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Colchester Local Plan Traffic Modelling

Technical Report

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Document Control Sheet

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Executive Summary

This report contains updated and detailed transport modelling evidence for testing the preferred option of Colchester Borough Council's Local Plan (2017-2033). The model used was based on the existing Colchester Area SATURN model, and a variable demand model developed specifically for the task. A nominal forecast year of 2032 was chosen which, although differing from the local plan horizon year, nonetheless contains all of the local plan development up to 2033.

A new committed development scenario and a new local plan development scenario were produced:

- Scenario 0b (2032) – Committed development scenario, which includes those developments contained in the current local plan and those which were completed subsequent to the modelled base year;
- Scenario 1c (2032) – Non-committed, preferred option, local plan scenario.

For each scenario a list of junctions and links, for which demand exceeded capacity, has been produced. In each case, the volume to capacity ratio has been identified along with the resulting delays which occur.

The network wide summary results show that the local plan development scenario experiences a reduction in average network speed with a corresponding increase in congestion and delay when compared against the committed development scenario.

Key local impacts were identified for the two forecast scenarios by comparing the amount of traffic through a link or junction with that link or junction's traffic capacity. A link or junction that is overcapacity or close to capacity would be expected to experience delay. The local impacts identified include:

- The A12 between Junctions 28 and 29 in both directions in the forecast year in both scenarios – the impacts are exacerbated by the presence of local plan development and the proposed A120/A133 link road, which reroutes high volumes of traffic to the A12;
- The A12 at Junction 26 in the PM peak – the cumulative impacts of the various committed and local plan developments in the area contribute to traffic through this junction;
- Haven Road and Colne Causeway – The Colchester Tendring borders Garden Settlement contributes to traffic issues in the local plan scenario.

- Greenstead Roundabout – traffic through this junction is comprised of various trip generators, including the committed employment site of Essex University;
- Ipswich Road – although not overcapacity it is close to capacity, which means the junction is susceptible to delays;
- Lexden Road/Southway – already overcapacity in the base year model and issues are exacerbated in 2032 due to traffic growth.

Four sensitivity tests of both the committed and local plan scenarios were conducted in order to identify the traffic implications on the road network from:

1. Widening the A12 between junctions 25 and 29 – this provided additional capacity to relieve the overcapacity problems identified above for the A12, and resulted in some rerouting in the model;
2. Removing traffic signals at junction 26 of the A12 combined with increased capacity at Greenstead roundabout – the latter reduced capacity problems in the AM peak at the roundabout but increased traffic on Eastern approach, while in PM peak there was an overall worsening of overcapacity problems as more traffic chose routes via Greenstead roundabout;
3. Assuming a lower level of car trip generation at the garden community developments combined with improvements at Greenstead roundabout – this partially resolved some overcapacity problems, but local rerouting created new overcapacity issues along Eastern Approach and on roads close to Greenstead roundabout as in the previous sensitivity test;
4. Introducing a southern distributor road in the Stanway area combined with improvements at Greenstead roundabout – this did not show any significant changes as the Stanway area was not presenting overcapacity problems in the reference case. Most of the changes in this scenario could be attributed to the Greenstead roundabout improvement.

In addition, options for a series of mitigation measures at key junctions and links which could be adversely affected by local plan developments have been generated. Consideration was given to previous and current studies in order that this SATURN study reflects and is consistent with other work.

For each location where over-capacity issues were identified, options were generated for traffic management, infrastructure and sustainable transportation measures, such as improvements for public transport, walking and cycling. In reality a combination of measures would be used which would need to be co-ordinated along the routes. The four main packages of mitigation measures identified would help to address:

- A12 corridor;
- East Colchester A134/A133 corridor;
- South and West Colchester A134 and A1124 corridor;
- Other locations including Colne Bank/Cymbeline Way, Harwich Road/East Street, Circular Road South, Shrub End Road/Maldon Road, Old Heath Road/Wimpole Road, Brook Street, Mersea Road/Normandy Avenue junction and junctions on the proposed new A120/A133 link road in East Colchester.

It should be recognised that the mitigation measures identified are at the option generation stage although, as far as possible, grounded in current studies and plans. Further research, design and appraisal would be essential, for which the scheme specific studies, where they exist, would be an optimum starting point.

1 Introduction

1.1 Background

In June 2015, Colchester Borough Council (CBC) asked Essex County Council (ECC) to provide transport modelling evidence to support their emerging Local Plan proposals. Through a staged process, two phases of work with associated reporting was conducted. Following this, CBC requested, as a third phase of work, additional modelling support to test the preferred option scenario for the local plan, and investigate potential mitigation measures. Essex Highways subsequently commissioned Jacobs to carry out this work.

1.2 Objectives

The objectives of the project are to:

- Conduct a review of assumptions in the forecasting model against known data sources;
- Produce revised forecast models reflecting CBC's preferred development scenario and other updates to the modelling methodology;
- Identify links and junctions within the model which have capacity and delay issues;
- Carry out sensitivity tests to explore how the capacity and delay issues are affected by changes to the network;
- Propose highway mitigation measures;
- Produce a report detailing the work, methodology and outcomes in line with National Planning Policy Guidance.

The methodology for producing the models to test the preferred local plan developments is consistent with previous work. As such, only the AM and PM peak hours have been assessed.

New forecasts scenarios 0b and 1c have been produced – with 0b containing committed developments only, and 1c containing additional non-committed local plan growth. In scenario 1c the total level of development (from specifically identified development and TEMPro background growth) is maintained at 2032 TEMPro levels, with 0b below TEMPro growth.

A list of junctions and links for which demand exceeded capacity has been produced for each scenario. In each case, the volume to capacity ratio has been identified, along with the resulting delays which occur. The forecast

scenarios have also been compared with each other to identify the relative impacts using a set of network summary statistics.

The sensitivity tests are described in detail in Section 7 and have explored how capacity and delay problems change by:

1. Widening the A12 to three lanes in both directions between junctions 25-29;
2. Removing signals at the roundabout at Junction 26 of the A12 since there is uncertainty around when plans to signalise the off ramps at this junction would be implemented;
3. Reducing the number of vehicle trips (reflecting a lower mode share by car) to and from the proposed garden community developments in order to reflect the aspiration that more sustainable transportation options will be an integral part of the design of these communities;
4. Adding the 'southern distributor scheme' to the model which links Warren Lane to Cunobelin Way in the Stanway area of Colchester.

In addition, sensitivity tests (2) to (4) above have been combined with an improvement to Greenstead roundabout.

Mitigation measures have been derived for locations where capacity and delay problems have been identified. With reference to previous and current studies options cover traffic management, infrastructure improvements and sustainable transportation measures.

It is recognised that further research, design and appraisal of options for mitigation measures would be required, in those cases where they are not based on established studies.

2 Ongoing studies and projects

There are a number of studies for future transport improvements and developments that are currently ongoing. While these are acknowledged, it has not always been possible to incorporate them fully into this work either due to their current status or the stage which they are at. It is important to note that these transport schemes and developments in surrounding areas will have an impact on travel patterns in the Colchester area. So while the Colchester transport model has used the best information available at the time, it should be recognised that, schemes in the wider area may have an impact on forecasts being made.

2.1 A120 Braintree to Marks Tey Junction Improvements

Highways England (HE) is currently investigating the potential for junction improvements to the A120 between Braintree and Marks Tey.

2.2 A120 Braintree to A12 Route Options

The Department for Transport (DfT), HE and ECC agreed that ECC will lead on feasibility work in order to determine options for a new A120 route between Braintree and the A12, with a suggested option to be determined by Summer 2017. It is envisaged that ECC will recommend to HE and the Secretary of State for Transport a preferred route to Government for inclusion in the next Government Road Investment Strategy (RIS2), which will run from 2020 to 2025.

In the route options under consideration the A120 either joins the A12 just north of Kelvedon or just south of Kelvedon, which lies to the south west of Colchester. This affects traffic levels on the B1023 to Tiptree and along the B1022 between Tiptree and Colchester. This indicates potential changes in route choice south west of Colchester, which have not been taken into consideration in this study.

2.3 A12 Widening between M25 and A12 J25.

HE are currently investigating widening the A12 to three lanes in each direction between the M25 and Junction 25 and beyond. The section between J19 and J25, that is between Chelmsford and Marks Tey, has been identified in the RIS1 document to be delivered first, with construction outlined to start by the end of the financial year 2019/20. The widening of the remainder of the route is to be included in RIS2 with the aim to complete construction by the end of 2025. As

the scheme has a high level of certainty the A12 up to Junction 25 is modelled as proposed with three lanes in each direction.

2.4 A12 Widening between J25 and J29

HE are beginning the process of investigating widening the A12 to three lanes in each direction on the A12 between Junctions 25 and 29. Also known as the Colchester A12 bypass the scheme could be part of RIS2. A sensitivity test of the Colchester model has been carried out to assess the impacts of this scheme.

2.5 Garden Communities

Three new Garden Communities have been proposed within the local plan period:

- Tendring/Colchester border – to provide up to 2,500 homes;
- Colchester/Braintree Borders – to provide up to 2,500 homes;
- West of Braintree – to provide up to 2,500 homes.

As part of the planning and design for the Garden Communities, a separate study has been undertaken to forecast the likely traffic impacts of the new communities, including evaluating the potential public transport requirements during the plan period, the potential for the internalisation of trips, and the likely trip distribution. There is an aspiration of achieving a modal split of: 40% Active, 30% Public Transport and 30% Car. The garden communities study has developed a simple transport demand tool for each of the developments, which provides trip ends to use in transport models, based on different modal splits being achieved.

This transport demand tool was not available when the Colchester local plan modelling commenced, however, it was used to inform one of the sensitivity tests described in Section 7 of this report.

2.6 Braintree and Tendring Local Plan Studies

Both Braintree District and Tendring District have undertaken traffic modelling in order to inform their respective local plans. Although the methodology used in these studies and the Colchester modelling project does differ, there is consistency in the assumptions for any developments on the borders of these districts and the trip rates applied.

3 Development Scenarios

3.1 Overview

The year 2032 scenarios 0b and 1c have been developed to represent the updated committed and local plan assumptions:

- Scenario 0b (2032) – committed development;
- Scenario 1c (2032) – non-committed, preferred option local plan development.

3.2 Committed development scenario

The committed development scenario includes those developments contained in the current local plan and those developments which have been built out since the modelled base year (2007). This committed development scenario was modelled to provide a reference case scenario – Scenario 0b.

A full list of housing developments assumed for this scenario is contained in Appendix A. A total of 11,053 dwellings, 193,052sqm gross floor area (GFA) of employment and 49,400sqm (GFA) of retail space have been included in the committed development scenario.

3.3 Preferred Option Local Plan development scenario

A scenario which included all committed development plus the preferred option local plan development was modelled as the test case – Scenario 1c.

A full list of developments is in Appendix A. A total of 10,268 dwellings, 30,750sqm (GFA) employment and 13,860sqm (GFA) retail, in addition to committed development, have been included.

3.4 Development summary

The total amount of local plan development in each scenario is summarised below in Table 1:

Table 1 Local Plan development summary

Scenario	Dwellings	Employment (sqm)	Retail (sqm)
Scenario 0b	11053	193052	49400
Scenario 1c	21321	223802	63260

Note that alongside these development increases, TEMPro growth was used to set the background growth in dwellings and employment (including retail sites).

The housing assumption for local plan scenario is also identified in Appendix A.

4 Modelling Methodology

4.1 Model Used

The transport model used for this assessment was derived from the original assessment commissioned by ECC in June 2015.

The proposed A133/A120 link road has been included in the local plan scenario with one junction in the middle connecting to the garden community development.

Some of the larger local plan developments have been modelled with new, separate zones. These zones have their own access points onto the network, reflecting the access arrangements for the specific development. Therefore, the total number of zones has increased to 265.

4.2 Demand Calculation

Although the same demand calculation methodology was used as in the previous phases on the Colchester modelling project, different adjustments were applied to the TEMPro NTEM v6.2 database due to a different quantum of development in the preferred option local plan scenario. The total level of growth in scenario 1c remains consistent with NTEM forecasts discounting the modelled developments. In scenario 0b the background growth is assumed the same as 1c, thus the only difference is the local plan growth.

4.3 Variable Demand Model

A variable demand model (VDM) was developed to assess the demand response to changes in highway travel time between the test scenario and the current allocated development scenario. The premise of a VDM is that any change in travel cost, through traffic intervention or changes in travel demand, is liable to either induce or suppress traffic. Therefore as traffic is added to the network from the local plan developments, with the result that travel time increases, this will impact on travel behaviour. Some trips may not be made at that time, be made by another mode or not be made at all.

Any changes in travel demand, will in turn affect travel times, which will consequentially affect travel demand again. The VDM model therefore follows an iterative process of modifying travel demand in response to changes in travel time. The model iterates until the changes in demand calculated from one iteration to the next are sufficiently small; this is termed ‘convergence’, and is measured by a statistic known as the ‘relative gap’, expressed as a percentage,

and often referred to as %GAP. Guidance (TAG Unit M2 – Paragraph 6.3.8) suggests that a relative gap (%GAP) under 0.1% is a favourable level of convergence. The %GAP values achieved in the scenario tests are provided in section 5.3.

4.4 Trips to and from development sites

4.4.1 Trip rates

Trip generation rates for developments included in the model were based on the standardised Essex countywide trip rates, in order to ensure consistency with other transport models and local plan assessments in the county. The trip rates used were calculated from TRICS data in each peak period. Housing trip rates are shown in Table 2.

Table 2 ECC trip rates for housing

	Trip rates/dwelling			
	AM Arrivals	AM Departures	PM Arrivals	PM Departures
Town Centre	0.04	0.09	0.09	0.07
Edge of Town Centre	0.10	0.21	0.20	0.16
Suburban Area	0.10	0.29	0.28	0.14
Edge of Town	0.13	0.33	0.33	0.16
Neighbourhood Centre	0.07	0.33	0.36	0.18

For employment and retail land uses the trip rates shown in Table 3 to Table 7 below were used. In these cases trip rates are differentiated by land use category and, for some employment classes, location.

Table 3 ECC employment and retail trip rates

	AM		PM	
	ARR	DEP	ARR	DEP
A1 / 100 sqm	1.35	0.88	2.02	2.10
A3 / 100 sqm	0.47	0.41	3.05	2.22
A4 / 100 sqm	0.47	0.41	3.05	2.22
B1 / 100 sqm	1.60	0.19	0.21	1.25
B2 / 100 sqm	0.54	0.20	0.17	0.56
B8 / 100 sqm	0.22	0.10	0.12	0.22
C1 / 100 sqm	0.16	0.22	0.76	0.44
D2 / 100 sm	6.99	1.61	13.98	10.75
A1S / 100 sqm	3.36	2.17	5.89	6.70

Table 4 Trip rates for (E)O land use

B1 (E)O	(Employment) Office	AM Arr	AM Dep	PM Arr	PM Dep
Town Centre / 100 sqm		0.50	0.05	0.07	0.52
Edge of Town Centre / 100 sqm		1.81	0.25	0.24	1.76
Suburban Area / 100 sqm		2.27	0.28	0.16	1.73
Edge of Town / 100 sqm		1.48	0.14	0.07	1.42
Rural / 100 sqm		-	-	-	-

Table 5 Trip rates for (E)IE land use

B2 (E)IE	(Employment) Industrial Estate	AM Arr	AM Dep	PM Arr	PM Dep
Town Centre / 100 sqm		-	-	-	-
Edge of Town Centre / 100 sqm		0.13	0.07	0.20	0.19
Suburban Area / 100 sqm		0.51	0.24	0.15	0.41
Edge of Town / 100 sqm		0.41	0.31	0.12	0.40
Rural / 100 sqm		-	-	-	-

Table 6 Trip rates for (E)WC land use

B8 (E)WC	(Employment) Warehousing Combined	AM Arr	AM Dep	PM Arr	PM Dep
Town Centre / 100 sqm		-	-	-	-
Edge of Town Centre / 100 sqm		0.12	0.05	0.06	0.21
Suburban Area / 100 sqm		0.08	0.11	0.04	0.15
Edge of Town / 100 sqm		0.11	0.07	0.04	0.08
Rural / 100 sqm		-	-	-	-

Table 7 Trip rates for (Re)RP-EF land use

(Re)RP-EF	(Retail) Retail Park Excluding Food	AM Arr	AM Dep	PM Arr	PM Dep
Town Centre / 100 sqm		-	-	-	-
Edge of Town Centre / 100 sqm		-	-	-	-
Suburban Area / 100 sqm		0.15	0.04	0.14	0.13
Edge of Town / 100 sqm		-	-	-	-
Rural/ 100 sqm		-	-	-	-

4.4.2 Total origins and destinations by local plan development zones

Table 8 shows the total arrivals and departures for each preferred option local plan development site.

Table 8 Total arrivals and departures to local development sites

			AM				PM			
			Pre VDM		After VDM		Pre VDM		After VDM	
Saturn zone	Description	Classification	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures
1,705	Tiptree	Edge of Town	82	200	81	202	198	96	196	98
1,706	West Mersea	Edge of Town	27	67	27	66	66	32	65	32
1,603	Wivenhoe	Suburban Area	31	79	31	83	75	38	72	47
1,814	Colchester Tendring Borders Garden Settlement	Suburban Area	314	785	295	760	753	379	701	444
602	East Colchester & Welshwood Park	Suburban Area	109	141	112	142	138	69	140	69
603	East Colchester by Cyrus Road	Suburban Area	71	314	72	312	222	84	224	84
407	East Colchester & Land north of Bromley Road	Suburban Area	154	132	155	135	82	65	82	59
1,712	Langham & Dedham	Edge of Town	577	686	581	695	482	394	480	392
1,711	Great Horkesley, Boxted & Worrmingford	Edge of Town	1,000	1,479	999	1,471	1,280	867	1,286	873
1,719	Colchester Braintree borders Garden Settlement	Suburban Area	303	795	296	800	781	384	775	399
1,710	West Bergholt	Edge of Town	374	888	376	879	666	435	679	444
1,709	Eight Ash Green	Edge of Town	300	708	299	707	437	305	435	305
1,003	Stanway	Suburban Area	89	239	89	238	233	118	230	119
524	Northern Gateway	Suburban Area	33	92	32	92	90	43	89	44
1,307	Middlewick Ranges	Suburban Area	107	301	107	310	278	142	272	134
1,101	Gosbecks Phase 2	Suburban Area	159	366	158	364	177	50	177	50
1,107	Land South of Berechurch Hall Road	Suburban Area	66	79	65	79	77	92	77	91
501	North Colchester (Braiswick)	Suburban Area	315	429	319	425	295	256	295	256
317	Magdalen Street sites	Town Centre	17	42	17	42	43	22	45	21
418	Hythe Special Policy Area	Edge of Town Centre	32	71	33	80	69	48	65	49
301	Port Lane	Edge of Town Centre	251	109	249	108	117	220	120	215
902	Chitts Hill Stanway (Railway Sidings)	Suburban Area	148	263	150	261	264	166	264	164
1,701	Abberton	Edge of Town	560	609	544	596	411	276	406	266
1,713	Chappel and Wakes Colne	Edge of Town	429	739	431	730	529	337	524	335
1,711	Fordham	Edge of Town	1,000	1,479	999	1,471	1,280	867	1,286	873
1,713	Great Tey	Edge of Town	429	739	431	730	529	337	524	335
1,703	Layer de la Haye	Edge of Town	532	671	533	660	428	312	429	308
1,502	Rowhedge	Edge of Town	121	180	118	175	291	92	276	88
1,815	Employment site by Colchester Tendring Borders Garden Settlement	Suburban Area	233	37	219	37	28	182	26	194
1,717	Employment site by Colchester Braintree borders Garden Settlement	Suburban Area	241	41	238	43	31	189	31	200

5 Results

5.1 Initial Demand

The trip totals in Passenger Car Units (PCUs) across base year, committed and local plan scenarios are summarised below in Table 9. The table includes intra-zonal trips in the total.

Table 9 Full development NTEM adjustment

Scenario	Time period	Year	No of trips	Increase from base	Increase from 0b
Base year	AM	2007	42535	n/a	n/a
Scenario 0b		2032	55451	12916	n/a
Scenario 1c			58700	16164	3248
Base year	PM	2007	39234	n/a	n/a
Scenario 0b		2032	51896	12661	n/a
Scenario 1c			55034	15799	3138

In both AM and PM peak hours, approximately 3,000 additional trips are generated as a result of the local plan developments in scenario 1c compared to scenario 0b. Over 12,500 additional trips are generated due to the already committed developments in both AM and PM peaks compared with the base year and about 16,000 trips if local plan developments are delivered.

5.2 Assignment of initial demand

The matrices referred to in the previous section were assigned to the model networks for each scenario. The assignment results prior to running VDM are detailed below.

