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1 Introduction

1.1 Introduction

This technical note details the local junction modelling undertaken as part of the transport impact appraisal of Chelmsford City Council (CCC)'s Local Plan Review Preferred Spatial Approach.

The report serves as an addendum to the published evidence base document titled: "Chelmsford Local Plan Review: Transport Impact Appraisal of Preferred Spatial Approach", issued by Essex Highways in March 2024.

Separation of this technical note has allowed the reporting of the Preferred Spatial Approach appraisal to cover the outcomes from modelling the latest junction designs (as of March 2024) from a developer-led assessment into the transport impact and mitigation of development trips associated with the Chelmsford Garden Community (Strategic Growth Site 6) development in north-east Chelmsford.

The outputs presented and summary of findings contained within this technical note 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 Preferred Spatial Approach. Junction infrastructure proposals presented in this technical note 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 Local Plan mitigation, up to 2041 is contained within the March 2024 Preferred Spatial Approach report.

2 Local Junction Modelling Methodology

2.1 Local Junction Modelling Scope

Capacity assessments were undertaken at 15 junctions on the strategic and local road network in Chelmsford. Junctions were selected for assessment based on expected Local Plan impact as a result of:

a) Their location in proximity to larger development sites proposed as part of CCC's preferred 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 2.1 below. Figure 2.1 shows the location of these junctions in relation to the preferred spatial approach development site areas.

Table 2.1: 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 J17 Howe Green	LinSig
	11) A12 J18 Sandon	Junctions 10
	12) A12 J19 Boreham Interchange	VISUM
City Centre	13) Army & Navy Roundabout	LinSig
	14) Odeon Roundabout	Junctions 10
Outer	15) Eves Corner, Danbury	Junctions 10

Figure 2.1: Location of modelled junctions in relation to Preferred Spatial Approach indicative development site areas.

2.2 Modelling Approach

2.2.1 Peak Hours Modelled

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

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

2.2.2 Assessment Years Modelled

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

Base year junction models were calibrated using 2022 journey time data, as detailed in the following sections of this technical note.

2.2.3 Junction Modelling Software Used

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

Eves Corner in Danbury was 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 of both the AM and PM peak hours. A decision was therefore made to model the junction without signal controls.

Equivalent junction capacity outputs were taken directly from the Chelmsford VISUM model for the A12 J19 Boreham Interchange. This removed the possibility of outputs from a bespoke LinSig model developed for the Local Plan review contrasting with outputs from comparable Boreham Interchange junction models built by/for National Highways as part of the A12 Chelmsford to A120 widening Development Consent Order (DCO).

2.2.4 Base Year Model Build

Models for eleven 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 as the Local Plan modelling appraisal made use of existing forecast-year LinSig models built and

approved for the appraisal of design options for the redevelopment of the junction (see section 1.3.6.2). As mentioned earlier, the A12 J19 Boreham Interchange was modelled in VISUM.

2.2.4.1 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 2.1). 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 and the A12 J18 Sandon Interchange, was taken from 2017 and 2018 surveys respectively. 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 the signalised junction at A12 J17 Howe Green, LinSig demand matrices were calculated through a furnessing process using turning count data from two separate MCC surveys collected in August 2020 (southern roundabout) and September 2021 (northern roundabout). The final furnessed matrices were then checked against historic 2016 origin-destination matrices to ensure that turning proportions were broadly comparable and suitable to take forward for model calibration.

2.2.4.2 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 2.2 below.

Table 2.2: 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.

2.2.4.3 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.

2.2.5 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.

2.2.5.1 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 modelled approach arms in alignment with established best practices and industry guidelines.

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.

2.2.5.2 Journey Time Calibration Statistics

Table 2.3 on the following page summarises the observed and modelled delay on junction approach arms following model calibration.

Table 2.3: 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	18	5	5
Maldon Road (W)	11	3	12	5
NB Slip	26	6	10	4
SB Slip	4	4	4	5
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
A12 J17 HOWE GREEN				
A12 SB off-slip	7	20	6	47
Southend Road	176	44	55	442
A130	79	10	61	8
A12 NB off-slip	72	39	82	36
A1114	27	29	13	30

Due 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.

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 NB on-slip extending back through the junction as shown in the Google Maps screenshot below.

Figure 2.2: Google Maps screenshot of peak hour queuing on A12 NB 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 findings will support those already highlighted in the preferred spatial approach strategic modelling report.

2.2.6 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 2.2.6.1), 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 sections 2.2.6.2 and 2.2.6.3 of this note.

2.2.6.1 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.

2.2.6.2 Army and Navy Roundabout Future Layout

Figure 2.3: 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[1] as shown in Figure 2.3 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.

2.2.6.3 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 2.4 overleaf.

