EB 026

Essex Highways

Chelmsford Local Plan

Preferred Option Strategic & Local Junction Modelling

January 2018

RINGWAY JACOBS integrated expertise | Essex County Council

Document Control Sheet

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Project Title	Chelmsford Local Plan – Junction Modelling
Report Title	Chelmsford Local Plan – Preferred Option Strategic & Local Junction Modelling
Project Number	B3553R6A – 41 CHLP
Status	Final
Revision	5
Location	N:\9 Trans Impr\TP\Projects\41TP001 - Chelmsford LP Junction Modelling (R6A)\005 - Working Documents\01 - Reports
Control Date	30th January 2018

Record of Issue

Issue	Status	Author	Date	Check	Date	Review	Date
1	Draft	J Wiffen / L Kiff	16/08/17	C Freeman / C Jameson	18/08/17	C Jameson	24/08/17
2	Revised Draft	J Wiffen / C Freeman	26/09/17	C Jameson	26/09/17	C Jameson	26/09/17
3	Final Draft	J Wiffen / C Freeman	08/11/17	J Jones	09/11/17	J Jones	10/11/17
4	Final	J Wiffen / C Freeman	18/12/17	C Jameson	20/12/17	C Jameson	20/12/17
5	Final Rev 1	C Freeman	04/01/18	C Jameson	04/01/18	C Jameson	04/01/18
6	Final Rev 2	C Freeman	29/01/18	C Jameson	29/01/18	C Jameson	29/01/18

Approved for Issue By	Date
Simon Jones	30/01/18

Distribution

Organisation	Contact	Number of Copies
Essex County Council	Hannah Neve / Hilary Gore	2
Chelmsford City Council	Claire Stuckey	1

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Background

This report presents the outputs and analysis of highways modelling undertaken for the assessment of Chelmsford City Council's (CCC's) Local Plan Preferred Spatial Option. Findings from this study will contribute towards the transport evidence base to support the Pre-Submission Spatial Option and package of mitigation measures when taken forward to Examination in Public.

The latest modelling utilises variable demand modelling in VISUM to provide a fuller appraisal of the Local Plan Preferred Option; through adjusting traffic demand in the peak hour in response to congestion, the impact of Local Plan development and infrastructure is modelled more robustly.

The base year VISUM model used in this study performs well in the detailed model area against WebTAG assessment criteria, providing reassurance that within that area the model is representative of the existing transport network and current traffic conditions. It is therefore considered to be suitable for use for Local Plan and mitigation appraisal at a strategic level. The variable demand model has been run through a series of realism tests and succeeds in converging to standard WebTAG criteria. Further sensitivity testing provides confidence that any uncertainty in the model parameters does not significantly affect the model outputs.

Earlier studies have assisted Chelmsford City Council in developing their Local Plan Preferred Option through understanding the likely impact of it and earlier Spatial Options on the road network. This latest study includes a further assessment of the wider impact of the updated Local Plan proposals on the road network across the Chelmsford Local Authority Area and then considers the likely impact at key junctions in the area. The assessment uses the development and transportation infrastructure assumptions provided by Chelmsford City Council and agreed with Essex County Council in May 2017. It is, however, acknowledged that the assumptions will be subject to further change following public engagement events held this summer.

Local capacity improvement measures are currently being consulted on as part of the South-East Local Enterprise Partnership funded 'Chelmsford City Growth Package'; a £15m investment in primarily sustainable transport in Chelmsford by 2021, which is expected to improve traffic flow by removing vehicles from the road network. As the schemes have not yet been refined or committed, proposals have not been included in the modelling.

Summary of VISUM Outputs

Peak hour (08:00 – 09:00 and 17:00 – 18:00) modelling in VISUM suggests that by 2036, background growth in Chelmsford without Local Plan development or infrastructure will likely result in significant congestion along corridor routes into the city centre, through the city centre and along the A12.

Modelling also illustrates the likely wider impact of Local Plan development traffic on the Chelmsford road network, with significant increases in peak hour vehicle flow focussed in the north east of Chelmsford and on northern corridor routes into the city centre. Growth in traffic flow over the Do Minimum scenario is more apparent in the AM peak, particularly in the city centre.

With the addition of Local Plan development, modelled congestion is shown to worsen along corridor routes into the city centre – notably along the A1060 Rainsford Road and A1016 Rainsford Lane, Springfield Road in the vicinity of Victoria Road, and B1008 Main Road through Broomfield. The junction of Chignal Road and Roxwell Road is also modelled to experience greater levels of congestion as a result of development proposals in the west of Chelmsford.

Summary of Junction Modelling

In total 27 junctions have been assessed in more detail using junction modelling software, and of these 9 are forecast to be within or nearing capacity by 2036 with Local Plan development and 18 are forecast to be at or overcapacity in 2036. For all junctions, the actual peak hours were modelled to represent a “worst case” scenario in terms of transport impact. The results, including committed mitigation but excluding proposed mitigation are summarised in the table below.

Junction	Forecast Capacity – Do Minimum 2036	Forecast Capacity – Local Plan 2036
1. Moulsham Hall Lane, Great Leighs	Within capacity	Within capacity
2. Main Road – Banters Lane, Great Leighs	Within capacity	Within capacity
3. Deres Bridge, Great Leighs	Overcapacity	Overcapacity
4. Sheepcotes, Little Waltham	Overcapacity	Overcapacity
5. Pratts Farm, Channels	Overcapacity	Overcapacity
6. Essex Regiment Way – Channels Drive, Channels	Within capacity	Overcapacity
7. Nabbots Farm, Springfield	Overcapacity	Overcapacity
8. Lawn Lane, Springfield	Overcapacity	Overcapacity
9. Valley Bridge, Springfield	Overcapacity	Overcapacity
10. Main Road – Hospital Approach, Broomfield	Near capacity	Near capacity
11. Main Road – School Lane, Broomfield	Overcapacity	Overcapacity

Junction	Forecast Capacity – Do Minimum 2036	Forecast Capacity – Local Plan 2036
12. Broomfield Road – Valley Bridge, Chelmsford	Near capacity	At capacity
13. Broomfield Road – Patching Hall Lane, Chelmsford	At capacity	At capacity
14. Roxwell Road – Lordship Road, Writtle	At capacity	Near capacity
15. Roxwell Road – Chignal Road, Melbourne	Within capacity	Near capacity
16. Essex Yeomanry Way – Maldon Road – Baddow Hall Avenue, Great Baddow	Within capacity	Within capacity
17. Essex Yeomanry Way – Maldon Road, Great Baddow	Within capacity	Within capacity
18. Main Road – Church Road, Boreham	Within capacity	Within capacity
19. Burnham Road – Ferrers Road, South Woodham Ferrers	Near capacity	At capacity
20. B1418 – Burnham Road, South Woodham Ferrers	At capacity	Overcapacity
21. Burnham Road – Hullbridge Road, South Woodham Ferrers	Within capacity	Overcapacity
22. Hullbridge Road – Clements Green Lane, South Woodham Ferrers	Within capacity	Within capacity
23. A12 Junction 19, Boreham Interchange (Mayer Brown Traffic Model)	Overcapacity	Overcapacity
24. A12 Junction 18, Sandon	Near capacity	Overcapacity
25. Rettendon Turnpike, South Woodham Ferrers	Near capacity	Overcapacity
26. Hawk Hill roundabout, South Woodham Ferrers	Near capacity	Overcapacity
27. A132/A130, South Woodham Ferrers	Overcapacity	Overcapacity

Improvement Measures

The modelling work has focussed on the peak hours, when by definition the junctions are likely to be most congested. The extent to which changes in travel behaviour will result in trips moving to the shoulders of the peak hours (peak spreading) is not quantified in the modelling, however, this is a likely response to congestion which could reduce the impact of the future traffic growth reported in the modelling results. Analysis has shown that eight of the ten junctions[1] that the modelling suggests are

[1] This does not include Burnham Road / Hullbridge Road and A130 / A132 junctions, as the data for these junctions was not available at the time of the assessment.

currently operating at or near to capacity are likely to be able to accommodate traffic growth if peak spreading occurred.

Essex County Council have set out a strategy for Chelmsford's Future Transport Network and have defined three zones of travel: Outer, Mid and Inner. Within these zones, the intention is to prioritise and promote travel via particular modes in order to reduce growing pressure on the road network:

- **Outer Zone:** Park and Ride, Rail, Bus and dynamic signage of general traffic to use appropriate strategic routes
- **Mid Zone:** Local Bus, Cycling
- **Inner Zone:** Walking and Cycling

This strategy will shape the nature of improvements needed at the junctions identified to be at or over capacity by 2036.

Improvement schemes, including committed developer schemes, have been modelled for ten of the junctions that are forecast to be operating near or at capacity in the 2036 Local Plan scenario. These are summarised in the table below. The right hand column indicates whether the junction is likely to be overcapacity with mitigation in place.

Junction	Improvement Scheme	Forecast to be overcapacity in 2036
Deres Bridge, Great Leighs	Addition of Chelmsford North East Bypass arm to junction	N
Sheepcotes, Little Waltham	Left turn slip from A131 Braintree Road to A130 Essex Regiment Way and widening of all other approaches.	N
Pratts Farm, Channels	Developer Scheme: Widen Essex Regiment Way Southern approach, widen Back Lane approach and Essex Regiment Way Northbound exit. Additionally Essex Regiment Way Northern approach could be widened to two general traffic lanes to fully mitigate the junction. Alternatively the additional lane could be a bus lane.	N
Nabbots Farm, Springfield	The A131 Route Based Strategy is proposing to widen the White Hart Lane and Pump Lane approaches. Developer is proposing to add a left	**Y**

Junction	Improvement Scheme	Forecast to be overcapacity in 2036
	turn slip from A130 Essex Regiment Way to White Hart Lane. Additionally, making Essex Regiment Way two lanes ahead with a merge on the southbound exit of Chelmer Valley Road was investigated.	
Lawn Lane, Springfield	Developer Scheme: Amendment of the nearside southbound approach on Chelmer Valley road to allow the ahead movement as well as left turning traffic with associated widening of the southbound exit to accommodate two ahead traffic lanes as well as the bus lane. Additionally, full signalisation of the junction was investigated.	**Y**
Valley Bridge, Springfield	Full signalisation of the junction.	N
Main Road – Hospital Approach, Broomfield	Developer Scheme: Currently under construction is a larger roundabout to replace the small roundabout currently located there. This includes widening all approaches.	N
Main Road – School Lane, Broomfield	The Broomfield Place developer is proposing a safety scheme which would consolidate the junction into a traditional T junction and would widen the School Lane approach.	**Y**
Roxwell Road – Chignal Road, Melbourne	Developer Scheme: Widening of the Chignal Road and Roxwell Road West approaches.	N
A12 Junction 19, Boreham Interchange (Mayer Brown Traffic Model)	Developer Scheme: New arm at the Generals Lane roundabout and a hamburger layout of the Generals Farm roundabout.	**Y**

The modelling suggests that four of these, see table above, are likely to operate over capacity during at least one of the peak hours with the improvement scheme in place. Two developer schemes are shown to be likely to provide sufficient mitigation and mitigation has been developed for the remaining four junctions.

The forecast capacity of the junctions modelled, assuming any schemes that the modelling suggests will improve operation, is shown on the plan below (Figure *1.1*).

Given the level of congestion predicted in the future, it is unlikely that improvements which benefit general traffic alone will be possible in the available road space or effective in resolving overall congestion. As such, developers will need to be encouraged to not only mitigate the local impact of their developments as much as possible, but also focus on sustainable transport links to their developments and provide contributions to or deliver sustainable transport infrastructure measures. At a number of the junctions forecast to be near, at or overcapacity in 2036, it is likely that the majority could be improved to encourage increased use of sustainable transport through cycle and/or bus links.

CCC have subsequently revised their Preferred Local Plan Scenario following public consultation. This has been refined and a further study has been undertaken to model the Pre-Submission scenario, summarise ongoing studies focussing on sustainable transport improvement schemes in the Local Plan area and respond to comments made during the public consultation. The Pre-Submission scenario work is reported in Chelmsford Local Plan – Pre-Submission Strategic & Local Junction Modelling, Essex Highways January 2018.

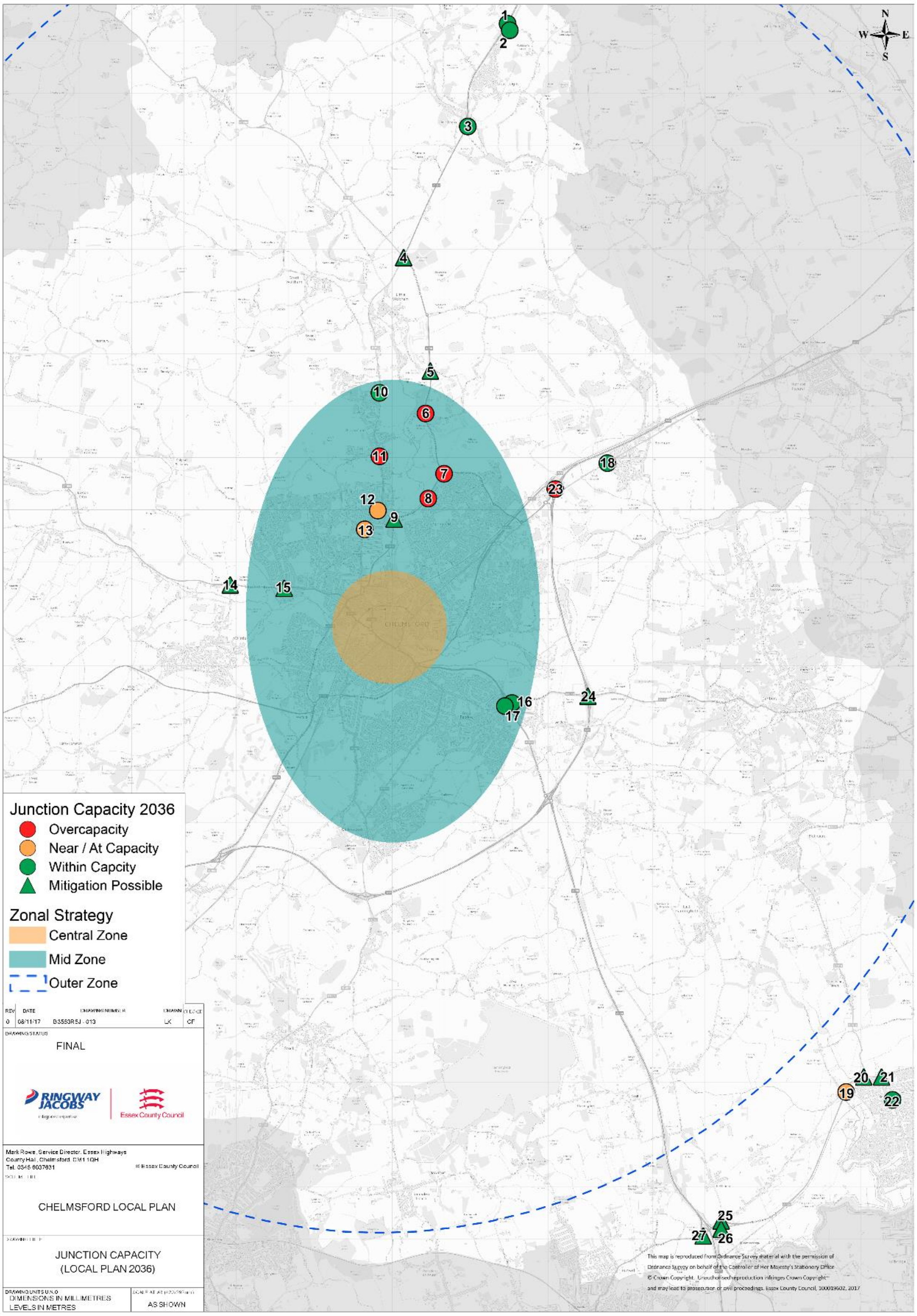

Figure 1.1: Modelled Impact on Junctions in Local Plan 2036 Scenario

1 Introduction

1.1 Background

This report presents the outputs and analysis of highways modelling undertaken for the assessment of Chelmsford City Council's (CCC) Local Plan Preferred Spatial Option. Findings from this study will contribute towards the transport evidence base to support the Pre-Submission Spatial Option and package of mitigation measures when taken forward to Examination in Public.

Initial modelling of the wider impacts of CCC's Preferred Option was reported in March 2017. Subsequent work has since been commissioned by Essex County Council (ECC) to update the earlier Preferred Option assessment using a version of the Chelmsford Strategic Model (in VISUM) with variable demand functionality. In addition, further work has been undertaken to understand the impact of Local Plan proposals on junctions in the city centre and across the wider administrative area. The latest commission also considers mitigation measures that may be possible at key junctions across the Chelmsford administrative area.

This study incorporates the Local Plan Preferred Option development and infrastructure assumptions agreed with CCC as of May 2017. This includes revisions to housing numbers and road infrastructure proposals. These changes/proposals have been documented in this report. An addendum is planned to document results from a supplementary study that will account for development and infrastructure assumptions that are correct at the time of the Local Plan Pre-Submission in November 2017.

1.1.1 Historical Studies

The work summarised in this report follows an earlier assessment of the transport impact of CCC's Local Plan Spatial Options and mitigation proposals as outlined in the 'Issues and Options Consultation Document – November 2015'. It also follows Local Plan Sensitivity Testing of hybrid Spatial Options identified by CCC alongside a review of potential sustainable transport infrastructure to help mitigate the impact of development traffic.

Earlier Essex Highways reports covering the transport appraisal of the 2021-2036 Local Plan are as follows:

- Chelmsford Local Plan Transport Impact of Local Plan Spatial Options – March 2017
- Chelmsford Local Plan Transport Impact Sensitivity Testing & Sustainability Review – March 2017

- Chelmsford Local Plan Transport Impact of Local Plan Preferred Spatial Option – March 2017

1.1.2 Ongoing Studies

There are a number of studies currently ongoing or that have recently been completed that support the Local Plan. These will be detailed in an addendum to this report. They are as follows:

- Chelmsford Cycling Action Plan
- Chelmsford City Growth Package including:
    - Broomfield Road Corridor Study
- A131 Chelmsford to Braintree Route Based Strategy
- Chelmsford North East Bypass Phasing Study
- Chelmsford Army & Navy Roundabout
- Howe Green: Stage 1 Study
- A132 Route Based Strategy / South Woodham Ferrers Integrated Transport Package
- Chelmsford Waterside Development Access Road Study
- A12 Widening (Junctions 19 – 25)
- Beaulieu Station Interconnectivity Study

1.1.3 Chelmsford's Future Transport Network

This study has been undertaken within the context of ECC's Chelmsford's Future Transport Network's zonal strategy. It identifies three zones within Chelmsford and the surrounding area and a preferred focus for transport schemes in each of these zones. The zones are as follows:

Schemes in the Outer Zone will focus on:

- Removing as much traffic as possible on the outskirts of the city using existing and proposed Park and Ride services;
- Encouraging rail use to access Chelmsford from outside the city;
- Encouraging bus use for inter-urban trips;
- Providing appropriate and dynamic signage systems to direct drivers onto the most appropriate route for their final destination; and
- Targeting investment at strategic schemes for longer distance journeys, such as widening of the A12 and the Chelmsford North East Bypass (CNEB).

Schemes in the Mid Zone will focus on:

- Targeting investment at providing viable sustainable alternatives to the private car; and

- Encouraging trips to be made using fast and reliable public transport and safe, high quality cycling network.

Schemes in the Inner Zone will focus on:

- Improving the quality of the public realm;
- Improving the quality of the pedestrian environment;
- Improving the quality of cycling provision (including City Centre cycle parking);
- Providing high quality public transport routes; and
- Making best use of the existing road network by managing remaining traffic as efficiently as possible with clear and dynamic signage to direct drivers onto the most appropriate roads for their journey, minimising rat-running, and to move vehicles off the road and into the most appropriate car park as quickly as possible.

1.2 Document Layout

This document consists of seven chapters, as follows:

- Chapter 1: **Introduction**;
- Chapter 2: **The VISUM Model** – this provides detail on the VISUM model, used and details of the variable-demand model build;
- Chapter 3: **Wider Impact on the Road Network** – this provides detail on the Do Minimum and Local Plan Preferred Option development assumptions used, along with modelled growth factors and trip generation/distributions. The section also documents the analysis of model results at a strategic level;
- Chapter 4: **Local Junction Modelling** – this provides detail on the modelling undertaken at key junctions in the vicinity of the proposal Local Plan development;
- Chapter 5: **Local Junction Mitigation** – this provides detail on the junction mitigation proposals considered to tackle future congestion on the road network across Chelmsford; and
- Chapter 6: **Summary, Conclusions & Next Steps**.

1.3 Glossary of Modelling Terms

Actual Flow	The modelled vehicle flow on a road accounting for both the reassignment of traffic as a result of network capacity constraint and through congestion caused by the presence of conflicting vehicle movements on the road network.
Degree of Saturation (DoS)	The volume of traffic calculated as a percentage of the capacity of the road. 100% equates to the road being at full capacity – often characterised by large queue extents and delays. The measure is used in the analysis of signalised junctions.
Demand Flow	The modelled vehicle flow on a road based on traffic assignment governed only by the free-flow speed and capacity of the road network, and not accounting for the presence of other vehicles.
Do Minimum / Do Min	Referred to in this study as a reference case against which to compare the various Local Plan Spatial Option scenarios. The 2036 Do Minimum scenario does not contain housing or job growth in Chelmsford covering the Local Plan period 2021-2036.
Fixed Demand	Demand for peak hour travel that does not change to take account of changes in travel behaviour such as changing frequency of trip, changing mode of travel or changing destination in response to levels of congestion on the road network.
Junctions 9	A junction modelling package used to assess the capacity of roundabouts and priority junctions (formerly known as ARCADY and PICADY respectively).
LinSig	A junction modelling package used to assess the capacity of signalised junctions.
Matrix Furness	Process of creating a matrix of vehicle trips based on known trip ends for both origins and destinations.

NTEM / TEMPro	National Trip End Model – 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).
Passenger Car Unit (PCU)	Passenger Car Unit (PCU) is a metric used to measure traffic flow on a highway. A Passenger Car Unit is a measure of the impact on road capacity compared to a single standard passenger car.
Ratio of Flow to Capacity (RFC)	The volume of traffic flow calculated as a ratio to the capacity of the road. 1 equates to the road being at full capacity – often characterised by large queue extents and delays. See Volume/Capacity (V/C).
Tidal Flow	A flow of traffic that is representative of typical peak hour patterns – i.e. city centre inbound flows are higher in the morning and outbound flows are higher in the evening.
Trafficmaster	A database provided by the Department for Transport containing Global Positioning System derived journey times of vehicles.
Trip Ends	Referred to in this study as the origin or destination trip totals to/from for a particular development or model zone.
Variable Demand	Demand for peak hour travel that does take account of changes in travel behaviour such as changing frequency of trip, changing mode of travel or changing destination in response to levels of congestion on the road network.
VISSIM	A micro-simulation modelling package used in this study to assess the impact of development traffic on the city centre road network.
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.
Volume/Capacity Ratio (V/C)	The volume of traffic flow calculated as a ratio to the capacity of the road. 1 equates to the road being at full capacity – often characterised by large queue extents and delays. See Ratio of Flow to Capacity (RFC).

2 The VISUM Model

2.1 Background

2.1.1 Model Build Reports

Development of the Chelmsford Strategic Model (in VISUM) has been documented in the following reports and technical notes:

- Chelmsford Traffic and Access Strategy - Local Model Validation Report Revision 4 - 25th August 2016;
- Chelmsford Traffic and Access Strategy - Traffic Forecast Report Version 2 - 26th August 2016;
- Chelmsford Traffic and Access Strategy - Variable Demand Model Technical Note - February 2017;
- Chelmsford Traffic and Access Strategy - Park and Ride and Station Parking Model Technical Note - February 2017; and
- Chelmsford Traffic and Access Strategy - Cycling Model Technical Note - February 2017.

2.1.2 Assessment of Fitness for Purpose

The Local Model Validation Report (LMVR) provides technical details of the Chelmsford Strategic Model build, along with convergence, validation and calibration statistics for a base year of 2014. This has been reviewed by Highways England.

The base model performance against the WebTAG[2] assessment criteria is summarised in the LMVR, and provides reassurance that the model is representative of the existing transport network and current traffic conditions within the urban area of Chelmsford. It is therefore considered to be suitable for use to model the likely impact of the Local Plan and mitigation appraisal within the urban area of Chelmsford at a strategic level.

In July 2017, Essex Highways received confirmation from Highways England that following a review of the Local Model Validation Report, the Chelmsford VISUM base model was considered fit for purpose in assessing the impact of the Local Plan. The model calibration to WebTAG standards was considered acceptable, although it was acknowledged that the model placed a greater focus on the city centre, with calibration considered less comprehensive along the A12 and its junctions. This observation was accepted by Essex Highways, and the methodology adopted for

[2] Web-based Transport Analysis Guidance (WebTAG), https://www.gov.uk/guidance/transport-analysis-guidance-webtag, Department for Transport

junction appraisals along the A12 was adjusted to incorporate observed data to support model outputs.

2.1.3 Fixed Demand Model Overview

To date, transport appraisal of Chelmsford's Local Plan has been undertaken using a fixed-demand version of the Chelmsford Strategic Model. Results and analysis have therefore been caveated on the basis that the modelling represents a 'worst case scenario' that does not account for changes in travel behaviour caused by the increased levels of congestion in the peak hours.

Analysis of outputs from earlier studies suggested that modelled congestion along trunk roads such as the A12 is likely to result in increased volumes of strategic traffic flow routing through the city centre and along rural routes. The impact of background congestion, particularly on the A12, may result in the network impact of Local Plan development being overshadowed by the greater impact of strategic traffic flow reassignment.

The inclusion of variable demand modelling in VISUM in this latest work is seen as providing a fuller appraisal of the Local Plan Preferred Option. Through adjustments in peak hour traffic flow resulting from congestion causing wider changes in travel behaviour, the impact of Local Plan development and infrastructure is modelled more robustly.

2.2 Variable Demand Modelling

2.2.1 Methodology

The Variable Demand Model (VDM) has been developed and validated according to guidance in WebTAG[2]. The model consists of private transport (car) and public transport (rail and bus) modes. Trips have been further divided into three separate trip purposes (commute, business and other), in keeping with the guidance and allowing model outputs to be used for Economic Assessment. The model has been developed for AM peak, average inter-peak and PM peak periods – with the AM and PM peaks covered in this section of the report.

The VDM calculates new travel costs for trips for each purpose and mode, and compares these against base year values. These differences in cost are then fed into the model, which estimates the following:

- Changes in trip mode between the car and public transport
- Changes to trip distribution

For the purpose of demonstrating that the model produces plausible outputs, a series of realism tests have been undertaken to validate the response of the VDM against the following scenarios: 10% Fuel Increase, 10% Public Transport Fare Increase and 10% Increase in Car Journey Times.

The VDM Reference Case has also been verified using a series of sensitivity tests to demonstrate that the impact of uncertainty in calibrated sensitivity parameters is realistic and within the required limits. These are as follows:

- Decrease parameters by 25%
- Increase parameters by 25%

Finally, in order to have confidence that the model is robust, analysis has been undertaken to demonstrate that the model converges to a satisfactory degree.

Summary results of the realism and sensitivity testing are reported in the following sections of this report. Supporting material can be found in Appendix A.

2.2.2 Results of Realism Testing

Table 2.1 below summarises the recommended elasticities that should be achieved during the realism testing as outlined by WebTAG[3].

Table 2.1 Summary of WebTAG required elasticities for realism testing

Realism Test	High	Low
Average Fuel Cost (veh km)	-0.35	-0.25
PT Main Mode Fare (trips)	-0.90	-0.20
Car Journey Time (trips)	No stronger than -2.0	

Following the WebTAG guidance explained above, the realism tests were performed and their results compared against WebTAG criteria shown in Table 2.1. Table 2.2 below summarises the elasticities achieved for the realism testing of the Chelmsford Strategic Model after the model calibration.

Table 2.2 Summary of elasticities after Realism Testing

Purpose	Fuel Cost Increase All Periods	Fare Cost Increase All Periods	Journey Time Increase All Periods
Business	-0.074	-0.334	-0.557
Other	-0.403	-0.840	-0.988

[3] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/603266/webtag-tag-unit-m2-variable-demand-modelling-march-2017.pdf, TAG M2, Table 6.2, page 52.

Purpose	Fuel Cost Increase All Periods	Fare Cost Increase All Periods	Journey Time Increase All Periods
Commute	-0.211	-0.752	-0.565
All	-0.313	-0.787	-0.799

Overall, the model elasticities for combined trip purposes are within the recommended advised boundaries and according to the guidance, the way fuel cost varies by purpose suggests that the fuel cost elasticity is more plausible[4].

2.2.3 Convergence Statistics Summary

To meet WebTAG[5] criteria, convergence of 0.1% is required, except for "problematic systems", where a convergence value of 0.2% is considered acceptable. Since the Chelmsford Strategic Model has relatively limited route choice and high demand, a convergence value of 0.2% is considered acceptable. Table 2.3 summarises the convergence values achieved in the various model runs for the realism testing. The table shows that all model runs achieved this convergence criteria.

Table 2.3 Realism testing convergence statistics

Convergence (% relative GAP)		
10% Fuel Increase		
AM	IP	PM
0.079	0.048	0.142
10% PT Fare Increase		
0.107	0.031	0.092

2.2.4 Results of the Reference Case Growth Forecasts

Prior to undertaking any sensitivity testing of the 2036 model, the Do Minimum and Local Plan scenarios were run for the calibrated parameters and results compared against starting matrices without VDM.

Table 2.4 below shows the percentage change in vehicle demand in the 2036 Chelmsford Strategic Model with Local Plan development and infrastructure as a result of VDM.

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[4] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/603266/webtag-tag-unit-m2-variable-demand-modelling-march-2017.pdf, TAG M2, Section 6.4.22, page 50.
[5] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/603266/webtag-tag-unit-m2-variable-demand-modelling-march-2017.pdf, TAG M2, Section 6.3.8, page 46.

Table 2.4 2036 percentage change in demand after VDM (with Local Plan development and infrastructure)

2036 Vehicle Demand				
Mode	Purpose	VDM - Calibrated Sensitivity Parameters		
		AM	IP	PM
Car	Commute	-2%	-2%	-2%
	Other	-6%	-4%	-4%
	Business	-1%	-1%	-1%
Total		-4%	-3%	-3%

Overall reductions are shown to be small as a proportion of total trips in each peak hour model, with the AM peak showing the greatest reductions. As commuting and business trips are less susceptible to mode shift, other trip purposes (shopping, leisure etc.) contribute the greatest percentage reduction in car journeys.

The 2036 Do Minimum scenario has also been modelled with the VDM. Overall car trip reductions are shown to be slightly smaller – which is due to lower levels of network congestion in the Do Minimum scenario which does not contain development in Chelmsford from 2021.

2.2.5 Results of Sensitivity Testing

Results from the sensitivity tests are summarised below along with the results from the calibrated version of the model.

Table 2.5 and Table 2.6 below provide a summary of how car demand changes for the different scenarios and time periods by purpose, for each test and the calibrated scenario, against forecast matrices without the VDM. Percentage changes in travel demand are summarised below, whilst actual changes in demand (along with changes in distances travelled) can be found in Appendix A of this report.

Table 2.5 Summary of sensitivity tests, 2036 Do Minimum - percentage changes in demand

2036 Do Minimum Travel Demand - Sensitivity Testing										
Mode	Purpose	VDM - Calibrated Parameters			VDM -25% Sensitivity Parameters			VDM +25% Sensitivity Parameters		
		AM	IP	PM	AM	IP	PM	AM	IP	PM
Car	Commute	-1.9%	-1.3%	-0.8%	-1.5%	-1.1%	-0.6%	-2.5%	-1.6%	-1.2%
	Other	-5.3%	-3.0%	-2.5%	-4.1%	-2.4%	-2.0%	-7.9%	-4.2%	-3.6%
	Business	-0.9%	-0.6%	-0.5%	-0.7%	-0.6%	-0.4%	-1.2%	-0.8%	-0.8%

Table 2.6 Summary of sensitivity tests, 2036 Local Plan Preferred Option - percentage changes in demand

2036 Local Plan Preferred Option Travel Demand - Sensitivity Testing										
Mode	Purpose	VDM - Calibrated Parameters			VDM -25% Sensitivity Parameters			VDM +25% Sensitivity Parameters		
		AM	IP	PM	AM	IP	PM	AM	IP	PM
Car	Commute	-2.1%	-1.9%	-2.1%	-1.8%	-1.6%	-1.8%	-2.9%	-2.6%	-2.9%
	Other	-5.6%	-3.7%	-4.0%	-4.3%	-3.0%	-3.2%	-8.3%	-5.2%	-5.7%
	Business	-1.3%	-0.8%	-1.2%	-1.0%	-0.7%	-1.0%	-1.7%	-1.0%	-1.6%

The overall changes in demand, for the 2036 Local Plan scenario, range between -0.8% and -5.6% for the calibrated version of the VDM, with a higher percentage changes for discretionary (Other) trips, particularly in the peak hours. Similar patterns are also shown in the Do Minimum modelled scenario. When testing the model against adjusted parameters, the resulting values stay within a reasonable range suggesting that any uncertainty in the model parameters does not result in a big impact on the outputs.

2.2.6 Impact of Variable Demand on Forecast Network Performance

The overall impact of the variable demand modelling is to remove a small quantity of vehicle trips from the model (relative to the total number modelled), with a proportion of journeys moved to public transport. Table 2.7 below shows the change in trips made by car and public transport as a result of variable demand modelling. The results shown are based on a 2036 scenario with the inclusion of Local Plan development and infrastructure (as detailed later in the report).

Table 2.7 Change in trips made by mode as a result of variable demand modelling (2036 Local Plan)

Time Period	Car trips (vehicles)	Public transport trips (persons)
AM	-4,400	+6,355
IP	-3,711	+5,649
PM	-3,776	+5,444

When spread across the Chelmsford Strategic Model road network, overall vehicle trip reductions as a result of variable demand modelling appear to have little impact on patterns of modelled traffic flow in the AM peak hour (Figure 2.1). In the AM peak hour, there is a modelled increase in flows along the proposed CNEB, which is also seen in the PM peak hour (Figure 2.2).

Figure 2.1 AM Peak 2036 change in vehicle flows with inclusion of variable demand in Chelmsford (Local Plan)

Figure 2.2 PM Peak 2036 change in vehicle flows with inclusion of variable demand in Chelmsford (Local Plan)

In the PM peak hour, there is a modelled overall vehicle trip reduction in Chelmsford, but there are more notable modelled increases in the number of journeys in north east Chelmsford at the Boreham Interchange and along the A12 northbound compared to the AM peak hour.

The small changes in traffic flow as a result of variable demand modelling would be expected to have a limited impact on levels of congestion experienced across Chelmsford in the peak hours, particularly along corridor routes into and through the city centre.

3 Wider Impact on the Road Network

3.1 Introduction

3.1.1 Background

Previous Local Plan modelling studies have focused on the wider impact of proposed development on the strategic road network. These have made use of the fixed demand VISUM Model to assess peak hour conditions on the road network.

This latest study builds upon the analysis from the earlier modelling by using outputs taken from a variable demand version of the VISUM model.

Strategic modelling has been undertaken in the AM, inter and PM peak hours identified as 08:00-09:00, 12:00-13:00 and 17:00-18:00 respectively. To aid the local junction modelling work undertaken for this study, focus has been placed on appraising the wider impact on the road network in the AM and PM peak hours. However, inter peak VISUM model outputs have been produced for reference and can be found in Appendix B of this report.

The VISUM Model is an area-wide assignment modelling package and, as such, it is not an appropriate tool for modelling traffic flow volumes at a detailed level. Reporting of the wider impact of Local Plan traffic on the strategic road network acknowledges this by presenting flow plots that illustrate patterns of vehicle flows without quoting specific numbers. It would be reasonable to expect assigned traffic flows of less than 50 vehicles on a particular stretch of road in VISUM to fall within a reasonable 'margin of error' due to the scope/breadth of the assignment process. The accuracy of the model outputs is further accounted for in the local junction modelling (covered in Chapter 4).

3.2 The Do Minimum Scenario

3.2.1 Development and Infrastructure Assumptions

The Do Minimum scenario in this study has been modelled for the purposes of comparing traffic flows and levels of congestion with the Preferred Spatial Option scenario. The scenario has been developed for a 2036 future year and includes committed development and infrastructure proposals in the current plan period between 2014 and 2021. A summary of the housing development included in the Do Minimum Scenario can be found in Table 3.1 below.

Table 3.1 Housing Site Schedule 2015-2021

Planned Housing Development 2015-2021	
Town Centre Area Action Plan	1,939
North Chelmsford Area Action Plan	2,677
Site Allocations Development Plan	870
Unallocated Large Sites	786
Unallocated Small Sites	517

Housing development between the years 2015 and 2021 has been taken from the Housing Site Schedule provided by CCC in 2016. It is consistent with the housing allocations identified for use in the earlier modelling of CCC's Spatial Options.

A number of non-residential developments planned between 2015 and 2021 were also confirmed with CCC in May 2017 to be included in the latest modelling. These are shown in Table 3.2 below.

Table 3.2 Non-Residential Developments 2015-2021

Development	**Land Use Type**	**Site area (sqm)**
Springfield Business Park	Supporting Commercial & Storage/Distribution	17,070
City Park West (Former ARU Central)	Office/Business Park	9,820
Marconi Evolution (Former Marconi Works)	Office/Business Park & Supporting Commercial	9,820
The Exchange (CM2) – Anderson Site	Office/Business Park & Supporting Commercial	6,214
Beaulieu Square	Supporting Commercial, Food Retail, GP Surgery, Nursery & Community Centre	2,287
Temple Farm (IBSA Village)	Office/Business Park & General Industrial	112,500
Channels Business Park (Relocated Police HQ)	Office/Business Park	16,000
Aquila, Bond Street Development	Supporting Commercial	26,644
Aldi	Food Retail	1,492
Essex County Cricket Club	Leisure	1,754
Clocktower Industrial and Retail Park	Office/Business Park, Supporting Commercial, General Industrial & Storage/Distribution	16,022
Crouch Vale Nurseries & Plantworld	Food Retail & Leisure	8,334
Chelmsford Trade Park - Westway	Office/Business Park, General Industrial & Storage/Distribution	10,393

Table 3-3 below shows the transport infrastructure schemes, considered to be committed by CCC and ECC in May 2017and thus included in the 2036 Do-Minimum scenario, but that are not present in the base year (2014) model.

Table 3.3 Infrastructure schemes 2015-2036

Infrastructure Scheme	Description	Location	Delivery Date
Radial Distributor Road	Single carriageway distributor road including improvements to Boreham Interchange	Between Boreham Interchange J19 A12 to Belsteads Farm Junction on A130	2021
Chelmer Viaduct	Replacement of Viaduct by Highways England. Single carriageway northbound and dual carriageway southbound.	A138 Chelmer Road	Winter 2016
Colchester Road, Springfield	Widening to provide two lane approach to Sainsbury roundabout	A130 between J19 A12 northbound off slip at Drovers Way and Sainsbury roundabout	Late 2017 / Early 2018
Rectory Lane junction with Chelmer Valley Road	Widening of southbound A1016 Chelmer Valley Road to two lane approach to Rectory Lane signals from Alan Cherry (ARU access)	Alan Cherry Drive to Rectory Lane	November 2017
Army and Navy Improvements	Two way flyover	Army and Navy roundabout	2021-2036
Boreham Interchange	Proposed layout by Mayer Brown[6]	Boreham Interchange	-

3.2.2 Traffic Growth Assumptions

No further growth in trips has been modelled for journeys starting or ending in the Chelmsford Administrative Area apart from growth due to changes in fuel and income. Trips starting or ending outside of the Chelmsford Administrative Area have been controlled to forecasts from the National Trip End Model (NTEM v7.2) as per the Department for Transport's guidance and in the absence of more up-to-date information at the time of undertaking this work. Appendix C shows the average growth in car trips forecast from NTEM for trips starting or ending outside of the Chelmsford Administrative Area (VISUM model zones 147-321[7]) by purpose for each

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[6] Beaulieu Park, Chelmsford Outline Planning Application Transport Assessment – Mayer Brown January 2012 - p42

[7] Chelmsford Traffic and Access Strategy - Local Model Validation Report Revision 4 - 25th August 2016

time period. Appendix M illustrates the zone system covering the Chelmsford Administrative Area and City Centre.

3.2.3 Development Trip Generation and Distribution

Vehicle trips to and from the developments by model zone have been calculated based on the assumptions listed above and using the same method as that employed for the Chelmsford Strategic Model initial forecasting as reported in the Traffic Forecasting Report, Version 2, August 2016. Zone connector shares have been updated to load the quantities of traffic associated with the development on the assumed connector nodes in the proportions detailed, whilst leaving the quantity of base traffic assigned as per the base model.

Average trip rates taken from the TRICS database and used in the calculation of development trips have been documented in Appendix D of this report.

The total forecast year trips have been distributed between start and end points (origins and destination zones) through a Furness process to create the demand matrices for the model. This method is also the same as that employed for the Chelmsford Strategic Model initial forecasting as reported in the Traffic Forecasting Report, Version 2, August 2016 and uses the distribution from the base model as a starting point.

Development distributions have been based on those from the parent zone housing the developments in the model.

This methodology has been used for both the Do Minimum and Local Plan Preferred Option scenario modelling.

3.2.4 2036 Do Minimum Forecast Traffic Flows

Through a comparison with the Local Plan Preferred Option scenario, the modelling of a Do Minimum scenario serves to illustrate the specific impact of proposed Local Plan development and infrastructure on the road network in the Chelmsford Local Authority Area (LAA).

On their own, modelled traffic flow outputs from the Do Minimum scenario are representative of a hypothetical scenario where no development has occurred in the Chelmsford LAA between 2021 and 2036. Vehicle flow plots for the AM and PM peak hours have therefore been produced from the VISUM model and have been included in Appendix E of this report, without commentary and for reference purposes only.

3.2.5 2036 Forecast Congestion

Modelled congestion plots for the 2036 Do Minimum scenario are provided below to illustrate the main areas of network constraint in the Chelmsford LAA without the addition of Local Plan development and infrastructure. In effect, the plots illustrate the areas of network ‘sensitivity’ where the impact of further development is likely to be most keenly felt.

Routes with a volume/capacity (V/C) ratio of 0.8 (operating at 80% of capacity) can be considered to be approaching capacity. It is likely that these links will be affected by rising levels of congestion as the ratio increases. Routes shown in the congestion plots as having a ratio exceeding 0.9 (operating at 90% capacity) have been highlighted as likely to experience moderate levels of congestion. Levels of congestion increase exponentially once the V/C ratio exceeds 1 (100%) and the flow of traffic along the route exceeds the capacity of the link.

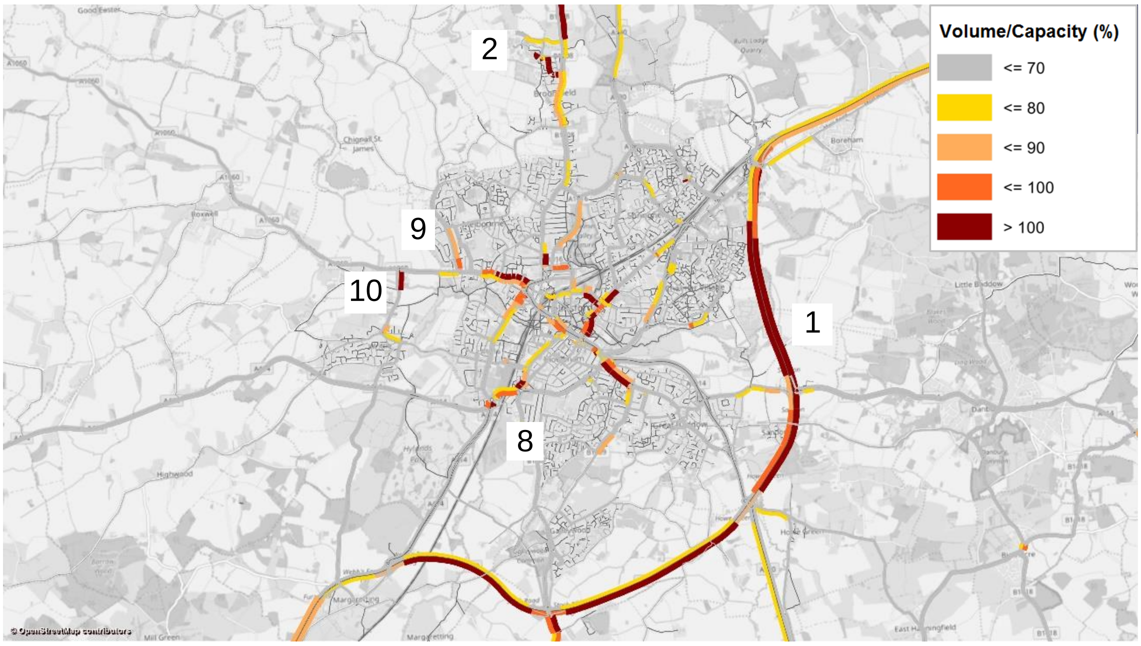

Figure 3.1 AM Peak 2036 forecast congestion in Chelmsford (Do Minimum)

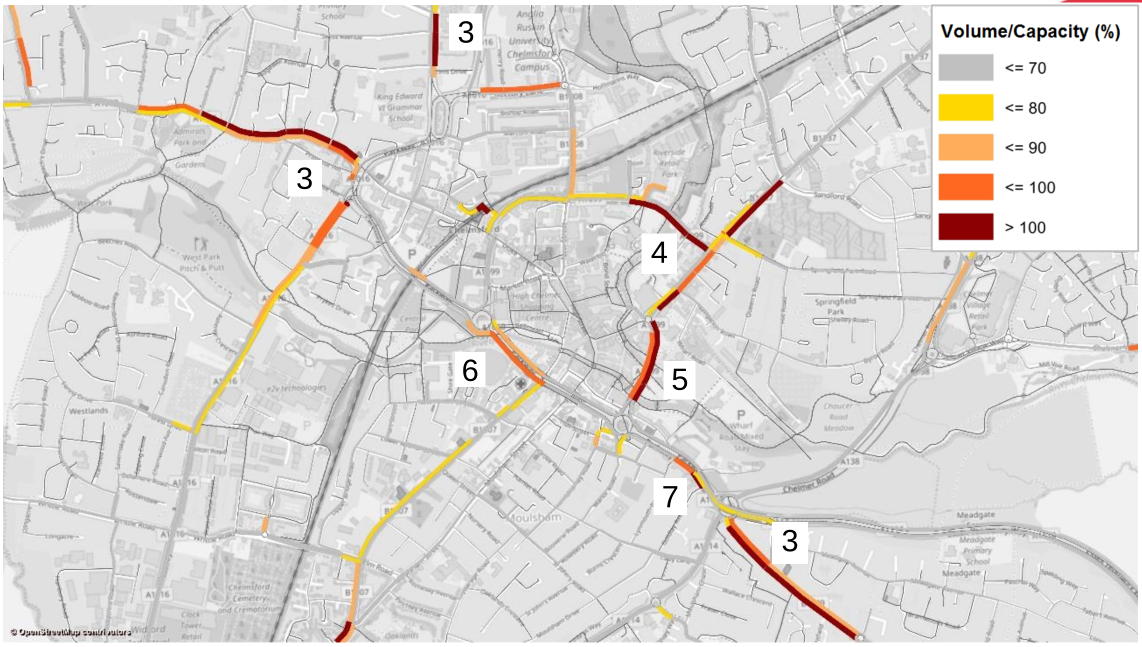

Figure 3.2 AM Peak 2036 forecast congestion in Chelmsford city centre (Do Minimum)

Figure 3.1 and Figure 3.2 illustrate the main areas of congestion in Chelmsford in the AM Peak Do Minimum scenario as follows:

1. A12 corridor between J15 and J19
2. B1008 Main Road Broomfield in the vicinity of Broomfield Hospital
3. Corridor routes approaching junctions with A1060 Parkway – specifically the B1008 Broomfield Road, A1060 Rainsford Road, A1016 Rainsford Lane and B1008 Baddow Road
4. B1137 Springfield Road on the approach to the junction with A1099 Victoria Road and at the Bond Street (Tesco) Roundabout
5. A1099 High Bridge Road on the approach to A1060 Parkway
6. A1060 Parkway on the westbound approach to Market Roundabout
7. A1060 Parkway at the westbound carriageway merge with the Army & Navy flyover
8. Widford Viaduct (A1114 London Road) westbound
9. Chignal Road on the approach to the junction with A1060 Roxwell Road
10. Lordship Road in Writtle

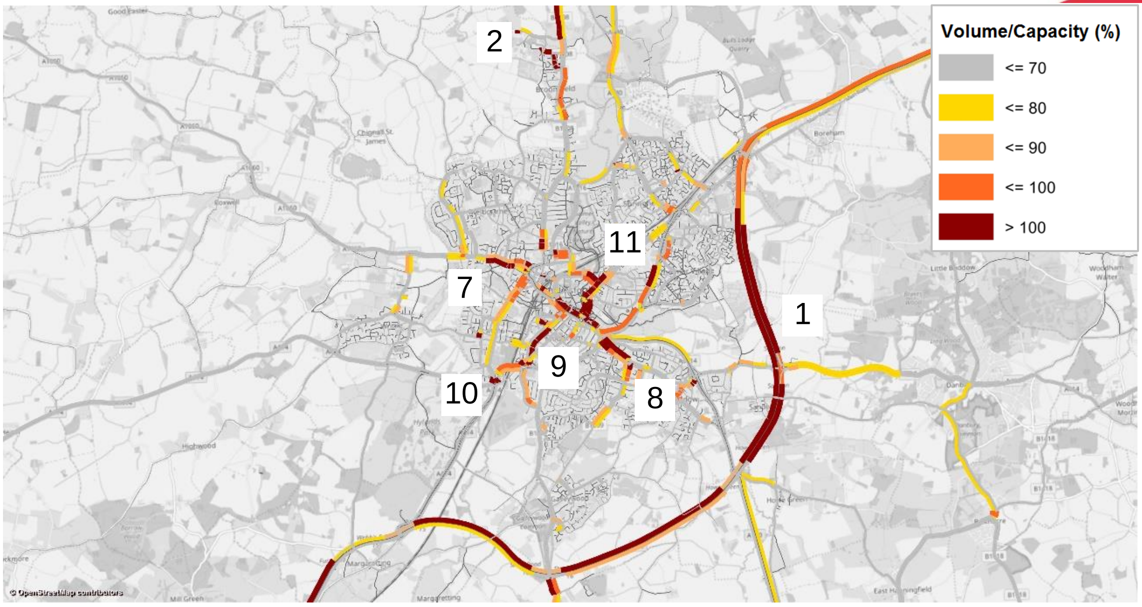

Figure 3.3 PM Peak 2036 forecast congestion in Chelmsford (Do Minimum)

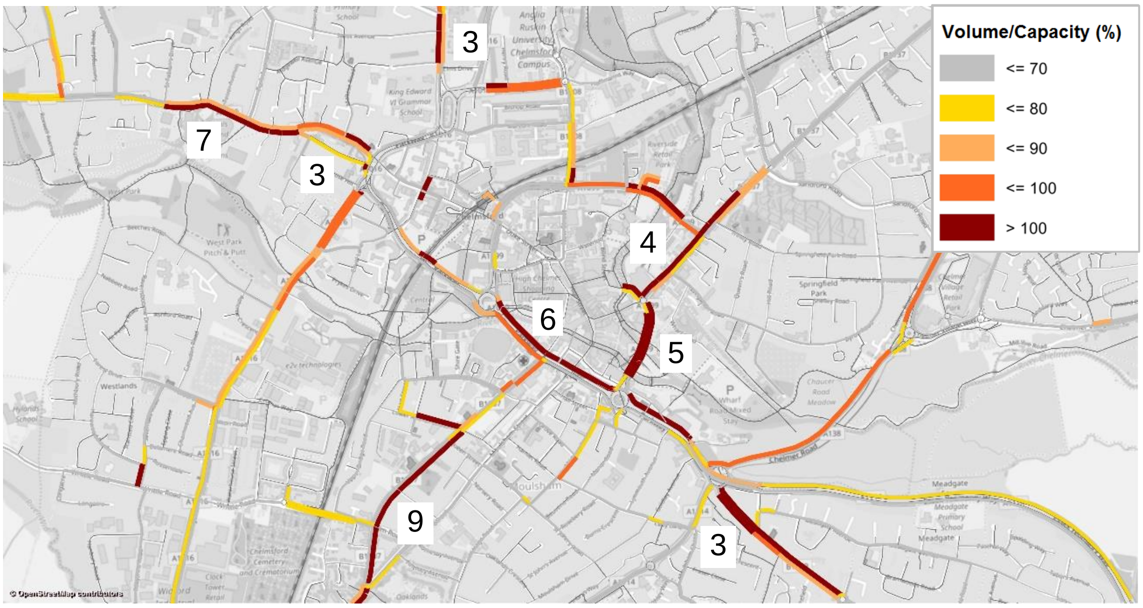

Figure 3.4 PM Peak 2036 forecast congestion in Chelmsford city centre (Do Minimum)

Figure 3.3 and Figure 3.4 illustrate the main areas of congestion in Chelmsford in the PM Peak Do Minimum scenario as follows:

1. A12 corridor between J15 and J19
2. B1008 Main Road Broomfield in the vicinity of Broomfield Hospital
3. Corridor routes approaching junctions with A1060 Parkway – specifically the B1008 Broomfield Road, B1008 Rectory Lane, A1060 Rainsford Road, A1016 Rainsford Lane and B1008 Baddow Road.

4. B1137 Springfield Road on the approach to the junction with Sandford Road – extending back through the Bond Street (Tesco) Roundabout
5. A1099 High Bridge Road in both directions
6. A1060 Parkway on the westbound approach to Market Roundabout and eastbound between Market Roundabout and the Army and Navy Roundabout
7. A1060 Rainsford Road westbound
8. B1009 Baddow Road eastbound towards junction with Beehive Lane
9. B1007 New London Road south-westbound towards Miami Roundabout
10. Widford Viaduct (A1114 London Road) in the vicinity of Miami Roundabout
11. A138 Chelmer Road north-eastbound between the Army & Navy Roundabout and the junction with New Dukes Way

As can be seen from the figures, congestion is shown in the modelling to be more extensive in the PM peak. Areas of congestion identified in the AM peak modelling on corridor routes into Chelmsford are largely replicated in the PM. However, further congestion is modelled on the same routes in the outbound direction heading away from the city centre in the PM peak hour.

