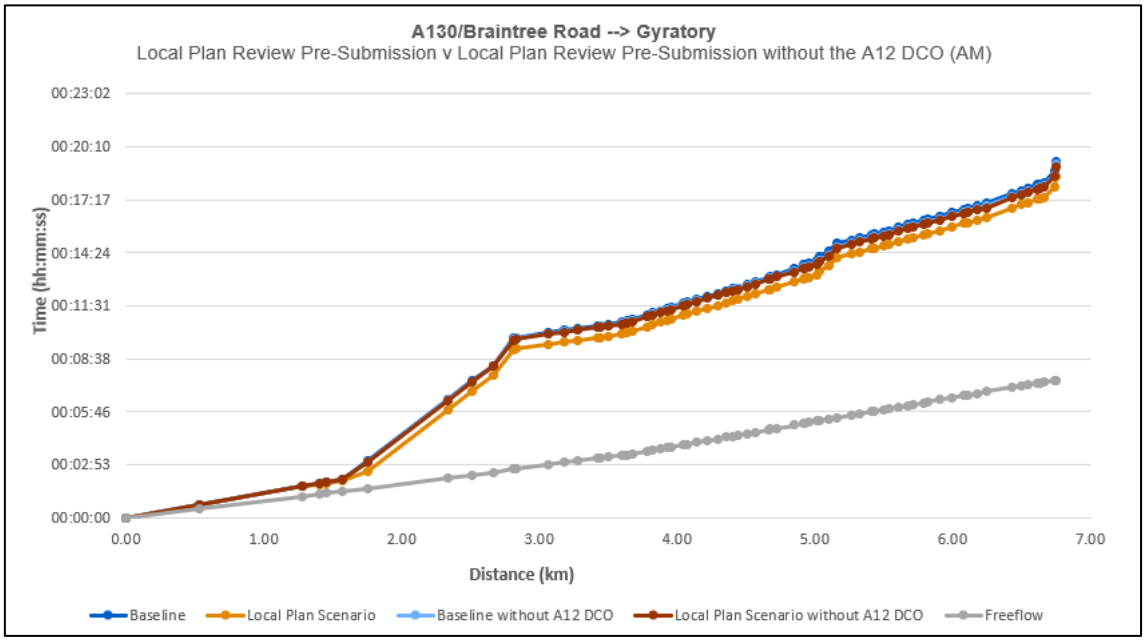
PM Peak



Appendix E 8: Journey Time Plot for Writtle Road / Elm Road --> 250 Ongar Road (PM Peak)

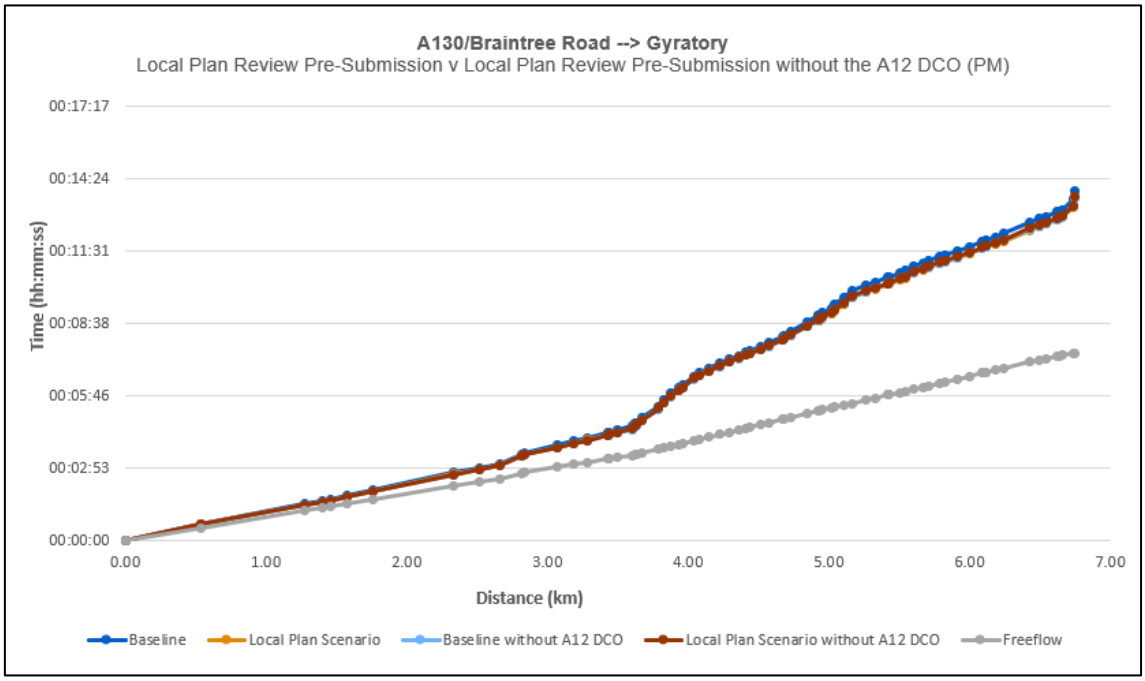
A130 / Braintree Road → Gyratory

AM Peak



Appendix E 9: Journey Time Plot for A130 / Braintree Road --> Gyratory (AM Peak)

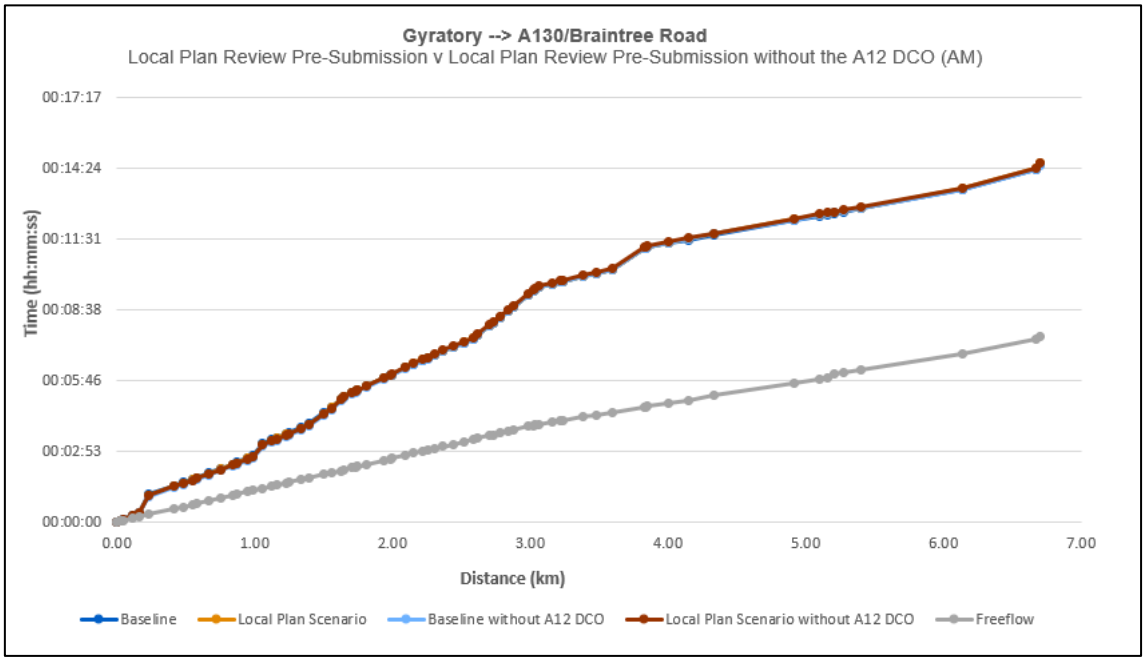
PM Peak



Appendix E 10: Journey Time Plot for A130 / Braintree Road --> Gyratory (PM Peak)

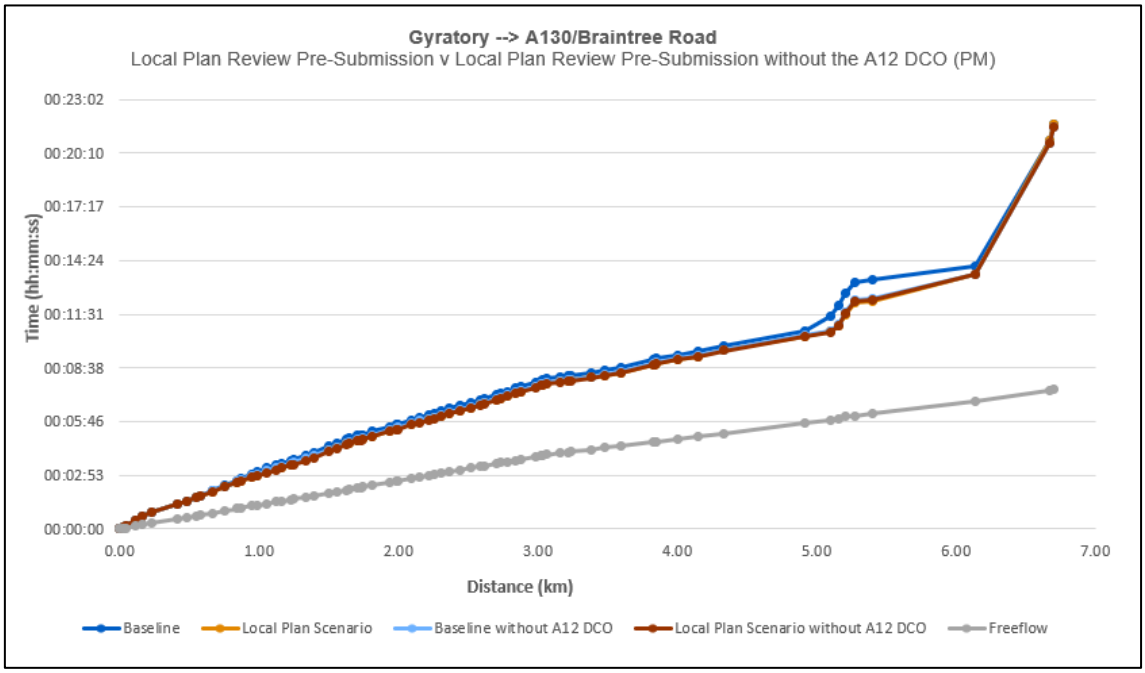
Gyratory → A130 / Braintree Road

AM Peak



Appendix E 11: Journey Time Plot for Gyratory --> A130 / Braintree Road (AM Peak)

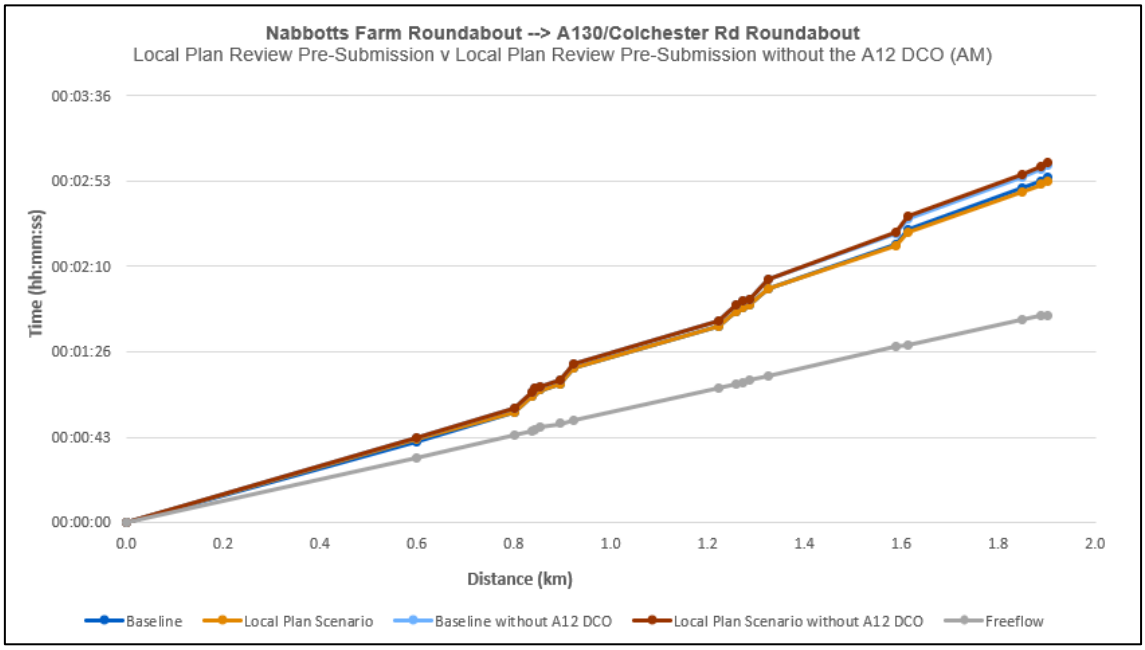
PM Peak



Appendix E 12: Journey Time Plot for Gyratory --> A130 / Braintree Road (PM Peak)

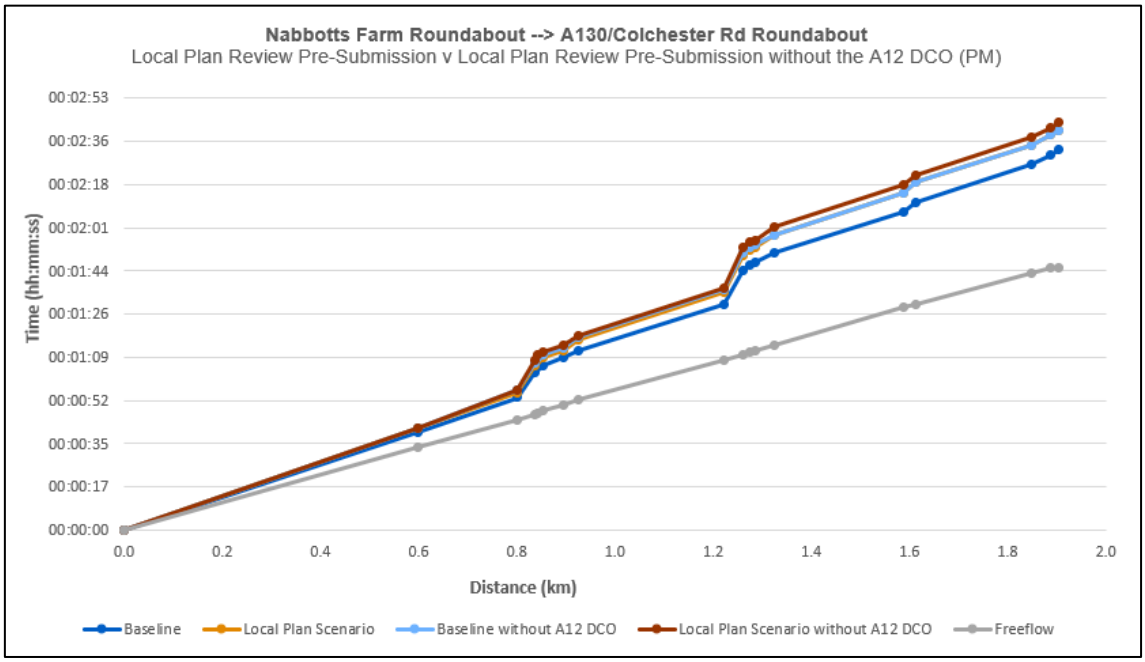
Nabbotts Farm Roundabout → A130 / Colchester Road Roundabout

AM Peak



Appendix E 13: Journey Time Plot for Nabbotts Farm Roundabout --> A130 Colchester Road Roundabout (AM Peak)

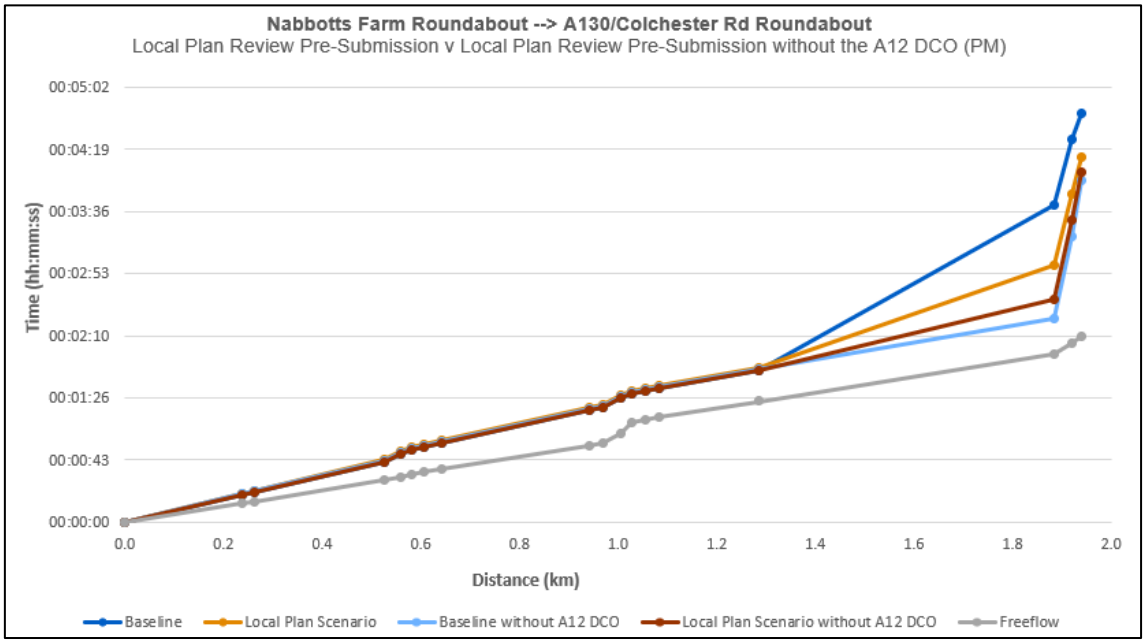
PM Peak



Appendix E 14: Journey Time Plot for Nabbotts Farm Roundabout --> A130 Colchester Road Roundabout (PM Peak)

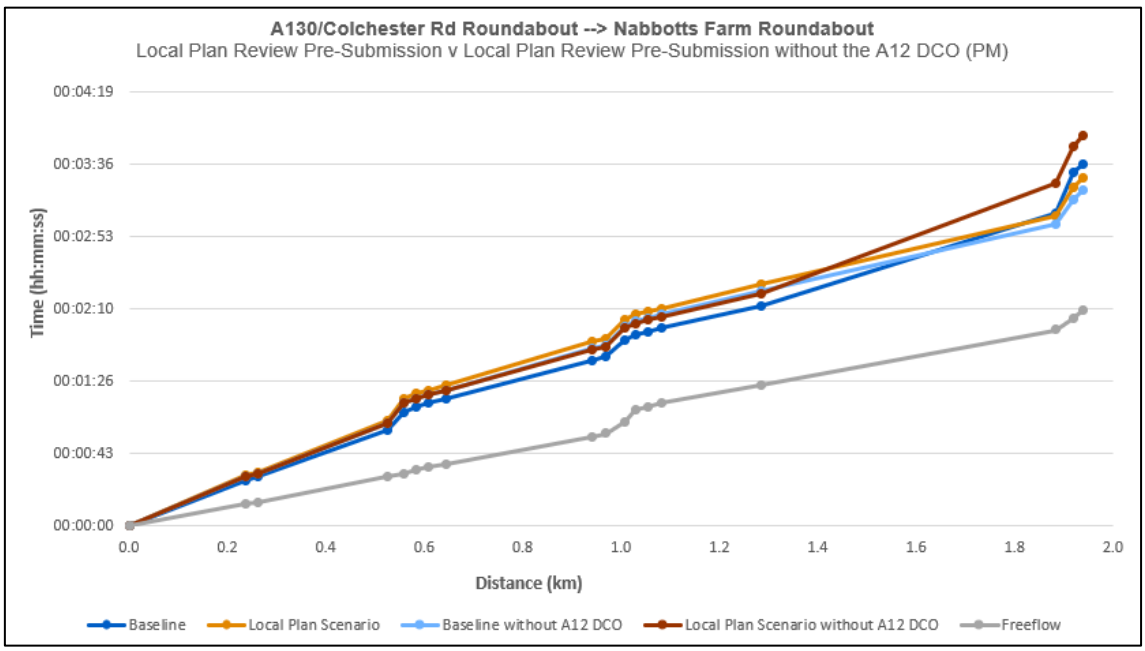
A130 / Colchester Road Roundabout → Nabbotts Farm Roundabout

