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Subject:	East of Luton Urban Extension Stage 2 – Traffic Modelling Results (North Hertfordshire District Council)		
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1 Introduction

1.1 AECOM has been commissioned by North Hertfordshire District Council to assess the traffic impact of a potential 2,100 dwelling urban extension to the east of Luton, within North Hertfordshire, on land in the vicinity of Cockernhoe village. The assessment consists of two stages:

- Stage 1) the estimation of trip generations and attractions of the East of Luton (EoL) development; and
- Stage 2) traffic modelling to provide an initial assessment on the potential impact of the EoL Development.

1.2 This technical note sets out the modelling results for the second part (i.e. Stage 2) of the assessment. The purpose of Stage 2 is to provide an initial high level overview on the potential impact of the EoL Development. The modelling task utilised the Central Bedfordshire and Luton Transport Model (CBLTM) and an existing 2031 forecast year scenario was used as the basis for this study. The analysis presented within this technical should be treated with some caution and further work is required to identify with confidence the likely impacts of the EoL Development.

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2 Modelling Overview

Modelling Approach

2.1 To assess the potential traffic impact of the EoL Development, two 2031 model scenarios were developed:

- 2031 Do Minimum – without EoL Development; and
- 2031 Do Something – with EoL Development (2,100 dwellings and 5-FE (FE) secondary school).

2.2 The following bullet points outline the approach adopted for Stage 2:

- An existing 2031 forecast year scenario from a previous Luton Local Plan test (i.e. Option C – Duty to Cooperate (DtC) scenario) was used as the basis for this modelling task. Paragraph 2.3 to 2.5 provide background information on the modelling assumptions for 2031 Luton Local Plan Option C. It should be noted that the highway infrastructure designs and planning assumptions adopted for the 2031 Luton Local Plan Option C scenario are considered not to be the most up to date (a new version of the model is currently under development to support Luton's forthcoming Local Plan).
- The demand data, such as trip generations / attractions, for the EoL Development was then updated based on the calculations from Stage 1.
- Demand distribution assumptions for the EoL school pupil trips were defined in Stage 1 which have been adopted for the modelling task. For other land use (i.e. residential), existing demand distribution from adjacent model zones covering Luton was adopted. It was also assumed that a small proportion of the pupils from the EoL Development will attend schools in Hitchin. The demand distribution assumptions are set out in more detail in Table 6.
- The CBLTM includes a demand model, a highway model and a public transport model. However for this initial assessment test, only the highway assignment model has been used and the impacts of the EoL Development on changes in demand and modes of travel have not been considered. It should also be noted that the EoL Development is located at the edge of the simulation network of CBLTM. The representation of the highway network is coarser towards the edge of the simulation network, and as such there is a higher degree of uncertainty on the assignment and scale of impacts (such as delay) of the additional EoL Development traffic.

2031 Luton Local Plan Option C – Duty to Cooperate (DtC) Scenario

2.3 An existing 2031 Luton Local Plan scenario was used as the starting point for this modelling task. The 2031 Luton Local Plan Option C scenario considers the developments in Luton Borough and known proposed development sites in adjacent Local Authority areas. Table 1 to Table 3 summarise the planning and network assumptions for 2031 Luton Local Plan Option C.

2.4 As shown in Table 1, 5,500 dwellings was assumed for the 2031 Luton Local Plan Option C scenario, but as part of this modelling task, the quantum of the EoL Development was updated and the development demand data for 2,100 dwellings and 5-Form Entry (FE) was used.

2.5 Table 3 shows that the A505 – Airport Bypass was also included for the 2031 Luton Local Plan Option C scenario. For this modelling task, the network was updated to exclude this scheme.

Table 1 – 2031 Luton Local Plan Option C – Additional Dwellings

Area	Site	2031 Option C
LBC	Luton SHLAA Reasonable Certainty	4,110
	Luton SHLAA No Certainty	1,643
CBC	Leighton Buzzard East	2,500
	East of Luton Extension ^{#1}	5,500
	North of Luton Extension	2,900
	Early release sites at Kestrel Way and East Bidwell	1,000
	Remaining Business Case HRDC development	4,150
	Phase 2 HRD on Shanley Land & Taylor Wimpey Land	550
	Houghton Regis North Development - Site 2	1,500
	Totals	23,853

Notes:

^{#1} 5,500 dwelling was assumed for 2031 Luton Local Option C, but for this modelling task, the quantum of EoL Development was updated to include 2,100 dwellings and 5FE secondary school.

Table 2 – 2031 Luton Local Plan Option C – Additional Jobs

Area	Site	2031 Option C
LBC	Butterfield Green	4,013
	Jct 10a	1,728
	Century Pk	2,599
	Power Ct	2,074
	Napier Pk	3,016
	Station Quarter	623
	Luton Airport	5,050
CBC	Leighton Linslade	2,099
	Sundon Quarry	2,289
	North Luton Urban Extension	2,116
	North Houghton Regis	3,263
	Totals	28,870

Table 3 – 2031 Luton Local Plan Option C – Transport Infrastructure Schemes

			2031 Option C
Networks	Bedford C+E	Bedford Western Bypass Phase 1	✓
		Bedford Western Bypass Phase 2	✓
		A421 Dualling	✓
	HA C+E	M1 J10a	✓
		M1 J10-13	✓
	Central Beds and Luton C+E	Morrison's Houghton Regis	✓
		Luton & Dunstable Guided Busway	✓
		Luton Town Centre	✓
		Luton Parkway Northern Access	✓
		Luton 20mph	✓
	Central Bedfordshire Proposed	A5 - M1 link	✓
		Woodside Connection (WSC)	✓
		Poynters Road Scheme (20mph speed limit and HGV ban)	✓
		Connection to WSC from Parkside Drive	✓
		Access to Early Release Kestrel Way	✓
		Access Road to Distribution Centre	✓
		HRDC development access over CBC land	✓
		Houghton Regis North Development 2 - Distributor Road	✓
		East Leighton Distributor Road	✓
		Leighton Buzzard Town Centre Schemes	✓
		Luton North Bypass (M1-A6 Link)	✓
		North of Luton Extension Distributor Roads	✓
	Luton Proposed	Dunstable Road Pinch Points	✓
		Airport Link to Century Park	✓
		Dualling of Airport Access Road	✓
		A505 - Airport Bypass ^{#1}	✓
		Airport Junction Mitigation ^{#2}	✓
Luton Airport Parkway Bus-Loop	✓		

Notes:

^{#1} The A505 – Airport Bypass scheme was included for the 2031 Luton Local Option C scenario. For this modelling task, the network has been updated to exclude this scheme.

^{#2} This includes junction mitigation for the immediate Airport Way at the Holiday Inn roundabout only.

East of Luton Development

- 2.6 Figure 1 shows the model network structure and zone connections for the EoL Development, i.e. zones 90011, 90012 and 90013. Table 4 summarises the planning assumption for each EoL zone for the 2031 DM and DS scenario.
- 2.7 As shown in Figure 1, the access for EoL zone 90011 and 90013 is via Luton Road whilst zone 90012 is connected to Luton Road and Eaton Green Road.
- 2.8 The trip generations / attractions for the EoL Development were estimated as part of Stage 1 of the study. Table 5 summarises the trip generation and attraction for the EoL Development by model zone, which is consistent with those presented in the Stage 1 Technical Note¹ except for the 'EoL Development to external pupil trips' which has been included specifically for this modelling task only.

