

Brentwood Borough Local Plan

Development Options – Highway Modelling

Please note that this report is published in draft form in order to transparently share information swiftly as part of the plan making process. However, it has not yet been fully considered by Highways England or Essex County Council as local highway authority. This work will be further developed in partnership with highways authorities before a final version is published.

On behalf of **Brentwood Borough Council**



Document Control Sheet

Project Name: Brentwood Borough Local Plan

Project Ref: 28085

Report Title: Development Options – Highway Modelling

Doc Ref: 1.1

Date: 09/02/2016

	Name	Position	Signature	Date
Prepared by:	Darren Rawls Perry Roose Tim Yau	Senior Technician Technician Graduate Engineer	DR PR TY	08/02/2016
Reviewed by:	Paul Gebbett	Associate	PG	08/02/2016
Approved by:	Robert Parker	Director	RP	09/02/2016
For and on behalf of Peter Brett Associates LLP				

Revision	Date	Description	Prepared	Reviewed	Approved
1	09/02/2016	Draft	TY	PG	RP

Peter Brett Associates LLP disclaims any responsibility to the Client and others in respect of any matters outside the scope of this report. This report has been prepared with reasonable skill, care and diligence within the terms of the Contract with the Client and generally in accordance with the appropriate ACE Agreement and taking account of the manpower, resources, investigations and testing devoted to it by agreement with the Client. This report is confidential to the Client and Peter Brett Associates LLP accepts no responsibility of whatsoever nature to third parties to whom this report or any part thereof is made known. Any such party relies upon the report at their own risk.

© Peter Brett Associates LLP 2016

Contents

1	Introduction	1
1.1	Commission	1
1.2	Report Structure	1
2	Modelling Overview.....	2
2.1	Introduction	2
2.2	Strategic Modelling Methodology	2
2.3	Junction Modelling.....	2
3	Development Options	5
3.1	Options Tested	5
3.2	Common Housing Sites to all Scenarios	5
3.3	Option 1 – Strategic Housing Sites	6
3.4	Option 2 – Strategic Housing Sites	6
3.5	Option 3 – Strategic Housing Sites	7
3.6	Option 4 – Strategic Housing Sites	7
3.7	Employment Sites.....	8
4	Spreadsheet Model	9
4.1	Introduction	9
4.2	Model Zoning System and Road Network.....	9
4.3	Trip Generation.....	12
4.4	Trip Distribution	13
4.5	Mode Share	15
4.6	Additional Vehicular Flows on the Road Network due to the Tested Options	15
5	Base Year Junction Modelling	17
5.1	Existing Junction Models.....	17
5.2	Traffic Surveys.....	17
5.3	Site Visit.....	17
5.4	Model Outputs	17
6	Future Baseline Junction Modelling	28
6.1	Introduction.....	28
6.2	Baseline Results.....	28
7	Option 1 - Results.....	39
7.1	Introduction	39
7.2	Results.....	39
8	Option 2 - Results.....	50
8.1	Introduction	50
8.2	Results.....	50
9	Option 3 – Results.....	61
9.1	Introduction	61

9.2	Results.....	61
10	Option 4 – Results.....	72
10.1	Introduction.....	72
10.2	Results.....	72
11	Summary of Junction Outputs.....	83
11.1	Introduction.....	83
11.2	Summary Junction Capacity Assessment.....	83
11.3	Junction Ranking.....	86

Figures

Figure 2-1: Location of Junctions Modelled.....	3
Figure 4-1: Census-based zones across Brentwood, using Census output area boundaries.....	10
Figure 4-2: LDP sites (labelled with site references) featured in the tested options.....	11

Tables

Table 2-1: Junctions Modelled and Junction Type.....	3
Table 3-1: Brownfield housing sites common to all options.....	5
Table 3-2: A12 urban extension housing sites common to all options.....	6
Table 3-3: Option 1 - Strategic Housing Sites.....	6
Table 3-4: Option 2 - Strategic Housing Sites.....	7
Table 3-5: Option 3 - Strategic Housing Sites.....	7
Table 3-6: Option 4 - Strategic Housing Sites.....	7
Table 3-7: Employment sites.....	8
Table 4-1: Person Trip Rates for AM Peak (0800-0900) from NTS.....	13
Table 4-2: Adjustment Factors for Development Employment Numbers.....	14
Table 4-3 Factors to Apply to NTS Work Trips.....	14
Table 5-1: Chelmsford Road/Hutton Road/Shenfield Road – Base Year.....	18
Table 5-2: A129 Rayleigh Road / Hanging Hill Lane - Base Year.....	18
Table 5-3: A128 Ongar Road / Doddington Road - Base Year.....	18
Table 5-4: A128 Ongar Road / Western Avenue - Base Year.....	19
Table 5-5: A128 Ongar Road / William Hunter Way – Base Year.....	19
Table 5-6: A128 Ongar Rd / A1023 Shenfield Rd / A128 Ingrave Rd / A1023 High Street - Base Year	20
Table 5-7: A128 Ingrave Road / B186 Queens Road - Base Year.....	20
Table 5-8: Ingrave Road/Middleton Hall Lane/Seven Arches Road - Base Year.....	21
Table 5-9 B185 Kings Road / B186 Queens Road - Base Year.....	21
Table 5-10: High Street/Kings Road/London Road/Weald Road – Base Year.....	21
Table 5-11: Weald Road / Western Road - Base Year.....	22
Table 5-12: Western Road / William Hunter Way - Base Year.....	22
Table 5-13: A127 / A128 Brentwood Road / A128 Tilbury Road - Base Year.....	23
Table 5-14: A127 / Childerditch Lane Northern Side - Base Year.....	23
Table 5-15: A127 / Childerditch Lane Southern Side - Base Year.....	24
Table 5-16: A128 Ingrave Rd / The Avenue / A128 Brentwood Rd / Running Waters - Base Year.....	24
Table 5-17: Brook Street/Mascalls Lane – Base Year.....	25
Table 5-18: Brook Street/Mascalls Lane – Base Year.....	25
Table 5-19: B186 Warley Street / A127 Eastbound - Base Year.....	26
Table 5-20 B186 Warley Street / A127 Westbound - Base Year.....	26

Table 5-21: A127 Westbound / Thorndon Avenue, West Horndon - Base Year.....	26
Table 5-22: A1023 Chelmsford Road / Alexander Lane - Base Year	27
Table 5-23: West Mayne/Lower Dunton Road – Base Year	27
Table 6-1: Chelmsford Road/Hutton Road/Shenfield Road – Baseline	28
Table 6-2: A129 Rayleigh Road / Hanging Hill - Baseline.....	29
Table 6-3 A128 Ongar Road / Doddington Road - Baseline	29
Table 6-4: A128 Ongar Road / Western Avenue - Baseline	29
Table 6-5: A128 Ongar Road / William Hunter Way - Baseline	30
Table 6-6: A128 Ongar Rd / A1023 Shenfield Rd / A128 Ingrave Rd / A1023 High Street - Baseline .	30
Table 6-7: A128 Ingrave Road / B186 Queens Road - Baseline	31
Table 6-8: Ingrave Road/Middleton Hall Lane/Seven Arches Road – Baseline.....	31
Table 6-9: B185 Kings Road / B186 Queens Road - Baseline	32
Table 6-10: High Street/Kings Road/London Road/Weald Road – Baseline	32
Table 6-11: Weald Road / Western Road - Baseline	33
Table 6-12: Western Road / William Hunter Way - Baseline	33
Table 6-13: A127 / A128 Brentwood Road / A128 Tilbury Road - Baseline	34
Table 6-14: A127 / Childerditch Lane Northern Side - Baseline	34
Table 6-15: A127 / Childerditch Lane Southern Side - Baseline.....	34
Table 6-16: A128 Ingrave Road / The Avenue / A128 Brentwood Road / Running Waters - Baseline	35
Table 6-17: Brook Street/Mascalls Lane – Baseline	35
Table 6-18: Brook Street/Mascalls Lane – Baseline	36
Table 6-19: B186 Warley Street / A127 Eastbound - Baseline	36
Table 6-20: B186 Warley Street / A127 Westbound - Baseline	37
Table 6-21: A127 Westbound / Thorndon Avenue, West Horndon - Baseline.....	37
Table 6-22: A1023 Chelmsford Road / Alexander Lane - Baseline	37
Table 6-23: West Mayne/Lower Dunton Road - Baseline	38
Table 7-1: Chelmsford Road/Hutton Road/Shenfield Road – Option 1	39
Table 7-2: A129 Rayleigh Road / Hanging Hill Lane - Option 1	39
Table 7-3: A128 Ongar Road / Doddington Road - Option 1	40
Table 7-4: A128 Ongar Road / Western Avenue - Option 1.....	40
Table 7-5: A128 Ongar Road / William Hunter Way – Option 1	41
Table 7-6: A128 Ongar Rd / A1023 Shenfield Rd / A128 Ingrave Rd / A1023 High Street - Option 1 .	41
Table 7-7: A128 Ingrave Road / B186 Queens Road - Option 1.....	42
Table 7-8: Ingrave Road/Middleton Hall Lane/Seven Arches Road - Option 1.....	42
Table 7-9 B185 Kings Road / B186 Queens Road - Option 1.....	43
Table 7-10: High Street/Kings Road/London Road/Weald Road – Option 1	43
Table 7-11: Weald Road / Western Road - Option 1	44
Table 7-12: Western Road / William Hunter Way - Option 1.....	44
Table 7-13: A127 / A128 Brentwood Road / A128 Tilbury Road - Option 1.....	45
Table 7-14: A127 / Childerditch Lane Northern Side - Option 1.....	45
Table 7-15: A127 / Childerditch Lane Southern Side - Option 1	45
Table 7-16: A128 Ingrave Road / The Avenue / A128 Brentwood Road / Running Waters - Option 1	46
Table 7-17: Brook Street/Mascalls Lane – Option 1	47
Table 7-18: Brook Street/Mascalls Lane – Option 1	47
Table 7-19: B186 Warley Street / A127 Eastbound - Option 1	48
Table 7-20: B186 Warley Street / A127 Westbound - Option 1	48
Table 7-21: A127 Westbound / Thorndon Avenue, West Horndon - Option 1	48
Table 7-22: A1023 Chelmsford Road / Alexander Lane - Option 1	48
Table 7-23: West Mayne/Lower Dunton Road – Option 1	49
Table 8-1: Chelmsford Road/Hutton Road/Shenfield Road – Option 2	50
Table 8-2: A129 Rayleigh Road / Hanging Hill Lane - Option 2.....	50
Table 8-3: A128 Ongar Road / Doddington Road - Option 2	51
Table 8-4: A128 Ongar Road / Western Avenue - Option 2.....	51
Table 8-5: A128 Ongar Road / William Hunter Way - Option 2.....	52
Table 8-6: A128 Ongar Rd / A1023 Shenfield Rd / A128 Ingrave Rd / A1023 High Street - Option 2 .	52
Table 8-7: A128 Ingrave Road / B186 Queens Road - Option 2.....	53
Table 8-9: B185 Kings Road / B186 Queens Road - Option 2.....	54
Table 8-10: High Street/Kings Road/London Road/Weald Road – Option 2	54

Table 8-11: Weald Road / Western Road - Option 2	55
Table 8-12: Western Road / William Hunter Way - Option 2.....	55
Table 8-13: A127 / A128 Brentwood Road / A128 Tilbury Road - Option 2.....	56
Table 8-14: A127 / Childerditch Lane Northern Side - Option 2.....	56
Table 8-15: A127 / Childerditch Lane Southern Side - Option 2.....	56
Table 8-16: A128 Ingrave Road / The Avenue / A128 Brentwood Road / Running Waters - Option 2 ..	57
Table 8-17: Brook Street/Mascalls Lane – Option 2	58
Table 8-18: Brook Street/Mascalls Lane – Option 2	58
Table 8-19: B186 Warley Street / A127 Eastbound - Option 2	59
Table 8-20: B186 Warley Street / A127 Westbound - Option 2	59
Table 8-21: A1023 Chelmsford Road / Alexander Lane - Option 2	59
Table 8-22: West Mayne/Lower Dunton Road – Option 2	60
Table 9-1: Chelmsford Road/Hutton Road/Shenfield Road – Option 3	61
Table 9-2: A129 Rayleigh Road / Hanging Hill Lane - Option 3.....	61
Table 9-3: A128 Ongar Road / Doddington Road - Option 3	62
Table 9-4: A128 Ongar Road / Western Avenue - Option 3.....	62
Table 9-5: A128 Ongar Road / William Hunter Way – Option 3.....	63
Table 9-6: A128 Ongar Rd / A1023 Shenfield Rd / A128 Ingrave Rd / A1023 High Street - Option 3 ..	63
Table 9-7: A128 Ingrave Road / B186 Queens Road - Option 3.....	64
Table 9-8: Ingrave Road/Middleton Hall Lane/Seven Arches Road - Option 3.....	64
Table 9-9 B185 Kings Road / B186 Queens Road - Option 3.....	65
Table 9-10: High Street/Kings Road/London Road/Weald Road – Option 3	65
Table 9-11: Weald Road / Western Road - Option 3	66
Table 9-12: Western Road / William Hunter Way - Option 3.....	66
Table 9-13: A127 / A128 Brentwood Road / A128 Tilbury Road - Option 3.....	67
Table 9-14: A127 / Childerditch Lane Northern Side - Option 3.....	67
Table 9-15: A127 / Childerditch Lane Southern Side - Option 3.....	67
Table 9-16: A128 Ingrave Road / The Avenue / A128 Brentwood Road / Running Waters - Option 3 ..	68
Table 9-17: Brook Street/Mascalls Lane – Option 3	69
Table 9-18: Brook Street/Mascalls Lane – Option 3	69
Table 9-19: B186 Warley Street / A127 Eastbound - Option 3	70
Table 9-20 B186 Warley Street / A127 Westbound - Option 3	70
Table 9-21: A1023 Chelmsford Road / Alexander Lane - Option 3	70
Table 9-22: West Mayne/Lower Dunton Road – Option 3	71
Table 10-1: Chelmsford Road/Hutton Road/Shenfield Road – Option 4	72
Table 10-2: A129 Rayleigh Road / Hanging Hill Lane - Option 4.....	72
Table 10-3: A128 Ongar Road / Doddington Road - Option 4	73
Table 10-4: A128 Ongar Road / Western Avenue - Option 4.....	73
Table 10-5: A128 Ongar Road / William Hunter Way – Option 4.....	74
Table 10-6: A128 Ongar Rd / A1023 Shenfield Rd / A128 Ingrave Rd / A1023 High Street - Option 4 ..	74
Table 10-7: A128 Ingrave Road / B186 Queens Road - Option 4	75
Table 10-8: Ingrave Road/Middleton Hall Lane/Seven Arches Road - Option 4.....	75
Table 10-9 B185 Kings Road / B186 Queens Road - Option 4.....	76
Table 10-10: High Street/Kings Road/London Road/Weald Road – Option 4	76
Table 10-11: Weald Road / Western Road - Option 4	77
Table 10-12: Western Road / William Hunter Way - Option 4.....	77
Table 10-13: A127 / A128 Brentwood Road / A128 Tilbury Road - Option 4.....	78
Table 10-14: A127 / Childerditch Lane Northern Side - Option 4.....	78
Table 10-15: A127 / Childerditch Lane Southern Side - Option 4.....	78
Table 10-16: A128 Ingrave Rd / The Avenue / A128 Brentwood Road / Running Waters - Option 4 ..	79
Table 10-17: Brook Street/Mascalls Lane – Option 4	79
Table 10-18: Brook Street/Mascalls Lane – Option 4	80
Table 10-19: B186 Warley Street / A127 Eastbound - Option 4	80
Table 10-20 B186 Warley Street / A127 Westbound - Option 4	81
Table 10-21: A127 Westbound / Thorndon Avenue, West Horndon - Option 4.....	81
Table 10-22: A1023 Chelmsford Road / Alexander Lane - Option 4	81
Table 10-23: West Mayne/Lower Dunton Road – Option 4	82
Table 11-1: Junction Modelling Summary Results – AM Peak	83

Table 11-2: Junction Modelling Summary Results – PM Peak	84
Table 11-3: Junction Ranking – By Worse Performing Junction	87

Appendices

Appendix A	Modelling Methodology Notes
Appendix B	Brentwood LDP Sites Options
Appendix C	Link Flow Plots – BBC Area
Appendix D	Link Flow Plots - M25 Junctions
Appendix E	Junction Layout Drawings
Appendix F	LinSig Model Development Note
Appendix G	Base Year Model Outputs
Appendix H	Forecast Junction Model Outputs

DRAFT

DRAFT
This page is intentionally blank

1 Introduction

1.1 Commission

- 1.1.1 Peter Brett Associates have been commissioned by Brentwood Borough Council (BBC) to assess the impact of options for strategic development within the Borough in the coming years.
- 1.1.2 The documents sets out our approach to this work, the results of the modelling and junction assessments and highlights those worse performing junctions that may require mitigation, to enable the development sites to come forward. This work is a high level appraisal that will be used to inform the selection of a preferred option for future development in the Borough.

1.2 Report Structure

- 1.2.1 Following this introduction this document is set out as follows:
- Section 2 provides an overview of the modelling methodology;
 - Section 3 sets out the development options;
 - Section 4 sets out the approach to the spreadsheet modelling;
 - Section 5 sets out the approach to the junction modelling and junction assessments;
 - Section 6 provides the modelling results for the baseline scenario;
 - Section 7 and 8 provide the results of the junction assessments for development options 1 and 2 respectively;
 - Section 9 sets out results of the assessment at M25 junctions 28 and 29; and
 - Section 10 sets out a summary of the results and highlights the worst performing junctions on an operational basis, to inform the next step in the project in identifying where mitigation may be required.

2 Modelling Overview

2.1 Introduction

- 2.1.1 The modelling methodology used consisted of a hybrid approach where trip generation and distribution for development options was estimated utilising spreadsheets for trip generation and Omnitrans for trip distribution. This produced traffic flows for both the baseline and the option tests, which then fed into the junction modelling.
- 2.1.2 Whilst not being a true strategic modelling tool which allows for the reassignment impacts, in the absence of such a modelling tool, this method is felt to be a robust (albeit worst-case) appraisal and proportionate both in terms of outputs and cost, for this stage of local plan testing.

