Project:	**Luton Local Plan Junction Assessment**	Job No:	**60247699**
Subject:	**Engineering Assessment and Cost Estimates**		
Prepared by:	**Leslie Gamadeku/Sam Thrower**	Date:	**1 July 2014**
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1. Introduction

1.1. Luton Borough Council (LBC) commissioned AECOM to undertake transport modelling tests of the proposed Luton Local Plan for a number of scenarios and forecast years. The modelling exercise, based on 2031 forecast year traffic conditions (2031 Option B), identified twenty-seven locations within the Luton network modelled as experiencing significant delays and congestion.

1.2. It should be noted that development, demand and infrastructure assumptions within the Central Bedfordshire and Luton Transport Model (CBLTM) may change over time as the Local Plan and Development Plan assumptions are refined in light of further understanding of proposals. Therefore the specific locations and junctions identified within this note may change as further information is refined.

1.3. Following on from the initial modelling exercise, a high-level engineering assessment of the identified locations was undertaken, with a view to identifying a range of potential highway improvement measures and associated budgetary construction costs. At this stage, only a very high level 'desktop' assessment has been undertaken, there can be no certainty that the prospective solutions suggested will resolve the problems identified in the strategic modelling. More detailed preliminary design and localised modelling of each option would be required if the schemes were to be taken to the next stage of assessment.

1.4. The information contained within this note provides an indication of the likely location of development related impacts and the broad associated cost range of mitigation which may be required.

1.5. This technical note presents the results of the assessment. The following key issues are addressed in this technical note;

- Identification of the links & junctions experiencing significant delay and congestion in the transport modelling exercise;
- Discussion of a range of potential engineering measures intended to reduce or eliminate congestion and delays at each identified location;
- Discussion of the advantages and disadvantages of each option, as well as any other issues in connection with each site or option that require further consideration; and
- Presentation of high level cost estimates of each of the proposed measures identified for each junction test location.

1.6. A number of these locations have either been previously assessed or improved or are earmarked for improvements by LBC over the coming years. These works previously undertaken or due to be undertaken in relation to these locations are also described in this technical note.

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1.7. This technical note is structured as follows:

- Section 2: lists the junction test locations and provides a brief description of the problems at each location identified through the strategic transport modelling;
- Section 3: describes the engineering assessment and costing process;
- Section 4: describes the schemes assessment which comprises a list of locations affected, the schemes previously identified or implemented by LBC, future proposals due to be implemented by LBC and potential proposals and associated construction cost estimates for each scheme; and
- Section 5: summarises the report.

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2. Local Plan Junction Test Locations

2.1. Table 1 lists, in order of decreasing delays or congestion, the locations identified as experiencing significant delay/congestion in the transport modelling exercise and outlines the problems at each location.

2.2. The junctions identified either have a delay of over 60 seconds or a volume:capacity ratio (V/C) greater than 85% in the morning or evening peak in 2031. This has been used as a basis to assess, at a high level, which junctions are likely to experience congestion in the future.

Table 1 Local Plan Junction Test Locations

Site ID	Site name	Existing junction type	Problem
1	A505 Roundabout with Crawley Green Road & St Marys Road.	Roundabout	Delay on all approaches and roundabout
2	A6 Crossroads with Austin Road and Kingdown Avenue	Traffic Signals	Delay from all approaches for all movements
3	Old Bedford Road and Midland Road junction	Traffic Signals	Delay from all approaches
4	Chapel Viaduct roundabout	Roundabout	Queues block back along Chapel Viaduct but also delay from Castle Street and straight on movement from Park Viaduct.
5	Castle Street and Hibbert Street junction	Traffic Signals	All arms delayed apart from Hibbert Street Westbound.
6	A6 junction with Cromwell Road/Hill	Traffic Signals	Delay on all approaches
7	A5065 Hatters Way junction with Dunstable Road and the A6 (Central Luton).	Roundabout	Queues block back onto the A505
8	Eaton Green Road and Frank Lester Way	Roundabout	Delay from Eaton Green Road Southbound
9	Old Bedford Road and Barnfield Avenue	Traffic Signals	Barnfield Avenue movements delayed.
10	London Road and Cutenhoe Road	Traffic Signals	Northbound London Road movement delayed.
11	Eaton Green Road and Lalleford Road	Roundabout	Movements to Eaton Green Road South High V/C
12	Windmill Road and Kimpton Road	Roundabout	Kimpton Road blocks back due to delay.
13	Dunstable Road junction with Leagrave Road	Give Way	Give way movement blocks back - delays (right turn) with high V/C on both movements.
14	Old Bedford Road and Stockingstone Road	Traffic Signals	Old Bedford Road NB & Stockingstone Road EB all movements have delays
15	Crawley Green Road and Crescent Road	Traffic Signals	Delay on all movements but delay is highest on the Crawley Green Road Movements
16	Junction of Dunstable Road, Inkerman Street and Cardiff Road	Traffic Signals	All arms