Table 4 – East of Luton Development

Zone	2031 DM (i.e. without EoL)	2031 DS (i.e. with EoL)
90011	N/A	1,050 dwellings
90012	N/A	1,050 dwellings
90013	N/A	5FE Secondary School Primary School

Table 5 – Trip Generations and Attractions for East of Luton Development (vehicle trips)^{#1}

Zone	Description	Morning Peak Hour (0800 to 0900)		Evening Peak Hour (1700 to 1800)	
		In (Attraction)	Out (Generation)	In (Attraction)	Out (Generation)
90011	Residential (1,050 dwellings) excluding school-related trips	63	205	233	143
	EoL to external pupil trips ^{#2}	0	41	0	0
90012	Residential (1,050 dwellings) excluding school-related trips	63	205	233	143
	EoL to external pupil trips	0	41	0	0
90013	School staff trips	124	0	0	75
	External pupil trips ^{#3}	86	86	0	0
TOTAL (EoL Development)		336	578	465	361

Notes:

^{#1} Figures may not add up due to rounding.

^{#2} Assumed 10% of the pupils within EoL Development will attend schools in Hitchin.

^{#3} Assumed 1FE secondary school pupil trips are external pupil trips (from North Hertfordshire only).

- 2.9 In order to distribute the EoL Development trips, the trip distribution of adjacent zones with similar land uses was adopted. For the residential development, distribution patterns of adjacent residential zones in Luton were utilised whilst for the school related trips, the distribution was based on nearby zones that contain a secondary school. Table 6 summarises the trip distribution assumptions for the EoL Development.

¹ Technical Note - East of Luton Urban Extension – traffic assessment (3 November 2015) ('TN_E of Luton Urban Extension - traffic assessment ISSUED 051115.pdf')

2.10 It should be noted that the EoL Development trips may have a different distribution pattern to the Luton parent zones identified for this modelling task. However the impact of alternative development trip distribution assumptions has not been considered for this study, and further sensitivity tests would be required if the distribution of the EoL Development trips is expected to be different to the distribution pattern derived from the parent zones and adopted for this modelling task. For example, the parent zone distribution may assume more trips route to/from or via Luton, whereas the distribution for the EoL Development may be weighted more towards the east including Hitchin and Stevenage.

Table 6 – East of Luton Trip Distribution Assumptions

Type of Development	Distribution Assumption
Residential	Based on adjacent residential zones (i.e. Zone 99547, 99550, 99557, 99622 and 99624 – as shown in Figure 2).
School Staff	Based on adjacent zones with school (i.e. Zone 99549, 99558 and 99623 and 99624 – as shown in Figure 3).
School Pupil (from External to EoL)	<p>External to EoL (from rural North Hertfordshire only) – based on catchment assumptions from Stage 1 of the study.</p> <p>Escorted trips – it was assumed 50% of the escorted trips return home (after dropping of children at school) and 50% going on to another destination such as work. For the trips that going on to another destination, the distribution will be based on the adjacent Luton residential zones.</p>
School Pupil (from EoL to External)	It was assumed that 10% of the pupils within EoL Development will attend schools in Hitchin. Error! Reference source not found. shows the zone boundary for the Hitchin model zones.