2.2 Strategic Modelling Methodology

- 2.2.1 The strategic modelling approach was set out in 'Brentwood Development Trip Methodology', Peter Brett Associates, June 2014. This document is attached as Appendix A. This describes the approach to trip generation and distribution for the development scenarios assessed; the methodology is also applicable to the generation and distribution of the future baseline traffic flows, which includes committed developments plus background growth.
- 2.2.2 A meeting was held with Essex County Council (ECC) and BBC on 16th July 2014 at BBC offices, where the methodology was discussed; a separate meeting was held with the Highways Agency on 27th August. Subsequently, a draft modelling note was issued on 8th September for comment. The modelling note was then revised to take account of ECC comments. These comments, together with PBA's response, are also included within Appendix A.
- 2.2.3 The strategic modelling process distributes traffic, between all origin and destination points, solely on the basis of the quickest route. The link speeds are supplied from TrafficMaster, to provide average speeds on all links for the desired time period. The modelling does not take account of congestion within the network, beyond that implicit within the TrafficMaster data, to effect re-assignment. Effectively a single iteration of an 'all or nothing' assignment is undertaken.
- 2.2.4 The network used for the purposes of the assessment is the Ordnance Survey Integrated Transport Network (ITN), which is imported into the OmniTrans suite to allow the distribution process to be undertaken and for geographically based graphics to be produced for trip distribution. The routing patterns associated with the developments included were checked to determine that they were sensible.
- 2.2.5 OmniTrans then also allows for turning flows, from each development scenario, to be extracted for each of the junctions to be modelled.

2.3 Junction Modelling

- 2.3.1 At the time that the general modelling methodology was agreed a list of junctions to be assessed was also agreed with ECC. In total, 23 junctions were modelled using the relevant software package. The junctions modelled are shown in Figure 2-1 and details of each junction provided in Table 2-1. It was agreed that the assessment of impacts on the Highways England network (M25, and A12) would only be assessed in terms of overall link impacts and, at least initially would not include any detailed assessment of the operation of individual junctions.

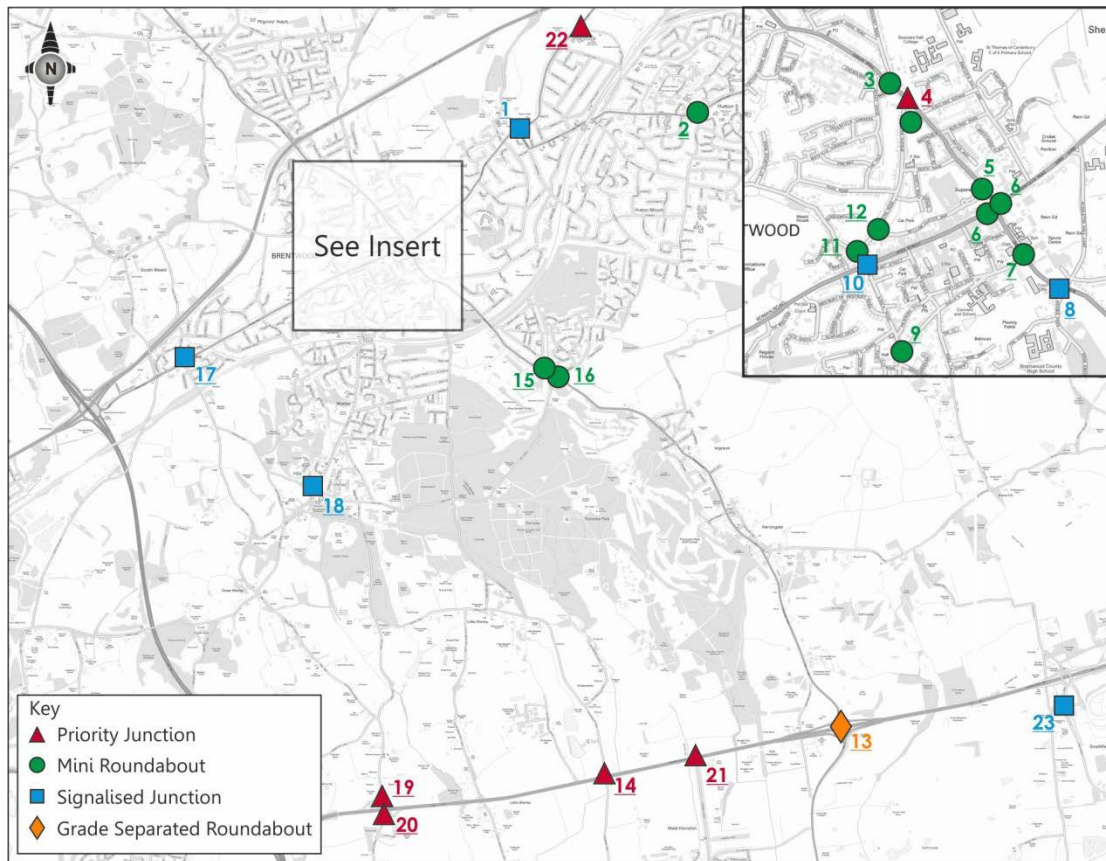


Figure 2-1: Location of Junctions Modelled

Table 2-1: Junctions Modelled and Junction Type

No.	Junction	Junction Type	Modelling Software
1	A1023 Chelmsford Road / A129 Hutton Road / A1023 Shenfield Road	Signalised Junction	LINSIG
2	A129 Rayleigh Road / Hanging Hill Lane	Mini Roundabout	JUNCTIONS 8
3	A128 Ongar Road / Doddinghurst Road	Mini Roundabout	JUNCTIONS 8
4	A128 Ongar Road / Western Avenue	Priority Junction	JUNCTIONS 8
5	A128 Ongar Road / William Hunter Way	Mini Roundabout	JUNCTIONS 8
6	A128 Ongar Road / A1023 Shenfield Road / A128 Ingrave Road / A1023 High Street	Double Mini Roundabout	JUNCTIONS 8

7	A128 Ingrave Road / B186 Queens Road	Mini Roundabout	JUNCTIONS 8
8	A128 Ingrave Road / Middleton Hall Lane / Seven Arches Road	Signalised Junction	LINSIG
9	B185 Kings Road / B186 Queens Road	Mini Roundabout	JUNCTIONS 8
10	A1023 High Street / B185 Kings Road / A1023 London Road / Weald Road	Signalised Junction	LINSIG
11	Weald Road / Western Road	Mini Roundabout	JUNCTIONS 8
12	Western Road / William Hunter Way	Mini Roundabout	JUNCTIONS 8
13	A127 / A128 Brentwood Road / A128 Tilbury Road	Grade Separated Roundabout	JUNCTIONS 8
14	A127 / Childerditch Lane	Priority Junction	JUNCTIONS 8
15	A128 Ingrave Road / The Avenue	Double Mini Roundabout (linked with J16)	JUNCTIONS 8
16	A128 Brentwood Road / Running Waters	Double Mini Roundabout (linked with J15)	JUNCTIONS 8
17	A1023 Brook Street / Mascalls Lane	Signalised Junction	LINSIG
18	B186 Warley Hill / Eagle Way / B186 Warley Road / Mascalls Lane	Signalised Junction	LINSIG
19	B186 Warley Street / A127 eastbound	Priority Junction	JUNCTIONS 8
20	B186 Warley Street / A127 westbound	Priority Junction	JUNCTIONS 8
21	A127 westbound / Thorndon Avenue, West Horndon	Priority Junction	JUNCTIONS 8
22	A1023 Chelmsford Road / Alexander Lane	Priority Junction	JUNCTIONS 8
23	B148 West Mayne / Lower Dunton Road	Signalised Junction	LINSIG

3 Development Options

3.1 Options Tested

- 3.1.1 Details of the development options to be tested were provided by BBC in the form of a spreadsheet. The four development options that were tested each incorporated a specific set of LDP development sites, as described in file 'Brentwood LDP Sites Options (4 Options) v3.xlsx' (Brentwood BC, Dec 2015), which is attached as Appendix B.
- 3.1.2 The forecast residential population by age band for each site was estimated using the mean values per household for all of Brentwood, from Census 2011. These rates were 0.475, 1.469 and 0.458 residents per household for age bands 0-16, 17-64, and 65+, respectively.

3.2 Common Housing Sites to all Scenarios

- 3.2.1 Some development sites were common to all four options and these are detailed in Table 3-1 for Brownfield Sites and Table 3-2 for Urban Extension Sites.

Table 3-1: Brownfield housing sites common to all options

Site Ref.	Site Description	Area (Ha.)	Dwellings	Estimated Residential Population (By Age Group)			
				0-16	17-64	65+	Total
001A	Land north of Highwood Close including St Georges Court, Brentwood	0.47	20	25	76	24	125
001B		0.81	32				
003	Wates Way Ind'l Estate, Ongar Road	0.96	80	38	117	37	192
005	Essex Cnty Fire Brigade HQ, Rayleigh Road	1.26	50	24	73	23	120
013B	Warley Training Centre, Essex Way, Warley	0.66	26	12	38	12	62
020	West and East Horndon Industrial Estates, Childerditch Lane and Station Road, West Horndon	6.39	192	91	282	88	461
021		9.84	295	140	433	135	708
152		0.83	25	12	37	11	60
039	Westbury Road Car Park, Brentwood	0.27	22	10	32	10	53
040	Chatham Way/Crown Street Car Park	0.33	26	12	38	12	62
042	Land at Bell Mead, Ingatestone	0.22	16	8	23	7	38
081	Council Depot, The Drive, Warley	1.71	68	32	100	31	163
098	Ingleton House, Stock Lane, Ingatestone	0.26	10	5	15	5	24
099	Victoria Court, Victoria Road, Brentwood	0.5	40	19	59	18	96
100	Baytree Centre, Brentwood	1.34	200	95	294	92	480
044	Land at Priests Lane (east and west), Brentwood	4.45	104	49	153	48	250
178		0.9	27	13	40	12	65

Table 3-2: A12 urban extension housing sites common to all options

Site Ref.	Site Description	Area (Ha.)	Dwellings	Estimated Residential Population (By Age Group)			
				0-16	17-64	65+	Total
010	Sow & Grow Nursery, Ongar Rd, Pilgrims Hatch	1.2	37	18	54	17	89
022	Land at Honeypot Lane, Brentwood	10.9	150	71	220	69	360
032	Land east of Nags Head Lane, Brentwood	5.8	130	62	191	60	312
034	Officer's Meadow, Alexander Lane, Shenfield	20.4	500	228	705	220	1153
235		1.4		9	29	9	48
023	Land off Doddinghurst Road, Brentwood	7.2	250	119	367	115	600
079A	Ingatestone By-Pass	1.39	42	20	62	19	101
128	Garden Centre, Roman Road, Ingatestone	3.25	60	28	88	28	144

3.3 Option 1 – Strategic Housing Sites

3.3.1 Details of the strategic development sites included within Option 1 are shown in Table 3-3.

Table 3-3: Option 1 - Strategic Housing Sites

Site Ref.	Site Description	Area (Ha.)	Dwellings	Estimated Residential Population (By Age Group)			
				0-16	17-64	65+	Total
200	Dunton Hills Garden Village	237.5	2500	1186	3672	1146	6004

3.4 Option 2 – Strategic Housing Sites

3.4.1 Details of the strategic development sites included within Option 2 are shown in Table 3-4.

Table 3-4: Option 2 - Strategic Housing Sites

Site Ref.	Site Description	Area (Ha.)	Dwellings	Estimated Residential Population (By Age Group)			
				0-16	17-64	65+	Total
037A	West Hornden Extention	8.42	118	56	173	54	283
037B		35.77	499	237	733	229	1198
037C		38.94	544	258	799	249	1306
038A		7.91	110	52	162	50	264
038B		68.56	957	454	1405	439	2298
126		19.47	272	129	399	125	653

3.5 Option 3 – Strategic Housing Sites

3.5.1 Details of the strategic development sites included within Option 3 are shown in Table 3-5.

Table 3-5: Option 3 - Strategic Housing Sites

Site Ref.	Site Description	Area (Ha.)	Dwellings	Estimated Residential Population (By Age Group)			
				0-16	17-64	65+	Total
024A	North of Brentwood	0.67	769	365	1129	353	1847
024B		19.58					
089		20.01	400	190	587	183	961

3.6 Option 4 – Strategic Housing Sites

3.6.1 Details of the strategic development sites included within Option 4 are shown in Table 3-6.

Table 3-6: Option 4 - Strategic Housing Sites

Site Ref.	Site Description	Area (Ha.)	Dwellings	Estimated Residential Population (By Age Group)			
				0-16	17-64	65+	Total
028A	Land East of Running Waters, Brentwood	26.57	1000	475	1469	458	2402
028B		0.67					

3.7 Employment Sites

- 3.7.1 Details of the employment sites included within the option testing are shown in Table 2-7. The first three sites are common for all option scenario tests, with additional sites included in the options as indicated in Table 3-7.

Table 3-7: Employment sites

Site Ref.	Site Description	Area (Ha.)	Workplaces	Option
079C	Land adjacent to Ingatestone By-pass	2.06	250	All
101A	Land at Codham Hall	23.41	2645	All
112D	Childeritch Industrial Estate	2.34	80	All
200	Land east of A128, South of A127	5	1500	1
037B	Land West of Thorndon Avenue, West Horndon	5	1500	2

4 Spreadsheet Model

4.1 Introduction

- 4.1.1 A spreadsheet-based approach was used to assess the potential impact of vehicle trips generated by each of four development options that were formulated by BBC as part of Brentwood's LDP (Local Development Plan).
- 4.1.2 The trip generation, distribution and mode share exercise was conducted in a series of spreadsheets in conjunction with a road network and zoning system developed in OmniTrans (transport modelling software), in order to produce link and turn flows of development trips. The development flow data was added to existing flows for a series of junctions in Brentwood for use in the junction modelling process, in order to assess the impact of each tested option on the performance of each junction.
- 4.1.3 The baseline for the testing of the options included existing residential and workplace data from Census 2011, plus housing data from all of Brentwood's planning permissions (either completed since 2011 or still outstanding, as provided by Brentwood BC), plus a 'windfall allowance' of 300 housing units distributed across the Borough pro rata with the existing residential population.
- 4.1.4 For local authorities in Essex other than Brentwood, a comparable baseline level of residential population was achieved in the model by applying growth factors, per local authority and age band, calculated using ONS population projections published to year 2020, then extrapolated to year 2025. The ONS projected growth within Brentwood was accounted for by the overall increase from 2011 existing levels of population to the levels forecast by each of the development options being tested.

4.2 Model Zoning System and Road Network

- 4.2.1 The zoning system that formed the geographical basis for the modelling work was constructed in a GIS and constituted proposed development zones and Census-based zones for the existing population. The Census-based zones were at single and multiple Output Area level within Brentwood BC, at Census ward level for neighbouring local authorities, and at local authority level to cover the wider area of London, Essex, Hertfordshire, and Kent. See Figure 4-1.
- 4.2.2 The development zones represented the larger sites with extant planning permissions, as featured in the baseline of the modelling, plus additional zones for the sites listed in each of the four options that were modelled. The locations of all of the LDP sites that were featured in the tested options are shown in Figure 4-2.
- 4.2.3 Within GIS, the road network was extracted from the ITN digital road network for all of Essex, with mean link speeds derived from TrafficMaster GPS data. Zone connectors were generated between each zone centroid and its nearest node on the road network, then the road network and zoning system were imported into the OmniTrans specialist transport modelling software. This was used to generate travel-time and distance matrices for use in the trip distribution and mode share elements of the spreadsheet-based trip modelling, and, after trip matrices had been calculated, assigning the trip matrices to the network to determine link flows and turning flows at junctions.