AM Peak



Appendix E 15: Journey Time Plot for A130 / Colchester Road Roundabout --> Nabbotts Farm Roundabout (AM Peak)

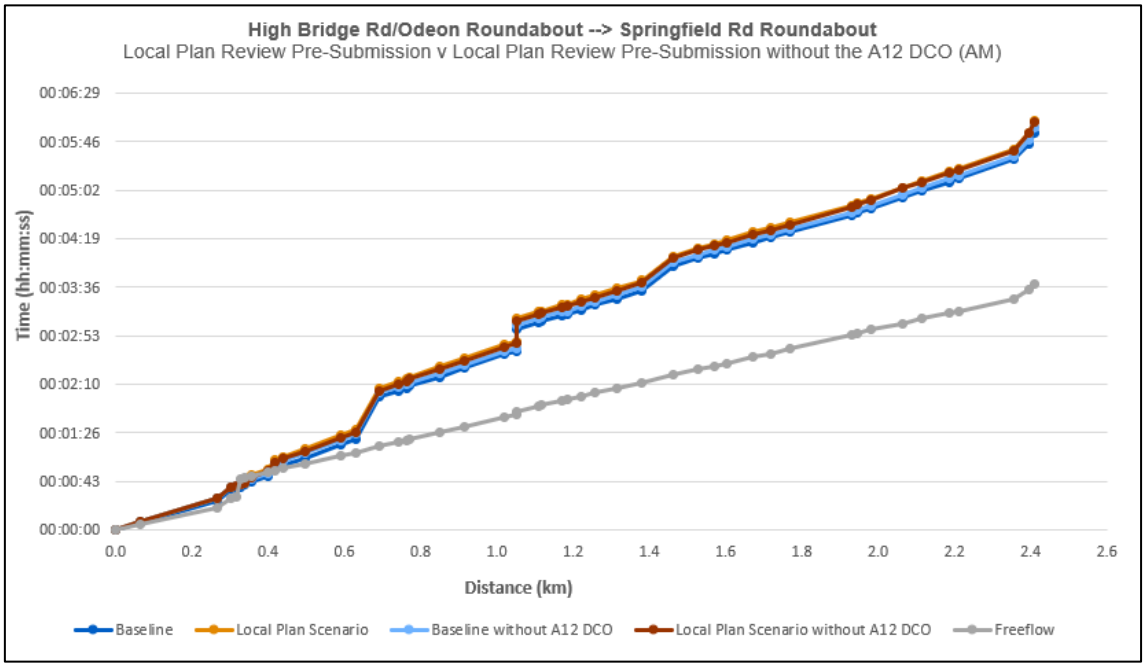
PM Peak



Appendix E 16: Journey Time Plot for A130 / Colchester Road Roundabout --> Nabbotts Farm Roundabout (PM Peak)

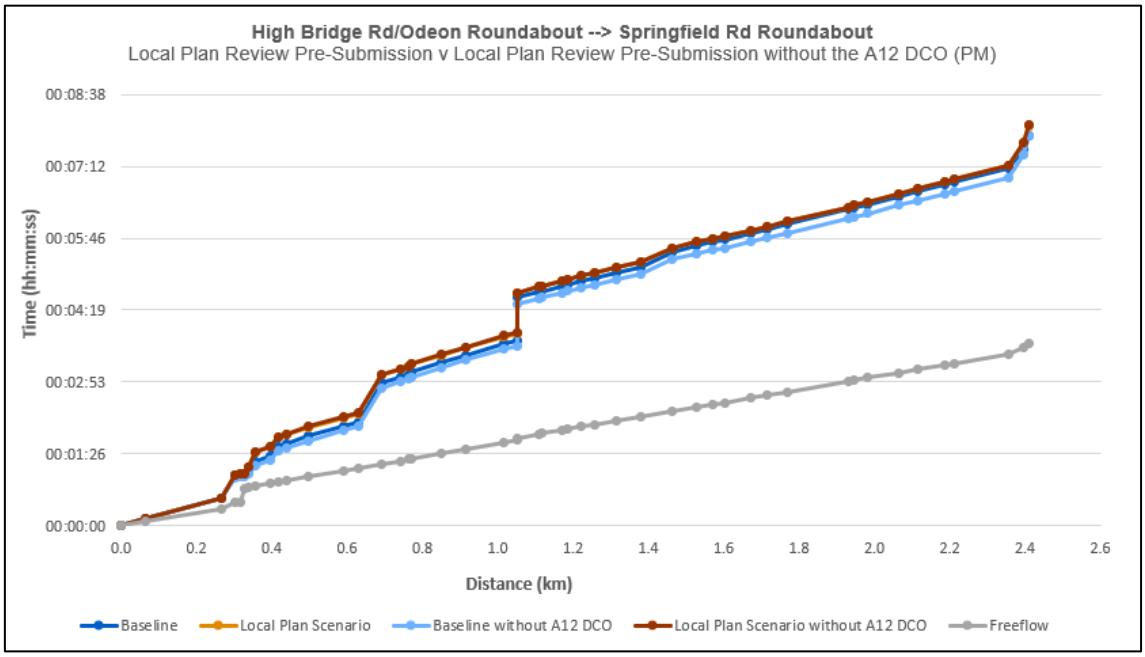
High Bridge Road / Odeon Roundabout → Springfield Road Roundabout

AM Peak



Appendix E 17: Journey Time Plot for High Bridge Road / Odeon Roundabout --> Springfield Road Roundabout (AM Peak)

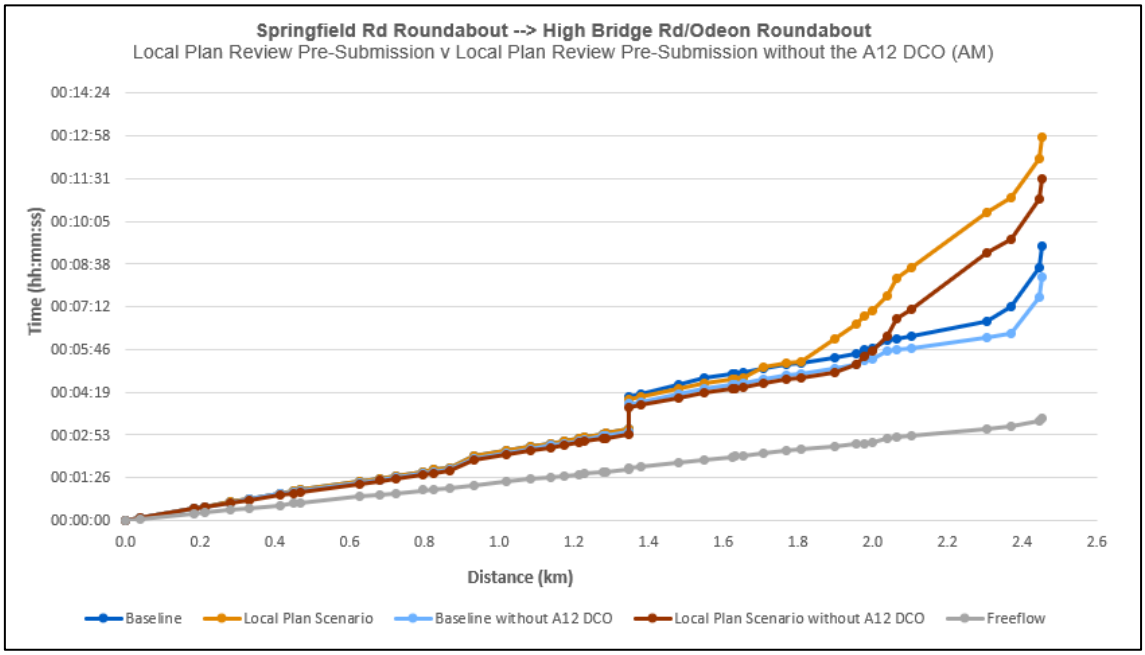
PM Peak



Appendix E 18: Journey Time Plot for High Bridge Road / Odeon Roundabout --> Springfield Road Roundabout (PM Peak)

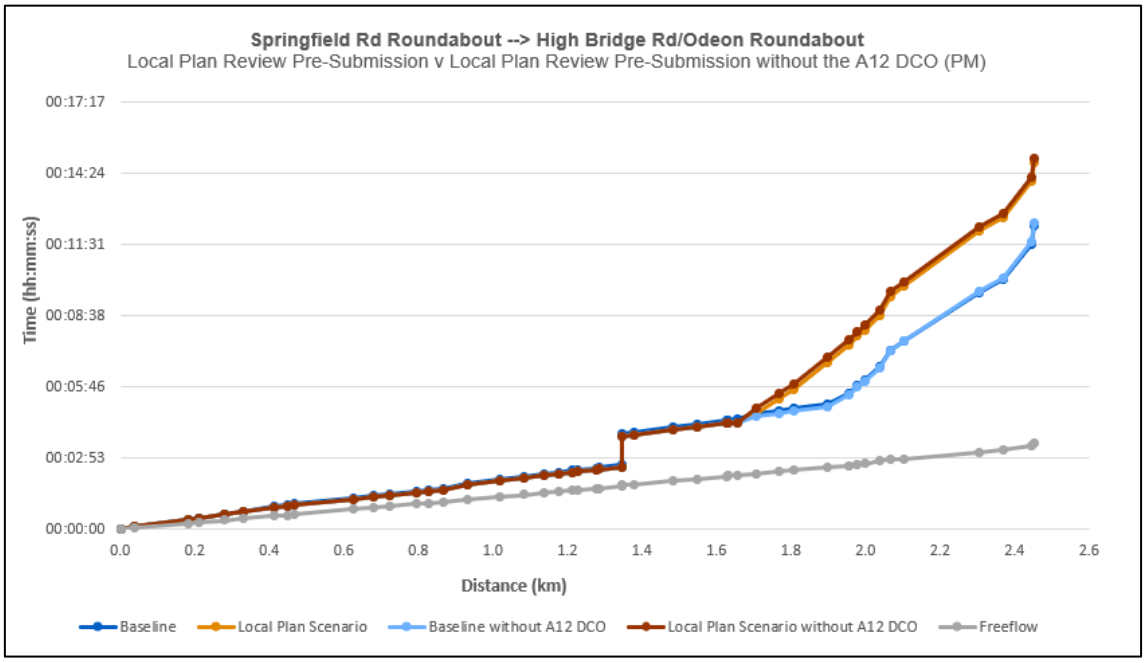
Springfield Road Roundabout → High Bridge Road / Odeon Roundabout

AM Peak



Appendix E 19: Journey Time Plot for Springfield Road Roundabout --> High Bridge Road / Odeon Roundabout (AM Peak)

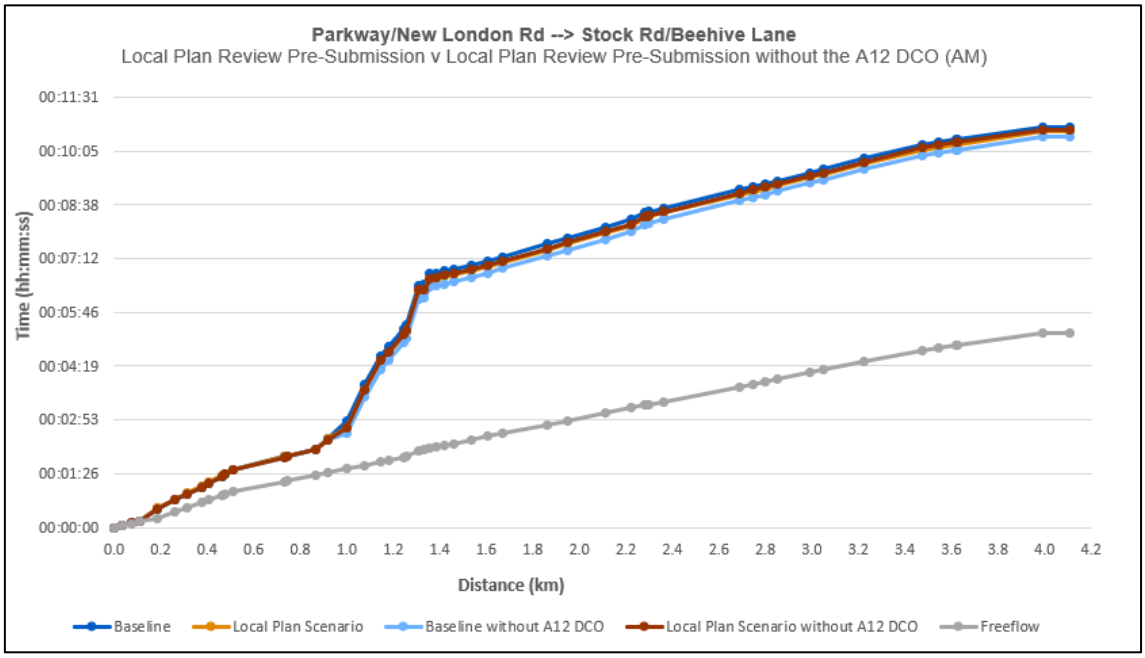
PM Peak



Appendix E 20: Journey Time Plot for Springfield Road Roundabout --> High Bridge Road / Odeon Roundabout (PM Peak)

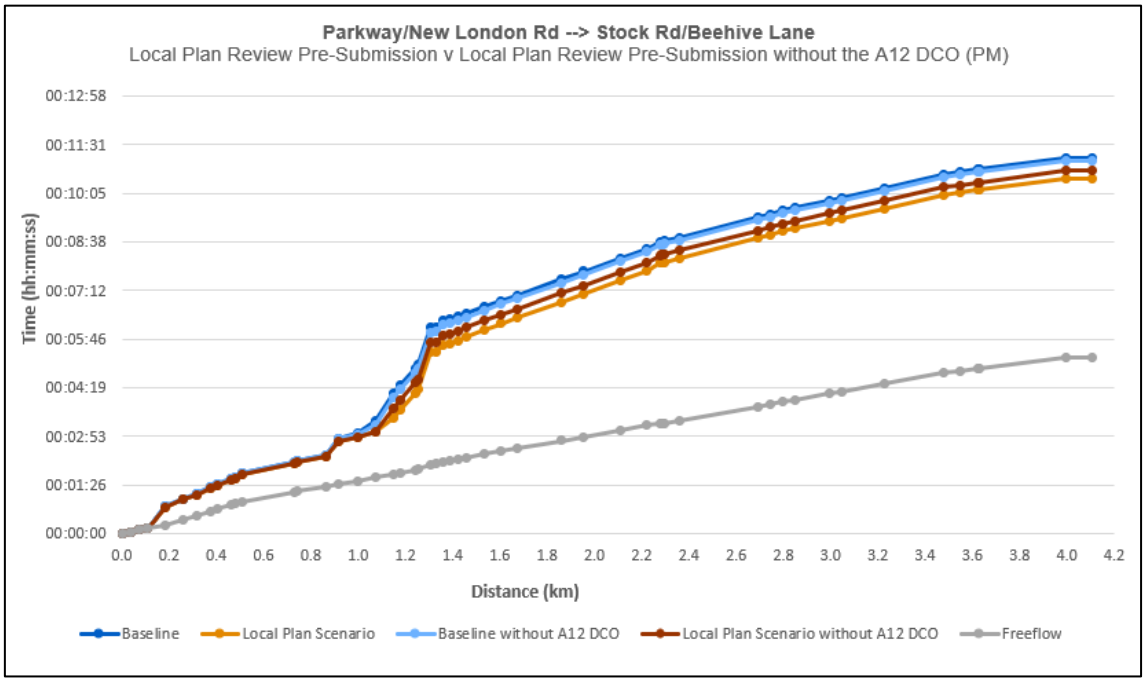
Parkway / New London Road → Stock Road / Beehive Lane

AM Peak



Appendix E 21: Journey Time Plot for Parkway / New London Road --> Stock Road / Beehive Lane (AM Peak)

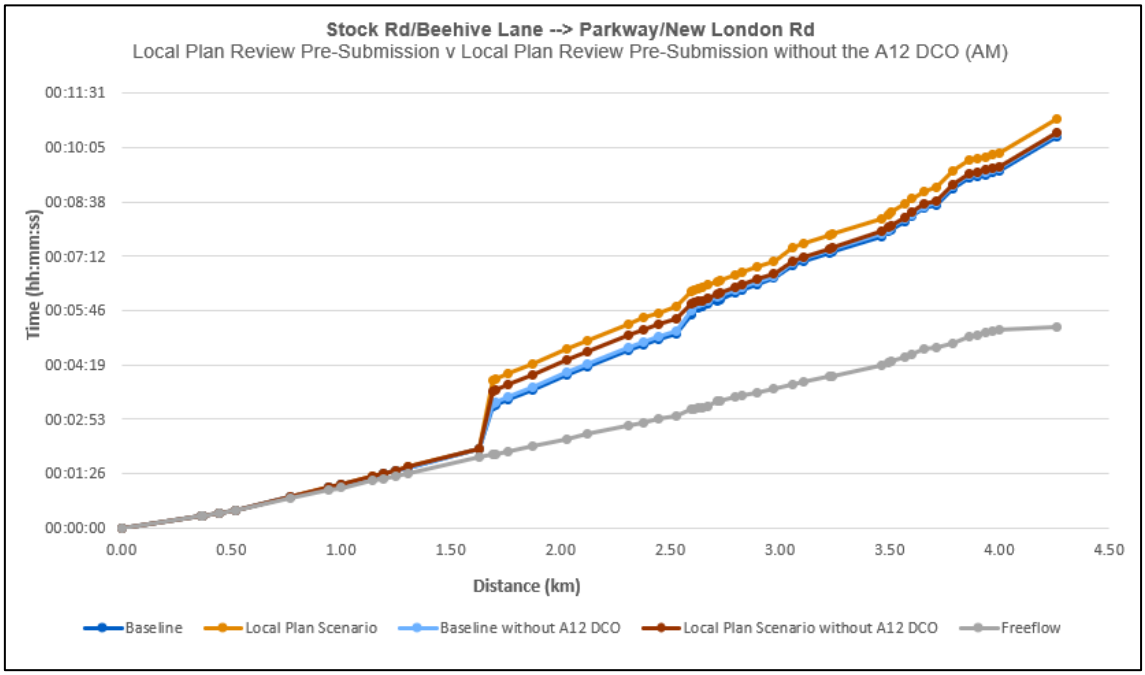
PM Peak



Appendix E 22: Journey Time Plot for Parkway / New London Road --> Stock Road / Beehive Lane (PM Peak)

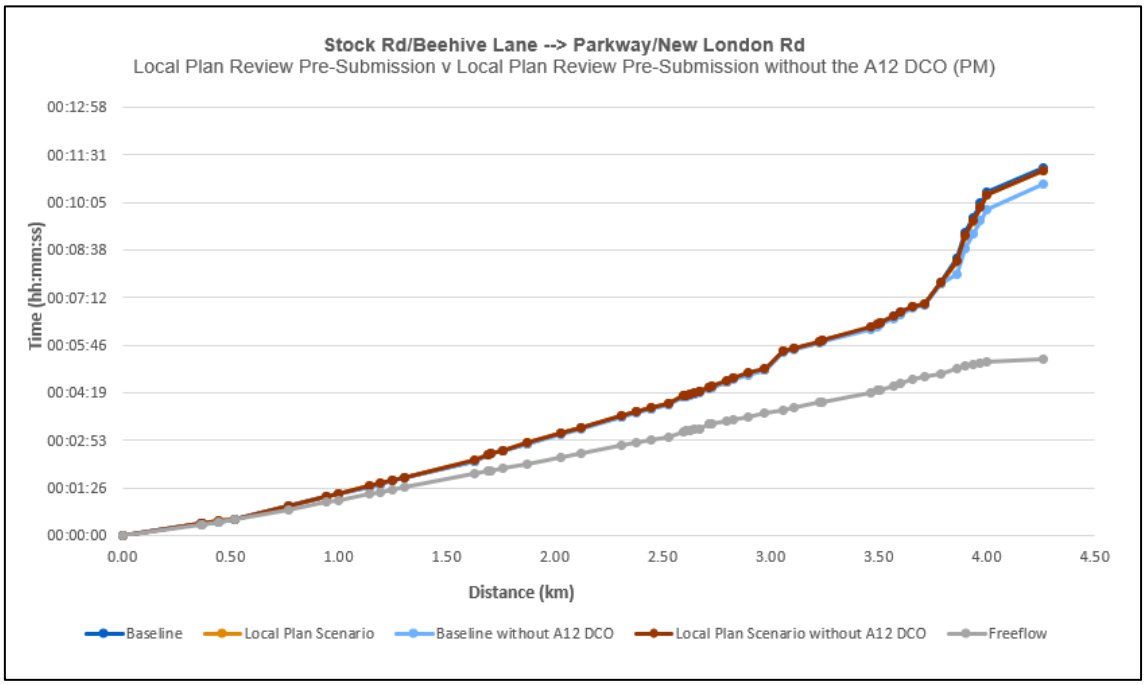
Stock Road / Beehive Lane → Parkway / New London Road

