Luton Development Plan - Junction Mitigation Assessment

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Table of Contents

Appendices

Tables

Figures

1. Introduction

Capabilities on project:
Transportation

1 Introduction

1.1 Introduction

1.1.1 AECOM has previously undertaken transport model testing of the proposed Luton Local Plan (November 2013) on behalf of Luton Borough Council (LBC) using the Central Bedfordshire and Luton Transport Model (CBLTM). The modelling exercise identified a number of junctions experiencing high delay and saturation levels in the forecast year 2031. Following on from this modelling exercise LBC requested that AECOM consider the development of potential improvement measures to mitigate against modelled future congestion.

1.1.2 This report should be read in conjunction with:

- Luton Local Plan: Initial Transport Evidence Base (November 2013); and
- Luton Local Plan Junction Assessment Testing Specification (December 2014).

1.1.3 LBC and AECOM agreed to proceed with outline design and traffic model testing of twelve junctions in Luton in January 2015.

1.1.4 This report presents the results of traffic model testing undertaken following iteration of junction outline design proposals and traffic modelling. This analysis is to identify future transport impacts at a strategic level, across the Luton Town Centre local network, following the introduction of junction mitigation measures in the modelled network.

1.1.5 The proposed outline design measures are intended to mitigate against delays and congestion as identified in model runs associated with the Luton Development Plan proposal. A comparison of delays and congestion with the previous model runs allow the efficiency and performance of the introduced measures to be determined at a network level.

1.2 Report Structure

1.2.1 This Report is structured as follows:

1. Introduction;
2. Background;
3. Assumptions and methodology;
4. Highway design methodology
5. Test 1 – Proposed design assessment and wider network impacts;
6. Test 2 – Proposed design assessment and wider network impacts;
7. Scheme cost estimate
8. Summary and recommendations.

2. Background

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Transportation

2 Background

2.1 Junction Mitigation Scheme Scope

2.1.1 LBC previously commissioned AECOM to undertake transport model testing of the proposed Luton Local Plan for a combination of scenarios and forecast years. The modelling exercise identified twenty-seven junctions experiencing delay of over 60 seconds or a volume over capacity ratio (V/C) greater than 85% in the morning or evening peak in 2031 resulting from increased growth levels.

2.1.2 Following on from the modelling exercise AECOM has presented to LBC a high level engineering assessment providing advice on potential improvement measures and associated costs for these twenty-seven junctions. These were prioritised and aggregated into four different packages. A number of options were presented for each junction.

2.2 Junction Mitigation Scheme Location

2.2.1 Luton Borough Council has agreed to proceed with the assessment of twelve junctions undertaking junction outline design and model testing. A summary of the proposed improvements can be found in **Table 1** and the location of the junctions is shown in **Figure 1** below.

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Table 1: Implemented Junction Improvement Measures

Site ID	Location	Junction Improvement
2	A6 crossroads with Austin Road/ Kingsdown Avenue	Additional lanes on both approaches of A6.
4	Chapel Viaduct roundabout	Replacing roundabout with signalised junction: 1. Crossroad; 2. Hamburger arrangement fully signalised; 3. Hamburger arrangement 2 arms signalised.
5	Castle Street and Hibbert Street junction	Banning right turning movement from Castle Street into Windsor Street. Increasing flare length on Castle Street (S).
9	Old Bedford Road and Barnfield Avenue	Short additional approach lane on Barnfield Avenue.
11	Eaton Green Road and Lalleford Road	Additional lanes on Eaton Green Road approaches.
14	Old Bedford Road and Stockingstone Road	Lengthening of two lane section on Old Bedford Road (S).
20	A5065 Hatters Way junction with Chaul End Lane	The cycle route alongside the busway, together with its connecting link to the subway under Hatters Way reduces the need for cyclists to negotiate the roundabout. The cycle facilities at the roundabout can be removed in parallel with localised widening on roundabout approaches.
22	Vauxhall Way/Crawley Green Road	Additional flare on Vauxhall Way.
25	Crossroad between Waller Avenue, Blundell Road, Marsh Road and Leagrave Road	Kerb realignment to provide wider left turn lane over longer distance on Leagrave Road, additional flare for left turn at Waller Avenue.
26	Hitchin Road junction with Ramridge Road	Signalise Hitchin Road and Stockingstone Road junctions and convert Ramridge Road/Stockingstone Road junction to priority.
201	Vauxhall Way/Stopsley Way/Hitchin Road Junction	Additional flare on all approaches. Dedicated left turn on Stopsley Way approach.
202	Vauxhall Way/Eaton Green Road Junction	Lengthen flares on Vauxhall Way and Eaton Green Road.

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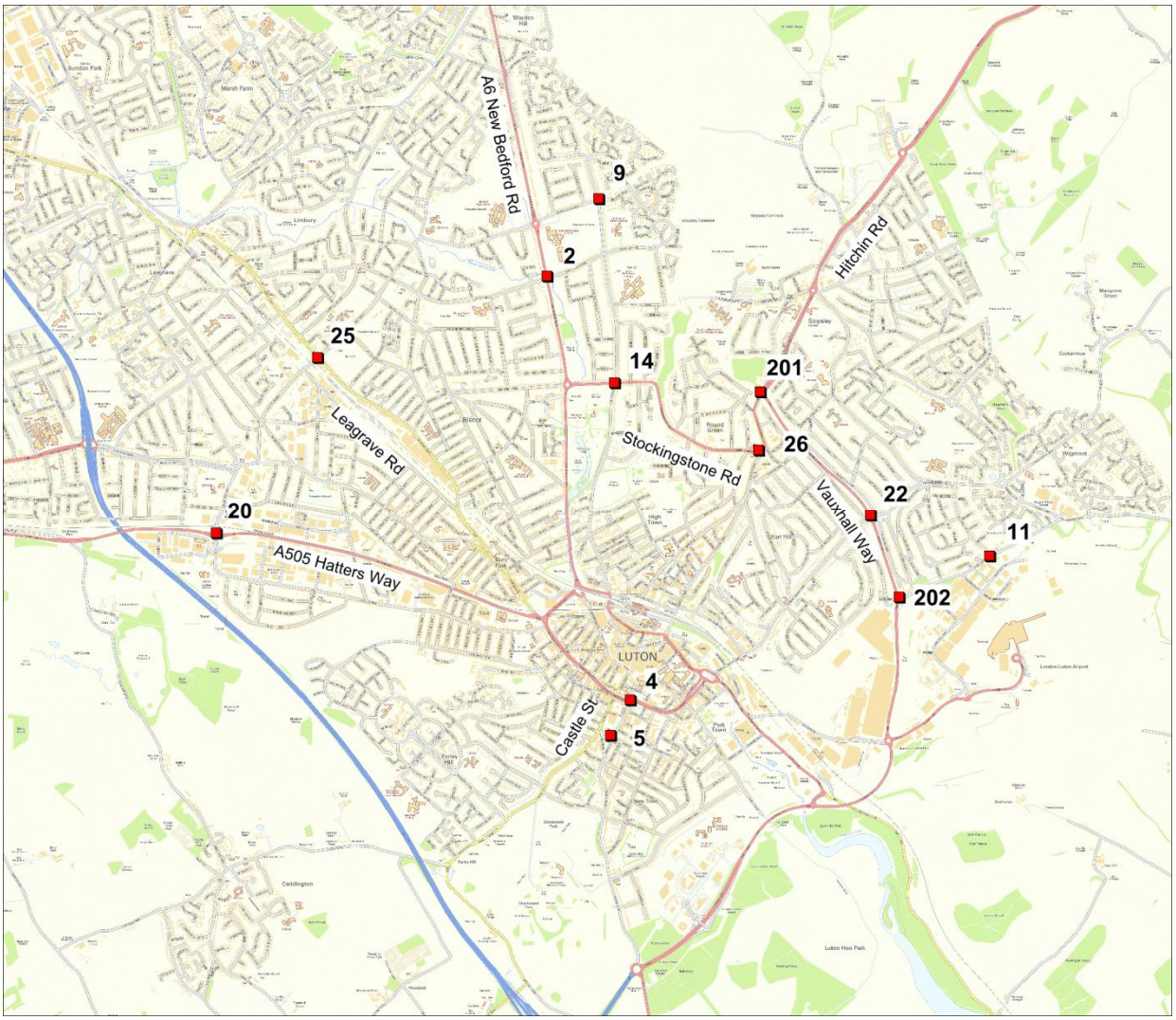
Figure 1: Junction Mitigation Scheme (Contains Ordnance Survey data © Crown Copyright and database right 2015)



3. Assumptions and methodology

3 Assumptions and methodology

3.1 Scheme Assessment Methodology

3.1.1 In order to maintain a consistent approach following on from the Luton Development Plan testing, the same measures were adopted to identify the congested junctions.

3.1.2 The proposed junction options were tested against:

- Total junction delay (considering a threshold of greater than 60 seconds); and
- Total junction saturation (considering a threshold of V/C of greater than 85%).

3.1.3 Since this task's main objective is to assess the network level impact of identified junction mitigation schemes on the network, impact at a strategic level was benchmarked looking at increase/decrease in traffic flows, delays and re-routeing based on network plots and statistics. The following information is presented in the next section to assess the network performance:

- Flows Difference Plots (Option Test – Reference Case);
- Total Delays at junction(Option Test – Reference Case); and
- Network Statistics (Option Test – Reference Case).

3.1.4 Each scheme option (Test) was compared to the original run identified in this report as Reference Case. There have been iterations of highway design and modelling to assess the performance of the junction mitigation schemes individually at junctions and at a network level.

3.1.5 Two iterations of highway design and model testing are reported here to illustrate how congestion may be modelled to transfer around the network to adjacent junctions and corridors in the forecast year 2031.

3.2 Modelling Assumptions

Modelling Package

3.2.1 Saturn version 10.9.24 was used to assess the impact of the suggested junction mitigation schemes. Saturn is not a specific junction assessment package, it is primarily used to assess traffic network performance at a strategic level. Saturn enables a good appreciation of the levels of saturation and delay at junctions while allowing for traffic to be assigned onto the network following the most convenient route through the wider network.

3.2.2 Data on delays and congestion are provided for each model run to reflect the new capacity introduced by changes in the highway design. The outputs produced show impacts on the network in terms of traffic re-routeing and congestion moving along the links. Delays and saturation tables provide an indication of the overall junction operation performance.

Constraints

3.2.3 This software was used following the guidance provided in the manual and according to best practice; nevertheless some limitations are given by the nature of the software when it comes to detailed junction representation.

3.2.4 Specifically the following discrepancies between highway design and modelling were found:

- Signals optimisation and offset - is available through Saturn however it does not provide results of sufficient detail to inform design. Specific signalised junction modelling is recommended for the purpose of detailed assessment;
- Roundabout/signalised junction turning lane assignment - where a specific lane is allocated for a turn such as in a signalised junction it has been found that junction capacity might be underestimated when compared to a roundabout type junction.

Model Runs

3.2.5 To allow for a direct comparison with the model run in which constraints were identified the most suitable CBLTM run for this task was:

- Luton Local Plan 2031 Option B (November 2013).

3.2.6 It should be noted that Luton Local Development Plan assumptions have been updated since November 2013. This run is therefore the most suitable for a direct comparison between proposed mitigation layouts and the Reference Case; however this run does not take into account updates in planning assumptions post November 2013.

3.2.7 This model run was developed to test the impacts on the highway network of a number of proposed developments. The network and demand assumptions for this model run are summarised in **Table 2**, **Table 3** and **Table 4**.

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Table 2: Network Infrastructure Assumptions

Committed/Existing and Proposed		Scheme	2031
			Option B
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 including M1 Junction 11a	✓
		Woodside Link (WSL)	✓
		Poynters Road scheme (20mph speed limit and HGV ban)	✓
		Connection to WSL from Parkside Drive	✓
		Access to early release Kestrel Way	✓
		Access road to distribution centre	✓
		East Leighton distributor road	✓
		Leighton Buzzard town centre schemes	✓
	Luton proposed	Dunstable Road pinch points	✓
		Airport Link to Century Park	✓
		Dualling of airport access road	✓
		Improve junctions on approaches to airport	✓
		Luton Airport Parkway Bus-Loop	✓

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Table 3: Additional Dwellings 2011-2031

Area	Site	2031
		Option B
Luton	Luton SHLAA reasonable certainty	4,110
	Luton SHLAA no certainty	1,643
Central Beds	Early release sites at Kestrel Way and East Bidwell	1,000
	Remaining Business Case HRDC development	4,150
	Totals	**10,903**

Table 4: Additional Jobs 2011-2031

Area	Site	2031
		Option B
LBC	Butterfield Green	4,013
	Junction 10a	1,728
	Century Park	2,599
	Power Court	2,074
	Napier Park	3,016
	Station Quarter	623
	Luton Airport	5,050
CBC	North Houghton Regis	2,648
	Totals	**21,750**

3.2.8 Specific network assumptions for each junction design are reported in **Table 5** below. Test 1 refers to the first iteration while Test 2 refers to the second iteration of junction mitigation tests.

