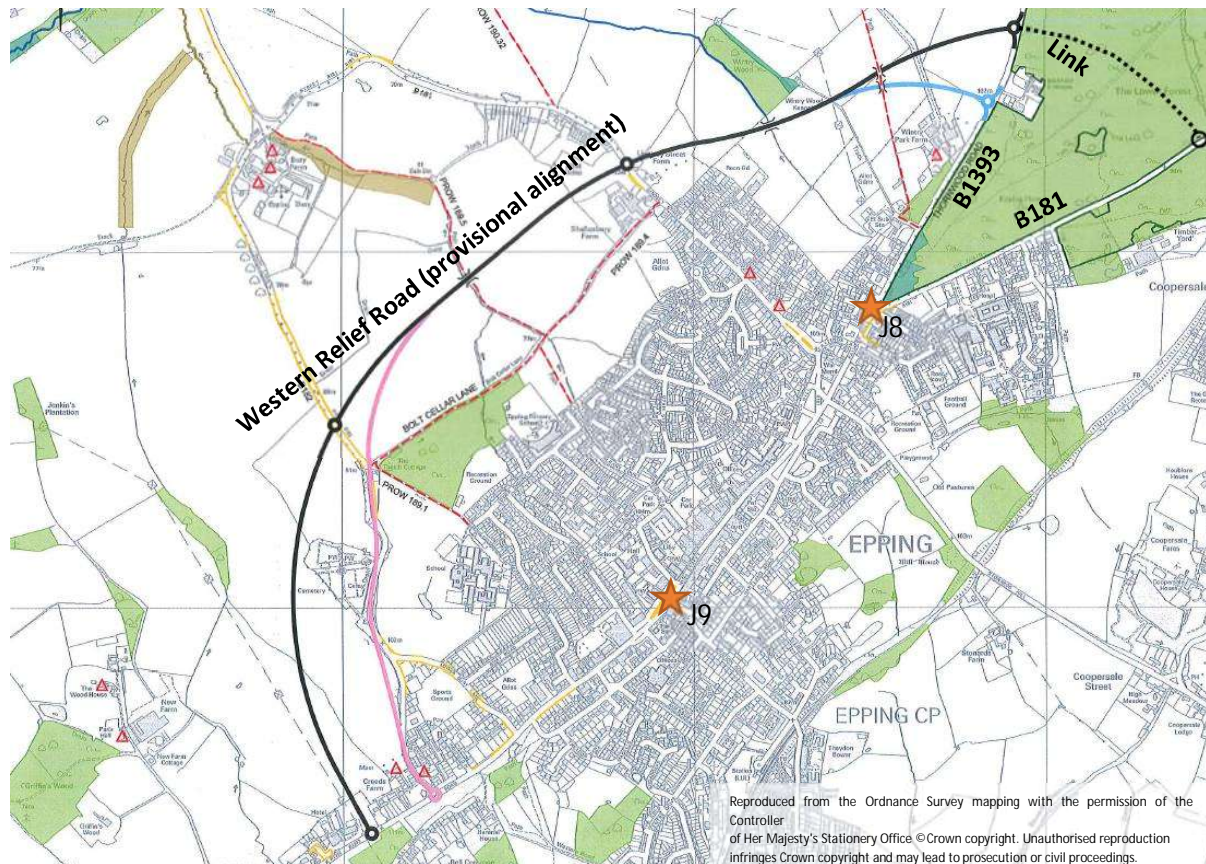


Junction 8 – Thornwood Road Signals, Epping

From discussions with EFDC, it is understood that an extension to existing proposals for a western relief road in Epping – providing a cut-through between the B181 and B1393 (illustrated below) - should be given due consideration despite the land-take required through Epping Forest.



With the relief road and extension in place, there is *potential* for the signalised junction along Thornwood Road to operate largely within capacity in 2036 with no alterations to the junction (other than signal optimisation) required. Although the junction is modelled to exceed capacity under the 'Ambitious Growth A' scenario, PM peak period congestion at the junction is shown to be less than that modelled with 2013 traffic flows.