3.2.6 Great Leighs & South Woodham Ferrers

Both these areas are of particular interest to this study, since they contain development in the Local Plan Preferred Option. It is important to acknowledge however, that outputs from the VISUM model that are extracted from peripheral areas of the Chelmsford LAA should be considered less robust, with network validation focussed on the urban area of Chelmsford.

Coverage of the road network at the periphery of the VISUM model is also less detailed and this has the potential to impact the assignment of traffic at a more local level through areas such as South Woodham Ferrers and Great Leighs.

Consequently, the strategic highway impact of Local Plan development in these areas cannot be robustly quantified using the same modelling approach adopted for developments closer to Chelmsford.

For this reason, the impact of Local Plan development and infrastructure has been assessed exclusively at a local junction level, with modelled results and analysis included in Chapter 5 of this report.

3.3 The Preferred Spatial Option Scenario

3.3.1 Development and Infrastructure Assumptions

A summary of the housing development included in the 2036 Preferred Spatial Option Scenario as of May 2017 can be found in Table 3.4 below.

Table 3.4 Local Plan Preferred Option Development Area Locations 2021-2036

Development Location	Housing (dwellings)	Employment (Business Park) sqm	Commercial (Retail) sqm
Location 1: Chelmsford Urban Area	2,957	17,000	5,000
Location 2: West Chelmsford	800		
Location 3: East Chelmsford (East of Great Baddow)	400	5,000	
Location 4: North East Chelmsford	3,000	45,000	
Location 5: Moulsham Hall and North Great Leighs	1,100		
Location 6: North Chelmsford (Broomfield)	800		
Location 7: Boreham	145		
Location 8: North of South Woodham Ferrers	1,000	1,000	
Location 9: Bicknacre	30		
Location 10: Danbury	100		
Beaulieu Post 2021 Roll-Over	2,580		
Windfall Sites	1,500		

Additional non-residential development included in the Preferred Spatial Option is shown in Table 3.5 below.

Table 3.5 Non-Residential Developments 2021-2036

Development	Land Use Type	Site Area (sqm)
NE Chelmsford Employment and Non-Residential Uses – permitted as part of Beaulieu scheme with Rail Station provided	Office/Business Park, Leisure, Nursery & Hotel	17,700
Greater Beaulieu Business Park	Office/Business Park	40,000

A full breakdown of the Local Plan Preferred Option development sites can be found in Appendix F of this report.

Brownfield Sites

It is acknowledged that a number of city centre Local Plan developments are located on urban brownfield sites that currently generate trips from their existing land uses. In order to avoid double-counting, current trips were calculated from an estimate of the size of existing developments, and then subtracted from the forecast model trip end totals. A full breakdown of the estimated m^2 area of brownfield developments can be found in Appendix F of this report.

By accounting for changing land use on urban brownfield sites, the adjusted quantum of trips generated by Local Plan developments in the city centre is shown to be around 25% lower than it would otherwise have been. Values are shown in Table 3.6 below.

Table 3.6 City centre Local Plan forecast trip calculations 2021-2036

2021-2036	AM	IP	PM
City centre Local Plan trip generation	2,859	5,914	3,681
Existing land use trips removed from brownfield sites	731	1,590	996
Total city centre Local Plan forecast trips	2,128	4,324	2,686

3.3.2 Traffic Growth Assumptions

When modelling the Local Plan Preferred Option, growth in housing and employment in the Chelmsford LAA has been based on the Preferred Option allocations identified in Table 3.4 and Table 3.5 above. Numbers have not subsequently been factored to overall levels of growth in TEMPro. Trips starting or ending outside of the Chelmsford Administrative Area have been controlled to forecasts from NTEM v7.2.

3.3.3 Development Trip Generation and Distribution

See Section 3.2.3.

3.3.4 Location and Access Assumptions

To better model accesses to/from proposed Local Plan development sites, it was possible to simulate new access points onto the road network in VISUM by increasing the number of zone connectors (the network entry and exit points associated with each model zone).

At the same time, the locations of developments in a particular zone were modelled more accurately by altering the proportion of trip origins and destinations that were assigned to each of the zone’s connectors. This was an effective method of managing the volume of development trips accessing the road network in the vicinity of the proposed development sites.

3.3.5 Proposed Infrastructure 2021-2036

A combination of developer and local authority-proposed infrastructure to be built between 2021 and 2036 has been included in the Preferred Option scenario together with the schemes included within the Do Minimum scenario, see Table 3.3. The schemes are listed below with superscript lettering used to identify the schemes in Figure 3.5 and Figure 3.6.

- A Chelmsford North East Bypass (CNEB) functioning as a single lane carriageway[a] between the Radial Distributor Road (RDR)[b] and a proposed new junction with the A131 Braintree Road at Chatham Green[c]; with a dualled section of carriageway[d] between the junction at Chatham Green and Deres Bridge Roundabout[e].
- An additional link road[f] (Radial Distributor Road 2) connecting a proposed new A130 access junction[g] north of Pratt's Farm to an at-grade junction on the CNEB[h].
- Park and Ride sites at Widford[i] and Boreham[j]
- Beaulieu Rail Station[k]
- Broomfield Hospital new northern link road[l]

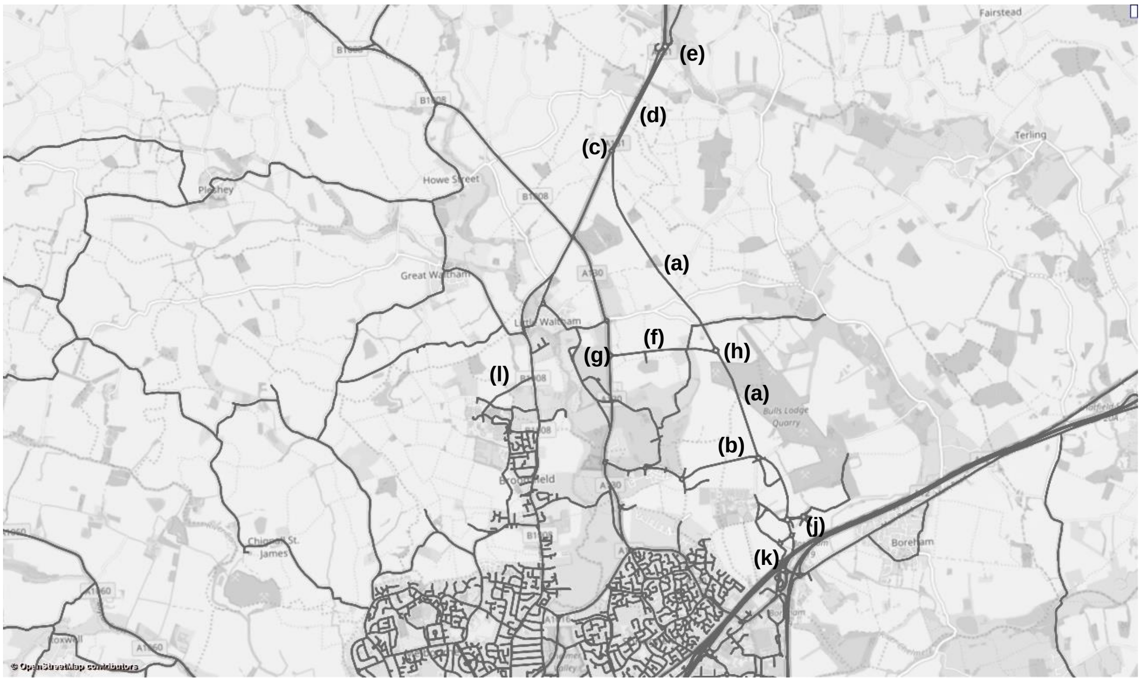

Figure 3.5 2036 modelled Local Plan infrastructure in North Chelmsford

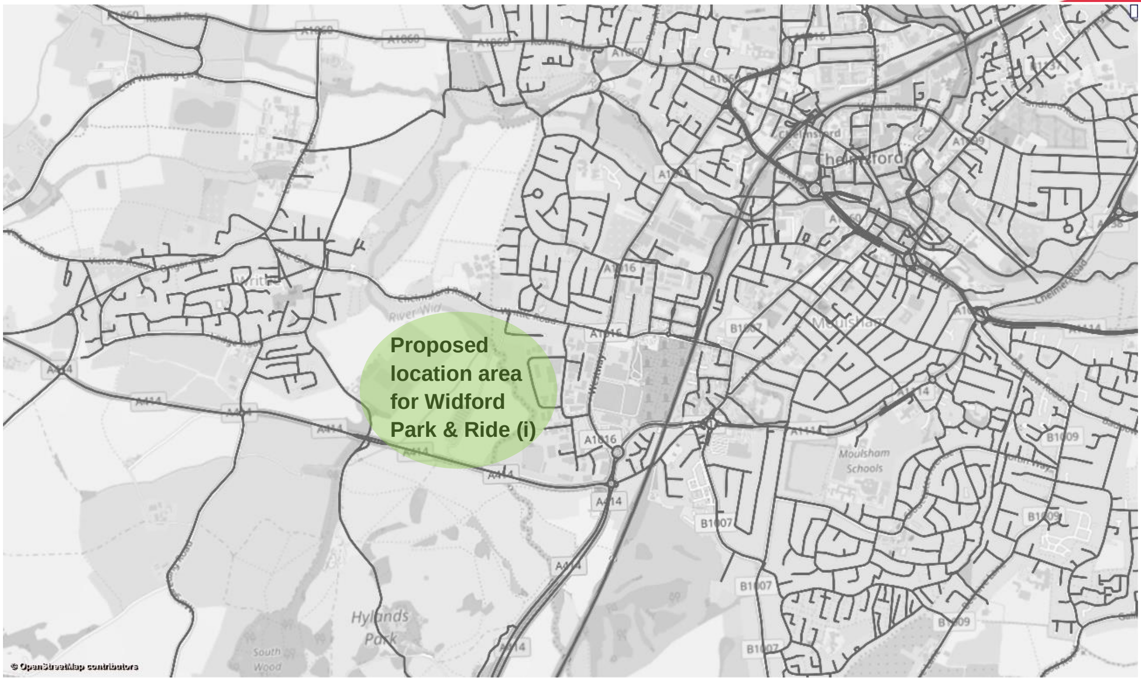

Figure 3.6 2036 modelled Local Plan infrastructure in West Chelmsford (Widford Park and Ride)

The long term plan for the CNEB is to provide a seamless dual carriageway link between the A12 and the A131. Details of the CNEB proposals are still under review at the time of reporting and are subject to change. The layout and route alignment of the CNEB modelled for this study reflects the proposals agreed with ECC as of April 2017.

Additional Park and Ride sites at Widford and Boreham have been included in the Preferred Option scenario. These are part of Essex County Council's strategic plan for Chelmsford. Their viability is dependent on a complementary parking strategy for the city centre. Along with the Park and Ride sites, a proposed Beaulieu Rail Station has also been included in the Preferred Option.

The Broomfield Hospital northern link road and Widford Park and Ride are still at an early design stage and have therefore been included in the modelling without prior knowledge of final route alignments or proposed connectivity to the existing network. The Widford Park and Ride site selection has yet to be confirmed, so the modelled location of the site access has been assumed to be from the A414 (Greenbury Way).

3.3.6 2036 Forecast Traffic Flows

Figure 3.7 and Figure 3.8 below illustrate the modelled traffic flows across the Chelmsford Road network in a 2036 AM peak scenario with Local Plan development and infrastructure present.

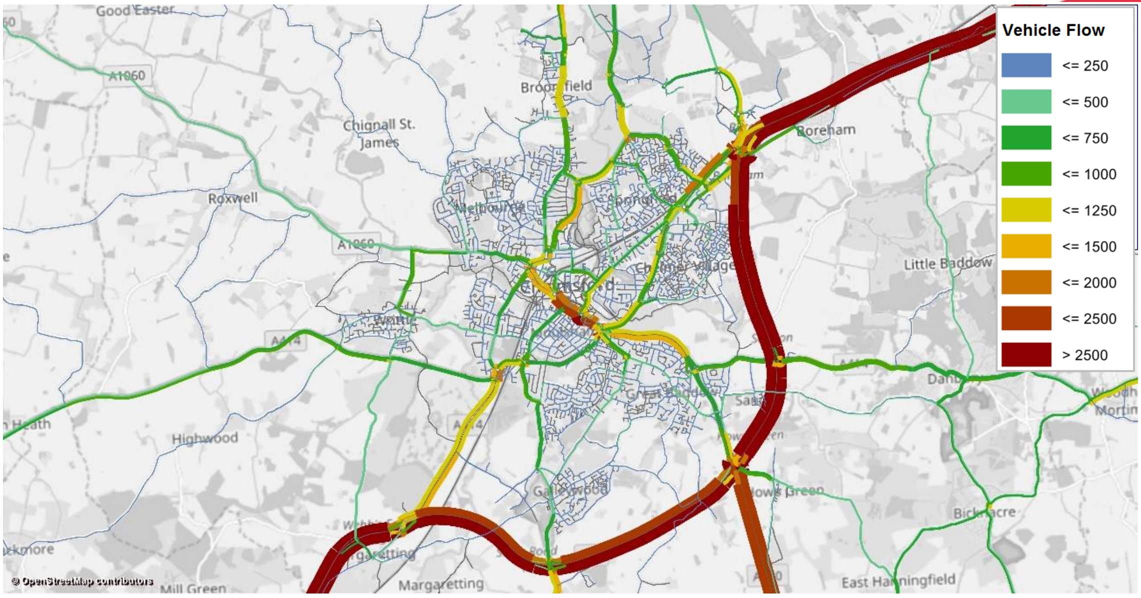

Figure 3.7 AM Peak 2036 forecast traffic flows in Chelmsford (with Local Plan)

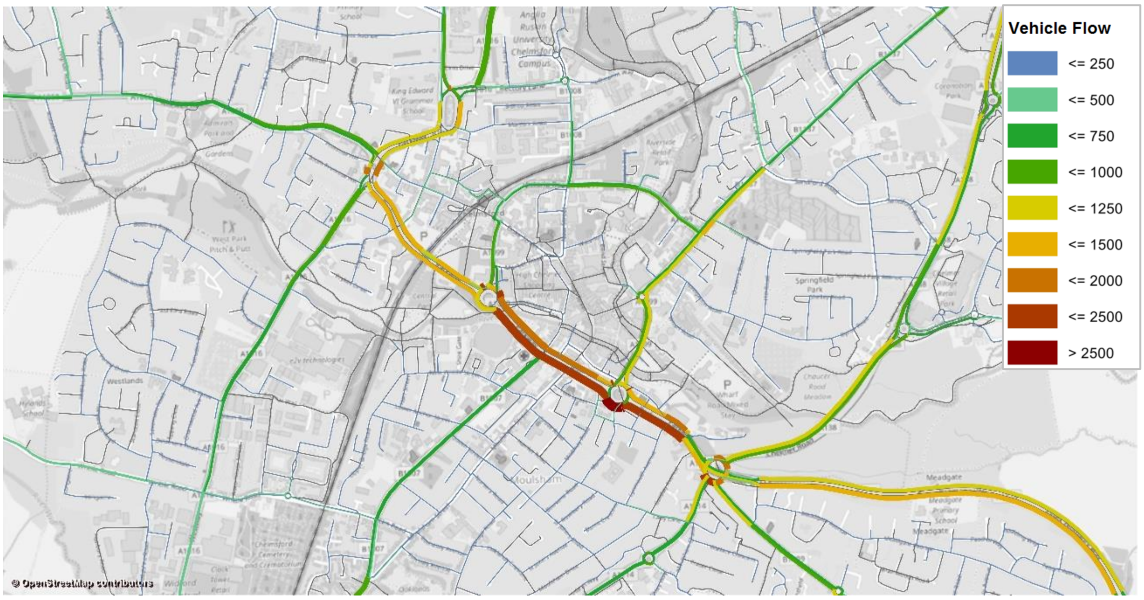

Figure 3.8 AM Peak 2036 forecast traffic flows in Chelmsford city centre (with Local Plan)

Flow outputs from the Local Plan scenario help provide context for understanding the scale of network flow change associated with Local Plan development and infrastructure provision (see Section 3.3.7).

Patterns of traffic flow reflect the road hierarchy in Chelmsford, with higher flows shown on trunk roads (A12 and A130 south) and corridor routes into Chelmsford such as the A414 Three Mile Hill London Road, A1114 Essex Yeomanry Way (Baddow Bypass) and B1008 Main Road, Broomfield.

Some of the key routes demonstrate flow ‘tidality’, with greater volumes of traffic modelled heading into the city centre in the AM peak and larger volumes heading away from the city centre in the PM peak – see Figure 3.9 and Figure 3.10 below. Flows along Parkway also demonstrate tidality, with westbound flows higher in the AM peak and eastbound flows higher in the PM peak.

Across the modelled network and in the city centre in particular, traffic flows are shown to be higher in the PM peak.

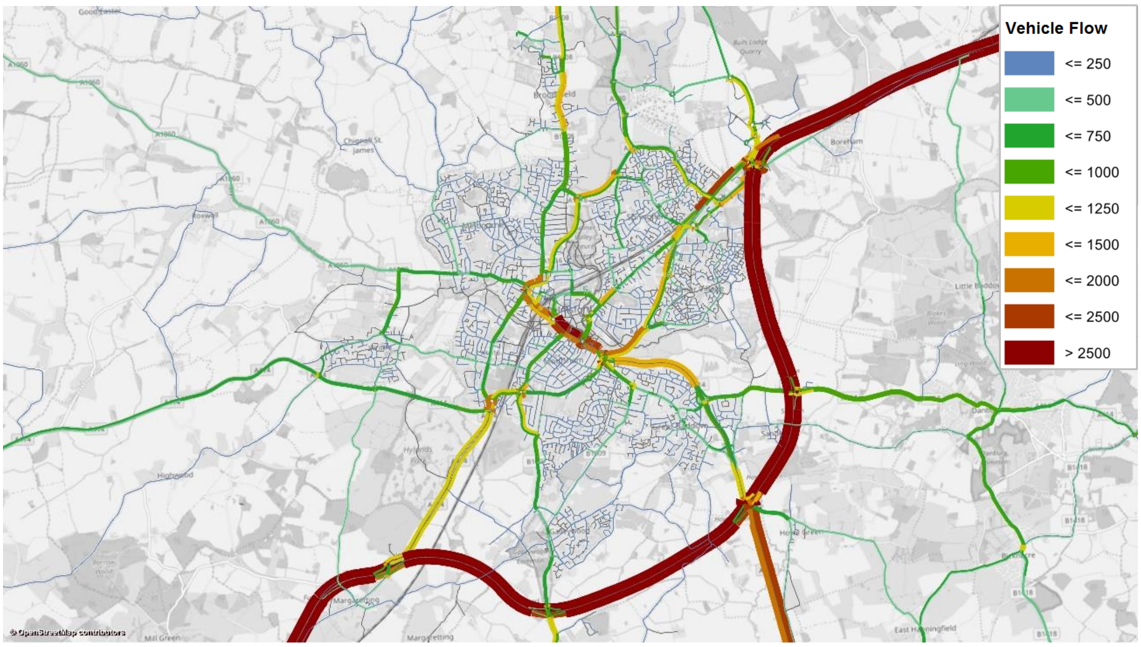

Figure 3.9 PM Peak 2036 forecast traffic flows in Chelmsford (with Local Plan)

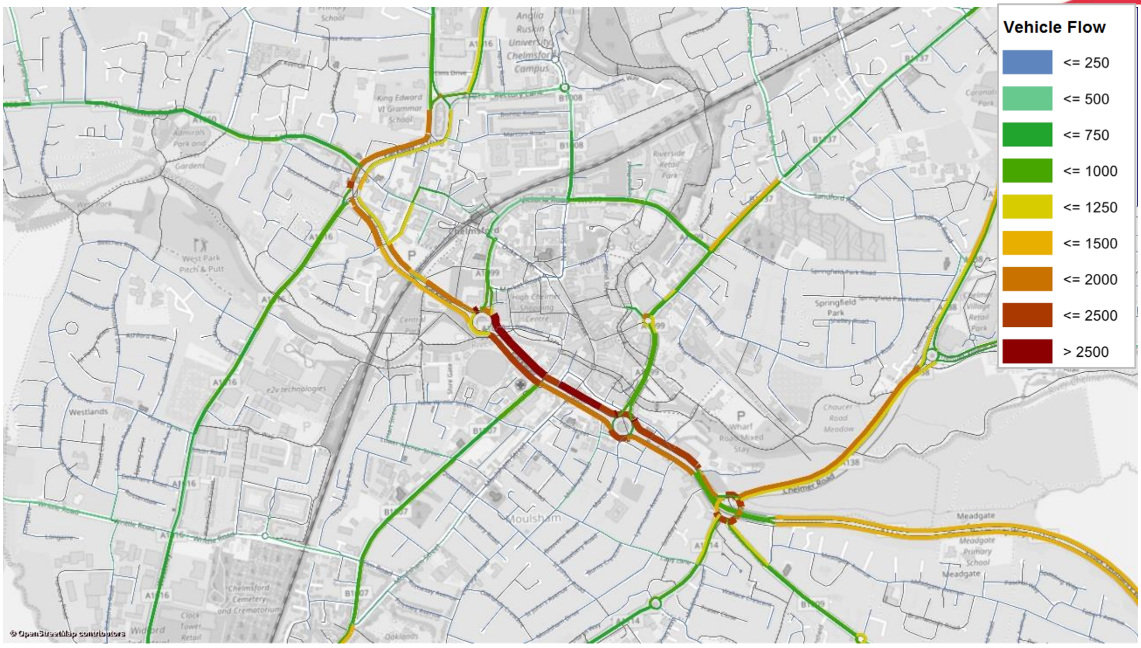

Figure 3.10 PM Peak 2036 forecast traffic flows in Chelmsford city centre (with Local Plan)

3.3.7 Change in Traffic Flow over the Do Minimum Scenario – Impact of the Local Plan

Figure 3.11 and Figure 3.12 below illustrate the change in traffic flow modelled between the Do Minimum scenario and Local Plan scenario in the AM peak. The changes in modelled traffic flow can therefore be viewed as being a direct result of Local Plan development and associated infrastructure.

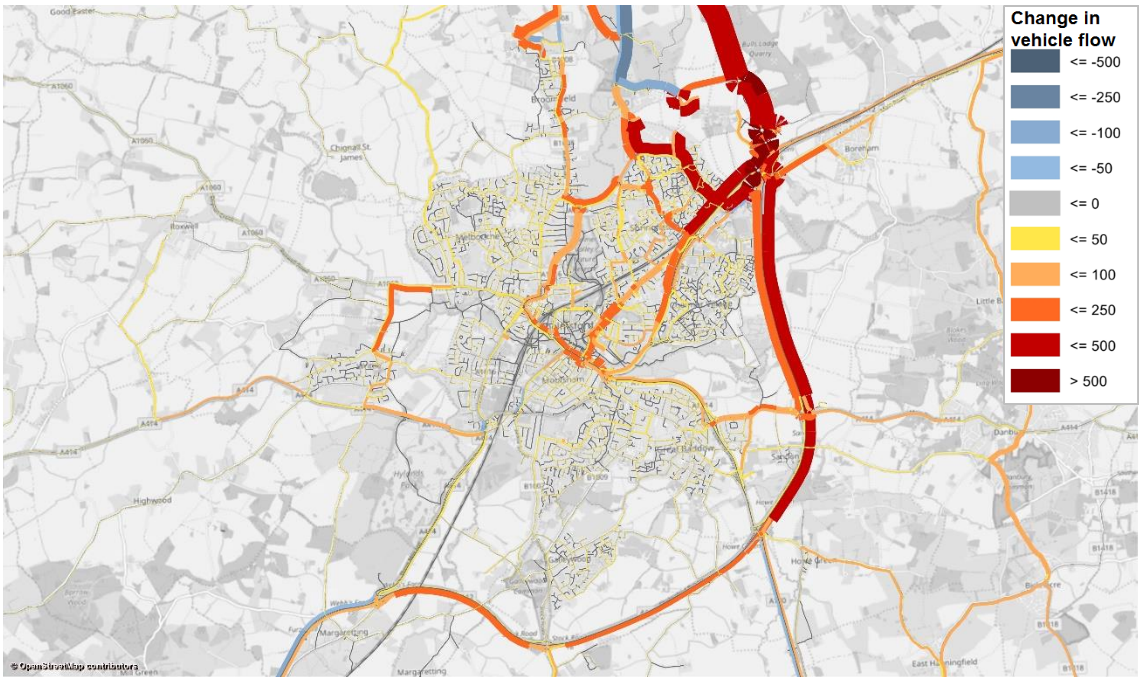

Figure 3.11 AM Peak 2036 traffic flow difference with Local Plan in Chelmsford

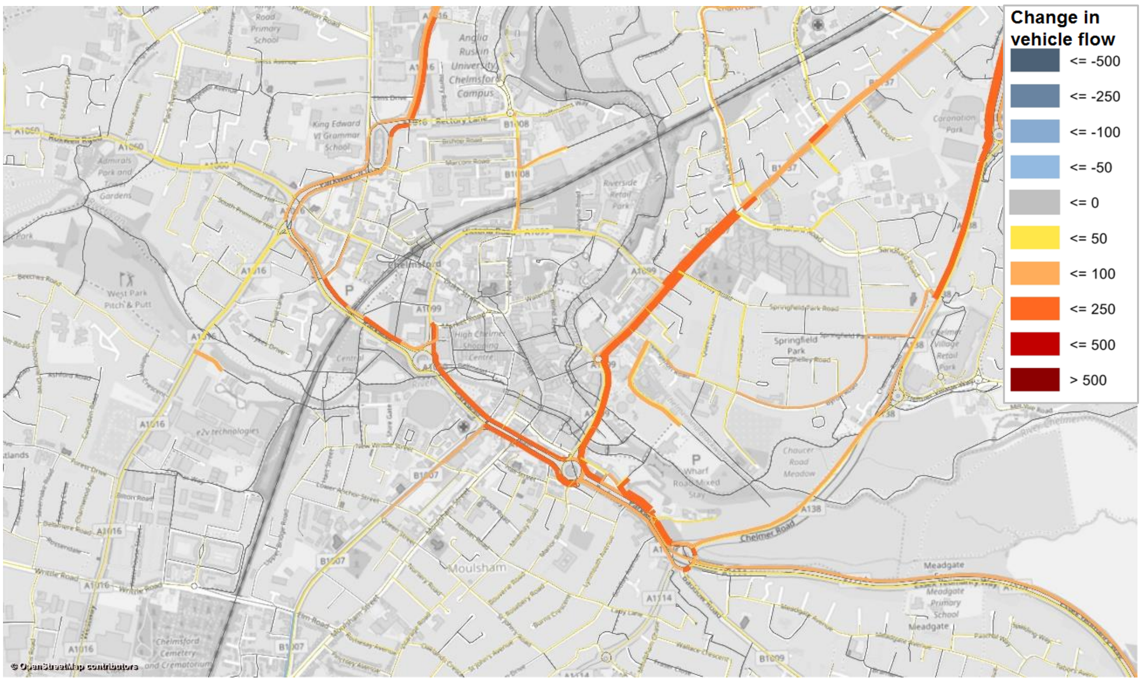

Figure 3.12 AM Peak 2036 traffic flow difference with Local Plan in Chelmsford city centre

The focus of modelled traffic flow increase on the Chelmsford road network in the AM peak is in North East Chelmsford. White Hart Lane is shown to accommodate a considerable proportion of development flow from Greater Beaulieu, whilst the proposed Beaulieu rail station and Park and Ride site are shown to attract additional flows through the Boreham Interchange and RDR. At the same time, the CNEB is modelled to accommodate flows that have transferred from A130 Essex Regiment Way, leaving the existing route with an overall reduction in traffic flow north of the RDR.

Development and infrastructure in North East Chelmsford are also modelled to increase flows along the A12 corridor – notably between J19 (Boreham Interchange) and J17 (Howe Green).

Elsewhere, traffic flow increases are modelled in the vicinity of development sites to the East of Chelmsford on the A414 in Sandon, and to the West of Chelmsford on the A1060 Roxwell Road and Lordship Road. Traffic is also modelled to transfer to the proposed new link in Broomfield. Moderate traffic flow increases are also shown in the city centre along Parkway and corridor routes to/from the north – specifically, A1016 Chelmer Valley Road, Springfield Road and A138 Chelmer Road.

Modelled flow increases in the AM peak are shown to occur along a number of ‘sensitive’ routes identified in the Do Minimum scenario modelling where congestion is expected to be more prevalent (see Figure 3.1 and Figure 3.2). Notable examples include Springfield Road and High Bridge Road in the city centre, Lordship Road in Writtle, White Hart Lane (as mentioned above) and the A12 between J19 and J17.

Figure 3.13 and Figure 3.14 below illustrate the change in traffic flow modelled between the 2036 Do Minimum scenario and 2036 Local Plan scenario in the PM peak.

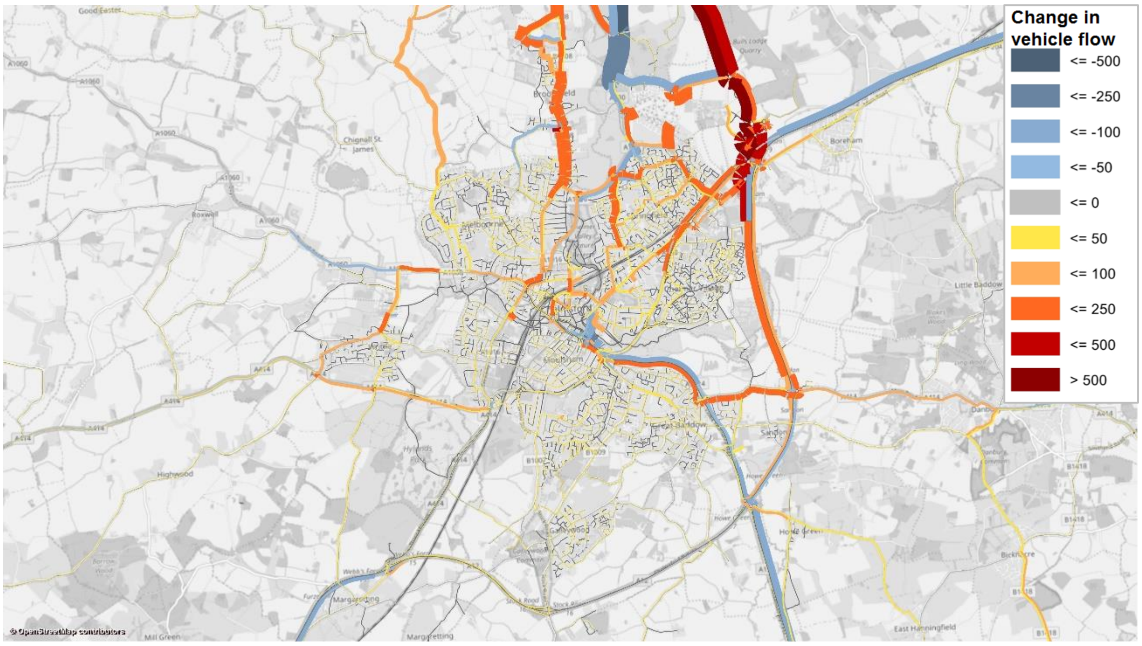

Figure 3.13 PM Peak 2036 traffic flow difference with Local Plan in Chelmsford

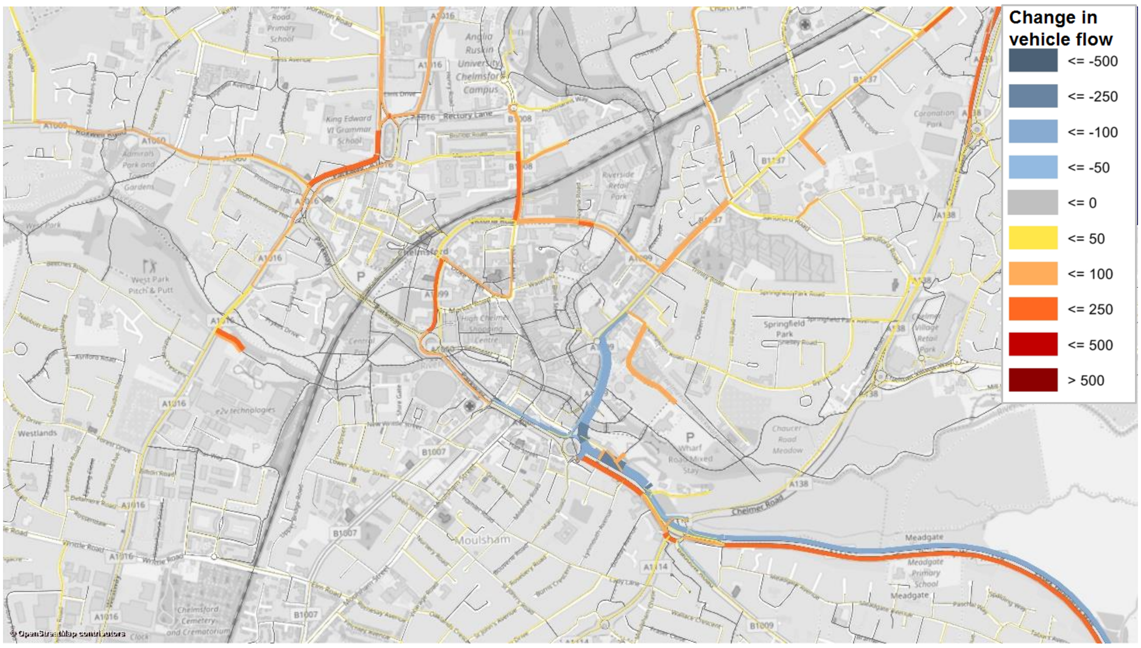

Figure 3.14 PM Peak 2036 traffic flow difference with Local Plan in Chelmsford city centre

The focus of traffic flow increase on the Chelmsford road network in the PM peak is again modelled in North East Chelmsford with patterns of flow change broadly in line with those shown in the AM peak, albeit to a lesser extent.

Elsewhere, traffic flow increases are modelled on the B1008 Main Road and to the East of Chelmsford on the A414 in Sandon. Traffic is also modelled to transfer to the proposed new link in Broomfield. Moderate traffic flow increases are also shown northbound along the A1016 Chelmer Valley Road corridor and westbound along the A1114 Essex Yeomanry Way (Baddow Bypass).

Overall changes in vehicle flow are shown to be lower in the PM peak than in the AM peak, particularly in the city centre.

Modelled flow increases in the PM peak are shown not to occur along 'sensitive' routes identified in the Do Minimum scenario modelling where congestion is expected to be more prevalent (see Figure 3.3 and Figure 3.4).

3.3.8 Change in Ratio of Flow to Capacity over the Do Minimum Scenario – Impact of the Local Plan

Figure 3.15 and Figure 3.16 below illustrate the change in the V/C ratio modelled between the Do Minimum scenario and Local Plan scenario in the AM peak. The changes in modelled V/C can therefore be viewed as being a direct result of Local Plan development and associated infrastructure. Links highlighted as dark red are modelled as having at least a 20% increase in their V/C ratio.

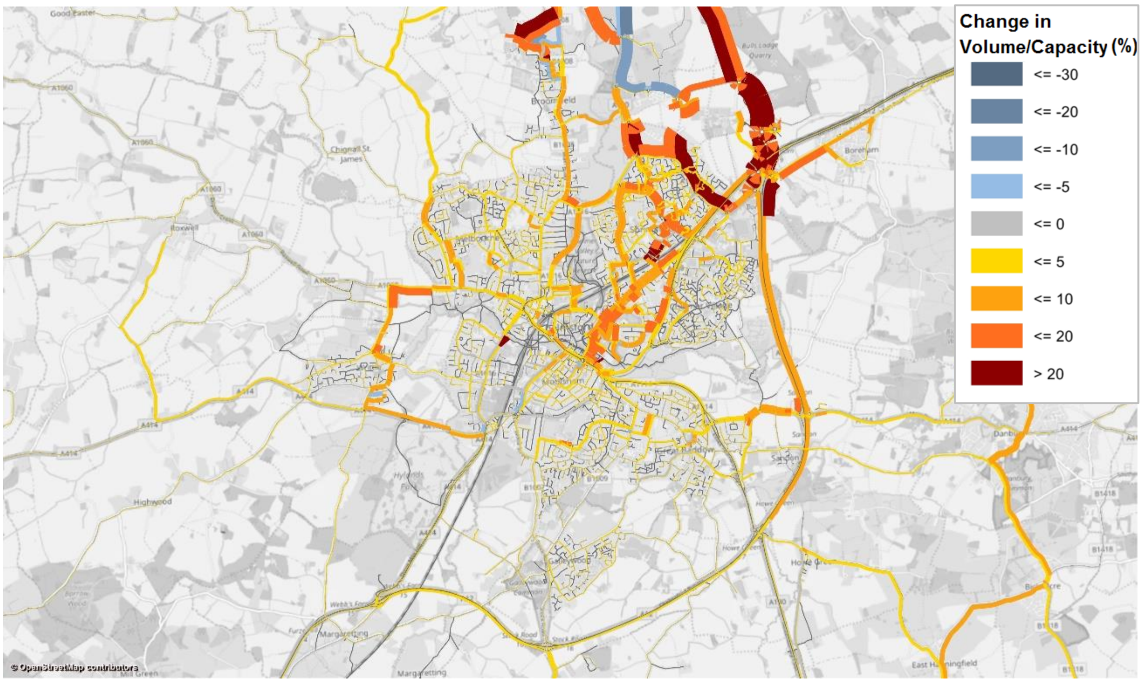

Figure 3.15 AM Peak 2036 change in network ratio of flow to capacity with Local Plan in Chelmsford

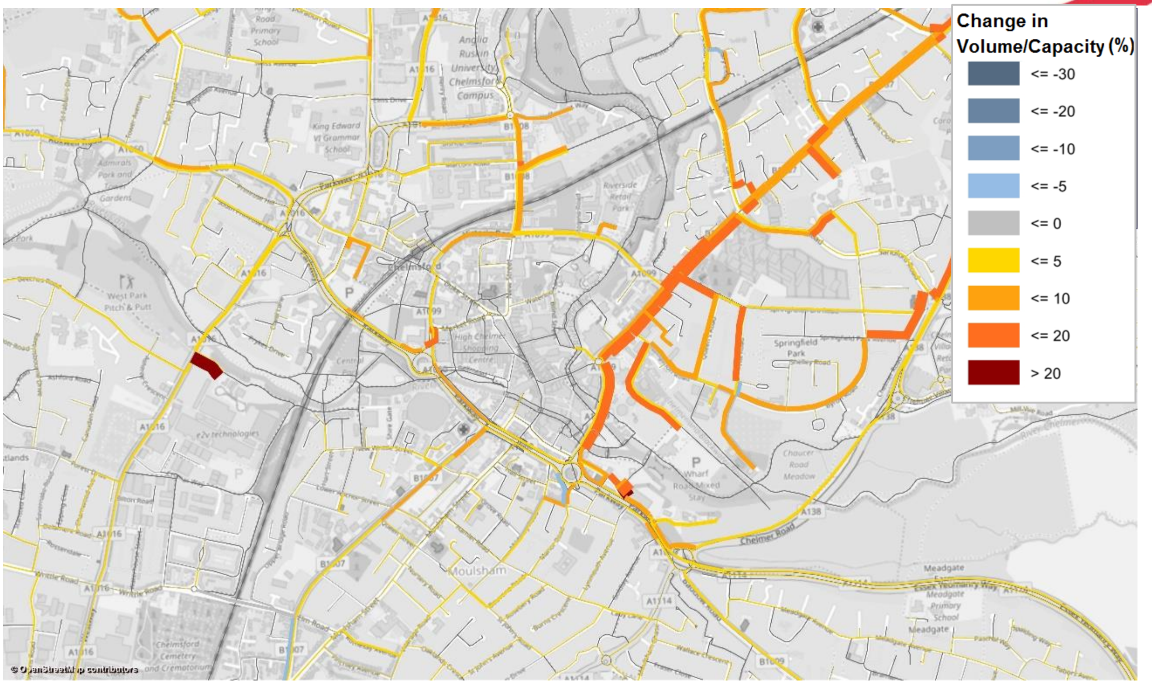

Figure 3.16 AM Peak 2036 change in network ratio of flow to capacity with Local Plan in Chelmsford city centre

The scale of increase in the V/C ratio along routes in and around Chelmsford is commensurate with the increase in traffic flow and the capacity of the network. New routes such as the CNEB are therefore modelled with a large increase in V/C as traffic flows are introduced to the route. Springfield Road and Parkway in the city centre experience similar increases in traffic flow to each other in the AM peak. However, as Springfield Road has a comparatively lower capacity, the increase in modelled V/C along the route is shown to be proportionally higher.

Figure 3.17 and Figure 3.18 below illustrate the change in the V/C ratio modelled between the Do Minimum scenario and Local Plan scenario in the PM peak. Together with the AM peak, the scale of change in V/C modelled on routes is placed in greater context when considering the overall level of congestion on the road network in 2036 with the Local Plan development and infrastructure in place. This is discussed in the following section of this report.

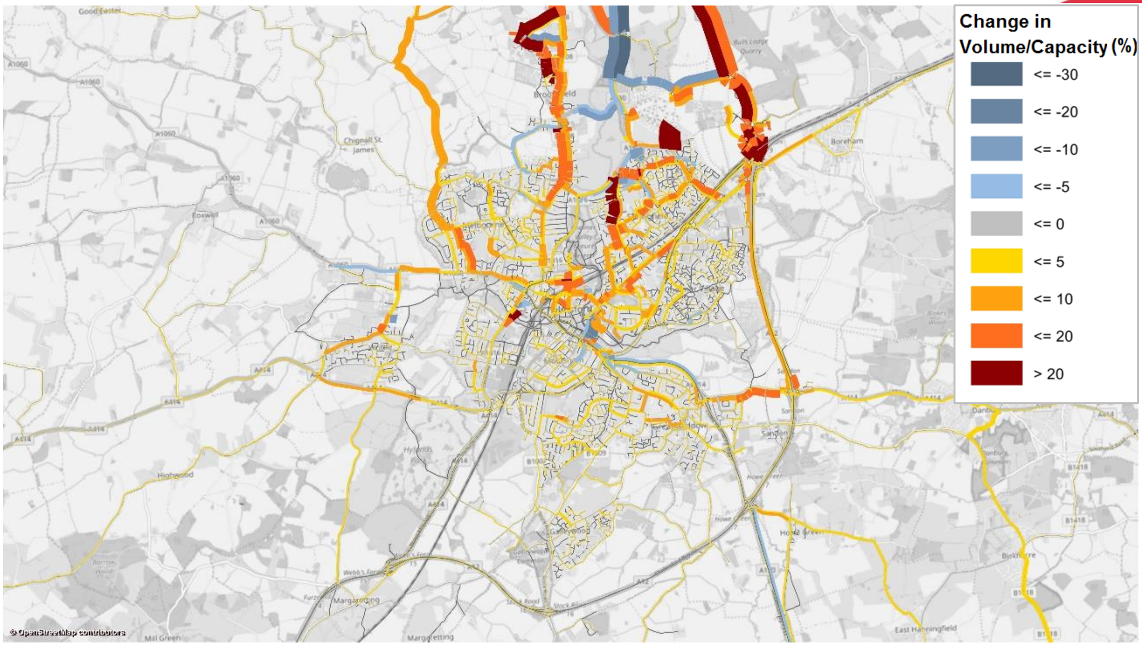

Figure 3.17 PM Peak 2036 change in network ratio of flow to capacity with Local Plan in Chelmsford

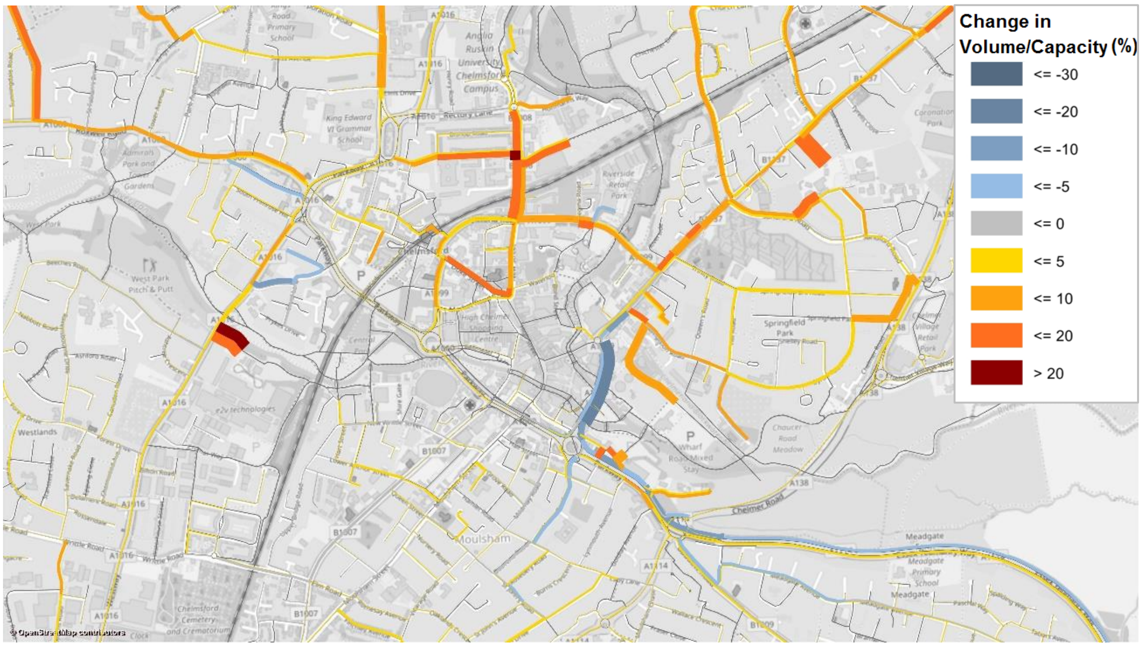

Figure 3.18 PM Peak 2036 change in network ratio of flow to capacity with Local Plan in Chelmsford city centre

3.3.9 2036 Forecast Congestion

Modelled congestion plots for the 2036 Local Plan scenario are provided below to illustrate the main areas of network constraint in the Chelmsford LAA with the addition of Local Plan development and infrastructure.

Routes with a V/C ratio of 0.8 (operating at 80% of capacity) can be considered to be approaching capacity. It is likely that these links will be affected by rising levels of congestion as the ratio increases. Routes shown in the congestion plots as having a ratio exceeding 0.9 (operating at 90% capacity) have been highlighted as likely to experience moderate levels of congestion. Levels of congestion increase exponentially once the V/C ratio exceeds 1 (100%) and the flow of traffic along the route exceeds the capacity of the link.

Figure 3.19 and Figure 3.20 below illustrate the main areas of congestion in Chelmsford in the AM peak Local Plan scenario. Patterns of congestion in the Chelmsford LAA and in the city centre are broadly similar to those shown in the Do Minimum scenario.

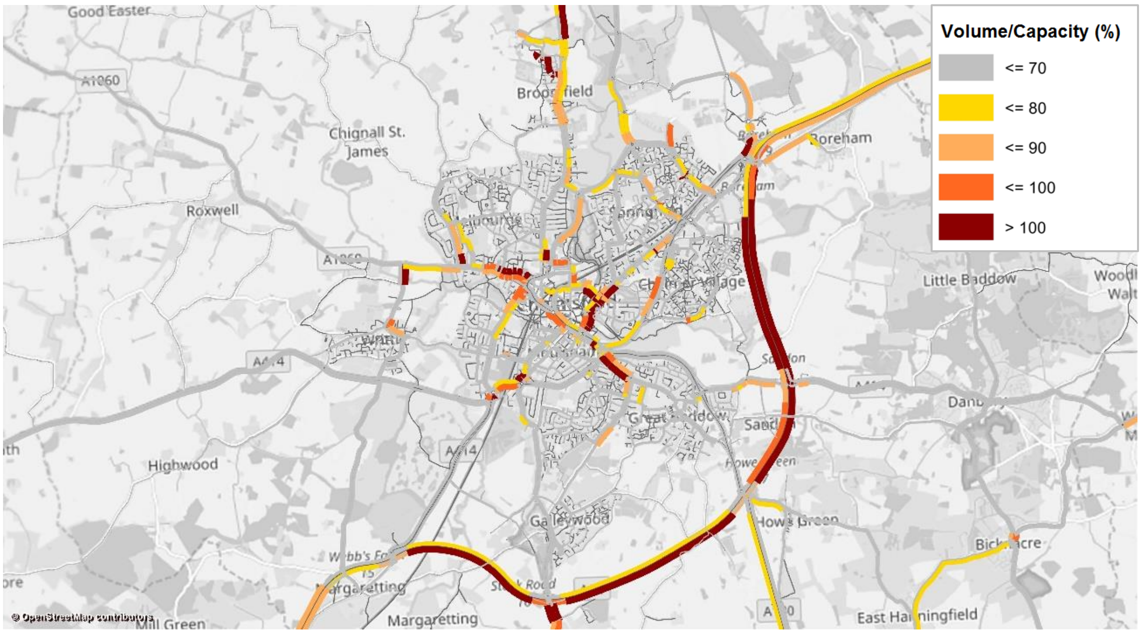

Figure 3.19 AM Peak 2036 forecast congestion in Chelmsford (Local Plan)

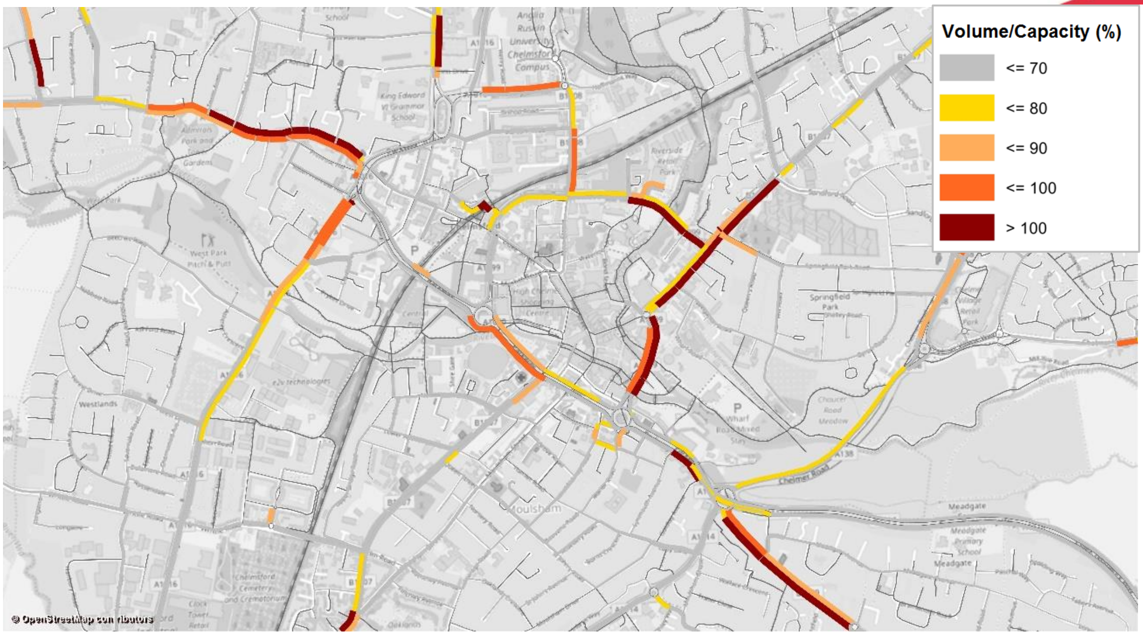

Figure 3.20 AM Peak 2036 forecast congestion in Chelmsford (Local Plan)

Figure 3.21 and Figure 3.22 illustrate the main areas of congestion in Chelmsford in the PM Peak Local Plan scenario. Again, patterns of congestion in the Chelmsford LAA and in the city centre are broadly similar to those shown in the Do Minimum scenario, with overall growth in congestion more apparent in the PM peak.

Figure 3.21 PM Peak 2036 forecast congestion in Chelmsford (Local Plan)

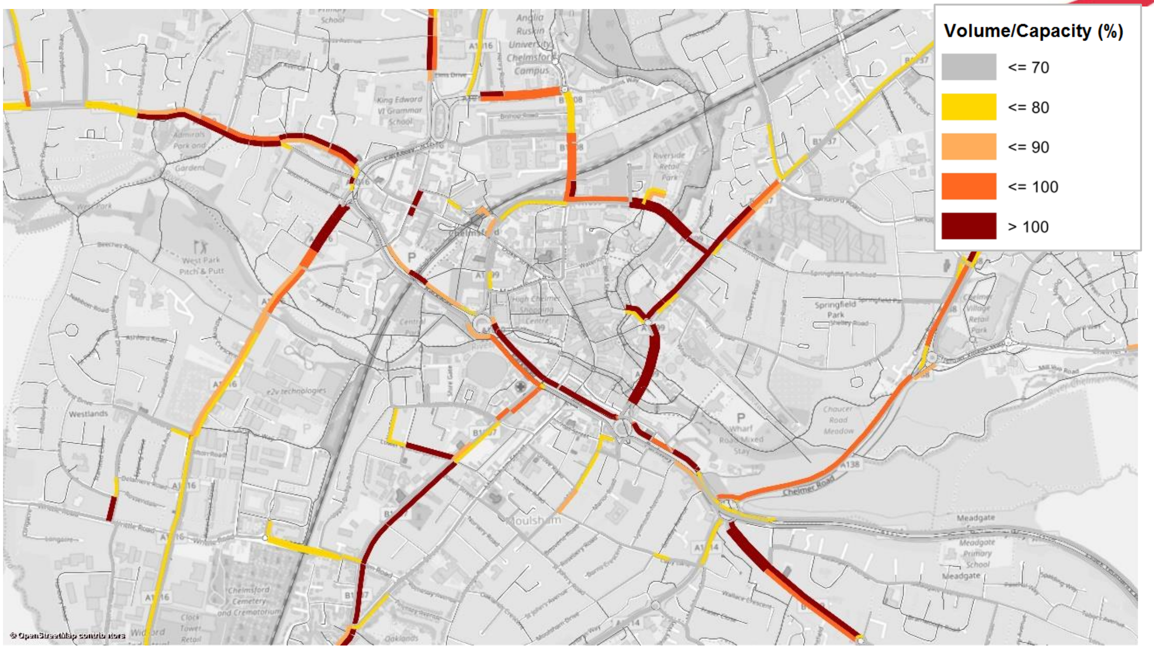

Figure 3.22 PM Peak 2036 forecast congestion in Chelmsford city centre (Local Plan)

Modelling highlights a number of routes where increases in congestion might be expected. These include corridor routes approaching junctions with Parkway – notably the A1060 Rainsford Road and A1016 Rainsford Lane, Springfield Road in the vicinity of Victoria Road, and B1008 Main Road through Broomfield. The junction of Chignal Road and Roxwell Road is also modelled to experience greater levels of congestion as a result of development proposals in the west of Chelmsford.