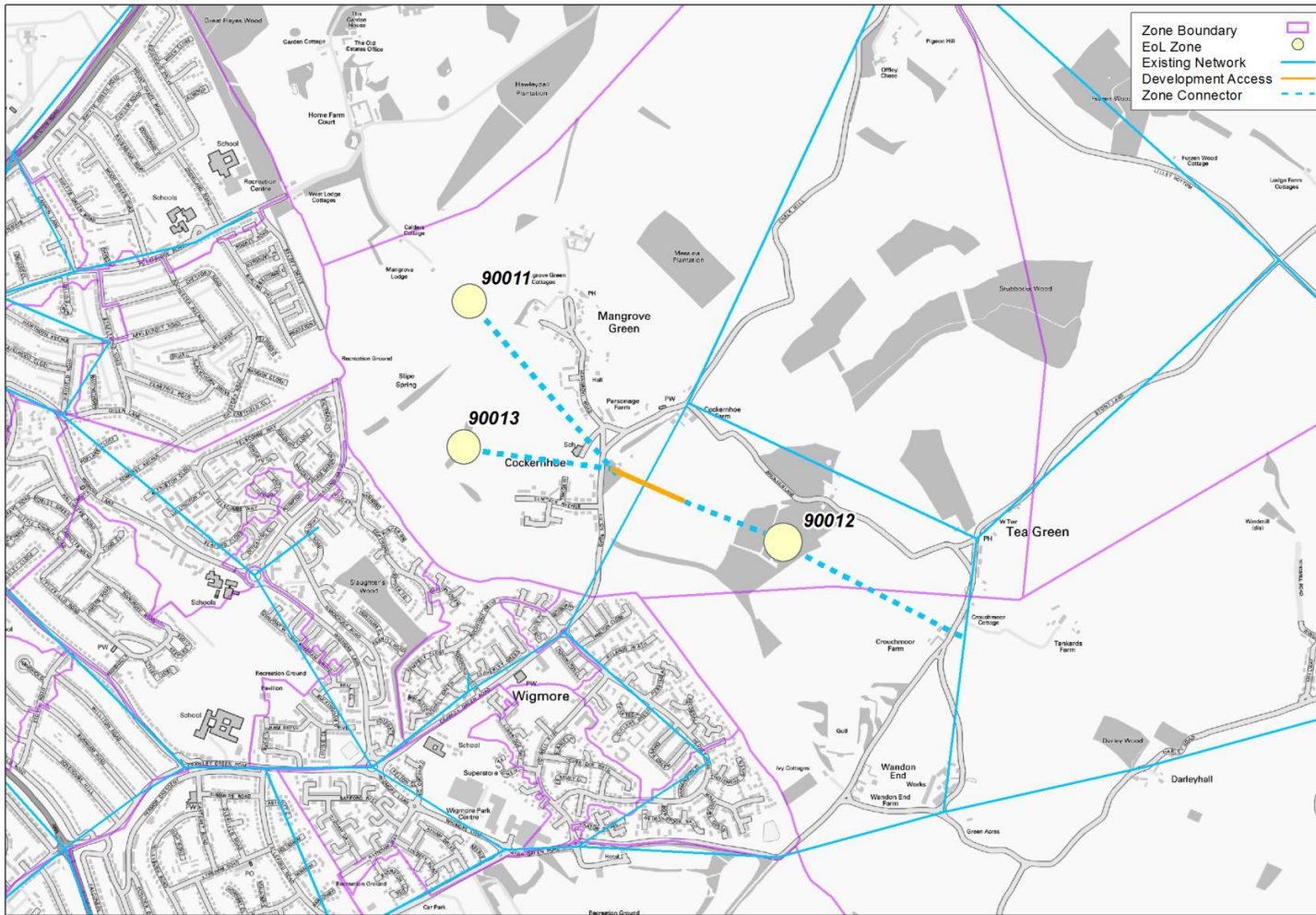


Figure 1 – East of Luton Development Access Connection

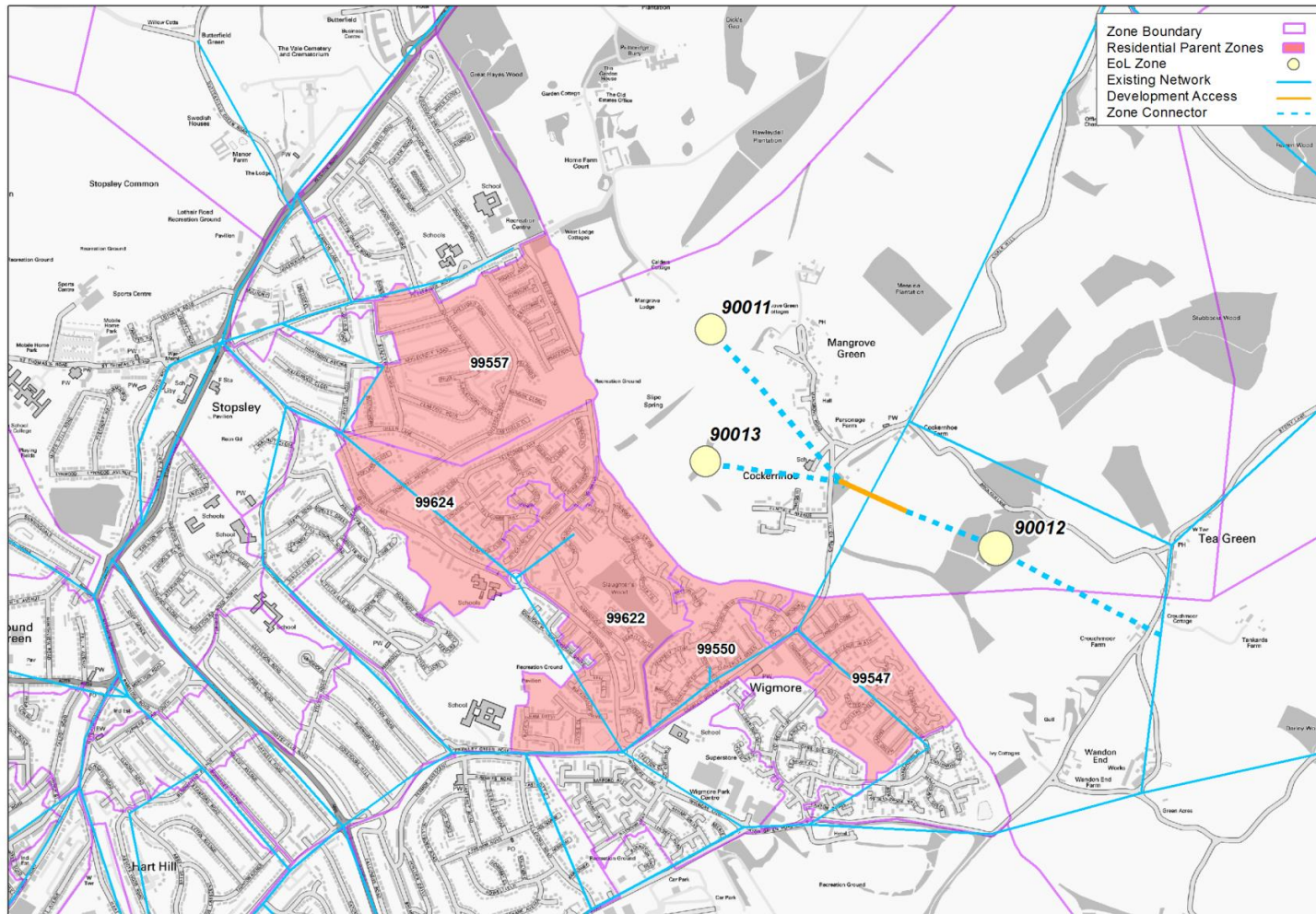


Figure 2 – East of Luton Development – Parent Zones for EoL Residential Trips

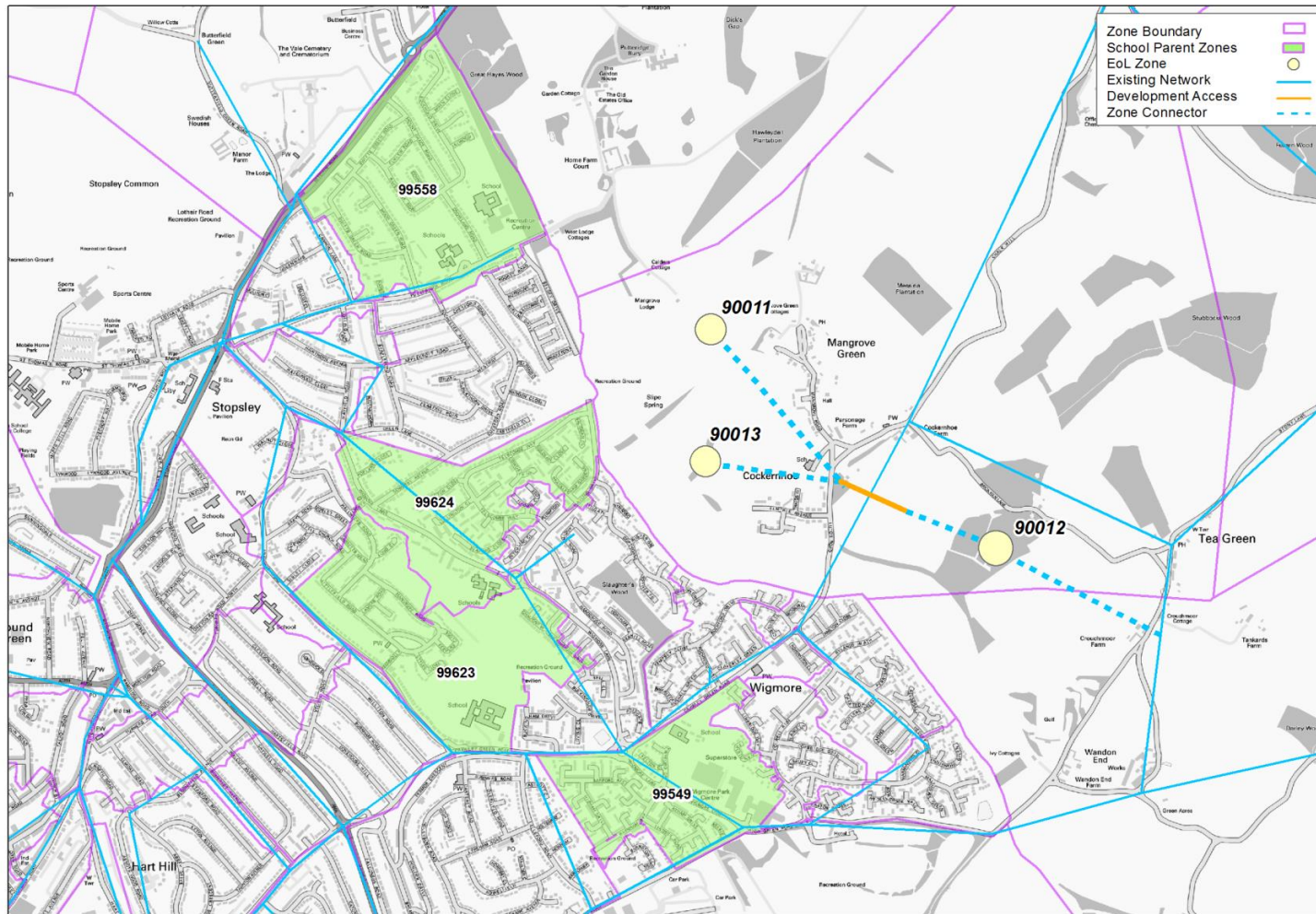
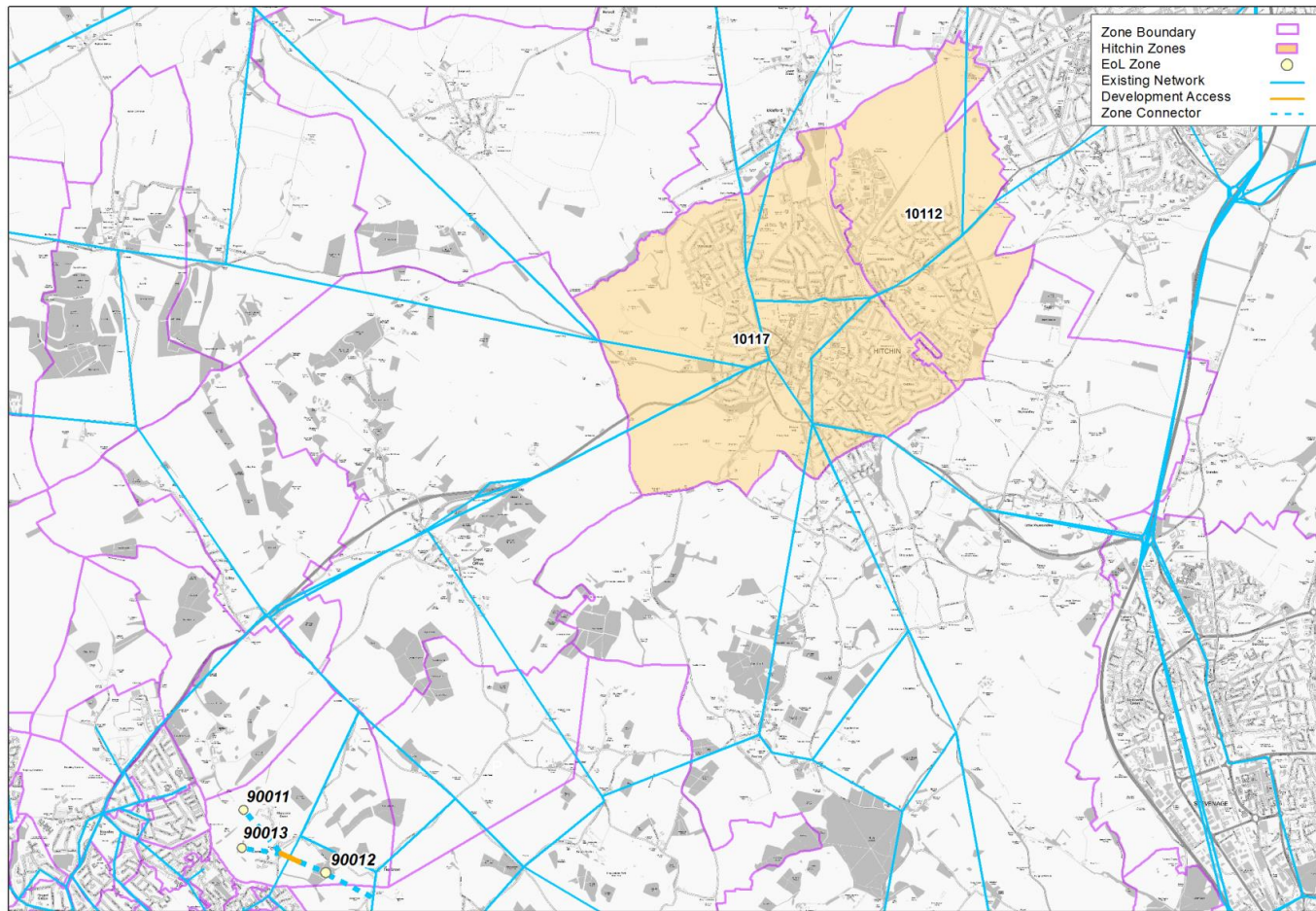