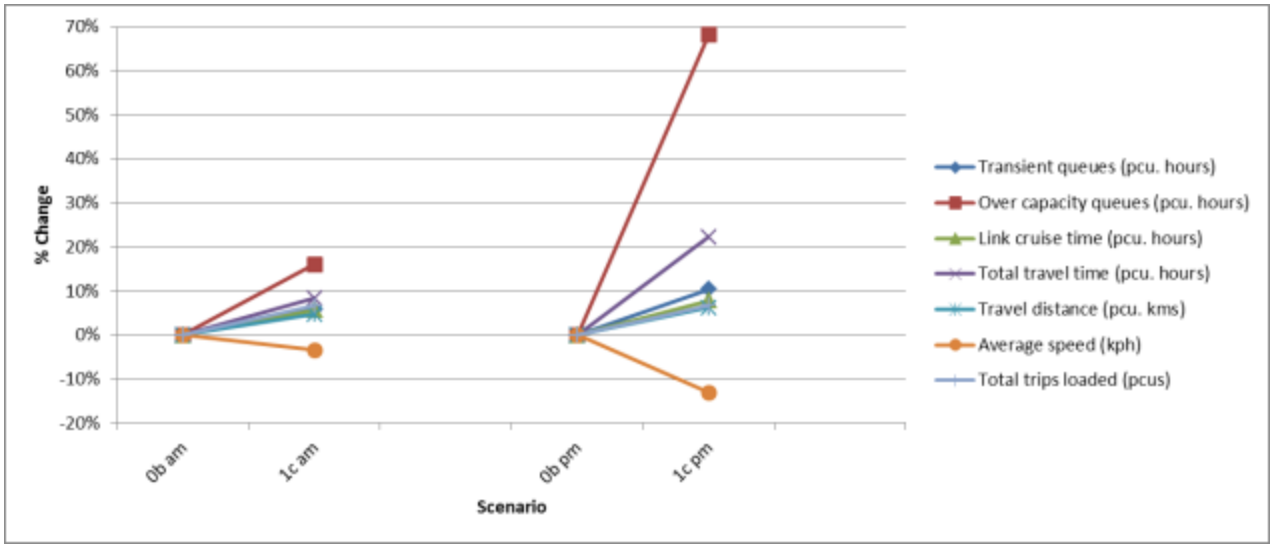
The standard SATURN assignment summary statistics for scenarios 0b and 1c are given in Table 10.

Table 10 Summary statistics for initial assignment scenarios 0b-1c

Attribute	AM		PM	
	0b	1c	0b	1c
Transient queues (pcu.hrs)	2,249	2,378	2,260	2,496
Overcapacity queues (pcu.hrs)	6,060	7,032	5,216	8,772
Link cruise time (pcu.hrs)	15,055	15,912	14,711	15,859
Total travel time (pcu.hrs)	23,365	25,322	22,187	27,126
Travel distance (pcu.kms)	987,209	1,033,434	986,182	1,047,989
Average speed (kph)	42	41	44	39
Total trips loaded (pcus)	52,730	56,208	49,481	52,824

Figure 1 displays the percentage change in summary statistics, for scenario 1c when compared against scenario 0b for the initial assignment.

Figure 1 % change in Summary Statistics compared to Current Allocated Development Scenario for the initial assignment scenario 1c



In scenario 1c average speed decreased by 1kph in the AM peak and 5kph in the PM peak compared to scenario 0b. Similarly there is less increase in the delay from overcapacity queues in the AM peak relative to the PM peak when the scenarios are compared. It should be noted, however, that scenario 0b does not include the proposed A120-A133 link road.

5.3 Demand Model Outputs

The variable demand model, described in Section 3.3 was utilised for scenario 1c. Given the levels of congestion described in the initial assignments, over and above the committed development reference case, some switching of trips away from the highway is likely.

The number of iterations, and the final relative gap between demand and assignment matrices (%GAP value) for each scenario, is summarised in Table 11.

Table 11 Demand model convergence

Scenarios	Time period	Number of Iterations	Final % GAP
Scenario 1c	AM	10	0.066
	PM	15	0.074

For all scenarios, the %GAP value is below 0.1%, which is considered an acceptable level of convergence. Note that the PM peak required more iterations than the AM peak in order to converge.

5.4 Assignment of final demand

The effect of the variable demand model is to forecast the change in highway trip generation as a result of transfer to alternative modes, and changes in trip frequency (including peak spreading) as a result of increased highway congestion relative to other modes of travel. With the reduction in highway trips predicted by the demand model, the finalised matrices were assigned to the network to derive the final assessment of the impact of development.

The overall network statistics from the final, post variable demand assignments for scenarios 0b and 1c are summarised in Table 12.

Table 12 Summary statistics for final assignment scenarios 0b-1c

Attribute	AM		PM	
	0b	1c	0b	1c
Transient queues (pcu.hrs)	2,249	2,347	2,260	2,348
Overcapacity queues (pcu.hrs)	6,060	6,450	5,216	5,156
Link cruise time (pcu.hrs)	15,055	15,833	14,711	15,683
Total travel time (pcu.hrs)	23,365	24,629	22,187	23,188
Travel distance (pcu.kms)	987,209	1,025,680	986,182	1,026,520
Average speed (kph)	42	42	44	44
Total trips loaded (pcus)	52,730	55,988	49,481	52,469

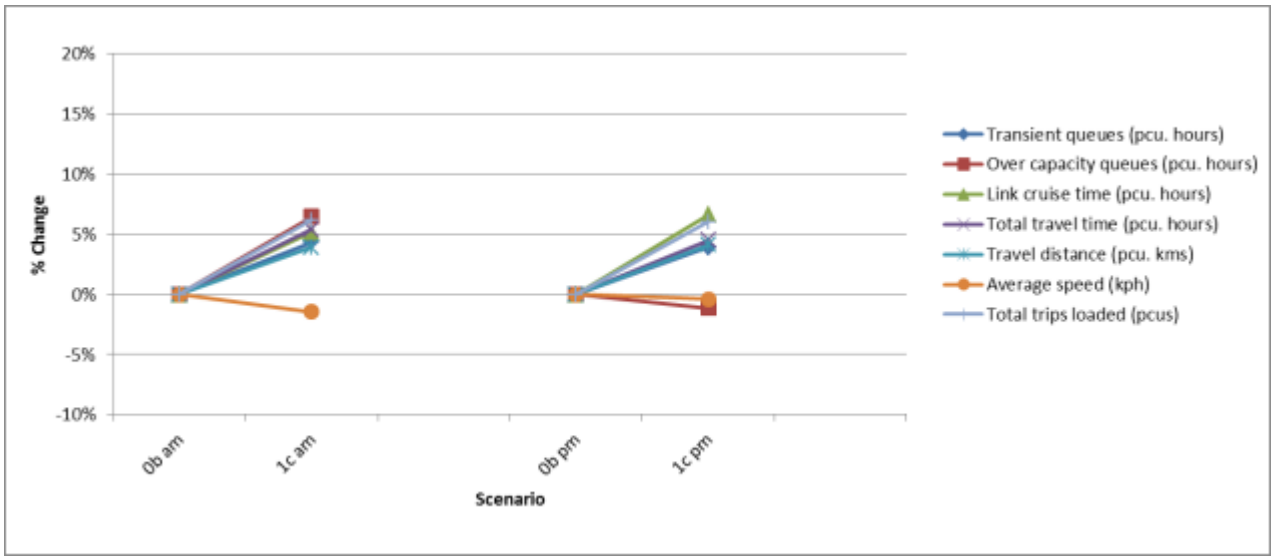
Through the variable demand modelling process, the highway demand was reduced based on the level of network congestion. In the AM peak, 220 trips were removed from scenario 1c and in the PM, 356 trips were removed. Table 13 shows the network statistics differences between the initial and final VDM assignments.

Table 13 Difference between initial and final assignments for scenarios 0b-1c

Attribute	AM		PM	
	0b	1c	0b	1c
Transient queues (pcu.hrs)	0	-32	0	-147
Overcapacity queues (pcu.hrs)	0	-582	0	-3,616
Link cruise time (pcu.hrs)	0	-79	0	-176
Total travel time (pcu.hrs)	0	-693	0	-3,939
Travel distance (pcu.kms)	0	-7,754	0	-21,469
Average speed (kph)	0	1	0	6
Total trips loaded (pcus)	0	-220	0	-356

Figure 2 displays the percentage change in summary statistics, for scenario 1c, when compared against Scenario 0b for the final assignment.

Figure 2 % change in Summary Statistics compared to Current Allocated Development Scenario for the final assignment scenarios 0b-1c



Following completion of the variable demand modelling, the resulting finalised assignments indicate that the overall impacts of Scenario 1c still have the effect of reducing network average speeds by a small amount, and increasing congestion, when compared with Scenario 0b.

6 Link and Junction Analysis

6.1 Link Analysis

In the Colchester area model there are 5,314 links in scenario 0b and 5,341 links in scenario 1c. For the link analysis all links with traffic volume in excess of capacity were analysed. In scenario 0b, 87 links are operating above capacity in the AM peak and 80 in the PM peak while in scenario 1c there are 96 links performing overcapacity in the AM peak and 88 in the PM peak. The locations of the links are highlighted in red in Figures 3 - 6 below.

It should be noted that the figures below highlight only links that are forecast as overcapacity and not the areas of network that may experience congestion related to other factors such as junction delay. For the local plan development scenario, the links which become overcapacity in the AM and PM peaks, in addition to those in the committed development scenario, are mainly located on the A12 between Junctions 28 and 29.

Figure 3 Locations of Overcapacity Links Scenario 0b – AM

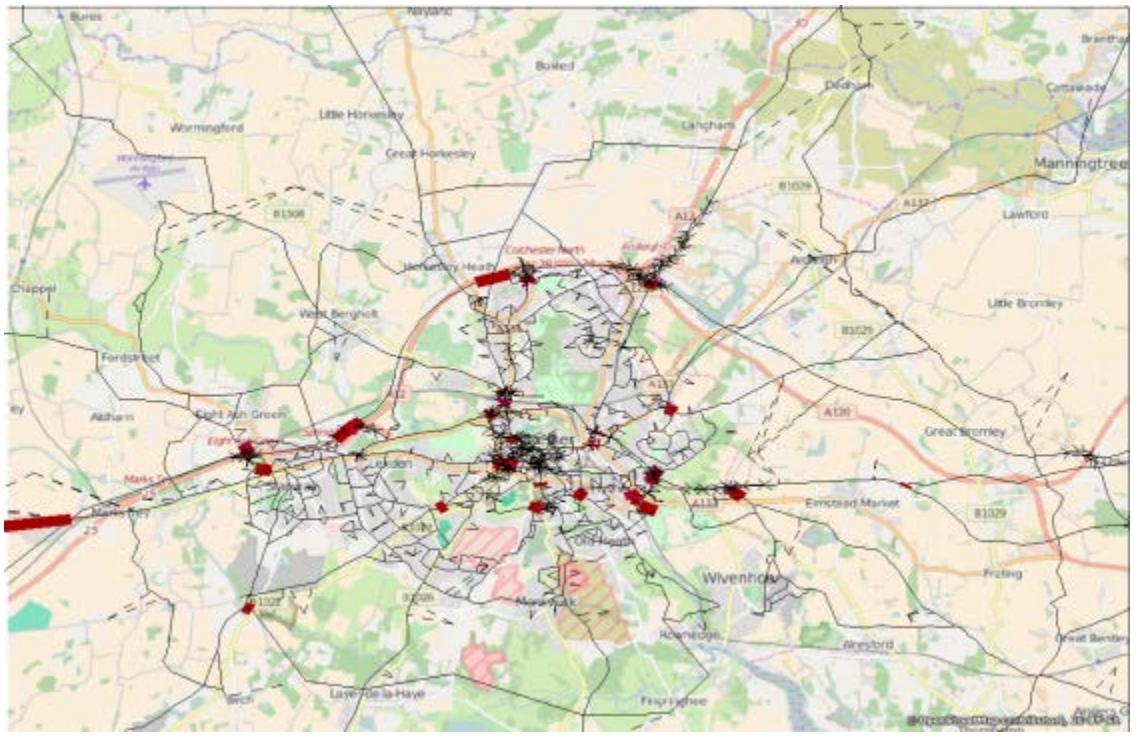


Figure 4 Locations of Overcapacity Links Scenario 1c Post-VDM – AM

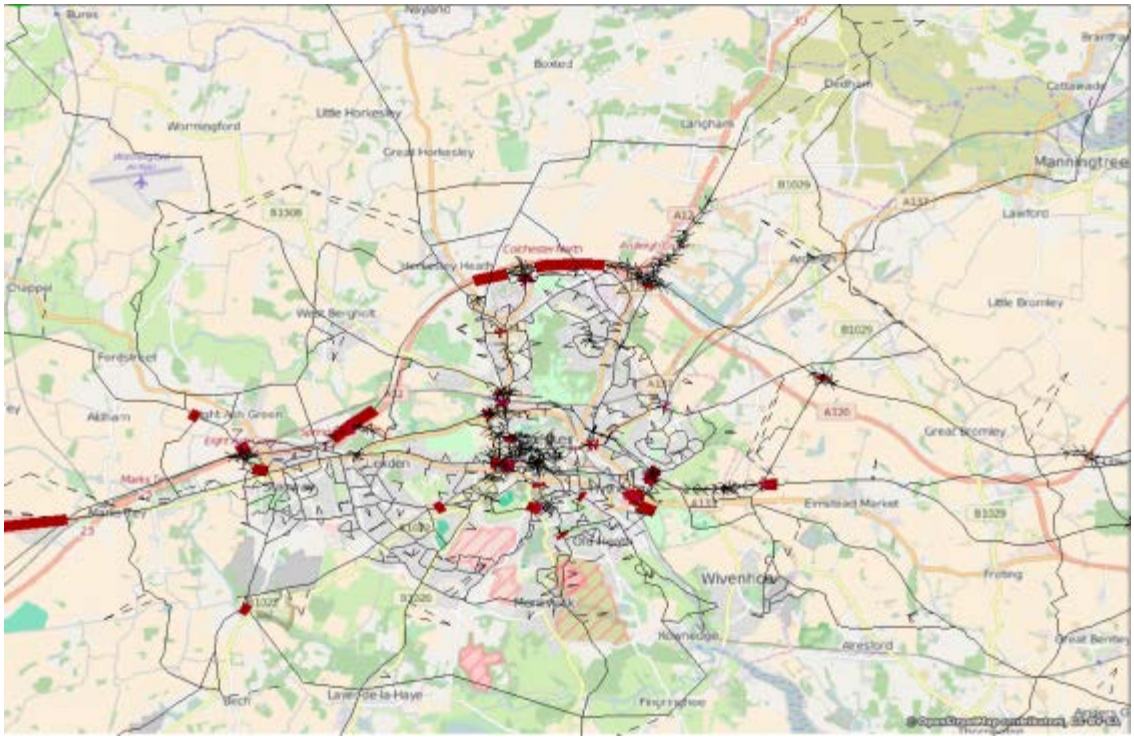


Figure 5 Locations of Overcapacity Links Scenario 0b – PM

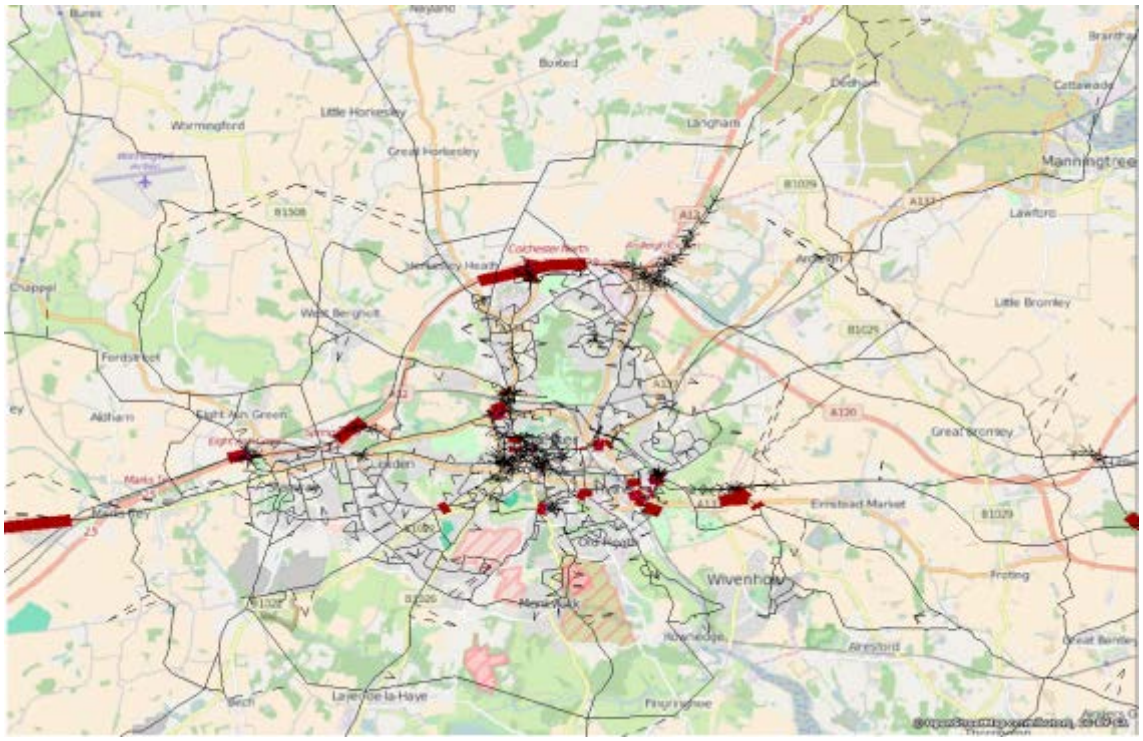
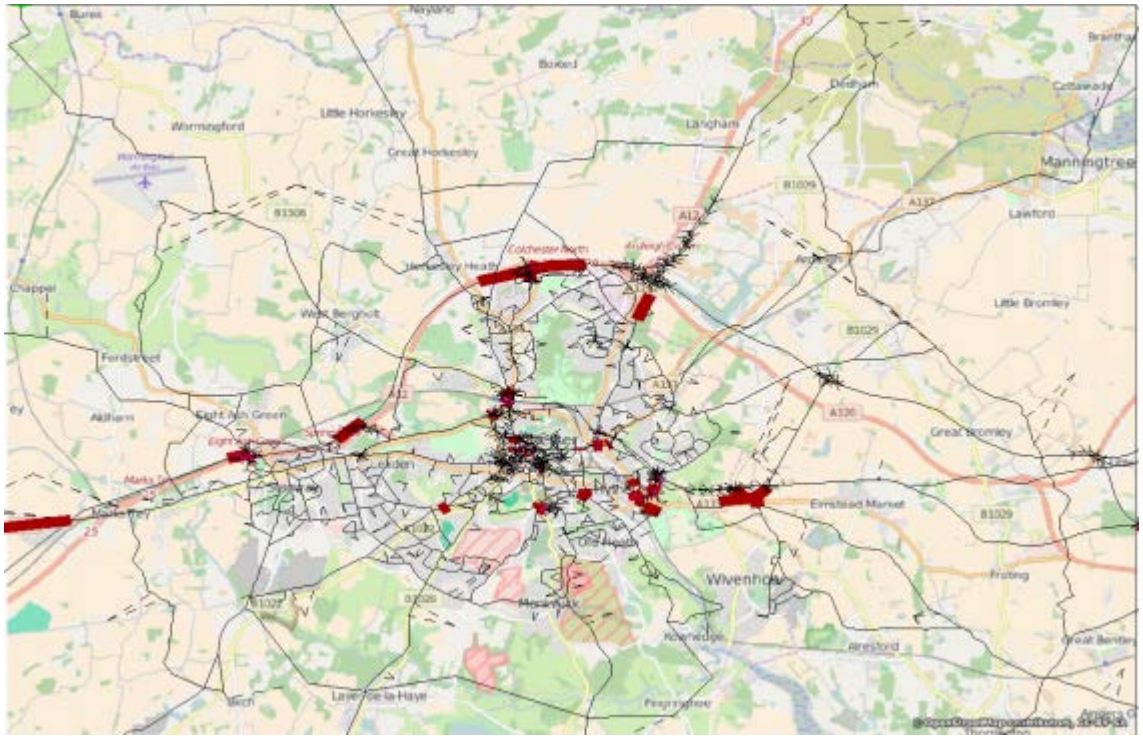


Figure 6 Locations of Overcapacity Links Scenario 1c Post-VDM – PM



It is notable in scenario 1c in both the AM and PM peaks that the proposed A120/A133 link road connectors to the network are modelled as being

overcapacity. However, the model loads all trips from the 2,500 dwellings in Colchester Tendring Borders Garden Settlement onto the link road when in reality there might be other access points of the development on to the network. The link is modelled as a 40mph single carriageway link with a junction at each end and an intermediate development access.

6.2 Junction Analysis

In addition to capacity issues on links, congestion often occurs at junctions where the flow of traffic is constrained. Junction congestion is not shown in the images above, and would occur in addition to the link capacity issues. The analysis of average volume / capacity (v/c) and delay among all the approaches to a junction and the analysis of maximum v/c and delay among all the approaches to a junction have been carried out.

In the Colchester Area model, there are 2,561 junctions within the model simulation area in scenario 0b and 2,574 junctions within the model simulation area in scenario 1c. Within Colchester town, the locations of over-capacity junctions (based on average v/c among all turns) in the committed scenario and the local plan development scenario are shown in Figures 7-8 and 9-10. The locations of junctions outside of Colchester which are overcapacity are illustrated in Figure 11 and Figure 12.

In scenario 0b, there are 15 junctions in total across the model (some within Colchester town, and some in the wider area) operating in excess of capacity; while in scenario 1c there are 18 junctions operating overcapacity in the AM peak and 16 in the PM peak, based on the average for all turns at the junction. The figures indicate junctions that may experience capacity issues as a result of additional land use development.

