Technical Note

AECOM

Project:	**Hertfordshire County Council Transport Planning Contract**	Job No:	**60265513**
Subject:	**Stevenage Local Plan Model Testing**		
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1.0 Introduction

AECOM was asked by Stevenage Borough Council (SBC) to look at future transport issues in the Borough resulting from a different proposals for the location of development in the future. The outcome of this testing will go forward and assist in the development of the Local Plan for the area. Specifically, the aim of this technical note is to identify the potential transport related issues that may arise as a result of the housing development proposals and provide sufficient mitigation proposals to alleviate the problems.

To inform the model testing the **S**tevenage and **H**itchin **U**TP **M**odel (SHUM) is being used. This model covers the whole of Stevenage Borough and the majority of the North Herts District around Hitchin, Letchworth and Baldock. For the purposes of this testing he impact of both development and highway mitigation proposals have been explored across the model area. The note then identifies, in a strategic context the mitigation that may be required as a result of the development located within Stevenage itself.

The development proposals identified two different housing development scenarios to be considered.

The two housing development scenarios, with the breakdown of the development components are:

Scenario 1: Stevenage 'Urban Capacity' (taken as scenario 4 from North Herts LDF Housing Assessment)

a. 6,000 dwellings South West Hitchin delivered by 2031 (as part of a 8,000 dwellings package)
b. 3,300 dwellings across many sites in North Herts District
c. 3,500 dwellings across many sites in Stevenage

Scenario 2: Stevenage 'Borough Capacity'

a. 6,000 dwellings South West Hitchin delivered by 2031 (as part of a 8,000 dwellings package)
b. 3,300 dwellings across many sites in North Herts District
c. 3,500 dwellings across many sites in Stevenage plus
d. 600 dwellings to the North of Stevenage (wholly within the Borough Boundary)
e. 1,200 dwellings West of Stevenage + 10,000m^2 of employment land (wholly within the Borough Boundary)

This technical note serves three key purposes:

- Firstly, to explain the stages undertaken during the forecasting of the highway model assignment including the development of the future year highway network and traffic demand, including the housing developments (***Section 2 to 4***).
- Secondly, to present details of potential transport issues on the highway network as a result of different housing development scenario proposals (***Section 5***).
- Thirdly, to discuss mitigation proposals, in response to the transport issues of the different housing development scenarios (***Section 6***).

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2.0 Background

A Stevenage and Hitchin Urban Transport Model (SHUM), covering Stevenage and some of the North Hertfordshire area (primarily Hitchin, with elements of Letchworth included) was developed by AECOM in 2009 and subsequently updated in October 2011 following a review and advice from the Highways Agency (HA). SHUM was developed to assist the preparation of the Hitchin and Stevenage Urban Transport Plans (UTP) and is validated to a 2008 base against observed traffic count data and journey times. The HA signed off the 2008 base year model (October 2011 version) on 8th December 2011.

It should be noted that the development that has taken place with the modelled study area between 2008 and 2011 has been incorporated within the model to ensure that it robustly reflects the today's base year situation. This therefore means there may appear to be slight discrepancies between modelled development figures and those numbers included in the Local Plan. Using SHUM in forecasting mode seeks to determine the impact on the future transport network as a consequence of shifting patterns of demand over time, and forms the basis of the forecasting and analysis of the housing development proposals.

The forecasting methodology for SHUM has been reviewed by the HA, who have provided advice on the approach and use of SHUM as a tool for forecasting. Where appropriate, this advice has been incorporated into this assessment. Details on the advice incorporated in this forecasting assessment are provided in the ***Appendix A***. The HA provided a letter (20/03/13) confirming they are content for the model to be used for development sifting, but that updates to the input forecasting data (EERM) would be required should the model be used for preferred options scenario testing.

For consistency with information previously provided as part of the North Herts consultation, the development log from this modelling exercise has been retained. A review of the development assumptions identified that there are some very minor discrepancies between what was assumed in the development log previously and what is now known to have been delivered or is likely to be delivered. These differences are not considered to make a material impact in the assignment of a strategic transport model such as SHUM. Retaining the same base assumptions across the Local Plan development testing for both Stevenage and North Herts will provide much more value in determining the highway impacts of development in the wider area.

3.0 Network Development

This section discusses the extent of the future year highway network, including constructed and committed infrastructure and anticipated network improvements associated with the developments.

Section 6 outlines the requirement and development of mitigation proposals to accommodate the future year growth.

As discussed, the basis for the model forecasting was SHUM, which covers North Hertfordshire and Stevenage, with the extent of the highway network shown in ***Figure 3.1***.