AM Peak



Appendix E 23: Journey Time Plot for Stock Road / Beehive Lane --> Parkway / New London Road (AM Peak)

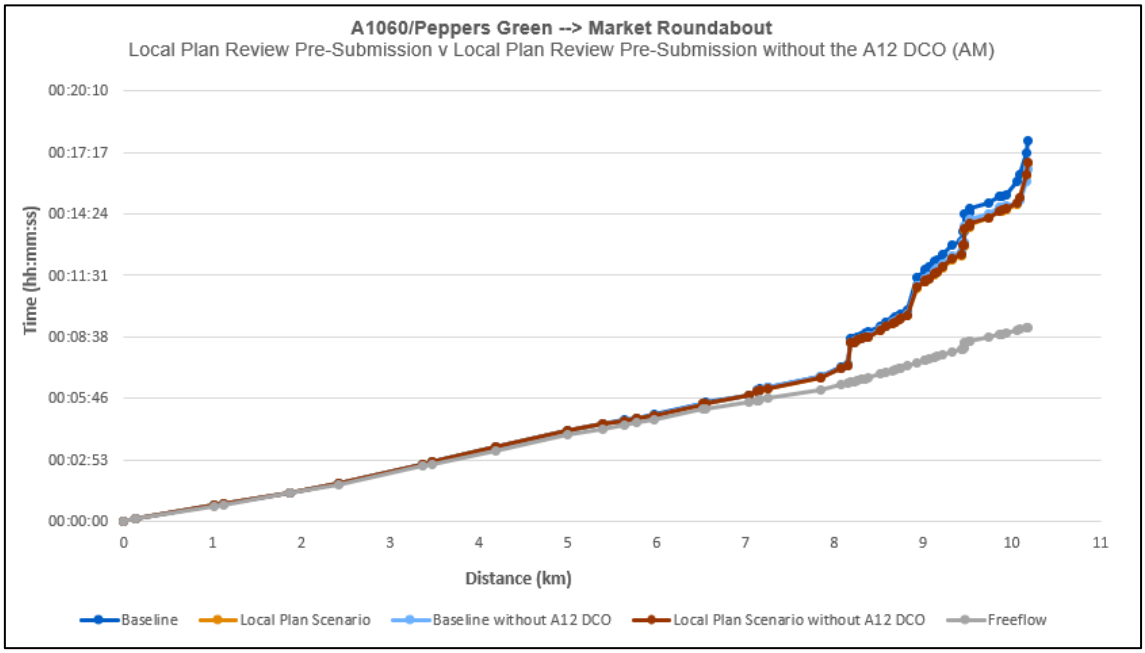
PM Peak



Appendix E 24: Journey Time Plot for Stock Road / Beehive Lane --> Parkway / New London Road (PM Peak)

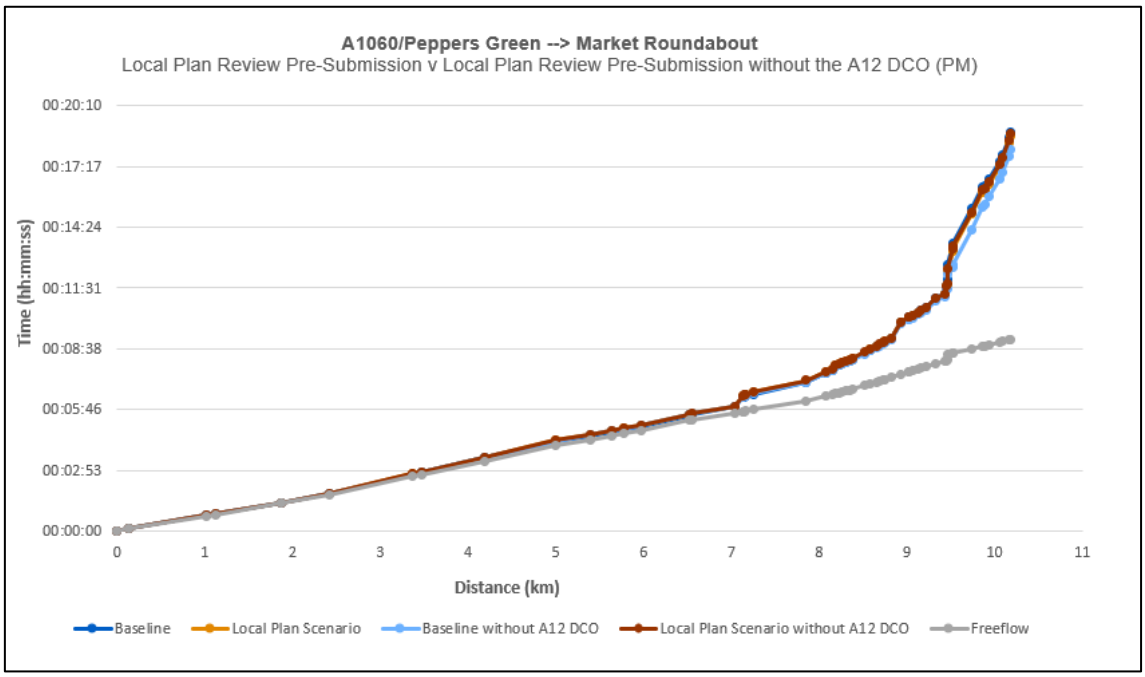
A1060 / Peppers Green → Market Roundabout

AM Peak



Appendix E 25: Journey Time Plot for A1060 / Peppers Green --> Market Roundabout (AM Peak)

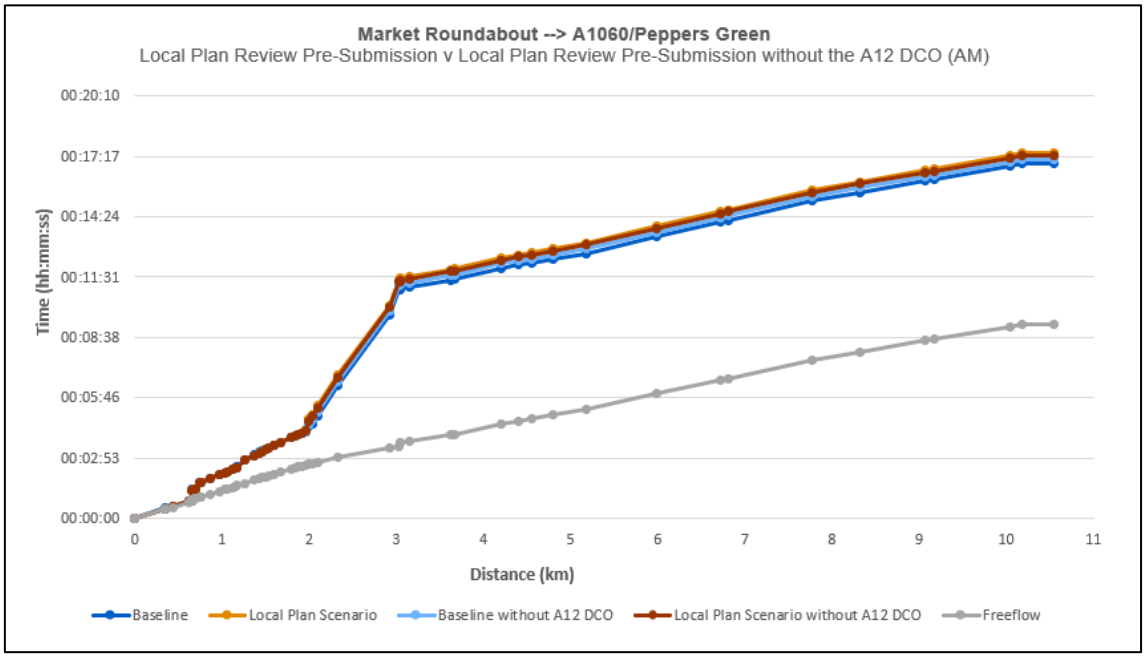
PM Peak



Appendix E 26: Journey Time Plot for A1060 / Peppers Green --> Market Roundabout (PM Peak)

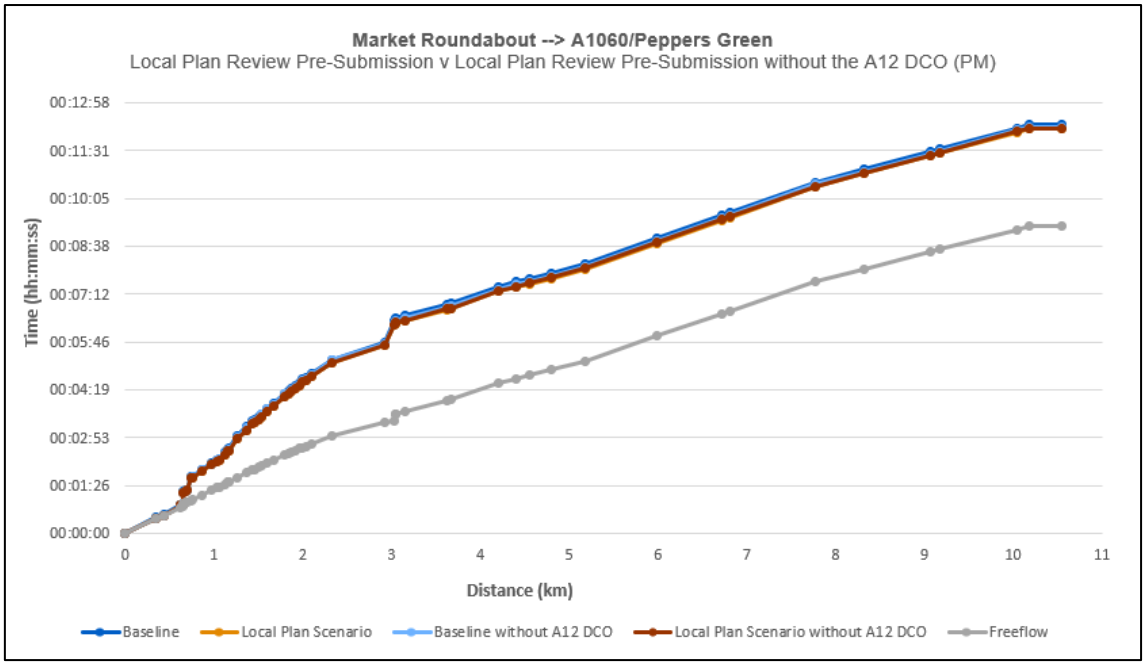
Market Roundabout → A01060 / Peppers Green

AM Peak



Appendix E 27: Journey Time Plot for Market Roundabout --> A1060 / Peppers Green (AM Peak)

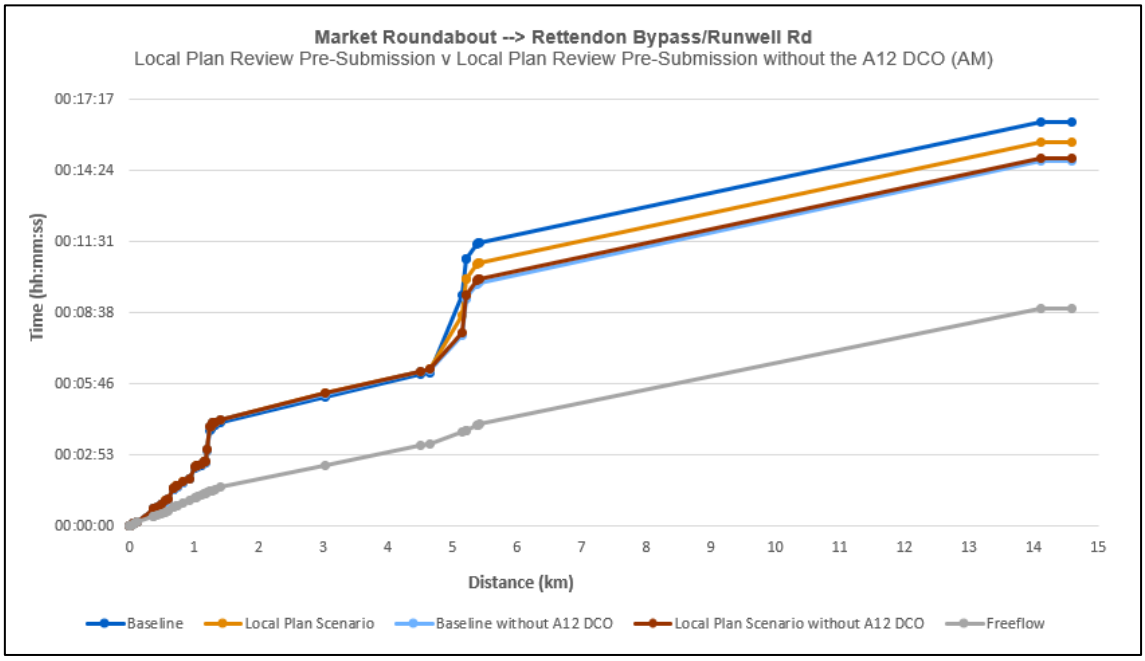
PM Peak



Appendix E 28: Journey Time Plot for Market Roundabout --> A1060 / Peppers Green (PM Peak)

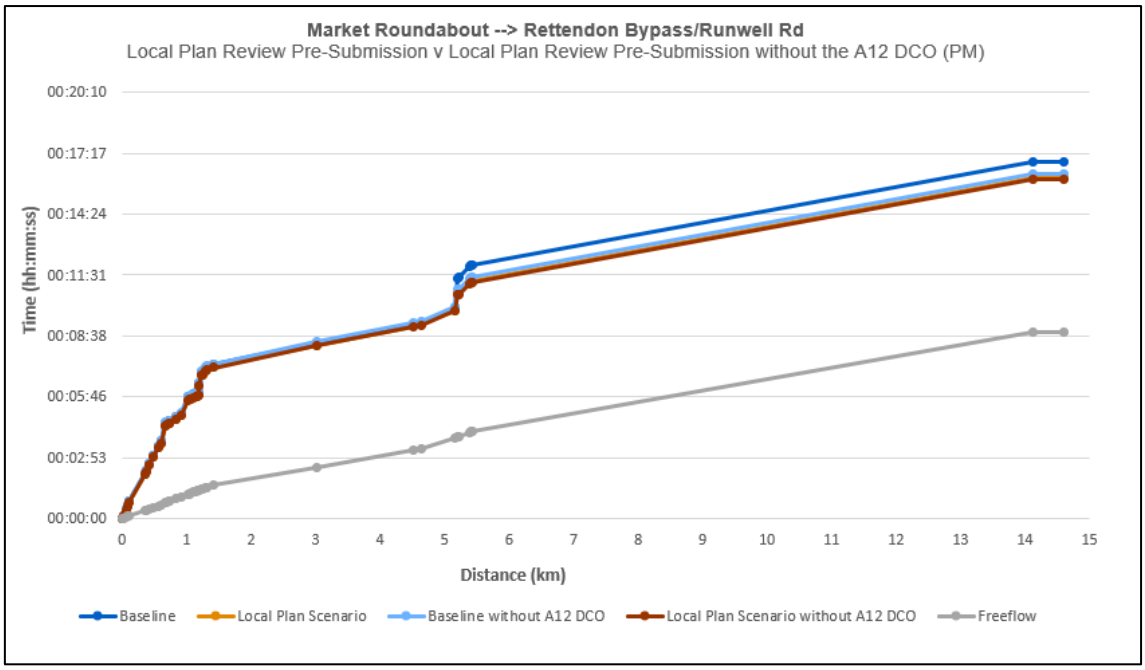
Market Roundabout → Rettendon Bypass / Runwell Road

AM Peak



Appendix E 29: Journey Time Plot for Market Roundabout --> Rettendon Bypass / Runwell Road (AM Peak)

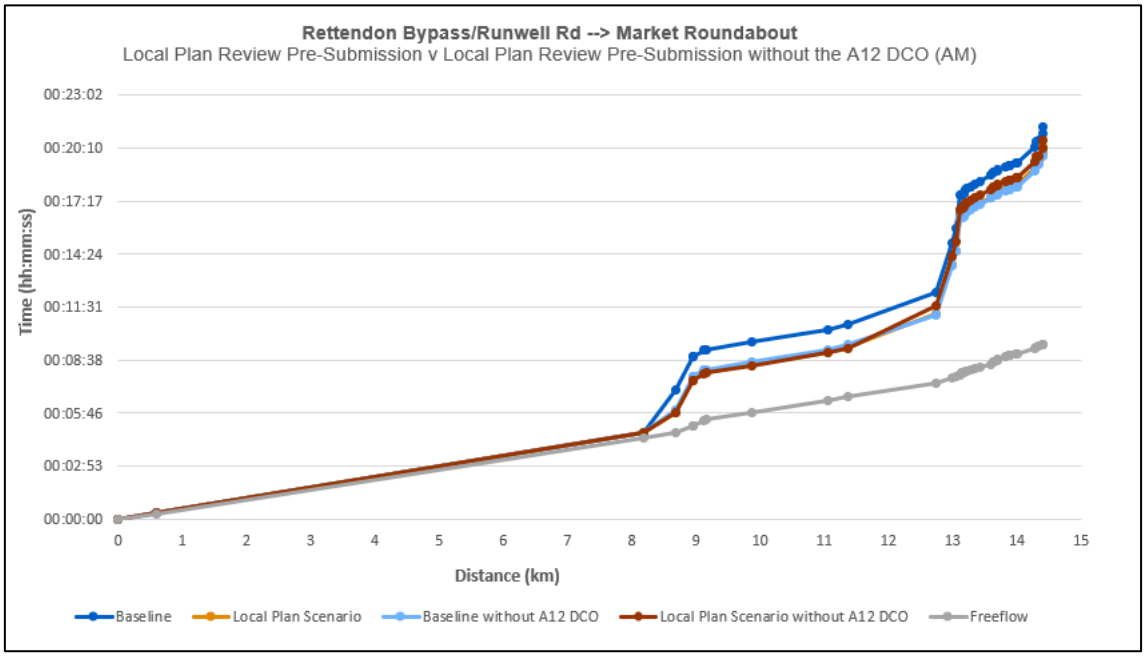
PM Peak



Appendix E 30: Journey Time Plot for Market Roundabout --> Rettendon Bypass / Runwell Road (PM Peak)

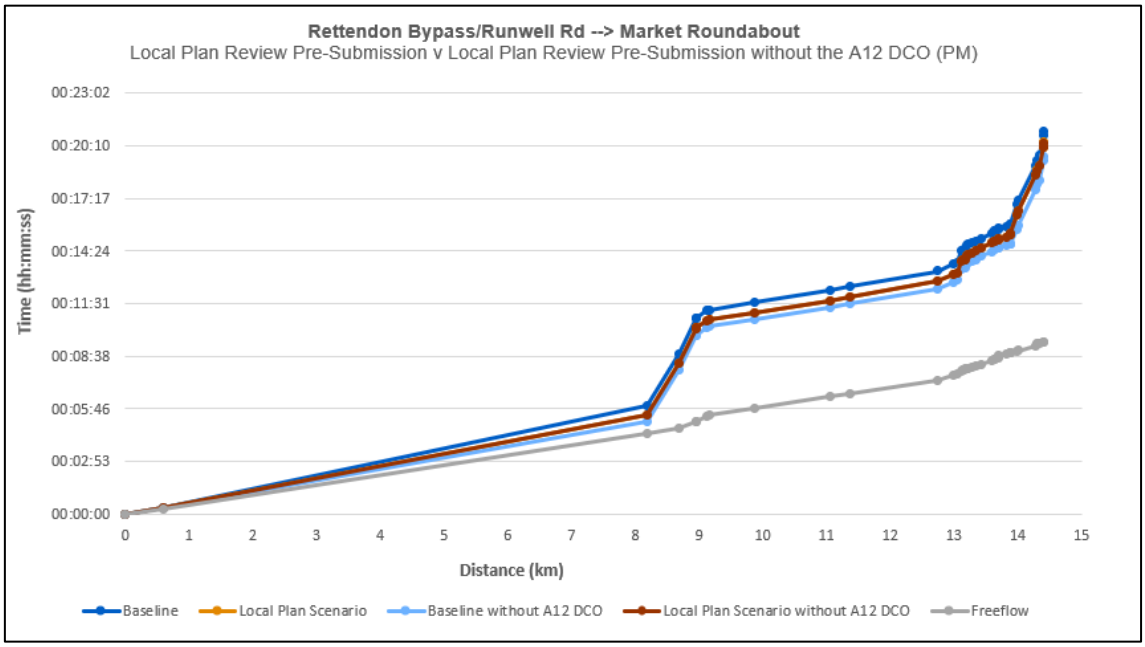
Rettendon Bypass / Runwell Road → Market Roundabout