Figure 7 Locations of Overcapacity Junctions Scenario 0b – AM

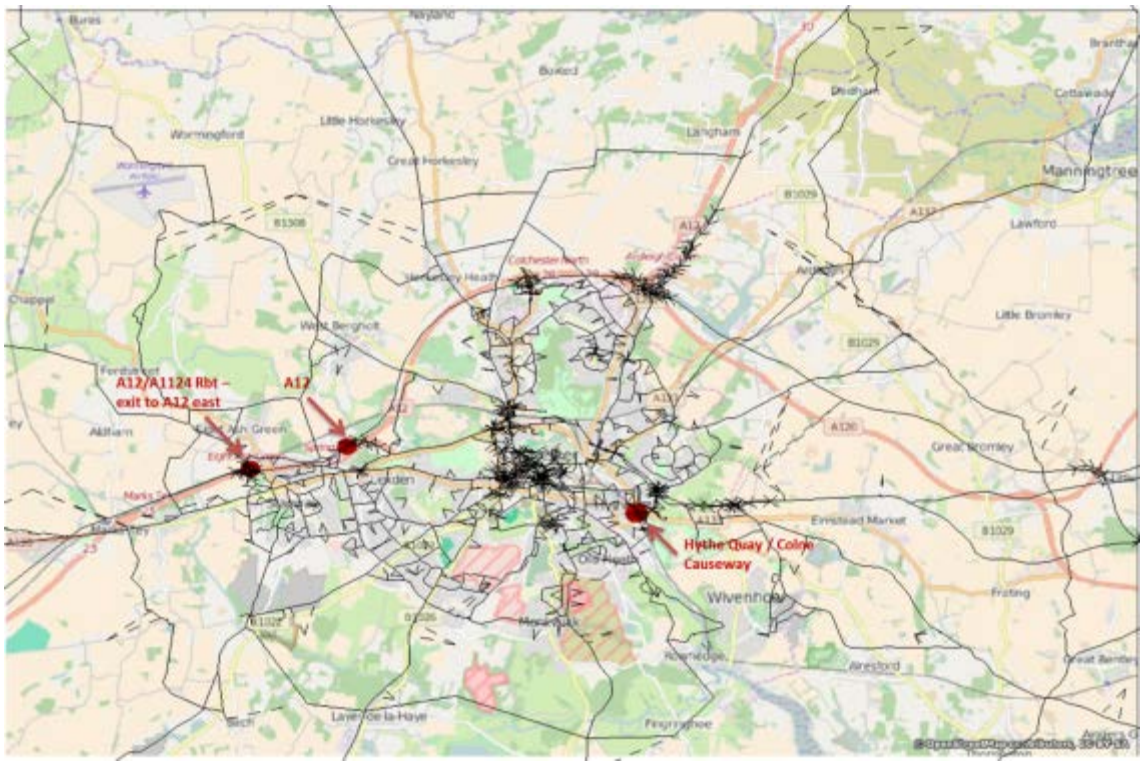


Figure 8 Locations of Overcapacity Junctions Scenario 1c Post-VDM – AM

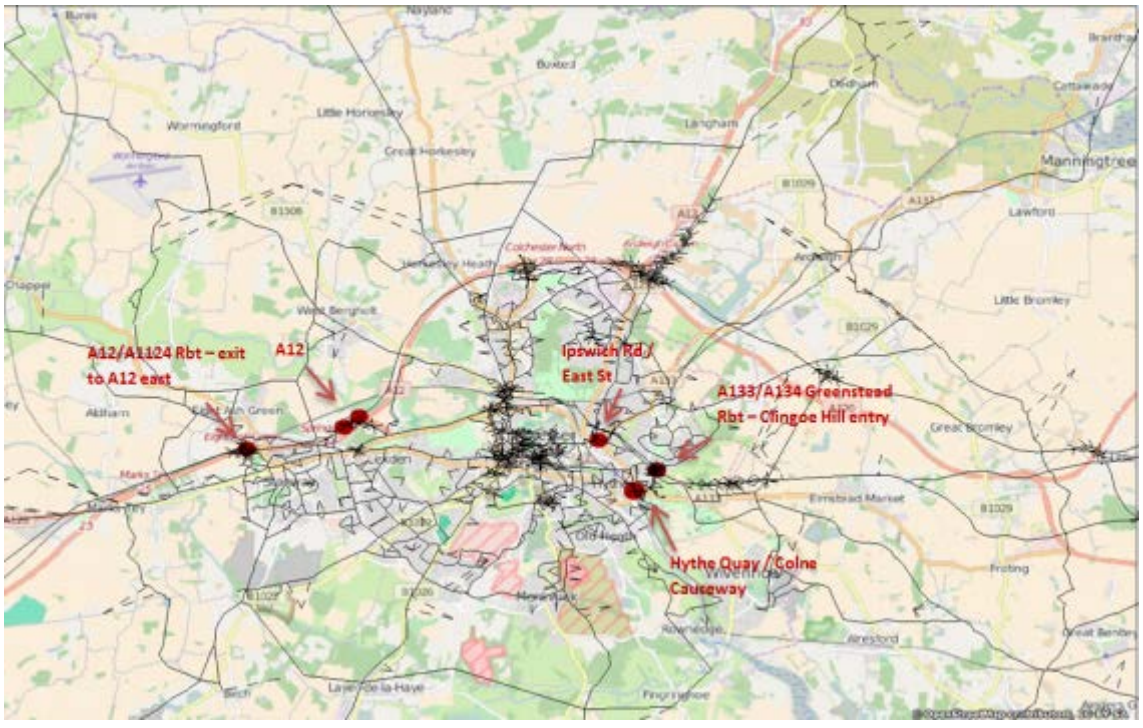


Figure 9 Locations of Overcapacity Junctions Scenario 0b – PM

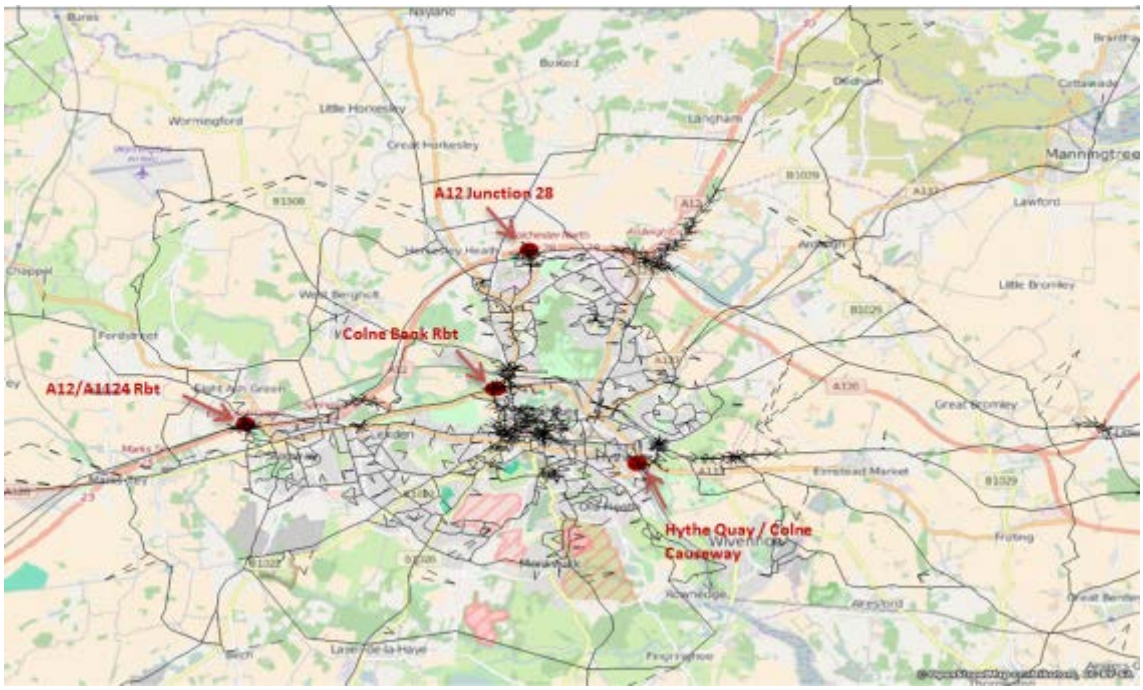
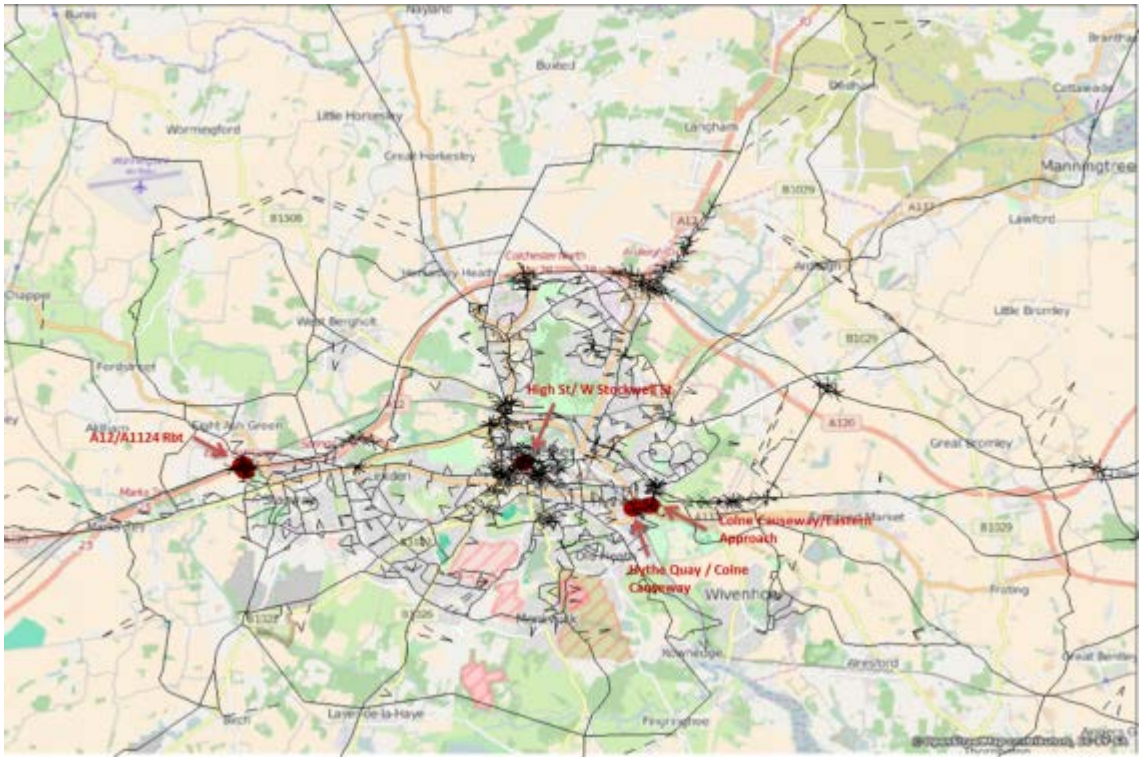


Figure 10 Locations of Overcapacity Junctions Scenario 1c Post-VDM – PM



In addition to the junctions shown above, a number of junctions located along the A120 west of Colchester are also operating overcapacity, which is common to all scenarios. They are displayed in Figures 11 and 12.

Figure 11 Overcapacity Junctions A120 West of Colchester - 1c Post-VDM AM

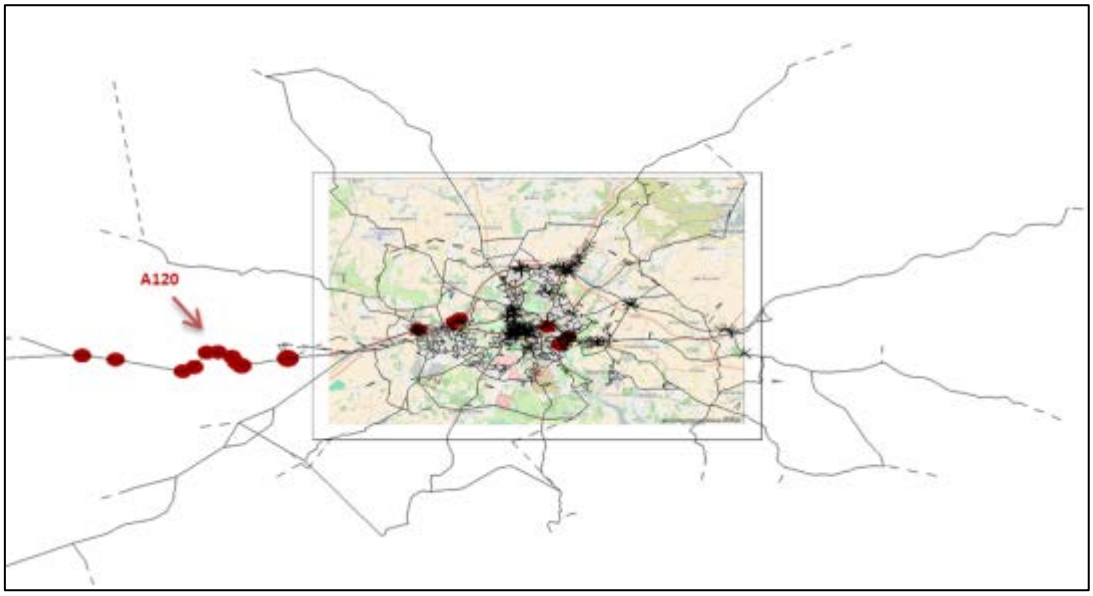
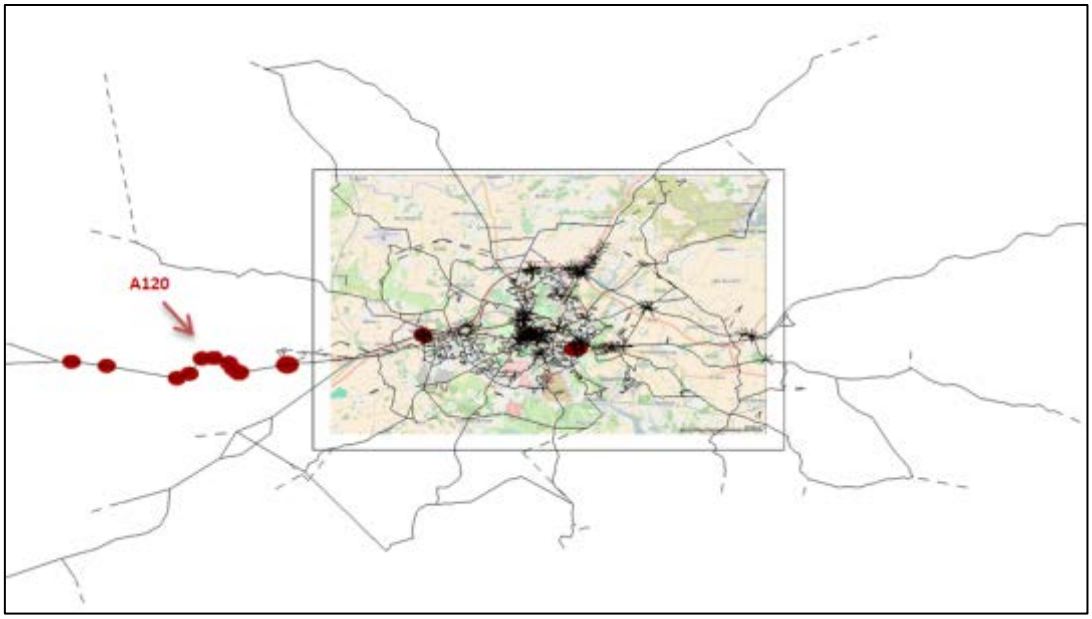


Figure 12 Overcapacity Junctions A120 West of Colchester - 1c Post-VDM PM



A list of overcapacity junctions (based on maximum v/c among all turns) in the committed scenario and the local plan development scenario is contained in Appendix B. In scenario 0b, using the maximum v/c indicator, 79 turning movements at junctions have been identified as operating in excess of capacity in the AM peak and 65 in the PM peak; while in scenario 1c there are 90 turning movements operating overcapacity in the AM peak and 73 in the PM peak.

Of note are junctions along the A12 which suffer increased congestion in the local plan scenario. This is a result of the additional demand, and the new A120-A133 link road which facilitates trips onto the A12.

7 Sensitivity testing

In transport modelling sensitivity testing is aimed at identifying the relative effects of selected parameters on the behaviour of a model. It is worthwhile considering changing parameters that have a substantial effect on the model's forecast; or parameters for which calibration is uncertain. Whilst this often means changing a parameter in the demand model, such as the value of time, any parameter that seems likely to have a substantial effect can be changed.

In the case of Colchester it was recognised that there is uncertainty over which schemes might be implemented by the forecast year, and whether the aspiration for sustainable travel at garden community developments would be realised. In scenarios 0b and 1c a series of reasonable assumptions were made to deal with this uncertainty. Aspects for which there was particular uncertainty were then altered in the sensitivity tests.

Four sensitivity tests have been carried out:

1. Widening the A12 to three lanes in both directions between junctions 25-29;
2. Removing signals at the roundabout at Junction 26 of the A12 since there is uncertainty around when plans to signalise the off ramps at this junction would be implemented;
3. Reducing the number of vehicle trips (reflecting a lower mode share by car) to and from the proposed garden community developments in order to reflect the aspiration that more sustainable transportation options will be an integral part of the design of these communities;
4. Adding the 'southern distributor scheme' to the model which links Warren Lane to Cunobelin Way in the Stanway area of Colchester.

In addition, in all sensitivity tests a centroid connector at a committed employment development adjacent to Nayland Road has been altered; and in sensitivity tests (2) to (4) Greenstead roundabout was changed to reflect an expected improvement scheme.

In this section of the report the model results from the sensitivity tests are compared with committed and local plan model findings. Table 14 below matches the model reference numbers used to a description of the scenario being tested.

Table 14 Summary of model scenarios for sensitivity testing

Scenario model reference	Description
0b	Committed growth
1c	Local Plan growth
1d	Sensitivity test – Local plan growth with A12 widening J25-29
1e	Sensitivity test – Local plan growth without A12 J26 improvements but with Greenstead Roundabout improvements
1f	Sensitivity test – Local plan growth with greater sustainable travel at Garden Community developments
1g	Sensitivity test – Local plan growth with the southern distributor and with Greenstead Roundabout improvements

7.1 Widening A12 between J25 and 29

This sensitivity test explores if capacity and delay problems are sensitive to increasing the capacity on the A12 between junctions 25 and 29.

The network was altered in order that the A12 was modelled with three lanes in each direction between junctions 25 and 29 as indicated in RIS. In the base model it has two lanes in each direction.

In addition it had been noticed that centroid 518 in the model, which represents an employment development on a golf course site adjacent to Nayland Road in the committed development scenario, had been linked to the network with multiple connectors towards the southern end of Nayland Road. This was altered to a single connector positioned on Nayland Road just north of the Boxted Road junction, which is a more accurate reflection of how such a development would be accessed.

The model was run for both the committed and preferred option scenarios. These scenarios were named 0c and 1d, respectively. Scenario 1d was also run using the variable demand model.

This report compares the outputs of preferred option 1c (without A12 widening) with preferred option 1d (with A12 widening) using the variable demand model. Further outputs and analysis are available.

As might be expected the summary statistics shown in Table 14 show small but overall network improvements for most measures.

Table 15 Summary statistics for final assignment scenarios 1c-1d

Attribute	AM		PM	
	1c	1d	1c	1d
Transient queues (pcu.hrs)	2,347	2,324	2,348	2,322
Overcapacity queues (pcu.hrs)	6,450	6,356	5,156	5,035
Link cruise time (pcu.hrs)	15,833	15,806	15,683	15,460
Total travel time (pcu.hrs)	24,629	24,487	23,188	22,817
Travel distance (pcu.kms)	1,025,680	1,029,259	1,026,520	1,022,327
Average speed (kph)	42	42	44	45
Total trips loaded (pcus)	55,988	56,044	52,469	52,189

The small scale of improvements can be more readily seen in Figure 13.

Figure 13 % change in summary statistics for scenarios 1c-1d

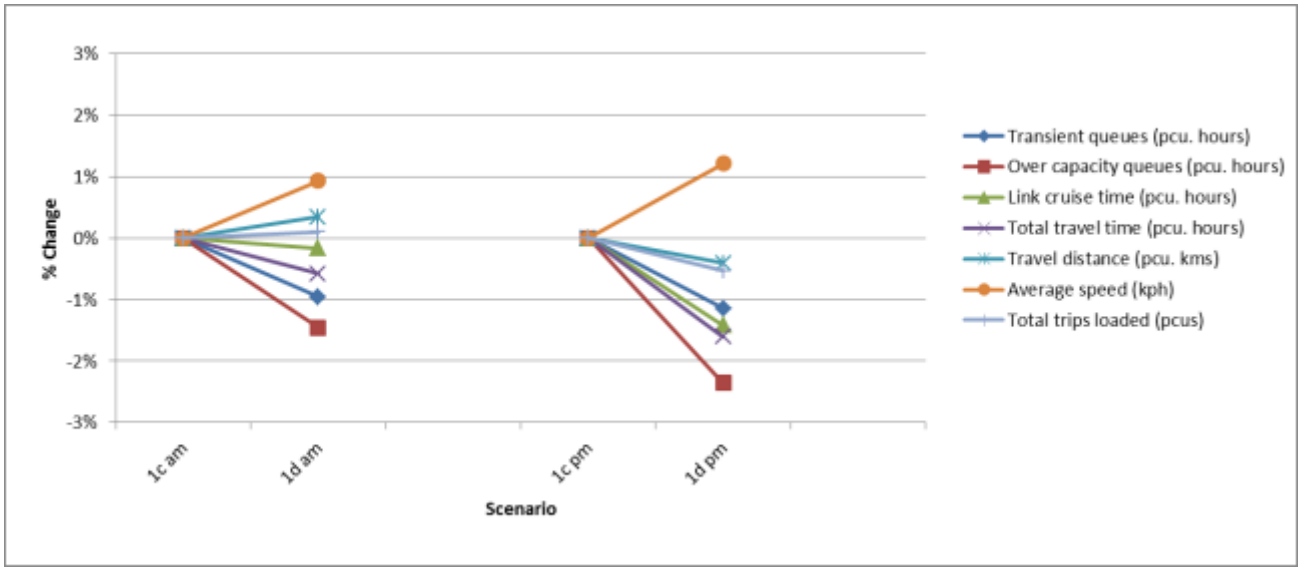


Figure 14 and Figure 15 below map the results of the link and junction analysis for scenario 1d. It can be seen that overcapacity issues and delays have been reduced on the A12, although remain on the junctions to the A12, which were not altered within the test.