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Site ID	Site name	Existing junction type	Problem
17	Church Street, Midland Road and Crescent Road Junction	Traffic Signals	Church Street SB all movements and Crescent Road right turners.
18	Chapel Street and Windsor Street junction	Traffic Signals	Chapel Street SB movements block back
19	Dunstable Road and Kingsway	Traffic Signals	Dunstable Road movements all delayed
20	A5065 Hatters Way junction with Chaul End Lane	Roundabout	Delay high A505 EB with Chaul End Lane SB also having a high V/C for all movements
21	Toddington Road and Grange Avenue	Traffic Signals	All approaches
22	Vauxhall Way and Crawley Green Road	Roundabout	Vauxhall Way NB all movements delayed and blocks back
23	Chapel Viaduct EB junction with Stuart Street	Give Way	High V/C, traffic blocks back from junction after node 13264
24	Dunstable Road junction with Humberstone Road	Traffic Signals	All movements from Humberstone Road
25	Crossroad between Waller Road, Blundell Road, Marsh Road and Leagrave Road	Traffic Signals	V/C High on all approaches.
26	Hitchin Road junction with Ramridge Road	Roundabout	Hitchin Road SB blocks back with high V/C
27	Airport Way junction with the Gipsy Lane	Traffic Signals	High V/C for all movements and high delay for buses turning right

*V/C = Ratio of traffic volume to lane capacity

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Figure 1: Identified Local Plan Junction Test Locations (Contains Ordnance Survey data © Crown copyright and database right 2013)

3. Engineering Assessment and Costing Process

3.1. A high level engineering assessment was undertaken and associated construction cost estimated for each scheme.

3.2. No site visits or engineering design / study were undertaken as part of this exercise.

3.3. The assessment comprised the following key tasks:

Task 1 - Review of location layout – this involved the use of imagery (from Google and Bing maps) of each site to assess the existing layout and to identify any constraints or opportunities at each location.

Task 2 - Options development – using the problem identified from the traffic model and issues, constraints and opportunities noted during Task 1, a range of potential solutions to improve the junction efficiency were identified, ranging from minor alterations to extensive modification to the junction layout.

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Task 3 – Costing –cost estimates for proposed improvement measures were established using approximate estimating rates provided in Spon's Civil Engineering and Highway Works Price Book (2014 edition). As no design work was undertaken as part of the agreed scope, the stated costs provide an indication of the order of cost for each option.

3.4. It should be noted that, due to the high-level nature of the engineering assessment, the cost estimates does not account for the following :

- Costs associated with underground utility diversions;
- Preliminaries, contingencies and traffic management costs - during construction stage;
- Annual uplifts for future implementation of schemes;
- Cost associated with related works elsewhere on the network to facilitate a scheme;
- Design fees; and
- Cost of purchasing private lands.

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4. Schemes Assessment

4.1. This section of the technical note discusses measures identified following the engineering assessment as well as the construction costs associated with implementing each measure. It also highlights locations which have been assessed by LBC.

4.2. The scheme locations are grouped into four separate packages namely:

i. Package 1 – Locations affected by Luton Town Centre Transport Scheme (LTCTS) and other LBC improvement works;
ii. Package 2 – Locations where schemes have previously been proposed or improvement works trialled but discontinued;
iii. Package 3 – Locations assessed by AECOM but where LBC identify particular constraints and opportunities likely to affect proposals; and
iv. Package 4 – Locations assessed by AECOM and proposed schemes and associated costs identified.

4.3. The subsequent sections describe each Package in further details.

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Package 1

4.4. Table 2 lists locations that are likely to be improved following implementation of the LTCTS or other LBC improvement works.