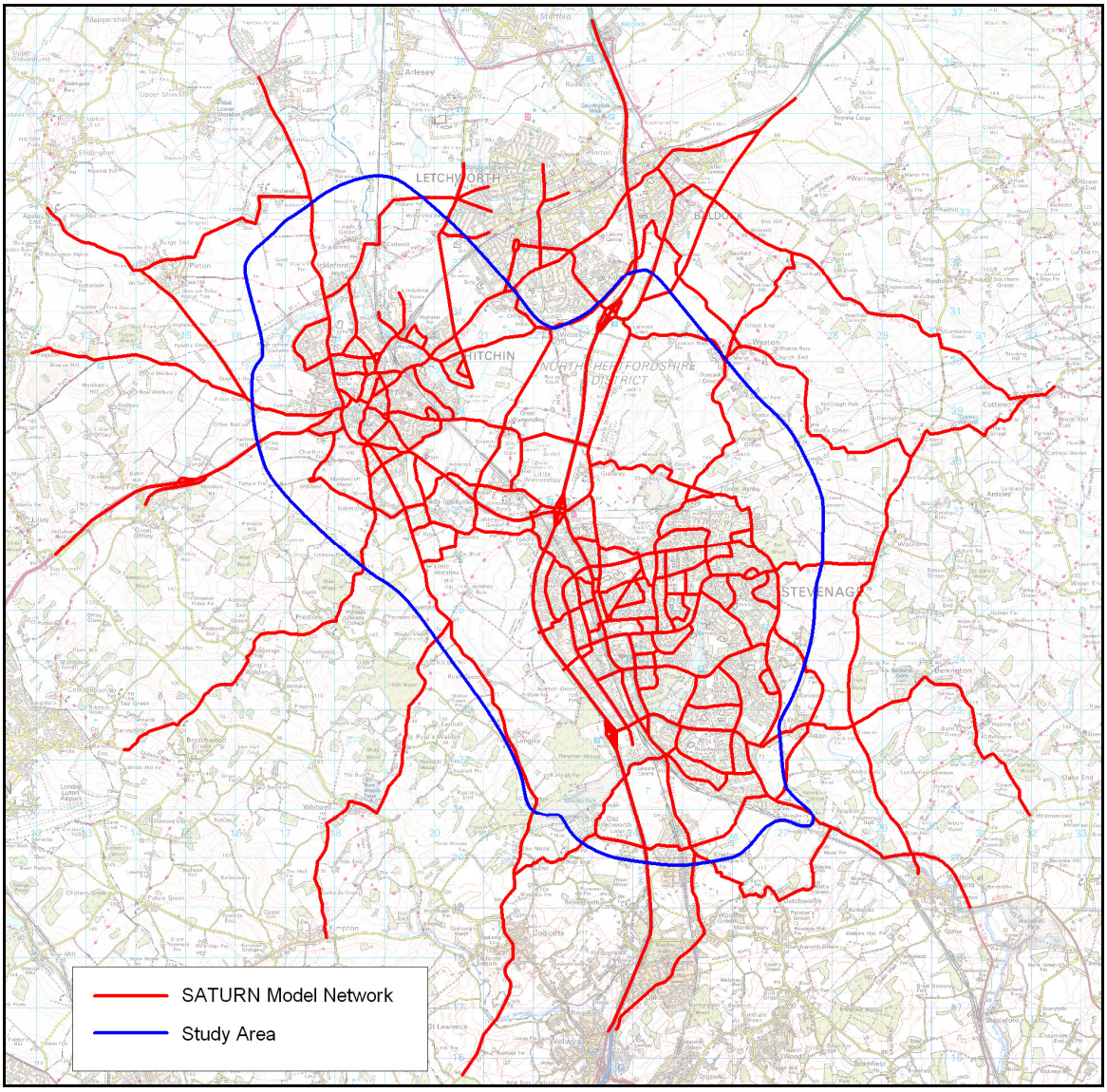
3.1 Future Year Do Minimum Highway Network

SHUM was validated to reflect the transport network operation in 2008. To provide a representative transport network for 2031, constructed and committed transport improvements in the study area were included. This resulted in the development of a do minimum network for 2031 which included the following improvements:

- Hitchin Payne's Park gyratory pedestrian crossing
- Glaxo Smith Kline junction improvements
- A1(M) Junction 7 signalised junctions
- A1(M) Junction 6 northbound all lane running, Welwyn, HA pinch point scheme.

The do minimum network formed the basis on which both future year scenario networks are developed.

Figure 3.1 SHUM Highway Network



3.2 Future Year Scenarios Highway Network

Both future year scenarios include the do minimum improvements. Each scenario then included additional network infrastructure specific to the identified housing development components to enable access to the sites.

These associated network infrastructure improvements are summarised in ***Table 3.1*** with the Component elements described in more detail below in ***sub-chapters***, ***3.2.1*** to ***3.2.2***. It is assumed that the Component infrastructure elements associated with a development is deliverable and this report does not provide any assessment of the costs or viability for the identified Component infrastructure.

Table 3.1 Future Year Scenarios – Associated Component Network Infrastructure

Scenario	South West Hitchin	West of Stevenage
1	✓	
2	✓	✓

3.2.4 South West Hitchin

A new South West bypass between A505 and A602 is assumed to be delivered with the South West Hitchin development. The new bypass will have connections to the existing highway network via at grade roundabouts at:

- A602 between the existing Chantry Lane underbridge and existing Blakemore End Road overbridge
- B656 between Sperberry Hill and Little Almshoe Road
- A505 at Carter's Lane.

For the housing development, multiple accesses are envisaged, with access represented in SHUM via:

- Pirton Road
- Charlton Road (at Brick Kiln Lane / Windmill Lane)
- Gosmore Road (Brick Kiln Lane)
- London Road
- Between Carter's Lane and the edge of the urban town to the East.

No direct access to the development is provided to the new bypass infrastructure.

3.2.5 West of Stevenage

The West of Stevenage development includes preliminary site access infrastructure.

3.26 North of Stevenage

The development in the North of Stevenage has no associated new highway infrastructure, the site is accessed directly from the existing highway network via the local roads of North Road and Rectory Lane.

4.0 Demand Development

An important part of forecasting the likely traffic conditions on the highway network includes understanding changes to travel demand. Demand changes are a reflection of changes in income, transport prices, demographics and land use changes. The methodology employed for developing the forecast demand matrices for the 2031 future year is discussed below. The assumptions associated with the future year demand and associated levels of development is included in ***Appendix C.***

The methodology can be broken down into four stages. Stage 1 of the process is the same, irrespective of the level of future year development. However, details of Stages 2 to 4 differ depending on the development scenario being tested.

- **Stage 1** – Development of background growth factors for internal to internal (within the modelled area) and internal to external trips. These factors were derived using the National Trip End

Model (NTEM) forecasts and TEMPRO. The latest version of the dataset, NTEM 6.2 was used in conjunction with the current version of TEMPRO 6.2. This ensured the forecasts benefit from nationally and locally derived growth projections in accordance with government guidance. For external to external movements, the East of England Regional Model (EERM) version 1.3 forecasts were used to provide growth factors. The growth factors were applied to the 2008 calibrated SHUM base year demand through a Furnessing process.

- **Stage 2** – Collection and assessment of development information in the area is undertaken to calculate the number of trips that specific developments can be expected to generate. These trips are then phased and allocated over the relevant model years, development scenarios and trip demand purposes.
- **Stage 3** – The trip distribution for the development trips is determined using a gravity model.
- **Stage 4** – The future background growth (Stage 1) and proposed development trips (Stage 2 and 3) are added to the base year demand and constrained to overall TEMPRO growth to produce final future year trip demand matrices.

Stages 1 to 3 above have been explained in more detail in ***Appendix B***. We have however summarised the outcome of the anticipated levels of growth between the Base Year of 2008 and the future year of 2031, for each scenario, ***Table 4.1***. This clearly shows that there is a growth in traffic levels across the model area of around 30% in 2031.