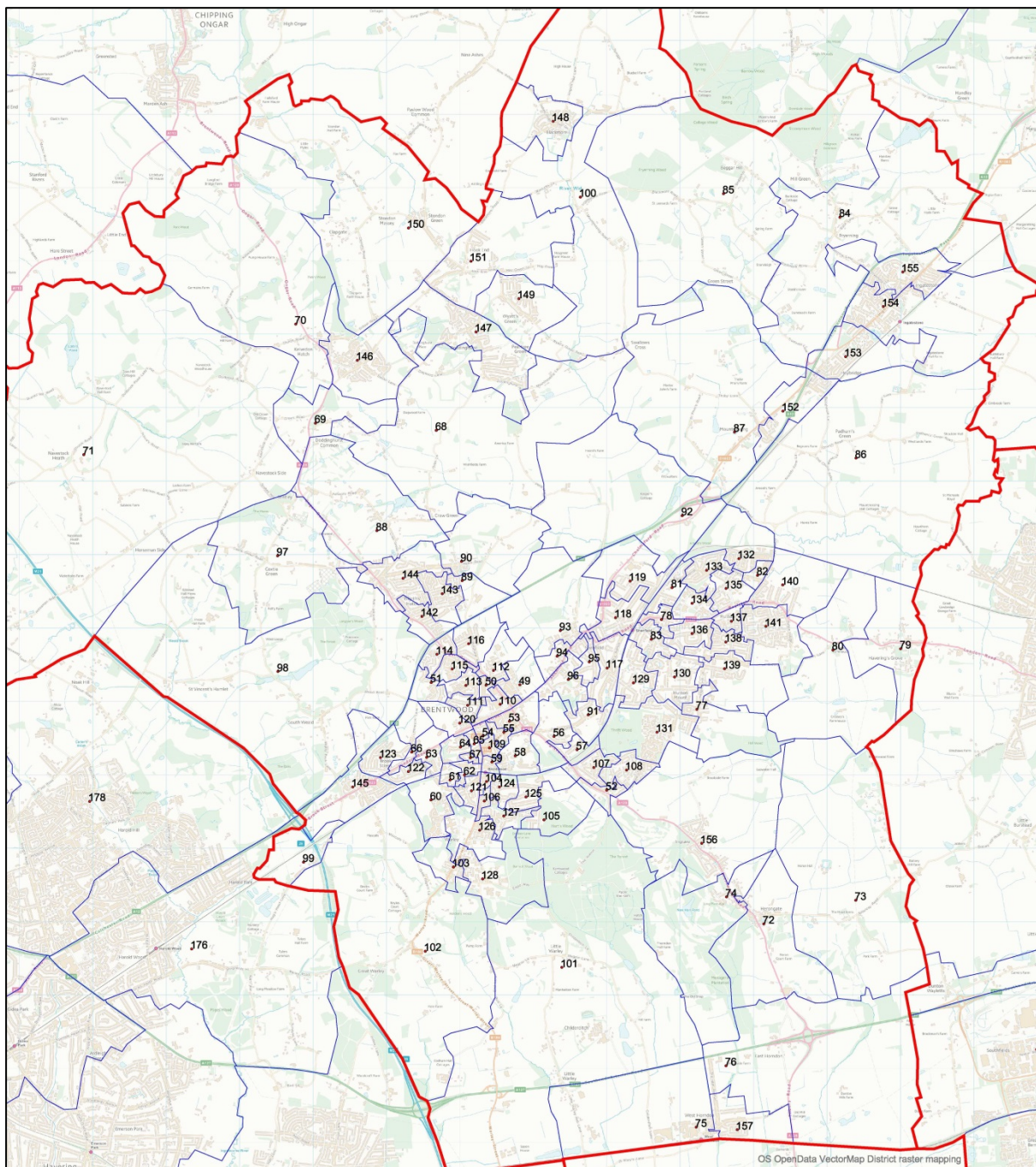


Figure 4-1: Census-based zones across Brentwood, using Census output area boundaries

Development Options – Highway Modelling Brentwood Borough Local Plan

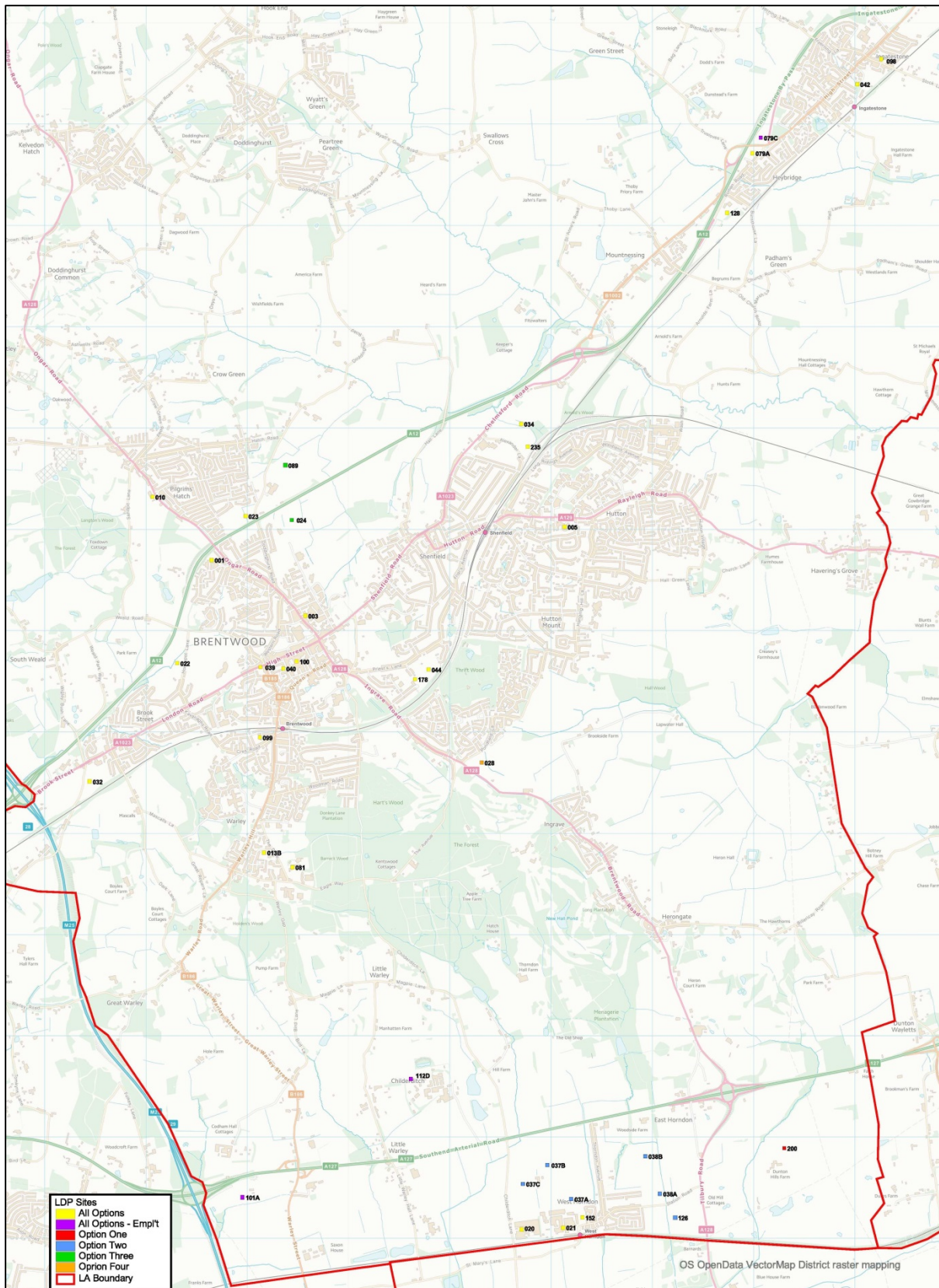


Figure 4-2: LDP sites (labelled with site references) featured in the tested options

4.3 Trip Generation

- 4.3.1 The generation, distribution and mode share of the trips resulting from each tested option was calculated using a series of spreadsheets, with an initial 'Control' sheet in order to select the required option and time period. The choice of options modelled within the spreadsheets and available to the user were :
- Existing
 - Baseline
 - Option 1
 - Option 2
 - Option 3
 - Option 4
- 4.3.2 The choice of time periods modelled and available to the user were :
- AM Peak (0800-0900)
 - PM Peak (1700-1800)
 - 24 hours
- 4.3.3 A 'Zone Data' sheet collated the number of proposed housing units and their estimated number of residents (by age band) for each residential development zone, and the estimated forecast number of employees for each employment development zone. Similarly, the number of residents (by age band) and workplaces was collated for each Census-based zone, using Census 2011 data.
- 4.3.4 Within sheet 'Trip Generation' the number of home-based trips generated by each zone was calculated for the selected option and time period. This used the zone data for the required user-option in conjunction with trip rates from the National Travel Survey (NTS), the AM Peak rates from which are shown in Table 4-1. (All NTS data used in this project was extracted using population selection criteria appropriate for the size and location of Brentwood). This provided all-mode trip numbers generated for each broad purpose by the resident population of each zone (as home-to-purpose, purpose-to-home and non-home-based). The home-based trip purposes modelled were work, education, escort-education, shop food, shop non-food and 'other'. Similarly, the non-home-based trip purposes modelled were work and other (non-home).
- 4.3.5 At the trip distribution stage (described below), the employment elements of the tested sites attracted trips from existing (non-development) residential areas as well as the tested development sites. Therefore it was necessary to calculate trips generated by all zones in the zoning system, and also to include the 'Existing' and 'Baseline' options. Vehicular trip results from the 'Existing' option were subtracted from the 'Baseline' results and, similarly, results from the 'Baseline' option were subtracted from results from each of the tested options to gain the net increase due to the baseline above 'existing' and the net increase due to each of the tested options above the baseline.

Table 4-1: Person Trip Rates for AM Peak (0800-0900) from NTS.

	Trips Per Person (By Age)			Equivalent Trips per Household
	0-16	17-64	65+	
Home-to-Purpose				
Work & Empl Business	0.00025	0.14153	0.00381	0.20977
Education	0.37640	0.02016	0.00003	0.20843
Shop Food	0.00040	0.00263	0.00883	0.00809
Shop Non-Food	0.00046	0.00262	0.01152	0.00934
Escort Education	0.03577	0.05074	0.00252	0.09268
Other	0.04391	0.02757	0.02737	0.07390
All Purposes	0.45720	0.24525	0.05409	0.60221
Purpose-to-Home				
Work & Empl Business	0.00010	0.00345	0.00039	0.00530
Education	0.00020	0.00002	0.00000	0.00012
Shop Food	0.00002	0.00078	0.00156	0.00187
Shop Non-Food	0.00001	0.00100	0.00692	0.00464
Escort Education	0.00625	0.01489	0.00129	0.02544
Other	0.00301	0.00910	0.00807	0.01850
All Purposes	0.00959	0.02925	0.01824	0.05587
Non-Home-Based				
Work/EB to Work/EB	0.00006	0.00685	0.00013	0.01014
Work/EB to Other (NHB)	0.00173	0.00136	0.00017	0.00289
Other (NHB) to Work/EB	0.00024	0.01766	0.00028	0.02619
Other (NHB) to Other (NHB)	0.02899	0.00977	0.00402	0.02997
Total NHB	0.03102	0.03563	0.00460	0.06919

4.4 Trip Distribution

- 4.4.1 The home-based generated trips were distributed separately for each trip purpose using appropriate trip attractors and the distance matrix from the OmniTrans model.
- 4.4.2 For work trips a matrix of weights was calculated using distance weights (which reduce as the distance increases) derived from Census journey-to-work data for Brentwood, in conjunction with the number of workplaces in each zone. At this stage, the workplaces in each of the development employment zones were adjusted to allow for a different peak-hour share of a whole day's trips for the proposed employment types than that of general employment, reflecting the differing day profile of types B1/B2/B8 compared with employment as a whole. The adjustment factors can be found in Table 4-2.

Table 4-2: Adjustment Factors for Development Employment Numbers

	NTS Rate	24-Hour Share	TRICS B1	24-Hour Share	TRICS B2	24-Hour Share	TRICS B8	24-Hour Share
Home-to-Work								
0800-0900	0.17284	30.4%	1.514	22.7%	0.426	16.4%	0.117	10.3%
1700-1800	0.01312	2.3%	0.173	2.6%	0.086	3.3%	0.046	4.1%
24-Hour	0.56814		6.68		2.603		1.132	
Work-to-Home								
0800-0900	0.00660	1.2%	0.241	3.9%	0.170	6.4%	0.051	4.3%
1700-1800	0.14760	27.6%	1.260	20.5%	0.405	15.4%	0.124	10.5%
24-Hour	0.53554		6.161		2.637		1.184	

Table 4-3 Factors to Apply to NTS Work Trips

	B1	B2	B8
Home-to-Work			
0800-0900	0.822	0.789	0.802
1700-1800	1.121	1.481	1.780
24-Hour	1.000	1.000	1.000
Work-to-Home			
0800-0900	8.174	3.181	3.493
1700-1800	0.819	0.779	0.814
24-Hour	1.000	1.000	1.000

- 4.4.3 The normalised matrix of weights was applied to the generated work trips in order to distribute them across all zones. For trip purposes other than work trips the Census data could not be used for the distance weightings, so a gravity modelling approach was used instead.

- 4.4.4 For the education trips, matrices of weights were calculated separately for each level; assuming education trips by the age 0-16 band was split 50-50 between primary school trips and secondary school trips, and Age 17-64 trips were to/from tertiary education.
- 4.4.5 The location of local stores was a component of the weights of both the shop-food trips and the shop-non-food trips. In addition, the shop-food trips used supermarket locations and the shop-non-food trips used various non-food retail locations, namely town centres, local retail parks, and larger shopping centres (Lakeside, Bluewater, Westfield).
- 4.4.6 Non-home based trips were generated and distributed using a similar method to that of the home-based trips. However, a 'double-distribution' approach was necessary, where trips were distributed firstly to find the trip origins (using the origin-purpose's weights), then distributed again to find the trip destinations (using the destination-purpose's weights). The non-home-based modelled trip purposes were simply 'work' and 'other' (hence matrices were calculated for work-to-work, work-to-other, other-to-work and other-to-other).

4.5 Mode Share

- 4.5.1 The trip distribution stage (above) resulted in trip matrices for each purpose (home-based and non-home-based) for the selected option and time period, for all transport modes combined. The next stage involved deriving the car-driver matrices from the all-mode matrices.
- 4.5.2 Walking and cycling trips were separated from the all-mode trip matrices to form non-walk-cycle matrices. The walk and cycle shares of trips for each distance band and trip purpose were derived from NTS data and used in this exercise.
- 4.5.3 For work-related trips, the car-driver trips were separated from the non-walk-cycle trips using the corresponding Census 2011 journey-to-work share for that particular origin-destination combination. For the purpose of this modelling exercise, the development zones inherited the car-driver shares of the Census zones that they were located within. For the other trip purposes (not work related), the car-driver trips were separated from the non-walk-cycle trips using the appropriate NTS mode shares for each particular time period and trip purpose (including non-home-based purposes).

4.6 Additional Vehicular Flows on the Road Network due to the Tested Options

- 4.6.1 Following the mode share stage of the spreadsheet-based exercise, resulting vehicle (car-driver) trip matrices were formed by aggregating the car-driver matrices across all trip purposes, for each required time period and modelling option. The vehicle matrices were assigned to the road network in OmniTrans that had already been used to calculate the distance and travel time matrices. It is noted that the OmniTrans model uses a simple, time based assignment and does not include any algorithms to represent the effects of increased congestion on traffic routing or mode share. The methodology will therefore provide a worst case (robust) assessment of impacts on individual junctions.
- 4.6.2 Option Two (West Horndon Strategic Sites) matrices were assigned to a variant of the base network, with Thorndon Avenue and Childerditch Lane closed their junctions with the A127, on the south side of the dual carriageway, following advice from Brentwood BC. This ensured that West Horndon traffic was assigned to use alternative routes to these minor roads, typically using the A128 Tilbury Road.
- 4.6.3 Bandwidth plots were produced in OmniTrans, showing the link loads in the AM and PM peaks, resulting from the assignment of the corresponding vehicle matrices. Comparison plots between modelling options showed net gains in flow resulting from the baseline (above the existing flows), and net gains in flow resulting from each of the tested options (above the

baseline). These comparison plots are shown for the Brentwood BC area in Appendix C, and for M25 junctions 28 and 29 in Appendix D.

- 4.6.4 A spreadsheet was compiled presenting the net increases in vehicular flow resulting from the tested options, for each turning movement of each junction that required junction modelling, for the AM and PM peaks. For simple junctions this information could be acquired by viewing the node data in OmniTrans following the assignment stage, and for more complex junctions cordon matrices were generated after defining a cordon around the junctions in OmniTrans. This turning flow data for each junction was used as input data for the modelling of the individual junctions.

DRAFT

5 Base Year Junction Modelling

5.1 Existing Junction Models

- 5.1.1 Traffic Models for each of the junctions was produced, using the relevant software package depending on the junction type. Junctions 8 was used for all priority and roundabout junctions and LinSig used for the traffic signalled junctions. The layout and measurements used within the models are shown on the plans attached as Appendix E.
- 5.1.2 Models have been produced for AM peak (0800-0900) and PM peak (1700-1800) hours.
- 5.1.3 Each of the models was initially run with traffic data taken directly from the survey data collected and these were checked against video surveys to ensure they matched as far as possible, conditions on the ground. Further detail of the calibration and development of the LinSig models is provided in Appendix F.

5.2 Traffic Surveys

- 5.2.1 The traffic flow data for the junctions 1 to 23 were received from Essex Highways. The turning counts for junctions 1 to 18 was performed on 28th November 2012. The turning counts for junctions 19 to 23 were performed on 27th March 2014.
- 5.2.2 Video surveys were also received from Essex Highways which were performed on 28th November 2012 for junctions 1 to 18.

5.3 Site Visit

- 5.3.1 A team of four members went to Brentwood on 3rd July 2014 to measure the road geometries where safe to do so, in order to gain accurate measurements for the modelling.
- 5.3.2 All measurements were recorded and drawn up in CAD. The drawings 28085/1003/SK01 to SK23 illustrates the measurements for each relevant junction.
- 5.3.3 Whilst on site the team members performed on-site observations in both the AM and PM peaks on a number of the junctions.

5.4 Model Outputs

- 5.4.1 For the junctions modelled in junctions 8, the key outputs are the Ratio of Flow to Capacity (RFC), delay (seconds per PCU) and Queue in PCU's. For LinSig models the key outputs are the degree of saturation (given as a %), mean maximum queue (MMQ) and average delay per vehicle (in seconds).
- 5.4.2 Where an arm at a junction is shown to be reaching capacity i.e. has an RFC above 0.85 or degree of saturation (for signalised junctions) above 85% this is shown in **Orange** and where an arm is shown to be over capacity i.e. RFC >1.00 or degree of saturation over 100% this is shown in **Red**.
- 5.4.3 Full results from the models are attached as Appendix G.

Junction 1 - Chelmsford Road/Hutton Road/Shenfield – Signalised Junction

- 5.4.4 This is a signalised junction and has been tested using LinSig software and a summary of the results is shown in Table 5-1.

Table 5-1: Chelmsford Road/Hutton Road/Shenfield Road – Base Year

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Shenfield Road (ahead & right)	79%	15	22	90%	30	31
Chelmsford Road (ahead & left)	67%	10	31	49%	8	23
Hutton Road (all movements)	66%	7	27	90%	16	54

- 5.4.5 The results show that the junction is within capacity in the AM peak but is at capacity in the PM peak.

Junction 2 - A129 Rayleigh Road / Hanging Hill Lane - Mini-Roundabout

- 5.4.6 The results of this assessment are shown in Table 5-2.

Table 5-2: A129 Rayleigh Road / Hanging Hill Lane - Base Year

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/ PCU)	Queue (PCU)	RFC (%)	Delay (s/ PCU)	Queue (PCU)
Rayleigh Road (Eastbound)	0.47	7.07	0.88	0.56	8.77	1.26
Rayleigh Road (Westbound)	0.79	19.19	3.64	0.60	10.03	1.46
Hanging Hill lane	1.01	172.36	22.93	0.80	31.77	3.93

- 5.4.7 The results show that in the AM peak Hanging Hill lane is over capacity, in the PM peak the junction works within capacity.

Junction 3 - A128 Ongar Road / Doddinghurst Road - Mini-Roundabout

- 5.4.8 The results of this assessment are shown in Table 5-3.

Table 5-3: A128 Ongar Road / Doddinghurst Road - Base Year

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/ PCU)	Queue (PCU)	RFC (%)	Delay (s/ PCU)	Queue (PCU)

Ongar Road (Southbound)	1.07	295.37	68.82	0.91	54.69	8.64
Doddinghurst Road	1.21	683.17	65.43	0.55	19.30	1.18
Ongar Road (Northbound)	0.64	8.39	1.79	1.04	198.60	69.16

- 5.4.9 The results show that in the AM peak, Doddinghurst Road and Ongar Road Southbound are over capacity. In the PM peak Ongar Road Northbound is over capacity with an RFC of 1.04.