Table 5: Junction improvement coding assumptions

Site ID	Proposed junction improvement	Modelling assumptions Test1	Modelling assumptions Test2
2	Additional lanes on both approaches of A6.	New nodes added to represent flared approaches north and south of A6.	As per Test 1.
4	Replacing roundabout with signalised junction: 1. Crossroad 2. Hamburger arrangement fully signalised 3. Hamburger arrangement two arms signalised	In the absence of proposed/modelled signal timing for the hamburger design proposal, a crossroad has been coded. Signal timings for cross road option assumptions have been made based on experience and Saturn signal optimisation was performed. As part of this junction mitigation Flowers Way junction with Castle Street has been changed from signalised to priority.	Hamburger arrangement was coded using the fully signalised junction option. High level LinSig modelling was undertaken based on Reference Case demand flows to derive an option for signal timings. Flowers Way junction with Castle Street as per Test 1.
5	Banning right turn movement from Castle Street into Windsor Street. Increasing flare length on Castle Street (S).	No capacity was given to the banned turn and flare was increased on Castle Street.	As per Test 1.
9	Additional approach lane on Barnfield Avenue.	Flare was introduced on Barnfield Avenue.	As per Test 1.
11	Additional approach lanes on Eaton Green Road approaches.	Flare was introduced to the roundabout approach.	As per Test 1.
14	Lengthening of two lane section on Old Bedford Road (S).	Additional flare introduced on Old Bedford Road.	Change in signal timing to allow for increased flow to pass through the junction.
20	Removal of cycle facilities at roundabout and localised widening on roundabout approaches.	Increased roundabout capacity provided additional flares on all approaches.	As per Test 1.
22	Additional flare on Vauxhall Way.	Additional flare introduced on both approaches of Vauxhall Way.	As per Test 1.
25	Kerb realignment to provide wider left turn lane over longer distance on Leagrave Road, additional flare for left turn at Waller Avenue.	Flare on Leagrave Road extended and additional flare for left turn at Waller Avenue introduced.	As per Reference Case.
26	Signalise Hitchin Road and Stockingstone Road junctions and convert Ramridge Road / Stockingstone Road junction to priority.	Signalised crossroad junction and priority junction coded. Signal timing based on experience introduced and Saturn signal optimisation was performed.	As per Reference Case.
201	Additional flare on all approaches. Dedicated left turn lane on Stopsley Way approach.	Flare increased on all approaches.	As per Test 1.
202	Lengthen flares on Vauxhall Way and Eaton Green Road.	Flare introduced on Vauxhall Way and Eaton Green Road.	As per Test 1.

3.3 Scheme Assessment Reporting

3.3.1 The proposed junction improvements are considered as part of a single package of mitigation measures and therefore have been represented in the network as a single Do Something 'Test' scenario.

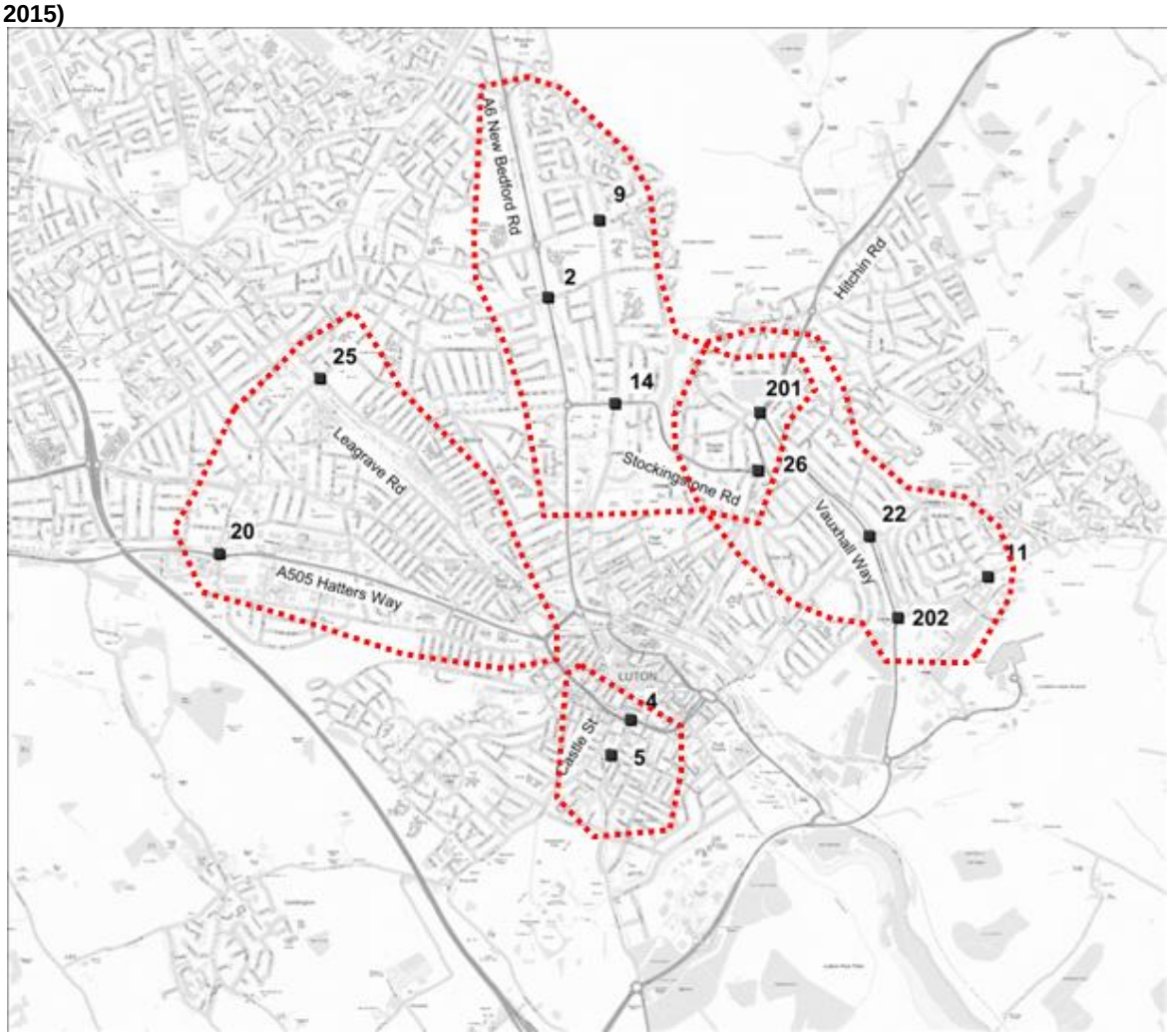
3.3.2 The impact of the proposed mitigation scheme at a network level can be seen in the network statistics provided at the beginning of Test 1 and Test 2 results section.

3.3.3 Highlighted below (**Figure 2**) are the areas of influence of groups of junctions that have been observed to perform as part of an inter-related sub-system. The areas of influence highlighted below are recognisable in the network.

3.3.4 As **Figure 2** shows, some of the schemes are likely to influence the operational performance of proposed schemes at upstream junctions. The A5065 and Leagrave Road form strategic arterial routes in and out of north and west Luton, other links such as New Bedford Road, Old Bedford Road and Stockingstone Road/Vauxhall Way opperate as complementary parallel routes from north Luton to the north and east of Luton.

3.3.5 Network plots and model output statics are collated within the Appendix, only the morning peak plots are considered in detail subsequently.

Figure 2: Area of mitigation measure influence (Contains Ordnance Survey data © Crown Copyright and database right 2015)



4. Highway Design Methodology

4 Highway Design Methodology

4.1 Design Criteria

4.1.1 Outline design proposals were generated in accordance with all relevant design standards and best practice guidance to ensure they complied with legislation, were buildable and safe whilst contributing to the capacity concerns outlined in initial model testing of the proposed Luton Local Plan.

4.1.2 Specific guidance documents and regulations adhered to during the design process include (but are not limited to):

- Traffic Signs Regulations and General Directions (TSRGD) (DfT, 2002);
- Traffic Signs Manual (DfT, various);
- Construction (Design and Management) Regulations (HSE, 2015);
- Design Manual for Roads and Bridges (DMRB) (DfT, various).
- Manual for Streets

4.2 Site Visits

4.2.1 Desktop review of OS Mapping (received 12 January 2015) and LBC feedback (24 & 25 November 2014) was performed in order to begin developing concept designs.

4.2.2 Site visits were undertaken following desktop review by AECOM over two days (15th and 19th January 2015) to better understand network conditions, driver behaviours, physical constraints and potential opportunities for design work. Measurements and photographs were taken along with notes to aid in the design process.

4.3 Initial Outline Design Proposals

4.3.1 Following the desktop review and site visit observations, outline designs were produced for each of the 12 sites listed in **Table 1**. Designs were kept illustrative and as such focussed on key features such as kerb line amendments and road markings to provide a simplistic overview of proposed junction operation and allow for model coding to take place. Additional detail such as signal equipment location, utility diversions and construction details were not provided at this early concept design stage.

4.3.2 A meeting between AECOM and LBC representatives took place on 29 January 2015 to discuss initial design proposals. A number of proposals or elements of proposals were either discounted or altered, with feedback incorporated into revised designs.

4.3.3 Expanding on **Table 1** further detail of the key proposals, suggested as part of initial outline design conception, at each of the 12 junctions can be found in **Appendix 1**.

4.4 Second Iteration of Outline Design Proposals

4.4.1 Following the Test 1 model run, a number of sites were identified as over capacity to predetermined criteria; these included both sites that formed part of the initial 12, and four new sites. Each was assessed in turn to determine whether further amendments should be made for the second model iteration.

4.4.2 Key findings from the first model iteration are highlighted and used in determining proposals for the second design iteration where necessary, these can be found in **Table 10** and **Table 11** within the model testing results, Section 5 and 6 of this report.

4.4.3 The impacts of these outline designs on pedestrian, cycle and bus movements at or on the approaches to these junctions will be considered as the designs for these junctions is progressed. Notwithstanding this, the provision of uncontrolled crossings at roundabouts is generally limited to crossing no more than two live traffic lanes.

5. Test 1 – Proposed design assessment and wider network impacts

5 Test 1 – Proposed design assessment and wider network impacts

5.1 Introduction

5.1.1 Test 1 scheme assumptions are the result of LBC liaison with the AECOM Local Roads team to put forward the best design to mitigate the congestion at the selected junctions. Modelling assumption for these schemes were summarised in **Table 5** while a complete list of all the options considered can be found in **Appendix 1**.

5.1.2 Below are presented the outcomes of the first iteration of design and modelling along with the summary and the conclusions that have informed the second iteration of this process.

5.2 Network impacts

5.2.1 The proposed junction mitigation schemes consist of appropriate interventions in the local network, these may subsequently impact on the traffic behaviour at a wider network level. The first check on the scheme performance is given by the network statistics. **Table 6** below summarises the general model statistics in the Luton modelled area with figures from the Reference Case compared with Test 1.

5.2.2 As can be seen in the table below queues and delays are modelled to increase at a network wide level, while the distance travelled by vehicles decreases following the introduction of the proposed schemes. The network wide statistics suggest that when considered as a single package the Test 1 junction mitigation schemes may introduce additional delay and congestion in the Luton Area.

Table 6: Network Statistics Test 1

Luton			
AM Peak	**Ref_Case**	**Test 1**	**Differences**
Vehicle Distance (veh-km)	233,217	232,010	-1,207
Road Distance (km)	344	342	-2
Free Flow Vehicle Time (veh-hours)	4,453	4,427	-26
Assigned Vehicle Time (veh-hours)	6,717	6,745	28
Vehicle Delay Time (veh-hours)	2,264	2,318	54
Vehicle Queued End of Hour (PCUs)	1,840	1,871	31
Speed (kph)	35	34	-1

5.2.3 To identify the location of the increased delays and congestion more detailed analysis of model assignment has been undertaken. As can be seen from the flow difference plot (**Figure 3**) the junction mitigation scheme leads to re-routeing around the network. Decreases in traffic flow are represented by blue scaled bars; green bars represent increases in flow.