Table 4.1 Summary of growth in demand in the model area for each Scenario

Peak	Base Year (2008) Matrix Total	S1 2031	S2 2031
AM	40,001	51,570	52,217
% growth over base year	-	*29%*	*31%*
PM	38,624	50,220	50,870
% growth over base year	-	*30%*	*32%*

The anticipated level of demand differs slightly for each scenario because of different levels of housing development proposed.

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5.0 Scenario Testing

This section discusses the transport impact of the different housing development proposal scenarios. As discussed in ***Section 1***, there are two different development scenarios:

- Scenario 1: Stevenage Urban Capacity
- Scenario 2: Stevenage Borough Capacity

The housing development scenarios have been analysed to understand the development impact on the highway network. The analysis and modelling undertaken for the two land-use scenarios has shown that many of the issues are consistent between each situation, as particular pinch points on the network act as constraints to effective operation of the network. Whilst the scale of the problem becomes worse in a particular scenario, many of the locations where mitigation is required are the same in each.

In this round of modelling we have not included a comparative Do Minimum scenario as the purpose of the testing is to identify which of the 2 development scenarios would be best to take forward for further refinement and consideration. A Do Minimum scenario provides an indication of the future year situation if only the development is included that is committed or nearly committed to be delivered as well as any other background traffic growth associated with economic factors. In a previous round of modelling work as part of some of the North Herts Local Plan testing a Do Minimum scenario was developed which forms the basis for many of the schemes identified to mitigate the impacts from the development scenarios presented above. This used a previous version of the forecasting models before review by the HA. This does however provide a useful proxy for what might be required regardless of the Scenario's identified above being delivered. The cost associated with delivering the transport infrastructure required to deliver an indicative Do Minimum scenario is presented in ***Section 6.***

The diagram ***Figure 5.1*** identifies where the modelling has indicated that in 2031 there is a problem with network operation, which has been identified through modelling indicators which show there is still more than 100 vehicles queuing at the end of the AM or PM peak hour. There are a whole range of indicators that could be used, but queuing traffic at particular locations at the end of the modelled peak hour enables us to focus on the pinch points on the network and identify in more detail what the issues are.

This information is also shown in tabular form in ***Table 5.1***. The table, for each of the identified problem locations, cross-references against the land-use scenarios, provides information on when the problem occurs (i.e. morning peak, evening peak or both). The table indicates in all scenarios' there are operational issues at the same locations across the network and there is no difference in what is required between Scenario 1 and Scenario 2.

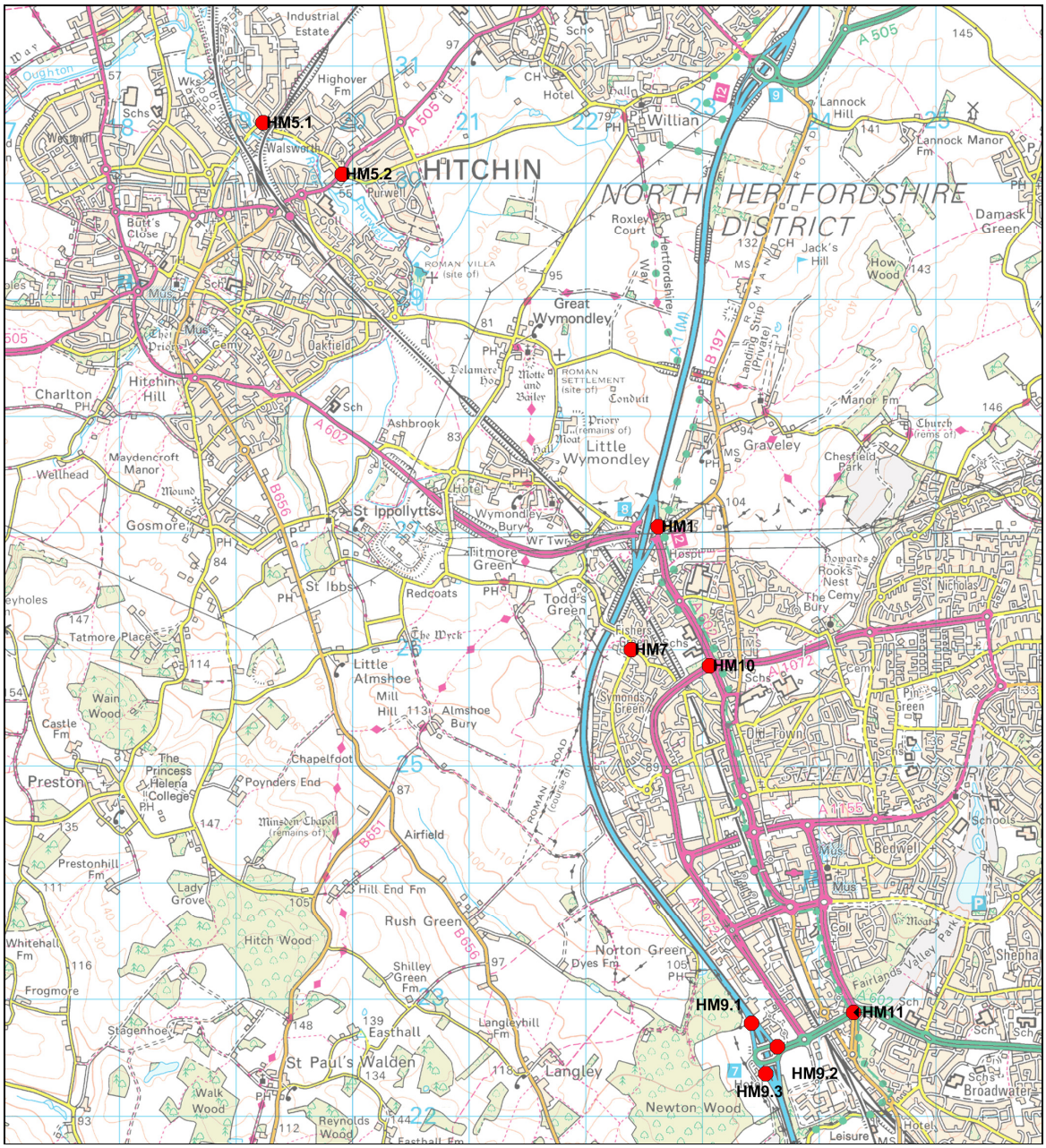
Table 5.1 Identified Problem Locations in 2031