Figure 3 – East of Luton Development – Parent Zones for EoL School Staff Trips



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Figure 4 – East of Luton Development – External Pupil Trips from East of Luton Development to Hitchin

3 Modelling Results

3.1 This section of the technical note presents the modelling results for the 2031 Do Minimum (i.e. without EoL) and Do Something (i.e. with EoL) scenarios.

3.2 The following modelling results have been included:

- Network Statistics – a summary of key highway statistics, such as free flow vehicle time, vehicle delay time and average speed, for the network within Luton;
- Flow Difference Plots – present the flow difference between the 2031 Do Minimum and Do Something scenarios to show the increase in traffic resulting from the EoL Development;
- Select Link Analysis – to show the distribution of trips from and to the EoL Development;
- Link Stress Plots – to show the flow over capacity ratio of road sections for the 2031 Do Minimum and Do Something scenarios; and
- Junction Delay Difference – to show the junction delay difference between the 2031 Do Minimum and Do Something scenarios to show the impact of the EoL Development.

Network Statistics

3.3 Table 7 shows the changes in key network statistics between the 2031 Do Minimum and Do Something scenarios for links within Luton.

3.4 The network statistics show that the EoL Development has a slight negative impact on performance of the Luton highway network and that the vehicle delay time and vehicle queued increase by 3% to 5%, whilst the network speed reduces by 1% to 2%.

Table 7 – 2031 Do Something versus Do Minimum Network Statistics for Luton

Network Statistics		2031 DM (Without EoL)	2031 DS (With EoL)	% Difference
Morning Peak Hour	Vehicle Distance (veh-km)	160,958	162,327	+0.85
	Road Distance (km)	315	315	0.00
	Free Flow Vehicle Time (veh-hours)	3,671	3,706	+0.95
	Assigned Vehicle Time (veh-hours)	5,825	5,933	+1.86
	Vehicle Delay Time (veh-hours)	2,154	2,227	+3.41
	Vehicle Queued End of Hour (PCUs)	1,890	1,955	+3.46
	Speed (kph)	27.6	27.4	-0.99
Evening Peak Hour	Vehicle Distance (veh-km)	163,941	165,416	+0.90
	Road Distance (km)	315	315	0.00
	Free Flow Vehicle Time (veh-hours)	3,670	3,711	+1.12
	Assigned Vehicle Time (veh-hours)	5,798	5,926	+2.21
	Vehicle Delay Time (veh-hours)	2,127	2,214	+4.10
	Vehicle Queued End of Hour (PCUs)	1,836	1,916	+4.41
	Speed (kph)	28.3	27.9	-1.28

Flow Difference Plots

- 3.5 Figure 5 and Figure 6 show the flow difference between the 2031 Do Something and Do Minimum scenarios. The blue bandwidths denote a reduction in flow for the Do Something scenario when compared to the Do Minimum scenario whilst the green bandwidths denote an increase in flow for the Do Something scenario.
- 3.6 The flow difference plots show that the EoL Development increases traffic flows on Luton Road, Eaton Green Road and Stony Lane. As expected, the scale of the traffic flow increase is greatest on the road links adjacent to the EoL Development which gradually dispersed onto the wider road network in Luton and North Hertfordshire.
- 3.7 It should be noted that the model network used for this modelling task includes the proposed road link between the Airport Way and Eaton Green Road which forms part of the Century Park development. It is believed that if this road link were not to be included, the impact would likely to be greater for Eaton Green Road and the urban network of Luton.

Select Link Analysis

- 3.8 Figure 7 and Figure 8 show the select link analysis for trips to and from the EoL Development (i.e. 2031 Do Something scenario) for the morning and evening peak hours.
- 3.9 For the morning peak hour (i.e. Figure 7), the select link analysis indicates that majority of the trips from the EoL Development trips travel westward into Luton. Likewise for trips travelling to EoL development, they are generally from the Luton direction. Figure 7 also shows a small proportion of trips to / from EoL Development are from / to Hitchin / North Hertfordshire. These are education related trips. It was assumed that 10% of the pupils from the EoL Development go to school in Hitchin whilst the external to EoL Development pupil trips (for 1-FE) were assumed to be from nearby North Hertfordshire rural zones only.
- 3.10 For the evening peak hour (i.e. Figure 8), the select link analysis shows that majority of the trips from / to the EoL Development are from the Luton direction. As it was assumed that there are no pupil trips for the evening peak hour, the proportion of EoL Development trips to / from North Hertfordshire is very limited for this peak hour.