4 Local Junction Modelling

4.1 Introduction

This study has additionally considered the impact of Local Plan proposals on junctions both in the city itself and within the wider administrative area and the potential for any future mitigation measures required. This has been done in the context of Chelmsford's Future Transport Network's zonal strategy, see Section 1.1.3.

This chapter outlines the locations of the junctions modelled in more detail and provides the base year and future year (2036 Do Minimum and with Local Plan) junction modelling results. Junction modelling packages, Junctions 9 and LinSig, have been used to undertake capacity assessments at junctions in the vicinity of proposed Local Plan developments.

4.2 Identification of Junctions to Model

The Preferred Option, as of February 2017[8], was reviewed in order to identify the junctions most likely to be affected by the Local Plan development traffic. Junctions were chosen, following a review of the Preferred Option development locations, the previous VISUM work reported in March 2017 (see Section 1.1.1) and Trafficmaster-based congestion mapping (see Appendix G), and are listed below and shown in Figure 4.1:

1. Moulsham Hall Lane, Great Leighs
2. Main Road – Banters Lane, Great Leighs
3. Deres Bridge, Great Leighs
4. Sheepcotes, Little Waltham
5. Pratts Farm, Channels
6. Essex Regiment Way – Channels Drive, Channels
7. Nabbots Farm, Springfield
8. Lawn Lane, Springfield
9. Valley Bridge, Springfield
10. Main Road – Hospital Approach, Broomfield
11. Main Road – School Lane, Broomfield
12. Broomfield Road – Valley Bridge, Chelmsford
13. Broomfield Road – Patching Hall Lane, Chelmsford
14. Roxwell Road – Lordship Road, Writtle
15. Roxwell Road – Chignal Road, Melbourne

[8] The Preferred Option was published in March 2017, however the junctions were chosen using the latest information available in February 2017.

16. Essex Yeomanry Way – Maldon Road – Baddow Hall Avenue, Great Baddow
17. Essex Yeomanry Way – Maldon Road, Great Baddow
18. Main Road – Church Road, Boreham
19. Burnham Road – Ferrers Road, South Woodham Ferrers
20. B1418 – Burnham Road, South Woodham Ferrers
21. Burnham Road – Hullbridge Road, South Woodham Ferrers
22. Hullbridge Road – Clements Green Lane, South Woodham Ferrers
23. A12 Junction 19 - Boreham Interchange (Mayer Brown Traffic Model)
24. A12 Junction 18 – Sandon
25. Rettendon Turnpike, South Woodham Ferrers
26. Hawk Hill roundabout, South Woodham Ferrers
27. A132/A130, South Woodham Ferrers

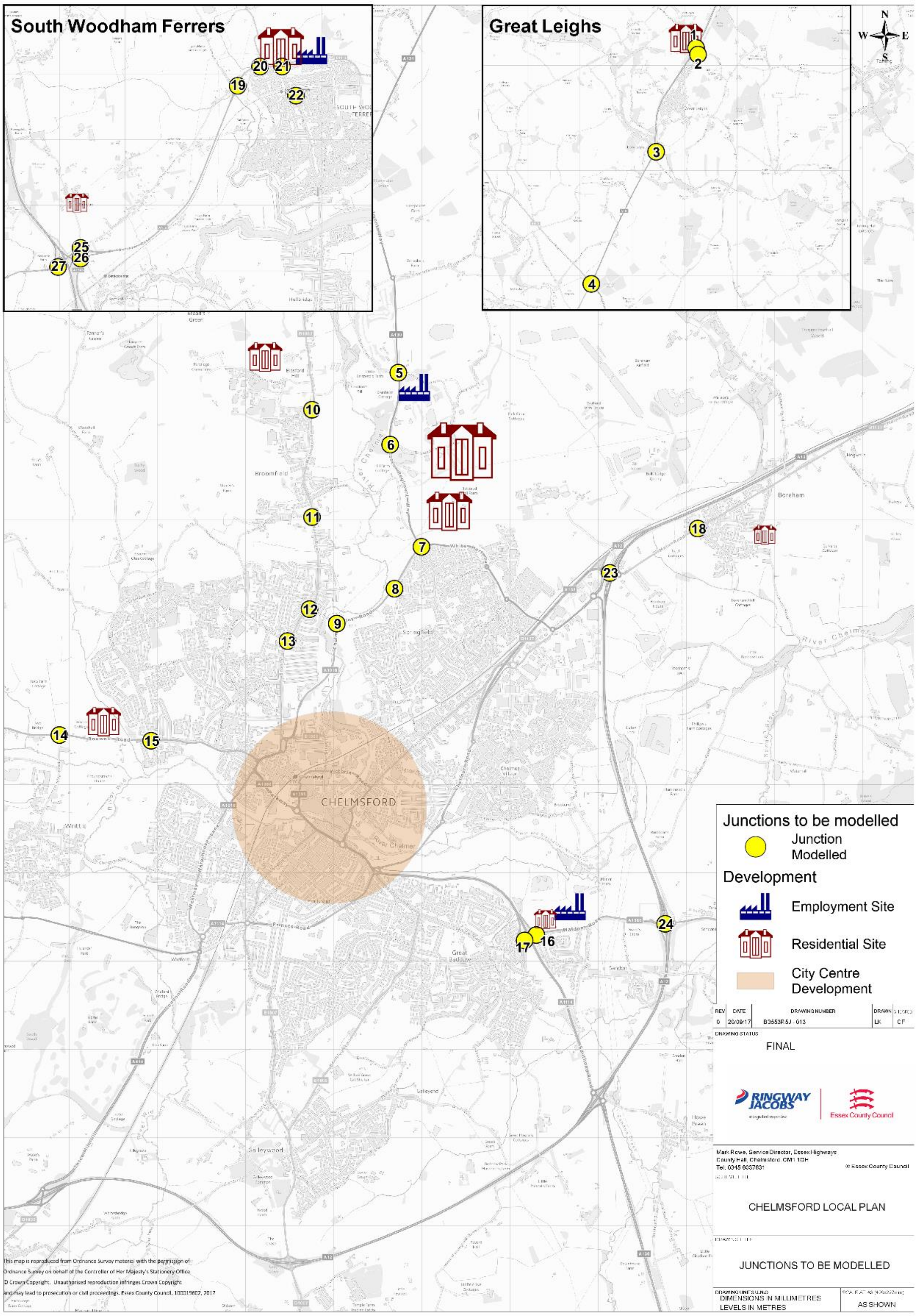

Figure 4.1 Junctions modelled

4.2.1 Impact of the Local Plan on other junctions

The Local Plan will also impact other junctions within the Chelmsford administrative area in addition to the junctions listed above. VISUM modelling suggests that impact on other junctions are likely to be much less significant.

However, modelling results suggest likely impacts of the Local Plan on the A414 London Road/A131 Greenbury Way roundabout, where there are modelled increases of 70-80 vehicles on eastbound A131 Greenbury Way in the AM and PM peak hours. The Do Minimum modelled volume/capacity is low (40-50%) on Greenbury Way, and therefore the Local Plan is not considered to be likely to have a significant impact on the junction.

There are also modelled increases at the Lawn Lane/Brackenden Drive junction; in the PM peak period, a 248 vehicle increase southbound on Lawn Lane and 146 vehicle increase eastbound on Brackenden Drive. However, the Chelmsford VISUM model is a strategic model, so is not calibrated for minor roads and junctions, and also as Brackenden Drive links two competing routes (Lawn Lane and Pump Lane), it is unlikely to provide an accurate indication of the impact of the Local Plan at this junction. It should also be noted that a developer is expected to provide future mitigation at the Lawn Lane/Brackenden Drive junction, which will help alleviate congestion at the junction.

With Local Plan development and infrastructure in place, modelling also highlights potential capacity concerns along on the A12 southbound on-slip at the Boreham Interchange and along the proposed Radial Distributor Road / General's Lane route between the Boreham Interchange and proposed Beaulieu Rail Station access.

4.3 Peak Hours and Base Year

For junctions outside of the Chelmsford urban area, analysis of the peak hours was undertaken to find the peak hour and if it was found to have a peak hour with a difference greater than 15 minutes from the VISUM peak hours, 08:00 – 09:00 and 17:00 – 18:00, then this peak hour was modelled. The following junctions were considered to potentially have alternative peak hours:

Table 4.1 Junction types

Junction	Junction Type
1. Moulsham Hall Lane, Great Leighs	Roundabout
2. Main Road – Banters Lane, Great Leighs	Mini-roundabout
3. Deres Bridge, Great Leighs	Roundabout
5. Pratts Farm, Channels	Roundabout
6. Essex Regiment Way – Channels Drive, Channels	Roundabout

Junction	Junction Type
7. Nabbots Farm, Springfield	Roundabout
8. Lawn Lane, Springfield	Roundabout
9. Valley Bridge, Springfield	Roundabout, signal controlled in PM
10. Main Road – Hospital Approach, Broomfield	Mini-roundabout
12. Broomfield Road – Valley Bridge, Chelmsford	Signal controlled priority junction
13. Broomfield Road – Patching Hall Lane, Chelmsford	Signal controlled priority junction
14. Roxwell Road – Lordship Road, Writtle	Roundabout
15. Roxwell Road – Chignal Road, Melbourne	Signal controlled priority junction
19. Burnham Road – Ferrers Road, South Woodham Ferrers	Roundabout
20. B1418 – Burnham Road, South Woodham Ferrers	Roundabout
21. Burnham Road – Hullbridge Road, South Woodham Ferrers	Priority junction
22. Hullbridge Road – Clements Green Lane, South Woodham Ferrers	Mini-roundabout
25. Rettendon Turnpike, South Woodham Ferrers	Roundabout
26. Hawk Hill roundabout, South Woodham Ferrers	Roundabout
27. A132/A130, South Woodham Ferrers	Signal controlled priority junction

This analysis is included in Appendix H. The peak hours modelled have been stated in the model results table, if they differ from 08:00 – 09:00 and 17:00 – 18:00. For all other junctions base year models were constructed using observed turning movement data and the VISUM peak hours of 08:00 – 09:00 (AM) and 17:00 – 18:00 (PM). These were then used to create models for the 2036 scenarios.

Some of the junction models used traffic count data collected in a different year to the base year of the VISUM model, 2014. In order to check that the traffic data was still reflecting the base year traffic situation in Chelmsford, Department for Transport (DfT) counts were analysed from around Chelmsford. There was found to be little difference between 2014 and the years in which the traffic data was collected, which most of which was in 2016, see Appendix I. As a result, the traffic count data were not adjusted.

4.4 Base and Future Year Junction Modelling

4.4.1 Base Year Model Development

Each junction has been analysed on an individual basis, using the software appropriate for the type of junction. Each junction model is built by measuring the geometry of each approach road, which for the junctions in this report, has been measured from Ordnance Survey data. The geometry is the main determiner of capacity available at a junction. Traffic flows are then input into the junction model and combined with the geometry, the model provides a result for likely delay per vehicle and the ratio of traffic flow to capacity for each approach road to the junction. Both delay and ratio of flow to capacity take into consideration the level of conflicting traffic movements at the junction and not just the theoretical capacity from the geometries.

It should be noted that delay and capacity are independent of each other and as such, approach arms can be shown as at capacity without significant delays or within capacity but with significant delays. The results depend on the geometry of the approach arm and the flows.

Junctions 9 software was used to model both priority junctions using its PICADY tool and also roundabouts using its ARCADY tool.

In terms of model outputs, the performance and operation of a junction in PICADY/ARCADY is given by the duration of delay and Ratio of Flow to Capacity (RFC) for each approach arm. The guidance for the software considers a delay exceeding 36 seconds on any approach arm to be unacceptable, however this is open to opinion and interpretation. Various levels of delay will be met with differing degrees of acceptance. For simplicity though, all delays of over 36 seconds have been shown in red. Generally, as the RFC approaches 1, the approach is said to be nearing capacity and any approach with an RFC above 1 exceeds the theoretical capacity and is likely to suffer from significant vehicle queues and delays. When the RFC exceeds 1, it should be noted that the accuracy of the delay results decreases. An RFC of between 0.85 and 1 is usually taken as an indication that an approach has reached its practical capacity and is where vehicles will start to experience noticeable delay and congestion. Therefore results have been presented using a "traffic light system" to indicate the results for each approach. RFCs below 0.75 have been shown in green. RFCs between 0.75 and 0.85 have been shown in orange to indicate the approach is nearing capacity and above 0.85 have been highlighted red to indicate that the approach is at or over capacity.

For the majority of the base year models, actual 15-minute observed flows have been used. However, this could not be done for the signalised junctions where it is only possible to enter the data in hourly segments and junctions where the traffic data was taken from developer transport assessments.

The signalised junction options were assessed using LinSig V3.2.29. The software is used for the assessment and design of traffic signal junctions either individually or as a network comprised of a number of junctions. It is used by traffic engineers to construct a model of the junction or network which can then be used to assess different designs and methods of operation.

Six signalised junctions were included in the key junctions list and so were assessed using LinSig. In terms of model outputs, the performance and operation of a junction in LinSig is given by the length of delay and percentage degree of saturation for each approach. Generally, as the degree of saturation approaches 100%, the approach is said to be nearing capacity and any approach with a degree of saturation above 100% exceeds the theoretical capacity and is likely to suffer from significant vehicle queues and delays. A degree of saturation of between 85% and 100% is usually taken as an indication that an approach has reached its practical capacity and where vehicles will start to experience noticeable delay and congestion. The same thresholds have been used to colour code the results as with the Junctions 9 models.

It is also important to appreciate that when undertaking LinSig modelling, signal timings are optimised to ensure that the junction operates as efficiently as possible. Thus different combinations of traffic flows on each arm of a junction result in different sets of signal timings and therefore differing levels of overall junction performance.

A micro-simulation model in VISSIM software was already available from another project for Sheepcotes roundabout, so was used instead of ARCADY. For consistency, where delays in these results exceeded 36 seconds, these were also highlighted red.

Trafficmaster data has been received from the DfT for the period September 2014 – August 2015. The Trafficmaster database holds information collected from in-vehicle GPS (Global Positioning System) tracking devices and is used to derive average speed, journey times and journey time reliability. Trafficmaster has been used to validate whether the model outputs are reasonable for all junctions modelled.

In order to produce the base year models for each junction, traffic data available for the junctions (see Appendix J for a full list) was reviewed to ensure there were no inconsistencies or apparent errors and then converted into matrices of average number of trips moving between junction arms. Following this, for each junction, the geometries of each approach were measured and input into the relevant modelling software. The matrices were then linked to the models and the models run. For Boreham Interchange, the initial modelling has been based on a proposed new layout of the junction by Mayer Brown (Transport Consultants for the existing NE

Chelmsford development) and has used 2016 developer traffic data. The model was provided by Mayer Brown. Some slight adjustments have been made to the model and results have been reported from this adjusted model.

4.4.2 Future Year Matrix Development

Future year matrices were created for 'with Local Plan' and Do Minimum scenarios. To do this, the VISUM base year flows and forecast year flows for both scenarios were extracted from the model and the percentage difference between them was calculated for both scenarios. This percentage difference was then applied to the matrix input into the base year junction model to create future year matrices for both the 'with Local Plan' and Do Minimum scenarios. These matrices were then input into the base year junction models to generate the future year junction models for the 'with Local Plan' and Do Minimum scenarios. Where a junction model had a different peak hour from the VISUM model, which is 08:00 – 09:00 and 17:00 – 18:00, in the absence of any other better forecast the 08:00 – 09:00 and 17:00 – 18:00 percentage differences were applied to the actual peak hour modelled.

From a review of the VISUM results, it was considered that forecast traffic flows at a selection of junctions were, in some instances, inconsistent with expectations. This was understood to be largely due to the amount of detail built into the modelled road network – commensurate with a 'strategic-level' assessment.

It became apparent that speeds achieved under congested conditions along the B1008 Main Road through Broomfield were too high, resulting in larger than expected traffic volumes routing through the village in the VISUM model in preference to Essex Regiment Way. To compensate for this, through traffic was manually reassigned from Main Road, Broomfield to Essex Regiment Way. In-scope northbound and southbound flows were determined using the VISUM model to identify the quantum of through traffic routing between Sheepcotes Roundabout (to the north) and the city centre to the south via the B1008 Main Road / Broomfield Road or via the B1008 Main Road, Valley Bridge Link and Chelmer Valley Road. The specific numbers of trips manually reassigned from the Broomfield Road corridor are shown in Table 4.2 below.

Table 4.2 Flows reassigned from Broomfield Road to Essex Regiment Way

Time Period	Scenario	Northbound	Southbound
AM	Do Minimum	68	416
	Local Plan	57	540
PM	Do Minimum	136	88
	Local Plan	140	190

The junctions located in Great Leighs and located within and adjacent to the urban area of South Woodham Ferrers are located outside the validated model area of the

Chelmsford Strategic Model in VISUM. In these areas the zoning and network within the VISUM model is not detailed enough to accurately model the flows of traffic through those junctions. For Great Leighs the future year flows from the Local Plan model were manually reassigned to the arms of the A131/Moulsham Hall Lane and Main Road/Banters Lane junctions, assuming that the development trips in Great Leighs have accesses/egresses distributed as follows:

- 68% Moulsham Hall Lane;
- 14% London Road;
- 9% Banters Lane; and
- 9% Main Road South.

For South Woodham Ferrers, additional runs of the Do Minimum and Local Plan VISUM models were undertaken assuming the following distribution of Local Plan development trip access/egress:

- 60% B1418;
- 5% Burnham Road between B1418 and Hullbridge Road; and
- 10% Burnham Road east of Hullbridge Road.
- 25% on new arm from roundabout at Burnham Rd/Woodham Rd/Ferrers Rd

Given the lack of accuracy in the VISUM model in the South Woodham Ferrers area, TEMPro alternative assumptions were used to create the Do Minimum matrices and also included to provide the background growth in the Local Plan matrices. This was done for the following junctions:

- Burnham Road/Ferrers Road;
- B1418/Burnham Road;
- Burnham Road/Hullbridge Road;
- Rettendon Turnpike;
- Hawk Hill; and
- Runwell Road.

4.4.3 Results

For each of the junctions shown below, results have been presented for the base year, Do Minimum 2036 and Local Plan 2036 scenarios in order to allow a direct comparison to be drawn. All the results shown in this section, unless stated otherwise, assume no change to the existing layout of the junction. Where different layouts have been used, the modelling results in the tables have been labelled as Existing (current layout), Proposed Mitigation (ECC scheme) and Developer (Developer scheme). These have been modelled in junction models only, since small scale capacity improvements would not affect the strategic modelling. Each arm of the junction has been designated a letter or number for ease of reporting.

For each junction that is forecast to be overcapacity, reference to its zone within Chelmsford's Future Transport Network has been made enabling recommendations as to what the preferred mitigation strategy ought to be.

1. Moulsham Hall Lane, Great Leighs

A – Main Road

B – A131 South

C – Moulsham Hall Lane

D – A131 North

Table 4.3 A131/Moulsham Hall Lane model results

		A	B	C	D
AM (07:30 – 08:30)					
Base Year 2014	RFC	0.08	0.27	0.06	0.51
	Delay (s)	4.25	1.68	2.49	2.51
Do Minimum 2036	RFC	0.46	0.35	0.07	0.60
	Delay (s)	7.84	1.98	2.91	3.04
Local Plan 2036	RFC	0.27	0.39	0.17	0.46
	Delay (s)	5.06	2.06	3.22	2.31

PM					
Base Year 2014	RFC	0.08	0.46	0.06	0.28
	Delay (s)	3.22	2.22	3.05	1.72
Do Minimum 2036	RFC	0.10	0.36	0.06	0.36
	Delay (s)	3.53	1.88	2.69	1.91
Local Plan 2036	RFC	0.06	0.46	0.14	0.39
	Delay (s)	3.61	2.22	3.17	2.05

This junction was modelled using the existing layout. The actual AM peak hour at this junction was calculated to be 07:30 – 08:30 and this peak hour was modelled for this junction. The modelling suggests that the roundabout is operating within capacity in the base year scenario. The two future year scenarios suggest that the junction will continue to operate within capacity in 2036 both with and without the Local Plan Preferred Scenario.

2. Main Road – Banters Lane, Great Leighs

A – Banters Lane

B – Main Road South

C – Main Road North

Table 4.4 Main Road/Banters Lane model results

		A	B	C
AM (07:30 – 08:30)				
Base Year 2016	RFC	0.04	0.28	0.49
	Delay (s)	8.40	5.80	7.63
Do Minimum 2036	RFC	0.03	0.62	0.46
	Delay (s)	7.32	10.96	7.21
Local Plan 2036	RFC	0.14	0.25	0.45
	Delay (s)	6.80	5.90	6.98
PM				
Base Year 2016	RFC	0.08	0.30	0.29
	Delay (s)	5.59	5.97	5.42
Do Minimum 2036	RFC	0.08	0.30	0.35
	Delay (s)	5.78	5.97	5.91
Local Plan 2036	RFC	0.08	0.28	0.22
	Delay (s)	5.38	5.83	4.92

The junction was modelled using the existing mini-roundabout layout. The actual AM peak hour at this junction was calculated to be 07:30 – 08:30 and this peak hour was modelled for this junction. This junction is currently operating within capacity in both peaks, and is forecast to remain within capacity in 2036 both with and without the Local Plan Preferred Scenario.

3. Deres Bridge, Great Leighs

A – A131 Great Leighs Bypass

B – Main Road

C – A131 Braintree Road

D – The Crescent

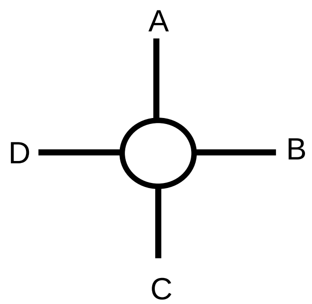

Table 4.5: Deres Bridge model results

		A	B	C	D
AM (07:15 – 08:15)					
Base Year 2015	RFC	0.97	0.80	0.45	0.20
	Delay (s)	40.08	51.06	3.50	36.92
Do Minimum 2036	RFC	1.09	1.01	0.51	0.42
	Delay (s)	176.99	178.47	3.95	117.22
PM					
Base Year 2015	RFC	0.27	0.13	0.80	0.02
	Delay (s)	1.63	3.80	9.33	4.35
Do Minimum 2036	RFC	0.31	0.16	0.81	0.02
	Delay (s)	1.74	4.16	10.08	4.42

The existing layout was modelled for the base scenario and the Route Based Strategy scheme (see Appendix L) was modelled for the Do Minimum scenario. The Route Based Strategy scheme, is a safety scheme and so does not affect capacity in comparison to the existing layout. For the Local Plan scenario a different layout was modelled as detailed below.

The actual AM peak hour for this junction was calculated to be 07:15 – 08:15 and this was the peak hour modelled for this junction. The results indicate that the roundabout is currently operating at capacity in the AM peak hour and is nearing capacity in the PM peak hour on the A131 Braintree Road approach. The Do Minimum scenario suggests the junction will be overcapacity in the AM peak, but is unlikely to experience much change in the PM peak. Although, the model results from The Crescent suggest it has a longer delay with a relatively low RFC, this could be due to a low volume of traffic (21 vehicles in the AM peak hour and 13 in the PM peak hour) using the road and giving way to the A131 Braintree Road.

As the CNEB is included in the Local Plan scenario and joins the A131 at Deres Bridge, the future year Local Plan scenario has been modelled in a different version of the junction model. This junction model uses the geometries from the Great Leighs Bypass arm for the CNEB arm. This is considered to be a reasonable assumption to make in the absence of a design. The VISUM model has the CNEB arm in the Local Plan scenario, but not in the base year scenario, so it is not possible to directly calculate a growth factor for the observed count data for this arm in the same way as for the other arms and junctions. Instead a combined growth factor has been calculated for the A131 Braintree Road and CNEB arms and the proportion of trips on each of the roads in the Local Plan scenario was applied to the combined forecast change to forecast the number of trips on each arm. It was assumed that all trips to / from the Crescent would enter / exit the junction from the A131 Braintree Road arm.

A – A131 Great Leighs Bypass

B – Main Road

C – CNEB

D – A131 Braintree Road

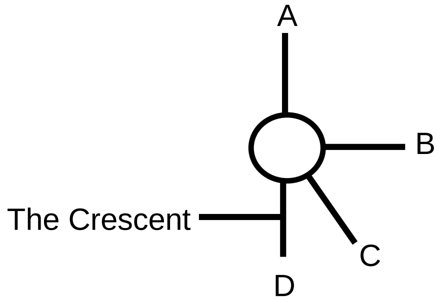

Table 4.6 Deres Bridge with CNEB model results

		A	B	C	D
AM (07:15 – 08:15)					
Local Plan 2036	RFC	0.39	0.25	0.38	0.06
	Delay (s)	1.92	5.30	2.11	2.79
PM					
Local Plan 2036	RFC	0.35	0.24	0.66	0.11
	Delay (s)	1.91	4.77	3.62	4.38

The results indicate that the new junction proposed at Deres Bridge to accommodate the CNEB would operate within capacity in the 2036 Local Plan scenario. It should be noted that if, for any reason, the CNEB is not delivered, then the Deres Bridge junction will need to be reviewed to ascertain what other mitigation could be provided given that the modelling suggests that it is currently near capacity and forecast to be overcapacity in the Do Minimum scenario.

4. Sheepcotes, Little Waltham

Mitigation has been proposed for this junction in the A131 Chelmsford to Braintree Route Based Strategy. The design, which consists of a left turn slip from A131 Braintree Road to A130 to Essex Regiment Way and widening of the other approaches, can be found in Appendix L. As this will be delivered by 2021, it has been considered the Do Minimum.

In order to accurately model this junction, VISSIM, a micro simulation software, has been used and results of this are shown in the table below. Results are reported as average queue lengths and average delay as VISSIM does not provide an indication of capacity. Where delay exceeds 36 seconds, this has been highlighted, to provide consistency with the other junction modelling results.

A – A131 Braintree Road

B – A130 Essex Regiment Way

C – B1008 Broomfield Road

D – B1008 Essex Regiment Way

Table 4.7 Sheepcotes RBS mitigation results

		A	B	C	D
AM					
Base Year 2016 (Existing)	Average Queue (m)	1140	4	2	57
	Average Delay (s)	101	17	16	56
Base Year 2016 (Mitigation)	Average Queue (m)	83	135	0.3	1.6
	Average Delay (s)	54	71	13	25

		A	B	C	D
Do Minimum 2036 (Mitigation)	Average Queue (m)	332	13	0.9	79
	Average Delay (s)	205	32	32	92
Local Plan 2036 (Mitigation)	Average Queue (m)	231	57	1	35
	Average Delay (s)	144	49	31	68
PM					
Base Year 2016 (Existing)	Average Queue (m)	0.2	67	42	506
	Average Delay (s)	12	34	47	291
Base Year 2016 (Mitigation)	Average Queue (m)	3	1	56	27
	Average Delay (s)	21	15	48	57
Do Minimum 2036 (Mitigation)	Average Queue (m)	2	1	51	183
	Average Delay (s)	18	15	42	128
Local Plan 2036 (Mitigation)	Average Queue (m)	6	2	8	258
	Average Delay (s)	24	15	40	166

The results of the VISSIM modelling indicate that the proposed mitigation will provide significant relief to the junction in both the AM and PM peak hours. In the PM peak, significant existing delays on Broomfield Road and Essex Regiment Way are forecast to be lower in 2036 as a result of the mitigation than they are currently. However, it should be noted that increased delays are forecast for the AM peak in 2036 on the A131 Braintree Road, but these are lower than forecast in the Do Minimum scenario, and the average queue length is likely to be significantly decreased. The B1008 Essex Regiment Way is also likely to have increased average delays in 2036 in the AM peak hour in comparison to the existing layout. However in both peak hours, the modelling suggests there will be reductions in the average queue length.

As this junction is located in the Outer Zone, the focus should be on promoting rail trips to Chelmsford from Braintree and surrounding villages, along with ensuring that strategic trips use the CNEB.

5. Pratts Farm, Channels

The North East Chelmsford Developer is proposing to widen the A130 South and Back Lane approaches at the junction to slightly increase capacity. This will be implemented by 2021 and as such is considered in the Do Minimum and Local Plan 2036 scenarios. The proposed design can be found in Appendix L. The results of which are shown below.

A – A130 Essex Regiment Way North

B – Chelmer Valley P&R and Pratts Farm Lane

C – A130 Essex Regiment Way South

D – Back Lane

Table 4.8 Pratts Farm developer mitigation results

		A	B	C	D
AM (07:15 – 08:15)					
Base Year 2015 (Existing)	RFC	0.80	0.23	0.60	0.16
	Delay (s)	9.84	7.45	4.64	5.62
Do Minimum 2036 (Developer)	RFC	1.34	0.36	0.81	0.21
	Delay (s)	957.12	13.96	8.88	9.12
Local Plan 2036 (Developer)	RFC	1.21	0.22	0.64	0.34
	Delay (s)	518.04	10.07	4.61	6.51
PM (17:30 – 18:30)					
Base Year 2015 (Existing)	RFC	0.52	0.40	0.67	0.29
	Delay (s)	4.15	6.30	5.60	8.55
Do Minimum 2036 (Developer)	RFC	0.67	0.20	0.86	0.64
	Delay (s)	6.12	6.09	11.35	21.56
Local Plan 2036 (Developer)	RFC	0.41	0.14	0.56	0.52
	Delay (s)	3.43	3.78	3.81	9.08

The modelling results suggest that the AM and PM peak hours are currently operating within capacity in the base scenario, although Essex Regiment Way is starting to near capacity in the AM peak.

In the 2036 scenarios, the VISUM modelling indicates that traffic will still use the A130 Essex Regiment Way for the Park & Ride and not transfer to the RDR via CNEB. This is as expected, and to be encouraged, with strategic through trips shifting to the CNEB.

In the Do Minimum scenario, the modelling results indicate that the A130 Essex Regiment northern approach is operating over capacity in the AM peak hour. All other approaches are shown to be operating within capacity. In the PM peak hour, the model shows the A130 Essex Regiment Way southern approach to be operating at capacity. The other approaches are indicated to be operating within capacity.

The A130 Essex Regiment Way northern approach arm is forecast to be overcapacity in the Do Minimum AM peak, even with the developer scheme in place. This is largely as a result of the volume of traffic forecast to use the route, which is in excess of the theoretical link capacity on that approach and reflected by the junction modelling. However it should be noted that the forecast modelling indicates the junction will be less overcapacity in the Local Plan scenario than in the Do Minimum scenario, indicating potential benefits from the infrastructure being proposed in North East Chelmsford as part of the Local Plan. In the PM peak hour, all approaches are forecast to be within capacity.

As this junction is located in the Outer Zone, the focus for managing future supply and demand should be on encouraging further use of the Park & Ride, encouraging strategic through trips to use the most appropriate route through dynamic signing and also encouraging trips onto rail. Therefore, while it may be possible to improve the approach on the A130 northern arm for general traffic, the focus should be on cycling and bus priority improvements to the section of Essex Regiment Way south of the proposed link road (labelled f in Figure 3.5), and the majority of strategic traffic would be encouraged to use the CNEB rather than this route.

6. Essex Regiment Way – Channels Drive, Channels

A – A130 Essex Regiment Way North

B – Services/Access

C – Channels Drive right turn

D – Channels Drive left turn

E – A130 Essex Regiment Way South

Table 4.9 Channels model results

		A	B	C	D	E
AM (07:30 – 08:30)						
Base Year 2016	RFC	0.53	0.18	0.04	0.10	0.05
	Delay (s)	2.85	7.70	6.68	5.91	1.72
Do Minimum 2036	RFC	0.66	0.15	0.04	0.14	0.06
	Delay (s)	3.91	9.97	9.23	8.57	1.61
Local Plan 2036	RFC	OC	0.14	0.02	0.09	0.10
	Delay (s)	OC	6.71	5.71	4.97	1.66
PM (16:00 – 17:00)						
Base Year 2016	RFC	0.41	0.11	0.04	0.18	0.05
	Delay (s)	2.27	4.61	5.20	4.74	1.83
Do Minimum 2036	RFC	0.29	0.08	0.02	0.15	0.06
	Delay (s)	1.91	3.71	4.20	3.80	1.96
Local Plan 2036	RFC	0.59	0.08	0.02	0.15	0.08
	Delay (s)	7.48	3.79	4.18	3.78	1.73

N.B. OC (Over Capacity) is where RFC or Degree of Saturation has exceeded 1.40 and 140% respectively. Corresponding delay also marked as OC.

The existing layout of this junction was modelled, however due to the nature of the junction and the limitations of the Junctions 9 software, there are several ways in which this junction could be modelled. The results reported above are based on modelling only the straight ahead lane from Essex Regiment Way North, as the second lane is left turn only and the modelling software does not enable distinction between two lanes straight ahead and two lanes, one straight ahead and one left.

The access to/from Channels Drive has been treated as two separate arms due to the segregated nature of them.

The actual AM peak hour at this junction was calculated to be 07:30 – 08:30 and the PM peak hour was calculated to be 16:00 – 17:00. These peak hours were modelled at this junction. The modelling suggests that the roundabout is currently operating within capacity, with only the A130 Essex Regiment Way northern approach arm forecast to be overcapacity in the 2036 Local Plan scenario in the AM peak hour.

The junction itself is quite constrained with two water bodies and many mature trees surrounding it. Potential mitigation might be to make both lanes straight ahead from Essex Regiment Way North, however there is currently no space to merge on the southbound exit. To create the space for the merge, the junction would need to be moved west slightly, but this would need to be investigated further from a feasibility perspective.

As this junction is located in the Outer Zone, the focus for managing future supply and demand should be on encouraging further use of the Park & Ride, encouraging strategic trips to use the CNEB through dynamic signing and also encouraging trips to switch to rail.

7. Nabbotts Farm, Springfield

The Beaulieu developer is proposing improvements to the Nabbotts Farm junction. The proposed design can be found in Appendix L. The main alteration in this proposal is the creation of a left turn slip from A130 Essex Regiment Way to White Hart Lane. ECC are also have undertaken a Route Based Study (RBS) of the A131 Chelmsford to Braintree and received funding from the South East Local Enterprise Partnership (SELEP), with all schemes to be implemented by 2021. This includes further improvements to the junction at Nabbotts Farm. The scheme under consideration includes widening the White Hart Lane and Pump Lane approaches (see Appendix L). Therefore both proposals have been considered together as they are complementary and both expected to be delivered by 2021 and as such are considered in the Do Minimum and Local Plan scenarios. The results are shown below.

A – A130 Essex Regiment Way

B – White Hart Lane

C – Pump Lane

D – A1016 Chelmer Valley Road

Table 4.10 Nabbotts Farm mitigation results

		A	B	C	D
AM					
Base Year 2015 (Existing)	RFC	0.90	0.70	0.85	0.48
	Delay (s)	23.61	9.25	25.44	4.63
Do Minimum 2036 (Developer)	RFC	1.36	0.77	0.84	0.72
	Delay (s)	869.37	10.76	24.34	8.32
Local Plan 2036 (Developer)	RFC	OC	0.77	0.84	0.72
	Delay (s)	OC	10.76	24.34	8.32
PM					
Base Year 2015 (Existing)	RFC	0.59	0.62	0.37	0.62
	Delay (s)	7.81	6.55	5.42	5.53
Do Minimum 2036 (Developer)	RFC	0.61	0.57	0.32	0.72
	Delay (s)	7.15	5.11	4.28	7.74
Local Plan 2036 (Developer)	RFC	0.64	0.44	0.21	0.73
	Delay (s)	7.15	3.96	3.57	7.43

N.B. OC (Over Capacity) is where RFC or Degree of Saturation has exceeded 1.40 and 140% respectively. Corresponding delay also marked as OC.

As with the modelling of the existing layout, A130 Essex Regiment Way has been modelled as one lane ahead / right as both the RBS and developer designs retain a dedicated left turn lane despite the provision of a left turn slip (see Appendix L).

The model results indicate the AM peak hour is currently operating near to capacity on A130 Essex Regiment Way and Pump Lane in the base scenario, with other approaches shown to be operating within capacity. The PM peak hour is shown by the modelling results to be operating within capacity on all approaches.

The Do Minimum scenario modelling shows that A130 Essex Regiment Way is operating over capacity in the AM peak hour in 2036. Both White Hart Lane and Pump Lane approaches are indicated to be operating near to capacity, and the A1016 Chelmer Valley Road is the only arm the modelling suggests is operating within capacity. The modelling suggests the PM peak hour is operating within capacity on all approaches.

The modelling suggests that the AM peak hour is likely to be operating overcapacity on the A130 Essex Regiment Way approach in the 2036 Local Plan scenario, and both White Hart Lane and Pump Lane are likely to be nearing capacity. In the PM peak hour, the junction is forecast to be operating within capacity.

In order to understand whether the capacity on the A130 Essex Regiment Way approach arm to this junction could be improved, the model was adjusted on this arm to a two lane approach, either as one lane ahead and one lane ahead / right or as two dedicated lanes (one ahead, one right) to allow more traffic to get through the junction from Essex Regiment Way. However, this reduced the amount that could get out from White Hart Lane or Pump Lane, and so the modelling suggests that this worsens the operation of the junction in AM peak hour.

Developers will be expected to provide sufficient sustainable transport links to their developments in order to mitigate impacts on the Nabbots Farm roundabout. There would appear to be scope to provide cycle links on all arms of the junction, providing links between Springfield, Beaulieu and up to Channels roundabout. Cycle links along these routes will encourage people living in the vicinity to cycle. Similarly Nabbots Farm roundabout already has a bus lane and consideration should be given to extending this to the Park and Ride and beyond, to the north and towards the Parkway Gyratory, to the south. Developers could contribute to delivering these bus lanes and providing bus services to reduce the private car trip generation of their sites and thus reduce the impacts on Nabbots Farm junction.

8. Lawn Lane, Springfield

The developer for Channels has proposed alterations to this junction. The proposed design can be found in Appendix L. These mainly consist of extending the southbound bus lane to the give way at the roundabout and then through the junction, continuing southbound on Chelmer Valley Road before merging with general traffic and providing two southbound ahead lanes. The scheme is due to be implemented by 2021 and is therefore considered in the Do Minimum and Local Plan scenarios. The results from these model runs are shown below.

A – A1016 Chelmer Valley Road North

B – Lawn Lane

C – A1016 Chelmer Valley Road South

D – Ambulance station

Table 4.11 A1016 Chelmer Valley Road/Lawn Lane developer mitigation results

		A	B	C	D
AM					
Base Year 2016 (Existing)	Degree of Saturation	87.6%	87.7%	61.5%	0.4%
	Delay / PCU (s)	19.2	20.9	2.3	2.1
Do Minimum 2036 (Developer)	Degree of Saturation	98.6%	48.8%	82.4%	0.4%
	Delay / PCU (s)	37.9	2.5	5	2.6
Local Plan 2036 (Developer)	Degree of Saturation	109.5%	53.2%	92.4%	0.5%
	Delay / PCU (s)	183.4	2.7	11.0	3.0
PM					
Base Year 2016 (Existing)	RFC	0.71	0.48	1.01	0.01
	Delay (s)	11.64	4.65	67.51	6.79
Do Minimum 2036 (Developer)	RFC	0.62	0.49	1.07	0.01
	Delay (s)	5.67	4.78	158.02	6.38
Local Plan 2036 (Developer)	RFC	0.73	0.57	1.15	0.01
	Delay (s)	8.3	5.9	385.9	6.5

The modelling indicates that this scheme, soon to be implemented, will provide sufficient capacity in the current AM peak, however the PM peak is forecast to be at capacity on the Chelmer Valley Road South approach. In the Do Minimum scenario the junction is forecast to be at capacity in the AM peak and slightly over capacity on the Chelmer Valley Road South approach.

The results suggest that in the 2036 Local Plan scenario, the junction is likely to be operating over capacity in the AM peak hour and Chelmer Valley South approach is likely to be over capacity in the PM peak hour. The results indicate that this layout would improve the operation of the roundabout for general traffic in comparison to the current layout.

Full signalisation of the junction has been investigated, however the modelling suggests that this would not provide sufficient capacity and so as the junction is located on a key Park & Ride route, people should be encouraged to use the Chelmer Valley Park & Ride, which should benefit from the proposed layout. Likewise other buses would also benefit from the bus lane and this should be provided for Channels and North East Chelmsford residents and its use promoted.

The Chelmsford Growth City Package has also recently consulted on a proposed cycle route along Lawn Lane that could potentially be connected into Beaulieu as part of a wider strategy. If this is not delivered by ECC, consideration should be given to asking developers to deliver the route and provide bus services to mitigate the impacts of their developments.

9. Valley Bridge, Springfield

A – Valley Bridge

B – Chelmer Valley Road North

C – Chelmer Valley Road South

Table 4.12 Valley Bridge model results

		A	B	C
AM				
Base Year 2016	RFC	0.60	0.45	0.57
	Delay (s)	5.02	4.64	4.52
Do Minimum 2036	RFC	0.61	0.38	0.65
	Delay (s)	5.54	3.90	5.39
Local Plan 2036	RFC	0.73	0.46	0.75
	Delay (s)	8.51	4.40	7.87
PM				
Base Year 2016	Degree of Saturation	102%	69%	94%
	Delay (s) / PCU	77.60	16.80	30.10
Do Minimum 2036	Degree of Saturation	114%	68%	97%
	Delay (s) / PCU	139.60	16.60	43.10
Local Plan 2036	Degree of Saturation	OC	81%	127%
	Delay (s) / PCU	OC	21.70	412.90

N.B. OC (Over Capacity) is where RFC or Degree of Saturation has exceeded 1.40 and 140% respectively. Corresponding delay also marked as OC.

The junction is currently a partially signalised roundabout and the AM peak hour has been modelled in Junctions 9 as the signals are not in operation at this time, whereas the PM peak hour has been modelled in LinSig as the signals are in operation at this time. However, it should be noted that neither software appears to replicate the effects of the pre-signals accurately. According to the modelling the part time signalised roundabout is shown to be operating within capacity in the AM peak hour and overcapacity in the PM peak hour in the base year. The Valley Bridge arm is forecast to be over capacity in all scenarios in the PM peak hour and the Chelmer Valley Road southern approach arm is shown to be at capacity in the base and Do Minimum scenarios and overcapacity in the Local Plan scenario.

This part time signalised roundabout is located within the Mid Zone of Chelmsford's Future Transport Network and so mitigation should focus on improving public transport and cycling links in the vicinity. The roundabout is also on the Chelmer Valley Park & Ride route, so vehicles should be encouraged to use the Park & Ride to reduce the number of through trips to the city centre.

10. Main Road – Hospital Approach, Broomfield

A – B1008 Main Road South

B – Hospital Approach

C – B1008 Main Road North

Table 4.13 Main Road/Hospital Approach model results

		A	B	C
AM				
Base Year	RFC	0.72	0.31	0.87
	Delay (s)	10.87	3.84	18.39
Do Minimum 2036	RFC	0.62	0.46	0.50
	Delay (s)	7.34	4.91	5.35
Local Plan 2036	RFC	0.61	0.35	0.36
	Delay (s)	6.64	4.09	4.27
PM (16:30 – 17:30)				
Base Year	RFC	0.44	0.93	0.55
	Delay (s)	4.35	23.06	6.93
Do Minimum 2036	RFC	0.44	0.81	0.53
	Delay (s)	4.27	12.24	6.49
Local Plan 2036	RFC	0.47	0.85	0.50
	Delay (s)	4.60	15.20	5.75

The actual peak hour for this junction in the PM was calculated to be 16:30 – 17:30, and this peak hour was modelled. The junction is shown to be operating at capacity in both the AM and PM peak hours in the base year.

There are currently improvement works underway at this roundabout as of August 2017, which, subject to weather conditions, are due for completion in winter 2017. A design for this is shown in Appendix L. Therefore, the junction that has been modelled for all scenarios is the revised layout, and not the existing layout that will shortly be replaced. The Broomfield Hospital new northern link road is modelled in the Local Plan scenario (and not in the Do Minimum scenario), and model results suggest that around 200-300 vehicles will use the northern link road in the AM and PM peak hours, which will reduce flows on the Hospital Approach Road entry to this junction. The 2036 models suggest that Hospital Approach is likely to be nearing capacity in the PM peak hour in both the Do Minimum and Local Plan scenarios. However, this forecast suggests that the junction will operate slightly better in both peaks in 2036 than it currently does, as a result of the link road.

11. Main Road – School Lane, Broomfield

A – Main Road South

B – School Lane

C – Main Road North

Table 4.14 Main Road/School Lane model results

		B	C
AM			
Base Year 2016	RFC	0.79	0.88
	Delay (s)	31.79	29.81
Do Minimum 2036	RFC	0.80	1.12
	Delay (s)	33.32	219.00
Local Plan 2036	RFC	0.81	1.20
	Delay (s)	34.55	379.27
PM (16:30 – 17:30)			
Base Year 2016	RFC	0.39	0.89
	Delay (s)	11.33	32.86
Do Minimum 2036	RFC	0.39	0.99
	Delay (s)	11.45	77.26
Local Plan 2036	RFC	0.41	1.06
	Delay (s)	12.40	178.87

Main Road South does not give way to traffic from either of the other arms, so it is not included in the results table. The modelling, based on the existing layout, suggests that the Main Road North arm of the junction is or will be at capacity in the AM and PM peak hours in all scenarios.

This junction is located within the Mid Zone of Chelmsford's Future Transport Network and so mitigation should focus on improving public transport and cycling links. The junction is part of a key public transport corridor, and so people need to be encouraged to use public transport as opposed to private cars to reduce the number of through trips to the city centre. However, it should be recognised that people may be deterred from using public transport if it is unreliable due to congestion issues along the route. This increases the need to reduce the number of car trips on Broomfield Road and thus make public transport more reliable.

12. Broomfield Road – Valley Bridge, Chelmsford

A – Broomfield Road North

B – Valley Bridge

C – Broomfield Road South

Table 4.15 Broomfield Road/Valley Bridge model results

		A	B	C
AM				
Base Year 2016	Degree of Saturation	91%	91%	89%
	Delay (s) / PCU	28.50	56.80	32.10
Do Minimum 2036	Degree of Saturation	77%	83%	84%
	Delay (s) / PCU	26.60	57.20	30.10
Local Plan 2036	Degree of Saturation	82%	92%	94%
	Delay (s) / PCU	34.70	76.60	43.90
PM				
Base Year 2016	Degree of Saturation	80%	80%	80%
	Delay (s) / PCU	12.90	42.00	21.10
Do Minimum 2036	Degree of Saturation	84%	82%	85%
	Delay (s) / PCU	18.30	63.40	40.10
Local Plan 2036	Degree of Saturation	88%	87%	88%
	Delay (s) / PCU	24.20	68.40	37.60

This junction has been modelled using the existing layout and existing signal timings for the base year. However for the 2036 Do Minimum and Local Plan scenarios, the signal timings have been optimised to demonstrate the maximum capacity available. This may lead to improvements in the future years in comparison to the base year, thus suggesting that more capacity could be gained from optimising the signal timings.

In the AM peak hour in the base year, the modelling indicates that all arms are operating at capacity, and in the Do Minimum scenario, all arms are nearing capacity. In the Local Plan scenario, Valley Bridge and Broomfield Road southern approach arms are likely to be operating at capacity, and Broomfield Road northern approach arm is shown to be nearing capacity. In the base year PM peak hour the modelling suggests that the junction is nearing capacity on all arms in the model.

The Do Minimum scenario is similar to the base year in terms of model capacity results, but Broomfield Road southern approach arm may be at capacity in this 2036 scenario. In the Local Plan scenario, all arms are shown to be operating near to capacity in the model.

This junction is located within the Mid Zone of Chelmsford's Future Transport Network and so mitigation should focus on improving public transport and cycling links in the vicinity. The junction is part of a key public transport corridor, and so people should be encouraged to use public transport as opposed to private cars to reduce the number of through trips to the city centre. However, it should be recognised that people may be deterred from using public transport if it is unreliable due to congestion issues along the route. This increases the need to reduce the number of car trips on Broomfield Road and thus make public transport more reliable.

13. Broomfield Road – Patching Hall Lane, Chelmsford

A – Broomfield Road North

B – Broomfield Road South

C – Patching Hall Lane

Table 4.16 Broomfield Road/Patching Hall Lane model results

		A	B	C
AM				
Base Year 2016	Degree of Saturation	54%	56%	57%
	Delay (s) / PCU	28.6	31.4	46.9
Do Minimum 2036	Degree of Saturation	45%	63%	63%
	Delay (s) / PCU	54.1	35.6	46.2
Local Plan 2036	Degree of Saturation	42%	66%	65%
	Delay (s) / PCU	54.6	35.9	47.9
PM				
Base Year 2016	Degree of Saturation	61%	64%	63%
	Delay (s) / PCU	60.2	32.8	50.2
Do Minimum 2036	Degree of Saturation	92%	89%	91%
	Delay (s) / PCU	140.3	69.5	61.5
Local Plan 2036	Degree of Saturation	91%	92%	94%
	Delay (s) / PCU	146.8	72.7	71.4

The modelling, based on the current layout following the recent upgrade, suggests that the junction is operating within capacity in the base year however delays are shown on Patching Hall Lane in both peak hours and Broomfield Road North in the PM peak hour. These delays though may still be at a level that is considered reasonable by drivers. The AM peak hour modelling indicates that in the future year scenarios all arms are within capacity but with longer delays. The PM peak hour in the future year scenarios is likely to be operating at capacity on all arms, with significant delays. The 2036 Local Plan scenario is not operating significantly worse than the Do-Minimum scenario in this location.

This junction is located within the Mid Zone of Chelmsford's Future Transport Network and so mitigation should focus on improving public transport and cycling links in the vicinity. The junction is part of a key public transport corridor, and so people should be encouraged to use public transport as opposed to private cars to reduce the number of through trips to the city centre. However, it should be recognised that people may be deterred from using public transport if it is unreliable due to congestion issues along the route. This increases the need to reduce the number of car trips on Broomfield Road and thus make public transport more reliable.

14. Roxwell Road – Lordship Road, Writtle

A – Roxwell Road East

B – Lordship Road

C – Roxwell Road West

Table 4.17 Roxwell Road/Lordship Road model results

		A	B	C
AM				
Base Year 2013	RFC	0.60	0.51	0.49
	Delay (s)	5.86	7.27	6.23
Do Minimum 2036	RFC	0.66	0.50	0.54
	Delay (s)	6.89	7.34	7.41
Local Plan 2036	RFC	0.80	0.53	0.54
	Delay (s)	11.49	7.72	7.47
PM				
Base Year 2013	RFC	0.42	0.76	0.42
	Delay (s)	3.84	13.50	5.39
Do Minimum 2036	RFC	0.44	0.92	0.48
	Delay (s)	4.07	29.38	6.44
Local Plan 2036	RFC	0.44	0.86	0.47
	Delay (s)	4.04	21.15	6.37

The junction has been modelled with the existing layout, which suggests that the AM peak hour is potentially nearing capacity in the 2036 Local Plan scenario only on the Roxwell Road eastern approach arm. In the PM peak hour, the junction is shown to be nearing capacity in the base year. The modelling suggests that the PM peak may be operating at capacity on Lordship Road arm in both scenarios in 2036. However, the junction has been modelled in isolation and so the results do not take into account exit blocking from the Chignal Road / Roxwell Road junction[9]. The Trafficmaster maps (Appendix F), indicate that there is congestion in both the AM and PM peak hours on Roxwell Road eastbound. This suggests there may be a slow moving queue that backs up to the Lordship Road junction, thus worsening the performance of the junction.

It should also be noted that analysis of the VISUM model (shown in the figures below) indicates that a number of trips are forecast to route through Writtle. If traffic was deterred from this route, this would likely increase the forecast flow on Roxwell Road

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[9] The junction was modelled in isolation as the Chignal Road junction is signalised and so it is not possible to model the two together in the same software. The two junctions could be modelled together using a micro-simulation model (e.g. VISSIM), however this was considered disproportionate for this work.

East and thus affect the modelling results for this roundabout. Additional figures can be found in Appendix K.

This junction is the proposed access point to the Warren Farm development and as it is bounded by their land, it is expected that they will provide a junction with sufficient capacity, likely to be achieved by provided an enlarged roundabout, to mitigate the impacts of their development and accommodate wider Local Plan growth.

Figure 4.2 and Figure 4.3 illustrate the impact on vehicle flows around Writtle due to the Chelmsford Local Plan in the AM and PM peak hours respectively. Numbers shown in the plots represent the directional vehicle flow on the road.