Junction 4 - A128 Ongar Road / Western Avenue - Priority Junction

- 5.4.10 The results of this assessment are shown in Table 5-4.

Table 5-4: A128 Ongar Road / Western Avenue - Base Year

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Western Avenue	0.48	15.93	0.91	0.71	25.93	2.35
Ongar Road Right-Turn	0.65	19.90	1.79	0.31	12.31	0.46

- 5.4.11 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 5 - A128 Ongar Road / William Hunter Way - Mini-Roundabout

- 5.4.12 The results of this assessment are shown in Table 5-5.

Table 5-5: A128 Ongar Road / William Hunter Way – Base Year

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
William Hunter Way	0.20	3.63	0.25	0.41	4.85	0.69
Ongar Road (Southbound)	0.49	5.74	0.94	0.42	5.56	0.74
Ongar Road (Northbound)	0.19	4.34	0.24	0.19	4.34	0.24

- 5.4.13 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 6 - A128 Ongar Road / A1023 Shenfield Road / A128 Ingrave Road / A1023 High Street - Double Mini-Roundabout

- 5.4.14 The results of this assessment are shown in Table 5-6.

Table 5-6: A128 Ongar Rd / A1023 Shenfield Rd / A128 Ingrave Rd / A1023 High Street - Base Year

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
J1 Ongar Road	1.10	361.97	19.14	0.24	5.57	0.31
J1 Shenfield Road	1.55	1626.45	297.22	0.68	10.24	2.13
J1 A1023 high Street (Junc 1)	0.51	6.48	1.04	0.51	7.16	1.04
J2 A1023 high Street (Junc 2)	0.51	7.38	1.04	0.48	6.89	0.93
J2 Ingrave Road	1.71	2198.56	297.99	2.18	3660.07	429.93
J2 A1023 High Street (Junc 2)	1.37	1051.38	97.13	1.56	1627.81	119.79

Note: J1 - Junction 1, J2 - Junction 2

- 5.4.15 The results show that in the AM peak Junction 1 is over capacity at Ongar Road and Shenfield Road; Junction 2 Ingrave Road and A1023 High Street is over capacity in the AM peak. In the PM peak Junction 2 Ingrave Road and A1023 High Street is over capacity.

Junction 7 - A128 Ingrave Road / B186 Queens Road Mini-Roundabout

- 5.4.16 The results of this assessment are shown in Table 5-7.

Table 5-7: A128 Ingrave Road / B186 Queens Road - Base Year

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Ingrave Road (Southbound)	0.57	6.86	1.29	0.53	7.66	1.11
Ingrave Road (Northbound)	1.12	433.99	101.64	0.79	20.19	3.67
Queens Road	0.52	7.80	1.06	0.77	15.95	3.26

- 5.4.17 The results show that in the AM peak Ingrave Road Northbound is over capacity, in the PM peak the junction works within capacity.

Junction 8 – Ingrave Road/Middleton Hall Lane/Seven Arches Road – Signalised

5.4.18 This is a signalised junction and has been tested using LinSig software and a summary of the results is shown in Table 5-8.

Table 5-8: Ingrave Road/Middleton Hall Lane/Seven Arches Road - Base Year

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Middleton Hall Lane (ahead/left & right)	99%	33	104	70%	14	56
Ingrave Road East (ahead/left & right)	97%	26	88	54%	11	27
Seven Arches (all movements)	77%	16	40	70%	13	57
Ingrave Road West (ahead/left & right)	94%	21	78	84%	23	36

5.4.19 The results show in the AM peak the junction is at capacity, in the PM peak the junction works within capacity.

Junction 9 - B185 Kings Road / B186 Queens Road - Mini-Roundabout

5.4.20 The results of this assessment are shown in Table 5-9.

Table 5-9 B185 Kings Road / B186 Queens Road - Base Year

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/ PCU)	Queue (PCU)	RFC (%)	Delay (s/ PCU)	Queue (PCU)
Kings Road (Southbound)	0.76	24.16	3.10	0.84	36.85	5.02
Queens Road	0.43	6.04	0.76	0.40	5.76	0.66
Kings Road (Northbound)	0.51	4.92	1.05	0.59	5.74	1.45

5.4.21 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 10 - High Street/Kings Road/London Road/Weald Road – Signalised

5.4.22 This is a signalised junction and has been tested using LinSig software and a summary of the results is shown in Table 5-10.

Table 5-10: High Street/Kings Road/London Road/Weald Road – Base Year

Arm	AM peak (08:00-09:00)	PM peak (17:00-18:00)
-----	--------------------------	--------------------------

	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Weald Road (ahead/left & right)	80%	15	38	62%	10	34
A1023 High Street East (all movements)	65%	10	30	57%	10	29
Kings Road (ahead/left & right)	54%	8	29	66%	13	32
A1023 High Street East (ahead/left & right)	67%	9	23	64%	9	19

5.4.23 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 11 - Weald Road / Western Road - Mini-Roundabout

5.4.24 The results of this assessment are shown in Table 5-11.

Table 5-11: Weald Road / Western Road - Base Year

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Weald Road (Southbound)	0.39	8.04	0.63	0.26	7.80	0.35
Western Road	0.49	8.51	0.94	0.39	6.60	0.62
Weald Road (Northbound)	0.47	7.01	0.88	0.69	12.10	2.24

5.4.25 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 12 - Western Road / William Hunter Way - Mini-Roundabout

5.4.26 The results of this assessment are shown in Table 5-12.

Table 5-12: Western Road / William Hunter Way - Base Year

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Western Road (Southbound)	0.57	9.61	1.30	0.33	6.54	0.50
William Hunter Way	0.14	6.32	0.20	0.30	6.84	0.40
Western Road (Northbound)	0.39	5.61	0.60	0.61	9.21	1.60

5.4.27 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 13 - A127 / A128 Brentwood Road / A128 Tilbury Road - Grade Separated Gyratory

5.4.28 The results of this assessment are shown in Table 5-13.

Table 5-13: A127 / A128 Brentwood Road / A128 Tilbury Road - Base Year

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Brentwood Road	0.41	2.82	0.71	0.40	3.17	0.66
A127 (Westbound)	0.58	5.42	1.36	0.57	5.33	1.31
Tilbury Road	0.37	2.37	0.59	0.39	2.30	0.63
A127 (Eastbound)	0.26	3.65	0.36	0.41	5.13	0.70

5.4.29 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 14a - A127 / Childerditch Lane Northern Side - Left in, Left out Priority Junction

5.4.30 The results of this assessment are shown in Table 5-14.

Table 5-14: A127 / Childerditch Lane Northern Side - Base Year

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Childerditch lane	0.59	65.48	1.41	0.74	79.21	2.58

5.4.31 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 14b - A127 / Childerditch Lane Southern Side - Left in, Left out Priority Junction

5.4.32 The results of this assessment are shown in Table 5-15.

Table 5-15: A127 / Childerditch Lane Southern Side - Base Year

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Childerditch lane	0.36	42.02	0.56	0.14	25.49	0.16

5.4.33 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 15 & 16 - A128 Ingrave Road / The Avenue / A128 Brentwood Road / Running Waters - Double Mini-Roundabout

5.4.34 The results of this assessment are shown in Table 5-16.

Table 5-16: A128 Ingrave Rd / The Avenue / A128 Brentwood Rd / Running Waters - Base Year

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
J1 The Avenue	0.41	8.83	0.70	1.71	2201.43	290.71
J1 Ingrave Road	0.66	10.34	1.91	1.64	1940.03	260.58
J1 Brentwood Road (Westbound)	0.98	53.70	12.40	0.75	15.23	3.01
J2 Brentwood Road (Eastbound)	0.86	27.61	6.06	0.98	55.28	12.40
J2 Running Waters	1.73	2281.34	309.22	0.55	14.30	1.21
J2 Brentwood Road (Westbound)	1.62	1889.55	427.64	0.79	17.17	3.71

Note: J1 - Junction 1, J2 - Junction 2

5.4.35 The results show that Junction 1 Brentwood Road westbound is at capacity and Junction 2 is over capacity in the AM peak. In the PM peak Junction 1 is over capacity, Junction 2 Brentwood Road eastbound is at capacity.

Junction 17 - Brook Street/Mascalls Lane – Signalised Junction

5.4.36 This is a signalised junction and has been tested using LinSig software and a summary of the results is shown in Table 5-17.

Table 5-17: Brook Street/Mascalls Lane – Base Year

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Spital Street (all movements)	82%	8	66	72%	6	69
A1023 London Road (all movements)	89%	23	47	83%	27	31
Mascalls Lane (ahead/right & left)	46%	7	25	55%	8	35
A1023 Brook Street (ahead/left & right)	88%	34	28	69%	21	16

- 5.4.37 The results show that A1023 London Road and A1023 Brook Street are at capacity in the AM peak, in the PM peak the junction runs within capacity.

Junction 18 - Warley Hill/Eagle Way – Signalised Junction

- 5.4.38 This is a signalised junction and has been tested using LinSig software and a summary of the results is shown in Table 5-18.

Table 5-18: Brook Street/Mascalls Lane – Base Year

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Warley Road North (all movements)	85%	12	47	61%	11	30
Eagle Way (all movements)	92%	15	79	84%	13	59
Warley Road South (ahead/left & right)	92%	23	53	73%	12	36
Mascalls Lane (ahead/left & right)	92%	14	79	82%	10	63

- 5.4.39 The results show that in the AM peak the junction runs at capacity, in the PM peak the junction runs within capacity.

Junction 19 - B186 Warley Street / A127 Eastbound - Priority Junction

- 5.4.40 The results of this assessment are shown in Table 5-19.

Table 5-19: B186 Warley Street / A127 Eastbound - Base Year

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
A127 Slip Road	1.41	1322.22	132.42	0.75	37.84	2.89
Warley Street Right-Turn	0.31	7.38	0.82	0.38	7.09	1.07

5.4.41 The results show that in the AM peak, A127 Slip Road is over capacity, in the PM peak the junction runs within capacity.

Junction 20 - B186 Warley Street / A127 Westbound - Priority Junction

5.4.42 The results of this assessment are shown in Table 5-20.

Table 5-20 B186 Warley Street / A127 Westbound - Base Year

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
A127 Slip Road	1.21	722.75	67.93	1.18	624.37	83.39
Warley Street Right-Turn	0.47	7.00	1.83	0.34	6.78	0.88

5.4.43 The results show that in both the AM and PM peaks, A127 Slip Road is over capacity.

Junction 21 - A127 Westbound / Thorndon Avenue, West Horndon - Left in, Left out Priority Junction

5.4.44 The results of this assessment are shown in Table 5-21.

Table 5-21: A127 Westbound / Thorndon Avenue, West Horndon - Base Year

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Thorndon Avenue	0.09	19.03	0.10	0.10	20.79	0.11

5.4.45 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 22 - A1023 Chelmsford Road / Alexander Lane Priority Junction

5.4.46 The results of this assessment are shown in Table 5-22.

Table 5-22: A1023 Chelmsford Road / Alexander Lane - Base Year

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
A127 Slip Road	0.64	53.06	1.69	0.49	32.02	0.95
Chelmsford Road Right-Turn	0.07	8.56	0.08	0.01	6.42	0.01

5.4.47 The results show that the junction works within capacity in both the AM and PM peaks

Junction 23 - West Mayne/Lower Dunton Road – Signalised Junction

5.4.48 This is a signalised junction and has been tested using LinSig software and a summary of the results is shown in Table 5-23.

Table 5-23: West Mayne/Lower Dunton Road – Base Year

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
West Mayne North (ahead/left & right)	52%	5	14	58%	6	15
Ford Access (left only)	0%	0	0	0%	0	0
West Mayne North (ahead/left & right)	48%	5	13	53%	5	14
Lower Dunton (left only)	34%	3	15	27%	2	14

5.4.49 The results show that the junction works within capacity in both the AM and PM peaks.

6 Future Baseline Junction Modelling

6.1 Introduction

- 6.1.1 For each junction future traffic turning movements were produced by adding the flows derived within the strategic modelling approach onto the existing traffic counts. This was firstly done for the baseline scenario, which produced a reference case on which to compare future development options.
- 6.1.2 A summary of the results for the Baseline are provided in the following sections for each junction. The full results for each junction are provided in Appendix H.

6.2 Baseline Results

- 6.2.1 The following outputs were based on Baseline Flows.

Junction 1 - Chelmsford Road/Hutton Road/Shenfield Road – Signalised Junction

- 6.2.2 This is a signalised junction and has been tested using LinSig software and a summary of the results is shown in Table 6-1.

Table 6-1: Chelmsford Road/Hutton Road/Shenfield Road – Baseline

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Shenfield Road (ahead & right)	80%	16	23	91%	31	33
Chelmsford Road (ahead & left)	67%	10	31	50%	8	23
Hutton Road (all movements)	69%	8	29	92%	16	58

- 6.2.3 The results show that the junction runs within capacity in the AM peak and is at capacity in the PM peak.

Junction 2 - A129 Rayleigh Road / Hanging Hill Lane - Mini-Roundabout

- 6.2.4 The results of this assessment are summarised in Table 6-2.

Table 6-2: A129 Rayleigh Road / Hanging Hill - Baseline

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Rayleigh Road (Eastbound)	0.48	7.23	0.92	0.57	9.12	1.34
Rayleigh Road (Westbound)	0.80	19.94	3.81	0.61	10.56	1.58
Hanging Hill lane	1.03	224.97	31.12	0.83	35.95	4.53

- 6.2.5 The results show that Hanging Hill Lane in the morning peak is over capacity with an RFC of 1.03, in the PM peak the junction is within capacity.

Junction 3 - A128 Ongar Road / Doddinghurst Road - Mini-Roundabout

- 6.2.6 The results of this assessment are summarised in Table 6-3.

Table 6-3 A128 Ongar Road / Doddinghurst Road - Baseline

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Ongar Road (Southbound)	1.09	341.53	80.33	0.92	60.13	9.60
Doddinghurst Road	1.23	735.54	70.77	0.56	20.06	1.25
Ongar Road (Northbound)	0.64	8.60	1.80	1.06	228.39	80.54

- 6.2.7 The results show that in the AM peak Doddinghurst Road and Ongar Road southbound are over capacity with RFC's of 1.23 and 1.09. In the PM peak Ongar Road northbound is over capacity with an RFC of 1.06.

Junction 4 - A128 Ongar Road / Western Avenue - Priority Junction

- 6.2.8 The results of this assessment are summarised in Table 6-4.

Table 6-4: A128 Ongar Road / Western Avenue - Baseline

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Western Avenue	0.51	17.37	1.02	0.72	27.02	2.46
Ongar Road Right-Turn	0.65	20.39	1.85	0.32	12.50	0.47

6.2.9 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 5 - A128 Ongar Road / William Hunter Way - Mini-Roundabout

6.2.10 The results of this assessment are summarised in Table 6-5.

Table 6-5: A128 Ongar Road / William Hunter Way - Baseline

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
William Hunter Way	0.21	3.65	0.26	0.42	4.97	0.73
Ongar Road (Southbound)	0.50	5.92	0.99	0.44	5.76	0.78
Ongar Road (Northbound)	0.19	4.35	0.24	0.19	4.35	0.24

6.2.11 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 6 - A128 Ongar Road / A1023 Shenfield Road / A128 Ingrave Road / A1023 High Street - Double Mini-Roundabout

6.2.12 The results of this assessment are summarised in Table 6-6.

Table 6-6: A128 Ongar Rd / A1023 Shenfield Rd / A128 Ingrave Rd / A1023 High Street - Baseline

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
J1 Ongar Road	0.21	4.74	0.26	0.21	4.73	0.26
J1 Shenfield Road	0.82	18.06	4.40	0.70	11.00	2.36
J1 A1023 high Street (Junc 1)	0.19	4.14	0.23	0.20	4.39	0.24
J2 A1023 high Street (Junc 2)	0.10	4.12	0.11	0.10	4.02	0.11
J2 Ingrave Road	0.76	14.85	3.12	0.84	22.24	5.08
J2 A1023 High Street (Junc 2)	0.70	19.50	2.27	0.66	19.48	1.95

Note: J1 - Junction 1, J2 - Junction 2

6.2.13 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 7 - A128 Ingrave Road / B186 Queens Road - Mini-Roundabout

6.2.14 The results of this assessment are summarised in Table 6-7.

Table 6-7: A128 Ingrave Road / B186 Queens Road - Baseline

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Ingrave Road (Southbound)	0.58	7.09	1.36	0.56	8.16	1.24
Ingrave Road (Northbound)	1.19	634.17	150.33	0.82	24.21	4.53
Queens Road	0.54	8.14	1.15	0.78	17.02	3.50

6.2.15 The results show that Ingrave Road Northbound in the morning peak is over capacity with an RFC of 1.19, in the PM peak the junction is within capacity.

Junction 8 – Ingrave Road/Middleton Hall Lane/Seven Arches Road - Signalised

6.2.16 This is a signalised junction and has been tested using LinSig software and a summary of the results is shown in Table 6-8.

Table 6-8: Ingrave Road/Middleton Hall Lane/Seven Arches Road – Baseline

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Middleton Hall Lane (ahead/left & right)	118%	102	452	71%	14	57
Ingrave Road East (ahead/left & right)	102%	38	145	56%	11	27
Seven Arches (all movements)	82%	18	44	74%	15	62
Ingrave Road West (ahead/left & right)	94%	22	94	86%	24	38

6.2.17 The results show that the junction is overcapacity in the AM peak and Ingrave Road West is at capacity in the PM peak.

Junction 9 - B185 Kings Road / B186 Queens Road - Mini-Roundabout

6.2.18 The results of this assessment are summarised in Table 6-9.

Table 6-9: B185 Kings Road / B186 Queens Road - Baseline

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Kings Road (Southbound)	0.79	27.54	3.60	0.86	40.51	5.57
Queens Road	0.45	6.23	0.80	0.41	5.90	0.69
Kings Road (Northbound)	0.53	5.11	1.12	0.60	5.84	1.49

- 6.2.19 The results show that the junction works within capacity in the AM peak and Kings Road Southbound is at capacity in the PM peak with an RFC of 0.86.