Given the lack of space around the junction in which to expand, removal of peak hour traffic from the junction (via a scheme such as a relief road) would appear to be the best means of mitigating the forecast growth in congestion at the junction.

It should, however, be noted that broad assumptions were made in modelling trip assignment to the relief road, in the absence of origin/destination data.

Using turning count data available at junctions along the B1393, the maximum volume of in-scope background traffic to divert to the relief road was estimated by determining the point at which reassignment left turning movements at junctions along the existing B1393 route

with negative values in the Epping spreadsheet model. Development trips associated with were reassigned to the relief road where the link offered a reasonable alternative to the congested town centre route without significant diversion. The diverted flows were then split between the B1393 and B181 based on existing turning movement proportions at the Thornwood Road signalised junction.

Junction 9 – Station Road / St. John's Road Double-Mini Roundabout, Epping

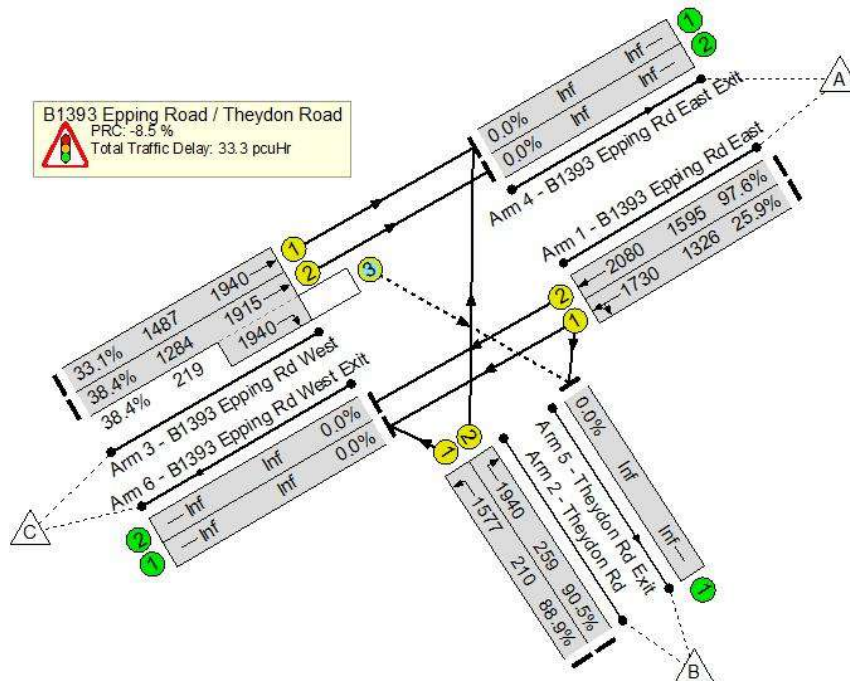
With a relief road in place, effectively bypassing the junction, modelling suggests that there is potential for the double-mini roundabout to accommodate 2036 traffic volumes - without the junction exceeding capacity and without the need for local infrastructure improvements. Model tests using ambitious growth scenarios indicate that all approach arms would operate within capacity.

These model results are however, caveated with an acknowledgement of the methodology and assumptions used in determining usage of the relief road.

Junction 10 – Theydon Road Signals, Epping

Option Test:

- Widened the B1393 eastbound approach arm to three lanes to accommodate two lanes for straight-ahead movements and a dedicated right-turn lane (approximately five vehicles in length) for access to Theydon Road.
- Widened the B1393 westbound approach arm to two lanes to accommodate straight-ahead movements in both.
- Widened the Theydon Road approach to two lanes for dedicated left and right-turn movements.
- Two-lane exits were modelled for both B1393 arms, whilst the length of road widening required along each approach arm was unspecified in the model, but presumed to be in excess of 60 metres.