AM Peak



Appendix E 31: Journey Time Plot for Rettendon Bypass / Runwell Road --> Market Roundabout (AM Peak)

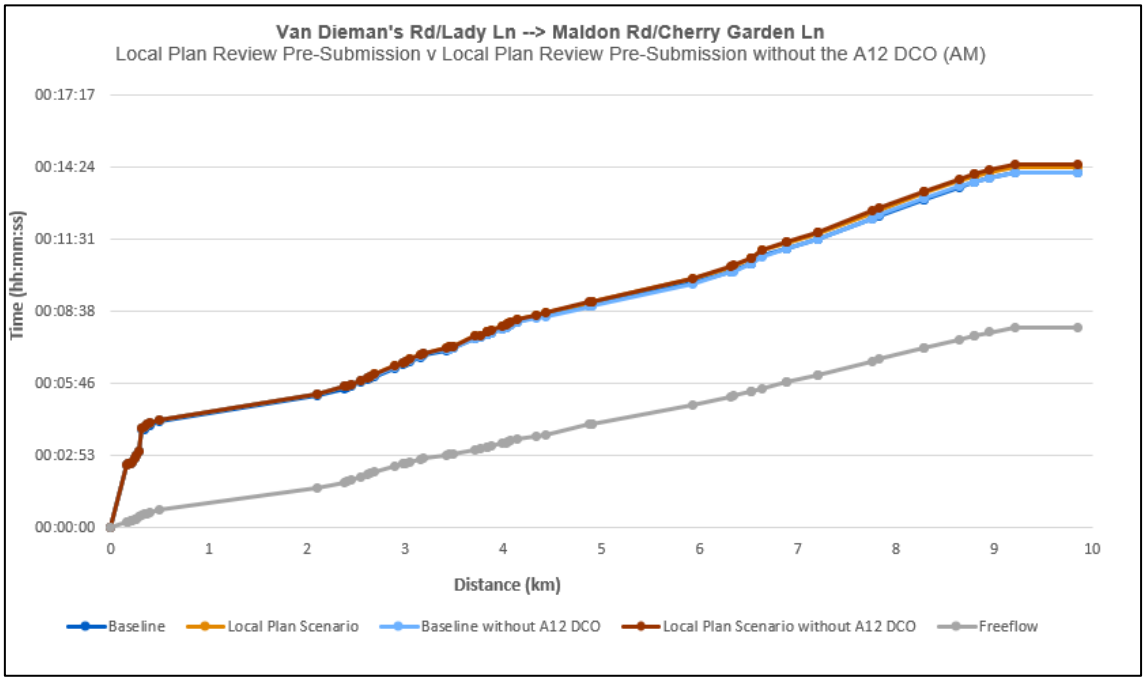
PM Peak



Appendix E 32: Journey Time Plot for Rettendon Bypass / Runwell Road --> Market Roundabout (PM Peak)

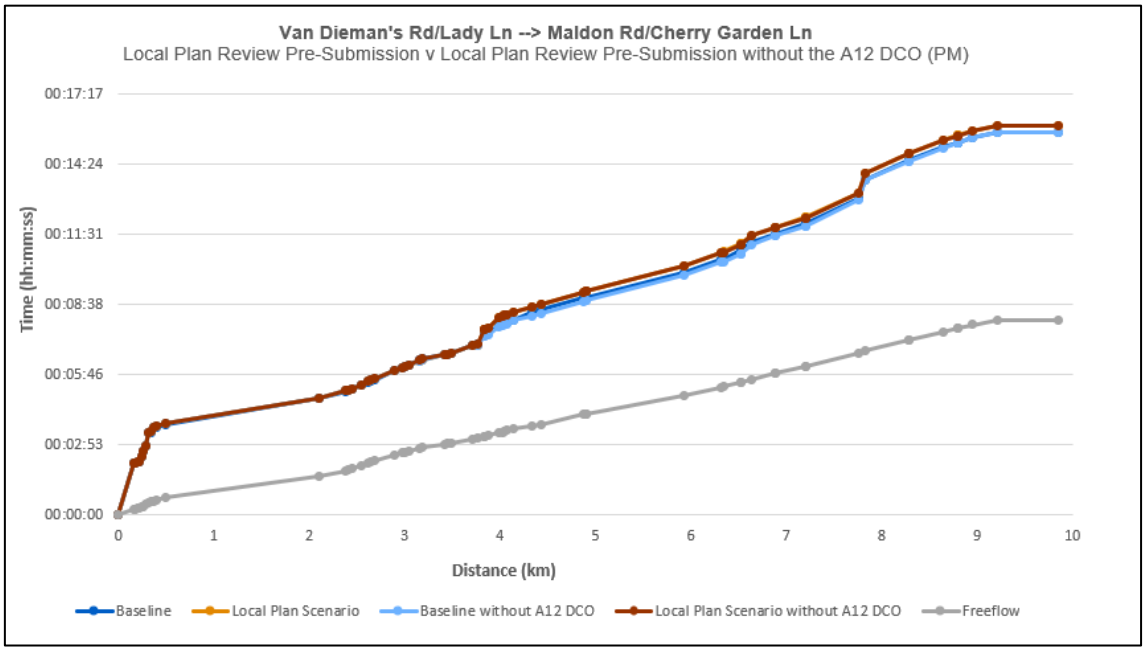
Van Dieman's Road / Lady Lane → Maldon Road / Cherry Garden Lane

AM Peak



Appendix E 33: Journey Time Plot for Van Dieman's Road / Lady Lane --> Maldon Road / Cherry Garden Lane (AM Peak)

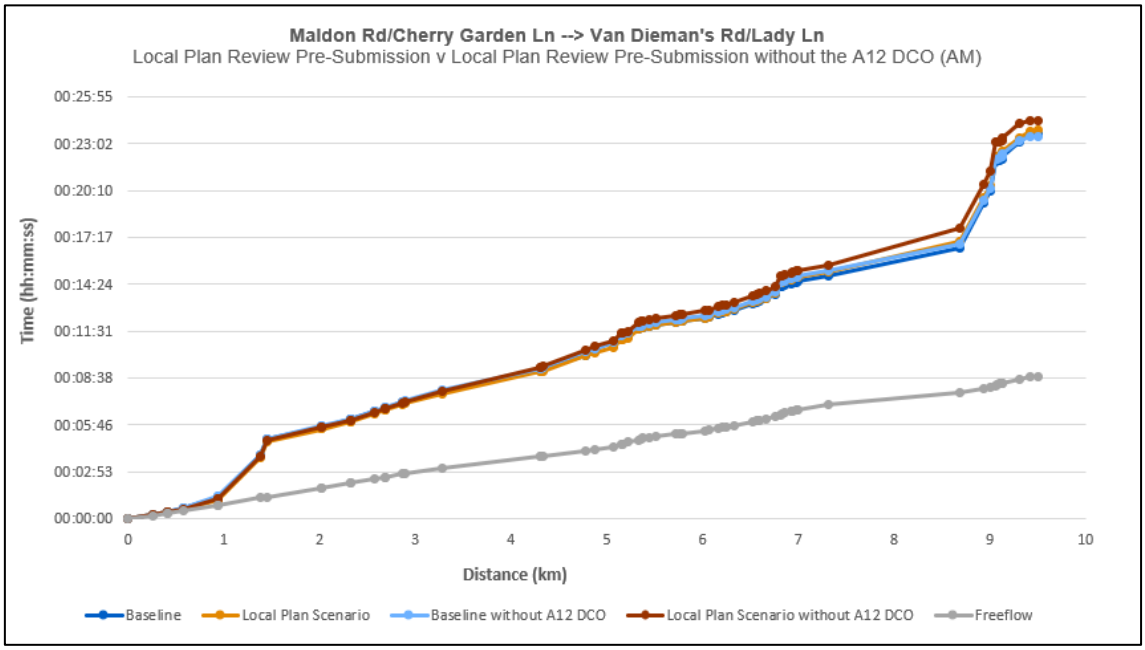
PM Peak



Appendix E 34: Journey Time Plot for Van Dieman's Road / Lady Lane --> Maldon Road / Cherry Garden Lane (PM Peak)

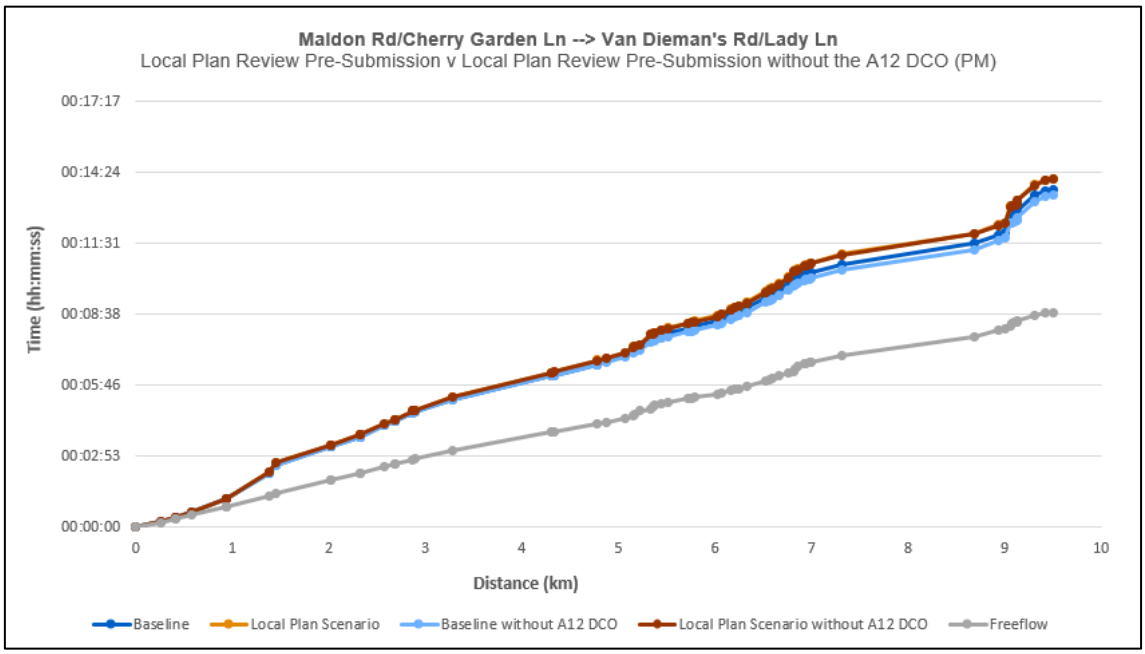
Maldon Road / Cherry Garden Lane → Van Dieman's Road / Lady Lane

AM Peak



Appendix E 35: Journey Time Plot for Maldon Road / Cherry Garden Lane --> Van Dieman's Road / Lady Lane (AM Peak)

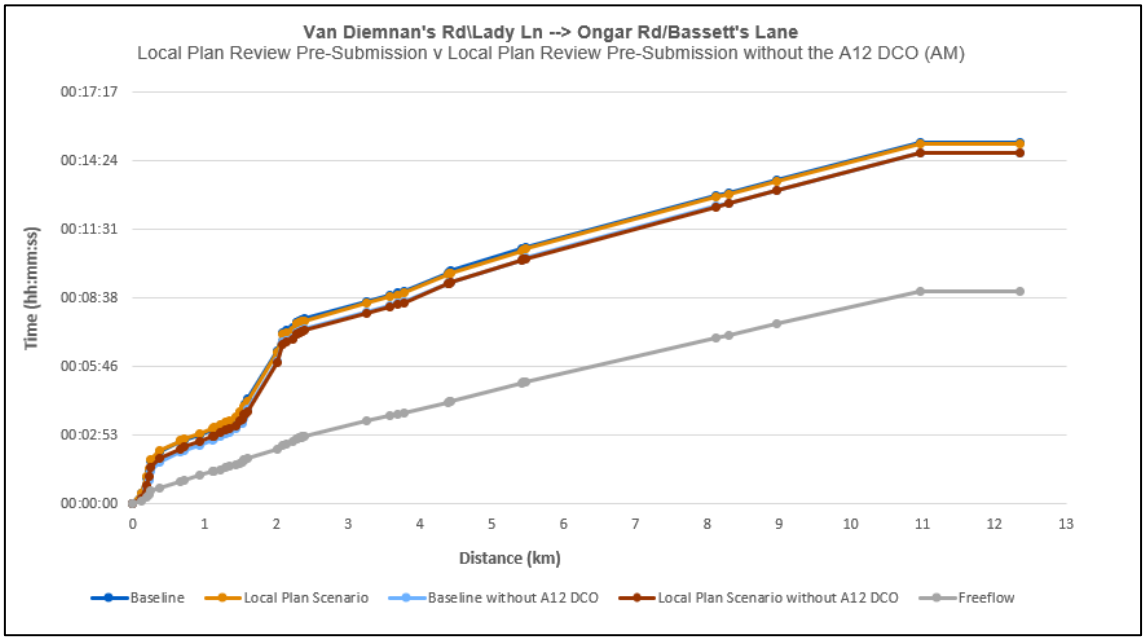
PM Peak



Appendix E 36: Journey Time Plot for Maldon Road / Cherry Garden Lane --> Van Dieman's Road / Lady Lane (PM Peak)

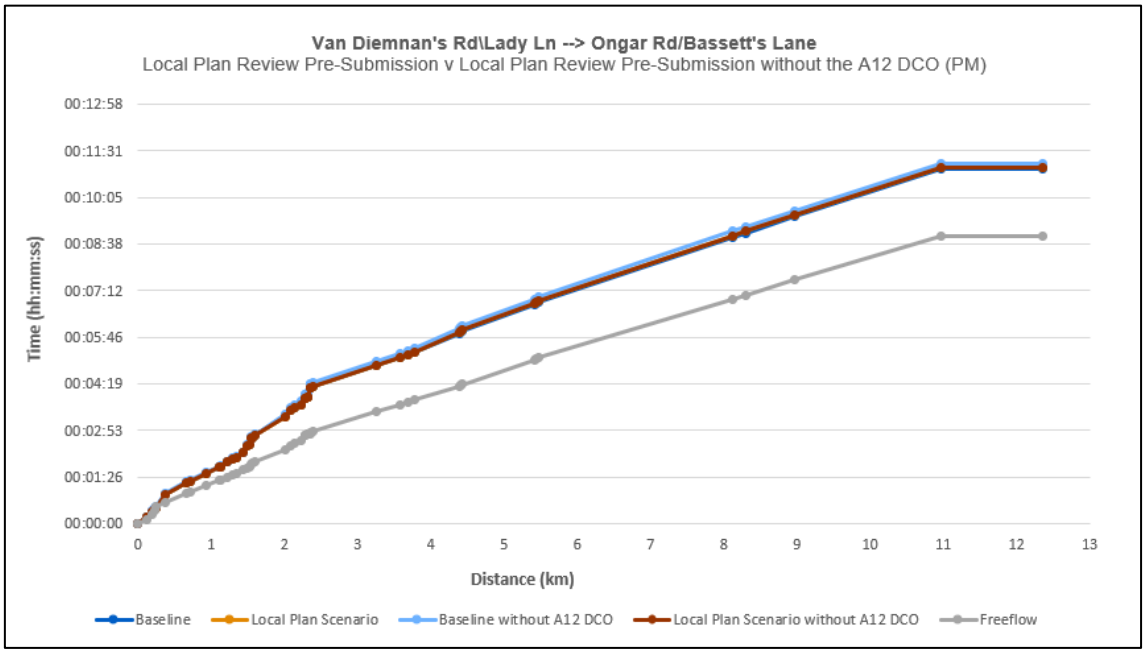
Van Dieman's Road / Lady Lane → Ongar Road / Bassett's Lane

AM Peak



Appendix E 37: Journey Time Plot for Van Dieman's Road / Lady Lane --> Ongar Road / Bassett's Lane (AM Peak)

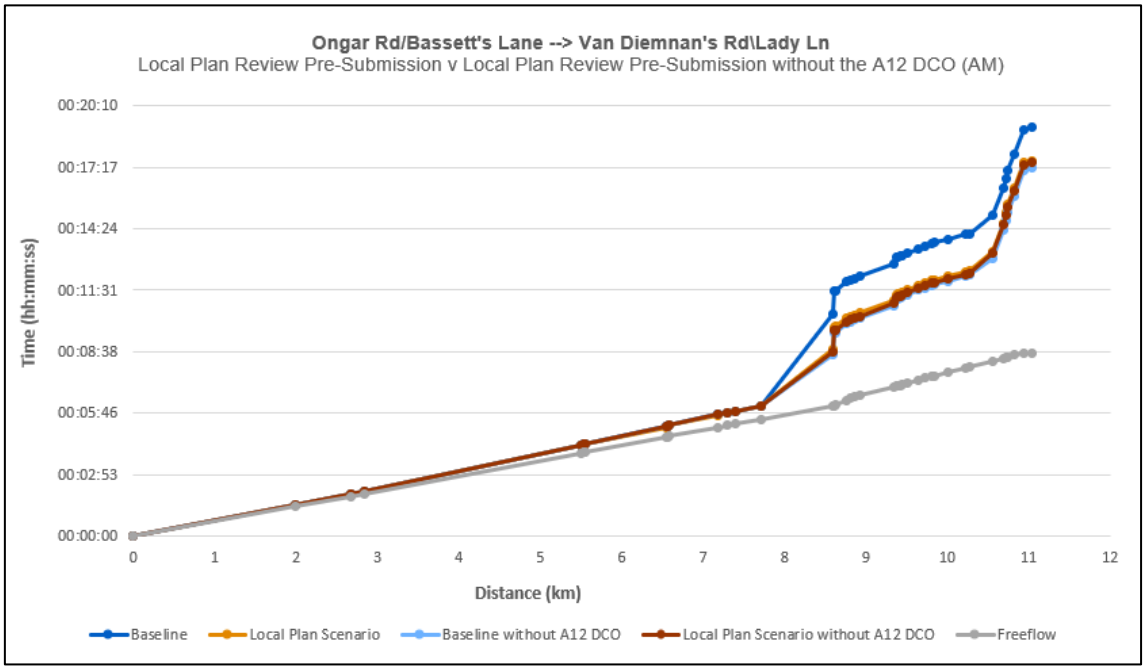
PM Peak



Appendix E 38: Journey Time Plot for Van Dieman's Road / Lady Lane --> Ongar Road / Bassett's Lane (PM Peak)

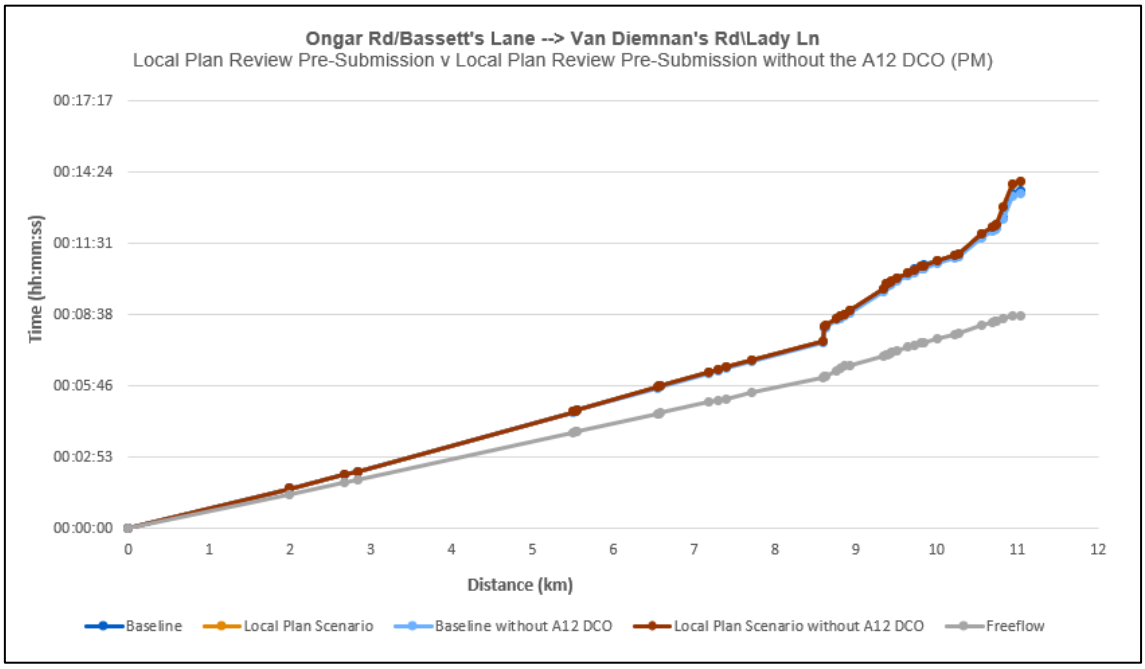
Ongar Road / Bassett's Lane → Van Dieman's Road / Lady Lane