Figure 14 Locations of Overcapacity Links and Junctions Scenario 1d Post-VDM – AM

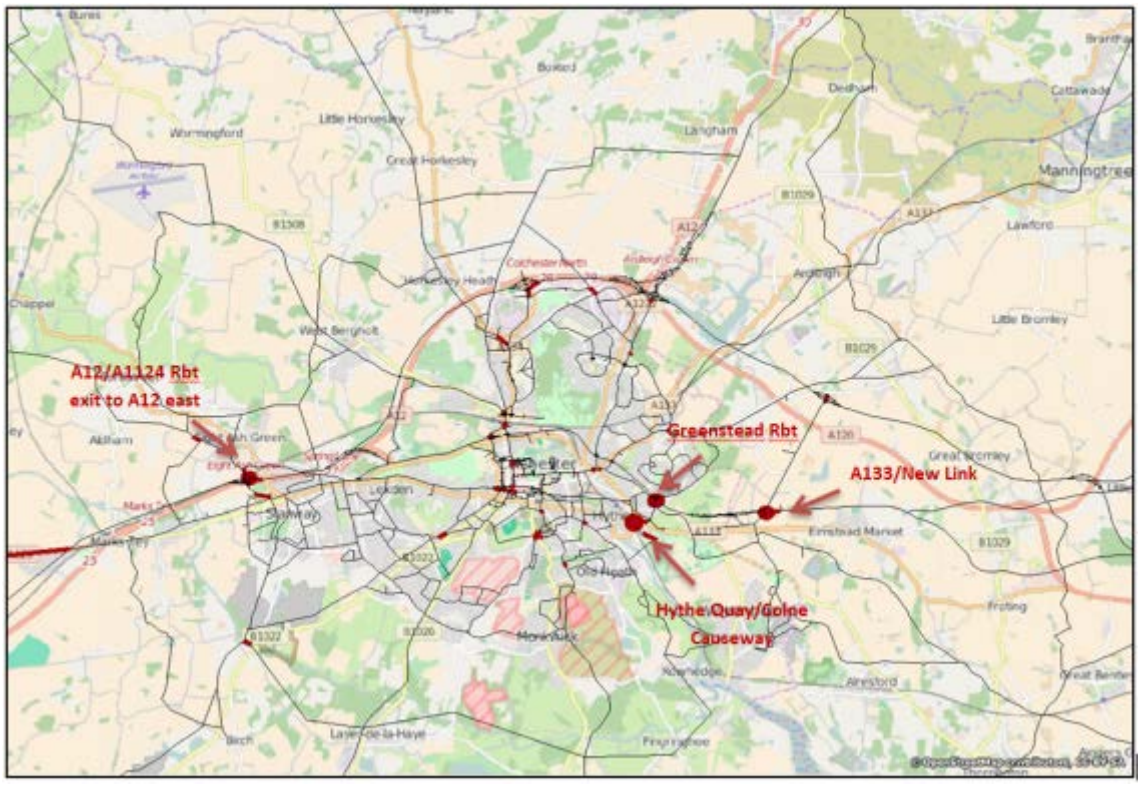
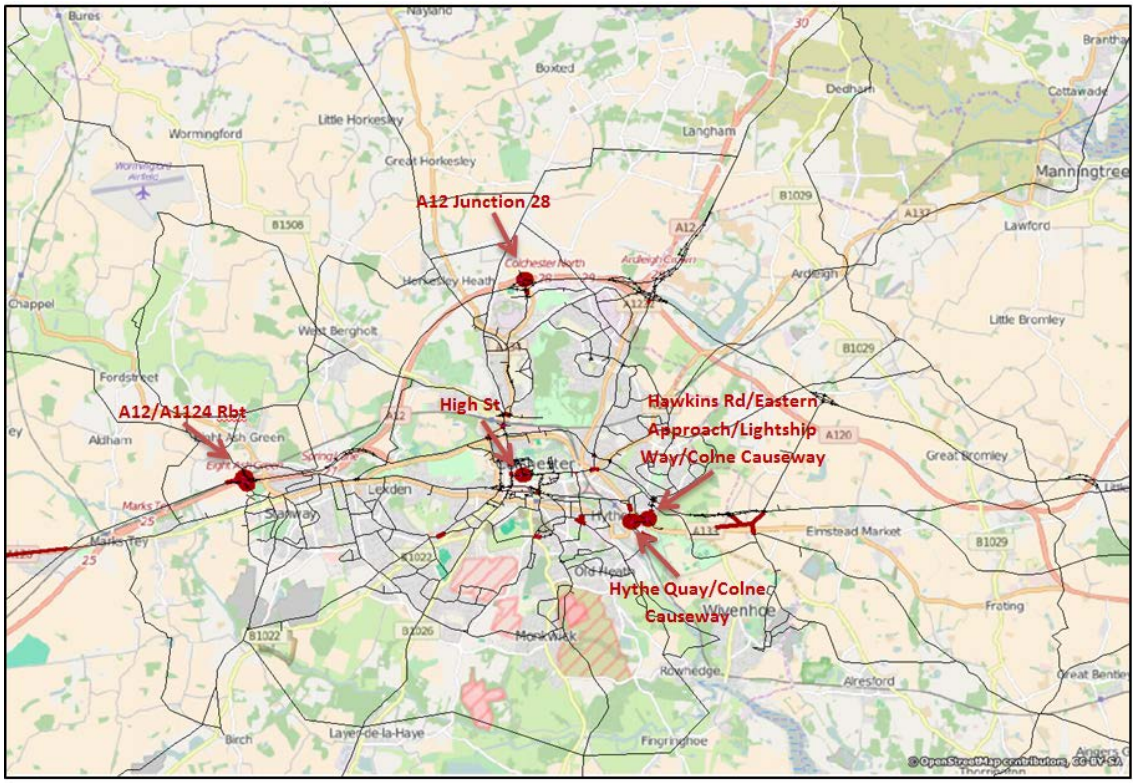


Figure 15 Locations of Overcapacity Links and Junctions Scenario 1d Post-VDM – PM



Based on the average for all turns at junctions, scenario 1d has 17 overcapacity junctions in both the AM and PM peaks – compared to 18 in the AM peak and 16 in the PM peak for scenario 1c.

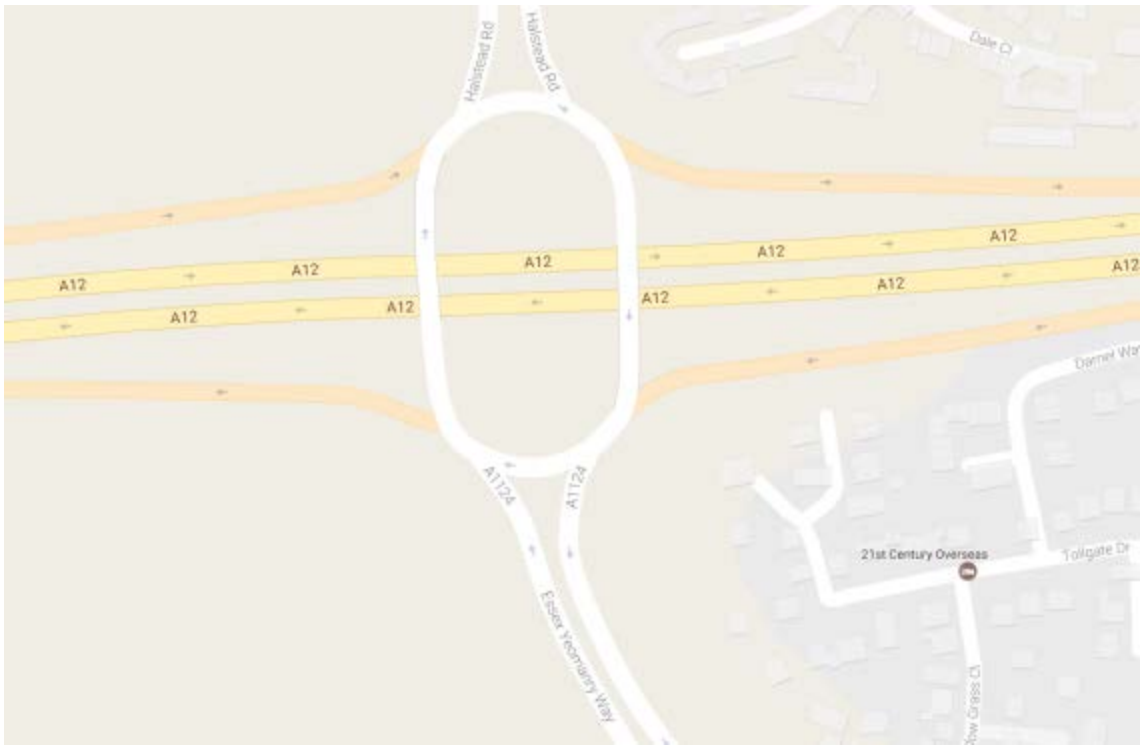
Based on the maximum volume/capacity ratio there are 81 junctions in the AM peak and 65 junctions in the PM peak overcapacity in scenario 1d, which compares to 90 and 73, respectively in scenario 1c.

The data for overcapacity junctions is shown in Appendix B where the capacity and delay measures for each junction can be compared across scenarios.

7.2 Junction 26 A12 and Greenstead roundabout

In the base network used for scenarios 0b and 1c, Junction 26 of the A12 was modelled with traffic signals controlling movements at the roundabout. This is based on a possible scheme for signalising the off ramps from the A12. However, since this is not a certain scheme the model was changed to represent J26 without signals, which is the current situation. J26 is shown in Figure 16.

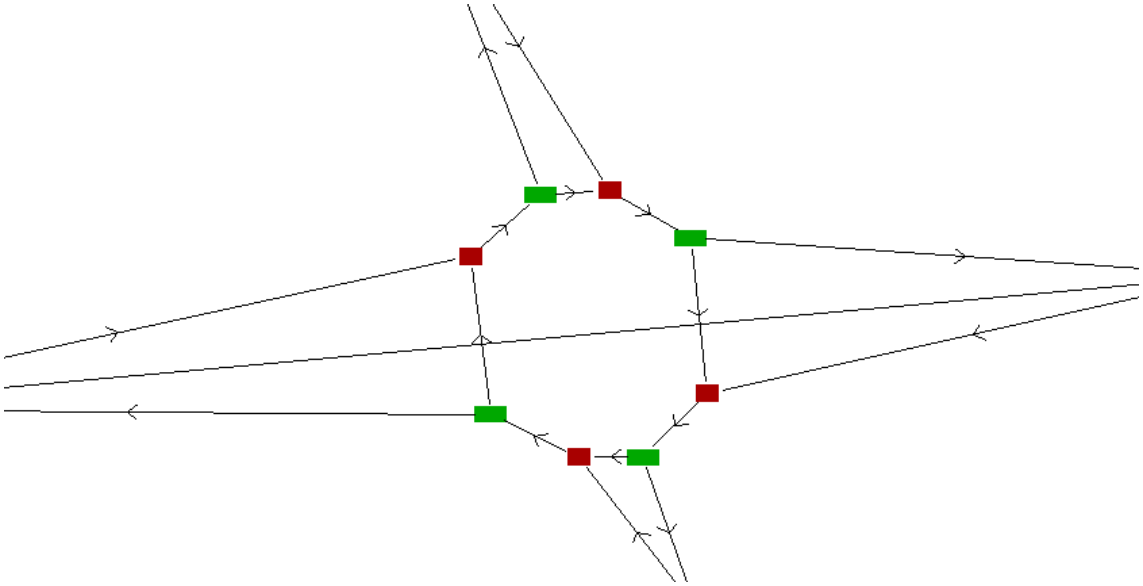
Figure 16 Junction 26 A12



Map data © 2017 Google

Meanwhile the position of the traffic signals in the base network, which were removed in this sensitivity test are shown in Figure 17 (as the red nodes)

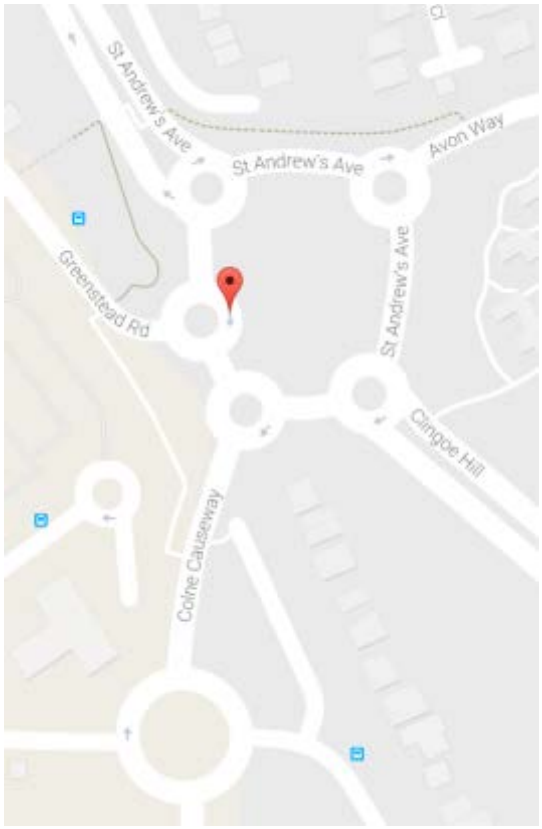
Figure 17 Traffic signal positions in the base model at Junction 26



It was also noted that a scheme at Greenstead roundabout, which will create extra lane space on some of the approaches, is expected to be implemented.

Hence Greenstead roundabout was altered to show this change. The road network is shown in Figure 18 and the extra lanes which were added to the model of the roundabout are illustrated in Figure 19. In particular, note the extra lane space on the approaches from the south along Colne Causeway and Clingoe Hill.

Figure 18 Map of Greenstead roundabout



Map data © 2017 Google

Figure 19 Changes at Greenstead roundabout

The centroid connector to zone 518 was kept as used in the previous sensitivity test as this only has a localised effect.

Hence this sensitivity test explores if capacity and delay problems are sensitive to retaining J26 without signals and noting that localised effects could arise from the Greenstead roundabout alteration and the zone 518 connector, when comparing with the existing model runs.

The model was run for both the committed and preferred option scenarios. These scenarios were named 0d and 1e, respectively. Scenario 1e was also run using the variable demand model.

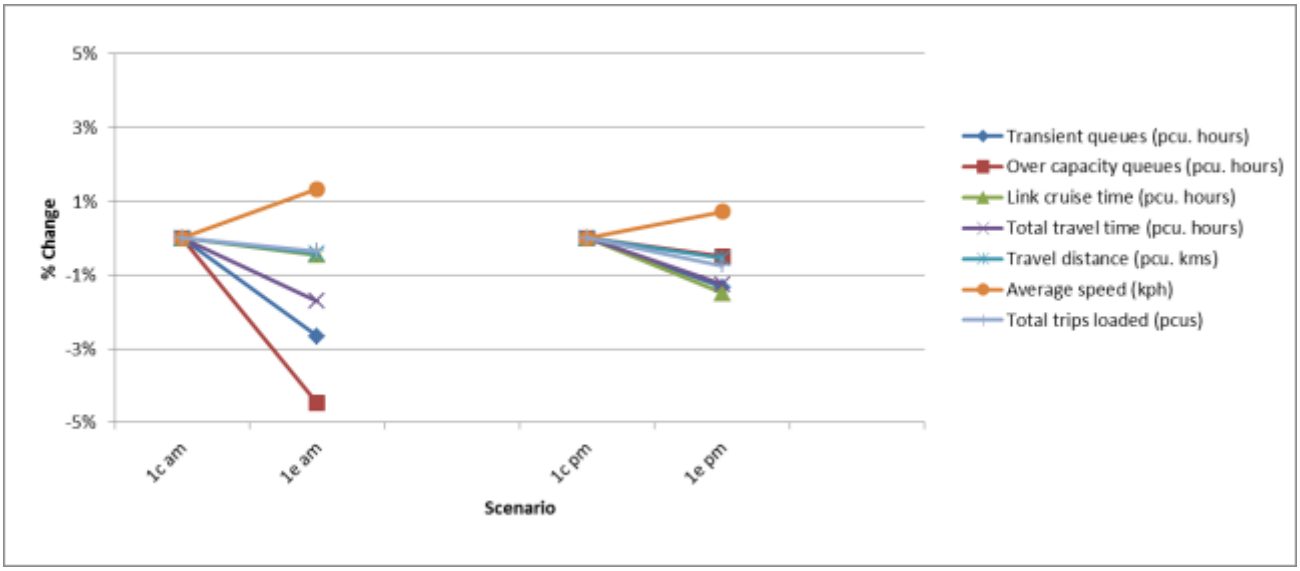
Table 15 and the accompanying illustration in

Figure 20 shows that this scenario results in nearly a 5% reduction in overcapacity queues in the AM peak. There is less effect in the PM peak.

Table 16 Summary statistics for final assignment scenarios 1c-1e

Attribute	AM		PM	
	1c	1e	1c	1e
Transient queues (pcu.hrs)	2,347	2,284	2,348	2,317
Overcapacity queues (pcu.hrs)	6,450	6,162	5,156	5,131
Link cruise time (pcu.hrs)	15,833	15,761	15,683	15,450
Total travel time (pcu.hrs)	24,629	24,207	23,188	22,899
Travel distance (pcu.kms)	1,025,680	1,021,477	1,026,520	1,020,954
Average speed (kph)	42	42	44	45
Total trips loaded (pcus)	55,988	55,794	52,469	52,079

Figure 20 % change in summary statistics for scenarios 1c-1e



As the following analysis shows, the improvements in network performance results, in the main, from improvements at Greenstead roundabout. Existing congestion problems can be seen to remain at Junction 26.

Figure 21 and Figure 22 below map the results of the link and junction analysis for scenario 1e.

Figure 21 Overcapacity Links and Junctions Scenario 1e Post-VDM – AM

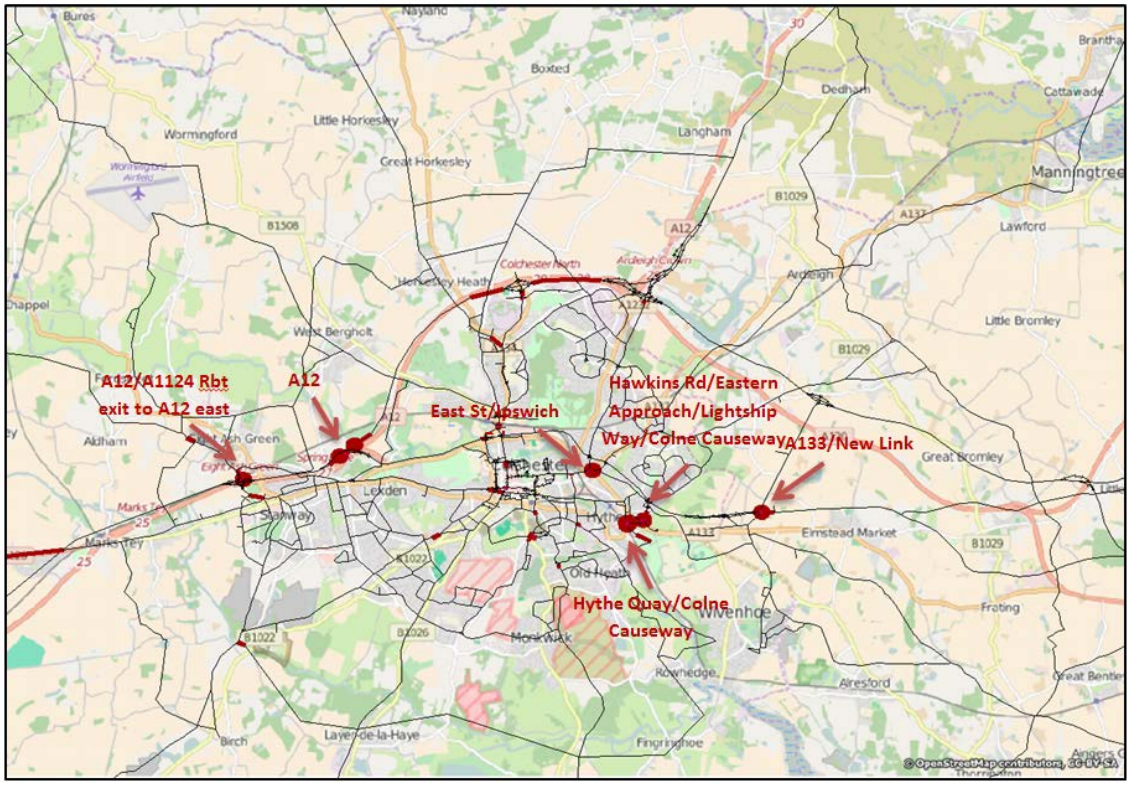
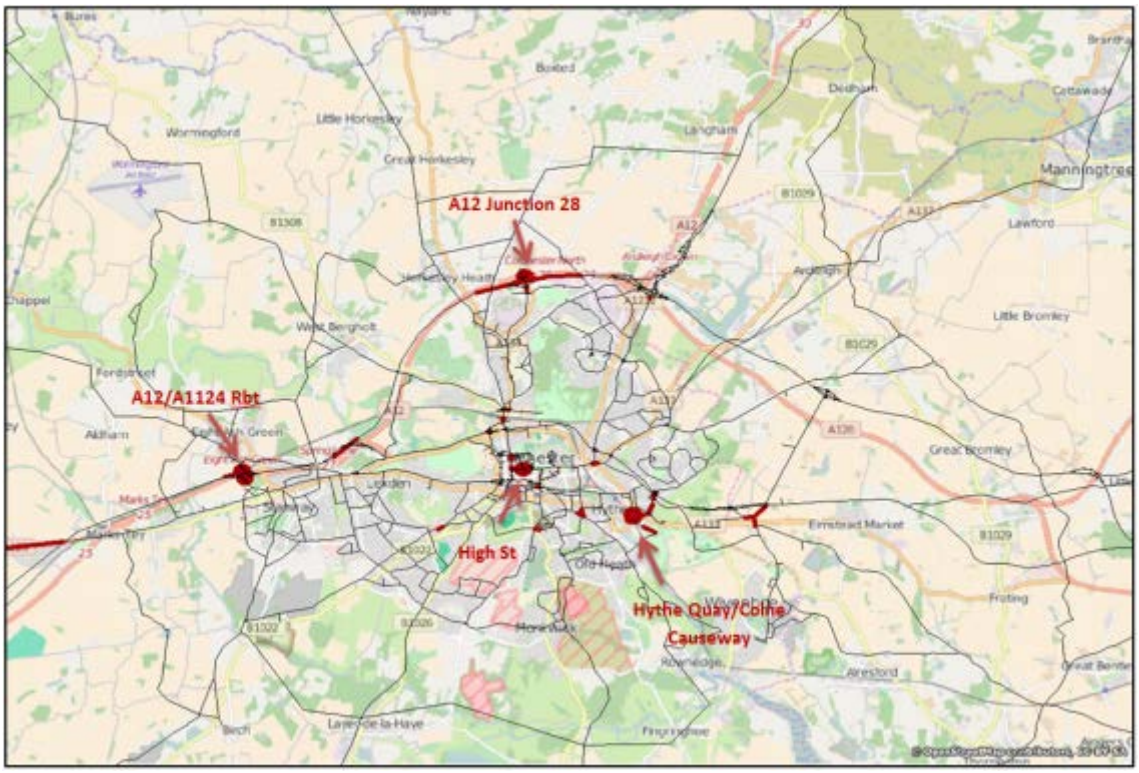


Figure 22 Overcapacity Links and Junctions Scenario 1e Post-VDM – PM



Based on the average for all turns at junctions, scenario 1e has 18 junctions in the AM peak and 17 junctions in the PM peak which are overcapacity – compared to 18 in the AM peak and 16 in the PM peak for scenario 1c.