Ref.	Problem Location	S1	S2	DM
HM1	A1(M) Junction 8 Roundabout (southbound offslip)	✓	✓	
HM5.1	Hitchin Industrial Area / Cadwell Lane	✓	✓	✓
HM5.2	A505 Cambridge Road / Woolgrove Road / Willian Road	✓	✓	
HM7	Fishers Green Road	✓	✓	✓
HM9.1	A1(M) Junction 7 Northbound Onslip	✓	✓	✓
HM9.2	A1(M) Junction 7 Roundabout (southbound offslip)	✓	✓	✓
HM9.3	A1(M) Junction 7 Northbound mainline (from Junction 6)	✓	✓	
HM10.1	A602 Hitchin Road / A1072 Gunnels Wood Road Roundabout (southbound approach)	✓	✓	
HM11.1	A602 Broadhall Way / A602 Monkswood Way (Westbound approach)	✓	✓	
HM11.2	A602 Broadhall Way / A602 Monkswood Way (Eastbound approach)	✓	✓	
✓	*Problem location in the morning peak only*			
✓	*Problem location in the evening peak only*			
✓	*Problem location in both morning and evening peak*			

As can be seen from the table above there is only provision for widening on the A1(M) between Junction 6 & 7 northbound (HM9.3). This is due to the fact that testing of a Do Minimum situation, where assumed national (TEMPRO) growth rates are applied, there is a significant amount of stress on the link capacity of the A1(M) between J6 – J8, suggesting that some form of widening or increase in carriageway capacity would be required. Given that this would be required regardless of the Local Plan growth proposals the requirement has not been included in the table above as it would be needed even if Local Plan proposals would not be required.

Appendix A outlines some the comments made by the Highways Agency when reviewing the forecasting process for the SHUM model – which had used the Do Minimum scenario for the assessment. This indicates that from the Highways Agency review of the model it is clear that the link section between J6 – J8 of the A1(M) is coming under significant pressure.

Figure 5.1 Problem locations in 2031 in the Local Plan Scenarios



6.0 Mitigation Testing

With the problem locations identified in 2031 for each land-use scenario, it is necessary to establish some mitigation proposals to address the problems and enable the growth to come forward. For each of the identified locations a mitigation proposal has been identified and tested within the model to establish whether it addresses the issues and importantly does not create a problem elsewhere. For each mitigation proposal, a scheme pro-forma has been developed to explain the issues that have been identified as a result of the growth and outline the mitigation proposals to address the problem. The scheme pro-formas are all presented in ***Appendix D***, but in summary they include the following proposals outlined in ***Table 6.1***.

Table 6.1 Summary of Mitigation Proposals

Ref.	Problem Location	Improvement
HM1	A1(M) Junction 8 Roundabout (southbound offslip)	Add an additional lane on the A1(M) slip road approach to make three lanes at the junction stopline.
HM5.1	Hitchin Industrial Area / Cadwell Lane	Connect Wilbury Way and Cadwell Lane to the north of the industrial area; Redesign Cadwell Lane junction movements
HM5.2	A505 Cambridge Road / Woolgrove Road / Willian Road	Implement a MOVA signal controlled system at the junction
HM7	Fishers Green Road	Add an additional southbound lane on the northern approach
HM9.1	A1(M) Junction 7 Northbound Onslip	Add an extra lane on the merge with the A1(M) using a tiger-tail
HM9.2	A1(M) Junction 7 Roundabout (Southbound Offslip)	Add an extra lane on the diverge from the A1(M) using a tiger-tail; Add an additional lane on the A1(M) slip road approach to make three lanes at the junction stopline; Change the lane definition at GSK junction to allow two lanes left / 2 lanes straight on
HM9.3	A1(M) Junction 7 Northbound Mainline and Offslip	Extend the 3 lane carriageway up to Junction 7; Dedicated offslip diverge at Junction 7. This is achieved through the utilisation of the existing hard shoulder as an operating lane.
HM10.1	A602 Hitchin Road / A1072 Gunnels Wood Road (southbound approach)	Widen the southbound approach to 3 lanes at the junction stop line; Implement a MOVA signal control system.
HM11.1	A602 Broadhall Way / A602 Monkswood Way (Westbound approach)	Implement a MOVA signal control system to control the tidal demand. Due to the physical constraints of the junction an additional lane at stop line would not be feasible.
HM11.2	A602 Broadhall Way / A602 Monkswood Way (Eastbound approach)	Implement a MOVA signal control system to control the tidal demand.

6.1 Mitigation Scheme Cost Estimates

A costing exercise has been undertaken for the mitigation proposals, but these can only be considered as preliminary designs and estimates at this stage, suitable to inform the development of the Local Plan and the associated Infrastructure Delivery Plan. We have included a caveat in association with these cost estimates which should be considered when interpreting the estimates, which can be found in ***Appendix E.***

The costs associated with the mitigation proposals that have been identified are summarised in ***Table 6.2***.

Table 6.2 Scheme Costing

Ref.	Mitigation Scheme Location	Cost (£)
DM	Schemes identified for the Do Minimum (Previous modeling) HM2. HM3, HM4, HM5.1, HM6, HM6, HM7, HM8, HM9.1 & HM9.2	**25,618,000**
HM1	A1(M) Junction 8 Roundabout (southbound offslip)	386,000
HM5.2	A505 Cambridge Road / Woolgrove Road / Willian Road	323,000
HM9.3	A1(M) Junction 7 Northbound Mainline and Offslip	20,000,000[1]
HM10.1	A602 Hitchin Road / A1072 Gunnels Wood Road (southbound approach)	240,000
	Hitchin Southern Bypass	38,000,000
HM11	A602 Broadhall Way / A602 Monkswood Way	323,000

From the information we have provided in ***Table 5.1,*** we have identified the costs associated with each of the land-use scenarios in ***Table 6.3***. It should be noted that given the high cost associated with 'mitigation scheme 9.3 - A1(M) Junction 7 Northbound Mainline and Offslip' the total land use scenario costs have been presented with and without the cost of this scheme. This scheme is required in each of the scenario's and given the fact the cost is estimated at being close to £20m it significantly increases the mitigation costs associated with all schemes. The total costs for providing an additional lane on the A1 (M) between Junctions 6 & 7 has been significantly reduced from the preliminary estimates. This cost saving is achieved through the optimisation of lane widths and the adoption of the existing hard shoulder as an operating lane.