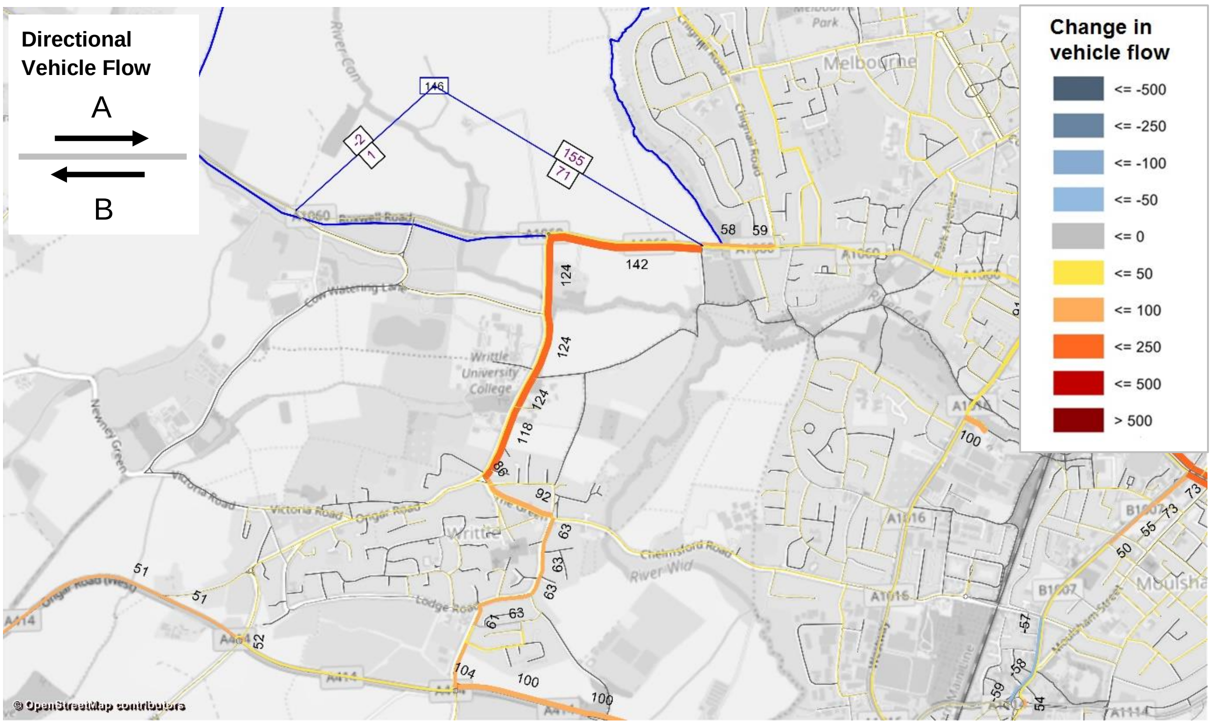

Figure 4.2 AM Peak 2036 difference in vehicle flows between Local Plan and Do-Minimum (no Local Plan) in Writtle (only changes >50 are labelled; zone 146 is Warren Farm Development – see Appendix M)

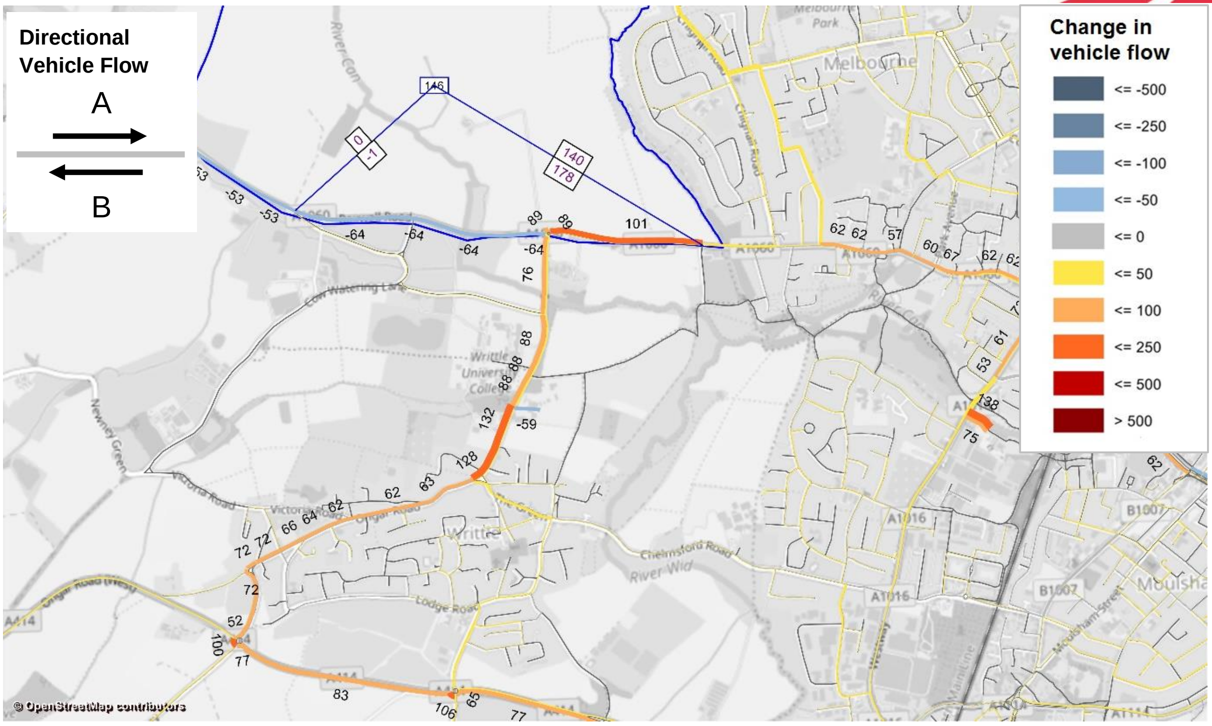

Figure 4.3: PM Peak 2036 difference in vehicle flows between Local Plan and Do-Minimum (no Local Plan) in Writtle (only changes >50 are labelled; zone 146 is Warren Farm Development – see Appendix M)

Analysis of the AM and PM flow difference plots in Writtle requires caveating given the strategic nature of the VISUM model used and, in particular, the fact the model has not been validated to journey times through Writtle during the model build process. Consequently, vehicle assignment in the model through Writtle village is unlikely to fully account for urban delay in the form of parked cars (for example). Rather than a definitive split along two routes between the A1060 and A414 (via Lodge Road (as seen in the AM peak) and Ongar Road (as seen in the PM peak)) in the AM and PM peaks, it is more likely that flows will be more evenly distributed across both routes.

The most significant increase in modelled traffic flow attributable to the Local Plan development is westbound along the A1060 Roxwell Road (142 vehicles) and southbound along Lordship Road (124 vehicles) in the AM peak hour. To put this into context, this equates to an approximate additional two-to-three vehicles a minute in a single direction during a peak hour.

The model suggests associated increases along a variety of routes in Writtle to access Writtle, south and west Chelmsford. The modelled increase in traffic along roads in Writtle with the Local Plan developments in place is considered to be relatively minor and could be reduced with effective implementation of public transport and cycling links.

Lordship Road is not classified as a B road, however it is a secondary distributor in the ECC Development Management Route Hierarchy whose function is "the carrying of traffic safely and efficiently between substantial rural populations and on through routes in built up areas". Also Lordship Road is a Priority Two County Route (PR2 route) in the functional route hierarchy (maintenance) whose function is to "perform an essential traffic management distributary function between the local network and Priority One County Routes. They will be accessed by a number of different types of user including local buses".

Lordship Road connects the A1060 and A414 and by the nature of its function as a distributor road it is suitable to accommodate through traffic, but that the impact of additional traffic needs to be mitigated by enhancement to public transport, cycle and walking routes and encouraging use of these more sustainable modes of transport. It is also appropriate to consider travel planning for Writtle College, to help reduce the number of private car trips along Lordship Road.

This junction is located within the Mid Zone of Chelmsford's Future Transport Network and so mitigation should focus on improving public transport and cycling links in the vicinity. It should be recognised that, although people should be encouraged to use public transport as opposed to private cars to reduce the number of through trips to the city centre, people may be deterred from using public transport if it is unreliable due to congestion issues along the route. This increases the need to reduce the number of car trips on Roxwell Road and thus make public transport more reliable.

15. Roxwell Road – Chignal Road, Melbourne

The developer of a North Melbourne site is committed to mitigating this junction by widening both the approaches of Roxwell Road West and Chignal Road to 2 lanes. This is due to be complete by 2021, and therefore is considered in the Do Minimum and Local Plan scenarios. The proposed design can be found in Appendix L.

A – Roxwell Road East

B – Chignal Road

C – Roxwell Road West

Table 4.18 Roxwell Road/Chignal Road mitigation model results

		A	B	C
AM				
Base Year 2013 (Existing)	Degree of Saturation	62.7%	94.8%	94%
	Delay (s) / PCU	31.8	81.8	64.2
Do Minimum 2036 (Developer)	Degree of Saturation	73.6%	72.9%	60.4%
	Delay (s) / PCU	29	30.1	32.6
Local Plan 2036 (Developer)	Degree of Saturation	76.8%	77.4%	67%
	Delay (s) / PCU	30	33.1	33.9
PM				
Base Year 2013 (Existing)	Degree of Saturation	94.1%	95.1%	94.3%
	Delay (s) / PCU	62.2	104.6	53.8
Do Minimum 2036 (Developer)	Degree of Saturation	46.5%	67.8%	68.3%
	Delay (s) / PCU	15.1	39.5	26.3
Local Plan 2036 (Developer)	Degree of Saturation	46.6%	70.9%	71.8%
	Delay (s) / PCU	15.1	41.1	27.6

Modelling of the developer scheme, to be shortly implemented, indicates that the junction will operate within capacity in the 2036 Do Minimum scenario, offering relief to the junction which is shown to currently be operating at capacity. However, the model results for the 2036 Local Plan scenario indicate that all three arms are likely to be nearing capacity again in the AM peak hour, and both Chignal Road and Roxwell Road West are forecast to be nearing capacity in the PM peak hour.

The junction has been modelled in isolation[10] and as with the Lordship Road junction, does not take into account any potential exit blocking that may occur from the Park Avenue / Roxwell Road junction. Trafficmaster maps (Appendix F), indicate that there is congestion in the AM peak on Roxwell Road eastbound. This suggests there may be a slow moving queue that backs up to the Chignal Road junction, thus worsening the performance of the junction.

It should also be noted that analysis of the VISUM model indicated that a number of trips are forecast to route through Writtle. If traffic were deterred from using this route, this would then likely increase the forecast flows on Roxwell Road West and East and thus affect the results of this junction modelling.

[10] The junction was modelled in isolation as the Chignal Road junction is signalised and so it is not possible to model the two together in the same software. The two junctions could be modelled together using a micro-simulation model (e.g. VISSIM), however this was considered disproportionate for this work.

This junction is also located within the Mid Zone where mitigation should focus on public transport and cycling improvements. Therefore any developments located near to this junction should focus their mitigation on these measures.

16. Essex Yeomanry Way – Maldon Road – Baddow Hall Avenue, Great Baddow

17. Essex Yeomanry Way – Maldon Road, Great Baddow

A – A1114 Essex Yeomanry Way off-slip

B – Maldon Road East

C – Baddow Hall Avenue

D – Maldon Road bridge (eastbound)

E – Maldon Road bridge (westbound)

F – Maldon Road West

Table 4.19 A1114 Essex Yeomanry Way/Maldon Road model results

		A	B	C	D	E	F
AM							
Base Year 2016	RFC	0.22	0.21	0.02	0.23	0.19	0.49
	Delay (s)	2.86	2.07	5.66	2.35	2.56	3.86
Do Minimum 2036	RFC	0.25	0.29	0.02	0.22	0.31	0.42
	Delay (s)	2.89	2.32	6.26	2.44	2.98	3.69
Local Plan 2036	RFC	0.27	0.32	0.02	0.24	0.34	0.43
	Delay (s)	3.03	2.42	6.51	2.51	3.12	3.91
PM							
Base Year 2016	RFC	0.52	0.23	0.01	0.22	0.13	0.32
	Delay (s)	4.39	2.14	4.16	2.30	2.42	2.87
Do Minimum 2036	RFC	0.54	0.27	0.01	0.22	0.18	0.35
	Delay (s)	4.48	2.26	4.41	2.40	2.58	3.08
Local Plan 2036	RFC	0.54	0.33	0.01	0.25	0.26	0.36
	Delay (s)	4.60	2.45	4.81	2.49	2.84	3.31

The modelling results, using the existing layout, indicate that this junction is currently operating within capacity and is likely to continue to do so in 2036.

18. Main Road – Church Road, Boreham

A – Main Road East

B – Church Road

C – Main Road West

Table 4.20 Main Road/Church Road model results

		A	B	C
AM				
Base Year 2013	RFC	0.31	0.39	0.23
	Delay (s)	2.95	11.95	8.26
Do Minimum 2036	RFC	0.41	0.43	0.27
	Delay (s)	3.42	13.95	9.46
Local Plan 2036	RFC	0.50	0.53	0.33
	Delay (s)	4.10	18.51	11.21
PM (16:30 – 17:30)				
Base Year 2013	RFC	0.21	0.38	0.30
	Delay (s)	2.55	13.10	8.18
Do Minimum 2036	RFC	0.28	0.40	0.28
	Delay (s)	2.77	14.02	8.38
Local Plan 2036	RFC	0.31	0.40	0.31
	Delay (s)	2.90	14.12	8.85

The junction has been modelled using the existing layout and the results indicate that this junction is currently operating within capacity and is likely to continue to do so in 2036.

19. Burnham Road – Ferrers Road, South Woodham Ferrers

A – Burnham Road

B – Ferrers Road

C – A132 Burnham Road

D – Willow Grove

Table 4.21 Burnham Road/Ferrers Road model results

		A	B	C	D
AM (07:15 – 08:15)					
Base Year 2016	RFC	0.62	0.76	0.59	0.20
	Delay (s)	3.84	14.59	4.03	4.67
Do Minimum 2036	RFC	0.66	0.87	0.63	0.22
	Delay (s)	4.11	24.07	4.54	5
Local Plan 2036	RFC	0.69	0.90	0.66	0.26
	Delay (s)	4.69	29.37	5	5.55
PM (16:45 – 17:45)					
Base Year 2016	RFC	0.54	0.50	0.84	0.75
	Delay (s)	3.55	5.87	9.57	22.95
Do Minimum 2036	RFC	0.57	0.54	0.88	0.86
	Delay (s)	3.81	6.63	12.11	41.32
Local Plan 2036	RFC	0.64	0.60	0.91	0.99
	Delay (s)	4.53	8.11	15.71	99.3

This junction has been modelled using the existing layout, and the modelling results indicate that the junction is currently operating within capacity in both peaks. The 2036 Do Minimum scenario shows that the junction is likely to be approaching capacity in both peaks, while in the Local Plan scenario, it is also likely to be approaching capacity in the AM peak and at capacity in the PM peak.

Mitigation was investigated at this junction but it was determine that it was too constrained. As it is likely to be overcapacity as a direct result of the proposed Local Plan growth in South Woodham Ferrers, the developer should be expected to mitigate the impact of their development through sustainable transport measures, potentially by providing public transport services for longer distance trips e.g. to Wickford / Basildon / Chelmsford that serve the development.

20. B1418 – Burnham Road, South Woodham Ferrers

As part of the mitigation for the new Sainsbury's, minor widening to the Burnham Road west approach of this junction will be implemented by 2021, and as such this layout has been modelled for the Do Minimum and Local Plan scenarios and the results are shown in the table below. A design of the alteration is shown in Appendix L.

A – B1418

B – B1012 Burnham Road East

C – Old Wickford Road

D – B1012 Burnham Road West

Table 4.22 B1418/Burnham Road model results

		A	B	C	D
AM (07:15 – 08:15)					
Base Year 2016 (Existing)	RFC	0.38	0.94	0.20	0.58
	Delay (s)	3.93	22.75	10.44	5.22
Do Minimum 2036 (Developer)	RFC	0.40	1.02	0.21	0.63
	Delay (s)	4.03	48.74	12.26	5.81
Local Plan 2036 (Developer)	RFC	0.47	1.09	0.24	0.69
	Delay (s)	4.74	165	14.43	7.17
PM (16:30 – 17:30)					
Base Year 2016 (Existing)	RFC	0.46	0.69	0.07	0.82
	Delay (s)	5.21	7.32	6.09	11.07
Do Minimum 2036 (Developer)	RFC	0.52	0.73	0.09	0.88
	Delay (s)	6.13	8.48	6.54	15.3
Local Plan 2036 (Developer)	RFC	0.64	0.82	0.10	0.95
	Delay (s)	8.06	12.65	7.75	26.72

The junction modelling results indicate the junction is currently nearing capacity on one approach in both peaks with the slight alteration to the junction. However it is likely to be at capacity on Burnham Road East in the AM peak in the 2036 Do Minimum scenario, with this exceeding capacity in the Local Plan scenario. In the PM peak, Burnham Road West is forecast to be near capacity in the 2036 Do Minimum scenario and at capacity in the 2036 Local Plan scenario.

Although the junction modelling results indicate that the junction is likely to be overcapacity in 2036 with the Local Plan growth, mitigation has not been designed for this junction. This is because this junction is proposed to be the main access point into the development site and is bounded by the site. Therefore, the developer would be expected to mitigate the junction to sufficiently accommodate all forecast development growth. This may require utilising some of the development land to enlarge the roundabout.

21. Burnham Road – Hullbridge Road, South Woodham Ferrers

This junction is currently a priority junction, however as part of the mitigation for the new Sainsburys, a new roundabout has been proposed at this junction that will be implemented by 2021, and as such this layout has also been modelled and the results are shown in the tables below. A design of the roundabout is shown in Appendix L.

A – Burnham Road East

B – Hullbridge Road

C – Burnham Road West

D – Sainsburys Access

Table 4.23: Burnham Road / Hullbridge Road existing layout model results

		B – AC	C – AB
AM (07:15 – 08:15)			
Base 2016	RFC	1.15	0.43
	Delay (s)	307.26	13.60
PM (16:45 – 17:45)			
Base 2016	RFC	0.50	0.82
	Delay (s)	17.00	32.11

Table 4.24 Burnham Road/Hullbridge Road developer layout model results

		A	B	C	D
AM (07:15 – 08:15)					
Do Minimum 2036	RFC	0.74	0.66	0.39	0.04
	Delay (s)	10.75	12.83	3.48	3.22
Local Plan 2036	RFC	0.91	0.84	0.60	0.01
	Delay (s)	27.86	30.03	5.43	3.93
PM (16:45 – 17:45)					
Do Minimum 2036	RFC	0.69	0.21	0.72	0.07
	Delay (s)	10.65	5.61	7.6	4.67
Local Plan 2036	RFC	1.01	0.31	0.86	0.02
	Delay (s)	48.4	7.43	15.02	5.53

The modelling results suggest that the junction is currently over capacity in the base year AM peak on Hullbridge Road. In the 2036 Do Minimum, it is expected that the junction will be operating within capacity, however in the Local Plan scenario, it is likely that the junction will be at capacity in both peaks. This is as a result of the proposed development surrounding Sainsbury's. Mitigation at the existing junction has not been investigated as it appears that the new roundabout maximises the land available to create as much capacity as possible at that location. Therefore the developer should look to further mitigate the impact of their development through other access arrangements and sustainable transport links.

22. Hullbridge Road – Clements Green Lane, South Woodham Ferrers

A – Hullbridge Road North

B – Clements Green Lane

C – Hullbridge Road South

Table 4.25 Hullbridge Road/Clements Green Lane model results

		A	B	C
AM (07:45 – 08:45)				
Base Year 2016	RFC	0.39	0.46	0.28
	Delay (s)	6.34	7.26	6
Do Minimum 2036	RFC	0.39	0.49	0.28
	Delay (s)	6.21	7.74	6.12
Local Plan 2036	RFC	0.46	0.51	0.28
	Delay (s)	7.01	7.98	6.22
PM (18:00 – 19:00)				
Base Year 2016	RFC	0.49	0.32	0.14
	Delay (s)	7.33	5.8	4.61
Do Minimum 2036	RFC	0.53	0.34	0.15
	Delay (s)	7.93	6.04	4.74
Local Plan 2036	RFC	0.58	0.35	0.15
	Delay (s)	8.97	6.12	4.77

The modelling results, using the existing layout, indicate that this junction is currently operating within capacity and is likely to continue to do so in 2036.

23. A12 Junction 19 - Boreham Interchange (Mayer Brown Traffic Model)

The Boreham Interchange was modelled using the Mayer Brown future layout (Appendix L) as this is considered the 2036 Do Minimum option, which includes a new arm at the Generals Lane roundabout and a hamburger[11] layout of the Generals Farm roundabout taking traffic from the A12 off-slip through to the link between the Generals Farm and Generals Lane roundabouts. Drovers Way roundabout, Generals Lane roundabout and Generals Farm roundabout have been modelled in one LinSig model.

Drovers Way roundabout:

A – A130 North

B – A12 Junction 19 eastbound off-slip

C – Winsford Way

D – A130 South

[11] A hamburger layout is usually the result of modifications to existing priority or signalised roundabouts. The modification takes the major through traffic movements out of the circulatory carriageway and routes them directly across the central island of the roundabout. Traffic signal control is then used at some or all of the points of conflict.
http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol6/section2/ta8603.pdf

E – Drovers Way

F – Boreham Services

Table 4.26 Drovers Way roundabout model results

		A	B	C	D	E	F
AM							
Base Year 2016	Degree of Saturation	45%	58%	30%	37%	4%	36%
	Delay (s) / PCU	3.50	14.10	7.50	2.70	3.00	3.80
Do Minimum 2036	Degree of Saturation	46%	70%	43%	53%	7%	36%
	Delay (s) / PCU	3.50	22.80	8.40	3.50	3.40	4.30
Local Plan 2036	Degree of Saturation	59%	100%	42%	84%	6%	55%
	Delay (s) / PCU	4.90	98.20	8.40	10.60	5.90	9.10
PM							
Base Year 2016	Degree of Saturation	43%	53%	65%	79%	18%	62%
	Delay (s) / PCU	3.60	12.60	13.30	9.10	5.80	9.10
Do Minimum 2036	Degree of Saturation	44%	53%	79%	75%	54%	66%
	Delay (s) / PCU	3.60	12.60	18.20	6.90	10.30	11.30
Local Plan 2036	Degree of Saturation	54%	73%	113%	81%	17%	62%
	Delay (s) / PCU	4.40	24.90	257.5	9.90	6.00	9.50

This roundabout modelled with the proposed layout operates within capacity in both peak hours using base year flows. In the AM peak hour the modelling suggests that the 2036 Do Minimum scenario is likely to also be operating within capacity, however, in the 2036 Local Plan scenario the results indicate that the A12 eastbound off-slip will likely be operating at capacity and the A130 southern approach will likely be nearing capacity in 2036. In the PM peak hour, the modelling suggests that the 2036 Do Minimum scenario is likely to be nearing capacity on both Winsford Way and the A130 southern approach in 2036. In the 2036 Local Plan scenario Winsford Way is forecast to be operating over capacity.

Generals Lane roundabout:

A – Generals Lane

B – Main Road westbound

C – A130 South

D – A138

Table 4.27 Generals Lane roundabout model results

		A	B	C	D
AM					
Base Year 2016	Degree of Saturation	39%	64%	93%	71%
	Delay (s) / PCU	32.50	5.70	78.50	40.90
Do Minimum 2036	Degree of Saturation	40%	95%	86%	84%
	Delay (s) / PCU	18.30	22.60	45.50	62.70
Local Plan 2036	Degree of Saturation	85%	OC	OC	96%
	Delay (s) / PCU	20.50	OC	OC	97.30
PM					
Base Year 2016	Degree of Saturation	21%	44%	66%	69%
	Delay (s) / PCU	23.00	8.50	18.40	36.80
Do Minimum 2036	Degree of Saturation	16%	50%	65%	64%
	Delay (s) / PCU	22.50	5.80	18.30	34.60
Local Plan 2036	Degree of Saturation	69%	58%	75%	103%
	Delay (s) / PCU	41.40	13.10	24.70	173.60

N.B. OC (Over Capacity) is where RFC or Degree of Saturation has exceeded 1.40 and 140% respectively. Corresponding delay also marked as OC.

The modelling results demonstrate that this roundabout is currently operating at capacity in the AM peak hour and is within capacity in the PM peak hour. In 2036, the modelling results show that the Do Minimum scenario is at capacity in the AM peak hour on Main Road eastbound arm and the A130 southern approach, though the PM peak hour is operating within capacity. The 2036 Local Plan scenario is forecast to be over capacity in both modelled peak hours.

Generals Farm roundabout:

A – A12 junction 19 westbound off-slip

B – B1137 Main Road East

C – Main Road West

Table 4.28 Generals Farm roundabout model results

		A	B	C
AM				
Base Year 2016	Degree of Saturation	82%	51%	94%
	Delay (s) / PCU	21.40	12.30	68.20
Do Minimum 2036	Degree of Saturation	110%	77%	71%
	Delay (s) / PCU	210.80	28.10	5.10
Local Plan 2036	Degree of Saturation	131%	69%	49%
	Delay (s) / PCU	481.30	15.20	1.80
PM				
Base Year 2016	Degree of Saturation	80%	56%	87%
	Delay (s) / PCU	27.70	21.70	21.60
Do Minimum 2036	Degree of Saturation	66%	59%	75%
	Delay (s) / PCU	17.90	22.40	5.20
Local Plan 2036	Degree of Saturation	93%	98%	67%
	Delay (s) / PCU	51.80	95.00	4.20

Currently the modelling suggests that in the AM peak hour and PM peak hour the junction is nearing capacity on the A12 westbound off-slip and is at capacity on Main Road West. In 2036, the modelling results suggest that the AM peak hour is likely to be operating over capacity in both scenarios on the A12 westbound off-slip. In the PM peak hour, the Do Minimum scenario is likely to be nearing capacity on Main Road western approach by 2036. For the 2036 Local Plan scenario it is the other two approach arms, A12 westbound off-slip and Main Road eastern approach that may be operating at capacity, according to the modelling results.

The junction is part of Highways England's A12 widening project, which is expected to start in 2020/21, but currently the extent of its impact on the junction is unknown. The junction is also affected by the Chelmsford North East Bypass proposals. That project has modelled this junction with different development assumptions and a different layout (assuming a dual carriageway bypass) and this indicated that the proposed mitigation should provide sufficient capacity in 2036 if it were implemented before then.

Boreham Interchange is located within the Outer Zone and is part of the strategic network which ECC would like to encourage strategic trips to use. However it is also the main access to Beaulieu Station and is likely to be the main access point to the proposed Boreham Park and Ride. Therefore consideration will need to be given to encouraging people to access, in particular, the station using sustainable transport modes to reduce the number of private cars travelling through Boreham Interchange.

24. A12 Junction 18 – Sandon

A – A12 junction 18 southbound off-slip

B – Hammonds Road

C – A414 Maldon Road East

D – A414 Maldon Road eastbound (bridge)

E – A414 Maldon Road westbound (bridge)

F – A12 junction 18 northbound off-slip

G – Maldon Road West

Table 4.29 A12 junction 18 roundabouts model results

		A	B	C	D	E	F	G
AM								
Base Year 2016	RFC	0.25	0.27	0.74	0.40	0.82	0.60	0.32
	Delay (s)	2.73	4.79	6.56	2.96	11.24	7.51	2.55
Do Minimum 2036	RFC	0.42	0.19	0.33	0.41	0.44	0.50	0.32
	Delay (s)	3.44	4.54	3.07	2.82	3.83	4.47	2.36
Local Plan 2036	RFC	0.53	0.32	1.04	0.39	1.22	0.90	0.37
	Delay (s)	4.4	7.02	74.55	2.76	585.52	28.84	2.65
PM								
Base Year 2016	RFC	0.39	0.12	0.47	0.83	0.58	0.51	0.70
	Delay (s)	4.91	5.35	3.31	9.46	5	4.35	6.08
Do Minimum 2036	RFC	0.42	0.06	0.18	0.85	0.39	0.53	0.73
	Delay (s)	4.24	5.05	2.65	10.71	3.63	4.52	6.68
Local Plan 2036	RFC	0.59	0.14	0.60	0.76	0.95	0.78	0.98
	Delay (s)	6.79	6.1	4.65	6.88	25.35	16.71	34.49

The modelling results show that in both the AM and PM peak hours the bridge between the roundabouts is likely to be approaching capacity in the base year. The eastbound bridge arm is forecast to be almost at practical capacity in the 2036 Do Minimum scenario in the PM, but the 2036 Local Plan scenario shows that the arm is only likely to be slightly less near capacity. This lower RFC in the Local Plan scenario is as a result of the reduction in traffic flows forecast on this link by 70 vehicles as a result of reassignment of traffic across the strategic model. In the AM peak in the Local Plan 2036 scenario, Maldon Road East and the A12 Northbound off-slip are forecast to be at capacity, while Maldon Road West is forecast to be at capacity in the PM peak.

With regards to the A12 Northbound off-slip, there is potentially insufficient capacity on the slip itself and so consideration will need to be given to providing more stacking capacity, likely to be done through widening. It is understood that the land adjacent to the slip road, is owned by a developer and so could be used to implement this.

The A414 Maldon Road westbound (bridge) approach is forecast to be significantly overcapacity in the 2036 Local Plan AM peak and at capacity in the 2036 Local Plan PM peak. This approach does not give way to any movements except u-turners from Maldon Road West and so the software could be overestimating the results. However, it should be noted that the forecast flows on this approach are likely to be at theoretical capacity and therefore there could be queues back through the eastern junction.

It should be noted that the modelling software recommends that the results should be treated with caution as the joining link between the junctions is small. This junction would be better modelled in micro-simulation software, such as VISSIM, to better understand the impacts of the Local Plan.

These roundabouts are located within the Outer Zone where mitigation should focus on encouraging Park & Ride use, routing traffic onto the strategic network through innovative signing and encouraging rail use. The Sandon Park & Ride is located on this junction and all buses and traffic leaving the Park & Ride site are currently directed through at least the western roundabout. These vehicles would enter from Maldon Road West and this arm is modelled as at capacity in the PM peak hour in the Local Plan scenario.

25. Rettendon Turnpike, South Woodham Ferrers

A – Woodham Road

B – Burnham Road

C – A1245

D – A132

E – Main Road, Rettendon

Table 4.30 Rettendon Turnpike roundabout model results

		A	B	C	D	E
AM (07:30 – 08:30)						
Base Year 2016	RFC	0.60	0.23	0.71	0.49	0.70
	Delay (s)	13.49	1.96	5.18	2.74	15.62
Do Minimum 2036	RFC	0.73	0.25	0.79	0.54	0.82
	Delay (s)	20.77	2.1	7.06	3.13	26.78
Local Plan 2036	RFC	1.05	0.34	0.93	0.67	1.20
	Delay (s)	104.44	2.31	22.02	4.66	209.91
PM (16:45 – 17:45)						
Base Year 2016	RFC	0.19	0.26	0.69	0.64	0.66
	Delay (s)	9.23	1.88	4.49	3.84	22.77
Do Minimum 2036	RFC	0.25	0.29	0.76	0.71	0.91
	Delay (s)	11.8	1.98	5.85	4.92	55.44
Local Plan 2036	RFC	0.34	0.46	0.86	0.85	OC
	Delay (s)	17.82	2.55	10.82	9.54	OC

N.B. OC (Over Capacity) is where RFC or Degree of Saturation has exceeded 1.40 and 140% respectively. Corresponding delay also marked as OC.

The junction has been modelled in isolation using the existing layout. The results indicate that it is currently operating within capacity in both peaks and is likely to still be within capacity in the 2036 Do Minimum scenario. However with the forecast 2036 Local Plan growth, specifically the growth at South Woodham Ferrers, the junction is forecast to be overcapacity on several arms in both the AM peak and the PM peak. As a result the developer would be expected to provide sufficient mitigation through both infrastructure improvements and sustainable transport mitigation.

26. Hawk Hill roundabout, South Woodham Ferrers

A – A1245

B – A132

C – Hawk Hill

D – A1245

E – A130 on/off-slip

Table 4.31 Hawk Hill roundabout model results

		A	B	C	D	E
AM (07:30 – 08:30)						
Base Year 2016	RFC	0.24	0.46	0.69	0.83	0.37
	Delay (s)	1.81	2.61	13.32	18.10	2.88
Do Minimum 2036	RFC	0.27	0.51	0.84	0.95	0.43
	Delay (s)	1.88	2.93	23.43	45.13	3.28
Local Plan 2036	RFC	0.30	0.73	OC	1.14	0.47
	Delay (s)	2.02	5.47	OC	238.71	3.57
PM (17:00 – 18:00)						
Base Year 2016	RFC	0.28	0.38	0.24	0.61	0.74
	Delay (s)	2.14	2.66	5.32	5.82	5.91
Do Minimum 2036	RFC	0.31	0.43	0.28	0.67	0.82
	Delay (s)	2.28	3.01	6.16	6.97	8.77
Local Plan 2036	RFC	0.36	0.76	0.39	0.73	0.87
	Delay (s)	2.55	7.26	9.91	9.12	11.58

N.B. OC (Over Capacity) is where RFC or Degree of Saturation has exceeded 1.40 and 140% respectively. Corresponding delay also marked as OC.

The junction has been modelled in isolation using the existing layout. The results indicate that it is currently operating near capacity in the AM peak and within capacity in the PM peak. In the 2036 Do Minimum scenario, the junction is likely to be near capacity in the AM peak and in the 2036 Local Plan scenario it is likely to be significantly overcapacity. In the PM peak the junction modelling indicates the junction will be near capacity in both the Do Minimum and Local Plan scenarios. The impact of the Local Plan scenario is directly as a result of the growth at South Woodham Ferrers, and therefore the developer would be expected to provide sufficient mitigation through both infrastructure improvements and sustainable transport mitigation.

27. A132/A130, South Woodham Ferrers

A – A132 Runwell Road East

B – A132 Runwell Road West

C – A130 northbound on-slip

Table 4.32 A132/A130 model results

		A	B	C
AM (07:30 – 08:30)				
Base Year 2016	Degree of Saturation	79.5%	79.4%	79.5%
	Delay (s) / PCU	56.9	9.0	35.1
Do Minimum 2036	Degree of Saturation	82.7%	131.1%	100.4%
	Delay (s) / PCU	69.2	378.9	77.7
Local Plan 2036	Degree of Saturation	118.9%	115.3%	120.6%
	Delay (s) / PCU	287.6	217.1	300.5
PM (17:15 – 18:15)				
Base Year 2016	Degree of Saturation	80.7%	86.5%	86.8%
	Delay (s) / PCU	67.9	21.4	27.0
Do Minimum 2036	Degree of Saturation	113.4%	107.5%	116.5%
	Delay (s) / PCU	224.5	125.3	245.3
Local Plan 2036	Degree of Saturation	107.7%	126.9%	OC
	Delay (s) / PCU	135.3	322.3	OC

N.B. OC (Over Capacity) is where RFC or Degree of Saturation has exceeded 1.40 and 140% respectively. Corresponding delay also marked as OC.

The junction has been modelled using the existing layout and the modelling results indicate that the junction is currently operating near to capacity in both peaks. It is likely that this will worsen in both the 2036 Do Minimum and 2036 Local Plan scenarios in both peaks. The Local Plan scenario results are as a direct result of the proposed growth at South Woodham Ferrers, and therefore the developer would be expected to provide sufficient mitigation through both infrastructure improvements and sustainable transport mitigation.

Summary of Junction Modelling

The junction modelling indicates that 18 of the 27 junctions assessed are currently operating near to or at capacity on at least one approach arm. The results from the modelling of the Local Plan scenario are summarised on the plan below (Figure 4.4) using a Red, Amber, Green status for whether they are overcapacity, near or at capacity or within capacity respectively. The plan also shows the different zones of Chelmsford's Future Transport Network's zonal strategy, which indicates the types of transport schemes preferred in each area.

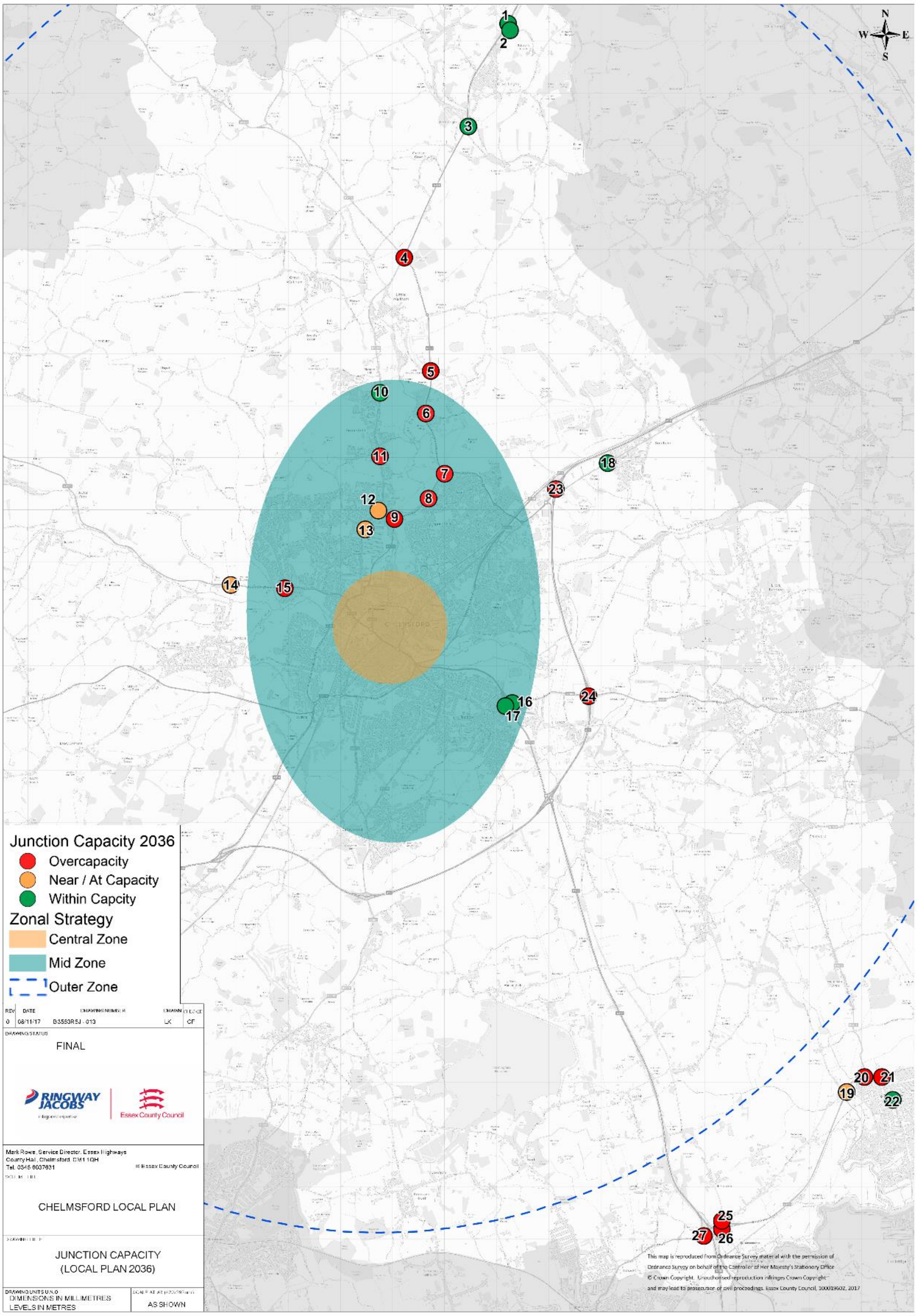

Figure 4.4 Modelled impact on junctions in Local Plan 2036 scenario without mitigation

5 Mitigation

5.1.1 Introduction

Modelling results outlined above for the following junctions suggest that they are likely to be operating within capacity in all scenarios and do not necessarily need to be considered for any mitigation:

- Moulsham Hall Lane, Great Leighs
- Main Road – Banters Lane, Great Leighs
- Essex Yeomanry Way – Maldon Road – Baddow Hall Avenue, Great Baddow
- Main Road – Church Road, Boreham
- Clements Green Lane – Hullbridge Road, South Woodham Ferrers

Chelmsford's Future Transport Network's zonal strategy suggests that mitigation in the Outer and Mid Zones should focus on improving signing for strategic trips, rail use, park and ride, public transport and cycling links in the vicinity. The following junctions are forecast to be nearing, at or overcapacity in the 2036 Local Plan scenario and at this stage in time have not been considered for mitigation:

- Essex Regiment Way – Channels Drive, Channels (Mid Zone)
- Broomfield Road – Valley Bridge, Chelmsford (Mid Zone)
- Broomfield Road – Patching Hall Lane, Chelmsford (Mid Zone)
- Roxwell Road – Lordship Road, Writtle (Outer Zone)
- A12 Junction 18 – Sandon (Mid Zone)
- A132 – Burnham Road, South Woodham Ferrers (Outer Zone)
- B1418 – Burnham Road, South Woodham Ferrers (Outer Zone)

This is due to physical constraints at these junctions or the expectation that developers will use their land to improve the junction and also in anticipation of potential future changes in travel behaviour, for example more people working from home. If highways infrastructure is built or improved upon to benefit the private car, it could quickly reach capacity again. If infrastructure is not provided for the private car, it should encourage the use of sustainable modes of travel. This can be enhanced further through improvements, hard or soft measures, to sustainable transport infrastructure.

The following section outlines the junction modelling results for mitigation proposed for a number of the remaining junctions considered that are forecast to be overcapacity by 2036. This study has also sought to consider all known developer and local authority schemes already proposed for implementation at the junctions that are forecast to be overcapacity by 2036. The following junctions have mitigation proposed and the junction modelling results have already been presented in Chapter 4:

- Deres Bridge, Great Leighs (assuming CNEB is built)
- Main Road – Hospital Approach, Broomfield
- A12 Junction 19 - Boreham Interchange

In terms of the highway mitigation proposed, shown in Appendix L, only what might be reasonably affordable and could be delivered within the land available around the junction has been considered, i.e. altering or removing physical features such as bridges, walls, buildings, has not been considered. This restriction has not been applied for sustainable transport schemes.

Where the mitigation has been proposed or is committed by a developer, this has been stated. Where mitigation is proposed by Essex Highways, it should be noted that the options tested have only looked at the potential transport benefits and have not, at this stage, considered Construction Design Management (CDM) regulations. The mitigation proposed has not considered historic collision data in the vicinity of the junctions nor whether the improvements would offer any safety benefits or not. The safety implications of these proposals will need to be considered as part of the next stage of design.

5.1.2 Results

5. Pratts Farm, Channels

Mitigation is being implemented by the North Chelmsford developer, however this is unlikely to provide sufficient capacity according to the modelling results. Therefore, further mitigation at this junction has been considered, in the form of widening the northern approach from Essex Regiment Way to two lanes ahead and creating a merge on the southbound exit from the junction. The results of modelling this layout are shown in the table below.

Table 5.1: Pratts Farm developer and ERW northern approach widening results

		A	B	C	D
AM					
Local Plan 2036 Developer	RFC	1.21	0.22	0.64	0.34
	Delay (s)	518.04	10.07	4.61	6.51
Local Plan 2036 Proposed Mitigation	RFC	0.82	0.44	0.64	0.34
	Delay (s)	7.77	26.54	4.63	6.51
PM					
Local Plan 2036 Developer	RFC	0.41	0.14	0.56	0.52
	Delay (s)	3.43	3.78	3.81	9.08
Local Plan 2036 Proposed Mitigation	RFC	0.28	0.14	0.56	0.52
	Delay (s)	1.92	3.78	3.81	9.08

The results indicate that by widening Essex Regiment Way to two lanes ahead, the approach would be nearing capacity in 2036, as opposed to being overcapacity.

As this junction is located in the Outer Zone though, the focus should be on encouraging use of the Park & Ride, relocating strategic through trips onto the CNEB and encouraging trips to be made by rail. With this in mind, an alternative to widening the approach to two lanes for the private car would be to widen it to create a bus lane as proposed in the North Essex Garden Communities Movement and Access Study[12], which would run along the A131 / A130 between Braintree and Chelmsford. Should widening of the northern approach to the junction be possible, then this should be used to promote public transport as opposed to providing an additional lane for private cars. Similarly there is also likely to be space to create a dedicated off-road cycle lane on either side of Essex Regiment Way and the developers in the North East of Chelmsford should be encouraged to investigate this in order to provide sustainable transport mitigation for their developments.

9. Valley Bridge, Springfield

This junction is currently a partially signalised roundabout, however it is proposed that it is converted into a fully signalised junction as the modelling results, outlined in the table below, indicate that this may operate better in the 2036 PM peak than the existing layout.

A – Valley Bridge

B – Chelmer Valley Road North

C – Chelmer Valley Road South

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[12] https://www.braintree.gov.uk/downloads/file/6510/north_essex_garden_communities_-_movement_access_study_may_2017

Table 5.2 Chelmer Valley Road - Valley Bridge Mitigation Comparison

		A	B	C
AM				
Local Plan 2036 Existing	RFC	0.73	0.46	0.75
	Delay (s)	8.51	4.40	7.87
Local Plan 2036 Proposed Mitigation	Degree of Saturation	84.9%	86.9%	88.6%
	Delay / PCU (s)	67.2	50.1	59.8
PM				
Local Plan 2036 Existing	Degree of Saturation	OC	81%	127%
	Delay / PCU (s)	OC	21.70	412.90
Local Plan 2036 Proposed Mitigation	Degree of Saturation	86%	86.8%	88.8%
	Delay / PCU (s)	82.1	56	58.2

The results indicate that all arms will be nearing capacity in both the AM and PM peaks by 2036. However the current layout is forecast to be overcapacity in the PM peak so the full signalisation may provide some short term relief.

In the longer term however, the focus needs to be on sustainable transport and encouraging people onto the Chelmer Valley Park & Ride service which operates through this junction. As noted earlier, there are also opportunities for off-road cycle lanes along Chelmer Valley Road. Developers should be encouraged to provide dedicated bus services that can make use of the existing bus lanes and also to provide cycle links to their developments along with contributing to or delivering more strategic cycle routes.

11. Main Road – School Lane, Broomfield

Currently, this junction is split as two priority junctions around a green. A safety scheme has been developed, that will only be delivered if the Broomfield Place development goes ahead, which would put all vehicles through one priority junction, with a two lane approach on the minor arm, School Lane. The proposed design can be found in Appendix L.

A – Main Road South

B – School Lane

C – Main Road North

Table 5.3 Main Road/School Lane model results

		A	B	C
AM				
Local Plan 2036 Existing	RFC	N/A	0.81	1.20
	Delay (s)	N/A	34.55	379.27
Local Plan 2036 Proposed Mitigation	RFC	0.44	0.72	0.79
	Delay (s)	3.52	23.68	22.26
PM				
Local Plan 2036 Existing	RFC	N/A	0.41	1.06
	Delay (s)	N/A	12.40	178.87
Local Plan 2036 Proposed Mitigation	RFC	0.33	0.68	1.14
	Delay (s)	2.97	99.14	395.22

The model results suggest that in the AM peak hour the Main Road northern approach arm will be nearing capacity and in the PM peak hour is likely to be operating over capacity by 2036. The scheme is likely to offer more capacity in the AM peak than the existing layout, but could cause significant delays in the PM peak when compared with the existing layout. Therefore, if the Broomfield Place development goes ahead, before this scheme is implemented, it will need to be reviewed to ensure that it will be beneficial. The mitigation for the Broomfield Place development should also have a strong focus on encouraging use of sustainable transport.

25. Rettendon Turnpike, South Woodham Ferrers

The mitigation proposed by Essex Highways for this junction is to increase the flare length on Main Road and to create 3 lanes from the A1245. The results of which are presented in the table below.

A – Woodham Road

B – Burnham Road

C – A1245

D – A132

E – Main Road, Rettendon

Table 5.4 Rettendon Turnpike roundabout mitigation model results

		A	B	C	D	E
AM (07:30 – 08:30)						
Local Plan 2036 Existing	RFC	1.05	0.34	0.93	0.67	1.20
	Delay (s)	104.44	2.31	22.02	4.66	209.91
Local Plan 2036 Proposed Mitigation	RFC	1.10	0.35	0.89	0.67	0.88
	Delay (s)	168.59	2.38	13.64	4.66	36.48
PM (16:45 – 17:45)						
Local Plan 2036 Existing	RFC	0.34	0.46	0.86	0.85	OC
	Delay (s)	17.82	2.55	10.82	9.54	OC
Local Plan 2036 Proposed Mitigation	RFC	0.40	0.47	0.82	0.86	0.96
	Delay (s)	22.59	2.64	8.32	9.57	67.05

N.B. OC (Over Capacity) is where RFC or Degree of Saturation has exceeded 1.40 and 140% respectively. Corresponding delay also marked as OC.

The results indicate that Woodham Road would be slightly overcapacity in the AM peak, while the junction would be near capacity in the PM peak with the mitigation in place. However this is an improvement on the current layout. A left turn slip from the A1245 was investigated but deemed to be difficult to implement due to the requirement to relocate a Public Right of Way and a bus stop. The mitigation proposed is therefore a suggested mitigation, however ECC may determine that this not sufficient and it is expected that the developer would have to demonstrate that they can sufficiently mitigate this junction. This is most likely to be through a combination of infrastructure improvements and sustainable transport improvements for the development.

26. Hawk Hill, South Woodham Ferrers

The mitigation proposed for this junction is to widen Hawk Hill to two lanes between the junction and the first property along Hawk Hill (approximately 200m), retaining the flare at the entrance to the junction. It is also proposed that the A1245 South approach be widened to create an increased flare, effectively creating two lanes for approximately 50m on the approach to the junction. The results of this proposed mitigation are shown in the table below.

A – A1245

B – A132

C – Hawk Hill

D – A1245

E – A130 on/off-slip

Table 5.5 Hawk Hill roundabout model results

		A	B	C	D	E
AM (07:30 – 08:30)						
Local Plan 2036 Existing	RFC	0.30	0.73	OC	1.14	0.47
	Delay (s)	2.02	5.47	OC	238.71	3.57
Local Plan 2036 Proposed Mitigation	RFC	0.31	0.73	0.93	0.94	0.54
	Delay (s)	2.03	5.54	42.73	51.03	4.84
PM (17:00 – 18:00)						
Local Plan 2036 Existing	RFC	0.36	0.76	0.39	0.73	0.87
	Delay (s)	2.55	7.26	9.91	9.12	11.58
Local Plan 2036 Proposed Mitigation	RFC	0.36	0.76	0.17	0.52	0.87
	Delay (s)	2.55	7.26	3.21	3.85	11.53

N.B. OC (Over Capacity) is where RFC or Degree of Saturation has exceeded 1.40 and 140% respectively. Corresponding delay also marked as OC.

The results of this proposed mitigation suggest that the junction would operate near capacity in the AM peak and within capacity in the PM peak. This particularly for the AM peak, is considerably better than the existing layout. Therefore it would be expected that the South Woodham Ferrers developer implements this mitigation or something similar to reduce the impacts of their development on the junction.

27. A132/A130, South Woodham Ferrers

The mitigation proposed for this junction is to widen the A130 Offlslip to create 3 lanes plus flare on approach to the junction, 2 lanes turning right and one plus flare turning left. It is also proposed that the left turn slip from the A132 to the A130 is widened to create one lane plus flare, as opposed to the one lane currently there. The results of this proposed mitigation are shown below.

A – A132 Runwell Road East

B – A132 Runwell Road West

C – A130 northbound on-slip

Table 5.6 A132/A130 model results

		A	B	C
AM (07:30 – 08:30)				
Local Plan 2036 Existing	Degree of Saturation	118.9%	115.3%	120.6%
	Delay (s) / PCU	287.6	217.1	300.5
Local Plan 2036 Proposed Mitigation	Degree of Saturation	91.2%	99.4%	97.4%
	Delay (s) / PCU	55.6	38.9	85.7
PM (17:15 – 18:15)				
Local Plan 2036 Existing	Degree of Saturation	107.7%	126.9%	OC
	Delay (s) / PCU	135.3	322.3	OC
Local Plan 2036 Proposed Mitigation	Degree of Saturation	106.4%	108.1%	105.5%
	Delay (s) / PCU	145.3	146.2	126.4

N.B. OC (Over Capacity) is where RFC or Degree of Saturation has exceeded 1.40 and 140% respectively. Corresponding delay also marked as OC.

The modelling results indicate that even with the proposed mitigation, the junction is likely to be at capacity in the AM peak and slightly overcapacity in the PM peak as a direct result of the Local Plan growth. However this would be better that the significantly overcapacity forecast for the existing layout. It will be up to the South Woodham Ferrers developer to prove that they can mitigate the impacts of their development, most likely through infrastructure improvements and sustainable transport measures to reduce the number of private car trips.

5.1.3 Sustainable Transport Mitigation

A number of the junctions are forecast to be nearing, at or over capacity and mitigation for the private car has not been identified for them. Likewise there are other junctions that have not been modelled specifically in this report that the VISUM model suggests are likely to be adversely affected by the Local Plan developments and so mitigation will be required to reduce the impacts on them. Developers will be required to mitigate the local impact of car trips from developments as much as possible, but this must focus strongly on sustainable transport. During the earlier stages of the Local Plan, work was undertaken to review the existing sustainable transport infrastructure in relation to a number of the developments[13]. This work concluded that even with the existing sustainable transport infrastructure, particularly for developments within 4km of the city centre, there was potential for a higher sustainable transport modal share than there is currently, however, this would require promotion of its use by developers. The work also identified the need, particularly for

[13] Essex Highways, Chelmsford Local Plan: Transport Impact Sensitivity Testing & Sustainability Review, March 2017.

larger developments, to provide extensions and upgrades to existing, or new, cycle routes.

For the junctions identified in this report as near, at or over capacity, the majority are along Broomfield Road, Essex Regiment Way or Chelmer Valley Road. Broomfield Road has been identified as a key public transport corridor in the Chelmsford Future Transport Strategy work, however it is also forecast to be congested by 2036. Congestion means that public transport becomes unreliable and slow, which will discourage rather than encourage public transport use, so measures must be implemented to improve journey times on Broomfield Road. The road itself is subject to a corridor study as part of the Chelmsford City Growth Package, which provides suggested measures along with a priority order for implementation, the details of which will be found in the addendum to this report.

Although the impacts of the Local Plan City Centre proposed developments have not been specifically investigated in this report, it is unlikely that any infrastructure mitigation to address impacts on the private car will be possible. Therefore the focus should be on walking and cycling links to and within the City Centre along with a focus on public transport links to the City Centre including the Park and Ride strategy.

ECC recently consulted on a number of cycling schemes in North Chelmsford, as part of the Chelmsford Growth Package, including a flagship cycle route on Broomfield Road in the form of a hybrid (stepped track) scheme from Patching Hall Lane to the Parkway Gyratory, a crossing of Essex Regiment Way connecting Broomfield to Beaulieu and a cycle route from Great Waltham to the City Centre. If all these are implemented, then they will be the first step in a long term strategy for improving the cycle network in Chelmsford, which developers will be able to extend. If ECC are not able to deliver all these schemes with this round of funding then developers will need to deliver or provide a contribution towards these schemes where appropriate to mitigate the impact of their developments.