Based on the maximum volume/capacity ratio there are 79 junctions in the AM peak and 74 junctions in the PM peak overcapacity in scenario 1e, which compares to 90 and 73, respectively in scenario 1c.

A large scale map has been produced which shows a comparison of how capacity problems on links and at junctions has altered between the local plan reference scenario 1c and sensitivity test 1e. Two excerpts are shown from this detailed map illustrating changes in capacity problems around J26 of the A12 and Greenstead roundabout.

Figure 23 Overcapacity changes at A12 Junction 26 in the AM peak in local plan scenario

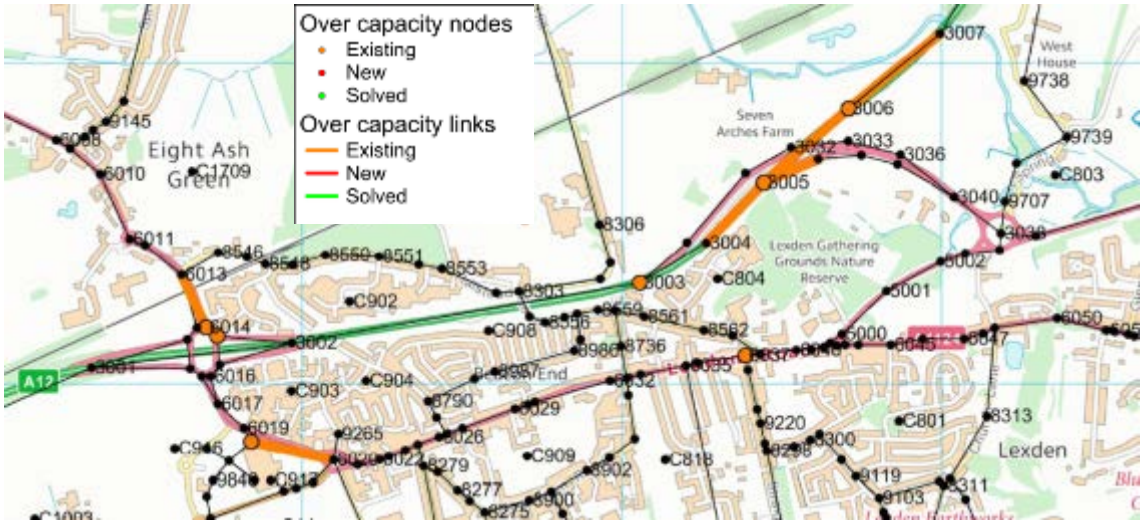
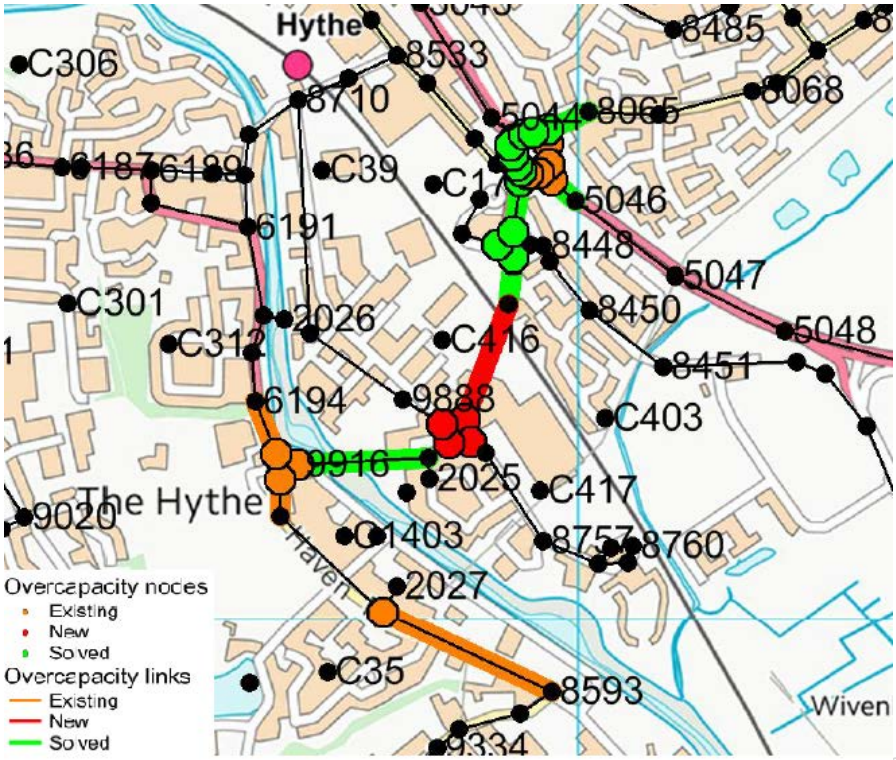


Figure 23 shows that removing signals in the model has had relatively little effect in terms of overcapacity links and nodes. Existing problems remain on approaches along the A1124 toward J26 and on the A12 around J27. Meanwhile Figure 24 shows the PM peak is similar – other than one short link on one side of the roundabout where an improvement is noticed, which does not alter the overall overcapacity problem at this junction.

Figure 24 Overcapacity changes at A12 Junction 26 in the PM peak in local plan scenario

Figure 25 illustrates the changes as a result of the Greenstead roundabout improvements. It shows partial improvements in the AM peak including an improvement at the Eastern Approach/Elmstead Road roundabout. However, new problems are created on Eastern Approach whilst existing problems remains on Haven Road.

Figure 25 Overcapacity changes at Greenstead roundabout in the AM peak in local plan scenario



In the PM peak Figure 26 shows an overall worsening of capacity problems on these streets. Furthermore, despite improving Greenstead roundabout, new overcapacity issues show around it because of traffic rerouting as this has become a more attractive route for car users. However, it should be noted that these locations were close to capacity in the reference case. An overcapacity section on Hythe Quay is solved in this scenario.

Figure 26 Overcapacity changes at Greenstead roundabout in the PM peak in local plan scenario

Data for overcapacity junctions is shown in Appendix B where the capacity and delay measures for each junction can be compared across scenarios.

7.3 Garden communities trip generation and Greenstead roundabout

In parallel to the Colchester transport modelling project, work has been progressing on a movement and access study at proposed garden communities in Essex (Garden Communities – Movement & Access Study – March 2017)

Following the recommendation of this study, car trips to and from these developments have been reduced by approximately one half in the model. This reduction is based on an ambitious target to achieve a modal split of: 40% Active, 30% Public Transport and 30% Car. The garden communities study has developed a simple transport demand tool for each of the developments, which provides trip ends to use in transport models, based on different modal splits being achieved.

Based on achieving the ambitious 40/30/30 mode split the demand tool was used to provide trip ends for arrivals and departures at two garden community developments called Colchester Braintree Borders Garden Settlement and Colchester Tendring Borders Garden Settlement. The trip end data applies only to home-based and employment trips since the retail on these development sites is assumed to be local and hence attracting only intra-zonal trips.

The trip matrix in the Colchester transport model was altered to match the trip ends provided by the garden communities demand model. This reduces car trips to and from these developments by approximately half. The centroid connector to zone 518 described in Section 6.1 and the improvement to Greenstead roundabout described in Section 6.2 were both retained.

Accordingly this sensitivity test explores if capacity and delay problems are sensitive to greater modal split away from cars at the proposed garden community developments. When making comparison with scenarios 0b and 1c it should be noted that localised effects could result from the Greenstead roundabout alteration and the zone 518 connector change described in Section 7.2.

The model was run for both the committed and preferred option scenarios. Although the garden communities are not in the committed scenario this enabled the model to be run with the changes to Greenstead roundabout included. These scenarios were named 0e and 1f, respectively. Scenario 1f was also run using the variable demand model.

Table 16 and the accompanying illustration in Figure 27 show that there is a noticeable improvement of approximately 7% in the measure for overcapacity queues across the network in the AM peak, alongside a slight improvement in average speed. Similar but not as pronounced patterns of change in network performance are observed in the PM peak.

Table 17 Summary statistics for final assignment scenarios 1c-1f

Attribute	AM		PM	
	1c	1f	1c	1f
Transient queues (pcu.hrs)	2,347	2,280	2,348	2,316
Over capacity queues (pcu.hrs)	6,450	5,985	5,156	5,039
Link cruise time (pcu.hrs)	15,833	15,588	15,683	15,243
Total travel time (pcu.hrs)	24,629	23,853	23,188	22,598
Travel distance (pcu.kms)	1,025,680	1,014,620	1,026,520	1,011,154
Average speed (kph)	42	43	44	45
Total trips loaded (pcus)	55,988	55,152	52,469	51,392

Figure 27 % change in summary statistics for scenarios 1c-1f

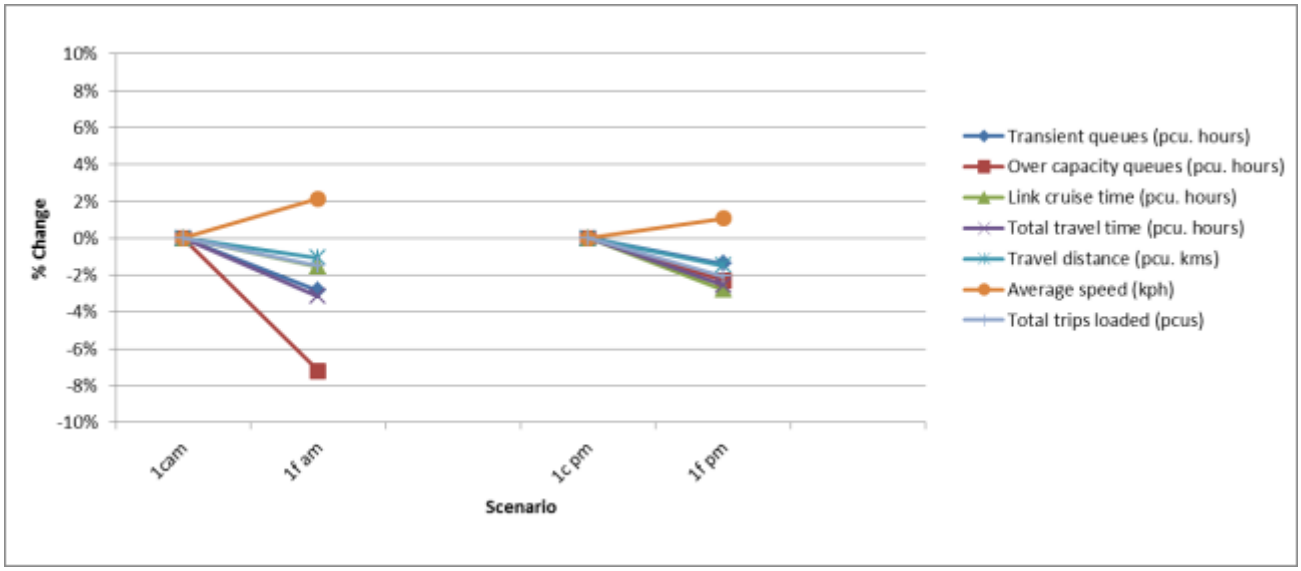


Figure 28 Locations of Overcapacity Links and Junctions Scenario 1f Post-VDM – AM

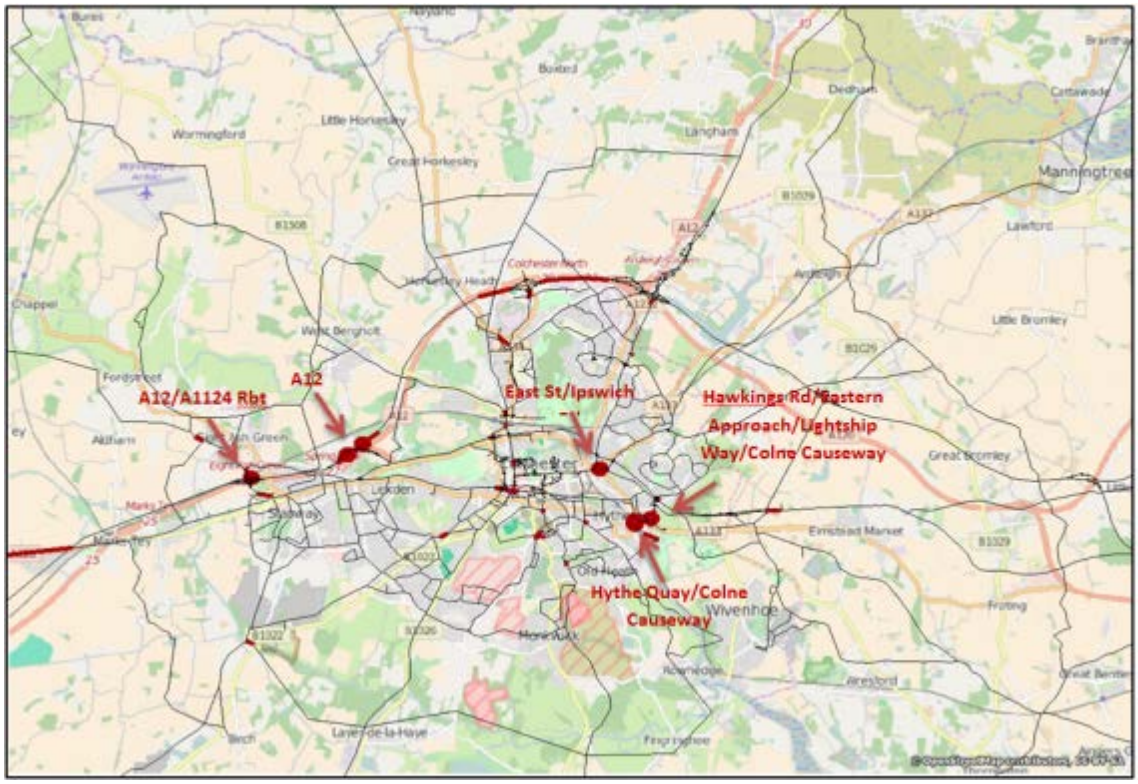


Figure 28 and Figure 29, above and below, map the results of the link and junction analysis for scenario 1f. Even though there is less travel demand at the new garden community developments, existing traffic issues in Colchester seen in the other scenarios remain.

Figure 29 Locations of Overcapacity Links and Junctions Scenario 1f Post-VDM – PM

Based on the average for all turns at junctions, scenario 1f has 17 junctions in the AM peak and 16 junctions in the PM peak which are overcapacity – compared to 18 in the AM peak and 16 in the PM peak for scenario 1c.

Based on the maximum volume/capacity ratio there are 78 junctions in the AM peak and 74 junctions in the PM peak overcapacity in scenario 1f, which compares to 90 and 73, respectively in scenario 1c.

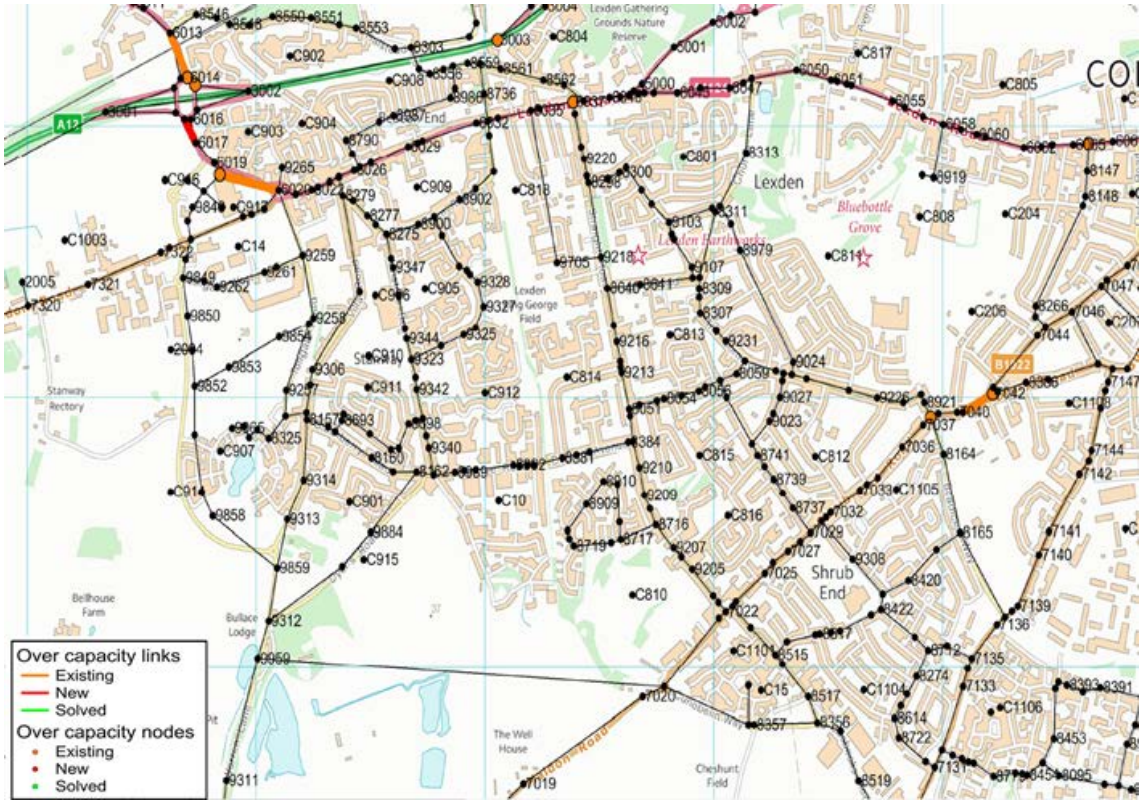
The data for overcapacity junctions is shown in Appendix B where the capacity and delay measures for each junction can be compared across scenarios.

7.4 Southern distributor and Greenstead roundabout

This sensitivity test includes three changes compared to scenario 1c. The first two have been already explained in the Section 7.2 and refer to the centroid connector to zone 518 and to the alterations in the Greenstead Roundabout. The third difference was the addition of a new southern distributor link.

The network was altered to accommodate the change. Specifically, Warren Lane was connected to Cunobelin Way. This route had originally been included at an earlier stage of the model's development. This link can be seen in Figure 30 joining nodes 9969 and 7021.

Figure 30 Location of the Southern Distributor



The model was run for both the committed and preferred option scenarios. These scenarios were named 0f and 1g, respectively. Scenario 1g was also run using the variable demand model.

Table 17 and the accompanying Figure 31 show that this scenario results in an approximately 2% reduction in overcapacity queues in the AM peak. The impact in the PM peak is less.