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

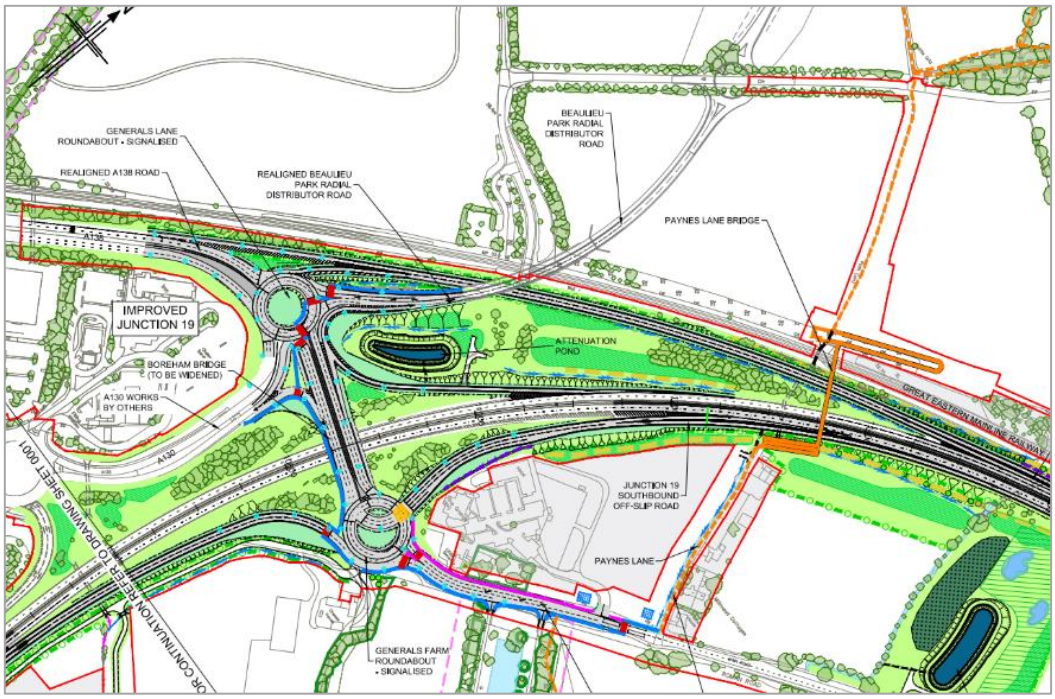

Figure 2.4: Latest National Highways proposals for the Boreham Interchange[2]

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

2.2.7 Future Junction Demand Matrices

With the exception of the A12 Junction 19 Boreham Interchange and 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 Local Plan Review development trips.

2.2.7.1 Hammonds Farm development modelling (Proposed Strategic Growth site 16a)

The 2041 demand flows derived from the 'With Local Plan' VISUM forecast modelled scenario, includes trips associated development on Hammonds Farm up to end of the Local Plan review period in 2041.

[2] 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

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 total planned on the site is for 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 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).

For a traffic impact appraisal to be of value, the full extent of the Hammonds Farm development would therefore be better modelled through the next iteration of a new or review Local Plan (alongside other, yet unknown, future Local Plan allocations, post 2041), as well as through the planning application process.

2.2.7.2 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 2.5 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.

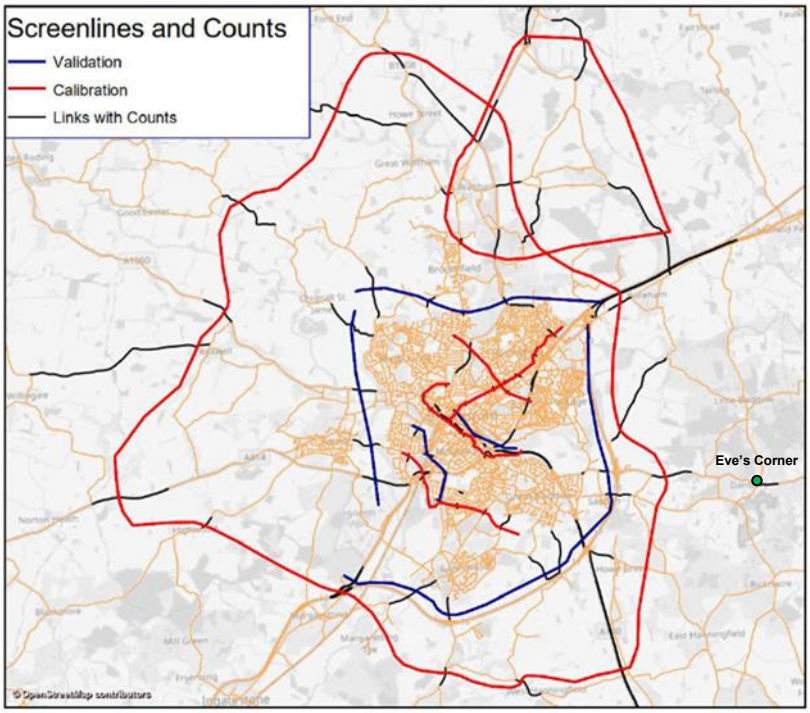

Figure 2.5: Cordons and Screenlines used in 2019 base model calibration/validation

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 Local Plan 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 2.4 below, to create a matching base with the 2019 Chelmsford VISUM model.

Table 2.4: 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

2.2.8 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.

3 Local Junction Modelling Outputs

This section presents the outputs of the local junction modelling for the 2041 'Baseline' and 'With Local Plan' 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.

3.1 Junctions 10 Modelling (ARCADY and PICADY) Outputs

3.1.1 Sheepcotes Roundabout

As shown in Figure 3.1 overleaf, 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 3.1 overleaf shows that the addition of Local Plan Preferred Spatial Approach 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 3.1: Sheepcotes Roundabout Existing Layout

Table 3.1: Sheepcotes 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 – Braintree Rd (N)	0	4.81	0.48	0	3.23	0.35
2 – Essex Regiment Way (S)	24	57.20	0.99	2	5.92	0.72
	*6	*16.82*	*0.87*			
3 – Braintree Rd (S)	2	13.06	0.74	2	12.38	0.67
4 – B1008	3	20.75	0.79	92	412.06	1.29
				59	*310.72*	***1.04***
2041 Forecast - 'With Local Plan' Scenario						
1 – Braintree Rd (N)	0	4.87	0.48	0	3.33	0.37
2 – Essex Regiment Way (S)	28	64.93	1.00	2	6.29	0.73
	7	*18.08*	*0.87*			
3 – Braintree Rd (S)	3	14.15	0.76	2	12.83	0.68
4 – B1008	4	22.23	0.80	99	443.12	1.32
				74	*387.59*	*1.06*

● Within Capacity ● Approaching Capacity ● Over Capacity

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

3.1.2 Wheelers Hill Roundabout

The existing layout of the three-arm Wheelers Hill roundabout is shown in Figure 3.2 below. 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 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 3.2: Wheelers Hill Roundabout Existing Layout

The results in Table 3.2 again show that the addition of Local Plan development trips from the Preferred Spatial Approach 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 3.2: Wheelers Hill 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)	6	17	**0.87**	4	14	**0.81**
2 – Wheelers Hill	5	17	**0.85**	1	5	**0.57**
3 – Essex Regiment Way (S)	1	6	**0.55**	2	7	**0.70**
2041 Forecast - 'With Local Plan' Scenario						
1 – Essex Regiment Way (N)	6	17	**0.87**	4	15	**0.81**
2 – Wheelers Hill	6	20	**0.87**	1	5	**0.58**
3 – Essex Regiment Way (S)	1	6	**0.55**	2	7	**0.70**

● Within Capacity ● Approaching Capacity ● Over Capacity

3.1.3 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 3.3 overleaf.