As noted earlier in the report, there are a number of proposals to improve the bus lanes on Essex Regiment Way. These include the proposal in the Chelmsford City Growth Package consultation to extend the bus lane from Lawn Lane towards the Gyratory and the proposal, as part of the A131 Chelmsford to Braintree Route Based Strategy, to extend the bus lane from the Nabbots Farm junction towards Pratts Farm junction. The North Essex Garden Communities Study has also suggested a bus lane from Deres Bridge to the Chelmer Valley Park and Ride. Developers, in particular those in North East Chelmsford and Great Leighs, should be encouraged to contribute towards the delivery of these schemes, provide their own dedicated bus services that can benefit from these schemes and encourage use of the Chelmer Valley Park and Ride. Similarly there may also be scope to provide a dedicated off-road cycle facility along both Essex Regiment Way and Chelmer Valley Road and developers may be able to help to deliver these schemes to help mitigate the impacts of their developments.

The Chelmsford Growth Package itself, detailed in the addendum, is the first step ECC are taking to try and make a step change in people's travel choices through improvements to sustainable transport infrastructure. However this needs to be supported by promotion of sustainable transport to encourage people to use the new infrastructure. Similarly work needs to be undertaken with the local bus operators to provide ticketing that encourages people to use the bus. This step change in mode choice is seen as essential by ECC to reduce the number of people in private cars and mitigate the impacts of the planned Local Plan growth. However the Growth Package is just the start and will need to be built upon beyond 2021 to continue to improve the sustainable transport mode share and should be supported by developers.

The Local Plan mitigation also includes two new Park and Rides, one at Widford and one at Boreham, however in order to enable these to be implemented, ECC and CCC will need to work together on a complementary Parking Strategy which supports the transfer of car based trips to Park and Ride.

Finally ECC have developed a Cycle Strategy for Chelmsford and options for improving public transport. As appropriate, developers should be expected to support ECC in the delivery of these strategies in order to help mitigate the impacts of their developments.

5.1.4 Summary of Findings

For the following junctions improvement schemes have been tested and the modelling suggests that the junctions are likely to be operating over capacity during at least one of the peak hours in the 2036 Local Plan scenario:

- Nabbotts Farm, Springfield (Mid Zone)
- Lawn Lane, Springfield (Mid Zone)
- Main Road – School Lane, Broomfield (Mid Zone)
- A12 Junction 19, Boreham Interchange (Outer Zone)
- A130 – A132 Runwell Road, South Woodham Ferrers (Outer Zone)

Chelmsford's Future Transport Network zonal strategy suggests that mitigation in the Outer and Mid Zones should focus on improving Park and Ride use, the use of the strategic road network by private cars, encouraging rail use, improving public transport and cycling links in the vicinity.

The following junctions have had mitigation identified that would potentially provide sufficient capacity for the private car in the future year:

- Deres Bridge, Great Leighs (assuming CNEB is built)
- Valley Bridge, Springfield
- A12 Junction 19 - Boreham Interchange
- Rettendon Turnpike, South Woodham Ferrers
- Hawk Hill, South Woodham Ferrers

5.2 Peak Hour Spreading

Modelling for this study has focussed on the peak hours when, by definition, the junctions are likely to be the most congested. As mentioned previously, increasing congestion in the peak hour is likely to result in a number of different responses in travel behaviour from the people making those trips. Taking an alternative route is considered the first response and this has been considered within the modelling presented in the earlier chapters. The next most likely response is to change the time of travel by a small amount, also known as peak hour spreading. The extent to which this is likely to take place is difficult to quantify, however, the fact that it will take place is important as this is likely to reduce the impact of the traffic growth in the future from the modelling results reported.

5.2.1 Methodology

The Design Manual for Roads and Bridges (DMRB) outlines that 'peak spreading' refers to 'a reduction in the proportion of traffic in the most congested part of the peak period, with corresponding increases immediately before and after the height of the peak'[14]. There are two categories of peak spreading, which are not always distinguishable; 'passive' peak spreading is when a vehicle journey extends beyond the peak due to increased delays, and 'active' peak spreading is when people start their journeys earlier or later to avoid the worst traffic conditions.

In order to demonstrate if there is room for peak spreading at the junctions considered to be approaching, at or overcapacity in the base year scenario modelling (i.e. an RFC or Degree of Saturation equal to or exceeding 0.85 and 85% respectively), the results of junction models were analysed in further detail. The junctions analysed were:

- Deres Bridge, Great Leighs
- Sheepcotes, Little Waltham[15]
- Nabbots Farm, Springfield
- Lawn Lane, Springfield
- Chelmer Valley Road – Valley Bridge, Springfield

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[14] DMRB Volume 12, Section 2 Appendix F – The Application of Peak Spreading, http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol12/section2/12s2p1.pdf
[15] For the purposes of this analysis, the Junctions 9 model was used.

- Main Road – Hospital Approach, Broomfield
- Main Road – School Lane, Broomfield
- Broomfield Road – Valley Bridge, Chelmsford
- Roxwell Road – Chignal Road, Melbourne
- B1418 – Burnham Road, South Woodham Ferrrers
- Burnham Road – Hullbridge Road, South Woodham Ferrers
- A12 Junction 19 - Boreham Interchange (Mayer Brown Traffic Model)
- A132/A130, South Woodham Ferrers.

Capacity, expressed as flow per hour, is available from the junction models.

Flows for the 3-hour peak periods, i.e. 07:00-10:00 and 16:00-19:00, were extracted from traffic survey data. Based on analysis by 15-minute period, it is possible to determine what room there is to accommodate additional demand, not only from the demand level to the capacity level for a single hour, but also what room is available before all three hours of the peak period are operating at capacity, i.e. over 12 consecutive 15 minute periods. This is illustrated in Figure 5.1 below, assuming the peak hour is 08:00-09:00.

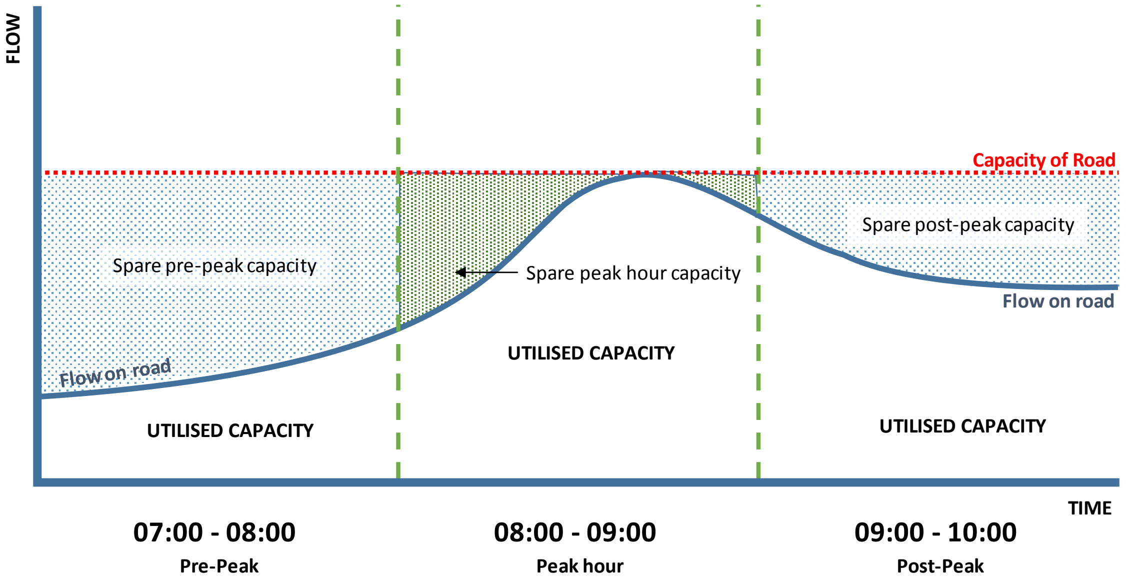


Figure 5.1 Illustration of spare junction capacity across a three hour peak period

For all junctions the first step was to take the current flow on each arm and divide it by the RFC / Degree of Saturation to work out the single hour capacity of that arm. However, two slightly different calculations were required depending on what type of model was used for the junction assessments used to determine capacity.

In the case of Junctions 9 models, used to assess roundabouts and priority junctions, the capacity and flows were assessed on a 15-minute basis. To calculate the three hour capacity for these, the single hour capacity was multiplied by three.

For LinSig models, used for signal controlled junctions, the flows and capacity are presented as the average over an hour and a peak period factor (PPF) was employed to calculate the difference in average hourly demand and the highest 15-minute demand. The PPF shows how full the peak period is compared to a 15-minute demand, calculated as the three hour flow divided by 12 times the highest 15- minute flow from actual flow counts. Capacity over a three hour period is obtained by multiplying the one hour capacity by three and then dividing by the peak period factor (PPF).

5.2.2 Application of Peak Spreading

The calculation of spare peak hour and peak period capacity helps to quantify the possible extent and viability of peak spreading to mitigate growth in traffic and manage congestion at junctions in the future. Figure 5.3 illustrates a typical over-capacity junction during the peak hour - representative of a number of junctions modelled in Chelmsford at a 2036 future year. Figure 5.3 illustrates the process and impact of peak spreading, by reallocating excess peak hour vehicle demand to periods with spare capacity either in the peak hour or peak shoulder hours.

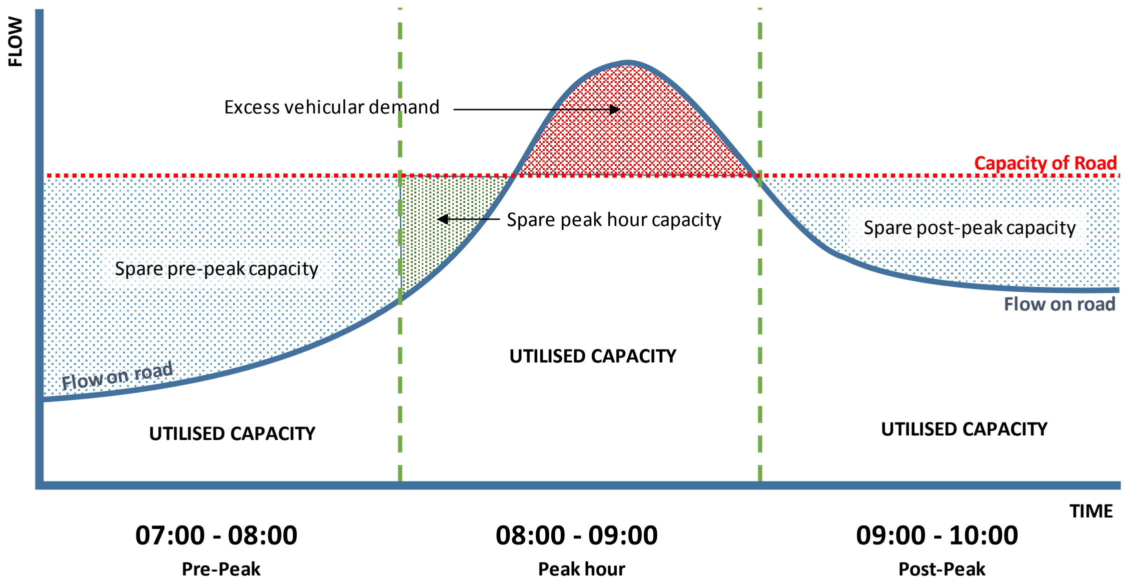


Figure 5.2 Illustration of capacity at a congested junction across a three hour peak period

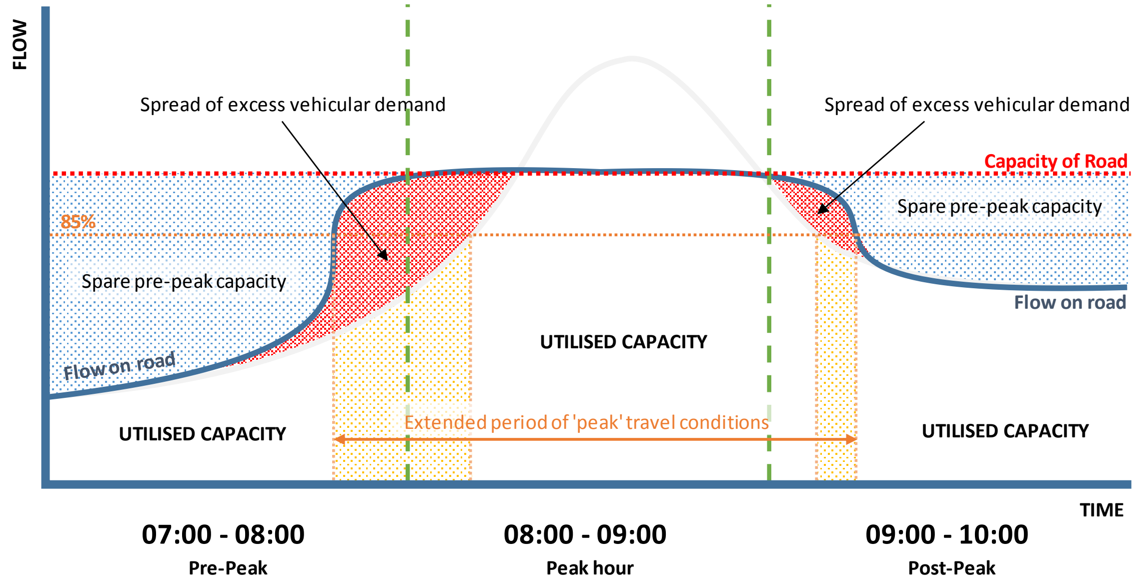


Figure 5.3 Illustration of the impact of peak spreading

The broad impact of peak spreading as shown in Figure 5.3 above, is to remove 'heavy' congestion in the peak hour where vehicular demand cannot be accommodated, and to lengthen the period of time across the peak hour and peak shoulders where 'typical' peak travel conditions are experienced. Peak travel conditions might be expected to represent moderate levels of congestion and delay at junctions.

It can be assumed that where there is little spare peak period capacity at a junction, either before or after peak spreading, it is likely that 'typical peak travel' conditions will be experienced across a greater proportion of the three hour time period. Tolerance of extended peak travel conditions across the three hour morning and evening periods is subjective, and the need for capacity improvements or sustainable mitigation will be dependent on tolerance limits.

Although this is not the standard methodology to quantify peak spreading. It is nevertheless a logical approach to better model driver behaviour, quantify the traffic impact on the hours either side of the peak hour, and provide a better platform for evaluating the extent of mitigation when considering the capacity of junctions in a 2036 future year.

5.2.3 Results

Table 5.7 below shows the current capacity available, in terms of number of vehicles, in the single modelled peak hour and in the 3-hour peak period at junction approaches that were identified as approaching, at or overcapacity in their base year. Arms that are modelled as overcapacity in the peak hour have been labelled as OC.

Table 5.7 Capacity Available through Peak Spreading

Junction name - arm	Peak hour spare capacity (Vehicles)	3 hour peak period spare capacity (Vehicles)
AM		
Deres Bridge – Great Leighs Bypass	41	776
Sheepcotes, Little Waltham – A131 Braintree Road	189	583
Sheepcotes, Little Waltham – A130 Essex Regiment Way	77	818
Nabbots Farm, Springfield – A130 Essex Regiment Way	145	686
Nabbots Farm, Springfield – Pump Lane	100	677
Lawn Lane, Springfield – Chelmer Valley Road North	171	1888
Lawn Lane, Springfield – Lawn Lane	98	985
Main Road – Hospital Approach, Broomfield - B1008 Main Road N	124	985
Main Road – School Lane, Broomfield – Broomfield Road N	111	483
Broomfield Road – Valley Bridge, Chelmsford – Broomfield Road North	149	1547
Broomfield Road – Valley Bridge, Chelmsford – Valley Bridge	27	1124
Broomfield Road – Valley Bridge, Chelmsford – Broomfield Road South	72	1507
Roxwell Road – Chignal Road, Melbourne – Chignal Road	28	935
Roxwell Road – Chignal Road, Melbourne – Roxwell Road West	44	1291
B1418 – Burnham Road, South Woodham Ferrers – Burnham Road E	85	985
Burnham Road – Hullbridge Road, South Woodham Ferrers – Hullbridge Road	OC	128
Boreham Interchange (Generals Lane) – A130 Northbound	66	283
Boreham Interchange (Generals Farm) – A12 Overbridge Eastbound	69	1026
PM		
Sheepcotes, Little Waltham – A130 Essex Regiment Way	158	820
Sheepcotes, Little Waltham – Braintree Road	87	327
Lawn Lane, Springfield – Chelmer Valley Road South	OC	357
Valley Bridge, Springfield – Valley Bridge	184	271

Junction name - arm	Peak hour spare capacity (Vehicles)	3 hour peak period spare capacity (Vehicles)
Valley Bridge, Springfield – Chelmer Valley Road South	50	1014
Main Road – Hospital Approach, Broomfield – Hospital Approach	177	1181
Main Road – School Lane, Broomfield – Broomfield Road N	131	717
Chelmer Valley Road / Valley Bridge, Springfield – Valley Bridge	OC	314
Chelmer Valley Road / Valley Bridge, Springfield – Chelmer Valley Road S	50	1029
Roxwell Road – Chignal Road, Melbourne – Roxwell Road East	39	511
Roxwell Road – Chignal Road, Melbourne – Chignal Road	19	495
Roxwell Road – Chignal Road, Melbourne – Roxwell Road West	56	1389
Boreham Interchange (Generals Farm) – A12 Overbridge Eastbound	244	2189
A132/A130, South Woodham Ferrers – A130 northbound on-slip	144	2103
A132/A130, South Woodham Ferrers – A132 Runwell Road West	142	1356

Table 5.7 illustrates how many additional vehicles each junction arm can potentially accommodate in the one hour peak and the three hour peak period based on base year scenario traffic volumes. On all the critical approaches, there is room to accommodate further traffic flow if it is accepted that typical peak hour conditions will extend further across the three hour peak period.

Looking to the future, it should be noted that while the results illustrate the potential for accommodating additional demand on the critical junction approach arms, a proportion of spare capacity would be expected to be taken up by growth in background traffic.

Longer periods of congested traffic would be an undesirable effect and should not be seen as a measure to accommodate growth. Peak spreading could, however, result from traffic growth where peak hour junction capacity is limited and options for providing additional capacity are limited or undesirable. The findings of this assessment should not be viewed in support of peak spreading as a form of mitigation, although it might be expected to occur as a result of Local Plan development proposals.

6 Summary, Conclusions & Next Steps

Peak hour modelling suggests that by 2036, background growth in Chelmsford without Local Plan development or infrastructure will likely result in significant congestion along corridor routes into the city centre, through the city centre and along the A12 - with the PM peak hour being most affected. The addition of Local Plan development traffic results in significant increases in peak hour vehicle flow focussed in the north east of Chelmsford and on northern corridor routes into the city centre.

In order to understand the impact of the Local Plan on junctions, 27 key junctions were identified with CCC and ECC, through analysis of previous VISUM modelling and Trafficmaster and consideration of their location in relation to the proposed developments, that were most likely to be impacted and thus were assessed. The junction modelling indicates that 18 of these are currently operating near to or at capacity on at least one approach arm. Of these, 13 had an approach with an RFC / Degree of Saturation equal to or exceeding 0.85 / 85% and so were then analysed to understand if they were likely to be near or at capacity in the hours either side of the peak hour. We found that within the peak period (i.e. the peak hour plus one hour either side), all 13 would be likely to be able to accommodate traffic growth if peak spreading occurred.

Table 6.1 shows the forecast capacity in both the 2036 scenarios and whether highway mitigation that would be likely to alleviate the junction in the 2036 Local Plan scenario is considered possible. In terms of the highway mitigation investigated, only what might be reasonably affordable and could be delivered within the land available around the junction has been looked at, i.e. altering or removing physical features such as bridges, walls, buildings, has not been considered. This does not include the sustainable transport schemes considered.

Table 6.1 Summary of junction capacity including committed mitigation and indication if mitigation is possible

Junction	Forecast Capacity – Do Minimum 2036	Forecast Capacity – Local Plan 2036	Highway Mitigation Possible (Y / N)
1. Moulsham Hall Lane, Great Leighs	Within capacity	Within capacity	N/A
2. Main Road – Banters Lane, Great Leighs	Within capacity	Within capacity	N/A
3. Deres Bridge, Great Leighs	Overcapacity	Overcapacity	Y
4. Sheepcotes, Little Waltham	Overcapacity	Overcapacity	Y
5. Pratts Farm, Channels	Overcapacity	Overcapacity	Y
6. Essex Regiment Way – Channels Drive, Channels	Within capacity	Overcapacity	**N**
7. Nabbotts Farm, Springfield	Overcapacity	Overcapacity	**N**

Junction	Forecast Capacity – Do Minimum 2036	Forecast Capacity – Local Plan 2036	Highway Mitigation Possible (Y / N)
8. Lawn Lane, Springfield	Overcapacity	Overcapacity	N
9. Valley Bridge, Springfield	Overcapacity	Overcapacity	Y
10. Main Road – Hospital Approach, Broomfield	Near capacity	Near capacity	Y
11. Main Road – School Lane, Broomfield	Overcapacity	Overcapacity	N
12. Broomfield Road – Valley Bridge, Chelmsford	Near capacity	At capacity	N
13. Broomfield Road – Patching Hall Lane, Chelmsford	At capacity	At capacity	N
14. Roxwell Road – Lordship Road, Writtle	At capacity	Near capacity	Y
15. Roxwell Road – Chignal Road, Melbourne	Within capacity	Near capacity	Y
16. Essex Yeomanry Way – Maldon Road – Baddow Hall Avenue, Great Baddow	Within capacity	Within capacity	N/A
17. Essex Yeomanry Way – Maldon Road, Great Baddow	Within capacity	Within capacity	N/A
18. Main Road – Church Road, Boreham	Within capacity	Within capacity	N/A
19. Burnham Road – Ferrers Road, South Woodham Ferrers	Near capacity	At capacity	N
20. B1418 – Burnham Road, South Woodham Ferrers	At capacity	Overcapacity	Y
21. Burnham Road – Hullbridge Road, South Woodham Ferrers	Within capacity	Overcapacity	Y
22. Hullbridge Road – Clements Green Lane, South Woodham Ferrers	Within capacity	Within capacity	N/A
23. A12 Junction 19, Boreham Interchange (Mayer Brown Traffic Model)	Overcapacity	Overcapacity	N
24. A12 Junction 18, Sandon	Near capacity	Overcapacity	Y
25. Rettendon Turnpike, South Woodham Ferrers	Near capacity	Overcapacity	Y
26. Hawk Hill roundabout, South Woodham Ferrers	Near capacity	Overcapacity	Y
27. A132/A130, South Woodham Ferrers	Overcapacity	Overcapacity	Y

Mitigation was investigated for all junctions forecast to be at or overcapacity in the 2036 Local Plan scenario. Improvement schemes were modelled for 14 of the junctions that are forecast to be operating at or overcapacity in the 2036 Local Plan scenario. The modelling suggests that nine[16] of these are likely to operate over capacity during at least one of the peak hours with the improvement scheme in place. Mitigation has been identified for five[17] of the junctions that were forecast to be overcapacity.

Of the remaining 13 junctions, six[18] are forecast to be operating within capacity by 2036, five[19] are forecast to be near or at capacity in 2036 and two[20] are forecast to be overcapacity. Therefore, including the junctions where improvement schemes have been tested, five junctions are forecast to be overcapacity in 2036 with no mitigation identified that would benefit the private car (see Table 6.1).

ECC's Chelmsford's Future Transport Network zonal strategy suggests that mitigation in the Outer and Mid Zones should focus on encouraging use of the Park and Ride and rail use, routing private car trips onto the strategic road network through dynamic signing, improving public transport and cycling links in the vicinity. The majority of the junctions that are forecast to be operating near or at capacity in the 2036 Local Plan scenario are located within these zones. The emphasis in terms of mitigation should therefore be on sustainable transport.

The Future Transport Strategy for Chelmsford is supplemented by cycling and public transport studies which provide potential schemes and solutions to help mitigate the impact of reliance on private car. Developers should be asked to not only mitigate their local impact but also to deliver or contribute to sustainable transport schemes that link their development to the wider area and enhance the overall transport strategy. For example developers should be looking to provide or contribute towards dedicated bus services, bus lanes to support those services and cycle links to and through their developments. Similarly those developments that are further afield from the main city of Chelmsford, should be looking to encourage trips by rail and use of the Park and Ride sites. Therefore they should be looking to provide measures to encourage residents of their developments to use these services.

CCC are currently in the process of revising their Preferred Local Plan Scenario following public consultation. Once this has been refined a further study is planned to model the Pre-Submission scenario, investigate the impact on the city centre, summarise ongoing studies focussing on sustainable transport improvement

[16] Junctions: 4, 7, 8, 11, 20, 21, 23, 25, 27
[17] Junctions: 3, 5, 9, 15, 26
[18] Junctions: 1, 2, 16, 17, 18, 22
[19] Junctions: 10, 12, 13, 14, 19
[20] Junctions: 6, 24

schemes in the Local Plan area and respond to comments made during the public consultation.

Appendices

Appendix A: Further VDM Statistics

Table A1 Sensitivity test results for forecast year 2036 Do Minimum, Demand Totals

2036 build Travel Demand (Trips) - Sensitivity Testing													
Mode	Purpose	No VDM			VDM - Calibrated Sensitivity Param			VDM -25% Sensitivity Param			VDM +25% Sensitivity Param		
		AM	IP	PM	AM	IP	PM	AM	IP	PM	AM	IP	PM
Car	Commute	17,134	7,351	20,295	16,812	7,256	20,131	16,870	7,270	20,164	16,704	7,229	20,059
	Other	19,507	24,845	19,523	18,470	24,107	19,042	18,705	24,242	19,139	17,967	23,811	18,826
	Business	1,778	853	1,416	1,762	848	1,408	1,765	849	1,410	1,757	847	1,405
Public Transport	Commute	4,366	564	2,229	4,726	670	2,414	4,661	655	2,376	4,846	700	2,494
	Other	5,162	3,231	2,780	6,788	4,387	3,533	6,419	4,176	3,381	7,575	4,851	3,871
	Business	312	151	386	331	157	395	327	156	393	337	158	399

Table A2 Sensitivity test results for forecast year 2036 Do Minimum, Vehicle-Passenger Kilometre Totals

2036 build Travel Demand (Trips) - Sensitivity Testing													
Mode	Purpose	No VDM			VDM - Calibrated Sensitivity Param			VDM -25% Sensitivity Param			VDM +25% Sensitivity Param		
		AM	IP	PM	AM	IP	PM	AM	IP	PM	AM	IP	PM
Car	Commute	546,351	317,208	674,330	513,541	312,313	660,208	518,597	313,202	663,351	504,860	310,592	654,270
	Other	788,923	550,265	561,348	888,284	671,551	658,088	871,860	647,369	640,059	915,189	716,902	691,521
	Business	80,891	19,319	42,245	80,056	18786	41,258	80,216	18870	41,404	79,706	18648	41,021
Public Transport	Commute	254,150	31,168	131,059	369,364	41,041	150,908	360,038	39,723	147,005	380,208	43,331	158,139
	Other	152,374	107,963	112,993	614,606	320,609	370,825	542,409	271,458	331,379	780,162	436,869	464,141
	Business	23838	12,784	29,874	28,799	13,515	30,552	27,645	13,400	30,363	30,752	13,711	30,873

Table A3 Sensitivity test results for forecast year 2036 Local Plan, Demand Totals

2036 build Travel Demand (Trips) - Sensitivity Testing													
Mode	Purpose	No VDM			VDM - Calibrated Sensitivity Param			VDM -25% Sensitivity Param			VDM +25% Sensitivity Param		
		AM	IP	PM	AM	IP	PM	AM	IP	PM	AM	IP	PM
Car	Commute	19,002	7,771	22,023	18,595	7,626	21,550	18,668	7,647	21,633	18,457	7,568	21,391
	Other	21,364	28,083	22,594	20,177	27,036	21,694	20,447	27,232	21,874	19,599	26,620	21,313
	Business	1,922	951	1,605	1,898	943	1,585	1,902	944	1,589	1,890	941	1,579
Public Transport	Commute	4,746	651	2,572	5,201	813	3,101	5,120	790	3,007	5,355	878	3,278
	Other	5,795	3,978	3,235	7,653	5,620	4,645	7,231	5,312	4,363	8,561	6,271	5,242
	Business	345	182	429	374	191	452	368	190	448	383	193	459

Table A4 Sensitivity test results for forecast year 2036 Local Plan, Vehicle-Passenger Kilometre Totals

2036 build Travel Demand (Trips) - Sensitivity Testing													
Mode	Purpose	No VDM			VDM - Calibrated Sensitivity Param			VDM -25% Sensitivity Param			VDM +25% Sensitivity Param		
		AM	IP	PM	AM	IP	PM	AM	IP	PM	AM	IP	PM
Car	Commute	565,132	321,013	693,050	528,532	314,402	663,130	534,255	315,602	668,604	518,839	311,781	653,307
	Other	813,747	580,612	595,143	927,040	707,047	705,780	909,048	681,762	684,595	956,634	753,882	740,647
	Business	83,000	20,172	44,350	81,570	19,421	42,753	81,839	19,532	43,006	81,066	19,235	42,350
Public Transport	Commute	275,130	35,382	49,741	39,818	47,066	182,766	382,115	45,429	176,804	403,870	49,874	193,613
	Other	161,482	123,574	121,661	643,502	368,522	425,622	564,943	310,321	374,049	824,851	505,382	548,246
	Business	26,853	15,226	32,341	32,692	16,158	33,525	31,463	16,011	33,258	34,734	16,405	33,989

Appendix B: Inter Peak VISUM Model Outputs

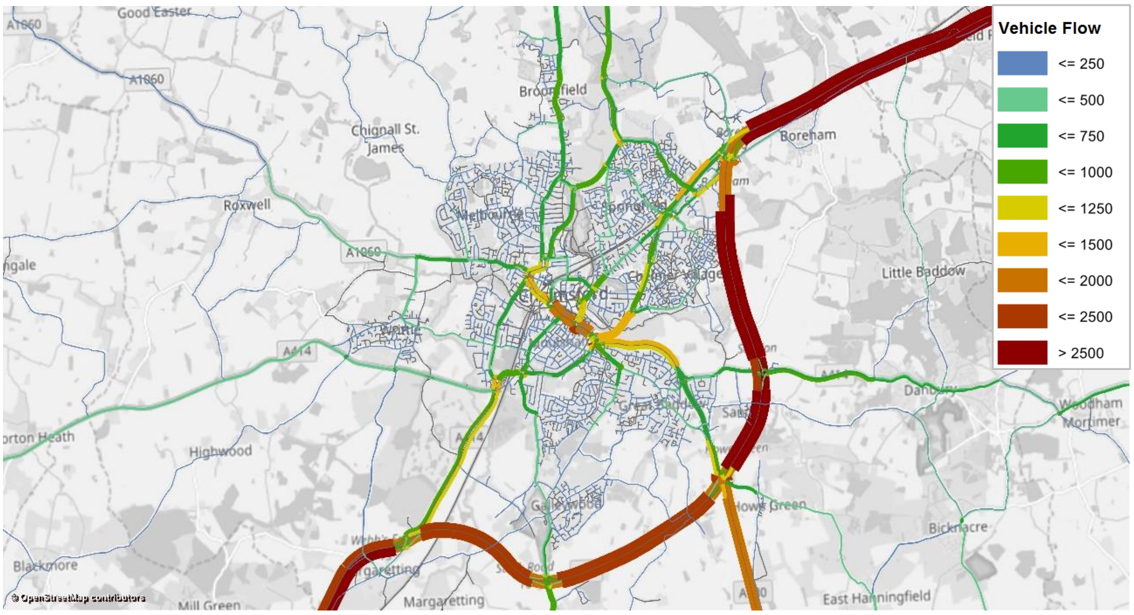


Figure B1 IP 2036 forecast traffic flows in Chelmsford (Do Minimum)

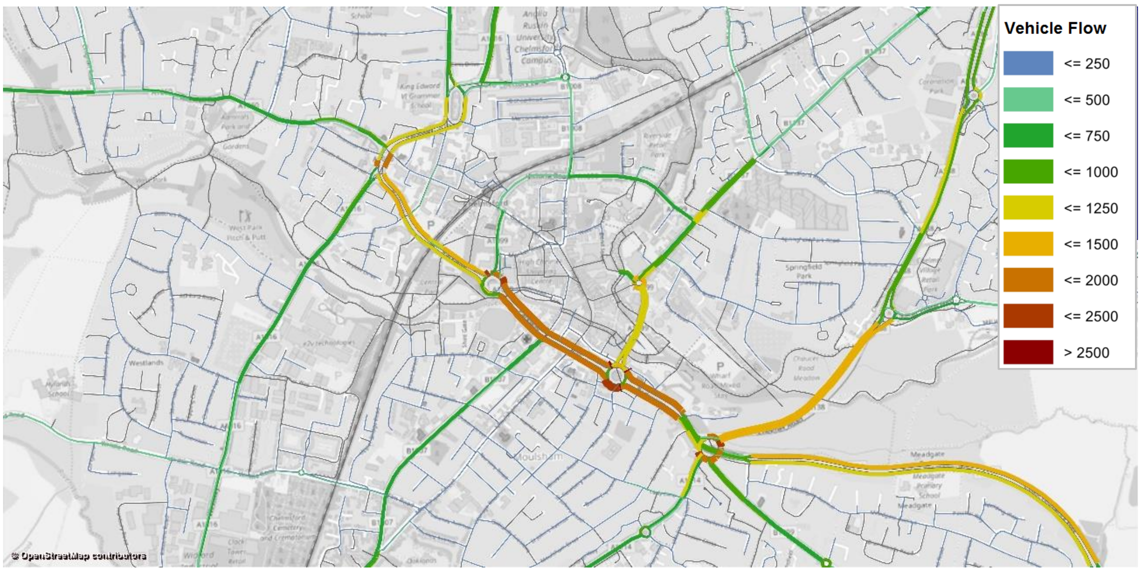


Figure B2 IP 2036 forecast traffic flows in Chelmsford City Centre (Do Minimum)

Figure B3 IP 2036 forecast congestion in Chelmsford (Do Minimum)

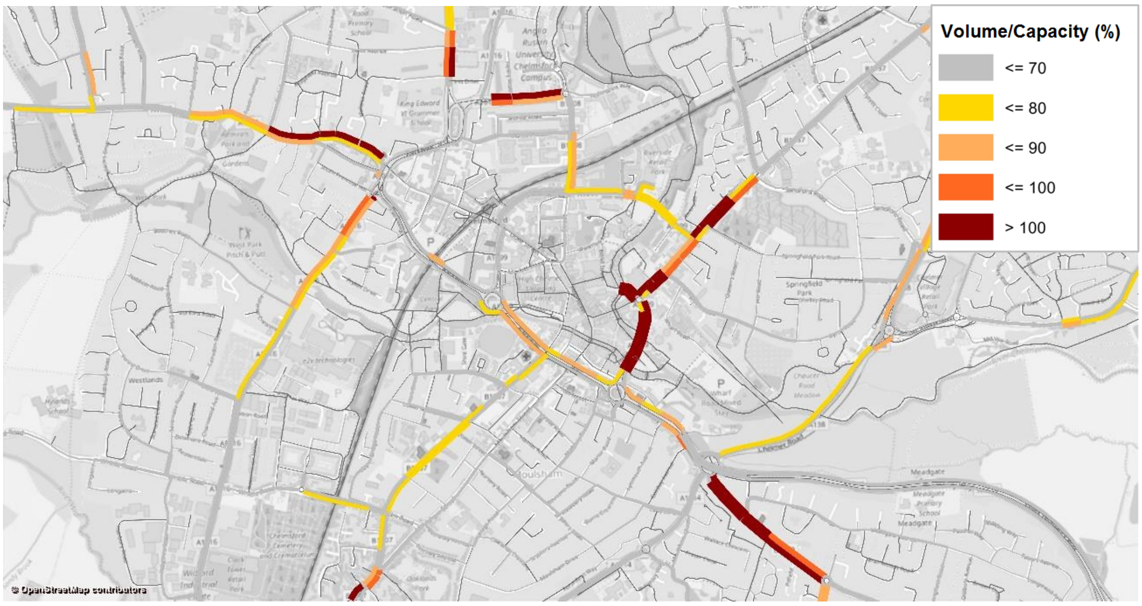


Figure B4 IP 2036 forecast congestion in Chelmsford City Centre (Do Minimum)

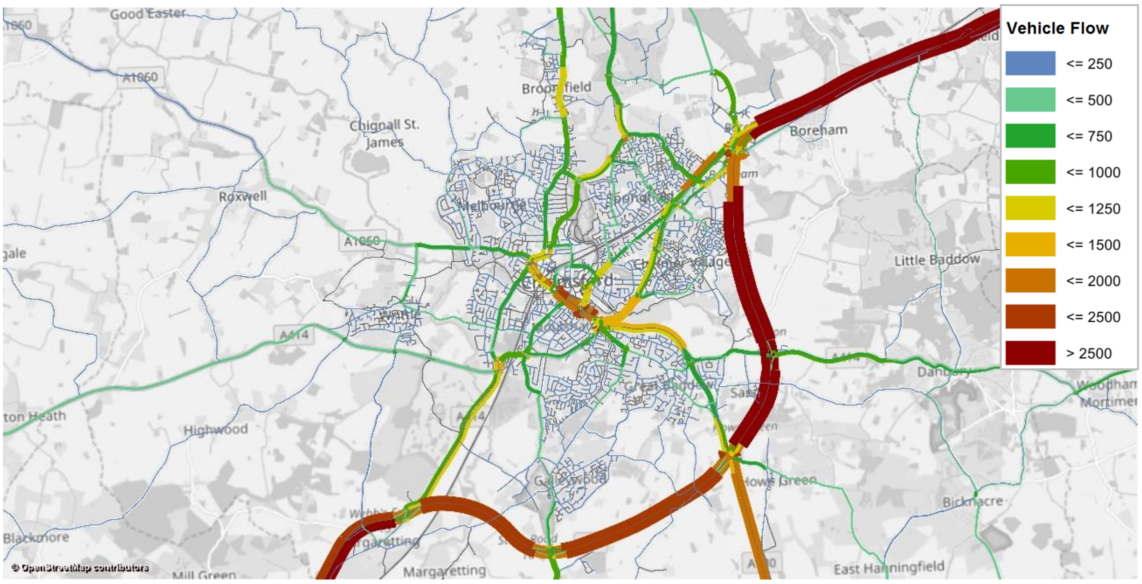


Figure B5 IP 2036 forecast traffic flows in Chelmsford (with Local Plan)

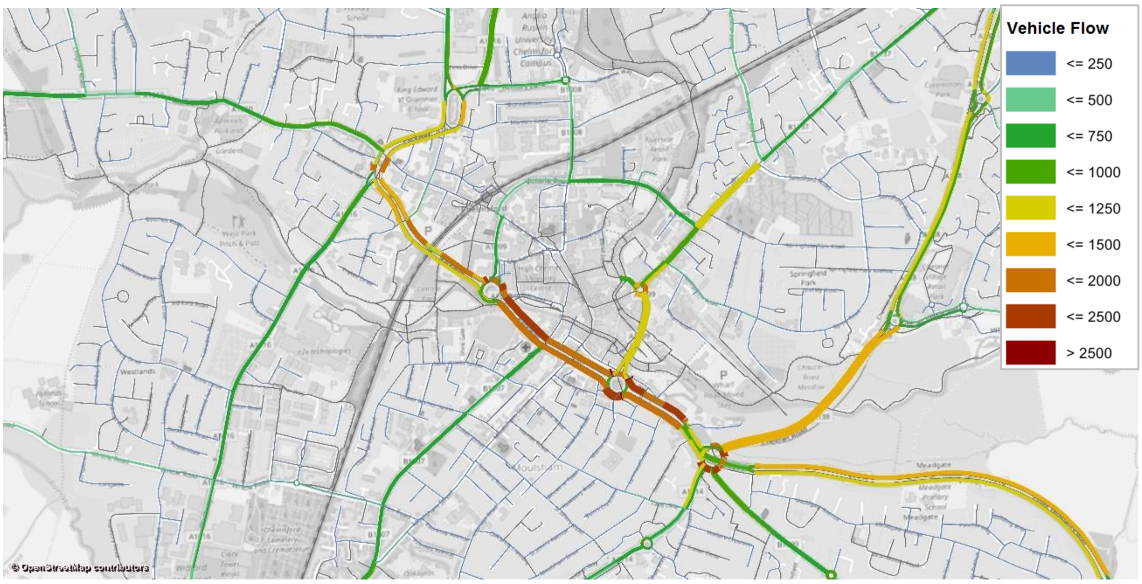


Figure B6 IP 2036 forecast traffic flows in Chelmsford City Centre (with Local Plan)

Figure B7 IP 2036 forecast congestion in Chelmsford City Centre (with Local Plan)

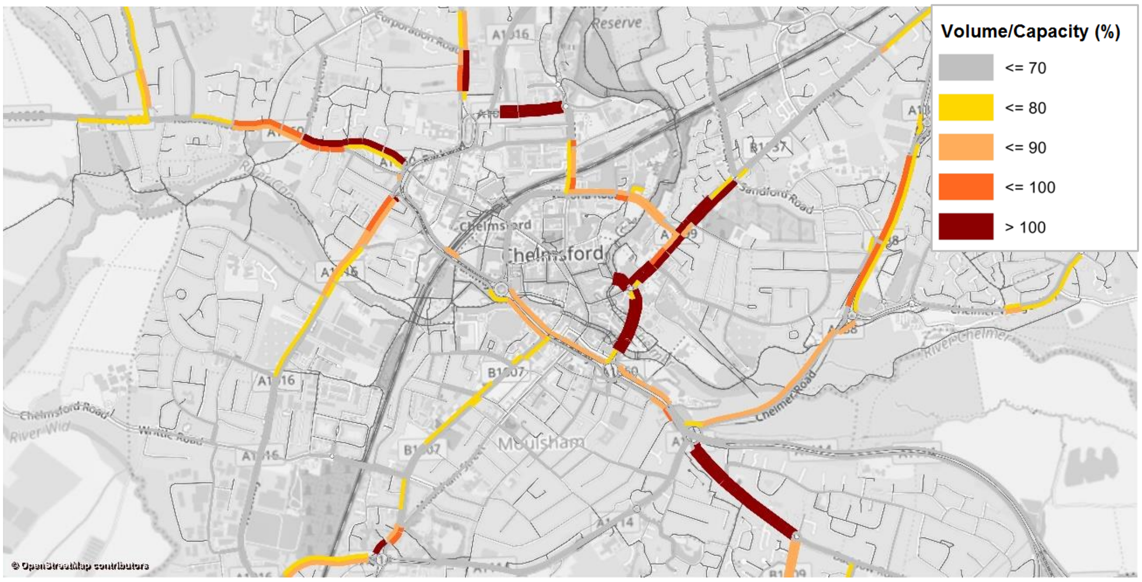


Figure B8 IP 2036 forecast congestion in Chelmsford City Centre (with Local Plan)

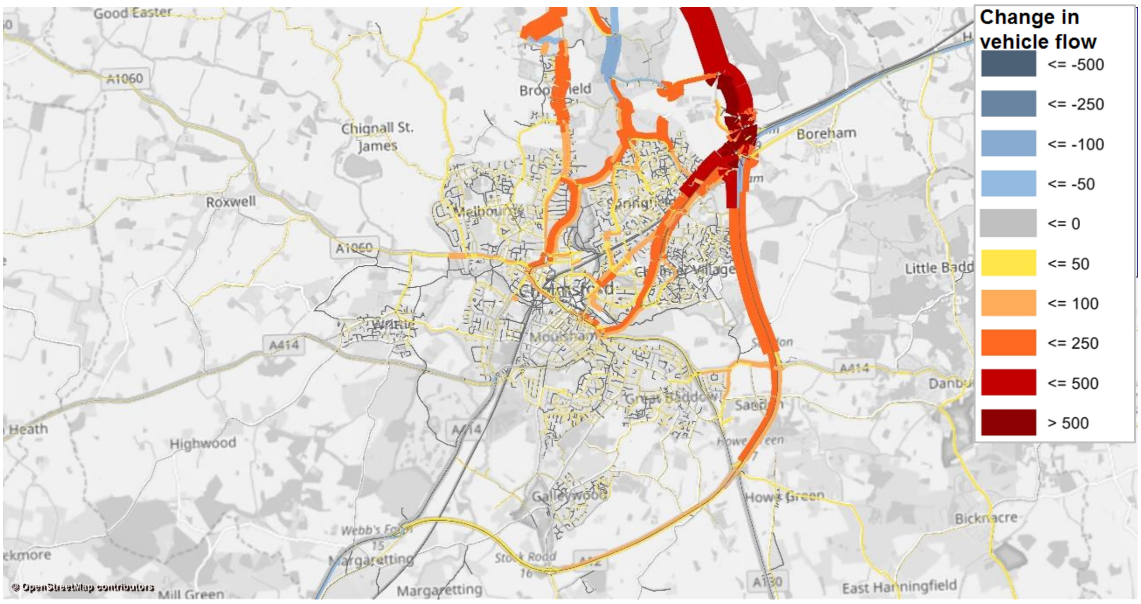


Figure B9 IP 2036 change in traffic flow with Local Plan in Chelmsford

Figure B10 IP 2036 change in traffic flow with Local Plan in Chelmsford City Centre

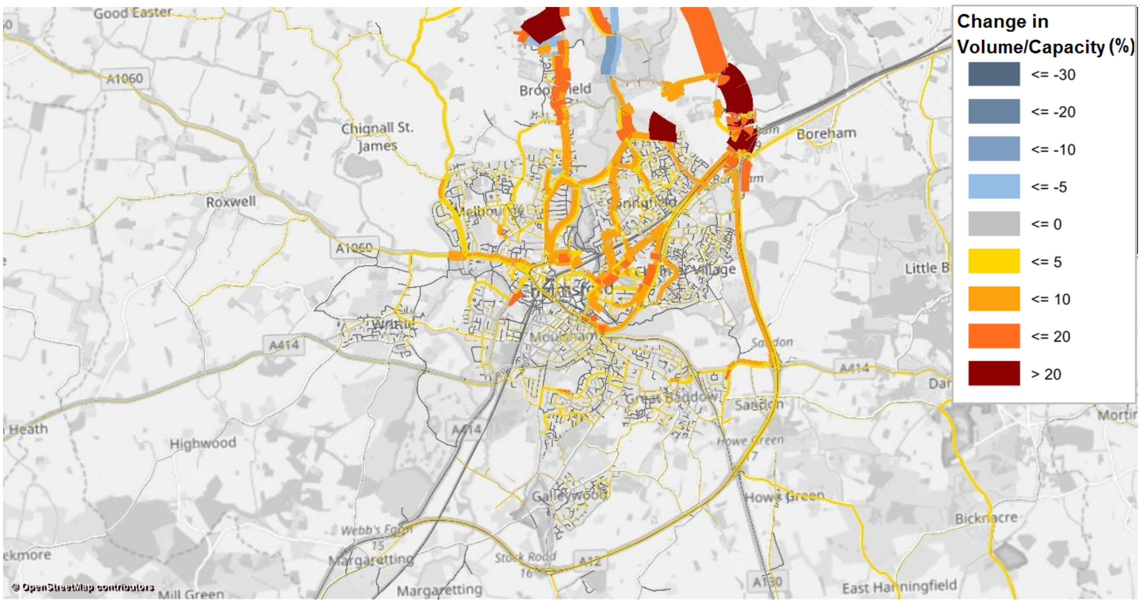


Figure B11 IP 2036 change in network flow capacity ratio (as a percentage) with Local Plan in Chelmsford

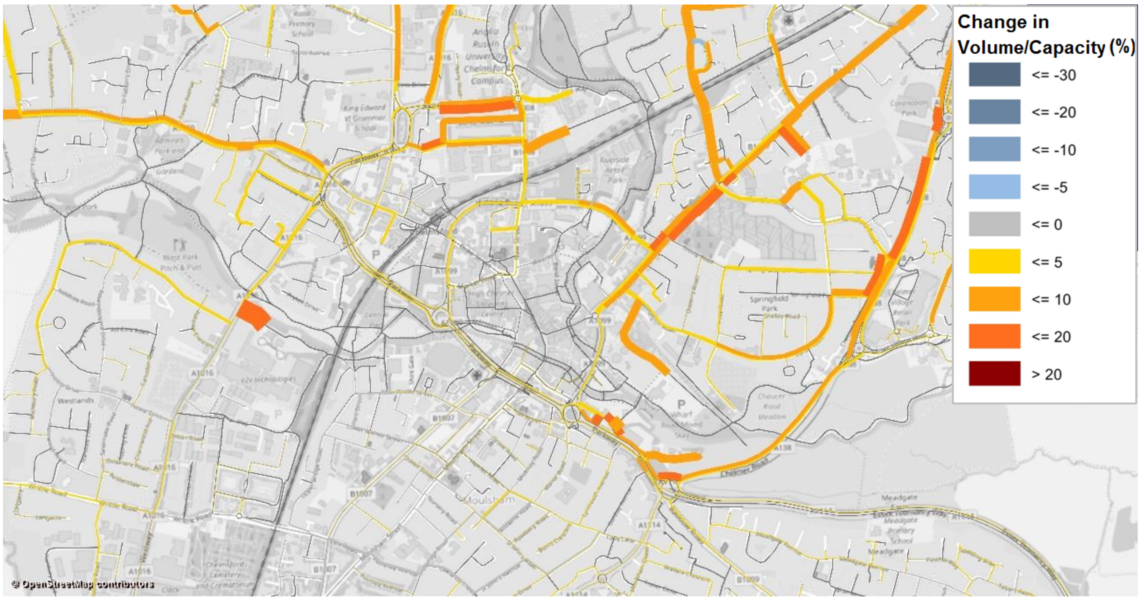


Figure B12- IP 2036 change in network flow capacity ratio (as a percentage) with Local Plan in Chelmsford City Centre

Appendix C: Average NTEM Car Growth Rates for Zones 147-321 (outside of Chelmsford Administrative Area)

Refer to Chelmsford Strategic Model (VISUM) Zone Plans in Appendix M

AM

Zone	Home Based Work		Home Based Other		Non-Home Based	
	Origin	Destination	Origin	Destination	Origin	Destination
147	-7%	4%	13%	20%	16%	16%
148	-7%	4%	13%	20%	16%	16%
149	-6%	4%	14%	20%	17%	17%
150	-5%	4%	17%	19%	15%	14%
151	-4%	5%	15%	21%	16%	16%
152	-4%	5%	15%	21%	16%	16%
153	-4%	5%	15%	21%	15%	16%
154	0%	5%	24%	23%	16%	16%
155	-5%	4%	15%	23%	19%	18%
156	-7%	4%	12%	19%	14%	15%
157	-6%	4%	14%	21%	16%	17%
158	-4%	5%	17%	22%	15%	16%
159	-6%	4%	14%	20%	17%	17%
160	0%	10%	15%	20%	18%	18%
161	1%	11%	17%	22%	19%	19%
162	2%	10%	17%	22%	16%	22%
163	1%	9%	17%	20%	18%	19%
164	1%	9%	16%	20%	18%	17%
165	2%	10%	19%	22%	17%	18%
166	0%	10%	16%	20%	17%	18%
167	1%	11%	16%	23%	21%	16%
168	-4%	10%	12%	20%	17%	18%
169	4%	11%	17%	22%	19%	19%
170	2%	11%	19%	22%	18%	18%
171	0%	10%	16%	21%	19%	19%
172	2%	10%	19%	22%	19%	19%
173	0%	10%	14%	21%	17%	18%
174	-1%	10%	12%	18%	16%	17%
175	2%	10%	16%	21%	22%	20%
176	2%	10%	17%	21%	19%	20%
177	5%	11%	18%	22%	18%	18%
178	3%	10%	18%	22%	20%	19%
179	4%	11%	20%	24%	19%	19%
180	3%	11%	16%	21%	16%	17%
181	1%	10%	13%	18%	16%	15%
182	-2%	9%	10%	20%	17%	17%
183	-2%	9%	10%	20%	17%	17%
184	2%	10%	17%	22%	19%	19%
185	1%	12%	17%	25%	22%	21%
186	-1%	8%	11%	18%	20%	19%
187	-4%	11%	10%	20%	17%	18%
188	0%	11%	15%	22%	19%	19%

Zone	Home Based Work		Home Based Other		Non-Home Based	
	Origin	Destination	Origin	Destination	Origin	Destination
189	-2%	11%	13%	21%	19%	19%
190	-5%	10%	8%	19%	17%	20%
191	-3%	12%	10%	20%	19%	21%
192	26%	12%	36%	26%	19%	19%
193	-3%	12%	10%	20%	18%	23%
194	-3%	11%	10%	20%	20%	21%
195	-3%	11%	9%	18%	18%	21%
196	-3%	10%	12%	19%	18%	18%
197	-1%	11%	14%	21%	19%	19%
198	-1%	11%	14%	22%	17%	18%
199	-1%	11%	14%	22%	18%	19%
200	-2%	11%	12%	22%	19%	18%
203	-5%	11%	8%	19%	19%	22%
204	-4%	10%	10%	19%	18%	19%
205	-1%	10%	12%	20%	18%	18%
206	-4%	10%	10%	19%	18%	19%
207	-5%	11%	9%	19%	17%	19%
208	5%	10%	20%	23%	19%	19%
209	5%	10%	20%	23%	19%	19%
210	4%	12%	19%	23%	21%	19%
211	5%	11%	20%	21%	19%	19%
212	5%	11%	20%	21%	18%	19%
213	4%	12%	21%	22%	18%	19%
214	3%	13%	18%	23%	18%	20%
215	3%	13%	18%	23%	18%	20%
216	2%	12%	19%	21%	17%	18%
217	2%	12%	19%	21%	17%	18%
218	0%	9%	21%	27%	22%	21%
219	0%	9%	21%	27%	22%	21%
220	2%	8%	25%	30%	23%	22%
221	-1%	8%	21%	26%	21%	21%
222	-1%	9%	20%	27%	20%	22%
223	-3%	4%	14%	22%	16%	16%
224	-2%	5%	17%	22%	14%	14%
225	-3%	4%	14%	19%	15%	15%
226	0%	5%	17%	18%	11%	13%
227	-3%	4%	15%	19%	15%	14%
228	-4%	3%	14%	19%	17%	16%
229	0%	4%	19%	23%	16%	17%
230	-3%	4%	13%	21%	18%	18%
231	-3%	4%	16%	20%	15%	16%
232	-3%	4%	16%	20%	15%	16%
233	-3%	4%	16%	20%	15%	16%
234	-3%	4%	16%	21%	15%	16%
235	0%	4%	22%	23%	14%	15%
236	-1%	3%	15%	19%	14%	15%
237	4%	4%	20%	20%	17%	17%
238	-1%	4%	17%	19%	14%	16%
239	-2%	4%	16%	19%	13%	16%
240	3%	4%	19%	21%	17%	17%
241	-3%	5%	14%	21%	16%	17%
242	-3%	4%	15%	20%	13%	14%
243	1%	5%	20%	24%	18%	16%
244	-2%	5%	15%	20%	14%	16%
245	-2%	5%	15%	21%	14%	17%