We have also included the cost associated with delivering the schemes that we had identified in the previous round of modelling for the Do Minimum scenario. This only provides a means of comparison and gives an indication of the level of mitigation that might be required even if the development doesn't go ahead. Only mitigation schemes HM1, HM5.2, HM9.3, HM10.1 and HM11 are not required in the Do Minimum scenario, meaning that (excluding Hard Shoulder running – HM9.3 and the Hitchin Southern Bypass) only an additional £0.949m would need to be spent for the mitigation scenarios associated with the Local Plan (not including access requirements for Stevenage West). It should however be stated that by providing the schemes as part of the Do Minimum means that the additional capacity is available in the network which can be used by trips associated with the Local Plan development – but the Local Plan developments themselves very much contribute to the need for the schemes.

Table 6.3 Summary of Cost per Land Use Scenario

Land Use Scenario		Total Cost (£) – excluding hard shoulder running (J6-J7)	Total Cost (£) – including hard shoulder running (J6-J7)
Do Minimum scenario - indicative		25,618,000	25,618,000
Scenario 1 & 2	with bypass costs	38,949,000	68,949,000
	without bypass costs	949,000	20,949,000

7.0 Summary

The assessment of the 2 different land-use scenarios in 2031, highlights that there will be highway impacts across the network when the developments are in place. However, this assessment does not specifically identify the highways impacts that occur as a direct result of the developments, or the

[1] Cost provided by Stevenage Borough Council

dependency of a development on the provision of a transport intervention. This assessment provides a broad overview of potential problem locations identified in the future year of 2031, when specific housing development scenarios are in place.

The transport modelling undertaken, and associated analysis presented in the this note indicates that the same highway mitigation is required in both scenarios. There are a number of highway infrastructure requirements required in association with the Do Minimum scenario, i.e. without the specific Local Plan housing allocations in place. Implementing these Do Minimum scenarios provides more capacity on the network, which is then used by the development allocations identified in the 2 scenarios – although further mitigation is required on top of this.

As discussed this assessment, provides a broad overview of potential problem locations in the future, if particular land-use development scenarios are implemented. Any further assessment, relating to a particular scenario or preferred scenario, would require further testing to fully understand the potential of any transport intervention(s), relating to a land-use scenario, or individual development components. For a development scenario, this would involve comparing the development scenario against a do minimum situation within the new forecast year models and without any form of transport intervention. This would assist in identifying if a housing development is dependent on a transport intervention, and would require defining the dependency of the new housing on some form of transport intervention.

Appendix A – Highways Agency Review Of SHUM Forecasting Methodology July 2012

AECOM has undertaken a review of the ***Stevenage and Hitchin Urban Transport Plan Model (SHUM) Forecasting Report – July 2012***, on behalf of the Highways Agency (HA). This report details the forecasting procedure and reference case models for 2021 and 2031 using SHUM. The purpose of the review was to assess the model's suitability for predicting future year traffic conditions on the A1(M) and its ability to respond plausibly to additional development demand.

AECOM produced a technical note, *TN - SHUM_Forecast_Technical Note_2012-10-19,* detailing their findings and advice on the process. In response to the HA review, AECOM, acting on behalf of Hertfordshire County Council, have provided comments and actions for any future work using SHUM. The comments and actions detailed in this Appendix, relate to the key points identified in the HA review for each section.

Forecast Growth (Background Growth and Committed Developments)

Key points identified:

- The source of the income and fuel adjustment factors used for background car growth has not been provided. **Likely consequence: LOW**;

Response:
The source of the income and fuel adjustment factors used for background car growth is TAG Unit 3.5.12, April 2009, Table 1. This is the current version of the guidance.

- NTM 2009 data have been used to growth freight trips instead of NTM 2011 data; this will result in fewer LGV trips and slightly more HGV trips than current guidance. **Likely impact: LOW to MEDIUM**.

Response:
*It is acknowledged that NTM 2011 data is available for use. This data has been checked and incorporated into the forecasting process. This data will be used to provide freight growth factors for all subsequent future work using SHUM, including this assessment. The impact of the change from NTM 2009 to NTM 2011 data is shown in **Table A.1** below. The impact of using NTM 2011 data is that a higher level of growth for both LGV and HGV is forecast (by 2031).*

Table A.1 NTM Freight Growth Forecast

Forecast	NTM Forecast		Data Source
	LGV	HGV	
2008 – 2031	*1.656*	*1.217*	*NTM 2009*
2008 – 2031	1.771	1.265	NTM 2011

- Out-dated EERM1.3 forecasts have been used for external growth – these include out-dated network scheme assumptions and demand forecasts that could affect regional strategic routing, possibly on the A1(M). **Likely impact: LOW to MEDIUM**.

Response:
The latest available EERM forecast for 2021 and 2031 has been used in the process. This latest available forecast is EERM 1.3. It is noted that the current model version is EERM 3.0. However, no forecasts, for the projected future years as required in SHUM are available using this version. Any future assessment, assuming that time and budget allows will commission and use future year forecasts from the EERM3.0 platform.

- The furness procedure employed to produce the background growth matrices has not been detailed sufficiently. The number of iterations undertaken by the process should be specified. **Likely impact: LOW**.

Response:
The furness procedure to produce background growth demand, is undertaken using the modelling software package PTV VISUM 12.0. This software allows doubly constrained (multi-procedure) matrices to be derived. For more information on the process, the PTV VISUM 12.0, November 2011 manual, Chapter 3.5.14.3 should be referred to.