Evaluation: The capacity enhancements detailed above allow the Theydon Road signalised junction to operate within capacity under the 'Ambitious Growth C' scenario with a high quota of development in and around Epping. Modelling of the other scenarios suggests that with lower volumes of traffic through the junction, the extent of road widening required along the B1393 approaches could be reduced, although the provision of additional lanes would still likely be required.

It is possible that for the junction concept to be realised, the B1393 carriageway could require realignment to make use of land to the south of the junction, given the lack of land available on the northern side.

Junction 11 – Bury Lane Mini-Roundabout, Epping

This junction was not considered as part of the mitigation study. Should the Epping Western Relief Road feed into the roundabout as a means of connecting to the B1393, the junction would necessarily require redesigning as part of the overall relief road scheme. Should the relief road connect into the B1393 further to the south, the Bury Lane mini-roundabout would then be bypassed, leaving a significantly reduced flow of traffic passing through. It is also possible that the relief road could connect to the B182 at a point north-west of the junction with the B1393. If this was to occur, the southern section of Bury Lane would effectively become a local access link.

As seen with the Station Road/ St. John's Road double-mini roundabout, under these circumstances, a reduction in flow along the B1393 would likely leave the junction operating within capacity in 2036.

Appendices

1) Junction Capacity Descriptions & Application

RFC = Ratio of Flow to Capacity

The ratio of flow to capacity provides a measure of the utilised capacity of a junction approach arm. Arms exceeding a ratio of 0.85 (i.e. 85% capacity utilised) are considered to be approaching capacity and characteristically have light-to-moderate levels of queued traffic flow. Arms exceeding a ratio of 1.00 (i.e. 100% capacity utilised) are considered to be over capacity and are characterised as having heavy volumes of queued traffic.

ARCADY results that exceed RFCs of 1.00 generate queue lengths that are subject to exponential growth. However, the instability of flows through over-capacity approach arms, results in an inherent difficulty in calibrating modelled outputs to observed conditions. For this reason, queue lengths attributed to over capacity approach arms should be seen as indicative rather than representative.

The capacity assessment tables at the end of this technical note use a colour-coding system to assist in appraisal:

- Arms with an RFC of less than 0.85 are coloured green
- Arms with an RFC between 0.85 and 0.99 are coloured amber
- Arms with an RFC of 1.00 or more are coloured red

DOS = Degree of Saturation

The degree of saturation is an output from LINSIG which provides a measure of the utilised capacity of a signalised junction approach lane. It is directly comparable to the RFC outputs obtained from ARCADY assessments (see above).

The colour-coding system used to categorise DOS in the model results tables is as follows:

- Lanes with a DOS of less than 85% are coloured green
- Lanes with a DOS between 85% and 99% are coloured amber
- Lanes with a DOS of 100% or more are coloured red

Junction 8: Thornwood Road Signals, Epping - No Mitigation (2026)

Junction 8 (Thornwood Road) - Epping									2026 Signals Maximum DoS Values							
Arm	AM PEAK								PM PEAK							
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C
B1393 Thornwood Rd - L/A	90	107	108	116	112	128	119	143	110.5	112	111	111	111	111	110	137
B181 The Plain - L/A	77	95	95	99	96	103	98	93	101	118	118	119	118	119	115	116
B1393 Palmers Hill - R/A	89	102	103	101	103	97	101	111	119.4	161	161	176	165	191	179	194

Junction 8 (Thornwood Road) - Epping									2026 Signals Maximum Queue Lengths							
Arm	AM PEAK								PM PEAK							
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C
B1393 Thornwood Rd - L/A	24	143	172	190	183	220	206	290	112.8	135	134	117	136	115	119	270
B181 The Plain - L/A	22	42	37	47	37	69	45	39	22	80	80	84	81	89	73	80
B1393 Palmers Hill - R/A	20	64	58	47	61	40	52	141	161	413	418	494	437	573	507	614

Junction 8: Thornwood Road Signals, Epping - Mitigation Option Test (2026 and 2036)