A5065 / Leagrave Road

5.2.4 The A5065 and Leagrave Road are adjacent corridors providing a route to/from Luton towards the north and west of the town. The suggested measures at sites 20 and 25 - increased capacity at the A5065/Chaul End Lane roundabout and increased stacking capacity at Leagrave Road/ Waller Avenue, are likely to make the route through the A5065 more attractive in the model, while a reduction in flows can be observed along Leagrave Road. This dynamic is also illustrated in Figure 6 at the end of this section.

Castle Street

5.2.5 The schemes proposed and tested along Castle Street are modelled to bring about a reduction of traffic flows along Castle Street and along Chapel and Park Viaducts. Traffic directed towards Luton Town Centre are modelled to route via alternative parallel links such as Cutenhoe Road and Park Street, see Figure 7. Network detail in the vicinity of Castle Street is limited and potential alternative north/south routes to Castle Street may not be modelled in sufficient detail to reflect trips using alternative routes. Constraining alternative parallel routes by modelling traffic calming measures may be required to fully test the impacts of proposed junction mitigation measures in Castle Street.

Stockingstone Road/Vauxhall Way

5.2.6 The schemes proposed along these links (sites 22, 201, 202) are modelled to increase capacity along the Vauxhall Way corridor, as a result modelled traffic volumes north and east bound increase along the Vauxhall Way corridor and are likely to use the junction at Stockingstone Road/Hitchin Road (site 26), however if this junction experiences delays and queued traffic, vehicles may re-route through secondary roads such as the area between Felstead Way and St Martin's Avenue. This dynamic is also illustrated in **Figure 8**, see page 26.

New Bedford Road/ Old Bedford Road and Stockingstone Road

5.2.7 The schemes proposed along these corridors (Sites 2, 9 and 14 in **Figure 8**) are modelled to bring about some re-routeing for traffic heading east and coming from the north along the A6. Modelled junction improvements along Old Bedford Road make this route more attractive for traffic turning into Stockingstone Road and traffic is likely to join Old Bedford Road through Barnfield Avenue and proceed southbound.

Wider Network Considerations

5.2.8 The changes in flows along the links where junction mitigation options have been tested are modelled to affect delays at junctions. **Figure 4** shows the difference in delay at junctions between Test 1 and Reference Case. At a network level, the junction mitigations modelled appear to relieve delay at the junctions in question, but the modelling suggests that a transfer of delay to upstream junctions towards the town centre may occur.

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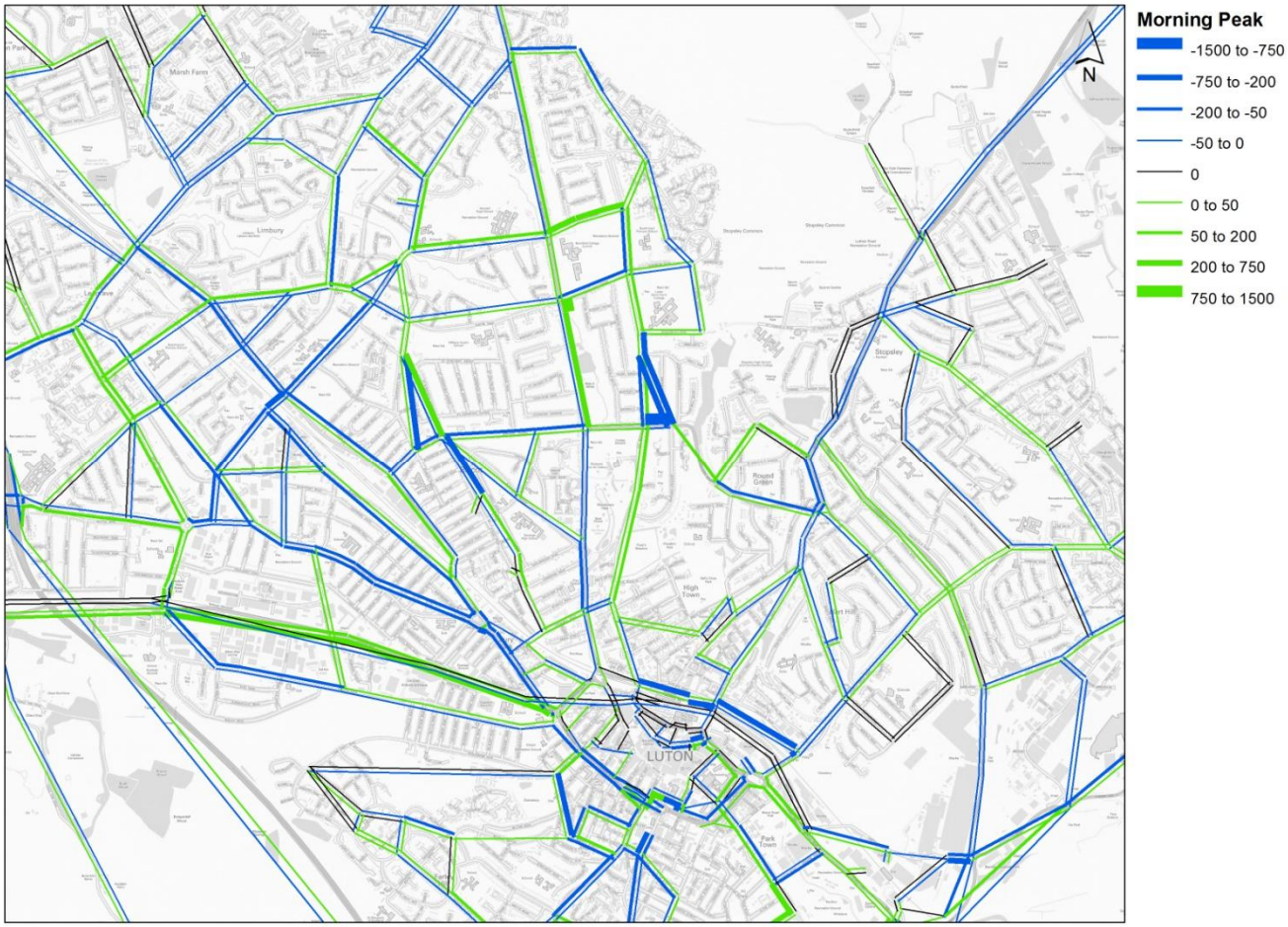
Transportation

Figure 3: Flows Differences (Test 1 - Reference Case) Morning Peak



5.3 Proposed Schemes Performance

5.3.1 **Figure 4** shows difference in delays for Test 1 against Reference Case in a graphical form, values on the right side of the graph are increases in delay and values on the left represent a decrease.

5.3.2 Delay summary can also be found in **Table 7**.

5.3.3 **Figure 5** shows differences in junction saturation as Volume over Capacity in a bar chart, values on the right side of the graph are increases and values on the left represent a decrease.

5.3.4 Volume over Capacity summary can be found in Table 8 below.

5.3.5 The strategic modelling undertaken as part of Test 1 suggest improvements to model performance at some of the key junctions, but in other locations modelled junction performance is reduced. The level of mitigation is also qualitatively assessed and used to inform the next iteration of the junction mitigation - Test 2.

Figure 4: Test 1 Difference in delays (Test 1- Reference Case)

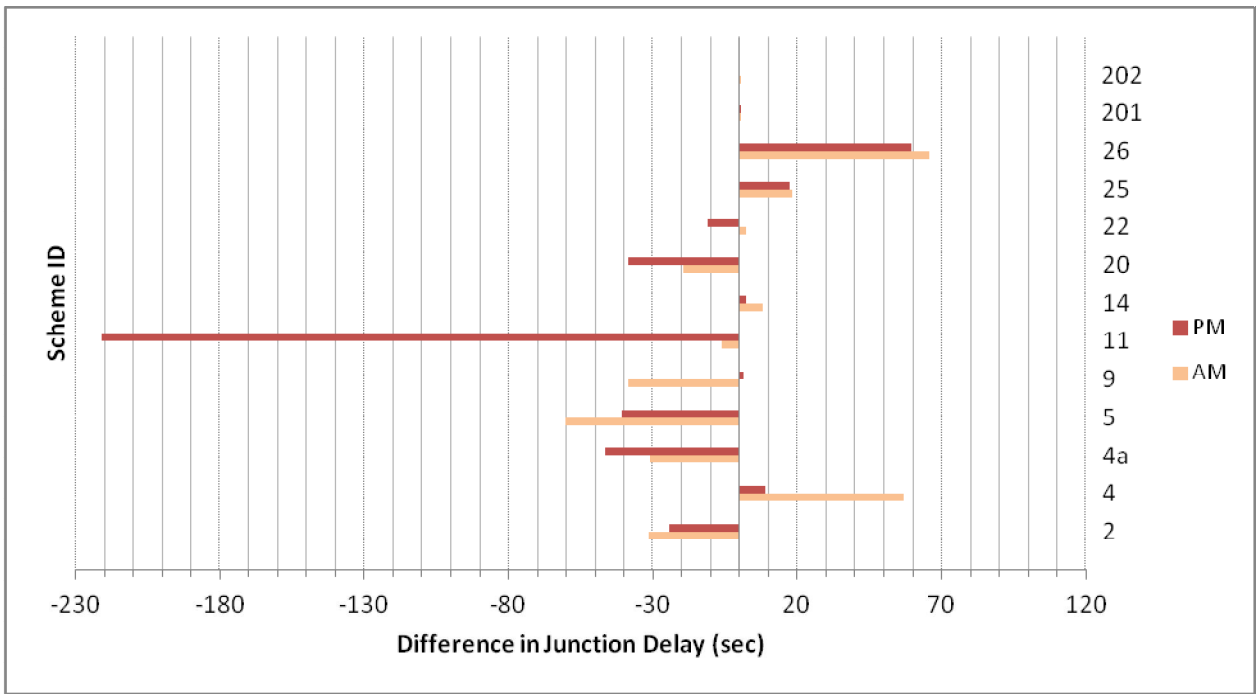


Table 7: Test 1 summary of junction performance - Delays

Scheme ID	Morning peak(sec)		Evening peak(sec)		Difference (sec)		Mitigates	
	Test 1	Ref Case	Test 1	Ref Case	AM	PM	Fully	Partially
2	70	101	59	84	-31	-24		✓
4	150	93	64	55	57	9	✗	
4a	0	31	0	47	-31	-46	✓	
5	30	90	51	92	-60	-41		✓
9	31	70	28	26	-39	2	✓	
11	8	14	6	227	-6	-221	✓	
14	60	52	124	122	8	2	✗	
20	29	49	29	68	-19	-38	✓	
22	16	14	52	63	2	-11	✓	
25	62	44	62	45	18	17	✗	
26	91	26	81	21	66	60	✗	
201	7	7	7	7	0	1	✓	
202	12	12	13	14	0	0	✓	

Capabilities on project:
Transportation

Figure 5: Test 1 Difference in Volume over Capacity (Test 1- Reference Case)