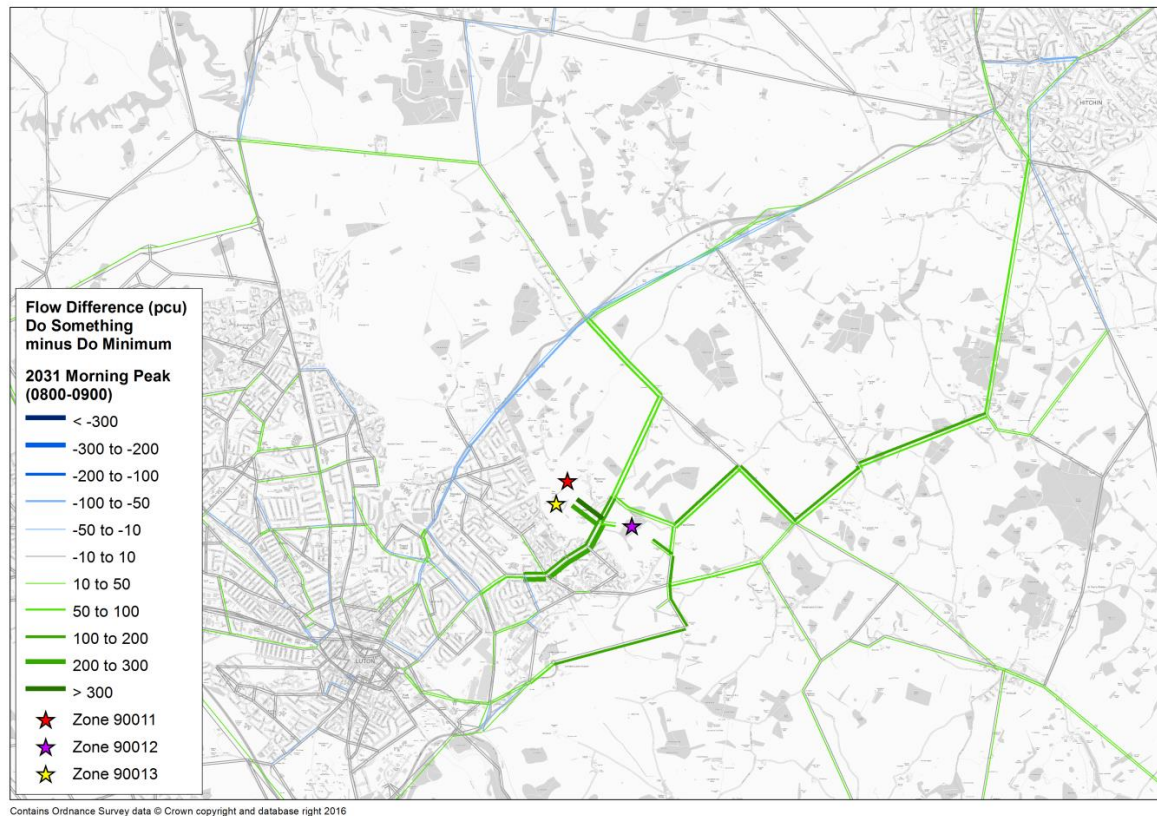


Figure 5 – Flow Difference (2031 Do Something minus Do Minimum) (Morning Peak Hour)

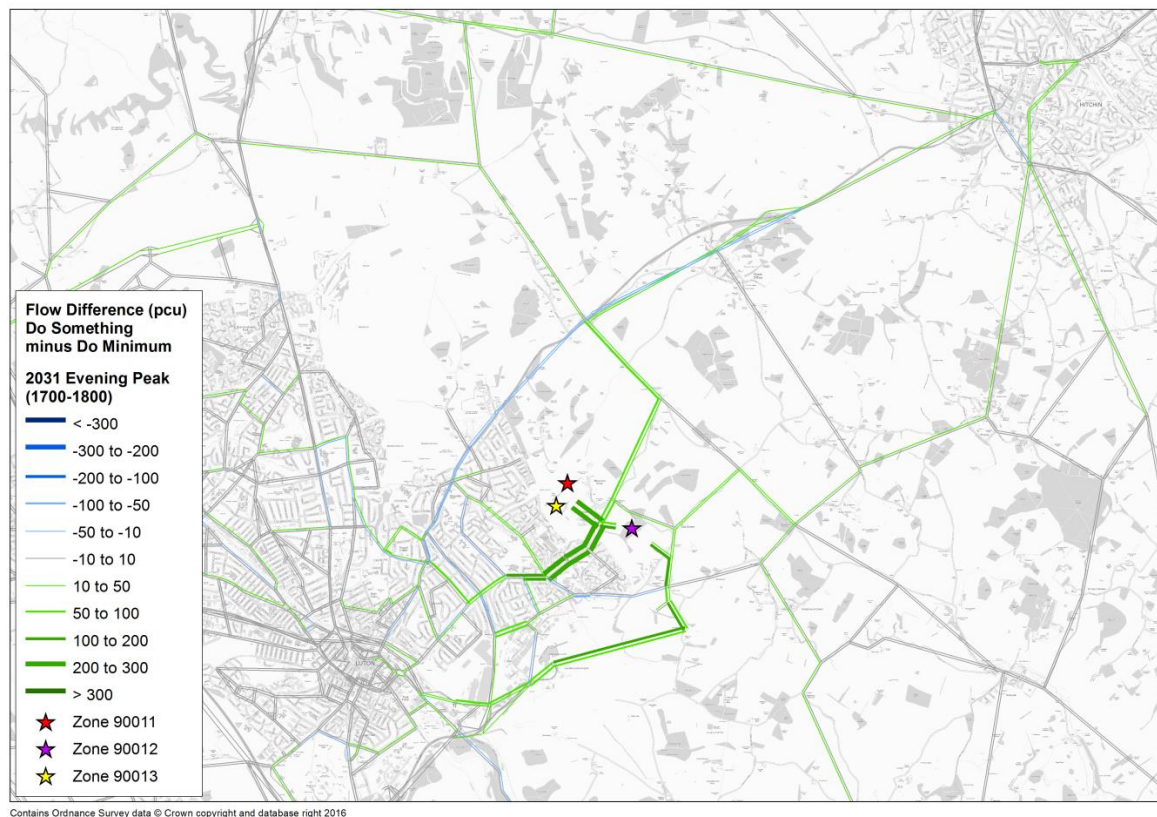


Figure 6 – Flow Difference (2031 Do Something minus Do Minimum) (Evening Peak Hour)