Zone	Home Based Work		Home Based Other		Non-Home Based	
	Origin	Destination	Origin	Destination	Origin	Destination
246	0%	5%	19%	22%	16%	16%
247	-2%	5%	15%	21%	16%	17%
248	3%	5%	20%	23%	18%	16%
249	1%	4%	18%	21%	16%	16%
250	1%	4%	19%	20%	14%	14%
251	0%	3%	14%	16%	13%	15%
252	1%	4%	19%	21%	16%	16%
253	3%	5%	25%	23%	16%	17%
254	4%	4%	20%	22%	17%	16%
255	0%	5%	18%	25%	16%	16%
256	0%	5%	20%	26%	19%	16%
257	-1%	5%	15%	19%	16%	19%
258	4%	4%	24%	21%	14%	15%
259	5%	5%	24%	23%	14%	17%
260	4%	4%	25%	21%	15%	14%
261	7%	5%	27%	24%	19%	16%
262	13%	6%	33%	26%	21%	19%
263	15%	6%	31%	24%	17%	16%
264	18%	5%	35%	27%	18%	17%
265	20%	6%	35%	28%	20%	19%
266	9%	5%	29%	26%	17%	18%
267	4%	4%	24%	21%	14%	15%
268	8%	5%	28%	25%	16%	17%
269	12%	5%	29%	25%	16%	17%
301	1%	5%	19%	22%	16%	16%
302	-12%	4%	7%	19%	16%	16%
303	9%	10%	28%	29%	21%	21%
304	11%	10%	29%	27%	21%	21%
305	6%	11%	20%	23%	19%	19%
306	5%	11%	19%	22%	19%	19%
307	20%	13%	27%	24%	20%	20%
308	20%	13%	28%	24%	19%	19%
309	23%	14%	33%	26%	20%	20%
310	13%	13%	24%	24%	20%	19%
311	15%	12%	26%	24%	20%	19%
312	9%	11%	21%	22%	18%	18%
313	8%	10%	19%	21%	17%	17%
314	7%	10%	17%	19%	15%	15%
315	9%	6%	27%	25%	17%	17%
316	9%	9%	16%	16%	13%	13%
317	5%	6%	19%	20%	15%	15%
318	9%	9%	18%	17%	13%	14%
319	9%	9%	13%	13%	11%	11%
320	11%	11%	14%	14%	12%	12%
321	9%	9%	13%	13%	11%	11%

IP

Zone	Home Based Work		Home Based Other		Non-Home Based	
	Origin	Destination	Origin	Destination	Origin	Destination
147	3%	-6%	17%	15%	19%	21%
148	3%	-6%	17%	15%	19%	21%
149	3%	-5%	17%	16%	18%	20%
150	3%	-4%	18%	17%	19%	20%
151	5%	-2%	19%	17%	18%	21%
152	5%	-2%	19%	17%	18%	21%
153	5%	-2%	19%	17%	18%	21%
154	5%	1%	22%	23%	18%	20%
155	3%	-4%	18%	15%	19%	20%
156	2%	-6%	15%	14%	18%	18%
157	4%	-5%	19%	16%	24%	24%
158	4%	-4%	20%	19%	18%	20%
159	3%	-5%	17%	16%	18%	20%
160	9%	-1%	17%	15%	21%	22%
161	9%	1%	19%	17%	19%	20%
162	8%	2%	18%	16%	20%	24%
163	8%	1%	18%	16%	19%	21%
164	8%	1%	18%	17%	18%	20%
165	9%	1%	18%	18%	18%	18%
166	8%	0%	16%	15%	17%	19%
167	10%	1%	19%	17%	20%	21%
168	7%	-3%	15%	12%	18%	20%
169	10%	4%	19%	18%	20%	20%
170	10%	2%	20%	18%	19%	20%
171	9%	0%	18%	16%	19%	21%
172	8%	1%	19%	17%	21%	20%
173	9%	-1%	15%	13%	19%	19%
174	8%	-1%	13%	11%	16%	17%
175	8%	2%	16%	15%	20%	21%
176	8%	2%	17%	16%	20%	19%
177	10%	4%	18%	17%	19%	19%
178	8%	3%	18%	17%	21%	20%
179	11%	4%	21%	19%	21%	21%
180	9%	2%	16%	15%	18%	19%
181	8%	0%	13%	12%	16%	16%
182	9%	-2%	15%	12%	20%	19%
183	9%	-2%	15%	12%	20%	19%
184	9%	2%	18%	17%	21%	21%
185	11%	1%	20%	17%	23%	22%
186	5%	-2%	12%	10%	17%	16%
187	10%	-3%	15%	12%	20%	20%
188	10%	-1%	16%	13%	20%	21%
189	9%	-2%	15%	12%	21%	19%
190	9%	-4%	13%	9%	21%	22%
191	11%	-3%	14%	11%	20%	19%
192	12%	25%	29%	33%	20%	21%
193	11%	-2%	15%	12%	19%	21%
194	11%	-2%	16%	13%	20%	22%
195	9%	-3%	13%	11%	21%	20%
196	10%	-2%	18%	14%	20%	20%
197	11%	0%	19%	15%	21%	21%

Zone	Home Based Work		Home Based Other		Non-Home Based	
	Origin	Destination	Origin	Destination	Origin	Destination
198	11%	0%	18%	15%	19%	20%
199	10%	-1%	17%	14%	20%	21%
200	10%	-2%	17%	13%	19%	21%
203	10%	-4%	14%	11%	20%	22%
204	9%	-3%	14%	10%	19%	20%
205	10%	-1%	17%	13%	21%	22%
206	9%	-3%	14%	10%	19%	20%
207	10%	-4%	13%	10%	20%	21%
208	10%	4%	19%	18%	20%	20%
209	10%	4%	19%	18%	20%	20%
210	11%	5%	21%	20%	21%	23%
211	10%	6%	21%	21%	20%	20%
212	10%	6%	21%	21%	20%	20%
213	11%	4%	21%	21%	19%	20%
214	12%	3%	21%	19%	21%	22%
215	12%	3%	21%	19%	21%	22%
216	11%	2%	20%	19%	19%	19%
217	11%	2%	20%	19%	19%	19%
218	8%	1%	23%	21%	23%	24%
219	8%	1%	23%	21%	23%	24%
220	8%	2%	26%	24%	25%	24%
221	8%	0%	24%	22%	23%	25%
222	8%	0%	23%	21%	24%	24%
223	4%	-2%	18%	17%	18%	23%
224	5%	0%	19%	18%	16%	18%
225	4%	-2%	17%	16%	17%	20%
226	4%	1%	18%	19%	15%	18%
227	4%	-2%	17%	17%	17%	18%
228	4%	-3%	17%	16%	19%	20%
229	4%	0%	19%	19%	18%	20%
230	4%	-2%	17%	15%	19%	21%
231	4%	-2%	18%	18%	16%	19%
232	4%	-2%	18%	18%	16%	19%
233	4%	-2%	18%	18%	16%	19%
234	4%	-2%	18%	18%	16%	19%
235	4%	0%	20%	21%	16%	19%
236	2%	-1%	16%	15%	19%	19%
237	5%	4%	21%	21%	19%	22%
238	4%	0%	19%	18%	18%	19%
239	4%	-1%	18%	17%	17%	18%
240	5%	3%	20%	20%	19%	22%
241	4%	-2%	17%	16%	20%	21%
242	4%	-2%	18%	18%	16%	19%
243	5%	2%	21%	20%	20%	19%
244	4%	-1%	17%	15%	19%	20%
245	5%	-1%	18%	16%	19%	19%
246	5%	1%	19%	17%	19%	19%
247	5%	-1%	18%	16%	19%	22%
248	5%	4%	20%	19%	19%	19%
249	4%	0%	18%	17%	18%	20%
250	3%	1%	17%	17%	15%	18%
251	3%	0%	14%	13%	13%	15%
252	5%	2%	19%	19%	19%	21%
253	5%	2%	21%	21%	19%	21%

Zone	Home Based Work		Home Based Other		Non-Home Based	
	Origin	Destination	Origin	Destination	Origin	Destination
254	5%	4%	19%	18%	18%	19%
255	5%	0%	19%	16%	18%	19%
256	5%	0%	21%	19%	21%	20%
257	4%	-1%	18%	16%	21%	20%
258	4%	4%	21%	23%	17%	19%
259	5%	5%	22%	23%	17%	18%
260	4%	5%	21%	22%	17%	17%
261	5%	7%	24%	25%	22%	22%
262	7%	14%	28%	29%	24%	23%
263	7%	15%	26%	29%	20%	19%
264	7%	17%	27%	30%	21%	21%
265	8%	20%	30%	31%	22%	21%
266	6%	10%	25%	26%	20%	20%
267	4%	4%	21%	23%	17%	19%
268	4%	9%	26%	26%	20%	21%
269	6%	11%	26%	28%	21%	22%
301	5%	1%	19%	18%	18%	18%
302	3%	-11%	14%	9%	18%	18%
303	9%	8%	28%	27%	24%	24%
304	10%	11%	27%	28%	24%	24%
305	10%	7%	21%	21%	20%	20%
306	11%	5%	20%	19%	19%	19%
307	14%	19%	25%	26%	21%	21%
308	13%	20%	26%	26%	20%	20%
309	14%	23%	28%	31%	21%	21%
310	13%	14%	24%	23%	21%	20%
311	12%	14%	25%	25%	21%	21%
312	11%	9%	21%	21%	19%	20%
313	10%	7%	20%	19%	19%	19%
314	9%	7%	18%	17%	17%	17%
315	6%	9%	24%	25%	20%	20%
316	8%	8%	15%	15%	14%	14%
317	6%	5%	18%	18%	17%	17%
318	8%	8%	17%	17%	15%	15%
319	8%	8%	13%	13%	12%	12%
320	9%	9%	13%	13%	13%	13%
321	7%	7%	12%	12%	12%	12%

PM

Zone	Home Based Work		Home Based Other		Non-Home Based	
	Origin	Destination	Origin	Destination	Origin	Destination
147	-7%	4%	13%	20%	16%	16%
148	-7%	4%	13%	20%	16%	16%
149	-6%	4%	14%	20%	17%	17%
150	-5%	4%	17%	19%	15%	14%
151	-4%	5%	15%	21%	16%	16%
152	-4%	5%	15%	21%	16%	16%
153	-4%	5%	15%	21%	15%	16%
154	0%	5%	24%	23%	16%	16%
155	-5%	4%	15%	23%	19%	18%
156	-7%	4%	12%	19%	14%	15%
157	-6%	4%	14%	21%	16%	17%
158	-4%	5%	17%	22%	15%	16%
159	-6%	4%	14%	20%	17%	17%
160	0%	10%	15%	20%	18%	18%
161	1%	11%	17%	22%	19%	19%
162	2%	10%	17%	22%	16%	22%
163	1%	9%	17%	20%	18%	19%
164	1%	9%	16%	20%	18%	17%
165	2%	10%	19%	22%	17%	18%
166	0%	10%	16%	20%	17%	18%
167	1%	11%	16%	23%	21%	16%
168	-4%	10%	12%	20%	17%	18%
169	4%	11%	17%	22%	19%	19%
170	2%	11%	19%	22%	18%	18%
171	0%	10%	16%	21%	19%	19%
172	2%	10%	19%	22%	19%	19%
173	0%	10%	14%	21%	17%	18%
174	-1%	10%	12%	18%	16%	17%
175	2%	10%	16%	21%	22%	20%
176	2%	10%	17%	21%	19%	20%
177	5%	11%	18%	22%	18%	18%
178	3%	10%	18%	22%	20%	19%
179	4%	11%	20%	24%	19%	19%
180	3%	11%	16%	21%	16%	17%
181	1%	10%	13%	18%	16%	15%
182	-2%	9%	10%	20%	17%	17%
183	-2%	9%	10%	20%	17%	17%
184	2%	10%	17%	22%	19%	19%
185	1%	12%	17%	25%	22%	21%
186	-1%	8%	11%	18%	20%	19%
187	-4%	11%	10%	20%	17%	18%
188	0%	11%	15%	22%	19%	19%
189	-2%	11%	13%	21%	19%	19%
190	-5%	10%	8%	19%	17%	20%
191	-3%	12%	10%	20%	19%	21%
192	26%	12%	36%	26%	19%	19%
193	-3%	12%	10%	20%	18%	23%
194	-3%	11%	10%	20%	20%	21%
195	-3%	11%	9%	18%	18%	21%
196	-3%	10%	12%	19%	18%	18%
197	-1%	11%	14%	21%	19%	19%

Zone	Home Based Work		Home Based Other		Non-Home Based	
	Origin	Destination	Origin	Destination	Origin	Destination
198	-1%	11%	14%	22%	17%	18%
199	-1%	11%	14%	22%	18%	19%
200	-2%	11%	12%	22%	19%	18%
203	-5%	11%	8%	19%	19%	22%
204	-4%	10%	10%	19%	18%	19%
205	-1%	10%	12%	20%	18%	18%
206	-4%	10%	10%	19%	18%	19%
207	-5%	11%	9%	19%	17%	19%
208	5%	10%	20%	23%	19%	19%
209	5%	10%	20%	23%	19%	19%
210	4%	12%	19%	23%	21%	19%
211	5%	11%	20%	21%	19%	19%
212	5%	11%	20%	21%	18%	19%
213	4%	12%	21%	22%	18%	19%
214	3%	13%	18%	23%	18%	20%
215	3%	13%	18%	23%	18%	20%
216	2%	12%	19%	21%	17%	18%
217	2%	12%	19%	21%	17%	18%
218	0%	9%	21%	27%	22%	21%
219	0%	9%	21%	27%	22%	21%
220	2%	8%	25%	30%	23%	22%
221	-1%	8%	21%	26%	21%	21%
222	-1%	9%	20%	27%	20%	22%
223	-3%	4%	14%	22%	16%	16%
224	-2%	5%	17%	22%	14%	14%
225	-3%	4%	14%	19%	15%	15%
226	0%	5%	17%	18%	11%	13%
227	-3%	4%	15%	19%	15%	14%
228	-4%	3%	14%	19%	17%	16%
229	0%	4%	19%	23%	16%	17%
230	-3%	4%	13%	21%	18%	18%
231	-3%	4%	16%	20%	15%	16%
232	-3%	4%	16%	20%	15%	16%
233	-3%	4%	16%	20%	15%	16%
234	-3%	4%	16%	21%	15%	16%
235	0%	4%	22%	23%	14%	15%
236	-1%	3%	15%	19%	14%	15%
237	4%	4%	20%	20%	17%	17%
238	-1%	4%	17%	19%	14%	16%
239	-2%	4%	16%	19%	13%	16%
240	3%	4%	19%	21%	17%	17%
241	-3%	5%	14%	21%	16%	17%
242	-3%	4%	15%	20%	13%	14%
243	1%	5%	20%	24%	18%	16%
244	-2%	5%	15%	20%	14%	16%
245	-2%	5%	15%	21%	14%	17%
246	0%	5%	19%	22%	16%	16%
247	-2%	5%	15%	21%	16%	17%
248	3%	5%	20%	23%	18%	16%
249	1%	4%	18%	21%	16%	16%
250	1%	4%	19%	20%	14%	14%
251	0%	3%	14%	16%	13%	15%
252	1%	4%	19%	21%	16%	16%
253	3%	5%	25%	23%	16%	17%

Zone	Home Based Work		Home Based Other		Non-Home Based	
	Origin	Destination	Origin	Destination	Origin	Destination
254	4%	4%	20%	22%	17%	16%
255	0%	5%	18%	25%	16%	16%
256	0%	5%	20%	26%	19%	16%
257	-1%	5%	15%	19%	16%	19%
258	4%	4%	24%	21%	14%	15%
259	5%	5%	24%	23%	14%	17%
260	4%	4%	25%	21%	15%	14%
261	7%	5%	27%	24%	19%	16%
262	13%	6%	33%	26%	21%	19%
263	15%	6%	31%	24%	17%	16%
264	18%	5%	35%	27%	18%	17%
265	20%	6%	35%	28%	20%	19%
266	9%	5%	29%	26%	17%	18%
267	4%	4%	24%	21%	14%	15%
268	8%	5%	28%	25%	16%	17%
269	12%	5%	29%	25%	16%	17%
301	1%	5%	19%	22%	16%	16%
302	-12%	4%	7%	19%	16%	16%
303	9%	10%	28%	29%	21%	21%
304	11%	10%	29%	27%	21%	21%
305	6%	11%	20%	23%	19%	19%
306	5%	11%	19%	22%	19%	19%
307	20%	13%	27%	24%	20%	20%
308	20%	13%	28%	24%	19%	19%
309	23%	14%	33%	26%	20%	20%
310	13%	13%	24%	24%	20%	19%
311	15%	12%	26%	24%	20%	19%
312	9%	11%	21%	22%	18%	18%
313	8%	10%	19%	21%	17%	17%
314	7%	10%	17%	19%	15%	15%
315	9%	6%	27%	25%	17%	17%
316	9%	9%	16%	16%	13%	13%
317	5%	6%	19%	20%	15%	15%
318	9%	9%	18%	17%	13%	14%
319	9%	9%	13%	13%	11%	11%
320	11%	11%	14%	14%	12%	12%
321	9%	9%	13%	13%	11%	11%

Appendix D: Trip Rates

Table D1 Trip Rates used in development traffic calculations (Source: TRICS Database)

		ARRIVALS			DEPARTURES			TOTALS		
	Unit	AM	IP	PM	AM	IP	PM	AM	IP	PM
Residential	per dwelling	0.11	0.17	0.28	0.25	0.17	0.18	0.36	0.34	0.47
Office	per 100sqm	0.87	0.27	0.13	0.17	0.29	0.78	1.04	0.56	0.91
Business Park	per 100sqm	0.89	0.30	0.18	0.19	0.33	0.78	1.08	0.63	0.96
Food Retail	per 100sqm	2.52	4.58	4.65	1.84	4.52	4.85	4.36	9.10	9.50
General Retail	per 100sqm	0.71	2.36	1.26	0.43	2.28	1.45	1.14	4.64	2.71
Leisure	per 100sqm	0.63	1.20	2.08	0.41	1.07	1.52	1.04	2.27	3.60
Industrial	per 100sqm	0.36	0.15	0.07	0.10	0.15	0.32	0.46	0.30	0.38
Warehouse	per 100sqm	0.05	0.04	0.02	0.03	0.04	0.04	0.08	0.09	0.07
GP Surgery	per 100sqm	3.11	3.59	1.83	1.99	3.66	2.76	5.10	7.24	4.59
Education Nursery	per 100sqm	2.79	0.87	1.89	2.27	0.92	2.31	5.06	1.78	4.20
Community Centre	per 100sqm	0.49	0.49	0.40	0.17	0.51	0.47	0.66	1.00	0.87
Hotel	per 100sqm	0.24	0.21	0.31	0.29	0.23	0.23	0.52	0.45	0.55
Food Retail with Petrol Stn	per 100sqm	2.88	5.15	5.32	1.97	5.10	5.58	4.86	10.25	10.90

Appendix E: 2036 Do Minimum Forecast Traffic Flows

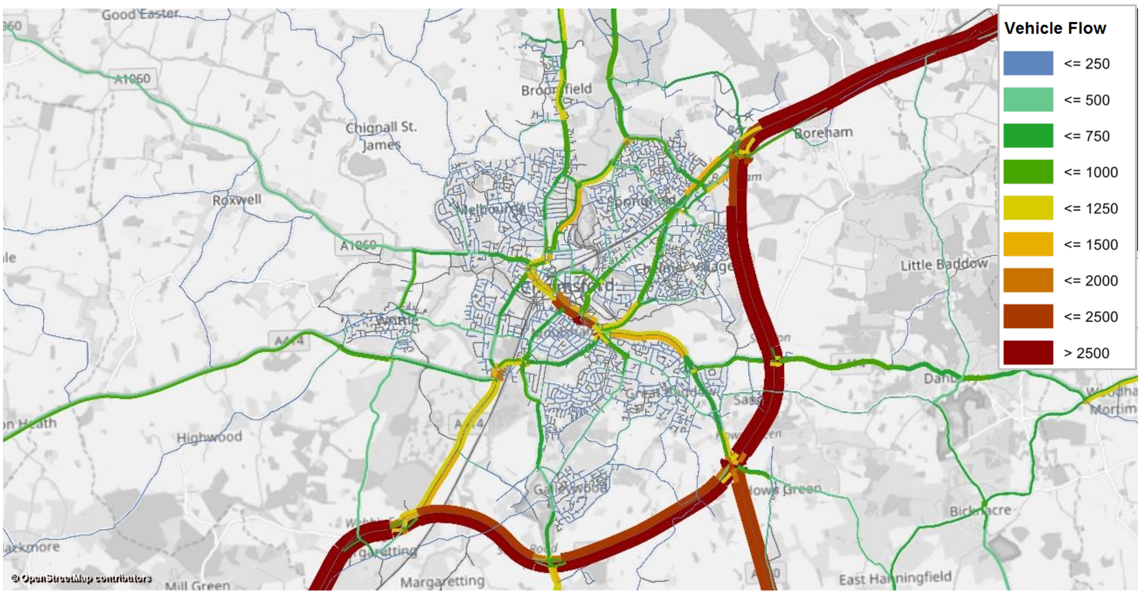


Figure E1 AM Peak 2036 forecast traffic flows in Chelmsford (Do Minimum)

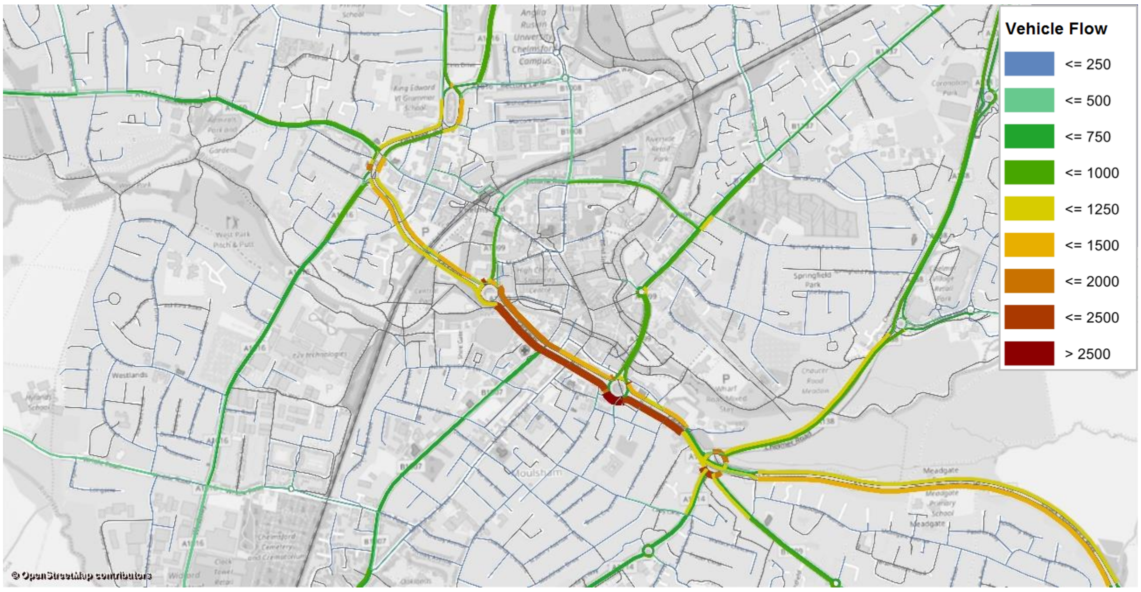


Figure E2 AM Peak 2036 forecast traffic flows in Chelmsford city centre (Do Minimum)

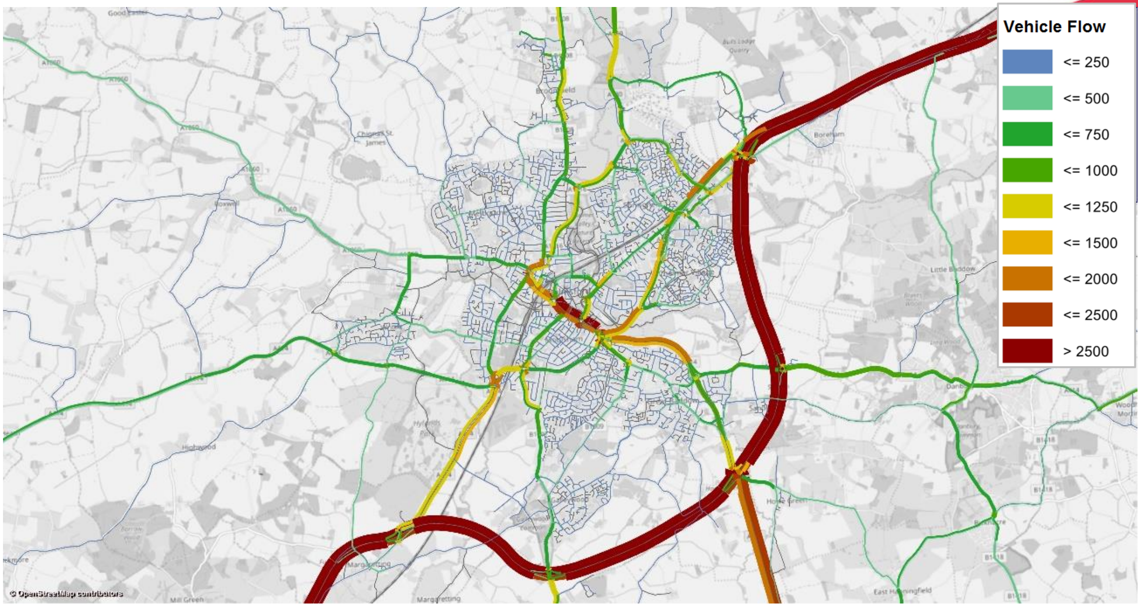


Figure E3 PM Peak 2036 forecast traffic flows in Chelmsford (Do Minimum)

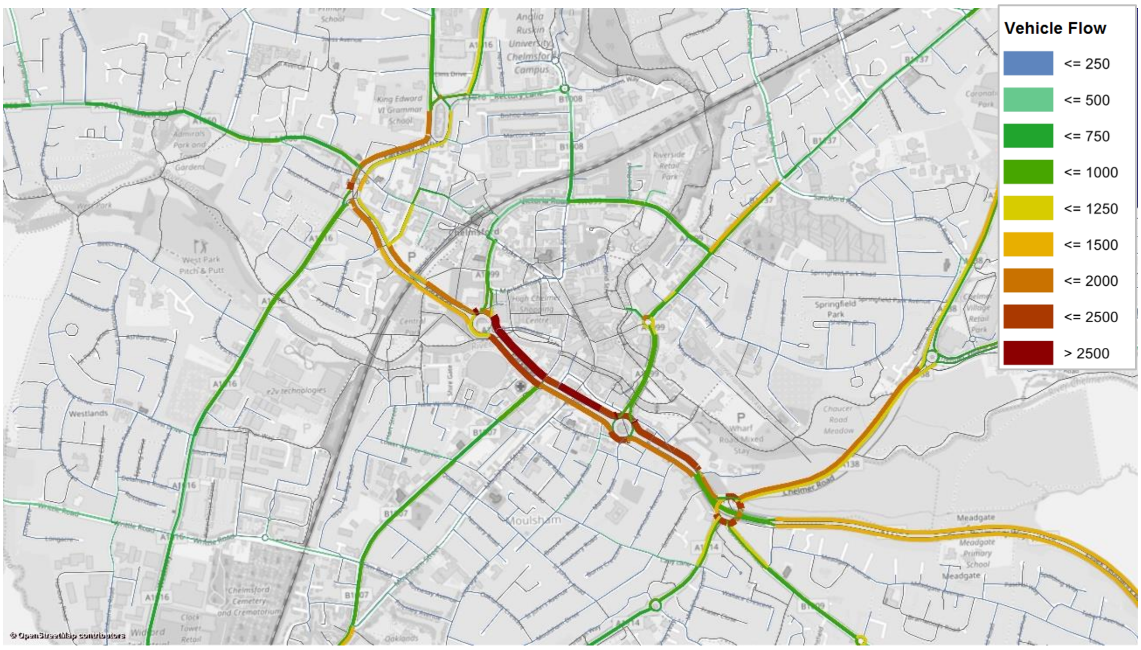


Figure E4 PM Peak 2036 forecast traffic flows in Chelmsford city centre (Do Minimum)

Appendix F: Local Plan Preferred Option Development Assumptions

Table F1 Proposed Local Plan housing sites and dwelling numbers 2021-2036

Development Locations	Site Description	No. of Dwellings	Employment (Business Park) sqm	Supporting Commercial (Retail) sqm
Location 1 Chelmsford Urban Area	Former Royal Mail Premises, Victoria Road, Chelmsford		3000	
	Rivermead, Bishop's Hall Lane, Chelmsford	80	7000	
	RAILWAY SIDINGS BROOK STREET CHELMSFORD		7000	
	NAVIGATION ROAD SITES	35		
	TRAVIS PERKINS NAVIGATION ROAD	75		
	Baddow Road Car Park and Land East of Car Park	190		1000
	Lockside	130		
	Former Gas Works and Penninsula	670		
	ESSEX POLICE HQ AND SPORTS GROUND NEW COURT ROAD	225 225		
	METEOR WAY INCLUDING CAR PARK AND E2V LAND	380		
	FORMER ST PETERS COLLEGE FOX CRESCENT	185		
	NORTH OF GLOUCESTER AVENUE (JOHN SHENNAN)	200		
	CIVIC CENTRE LAND, FAIRFIELD ROAD	100		1000
	RIVERSIDE ICE AND LEISURE, Victoria road	100		
	CHELMSFORD SOCIAL CLUB AND PRIVATE CAR PARK 55 SPRINGFIELD ROAD	90		
	GARAGE SITE AND LAND MEDWAY CLOSE	10		
	FORMER CHELMSFORD ELECTRICAL AND CAR WASH NEW STREET	40		1000
	WATERHOUSE LANE DEPOT AND NURSERY	20		1000
	EASTWOOD HOUSE (CAR PARK) GLEBE ROAD	20		
	CHURCH HALL SITE WOODHALL ROAD	19		
	10-30 COVAL LANE CHELMSFORD	15		
	BRITISH LEGION NEW LONDON ROAD	15		
	GARAGE SITE ST NAZAIRE ROAD	12		
	CAR PARK R/O BELLAMY COURT BROOMFIELD ROAD	11		
	ASHBY HOUSE CAR PARKS NEW STREET	80		
	BT TELEPHONE EXCHANGE COTTAGE PLACE	30		1000
Location 1 Subtotal		**2957**	**17000**	**5000**
Location 2 West Chelmsford	WARREN FARM	800		
Location 3 East Chelmsford (East of Great Baddow)	East Chelmsford - East of Chelmsford/North of Great Baddow (3a) - Manor Farm	250		
	East Chelmsford - East of Chelmsford/North of Great Baddow (3b) - Land North of Maldon Road		5000	
	East Chelmsford - East of Chelmsford/North of Great Baddow (3c) - Land South of Maldon Road	150		
Location 4 North East Chelmsford	NORTH EAST CHELMSFORD	300 2250 450	45000	
Beaulieu Post 2021 Roll-over	*Taken From Earlier Planning Assumptions*	1906 635 39		
Location 5 Moulsham Hall and North Great Leighs	MOULSHAM HALL AND NORTH GREAT LEIGHS	780 320		
Location 6 North Chelmsford (Broomfield)	NORTH OF BROOMFIELD	240 560		
Location 7 Boreham	BOREHAM	43 102		
Location 8 North of South Woodham Ferrers	NORTH OF SOUTH WOODHAM FERRERS	1000	1000	
Location 9 Bicknacre	BICKNACRE	15 15		
Location 10 Danbury	DANBURY	100		

Additional Assumptions:
Assume 1500 Windfall sites to be distributed across zones in the administrative area based on population density

Sites not modelled (as agreed with CCC):
- Existing Commitments EC1-4
- Travellers Site TS1
- Travelling Showpeople Plots

No changes proposed to residential developments modelled 2015-2021 (5-Year Housing Supply)

Table F2 Modelled employment sites 2015-2021 and 2021-2036

Development Locations	Employment (Business Park) sqm	Supporting Commercial (Retail) sqm	Food Retail sqm	Leisure sqm	General Industrial sqm	Storage & Distribution sqm	GP Surgery sqm	Education Nursery sqm	Community Centre sqm	Hotel sqm	TOTAL
2015-2021											
Springfield Business Park	8535					8535					17070
City Park West (Former ARU Central)	9820										9820
Marconi Evolution (Former Marconi Works)	4910	4910									9820
The Exchange (CM2) – Anderson Site	5524	690									6214
Beaulieu Square		910	432				450	225	270		2287
Temple Farm (IBSA Village)	62500				50000						112500
Channels Business Park	8000										8000
	8000										8000
Aquila, Bond Street Development		26644									26644
Aldi			1492								1492
Essex County Cricket Club,				1754							1754
Clocktower Industrial and Retail Park	2600	8222			2600	2600					16022
Crouch Vale Nurseries & Plantworld			6899	1435							8334
Chelmsford Trade Park - Westway	3464				3464	3464					10393
2021-2036											
NE Chelmsford Employment and Non-Residential Uses – permitted as part of Beaulieu scheme with Rail Station provided	9000			2000				3000		3700	17700
Greater Beaulieu Business Park	40000										40000

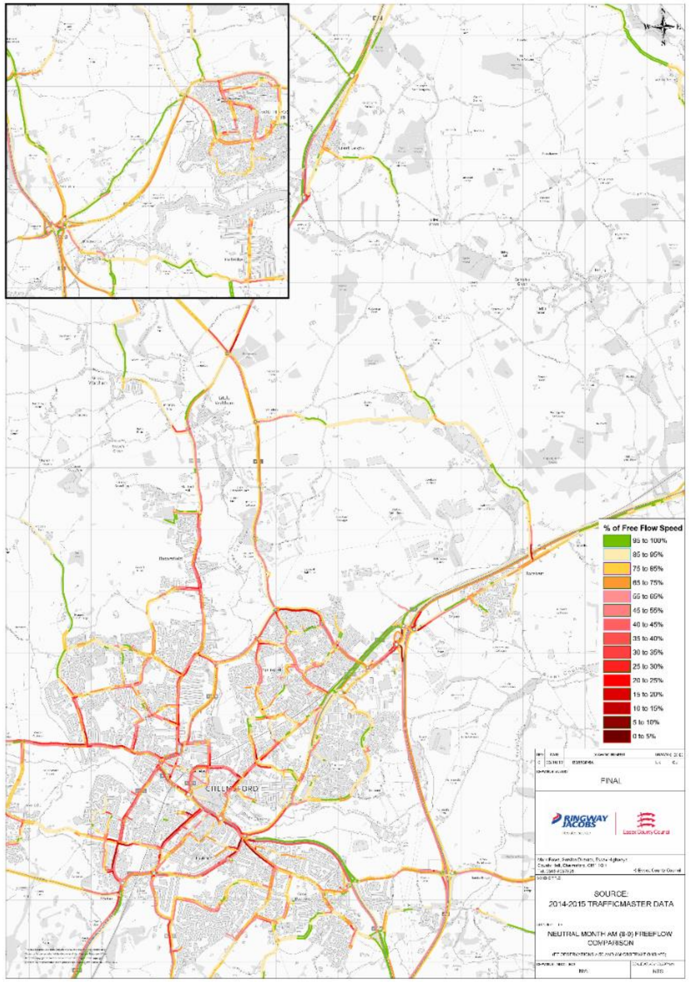
*Table F3 Existing land use on brownfield sites proposed for development 2015-2021 and 2021-2036 *Do Minimum*

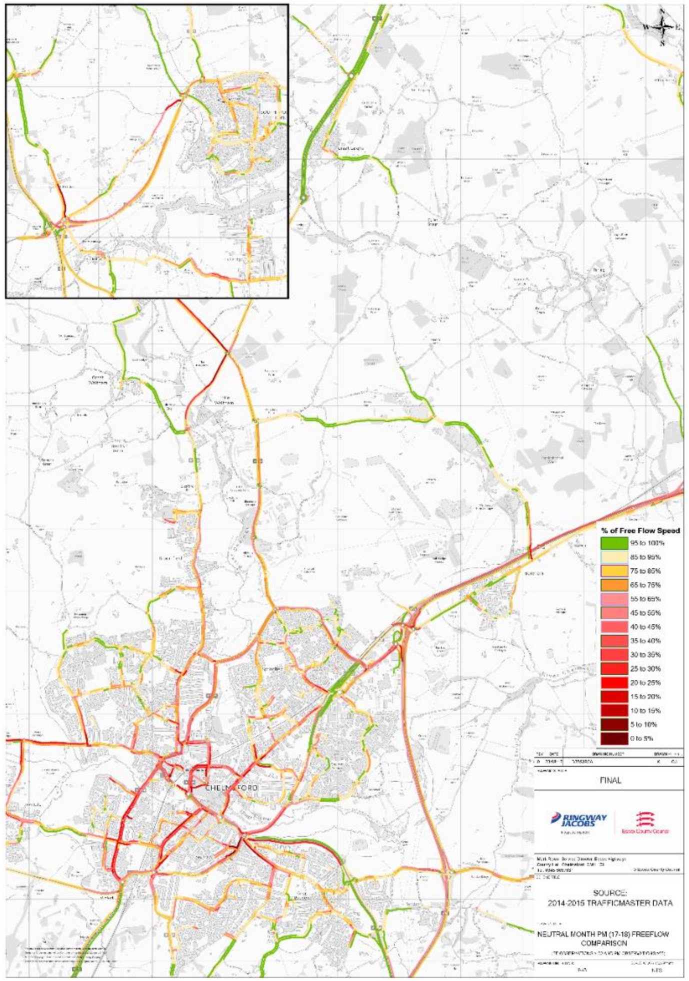
2015-2021 sites have not been included if they are considered to generate low levels of car traffic – either due to site size (<1000sqm), land use type or lack of available parking.
- Office sites <1000sqm are calculated to generate/attract fewer than 10 trips in the peak hour. Business park and industrial land uses generate fewer trips.

Development Locations	Employment (Office) sqm	Supporting Commercial (Retail) sqm	Leisure sqm	General Industrial sqm	Storage & Distribution sqm	Community Centre sqm	Hotel sqm	TOTAL
2015-2021								
Royal Mail Sorting Office, 30 Victoria Road, Chelmsford				-3000				-3000
64-66 Broomfield Road	-2536							-2536
South Lodge Hotel, 196 New London Road, Chelmsford							-1463	-1463
London House, 111 New London Road, Chelmsford	-2562							-2562
Gemini House, 88-90 New London Road, Chelmsford	-1968							-1968
2021-2036								
BT TELEPHONE EXCHANGE COTTAGE PLACE				-11000				-11000
EASTWOOD HOUSE (CAR PARK) GLEBE ROAD	-3750							-3750
CAR PARK R/O BELLAMY COURT BROOMFIELD ROAD		-100						-100
NAVIGATION ROAD SITES		-1250						-1250
TRAVIS PERKINS NAVIGATION ROAD				-7500				-7500
LAND NORTH WEST OF LOCKSIDE MARINA HILL ROAD SOUTH				-5000				-5000
CHELMSFORD SOCIAL CLUB AND PRIVATE CAR PARK 55 SPRINGFIELD ROAD						-2500		-2500
RIVERSIDE ICE AND LEISURE, Victoria road			-3750					-3750
ASHBY HOUSE CAR PARKS NEW STREET	-2364							-2364
FORMER CHELMSFORD ELECTRICAL AND CAR WASH NEW STREET				-3750				-3750
RIVERMEAD INDUSTRIAL ESTATE BISHOP'S HALL LANE CHELMSFORD				-18750				-18750
WATERHOUSE LANE DEPOT AND NURSERY					-8750			-8750
BRITISH LEGION NEW LONDON ROAD						-1250		-1250
METEOR WAY INCLUDING CAR PARK AND E2V LAND				-11250				-11250

Public Car Park Closures 2021-2036:
Wharf Road Long Stay
Meteor Way Long Stay

Appendix G: Trafficmaster congestion maps





Appendix H: Peak Hour Analysis

Junction		18. Burnham Road – Ferrers Road, South Woodham Ferrers			19. B1418 – Burnham Road, South Woodham Ferrers			20. Burnham Road – Hullbridge Road, South Woodham Ferrers			21. Hullbridge Road – Clements Green Lane, South Woodham Ferrers		
Collection Date(s)		18-Oct-16	19-Oct-16	Average	18-Oct-16	19-Oct-16	Average	18-Oct-16	19-Oct-16	Average	18-Oct-16	19-Oct-16	Average
07:00	08:00	3326	3328	3327	2686	2686	2686	2055	2032	2044	732	737	735
07:15	08:15	3410	3437	3424	2805	2777	2791	2130	2080	2105	753	728	741
07:30	08:30	3455	3494	3475	2815	2833	2824	2135	2125	2130	739	721	730
07:45	08:45	3350	3360	3355	2701	2693	2697	2086	2088	2087	792	793	793
08:00	09:00	3147	3172	3160	2547	2544	2546	1993	2005	1999	753	813	783
08:15	09:15	2975	2980	2978	2334	2372	2353	1795	1879	1837	764	826	795
08:30	09:30	2756	2702	2729	2162	2137	2150	1684	1729	1707	729	789	759
08:45	09:45	2524	2546	2535	1995	2023	2009	1559	1616	1588	631	667	649
09:00	10:00	2311	2346	2329	1794	1815	1805	1419	1447	1433	554	520	537
Maximum Hourly Flow		-	-	3475	-	-	2824	-	-	2130	-	-	795
Peak Hour Period		-	-	07:30-08:30	-	-	07:30-08:30	-	-	07:30-08:30	-	-	08:15-09:15
16:00	17:00	3328	3323	3326	2534	2600	2567	2040	2011	2026	706	732	719
16:15	17:15	3514	3505	3510	2660	2664	2662	2116	2095	2106	715	729	722
16:30	17:30	3528	3536	3532	2734	2728	2731	2169	2116	2143	769	715	742
16:45	17:45	3603	3537	3570	2816	2727	2772	2238	2137	2188	820	717	769
17:00	18:00	3541	3481	3511	2840	2658	2749	2248	2120	2184	823	741	782
17:15	18:15	3452	3289	3371	2786	2532	2659	2215	2024	2120	881	813	847
17:30	18:30	3399	3159	3279	2697	2465	2581	2152	1967	2060	874	828	851
17:45	18:45	3204	3047	3126	2528	2328	2428	2015	1880	1948	840	806	823
18:00	19:00	2994	2861	2928	2241	2162	2202	1845	1738	1792	836	789	813
Maximum Hourly Flow		-	-	3570	-	-	2772	-	-	2188	-	-	851
Peak Hour Period		-	-	16:45-17:45	-	-	16:45-17:45	-	-	16:45-17:45	-	-	17:30-18:30

Junction		1. Moulsham Hall Lane, Gt Leighs	6. Essex Regiment Way – Channels Drive, Channels	3. Deres Bridge roundabout	7. Nabbots Farm roundabout	14. A1060 Roxwell Road/Lordship Road	15. A1060 Roxwell Road/Chignal Road	10. B1008 Main Road/Hospital Approach
Collection Date(s)		18-Oct-16	18-Oct-16	19-May-15	19-May-15	30-Jan-13	30-Jan-13	18-Oct-16
07:00	08:00	504	2580	2308	3344	1532	2040	2040
07:15	08:15	543	2672	2333	3410	1754	2203	2203
07:30	08:30	566	2705	2262	3340	1920	2252	2252
07:45	08:45	538	2619	2143	3287	1943	2248	2248
08:00	09:00	481	2554	2004	3158	1895	2282	2282
08:15	09:15	436	2430	1892	3065	1817	2211	2211
08:30	09:30	396	2354	1802	2957	1662	2062	2062
08:45	09:45	330	2326	1733	2723	1486	1868	1868
09:00	10:00	282	2139	1648	2623	1398	1746	1746
Maximum Hourly Flow		566	2705	2333	3410	1917	1943	2282
Peak Hour Period		07:30-08:30	07:30-08:30	07:15-08:15	07:15-08:15	07:45-08:45	07:45-08:45	08:00-09:00
16:00	17:00	407	2630	2026	3141	1724	2168	2168
16:15	17:15	435	2608	2140	3228	1836	2143	2143
16:30	17:30	435	2596	2195	3282	1841	2194	2194
16:45	17:45	435	2567	2298	3317	1919	2131	2131
17:00	18:00	465	2577	2293	3336	1891	2174	2174
17:15	18:15	434	2601	2286	3293	1828	2079	2079
17:30	18:30	418	2497	2265	3221	1833	1900	1900
17:45	18:45	385	2431	2111	3026	1718	1756	1756
18:00	19:00	334	2211	1938	2810	1650	1571	1571
Maximum Hourly Flow		465	2630	2298	3336	1764	1919	2194
Peak Hour Period		17:00-18:00	16:00-17:00	16:45-17:45	17:00-18:00	16:45-17:45	16:45-17:45	16:30-17:30

Junction		25. Rettendon Turnpike			26. Hawk Hill			27. A132/A130		
Collection Date(s)		18-Oct-16	19-Oct-16	Average	18-Oct-16	19-Oct-16	Average	18-Oct-16	19-Oct-16	Average
07:00	08:00	3718	3610	3664	3484	3498	3491	3138	2972	3055
07:15	08:15	3900	3827	3864	3730	3688	3709	3150	3037	3094
07:30	08:30	3887	3754	3821	3833	3673	3753	3030	2943	2987
07:45	08:45	3808	3575	3692	3780	3580	3680	2956	2771	2864
08:00	09:00	3619	3306	3463	3637	3387	3512	2807	2602	2705
08:15	09:15	3418	3066	3242	3322	3108	3215	2695	2467	2581
08:30	09:30	3185	2909	3047	2954	2858	2906	2588	2337	2463
08:45	09:45	2894	2724	2809	2670	2624	2647	2363	2190	2277
09:00	10:00	2561	2570	2566	2334	2470	2402	2061	2039	2050
Maximum Hourly Flow		-	-	3864	-	-	3753	-	-	3094
Peak Hour Period		-	-	07:15-08:15	-	-	07:30-08:30	-	-	07:15-08:15
16:00	17:00	3811	3761	3786	3558	3427	3493	3028	2991	3010
16:15	17:15	3942	3944	3943	3696	3646	3671	3161	3162	3162
16:30	17:30	4022	4080	4051	3795	3735	3765	3249	3331	3290
16:45	17:45	4120	4136	4128	3829	3850	3840	3319	3418	3369
17:00	18:00	4179	4188	4184	3841	3829	3835	3418	3433	3426
17:15	18:15	4122	3998	4060	3732	3674	3703	3371	3309	3340
17:30	18:30	3963	3792	3878	3546	3481	3514	3217	3124	3171
17:45	18:45	3675	3510	3593	3258	3180	3219	2989	2858	2924
18:00	19:00	3295	3161	3228	2875	2809	2842	2638	2546	2592
Maximum Hourly Flow		-	-	4184	-	-	3840	-	-	3426
Peak Hour Period		-	-	17:00-18:00	-	-	16:45-17:45	-	-	17:00-18:00

Appendix I: Department for Transport's Count Growth Factors[21]

Count number	Road	Easting	Northing	2000-2015 Average Growth p.a.	2010-2015 Average Growth p.a.	2014-2015 Average Growth
48398	A132	578900	196000	2.5%	3.3%	4.4%
80767	A130	577240	195180	Unavailable	3.4%	4.5%
80766	A130	576940	195160	Unavailable	4.0%	4.7%
80762	A131	571380	214200	Unavailable	1.8%	4.1%
60001	A130	571650	211000	1.2%	-0.4%	4.1%
58301	A130	572100	209748	0.7%	1.0%	2.1%
38471	A138	573700	209230	1.1%	2.1%	4.0%
75042	A130	574120	209420	0.7%	0.5%	5.3%
48769	A138	572530	207400	0.6%	1.0%	-0.7%
58393	A1016	571000	208400	-0.4%	1.2%	-1.0%
56777	A1060	568600	207500	0.6%	1.9%	4.3%
77151	A1060	569500	207480	0.5%	1.0%	2.2%
18688	A1099	571000	207150	-1.7%	2.4%	2.1%
77250	A1016	570285	207334	-0.4%	1.2%	-1.0%
48678	A1016	570130	207210	-1.0%	-0.6%	-1.0%
28834	A1099	570700	207150	-2.6%	-3.5%	2.2%
7513	A1099	570600	206900	-1.7%	-0.1%	2.3%
16650	A1060	570500	206760	0.1%	-2.9%	-0.9%
38697	A1016	569770	206700	-0.2%	2.6%	-0.8%
28478	A1060	570700	206600	0.2%	2.0%	4.6%

[21] Data was downloaded from http://www.dft.gov.uk/traffic-counts/

Count number	Road	Easting	Northing	2000-2015 Average Growth p.a.	2010-2015 Average Growth p.a.	2014-2015 Average Growth
18390	A1060	570850	206470	0.4%	1.5%	-1.1%
46690	A1060	571250	206250	0.0%	-1.3%	-1.1%
26681	A1114	572000	205950	-1.0%	-6.0%	4.2%
77249	A1060	573500	205350	-2.1%	-1.3%	2.3%
38490	A1060	574000	205480	-0.3%	-1.3%	2.3%
48473	A1114	573800	204000	5.9%	1.1%	4.2%
48617	A1114	571000	205540	-0.9%	0.9%	2.2%
38635	A1114	569800	205430	-0.5%	0.8%	6.6%
8614	A1114	569500	205210	-0.1%	-0.1%	-0.5%
18372	A414	569450	205000	-0.2%	0.9%	-1.5%

Appendix J: Traffic data collection information

Junction Number	Junction Name	Collection Data	Source
1	Moulsham Hall Lane, Great Leighs	06/05/2014	Developer (Ashley Helme Associates)
2	Main Road – Banters Lane, Great Leighs	18/10/2016	Essex Highways
3	Deres Bridge, Great Leighs	19/05/2015	Essex Highways
4	Sheepcotes, Little Waltham	19/05/2015	Essex Highways
5	Pratts Farm, Channels	19/05/2015	Essex Highways
6	Essex Regiment Way – Channels Drive, Channels	18/10/2016	Essex Highways
7	Nabbots Farm, Springfield	19/05/2015	Essex Highways
8	Lawn Lane, Springfield	18/10/2016	Essex Highways
9	Valley Bridge, Springfield	18/10/2016	Essex Highways
10	Main Road – Hospital Approach, Broomfield	18/10/2016	Essex Highways
11	Main Road – School Lane, Broomfield	18/10/2016	Essex Highways
12	Broomfield Road – Valley Bridge, Chelmsford	18/10/2016	Essex Highways
13	Broomfield Road – Patching Hall Lane, Chelmsford	18/10/2016	Essex Highways
14	Roxwell Road – Lordship Road, Writtle	30/01/2013	Developer (Vectos)
15	Roxwell Road – Chignal Road, Melbourne	30/01/2013	Developer (Vectos)
16	Essex Yeomanry Way – Maldon Road – Baddow Hall Avenue, Great Baddow	18/10/2016	Essex Highways
17	Main Road – Church Road, Boreham	04/10/2013	Developer (Cogent Land LLP)
18	Burnham Road – Ferrers Road, South Woodham Ferrers	18/10/2016 and 19/10/2016	Developer (Mayer Brown)
19	B1418 – Burnham Road, South Woodham Ferrers	18/10/2016 and 19/10/2016	Developer (Mayer Brown)
20	Burnham Road – Hullbridge Road, South Woodham Ferrers	18/10/2016 and 19/10/2016	Developer (Mayer Brown)
21	Hullbridge Road – Clements Green Lane, South Woodham Ferrers	18/10/2016 and 19/10/2016	Developer (Mayer Brown)
22	A12 Junction 19 - Boreham Interchange (Mayer Brown Traffic Model)	20/04/2016	Developer (Mayer Brown)
23	A12 Junction 18 – Sandon	18/10/2016	Essex Highways
24	Rettendon Turnpike, South Woodham Ferrers	18/10/2016 and 19/10/2016	Developer (Mayer Brown)
25	Hawk Hill roundabout, South Woodham Ferrers	18/10/2016 and 19/10/2016	Developer (Mayer Brown)
26	A132/A130, South Woodham Ferrers	18/10/2016 and 19/10/2016	Developer (Mayer Brown)

Appendix K: Writtle Outputs

Figure K1 AM Peak 2036 vehicle flows in Writtle (Local Plan)