Table 2 Locations affected by LTCTS or other LBC Improvement Works

Site ID	Site name	Problem/suggested cause of problem	Proposed LTCTS or LBC Improvement Works
1	A505 Roundabout with Crawley Green Road & St Marys Road.	Delay on all approaches and roundabout	Option 1 - Traffic signal proposals have been developed for these junctions as part of Luton Town Centre Transport Scheme (LTCTS). AECOM understand that optimised signal timings have been developed as part of the design process, however, these have not been provided as part of this exercise. It is assumed that these designs have taken into account future demand and that these timings may alleviate the modelled delays.
3	Old Bedford Road and Midland Road Junction	Delay from all approaches	
15	Crawley Green Road and Crescent Road	All Movements but delay is highest on the Crawley Green Road Movements	
17	Church Street, Midland Road and Crescent Road Junction	Church street Southbound all movements and Crescent Road right turners	
10	London Road and Cutenhoe Road	Northbound London Road movement delayed	The new roundabout junction on London Road being constructed as part of the Junction 10a improvements could assist in controlling traffic movements on the London Road approach to the traffic signals with Cutenhoe Road. Suggest that situation is revisited once the new Junction 10a is operational.

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Site ID	Site name	Problem/suggested cause of problem	Proposed LTCTS or LBC Improvement Works
19	Dunstable Road and Kingsway	Dunstable Road movements all delayed	Improved pedestrian facilities provided in 2013/14. However, the only way to further improve capacity would be by removing a movement from this junction which is not considered appropriate.
24	Dunstable Road junction with Humberstone Road	Delays on all movements from Humberstone Road	Replacement of ageing traffic signals at this junction is planned for 2014/15
27	Airport Way junction with the Gipsy Lane	High V/C for all movements and high delay for buses turning right	The new bus only road between the north and south sides of the airport parkway station will make bus only right turn lane redundant and enable re-phasing of signals at this junction.

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Package 2

4.5. Table 3 lists locations that have been reviewed by LBC either as part of unsuccessful Pinchpoint bid submissions or as separate review exercises.

4.6. For these locations, it is identified that significant changes, including land take and major infrastructure works, may be required to the physical layout of junctions in order deliver the improvements required to address congestion issues resulting from 2031 traffic flows.

Table 3 Locations previously assessed or improvement works trialled and discontinued by LBC

Site ID	Site Name	Problem/Suggested cause of problem	LBC Measures proposed or implemented
6	A6 junction with Cromwell Road/Hill	Delay on all approaches	Temporary Closure of Cromwell Road/Cromwell Hill about 18 months ago for utility works demonstrated that it is the side roads that create capacity problems at this junction. However as a permanent solution, this option is unlikely to be acceptable. There appears to be minimum scope to improve this junction within the existing highway layout. Land take between the highway boundary and River Lea may provide opportunity to increase junction capacity.
7	A5065 Hatters Way Junction with Dunstable Road and the A6 (Central Luton).	Blocks back onto the A5065	Consideration previously given to signalising this junction, but no options provided extra capacity to improve its operation. Alternative suggestion from this work was to rearrange lane allocations on Dunstable Road.
12	Windmill Road and Kimpton Road	Kimpton Road blocks back due to delay	Original Pinchpoint bid not appropriate as the derelict property required to implement has been refurbished. Worthwhile monitoring this junction once implementation of the strategic development site at Napier Park commences.
16	Junction of Dunstable Road, Inkerman Street and Cardiff Road	Delays on all arms	Right turn movements at this junction are not “hooking”. Unsuccessful Pinchpoint bid at this junction to replace old signals, combined with rearrangement of lane allocations on Dunstable Road by moving over the Central Reserve.
21	Toddington Road and Grange Avenue	Delays on all Approaches	The Station Road approach to this junction was trialled as one- way about 18 months ago, but following concerns raised by Members reverted to 2 way.
22	Vauxhall Way and Crawley Green Road	Vauxhall Way NB all movements delayed and blocks back	Signalising this junction was initially considered as a result of improvements required to increase capacity to cater for increased traffic to airport, but rejected in favour of localised widening at the roundabout. Vacant highway land on Vauxhall Way approaches may provide opportunities for this localised widening.

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Package 3

4.7. Table 4 contains a list of locations assessed as part of this exercise. A number of constraints and opportunities identified by LBC in relation to improvement works at these locations are also described in the table.