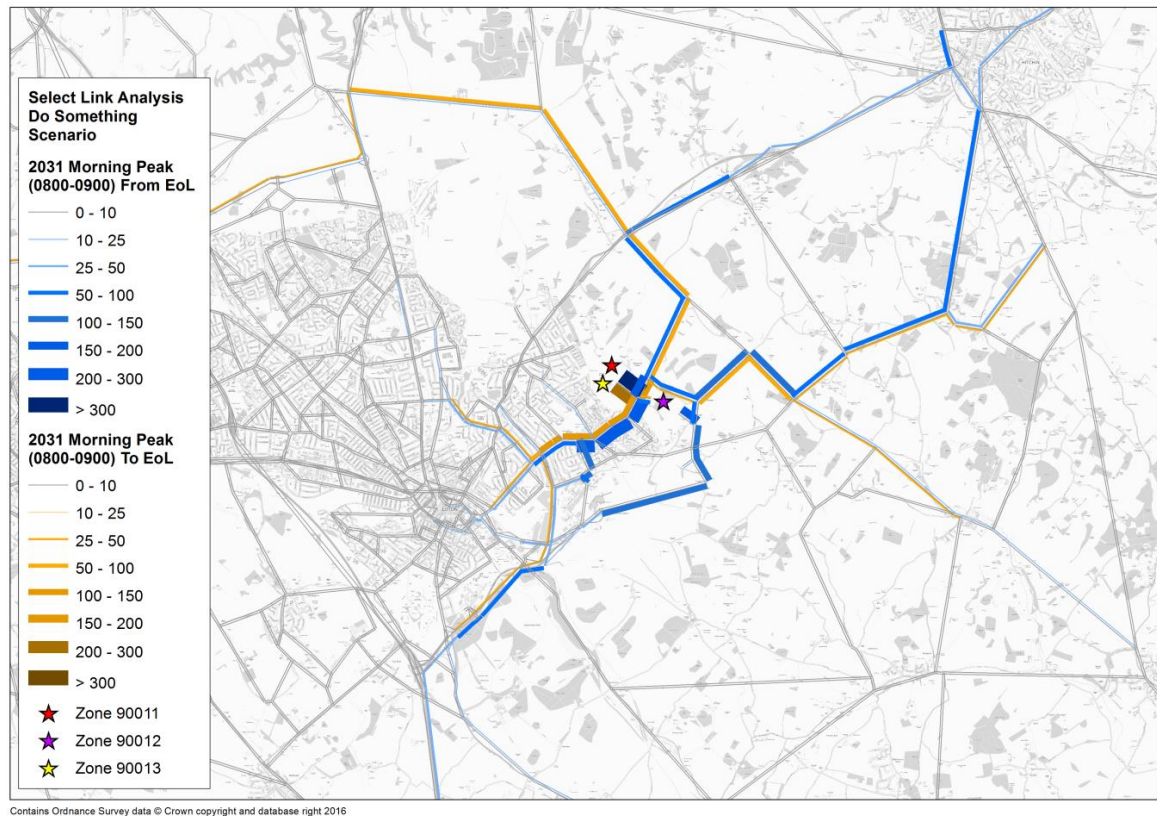


Figure 7 – Select Link Plot for all EoL Development Zones (2031 Do Something) (Morning Peak Hour)

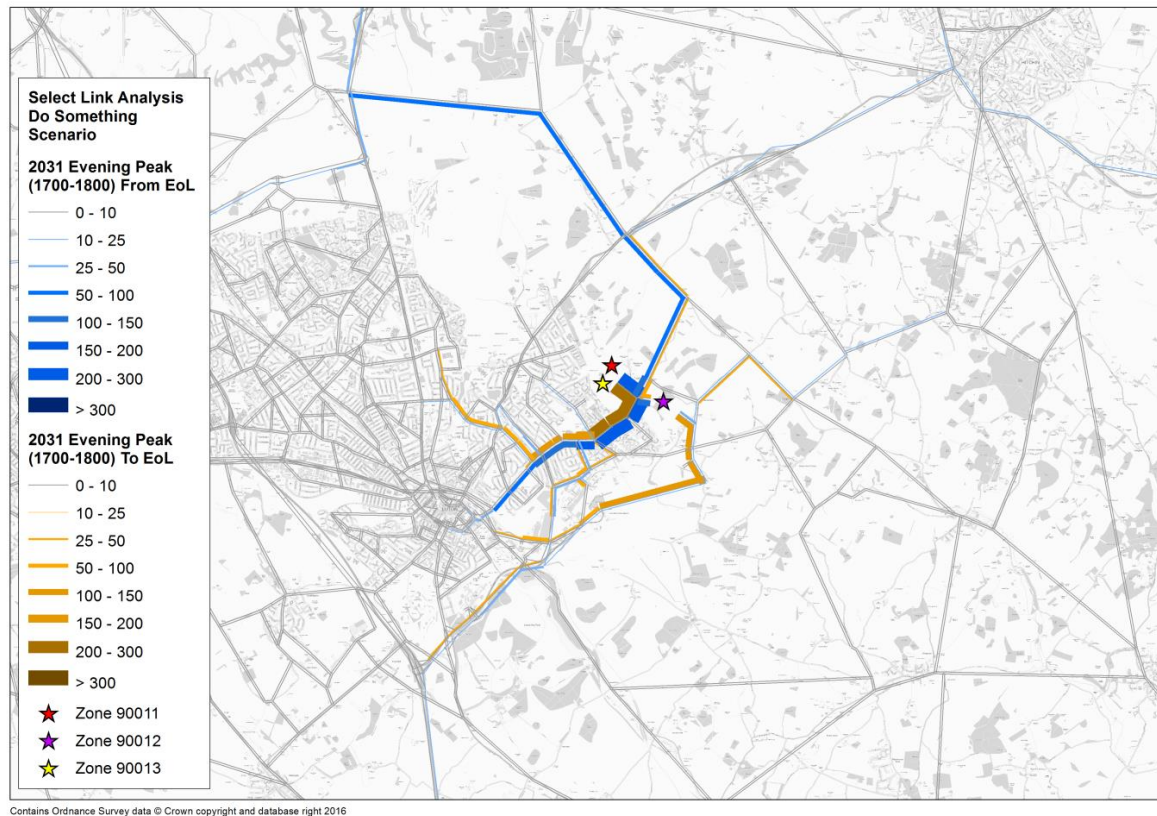


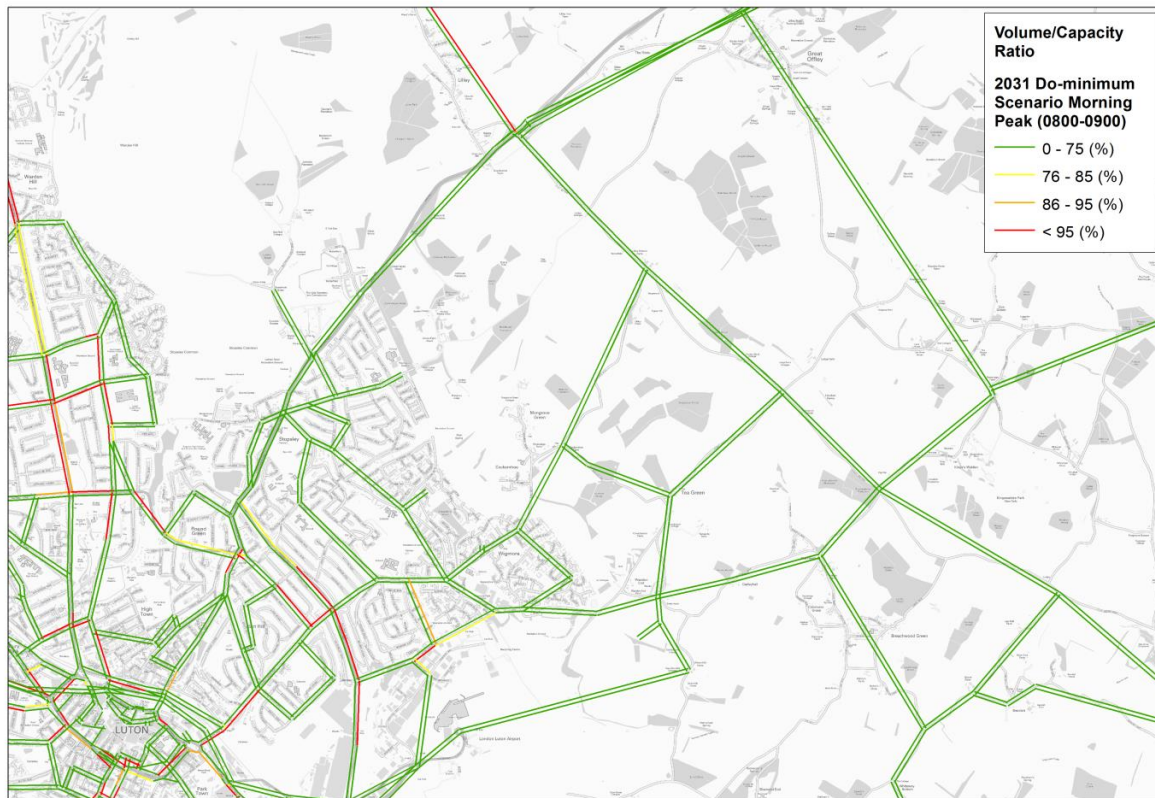
Figure 8 – Select Link Plot for all EoL Development Zones (2031 Do Something) (Evening Peak Hour)