AM Peak



Appendix E 39: Journey Time Plot for Ongar Road / Bassett's Lane --> Van Dieman's Road / Lady Lane (AM Peak)

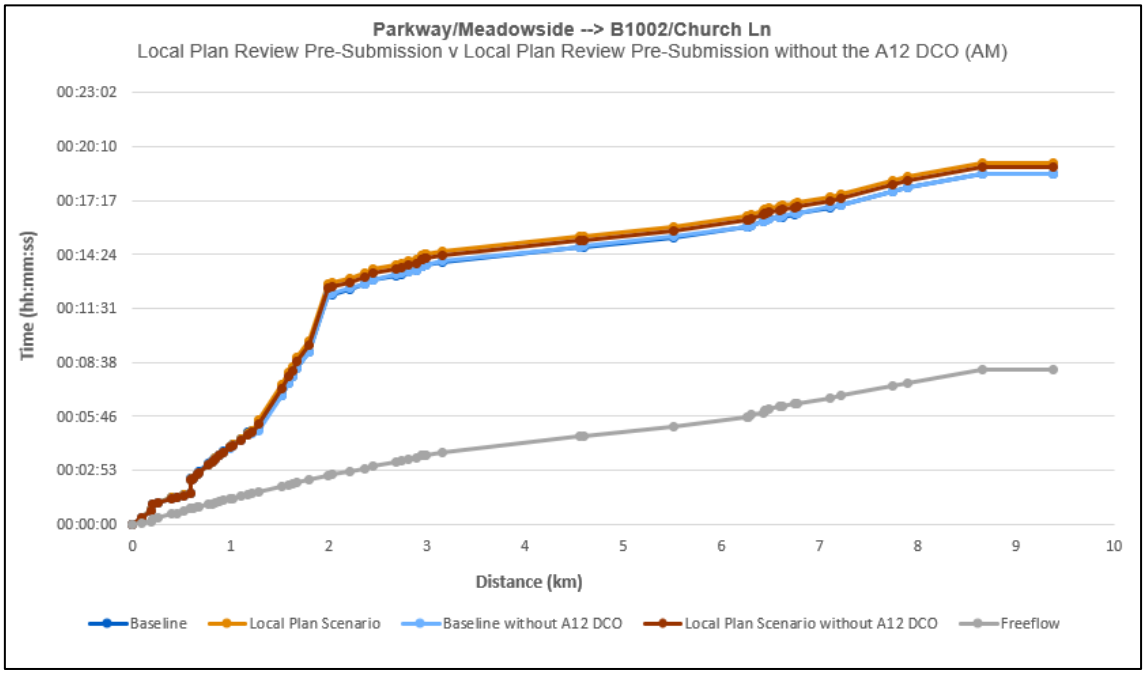
PM Peak



Appendix E 40: Journey Time Plot for Ongar Road / Bassett's Lane --> Van Dieman's Road / Lady Lane (PM Peak)

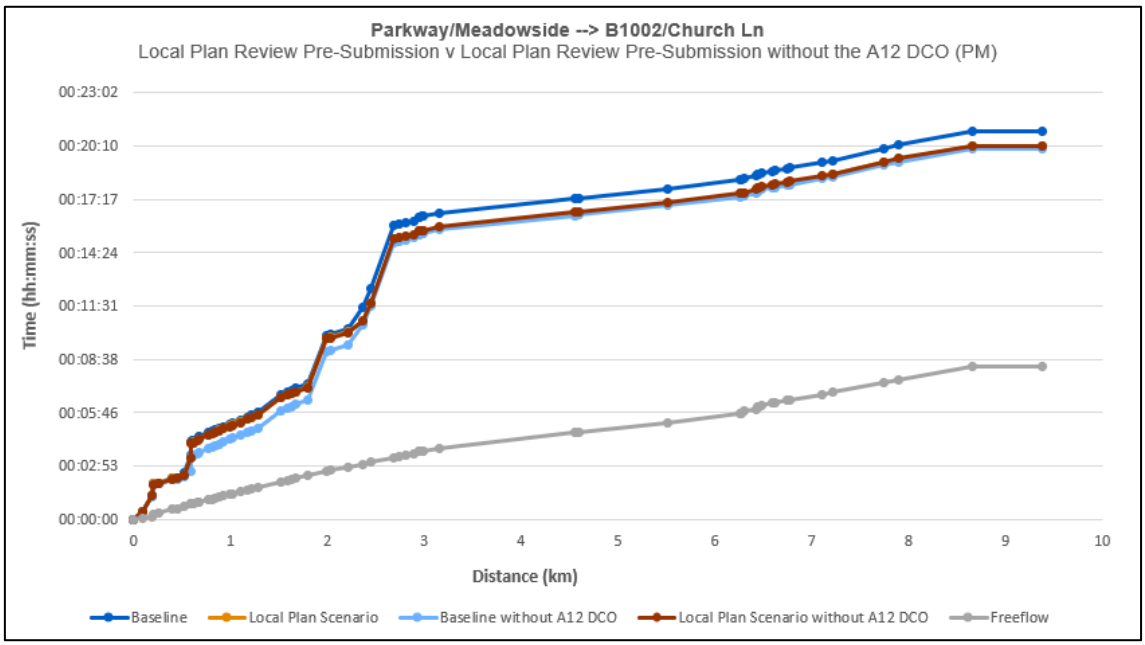
Parkway / Meadowside → B1002 / Church Lane

AM Peak



Appendix E 41: Journey Time Plot for Parkway / Meadowside --> B1002 / Church Lane (AM Peak)

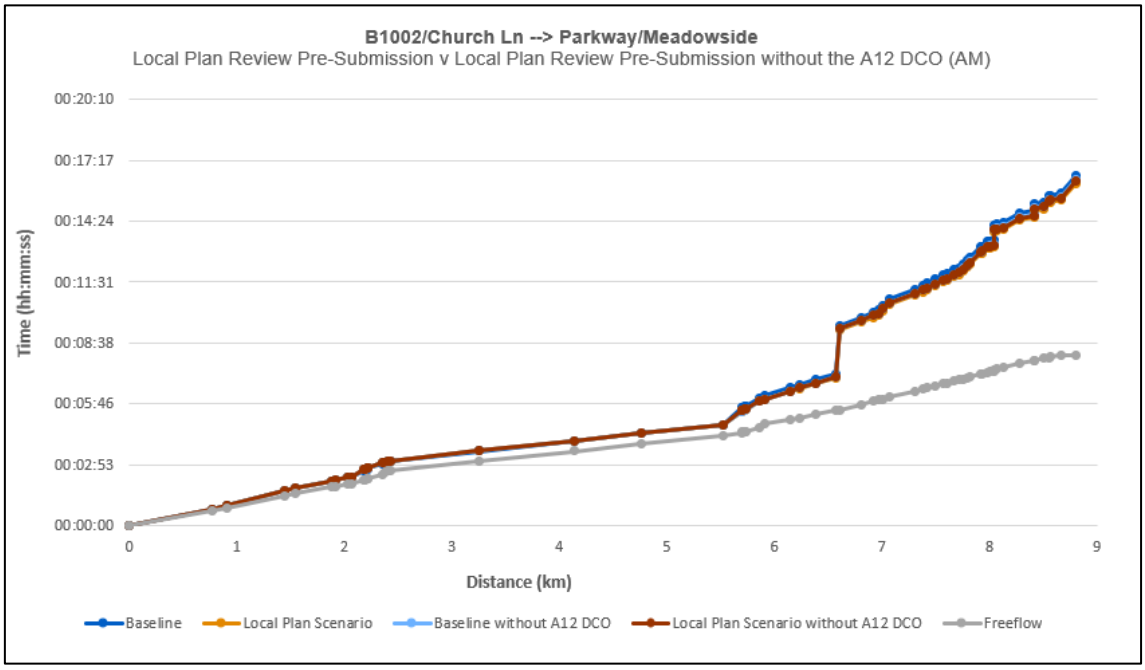
PM Peak



Appendix E 42: Journey Time Plot for Parkway / Meadowside --> B1002 / Church Lane (PM Peak)

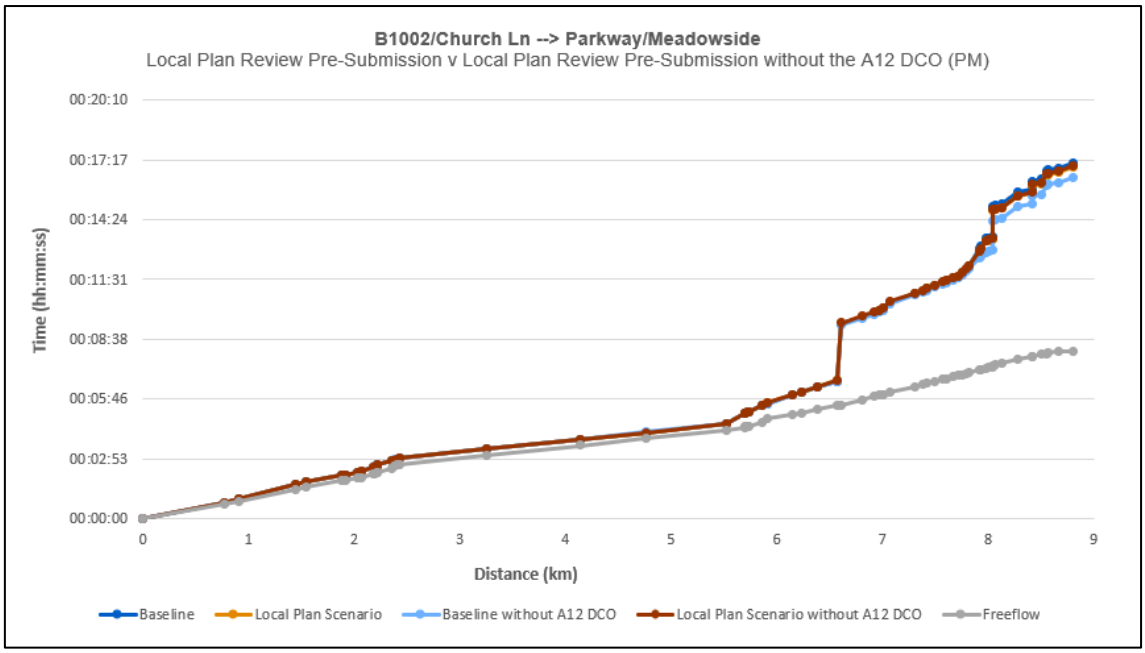
B1002 / Church Lane → Parkway / Meadowside

AM Peak



Appendix E 43: Journey Time Plot for B1002 / Church Lane --> Parkway / Meadowside (AM Peak)

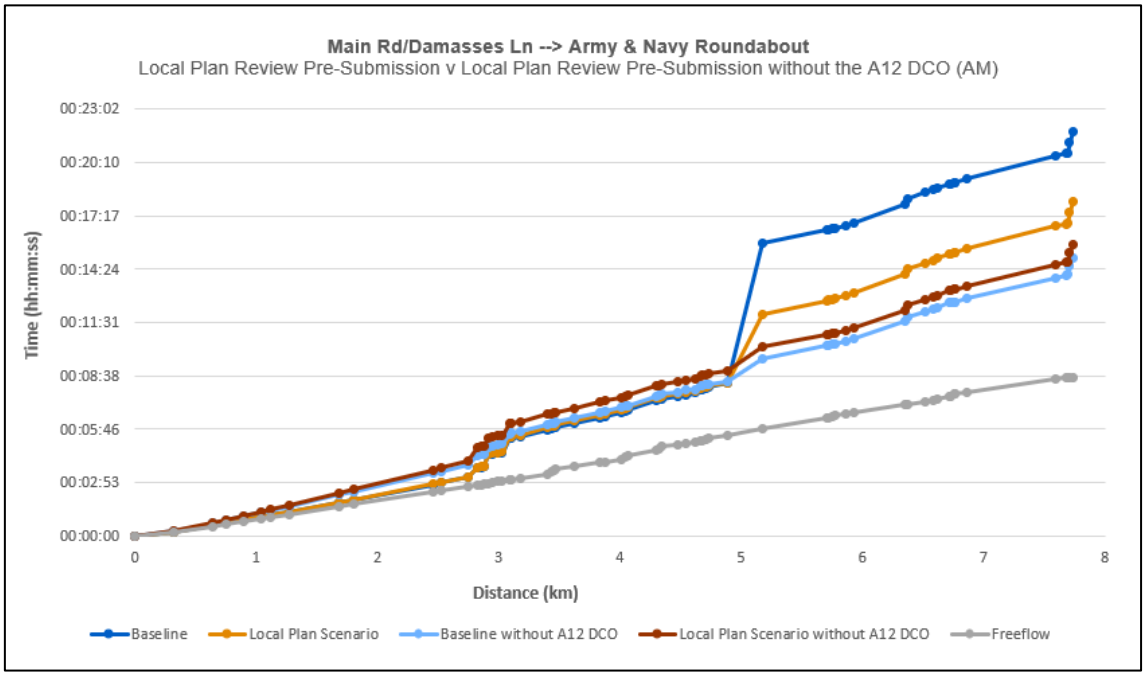
PM Peak



Appendix E 44: Journey Time Plot for B1002 / Church Lane --> Parkway / Meadowside (PM Peak)

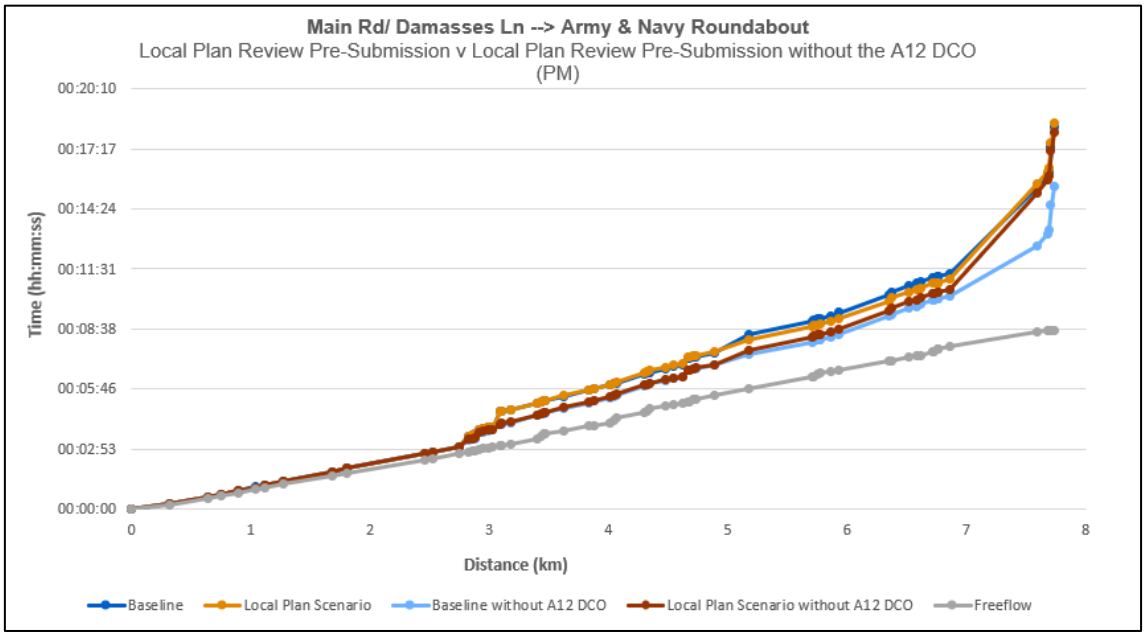
Main Road / Damasses Lane → Army and Navy Roundabout

AM Peak



Appendix E 45: Journey Time Plot for Main Road / Damasses Lane → Army and Navy Roundabout (AM Peak)

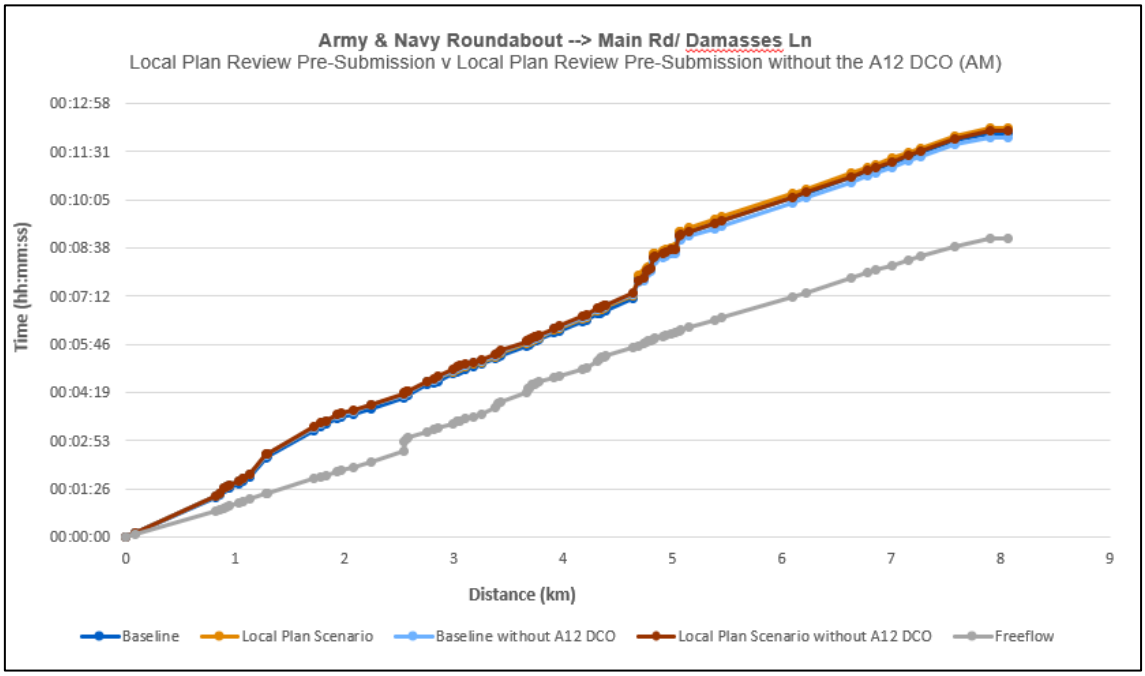
PM Peak



Appendix E 46: Journey Time Plot for Main Road / Damasses Lane → Army and Navy Roundabout (PM Peak)