Committed Development Growth

The zone allocation for committed developments in SHUM was not provided in the SHUM Forecasting Report – July 2012. This can be included in any revised version of the report. Any future assessment using SHUM will detail the respective SHUM zone and identified development. For this assessment, this is shown in ***Appendix C****.*

Specific Development Growth

Key points identified:

- Car trip segmentation of new developments, in the case of 'Retail' sites *(in the Stevenage urban area)*, has been based on model zones where the predominant land-use in the base-year model does not appear to be for retail activity. This will affect the car trip segmentation of demand to/from these zones. **Likely impact: LOW;**

Response:
The car trip segmentation for the 'retail' sites, within the Stevenage urban area has been reviewed. It is agreed that this segmentation does not reflect retail activity as realistically as possible. Therefore, the model zones used to reflect the 'retail' sites has been revised, as shown in ***Table A.2****. The new demand segment proportions for each car user class, as a result of redefining the representative zones is shown in* ***Table A.3****. The new Retail – Stevenage segmentation and trip proportions will be used for all future assessments using SHUM, including this assessment.*

Table A.2 'Typical' Land Use Development Zones

Land Use	Previous Land Use Segmentation		Revised Land Use Segmentation	
	SHUM Zone	SHUM Location	SHUM Zone	SHUM Location
Retail Stevenage	*3122*	*Town Centre APP - Commercial*	3109	Town Centre AAP - Short Stay Parking
	3112	*Town Centre AAP - Leisure*	3118	Old Town AAP - Site 1 / 3 / 4
	3128	*Census Zone*	3124	Roaring Meg Retail Park
	2101	*Census Zone*	3126	Roebuck Retail Park
	3101	*Pin Green Industrial Estate*	3162	Town Centre AAP - Station Parking

Table A.3 **Average Demand Segment Proportion Splits**

Retail Stevenage		HBW		HBE		HBO		NHBO		EB	
		Dest.	Orig.	Dest.	Orig.	Dest.	Orig.	Dest.	Orig.	Dest.	Orig.
AM	*Previous*	*0.62*	*0.53*			*0.31*	*0.18*	*0.07*	*0.29*		
	Revised	0.54	0.31			0.36	0.19	0.10	0.50		
PM	*Previous*	*0.37*	*0.40*			*0.43*	*0.49*	*0.20*	*0.11*		
	Revised	0.14	0.38			0.64	0.40	0.21	0.22		

- The gravity model is based on the base year trip length distribution profile, and as such forecast year development trips are calibrated assuming no change in travel costs between

base and future years, which is unlikely. This will affect the non-development trip ends. **Likely impact: LOW**.

Response:
The gravity model is based on base year costs because there is a need to calibrate the gravity model against observed and known data. For this reason, the observed and known base year conditions are reflected by using the current (base year) costs in the gravity model process. It is likely that the impact of using the observed base year costs in the process would be minimal on any future year forecast, as only a small number of sites use the gravity model for the trip distribution. The observed base conditions are used as the basis for the gravity model, because they are known. It is not possible to use future year costs in the gravity model process, without creating a gravity model first to define the future year costs. This paradox means that the only possible way to form a gravity model is to base it on known base year conditions and costs.

- It is unclear whether or not separate gravity models exist for separate car journey purposes – this could result in different average trip lengths by different purpose applications not being represented within the model. **Likely impact: LOW;**

Response:
A separate gravity model has been developed for origins and destinations, for a single car vehicle class. The single car vehicle class sum's all the car user classes (Home Based Work; Home Based Education; Home Based Other; Non Home Based other; Employers Business). It is accepted that a single gravity model for each car user class, per origin and destination would be preferable. However, the overall impact of using a single vehicle class gravity model to determine the distribution for different user classes is minimal.

- The average trip length distribution profiles are only provided for the overall matrix and not the zones which previously had no observed trip distribution and require the use of the gravity model for future year distributions. This would be required to fully assess whether sensible distributions have been applied to the new developments. **Likely impact: MEDIUM to HIGH**.

Response:
*The average trip length distribution for the development trips that use the gravity model to determine their trip distribution can be provided. This information has been provided for this assessment in **Appendix B**. This information shows that the distribution is within the acceptable limits of the base trip length.*
The trip length distribution profile could also be provided for the development trips which use the gravity model, to provide further confidence in the forecasting process. Analysis of the information relating to this assessment highlights that the trip length distribution is within acceptable limits, providing confidence in the use of the gravity model for future trip distributions.

Forecast Model Outputs

Key points identified:

- The A1(M) has been assumed to remain as D2M standard between Junctions 6-8 in both directions. Whilst this is the current funding position, it is possible that 'pinch-point' funding may be granted for schemes at Junctions 6 (Northbound merge) and Junctions 7 (southern slips). If this is the case, then any future model updates will need to consider the schemes. **Likely consequence: LOW**;

Response:
*Since the **Forecasting Report, July 2012** was written, the Department for Transport (DfT), have announced £170 million of funding for pinch point schemes across its highway network. This was announced on 8th October 2012. This includes the pinch point scheme at A1(M) Junction 6, northbound all lane running, Welwyn. Whilst Junction 6 is not explicitly modelled within SHUM, it is acknowledged that the A1(M) mainline extends all the way south of Stevenage to this location. As such, the detail at the junction is not represented but the 3 lane attributes as far as Potters Heath overbridge in the northbound direction, with a resulting lane-drop to D2M standard at this location is included. This will be included in all future assessments using SHUM, including this assessment.*

The possible pinch-point scheme at A1(M) Junction 7, was originally being taken forward by the HA for inclusion in the third tranche of Pinch-Point funding to be decided in December 2012. However, due to the associated costs and timescales involved it is unlikely that this scheme will be able to be implemented by the March 2015 date required and as such is unlikely to be taken forward in the near-to-medium term. The HA acknowledged that the current position for this improvement, in relation to SHUM, is not to include this scheme within the SHUM forecasts. However, it would be worthwhile bearing the scheme in-mind if any model forecasts identify any requirements for mitigation at Junction 7.

- Model results show that sections of the A1(M) between junctions 6-7 and 7-8 demonstrate significant stress by 2021, with junctions 6-7 operating at capacity in both directions across all time periods, and junctions 7-8 operating at capacity in the peak flow direction in the AM and PM peaks. These modelled scenarios contain only committed development growth, and A1(M) performance will therefore likely worsen further when considering proposed future developments (e.g. Local Plan implementation) in the modelled area. **Likely consequence: MEDIUM to HIGH**;

Response:
*This is a comment relating to the performance of the model, and highway network in the future years. The scope of the **Forecasting Report** was to provide a robust forecasting methodology to enable the forecasting of future year demand. The **Forecasting Report** does not cover and provide any comments on the potential impacts, if any, that SHUM forecasts in the future.*
Any future assessment using SHUM (i.e. Local Plan assessment) would cover this, looking at the likely highway impacts in the future. This is not covered by the Forecasting Report.