Stress Plots

- 3.15 Figure 9 and Figure 10 show the flow over capacity ratio in percentages for the 2031 Do Minimum and Do Something scenario for the morning peak hour respectively, and Figure 11 and Figure 12 show the corresponding model output for the evening peak hour.
- 3.16 The stress plots show that there are a number of links experiencing over 85% of volume over capacity ratio in the eastern part of the Luton urban highway network (e.g. Vauxhall Way, Hitchin Road) for the 2031 Do Minimum scenario for both morning and evening peak hours. This indicates that these road links are expected to operate at / over capacity in 2031 even without the EoL Development.
- 3.16 For the 2031 Do Something scenario, the pattern of the link stress plots is generally similar to the 2031 Do Minimum scenario. This suggests that the links that are operating at or over capacity in 2031 Do Minimum scenario will continue to experience high volume over capacity ratio for the 2031 Do Something scenario, however, the additional EoL Development trips are not expected to cause additional congestion spots to materialise.

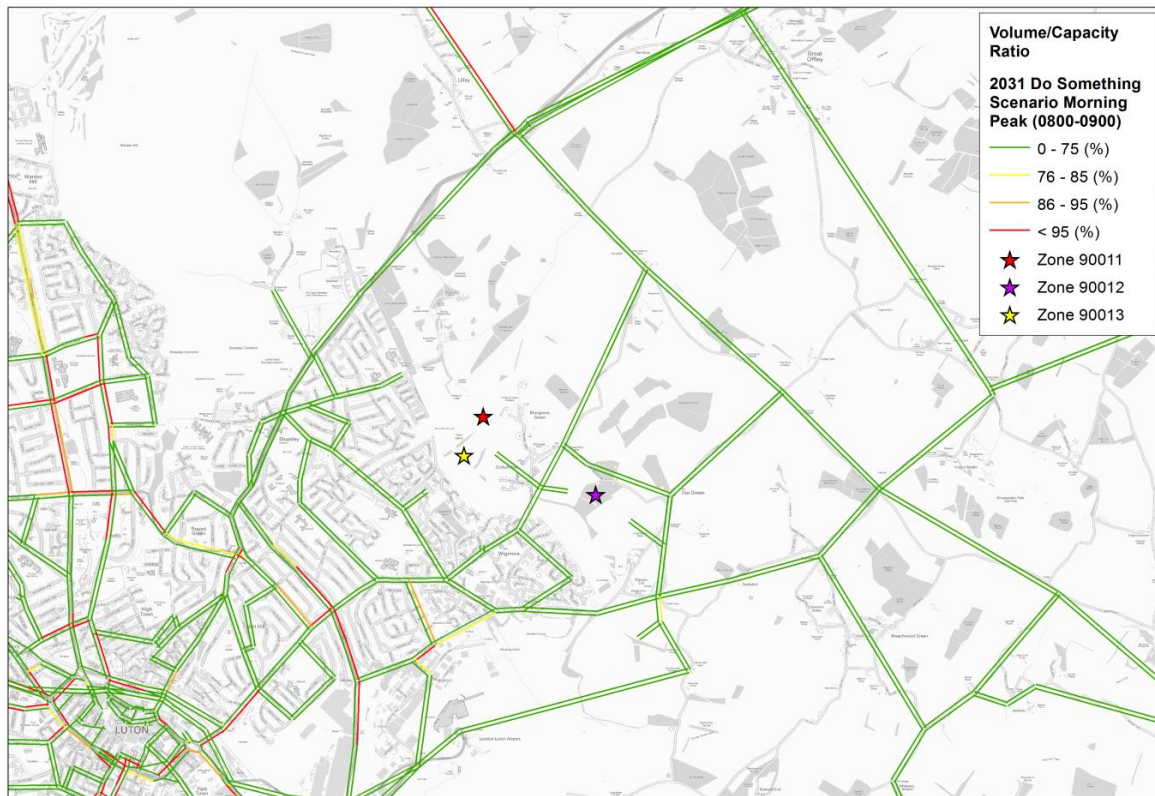
Junction Delay

- 3.19 Figure 13 and Figure 14 show the modelled junction delay differences between the 2031 Do Something and Do Minimum scenarios for the morning and evening peak hours.
- 3.20 The modelling suggests that the additional EoL Development trips will cause increased junction delay at junctions in the vicinity of the development such as on A505 Vauxhall Way and Hitchin Road.
- 3.20 The junction delay difference plots also show that delay for junctions on the Luton Town Centre Ring Road will increase as a result of the EoL Development trips. The flow difference plots (i.e. Figure 5 and Figure 6) show that the difference in link flows for the Luton Town Centre Ring Road links are marginal. These links are operating at / over capacity for the 2031 Do Minimum scenario (as shown in Figure 9 and Figure 11) and the modelling suggests that these junctions are likely to be more sensitive to flow increase.



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Figure 9 – Link Stress Plot (2031 Do Minimum) (Morning Peak Hour)



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Figure 10 – Link Stress Plot (2031 Do Something) (Morning Peak Hour)