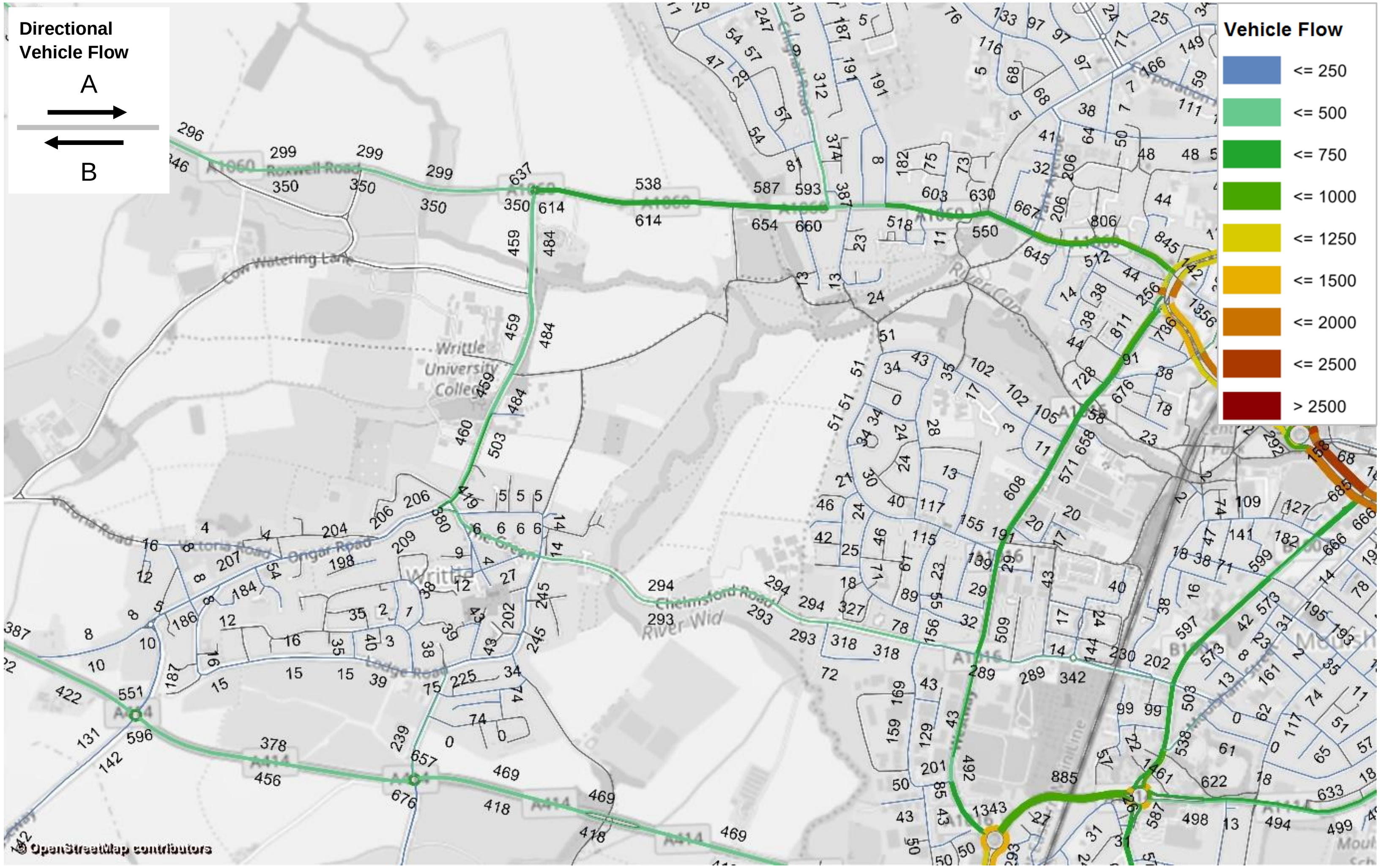


Figure K2 IP Peak 2036 vehicle flows in Writtle (Local Plan)

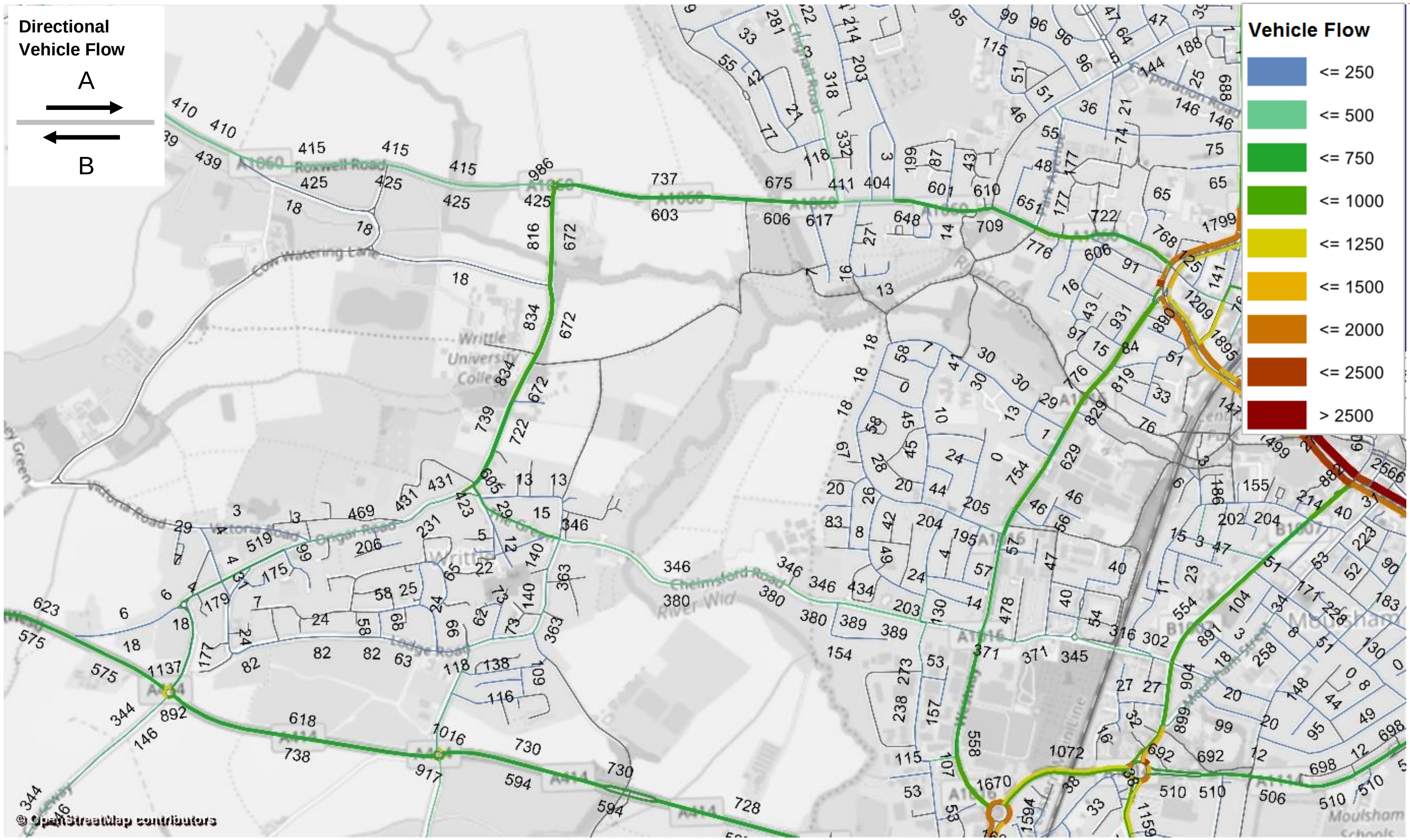


Figure K3 PM Peak 2036 vehicle flows in Writtle (Local Plan)

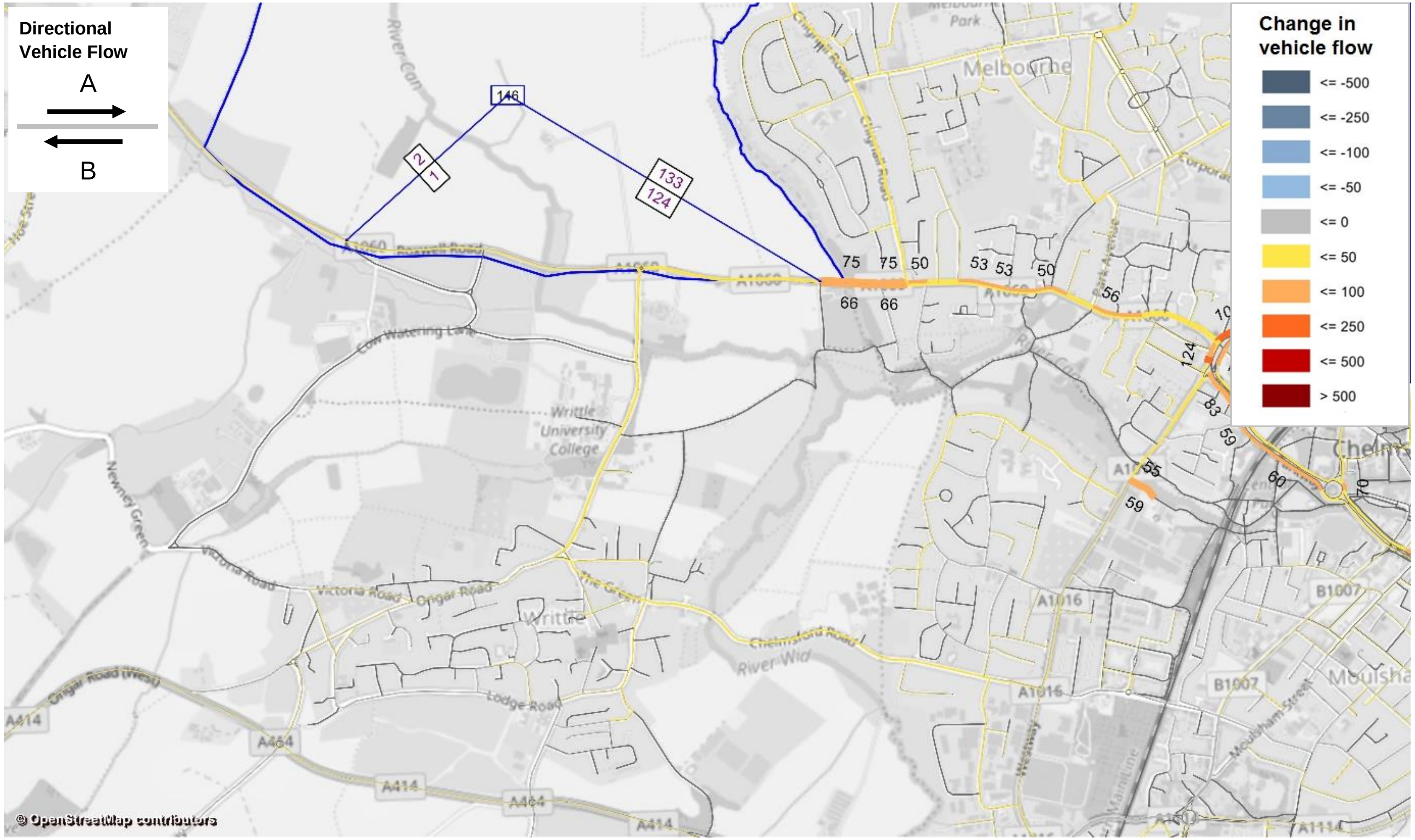
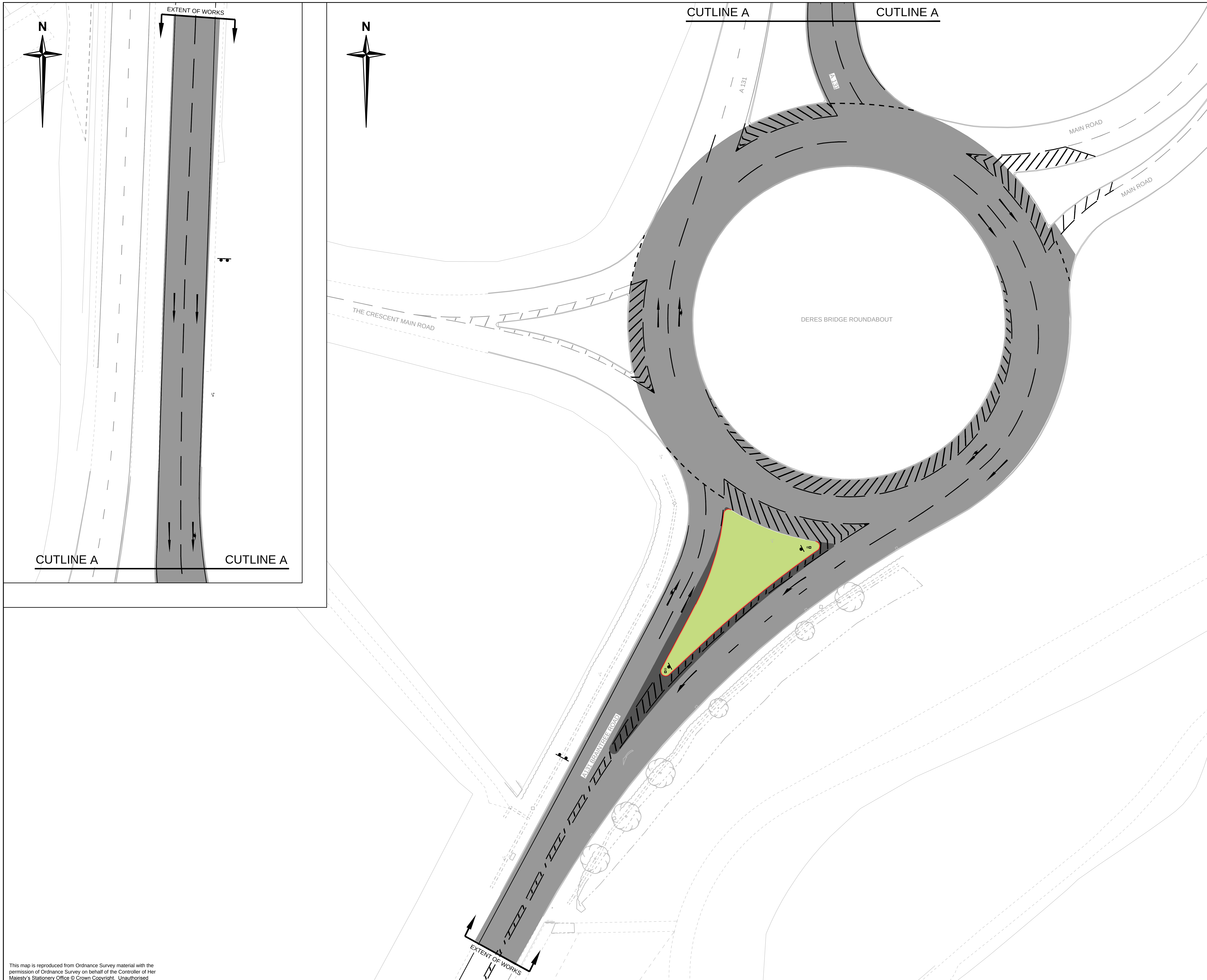


Figure K4 IP Peak 2036 difference in vehicle flows between Local Plan and Do-Minimum (no Local Plan) in Writtle (only changes >50 are labelled; zone 146 is Warren Farm Development – see Appendix M)

Appendix L: Junction Designs



File Location N:\9 Trans Impr\2 Major Projects Design\1 Projects\B355301A A131 Chelmsford to Braintree RBS\03_CAD\04 Deres Bridge RAB\B355301A-04-01-004 B.dwg Last saved by mauricio.jardim on 9 November 2017 Printed By Mauricio Jardim on 9 November 2017

Notes

1. Do not scale.
2. This drawing is to be read in conjunction with all other contract drawings and documents.
3. All works to be in accordance with the Department for Transports Specification for Highway Works and Essex County Council Specifications and Standard Construction Drawings.

Key

- Existing kerb to remain
- Proposed kerb
- Proposed white road marking
- Proposed carriageway resurfacing
- Proposed full depth carriageway construction
- Area of existing splitter island to remain
- Proposed sign
- Proposed bollard

Rev.	Date	Description of revision	Drawn	Checked	Review'd	Approv'd
B	11/17	layout altered to show full extent of scheme and clarification of key.	KJH	MJ	PAB	PAB
A	10/17	Add road markings to diag. 1038	MJ	PFW	PAB	PAB

DRAWING STATUS

FOR TENDER

Essex Highways

Mark Rowe, Service Director, Highways
Seax House, Victoria Road South, Chelmsford, CM1 1QH.
Tel: 0345 6037631

SCHEME TITLE

A131/A130
CHELMSFORD TO BRAINTREE
ROUTE BASED STRATEGY

DRAWING TITLE

DERES BRIDGE ROUNDABOUT
GENERAL ARRANGEMENT

DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
HB/MJ	MJ/HB	PFW	PAB	PAB
DATE SEP 17	DATE SEP 17	DATE OCT 17	DATE OCT17	DATE OCT 17

DRAWING UNITS U.N.O.: DIMENSIONS IN METRES

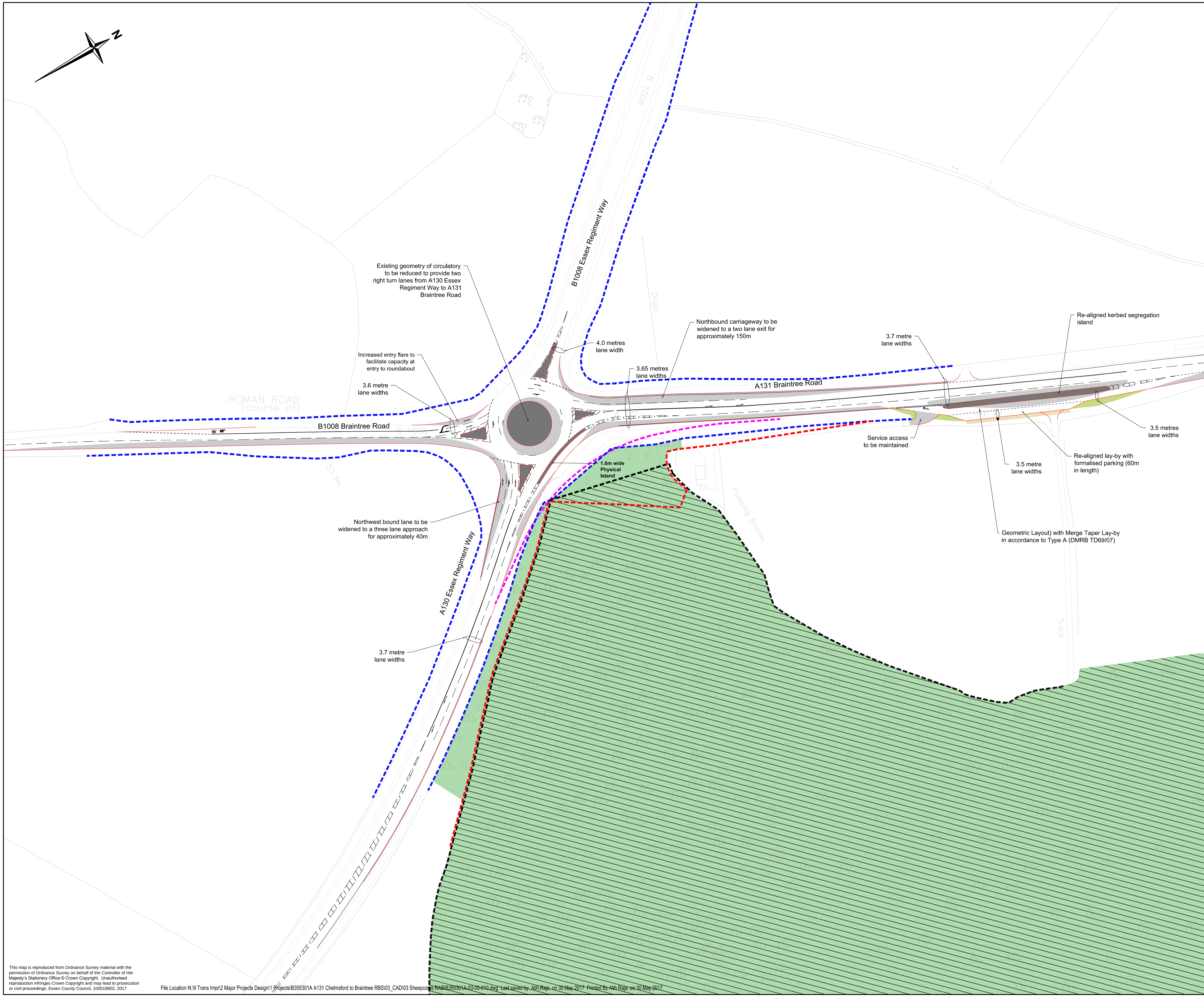
SCALE AT A2 (594x420mm): 1:500

DRAWING No.: **B355301A-04-01-004**

REV.: **B**

RINGWAY JACOBS integrated expertise

Essex County Council



Notes

1. Do not scale.
2. Drawing based on Ordnance Survey information.
3. Removal of existing hedgerows required on A131 Braintree Rd as part of the proposed carriageway widening.

Key

- Area of interest

Key

- Highway Boundary
- ECC Land without Highway Status
- Desirable Minimum Stopping Sight Distance 90m
- Ancient Woodland Area - This is an assumed boundary (from Magic Map). The exact boundary to be confirmed with the Forestry Commission.
- Biodiversity Action Plan
- Proposed kerb
- Proposed carriageway widening
- Proposed traffic island
- Proposed footway
- Proposed grass verge

Rev.	Date	Description of revision	Drawn	Checked	Review'd	Approv'd

DRAWING STATUS

PRELIMINARY DESIGN

RINGWAY JACOBS integrated expertise — Essex County Council

Mark Rowe, Service Director, Highways
Seax House, Victoria Road South, Chelmsford, CM1 1QH.
Tel: 0345 6037631

SCHEME TITLE

A131 CHELMSFORD TO BRAINTREE ROUTE BASED STRATEGY

DRAWING TITLE

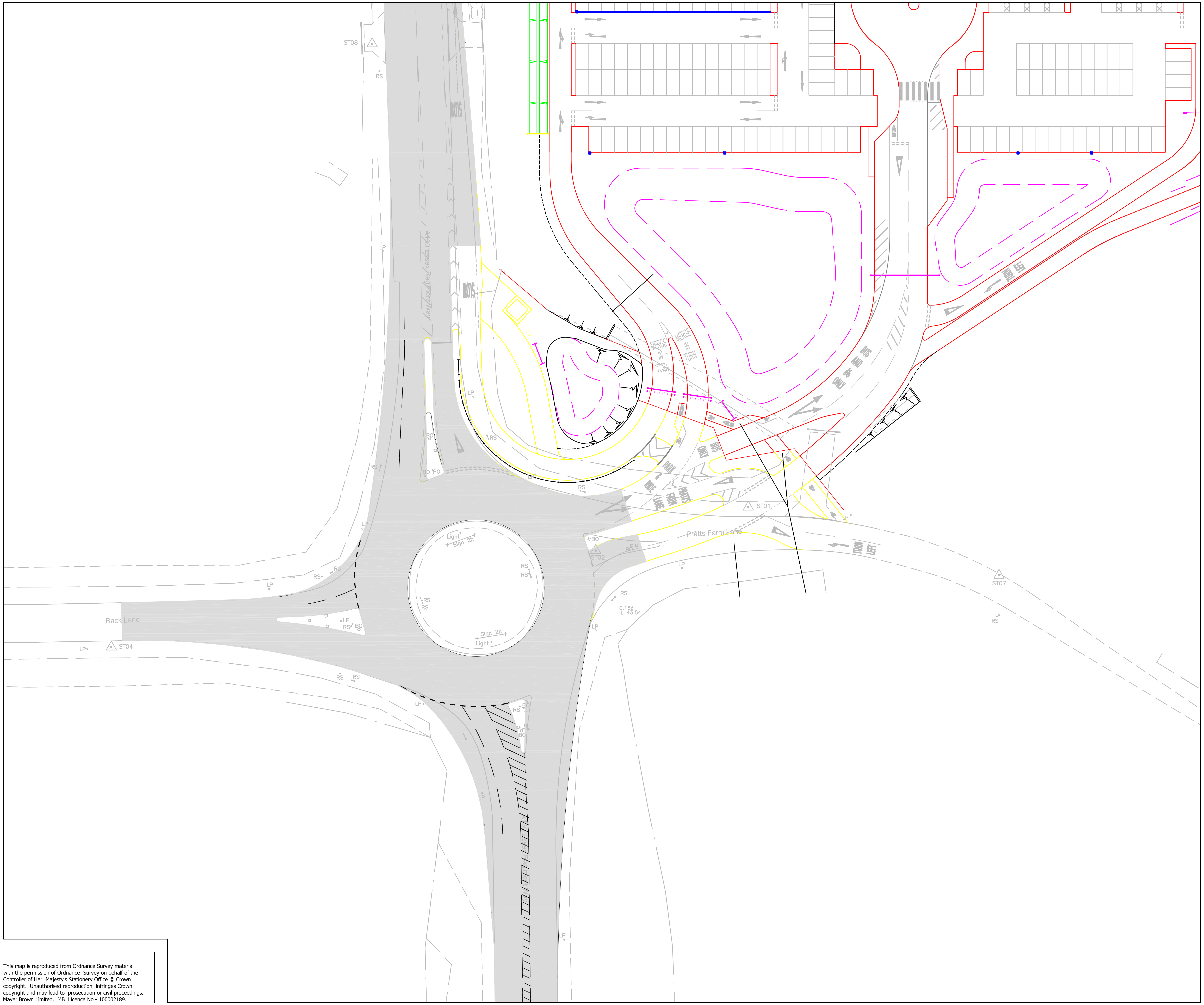
SHEEPCOTES ROUNDABOUT

DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
MJ	AR	JW	PAB	PAB
DATE MAY 17	DATE MAY 17	DATE MAY 17	DATE MAY 17	DATE MAY 17

DRAWING UNITS U.N.O.	SCALE AT A1 (841X594mm)
DIMENSIONS IN METRES	1:1000

DRAWING No.	REV.
B355301A-03-00-010	-

File Location N:\9 Trans Impr\2 Major Projects Design\1 Projects\B355301A A131 Chelmsford to Braintree RBS\03_CAD\03 Sheepcotes RAB\B355301A-03-00-010.dwg Last saved by Atih.Raja on 30 May 2017 Printed By Atih.Raja on 30 May 2017



rev.	amendment	checked	date
B	MEASUREMENTS REMOVED	IM	SEP 13
A	ATERATION TO LANES ON ACCESS & EXIT	IM	AUG 10

mayer brown

Mayer Brown Limited Lion House
Oriental Road Woking Surrey GU22 8AR
Telephone 01483 750 508 Fax 01483 750 437
wokingoffice@mayerbrown.co.uk www.mayerbrown.co.uk

client
Countryside Zest (Beaulieu Park) LLP

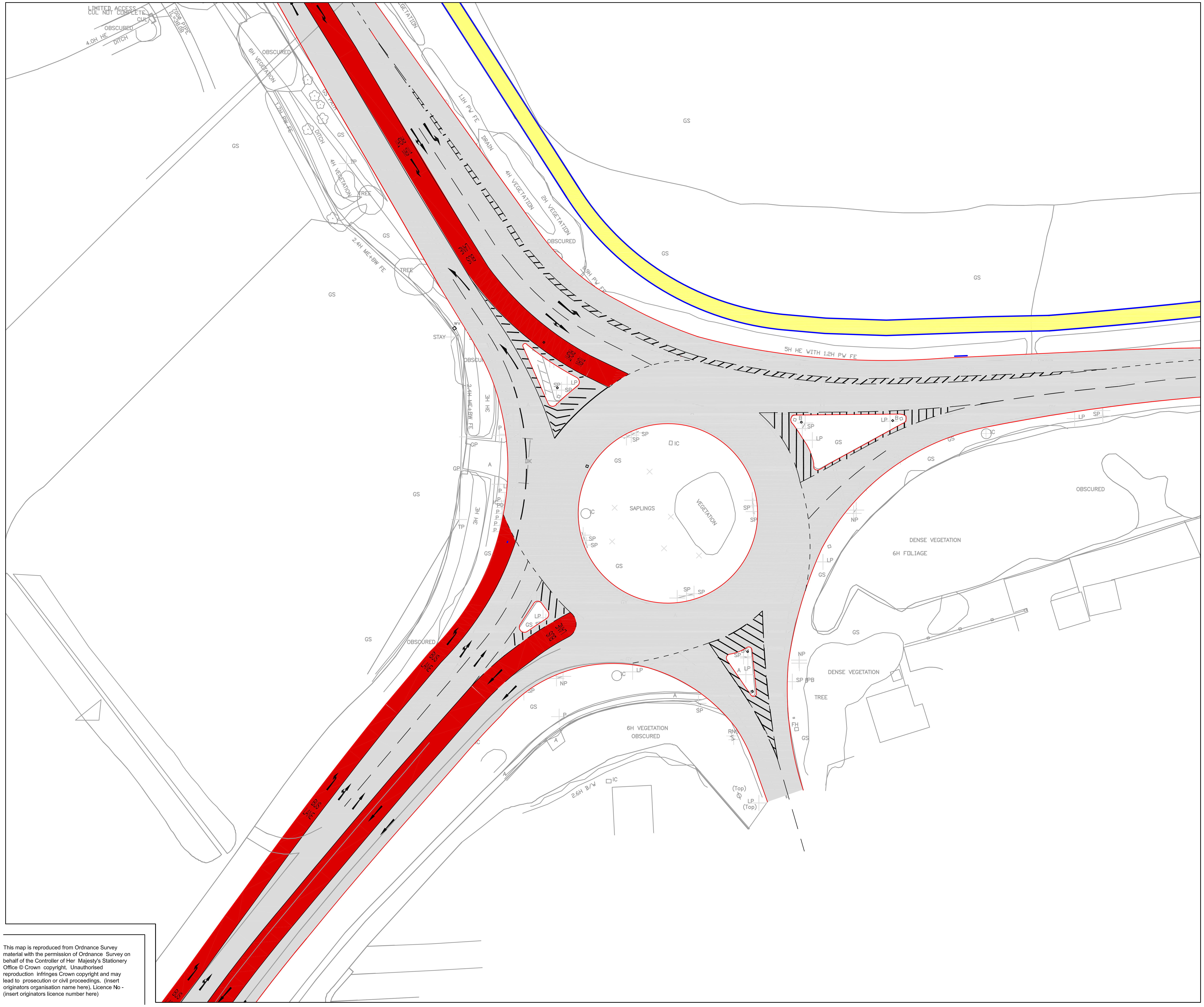
project
BEAULIEU PARK DEVELOPMENT

scale	drawn by	checked by
1:500 @ A2	HS	IM

date	cad file
MAY 2010	MASTER.DWG

title
PRATTS FARM ROUNDABOUT
ARCADY MEASUREMENTS

drawing number	rev.
CP.BEAULIEU-PRATTSFARM.1	B



PLANNING APPLICATION .DRG REF:
master 13 (Drwgs 32 onwards)
NE bypass Bridge Option with Relief Road
-Option Final on Topo - 08.09.10.dwg

rev.	amendment	checked	date
B	ADJUSTMENTS TO ECC ALIGNMENTS	IM	MAY 2012
A	ERW BUS LANE ADDED CHELMER VALLEY ROAD BUS LANE ADDED	IM	MAR 2012

mayer brown

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wokingoffice@mayerbrown.co.uk www.mayerbrown.co.uk

BM TRADA CERTIFICATION ISO 9001:2000

client
Countryside Zest (Beaulieu Park) LLP

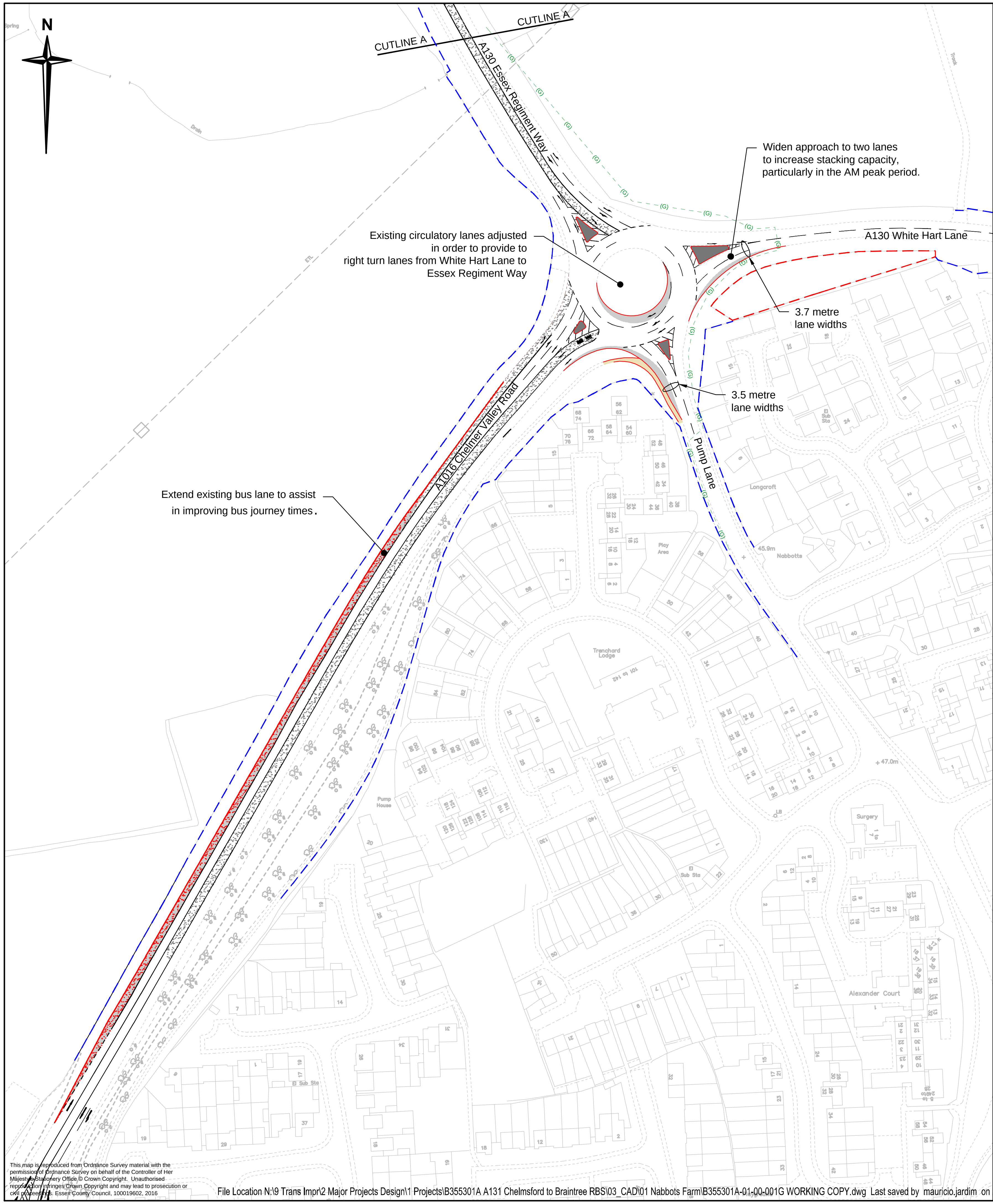
project
BEAULIEU PARK DEVELOPMENT

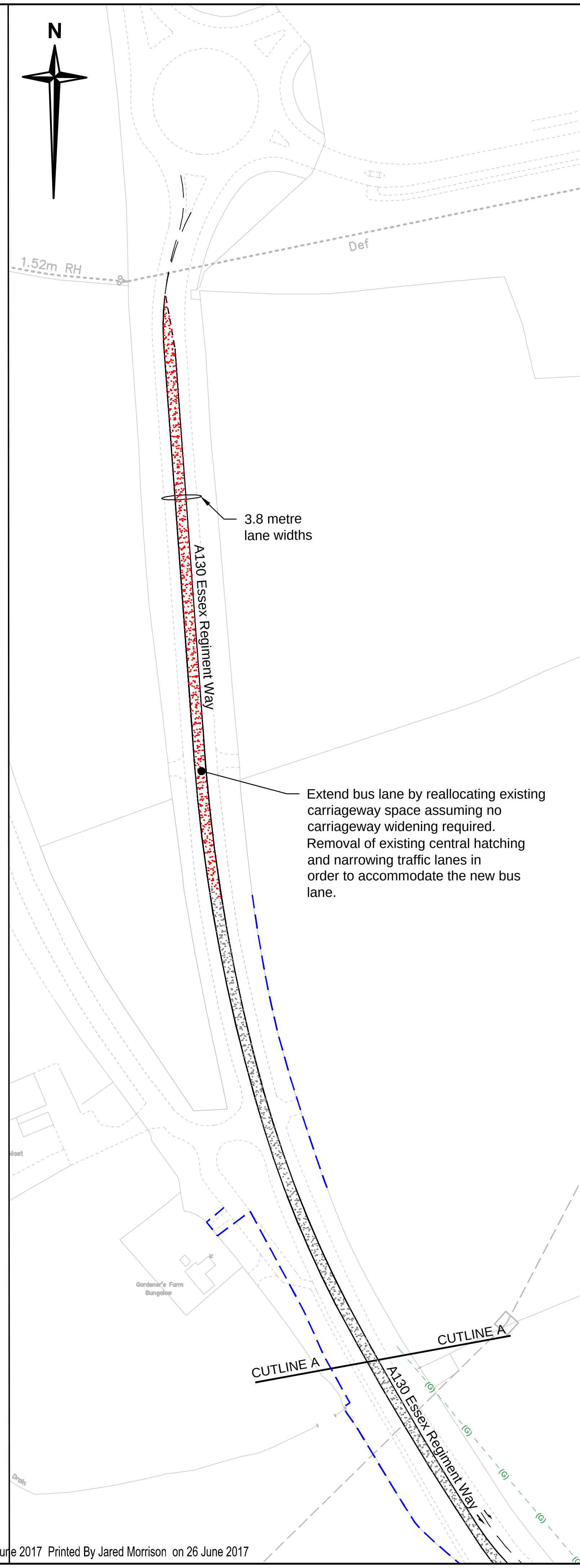
scale	drawn by	checked by
1:500@A2	HS	IM

date	cad file
SEPT 10	master 13 (Drwgs 32 onwards) NE bypass Bridge Option with Relief Road -Option Final on Topo - 08.09.10.dwg

title
NABBOTTS FARM ROUNDABOUT

drawing number	rev.
CP.BEAULIEU.1/32/FS(NF)	B





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Notes

1. Do not scale.
2. Drawing based on Ordnance Survey information.
3. Utilities shown based on C2 returns.

Key

- Highway Boundary
- ECC Land without Highway Status
- Proposed kerb
- Proposed carriageway widening
- Proposed footway
- Traffic island
- Existing bus lane
- Proposed bus lane extension
- Proposed road markings
- Existing road markings
- Existing National Grid intermediate gas main shown indicatively

Rev.	Date	Description of revision	Drawn	Checked	Review'd	Approv'd
G	Jun 17	Extend bus lane to Lawn Lane Roundabout	JM	MJ	PAB	PAB
F	Jan 17	Change to Pump Lane arm	JT	MJ	CC	CC
E	Jan 17	Addition of NGG gas main and kerb realignment	JT	MJ	CC	CC

DRAWING STATUS

FEASIBILITY

RINGWAY JACOBS Integrated expertise | Essex County Council

Mark Rowe, Service Director, Highways
Seax House, Victoria Road South, Chelmsford, CM1 1QH.
Tel: 0345 6037631

SCHEME TITLE

A131 CHELMSFORD TO BRAINTREE ROUTE BASED STRATEGY

DRAWING TITLE

NABBOTTS FARM ROUNDABOUT OPTION

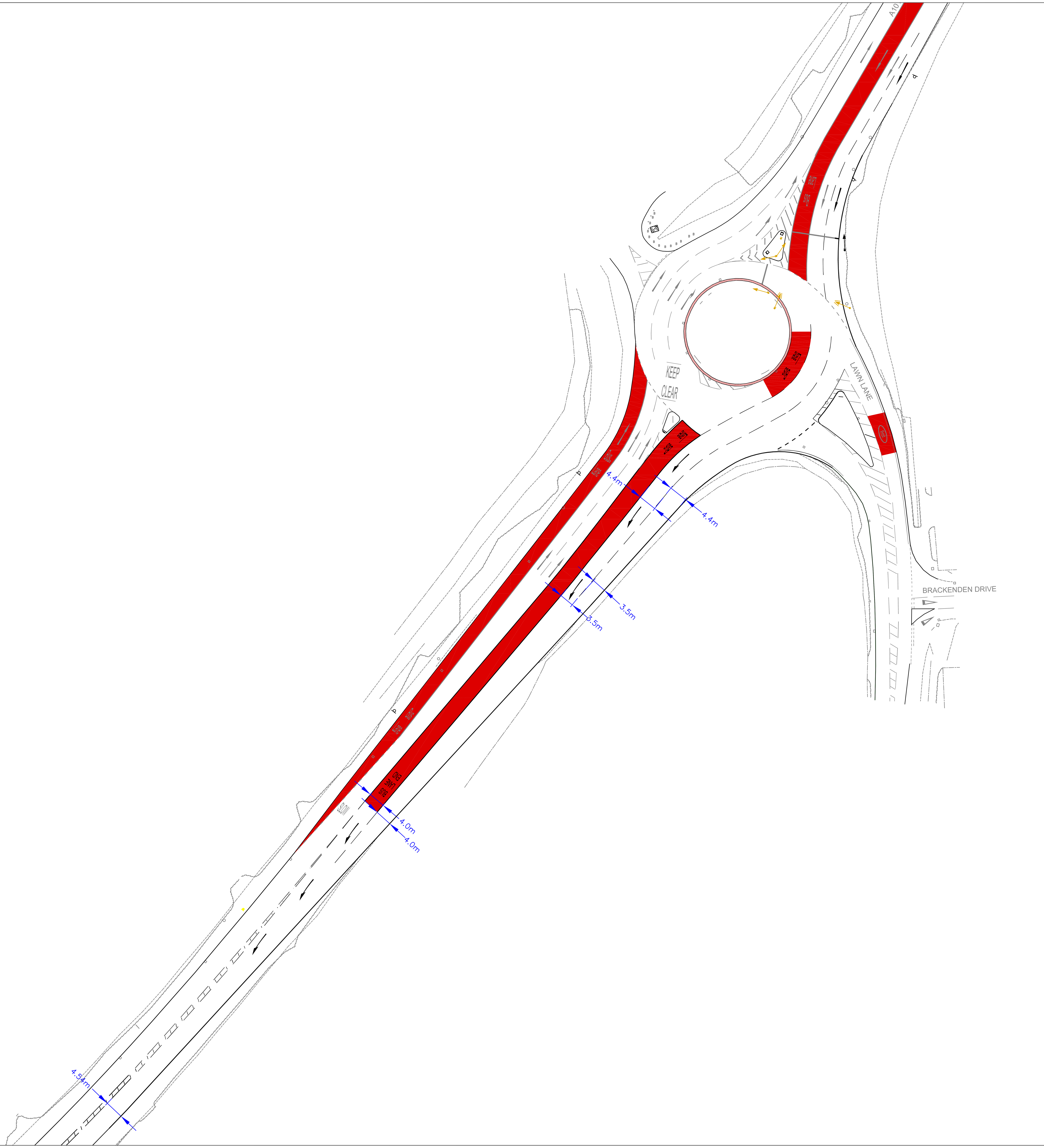
DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
JJ/JT	MJ	MA	PM	PM
DATE JUN 16	DATE JUN 16	DATE JUN 16	DATE JUN16	DATE JUN 16

DRAWING UNITS U.N.O.: DIMENSIONS IN METRES

SCALE AT A3 (420x297mm): 1:2000

DRAWING No.: B355301A-01-00-001

REV.: G



NOTES:
1. Indicative un-surveyed road markings.

Rev	Date	Details	Drawn by	Checked by	Approved by
B	4/12/14	Carriageway amendments	JA	IB	IB
A	23/10/14	Carriageway amendments	JA	IB	IB

tpa Transport Planning Associates
Bristol
Cambridge
Cardiff
London
Welwyn Garden City

Sheraton House
Castle Park
Cambridge
CB3 0AX
0122 3370 135
www.tpa.uk.com

CLIENT:
PTARMIGAN LAND, FOR CHELMSFORD LAND LTD AND CHANNELS

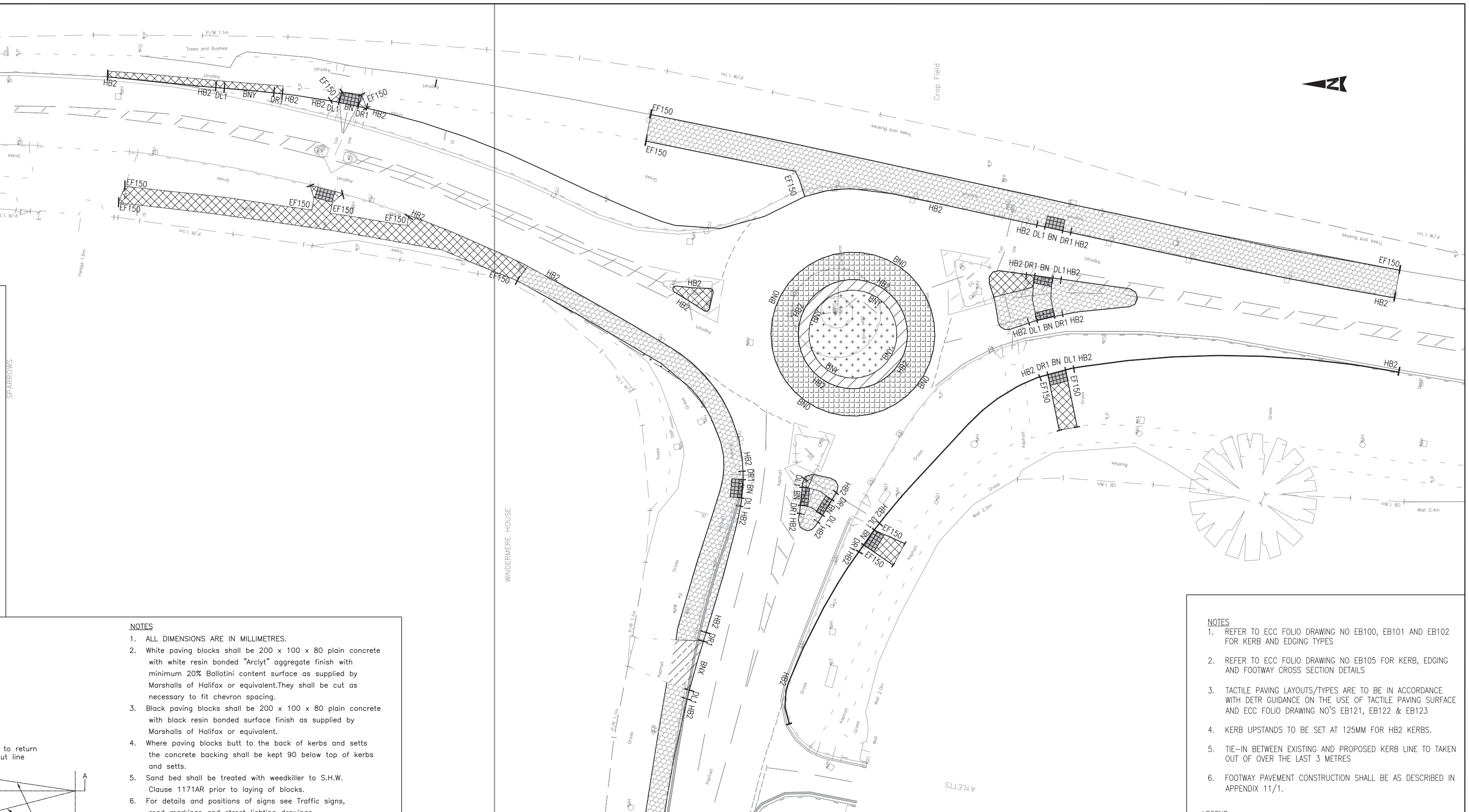
PROJECT:
CHANNELS
NORTH EAST
CHELMSFORD

TITLE:
Lawn Lane & A1016 Chelmer Valley Road Roundabout Modifications - Context

STATUS:
FOR INFORMATION

SCALE:	DATE:	DRAWN:	CHECKED:	APPROVED:
1:500	24/09/14	JA	IB	IB

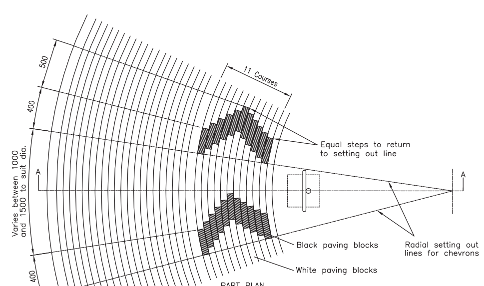
JOB NO:	DRAWING NO:	REVISION:
1303-69	PL09	B

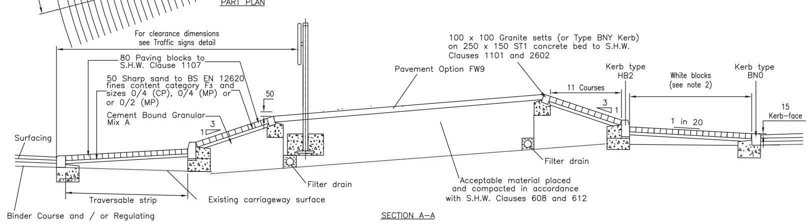


KEY

- FOOTWAY PAVEMENT OPTION FW1 (NEW FULL DEPTH CONSTRUCTION)
- FOOTWAY PAVEMENT OPTION FW2 (FOOTWAY CONSTRUCTION OVER EXISTING PAVEMENT)
- VEHICLE CROSSING PAVEMENT OPTION FW4 (VEHICLE CROSSING OVER EXISTING PAVEMENT)
- TACTILE PAVING FOR PEDESTRIAN: PAVEMENT OPTION FW6 NEW FULL DEPTH CONSTRUCTION (BUFF COLOURED)
- TACTILE PAVING FOR PEDESTRIAN: PAVEMENT OPTION FW7 OVER EXISTING CARRIAGEWAY (BUFF COLOURED)
- BLOCK PAVED CHEVERON PAVEMENT OPTION FW8
- CENTRAL ISLAND PAVEMENT OPTION FW9 (ARTIFICAL GRASS)
- TRAVERSABLE STRIP PAVEMENT OPTION FW10

NOTE – PAVEMENT OPTIONS FW3 & FW5 NOT USED





NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. White paving blocks shall be 200 x 100 x 80 plain concrete with white resin bonded "Arclyt" aggregate finish with minimum 20% Ballotini content surface as supplied by Marshalls of Halifax or equivalent.They shall be cut as necessary to fit chevron spacing.
3. Black paving blocks shall be 200 x 100 x 80 plain concrete with black resin bonded surface finish as supplied by Marshalls of Halifax or equivalent.
4. Where paving blocks butt to the back of kerbs and setts the concrete backing shall be kept 90 below top of kerbs and setts.
5. Sand bed shall be treated with weedkiller to S.H.W. Clause 1171AR prior to laying of blocks.
6. For details and positions of signs see Traffic signs, road markings and street lighting drawings.
7. The minimum clearance distance between the edge of the concrete base to any sign and the edge of a filter trench shall be 200.

PAVED CHEVRONS TO ROUNDABOUTS WITH TRAVERSABLE STRIP

NOTES

1. REFER TO ECC FOLIO DRAWING NO EB100, EB101 AND EB102 FOR KERB AND EDGING TYPES
2. REFER TO ECC FOLIO DRAWING NO EB105 FOR KERB, EDGING AND FOOTWAY CROSS SECTION DETAILS
3. TACTILE PAVING LAYOUTS/TYPES ARE TO BE IN ACCORDANCE WITH DETR GUIDANCE ON THE USE OF TACTILE PAVING SURFACE AND ECC FOLIO DRAWING NO'S EB121, EB122 & EB123
4. KERB UPSTANDS TO BE SET AT 125MM FOR HB2 KERBS.
5. TIE-IN BETWEEN EXISTING AND PROPOSED KERB LINE TO TAKEN OUT OF OVER THE LAST 3 METRES
6. FOOTWAY PAVEMENT CONSTRUCTION SHALL BE AS DESCRIBED IN APPENDIX 11/1.

LEGEND

BNX	BULL NOSE KERB (UPSTAND 25MM)
BNO	BULL NOSE KERB (UPSTAND 15MM)
BNY	BULL NOSE KERB (UPSTAND 0MM)
BN	BULL NOSE KERB (UPSTAND 6 – 10MM)
DL	DROPPER LEFT KERB.
DR	DROPPER RIGHT KERB.
HB2	HALF BATTERED KERB.
EF150	FLAT TOP EDGING.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS

CONSTRUCTION
NONE
MAINTENANCE/CLEANING
NONE
USE
NONE
DECOMMISSIONING/DEMOLITION
NONE

Stat	Rev	Purpose of Issue	Date	Auth	Rev	Description	By	Date	Chk'd	Auth
C	B	CONTRACT ISSUE	20/7/10	TAW	B	BULLNOSE UPSTAND REVISED	GJW	10/05/10	MJC	TW
C	A	TENDER ISSUE	24/02/10	NH	A	ORIGINAL ISSUE	SEE TITLE BLOCK			

ATKINS™

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Threadneedle House
9–10 Market Road
Chelmsford, Essex, England,
CM1 1XA
Tel: (01245) 245245
Fax: (01245) 345010
www.atkinsglobal.com

©

Client: MID ESSEX HOSPITALS

Project: MAIN ROAD ROUNDABOUT

Title: GENERAL ARRANGEMENT KERBING, FOOTWAY AND PAVED AREAS

Sheet Size	Original Scale	Designed/Drawn	Checked	Authorised
A1	1:250	CTI, Date 24/02/10	MJC, Date 24/02/10	NH, Date 24/01/10

Status	Drawing Number	Rev
C	5082296/HW/GA/1101	B

A1 0 10 100

DO NOT SCALE

Status C | Drawing Number 5082296/HW/GA/1101 | Rev B

File: C5082296_HW_GA_1101_REV_B.dwg
Date: Jul 21, 2010 – 2:13pm Plotted by: kosk7445

P:\GBCMA\HandT\TSol\AI\Projects\5082296_Broomfield Hospital Roundabout-FROB3723\11 Drawings\Current working drawings\contract dwgs\C5082296_HW_GA_1101_REV_B.dwg

Rev No.	Revision	Date	Drawn By	Checked By
A	AutoTurn tracking added.	01.03.12	AMZ	ACC
B	Colour surfacing added	05.03.12	DTK	ACC
C	Northern island removed and high PSV surfacing added.	24.05.12	DTK	ACC
D	Island amended after STAGE 1 RSA.	18.06.12	DTK	ACC

Written dimensions to be taken. Do not scale off the drawing

Any discrepancies, written or scaled, should be brought to the attention ofthe engineer immediately

This drawing to be read in conjunction with the relevant Bills of Quantities and Local Authority Specification.

CDM NOTE: The design has been undertaken as far as possible to avoid risks to health and safety or to reduce and control the effects of any unavoidable risks.

All relevant information identifying the unavoidable risks has been passed to the planning supervisor for inclusion in the Health & Safety plan.

The Health & Safety plan will be issued by the planning supervisor with these drawings.

