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1 Introduction

1.1 Background

1.1.1 The following technical note details the results of a mode-shift sensitivity test which forms part of a broader transport modelling commission in 2019/20 to enhance the transport evidence base in support of the Basildon Local Plan at Examination.

1.1.2 Junction modelling presented in earlier Transport & Highway Impact Assessment (THIA) reports is acknowledged to represent a worst-case scenario, where variable demand elements such as route choice, peak spreading and mode-shift are not specifically determined, but which would be expected to occur in response to peak hour network congestion.

1.1.3 This latest sensitivity testing explores the potential impact of mode-shift away from private car trips to public transport, walking and cycling alternatives, looking at the effect on overall vehicle numbers modelled in Basildon, Wickford and Billericay and the subsequent impact on junction capacity.

1.1.4 This note references methodologies, outputs and findings as reported in the following Local Plan evidence base reports:

- 'Basildon Local Plan Part 2 – Publication Local Plan Transport & Highway Impact Assessment (THIA)': Essex Highways, March 2018 (EV069_BC)
- 'Basildon Local Plan – Publication Local Plan Transport & Highway Impact Assessment-Pound Lane/Cranfield Park Road Junction Addendum': Essex Highways, October 2019

1.1.5 This study makes use of the existing junction models and matrix development spreadsheets built for the earlier THIA studies. Serving as a sensitivity test, it is intended for the latest outputs to support rather than supersede previous findings and conclusions; and, where expected, the modelling approach remains consistent with earlier work.

1.2 Format of this Note

1.2.1 This technical note sets out the methodology and findings of the mode-shift sensitivity test on junction capacity performance, and is structured as follows:

Section 1 Introduction

Section 2 Trip rate reclassification based on mode-shift

Section 3 Modelling Methodology

Section 4 Junction Capacity Appraisal

Section 5 Summary & Conclusions

2 Trip rate reclassification based on mode-shift

2.1.1 Mode-shift sensitivity testing made use of existing Essex Public Transport Accessibility Level (EPTAL) research carried out for previous Local Plan appraisals in the county. The EPTAL analysis made use of data from the Trip Rate Information Computer System (TRICS) to establish trip rates for developments based on urban classification (e.g. town centre, suburban, edge of town) and an associated level of public transport provision.

2.1.2 Using the EPTAL research it was possible to identify opportunities to alter the urban classification of Local Plan sites and with it, reduce the trip rates applied to developments. This reclassification could be justified in two ways:

1) If the existing level of public transport provision was already representative of a more urbanised area
2) If additional public transport services and/or infrastructure could be provided such that it became representative of a more urbanised area

2.1.3 EPTAL average scores for urban categories were developed based on site survey data contained within TRICS. An 'EPTAL score' was defined as the average wait time for a person arriving at a bus stop and a train station at a random time within a peak hour for both types of transport combined. The formula is shown below:

$$EPTAL\ (Combined\ average\ wait\ time) = \frac{1}{2} \times ({}^{60}/_{Bus\ frequency} + {}^{60}/_{Train\ frequency})$$

2.1.4 Basildon Local Authority area is well served by rail, with all proposed Local Plan development sites located with a 4km radius of a rail station providing frequent mainline Abellio Greater Anglia or C2C rail services into London. See Figure 2-1 below and Table 2-1 below:

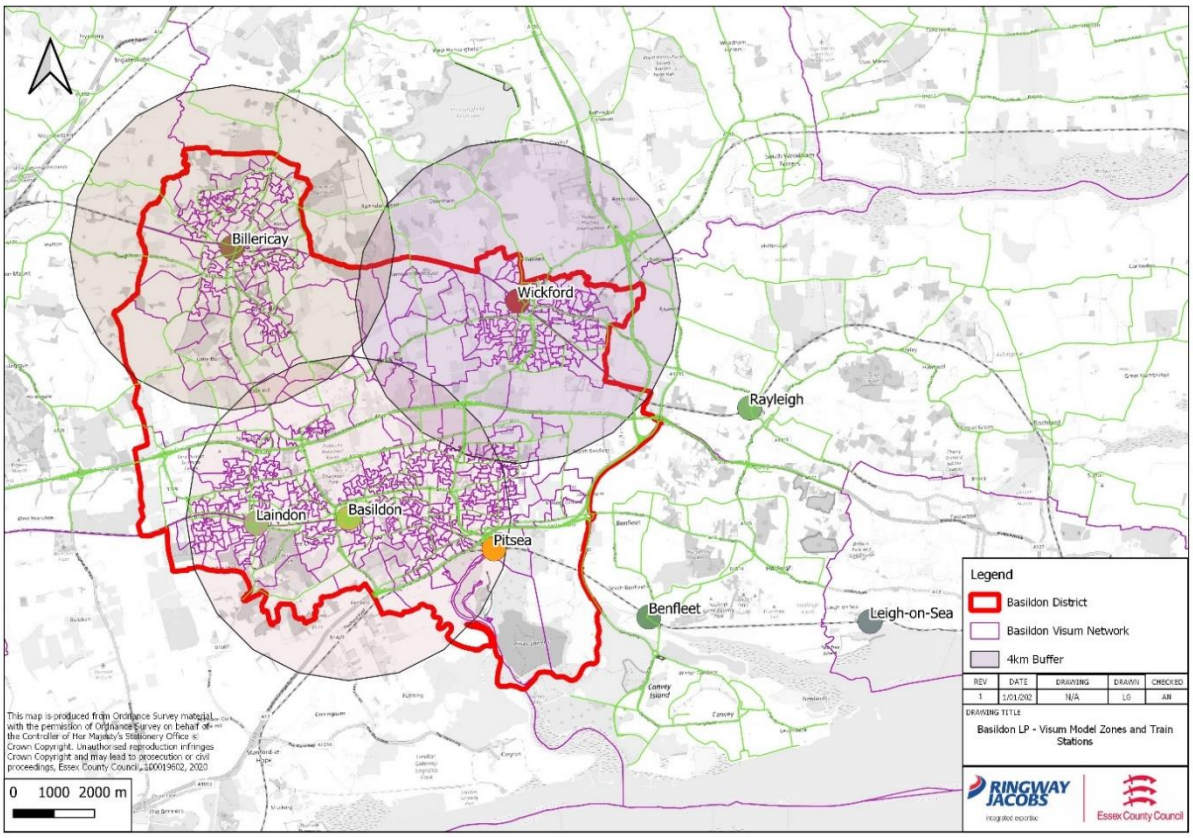

Figure 2-1: Proposed Local Plan development sites located within 4km buffer of Basildon, Wickford and Billericay rail stations

Table 2-1: Train frequencies to/from London by area and peak hours

Location	No. AM Peak (8-9) services to London	No. PM Peak (17-18) services from London
Basildon	6	8
Billericay	8	6
Wickford	7	7

2.1.5 EPTAL analysis demonstrated that the high level of existing rail service provision accessible to Local Plan developments in Basildon, Wickford and Billericay, was representative of urban sites within the TRICS database.

2.1.6 With the level of rail provision demonstrated in Table 2-1, the number of bus services required to justify a change in urban classification was calculated and summarised as follows:

- One bus service per hour to/from developments in edge of town and suburban areas, and
- Three bus services per hour to/from developments in town centre and edge of town centre areas

2.1.7 On the assumption that the required level of bus service provision should be met, the EPTAL analysis thus provided justification for a shift in the urban classification of sites upwards by a single category for this sensitivity test. This would, however, be dependent on there being available capacity on the existing public transport network to accommodate growth in demand from new developments.