Table 18 Summary statistics for final assignment scenarios 1c-1g

Attribute	AM		PM	
	1c	1g	1c	1g
Transient queues (pcu.hrs)	2,347	2,302	2,348	2,334
Over capacity queues (pcu.hrs)	6,450	6,156	5,156	5,144
Link cruise time (pcu.hrs)	15,833	15,737	15,683	15,463
Total travel time (pcu.hrs)	24,629	24,195	23,188	22,941
Travel distance (pcu.kms)	1,025,680	1,021,242	1,026,520	1,021,463
Average speed (kph)	42	42	44	45
Total trips loaded (pcus)	55,988	55,822	52,469	52,170

Figure 31 % change in summary statistics for scenarios 1c-1g

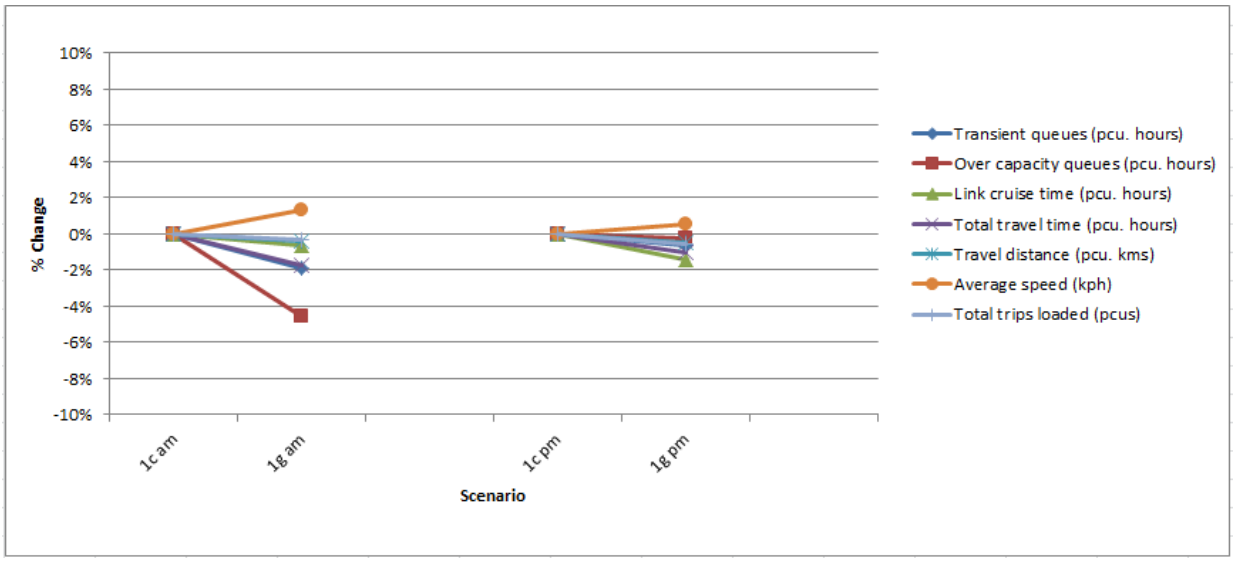


Figure 32 and Figure 33 below show the results of the link and junction analysis for scenario 1g.

Figure 32 Overcapacity Links and Junctions Scenario 1g Post-VDM – AM

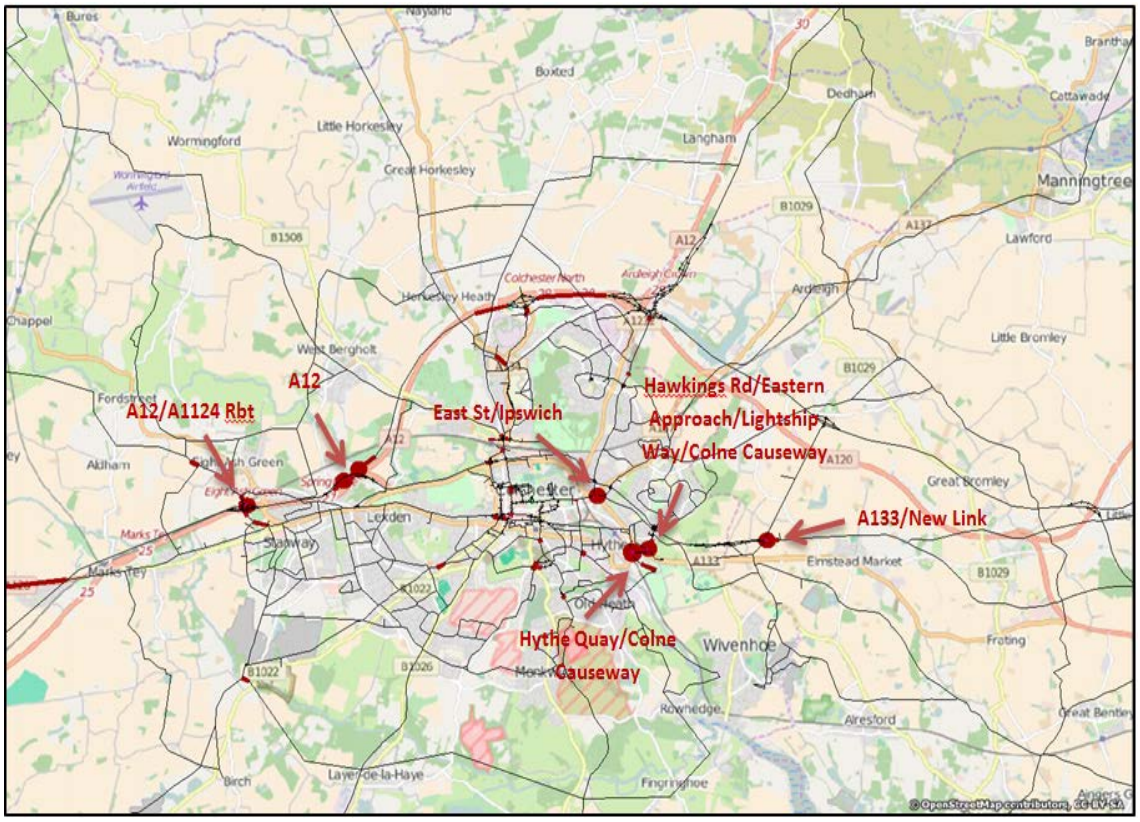
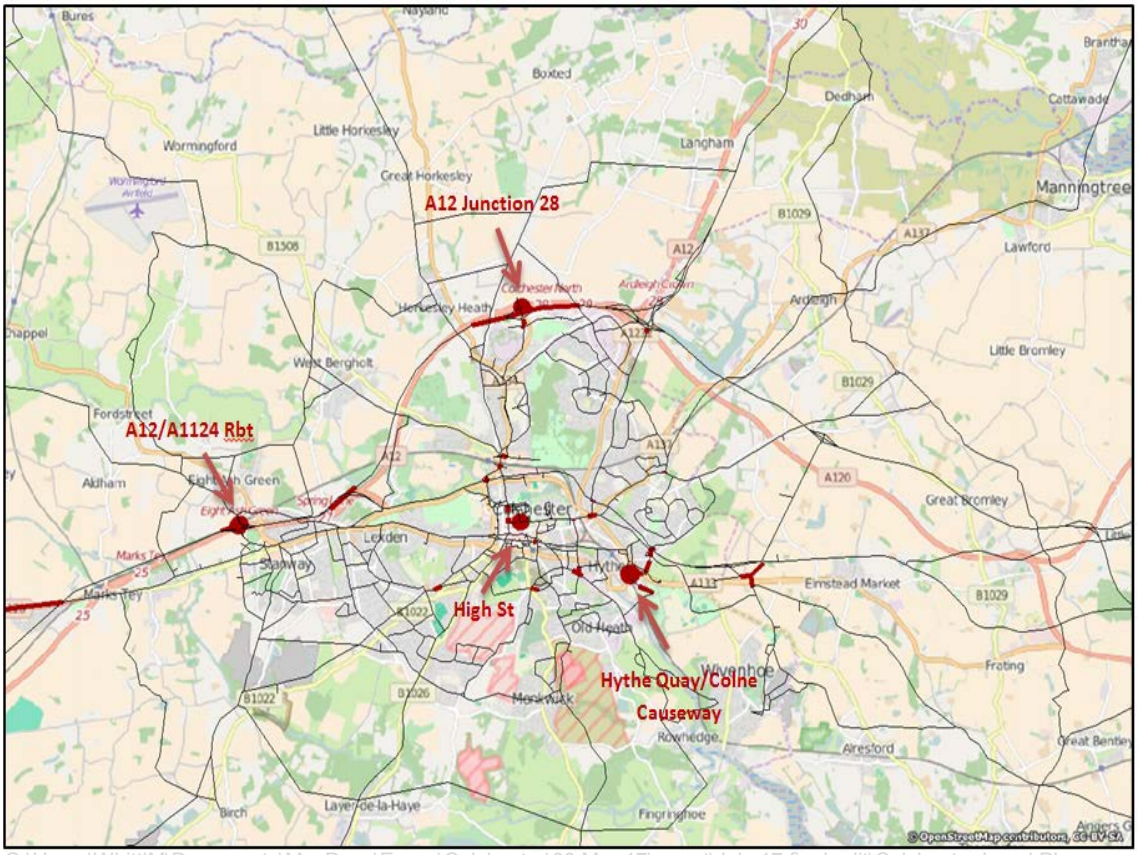


Figure 33 Overcapacity Links and Junctions Scenario 1g Post-VDM – PM



Based on the average for all turns at junctions, scenario 1g has 18 junctions in the AM peak and 17 in the PM peak which are overcapacity compared to 18 in the AM peak and 16 in the PM peak of scenario 1c.

Based on the maximum volume/capacity ratio there are 78 junctions in the AM peak and 74 junctions in the PM peak overcapacity in scenario 1g, compared to 90 and 73, respectively in scenario 1c.

More information about the overcapacity junctions is included in Appendix B where capacity measures for each junction can be compared across scenarios.

8 Mitigation Measures

In Chapters 5 and 6 numerous links and junctions have been identified that have over-capacity issues during peak times in either or both the committed and local plan scenarios; and links and junctions which are susceptible to becoming overcapacity should changes to the network be made. In order to respond to forecast changes at these locations and routes a series of potential mitigation measures have been developed. The locations identified are based on analysing an AM and PM peak weekday traffic model. It is recognised that there are traffic congestion and impacts at other times and locations, for example on Saturday mornings, which should also be considered as part of any transport statement or assessment.

The proposals for mitigation measures link to relevant previous and current studies in the Colchester area; and show how this modelling study reflects and is consistent with other work. While the options presented have not been fully assessed for feasibility as part of this study they, nevertheless, reflect a realistic approach to mitigation – being carefully grounded in evidence and past experience.

Should any of the options be taken forward, further feasibility studies would be required, for which the best starting point would be one of the previous or current scheme studies, where they exist, which have been referenced. Potential measures need to be further tested against policy, deliverability, viability and timing – especially in relation to the timing of the delivery of any developments.

Four locations have been identified in the model's forecasts based on analysis of overcapacity links and junctions. These are:

- A12 corridor;
- East Colchester A134/A133 corridor;
- South and West Colchester A134 and A1124 corridor;
- Other locations including Colne Bank/Cymbeline Way, Harwich Road/East Street, Circular Road South, Shrub End Road/Maldon Road, Old Heath Road/Wimpole Road, Brook Street, Mersea Road/Normandy Avenue junction and junctions on the proposed new A120/A133 link road in East Colchester.

For each of the junctions and links in these groups of locations, a series of suggestions for mitigation measures have been developed which include:

- Basic traffic management – such as signing and lining, part signalisation, changing kerb lines to increase stop line capacity and turning restrictions;
- Enhanced traffic management – such as upgrades to and investment in signal control systems especially when there are junctions in close proximity;
- Minor infrastructure upgrades – such as widening of approaches to increase lane capacity and left turn slips at junctions (which takes place within the designated highway boundary);
- Major infrastructure upgrades – such as major reconstruction to add capacity (which requires land outside the designated highway boundary and involves complex engineering);
- Complementary measures – which includes sustainable transportation improvements to public transport, walking and cycling, and park and ride.

For each measure a qualitative assessment of why it could be worth considering has been given along with an indicative cost range. In addition, reference to previous and current studies that might also be considering that measure has been provided.

It should be noted that in practice a package of measures would be chosen from the range of those presented, which would include combinations of traffic management, infrastructure and sustainable transport measures. In addition, improvements would be considered along routes and not as isolated junction schemes. Development will still need to produce Transport Statements or Assessments in line with national and local guidance. This local plan modelling work will help inform the scope of such transport statements and assessments.

A full list of these measures is provided in Appendix C.

Appendices

Appendix A: List of Development

Table A.1 Committed and LDF Development – Housing

SATURN Zone	Committed Housing Sites	No of dwellings used for scenario
115	Jarmin Road Former Cbc Depot	57
120	Ipswich Road	-
121	Cowdary Avenue	38
121	Bypass Nursery, Cowdray Avenue	81
122	Cowdray Centre, Cowdray Avenue	154
123	Clarendon Way	88
124	Westway Adjacent River Colne	-
125	St Marys Hospital Site	-
126	St Botolphs	120
127	Britannia Car Park	100
133	Bay Mill	-
209	Garrison Central 1	-
209	Garrison Development - J	407
209	Garrison Development - H	4
209	Garrison Development - K1/2	14
306	Paxmans Former Club, Hythe Hill	52
306	Paxmans Main Site, Port Lane	224
312	Gas Works Site, Hythe Quay	85
314	Brook Street	-
314	Land Rear Of Brook Street	110
315	Garrison Development - A1	537
316	Garrison Development - B1B	138
316	Garrison Development - B1A	11
316	Garrison Central 3 - C2	30
403	University, Salary Brook Medows	-
403	Land West Of Boundary Road, Uofea	5
416	Jewsons Site	221
416	Hawkins Road	360
416	Hawkins Road	-
416	Hawkins Road	-
417	Lightship Way, Hythe Quay	168
501	Flakt Woods Site, Brainswick	495

510	South Of Myland Rectory	-
514	Cuckoo Point, Severalls Lane	173
515	Royal London Mill Road	163
516	Cowies, Boxted Road	-
517	Severalls Hospital	978
518	NGAUE Sw (Golf Course Site)	-
518	Chesterwell	1600
523	Turner Village	432
604	Betts Factory, Ipswich Road	128
902	Railway Sidings Site, Halsead Road	123
912	Winstree Road, Stanway	111
914	Lakelands Phase 2	436
915	Fiveways Fruit Farm And Dyers Road	547
1001	Land Between A12/London Road, Stanway (Wyvern Farm)	358
1103	Layer Road Football Stadium	58
1109	Garrison Central 4 - L/N	266
1109	Garrison Central 4 - P1	203
1109	Garrison Central 4 - O	38
1110	Breachfield	261
1205	Garrison Development - S1	212
1205	Garrison Development - S2N	163
1205	Garrison Development - S2Nw	48
1205	Garrison Development - S2Sw	21
1205	Garrison Development - S2S	146
1211	Garrison Development - Q	46
1403	King Edward Quay	153
1601	Cooks Shipyard, Wivenhoe	77
1701	East Road, West Mersea	37
1702	Rowhedge Port At End Of High St.	256
1704	Grange Road, Tiptree	103
1704	Petrol Station,Maypole Road, Tip	28
1704	Jam Factory Site, Tiptree	244
1711	Tile House Farm, Gt. Horkesley	145
Total		**11053**

Table A.2 Housing for Preferred Option Local Plan Scenarios

SATURN Zone	Proposed LDF Housing Sites	No of dwellings used for scenario
1705	Tiptree	600
1706	West Mersea	200
1603	Wivenhoe	250
1814	Colchester Tendring Borders Garden Settlement	2500
602	East Colchester & Welshwood Park	20
603	East Colchester by St Cyrus Road	80
407	East Colchester & Land north of Bromley Road	100
1712	Langham & Dedham	130
1711	Great Horkesley, Boxted & Worrmingford	129
1719	Colchester Braintree Borders Garden Settlement	2500
1710	West Bergholt	120
1709	Eight Ash Green	150
1003	Stanway	780
524	Northern Gateway	300
1307	Middlewick Ranges	1000
1101	Gosbecks Phase 2	150
1107	Land South of Berechurch Hall Road	150
501	North Colchester (Braiswick)	105
317	Magdalen Street sites	237
418	Hythe Special Policy Area	300
301	Port Lane	130
902	Chitts Hill Stanway (Railway Sidings)	100
1701	Abberton	40
1713	Chappel and Wakes Colne	30
1711	Fordham	20
1713	Great Tey	57
1703	Layer de la Haye	50
1502	Rowhedge	40
Total		**10268**

Appendix B: Overcapacity Junction Analysis

Table B.1 Overcapacity Junctions (based on the turn with biggest v/c) after VDM – AM

		v/c (%)					
Node	Description	0b – Committed	1c – Local Plan	1d – A12 Widening	1e – Junction 26	1f – Demand	1g – Southern Distributor
3003	A12	95	103	105	102	100	102
3005	A12	104	118	72	118	116	117
3006	A12	100	100	71	101	100	101
3015	A12	96	100	66	100	100	100
3016	A12	96	100	66	100	100	100
3017	A12	96	104	66	103	101	103
3018	A12/A120 slip road	103	104	110	105	105	105
4040	A120 roundabout	101	79	83	78	81	78
5008	A133 Colchester Rd	91	100	100	100	100	100
5009	A133 Colchester Rd	91	100	100	100	100	100
5010	A133 Colchester Rd	91	100	100	100	100	100
5011	A133 Colchester Rd	91	104	104	104	104	104
5012	A133 Colchester Rd/heckford's Rd	100	100	100	100	100	100
5013	A133 Colchester Rd	100	100	100	100	100	100
5014	A133 Colchester Rd	100	102	102	102	102	102
5030	Cowdray Ave/Mason Rd	118	118	119	118	118	118
5062	A133/B1028 Colchester Rd	101	86	86	86	42	86

5076	Bromley Rd	111	73	76	21	26	21
5517	A134 Westway (between Essex Hall and Colne Bank Roundabout)	102	102	102	102	102	102
5518	Colne Bank Roundabout	101	101	101	101	101	101
5519	Colne Bank Roundabout	101	101	101	101	101	101
5520	Colne Bank Avenue	130	129	129	126	126	126
6007	A1224 Halstead Rd	96	102	102	102	102	102
6014	A1124 Halstead Rd	104	104	104	105	104	105
6018	A1124 Essex Yeomanry Way	89	96	86	65	13	100
6037	A1124 London Rd/ Straight Rd	101	102	101	101	101	102
6066	Lexden Rd/W Lodge Rd	104	107	106	106	106	105
6073	A1124 Halstead Rd Gyratory	101	101	101	101	101	101
6074	A1124 Gyratory	97	86	103	56	88	85
6109	Ipswich Rd	#N/A	97	100	99	100	100
6116	A1232 Ipswich Road	115	118	118	119	118	119
6147	Mill Rd/A134 Northern Approach	108	112	109	109	109	109
6169	Butt Rd	109	109	112	109	108	108
6200	East St	102	107	108	107	105	107
6561	St Andrew's Ave/Ipswich Rd Rbt	100	96	95	95	92	95
6566	Northern Approach/A134 VUR	55	80	105	104	104	104

6568	Ipswich Rd	99	97	100	99	100	100
7013	Birch Park	111	115	108	114	114	109
7038	Shrub End Rd/Norman Way/Boadicea Way	111	109	111	109	109	110
7042	Shrub End Rd	115	115	115	115	115	115
7091	B1025 Mersea Rd/Normandy Ave	98	101	101	102	101	102
7112	B1025 Mersea Rd	101	100	100	100	100	100
7162	B1028 Colchester Rd	116	117	116	120	118	120
8130	Berechurch Rd	112	113	113	113	113	113
8195	Old Heath Rd	102	104	102	102	103	103
8371	Defoe Cres	25	102	14	13	13	13
8592	Haven Rd	104	107	107	110	107	110
8636	Headgate St	104	104	104	104	104	104
8671	B1022 Shrub End Rd/Maldon Rd/Drury Rd	109	113	111	113	111	113
8819	North Hill	101	101	101	101	101	101
8866	Mill Rd/Severalls Ln/The Crescent Rbt	79	86	101	94	92	95
8929	North Hill	103	103	103	103	103	103
9403	Avon Way	118	109	103	71	68	72
9404	A133 Clingoe Hill	111	103	106	101	101	101
9405	Colne Causeway	114	111	110	76	74	77
9406	A133/A134 Greenstead Rbt	108	27	28	36	31	36
9407	A133/A134 Greenstead	108	50	53	45	43	45

	Rbt						
9413	B1508 Bergholt Rd	112	113	114	114	114	114
9815	A133/A134 Greenstead Rbt	102	102	102	102	102	102
9816	A133/A134 Greenstead Rbt	104	102	102	101	101	101
9817	A133/A134 Greenstead Rbt	102	102	102	101	66	101
9818	A133/A134 Greenstead Rbt	104	103	103	62	61	62
9819	A133/A134 Greenstead Rbt	102	102	102	52	53	53
9820	A133/A134 Greenstead Rbt	107	105	102	35	33	36
9821	A133/A134 Greenstead Rbt	105	103	102	54	53	47
9822	A133/A134 Greenstead Rbt	104	102	39	42	42	43
9823	A133/A134 Greenstead Rbt	106	104	103	62	63	63
9824	A133/A134 Greenstead Rbt	102	102	102	101	86	100
9844	A1124 Essex Yeomanry Way	103	104	103	104	104	104
9860	A12 slip road	94	100	62	100	100	100
9861	A12 slip road	100	100	66	100	100	100
9867	A12 junction 28 southern Rbt	49	40	101	28	44	42

9868	Via Urbis Romanae (between the two roundabouts close to A12)	104	104	104	104	104	104
9871	Via Urbis Romanae (between the two roundabouts close to A12)	104	102	104	104	104	104
9872	Via Urbis Romanae/Axial Way Rbt	60	101	54	98	59	98
9873	Via Urbis Romanae/Axial Way Rbt	65	103	61	101	100	101
9874	Via Urbis Romanae/Axial Way Rbt	100	102	59	102	102	102
9906	Eastern Approach/Elmstead Rd Rbt	103	101	68	74	72	75
9907	Colne Causeway/ A134 Eastern Approach Rbt	106	106	105	53	51	28
9908	Colne Causeway - Elmstead Rd Rbt	103	103	103	67	64	67
9909	Hawkins Rd / Eastern Approach / Lightship Way / Colne Causeway Roundabout	68	34	62	102	101	102
9910	Hawkins Rd / Eastern Approach / Lightship Way / Colne Causeway Roundabout	35	47	46	102	102	102
9911	Hawkins Rd / Eastern Approach / Lightship Way / Colne Causeway Roundabout	62	95	93	101	101	101
9912	Hawkins Rd / Eastern Approach / Lightship Way / Colne Causeway	55	57	56	101	102	101