Junction 10 – High Street/Kings Road/London Road/Weald Road – Signalised

- 6.2.20 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 6-8.

Table 6-10: High Street/Kings Road/London Road/Weald Road – Baseline

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Weald Road (ahead/left & right)	82%	16	39	66%	10	36
A1023 High Street East (all movements)	67%	11	30	63%	11	31
Kings Road (ahead/left & right)	56%	9	29	67%	13	32
A1023 High Street East (ahead/left & right)	74%	10	26	68%	10	20

- 6.2.21 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 11 - Weald Road / Western Road - Mini-Roundabout

- 6.2.22 The results of this assessment are summarised in Table 6-11.

Table 6-11: Weald Road / Western Road - Baseline

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Weald Road (Southbound)	0.39	8.14	0.65	0.26	7.91	0.35
Western Road	0.50	8.67	0.98	0.40	6.77	0.67
Weald Road (Northbound)	0.48	7.09	0.90	0.71	12.66	2.39

6.2.23 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 12 - Western Road / William Hunter Way - Mini-Roundabout

6.2.24 The results of this assessment are summarised in Table 6-12.

Table 6-12: Western Road / William Hunter Way - Baseline

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Western Road (Southbound)	0.65	13.62	1.84	0.38	8.11	0.62
William Hunter Way	0.16	7.45	0.19	0.36	8.54	0.55
Western Road (Northbound)	0.44	6.74	0.78	0.69	12.85	2.24

6.2.25 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 13 - A127 / A128 Brentwood Road / A128 Tilbury Road - Grade Separated Gyratory

6.2.26 The results of this assessment are summarised in Table 6-13.

Table 6-13: A127 / A128 Brentwood Road / A128 Tilbury Road - Baseline

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Brentwood Road	0.48	3.56	0.90	0.44	3.68	0.78
A127 (Westbound)	0.63	6.17	1.67	0.72	8.38	2.57
Tilbury Road	0.40	2.56	0.66	0.44	2.78	0.78
A127 (Eastbound)	0.44	4.89	0.79	0.53	6.56	1.14

6.2.27 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 14a - A127 / Childerditch Lane Northern Side - Left in, Left out Priority Junction

6.2.28 The results of this assessment are summarised in Table 6-14.

Table 6-14: A127 / Childerditch Lane Northern Side - Baseline

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Childerditch lane	0.85	193.18	4.24	0.87	151.53	4.99

6.2.29 The results show that the junction is at capacity in both the AM and PM peaks.

Junction 14b - A127 / Childerditch Lane Southern Side - Left in, Left out Priority Junction

6.2.30 The results of this assessment are summarised in Table 6-15.

Table 6-15: A127 / Childerditch Lane Southern Side - Baseline

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Childerditch lane	0.42	50.60	0.70	0.21	34.73	0.26

6.2.31 The results show that the junction is running within capacity in both the AM and PM peaks.

Junction 15 & 16 - A128 Ingrave Road / The Avenue / A128 Brentwood Road / Running Waters Double Mini-Roundabout

6.2.32 The results of this assessment are summarised in Table 6-16.

Table 6-16: A128 Ingrave Road / The Avenue / A128 Brentwood Road / Running Waters - Baseline

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
J1 The Avenue	0.43	9.10	0.74	1.75	2336.66	308.06
J1 Ingrave Road	0.68	11.09	2.09	1.68	2046.36	274.10
J1 Brentwood Road (Westbound)	0.98	53.85	12.40	0.78	16.94	3.45
J2 Brentwood Road (Eastbound)	0.89	32.51	7.27	0.98	55.45	12.40
J2 Running Waters	1.79	2454.83	331.84	0.57	14.96	1.33
J2 Brentwood Road (Westbound)	1.65	1995.45	448.02	0.81	19.36	4.25

Note: J1 - Junction 1, J2 - Junction 2

- 6.2.33 The results show that the junction is at capacity in the AM peak for junction 1, and for junction 2 arms Running Waters and Brentwood Road Westbound are over capacity with RFC's of 1.79 and 1.65. In the PM peak for junction 1 arms The Avenue and Ingrave Road are over capacity with RFC's of 1.75 and 1.68. Junction 2 is at capacity in the PM peak.

Junction 17 – Brook Street/Mascalls Lane – Signalised Junction

- 6.2.34 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 6-17.

Table 6-17: Brook Street/Mascalls Lane – Baseline

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Spital Street (all movements)	83%	9	69	75%	6	73
A1023 London Road (all movements)	93%	26	57	91%	32	42
Mascalls Lane (ahead/right & left)	49%	7	25	61%	9	37
A1023 Brook Street (ahead/left & right)	95%	41	42	72%	23	18

- 6.2.35 The results show that the junction is at capacity in the AM and A1023 London Road is at capacity in the PM peak.

Junction 18 – Warley Hill/Eagle Way – Signalised Junction

6.2.36 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 6-18.

Table 6-18: Brook Street/Mascalls Lane – Baseline

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Warley Road North (all movements)	92%	14	62	63%	12	31
Eagle Way (all movements)	93%	16	83	88%	14	65
Warley Road South (ahead/left & right)	94%	24	56	75%	13	37
Mascalls Lane (ahead/left & right)	100%	21	125	85%	11	66

6.2.37 The results show that the junction is over capacity in the AM and at capacity in the PM peak.

Junction 19 - B186 Warley Street / A127 Eastbound Priority Junction

6.2.38 The results of this assessment are summarised in Table 6-19.

Table 6-19: B186 Warley Street / A127 Eastbound - Baseline

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/ PCU)	Queue (PCU)	RFC (%)	Delay (s/ PCU)	Queue (PCU)
A127 Slip Road	1.46	1494.53	148.75	0.80	46.22	3.71
Warley Street Right-Turn	0.32	7.29	0.86	0.39	7.01	1.17

6.2.39 The results show that the A127 Slip Road is over capacity and has an RFC of 1.46 in the AM peak, in the PM peak the junction runs within capacity.

Junction 20 - B186 Warley Street / A127 Westbound – Priority Junction

6.2.40 The results of this assessment are summarised in Table 6-20.

Table 6-20: B186 Warley Street / A127 Westbound - Baseline

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
A127 Slip Road	1.24	827.57	76.81	1.21	717.00	94.71
Warley Street Right-Turn	0.48	7.12	1.91	0.34	6.91	0.93

- 6.2.41 The results show that the A127 Slip Road is over capacity and has an RFC of 1.24 in the AM peak. In the PM peak the A127 Slip Road is over capacity and has an RFC of 1.21.

Junction 21 - A127 Westbound / Thorndon Avenue, West Horndon - Left in, Left out Priority Junction

- 6.2.42 The results of this assessment are summarised in Table 6-21.

Table 6-21: A127 Westbound / Thorndon Avenue, West Horndon - Baseline

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Thorndon Avenue	0.10	20.37	0.11	0.13	25.84	0.14

- 6.2.43 The results show that the junction is working within capacity in both the AM and PM peaks.

Junction 22 - A1023 Chelmsford Road / Alexander Lane - Priority Junction

- 6.2.44 The results of this assessment are summarised in Table 6-22.

Table 6-22: A1023 Chelmsford Road / Alexander Lane - Baseline

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
A127 Slip Road	0.67	59.13	1.92	0.52	34.30	1.05
Chelmsford Road Right-Turn	0.07	8.63	0.08	0.01	6.46	0.01

- 6.2.45 The results show that the junction is working within capacity in both the AM and PM peaks.

Junction 23 – West Mayne/Lower Dunton Road – Signalised Junction

- 6.2.46 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 6-23.

Table 6-23: West Mayne/Lower Dunton Road - Baseline

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
West Mayne North (ahead/left & right)	55%	6	14	59%	6	15
Ford Access (left only)	0%	0	0	0%	0	0
West Mayne North (ahead/left & right)	49%	5	14	56%	6	14
Lower Dunton (left only)	34%	3	15	27%	2	14

6.2.47 The results show that the junction is working within capacity in both the AM and PM peaks.

7 Option 1 - Results

7.1 Introduction

- 7.1.1 A summary of the results for Option 1 are provided in the following sections for each junction. The full results for each junction are provided in Appendix H.

7.2 Results

- 7.2.1 The following junction's outputs were based on Option 1 Flows.

Junction 1 – Chelmsford Road/Hutton Road/Shenfield – Signalised Junction

- 7.2.2 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 7-1.

Table 7-1: Chelmsford Road/Hutton Road/Shenfield Road – Option 1

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Shenfield Road (ahead & right)	83%	18	24	95%	36	46
Chelmsford Road (ahead & left)	70%	11	33	53%	9	24
Hutton Road (all movements)	72%	8	31	94%	18	67

- 7.2.3 The junction runs within capacity in the AM peak and is at capacity in the PM peak.

Junction 2 - A129 Rayleigh Road / Hanging Hill Lane - Mini-Roundabout

- 7.2.4 The results of this assessment are summarised in Table 7-2.

Table 7-2: A129 Rayleigh Road / Hanging Hill Lane - Option 1

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Rayleigh Road (Eastbound)	0.53	8.06	1.14	0.59	9.66	1.45
Rayleigh Road (Westbound)	0.81	21.86	4.21	0.65	11.84	1.88
Hanging Hill lane	1.06	272.84	38.63	0.89	54.93	7.14

- 7.2.5 The results show that Hanging Hill Lane in the morning peak is over capacity with an RFC of 1.06, in the PM peak the junction is at capacity.

Junction 3 - A128 Ongar Road / Doddinghurst Road - Mini-Roundabout

7.2.6 The results of this assessment are summarised in Table 7-3.

Table 7-3: A128 Ongar Road / Doddinghurst Road - Option 1

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Ongar Road (Southbound)	1.12	431.70	102.23	0.97	97.71	16.09
Doddinghurst Road	1.40	1271.49	125.59	0.61	22.84	1.52
Ongar Road (Northbound)	0.67	9.47	2.05	1.12	413.29	150.24

7.2.7 The results show that in the AM peak Doddinghurst Road and Ongar Road southbound are over capacity with RFC's of 1.40 and 1.12. In the PM peak Ongar Road northbound is over capacity with an RFC of 1.12.

Junction 4 - A128 Ongar Road / Western Avenue - Priority Junction

7.2.8 The results of this assessment are summarised in Table 7-4.

Table 7-4: A128 Ongar Road / Western Avenue - Option 1

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Western Avenue	0.59	23.05	1.40	0.80	39.25	3.86
Ongar Road Right-Turn	0.67	22.09	2.03	0.33	13.03	0.49

7.2.9 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 5 - A128 Ongar Road / William Hunter Way - Mini-Roundabout

7.2.10 The results of this assessment are summarised in Table 7-5.

Table 7-5: A128 Ongar Road / William Hunter Way – Option 1

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
William Hunter Way	0.21	3.68	0.27	0.46	5.31	0.85
Ongar Road (Southbound)	0.55	6.61	1.21	0.48	6.39	0.91
Ongar Road (Northbound)	0.20	4.37	0.24	0.20	4.36	0.24

7.2.11 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 6 - A128 Ongar Road / A1023 Shenfield Road / A128 Ingrave Road / A1023 High Street - Double Mini-Roundabout

7.2.12 The results of this assessment are summarised in Table 7-6.

Table 7-6: A128 Ongar Rd / A1023 Shenfield Rd / A128 Ingrave Rd / A1023 High Street - Option 1

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
J1 Ongar Road	0.21	4.72	0.26	0.21	4.71	0.26
J1 Shenfield Road	0.84	21.00	5.26	0.75	12.79	2.89
J1 A1023 high Street (Junc 1)	0.19	4.18	0.23	0.20	4.46	0.25
J2 A1023 high Street (Junc 2)	0.10	4.15	0.12	0.10	4.05	0.11
J2 Ingrave Road	0.85	23.19	5.35	0.93	48.47	12.00
J2 A1023 High Street (Junc 2)	0.81	32.56	3.95	0.77	31.11	3.24

Note: J1 - Junction 1, J2 - Junction 2

7.2.13 The results show that the junction 2 is at capacity on Ingrave Road in both the AM and PM peaks.

Junction 7 - A128 Ingrave Road / B186 Queens Road Mini-Roundabout

7.2.14 The results of this assessment are summarised in Table 7-7.

Table 7-7: A128 Ingrave Road / B186 Queens Road - Option 1

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Ingrave Road (Southbound)	0.61	7.88	1.59	0.64	1.76	1.76
Ingrave Road (Northbound)	1.34	1083.21	258.41	0.94	12.89	12.89
Queens Road	0.57	8.90	1.33	0.83	4.67	4.67

- 7.2.15 The results show that Ingrave Road Northbound in the morning peak is over capacity with an RFC of 1.34 and is at capacity in the PM peak with an RFC of 0.94.

Junction 8 – Ingrave Road/Middleton Hall Lane/Seven Arches Road - Signalised

- 7.2.16 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 7-8.

Table 7-8: Ingrave Road/Middleton Hall Lane/Seven Arches Road - Option 1

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Middleton Hall Lane (ahead/left & right)	122%	128	538	73%	14	60
Ingrave Road East (ahead/left & right)	120%	111	505	64%	13	30
Seven Arches (all movements)	80%	19	42	89%	21	80
Ingrave Road West (ahead/left & right)	109%	57	290	93%	31	51

- 7.2.17 The results show that the junction is over capacity in the AM peak, Ingrave Road West and Seven Arches is at capacity in the PM peak.

Junction 9 - B185 Kings Road / B186 Queens Road - Mini-Roundabout

- 7.2.18 The results of this assessment are summarised in Table 7-9.

Table 7-9 B185 Kings Road / B186 Queens Road - Option 1

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Kings Road (Southbound)	0.82	31.83	4.26	0.89	50.42	7.07
Queens Road	0.48	6.74	0.93	0.42	5.99	0.72
Kings Road (Northbound)	0.55	5.39	1.20	0.61	5.96	1.54

- 7.2.19 The results show that the junction works within capacity in both the AM peak and Kings Road Southbound is at capacity in the PM peak.

Junction 10 – High Street/Kings Road/London Road/Weald Road – Signalised

- 7.2.20 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 7-10.

Table 7-10: High Street/Kings Road/London Road/Weald Road – Option 1

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Weald Road (ahead/left & right)	84%	17	41	69%	11	37
A1023 High Street East (all movements)	70%	11	31	68%	12	32
Kings Road (ahead/left & right)	59%	10	30	67%	13	32
A1023 High Street East (ahead/left & right)	84%	13	33	78%	13	24

- 7.2.21 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 11 - Weald Road / Western Road - Mini-Roundabout

- 7.2.22 The results of this assessment are summarised in Table 7-11.

Table 7-11: Weald Road / Western Road - Option 1

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Weald Road (Southbound)	0.40	8.20	0.66	0.28	8.38	0.38
Western Road	0.51	9.00	1.05	0.41	6.90	0.70
Weald Road (Northbound)	0.48	7.17	0.93	0.75	14.90	2.97

7.2.23 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 12 - Western Road / William Hunter Way - Mini-Roundabout

7.2.24 The results of this assessment are summarised in Table 7-12.

Table 7-12: Western Road / William Hunter Way - Option 1

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Western Road (Southbound)	0.66	14.05	1.93	0.39	8.22	0.63
William Hunter Way	0.17	7.59	0.21	0.37	8.81	0.60
Western Road (Northbound)	0.44	6.79	0.79	0.74	15.28	2.83

7.2.25 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 13 - A127 / A128 Brentwood Road / A128 Tilbury Road - Grade Separated Gyratory

7.2.26 The results of this assessment are summarised in Table 7-13.

Table 7-13: A127 / A128 Brentwood Road / A128 Tilbury Road - Option 1

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Brentwood Road	0.68	7.80	2.10	0.73	11.15	2.63
A127 (Westbound)	0.83	14.56	4.66	1.25	773.96	282.47
Tilbury Road	0.73	5.95	2.64	0.58	3.70	1.39
A127 (Eastbound)	0.84	23.69	5.16	0.99	96.12	27.63

- 7.2.27 The results show that the junction running within capacity in the AM peak and is over capacity on the A127 westbound and eastbound with RFC's of 1.25 and 0.99 in the PM peak.

Junction 14a - A127 / Childerditch Lane Northern Side - Left in, Left out Priority Junction

- 7.2.28 The results of this assessment are summarised in Table 7-14.

Table 7-14: A127 / Childerditch Lane Northern Side - Option 1

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Childerditch lane	1.36	1323.19	27.27	1.68	2252.86	59.73

- 7.2.29 The results show that the junction is over capacity in both the AM and PM peaks with an RFC of 1.36 in the AM and an RFC of 1.68 in the PM.

Junction 14b - A127 / Childerditch Lane Southern Side - Left in, Left out Priority Junction

- 7.2.30 The results of this assessment are summarised in Table 7-15.

Table 7-15: A127 / Childerditch Lane Southern Side - Option 1

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Childerditch lane	2.09	3572.01	64.11	0.57	97.07	1.26

- 7.2.31 The results show that the junction is over capacity in the AM peak with an RFC of 2.09 and within capacity in the PM peak.

Junction 15 & 16 - A128 Ingrave Road / The Avenue / A128 Brentwood Road / Running Waters - Double Mini-Roundabout

7.2.32 The results of this assessment are summarised in Table 7-16.

Table 7-16: A128 Ingrave Road / The Avenue / A128 Brentwood Road / Running Waters - Option 1

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
J1 The Avenue	0.45	9.59	0.80	1.84	2611.64	330.97
J1 Ingrave Road	0.73	13.42	2.72	1.82	2497.39	337.37
J1 Brentwood Road (Westbound)	0.98	54.23	12.40	0.84	23.61	5.13
J2 Brentwood Road (Eastbound)	0.94	52.98	12.35	0.98	56.28	12.40
J2 Running Waters	1.91	2829.76	366.88	0.61	16.50	1.56
J2 Brentwood Road (Westbound)	1.78	2384.15	542.61	0.89	33.05	7.77

Note: J1 - Junction 1, J2 - Junction 2

7.2.33 The results show that the junction is at capacity in the AM peak for junction 1, and for junction 2 arms Running Waters and Brentwood Road Westbound are over capacity with RFC's of 1.91 and 1.78. In the PM peak for junction 1 arms The Avenue and Ingrave Road are over capacity with RFC's of 1.84 and 1.82. Junction 2 is at capacity in the PM peak.