2.1.8 Adjustments were applied to all residential and employment trip purposes and is summarised in Table 2-2 below.

Table 2-2: Urban categorisation shift applied to local plan development trips

Existing Urban Categorisation	Adjusted Urban Categorisation (based on mode-shift)
Town Centre	Town Centre
Edge of Town Centre	Town Centre
Suburban Area	Edge of town centre
Edge of Town	Suburban Area
Neighbourhood Centre	Neighbourhood Centre

2.1.9 Town Centre categorisation remained unchanged given there is no urban categorisation above this. Neighbourhood Centre also remained unchanged as EPTAL data was not available for this development type.

2.1.10 The new urban classification for Local Plan developments in Table 2-2 was used to determine new trip rates for the Local Plan developments. The trip rates applied per urban classification is shown in Table 2-3 below.

Table 2-3: Summary of vehicle trip rates and EPTAL score by urban categorisation

Location of Site	Hourly Vehicle Movements Per Unit				EPTAL Score
	AM Peak (08:00 – 09:00)		PM Peak (17:00 – 18:00)		
	Arrivals	Departures	Arrivals	Departures	
Town Centre	0.042	0.091	0.091	0.065	14.77
Edge of Town Centre	0.097	0.209	0.196	0.158	31.13
Suburban Area	0.099	0.287	0.276	0.138	40.41
Edge of Town	0.134	0.334	0.330	0.158	56.67
Neighbourhood Centre	0.073	0.327	0.362	0.181	No score

2.1.11 The single-category shift in urban classification to better account for mode-shift was shown to reduce overall development trips modelled by 15%.

2.1.12 It should be noted that the EPTAL method for adjusting trip rates was used to reduce only the development trips modelled in the THIA. Forecast background traffic flows were determined by applying growth factors to observed data at individual junctions, and as such could not be reduced through adjustments made to trip rates.

2.1.13 The mode-shift sensitivity testing therefore does not consider the traffic impact of a transfer of background trips to sustainable alternatives. This would be more robustly assessed through use of a full variable demand modelling package.

3 Modelling Methodology

3.1 Assessed Junctions

3.1.1 To facilitate a comparison with earlier findings, the following junctions modelled in the previous 2019 THIA Pound Lane Addendum were included:

- Ba4 - A127/A132 Nevendon Interchange Junction
- Ba7 - Broadmayne / South Mayne / Ashlyns
- Ba15 - Cranes Farm Road / A132 East Mayne
- Ra1 - A1245 Chelmsford Road / A129 London Road
- W1 - A132 Runwell Road / A132 / Runwell Road
- W2 - A132 Golden Jubilee Way/Radwinter Ave/ A129 London Rd
- W3 - A132 Runwell Road / Church End Lane
- W4 - A129 London Road / Nevendon Road / High Street
- W5 - A132 / Cranfield Park Road / Nevendon Road

3.1.2 Within the Basildon Administrative area, the following junctions were included in the scope of the sensitivity test as they were shown to exceed capacity without mitigation in the original 2018 THIA study.

- Ba1 - B1007 Stock Road / Queens Park Avenue / Potash Road
- Ba14 - B1464 London Road / High Road / Clay Hill Road
- Ba19 - High Road / West Mayne / St. Nicholas Lane
- Ba24 - A13/A176 Five Bells Interchange North

3.1.3 Further to the above, a selection of junctions in Billericay (Bi1, Bi2, Bi3, Bi6, Bi8 and Bi10) were also assessed. Results indicated that these junctions would not be impacted by mode-shift trip reductions given their relative distance away from Local Plan development sites, or the presence of highway mitigation (i.e. the Western Link Road) to route development trips away. Findings for each junction in Billericay have therefore not been reported.

3.1.4 The locations of the junctions included in this sensitivity test are illustrated in Figure 3-1 in the following section of this technical note.

3.2 Modelled Scenarios Used

3.2.1 The VISUM 2034 Final Growth forecast models 'With' and 'Without' highway mitigation from the 2018 THIA study and 2019 THIA Addendum were used to forecast development trips at junctions for the sensitivity test. The Visum network in the 'With' highway mitigation model includes the grade-separated junction at Pound Lane, Western Link Road in Billericay and access link road in Dunton.