Table 4 LBC-identified site limitations and opportunities and AECOM proposals and associated cost estimates

Site ID	Site Name	Problem/Suggested cause of problem	Proposed measures	Comments	Proposed scheme cost	
					Lower limit	Upper limit
2	A6 Crossroads with Austin Road and Kingdown Avenue	Delay from all approaches for all movements	AECOM proposal: Option 1 - Provide additional lanes in both directions on A6. Scheme to include culvert widening or strengthening works to facilitate widening (if required).	There appears to be adequate land within highway boundary to provide additional lanes on both approaches of the A6. The main limitation to widening the approaches to this junction is that the River Lea runs in a culvert diagonally under two approaches to this junction; New Bedford Road on the north side and Kingsdown Avenue on the east side. The culvert was strengthened in 2004/5 to accommodate additional vehicle loading, although if the approaches are widened, further strengthening may be required. Cost estimates account for carriageway widening on both approaches of the A6, approximately 100m from the junction. Increasing the number of approach lanes along the A6 will require the existing straight pedestrian crossings to be converted to a staggered arrangement and this could make the junction less attractive for cyclists and pedestrians. Also, the re-phasing of the junction signals may have to be reconfigured as part of the works.	Option 1 - £182,400 (excl. culvert works)	Option 1 - £243,600 (excl. culvert works)

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Site ID	Site Name	Problem/Suggested cause of problem	Proposed measures	Comments	Proposed scheme cost	
					Lower limit	Upper limit
20	A5065 Hatters Way junction with Chaul End Lane	Delay high A5065 EB with Chaul End Lane SB also having a high V/C for all movements		Capacity at this roundabout was dramatically reduced in 2008 in order to provide cycle facilities at the roundabout. However a new cycleway alongside the Busway, which runs under the Chaul End Lane approach, could provide opportunity in some options to amend the cycle facilities at this junction and increase junction capacity		
			AECOM proposal: Option 1 - Signalise all arms of roundabout	Option 1 - This option may provide some benefits in terms of capacity and will enable the existing cyclist facilities at the roundabout to be maintained.	Option 1 - £68,000	Option 1 - £78,000
			Option 2 - Convert roundabout to signalised junction	Option 2 - Option 2 is likely to present the best results in terms of capacity but is also the most expensive option. Due to the amount of land, currently taken within the roundabout, to be released by converting to a signalised junction, there is scope to improve cycle facilities at the junction.	Option 2 - £858,000	Option 2 - £988,000
			Option 3 - Provide longer flares or additional approach lanes (20m) on all approaches	Option 3 - This option is a quick-win approach that combines removing the cycling facilities on some approaches to the roundabout (using the adjacent route alongside the Busway instead) together with changes to the existing facilities at and on the approaches to the roundabout that may require widening of some approaches and pushing some cyclists facilities away from their existing alignment.	Option 3 - £48,000	Option 3 - £68,800
				For Option 2 and 3, the highway boundary will have to be ascertained to determine the extent of improvement works feasible and the amount of land to be purchased to facilitate the improvement.		

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Site ID	Site Name	Problem/Suggested cause of problem	Proposed measures	Comments	Proposed scheme cost	
					Lower limit	Upper limit
4	Chapel Viaduct Roundabout	Queues block back along Chapel Viaduct but also delay from Castle Street and straight on movement from Park Viaduct	AECOM proposal: Option 1 - Signalise roundabout Option 2 - Signalise roundabout, remove pedestrian underpass and provide at grade pedestrian crossing facilities Option 3 - Convert to signalised junction	Option 1 - This option is likely to improve capacity at the roundabout without requiring significant civil works. The existing pedestrian underpass will be retained under this option. Option 2 - Similar to Option 1 but involves removal of the pedestrian underpass to facilitate provision of an additional lane on the Park Viaduct approach. As part of this option, at grade pedestrian facilities will be provided to improve connectivity within the area. Option 3 - This option would involve significant earthworks and will require the removal of green space/trees within the existing roundabout. A number of benefits may be realised from this option including improved connectivity particularly for pedestrians and release of land for other development. In addition to these options, additional benefits may be achieved from implementing the proposed schemes at Junctions 5 and 18 and it may be appropriate to implement measures at these two junctions in advance of implementing changes to the Chapel Viaduct roundabout and to monitor the impact of the changes at junctions 5 and 18 on the operation of the Chapel Viaduct roundabout.	Option 1 - £68,000 Option 2 - £86,000 Option 3 - £1,253,000	Option 1 - £78,000 Option 2 - £103,800 Option 3 - £1,443,000

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Package 4

4.8. Table 5 contains locations that have not been reviewed by LBC. It details the proposals and associated costs for improving congestion and reducing delays at these locations.