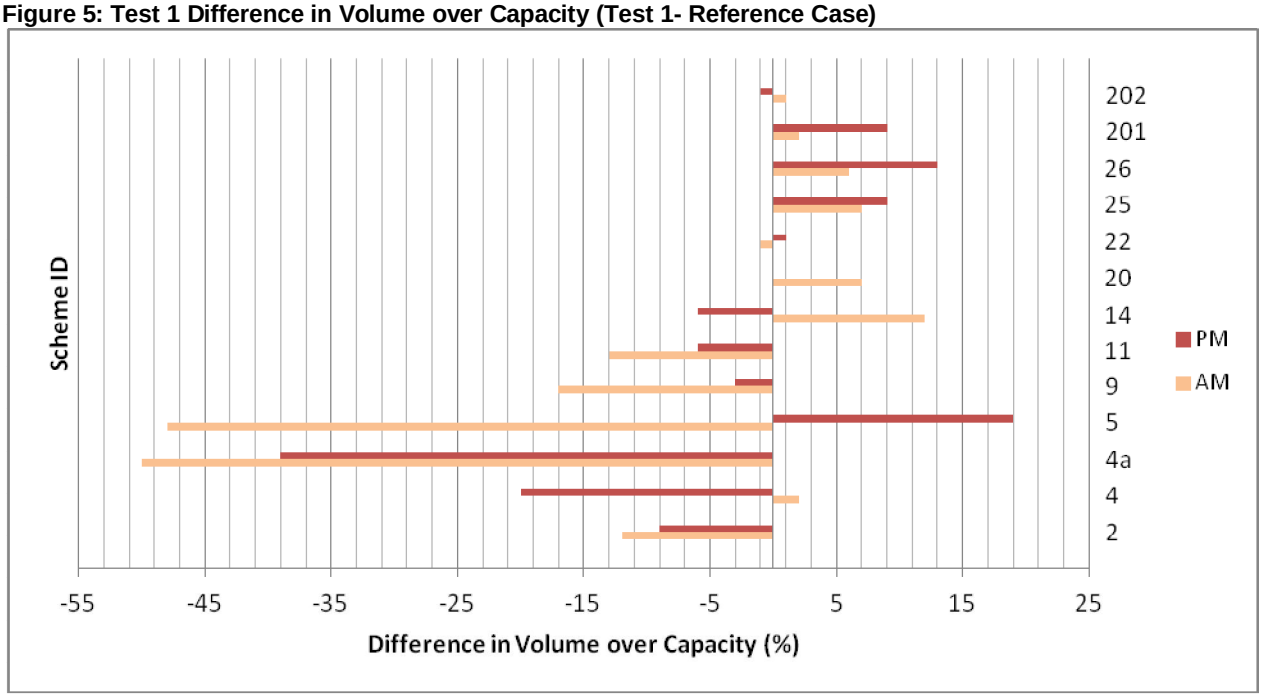


Table 8: Test 1 summary of junction performance - Volume over Capacity (%)

Scheme ID	Morning peak		Evening peak		Difference (%)		Mitigates	
	Test 1	Ref Case	Test 1	Ref Case	AM	PM	Fully	Partially
2	92	104	75	84	-12	-9		✓
4	91	89	72	92	2	-20		✓
4a	9	59	8	47	-50	-39	✓	
5	46	94	86	67	-48	19		✓
9	52	69	26	29	-17	-3	✓	
11	42	55	50	56	-13	-6	✓	
14	93	81	62	68	12	-6		✖
20	85	78	87	87	7	0		✓
22	74	75	88	87	-1	1		✖
25	98	91	102	93	7	9	✖	
26	103	97	102	89	6	13	✖	
201	58	56	59	50	2	9	✓	
202	60	59	64	65	1	-1	✓	

Capabilities on project:
Transportation

5.4 Summary of Test 1

5.4.1 The Test 1 run is based on the Luton Local Plan 2031 Option B run with the introduction and modelling of twelve junction mitigation schemes. The junction mitigation scheme assumptions have been agreed with LBC prior to the commencement of modelling and are summarised in **Table 5**.

5.4.2 As a result of the introduction of the proposed schemes, Test 1 modelling has shown traffic impacts at wider network level. These impacts can be seen in the network statics as an increase in total delays and queues in the Luton Area.

5.4.3 Despite the schemes having been introduced as a single scenario, in one model run, some dynamics between junctions and parallel corridors working collaboratively can be identified from the plots.

5.4.4 The A5065 and Leagrave Road are parallel routes for traffic travelling in/out Luton towards the northwest, changes in capacity and operation at junctions of Hatters Way/ Chaul End Lane and Leagrave Road/ Waller Road are modelled to bring about some re-routeing increasing traffic through the A5065.

5.4.5 New Bedford Road and Old Bedford Road are parallel routes for traffic travelling North-South in and out of Luton. Enhanced capacity at junctions along Old Bedford Road could encourage some southbound traffic turning off New Bedford Road at Barnfield Avenue to proceed south and then east along Stockingstone Road.

5.4.6 The schemes proposed along Castle Street seem to induce a reduction in traffic along Castle Street and along Chapel and Park Viaducts. Traffic directed towards Luton town centre is modelled to choose alternative routes via more minor links such as Cutenhoe Road and Park Street.

5.4.7 Flows and delays plots indicate the likely increase in traffic routeing via secondary routes as a result of the schemes along Castle Street and Stockingstone/ Hitchin Road. These conclusions however should be taken with caution since the modelled network is not sufficiently detailed in these areas as to offer realistic alternative routes to Castle Street and Stockingstone Road.

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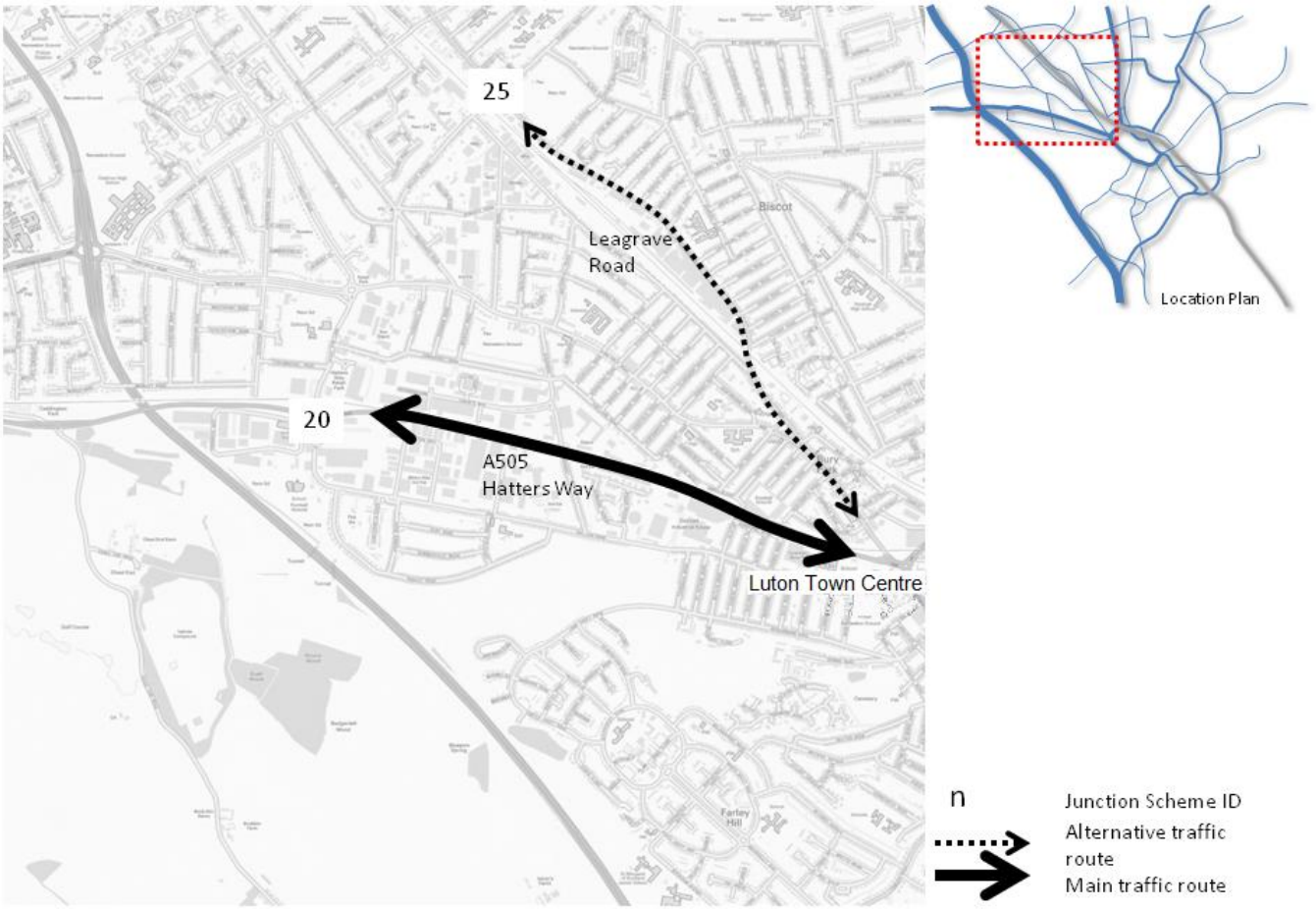
Transportation

Figure 6: A5065/ Leagrave Road potential re-routeing



Capabilities on project:
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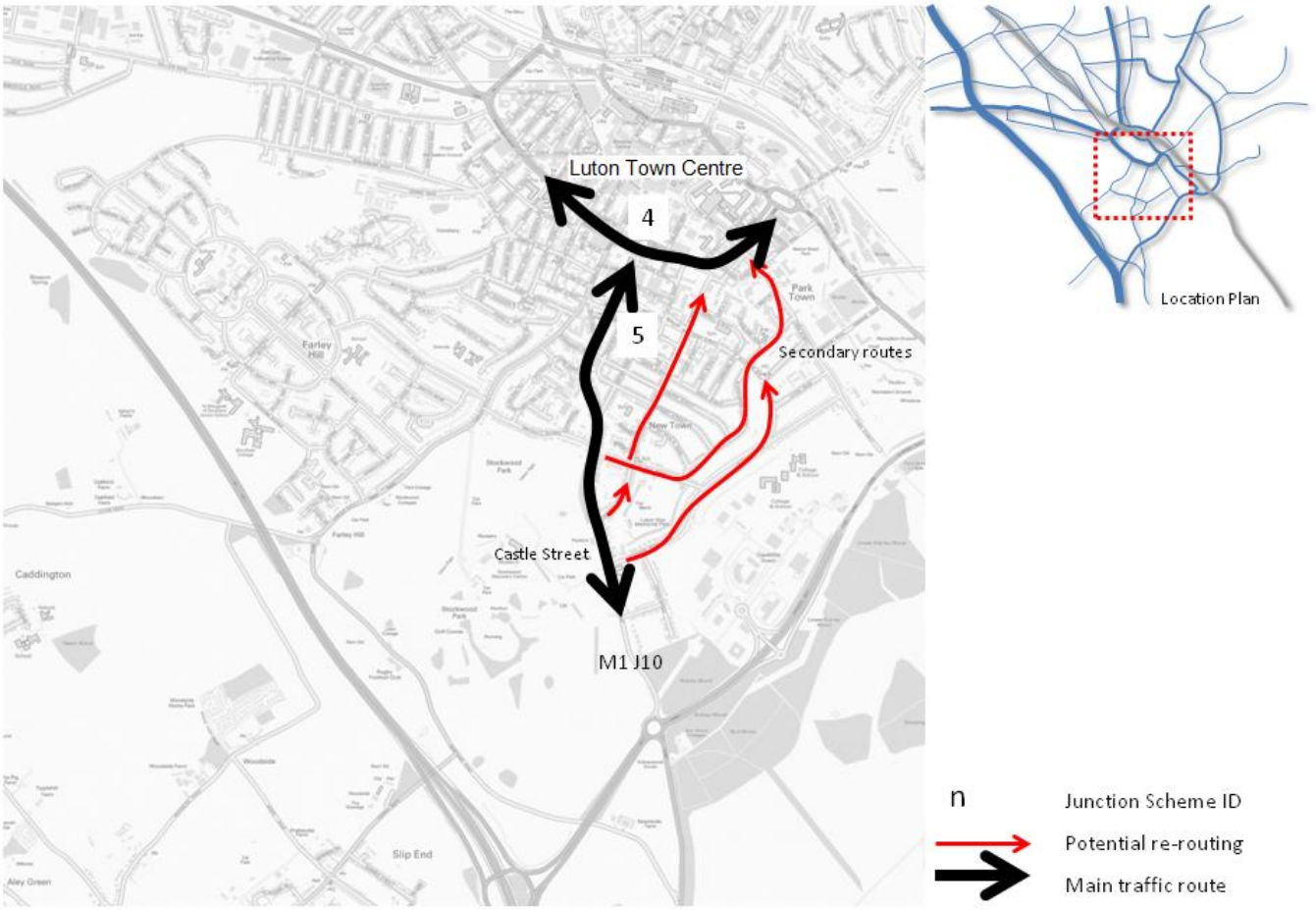
Figure 7: Castle Street potential re-routeing