3.2.2 Table 3-1 below lists the assessed junctions and the 2034 Visum model used to extract development trips.

Table 3-1: Visum model used for assessed junctions

2034 'With' Highway Mitigation Model	2034 'Without' Highway Mitigation Model
Ba1 - A127 / A176 Noak Bridge Interchange North	Ba4 - A127 / A132 Nevendon Interchange Junction
Ba14 - B1464 London Road / High Road / Clay Hill Road	Ba7 - Broadmayne / South Mayne / Ashlyns
Ba19 - High Road / West Mayne / St. Nicholas Lane	Ba15 - Cranes Farm Road / A132 East Mayne
Ba24 - A13/A176 Five Bells Interchange North	Ra1 - A1245 Chelmsford Road / A129 London Road
	W1 - A132 Runwell Road / A132 / Runwell Road
	W2 - A132 Golden Jubilee Way / Radwinter Avenue / A129 London Road
	W3 - A132 Runwell Road / Church End Lane
	W4 - A129 London Road / Nevendon Road / High Street
	W5 - A132 / Cranfield Park Road / Nevendon Road

3.2.3 Mode-shift sensitivity testing was carried out at each junction using the most appropriate modelled scenario taken from the 2019 THIA Addendum as follows:

- Scenario 2 – 2034 Final Growth Scenario: No Mitigation
- Scenario 3a – 2034 Final Growth Scenario: 2018 junction improvements 'Without' Visum highway mitigation
- Scenario 3b – 2034 Final Growth Scenario: 2019 additional junction improvements 'Without' Visum highway mitigation
- Scenario 4 – 2034 Final Growth Scenario: 2018 junction improvements 'With' Visum highway mitigation

3.2.4 On the understanding that the proposed grade separated junction on the A127 would not be included in the sensitivity testing, assessed junctions located in Wickford and East Basildon used scenarios with local junction mitigation - where modelled in Junctions 9 / LinSig software, but using the Visum forecast model 'Without' highway mitigation as the basis for the sensitivity test.

3.2.5 Junctions located in Billericay and West Basildon used Scenario 4 – 'With' highway mitigation modelled in Visum. This enabled the impact of the Dunton Link Road and the Western Link Road in Billericay to be modelled at these junctions, whilst it was felt that the A127 grade-separated junction would have little impact on traffic flows.

3.2.6 A location map of the junctions modelled, and the scenarios used for the sensitivity testing at each junction, is shown in Figure 3-1 below. 'The Highways Mitigation Divide' shown on the map, shows the geographic split in junctions using the Visum model 'With' and 'Without' highway mitigation.