Junction 8 (Thornwood Road) - Epping									2026 Signals Maximum DoS Values							
Arm	AM PEAK								PM PEAK							
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C
B1393 Thornwood Rd - L/A		65	66	69	66	73	69	67		75	75	78	78	81	79	79
B181 The Plain - L/A		51	50	57	52	64	58	56		25	25	27	27	28	28	30
B1393 Palmers Hill - R/A		44	43	45	44	46	46	45		84	83	86	86	88	87	85

Junction 8 (Thornwood Road) - Epping									2026 Signals Maximum Queue Lengths							
Arm	AM PEAK								PM PEAK							
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C
B1393 Thornwood Rd - L/A		14	14	16	14	17	16	15		9	9	9	9	9	9	10
B181 The Plain - L/A		12	11	13	12	16	13	13		4	4	5	5	5	5	5
B1393 Palmers Hill - R/A		7	7	7	7	7	7	7		15	15	17	17	19	17	16

Junction 8 (Thornwood Road) - Epping									2036 Signals Maximum DoS Values							
Arm	AM PEAK								PM PEAK							
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C
B1393 Thornwood Rd - L/A		74	72	81	73	91	82	80		87	87	94	94	103	99	96
B181 The Plain - L/A		63	63	76	65	91	79	75		30	30	32	32	34	35	41
B1393 Palmers Hill - R/A		50	50	52	51	54	54	53		93	93	98	98	102	99	97

Junction 8 (Thornwood Road) - Epping									2026 Signals Maximum Queue Lengths							
Arm	AM PEAK								PM PEAK							
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C
B1393 Thornwood Rd - L/A		17	17	21	18	28	22	21		11	11	15	15	33	20	17
B181 The Plain - L/A		15	15	20	16	30	21	20		6	6	6	6	6	7	8
B1393 Palmers Hill - R/A		8	8	8	8	8	8	8		27	26	36	36	57	42	33

Junction 9: Station Road/ St John's Road Double Mini-Roundabout, Epping - No Mitigation (2026)

Junction 9a (Station Rd) - Epping									2026 Roundabout Maximum RFC Values							
Arm	AM PEAK								PM PEAK							
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C
B1393 High Street RAB Link	0.80	1.01	1.02	1.08	1.04	1.17	1.14	1.04	0.92	1.10	1.10	1.12	1.12	1.13	1.13	1.16
Station Road	0.77	0.99	0.99	1.04	1.02	1.05	1.02	1.01	0.69	0.85	0.85	0.87	0.87	0.88	0.88	0.86
B1393 High Street	0.92	1.11	1.11	1.13	1.13	1.14	1.14	1.16	0.87	1.12	1.13	1.20	1.15	1.29	1.26	1.15

Junction 9a (Station Rd) - Epping									2026 Roundabout Maximum Queue Lengths							
Arm	AM PEAK								PM PEAK							
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C
B1393 High Street RAB Link	4	26	29	56	36	99	87	35	9	59	63	70	70	76	77	91
Station Road	3	14	14	20	18	22	18	15	2	5	5	6	6	6	6	5
B1393 High Street	9	64	63	73	72	78	80	92	6	72	79	115	89	175	155	87

Junction 9b (St. John's Rd) - Epping									2026 Roundabout Maximum RFC Values							
Arm	AM PEAK								PM PEAK							
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C
St. John's Road	0.37	1.01	1.01	1.03	1.02	1.07	1.06	1.01	0.82	1.20	1.21	1.24	1.23	1.28	1.27	1.30
B1393 High Street	0.69	1.19	1.20	1.29	1.23	1.41	1.38	1.23	0.93	1.22	1.23	1.26	1.25	1.28	1.28	1.30
B1393 High Street RAB Link	0.89	1.05	1.05	1.07	1.07	1.08	1.08	1.10	0.72	0.92	0.93	1.00	0.95	1.07	1.05	0.95