- The proposed A602 junction improvement scheme associated with the Glaxo Smithkline facility in Stevenage is shown to cause blocking back in the morning peak hour which causes delays where the southbound off-slip meets the gyratory at junction 7. This blocking back inhibits the operation of the gyratory at this location, but the model does not show any associated blocking back to the A1(M) mainline. **Likely impact: MEDIUM**

Response:
*This is a comment relating to the performance of the model, and highway network in the future years. The scope of the Forecasting Report was to provide a robust forecasting methodology to enable the forecasting of future year demand. The **Forecasting Report** does not cover and provide any comments on the potential impacts, if any, that SHUM forecasts in the future.*

- The 10% demand uplift sensitivity test has demonstrated decreases in northbound traffic on from junctions 7 onwards, due to a decrease in flow from its northbound on-slip as traffic primarily from Gunnel's Wood Road avoids the Glaxo SmithKline junction to the south. This demonstrates that the junction could potentially be affected by development above the committed scenario. **Likely consequence: MEDIUM to HIGH**.

Response:
This is a comment relating to the performance of the model, and highway network in the future years. The scope of the Forecasting Report was to provide a robust forecasting methodology to enable the forecasting of future year demand. The Forecasting Report does not cover and provide any comments on the potential impacts, if any, that SHUM forecasts in the future.
Any future assessment using SHUM (i.e. Local Plan assessment) would cover this, looking at the likely highway impacts in the future. This is not covered by the Forecasting Report.

Appendix B – Development of Future Year Growth Assumptions

B.1 Stage 1 – Background Growth

B.1.1 Car Growth

Background growth is the growth in trips occurring from existing land uses and is primarily due to economic factors reflecting the fact that, over time, people become better off, car ownership increases and trip making increases. The converse of this can also be true as trip making can be seen to decline if people are considered to be getting worse off or car ownership is falling. The TEMPRO factors are used to derive background growth for all the car journey purposes was based on NTEM 6.2 forecasts and were applied to all trips with an origin and/or destination within the study area. The background growth factors were adjusted by fuel and income factors, accordingly to current guidance. The fuel and income factors used were taken from TAG Unit 3.5.12 April 2009, Table 1. The factors applied to car driver trip ends are given in the ***Table B.1***. This process is appropriate as it omits the potential for double counting the growth due to committed developments.

Table B.1 Car Background Growth Factors 2008 – 2031

Area	AM Peak		Inter Peak		PM Peak	
	Origin	Destination	Origin	Destination	Origin	Destination
Hitchin	1.103	1.247	1.227	1.138	1.103	1.247
Stevenage	1.077	1.220	1.197	1.109	1.077	1.220
Buntingford	1.107	1.228	1.214	1.139	1.107	1.228
Codicote	1.094	1.227	1.210	1.125	1.094	1.227
Letchworth	1.060	1.214	1.186	1.090	1.060	1.214
Knebworth	1.088	1.223	1.205	1.116	1.088	1.223
Welwyn North	1.216	1.240	1.235	1.218	1.216	1.240

B.1.2 LGV and HGV Growth

Background growth for LGV and HGV demand was taken directly from the NTM 2011 forecasts. These forecasts do not provide a time of day or origin/destination split, only yearly growth factors. The factors used are shown in ***Table B.2***.

Table B.2 NTM Growth Forecast

Forecast	NTM Forecast	
	LGV	HGV
2008 – 2031	1.771	1.265

B.1.3 External to External Growth

In regards to longer distance external to external trips, the strategic EERM model was used to provide the background growth as this model reflects the strategic level of trip making across the study area. EERM is the parent strategic model from which a cordon was taken for the SHUM base year models. EERM has been validated to a 2008 base year and has future forecast years for 2031.

It is understood that there is an EERM version 3.0 available, however due to time constraints it was not possible to create a 2031 forecast from this version. Instead, the latest available 2031 EERM version 1.3 assignment was used.

The only issue that was identified in using EERM is that it has different car demand trip matrix segmentation to that used in the SHUM. To overcome this, one generic set of external growth factors was extracted from EERM for all car purposes along with separate LGV and HGV factors.

B.1.4 Background Growth Furnessing

The trip end growth factors generated were applied to the SHUM base year matrices using a Furnessing process to produce background growth forecast year matrices. The matrices were furnessed using a matrix manipulation package, MUULI in VISUM software. The matrices were furnessed on the criteria of the 'doubly constrained' and the 'mean (average)'. These criteria ensure the balancing of the origin and destination growth factors to a mean average, whilst maintaining an overall constraint to the level of growth expected in the area.

B.2 Stage 2 – Development Growth

B.2.1 Development Proposals

The proposed developments for each scenario were identified and the trip volumes that were likely to be produced from each development calculated. A definitive list of developments, their size, location and year of implementation was derived and is shown in the ***Appendix C***. Do Minimum development was included in both development scenarios. This represented known, committed potential future developments in Stevenage Borough, along with employment development across the study area. The difference between the scenarios is then the amount of additional Local Plan housing related development proposed.

B.2.2 Trip Rate Generation

Trip rates were used to calculate the number of trips each development proposal would generate and attract, or in some instances for developments which replace existing development to determine the existing trip generation for the purpose of removing the existing trips.

There were no agreed trip rates for the study area, therefore unless specified in a development Traffic Assessment (TA), trips rates were derived using TRICS (an industry standard database for development trip generation and analysis). TRICS produces average trip rates from available data, the more detailed the input survey information, the more specific the trip rate.

Vehicle trip rates were extracted for the three modelled time periods (08:00-09:00; average hour between 10:00-16:00 and 17:00-18:00). For the majority of land uses, there were no trip rates available at the Hertfordshire level so rates were extracted for the South East region. This region excludes Greater London which has a distinctly different trip pattern. There were some development locations where the specific employment use was not stated, nor available. In this instance, the floor space was split between office (B1), industrial (B2) and warehouse (B8).

The trip rates adopted are given in ***Table B.3***. In some instances, trip rates were extracted for specific known developments, whether new or being replaced, which are shown in ***Table B.4***.