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 Tables 3.3 and 3.4 demonstrate very little difference between the Baseline and Local Plan modelled scenarios, suggesting that trips associated with the Preferred Spatial Approach 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 3.3: Pratts Farm Roundabout Existing Layout

Table 3.3: 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)	131.1	567	**1.28**	1	9.16	**0.64**
	**180.7*	*743*	***1.14***			
2 – Pratts Farm Lane	0	3	**0.04**	0	6.75	**0.46**
3 – Essex Regiment Way (S)	2	8	**0.75**	1	4.42	**0.61**
4 – Back Lane	0	6	**0.32**	36	168.15	**1.08**
				7	*42.90*	**0.89**
2041 Forecast - 'With Local Plan' Scenario						
1 – Essex Regiment Way (N)	136.3	589	**1.29**	1.7	9	**0.64**
	189.2	*780*	***1.15***			
2 – Pratts Farm Lane	0	3	**0.04**	0	7	**0.46**
3 – Essex Regiment Way (S)	3	9	**0.77**	1	4	**0.61**
4 – Back Lane	0	6	**0.33**	62	261	**1.17**
				62	*91*	***0.96***

● Within Capacity ● Approaching Capacity ● Over Capacity

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

Table 3.4: 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)	6	23	0.87	0	3.72	0.43
2 – P&R	0	0	0	0	5.22	0.31
3 – Pratts Farm Lane	0	4	0.06	0	7.52	0.22
4 – Essex Regiment Way (S)	5	17	0.86	3	6.93	0.71
5 – Back Lane	0	5	0.31	18	89.80	1.00
				*4	*42.90*	0.89
2041 Forecast - 'With Local Plan' Scenario						
1 – Essex Regiment Way (N)	7	26	0.89	0	4	0.43
2 – P&R	0	0	0	0	5	0.31
3 – Pratts Farm Lane	0	4	0.06	0	8	0.23
4 – Essex Regiment Way (S)	8	25	0.91	2	7	0.71
5 – Back Lane	0	5	0.33	39	166	1.08
				8	*46*	0.90

Within Capacity Approaching Capacity Over Capacity

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

3.1.4 Belsteads Farm Roundabout

As shown in Figure 3.4 overleaf, 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 Tables 3.5 and 3.6 indicate that the Local Plan Preferred Spatial Approach 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 3.4: Belsteads Farm Roundabout Existing Layout

Table 3.5: 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	6	**0.68**	7	20	**0.89**
2 – Retail Access	0	0	**0**	0	0	**0**
3 – Channels Drive (offside)	1	13	**0.52**	0	7	**0.17**
4 – Channels Drive (nearside)	1	11	**0.52**	1	6	**0.33**
5 – Essex Regiment Way (S)	0	4	**0.12**	0	4	**0.27**
2041 Forecast - 'With Local Plan' Scenario						
1 – Essex Regiment Way (N)	2	6	**0.68**	8	24	**0.90**
2 – Retail Access	0	0	**0**	0	0	**0**
3 – Channels Drive (offside)	1	13	**0.55**	0	7	**0.18**
3 – Channels Drive (nearside)	1	12	**0.54**	1	6	**0.33**
4 – Essex Regiment Way (s)	0	4	**0.12**	0	4	**0.28**

● Within Capacity ● Approaching Capacity ● Over Capacity

Table 3.6: 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	6	**0.68**	2	6	**0.68**
2 – Retail Access	0	0	**0**	0	0	**0**
3 – Channels Drive (offside)	1	13	**0.52**	1	13	**0.55**
4 – Channels Drive (nearside)	1	11	**0.52**	1	12	**0.54**
5 – Essex Regiment Way (S)	0	2	**0.06**	0	2	**0.06**
2041 Forecast - 'With Local Plan' Scenario						
1 – Essex Regiment Way (N)	7	20	**0.89**	8.4	24	**0.90**
2 – Retail Access	0	0	**0**	0	0	**0**
3 – Channels Drive (offside)	0	7	**0.17**	0	7	**0.18**
4 – Channels Drive (nearside)	0	6	**0.33**	1	6	**0.33**
5 – Essex Regiment Way (S)	0	2	**0.13**	0	2	**0.14**

● Within Capacity ● Approaching Capacity ● Over Capacity

3.1.5 Armistice Avenue Roundabout

Armistice Avenue Roundabout operates as a four-arm junction as illustrated in Figure 3.5 overleaf.

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 Tables 3.7 and 3.8 again show a negligible impact from Local Plan development trips from the Preferred Spatial Approach 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 3.5: Armistice Avenue Junction Existing Layout

Table 3.7: Armistice Avenue 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)	38	96	1.03	3	10	0.78
	*12	38	0.93			
2 – Development Access	0	0	0	0	0	0
3 – Armistice Avenue	10	58	0.94	0	5	0.20
4 – Essex Regiment Way (S)	1	4	0.53	4	10	0.82
2041 Forecast - 'With Local Plan' Scenario						
1 – Essex Regiment Way (N)	40	99	1.03	3	10	0.77
	13	39	0.94			
2 – Development Access	0	0	0	0	0	0
3 – Armistice Avenue	9	56	0.94	0	5	0.19
4 – Essex Regiment Way (S)	1	4	0.54	4	10	0.82

● Within Capacity ● Approaching Capacity ● Over Capacity

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

Table 3.8: 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)	1.4	4	**0.58**	1	4	**0.59**
2 – Development Access	0	0	**0**	0	0	**0**
3 – Armistice Avenue	1	7	**0.45**	0	4	**0.05**
4 – Essex Regiment Way (S)	0	3	**0.09**	0	3	**0.15**
2041 Forecast - 'With Local Plan' Scenario						
1 – Essex Regiment Way (N)	1	4	**0.58**	1	4	**0.59**
2 – Development Access	0	0	**0**	0	0	**0**
3 – Armistice Avenue	1	7	**0.45**	0	4	**0.05**
4 – Essex Regiment Way (S)	0	3	**0.08**	0	3	**0.15**

● Within Capacity ● Approaching Capacity ● Over Capacity

3.1.6 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 3.6 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.