Capabilities on project:
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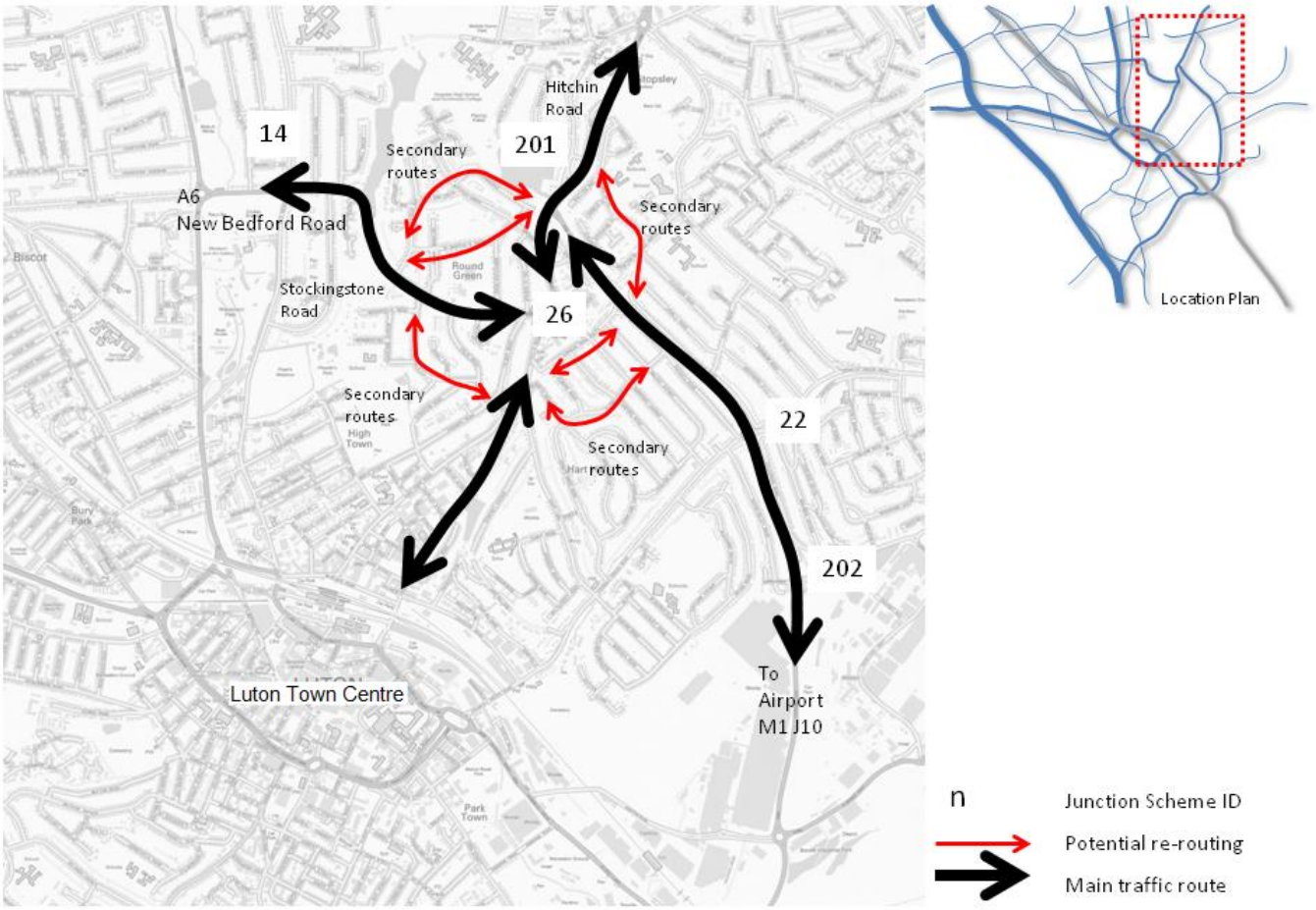
Figure 8: Stockingstone Road/ Hitchin Road potential re-routeing



Capabilities on project:
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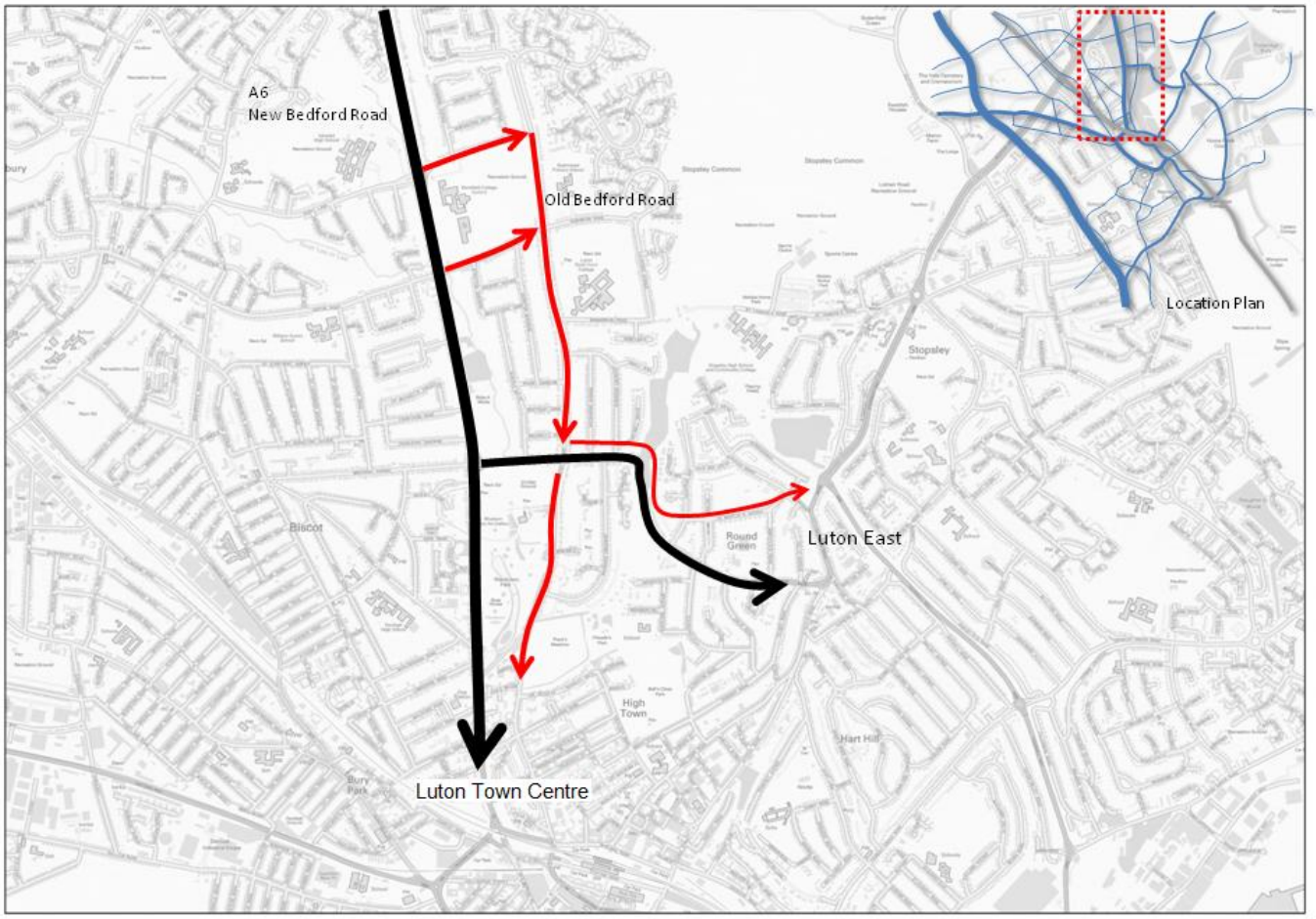
Figure 9: A6/ Old Bedford Road potential re-routeing



5.4.8 An assessment has been undertaken looking at single junction performance in terms of delays and Volume over Capacity differences (Test 1 to Reference Case).

5.4.9 The outcome of the first iteration (Test 1) was reviewed and the design of some junctions that were found to under-perform was changed or reversed to the original layout, for a second iteration of model testing.

5.4.10 Summary of these considerations can be found in **Table 9** below.

Table 9: Test 1 junction performance considerations

Scheme ID	Morning peak		Evening peak		Comments
	Delays	V/C	Delays	V/C	
4	+57	+2	+9	-20	New geometry results in reduction of turning lanes capacity hence delays at this junction increase. Significant delays on approaches from Castle Street (south) and A5065 (west) for all movements. Decrease along Chapel Viaduct and Park viaduct caused by banned U turn on the cross roads layout.
14	+8	+12	+2	-6	Delays on approach from Old Bedford Road (south) and Stockingstone Road (west).
25	+18	+7	+17	+9	Delays on all approaches. From Leagrave Road (south) and Waller Avenue up to approx 50 sec, from Blundell Road up to two minutes.
26	+66	+6	+60	+13	New geometry results in reduction of turning lanes capacity hence delays at this junction increase. Delays on all approaches. From Stockingstone Road up to 2 min for all turns, delays on Hitchin Road (north) at the signalised junction and blocking back, delays on Hitchin Road (south).

6. Test 2 – Proposed design assessment and wider network impacts

Capabilities on project:
Transportation

6 Test 2 – Proposed design assessment and wider network impacts

6.1 Introduction

6.1.1 Building on the results of Test 1 junction mitigation scheme assessment, changes in the layout were considered for those junctions found to perform poorly. These were highlighted in **Table 9**.

6.1.2 Furthermore a test has been performed on the results of Test 1 to determine whether up-stream and adjacent junctions experience increased delay or V/C over the threshold following the modelling of Test 1 mitigation options.

6.1.3 The result of the considerations summarised in **Table 9** (Test 1 junction performance considerations) together with the results of the test to identify new congested junctions (resulting in delay over 60 seconds and Volume over Capacity over 85% as result of the junction mitigation schemes introduction) were the basis of the new iteration of design and modelling.

6.1.4 This second iteration was identified as Test 2. The assumptions behind this further modelling run are summarised in **Table 10** (junctions resulting in increased delay/ V/C as consequence of Test 1) and **Table 11**(junctions forming part of the original scope).

6.1.5 The location of these junctions is shown in Figure 10 below.

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Transportation

Table 10: Test 2 assumptions (junctions resulting in increased delay/ V/C as consequence of Test 1)

Site ID	Location	Result of Test1	Modelling Assumptions Test2
13331	London Road/ Cutenhoe Road	• General V/C improvement was noted during the AM peak, however the southern approach remained over 90%. • All flows are comparable to the reference case, with the southern arm receiving 60 fewer ahead vehicles but 90 more right turners. • Delay on each individual approach is reduced. .	Given individual approaches were modelled as having reduced V/Cs and delay values, no further amendments were proposed. As per Reference Case.
14505	B4540/ Windsor St	• Very minor or no change in V/C. • Minor flow reductions across the junction. • Delay reduction on two approaches, with an increase on the southern approach (~30 seconds).	Given no significant increases in individual approach arm V/C or Delay, no design amendments are proposed. As per Reference Case.
14233	Stuart St/ Cardiff Road	• Far fewer approaching vehicles from the North/West (~500), with minor changes elsewhere (<50). • V/C similar on approaches, with the exception of large increases on the east and north approaches. • Significant delay increases on three of four approaches. • Staging adjusted; remove Stage 2, Stage 3 green time to 8 seconds and lengthen Stage 4 (now Stage 3) by 2 seconds (assumes retention of cycle time).	No scope for significant civils work given the urban nature of the site. Signal staging improved/optimised.
14234	Dunstable Road/ Kingsway	• V/C very similar to previous (still over capacity on East & West approaches), with minor reductions. • Negligible changes in flow through the junction. • Delay reduction on all approaches.	Given no significant increase, no design change is proposed. As per Reference Case.