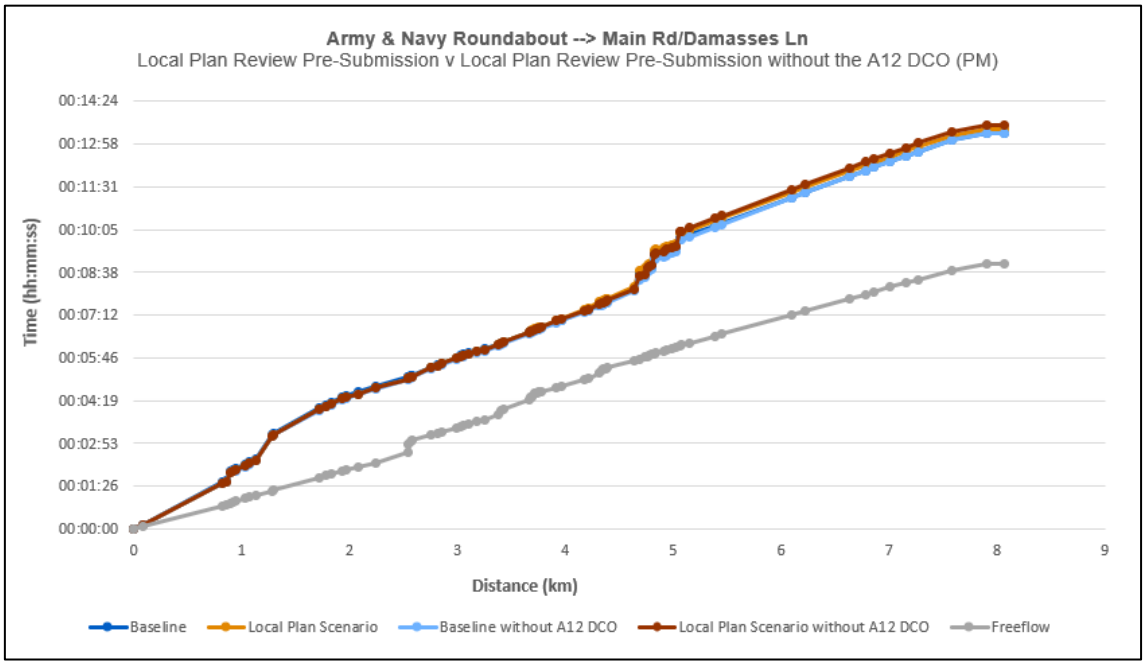
Army and Navy Roundabout → Main Road / Damasses Lane

AM Peak



Appendix E 47: Journey Time Plot for Army and Navy Roundabout --> Main Road / Damasses Lane (AM Peak)

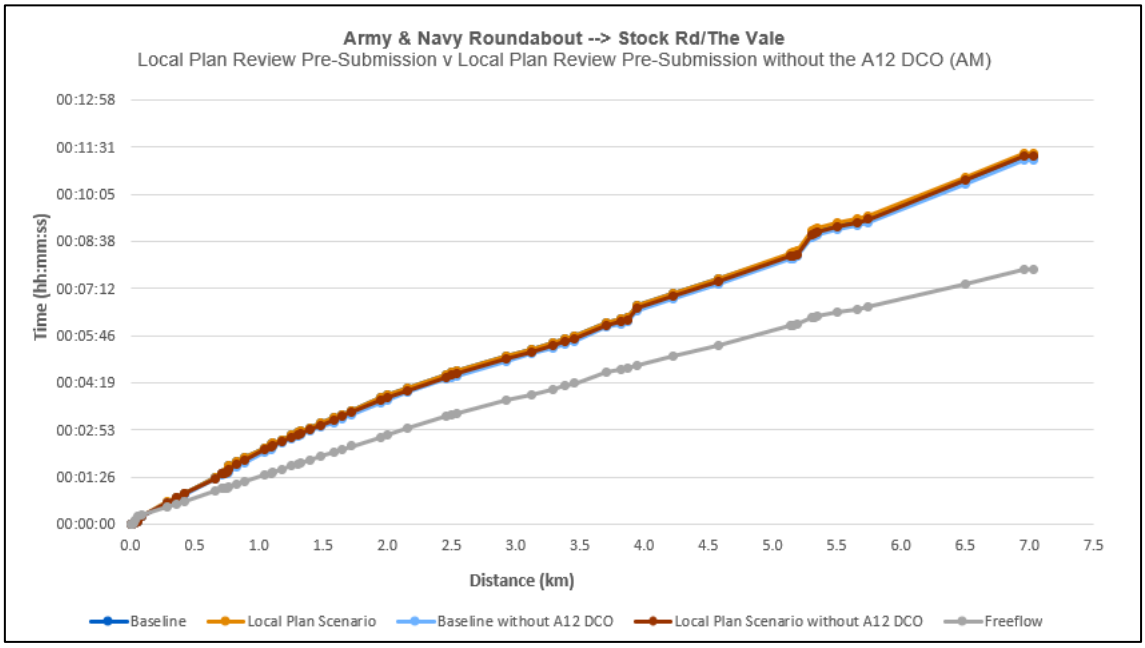
PM Peak



Appendix E 48: Journey Time Plot for Army and Navy Roundabout --> Main Road / Damasses Lane (PM Peak)

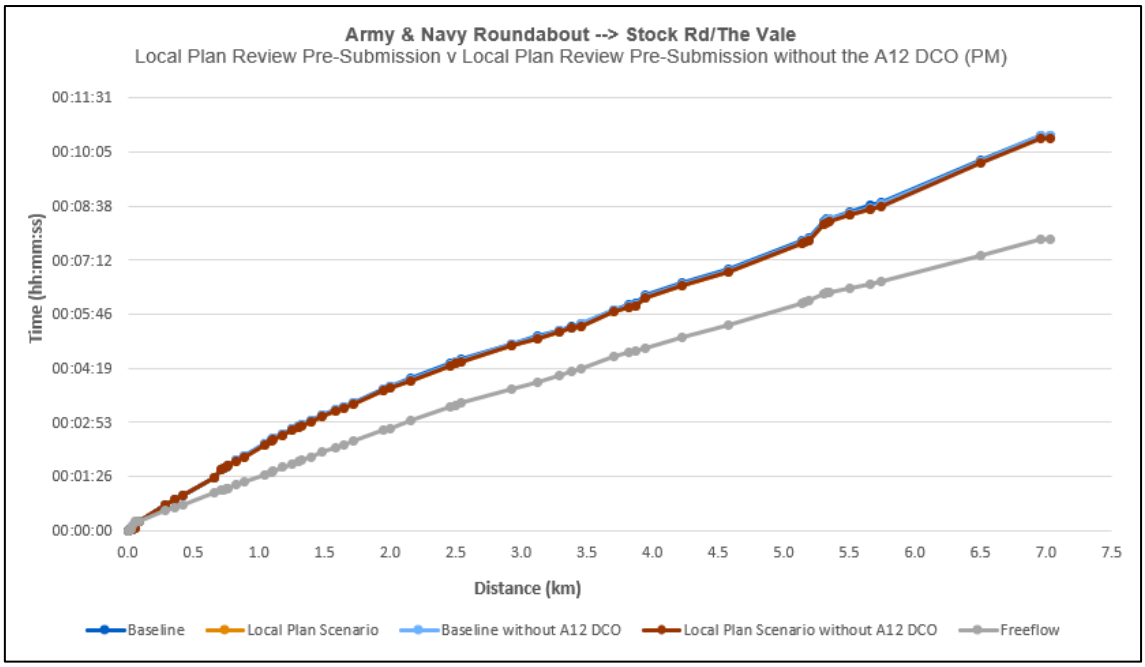
Army and Navy Roundabout → Stock Road / The Vale

AM Peak



Appendix E 49: Journey Time Plot for Army and Navy Roundabout --> Stock Road / The Vale (AM Peak)

PM Peak



Appendix E 50: Journey Time Plot for Army and Navy Roundabout --> Stock Road / The Vale (PM Peak)

Table E-1: Main Scenarios - AM Peak hour journey times extracted for 14 journey time routes in Chelmsford

Route Description	Route Length	Main Scenarios		
		Modelled Time - Baseline	Modelled Time - LP Scenario	Modelled Time - Freeflow
A12/Terling Hall Rd --> A12/Ingatestone	20.01	00:17:36	00:17:39	00:10:12
A12/Ingatestone --> A12/Terling Hall Rd	19.51	00:15:47	00:15:56	00:10:13
250 Ongar Road --> Writtle Road/Elm Road	3.97	00:25:09	00:21:06	00:05:48
Writtle Road/Elm Road --> 250 Ongar Road	3.87	00:10:10	00:10:45	00:05:37
A130/Braintree Road --> Gyratory	6.75	00:19:23	00:18:32	00:07:27
Gyratory --> A130/Braintree Road	6.70	00:14:33	00:14:36	00:07:32
Nabbotts Farm Roundabout --> A130/Colchester Rd Roundabout	1.90	00:02:55	00:02:53	00:01:45
A130/Colchester Rd Roundabout --> Nabbotts Farm Roundabout	1.94	00:04:44	00:04:14	00:02:09
High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.41	00:05:54	00:06:04	00:03:39
Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	00:09:14	00:12:54	00:03:27
Parkway/New London Rd --> Stock Rd/Beehive Lane	4.11	00:10:44	00:10:36	00:05:13
Stock Rd/Beehive Lane --> Parkway/New London Rd	4.26	00:10:22	00:10:50	00:05:20
A1060/Peppers Green --> Market Roundabout	10.18	00:17:50	00:16:44	00:09:03
Market Roundabout --> A1060/Peppers Green	10.54	00:16:55	00:17:25	00:09:15
Market Roundabout --> Rettendon Bypass/Runwell Rd	14.59	00:16:22	00:15:34	00:08:47
Market Roundabout --> Rettendon Bypass/Runwell Rd (J17)	14.01	00:19:21	00:18:10	00:09:00
Rettendon Bypass/Runwell Rd --> Market Roundabout	14.41	00:21:19	00:20:13	00:09:28
Rettendon Bypass/Runwell Rd --> Market Roundabout (J17)	14.30	00:20:31	00:19:21	00:09:22
Van Dieman's Rd/Lady Ln --> Maldon Rd/Cherry Garden Ln	9.86	00:14:11	00:14:25	00:07:59

Maldon Rd/Cherry Garden Ln --> Van Dieman's Rd/Lady Ln	9.50	00:23:39	00:23:53	00:08:41
Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	12.36	00:15:10	00:15:07	00:08:54
Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	11.04	00:19:09	00:17:36	00:08:35
Parkway/Meadowside --> B1002/Church Ln	9.38	00:18:41	00:19:17	00:08:16
B1002/Church Ln --> Parkway/Meadowside	8.80	00:16:34	00:16:12	00:08:04
Main Rd/Damasses Ln --> Army & Navy Roundabout	7.73	00:21:48	00:18:01	00:08:35
Army & Navy Roundabout --> Main Rd/Damasses Ln	8.07	00:12:05	00:12:13	00:08:55
Army & Navy Roundabout --> Stock Rd/The Vale	7.02	00:11:13	00:11:21	00:07:46
Stock Rd/The Vale --> Army & Navy Roundabout	7.13	00:21:09	00:20:36	00:07:59

Table E-2: Main Scenarios - PM Peak hour journey times extracted for 14 journey time routes in Chelmsford

Route Description	Route Length	Main Scenarios		
		Modelled Time - Baseline	Modelled Time - LP Scenario	Modelled Time - Freeflow
A12/Terling Hall Rd --> A12/Ingatestone	20.01	00:15:44	00:15:36	00:10:12
A12/Ingatestone --> A12/Terling Hall Rd	19.51	00:15:39	00:15:38	00:10:13
250 Ongar Road --> Writtle Road/Elm Road	3.97	00:14:11	00:14:14	00:05:48
Writtle Road/Elm Road --> 250 Ongar Road	3.87	00:11:36	00:11:13	00:05:37
A130/Braintree Road --> Gyratory	6.75	00:13:55	00:13:37	00:07:27
Gyratory --> A130/Braintree Road	6.70	00:21:44	00:21:43	00:07:32
Nabbotts Farm Roundabout --> A130/Colchester Rd Roundabout	1.90	00:02:32	00:02:40	00:01:45
A130/Colchester Rd Roundabout --> Nabbotts Farm Roundabout	1.94	00:03:36	00:03:28	00:02:09
High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.41	00:07:49	00:08:00	00:03:39

Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	00:12:17	00:14:50	00:03:27
Parkway/New London Rd --> Stock Rd/Beehive Lane	4.11	00:11:09	00:10:32	00:05:13
Stock Rd/Beehive Lane --> Parkway/New London Rd	4.26	00:11:09	00:11:03	00:05:20
A1060/Peppers Green --> Market Roundabout	10.18	00:18:55	00:18:42	00:09:03
Market Roundabout --> A1060/Peppers Green	10.54	00:12:18	00:12:11	00:09:15
Market Roundabout --> Rettendon Bypass/Runwell Rd	14.59	00:16:51	00:16:06	00:08:47
Market Roundabout --> Rettendon Bypass/Runwell Rd (J17)	14.01	00:19:21	00:18:10	00:09:00
Rettendon Bypass/Runwell Rd --> Market Roundabout	14.41	00:20:56	00:20:20	00:09:25
Rettendon Bypass/Runwell Rd --> Market Roundabout (J17)	14.30	00:20:31	00:19:21	00:09:22
Van Dieman's Rd/Lady Ln --> Maldon Rd/Cherry Garden Ln	9.86	00:15:42	00:15:59	00:07:59
Maldon Rd/Cherry Garden Ln --> Van Dieman's Rd/Lady Ln	9.50	00:13:42	00:14:09	00:08:41
Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	12.36	00:10:57	00:11:00	00:08:54
Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	11.04	00:13:38	00:14:02	00:08:35
Parkway/Meadowside --> B1002/Church Ln	9.38	00:20:55	00:20:08	00:08:16
B1002/Church Ln --> Parkway/Meadowside	8.80	00:16:27	00:16:58	00:16:53
Main Rd/Damasses Ln --> Army & Navy Roundabout	7.73	00:18:19	00:18:30	00:08:35
Army & Navy Roundabout --> Main Rd/Damasses Ln	8.07	00:13:19	00:13:28	00:08:55
Army & Navy Roundabout --> Stock Rd/The Vale	7.02	00:10:31	00:10:28	00:07:46
Stock Rd/The Vale --> Army & Navy Roundabout	7.13	00:12:24	00:12:34	00:07:59

Table E-3: Sensitivity Test - AM Peak hour journey times extracted for 14 journey time routes in Chelmsford

Route Description	Route Length	Main Scenarios			Sensitivity Test 1: Without A12 DCO	
		Modelled Time - Baseline	Modelled Time - LP Scenario	Modelled Time - Freeflow	Modelled Time - Baseline v Baseline without A12 DCO	Modelled Time - LP Scenario without A12 DCO
A12/Terling Hall Rd --> A12/Ingatestone	20.01	00:17:36	00:17:39	00:10:12	00:17:19	00:18:08
A12/Ingatestone --> A12/Terling Hall Rd	19.51	00:15:47	00:15:56	00:10:13	00:15:46	00:15:58
250 Ongar Road --> Writtle Road/Elm Road	3.97	00:25:09	00:21:06	00:05:48	00:19:02	00:20:44
Writtle Road/Elm Road --> 250 Ongar Road	3.87	00:10:10	00:10:45	00:05:37	00:10:25	00:10:26
A130/Braintree Road --> Gyratory	6.75	00:19:23	00:18:32	00:07:27	00:19:12	00:19:05
Gyratory --> A130/Braintree Road	6.70	00:14:33	00:14:36	00:07:32	00:14:32	00:14:37
Nabbotts Farm Roundabout --> A130/Colchester Rd Roundabout	1.90	00:02:55	00:02:53	00:01:45	00:03:01	00:03:02
A130/Colchester Rd Roundabout --> Nabbotts Farm Roundabout	1.94	00:04:44	00:04:14	00:02:09	00:03:58	00:04:03
High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.41	00:05:54	00:06:04	00:03:39	00:05:58	00:06:03
Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	00:09:14	00:12:54	00:03:27	00:08:12	00:11:31
Parkway/New London Rd --> Stock Rd/Beehive Lane	4.11	00:10:44	00:10:36	00:05:13	00:10:27	00:10:39
Stock Rd/Beehive Lane --> Parkway/New London Rd	4.26	00:10:22	00:10:50	00:05:20	00:10:26	00:10:29
A1060/Peppers Green --> Market Roundabout	10.18	00:17:50	00:16:44	00:09:03	00:16:29	00:16:48
Market Roundabout --> A1060/Peppers Green	10.54	00:16:55	00:17:25	00:09:15	00:17:07	00:17:19
Market Roundabout --> Rettendon Bypass/Runwell Rd	14.59	00:16:22	00:15:34	00:08:47	00:14:46	00:14:54
Market Roundabout --> Rettendon Bypass/Runwell Rd (J17)	14.01	00:19:21	00:18:10	00:09:00	00:18:05	00:18:34
Rettendon Bypass/Runwell Rd --> Market Roundabout	14.41	00:21:19	00:20:13	00:09:28	00:20:04	00:20:34

Rettendon Bypass/Runwell Rd --> Market Roundabout (J17)	14.30	00:20:31	00:19:21	00:09:22	00:19:14	00:19:42
Van Dieman's Rd/Lady Ln --> Maldon Rd/Cherry Garden Ln	9.86	00:14:11	00:14:25	00:07:59	00:14:12	00:14:30
Maldon Rd/Cherry Garden Ln --> Van Dieman's Rd/Lady Ln	9.50	00:23:39	00:23:53	00:08:41	00:23:29	00:24:30
Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	12.36	00:15:10	00:15:07	00:08:54	00:14:44	00:14:43
Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	11.04	00:19:09	00:17:36	00:08:35	00:17:15	00:17:30
Parkway/Meadowside --> B1002/Church Ln	9.38	00:18:41	00:19:17	00:08:16	00:18:43	00:19:04
B1002/Church Ln --> Parkway/Meadowside	8.80	00:16:34	00:16:12	00:08:04	00:16:20	00:16:18
Main Rd/Damasses Ln --> Army & Navy Roundabout	7.73	00:21:48	00:18:01	00:08:35	00:14:59	00:15:45
Army & Navy Roundabout --> Main Rd/Damasses Ln	8.07	00:12:05	00:12:13	00:08:55	00:11:58	00:12:08
Army & Navy Roundabout --> Stock Rd/The Vale	7.02	00:11:13	00:11:21	00:07:46	00:11:07	00:11:15
Stock Rd/The Vale --> Army & Navy Roundabout	7.13	00:21:09	00:20:36	00:07:59	00:19:19	00:20:04

Table E-4: Sensitivity Test - PM Peak hour journey times extracted for 14 journey time routes in Chelmsford

Route Description	Route Length	Main Scenarios			Sensitivity Test 1: Without A12 DCO	
		Modelled Time - Baseline	Modelled Time - LP Scenario	Modelled Time - Freeflow	Modelled Time - Baseline v Baseline without A12 DCO	Modelled Time - LP Scenario without A12 DCO
A12/Terling Hall Rd --> A12/Ingatestone	20.01	00:15:44	00:15:36	00:10:12	00:15:13	00:15:37
A12/Ingatestone --> A12/Terling Hall Rd	19.51	00:15:39	00:15:38	00:10:13	00:15:22	00:15:38
250 Ongar Road --> Writtle Road/Elm Road	3.97	00:14:11	00:14:14	00:05:48	00:14:06	00:14:26
Writtle Road/Elm Road --> 250 Ongar Road	3.87	00:11:36	00:11:13	00:05:37	00:11:20	00:11:20
A130/Braintree Road --> Gyratory	6.75	00:13:55	00:13:37	00:07:27	00:13:38	00:13:41
Gyratory --> A130/Braintree Road	6.70	00:21:44	00:21:43	00:07:32	00:21:36	00:21:35
Nabbotts Farm Roundabout --> A130/Colchester Rd Roundabout	1.90	00:02:32	00:02:40	00:01:45	00:02:40	00:02:43
A130/Colchester Rd Roundabout --> Nabbotts Farm Roundabout	1.94	00:03:36	00:03:28	00:02:09	00:03:21	00:03:53
High Bridge Rd/Odeon Roundabout --> Springfield Rd Roundabout	2.41	00:07:49	00:08:00	00:03:39	00:07:48	00:08:02
Springfield Rd Roundabout --> High Bridge Rd/Odeon Roundabout	2.45	00:12:17	00:14:50	00:03:27	00:12:24	00:14:59
Parkway/New London Rd --> Stock Rd/Beehive Lane	4.11	00:11:09	00:10:32	00:05:13	00:11:04	00:10:46
Stock Rd/Beehive Lane --> Parkway/New London Rd	4.26	00:11:09	00:11:03	00:05:20	00:10:38	00:11:03
A1060/Peppers Green --> Market Roundabout	10.18	00:18:55	00:18:42	00:09:03	00:18:03	00:18:49
Market Roundabout --> A1060/Peppers Green	10.54	00:12:18	00:12:11	00:09:15	00:12:15	00:12:12
Market Roundabout --> Rettendon Bypass/Runwell Rd	14.59	00:16:51	00:16:06	00:08:47	00:16:19	00:16:03
Market Roundabout --> Rettendon Bypass/Runwell Rd (J17)	14.01	00:19:21	00:18:10	00:09:00	00:18:05	00:18:34