Tables 3.9 and 3.10 show very little change between the baseline and Local Plan modelled scenarios – suggesting that the impact of Preferred Spatial Approach development trips at this junction is likely to be very small.

Whilst the addition of Local Plan 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 3:6: Nabbotts Farm Roundabout Existing Layout

Table 3.9: Nabbotts 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)	14	32	0.95	1	4	0.59
2 – White Hart Lane	1	9	0.51	2	12	0.68
3 – Pump Lane	0	4	0.29	0	5	0.36
4 – Chelmer Valley Road	1	5	0.55	7	23	0.89
2041 Forecast - 'With Local Plan' Scenario						
1 – Essex Regiment Way (n)	14	31	0.95	1	4	0.59
2 – White Hart Lane	1	8	0.47	2	11	0.66
3 – Pump Lane	0	4	0.32	0	5	0.38
4 – Chelmer Valley Road	1	5	0.56	8	28	0.91

● Within Capacity ● Approaching Capacity ● Over Capacity

Table 3.10: Nabbotts Farm 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)	5	11	**0.85**	1	3	**0.53**
2 – White Hart Lane	1	9	**0.51**	2	12	**0.68**
3 – Pump Lane	0	4	**0.29**	0	5	**0.36**
4 – Chelmer Valley Road	1	5	**0.55**	7	23	**0.89**
2041 Forecast - 'With Local Plan' Scenario						
1 – Essex Regiment Way (n)	5	11	**0.85**	1	3	**0.53**
2 – White Hart Lane	1	8	**0.48**	2	11	**0.66**
3 – Pump Lane	0	4	**0.32**	0	5	**0.38**
4 – Chelmer Valley Road	1	5	**0.56**	8	28	**0.91**

● Within Capacity ● Approaching Capacity ● Over Capacity

3.1.7 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 3.7 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 Tables 3.11 and 3.12, suggest that Local Plan impact from the Preferred Spatial Approach 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 3.7: Beaulieu Parkway / CNEB Roundabout Existing Layout

Table 3.11: 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)	16	56	0.97	1	9	0.62
2 – Generals Lane (N)	0	0	0	0	0	0
3 – Beaulieu Parkway (E)	1	6	0.57	115	241	1.14
				*87	199	1.03
4 – Generals Lane (S)	0	4	0.19	0	6	0.12
5 – Remembrance Ave	0	5	0.21	0	5	0.11
6 – Beaulieu Parkway (W)	1	6	0.49	2	14	0.74
2041 Forecast - 'With Local Plan' Scenario						
1 – CNEB (N)	19	64	0.98	1	9	0.65
2 – Generals Lane (N)	0	0	0	0	0	0
3 – Beaulieu Parkway (E)	1	6	0.59	116	244	1.14
				89.5	204	1.03
4 – Generals Lane (S)	0	5	0.20	0	6	0.12
5 – Remembrance Ave	0	5	0.21	0	5	0.11
6 – Beaulieu Parkway (W)	1	6	0.50	2	14	0.75

● Within Capacity ● Approaching Capacity ● Over Capacity

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

Table 3.12: 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)	11	41	0.94	1	8	0.61
2 – Generals Lane (N)	0	0	0	0	0	0
3 – Beaulieu Parkway (E)	0	3	0.45	7	17	0.90
4 – Generals Lane (S)	0	4	0.19	0	7	0.14
5 – Remembrance Ave	0	5	0.21	0	6	0.13
6 – Beaulieu Parkway (W)	1	6	0.49	3	18	0.79
2041 Forecast - 'With Local Plan' Scenario						
1 – CNEB (N)	13	46	0.95	1	8	0.63
2 – Generals Lane (N)	0	0	0	0	0	0
3 – Beaulieu Parkway (E)	0	4	0.47	8	18	0.90
4 – Generals Lane (S)	0	5	0.20	0	7	0.14
5 – Remembrance Ave	0	5	0.21	0	6	0.13
6 – Beaulieu Parkway (W)	1	6	0.50	3	18	0.80

● Within Capacity ● Approaching Capacity ● Over Capacity

3.1.8 Beaulieu Parkway / Railway Station Access Roundabout

The existing layout for the Beaulieu Station access roundabout consists of four arms as shown in Figure 3.8 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 3.13 again show the very minor impact that Local Plan development trips associated with the Preferred Spatial Approach 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 3.8: Beaulieu Parkway / Railway Station Access Roundabout - Existing Layout

Table 3.13: Beaulieu Parkway / Railway Station Access Roundabout Local Junction Modelling Outputs - Mitigation Layout

Future Layout	AM Queue (PCUs)	AM Delay (s)	AM RFC	PM Queue (PCUs)	PM Delay (s)	PM RFC
2041 Forecast - Baseline						
1 – Beaulieu Parkway (N)	94	173	1.11	3	10	0.78
	*32	76	0.98			
2 – Loverose Way (E)	0	9	0.19	2	22	0.72
3 – Beaulieu Parkway (S)	12	33	0.94	146	312	1.17
				150	320	1.06
4 – Loverose Way (W)	0	7	0.40	4	26	0.82
2041 Forecast - 'With Local Plan' Scenario						
1 – Beaulieu Parkway (N)	103	187	1.12	3	11	0.79
	41	95	0.99			
2 – Loverose Way (E)	0	9	0.19	2	24	0.73
3 – Beaulieu Parkway (S)	17	42	0.96	147	315	1.17
				153	325	1.06
4 – Loverose Way (W)	0	7	0.41	4	26	0.82

Within Capacity Approaching Capacity Over Capacity

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

3.1.9 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 3.9 overleaf. Currently there are no plans in place to revise the layout of this junction.