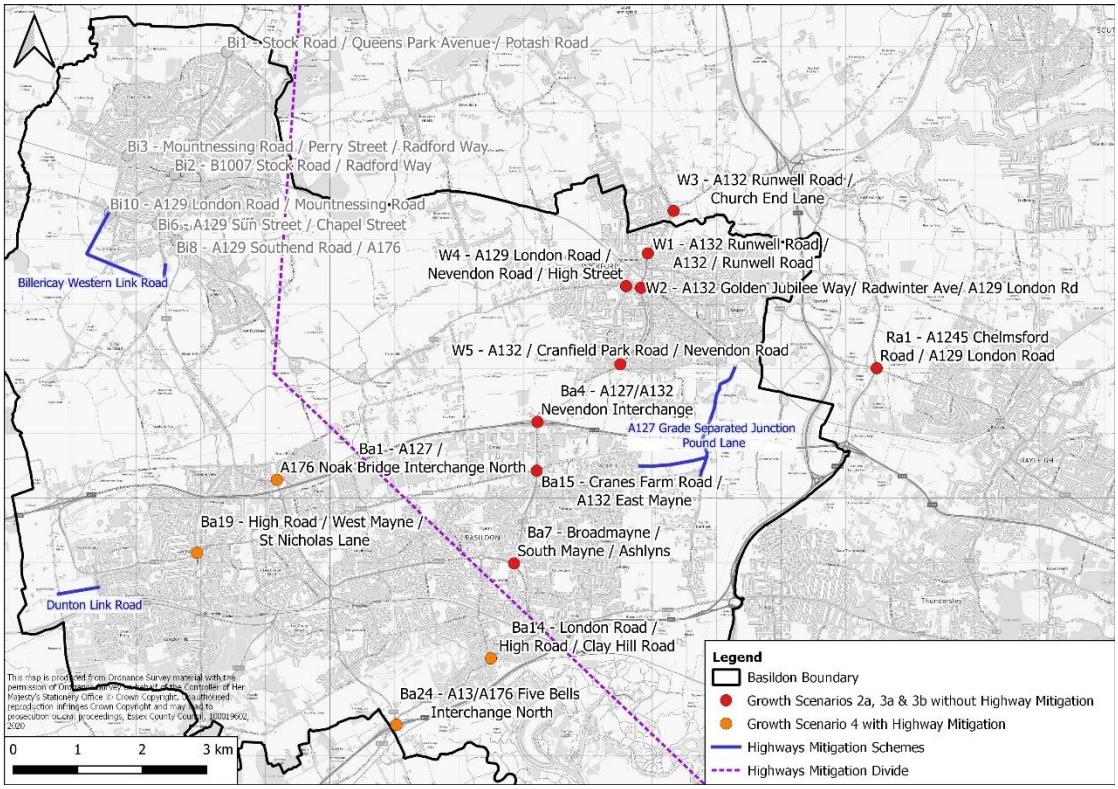

Figure 3-1: Map of junction modelling scenarios and highway mitigation

3.2.7 Background traffic flows at all assessed junctions were taken directly from the scenario models developed for the 2018 and 2019 THIA studies. No further changes were made as part of the sensitivity test.

3.3 Modelled Junction Mitigation

3.3.1 For reference, Table 3-2 below summarises the mitigation included at each junction. The table also states the modelled scenario for each junction taken forward from the 2019 THIA Addendum study for this latest mode-shift sensitivity test.

Table 3-2: Junction Layout Changes and Modelling Scenario

Junction ID	Junction Location	Existing Junction Type	Preferred Mitigation (if any)	Modelling Scenario
Basildon				
Ba1	A127 / A176 Noak Bridge Interchange North	Standard Roundabout	Signal Roundabout. Increased circulatory carriageway widen entries	4
Ba4	A127 / A132 Nevendon Interchange Junction	Signal Roundabout	Additional lane on circulatory and entry lanes	2
Ba7	Broadmayne / South Mayne / Ashlyns	Standard Roundabout	South Mayne approach as 3-lane entry and provide 3-lane circulatory between South Mayne and Broadmayne arms	3b
Ba14	B1464 London Road / High Road / Clay Hill Road	Mini Roundabout	Signalised (3-arm) (Only previously modelled Scenario 4)	4
Ba15	Cranes Farm Road / A132 East Mayne	Standard Roundabout	Widen 3-lane East Mayne southern approach to 3.5m per lane	3b
Ba19	High Road / West Mayne / St. Nicholas Lane	Standard Roundabout	No Mitigation	4
Ba24	A13 / A176 Five Bells Interchange North	Standard Roundabout	Signalised Roundabout (Only previously modelled Scenario 4)	4
Ra1	A1245 Chelmsford Road / A129 London Road	Standard Roundabout	Dedicated A1245 N to A129 E slip & widening	3a
Wickford				
W1	A132 Runwell Road / A132 / Runwell Road	Standard Roundabout	Part-time signalisation of A132 Golden Jubilee Way	3b
W2	A132 Golden Jubilee Way / Radwinter Avenue / A129 London Road	Standard Roundabout	Widened approach on A132 Golden Jubilee Way North	3a
W3	A132 Runwell Road / Church End Lane	Priority (3-arm)	Convert junction to mini-roundabout	3b

W4	A129 London Road / Nevendon Road / High Street	Signal (4-arm)	Traffic redistribution on London Road East Widened carriageway on London Road West	3a
W5	A132 / Cranfield Park Road / Nevendon Road	Standard Roundabout	No Mitigation	2

4 Junction Capacity Appraisal

4.1.1 The application of lower trip rates to Local Plan developments was shown to result in a 15% reduction in development trips assigned through the Basildon VISUM model.