Junction 9b (St. John's Rd) - Epping									2026 Roundabout Maximum Queue Lengths							
Arm	AM PEAK								PM PEAK							
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C
St. John's Road	1	10	10	11	10	13	13	10	4	31	32	38	35	45	42	50
B1393 High Street	2	82	86	140	99	230	206	100	9	85	90	106	103	119	121	126
B1393 High Street RAB Link	7	43	42	54	53	58	56	67	3	10	11	23	14	54	44	13

Junction 9: Station Road/ St John's Road Double Mini-Roundabout, Epping - Mitigation Option Test (2026 and 2036)

Junction 9a (Station Rd) - Epping									2026 Roundabout Maximum RFC Values								
Arm	AM PEAK								PM PEAK								
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	
B1393 High Street RAB Link						0.56	0.52	0.43						0.52	0.52	0.54	
Station Road						0.73	0.70	0.66						0.61	0.60	0.60	
B1393 High Street						0.43	0.45	0.49						0.50	0.56	0.55	

Junction 9a (Station Rd) - Epping									2026 Roundabout Maximum Queue Lengths								
Arm	AM PEAK								PM PEAK								
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	
B1393 High Street RAB Link						1	1	1						1	1	1	
Station Road						3	2	2						2	2	2	
B1393 High Street						6	1	1						1	1	1	

Junction 9b (St. John's Rd) - Epping										2026 Roundabout Maximum RFC Values									
Arm	AM PEAK								PM PEAK										
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C			
St. John's Road						0.30	0.30	0.30						0.51	0.52	0.57			
B1393 High Street						0.49	0.45	0.36						0.29	0.28	0.26			
B1393 High Street RAB Link						0.46	0.47	0.51						0.38	0.44	0.43			

Junction 9b (St. John's Rd) - Epping									2026 Roundabout Maximum Queue Lengths								
Arm	AM PEAK								PM PEAK								
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	
St. John's Road						0	0	0						1	1	1	
B1393 High Street						1	1	1						0	0	0	
B1393 High Street RAB Link						1	1	1						1	1	1	

Junction 9a (Station Rd) - Epping										2036 Roundabout Maximum RFC Values							
Arm	AM PEAK								PM PEAK								
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	
B1393 High Street RAB Link						0.86	0.79	0.60						0.69	0.68	0.72	
Station Road						0.98	0.90	0.80						0.74	0.73	0.74	
B1393 High Street						0.49	0.53	0.61						0.56	0.69	0.68	

Junction 9a (Station Rd) - Epping									2036 Roundabout Maximum Queue Lengths								
Arm	AM PEAK								PM PEAK								
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	
B1393 High Street RAB Link						6	4	2						2	2	3	
Station Road						14	7	4						3	3	3	
B1393 High Street						1	1	2						1	2	2	

Junction 9b (St. John's Rd) - Epping										2036 Roundabout Maximum RFC Values							
Arm	AM PEAK								PM PEAK								
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	
St. John's Road						0.34	0.35	0.35						0.64	0.67	0.78	
B1393 High Street						0.78	0.71	0.52						0.40	0.40	0.36	
B1393 High Street RAB Link						0.54	0.55	0.63						0.44	0.55	0.54	

Junction 9b (St. John's Rd) - Epping									2036 Roundabout Maximum Queue Lengths								
Arm	AM PEAK								PM PEAK								
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	
St. John's Road						1	1	1						2	2	3	
B1393 High Street						4	2	1						1	1	1	
B1393 High Street RAB Link						1	1	2						1	1	1	

Junction 10: Theydon Road Signals, Epping - No Mitigation (2026)

Junction 10 (Theydon Road) - Epping									2026 Signals Maximum DoS Values							
Arm	AM PEAK								PM PEAK							
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C
B1393 Epping Rd (E) L/A	82	115	116	120	119	126	105	149	65	74	74	115	113	127	121	126
Theydon Road	92	340	343	347	346	348	163	344	84	120	126	337	335	341	351	551
B1393 Epping Rd (W) R/A	87	115	115	120	117	126	203	120	75	98	98	111	111	111	110	112