Capabilities on project:
Transportation

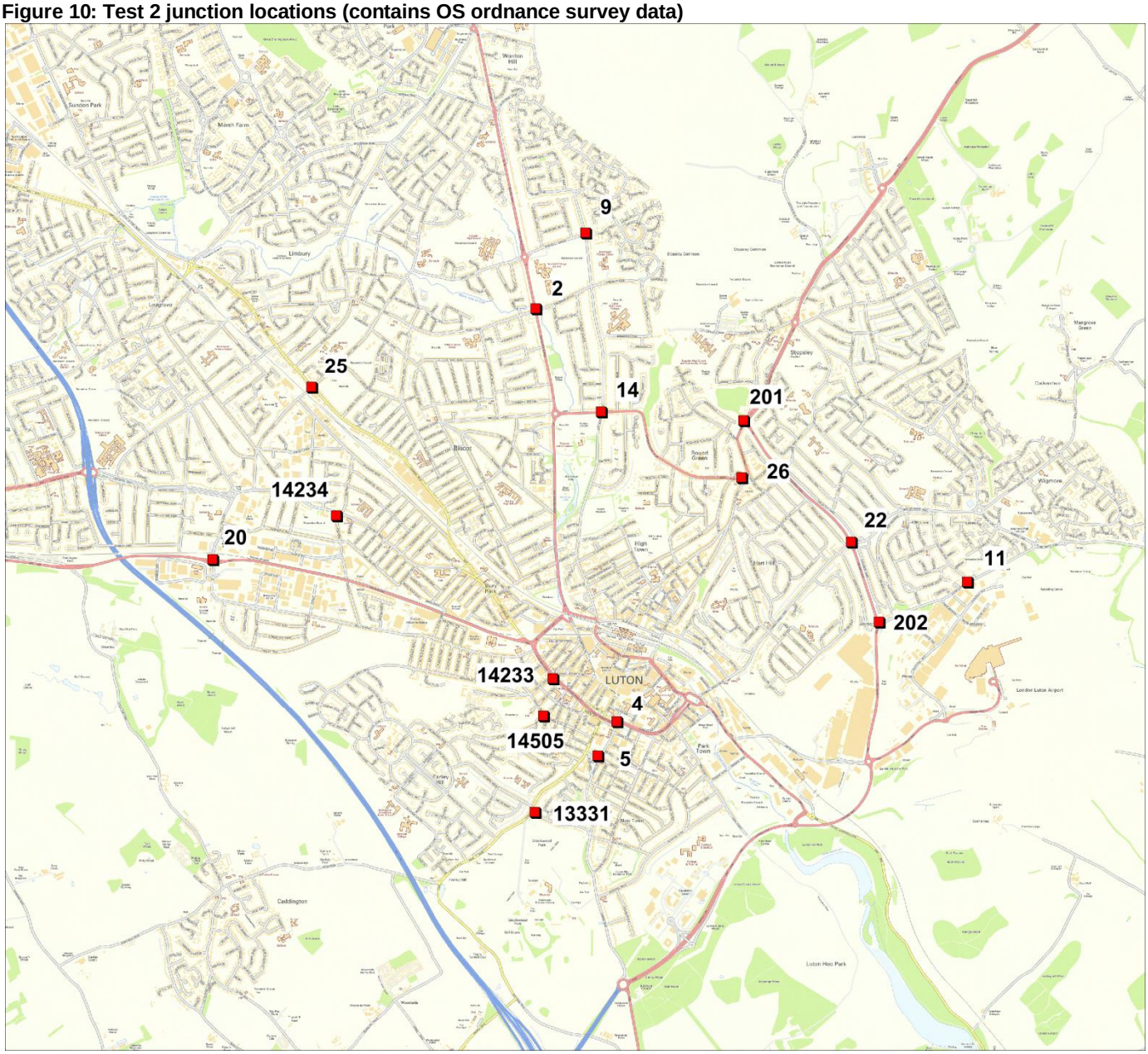
Table 11: Test 1 result and Test 2 assumptions (junctions forming part of Test 1 scope)

Site ID	Location	Result of Test1	Modelling Assumptions Test2
2	A6 Crossroads with Austin Road/ Kingsdown Avenue	• V/C improved on three approaches, however an increase on East approach. South & West approaches remain over capacity. • Delay was improved on all approaches.	Given predominantly positive impact on individual approaches, no further design amendments are proposed. As per Test 1.
4	Chapel Viaduct Roundabout	• New geometry results in reduction of turning lanes capacity hence delays at this junction increase. • Significant delays on approaches from Castle Road (south) and A5065 (west) for all movements. • Decrease along Chapel Viaduct and Park viaduct caused by banned U turn on the cross roads layout.	Hamburger arrangement was coded using the fully signalised junction option. High level LinSig model was done based on Reference Case demand flows to derive an option for signals timing. Flowers Way junction with Castle Way as per Test 1.
14	Old Bedford Road and Stockingstone Road	• V/C improvements on all approaches with the exception of minor increase on the western approach. Approaches remain over capacity. • Large flow changes on southern and eastern approaches as a result of wider network changes. • Delay increase on western arm with greater reduction on the southern arm. • Given altered flow patterns are accommodated within proposed layout with nil detriment to junction performance, as well as the limitation on civil works possible identified during the initial design conception, no further design amendments are proposed.	No scope for significant civil work given the urban nature of the site. As per Test 1.
25	Crossroad between Waller Avenue, Blundell Road, Marsh Road and Leagrave Road	• Increased delays on northern and western approach. • Little space within the junction for the many conflicting movements, increased stacking capacity brings more vehicles into the junction causing more delays.	Given little benefit and high cost caused by underground stats recommended to switch back to existing layout. As per Reference Case.
26	Hitchin Road junction with Ramridge Road	• New geometry results in reduction of turning lanes capacity hence modelled delays at this junction increase. • Delays on all approaches. From Stockingstone Road up to 2 min for all turns, delays on Hitchin Road (north) at the signalised junction and blocking back, delays on	Given sparse network coverage it is recommended to switch back to existing modelled layout to avoid re-routeing to affect the results on the nearby junctions. As per Reference Case.

Capabilities on project:
Transportation

		Hitchin Road (south). • Traffic is likely to re-route through secondary routes.	

Figure 10: Test 2 junction locations (contains OS ordnance survey data)



6.2 Network Impacts

6.2.1 This section summarises the results of the Test 2 model iteration, showing first the impacts at a network level and then assessing the individual scheme performance.

6.2.2 Network statistics of the Test 2 run can be found in **Table 12** below. The statistics suggest there is a reduction in total delay time and queues in the Luton area while the average speed is the same as per the Reference Case.

Table 12: Network Statistics Test 2

Luton			
AM Peak	**Ref_Case**	**Test 2**	**Differences**
Vehicle Distance (veh-km)	233,217	231,388	-1,829
Road Distance (km)	344	341	-3
Free Flow Vehicle Time (veh-hours)	4,453	4,409	-44
Assigned Vehicle Time (veh-hours)	6,717	6,637	-80
Vehicle Delay Time (veh-hours)	2,264	2,227	-37
Vehicle Queued End of Hour (PCUs)	1,840	1,756	-84
Speed (kph)	35	35	0

6.2.3 As can be seen from the flow difference plot, **Figure 11**, some modelled re-routeing around the network is experienced. In blue are represented the absolute differences as decrease of traffic flows whilst in green are represented the increases.

A5065 / Leagrave Road

6.2.4 The flow difference plot suggests an increase in traffic along the A5065 and a decrease along Leagrave Road.

Castle Street

6.2.5 Unlike the previous run, Test 2 suggests an increase in flows approaching the Castle Street/Chapel Viaduct junction, this is mainly accounted for by right turners. The signalised hamburger scheme would allow for U-turns approaching the junction from east and west and the re-routeing through alternative parallel routes in the south east area, such as via Cutenhoe Road, is not evident in this modelled run.

6.2.6 A degree of re-routeing is still modelled along Cardiff Road and Napier Road southbound, suggesting this alternative route is more attractive than passing through Chapel Viaduct and Castle Street for traffic heading south of Luton in the morning peak. This is a result of a combined scheme on the Castle Street junction with Chapel Viaduct (site 4) and Cardiff Street junction with Stuart Street. This dynamic is also illustrated in **Figure 14** at the end of this section.

6.2.7 A significant reduction in modelled traffic approaching the junction from the viaduct eastbound and westbound can be observed, suggesting latent demand for traffic passing through this junction was unreleased and the additional capacity provided is still not sufficient to accommodate the traffic demand.

Stockingstone Road/ Vauxhall Way

6.2.8 The schemes proposed along these links are modelled to increase capacity along Vauxhall Way corridor, as a result traffic along the north and northeast route is modelled to be more likely to use the Vauxhall Way corridor and is likely to use the junction at Stockingstone Road/ Hitchin Road, however if the junction operates with high delays and queues, traffic is more likely to re-route through parallel roads such as the area between Felstead Way and St Martin's Avenue.

6.2.9 Again caution is recommended in considering these secondary routes as the only natural alternative route option for Stockingstone Road and Hitchin Road since the model network representation is not detailed in this area and therefore there is a shortage of potential alternative routes in the model.

6.2.10 As in the previous model run, a reduction in vehicle flow through the Stockingstone Road/ Hitchin Road was observed. The increased capacity at the adjacent junctions along the Stockingstone Road and Vauxhall Way corridors has the potential to increase the demand through this junction increasing the already high saturation and delays.

New Bedford Road/ Old Bedford Road and Stockingstone Road

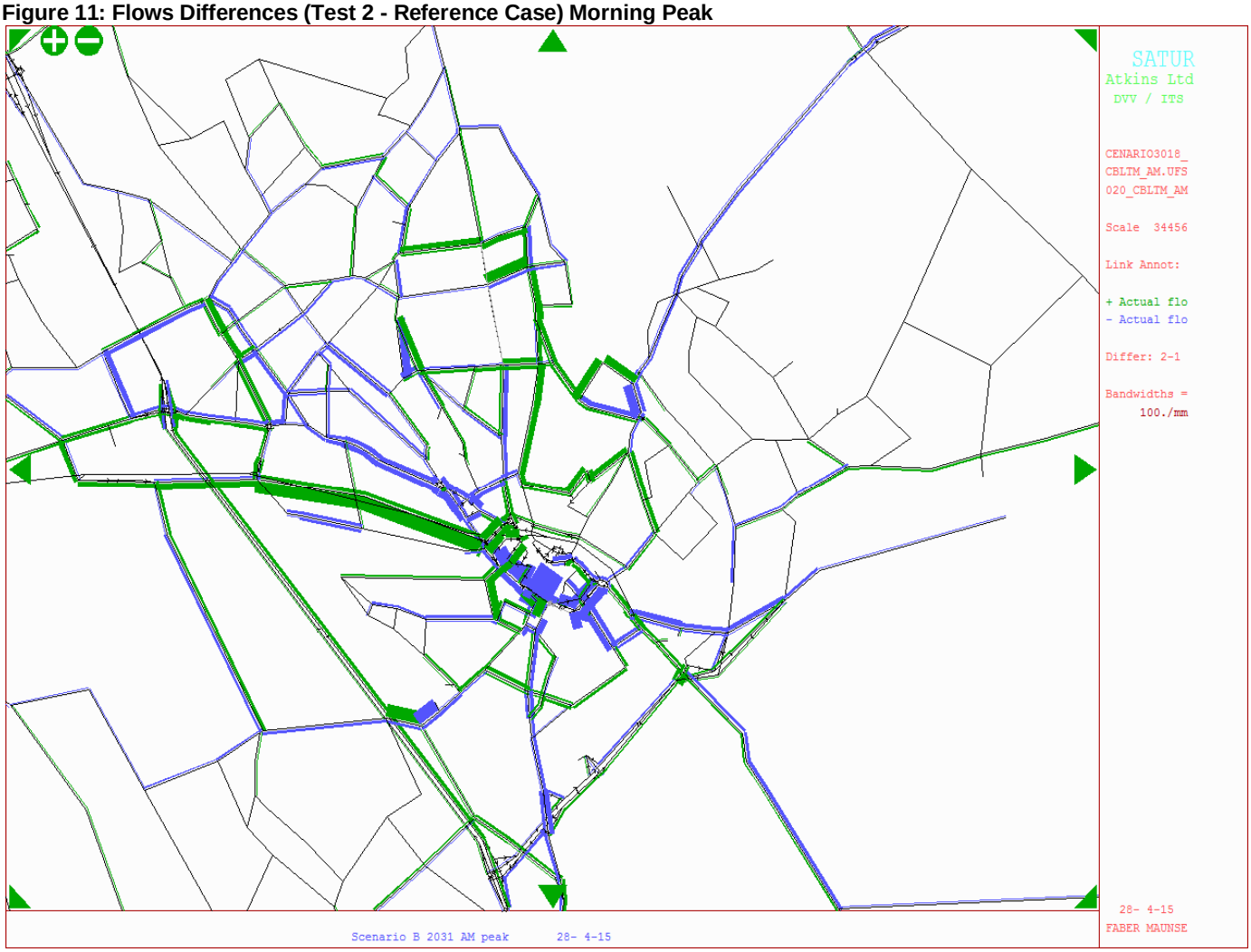
6.2.11 The schemes proposed along these corridors are modelled to bring about a slight re-routeing for traffic heading east and coming from the north along the A6. Modelled improvements along Old Bedford Road are modelled to make this route more attractive for traffic turning into Stockingstone Road and traffic is likely to join Old Bedford Road through Barnfield Avenue and proceed southbound.