4.1.2 Table 4-1 below details the percentage reduction in development trips modelled at each individual junction along with the total percentage reduction – taking account of background traffic flows.

Table 4-1: Percentage change in development and total trips by junction

Junction	% Change AM Trips		% Change PM Trips	
	Development	Total	Development	Total
Basildon				
Ba1	-14.5%	-1.7%	-17.2%	-2.8%
Ba4	-16.2%	-2.3%	-13.2%	-2.7%
Ba7	-15.1%	-2.5%	-12.4%	-2.1%
Ba14	-14.9%	-0.7%	-10.8%	-0.7%
Ba15	-14.0%	-1.6%	-15.7%	-2.0%
Ba19	-13.0%	-1.3%	-12.9%	-1.0%
Ba24	-5.4%	-0.2%	-22.9%	-1.4%
Ra1	-13.8%	-0.3%	-20.2%	-0.7%
Wickford				
W1	-22.0%	-2.5%	-15.6%	-2.2%
W2	-16.1%	-1.5%	-12.4%	-1.3%
W3	-19.4%	-2.5%	-18.6%	-3.2%
W4	-13.3%	-1.9%	-2.9%	-0.6%
W5	-18.3%	-3.1%	-17.0%	-3.5%

4.1.3 With reductions applied to the junction demand matrices, junction capacity modelling results for the mode-shift sensitivity test are summarised in Table 4-2 & Table 4-3 at the end of this chapter, and are presented as 'Scenario 6'.

4.1.4 Both tables are laid out in the same format as the summary tables found in the 2018 and 2019 THIA reports. They also include the results from the capacity modelling of Scenarios 1-4 for reference. The interim year sensitivity test carried out for the 2019 THIA Addendum (Scenario 5) was not included.

4.1.5 It can be inferred from the Scenario 6 capacity analysis results that mode-shift offers small reductions in traffic flows through existing junctions within the study area. The reductions in the Ratio of Flow to Capacity (RFC) have been observed across almost all junctions as the result of reduced development traffic.

4.1.6 Junctions modelled to operate with an RFC between 1.00 and 1.15 have been acknowledged in the THIA studies as being over-capacity but assumed to have excess peak hour traffic flow that could potentially be accommodated, in part, through successful implementation of sustainable transport measures.

4.1.7 It is therefore notable that the mode-shift sensitivity test has resulted in the following two junctions being brought within capacity:

- Ba19 - High Road / West Mayne / St. Nicholas Lane
- W5 - A132 / Cranfield Park Road / Nevendon Road

4.1.8 Perhaps understandably, assessed junctions with the largest reductions in RFC tend to be those located nearer to Local Plan development sites, and therefore with higher proportions of development trips relative to total trips.

4.1.9 Whilst the reductions modelled as part of this sensitivity test are relatively small, it should be reiterated that the mode-shift assessment only considers one element of variable demand modelling applied to Local Plan development trips only.

4.1.10 Further improvements made to public transport accessibility in Basildon Borough (such as travel planning initiatives and the installation of infrastructure for active travel and improved bus services) may be expected to encourage a broader scope of mode-shift away from private car use amongst both Local Plan development trips and background traffic flows.