Table 5 Proposed scheme costs and associated cost estimates

Site ID	Site Name	Problem/Suggested cause of problem	Proposed measures	Comments	Proposed scheme cost	
					Lower limit	Upper limit
5	Castle Street and Hibbert Street Junction	All arms delayed apart from Hibbert Street Westbound	Option 1 - Provide longer right turn lane along Castle Street. Option 2 - Divert traffic onto routes/junctions with spare or adequate capacity.	Option 1 - Due to built-up nature of area, there is little scope to significantly change/improve the junction layout. Some widening to provide a longer left turn lane may be possible along the northbound arm of Castle Street but this may require land take. Option 2 - Traffic management measures to divert traffic onto junctions and routes with more capacity may contribute to reducing delays at this junction.	Option 1 - £50,000	Option 1 - £70,500
8	Eaton Green Road and Frank Lester Way	Delay from Eaton Green Road Southbound	Option 1 - Remove roundabout and install signals.	Option 1 – In addition to improving capacity at the junction, this option also presents opportunities to provide pedestrian and cyclists' facilities at the junction.	Option 1 - £70,800	Option 1 - £80,120
9	Old Bedford Road and Barnfield Avenue	Barnfield Avenue movements delayed.	Option 1 - Provide additional approach lane on Barnfield Avenue.	Option 1 - There appears to be scope to widen the carriageway into the existing verge. The highway boundary needs to be ascertained if any private land take is required.	Option 1 - £36,000	Option 1 - £51,600

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Site ID	Site Name	Problem/Suggested cause of problem	Proposed measures	Comments	Proposed scheme cost	
					Lower limit	Upper limit
11	Eaton Green Road and Lalleford Road	Movements to Eaton Green Road South High V/C	Option 1 - Provide flares on Eaton Green Road approaches. Option 2 - Convert roundabout to signalised junction	Option 1 - There appears to be adequate land either side of Eaton Green Road to widen the approaches and provide entry flares (over approximately 15m distances). The highway boundary needs to be ascertained to determine the viability of this option. Option 2 - By signalising this junction there is opportunity to provide facilities for pedestrians and cyclists, which may otherwise not be possible at the existing mini-roundabout. This option may require carriageway widening (over a 30m distance) from the junction on Eaton Green Road. Again the highway boundary needs to be ascertained to establish the extent of widening that can be undertaken as part of any signals proposals.	Option 1 - £21,360 Option 2 - £82,720	Option 1 - £29,640 Option 2 - £105,280
13	Dunstable Road with Leagrave Road	Give way movement from Leagrave Road blocks back - delay (right turn) with high V/C on both movements	Option 1 - Provide additional approach lane for northbound traffic (right turn)	Option 1 - There appears to be scope to relocate the existing separation island southwards as well as reduce its size to provide an additional right turn lane (for northbound traffic) at the junction. Also, existing kerbside parking along the northern side of Dunstable Road, within close proximity to the junction, may have to be taken out to ensure two streams of traffic approach the junction over a longer distance. This option will involve kerb and signal works to realign the central island and reposition traffic signal equipment.	Option 1 - £87,680	Option 1 - £99,000
14	Old Bedford Road and Stockingstone Road	Old Bedford Road NB & Stockingstone Road EB all movements have delays	Option 1 - Remove verge and widen carriageway to provide 2 lanes on eastern arm over longer distance to junction. Widen carriageway and realign lane markings to provide 2 lanes on southern arm over longer distance to junction.	Option 1 - There appears to be scope to widen the carriageway along the western arm of Stockingstone Road over a longer distance. This can be achieved by removing the existing grass verge and/or narrowing the westbound lane. Along Old Bedford Road, there may be scope to improve capacity along the southern arm by narrowing the footway along the eastern side and realigning road markings to provide wider approach lanes. If the extent of queuing and delays are excessive then alternative options such as banning turning movements may have to be investigated.	Option 1 - £36,000	Option 1 - £51,600