Wider Network Considerations

6.2.12 The changes in flows along the links have also affected delays at junctions. **Figure 12** shows the difference in delay at junctions between Test 2 and Reference Case. Observing the plot a movement of delay at junctions along the links can be observed, increase in delays in fact seems to be moving towards the Town Centre.

6.2.13 The degree of delays moving along the network is however modelled to be mitigated to some degree.

Figure 11: Flows Differences (Test 2 - Reference Case) Morning Peak



6.3 Proposed Schemes Performance

6.3.1 Again, the modelled schemes have been measured against delays and saturation, the threshold for delays was of 60 seconds and saturation was of 85% V/C. Graphs and tables can be found below summarising results for Test 2 junction delays and saturation.

6.3.2 **Figure 12** shows difference in delays for Test 2 against Reference Case in a bar chart values on right side of the graph are increases in delay and values on the left represent a decrease. Modelled junction delay is also summarised in **Table 13**.

6.3.3 **Figure 13** shows differences in junction saturation as V/C, values on right-hand side of the graph are increases and values on the left represent a decrease. A V/C is also summarised in **Table 14** below.

Capabilities on project:
Transportation

Figure 12: Test 2 Difference in delays (Test 2- Reference Case)

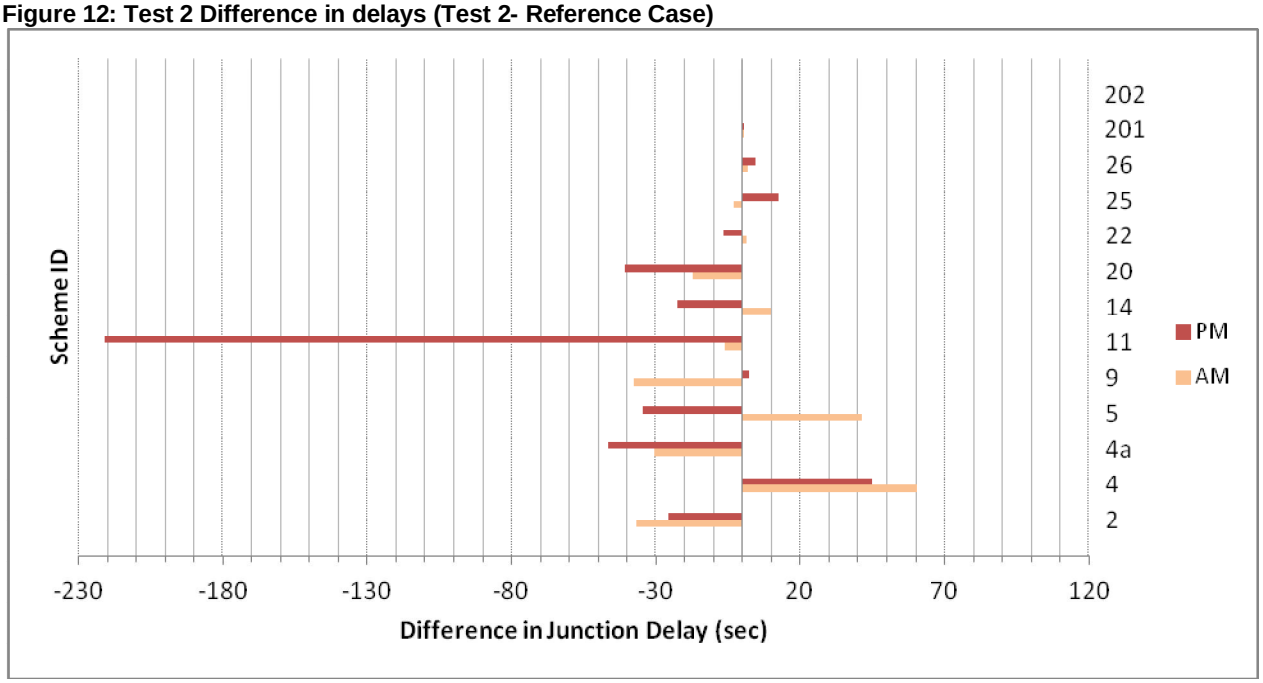


Table 13: Test 2 summary of junction performance - Delays

Scheme ID	Morning peak(sec)		Evening peak(sec)		Difference (sec)		Mitigates	
	Test 2	Ref Case	Test 2	Ref Case	AM	PM	Fully	Partially
2	64	101	58	84	-37	-26		✓
4	153	93	100	55	60	45	✗	
4a	1	31	0	47	-31	-47	✓	
5	132	90	57	92	41	-35		✓
9	32	70	28	26	-38	2	✓	
11	8	14	6	227	-6	-221	✓	
14	61	52	99	122	10	-23	✗	
20	32	49	27	68	-17	-41	✓	
22	15	14	56	63	1	-7	✓	
25	41	44	58	45	-3	13	-	-
26	27	26	26	21	2	5	-	-
201	7	7	7	7	0	0	✓	
202	12	12	13	14	0	0	✓	

Capabilities on project:
Transportation

Figure 13: Test 2 Difference in Volume over Capacity (Test 2- Reference Case)

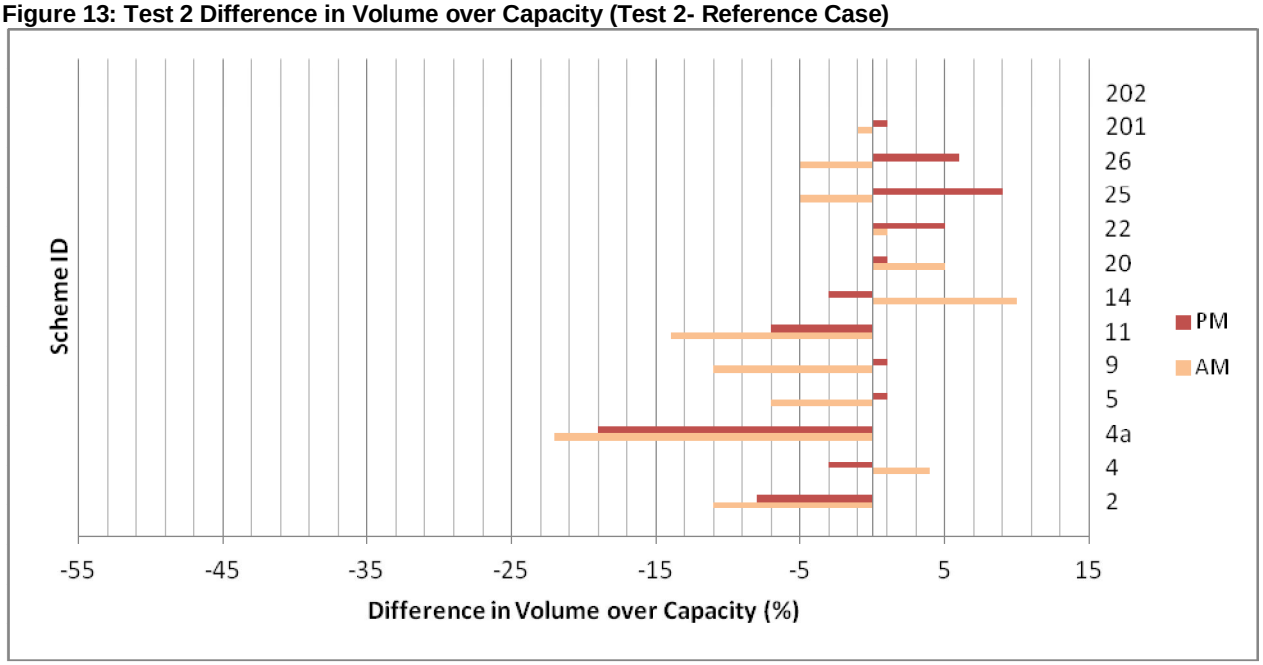


Table 14: Test 2 summary of junction performance - Volume over Capacity (%)

Scheme ID	Morning peak		Evening peak		Difference (%)		Mitigates	
	Test 2	Ref Case	Test 2	Ref Case	AM	PM	Fully	Partially
2	93	104	76	84	-11	-8		✓
4	93	89	89	92	4	-3		✗
4a	37	59	28	47	-22	-19	✓	
5	87	94	68	67	-7	1		✓
9	58	69	30	29	-11	1	✓	
11	41	55	49	56	-14	-7	✓	
14	91	81	65	68	10	-3		✗
20	83	78	88	87	5	1		✓
22	76	75	92	87	1	5		✗
25	86	91	102	93	-5	9	-	-
26	92	97	95	89	-5	6	-	-
201	55	56	51	50	-1	1	✓	
202	59	59	65	65	0	0	✓	

6.4 Summary of Test 2

6.4.1 Model Test 2 is based upon the Luton Local Plan 2031 Option B run incorporating the introduction of ten prospective junction congestion mitigation schemes. The junction mitigation scheme assumptions have been discussed and agreed with LBC prior to the assessment of Test 1. The Test 2 run assumptions are informed by the results of Test 1, these conclusions and the assumptions for Test 2 are summarised in **Table 10** and **Table 11**, further improvements to junctions 25 and 26 were excluded from the Test 2 as result of the poor performance identified in Test 1.

6.4.2 The junction schemes have been introduced as a single scenario in one model run, but some dynamics between junctions and parallel corridors working collaboratively have be identified from the model results plots.

6.4.3 As a result of the introduction of the proposed schemes in the second iteration, Test 2 models, the traffic impacts were experienced on a wider network level. These impacts can be seen in the network statistics as an increase in total delays and queues in the Luton area.

6.4.4 Modelled vehicle movements in/out of Luton towards the north and west, suggest changes in capacity and operation at the junctions of Hatters Way/ Chaul End Lane may make the A5065 route more attractive than Leagrave Road.

6.4.5 New Bedford Road and Old Bedford Road are parallel routes for traffic travelling north to south, in and out of Luton. Enhanced capacity at junctions along Old Bedford Road could encourage some southbound traffic turning off New Bedford Road at Barnfield Avenue to proceed south and then east along Stockingstone Road.

6.4.6 Network plots indicate the likely decrease in traffic approaching the junction at the Chapel Viaduct junction with Castle Street and some re-routeing through alternative parallel links to the north/west of Castle Street. These changes are related to the changes at the Castle Street/ Chapel Viaduct junction layout and to the Cardiff Road and Stuart Road junction changes in signalisation, **Figure 14**.