Wormald Burrows Partnership
Civil Engineering Consultants
12a - 18a Hitchin Street, Biggleswade, SG18 8AX
Tel: (01767) 317244 Fax: (01767) 315434
Web: www.wormburp.com
Email: engineer@wormburp.com

Project:
Proposed Development at
Patching Hall Lane, Chelmsford

Drawing Description:
Junction 3 B1008 Main Road/ School Lane
Modified Priority Junction
Alternative Layout

Client:
Persimmon Homes Essex Limited

Drawing Number:
E0958/218/D

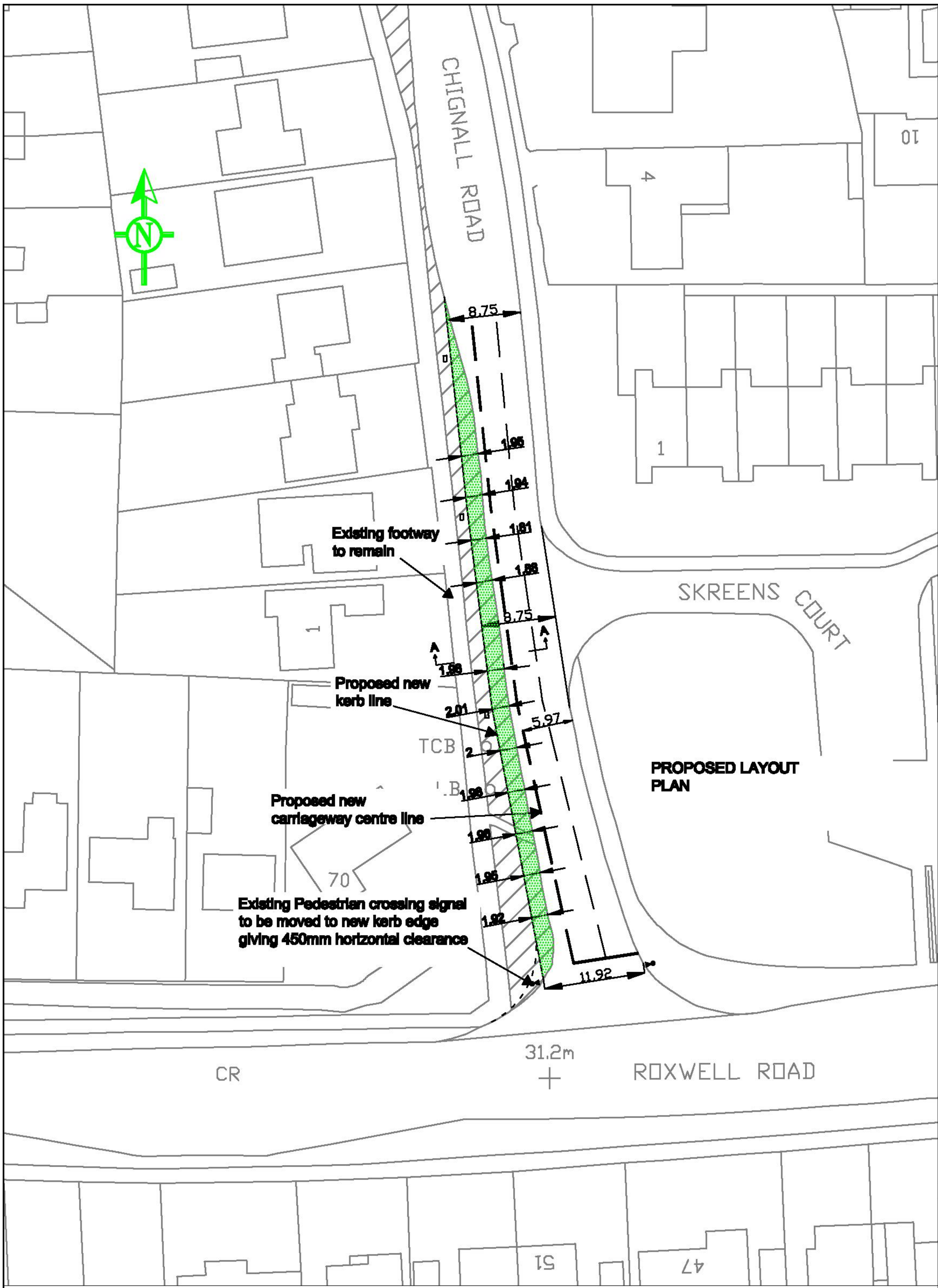
Drawn By: ACC
Date: 3.02.12

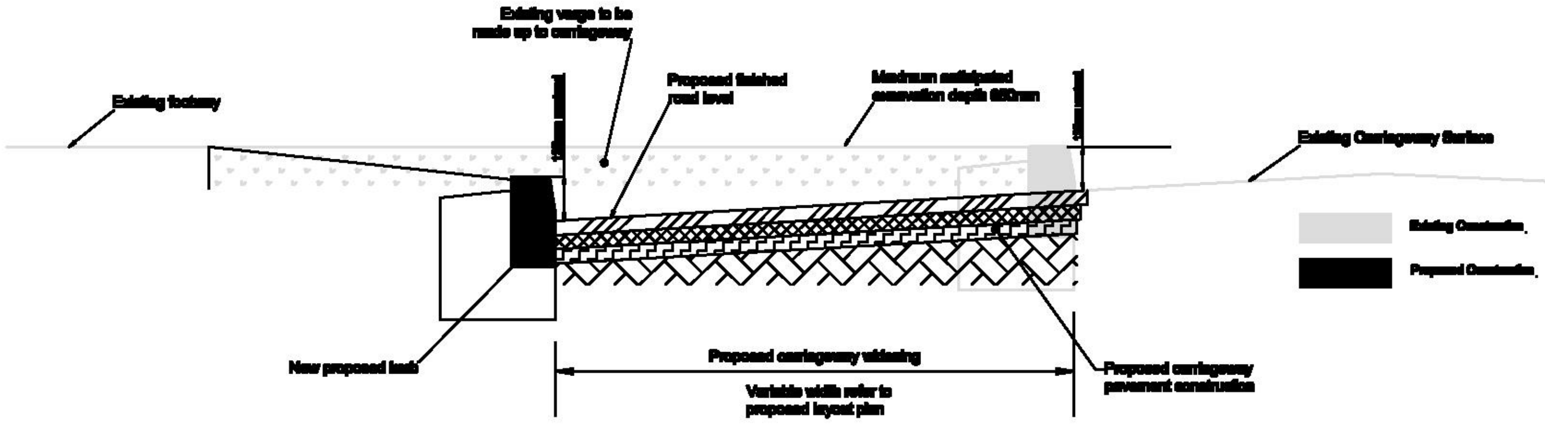
Scale:
1:250 @ A1
1:500 @ A3

Checked By: GMB
Date: 6.02.12

Architect:
RUA Architecture & Urban Design
4 Trinity Avenue
Northampton
NN2 6JJ

If there are any discrepancies in this drawing they should be referred to the Mid Area Highways Manager before proceeding.
Only figured dimensions are to be worked to, all dimensions are in millimetres unless otherwise noted.





Rev	Description	Chkd	Appd

Essex County Council

ROBERT OVERALL
EXECUTIVE DIRECTOR FOR
ENVIRONMENT, SUSTAINABILITY AND
HIGHWAYS
COUNTY HALL, CHELMSFORD, CM1 1QH
Telephone 0845 743 0430

Project
**Junction Improvements
Chignall Road / Roxwell Road
Chelmsford**

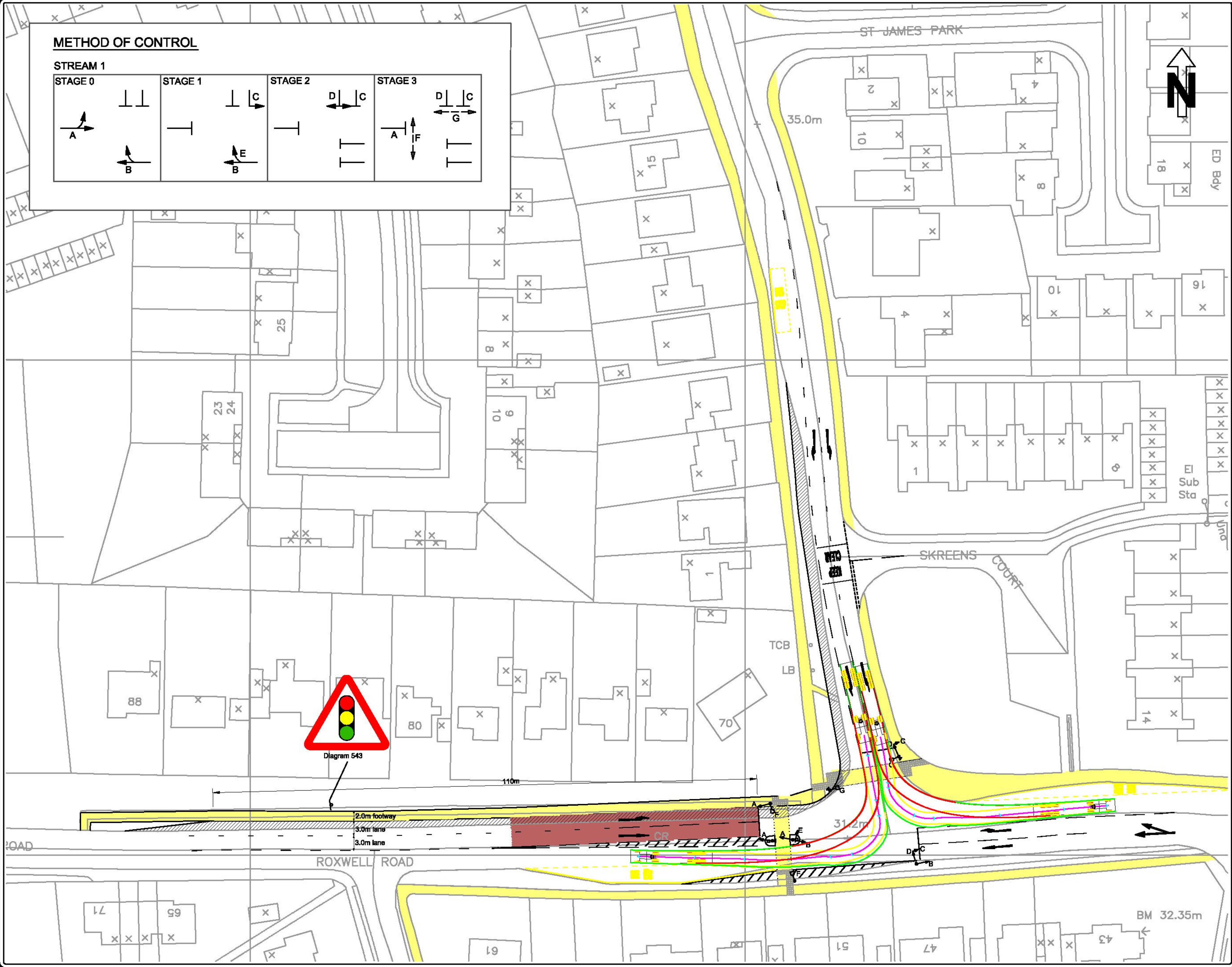
Scale		Date
1:500	@A3	Nov 09

Drawing
DRAFT Indicative Layout Plan

Drawn by	Checked	Approved
KO		

Drawing Number
2149/DES/004

Drawing - L:\engineering\Highways\Capitalworks\-ALL SCHEMES-\Highway Improvements\Chignal Road, Roxwell Junction Imp\chignalA.dwg, Layout - c3, Plotted, Wednesday 20 October 2010 - 14:04 by kieran.osborn



AUTOTURN

1.80 13.30 1.20 8.90 0.80 1.40 3.60

SVT
meters

Tractor Width : 2.55
Trailer Width : 2.55
Tractor Track : 2.50
Trailer Track : 2.50
Lock to Lock Time : 6.0
Steering Angle : 30.0
Articulating Angle : 70.0

- Front wheels
- Back wheels
- Centreline
- Body

KEY

- Footway
- Anti-skid surfacing (50m from stop line)
- Tactile paving
- New road construction

Rev No.	Revision	Date	Drawn By	Checked By
A	Amendment after Stage 1Road Safety Audit	11.02.11	AMZ	ACC

Written dimensions to be taken. Do not scale off the drawing.

Any discrepancies, written or scaled, should be brought to the attention of the engineer immediately

This drawing to be read in conjunction with the relevant Bills of Quantities and Local Authority Specification.

CDM NOTE: The design has been undertaken as far as possible to avoid risks to health and safety or to reduce and control the effects of any unavoidable risks.

All relevant information identifying the unavoidable risks has been passed to the planning supervisor for inclusion in the Health & Safety plan.

The Health & Safety plan will be issued by the planning supervisor with these drawings.

Wormald Burrows Partnership
Civil Engineering Consultants

Project:
Chelmsford, Land to Northwest

Drawing Description:
Roxwell Road with Chignall Road Junction Improvements

Client:
Persimmon Homes Essex Ltd.

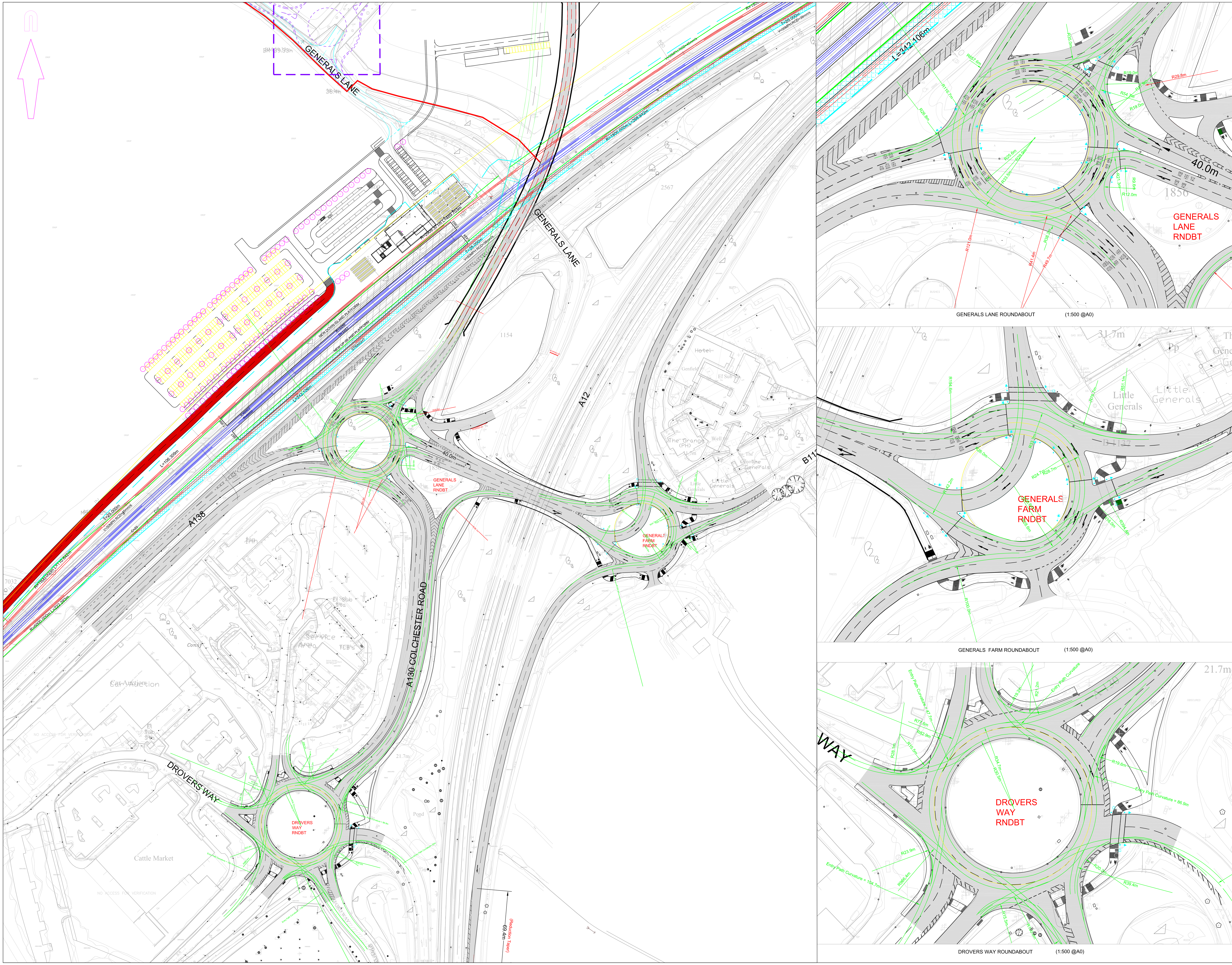
Architect:

Drawing Number:
E0958/169/A

Drawn By: JNG/AMZ
Date: 07.01.11

Scale: 1:500 @ A2

Checked By: ACC
Date: 28.01.11



PLANNING APPLICATION .DRG REF:
master 15 (Drwgs 34 onwards)
NE bypass Bridge Option with Relief Road
-Option Final on Topo - 10.02.11.dwg

rev.	amendment	checked	date

Mayer Brown Limited Lion House
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Telephone 01483 750 508 Fax 01483 750 437
wokingoffice@mayerbrown.co.uk www.mayerbrown.co.uk

client
Countryside Zest (Beaulieu Park) LLP

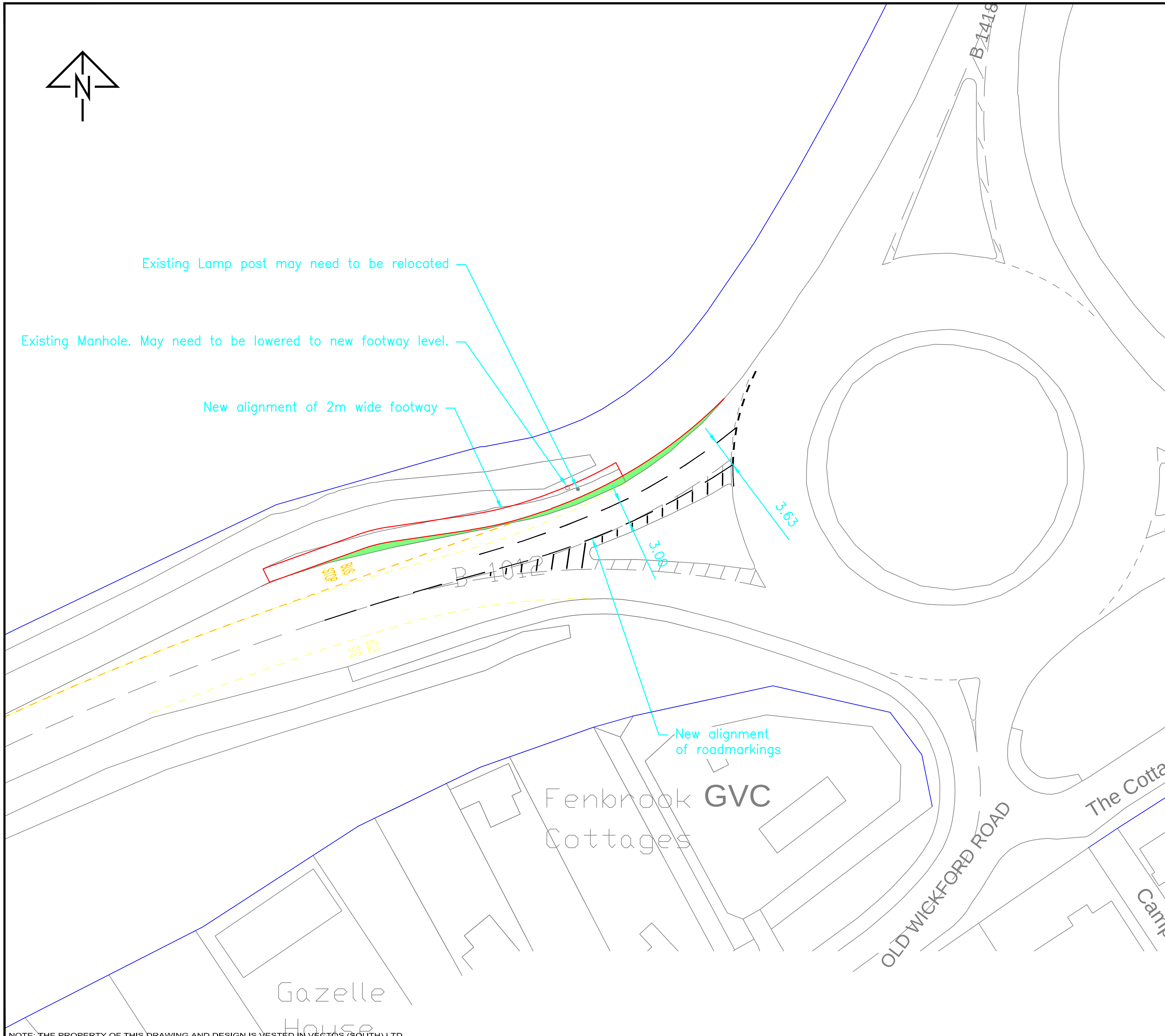
project
BEAULIEU PARK DEVELOPMENT

scale 1:1000@A0 | drawn by HS | checked by IM

date SEPT 10 | cad file master 15 (Drwgs 34 onwards) NE bypass Bridge Option with Relief Road -Option Final on Topo - 10.02.11.dwg

title
BOREHAM INTERCHANGE
TURNING RADIUS

drawing number
CP.BEAULIEU.1/34/FS(TR)
rev.



Notes:
1. This is not a construction drawing and is intended for illustrative purposes only.
2. White lining is indicative only.

Key

- Highway Boundary
- Additional Carriageway

REV.	DETAILS	DRAWN	CHECKED	DATE
A	Eastern arm - retain existing layout	JM	CS	24/02/2014

CLIENT: Sainsbury's

PROJECT: South Woodham Ferrers

DRAWING TITLE:

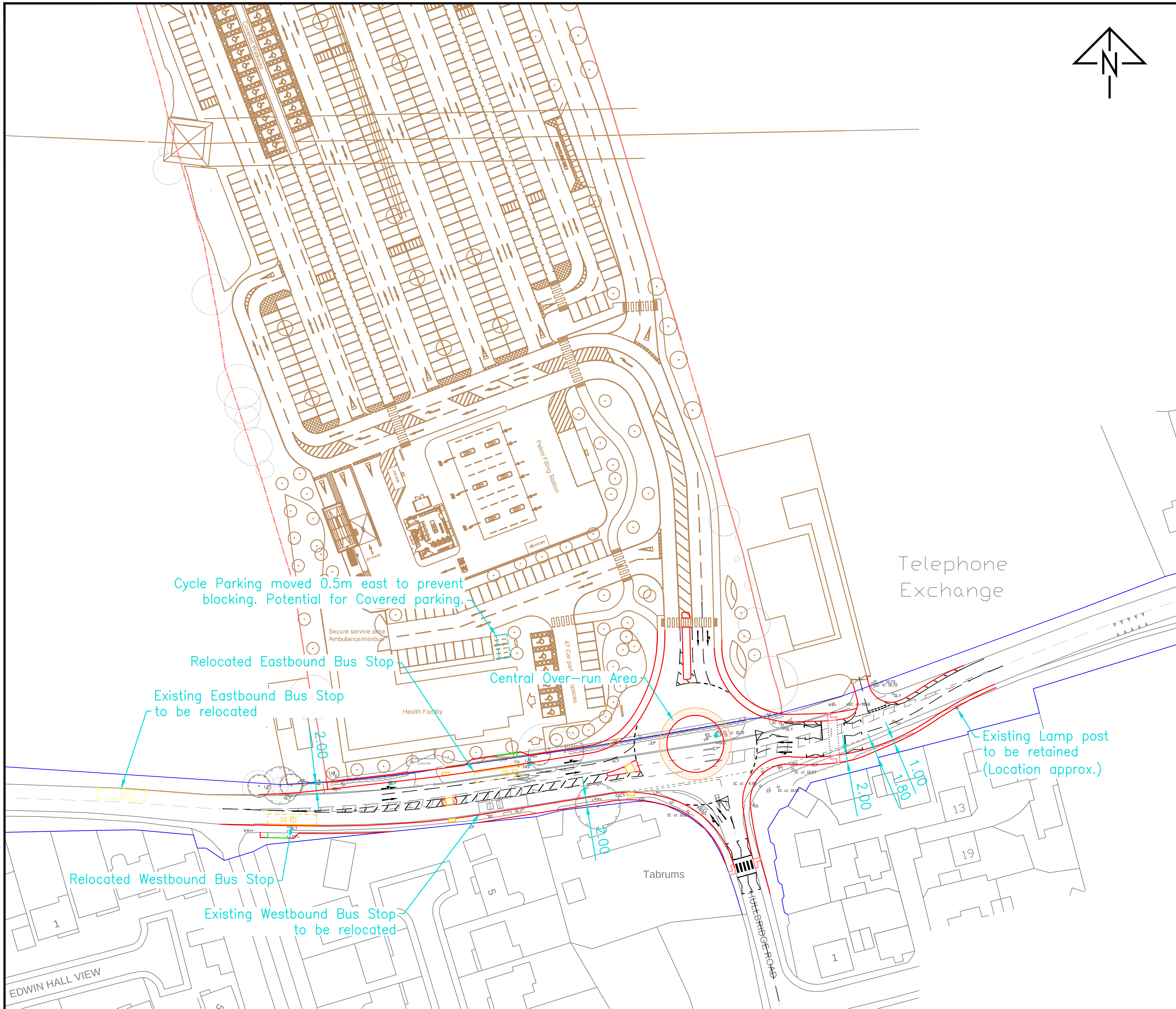
Site 2
B1012/B1418 Roundabout
Capacity Improvement

SCALES: 1:500 at A3

DRAWN: JM | CHECKED: CS | DATE: 20/12/2013

vectos
transport planning specialists
Network Building, 97 Tottenham Court Road, London W1T 4TP
t: 020 7580 7373 e: enquiries@vectos.co.uk

DRAWING NUMBER: 110175/A/26
REVISION: A



Notes:

1. This is not a construction drawing and is intended for illustrative purposes only.
2. White lining is indicative only.
3. Site Plan is Proposed Site Plan by CHQ, received on the 17th of April.
4. Topographical Survey is ESSE8775 by Barry Lowe Surveys Ltd.
5. Footways are 2m wide unless shown otherwise.
6. For Swept Path Analysis see 110175/AT/N Series Rev A.

Key

Highway Boundary

Existing Lamp Post to be relocated behind proposed Kerb line (3 No.)

REV.	DETAILS	DRAWN	CHECKED	DATE
C	Relocated westbound bus stop moved 50m east, site access arm island extended to pedestrian crossing, cycle parking moved.	JM	KH	29/07/2014
B	Latest Architects Layout	JM	KH	24/04/2014
A	Access to Telephone exchange - kerb line pushed out another metre.	JM	KH	17/02/2014

CLIENT:

Sainsbury's

PROJECT:

South Woodham Ferrers

DRAWING TITLE:

Site 3
Site Access Roundabout
Burnham Road/Hullbridge Road

SCALES: 1:1000 at A3

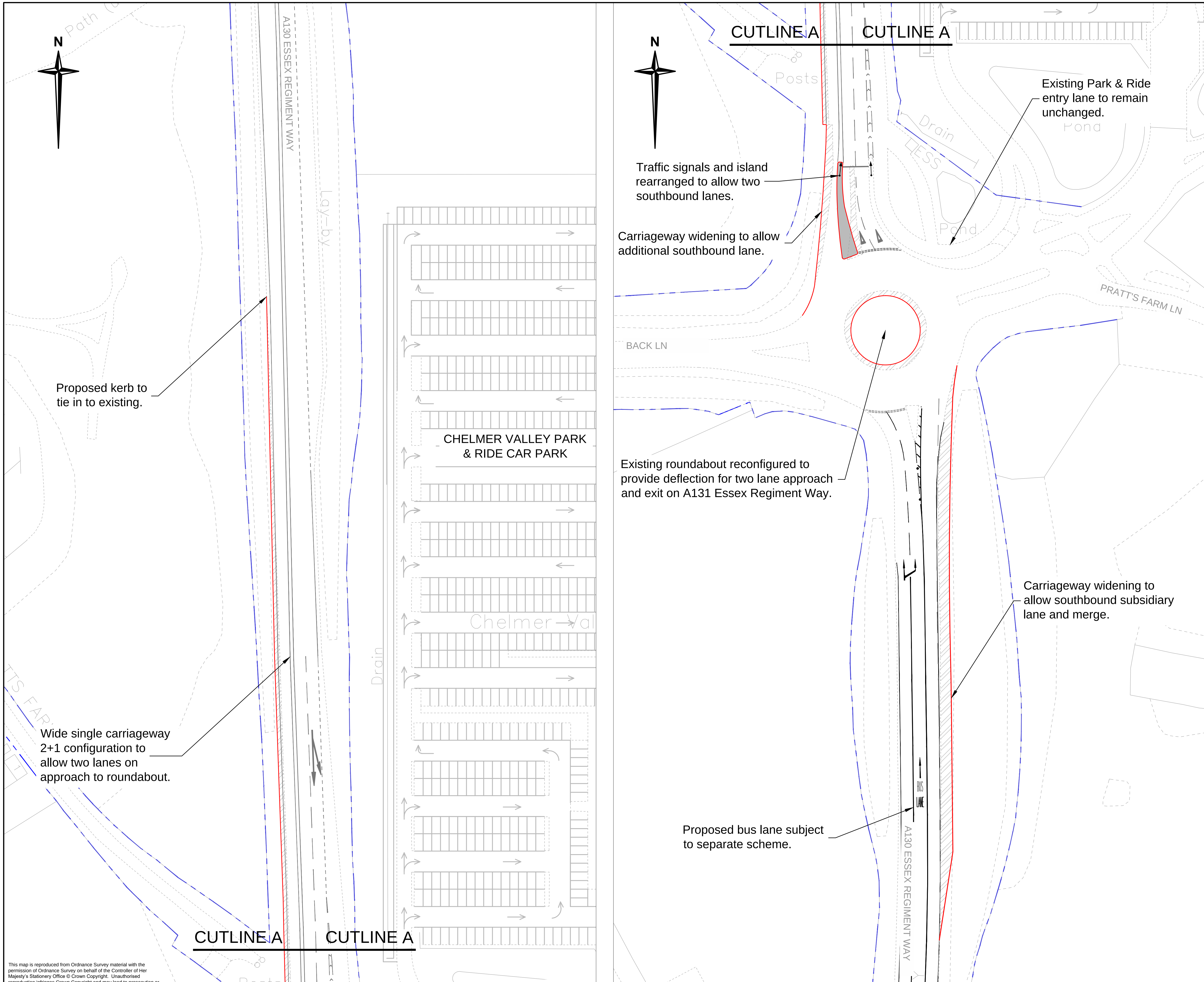
DRAWN: JM | CHECKED: CS | DATE: 05/02/2014

vectos
transport planning specialists

Network Building, 97 Tottenham Court Road, London W1T 4TP
t: 020 7580 7373 e: enquiries@vectos.co.uk

DRAWING NUMBER: 110175/A/31

REVISION: C



Notes

1. Do not scale.
2. Drawing based on Ordnance Survey information.

Key

- Proposed full depth carriageway construction
- Proposed traffic island
- Proposed kerb
- Highway Boundary
- Proposed road marking
- Signal head

Rev.	Date	Description of revision	Drawn	Checked	Review'd	Approv'd

DRAWING STATUS
FOR INFORMATION

Essex Highways

Mark Rowe, Service Director, Highways
Seax House, Victoria Road South, Chelmsford, CM1 1QH.
Tel: 0345 6037631

SCHEME TITLE
CHELMSFORD LOCAL PLAN JUNCTION MITIGATION - PRATT'S FARM ROUNDABOUT

DRAWING TITLE
SCHEME OVERVIEW

DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
PB	PB	IHJ	PAB	PAB
DATE DEC 17	DATE DEC 17	DATE DEC 17	DATE DEC 17	DATE DEC 17

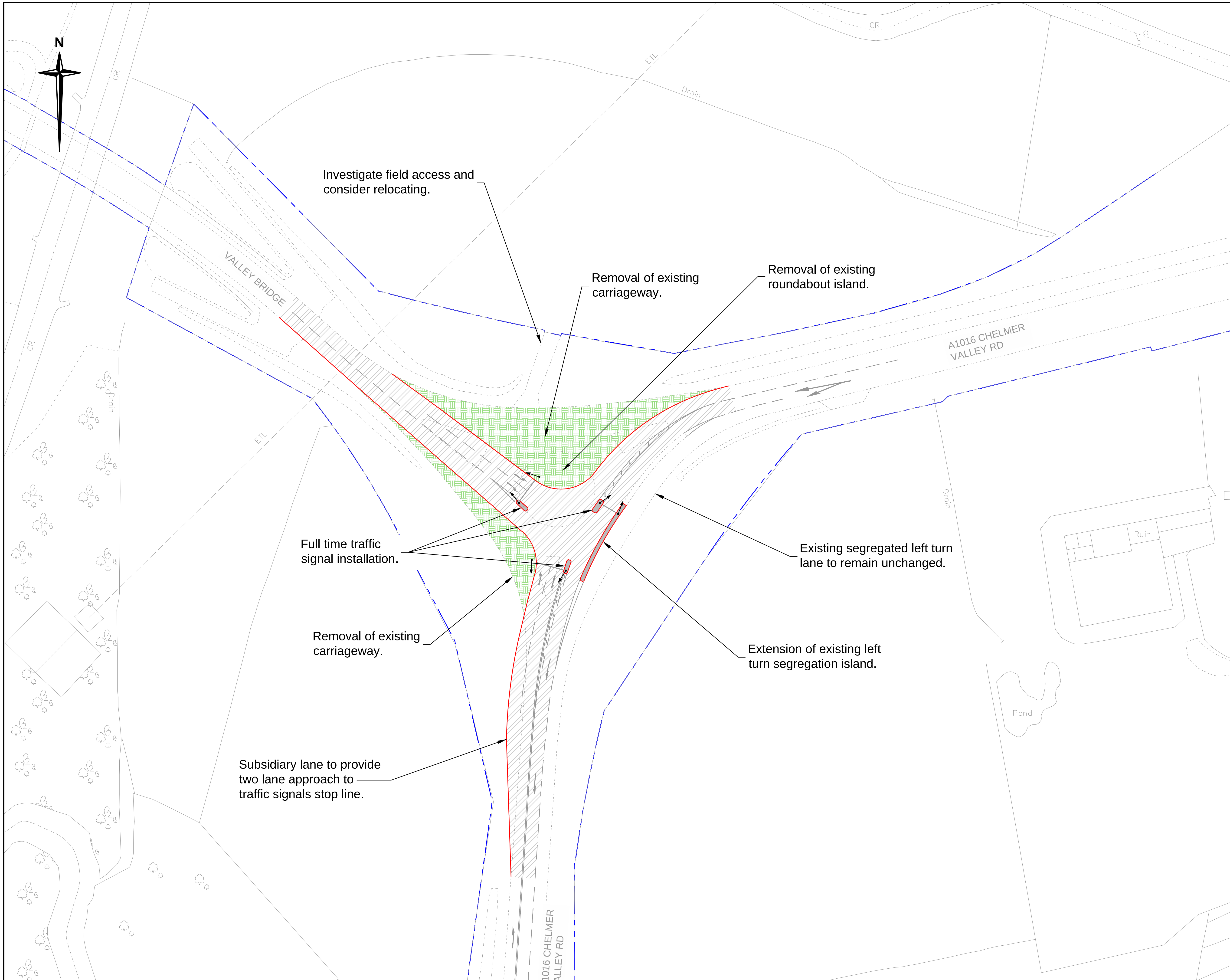
DRAWING UNITS U.N.O.
DIMENSIONS IN MILLIMETRES
LEVELS IN METRES

SCALE AT A3 (420x297mm) 1:1000

DRAWING No. B3553R6A-04-00-001 REV. -

RINGWAY JACOBS Integrated expertise
Essex County Council

File Location N:\9 Trans Impr\2 Major Projects Design\1 Projects\B3553R6A_41CHLP_Chelmsford LP Junction Mitigation\03_CAD\04_Pratts Farm RAB\B3553R6A-04-00-001.dwg Last saved by Prabushan.Balakumar on 14 December 2017 Printed By Prabushan Balakumar on 15 December 2017



Notes

1. Do not scale.
2. Traffic signal arrangement is indicative only.

Key

- Proposed carriageway re-profiling and surfacing.
- Proposed carriageway removal
- Proposed traffic island
- Proposed kerb
- Highway Boundary
- Proposed road marking
- Signal head

Rev.	Date	Description of revision	Drawn	Checked	Review'd	Approv'd

DRAWING STATUS

FEASIBILITY

Essex Highways

Mark Rowe, Service Director, Highways
Seax House, Victoria Road South, Chelmsford, CM1 1QH.
Tel: 0345 6037631 © Essex County Council

SCHEME TITLE

CHELMSFORD LOCAL PLAN JUNCTION MITIGATION - VALLEY BRIDGE ROUNDABOUT

DRAWING TITLE

SCHEME OVERVIEW

DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
PB	PB	IHJ	PAB	PAB
DATE DEC 17	DATE DEC 17	DATE DEC 17	DATE DEC 17	DATE DEC 17

DRAWING UNITS U.N.O.
DIMENSIONS IN MILLIMETRES
LEVELS IN METRES

SCALE AT A3 (420x297mm) 1:1000

DRAWING No. **B3553R6A-03-00-001** REV. -

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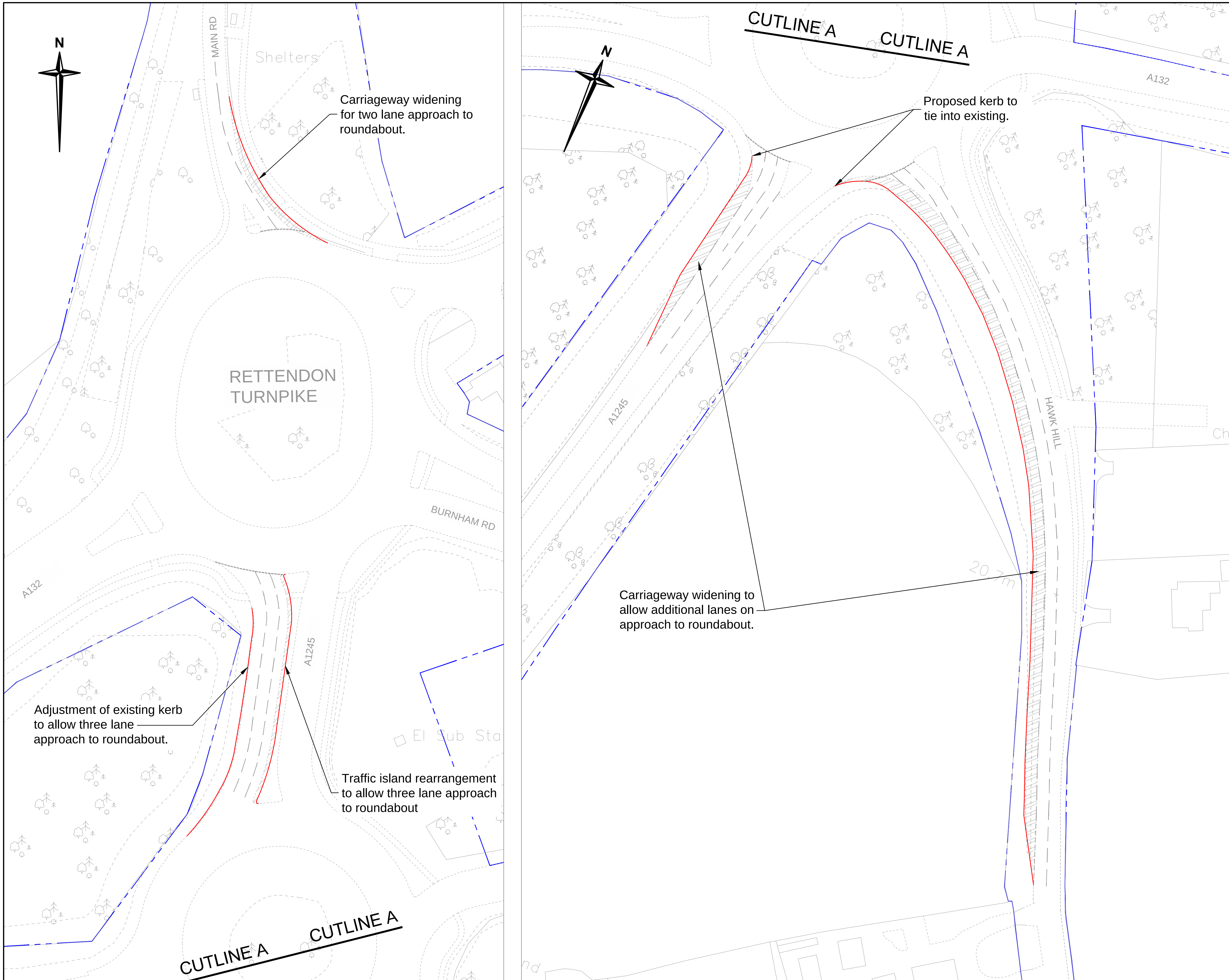

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Notes

1. Do not scale.

Key

- Proposed full depth carriageway construction
- Proposed kerb
- Highway Boundary
- Proposed road marking

Rev.	Date	Description of revision	Drawn	Checked	Review'd	Approv'd

DRAWING STATUS

FEASIBILITY

Essex Highways

Mark Rowe, Service Director, Highways
Seax House, Victoria Road South, Chelmsford, CM1 1QH.
Tel: 0345 6037631

SCHEME TITLE

CHELMSFORD LOCAL PLAN JUNCTION MITIGATION - RETTENDON TURNPIKE/ HAWK HILL ROUNDABOUT

DRAWING TITLE

SCHEME OVERVIEW

DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
PB	PB	IHJ	PAB	PAB
DATE DEC 17	DATE DEC 17	DATE DEC 17	DATE DEC 17	DATE DEC 17

DRAWING UNITS U.N.O.
DIMENSIONS IN MILLIMETRES
LEVELS IN METRES

SCALE AT A3 (420x297mm) 1:1000

DRAWING No. B3553R6A-02-00-001

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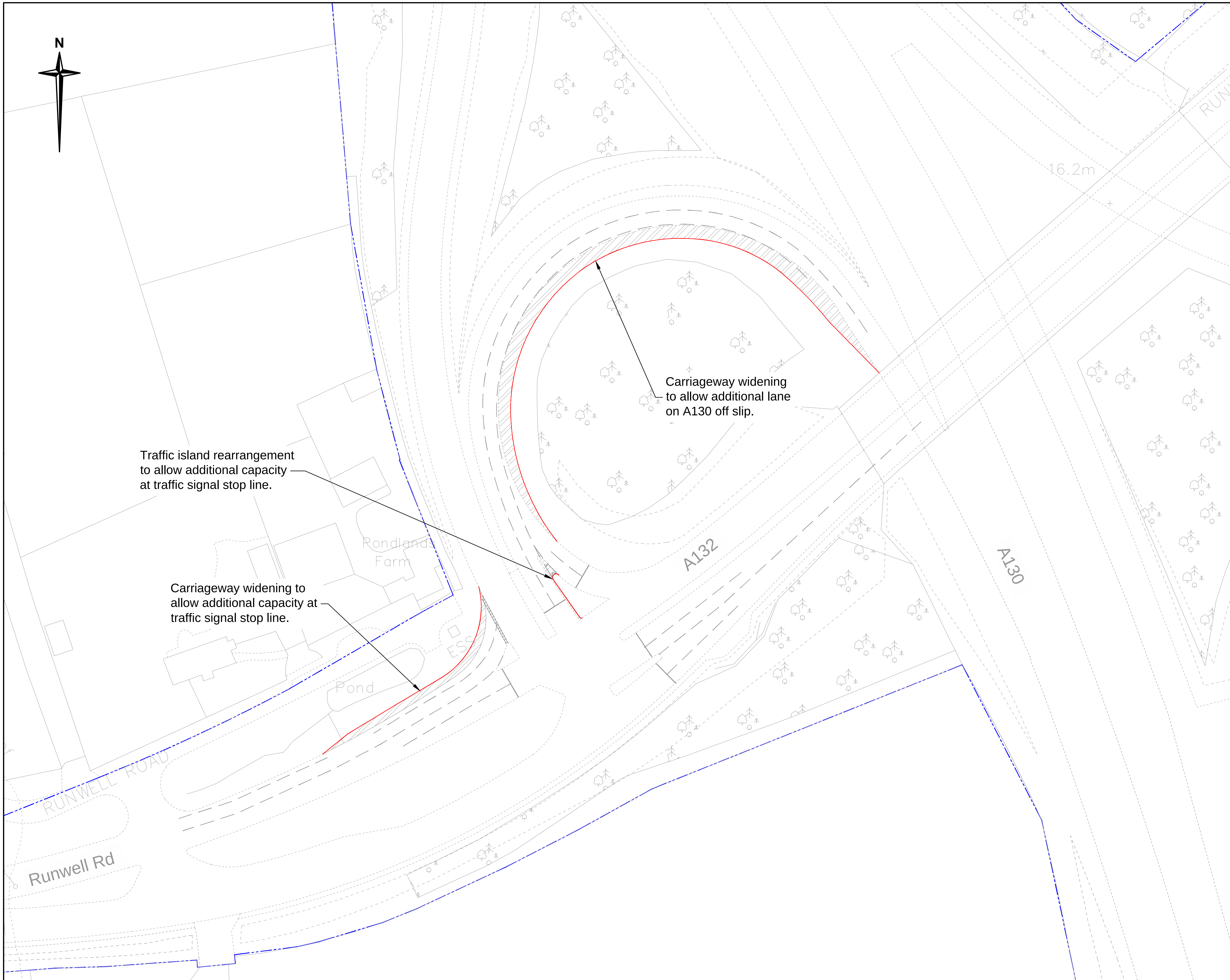

Notes

1. Do not scale.

Key

- Proposed full depth carriageway construction
- Proposed kerb
- Highway Boundary
- Proposed road marking

Rev.	Date	Description of revision	Drawn	Checked	Review'd	Approv'd

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SCHEME TITLE

CHELMSFORD LOCAL PLAN JUNCTION MITIGATION - A130 J/W A132 RUNWELL ROAD

DRAWING TITLE

SCHEME OVERVIEW

DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
PB	PB	IHJ	PAB	PAB
DATE DEC 17	DATE DEC 17	DATE DEC 17	DATE DEC 17	DATE DEC 17

DRAWING UNITS U.N.O.
DIMENSIONS IN MILLIMETRES
LEVELS IN METRES

SCALE AT A3 (420x297mm)
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DRAWING No.
B3553R6A-01-00-001

REV.
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Appendix M: Chelmsford Strategic Model (VISUM) Zone Plan

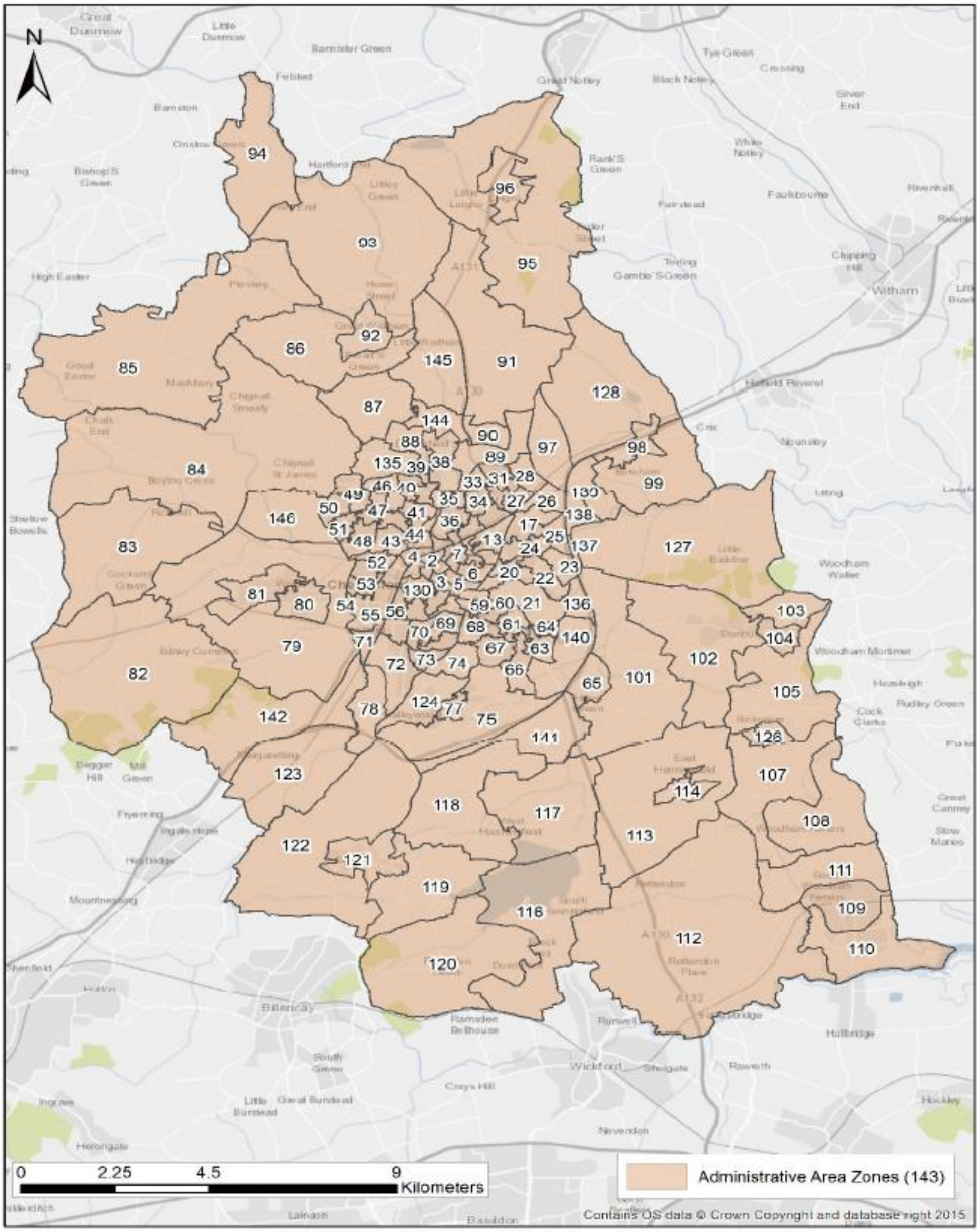

Figure M1 Chelmsford Strategic Model (VISUM) zone system for Chelmsford Administrative Area

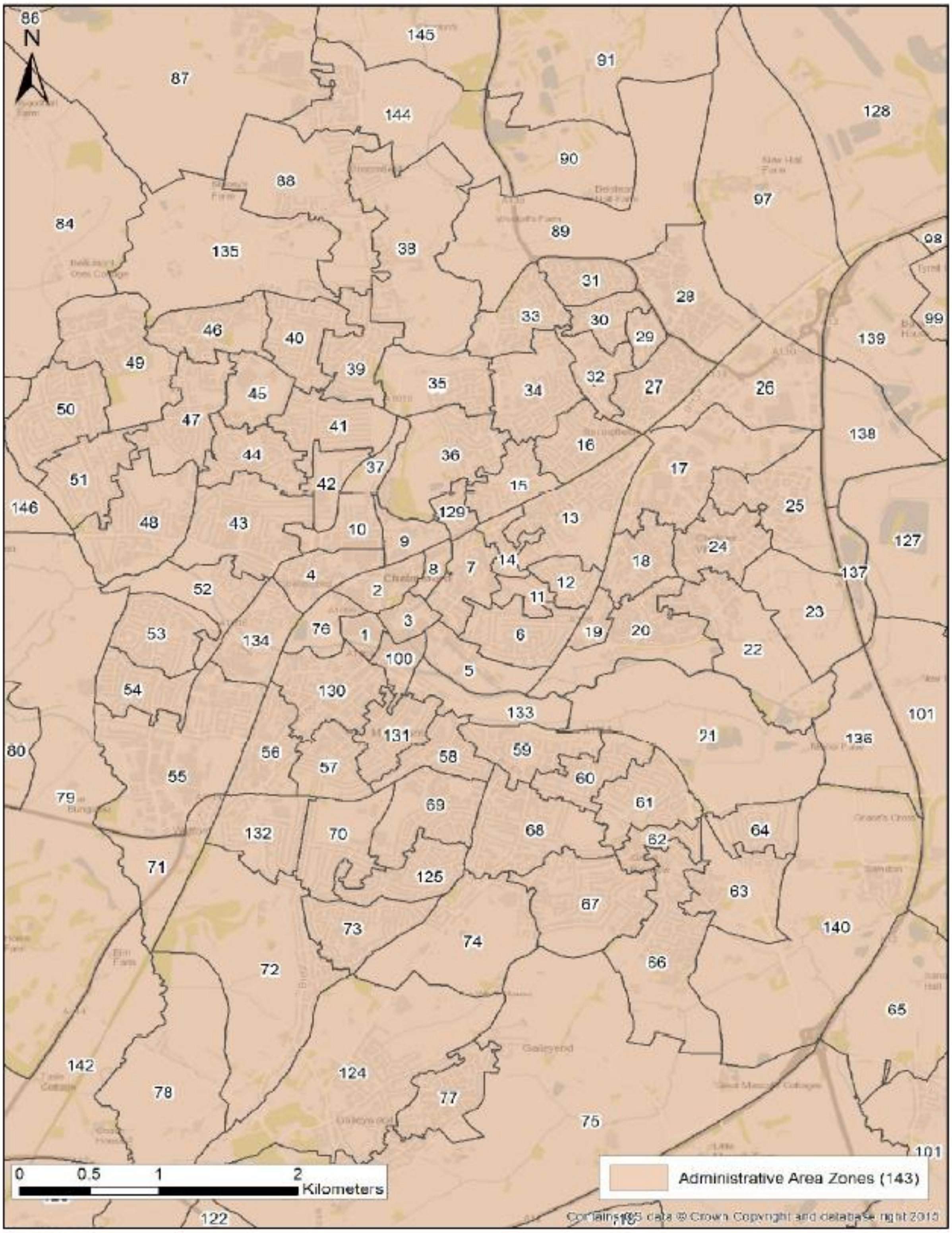

Figure M2 Chelmsford Strategic Model (VISUM) zone system for Chelmsford City Centre