Junction 17 – Brook Street/Mascalls Lane – Signalised Junction

7.2.34 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 7-17.

Table 7-17: Brook Street/Mascalls Lane – Option 1

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Spital Street (all movements)	87%	9	81	78%	6	76
A1023 London Road (all movements)	99%	36	84	98%	42	70
Mascalls Lane (ahead/right & left)	55%	8	28	65%	10	38
A1023 Brook Street (ahead/left & right)	99%	52	66	79%	30	20

- 7.2.35 The results show the junction is at capacity in the AM peak and A1023 London Road is at capacity in the PM peak.

Junction 18 – Warley Hill/Eagle Way – Signalised Junction

- 7.2.36 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 7-18.

Table 7-18: Brook Street/Mascalls Lane – Option 1

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Warley Road North (all movements)	99%	20	101	65%	12	32
Eagle Way (all movements)	99%	20	123	91%	15	71
Warley Road South (ahead/left & right)	95%	26	62	76%	14	37
Mascalls Lane (ahead/left & right)	99%	21	119	87%	11	70

- 7.2.37 The results show the junction is at capacity in the AM peak and Eagle Way is at capacity in the PM peak.

Junction 19 - B186 Warley Street / A127 Eastbound - Priority Junction

- 7.2.38 The results of this assessment are summarised in Table 7-19.

Table 7-19: B186 Warley Street / A127 Eastbound - Option 1

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
A127 Slip Road	1.55	1772.19	170.90	0.97	152.65	13.97
Warley Street Right-Turn	0.33	7.23	0.96	0.41	7.08	1.29

7.2.39 The results show that the A127 Slip Road is over capacity and has an RFC of 1.55 in the AM peak. In the PM peak the A127 Slip Road is at capacity with an RFC of 0.97.

Junction 20 - B186 Warley Street / A127 Westbound - Priority Junction

7.2.40 The results of this assessment are summarised in Table 7-20.

Table 7-20: B186 Warley Street / A127 Westbound - Option 1

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
A127 Slip Road	1.37	1194.96	108.17	1.31	1022.47	129.55
Warley Street Right-Turn	0.49	7.33	2.03	0.36	7.17	1.00

7.2.41 The results show that the A127 Slip Road is over capacity and has an RFC of 1.37 in the AM peak. In the PM peak the A127 Slip Road is over capacity with an RFC of 1.31.

Junction 21 - A127 Westbound / Thorndon Avenue, West Horndon - Left in, Left out Priority Junction

7.2.42 The results of this assessment are summarised in Table 7-21.

Table 7-21: A127 Westbound / Thorndon Avenue, West Horndon - Option 1

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Thorndon Avenue	0.14	31.77	0.17	0.22	40.74	0.28

7.2.43 The results show that the junction is working within capacity in both the AM and PM peaks.

Junction 22 - A1023 Chelmsford Road / Alexander Lane Priority Junction

7.2.44 The results of this assessment are summarised in Table 7-22.

Table 7-22: A1023 Chelmsford Road / Alexander Lane - Option 1

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
A127 Slip Road	1.18	678.43	37.19	0.72	63.25	2.48
Chelmsford Road Right-Turn	0.09	8.91	0.10	0.08	7.25	0.09

- 7.2.45 The results show that in the AM peak the A127 Slip Road is overcapacity with an RFC of 1.18. In the PM peak the junction is working within capacity.

Junction 23 – West Mayne/Lower Dunton Road – Signalised Junction

- 7.2.46 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 7-23.

Table 7-23: West Mayne/Lower Dunton Road – Option 1

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
West Mayne North (ahead/left & right)	61%	6	15	61%	6	15
Ford Access (left only)	0%	0	0	0%	0	0
West Mayne North (ahead/left & right)	50%	5	14	60%	6	15
Lower Dunton (left only)	34%	3	15	27%	2	14

- 7.2.47 The results show the junction is working within capacity in both the AM and PM peaks.

8 Option 2 - Results

8.1 Introduction

- 8.1.1 A summary of the results for Option 2 are provided in the following sections for each junction. The full results for each junction are provided in Appendix H.

8.2 Results

- 8.2.1 The following junction's outputs were based on Option 2 Flows.

Junction 1 – Chelmsford Road/Hutton Road/Shenfield – Signalised Junction

- 8.2.2 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 8-1.

Table 8-1: Chelmsford Road/Hutton Road/Shenfield Road – Option 2

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Shenfield Road (ahead & right)	83%	18	24	95%	36	45
Chelmsford Road (ahead & left)	70%	11	33	53%	9	24
Hutton Road (all movements)	72%	8	31	94%	18	67

- 8.2.3 The results show that the junction is within capacity in the AM peak and at capacity in the PM peak.

Junction 2 - A129 Rayleigh Road / Hanging Hill Lane - Mini-Roundabout

- 8.2.4 The results of this assessment are summarised in Table 8-2.

Table 8-2: A129 Rayleigh Road / Hanging Hill Lane - Option 2

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/ PCU)	Queue (PCU)	RFC (%)	Delay (s/ PCU)	Queue (PCU)
Rayleigh Road (Eastbound)	0.53	8.06	1.14	0.59	9.71	1.46
Rayleigh Road (Westbound)	0.81	21.86	4.21	0.65	11.76	1.86
Hanging Hill lane	1.05	263.43	37.13	0.90	57.21	7.47

- 8.2.5 The results show that Hanging Hill Lane in the morning peak is over capacity with an RFC of 1.05, in the PM peak the junction is at capacity.

Junction 3: A128 Ongar Road / Doddinghurst Road - Mini-Roundabout

- 8.2.6 The results of this assessment are summarised in Table 8-3.

Table 8-3: A128 Ongar Road / Doddinghurst Road - Option 2

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Ongar Road (Southbound)	1.12	431.70	102.23	0.97	102.25	16.96
Doddinghurst Road	1.40	1271.49	125.59	0.61	23.02	1.53
Ongar Road (Northbound)	0.67	9.44	2.04	1.12	418.35	152.14

- 8.2.7 The results show that in the AM peak Doddinghurst Road and Ongar Road Southbound are over capacity with RFC's of 1.40 and 1.12. In the PM peak Ongar Road northbound is over capacity with an RFC of 1.12.

Junction 4 - A128 Ongar Road / Western Avenue Priority Junction

- 8.2.8 The results of this assessment are summarised in Table 8-4.

Table 8-4: A128 Ongar Road / Western Avenue - Option 2

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Western Avenue	0.59	22.99	1.40	0.80	39.46	3.88
Ongar Road Right-Turn	0.67	22.06	2.03	0.33	13.04	0.49

- 8.2.9 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 5 - A128 Ongar Road / William Hunter Way - Mini-Roundabout

- 8.2.10 The results of this assessment are summarised in Table 8-5.

Table 8-5: A128 Ongar Road / William Hunter Way - Option 2

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
William Hunter Way	0.21	3.68	0.27	0.46	5.33	0.86
Ongar Road (Southbound)	0.55	6.61	1.21	0.48	6.44	0.93
Ongar Road (Northbound)	0.20	4.37	0.24	0.20	4.36	0.24

8.2.11 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 6 - A128 Ongar Road / A1023 Shenfield Road / A128 Ingrave Road / A1023 High Street - Double Mini-Roundabout

8.2.12 The results of this assessment are summarised in Table 8-6.

Table 8-6: A128 Ongar Rd / A1023 Shenfield Rd / A128 Ingrave Rd / A1023 High Street - Option 2

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
J1 Ongar Road	0.21	4.72	0.26	0.21	4.71	0.26
J1 Shenfield Road	0.85	21.02	5.26	0.75	12.82	2.90
J1 A1023 high Street (Junc 1)	0.19	4.18	0.23	0.20	4.46	0.25
J2 A1023 high Street (Junc 2)	0.10	4.15	0.12	0.10	4.06	0.11
J2 Ingrave Road	0.85	23.33	5.39	0.93	47.86	11.84
J2 A1023 High Street (Junc 2)	0.81	32.74	3.97	0.78	32.06	3.34

Note: J1 - Junction 1, J2 - Junction 2

8.2.13 The results show that the junction is at capacity in Shenfield Road and Ingrave Road in the AM peak. In the PM Peak Ingrave Road is at capacity.

Junction 7 - A128 Ingrave Road / B186 Queens Road - Mini-Roundabout

8.2.14 The results of this assessment are summarised in Table 8-7.

Table 8-7: A128 Ingrave Road / B186 Queens Road - Option 2

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Ingrave Road (Southbound)	0.62	7.91	1.59	0.65	10.59	1.86
Ingrave Road (Northbound)	1.35	1128.33	269.29	0.95	66.99	13.95
Queens Road	0.57	8.90	1.33	0.84	23.74	4.94

- 8.2.15 The results show that Ingrave Road northbound is over capacity with an RFC of 1.35 in the AM and at capacity with an RFC of 0.95 in the PM.

Junction 8 - Ingrave Road/Middleton Hall Lane/Seven Arches Road - Signalised

- 8.2.16 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 8-8.

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Middleton Hall Lane (ahead/left & right)	122%	128	538	73%	14	60
Ingrave Road East (ahead/left & right)	122%	121	541	67%	14	30
Seven Arches (all movements)	80%	19	42	87%	21	80
Ingrave Road West (ahead/left & right)	109%	59	297	95%	34	58

- 8.2.17 The results show that the junction is overcapacity in the AM peak, Seven Arches and Ingrave Road West is at capacity in the PM peak.

Junction 9 - B185 Kings Road / B186 Queens Road - Mini-Roundabout

- 8.2.18 The results of this assessment are summarised in Table 8-9.

Table 8-9: B185 Kings Road / B186 Queens Road - Option 2

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Kings Road (Southbound)	0.82	31.99	4.28	0.89	50.42	7.07
Queens Road	0.48	6.76	0.94	0.42	5.96	0.71
Kings Road (Northbound)	0.55	5.42	1.21	0.61	5.96	1.54

- 8.2.19 The results show that the junction works within capacity in the AM peak but Kings Road southbound is at capacity in the PM peak.

Junction 10 – High Street/Kings Road/London Road/Weald Road – Signalised

- 8.2.20 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 8-10.

Table 8-10: High Street/Kings Road/London Road/Weald Road – Option 2

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Weald Road (ahead/left & right)	84%	17	41	69%	11	37
A1023 High Street East (all movements)	70%	11	31	67%	12	32
Kings Road (ahead/left & right)	59%	10	30	67%	13	32
A1023 High Street East (ahead/left & right)	84%	13	33	77%	13	23

- 8.2.21 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 11 - Weald Road / Western Road - Mini-Roundabout

- 8.2.22 The results of this assessment are summarised in Table 8-11.

Table 8-11: Weald Road / Western Road - Option 2

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Weald Road (Southbound)	0.40	8.20	0.66	0.28	8.37	0.38
Western Road	0.51	8.98	1.04	0.41	6.90	0.70
Weald Road (Northbound)	0.48	7.17	0.9.	0.75	14.84	2.96

8.2.23 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 12 - Western Road / William Hunter Way - Mini-Roundabout

8.2.24 The results of this assessment are summarised in Table 8-12.

Table 8-12: Western Road / William Hunter Way - Option 2

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Western Road (Southbound)	0.66	13.83	1.89	0.37	8.01	0.59
William Hunter Way	0.15	7.34	0.17	0.35	8.47	0.55
Western Road (Northbound)	0.44	6.77	0.79	0.73	14.63	2.67

8.2.25 The results show that the junction works within capacity in both the AM and PM peaks.

Junction 13 - A127 / A128 Brentwood Road / A128 Tilbury Road - Grade Separated Gyratory

8.2.26 The results of this assessment are summarised in Table 8-13.

Table 8-13: A127 / A128 Brentwood Road / A128 Tilbury Road - Option 2

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Brentwood Road	0.68	7.83	2.10	0.72	10.69	2.54
A127 (Westbound)	0.84	16.07	4.99	1.21	648.44	235.95
Tilbury Road	0.63	4.30	1.67	0.53	3.33	1.14
A127 (Eastbound)	0.86	24.95	5.83	1.00	103.31	30.00

- 8.2.27 The results show that the junction in the AM peak is at capacity on the A127 eastbound with an RFC of 0.86. In the PM peak the junction is over capacity on the A127 westbound and eastbound with RFC's of 1.21 and 1.00.

Junction 14a - A127 / Childerditch Lane Northern Side - Left in, Left out Priority Junction

- 8.2.28 The results of this assessment are summarised in Table 8-14.

Table 8-14: A127 / Childerditch Lane Northern Side - Option 2

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Childerditch lane	1.59	2012.83	37.08	1.77	2527.84	67.84

- 8.2.29 The results show that Childerditch Lane is over capacity in both peak with an RFC of 1.59 in the AM peak and an RFC of 1.77 in the PM peak.

Junction 14b - A127 / Childerditch Lane Southern Side - Left in, Left out Priority Junction

- 8.2.30 The results of this assessment are summarised in Table 8-15.

Table 8-15: A127 / Childerditch Lane Southern Side - Option 2

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Childerditch lane	0.08	49.05	0.08	0.00	0.00	0.00

- 8.2.31 The results show that the junction is within capacity in both the AM and PM peaks.

Junction 15 & 16 - A128 Ingrave Road / The Avenue / A128 Brentwood Road / Running Waters Double - Mini-Roundabout

8.2.32 The results of this assessment are summarised in Table 8-16.

Table 8-16: A128 Ingrave Road / The Avenue / A128 Brentwood Road / Running Waters - Option 2

Arm	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
J1 The Avenue	0.45	9.64	0.81	1.85	2651.07	333.63
J1 Ingrave Road	0.75	14.34	2.99	1.84	2567.29	347.95
J1 Brentwood Road (Westbound)	0.98	55.05	12.40	0.86	25.83	5.68
J2 Brentwood Road (Eastbound)	0.93	48.25	11.18	0.98	56.36	12.40
J2 Running Waters	1.92	2849.85	357.56	0.61	16.41	1.54
J2 Brentwood Road (Westbound)	1.80	2470.40	559.45	0.91	38.14	9.08

Note: J1 - Junction 1, J2 - Junction 2

8.2.33 The results show that the junction is at capacity in the AM peak for junction 1 and for junction 2 arms Running Waters and Brentwood Road westbound are over capacity with RFC's of 1.92 and 1.80. In the PM peak for junction 1 arms The Avenue and Ingrave Road are over capacity with RFC's of 1.85 and 1.84. Junction 2 is at capacity in the PM peak.

Junction 17 – Brook Street/Mascalls Lane – Signalised Junction

8.2.34 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 8-17.

Table 8-17: Brook Street/Mascalls Lane – Option 2

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Spital Street (all movements)	87%	9	81	78%	6	76
A1023 London Road (all movements)	98%	36	83	97%	41	66
Mascalls Lane (ahead/right & left)	55%	8	28	65%	10	38
A1023 Brook Street (ahead/left & right)	99%	52	66	79%	30	20

- 8.2.35 The results show that A1023 in both directions is at capacity in the AM peak and A1023 London Road is at capacity in the PM peak.

Junction 18 – Warley Hill/Eagle Way – Signalised Junction

- 8.2.36 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 8-18.

Table 8-18: Brook Street/Mascalls Lane – Option 2

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Warley Road North (all movements)	105%	28	167	65%	12	32
Eagle Way (all movements)	99%	20	123	91%	15	72
Warley Road South (ahead/left & right)	96%	27	65	76%	14	37
Mascalls Lane (ahead/left & right)	99%	21	119	87%	11	70

- 8.2.37 The results show that the junction is over capacity in the AM peak, Eagle Way and Mascalls Lane is at capacity in the PM peak.

Junction 19 - B186 Warley Street / A127 Eastbound - Priority Junction

- 8.2.38 The results of this assessment are summarised in Table 8-19.

Table 8-19: B186 Warley Street / A127 Eastbound - Option 2

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
A127 Slip Road	1.39	1277.58	124.58	0.98	157.23	14.41
Warley Street Right-Turn	0.34	7.31	0.99	0.41	7.06	1.31

- 8.2.39 The results show that the A127 Slip Road is over capacity in the AM peak with an RFC of 1.39 and at capacity with an RFC of 0.98 in the PM peak.

Junction 20 - B186 Warley Street / A127 Westbound - Priority Junction

- 8.2.40 The results of this assessment are summarised in Table 8-20.

Table 8-20: B186 Warley Street / A127 Westbound - Option 2

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
A127 Slip Road	1.30	987.58	91.99	1.31	1012.06	128.05
Warley Street Right-Turn	0.49	7.14	2.02	0.36	7.18	1.02

- 8.2.41 The results show that the A127 Slip Road is over capacity in both peaks and has an RFC of 1.30 in the AM and an RFC of 1.31 in the PM.

Junction 22 - A1023 Chelmsford Road / Alexander Lane - Priority Junction

- 8.2.42 The results of this assessment are summarised in Table 8-21.

Table 8-21: A1023 Chelmsford Road / Alexander Lane - Option 2

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
A127 Slip Road	1.18	675.83	37.06	0.72	63.25	2.48
Chelmsford Road	0.09	8.91	0.10	0.08	7.25	0.09

- 8.2.43 The results show that the A127 Slip Road is over capacity in the AM peak with an RFC of 1.18. In the PM peak the junction is working within capacity.

Junction 23 – West Mayne/Lower Dunton Road – Signalised Junction

8.2.44 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 8-22.

Table 8-22: West Mayne/Lower Dunton Road – Option 2

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
West Mayne North (ahead/left & right)	60%	6	15	61%	6	15
Ford Access (left only)	0%	0	0	0%	0	0
West Mayne North (ahead/left & right)	50%	5	14	59%	6	15
Lower Dunton (left only)	34%	3	15	27%	2	14

8.2.45 The results show that the junction is within capacity in both the AM and PM peaks.

9 Option 3 – Results

9.1 Introduction

- 9.1.1 A summary of the results for Option 3 are provided in the following sections for each junction. The full results for each junction are provided in Appendix H.

9.2 Results

- 9.2.1 The following junction's outputs were based on Option 3 Flows.

Junction 1 – Chelmsford Road/Hutton Road/Shenfield – Signalised Junction

- 9.2.2 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 9-1.