Table 4-2: Junction capacity results for Scenario 6 – 2034 Final Growth Scenario: Mode-shift without A127 grade-separated junction – AM Peak

	Junction Location	Existing Junction Type	Performance Summary (Ratio of Flow to Capacity)						
			AM Peak						
			Scenario 0	Scenario 1	Scenario 2	Scenario 3a	Scenario 3b	Scenario 4	Scenario 6
			2014 Base	2034 Background Growth	2034 Final Growth Scenario - No Mitigation	2034 Final Growth Scenario: Initial mitigation without A127 grade-separated junction	2034 Final Growth Scenario: Initial + further mitigation without A127 grade-separated junction	2034 Final Growth Scenario: Initial mitigation with A127 grade-separated junction	2034 Final Growth Scenario: Mode-shift without A127 grade-separated junction
Basildon									
Ba1	A127 / A176 Noak Bridge Interchange North	Standard rbt	0.80	0.95	1.31	1.31	1.31	1.06	1.06
Ba4	A127/A132 Nevendon Interchange Junction	Signal rbt	0.99	1.00	1.03	1.03	1.03	0.50	1.02
Ba7	Broadmayne / South Mayne / Ashlyns	Standard rbt	0.97	1.18	1.52	1.52	1.09	1.05	1.01
Ba14	B1464 London Road / High Road / Clay Hill Road	Mini rbt	0.93	1.04	1.05	1.05	1.05	0.88	0.88
Ba15	Cranes Farm Road / A132 East Mayne	Standard rbt	1.04	1.11	1.24	1.24	1.15	0.99	1.14
Ba19	High Road / West Mayne / St. Nicholas Lane	Standard rbt	0.71	0.81	0.91	0.91	0.91	1.00	0.98
Ba24	A13/A176 Five Bells Interchange North	Standard rbt	1.37	1.67	1.93	1.93	1.93	1.16	1.16
Ra1	A1245 Chelmsford Road / A129 London Road	Standard rbt	0.76	0.86	0.86	0.86	0.86	0.66	0.86
Wickford									
W1	A132 Runwell Road / A132 / Runwell Road	Standard rbt	1.07	1.19	1.42	1.42	1.02	1.12	1.01
W2	A132 Golden Jubilee Way/Radwinter Ave/ A129 London Rd	Standard rbt	0.81	0.96	1.02	1.02	1.02	1.04	0.97
W3	A132 Runwell Road / Church End Lane	Priority	0.57	1.86	X	X	1.38	1.06	1.34
W4	A129 London Road / Nevendon Road / High Street	Signal	0.88	1.00	1.15	0.89	0.89	0.92	0.89
W5	A132 / Cranfield Park Road / Nevendon Road	Standard rbt	0.80	0.77	0.87	0.87	0.87	0.41	0.80

- RFC values of 'X' recorded in earlier scenarios are presented where the ratio of flow to capacity at specific junctions could not be calculated due to excessively high conflicting turning flows modelled.

Table 4-3: Junction capacity results for Scenario 6 – 2034 Final Growth Scenario: Mode-shift without A127 grade-separated junction – PM Peak