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Site ID	Site Name	Problem/Suggested cause of problem	Proposed measures	Comments	Proposed scheme cost	
					Lower limit	Upper limit
18	Chapel Street and Windsor Street Junction	Chapel Street SB movements block back	Option 1 – Link signals at Chapel Street / Windsor Street and Castle Street / Hibbert Street junctions	Option 1 - Due to the built up nature of the area, there is limited scope to carry out any junction or lane widening works at this location. A review of the existing signals at along Windsor Street and Hibbert Street with the view to link them may provide some benefits.	£20,000	£50,000
23	Chapel Viaduct EB junction with Stuart Street	High V/C but traffic blocks back from junction	Option 1 - Signalise junction Option 2 - Minor traffic management measures - yellow box junction	Option 1 - Signalising this priority junction may improve capacity and performance. As part of this proposal, consideration should be given to the existing bus lane as well as movements in and out of Kings Street. Option 2 - Introduction of a yellow junction box may ensure that the junction is kept clear thus preventing blocking back along Stuart Street. **It should be noted that due to the complex layout of the existing junction, a more detailed assessment is required to develop and test options for this junction taking full account of the local network, routeings and constraints.**	Option 1 - £68,000 Option 2 - £1,000	Option 1 - £78,000 Option 2 - £5,000

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Site ID	Site Name	Problem/Suggested cause of problem	Proposed measures	Comments	Proposed scheme cost	
					Lower limit	Upper limit
25	Crossroad between Waller Road, Blundell Road, Marsh Road and Leagrave Road	V/C high on all approaches.	Option 1 - Kerb realignments to provide longer approach lanes on Leagrave Road.	Option 1 - Leagrave Road has adequate footway width to enable the left turn lane to be lengthened/widened (further southwards).	Option 1 - £30,000	Option 1 - £40,000
			Option 2 - Review kerbside restrictions along Blundell Road with a view to introduce 'At Anytime' waiting restrictions on approach to junction.	Option 2 - By extending 'At Anytime' waiting restrictions further down Blundell Road, full width of carriageway can be retained for traffic movement.	Option 2 - £1,000	Option 2 - £3,000
			Option 3 - Widen approach lanes along Waller Avenue.	Option 3 - There is adequate footway width to widen section of Waller Avenue between the rail bridge wall and the junction. The existing rail bridge prevents any improvement works to be undertaken over a longer distance on this arm of the junction.	Option 3 - £6,000	Option 3 - £8,600
26	Hitchin Road junction with Ramridge Road	Hitchin Road Southbound blocks back with high VC	Option 1 - Signalise Hitchin Road and Stockingstone Road junctions and convert Ramridge Road / Stockingstone Road junction to priority.	Both options will provide benefits for pedestrians and cyclists' by enabling safer facilities to be provided at the junctions when signals are introduced. Although the more expensive option, Option 2 is likely to provide the most benefits as linking signals will enable traffic to be dispersed in a more efficient manner.	Option 1 - £366,000	Option 1 - £468,000
			Option 2 - Signalise Hitchin Road & Stockingstone Road and Ramridge Road & Stockingham Road & link both sets of signals.	There appears to be adequate space within the existing carriageway to undertake both schemes hence it is not anticipated that any land take will be required.	Option 2 - £472,000	Option 2 - £584,000

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5. Summary and Way Forward

5.1. AECOM undertook transport modelling tests of the proposed Luton Local Plan which identified twenty-seven locations likely to experience significant delay and congestion within the network. Subsequently Luton Borough Council (LBC) requested further high-level engineering assessments to identify possible solutions and associated construction costs to improve these locations.

5.2. Table 2 and 3, contained in Section 4, lists various schemes due to be implemented that are likely to improve congestion at the sites identified from the transport modelling exercise. Table 4 discusses proposed schemes put forward by AECOM and specific limitations and opportunities identified by LBC in relation to each of these locations. The cost of implementing these schemes range from between approximately £300,000 and £2,650,000.

5.3. Table 5 outlines potential schemes that have not been previously reviewed by LBC and their corresponding construction cost estimates. If all of the suggested schemes were implemented the total cost would range between a lower limit of £690,000 and an upper limit of £1,200,000. Total cost for implementing these schemes would therefore be approximately £990,000 and £3,850,000.

5.4. Further investigation and design work is required, going forward, to assess the viability of each of the options outlined in this technical note. At this stage, following this 'desktop' assessment the solutions suggested offer no certainty that they can resolve the problems identified. Indeed the specific locations and junctions identified within this note may change as further information is refined.

5.5. It is recommended the proposed junction improvement options are incorporated into a further run of the transport model, to determine the effectiveness of the schemes to address the likely congestion at these locations. Furthermore, the scenario would also ascertain if as a result of additional capacity provided, other junctions come under pressure which currently have not been assessed.

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