Table 9-1: Chelmsford Road/Hutton Road/Shenfield Road – Option 3

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Shenfield Road (ahead & right)	86%	20	27	98%	42	60
Chelmsford Road (ahead & left)	74%	12	35	55%	9	24
Hutton Road (all movements)	72%	8	31	99%	23	104

- 9.2.3 The results show that Shenfield Road and Hutton Road are at capacity in the PM peak, Shenfield Road is at capacity in the AM peak.

Junction 2 - A129 Rayleigh Road / Hanging Hill Lane - Mini-Roundabout

- 9.2.4 The results of this assessment are summarised in Table 9-2.

Table 9-2: A129 Rayleigh Road / Hanging Hill Lane - Option 3

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/ PCU)	Queue (PCU)	RFC (%)	Delay (s/ PCU)	Queue (PCU)
Rayleigh Road (Eastbound)	0.54	8.15	1.17	0.58	9.31	1.37
Rayleigh Road (Westbound)	0.82	22.61	4.38	0.66	11.94	1.91
Hanging Hill lane	1.07	304.33	43.35	0.88	51.66	6.61

- 9.2.5 The results show that Hanging Hill Lane in the morning peak is over capacity with an RFC of 1.07, in the PM peak the junction is at capacity.

Junction 3 - A128 Ongar Road / Doddinghurst Road - Mini-Roundabout

9.2.6 The results of this assessment are summarised in Table 9-3.

Table 9-3: A128 Ongar Road / Doddinghurst Road - Option 3

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Ongar Road (Southbound)	1.19	644.12	151.98	1.06	272.58	47.21
Doddinghurst Road	2.14	3583.65	369.67	0.73	32.01	2.65
Ongar Road (Northbound)	0.71	10.99	2.45	1.36	1146.69	417.43

9.2.7 The results show that in the AM peak Doddinghurst Road and Ongar Road Southbound are over capacity with RFC's of 2.14 and 1.19. In the PM peak Ongar Road northbound is over capacity with an RFC of 1.06 southbound and 1.36 northbound.

Junction 4 - A128 Ongar Road / Western Avenue - Priority Junction

9.2.8 The results of this assessment are summarised in Table 9-4.

Table 9-4: A128 Ongar Road / Western Avenue - Option 3

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Western Avenue	0.67	31.93	1.93	1.18	631.69	83.24
Ongar Road Right-Turn	0.73	26.58	2.60	0.37	14.83	0.59

9.2.9 The results show that in the junction is within capacity in the AM peak, Western Avenue is overcapacity with an RFC of 1.18 in the PM peak.

Junction 5 - A128 Ongar Road / William Hunter Way - Mini-Roundabout

9.2.10 The results of this assessment are summarised in Table 9-5.

Table 9-5: A128 Ongar Road / William Hunter Way – Option 3

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
William Hunter Way	0.22	3.70	0.28	0.47	5.44	0.89
Ongar Road (Southbound)	0.66	8.68	1.90	0.51	6.71	1.04
Ongar Road (Northbound)	0.20	4.44	0.25	0.20	4.42	0.25

9.2.11 The results show that the junction is working within capacity in both the AM and PM peaks.

Junction 6 - A128 Ongar Road / A1023 Shenfield Road / A128 Ingrave Road / A1023 High Street - Double Mini-Roundabout

9.2.12 The results of this assessment are summarised in Table 9-6.

Table 9-6: A128 Ongar Rd / A1023 Shenfield Rd / A128 Ingrave Rd / A1023 High Street - Option 3

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
J1 Ongar Road	0.21	4.73	0.26	0.21	4.70	0.26
J1 Shenfield Road	0.89	29.23	7.57	0.76	13.69	3.16
J1 A1023 high Street (Junc 1)	0.19	4.25	0.24	0.20	4.50	0.25
J2 A1023 high Street (Junc 2)	0.10	4.15	0.12	0.10	4.05	0.11
J2 Ingrave Road	0.82	19.40	4.35	1.00	113.75	31.12
J2 A1023 High Street (Junc 2)	0.80	31.39	3.94	0.86	51.43	5.42

Note: J1 - Junction 1, J2 - Junction 2

9.2.13 The results show that Shenfield Road is at capacity but junction 2 works within capacity in the AM peak, during the PM peak Ingrave Road is running overcapacity with an RFC of 1.00.

Junction 7 - A128 Ingrave Road / B186 Queens Road Mini-Roundabout

9.2.14 The results of this assessment are summarised in Table 9-7.

Table 9-7: A128 Ingrave Road / B186 Queens Road - Option 3

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Ingrave Road (Southbound)	0.67	9.30	2.05	0.62	9.52	1.60
Ingrave Road (Northbound)	1.27	858.11	203.02	0.98	96.94	20.96
Queens Road	0.57	8.71	1.29	0.84	24.77	5.12

- 9.2.15 The results show that Ingrave Road northbound in the AM peak is over capacity with an RFC of 1.27 and in the PM peak is at capacity.

Junction 8 – Ingrave Road/Middleton Hall Lane/Seven Arches Road – Signalised

- 9.2.16 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 9-8.

Table 9-8: Ingrave Road/Middleton Hall Lane/Seven Arches Road - Option 3

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Middleton Hall Lane (ahead/left & right)	122%	128	538	73%	14	60
Ingrave Road East (ahead/left & right)	122%	121	541	67%	14	30
Seven Arches (all movements)	80%	19	42	87%	21	80
Ingrave Road West (ahead/left & right)	109%	59	297	95%	34	58

- 9.2.17 The results show that the junction is overcapacity in the AM peak, Seven Arches and Ingrave Road West are at capacity in the PM peak.

Junction 9 - B185 Kings Road / B186 Queens Road - Mini-Roundabout

- 9.2.18 The results of this assessment are summarised in Table 9-9.

Table 9-9 B185 Kings Road / B186 Queens Road - Option 3

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Kings Road (Southbound)	0.84	36.81	5.05	0.89	51.70	7.27
Queens Road	0.49	6.98	0.96	0.42	6.02	0.72
Kings Road (Northbound)	0.55	5.40	1.20	0.61	6.02	1.57

- 9.2.19 The results show the junction is running within capacity in the AM peak and Kings Road southbound is at capacity in the PM peak.

Junction 10 – High Street/Kings Road/London Road/Weald Road – Signalised

- 9.2.20 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 9-10.

Table 9-10: High Street/Kings Road/London Road/Weald Road – Option 3

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Weald Road (ahead/left & right)	88%	19	46	71%	11	38
A1023 High Street East (all movements)	73%	12	33	70%	13	33
Kings Road (ahead/left & right)	59%	10	30	68%	14	32
A1023 High Street East (ahead/left & right)	90%	16	44	99%	37	68

- 9.2.21 The results show that A1023 High Street is at capacity in both peaks, Weald Road is at capacity in the AM peak, the rest of the junction is running within capacity.

Junction 11 - Weald Road / Western Road - Mini-Roundabout

- 9.2.22 The results of this assessment are summarised in Table 9-11.

Table 9-11: Weald Road / Western Road - Option 3

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Weald Road (Southbound)	0.40	8.22	0.65	0.32	10.24	0.48
Western Road	0.55	9.68	1.20	0.42	6.99	0.72
Weald Road (Northbound)	0.49	7.26	0.95	0.89	33.04	7.60

9.2.23 The results show that Weald Street northbound is at capacity in the PM peak, the rest of the junction is running within capacity. In the AM peak the junction runs within capacity.

Junction 12 - Western Road / William Hunter Way - Mini-Roundabout

9.2.24 The results of this assessment are summarised in Table 9-12.

Table 9-12: Western Road / William Hunter Way - Option 3

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Western Road (Southbound)	0.70	15.83	2.30	0.40	8.33	0.65
William Hunter Way	0.18	7.86	0.21	0.37	8.81	0.59
Western Road (Northbound)	0.44	6.82	0.80	0.89	35.37	7.65

9.2.25 The results show that Western Road northbound is at capacity in the PM peak, the rest of the junction is working within capacity in both the AM and PM peaks.

Junction 13 - A127 / A128 Brentwood Road / A128 Tilbury Road - Grade Separated Gyratory

9.2.26 The results of this assessment are summarised in Table 9-13.

Table 9-13: A127 / A128 Brentwood Road / A128 Tilbury Road - Option 3

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Brentwood Road	0.57	4.73	1.30	0.51	4.65	1.03
A127 (Westbound)	0.72	8.24	2.49	0.87	18.17	6.37
Tilbury Road	0.46	3.01	0.84	0.50	3.41	0.98
A127 (Eastbound)	0.57	6.61	1.32	0.71	11.17	2.43

9.2.27 The results show that A127 westbound is at capacity in the PM peak, the rest of the junction is working within capacity in both the AM and PM peaks.

Junction 14a – A127 / Childerditch Lane Northern Side - Left in, Left out Priority Junction

9.2.28 The results of this assessment are summarised in Table 9-14.

Table 9-14: A127 / Childerditch Lane Northern Side - Option 3

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Childerditch lane	1.11	633.18	14.15	1.07	456.92	15.63

9.2.29 The results show that Childerditch Lane is over capacity in both peak with an RFC of 1.11 in the AM and an RFC of 1.07 in the PM.

Junction 14b - A127 / Childerditch Lane Southern Side - Left in, Left out Priority Junction

9.2.30 The results of this assessment are summarised in Table 9-15.

Table 9-15: A127 / Childerditch Lane Southern Side - Option 3

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Childerditch lane	1.12	620.65	17.60	0.45	59.01	0.78

9.2.31 The results show that Childerditch Lane is over capacity in the AM peak with an RFC of 1.12, in the PM peak the junction is running within capacity.

Junction 15 & 16 - A128 Ingrave Road / The Avenue / A128 Brentwood Road / Running Waters - Double Mini-Roundabout

9.2.32 The results of this assessment are summarised in Table 9-16.

Table 9-16: A128 Ingrave Road / The Avenue / A128 Brentwood Road / Running Waters - Option 3

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
J1 The Avenue	0.99	136.72	11.12	1.81	2532.34	327.98
J1 Ingrave Road	1.05	155.02	34.48	1.73	2212.76	299.20
J1 Brentwood Road (Westbound)	0.98	54.02	12.40	0.85	24.95	5.47
J2 Brentwood Road (Eastbound)	0.97	53.12	12.40	0.98	55.69	12.40
J2 Running Waters	1.84	2631.26	349.62	0.60	15.79	1.46
J2 Brentwood Road (Westbound)	1.65	1993.99	453.44	0.89	31.19	7.28

Note: J1 - Junction 1, J2 - Junction 2

9.2.33 The results show that the junction is at capacity in the AM peak for junction 1, and for junction 2 arms Running Waters and Brentwood Road westbound are over capacity with RFC's of 1.84 and 1.65. In the PM peak for junction 1 arms The Avenue and Ingrave Road are over capacity with RFC's of 1.81 and 1.73. Junction 2 is at capacity in the PM peak.

Junction 17 – Brook Street/Mascalls Lane – Signalised Junction

9.2.34 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 9-17.

Table 9-17: Brook Street/Mascalls Lane – Option 3

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Spital Street (all movements)	90%	10	85	78%	6	76
A1023 London Road (all movements)	101%	43	95	101%	51	98
Mascalls Lane (ahead/right & left)	62%	9	32	65%	10	38
A1023 Brook Street (ahead/left & right)	101%	57	84	88%	40	26

- 9.2.35 The results show that the junction is running overcapacity in the AM peak and A1023 London Road is overcapacity in the PM peak.

Junction 18 – Warley Hill/Eagle Way – Signalised Junction

- 9.2.36 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 9-18.

Table 9-18: Brook Street/Mascalls Lane – Option 3

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Warley Road North (all movements)	97%	18	89	84%	12	32
Eagle Way (all movements)	100%	21	129	91%	16	72
Warley Road South (ahead/left & right)	95%	26	61	76%	14	37
Mascalls Lane (ahead/left & right)	99%	20	115	87%	70	11

- 9.2.37 The results show that the junction is running overcapacity in the AM peak, Mascalls Lane and Eagle Way is at capacity in the PM peak.

Junction 19 - B186 Warley Street / A127 Eastbound - Priority Junction

- 9.2.38 The results of this assessment are summarised in Table 9-19.

Table 9-19: B186 Warley Street / A127 Eastbound - Option 3

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
A127 Slip Road	1.54	1732.98	168.44	0.98	156.85	14.46
Warley Street Right-Turn	0.33	7.15	0.96	0.41	7.01	1.28

9.2.39 The results show that A127 Slip Road is running overcapacity with and RFC of 1.54 in the AM peak and at capacity in the PM peak.

Junction 20 - B186 Warley Street / A127 Westbound - Priority Junction

9.2.40 The results of this assessment are summarised in Table 9-20.

Table 9-20 B186 Warley Street / A127 Westbound - Option 3

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
A127 Slip Road	1.31	1036.91	94.03	1.29	967.10	122.70
Warley Street Right-Turn	0.49	7.34	2.04	0.36	7.17	1.01

9.2.41 The results show that A127 Slip Road is running overcapacity with an RFC of 1.31 in the AM peak and 1.29 in the PM peak.

Junction 22 - A1023 Chelmsford Road / Alexander Lane Priority Junction

9.2.42 The results of this assessment are summarised in Table 9-21.

Table 9-21: A1023 Chelmsford Road / Alexander Lane - Option 3

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
A127 Slip Road	1.26	909.91	48.46	0.76	74.76	2.91
Chelmsford Road Right-Turn	0.09	9.17	0.10	0.09	7.40	0.10

9.2.43 The results show that A127 Slip Road is running overcapacity with and RFC of 1.26 in the AM peak, the junction is running within capacity in the PM peak.

Junction 23 – West Mayne/Lower Dunton Road – Signalised Junction

9.2.44 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 9-22.

Table 9-22: West Mayne/Lower Dunton Road – Option 3

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
West Mayne North (ahead/left & right)	59%	6	15	60%	6	15
Ford Access (left only)	0%	0	0	0%	0	0
West Mayne North (ahead/left & right)	50%	5	14	59%	6	15
Lower Dunton (left only)	34%	3	15	27%	2	14

9.2.45 The results show that the junction is working within capacity in both the AM and PM peaks.

10 Option 4 – Results

10.1 Introduction

- 10.1.1 A summary of the results for Option 4 are provided in the following sections for each junction. The full results for each junction are provided in Appendix H.

10.2 Results

- 10.2.1 The following junction's outputs were based on Option 1 Flows.

Junction 1 – Chelmsford Road/Hutton Road/Shenfield – Signalised Junction

- 10.2.2 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 10-1.

Table 10-1: Chelmsford Road/Hutton Road/Shenfield Road – Option 4

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Shenfield Road (ahead & right)	83%	18	25	98%	40	59
Chelmsford Road (ahead & left)	74%	12	35	53%	9	24
Hutton Road (all movements)	72%	8	31	94%	18	68

- 10.2.3 The results show that the junction is running within capacity in the AM peak and at capacity in the PM peak.

Junction 2 - A129 Rayleigh Road / Hanging Hill Lane - Mini-Roundabout

- 10.2.4 The results of this assessment are summarised in Table 10-2.

Table 10-2: A129 Rayleigh Road / Hanging Hill Lane - Option 4

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/ PCU)	Queue (PCU)	RFC (%)	Delay (s/ PCU)	Queue (PCU)
Rayleigh Road (Eastbound)	0.53	8.08	1.14	0.59	9.50	1.41
Rayleigh Road (Westbound)	0.82	23.12	4.49	0.67	12.47	2.03
Hanging Hill lane	1.12	433.39	63.75	0.89	55.67	7.24

- 10.2.5 The results show that Hanging Hill Lane in the morning peak is over capacity with an RFC of 1.12, in the PM peak the junction is at capacity.

Junction 3 - A128 Ongar Road / Doddinghurst Road - Mini-Roundabout

10.2.6 The results of this assessment are summarised in Table 10-3.

Table 10-3: A128 Ongar Road / Doddinghurst Road - Option 4

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Ongar Road (Southbound)	1.16	55.08	131.23	0.97	100.25	16.59
Doddinghurst Road	1.42	1349.65	133.57	0.62	23.57	1.59
Ongar Road (Northbound)	0.68	9.65	2.11	1.15	500.54	183.12

10.2.7 The results show that in the AM peak Doddinghurst Road and Ongar Road Southbound are over capacity with RFC's of 1.42 and 1.16. In the PM peak Ongar Road northbound is over capacity.

Junction 4 - A128 Ongar Road / Western Avenue - Priority Junction

10.2.8 The results of this assessment are summarised in Table 10-4.

Table 10-4: A128 Ongar Road / Western Avenue - Option 4

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Western Avenue	0.59	23.36	1.41	0.82	42.99	4.19
Ongar Road Right-Turn	0.67	22.15	2.03	0.34	13.45	0.51

10.2.9 The results show that the junction is working within capacity in both the AM and PM peaks.

Junction 5 - A128 Ongar Road / William Hunter Way - Mini-Roundabout

10.2.10 The results of this assessment are summarised in Table 10-5.

Table 10-5: A128 Ongar Road / William Hunter Way – Option 4

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
William Hunter Way	0.22	3.69	0.28	0.47	5.40	0.88
Ongar Road (Southbound)	0.59	7.30	1.44	0.50	6.64	0.99
Ongar Road (Northbound)	0.20	4.39	0.24	0.20	4.38	0.24

10.2.11 The results show that the junction is working within capacity in both the AM and PM peaks.

Junction 6 - A128 Ongar Road / A1023 Shenfield Road / A128 Ingrave Road / A1023 High Street - Double Mini-Roundabout

10.2.12 The results of this assessment are summarised in Table 10-6.

Table 10-6: A128 Ongar Rd / A1023 Shenfield Rd / A128 Ingrave Rd / A1023 High Street - Option 4

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
J1 Ongar Road	0.21	4.73	0.26	0.21	4.71	0.26
J1 Shenfield Road	0.89	29.08	7.55	0.76	13.53	3.11
J1 A1023 high Street (Junc 1)	0.19	4.25	0.24	0.20	4.48	0.25
J2 A1023 high Street (Junc 2)	0.10	4.15	0.12	0.10	4.06	0.11
J2 Ingrave Road	0.85	24.05	5.58	0.96	67.96	17.36
J2 A1023 High Street (Junc 2)	0.84	38.21	4.74	0.84	44.67	4.80

Note: J1 - Junction 1, J2 - Junction 2

10.2.13 The results show that the both the junctions are at capacity in both the AM and PM peaks.

Junction 7 - A128 Ingrave Road / B186 Queens Road Mini-Roundabout

10.2.14 The results of this assessment are summarised in Table 10-7.

Table 10-7: A128 Ingrave Road / B186 Queens Road - Option 4

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Ingrave Road (Southbound)	0.65	8.74	1.86	0.66	10.91	1.95
Ingrave Road (Northbound)	1.36	1149.84	273.87	0.97	85.10	18.10
Queens Road	0.57	8.94	1.34	0.84	24.72	5.13

10.2.15 The results show that Ingrave Road northbound in the AM peak is over capacity with an RFC of 1.36 and in the PM peak is at capacity.