Junction ID	Junction Location	Existing Junction Type	Performance Summary (Ratio of Flow to Capacity)						
			PM Peak						
			Scenario 0	Scenario 1	Scenario 2	Scenario 3a	Scenario 3b	Scenario 4	Scenario 6
			2014 Base	2034 Background Growth	2034 Final Growth Scenario No Mitigation	2034 Final Growth Scenario: Initial mitigation without A127 grade-separated junction	2034 Final Growth Scenario: Initial + further mitigation without A127 grade-separated junction	2034 Final Growth Scenario: Initial mitigation with A127 grade-separated junction	2034 Final Growth Scenario: Mode-shift without A127 grade-separated junction
Basildon									
Ba1	A127 / A176 Noak Bridge Interchange North	Standard rbt	1.06	1.17	1.38	1.38	1.38	1.24	1.20
Ba4	A127/A132 Nevendon Interchange Junction	Signal rbt	0.90	0.89	0.97	0.97	0.97	0.37	0.92
Ba7	Broadmayne / South Mayne / Ashlyns	Standard rbt	0.84	0.99	1.13	1.13	1.09	0.81	1.05
Ba14	B1464 London Road / High Road / Clay Hill Road	Mini rbt	1.22	1.34	1.38	1.38	1.38	1.07	0.99
Ba15	Cranes Farm Road / A132 East Mayne	Standard rbt	0.85	0.90	1.04	1.04	1.04	0.62	1.01
Ba19	High Road / West Mayne / St. Nicholas Lane	Standard rbt	0.63	0.72	0.84	0.84	0.84	1.21	1.19
Ba24	A13/A176 Five Bells Interchange North	Standard rbt	1.19	1.36	1.71	1.71	1.71	1.21	1.21
Ra1	A1245 Chelmsford Road / A129 London Road	Standard rbt	0.95	1.14	1.09	0.89	0.89	0.91	0.87
Wickford									
W1	A132 Runwell Road / A132 / Runwell Road	Standard rbt	1.07	1.34	1.48	1.48	1.02	0.74	1.01
W2	A132 Golden Jubilee Way/Radwinter Ave/ A129 London Rd	Standard rbt	0.85	1.00	1.11	1.08	1.08	1.16	1.06
W3	A132 Runwell Road / Church End Lane	Priority	1.34	X	X	X	1.66	1.13	1.53
W4	A129 London Road / Nevendon Road / High Street	Signal	0.73	0.90	0.99	0.83	0.83	0.75	0.81
W5	A132 / Cranfield Park Road / Nevendon Road	Standard rbt	0.63	0.69	1.03	1.03	1.03	0.34	0.97

- As outlined in Section 3, to ensure a like-for-like comparison of results the following junctions in Scenario 6 should be compared to the lowest RFC in Scenario 4
  - Ba1, B14, Ba19 and Ba24

5 Summary & Conclusions

5.1 Overview

5.1.1 This latest sensitivity testing explores the potential impact of mode-shift away from private car trips to public transport, walking and cycling alternatives, looking at the effect on overall vehicle numbers modelled in Basildon, Wickford and Billericay and the subsequent impact on junction capacity.

5.1.2 EPTAL analysis demonstrated that the high level of existing rail service provision accessible to Local Plan developments in Basildon, Wickford and Billericay, was representative of urban sites within the TRICS database.

5.1.3 On the assumption that a required level of bus service provision should be met, the EPTAL analysis thus provided justification for a shift in the urban classification of sites upwards by a single category for this sensitivity test. The new urban classification for Local Plan developments was used to determine new trip rates for the Local Plan developments

5.1.4 The single-category shift in urban classification was shown to result in a reduction in overall development trips modelled by 15%, although this reduction varied on a junction by junction basis.

5.1.5 The mode-shift sensitivity testing does not consider the traffic impact of a transfer of background trips to sustainable alternatives. This would be more robustly assessed through use of a full variable demand modelling package.

5.1.6 The sensitivity testing undertaken suggests that there is scope for limited traffic flow reduction at junctions assessed in the previous THIA assessments as a result of potential mode-shift – although this is dependent on there being available capacity on the existing public transport network to accommodate growth in demand from new developments. In this regard, an assessment of mode-shift could be expanded through further detailed demand modelling.

5.1.7 Findings from the sensitivity testing nevertheless back the assertion that the fixed demand approach adopted for the THIA / Local Plan evidence base, presents a worst-case scenario with regards to future junction capacity performance.

5.1.8 Whilst the reductions modelled as part of this sensitivity test are relatively small, it should be reiterated that the mode-shift assessment only considers one element of variable demand modelling applied to Local Plan development trips only.

5.1.9 Further improvements made to public transport accessibility in Basildon Borough may be expected to encourage a broader scope of mode-shift away from private car use amongst both Local Plan development trips and background traffic flows.

5.1.10 Investment in services and infrastructure to encourage mode-shift will play an important role in ensuring that worse-case scenario modelled delays and RFC values are not realised. Such schemes should be prioritised within Local Plan mitigation, although they do not diminish the need for highway infrastructure improvements as set out in the THIA.