Junction 10 (Theydon Road) - Epping									2026 Signals Maximum Queue Lengths							
Arm	AM PEAK								PM PEAK							
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C
B1393 Epping Rd (East) L/A	28	140	151	174	168	216	95	358	17	21	21	108	97	154	135	162
Theydon Road	15	160	162	165	164	165	96	163	12	48	57	160	158	162	169	302
B1393 Epping Rd (West) R/A	17	98	96	115	105	137	290	126	22	47	47	106	105	113	108	117

Junction 10: Theydon Road Signals, Epping - Mitigation Option Test (2026 and 2036)

Junction 10 (Theydon Road) - Epping									2026 Signals Maximum DoS Values							
Arm	AM PEAK								PM PEAK							
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C
B1393 Epping Rd (E) L/A		55	56	58	57	61	62	78		45	46	46	46	47	48	61
B1393 Epping Rd (E) A		38	39	40	40	43	43	42		27	28	28	28	29	29	39
Theydon Road (L)		61	61	63	63	66	61	67		29	29	31	31	31	28	18
Theydon Road (R)		65	66	65	65	69	67	74		73	74	74	73	75	76	84
B1393 Epping Rd (W) A		29	29	29	29	30	30	31		37	38	40	39	43	43	51
B1393 Epping Rd (W) R/A		33	33	34	34	34	34	36		43	44	46	45	50	49	58

Junction 10 (Theydon Road) - Epping									2026 Signals Maximum Queue Lengths							
Arm	AM PEAK								PM PEAK							
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C
B1393 Epping Rd (E) L/A		12	12	13	12	14	14	23		9	9	9	9	9	10	15
B1393 Epping Rd (E) A		8	8	8	8	9	9	8		5	5	5	5	5	6	9
Theydon Road (L)		6	6	6	6	6	6	6		3	3	3	3	3	3	2
Theydon Road (R)		7	8	8	7	8	8	8		10	10	10	10	10	11	19
B1393 Epping Rd (W) A		5	5	5	5	5	5	5		7	7	8	7	9	9	12
B1393 Epping Rd (W) R/A		5	5	5	5	5	5	5		7	8	8	8	10	9	13

Junction 10 (Theydon Road) - Epping									2036 Signals Maximum DoS Values							
Arm	AM PEAK								PM PEAK							
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C
B1393 Epping Rd (E) L/A		64	65	69	67	76	78	86		52	53	53	53	55	59	72
B1393 Epping Rd (E) A		45	46	49	48	55	54	78		32	32	33	32	34	36	82
Theydon Road (L)		66	66	71	68	75	70	73		31	31	35	35	35	28	14
Theydon Road (R)		71	73	72	68	76	80	83		77	78	79	77	80	82	97
B1393 Epping Rd (W) A		33	32	34	34	34	35	76		45	47	50	48	58	59	93
B1393 Epping Rd (W) R/A		38	37	39	39	46	47	57		51	53	57	55	65	65	80

Junction 10 (Theydon Road) - Epping									2036 Signals Maximum Queue Lengths							
Arm	AM PEAK								PM PEAK							
	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C	Base	Low A	Low B	Med A	Med B	Amb A	Amb B	Amb C
B1393 Epping Rd (E) L/A		15	16	18	17	22	24	28		11	11	11	11	12	14	18
B1393 Epping Rd (E) A		9	10	11	11	13	12	26		6	6	6	6	7	7	25
Theydon Road (L)		6	6	7	7	7	7	7		3	3	3	3	3	3	2
Theydon Road (R)		9	9	9	8	9	10	10		11	11	11	11	12	13	36
B1393 Epping Rd (W) A		6	6	6	6	6	6	23		9	10	11	10	14	14	33
B1393 Epping Rd (W) R/A		6	6	6	6	6	6	1		10	11	12	12	16	16	22