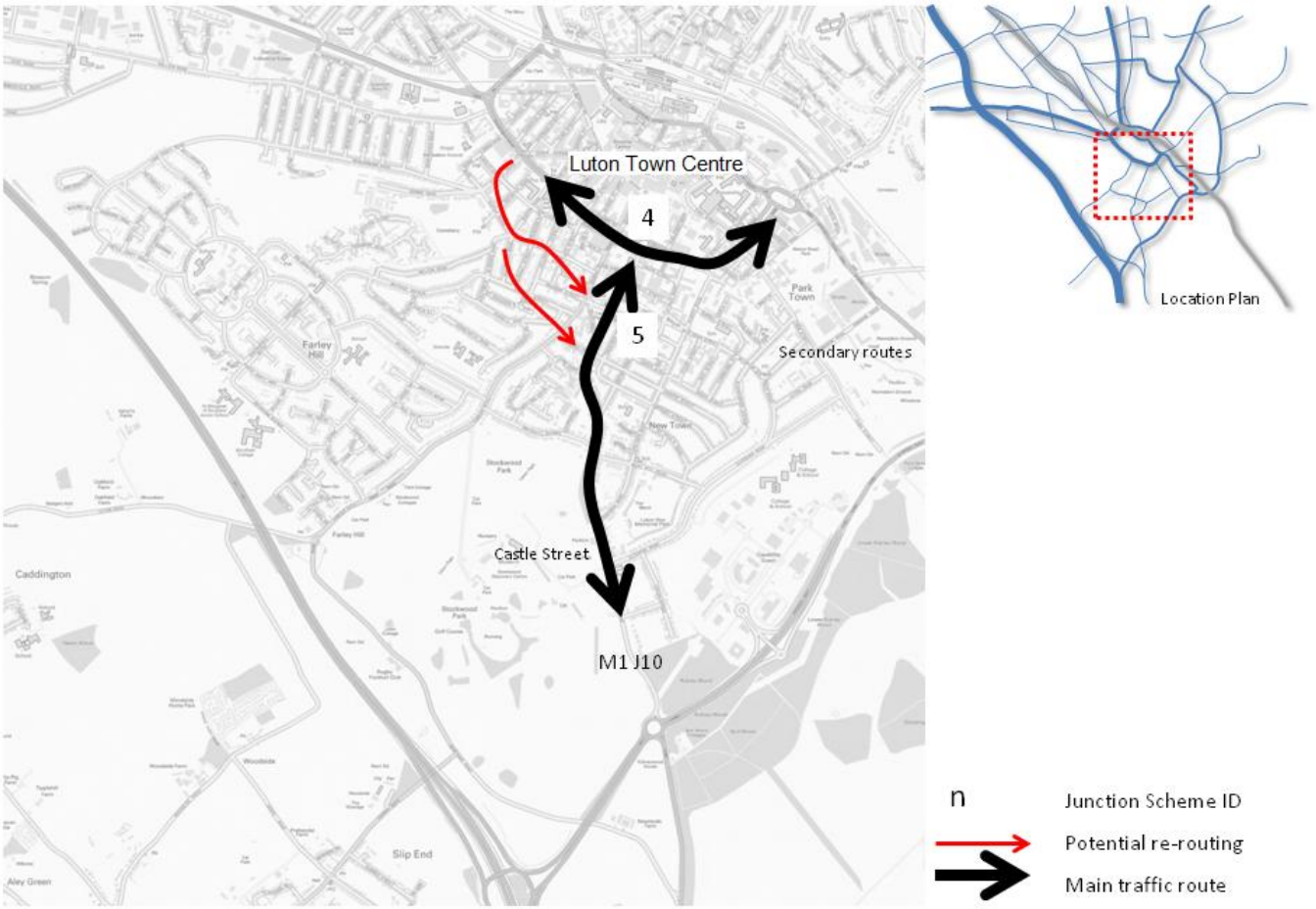
6.4.7 Given the modelled increase in flow and delay at the new signalised hamburger junction, it is likely that the increased capacity at this junction has attracted demand from competing routes in the model and more vehicles are likely to use this junction.

6.4.8 An assessment has been undertaken looking at single junction performance in terms of delays and V/C differences (Test 2 to Reference Case).

6.4.9 The outcomes of the first iteration (Test 1) and second iteration (Test 2) have suggested the junction mitigation schemes may partially mitigate congestion at some locations and fully mitigate at others. Conclusions are reported with recommendations in the following section of this report.

Capabilities on project:
Transportation

Figure 14: Chapel Viaduct potential re-routeing



7. Schemes budgetary cost estimates

7 Schemes budgetary cost estimates

7.1 Methodology

7.1.1 Composite cost estimates were produced for each of the proposals identified within this report. These estimates were derived using Spon's Civil Engineering and Highway Works Price Book (AECOM, 2015) and focus on four main elements of highway engineering works, namely: Earthworks, Carriageway works, Footway works and Traffic Signals.

7.1.2 Cost estimates were derived using rates taken from Spon's, with rates for certain elements of the works generalised for consistency across all schemes (e.g. same sub-base, base and wearing course rates assumed for all carriageway works at all sites).

7.1.3 Proposal drawings were used to derive surface areas, and assumptions made on depth where required, for area or volume based costs (i.e. where the unit rate is given in £/m^2 or £/m^3).

7.1.4 Table 15 below provides cost estimates for each of the sites assessed within this study.

Table 15: Budgetary cost estimates for each site

Scheme	Cost Estimates
Site 2 - New Bedford Road / Austin Road / Kingsdown Road (Refer to drawing 60247699-FY15-004-DWG-0101)	£918,000
Site 4 Chapel Viaduct Roundabout Options	
Option 1	£1,050,000
Option 2	£410,000
Option 3	£360,000
Site 5 - Castle Street / Hibbert Street / Windsor Street (Refer to drawing 60247699-FY15-004-DWG-0103)	£132,000
Site 9 - Old Bedford Road / Barnfield Avenue (Refer to drawing 60247699-FY15-004-DWG-0105)	£95,000
Site 11 - Eaton Green Road / Lalleford Road (Refer to drawing 60247699-FY15-004-DWG-0106)	£96,000
Site 14 - Old Bedford Road / Stockingstone Road (Refer to drawing 60247699-FY15-004-DWG-0107)	£62,000
Site 20 - A5065 Hatters Way / Chaul End Lane (Refer to drawing 60247699-FY15-004-DWG-0109)	£475,000
Site 22 - Vauxhall Way / Crawley Green Road (Refer to drawing 60247699-FY15-004-DWG-0110)	£105,000
Site 201 - Vauxhall Way/ Stopsley Way/Hitchin Road (Refer to drawing 60247699-FY15-004-DWG-0113)	£860,000
Site 202 - Vauxhall Way/ Eaton Green Road Junction (Refer to drawing 60247699-FY15-004-DWG-0114)	£350,000

8. Summary and recommendation

8 Summary and Recommendations

8.1 Summary

8.1.1 AECOM has previously undertaken transport model testing of the proposed Luton Local Plan on behalf of LBC. The modelling exercise identified a number of junctions experiencing high delay and saturation levels in forecast year 2031. Following on from this modelling exercise AECOM has provided LBC with advice on potential improvement measures to mitigate against future congestion.

8.1.2 In this report, the results of traffic model testing undertaken following multiple iterations of junction outline design proposals and traffic modelling were presented. A comparison of delays and congestion with previous model runs allowed the efficiency of the introduced measures to be determined.

8.1.3 Two iterations of highway design and modelling testing were reported to illustrate how modelled congestion might transfer around the network to nearby junctions and adjacent corridors in the forecast year 2031 and to identify network impacts.

8.2 Recommendations

8.2.1 Following the study undertaken, this section summarises our recommendations for potential junction mitigation schemes. It should be noted that since the initial Local Plan testing was undertaken in 2013, it is understood that changes to Local Plan allocations have been made. Changes to the Local Plan are not reflected in this work, but may have an impact on the junctions assessed and hence potential options put forward may develop and need to be re-visited.

8.2.2 The junction schemes have been introduced as a single modelled scenario, some dynamics between junctions and parallel corridors working collaboratively were identified. Effects such as re-routeing and up-stream congestion were identified and presented for specific corridors. Should LBC consider further work on junction mitigation sites we would recommend widening the area of influence of future studies to take in the corridors identified to capture potential re-routeing.

8.2.3 Where schemes are introduced on parallel routes as is the case of A5065 Hatters Way/ Leagrave Road and A6/ Old Bedford Road (Site 20, 2, 9 and 14) it may be advisable to consider introduction of traffic calming measures along the parallel adjacent routes to constrain traffic willing to rut-run and avoid the main corridors.

8.2.4 If further work is undertaken at site 4 (Castle Street and Chapel Viaduct) observed data on a wider area (corridors of potential re-routeing) would be recommended to determine the current traffic patterns, vehicle behaviours and estimate future impacts of the proposed schemes.

8.2.5 It may also be worth considering further optioneering in relation to sites 25 and 26, to determine if more detailed operational modelling can refine scheme options suggested.

8.2.6 Traffic micro- simulation models would allow a more detailed operational representation of traffic patterns, vehicle behaviour and an assessment of queue lengths where the proposed highway design layout may benefit from a change junction type, such as from roundabout to signalised crossroads or signalised ‘hamburger’ as these changes in the modelled network have shown potential impacts on wider network. Micro-simulation tools would potentially allow the observation of interactions between junctions and parallel links and would best inform the detailed design of junctions while allowing to monitor the impacts on the adjacent network. Furthermore, the performance assessment of the proposed junction mitigation can be more effectively assessed through operational modelling. This should be considered as the schemes are taken forward to the next stage, in order to evaluate the adequacy and future-proofing.

Appendices

Capabilities on project:
Transportation

Appendix 1: Summary of Highway Design Proposals

Site ID	Location	Proposed Design
Site 2	A6 New Bedford Road / Austin Road / Kingsdown Ave	- Extend two lane sections on approaches of A6 New Bedford Way. - Widen A6 New Bedford Way approaches to three lanes. - Staggered Toucan pedestrian crossing facilities across A6 New Bedford Way.
Site 4	Chapel Viaduct Roundabout – Option 1	- Convert to signal controlled junction. - Ban Castle St (N) movements to operate Left in / Left out only. - Additional lane on Chapel Viaduct approach. - Signalled crossing facilities provided on Castle St (N) & (S) arms, whilst Park Viaduct subway is retained. - Signals removed at Castle St / Flowers Way junction to the north.
Site 4	Chapel Viaduct Roundabout – Option 2a	- Convert to signal controlled “cut-through” (hamburger) roundabout. - All junction approaches to be signal controlled, with further signals on gyratory. - Signalled crossing facility provided on Castle St (S), whilst Park Viaduct subway is retained. - Gyratory movements to remain in footprint of existing carriageway. - Signals removed at Castle St / Flowers Way junction to the north.
Site 4	Chapel Viaduct Roundabout – Option 2b	- Convert to signal controlled “cut-through” (hamburger) roundabout. - Chapel Viaduct & Park Viaduct approaches signal controlled, whilst Castle St (N) & (S) approaches are retained as priority. Signals on gyratory control conflicts. - No signal controlled pedestrian facilities provided; Park Viaduct subway is retained. - Gyratory movements to remain in footprint of existing carriageway. - Signals removed at Castle St / Flowers Way junction to the north.
Site 5	Castle St / Hibbert Street / Windsor St	- Lengthen Castle St (S) approach through kerb realignment. - Ban Castle St (N) right turn movement into Windsor St. - Remove 30m of parking bays on Hibbert St.
Site 9	Old Bedford Road / Barnfield Ave	- Additional flared approach lane on Barnfield Avenue.
Site 11	Eaton Green Road / Lalleford Road	- Additional flared approach lanes on Eaton Green Road (E) & (W) approaches.
Site 14	Old Bedford Road / Stockingstone Road	- Lengthening of two lane section on Old Bedford Road (S).
Site 20	A5065 Hatters Way / Chaul End Ln	- Remove cycle lanes and separation islands from all approaches. - Widen A5065 Hatters Way approaches to three lanes at give-way line. - Widen Chaul End Lane to three lanes at give-way line. - Footway introduced connecting Chaul End Lane to Dallow Road via an uncontrolled crossing across A5065 Hatters Way (E). - Signalled crossing facility introduced across Chaul End Lane to connect proposed footway to existing footway network on western side of Chaul End Lane. - Reduce roundabout diameter to accommodate three circulatory lanes.
Site 22	Vauxhall Way / Crawley Green Road	- Lengthen two lane section on Vauxhall Way (N) approach. - Widen Vauxhall Way (S) approach to three lanes at give-way line by relocating the central island east.
Site 25	Waller Avenue / Blundell Road / Marsh Road / Leagrave Road	- - Lengthen two lane section on Leagrave Road approach. - Widen Waller Ave. approach to three lanes at stop line. - Relocate signalled pedestrian crossing across Marsh Road north to accommodate kerb line alteration. - Amend Waller Ave. pedestrian crossing arrangement and introduce signalled pedestrian facilities across Leagrave Road.
Site 26	Hitchin Road / Ramridge Road	- Convert Stockingstone Road / Hitchin Road roundabout to signal controlled junction. - Introduce signal controlled pedestrian facilities across Hitchin Road / Stockingstone Road approaches. - Additional lane at stop line on Hitchin Road (S) approach. - Retain Ramridge Road approach as priority junction but allow right turn movement (to serve movements that would currently U-turn at roundabout to access Hitchin Road (N), including bus routes 14 & 17A).
Site 201	Vauxhall Way / Stopsley Way / Hitchin Road	- Relocate roundabout west to enable widening of Hitchin Road exit to two lanes (merging to one). - Relocate footway on western side of roundabout to enable Hitchin Road approach widening to three lanes at give-way line. - Lengthen Vauxhall Way approach two lane section. - Widen Vauxhall Way exit to two lanes (merging to one). - Introduce dedicated left turn lane on Stopsley Way approach. - Widen Stopsley Way approach at give-way line to three lanes (downstream of uncontrolled pedestrian crossing).
Site 202	Vauxhall Way / Eaton Green Road	- Lengthen Vauxhall Way (N) & (S) two lane sections on approaches. - Lengthen Eaton Green Road two and three lane sections on approach.

Capabilities on project:
Transportation

Appendix 2: Flows Differences (Test 1 - Reference Case) Evening Peak