The modelled results shown in Table 3.14 indicate that the junction is mostly expected to operate within capacity, except for Main Road which operates fractionally over-capacity in the PM peak in the forecast Baseline scenario. This is likely due to an increase in right-turning vehicles blocking straight-ahead movements at the junction.

The addition of Local Plan development trips associated with the Preferred Spatial Approach does not appear to worsen conditions modelled along Main Road in either peak hour. Journey time delay and RFC values for Waltham Road do increase; however, the approach arm remains sufficiently within capacity.

Figure 3.9: Waltham Road / Main Road Priority Junction Existing Layout

Table 3.14: 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)	0	16	**0.23**	0	19	**0.37**
2 – Waltham Rd to Main Rd (w)	2	25	**0.69**	2	34	**0.75**
3 – Main Road	2	14	**0.64**	24	107	**1.01**
				*9	*42*	***0.88***
2041 Forecast - 'With Local Plan' Scenario						
1 – Waltham Rd to Main Rd (e)	0	25	**0.33**	0	26	**0.44**
2 – Waltham Rd to Main Rd (w)	3	38	**0.81**	3	42	**0.81**
3 – Main Road	2	14	**0.64**	21	95	**0.99**

● Within Capacity ● Approaching Capacity ● Over Capacity

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

3.1.10 Eves Corner Double Mini Roundabout, Danbury

As shown in Figure 3.10 below, 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 3.15 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 Preferred Spatial Approach. The Local Plan 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 3.15 would be best used to consider the relative impact of Local Plan development trips at the junction, as opposed to focussing on absolute junction capacity values.

Figure 3.10: Eves Corner Roundabout Existing Layout

Table 3.15: 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	0	29	0.1	0	24	0.26
2 – A414 Main Road (W)	4	22	0.82	74	286	1.15
				*67.9	272	1.04
Little Baddow Road Roundabout (W)						
3 – A414 Main Road (E)	145	556	1.27	9	39	0.92
	197.2	725	1.15			
4 - Little Baddow Road	14	142	1.05	4	66	0.84
	2	28	0.73			
2041 Forecast - 'With Local Plan' Scenario						
Mayes Lane Roundabout (E)						
1 - Mayes Lane	0	29	0.11	0	27	0.31
2 – A414 Main Road (W)	3	18	0.77	17	77	0.99
Little Baddow Road Roundabout (W)						
3 – A414 Main Road (E)	162	648	1.29	11	46	0.94
	242	923	1.19			
4 - Little Baddow Road	32	274	1.17	4	70	0.87
	22.7	227	1.01			

● Within Capacity ● Approaching Capacity ● Over Capacity

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

3.1.11 A12 Junction 18, Sandon Interchange

As shown in Figure 3.11 overleaf, the Sandon Interchange is a grade-separated 'dumbbell roundabout' junction on the A12.

The modelled results shown in Table 3.16 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. However, the impact on the capacity of the A414 Maldon Road (E) arm will likely be significant as a direct result of proposed Local Plan development at Hammonds Farm and the employment site located east of the A12 (south of the A414).

A sensitivity test using a FLAT demand profile was shown to reduce overall RFC values at the junction – particularly along Maldon Road (E), although modelled queues and delays along the approach were not similarly reduced.

Initial proposals to mitigate the traffic impact of development at Hammonds Farm on this junction are contained within section 7.3.2 of the Transport Impact Appraisal of Preferred Spatial Approach (March 2024). These will be further refined through the ongoing Local Plan, master planning and planning application process.

Figure 3.11: A12 Junction 18 Sandon Interchange Existing Layout

Table 3.16: A12 Junction 18 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						
A12 J18 East						
1 - A12 J18 SB off-slip	0	5	0.41	2	12	0.71
2 - Hammonds Road	3	22	0.8	2	24	0.73
3 - A414 Maldon Road E	28	65	1.00	2	8	0.72
	*7	19	0.88			
4 - A414 Maldon Road bridge	1	4	0.55	3	8	0.79
A12 J18 West						
5 - A414 Maldon Rd bridge	18	44	0.97	7	20	0.89
6 - A12 J18 NB off-slip	1	7	0.53	2	12	0.74
7 - Maldon Road W	1	5	0.58	8	27	0.9
2041 Forecast - 'With Local Plan' Scenario						
A12 J18 East						
1 - A12 J18 SB off-slip	1	7	0.56	9	41	0.93
2 - Hammonds Road	41	187	1.1	13	111	1.00
	8	45	0.89	3	30	0.77
3 - A414 Maldon Road E	176	402	1.21	17	43	0.98
	218	460	1.09			
4 - A414 Maldon Road bridge	1	5	0.66	4	10	0.83
A12 J18 West						
5 - A414 Maldon Rd bridge	10	28	0.92	21	51	0.98
6 - A12 J18 NB off-slip	1	8	0.59	7	29	0.89
7 - Maldon Road W	2	8	0.71	27	84	1.02
				5	20	0.85

● Within Capacity ● Approaching Capacity ● Over Capacity

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

3.1.12 Odeon Roundabout

As shown in Figure 3.12 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 3.17 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 Local Plan Preferred Spatial Approach development has little impact on the performance on this junction. The A1060 Parkway (both the E and W 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 (E) would potentially operate near to capacity.