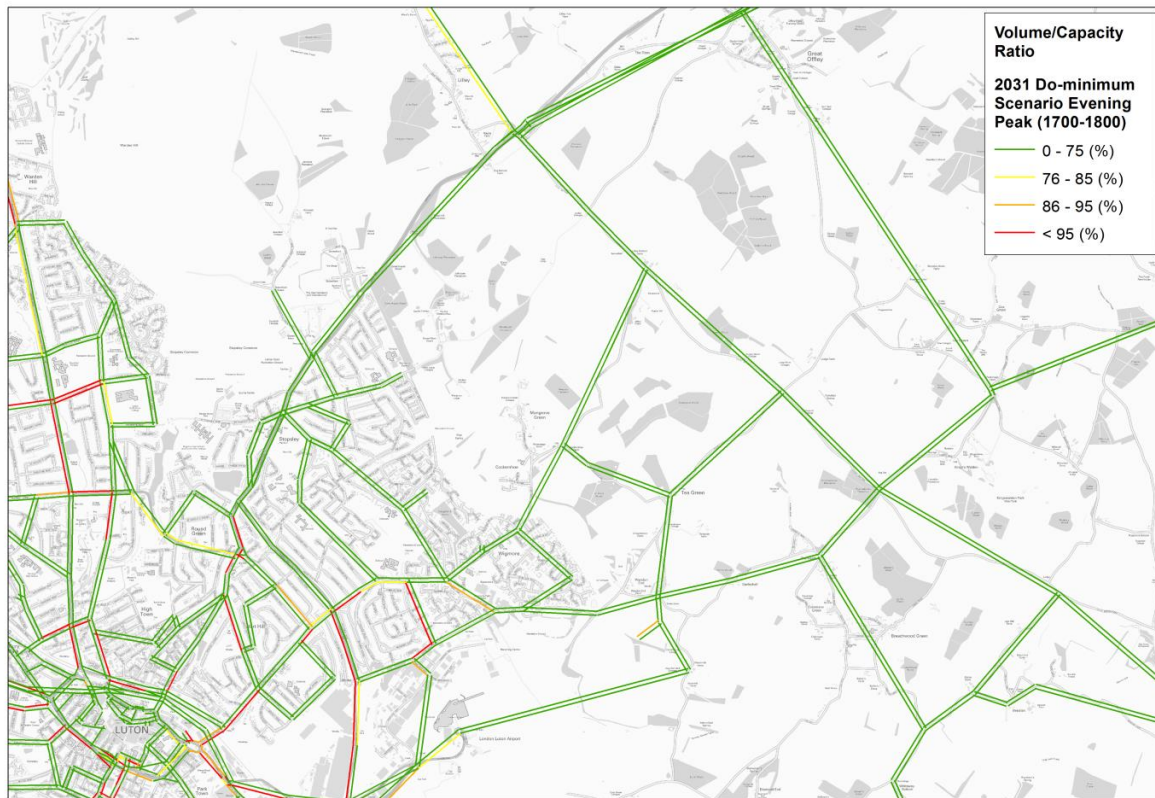


Figure 11 – Link Stress Plot (2031 Do Minimum) (Evening Peak Hour)

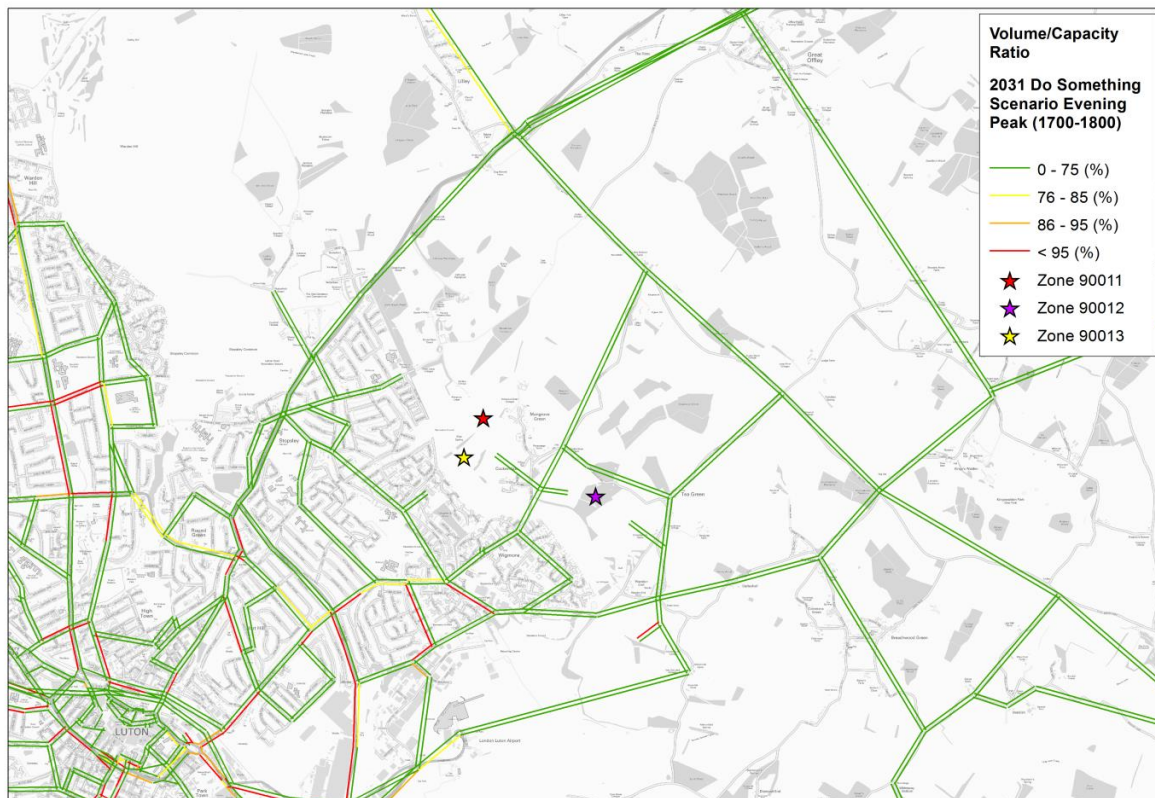


Figure 12 – Link Stress Plot (2031 Do Something) (Evening Peak Hour)



Figure 13 – Junction Delay Difference Plot (2031 Do Something minus Do Minimum) (Morning Peak Hour)



Figure 14 – Junction Delay Difference Plot (2031 Do Something minus Do Minimum) (Evening Peak Hour)

4 Conclusion

- 4.1 AECOM has been commissioned by North Hertfordshire District Council to assess the traffic impact of a potential 2,100 dwelling urban extension including a secondary school to the east of Luton (namely the East of Luton (EoL) Development), within North Hertfordshire.
- 4.2 AECOM's commission is in two parts, the first (i.e. Stage 1) of which is to calculate traffic flows associated with the potential urban extension, and the second (i.e. Stage 2) to provide an initial indication on the potential impact of the development traffic on surroundings roads.
- 4.3 This technical note sets out the modelling methodology, assumptions and results for Stage 2. For this modelling task, an existing 2031 forecast year Central Bedfordshire and Luton Transport Model (CBLTM) scenario (i.e. Luton Local Plan Option C Duty to Cooperate scenario) was used. To provide an initial indication on the impact of the EoL Development, two 2031 model scenarios were created (i.e. 2031 Do Minimum (without EoL Development) and 2031 Do Something (with EoL Development)).
- 4.4 The modelling shows that the additional EoL Development trips will increase the traffic flows on the road links adjacent to the development such as Luton Road, Eaton Green Road and Stony Lane. Based on the distribution assumptions used for the modelling, majority of the EoL Development trips will travel to / from the Luton direction, and the additional trips are likely to increase delay on the urban highway links in the eastern part of Luton, such as A505 Vauxhall Way and Hitchin Road.
- 4.5 This initial modelling assessment is intended to provide a high level initial analysis of the potential impact for the EoL Development. The following modelling limitations and assumptions should be noted when considering the modelling results presented in this technical note:
 - It should be noted that the model network used in this modelling task includes the proposed road link between the Airport Way and Eaton Green Road. It is believed that if this road link is not included, the impact is likely to be greater for Eaton Green Road and parts of the urban network of Luton in the eastern area of the town, including potentially the A505 Vauxhall Way/Eaton Green Road and Crawley Green Road roundabouts.
 - The CBLTM includes a demand model, a highway model and a public transport model. However for this initial modelling assessment, only the highway assignment model has been used and the impact of the EoL Development on changes in demand and modes of travel have not been considered.
 - It should be noted that the highway infrastructure designs and planning assumptions adopted for the 2031 Luton Local Plan Option C model, which was used as the basis for this initial modelling assessment, are considered not to be the most up to date (an updated model is currently under development).
 - It should also be noted that the EoL Development is located at the edge of the simulation network of CBLTM. The representation of the highway network is coarser towards the edge of the simulation network, and as such there is a higher degree of uncertainty on the assignment and scale of impacts (such as delay) of the additional EoL Development traffic.
 - The trip distribution pattern used for the EoL Development for this modelling task was derived from adjacent parent zones in Luton. This may or may not be appropriate for the EoL Development and if alternative distribution assumption is expected for the EoL Development, further sensitivity tests will be required.

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