	Roundabout						
9913	Ipswich Rd	100	105	106	104	102	104
9914	East St/Ipswich Rbt	101	101	101	101	101	101
9915	East St	101	101	101	101	101	101
9916	Hythe Quay/Colne Causeway Rbt	101	102	102	101	101	101
9917	Haven Rd	122	126	127	128	128	128
9918	A134 Hythe Quay	103	107	109	112	110	112
9920	Bromley rd/Parsons Heath Rbt	103	87	83	72	67	72
9921	Bromley Rd - A137 Harwich Rd Rtb	101	100	100	93	91	94
9932	A134 north of Essex Hall Rbt	100	100	100	100	100	100
9933	Essex Hall Roundabout Gyratory	100	100	100	100	100	100
9940	A134 Balkerne Hill	103	103	103	103	103	103
9941	A134 Southway east of Maldon Rd Rbt	112	111	113	110	111	110
9942	Maldon Rd Rbt	105	105	106	105	105	105
9943	Southway west of Maldon Rd Rbt	106	106	107	106	106	107
9950	Essex Hall Roundabout Gyratory	101	101	100	100	42	42
9953	Essex Hall Roundabout Gyratory	101	101	101	101	101	101
9954	A133 Colchester Rd	124	108	106	108	108	108

9955	A120/A133/Main Rd Rbt	101	101	101	101	101	101
9956	A120/A133/Main Rd Rbt	100	100	100	89	89	89
9962	A120-A133 link road- Rbt on A133	0	101	101	101	101	101
9963	A120-A133 link road- Rbt on A133	0	102	102	102	102	102
9965	A120-A133 link road- Rbt on A133	0	101	100	104	101	105
9969	A120-A133 link road- Rbt on A120	0	103	103	95	92	95
9974	Brook St	133	139	139	134	132	133

Table B.2 Overcapacity Junctions (based on the turn with biggest v/c) after VDM – PM

		v/c (%)					
Node	Description	0b – Committed	1c – Local Plan	1d – A12 Widening	1e – Junction 26	1f – Demand	1g – Southern Distributor
3003	A12 close to Chitts Hill	100	105	108	106	104	106
3005	A12 to east	106	106	71	106	106	106
3006	A12	100	100	71	100	100	100
3015	A12	102	102	71	102	102	102
3016	A12	100	100	71	100	100	100
3017	A12	100	100	71	100	100	100
3018	A12	99	103	108	103	101	103
5008	A133 Colchester Rd	104	103	103	103	104	103
5009	A133 Colchester Rd	100	100	100	100	100	100

5010	A133 Colchester Rd	100	100	100	100	100	100
5011	A133 Colchester Rd	100	100	100	100	100	100
5029	Cowdray Ave/Mason Rd	121	125	124	125	123	125
5062	B1028 Colchester Rd	104	63	67	80	75	80
5517	A134 Westay (between Essex Hall and Colne Bank Roundabout)	108	102	102	102	102	102
5518	Colne Bank Roundabout	103	101	101	101	101	101
5519	Colne Bank roundabout	101	101	101	101	101	101
5520	Colne Bank Avenue	114	102	102	103	102	103
6015	A12/A1124 Rbt	101	101	101	101	101	101
6016	A1124/A12	92	100	100	101	97	100
6072	A12/A1124 Rbt	101	102	103	103	102	102
6116	A120/Ipswich Rd	80	88	102	101	100	101
6147	A134 Northern Approach/Mill Rd	109	109	109	109	109	109
6152	A134/Turner Rd	89	101	99	100	100	100
6161	Colne Bank Roundabout	105	43	42	41	43	41
6169	A134 Magdalen St	100	86	91	87	98	88
6171	A134 Approach to St Botolph's Circus EB	110	107	106	106	106	106
6192	A134	101	104	103	51	100	57
6200	East St	104	104	103	103	102	104
6202	Harwich Rd	104	102	22	24	21	24

6561	Rbt between Cowdray Ave and St Andrew's Ave	99	100	100	100	98	100
6566	A134	74	101	107	107	108	107
7038	Shrub End Rd/Norman Way/Boadicea Way	102	102	101	101	101	101
7042	Shrub End Rd	101	102	102	102	101	102
7160	Park Rd	106	121	113	42	44	43
7162	B1028 Colchester Rd	107	109	109	109	109	109
8130	Pownall Cres	101	100	100	100	100	100
8195	Old Heath Rd	106	102	102	102	102	102
8261	Mile End Rd/Bruff Cl	66	74	100	101	101	101
8592	Haven Rd	111	116	115	112	113	112
8630	North Hill SB	103	106	105	105	105	105
8671	B1022 Shrub End Rd/Maldon Rd/Drury Rd	125	125	125	125	125	125
8672	High St/Maidenburgh St	105	105	105	105	105	105
8819	North Hill	101	101	101	101	101	101
8929	North Hill	104	106	106	107	105	107
9404	A133 Clingoe Hill	133	101	101	68	64	68
9405	Colne Causeway	102	101	101	110	107	110
9412	B1508/A134	77	100	33	34	34	34
9413	B1508 Bergholt Rd	103	104	103	102	102	102

9416	A134 between Mile End Rd Rbt and Turner Rd Rbt	97	101	101	101	101	101
9518	North Hill High St EB	87	102	102	103	100	103
9519	Cowdray Ave	100	96	96	96	96	96
9522	North Hill High St EB West of W Stockwell St	106	106	106	106	106	106
9557	St Botolph's St	103	103	103	103	103	103
9815	St Andrew's Ave	102	100	102	108	108	108
9816	St Andrew's Ave	103	101	101	100	100	100
9817	Greenstead Roundabout	101	101	100	101	101	101
9818	St Andrew's Ave	102	82	97	103	103	103
9819	Greenstead Rd/St Andrew's Ave	36	37	42	101	100	101
9820	Greenstead Rd/St Andrew's Ave	44	49	60	100	34	101
9860	A12 Rbt close to Boxted Rd	101	103	67	101	102	101
9861	A12 slip road	100	100	68	100	100	100
9863	A12 Junction 28	39	38	100	39	20	39
9864	A12 Junction 28	100	99	103	101	100	101
9868	Via Urbis Romanae (between the two roundabouts close to A12)	103	104	104	104	104	104
9871	Via Urbis Romanae (between the two roundabouts close to A12)	99	102	101	102	102	102
9874	A12 Junction 28	58	61	59	60	60	100
9906	Colne Causeway/Elmstead	104	100	84	76	103	77

	Rd/A134						
9907	Colne Causeway/Elmstead Rd/A135	102	71	68	40	102	40
9908	Colne Causeway/Elmstead Rd/A136	101	88	87	100	102	100
9909	Eastern Approach to Hawkins Rd Rbt	101	113	111	108	109	108
9910	Eastern Approach/Lightship Way Rbt	45	102	102	102	102	102
9911	Eastern Approach/Lightship Way Rbt	90	101	101	101	101	101
9913	Ipswich Rd	102	110	109	110	108	110
9914	East St between Ipswich Rd and Old Coach Rd WB	106	106	106	106	106	106
9915	East St	101	101	101	101	101	101
9916	Hythe Quay - Colne Causeway Roundabout	101	101	101	101	101	101
9917	Haven Rd	122	123	123	123	123	123
9918	Haven Rd/Colne Causeway Rbt	113	113	113	113	113	113
9923	Colne Bank Avenue	102	82	81	79	78	70
9932	A134 north of Essex Hall Rbt	65	100	100	100	100	100
9933	Essex Hall Roundabout Gyratory	94	100	100	100	100	100
9940	A134 Balkerne Hill	103	103	103	103	103	103
9942	Maldon Rd Rbt	78	100	50	101	76	101
9943	Southway west of Maldon	60	102	101	102	101	102

	Rd Rbt						
9950	Essex Hall Roundabout Gyratory	41	103	103	102	102	102
9953	Essex Hall Roundabout Gyratory	79	101	101	101	101	101
9954	A133 Colchester Rd	101	99	100	99	100	99
9956	A120/A133/Main Rd Rbt	101	76	75	75	76	75
9961	Park Rd	0	115	115	113	115	113
9974	Brook St	133	137	138	139	136	139

Appendix C: Options for mitigation measures

Group	Location	Summary of problem		Traffic management		Infrastructure		Sustainable and complementary measures
				Basic	Enhanced	Minor	Major	
A12 corridor	A120 Marks Tey (close to J25 of A12)	Over capacity link in committed and local plan scenarios during both the AM and PM peak westbound and eastbound. This link is an entrance/exit to Colchester and have one lane in both directions. The Braintree/Colchester Borders Garden Communities zones are being loaded onto this road causing more congestion issues. The problem remains in all of the Sensitivity Scenarios.	Description of measure(s)	Clearer lane designation with A12 inside lane being hatched off to allow dedicated lanes onto the A12	Signalise both Station Road and London Road roundabouts	Introduce a slip road from London Road East to west arm at the London Rd Roundabout	A120 Braintree to Marks Tey	Bus or rapid transit corridor Cycle route
			Linked work	Refer to West Colchester Stanway travel strategy	n/a	n/a	Highways England	See Braintree Borders Off-site transport ideas
			Estimated cost	£54,000	£100,000 to £500,000	£500,000 to £1m	As per HE proposals	£5m to £10m
			Qualitative assessment	Will decrease weaving at the slip roads, reducing delay both on the A12 and slip roads	Signals on roundabouts generally increases capacity	Reduces London Road East to West journey times	Not known	Would encourage drivers to use buses or cycle more, reducing number of cars passing through the junctions

Group	Location	Summary of problem		Traffic management		Infrastructure		Sustainable and complementary measures
				Basic	Enhanced	Minor	Major	
A12 corridor	A12 J26 slip roads	Over capacity issues in the AM peak in the southbound direction (Halstead Rd) in the local plan scenario. It is noted that the Eight Ash Green housing development contributes to the traffic. Over capacity issues in the PM peak in the eastbound direction in the local plan scenario. The reason is that traffic coming from the east is already experiencing some delays which are being propagated downstream along the A12. None of the Sensitivity Tests alleviated the issue.	Description of measure(s)	Signalisation of all approaches to Junction 26	A12 technology package	Redesign of slip roads to increase capacity including widening/lengthening off-slips. Combine with signalisation	Junction reconstruction as part of A12 widening	Improved frequent high quality bus services serving Tollgate and Stanway including evenings and weekends Also Rapid Transit link and/or P&R from Braintree/Colchester Borders Garden Settlement
			Linked work	RIS scheme under investigation by HE	RIS scheme under investigation by HE	n/a	n/a	Bus Blueprint being developed by ECC with support from CBC
			Estimated cost	£100,000 to £500,000	Not known	£ 3 mil to £5 mil	>£10 mil	P&R: £5m to 10m Rapid Transit Costs: Opt 1 £29.8m Opt 2: £48.0m Opt 3: £31.3m Opt 4: £37.3m Tram: £164.6m
			Qualitative assessment	The SATURN model has coded J26 with signals - however, congestion issues remain	Not known	Capacity increase may be limited unless the roundabout is enlarged too	Assessment in VISSIM would need to be undertaken to find the most efficient junction design	Would significantly reduce number of private cars passing through junction

Group	Location	Summary of problem		Traffic management		Infrastructure		Sustainable and complementary measures
				Basic	Enhanced	Minor	Major	
A12 corridor	A1124 – approach to A12 junction 26/Essex Yeomanry Way	Over capacity in committed and local plan scenarios during the AM peak period. There are committed employment sites at Stane Park and Sainsbury's alongside housing proposals which increase the volume of trips to and from the A12 using this roundabout. The PM peak period shows better results than the AM as the A1124 approach to A12 is below over capacity. The issue remains in all of the Sensitivity Tests.	Description of measure(s)	Clearer lane designation with A12 inside lane being hatched off to allow dedicated lanes onto the A12. This would decrease capacity of the A12 through the junction	Signals, including on the slip road using queue loops	Part signalisation of the A12 and A1124 roundabout for the A12 off-slips with two dedicated left turn slips linking Essex Yeomanry Way to A12 on-slip westbound and A12 off-slip westbound to Essex Yeomanry Way.	Full signalisation. Left turn slips provided for all four arms of the roundabout	Bus priority measures on Tollgate Road Bus Interchange proposed in Tollgate area
			Linked work	Refer to West Colchester Stanway travel strategy	Refer to West Colchester Stanway travel strategy	Refer to West Colchester Stanway travel strategy	n/a	Refer to West Colchester Stanway travel strategy
			Estimated cost	£54,000	£100,000 to £500,000	£6.03m	>£10m	Bus Priority measures: £3 mil to £5m Bus Interchange: £3.36m
			Qualitative assessment	Will decrease weaving at the slip roads, reducing delay both on the A12 and slip roads	Will alleviate queues on the off slips and on the roundabout. Signals would be part time	Will alleviate queues on the off slips and on the roundabout. Signals would be part time	Will alleviate queues on the off slips and on the roundabout. Signals would be part time	Would reduce number of private cars through the junction

Group	Location	Summary of problem		Traffic management		Infrastructure		Sustainable and complementary measures
				Basic	Enhanced	Minor	Major	
A12 corridor	A12 junction 27 (Spring Lane Rbt + Slips)	This junction does not appear to be that congested. Minor issues in the northbound direction during both the AM and PM peak in the committed and local plan scenarios. The issue is completely solved in the A12 Sensitivity Test which is the A12 widening (1d) in both periods.	Description of measure(s)	Improved lane markings, such as directional arrows on the entries and spiral markings on roundabout to guide drivers (only if the roundabout is considered to be overcapacity)	Signalise all arms except the Spring Lane arm (only if the roundabout is considered to be overcapacity)	Left slip from Cymbeline Way West arm to slip road	Left slip from Cymbeline Way West arm to slip road plus length two lane sections for both Cymbeline Way arms	Improved frequent high quality bus services serving Northern Colchester including evenings and weekends Colchester Rapid Transit
			Linked work	n/a	n/a	n/a	n/a	Refer to West Colchester Stanway travel strategy
			Estimated cost	£25,000 to £100,000	£100,000 to £500,000	£500,000 to £1m	£1 mil to £3 mil	Rapid Transit Costs: Opt 1 £29.8m Opt 2: £48.0m Opt 3: £31.3m Opt 4: £37.3m Tram: £164.6m
			Qualitative assessment	Will decrease weaving on the roundabout. This has the benefit of improving safety as well as reducing delay	Signals on roundabouts generally increases capacity. Three arms signalised roundabouts in particular work very well.	Reduces journey time from A12 slip road to Cymbeline Rd West	Will decrease queues on entries	Would encourage more bus use and hence reduce traffic flows

Group	Location	Summary of problem		Traffic management		Infrastructure		Sustainable and complementary measures
				Basic	Enhanced	Minor	Major	
A12 corridor	Junction 28	Over capacity issue only in the PM peak in the slip road to the A12 (eastbound direction) in the committed and local plan scenarios. The issue is solved in the A12 Sensitivity Test (1d).	Description of measure(s)	Traffic management at roundabout	A12 technology package (RIS scheme)	Widen slip roads to two lanes and signalisation	Junction reconstruction as part of A12 widening	Improved frequent high quality bus services serving Axial Way and Northern Gateway including evenings and weekends
			Linked work	n/a	n/a	Under investigation by HE	Under investigation by HE	Bus Blueprint being developed by ECC with support from CBC
			Estimated cost	£25,000 to £100,000	Not known	£1m to £3m	>£10m	Costs vary
			Qualitative assessment	Will decrease weaving on the roundabout	No known	Will decrease queues on entries. Signals on roundabouts generally increase capacity	Assessment in VISSIM would need to be undertaken to find most the efficient junction design	Would encourage more bus use and hence reduce traffic flows
A12 corridor	Axial Way /Via Urbis Romanae roundabout (close to J28 of A120)	Over capacity issues in both the AM and PM peak northbound and southbound directions in the committed and local plan scenarios. Each of the new developments will contribute a small percentage to the total increase of traffic which will inevitably lead to congestion. In the 1d, 1e and 1f scenarios, in the AM peak period, the problem remains. However, in the PM period, a partial improvement is observed on the VUR approach to J28 but the VUR/Axial Way Rbt still remains overcapacity.	Description of measure(s)	Traffic management at roundabout. Directional lane arrows at roundabout entries	Improved lane markings within the roundabout, such as spiral markings to direct drivers	Widen Axial Way to two lanes	Widen Via Urbis Romanae north of junction to 2 lanes.	Improved frequent high quality bus services serving Axial Way and Northern Gateway including evenings and weekends Segregated cycle lanes
			Linked work	n/a	n/a	n/a	n/a	Bus Blueprint being developed by ECC with support from CBC
			Estimated cost	<£10,000	£25,000 to £100,000	£100,000 to £500,000	£1m to 3m	£1m to £3m for cycle lane
			Qualitative assessment	Will decrease weaving on the roundabout	Will decrease weaving on the roundabout, more than simple traffic management	Will decrease queues on Axial Way	This will increase storage capacity and reduce the risk of J28 queues blocking back to this roundabout	Would encourage cycling and hence reduce traffic flows

Group	Location	Summary of problem		Traffic management		Infrastructure		Sustainable and complementary measures
				Basic	Enhanced	Minor	Major	
A12 corridor	A12 J28-29 - on link	Overcapacity issues in the links between the J28 & J29 in both the AM and PM peak periods in committed and local plan scenarios. Overcapacity issues are due to the already high traffic along the A12. The new link added in the Colchester Tendring Garden Community contributes to an increase in traffic, as the link provides an alternative route towards this section of the A12 corridor. The Sensitivity Test (scenario 1d) solves the issue due to the increased number of lanes per direction.	Description of measure(s)	Improved lane markings	A12 technology package (RIS scheme)	Partial widening	Widen to three lanes in both directions	Options for enhancing the Park and Ride service at this location could be considered Colchester Rapid Transit
			Linked work	n/a	n/a	n/a	n/a	Refer to Colchester Rapid Transit Final Report
			Estimated cost	£25,000 to £100,000	Not known	£3m - 5m	>£5m	£3 mil to £5 mil for Park and Ride Rapid Transit Costs: Opt 1 £29.8m Opt 2: £48.0m Opt 3: £31.3m Opt 4: £37.3m Tram: £164.6m
			Qualitative assessment	Will decrease weaving on the roundabout	Not known	Will relieve congestion in the peaks, though not as much as major infrastructure changes	SATURN model has tested widening btwn J25-29, which has been shown to relieve congestion at peaks	Improved bus services would encourage drivers to use buses more

Group	Location	Summary of problem		Traffic management		Infrastructure		Sustainable and complementary measures
				Basic	Enhanced	Minor	Major	
A12 corridor	A1132 Ipswich Road approach to junction 29	Overcapacity issues in the AM peak northbound direction at the Ipswich Road Approach to the J29 in the committed and local plan scenarios. Nearby new housing developments (e.g. Betts Factory, Ipswich Road) contribute to the increase in traffic. The issue remains unsolved in all of the sensitivity tests.	Description of measure(s)	Signalise Ipswich Road northbound arm of A120 roundabout junction	Signalise all arms of the A120 roundabout	Widen Ipswich Road on the approach to the roundabout	Introduce Left slip from Ipswich Road to A120 onslip	A120 / A12 junction could be a good location for a Park and Ride given its location next to two major junctions. This has not been proposed elsewhere Colchester Rapid Transport
			Linked work	n/a	n/a	n/a	n/a	Refer to Colchester Rapid Transit Final Report
			Estimated cost	£25,000 to £100,000	£100,000 to £500,000	£500,000 to £1m	£1m to £3m	£3 mil to £5 mil for Park and Ride Rapid Transit Costs: Opt 1 £29.8m Opt 2: £48.0m Opt 3: £31.3m Opt 4: £37.3m Tram: £164.6m
			Qualitative assessment	Will reduce queues on Ipswich Road. Queues will form on the Rbt which cannot properly be managed unless all arms are signalised. This could lead to greater queuing on other arms	Signals on roundabouts generally increases capacity. Will allow for queues on roundabout to be managed	Will reduce queues on Ipswich Road, however benefit may be limited unless roundabout is enlarged to accommodate this extra capacity	Will decrease Ipswich Road to A120 journey times	Park and Ride would reduce traffic along Ipswich Road Rapid Transit will reduce number of private vehicles

Group	Location	Summary of problem		Traffic management		Infrastructure		Sustainable and complementary measures
				Basic	Enhanced	Minor	Major	
A12 corridor	Ipswich Road	Links operate close to their capacities but no one of them is over capacity in both the AM and PM periods.	Description of measure(s)	Optimise Severalls Lane / Ipswich Road traffic signal method of control	Implement UTC SCOOT on junction	Implement a 50m two lane section on Ipswich Road SW/B SW on the exit of the junction	Increase Ipswich Rd SW/B to 2 lanes from Severalls Lane to Lancaster Approach	Improved bus services Segregated cycle lane on Ipswich Rd, road in the most part is wide enough to accommodate this
			Linked work	n/a	n/a	n/a	n/a	n/a
			Estimated cost	<£25,000	£25,000 to £100,000	£100,000 to £500,000	£1m to £3m	£1m to £3m for cycle lane
			Qualitative assessment	Modelling will need to be undertaken to determine the best method of control	Will reduce delays, typically around 10% to 20%	Will reduce weaving on the SW bound exit, increasing capacity, particularly for Ipswich Rd	Should reduce queues on all arms as it will allow some Ipswich Rd green time to be distributed to other arms	Would encourage cycling and hence reduce traffic flows
East Colchester A134/A133 corridor	Haven Road (between Whitehall Road and Haven Road roundabout)	Overcapacity issues in both the AM and PM peak period westbound in the committed and in the local plan scenarios. Developments, which include Colchester Tendring Garden Communities contribute to increased traffic along Haven Road and through this roundabout. The issues remains in all Sensitivity Tests.	Description of measure(s)	Directional arrows on the roundabout entries	Realign Haven Rd island to the east so there are 2 Haven Rd entry lanes. Haven Rd exit would be one lane	Replace Haven Rd / Colne Causeway Rbt with a signalised junction	Enlarge the Haven Rd / Colne Causeway Rbt	Improved bus service along Haven Rd Cycle lanes
			Example or current work	n/a	n/a	n/a	n/a	n/a
			Estimated cost	< £25,000	£25,000 to £100,000	£100,000 to £500,000	> £10m	£1m to £3m for cycle lane
			Qualitative assessment	Will decrease weaving on the roundabout	Will decrease Haven Rd Northbound queues	May work better given the small footprint of the junction. Modelling would need to be undertaken to confirm this is the case	Will increase capacity. Probably would be very expensive due to the River Colne	Would encourage cycling and hence reduce traffic flows