Figure 3.12: Odeon Roundabout Existing Layout

Table 3.17: Odeon 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 - A1099 High Bridge Road	3	15	**0.77**	3	15	**0.78**
2 - A1060 Parkway (E)	7	10	**0.89**	53	88	**1.04**
						0.93
3 - Manor Road	0	0	**0**	0	0	**0**
4 - A1060 Parkway (W)	2	3	0.63	174	214	**1.14**
				**86*	*123*	***1.01***
2041 Forecast - 'With Local Plan' Scenario						
1 - A1099 High Bridge Road	4	20	**0.82**	4	17	**0.82**
2 - A1060 Parkway (E)	9	12	**0.91**	92	141	**1.08**
				25	*51*	*0.97*
3 - Manor Road	0	0	**0**	0	0	**0**
4 - A1060 Parkway (W)	2	4	**0.65**	194	264	**1.15**
				157	*220*	***1.04***

● Within Capacity ● Approaching Capacity ● Over Capacity

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

3.2 LinSig Modelling Outputs

3.2.1 A12 Junction 17, Howe Green

As shown in Figure 3.13 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 3.18 demonstrate that the junction is expected to operate over capacity in both the AM and PM peak hours, across both Baseline and Local Plan scenarios. Modelled queues and delay times are significant across all arms of the junction, particularly Southend Road (E).

Local Plan 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 Local Plan development trips.

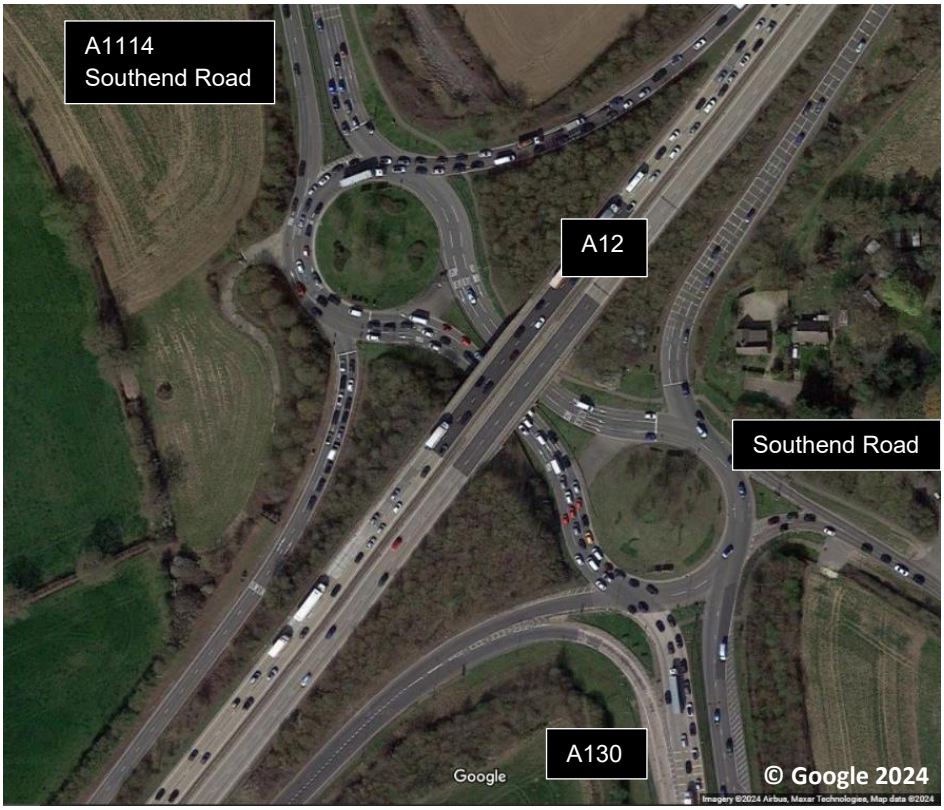

Figure 3.13: A12 Junction 17 Howe Green Interchange, Existing Layout

Table 3:18: 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 (N)	91	633	1.5	87	150	921	1.9	147
2 - Southend Rd (E)	74	1043	2.1	70	193	1385	3.4	188
3 - A130	293	330	1.2	194	203	195	1.1	105
4 - A12 (S)	90	137	1.1	73	66	109	1.0	52
5 - A1114 Southend Rd (W)	139	611	1.4	133	67	252	1.1	59
2041 Forecast - 'With Local Plan' Scenario								
1 - A12 (N)	59	397	1.2	55	131	804	1.7	128
2 - Southend Rd (E)	54	794	1.7	53	206	1406	3.6	200
3 - A130	341	409	1.3	244	276	318	1.2	179
4 - A12 (S)	146	235	1.1	130	85	144	1.1	71
5 - A1114 Southend Rd (W)	116	488	1.3	109	89	329	1.2	82

Within Capacity Approaching Capacity Over Capacity

3.2.2 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[3] as shown in Figure 3.14 below. 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 3.19 shows that whilst the addition of Local Plan Preferred Spatial Approach development traffic through the junction is expected to increase the level of queueing and delay along Essex Yeomanry Way and Chelmer Road in the PM peak period, other arms of the junction are less significantly impacted.

Both Chelmer Road and Van Diemans Road are modelled as operating over-capacity in the AM and PM peak hour Baseline scenario. However, it should be reiterated that the proposed redesign of the roundabout is expected to offer notable congestion relief over the existing layout.