Rettendon Bypass/Runwell Rd --> Market Roundabout	14.41	00:20:56	00:20:20	00:09:25	00:19:34	00:20:19
Rettendon Bypass/Runwell Rd --> Market Roundabout (J17)	14.30	00:20:31	00:19:21	00:09:22	00:19:14	00:19:42
Van Dieman's Rd/Lady Ln --> Maldon Rd/Cherry Garden Ln	9.86	00:15:42	00:15:59	00:07:59	00:15:42	00:15:58
Maldon Rd/Cherry Garden Ln --> Van Dieman's Rd/Lady Ln	9.50	00:13:42	00:14:09	00:08:41	00:13:29	00:14:07
Van Diemnan's Rd\Lady Ln --> Ongar Rd/Bassett's Lane	12.36	00:10:57	00:11:00	00:08:54	00:11:09	00:11:01
Ongar Rd/Bassett's Lane --> Van Diemnan's Rd\Lady Ln	11.04	00:13:38	00:14:02	00:08:35	00:13:33	00:14:02
Parkway/Meadowside --> B1002/Church Ln	9.38	00:20:55	00:20:08	00:08:16	00:20:01	00:20:11
B1002/Church Ln --> Parkway/Meadowside	8.80	00:16:27	00:16:58	00:16:53	00:16:27	00:16:58
Main Rd/Damasses Ln --> Army & Navy Roundabout	7.73	00:18:19	00:18:30	00:08:35	00:15:30	00:18:05
Army & Navy Roundabout --> Main Rd/Damasses Ln	8.07	00:13:19	00:13:28	00:08:55	00:13:19	00:13:36
Army & Navy Roundabout --> Stock Rd/The Vale	7.02	00:10:31	00:10:28	00:07:46	00:10:30	00:10:27
Stock Rd/The Vale --> Army & Navy Roundabout	7.13	00:12:24	00:12:34	00:07:59	00:12:16	00:12:34

16 Appendix F: Sustainable Accessibility Scores

	Chelmsford Urban Area (Residential)	Chelmsford Urban Area (Employment)	Ford End	Boreham	Little Boyton Hall Farm	North East Chelmsford	South and East Chelmsford	Bicknacre	East Hanningfield
Accessibility to urban centres	3	3	1	2	2	1	2	1	2
Accessibility to employment locations	3		2				2	2	2
Accessibility to rail stations (walking and cycling)	3	3	1	1	1	3	1	1	1
Accessibility to rail stations (public transport)	3	3	3	3	3	3	3	2	3
Weekday bus services and frequency	3	3	1	3	1	3	3	2	1
Saturday bus services and frequency	3	3	1	3	1	3	2	1	1
Sunday and night (out of hours) frequency	3	3	1	1	1	2	1	1	1
Walking access to bus stops	3	3	2	2	1	3	3	2	1
UFBB internet connectivity	3		3				3	1	1
Car driver mode share	3		1				1	1	1
Accessibility to healthcare	3		1				3	3	2
Accessibility to nurseries	3		1				3	3	3
Accessibility to primary schools	3		3				3	2	1
Accessibility to secondary schools	3		1				1	1	1
Sustainable Access RAG Score	3.00	3.00	1.57	2.14	1.43	2.57	2.21	1.64	1.50

Table F-1: RAG Assessment of LPRPS Development Sites

17 Appendix G: Cross-Boundary Impact for LPRPS without A12 DCO Scenario

To assess the comparative cross-boundary impact of development under the LPRPS, without A12 DCO Scenario, a review has been undertaken of the forecast flows on key routes travelling in and out of neighbouring Districts and Boroughs.

Inbound and outbound 2041 forecast traffic flows have been extracted from eight key routes at the point the route crosses the Chelmsford administrative boundary. These are shown in Figure 5-28 in Section 5.6 of this report.

Table 6-1 below details the directional vehicle flows on these key corridor routes crossing the Chelmsford administrative boundary in the 2041 Baseline scenario (without A12 DCO). Table 6-2 shows the modelled flow differences between the 2041 baseline (without A12 DCO scenario) and the 2041 LPRPS (without A12 DCO) scenario.

'Inbound' refers to flows travelling from neighbouring areas into the Chelmsford administrative boundary, and Outbound refers to flows travelling out of the Chelmsford administrative boundary into neighbouring areas.

Table G-1: Modelled flows in Baseline (without A12 DCO) Scenario on key cross-boundary routes

Road	Neighbouring Authority	Baseline without A12 DCO			
		AM Directional Flow		PM Directional Flow	
		IB Flow	OB Flow	IB Flow	OB Flow
A131	Braintree	1368	1103	1110	1305
A12 (north)	Braintree	4789	4391	4364	4373
A414 (east)	Maldon	741	555	620	729
A130 (south)	Basildon	2400	2275	2581	2047
B1007	Basildon	961	708	988	688
A12 (south)	Brentwood	3556	4186	4150	3572
A414 (west)	Epping Forest	527	709	767	537
A1060	Uttlesford	397	414	421	402
B1008	Uttlesford	573	662	620	672

Table G-2: Modelled flow comparisons and % change between LPRPS Without A12 DCO Scenario and Baseline Without A12 DCO Scenario on key cross-boundary routes

		Local PlanReview Pre-Submission without A12 DCO Scenario							
		AM Directional Flow				PM Directional Flow			
Road	Neighbouring authority	IB Flow	% change	OB Flow	% change	IB Flow	% change	OB Flow	% change
A131	Braintree	1381	1.0%	1119	1.5%	1089	-1.9%	1304	-0.1%
A12 (north)	Braintree	4475	-6.6%	4432	0.9%	4404	0.9%	4372	0.0%
A414 (east)	Maldon	731	-1.3%	559	0.7%	626	1.0%	711	-2.5%
A130 (south)	Basildon	2382	-0.8%	2276	0.0%	2589	0.3%	2029	-0.9%
B1007	Basildon	969	0.8%	734	3.7%	1009	2.1%	678	-1.5%
A12 (south)	Brentwood	3538	-0.5%	4189	0.1%	4195	1.1%	3541	-0.9%
A414 (west)	Epping Forest	523	-0.8%	709	0.0%	777	1.3%	526	-2.0%
A1060	Uttlesford	392	-1.3%	416	0.5%	433	2.9%	397	-1.2%
B1008	Uttlesford	561	-2.1%	687	0.7%	631	1.8%	663	-1.3%

18 Appendix H: A12 Merge / Diverge Assessment for LPRPS without A12 DCO Scenario

Following discussions with National Highways regarding the impact of development on the A12 Corridor, merge and diverge assessments were carried out for all on- and off-slips of Junctions 15-19 on the A12, for both the main LPRPS Scenario (Section 5.9) and LPRPS Scenario without the A12 DCO.

Modelled flows for the on and off slips have been compared against the Design Manual for Roads and Bridges (DMRB) standards[16] to help identify where improvements to the merge / diverge layouts and number of lanes upstream and downstream of the merge / diverge may be required.

Table H-1 below outlines the recommended layouts and number of lanes for each on and off-slip. Yellow has been used to indicate where the recommended junction layout and number of lanes is different to the existing layout / number of lanes. In cases where the DMRB appropriate layout differed across the AM and PM peaks, the layout offering the most capacity has been identified as the recommended layout. Where the existing layout offered greater capacity than the DMRB appropriate layout, the existing layout has been identified as the recommended layout.

[16] Design Manual for Roads and Bridges, 2022. CD 122 – Geometric design of grade separated junctions. Available at: < 3ab9ef31-9880-4e8e-a7eb-f3d218e74ffd >

Table H-1: Merge / Diverge Assessment of A12 Junctions 15-19 for the LPRPS Scenario, without A12 DCO.

Junction	Slip Road	Recommended Layout	Recommended No. of Lanes	
			Upstream	Downstream
J15	NB On slip	D	2	3
	NB Off slip	C	3	2
	SB On slip	E	2	3
	SB Off slip	A	2	2
J16	NB On slip	A	2	2
	NB Off slip	C	3	2
	SB On slip	A	2	2
	SB Off slip	A	2	2
J17	NB On slip	E	2	3
	NB Off slip	A	2	2
	SB On slip	A	2	2
	SB Off slip	D	3	2
J18	NB On slip	D	2	3
	NB Off slip	C	3	2
	SB On slip	A	3	3
	SB Off slip	A	3	3
J19	NB On slip	E	2	3
	NB Off slip	C	3	2
	SB On slip	D	2	3
	SB Off slip	C	3	2

The recommended changes have been listed out overleaf. These remain consistent with the recommendations made for the on- and off-slips under the LPRPS Scenario, with the exception of there being no recommendation, under the without A12 DCO Scenario to change the layout of the SB off-slip to layout C from existing layout D.

Junction 15

Recommended Layout Changes:
- NB On-slip to change from layout A to layout D.

Lane Changes:
- NB On-Slip downstream lanes to change from 2 to 3.

Junction 16

Recommended Layout Changes:
- NB Off-slip to change from layout A to layout C.

Lane Changes:
- NB Off-Slip upstream lanes to change from 2 to 3.

Junction 17

Recommended Layout Changes:
- NB On-slip to change from layout A to layout E.
- SB Off-slip to change from layout A to layout D.

Lane Changes:
- NB On-Slip downstream lanes to change from 2 to 3.
- SB Off-slip upstream lanes to change from 2 to 3.

Junction 18

Recommended Layout Changes:
- NB On-Slip to change from layout A to layout D.
- NB Off-Slip to change from layout A to layout C.

Lane Changes:
- NB On-slip downstream lanes to change from 2 to 3.
- NB Off-slip upstream lanes to change from 2 to 3.
- SB On-slip upstream and downstream lanes to both change from 2 to 3.
- SB Off-slip upstream and downstream lanes to both change from 2 to 3.

Junction 19

Recommended Layout Changes:
- NB Off-slip to change from layout A to layout C.
- SB On-slip to change from layout A to layout D.

Lane Changes:
- NB Off-Slip upstream lanes to change from 2 to 3.
- SB On-Slip downstream lanes to change from 2 to 3.

19 Appendix I: Junction Modelling Outputs (Without A12 DCO)

The following section outlines the modelling outputs for the Sensitivity Test without the A12 DCO proposals. Outputs have been provided for both the 2041 Baseline and the 2041 LPRPS scenario.

Whilst detailed analysis has not been provided for the individual plots below, a high-level review of the findings indicates that without the A12 DCO (widening and Boreham Interchange capacity improvements) the impact of the Local Plan development would not worsen the performance of these junctions, compared to the main baseline and LPRPS scenarios covered in the report. However, Local Plan development is expected to have a negative impact on the A12 Junction 19, Boreham Interchange, without the DCO improvements in place. Additional congestion at this junction is likely to result in a redistribution of traffic and/or a reduction in background trips made during the peak hours (modelled through VDM) which is likely a contributing factor to the minimal impact, or slight improvements seen at other junctions on the network.

The modelling methodology is consistent with the junction modelling for the main scenarios, and therefore can be found in Section 8-1 of this report. In addition, existing and future layouts for each of the junctions can be found in Section 8.2.

19.1 Junctions 10 Modelling (ARCADY)

19.1.1 Sheepcotes Roundabout

Table I-1: Sheepcotes Roundabout Local Junction Modelling Outputs - Existing Layout without A12 DCO

Existing Layout	AM			PM		
	Queue (PCUs)	Delay (s)	RFC	Queue (PCUs)	Delay (s)	RFC
2041 Forecast – Baseline without A12 DCO						
1 – Braintree Rd (N)	1	5.0	0.50	1	3.2	0.34
2 – Essex Regiment Way (S)	17	41.9	0.96	3	5.6	0.71
3 – Braintree Rd (S)	3	11.6	0.71	2	12.2	0.66
4 – B1008	4	20.1	0.78	56	262.2	1.17
				*13**	*78.6*	*0.94*
2041 Forecast – Local Plan Review Pre-Submission without A12 DCO						
1 – Braintree Rd (N)	1	4.9	0.50	1	3.2	0.34
2 – Essex Regiment Way (S)	20	46.8	0.97	3	5.7	0.71
3 – Braintree Rd (S)	3	12.1	0.73	2	12.5	0.67
4 – B1008	4	20.1	0.78	61	287.0	1.19
				17	*96.2*	*0.96*

Within Capacity Approaching Capacity Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

19.1.2 Wheelers Hill Roundabout

Table I-2: Wheelers Hill Roundabout Local Junction Modelling Outputs - Existing Layout without A12 DCO

Future Layout	AM			PM		
	Queue (PCUs)	Delay (s)	RFC	Queue (PCUs)	Delay (s)	RFC
2041 Forecast – Baseline without A12 DCO						
1 – Essex Regiment Way (N)	6.8	18.33	0.88	4.1	14.67	0.81
2 – Wheelers Hill	6.0	18.61	0.86	1.2	4.69	0.54
3 – Essex Regiment Way (S)	1.1	5.74	0.51	1.9	5.71	0.66
2041 Forecast – Local Plan Review Pre-Submission without A12 DCO						
1 – Essex Regiment Way (N)	6.7	18.20	0.87	4.2	15.02	0.81
2 – Wheelers Hill	7.5	22.81	0.89	1.2	4.69	0.54
3 – Essex Regiment Way (S)	1.1	5.73	0.51	1.9	5.71	0.66

Within Capacity Approaching Capacity Over Capacity

19.1.3 Pratts Farm Roundabout

Table I-3: Pratts Farm Roundabout Local Junction Modelling Outputs - Existing Layout without A12 DCO

Existing Layout	AM			PM		
	Queue (PCUs)	Delay (s)	RFC	Queue (PCUs)	Delay (s)	RFC
2041 Forecast - Baseline without A12 DCO						
1 – Essex Regiment Way (N)	93.9	387.28	**1.20**	1.5	7.86	**0.60**
	**104.7*	*428.63*	***1.07***			
2 – Pratts Farm Lane	0.00	3.41	**0.04**	0.7	6.02	**0.42**
3 – Essex Regiment Way (S)	2.3	6.81	**0.70**	1.3	4.01	**0.57**
4 – Back Lane	0.3	5.06	**0.26**	13.1	70.72	**0.96**
2041 Forecast - LPRPS without A12 DCO						
1 – Essex Regiment Way (N)	91.3	374.63	**1.20**	1.5	7.57	**0.57**
	99.0	*406.45*	***1.07***			
2 – Pratts Farm Lane	0.00	3.42	**0.04**	0.6	5.72	**0.38**
3 – Essex Regiment Way (S)	2.4	7.02	**0.71**	1.1	3.58	**0.52**
4 – Back Lane	0.4	5.05	**0.27**	8.0	42.64	**0.89**

Within Capacity Approaching Capacity Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

Table I 4: Pratts Farm Roundabout Local Junction Modelling Outputs - Future Layout without A12 DCO

Future Layout	AM			PM		
	Queue (PCUs)	Delay (s)	RFC	Queue (PCUs)	Delay (s)	RFC
2041 Forecast - Baseline						
1 – Essex Regiment Way (N)	1.2	4.21	**0.54**	0.6	3.13	**0.27**
2 – P&R	0.00	0.00	**0.00**	0.5	5.33	**032**
3 – Pratts Farm Lane	0.1	4.23	**0.05**	0.2	5.40	**0.17**
4 – Essex Regiment Way (S)	9.3	28.68	**0.91**	57.2	156.71	**1.08**
5 – Back Lane	0.3	4.89	**0.25**	5.8	31.70	**0.87**
2041 Forecast - 'With LPRPS ' Scenario						
1 – Essex Regiment Way (N)	1.2	4.22	**0.54**	0.6	3.15	**0.37**
2 – P&R	0.00	0.00	**0.00**	0.5	5.53	**0.32**
3 – Pratts Farm Lane	0.1	4.24	**0.05**	0.2	5.48	**0.17**
4 – Essex Regiment Way (S)	10.7	32.49	**0.93**	62.0	168.61	**1.09**
				**27.1*	*92.04*	***0.98***
5 – Back Lane	0.4	4.89	**0.26**	7.5	39.60	**0.90**

Within Capacity Approaching Capacity Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

19.1.4 Belsteads Farm Roundabout

Table I-5: Belsteads Farm Roundabout Local Junction Modelling Outputs - Existing Layout without A12 DCO

Existing Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast – Baseline						
1 – Essex Regiment Way (N)	2	5.0	0.61	4	9.5	0.76
2 – Retail Access	0	0.0	0.00	0	7.9	0.71
3 – Channels Drive (offside)	40	196.8	1.10	2	17.0	0.67
	*2**	*12.5*	*0.57*			
4 – Channels Drive (nearside)	0	0.0	0.00	0	0.0	0.00
4 – Essex Regiment Way (S)	1	3.5	0.13	1	4.1	0.28
2041 Forecast - 'Without LPRPS ' Scenario						
1 – Essex Regiment Way (N)	2	5.0	0.61	4	9.8	0.77
2 – Retail Access	0	0.0	0.00	0	8.0	0.01
3 – Channels Drive (offside)	43	213.0	1.12	3	18.5	0.70
	2	*13.2*	*0.60*			
4- Channels Drive (nearside)	0	0.0	0.00	0	0.0	0.00
4 – Essex Regiment Way (s)	1	3.5	0.13	1	4.1	0.29

Within Capacity Approaching Capacity Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

Table I-6: Belsteads Farm Roundabout Local Junction Modelling Outputs – Future Layout without A12 DCO

Future Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast – Baseline						
1 – Essex Regiment Way (N)	2	5.7	0.64	5	13.3	0.82
2 – Retail Access	0	0.0	0.0	0	7.9	0.01
3 – Channels Drive (offside)	39	196.6	1.10	2	17.0	0.67
	*12**	*74.7*	*0.94*			
4 – Channels Drive (nearside)	0	0.0	0.0	0	0.0	0.0
5 – Essex Regiment Way (S)	1	1.6	0.06	1	1.7	0.14
2041 Forecast - 'With LPRPS ' Scenario						
1 – Essex Regiment Way (N)	2	5.7	0.64	5	14.1	0.83
2 – Retail Access	0	0	0.0	0	8.0	0.01
3 – Channels Drive (offside)	43	212.8	1.12	3	18.5	0.70
	14	*86.2*	*0.95*			
4 – Channels Drive (nearside)	0	0.0	0.0	0	0.0	0.0
5 – Essex Regiment Way (S)	1	1.6	0.06	1	1.7	0.14

Within Capacity Approaching Capacity Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

19.1.5 Armistice Avenue Roundabout

Table I-7: Armistice Avenue Roundabout Local Junction Modelling Outputs - Existing Layout without A12 DCO

Existing Layout	AM			PM		
	Queue (PCUs)	Delay (s)	RFC	Queue (PCUs)	Delay (s)	RFC
2041 Forecast – Baseline without A12 DCO						
1 – Essex Regiment Way (N)	78.6	174.46	**1.10**	4.3	12.56	**0.82**
	**2.7*	*8.67*	***0.73***			
2 – Development Access	0.0	0.0	**0.0**	0.0	0.0	**0.0**
3 – Armistice Avenue	9.9	57.28	**0.94**	0.3	4.98	**0.20**
4 – Essex Regiment Way (S)	1.2	4.09	**0.54**	3.8	8.43	**0.79**
2041 Forecast – LPRPS without A12 DCO						
1 – Essex Regiment Way (N)	81.3	179.72	**1.10**	4.5	13.12	**0.82**
	2.8	*8.91*	***0.74***			
2 – Development Access	0.0	0.0	**0.0**	0.0	0.0	**0.0**
3 – Armistice Avenue	10.4	59.56	**0.94**	0.3	4.99	**0.20**
4 – Essex Regiment Way (S)	1.3	4.16	**0.55**	4.0	8.81	**0.80**

● Within Capacity ● Approaching Capacity ● Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

19.1.6 Nabbotts Farm Roundabout

Table I-8: Nabbotts Farm Roundabout Local Junction Modelling Outputs - Existing Layout without A12 DCO

Existing Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast – Baseline without A12 DCO						
1 – Essex Regiment Way (n)	22.1	44.04	0.98	1.7	5.00	0.63
2 – White Hart Lane	1.8	11.93	0.64	5.8	26.15	0.86
3 – Pump Lane	0.3	3.74	0.21	0.6	4.83	0.36
4 – Chelmer Valley Road	1.2	5.02	0.54	5.9	19.91	0.86
2041 Forecast – LPRPS without A12 DCO						
1 – Essex Regiment Way (n)	21.4	42.68	0.98	1.7	5.00	0.63
2 – White Hart Lane	1.7	11.42	0.62	5.3	24.21	0.85
3 – Pump Lane	0.3	3.74	0.21	0.6	4.84	0.36
4 – Chelmer Valley Road	1.2	5.00	0.54	6.5	21.78	0.88