Group	Location	Summary of problem		Traffic management		Infrastructure		Sustainable and complementary measures
				Basic	Enhanced	Minor	Major	
East Colchester A134/A133 corridor	Colne Causeway and Haven Road roundabout	In the AM peak there are overcapacity issues both at Haven rbt but also on Colne Causeway (westbound and eastbound). In the PM peak period the overcapacity issue is only at Haven rbt. Developments including Colchester Tendring Garden Community and the University of Essex employment site contribute to increasing traffic. In the 1d, 1e and 1g scenarios and in the AM peak period, the problem is partially alleviated. In specific, Haven Rd is not overcapacity, however, the roundabout remains overcapacity. On the other hand, the PM sensitivity models show no difference and the situation remains the same.	Description of measure(s)	Junction Improvements at Colne Causeway/Haven Road RAB	Signal optimisation and bus priority	Convert roundabouts on either end of Colne Causeway to signalised junctions to better manage queuing	Widen Colne Bank causeway to two lanes in each direction	Park & Ride (Garden Settlement) Proposed Colchester Rapid Transit Study
			Linked work	n/a	n/a	n/a	n/a	Refer to Colchester Rapid Transit Final Report
			Estimated cost	< £25,000	£25,000 to £100,000	£500,000 to £1m for both roundabout	> £10 mil	Park and Ride: £5 mil to £10 mil Rapid Transit Costs: Opt 1 £29.8m Opt 2: £48.0m Opt 3: £31.3m Opt 4: £37.3m Tram: £164.6m
			Qualitative assessment	Will decrease weaving on the roundabout	Will decrease Haven Rd Northbound queues	May work better given the small footprint of the junction. Modelling would need to be undertaken to confirm this is the case	Will increase capacity. Probably would be very expensive due to the River Colne	Potential to construct as part of the Garden Community
East Colchester A134/A133 corridor	A134/Elm stead Road RAB	The roundabout is overcapacity both in the AM and PM peak periods in the committed and local plan scenarios. Developments including Colchester Tendring Garden Community and the University of Essex employment site contribute to increasing traffic. The issue at the roundabout is resolved for the AM peak in the Southern Distributor (1g), Demand (1f) and J26 (1d) sensitivity tests in which the Greenstead rbt was improved. In the corresponding PM models, the roundabout remains overcapacity. For the A12 widening sensitivity test the overcapacity is alleviated in the PM only.	Description of measure(s)	Directional markings on entries. Spiral markings on roundabout to guide drivers	Implement traffic signals on roundabout	Widen approaches to roundabout and give bus priority	Southern Distributor	Southern Distributor – rapid transit/sustainable modes scheme Rapid Transit scheme from Garden Settlement
			Linked work	n/a	n/a	n/a	n/a	See Rapid Transit study
			Estimated cost	<£25,000	£25,000 to £100,000	£500,000 to £1m	> £10 mil	Rapid Transit Costs: Opt 1 £29.8m Opt 2: £48.0m Opt 3: £31.3m Opt 4: £37.3m Tram: £164.6m
			Qualitative assessment	Will decrease weaving on the roundabout	Signals on roundabouts generally increases capacity.	Will reduce queues on entry arms, however benefit may be limited unless roundabout is enlarged to accommodate this extra capacity	No major developments in south Colchester so could remain aspirational. Southern distributor set to be modelled.	Would significantly reduce number of private cars passing through junction

Group	Location	Summary of problem		Traffic management		Infrastructure		Sustainable and complementary measures
				Basic	Enhanced	Minor	Major	
East Colchester A134/A133 corridor	Greenstead Roundabout	The Greenstead roundabout is heavily congested in the AM peak period. During the PM peak period traffic flow performance improves, however, the westbound direction from the Clingoe Hill remains overcapacity. General traffic growth and developments cumulatively contribute to overcapacity. It is noted that the nearby employment site at Essex University generates a large number of trips. In the sensitivity tests in which the Greenstead rbt is improved, overcapacity is partially alleviated in the AM peak period, however, the PM model remains the same.	Description of measure(s)	Improved lane markings on entries advising what lane drivers should use for each exit	Replace zebra crossings on Clingoe Hill with signalised crossings	1) Widen approaches to roundabout 2) Convert roundabout into a more conventional layout	Southern Distributor	Could benefit from the proposed Rapid Transit System
			Linked work	n/a	n/a	n/a	Proposed scheme	See Rapid Transit study
			Estimated cost	<£25,000	£25,000 to £100,000	£1m to £3m	>£10m	Rapid Transit Costs: Opt 1 £29.8m Opt 2: £48.0m Opt 3: £31.3m Opt 4: £37.3m Tram: £164.6m
			Qualitative assessment	Will decrease weaving on the roundabout	Signalised crossing means traffic only stops when signals are red, not whenever there is a pedestrian waiting. Therefore queues should be reduced	Would need to undertake testing using VISSIM of whether a more conventional roundabout would perform better	No major developments in south Colchester so could remain aspirational. Southern distributor set to be modelled.	Would significantly reduce number of private cars passing through junction
East Colchester A134/A133 corridor	A134 Hythe Quay from Colne Causeway roundabout to Maudlyn Road	Over capacity issues both in AM and PM peak periods (northbound and southbound) in the committed and local plan scenarios. Developments including the Colchester Tendring Garden Community contribute to increases in traffic. Overcapacity remains in all the Sensitivity Test scenarios.	Description of measure(s)	Open Hythe Hill E/B to all traffic	Replace Maudlyn Rd / Hythe Quay and Maudlyn Rd / Hythe Hill Rbt with priority junctions with Maudlyn Rd having priority	Replace Maudlyn Rd / Hythe Quay and Maudlyn Rd / Hythe Hill Rbt	Close of Hythe Quay access from the Maudlyn Rd / Hythe Quay Rbt, allowing Maudlyn Rd / Hythe Quay Rbt to be removed	Could benefit from the proposed Rapid Transit System
			Linked work	n/a	n/a	n/a	n/a	See Rapid Transit study
			Estimated cost	<£25,000	£25,000 to £100,000	£25,000 to £100,000	£25,000 to £100,000	Rapid Transit Costs: Opt 1 £29.8m Opt 2: £48.0m Opt 3: £31.3m Opt 4: £37.3m Tram: £164.6m
			Qualitative assessment	Would provide an alternative route, however could increase bus delay	Reduced delay and journey times on Maudlyn Road, however delay on side roads may increase	May work better given the small footprint of the junction. Modelling would need to be undertaken to confirm this is the case	Would decrease journey time and delay on Maudlyn Rd. Hythe Hill E/B would need to be opened to all traffic to allow this. Some movements would experience longer journey times	Would significantly reduce number of private cars passing through junction

Group	Location	Summary of problem		Traffic management		Infrastructure		Sustainable and complementary measures
				Basic	Enhanced	Minor	Major	
South/West Colchester A134 (A1124) corridor	Lexden Road /Maldon Rd /Southway roundabout	The roundabout is currently overcapacity in the base year model and set to worsen in 2032 due to traffic growth. Therefore, there are over capacity issues in the AM peak period in the committed and local plan scenarios (in the western approach as well as in the southern approach to the roundabout). The PM models show better results and there are no capacity issues. The issue remains unsolved in all of the sensitivity tests.	Description of measure(s)	Improved lane markings, such as spiral markings on the roundabout to guide drivers	Linked signalisation of junctions with bus priority	Reduce size of central island	Major redesign of the junction, such as a "Hamburger Layout"	Bus priority from Lexden Road, Maldon Road through to Headgate Improve walking and cycling routes at key access point to the town centre.
			Linked work	n/a	n/a	n/a	n/a	Refer to West Colchester Stanway travel strategy
			Estimated cost	<£25,000	£100,000 to £500,000	£500,00 to £1m	£1m to £3m	£1.73m
			Qualitative assessment	Will decrease weaving on the roundabout	Signals on roundabouts generally increases capacity.	Will increase roundabout capacity	Could significantly increase roundabout capacity. Would require modelling	Will encourage more walking, cycling and bus use reducing car use
South/West Colchester A134 (A1124) corridor	Southway - Maldon Road Roundabout to St Botolphs Roundabout	The model shows congestion in the committed and local plan scenarios in the AM peak on the section of Southway between Chapel Street and Maldon Road roundabout. Congestion on Southway is reduced in the sensitivity tests altering J26 and introducing the Southern distributor	Description of measure(s)	Provide signalised pedestrian crossings on all approaches to the roundabout	Signalise all arms of the roundabout. Provide signalised pedestrian crossings on pedestrian desire lines	Convert to two way operation with a mini roundabout at the Southway (West arm)	Convert to two way operation with Right Turn from Stanwell Street to Southway (west) permitted	Could benefit from the proposed Rapid Transit System. Given location in the centre of Colchester any public transport improvements could reduce congestion here
			Linked work	St Botolph's Roundabout study, being undertaken by Essex Highways	St Botolph's Roundabout study, being undertaken by Essex Highways	St Botolph's Roundabout study, being undertaken by Essex Highways	St Botolph's Roundabout study, being undertaken by Essex Highways	See Rapid Transit study
			Estimated cost	£500,00 to £1m	£500,00 to £1m	£3m - 5m	£3m - 5m	Rapid Transit Costs: Opt 1 £29.8m Opt 2: £48.0m Opt 3: £31.3m Opt 4: £37.3m Tram: £164.6m
			Qualitative assessment	For 2021 LinSig modelling predicts a 20% increase in capacity in the AM peak, 10% in the PM peak and 0% increase for the Saturday peak	For 2021 LinSig modelling predicts a 20% increase in capacity in the AM peak, 10% in the PM peak and a 5% decrease for the Saturday peak	For 2021 LinSig modelling predicts a 20% increase in capacity for all three peaks	For 2021 LinSig modelling predicts a 20% increase in capacity for all three peaks	Would significantly reduce number of private cars passing through junction

Group	Location	Summary of problem		Traffic management		Infrastructure		Sustainable and complementary measures
				Basic	Enhanced	Minor	Major	
Other	Colne Bank/ Essex Hall junction/ Cymbeline Way	The roundabout has some links over capacity in the southbound direction both in the AM and PM peak periods in the committed and local plan scenarios. The traffic situation in the base year is already congested, with some links being over capacity. The traffic growth that is expected in the year 2032 alongside new developments north of this roundabout will worsen the situation and therefore both the AM and PM models have traffic issues. The issue remains unsolved in all of the sensitivity tests.	Description of measure(s)	Signalisation of the A134 and North Station Road arms of the Essex Hall Roundabout. Clarendon Way and Essex Hall Road would remain unsignalised	Signal optimisation from Colne Bank to North Station Road roundabouts (including Albert Rbt)	Colne Bank to Albert Widening Also consider Colne Bank left turn slips	Convert the Essex Hall roundabout to a "Hamburger Roundabout", in which A134 traffic will pass straight through the middle of the roundabout. Similar to the Colchester North Station roundabouts	Greater promotion of Park and ride Alter access to and from Railway Station Improve walking and cycling routes
			Linked work	Question on whether this required as part of a NGAUE ta	Identified in A133 corridor study	Colne Bank to Albert widening under construction	Currently being tested for the Colchester North West Study. The Colchester Study is a study being undertaken by the London NCC office	Colchester North West Study is looking at improving cycle and pedestrian facilities at the Colchester North Station, Essex Hall and The Albert Roundabouts.
			Estimated cost	£500,00 to £1m	£1m to £3m	£3m to £5m	>£10m	£1m to £3m
			Qualitative assessment	Modelling in LinSig has already been done for this and was found to increase capacity	Will decrease delays. Would require traffic modelling	Will decrease queues and journey times, particularly on A133	Modelling undertaken to date shows this significantly reduces delays and journey times	Will encourage more walking and cycling, reducing car use

Group	Location	Summary of problem		Traffic management		Infrastructure		Sustainable and complementary measures
				Basic	Enhanced	Minor	Major	
Other	A137 Harwich Road/East Street	The PM model in the southbound direction is over capacity in the committed and local plan scenarios. This is caused due to the Greenstead roundabout that is overcapacity which causes rerouting of the traffic. All sensitivity tests alleviate the overcapacity issue on the Harwich Road approaching the East St junction.	Description of measure(s)	Replace keep clear with yellow box	Convert to a mini roundabout	Convert to a junction. Signals would need to be incorporated with level crossing	Replace level crossing with a bridge	Could benefit from the proposed Rapid Transit System
			Linked work	n/a	n/a	n/a	n/a	Refer to West Colchester Stanway travel strategy
			Estimated cost	<£25,000	£25,000 to £100,000	£100,000 to £500,000	>£10m	Rapid Transit Costs: Opt 1 £29.8m Opt 2: £48.0m Opt 3: £31.3m Opt 4: £37.3m Tram: £164.6m
			Qualitative assessment	Will prevent traffic from blocking other movements. Will be particularly effective when the level crossing barriers are closed	Modelling would be required to assess whether this would improve the situation	Modelling would be required to assess whether this would improve the situation	Will significantly reduce delays. Likely to be extremely expensive given the lack of room for a bridge	Would significantly reduce number of private cars passing through junction

Group	Location	Summary of problem		Traffic management		Infrastructure		Sustainable and complementary measures
				Basic	Enhanced	Minor	Major	
Other	A133/A120 link southern end junction arrangements	Some over capacity issues in the AM peak period in the local plan scenario (westbound approach). The PM model shows better performance around the roundabout. The Colchester Tendring Garden Community along with redistribution of traffic around this area contribute to overcapacity. The problem remains unsolved in all the Sensitivity Scenarios.	Description of measure(s)	Directional arrows on the roundabout entries and spiral markings on the roundabout	Signalise roundabout	Left slip from the A133 SE to W arm	2 lane entries on A133 for 50 metres up to junction	Improve bus services into Colchester
			Linked work	n/a	n/a	n/a	n/a	n/a
			Estimated cost	<£25,000	£100,000 to £500,000	£500,000 to £1m	£1m to £3m	£ varies
			Qualitative assessment	Will decrease weaving on the roundabout	Signals on roundabouts generally increases capacity.	Will decrease journey times from the A133 SE to W	Will decrease queues on entries. Decrease may be limited unless roundabout is enlarged	Could reduce number of private vehicles passing through junction
Other	Circular Road South/ Berechurch Road/ Pownall Cres	Overcapacity issues both in the AM and PM peak periods in the committed and local plan scenarios. The overcapacity approaches to this junction are the north/west and south arms. It should also be noted that the junction was operating close to its capacity in the base year. Therefore, it is reasonable to expect overcapacity issues arise due to general traffic growth. Nearby new housing developments, which includes the Garrison Development, contribute to further growth in traffic. The AM sensitivity test scenarios could not alleviate overcapacity. However, in all the PM sensitivity test scenarios, the problem is partially resolved by the improvement of	Description of measure(s)	Implement yellow box at junction	Implement UTC SCOOT or similar on junction	Lane widening on Berechurch Rd North and Circular Rd S. There is sufficient room to do this in the highway boundary	As Minor but with lane widening on Berechurch Rd South arm as well. There is a retaining wall on this arm which will increase costs for this arm	Improve cycle facilities at junction, such as advanced cycle stoplines Improve bus services and implement bus priority measures at junction
			Linked work	n/a	n/a	n/a	n/a	n/a
			Estimated cost	<£25,000	£25,000 to £100,000	£100,000 to £500,000	£1m to £3m	£25,000 to £100,000 for improved cycle facilities. £100,000 to £500,000 for bus priority measures
			Qualitative assessment	Will prevent traffic from blocking other movements	Will reduce delays, typically around 10% to 20%	Will increase junction capacity, decreasing delay	Will further increase junction capacity, decreasing delay	Would improve bus services encouraging bus use and also encouraging people to cycle more

Group	Location	Summary of problem		Traffic management		Infrastructure		Sustainable and complementary measures
				Basic	Enhanced	Minor	Major	
Other	B1022 Shrub End Road (on approach to junction with Maldon Road/Drury Road)	Both in the AM and PM peak period, the northbound direction of the B1022 is overcapacity in the committed and local plan scenarios. In the base year the link is overcapacity; thus the new developments and general traffic growth contribute to a worsening in overcapacity. The problem remains unsolved in all Sensitivity Test scenarios.	Description of measure(s)	Implement yellow box at junction	Implement UTC SCOOT or similar on junction	Replace signalised junction with roundabout, utilising the existing island Roundabout could be signalised	Limited scope for lane widening on B1022 east arm. This may involve removal of the island	Bus priority measures on Shrub End Road
			Linked work	Example	Example	Example	Example	Refer to Stanway Travel Strategy
			Estimated cost	<£25,000	£25,000 to £100,000	£100,000 to £500,000	£500,000 to £1m	£574,000
			Qualitative assessment	Will prevent traffic from blocking other movements	Will reduce delays, typically around 10% to 20%	Three arm signalised roundabouts operate very efficiently so should reduce delay. Will require modelling	Will reduce delay. Removal of island may be locally unpopular	Would improve bus services encouraging bus use
Other	Old Heath Road/Wimpole Road junction	Over capacity issues in the AM and PM peak period in the committed and local plan scenarios. The problem is on the Old Heath Road northbound in the AM, while in the PM the issue regards all the approaches of the junction apart from the south approach. In the base year, the junction was over capacity. Overcapacity remains in all the Sensitivity Scenarios.	Description of measure(s)	Implement yellow box at junction	Implement UTC SCOOT or similar on junction	Lane widening could be done on Wimpole Rd North and Old Heath Rd West	Shift junction to the Northeast to allow wider lanes on all approaches. Land would have to be taken from the park	Improve cycle facilities at junction, such as advanced cycle stoplines Improve bus services and implement bus priority measures at junction
			Linked work	n/a	n/a	n/a	n/a	n/a
			Estimated cost	<£25,000	£25,000 to £100,000	£500,000 to £1m	£5m to £10m	£25,000 to £100,000 for improved cycle facilities £100,000 to £500,000 for bus priority measures
			Qualitative assessment	Will prevent traffic from blocking other movements	Will reduce delays, typically around 10% to 20%	Will reduce delay and increase junction capacity	Will significantly reduce delay. Taking land from park likely to be unpopular	Would improve bus services, encouraging bus use and also encouraging people to cycle more

Group	Location	Summary of problem		Traffic management		Infrastructure		Sustainable and complementary measures
				Basic	Enhanced	Minor	Major	
Other	Mersea Road/Normandy Avenue junction	In the AM peak the northbound carriageway of Mersea Road on the approach to the Normandy Avenue junction is operating at just over full capacity in the local plan scenario; and just under full capacity in the committed plan scenario. This could suggest right turners into Normandy Avenue frequently block ahead traffic. This is not affected in the sensitivity tests.	Description of measure(s)	Add right turn arrow on the pocket opposite Normandy Avenue westbound carriageway	Traffic calming measures on Normandy Avenue	Realign Normandy Avenue westbound carriageway to allow a longer right turn pocket	Replace junction with a roundabout	n/a
			Linked work	n/a	n/a	n/a	n/a	n/a
			Estimated cost	<£25,000	£25,000 to £100,000	£500,000 to £1m	£1m to £3m	n/a
			Qualitative assessment	Will encourage Normandy Avenue right turners to queue in the pocket instead of on Normandy Avenue	This will discourage rat running, reducing traffic on Normandy Road and therefore delay at the junction	Unusual shape of the junction restricts the length of the pocket. A longer pocket would mean more traffic could store without impeding ahead traffic	Could be done for a relatively low cost due to the large footprint of the junction. Should reduce delay on all approaches	n/a
Other	Brook Street/East Hill/East Street junction	In both the committed and local plan scenarios the Brook Street with East Hill/East Street signalised junction is shown as being overcapacity in the AM and PM peaks. The problem is on the Brook Street arm. The issue was repeated in each of the sensitivity tests.	Description of measure(s)	Reoptimise signal timings	Implement SCOOT or MOVA at junction	Relocate the East Street pedestrian crossing further to the east	Widening on the East Street Approach to provide 2 ahead lanes and 1 left turn lane	Could benefit from the proposed Rapid Transit System
			Linked work	n/a	n/a	n/a	n/a	Refer to West Colchester Stanway travel strategy
			Estimated cost	<£25,000	£25,000 to £100,000	£100,000 to £500,000	£500,000 to £1m	Rapid Transit Costs: Opt 1 £29.8m Opt 2: £48.0m Opt 3: £31.3m Opt 4: £37.3m Tram: £164.6m
			Qualitative assessment	Reoptimise signal timings to reduce queues on Brook Street. This would likely increase queues on East Hill / East Street	Would more effectively optimise traffic signals, reducing queues, particularly on the Brook Street arm	Would shorten queues on the East Street approach, allowing signals to be reoptimised to increase green time to Brook Street	Would allow signals to be reoptimised to increase green time to Brook Street	Would significantly reduce number of private cars passing through the junction