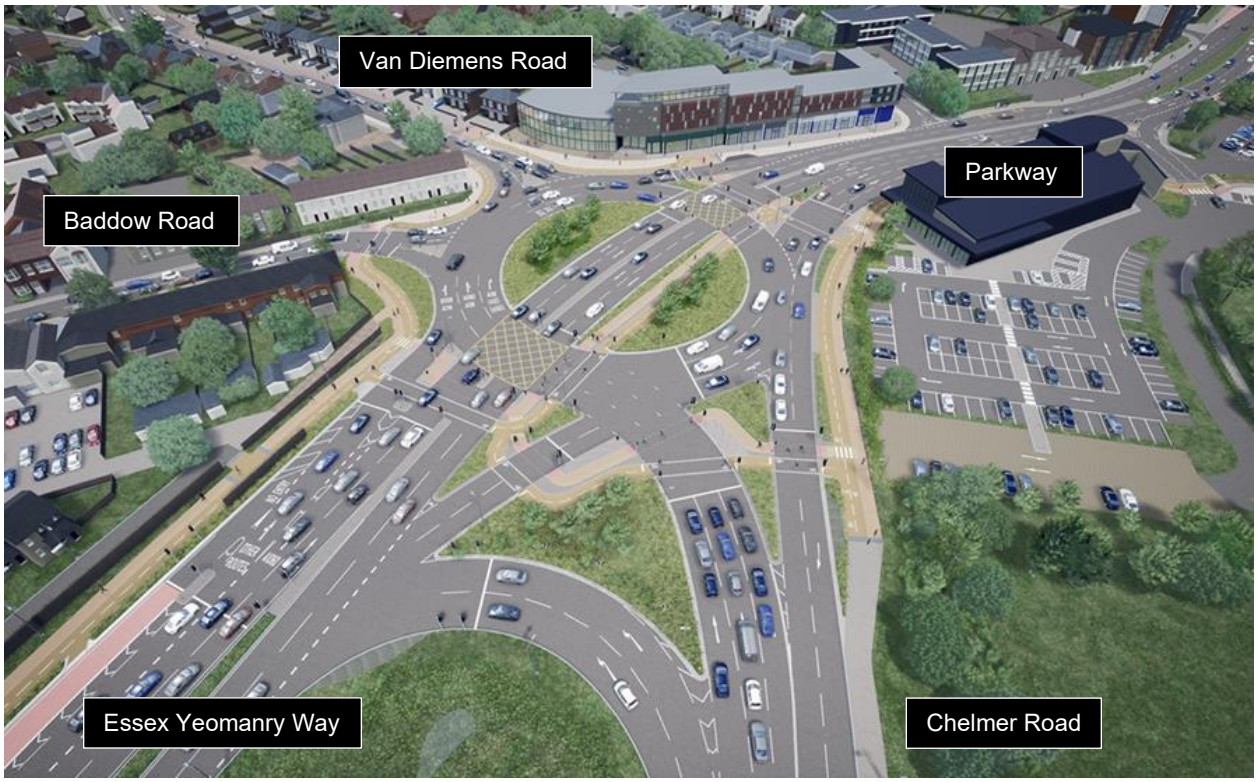

Figure 3.14: Concept image of the Army and Navy Roundabout proposed 'hamburger' layout.

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

Table 3:19: 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	12	39	0.86	5	14	43	0.89	7
2 - Chelmer Road	135	448	1.27	123	78	458	1.28	73
3 - Essex Yeomanry Way	6	33	0.90	4	8	44	0.95	7
4 - Baddow Road	14	37	0.94	8	16	37	0.92	6
5 - Van Diemans Road	70	156	1.06	33	120	324	1.18	80
2041 Forecast - 'With Local Plan' Scenario								
1 - Parkway	14	53	0.92	7	13	38	0.87	6
2 - Chelmer Road	133	428	1.25	121	94	531	1.34	89
3 - Essex Yeomanry Way	7	33	0.90	4	20	98	1.02	18
4 - Baddow Road	14	40	0.94	8	16	37	0.92	6
5 - Van Diemans Road	75	182	1.08	39	127	343	1.20	86

● Within Capacity ● Approaching Capacity ● Over Capacity

3.3 VISUM Modelling Outputs

3.3.1 A12 Junction 19, Boreham Interchange

As explained in section 2.2.3, junction capacity outputs were taken directly from the Chelmsford VISUM model for the A12 Junction 19, Boreham Interchange. The forecast-year VISUM model incorporates the latest junction design proposals for the A12 Junction 19 Boreham Interchange, as shown in Figure 2.4.

Figure 3.15 overleaf shows the layout of the existing junction with approach arms labelled. Flows on Drovers Way and the Service Access have not been modelled robustly in the Chelmsford VISUM Model, owing to the positioning of zone connectors (see the Chelmsford VISUM Model Local Model Validation Report for more information on the model zone arrangement[4]). Link flow and Volume/Capacity Ratio information for these arms has therefore been omitted from the reporting.

[4] Local Model Validation Report (LMVR) – Chelmsford Model Update – Essex Highways, April 2021