Within Capacity Approaching Capacity Over Capacity

Table I-9: Nabbotts Farm Roundabout Local Junction Modelling Outputs - Existing Layout without A12 DCO

Future Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast – Baseline without A12 DCO						
1 – Essex Regiment Way (n)	6.5	12.91	0.87	1.3	3.73	0.56
2 – White Hart Lane	1.9	12.17	0.64	5.8	26.16	0.86
3 – Pump Lane	0.3	3.77	0.21	0.6	4.83	0.36
4 – Chelmer Valley Road	1.2	5.02	0.54	5.9	19.91	0.86
2041 Forecast - LPRPS without A12 DCO						
1 – Essex Regiment Way (n)	6.4	12.68	0.87	1.3	3.73	0.56
2 – White Hart Lane	1.7	11.62	0.63	5.3	24.21	0.85
3 – Pump Lane	0.3	3.77	0.21	0.6	4.84	0.36
4 – Chelmer Valley Road	1.2	5.00	0.54	6.5	21.79	0.88

Within Capacity Approaching Capacity Over Capacity

19.1.7 Beaulieu Parkway / CNEB Roundabout

Table I-10: Beaulieu Parkway / CNEB Roundabout Local Junction Modelling Outputs - Existing Layout without A12 DCO

Existing Layout	AM			PM		
	Queue (PCUs)	Delay (s)	RFC	Queue (PCUs)	Delay (s)	RFC
2041 Forecast – Baseline without A12 DCO						
1 – CNEB (N)	5.8	21.50	**0.86**	1.4	7.26	**0.58**
2 – Generals Lane (N)	0.00	0.00	**0.00**	0.00	0.00	**0.00**
3 – Beaulieu Parkway (E)	1.1	4.93	**0.51**	72.5	143.66	**1.08**
				**26.2*	*66.09*	*0.97*
4 – Generals Lane (S)	0.2	4.24	**0.18**	0.1	5.70	**0.12**
5 – Remembrance Ave	0.2	4.66	**0.20**	0.1	5.32	**0.11**
6 – Beaulieu Parkway (W)	0.6	5.16	**0.38**	1.3	8.37	**0.56**
2041 Forecast – LPRPS without A12 DCO						
1 – CNEB (N)	6.0	22.09	**0.86**	1.4	7.22	**0.58**
2 – Generals Lane (N)	0.00	0.00	**0.00**	0.00	0.00	**0.00**
3 – Beaulieu Parkway (E)	1.1	4.95	**0.51**	70.0	139.46	**1.08**
				24.4	*62.05*	*0.97*
4 – Generals Lane (S)	0.2	4.25	**0.18**	0.1	5.72	**0.12**
5 – Remembrance Ave	0.2	4.66	**0.20**	0.1	5.33	**0.11**
6 – Beaulieu Parkway (W)	0.6	5.14	**0.38**	1.4	8.54	**0.58**

Within Capacity Approaching Capacity Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

Table I-11: Beaulieu Parkway / CNEB Roundabout Local Junction Modelling Outputs - Future Layout without A12 DCO

Future Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast – Baseline without A12 DCO						
1 – CNEB (N)	4.9	17.78	**0.83**	1.3	6.76	**0.57**
2 – Generals Lane (N)	0.00	0.00	**0.00**	0.00	0.00	**0.00**
3 – Beaulieu Parkway (E)	0.7	3.19	**0.40**	5.4	12.40	**0.85**
4 – Generals Lane (S)	0.2	4.24	**0.18**	0.1	6.28	**0.13**
5 – Remembrance Ave	0.2	4.66	**0.20**	0.1	5.78	**0.12**
6 – Beaulieu Parkway (W)	0.6	6.16	**0.38**	1.4	9.16	**0.59**
2041 Forecast – LPRPS without A12 DCO						
1 – CNEB (N)	5.0	18.2	**0.84**	1.3	6.72	**0.56**
2 – Generals Lane (N)	0.00	0.00	**0.00**	0.00	0.00	**0.00**
3 – Beaulieu Parkway (E)	0.7	3.19	**0.41**	5.3	12.18	**0.85**
4 – Generals Lane (S)	0.2	4.25	**0.18**	0.1	6.27	**0.13**
5 – Remembrance Ave	0.2	4.66	**0.20**	0.1	5.77	**0.12**
6 – Beaulieu Parkway (W)	0.6	5.14	**0.38**	1.5	9.32	**0.60**

● Within Capacity ● Approaching Capacity ● Over Capacity

19.1.8 Beaulieu Parkway / Railway Station Access Roundabout

Table I-12: Beaulieu Parkway / Railway Station Access Roundabout Local Junction Modelling Outputs - Future Layout without A12 DCO

Future Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast – Baseline without A12 DCO						
1 – Beaulieu Parkway (N)	18.3	45.01	**0.97**	2.0	6.59	**0.66**
2 – Loverose Way (E)	0.2	8.26	**0.18**	1.8	15.16	**0.64**
3 – Beaulieu Parkway (S)	8.88	23.22	**0.91**	70.3	135.27	**1.07**
				**23.5*	*57.74*	***0.97***
4 – Loverose Way (W)	0.6	6.24	**0.39**	5.3	31.71	**0.86**
2041 Forecast – LPRPS without A12 DCO						
1 – Beaulieu Parkway (N)	18.2	44.87	**0.97**	2.0	6.57	**0.66**
2 – Loverose Way (E)	0.22	8.27	**0.18**	1.8	15.07	**0.64**
3 – Beaulieu Parkway (S)	9.0	23.68	**0.91**	64.9	126.95	**1.07**
				20.5	*50.98*	***0.96***
4 – Loverose Way (W)	0.7	6.26	**0.39**	5.4	32.17	**0.86**

● Within Capacity ● Approaching Capacity ● Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

19.1.9 Waltham Road / Main Road

Table I-13: Waltham Road / Main Road Roundabout Local Junction Modelling Outputs - Existing Layout without A12 DCO

Existing Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast – Baseline without A12 DCO						
1 – Waltham Rd to Main Rd (e)	13	268.1	**1.09**	3	47.9	**0.76**
	**7*	*268.3*	***0.92***			
2 – Waltham Rd to Main Rd (w)	30	213.9	**1.11**	5	45.2	**0.84**
	13	*109.9*	***0.95***			
3 – Main Road	12	42.7	**0.91**	2	12.9	**0.48**
2041 Forecast – LPRPS without A12 DCO						
1 – Waltham Rd to Main Rd (e)	12	267.7	**1.09**	6	85.5	**0.89**
	7	*185.0*	***0.92***			
2 – Waltham Rd to Main Rd (w)	31	231.5	**1.14**	8	68.9	**0.92**
	13	*109.9*	***0.95***			
3 – Main Road	38	134.5	**1.04**	2	12.8	**0.48**
	5	*19.2*	***0.77***			

Within Capacity Approaching Capacity Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

19.1.10 Eves Corner Danbury

Table I-14: Eves Corner Danbury Roundabout Local Junction Modelling Outputs - Existing Layout without A12 DCO

Existing Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast – Baseline without A12 DCO						
Mayes Lane Roundabout (E)						
1 - Mayes Lane	1	28.3	0.10	1	25.4	0.26
2 – A414 Main Road (W)	6	26.6	0.85	87	356.3	1.17
				*95	371.5	1.06
Little Baddow Road Roundabout (W)						
3 – A414 Main Road (E)	153	576.1	1.28	12	46.3	0.94
	209	758.6	1.15			
4 - Little Baddow Road	12	118.9	1.01	7	88.0	0.90
	3	27.0	0.68			
2041 Forecast - LPRPS without A12 DCO						
Mayes Lane Roundabout (E)						
1 - Mayes Lane	1	28.7	0.11	1	29.1	0.31
2 – A414 Main Road (W)	6	28.2	0.86	45	162.3	1.08
				23	99.9	0.97
Little Baddow Road Roundabout (W)						
3 – A414 Main Road (E)	160	613.1	1.28	15	58.0	0.96
	232.4	861.2	1.18			
4 - Little Baddow Road	22	210.6	1.11	8	100.2	0.93
	6	56.4	0.92			

Within Capacity Approaching Capacity Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

19.1.11 A12 J15, Margaretting Interchange

Table I 15: A12 J15, Margaretting Interchange Local Junction Modelling Outputs - Existing Layout without A12 DCO

Existing Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast – Baseline without A12 DCO						
A12 J15 North						
1 – Three Mile Hill	3.2	6.50	**0.76**	3.1	6.60	**0.75**
3 – A414	1.4	5.37	**0.59**	0.8	3.92	**0.44**
4 – A12 NB off-slip	1.2	3.79	**0.52**	0.8	2.85	**0.43**
5 – Golf Club	0.00	0.00	**0.00**	0.00	0.00	**0.00**
A12 J15 South						
1 – A414	2.9	7.27	**0.74**	1.6	4.80	**0.60**
2 – A12 SB off-slip	14.3	59.28	**0.96**	0.8	5.79	**0.44**
3 – B1002	6.8	58.92	**0.90**	1.2	10.08	**0.54**
2041 Forecast – LPRPS without A12 DCO						
A12 J15 North						
1 – Three Mile Hill	3.4	6.87	**0.77**	3.0	6.51	**0.75**
3 – A414	1.5	5.46	**0.59**	0.8	3.96	**0.44**
4 – A12 NB off-slip	1.2	3.82	**0.52**	0.8	2.89	**0.44**
5 – Golf Club	0.0	0.00	**0.00**	0.0	0.00	**0.00**
A12 J15 South						
1 – A414	3.1	7.71	**0.76**	1.5	4.73	**0.60**
2 – A12 SB off-slip	17.8	71.83	**0.98**	0.8	5.75	**0.44**
3 – B1002	8.7	74.20	**0.94**	1.2	10.15	**0.54**

● Within Capacity ● Approaching Capacity ● Over Capacity

19.1.12 A12 J16, Galleywood Interchange

Table I-16: A12 J16, Galleywood Interchange Local Junction Modelling Outputs - Existing Layout without A12 DCO

Existing Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast – Baseline without A12 DCO						
A12 J15 North						
1 – Three Mile Hill	3.2	6.50	**0.76**	3.1	6.60	**0.75**
3 – A414	1.4	5.37	**0.59**	0.8	3.92	**0.44**
4 – A12 NB off-slip	1.2	3.79	**0.52**	0.8	2.85	**0.43**
5 – Golf Club	0.00	0.00	**0.00**	0.00	0.00	**0.00**
A12 J15 South						
1 – A414	2.9	7.27	**0.74**	1.6	4.80	**0.60**
2 – A12 SB off-slip	14.3	59.28	**0.96**	0.8	5.79	**0.44**
3 – B1002	6.8	58.92	**0.90**	1.2	10.08	**0.54**
2041 Forecast – LPRPS without A12 DCO						
A12 J15 North						
1 – Three Mile Hill	3.4	6.87	**0.77**	3.0	6.51	**0.75**
3 – A414	1.5	5.46	**0.59**	0.8	3.96	**0.44**
4 – A12 NB off-slip	1.2	3.82	**0.52**	0.8	2.89	**0.44**
5 – Golf Club	0.0	0.00	**0.00**	0.0	0.00	**0.00**
A12 J15 South						
1 – A414	3.1	7.71	**0.76**	1.5	4.73	**0.60**
2 – A12 SB off-slip	17.8	71.83	**0.98**	0.8	5.75	**0.44**
3 – B1002	8.7	74.20	**0.94**	1.2	10.15	**0.54**

● Within Capacity ● Approaching Capacity ● Over Capacity

19.1.13 A12 J18, Sandon Interchange

Table I-17: A12 J18, Sandon Interchange Local Junction Modelling Outputs - Existing Layout without A12 DCO

Existing Layout	AM			PM		
	Queue (PCUs)	Delay (s)	RFC	Queue (PCUs)	Delay (s)	RFC
2041 Forecast – Baseline without A12 DCO						
A12 J18 East						
1 - A12 J18 SB off-slip	1.5	8.0	**0.59**	3.9	21.1	**0.80**
2 - Hammonds Road	4.1	23.5	**0.81**	1.0	12.0	**0.50**
3 - A414 Maldon Road E	9.3	22.7	**0.91**	1.5	4.7	**0.59**
4 - A414 Maldon Road bridge	1.0	3.6	**0.50**	3.3	7.6	**0.77**
A12 J18 West						
5 - A414 Maldon Rd bridge	19.1	45.3	**0.97**	4.0	11.4	**0.81**
6 - A12 J18 NB off-slip	1.2	7.7	**0.55**	2.4	9.9	**0.70**
7 - Maldon Road W	2.2	9.2	**0.69**	35.0	102.0	***1.03***
				*5.2**	*18.2*	***0.84***
2041 Forecast – Local Plan Review Pre-Submission without A12 DCO						
A12 J18 East						
1 - A12 J18 SB off-slip	2.0	10.1	**0.67**	31.9	127.6	**1.05**
				6.6	*32.0*	***0.87***
2 - Hammonds Road	63.3	228.0	**1.14**	3.9	27.0	**0.81**
	18.2	*83.2*	***0.96***			
3 - A414 Maldon Road E	9.8	24.6	**0.92**	2.2	6.5	**0.68**
4 - A414 Maldon Road bridge	1.3	4.0	**0.56**	4.7	10.2	**0.83**
A12 J18 West						
5 - A414 Maldon Rd bridge	65.6	123.5	**1.06**	10.6	26.9	**0.93**
	22.0	*52.5*	***0.97***			
6 - A12 J18 NB off-slip	1.3	8.2	**0.55**	5.2	20.9	**0.84**
7 - Maldon Road W	3.3	12.7	**0.77**	105.7	288.7	**1.20**
				19.3	*66.1*	***0.96***

Within Capacity Approaching Capacity Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

19.1.14 Odeon Roundabout

Table I-18: Odeon Roundabout Local Junction Modelling Outputs - Existing Layout without A12 DCO

Existing Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast – Baseline without A12 DCO						
1 - A1099 High Bridge Road	2.8	12.61	**0.74**	3.2	14.40	**0.77**
2 - A1060 Parkway (E)	6.4	8.44	**0.87**	19.3	38.21	**0.97**
3 - Manor Road	0.0	0.0	**0.00**	0.00	0.00	**0.00**
4 - A1060 Parkway (W)	1.7	3.40	**0.62**	152.8	177.07	**1.12**
				*41.8	*63.17*	***0.99***
2041 Forecast - 'With LPRPS' Scenario						
1 - A1099 High Bridge Road	5.3	21.70	**0.85**	4.8	19.40	**0.84**
2 - A1060 Parkway (E)	8.3	10.93	**0.90**	56.1	92.23	**1.04**
				*13.0	*26.68*	***0.93***
3 - Manor Road	0.00	0.00	**0.00**	0.00	0.00	**0.00**
4 - A1060 Parkway (W)	1.8	3.60	**0.64**	168.9	209.01	**1.13**
				*41.8	*63.17*	***0.99***

● Within Capacity ● Approaching Capacity ● Over Capacity

** Outputs in italics have been modelled using a FLAT demand profile*

19.2 LinSig Modelling Outputs

19.2.1 A12 J17, Howe Green

Table I-19: A12 J17, Howe Green Local Junction Modelling Outputs - Existing Layout without A12 DCO

Existing Layout	AM				PM			
	Mean Max Queue (PCUs)	Average Delay (s/pcus)	DoS	Total Delay (pcu hrs)	Mean Max Queue (PCUs)	Average Delay (s/pcus)	DoS	Total Delay (pcu hrs)
2041 Forecast – Baseline without A12 DCO								
1 - A12 (SB off-slip)	17.6	20.6	0.82	5.6	16.2	22.9	0.80	5.5
2 - Southend Rd (SE)	2.4	30.4	0.66	1.5	58.8	387.9	1.23	48.7
3 - A130	590.3	769.2	1.65	481.6	513.6	746.6	1.62	414.5
4 - A12 (NB off-Slip)	50.9	566.7	1.36	48.5	99	868.8	1.75	95.3
5 - A1114 Southend Rd (NW)	166.1	801.0	1.67	158.2	145.1	689.0	1.52	154.6
2041 Forecast – LPRPS without A12 DCO								
1 - A12 (SB off-slip)	18.0	20.9	0.82	5.7	16.3	23.2	0.81	5.6
2 - Southend Rd (E)	3.0	36.9	0.74	2.0	48.9	4.0	1.25	1.6
3 - A130	583.7	768.3	1.65	475.9	531.9	776.0	1.66	433.9
4 - A12 (NB off-Slip)	49.9	588.9	1.38	47.6	92.9	837.4	1.70	89.3
5 - A1114 Southend Rd (W)	171.5	816.8	1.69	163.6	166	685.1	1.52	158.7

● Within Capacity ● Approaching Capacity ● Over Capacity

19.2.2 Army and Navy Roundabout

Table I-20: Army and Navy Roundabout Local Junction Modelling Outputs - Future Layout without A12 DCO

Future Layout	AM				PM			
	Mean Max Queue (PCUs)	Average Delay (per PCUs)	DoS	Total Delay (pcu hrs)	Mean Max Queue (PCUs)	Average Delay (per PCUs)	DoS	Total Delay (pcu hrs)
2041 Forecast – Baseline								
1 – Parkway	11	33.1	0.90	5.0	56	188	0.89	46.9
2 - Chelmer Road	269	602.5	0.50	254.9	13	45.9	0.58	10.3
3 - Essex Yeomanry Way	7	22.9	0.80	2.7	7	38.1	0.92	6.2
4 - Baddow Road	134	690.5	1.51	129.1	11	30.1	0.78	4.5
5 - Van Diemans Road	27	70.6	0.99	14.5	116	312.2	1.18	75.7
2041 Forecast - 'With LPRPS' Scenario								
1 – Parkway	11	33.1	0.90	5.4	11	37.5	0.93	8
2 - Chelmer Road	272	603.3	0.52	257.9	71	289.3	0.71	67.8
3 - Essex Yeomanry Way	12	37.5	0.85	4.6	8	42.5	0.93	7
4 - Baddow Road	135	692.4	1.51	129.6	12	32.6	0.82	5.1
5 - Van Diemans Road	8	6.7	0.54	1.4	122	337.2	1.19	82.3

● Within Capacity ● Approaching Capacity ● Over Capacity

19.2.3 Sandon Park and Ride Access

Table I-21: Sandon Park and Ride Access Local Junction Modelling Outputs - Future Layout without A12 DCO

Future Layout	AM				PM			
	Mean Max Queue (PCUs)	Average Delay (per PCUs)	DoS	Total Delay (pcu hrs)	Mean Max Queue (PCUs)	Average Delay (per PCUs)	DoS	Total Delay (pcu hrs)
2041 Forecast – Baseline without A12 DCO								
1 – Sandon P&R	0.0	0.0	**0.0**	0.0	5.5	30.4	0.66	2.6
2 – Maldon Road (E)	5.6	8.2	0.64	2.7	0.6	2.0	0.54	0.6
3 – Maldon Road (W)	6.6	15.7	0.73	4.1	5.9	15.8	0.66	3.6
2041 Forecast – LPRPS without A12 DCO								
1 – Sandon P&R	0.0	0.0	0.0	0.0	5.8	31.4	0.68	2.8
2 – Maldon Road (E)	5.5	8.1	0.67	2.8	0.6	2.2	0.57	0.6
3 – Maldon Road (W)	7.7	16.7	0.79	4.8	6.2	16.3	0.69	3.8

● Within Capacity ● Approaching Capacity ● Over Capacity

19.3 VISSIM Modelling Outputs

19.3.1 A12 Junction 19, Boreham Interchange

As documented in Section 8.1.2 in the main body of the report, findings from a recent AECOM junction modelling study strongly indicate that the current layout of the Boreham Interchange would have insufficient capacity to accommodate forecast development. It is therefore expected that capacity improvements proposed as part of the A12 widening DCO would be required, as a minimum, to support delivery of future housing and employment in Chelmsford.

With this in mind, a decision has been made to not model the capacity performance of the Boreham Interchange for the Local Plan Pre-Submission sensitivity test scenarios without capacity improvements associated with the A12 widening DCO.