Junction 8 – Ingrave Road/Middleton Hall Lane/Seven Arches Road – Signalised

10.2.16 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 10-8.

Table 10-8: Ingrave Road/Middleton Hall Lane/Seven Arches Road - Option 4

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Middleton Hall Lane (ahead/left & right)	122%	128	538	73%	14	60
Ingrave Road East (ahead/left & right)	122%	121	541	67%	14	30
Seven Arches (all movements)	80%	19	42	87%	21	80
Ingrave Road West (ahead/left & right)	109%	59	297	95%	34	58

10.2.17 The results show that the junction is overcapacity in the AM peak, Seven Arches and Ingrave Road West at capacity in the PM peak.

Junction 9 - B185 Kings Road / B186 Queens Road - Mini-Roundabout

10.2.18 The results of this assessment are summarised in Table 10-9.

Table 10-9 B185 Kings Road / B186 Queens Road - Option 4

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Kings Road (Southbound)	0.81	31.29	4.17	0.89	51.17	7.17
Queens Road	0.48	6.75	0.93	0.42	5.99	0.72
Kings Road (Northbound)	0.55	5.41	1.20	0.61	5.97	1.55

10.2.19 The results show that the junction is working within capacity in the AM peak and in the PM peak Kings Road southbound is at capacity.

Junction 10 – High Street/Kings Road/London Road/Weald Road – Signalised

10.2.20 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 10-10.

Table 10-10: High Street/Kings Road/London Road/Weald Road – Option 4

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Weald Road (ahead/left & right)	84%	17	42	68%	11	37
A1023 High Street East (all movements)	73%	12	33	69%	12	33
Kings Road (ahead/left & right)	59%	10	30	67%	13	32
A1023 High Street East (ahead/left & right)	90%	16	44	80%	14	25

10.2.21 The results show that the junction is working within capacity in the PM peak and in the AM peak A1023 is at capacity.

Junction 11 - Weald Road / Western Road - Mini-Roundabout

10.2.22 The results of this assessment are summarised in Table 10-11.

Table 10-11: Weald Road / Western Road - Option 4

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Weald Road (Southbound)	0.40	8.19	0.65	0.28	8.41	0.39
Western Road	0.52	9.05	1.06	0.41	6.90	0.69
Weald Road (Northbound)	0.48	7.22	0.94	0.75	14.66	2.91

10.2.23 The results show that the junction is working within capacity in both the AM and PM peaks.

Junction 12 - Western Road / William Hunter Way - Mini-Roundabout

10.2.24 The results of this assessment are summarised in Table 10-12.

Table 10-12: Western Road / William Hunter Way - Option 4

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Western Road (Southbound)	0.97	14.21	1.96	0.39	8.20	0.63
William Hunter Way	0.17	7.62	0.21	0.37	8.73	0.58
Western Road (Northbound)	0.44	6.78	0.79	0.74	15.05	2.78

10.2.25 The results show that the junction is working within capacity in the PM peak and in the AM peak Western Road southbound is at capacity.

Junction 13 - A127 / A128 Brentwood Road / A128 Tilbury Road - Grade Separated Gyratory

10.2.26 The results of this assessment are summarised in Table 10-13.

Table 10-13: A127 / A128 Brentwood Road / A128 Tilbury Road - Option 4

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Brentwood Road	0.58	4.84	1.35	0.51	4.67	1.04
A127 (Westbound)	0.72	8.39	2.54	0.88	19.50	6.88
Tilbury Road	0.46	3.02	0.84	0.50	3.47	1.00
A127 (Eastbound)	0.57	6.63	1.33	0.72	11.74	2.55

10.2.27 The results show that the junction is working within capacity in the AM peak and in the PM peak A127 westbound is at capacity.

Junction 14a - A127 / Childerditch Lane Northern Side - Left in, Left out Priority Junction

10.2.28 The results of this assessment are summarised in Table 10-14.

Table 10-14: A127 / Childerditch Lane Northern Side - Option 4

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Childerditch lane	1.11	633.18	14.15	1.07	456.92	15.63

10.2.29 The results show that Childerditch Lane is over capacity in both peak with an RFC of 1.11 in the AM and an RFC of 1.07 in the PM.

Junction 14b - A127 / Childerditch Lane Southern Side - Left in, Left out Priority Junction

10.2.30 The results of this assessment are summarised in Table 10-15.

Table 10-15: A127 / Childerditch Lane Southern Side - Option 4

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Childerditch lane	1.12	624.97	17.71	0.45	59.15	0.78

10.2.31 The results show that Childerditch Lane is over capacity in the AM peak with a RFC of 1.12, in the PM peak is running within capacity.

Junction 15 & 16 - A128 Ingrave Road / The Avenue / A128 Brentwood Road / Running Waters - Double Mini-Roundabout

10.2.32 The results of this assessment are summarised in Table 10-16.

Table 10-16: A128 Ingrave Rd / The Avenue / A128 Brentwood Road / Running Waters - Option 4

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
J1 The Avenue	0.97	107.96	9.10	2.07	3321.08	438.34
J1 Ingrave Road	1.03	123.75	27.11	1.91	2826.05	372.09
J1 Brentwood Road (Westbound)	0.98	54.14	12.40	0.89	32.68	7.39
J2 Brentwood Road (Eastbound)	0.96	52.43	12.40	0.98	55.68	12.40
J2 Running Waters	2.05	3245.12	388.96	0.62	17.18	1.59
J2 Brentwood Road (Westbound)	1.96	2962.78	675.16	0.89	44.45	10.70

Note: J1 - Junction 1, J2 - Junction 2

10.2.33 The results show that the junctions are running overcapacity in the AM peak. In the PM peak junction 1 arms The Avenue and Ingrave Road are over capacity with RFC's of 2.07 and 1.91. Junction 2 is at capacity in the PM peak.

Junction 17 – Brook Street/Mascalls Lane – Signalised Junction

10.2.34 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 10-17.

Table 10-17: Brook Street/Mascalls Lane – Option 4

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Spital Street (all movements)	90%	10	94	78%	6	76
A1023 London Road (all movements)	99%	36	84	98%	42	70
Mascalls Lane (ahead/right & left)	62%	10	30	67%	10	39
A1023 Brook Street (ahead/left & right)	99%	52	67	80%	31	21

10.2.35 The results show that the junction is at capacity in the AM peak and in the PM peak, A1023 London Road is at capacity.

Junction 18 – Warley Hill/Eagle Way – Signalised Junction

10.2.36 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 10-18.

Table 10-18: Brook Street/Mascalls Lane – Option 4

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
Warley Road North (all movements)	97%	18	85	64%	12	62
Eagle Way (all movements)	105%	31	192	93%	17	80
Warley Road South (ahead/left & right)	95%	26	61	76%	14	37
Mascalls Lane (ahead/left & right)	103%	26	160	93%	14	87

10.2.37 The results show that the junction is overcapacity in the AM peak and is at capacity in the PM peak.

Junction 19 - B186 Warley Street / A127 Eastbound - Priority Junction

10.2.38 The results of this assessment are summarised in Table 10-19.

Table 10-19: B186 Warley Street / A127 Eastbound - Option 4

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/ PCU)	Queue (PCU)	RFC (%)	Delay (s/ PCU)	Queue (PCU)
A127 Slip Road	1.58	1854.01	175.89	0.98	164.53	15.20
Warley Street Right-Turn	0.34	6.91	1.07	0.41	7.00	1.32

10.2.39 The results show that A127 Slip Road is running overcapacity with and RFC of 1.58 in the AM peak and at capacity in the PM peak.

Junction 20 - B186 Warley Street / A127 Westbound - Priority Junction

10.2.40 The results of this assessment are summarised in Table 10-20.

Table 10-20 B186 Warley Street / A127 Westbound - Option 4

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
A127 Slip Road	1.35	1135.15	100.69	1.30	984.18	124.37
Warley Street Right-Turn	0.51	7.65	2.20	0.36	7.22	1.03

10.2.41 The results show that A127 Slip Road is running overcapacity in both peaks with a RFC of 1.35 in the AM peak and 1.30 in the PM peak.

Junction 21 - A127 Westbound / Thorndon Avenue, West Horndon - Left in, Left out Priority Junction

10.2.42 The results of this assessment are summarised in Table 10-21.

Table 10-21: A127 Westbound / Thorndon Avenue, West Horndon - Option 4

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
Thorndon Avenue	0.11	23.14	0.12	0.16	31.04	0.19

10.2.43 The results show that the junction is running within capacity in both the AM and PM peaks.

Junction 22 - A1023 Chelmsford Road / Alexander Lane Priority Junction

10.2.44 The results of this assessment are summarised in Table 10-22.

Table 10-22: A1023 Chelmsford Road / Alexander Lane - Option 4

	AM Peak Hour 0800 - 0900			PM Peak Hour 1700 - 1800		
	RFC (%)	Delay (s/PCU)	Queue (PCU)	RFC (%)	Delay (s/PCU)	Queue (PCU)
A127 Slip Road	1.24	870.30	46.75	0.75	69.88	2.72
Chelmsford Road Right-Turn	0.09	9.17	0.10	0.09	7.34	0.10

10.2.45 The results show that A127 Slip Road is overcapacity with an RFC value of 1.24 in the AM peak and in the PM peak the junction is running within capacity.

Junction 23 – West Mayne/Lower Dunton Road – Signalised Junction

10.2.46 This is a signalised junction and was tested using LinSig software. A summary of the results is shown in Table 10-23.

Table 10-23: West Mayne/Lower Dunton Road – Option 4

Arm	AM peak (08:00-09:00)			PM peak (17:00-18:00)		
	Deg Sat	MMQ (vehs)	Delay (secs)	Deg Sat	MMQ (vehs)	Delay (secs)
West Mayne North (ahead/left & right)	59%	6	15	60%	6	15
Ford Access (left only)	0%	0	0	0%	0	0
West Mayne North (ahead/left & right)	50%	5	14	59%	6	15
Lower Dunton (left only)	34%	3	15	27%	2	14

10.2.47 The results show that the junction is working within capacity in both the AM and PM peaks.

11 Summary of Junction Outputs

11.1 Introduction

11.1.1 This section sets out an overall comparison of each option against the baseline

11.2 Summary Junction Capacity Assessment

11.2.1 A summary comparison of the results for the AM peak is provided in Table 11-1, with similar results for the PM peak shown in Table 11-2. This indicates the highest RFC or degree of saturation for each junction in each peak and can be used to inform which junctions are most likely to require some form of mitigation, dependent on the option taken forward.

11.2.2 Where the highest value is below 0.85 or 85%, this is shown in **Green**, for junctions approaching capacity (i.e. between 0.85/85% and 1.00/100%), these are shown in **Orange** and where over capacity (1.00/100% or above), these are shown in **Red**.

Table 11-1: Junction Modelling Summary Results – AM Peak

Junction No.	Type	Baseline	Option 1	Option 2	Option 3	Option 4
1	Signalised	80%	83%	83%	86%	83%
2	Rbt	1.03	1.06	1.05	1.07	1.12
3	Rbt	1.23	1.40	1.40	2.14	1.42
4	Priority	0.65	0.67	0.67	0.73	0.67
5	Rbt	0.50	0.55	0.55	0.66	0.59
6	Double Mini-Rbt	0.82	0.85	0.85	0.89	0.89
7	Rbt	1.19	1.34	1.35	1.27	1.36
8	Signalised	118%	122%	122%	122%	122%
9	Rbt	0.79	0.82	0.82	0.84	0.81
10	Signalised	82%	84%	84%	90%	90%
11	Rbt	0.50	0.51	0.51	0.55	0.52
12	Rbt	0.65	0.66	0.66	0.70	0.97
13	Rbt	0.63	0.84	0.86	0.72	0.72

14	Priority (Left-in Left-out)	0.85	1.36	1.59	1.11	1.11
15	Priority (Left-in Left-out)	0.42	2.09	0.08	1.12	1.12
16	Double Mini-Rbt	1.79	1.91	1.92	1.84	2.05
17	Signalised	95%	99%	99%	101%	99%
18	Signalised	100%	99%	105%	100%	105%
19	Priority	1.46	1.55	1.39	1.54	1.58
20	Priority	1.24	1.37	1.30	1.31	1.35
21	Priority	0.10	0.14	N/A	N/A	0.11
22	Priority	0.67	1.18	1.18	1.26	1.24
23	Signalised	55%	61%	60%	59%	59%

Table 11-2: Junction Modelling Summary Results – PM Peak

Junction No.	Type	Baseline	Option 1	Option 2	Option 3	Option 4
1	Signalised	92%	95%	95%	99%	98%
2	Rbt	0.83	0.89	0.90	0.88	0.89
3	Rbt	1.06	1.12	1.12	1.36	0.97
4	Priority	0.72	0.80	0.80	1.18	0.82
5	Rbt	0.44	0.48	0.48	0.51	0.50
6	Double Mini-Rbt	0.84	0.93	0.93	1.00	0.96
7	Rbt	0.82	0.94	0.95	0.98	0.97
8	Signalised	86%	93%	95%	95%	95%
9	Rbt	0.86	0.89	0.89	0.89	0.89

10	Signalised	68%	78%	77%	99%	80%
11	Rbt	0.71	0.75	0.75	0.89	0.75
12	Rbt	0.69	0.74	0.74	0.89	0.74
13	Rbt	0.72	1.25	1.21	0.87	0.88
14	Priority (Left-in Left-out)	0.87	1.68	1.77	1.07	1.07
15	Priority (Left-in Left-out)	0.21	0.57	N/A	0.45	0.45
16	Double Mini-Rbt	1.75	1.84	1.85	1.81	2.07
17	Signalised	91%	98%	97%	101%	98%
18	Signalised	88%	91%	91%	91%	93%
19	Priority	0.80	0.97	0.98	0.98	0.98
20	Priority	1.21	1.31	1.31	1.29	1.30
21	Priority	0.13	0.22	N/A	N/A	0.16
22	Priority	0.52	0.72	0.72	0.76	0.75
23	Signalised	59%	61%	61%	60%	60%

11.2.3 Overall it appears that Option 1 and 4 have resulted in lower RFC/Degree of Saturation values in general when compared to the other two options.

11.2.4 The following junctions are shown to be over capacity in all scenarios, including baseline and in both peaks:

- Junction 3 - A128 Ongar Road/Doddinghurst Road;
- Junction 16 - A128 Ingrave Road/The Avenue/Brentwood Road/Running Waters; and
- Junction20 - B186 Warley Street/A127.

11.2.5 The following junctions are close to or overcapacity in all (or nearly) all scenarios and time periods:

- Junction 7 - A128 Ingrave Road/B186 Queens Road;

- Junction 8 - Ingrave Road/Middleton Hall Lane/Seven Arches Road;
- Junction 17 - Brook Street/Mascalls Lane;
- Junction 18 - Warley Hill/Eagle Way; and
- Junction 19 - B186 Warley Street/A127.

11.2.6 Junction 13 (A127/A128 Brentwood Road/A128 Tilbury Road) is shown to be overcapacity in all the option tests, in the AM peak. This is shown to worsen markedly from the Baseline scenario in options 1 and 2 in particular, where the junction is shown to be operating within capacity.

11.2.7 Junction 2 is shown to be over capacity in the AM peak for all the scenarios and is close to capacity in the PM peak.

11.2.8 Junction 22 (A1023 Chelmsford Road/Alexander Lane) is shown to be over capacity for all Options in the AM peak only. For the PM peak, the junction operates well within capacity.

11.2.9 Junction 9 (B185 Kings Road/B186 Queens Road) is shown to be working reasonably well in all scenarios, although it has an RFC of just above 0.85 for all scenarios in the PM peak.

11.2.10 Junction 4 is over capacity in the PM peak for Option 3 only.

11.2.11 Junction 10 is reaching capacity for Options 3 and 4 in both peaks.

11.2.12 The following junctions are shown to be operating satisfactorily in all scenarios and time periods:

- Junction 5 – A128 Ongar Road/William Hunter Way;
- Junction 11 – Weald Road/Western Avenue;
- Junction 12 – Western Road/William Hunter Way; and
- Junction 23 – West Mayne/Lower Dunton Road

11.2.13 The results for junctions 14 and 15 appear to be very much influenced by the level of mainline traffic. Both these junctions are left-in/left-out only and traffic does seem to be struggling to get out onto the mainline, which is leading to some spurious results within the Picady assessments. There also seems to be some traffic re-assignment within the option tests when the development traffic is added to the baseline traffic.

11.3 Junction Ranking

11.3.1 Based on the results from the capacity assessment the junctions have been ranked in order to determine those which are most likely to require mitigation in each of the two option tests. The worst 10 performing junctions are shown in Table 11-3.

Table 11-3: Junction Ranking – By Worse Performing Junction

Ranking (Worst First)	Option 1	Option 2	Option 3	Option 4
1	16	16	16	16
2	20	20	3	20
3	19	3	20	19
4	3	19	19	3
5	7	7	7	7
6	8	8	8	8
7	13	13	17	2
8	17	17	22	22
9	2	18	2	18
10	22	2	18	17

11.3.2 The rankings within the table indicate that the worst performing junctions in each case are the same, but in a slightly different order.

11.3.3 These results have excluded the motorway junctions.

Way Forward

11.3.4 It is recommended that mitigation is examined for the worst performing junctions to understand how the development proposals can be accommodated. In total, the results indicate that at least 10 of the junctions are shown to be over capacity in at least one time period.

11.3.5 Further work is required to examine the impact on M25 junctions 28 and 29, as the flows indicate high levels of traffic growth in both Options at these junctions.