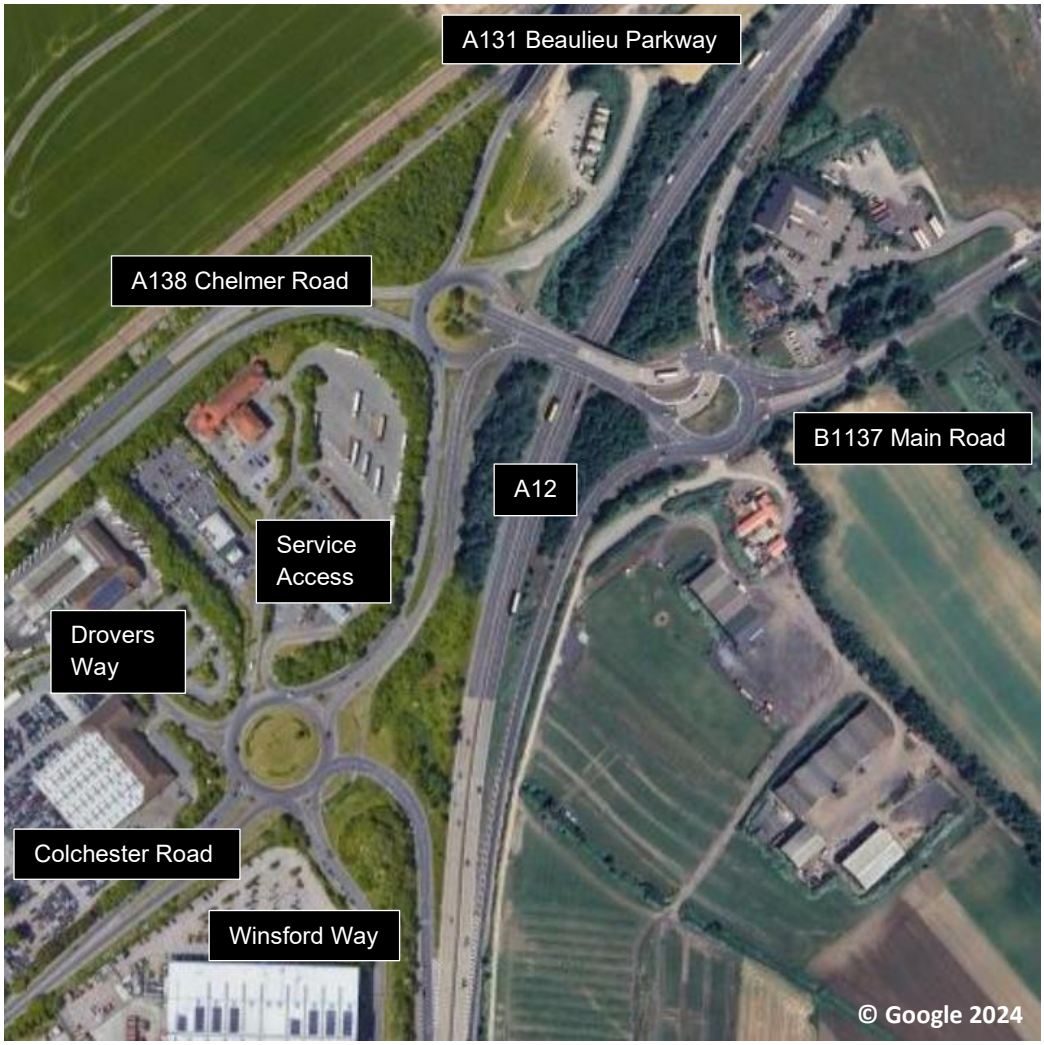

Figure 3.15: Existing A12 Junction 19 Boreham Interchange layout.

It should be noted that link-based Volume/Capacity ratios from the VISUM model are not directly comparable with RFC or DoS values from Junctions 10 and LinSig models respectively, and are not as robust a measure of local junction capacity. There is an expectation that outputs from VISUM models will more likely underestimate junction capacity, delays and queue lengths.

Outputs from the VISUM strategic model are presented for the Boreham Interchange (A12 Junction 19) to provide comprehensive coverage of local junction capacity impact along the A12 corridor in the vicinity of the Local Plan development. Results should, however, be treated with caution, and should be viewed alongside the strategic modelling analysis contained within Chapter 5 of the Preferred Spatial Approach main modelling report.

Table 3.20 overleaf suggests that the addition of Local Plan development traffic associated with the Preferred Spatial Approach will have only a minor impact on both

traffic flows and Volume/Capacity ratios on the approach arms to the Boreham Interchange junction.

Whilst National Highways' latest design proposals might be expected to improve the capacity of the A12 junction, more detailed junction modelling, particularly on Generals Farm Roundabout, where Hammonds Farm (Strategic Growth Site 16a) development access is proposed, will be undertaken as part of the Local Plan Review Pre-Submission to provide a more robust appraisal of development impact and potential mitigation required.

Table 3.20: A12 Junction 19, Boreham Interchange VISUM Outputs - Future Layout

Future Layout	AM		PM	
	Actual Flows	Volume Capacity Ratio (VCR)	Actual Flows	Volume Capacity Ratio (VCR)
2041 Forecast - Baseline				
Generals Farm Roundabout				
A12 southbound off-slip	2130	34	1214	19
B1137 Main Road	535	16	359	11
A12 Bridge Link	1211	26	1363	28
Generals Lane Roundabout				
A131 Beaulieu Parkway (N)	1040	65	1137	70
A12 Bridge Link	1815	19	988	16
A131 Link (S)	986	20	1389	29
A138 Chelmer Road	553	17	745	22
Drovers Way Roundabout				
A131 Link	762	24	447	14
A12 northbound off-slip	1064	34	1337	43
Winsford Way	31	3	108	12
Colchester Road	597	19	653	20
2041 Forecast - With Local Plan Scenario				
Generals Farm Roundabout				
A12 southbound off-slip	2145	34	1297	20
B1137 Main Road	560	17	387	12
A12 Bridge Link	1302	27	1560	32
Generals Lane Roundabout				
A131 Beaulieu Parkway (N)	1044	65	1137	70
A12 Bridge Link	1911	19	1096	16
A131 Link Road (S)	1021	21	1537	31
A138 Chelmer Road	588	18	780	23
Drovers Way Roundabout				
A131	818	26	489	16
A12 northbound off-slip	1066	34	1444	46
Winsford Way	31	3	108	12
Colchester Road	611	19	683	21

● Within Capacity ● Approaching Capacity ● Over Capacity

3.4 Summary of Findings

- The results of the local junction modelling are broadly aligned with the overall findings from the strategic impact assessment of the Local Plan Preferred Spatial Approach.
- 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 Local Plan sites in the Preferred Spatial Approach.
- The impact on city centre junctions is similarly limited, although Local Plan development trips would be expected to add to delays and queues on certain approach arms that are already over-capacity.
- With the largest allocation of development in the Preferred Spatial Approach at Hammonds Farm (Strategic Growth Site 16a) in the vicinity of A12 Junction 18, Sandon Interchange, the roundabout is therefore most impacted by Local Plan 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 need identified within the Transport Impact Appraisal of the Preferred Spatial Approach 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 this junction are contained within section 7.3.2 of the Transport Impact Appraisal of Preferred Spatial Approach (March 2024) which will be further refined through the ongoing Local Plan, master planning and planning application process.
- Local Plan impact modelled at A12 Junction 17, Howe Green Interchange is relatively minor, caused by 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 redesign the junction and the A12 carriageway at this location.
- The A12 Junction 19, Boreham Interchange, as modelled in the Chelmsford VISUM model, is shown to operate within capacity in the Baseline and with the addition of Local Plan development traffic. However, more detailed junction modelling, particularly on Generals Farm Roundabout, where access to the Hammonds Farm development is proposed, will be undertaken as part of the

Local Plan Review Pre-Submission to provide a more robust appraisal of development impact and potential mitigation required.