For consistency generic trip rates have been applied to the West of Stevenage development for this assessment therefore the total trips will differ slightly to those used in the Capita Symonds Assessment.

Table B.3 Generic Trip Rates (TRICS)

Development Type	TRICS Use	AM Peak		Inter Peak		PM Peak	
		Arr.	Dep.	Arr.	Dep.	Arr.	Dep.
Education (per pupil)	Primary	0.424	0.264	0.085	0.096	0.000	0.009
	Secondary	0.228	0.163	0.035	0.042	0.019	0.036
	College/University	0.094	0.031	0.025	0.028	0.024	0.043
Housing (per dwelling)	Private	0.106	0.366	0.119	0.125	0.293	0.153
	Non Private	0.058	0.223	0.137	0.135	0.290	0.168
	Private/Non Private	0.088	0.307	0.115	0.121	0.289	0.126
Employment (per 100 sq. m)	B1 – Office	1.211	0.132	0.178	0.191	0.104	1.052
	B1 – Business Park	1.356	0.314	0.311	0.344	0.199	1.103
	B2 – Industrial Unit	0.322	0.083	0.173	0.194	0.035	0.287
	B8 - Warehouse	0.098	0.051	0.090	0.094	0.036	0.092
Leisure (per 100 sq. m)	Leisure Centre	0.599	0.369	0.558	0.534	1.691	1.106
Primary Care Centre (per 100 sq.m)	GP Surgery	6.397	2.742	4.816	4.874	3.046	4.439

Table B.4 Specific Development Trip Rates (TRICS)

Development Type	TRICS Use	AM Peak		Inter Peak		PM Peak	
		Arr.	Dep.	Arr.	Dep.	Arr.	Dep.
Retail Park (per 100 sq. m)	Excluding Food	0.734	0.202	3.994	3.804	2.493	3.512
Retail (per 100 sq. m)	Garden Centre	0.199	0.052	0.754	0.731	0.155	0.313
	Local Centre Shops	4.591	4.476	5.152	5.120	4.973	5.126
	Non-food Superstore *(Matalan site)*	0.400	0.067	2.428	2.217	0.767	1.833
	DIY Centre *(B&Q site)*	2.520	2.033	8.252	8.130	3.279	4.661
Employment (per 100 sq. m)	Parcel Distribution Centre *(Hitchin Post Office/Sorting Office)*	0.600	1.282	0.508	0.546	1.152	1.152

B.3 Stage 3 – Gravity Model

B.3.1 Existing Trip Distribution

The development trips at this stage of the process are zone trip ends, having an origin or destination at the development site location but the other end of each trip is still to be defined. Where development trips are identified in zones which contain an existing observed base year trip distribution, the zone trip end is distributed based on the observed distribution. However, in locations where no observed trip distribution exists, the matrix trip cells, and therefore distribution of the trips, are filled by means of a standard gravity model.

B.3.2 Gravity Model

A gravity model distributes trip ends across the entire network according to weightings based upon the 'population' of different zones and relative attractiveness between each zone pair. In this instance, the attractiveness is based on trip volume and the time between each zone pair. Zone to zone travel times were obtained from skimming the base year highway network for the car vehicle class in the transport model, whilst the populations at both zones were defined using the existing car vehicle class trip demand.

Gravity Model calculation

$$Tij = K \frac{Po\ Pd}{Dij}$$

Where:

T_{ij} = *Trips produced at I and attracted at J*

K = Constant (calibration factor)

P_o = *Total size of Origin*

P_d = *Total size of Destination*

D_{ij} = *Time for Origin – Destination pair*

Before the gravity model was used for predicting the future travel demand, it was calibrated by adjusting the constant (K) to replicate the known base year trip distribution. Once the gravity model was calibrated, the trip distributions for each unknown development distribution were derived using the gravity model. This trip distribution matrix was then applied to the individual car demand segments for each development scenario for the future years.

B.4 Stage 4 – Future Year Demand

The final stage of the matrix demand process is to add all of the components of the future year matrix build demand process to create the final future year matrices. This consisted of adding the net background growth and development trips to the base year demand. The final demand has not been constrained to regional growth forecasts as this assessment was to understand the impact of future development forecasts, so would ultimately inform and update the current growth forecasts. The final gross matrix totals are given in ***Table B.5*** and ***B.6***.

Table B.5 2031 AM Peak Demand Matrices (Vehicles)

Journey Purpose	Scenario 1	Scenario 2
Home Based Work	29,660	30,106
Home Based Education	2,689	2,774
Home Based Other	7,747	7,831
Non Home Based	2,643	2,664
Employers Business	1,882	1,895
LGV	4,565	4,565
HGV	2,382	2,382
Total	**51,569**	**522,17**

Table B.6 2031 PM Peak Demand Matrices (Vehicles)

Journey Purpose	Scenario 1	Scenario 2
Home Based Work	21,274	21,590
Home Based Education	1,399	1,419
Home Based Other	14,369	14,579
Non Home Based	5,835	5,924
Employers Business	1,666	1,680
LGV	4,235	4,235
HGV	1,441	1,441
Total	**50,220**	**50868**

Appendix C – List of developments included within the modelling

Site Location/Name	Dwellings	Use	Floorspace (Sq.ms)	Scenario	SHUM Zone
Stevenage Housing					
11 Walkern Road (Pond Close), Stevenage	12			**S1/S2**	3120
Heckford Norton, 29-29a High Street, Stevenage	6			**S1/S2**	3120
172 & R/O 170 Fairview Road, Stevenage	12			**S1/S2**	3119
Former Mastercare Service & Distribution, Wedgwood Way, Stevenage	184			**S1/S2**	3101
32 - 34 + 32a Queensway, Stevenage	5			**S1/S2**	3122
Land Off Hertford Road, Stevenage, SG2 8SE	100			**S1/S2**	2105
Land Off Edmonds Drive, Stevenage, SG2 9TJ	88			**S1/S2**	3143
Land West Of Bragbury Lane	5			**S1/S2**	2101
12 North Road	6			**S1/S2**	3134
Pond Close	21			**S1/S2**	3120
Archer Road Neighbourhood Centre	25			**S1/S2**	3131
Land At Vardon Road	29			**S1/S2**	3131
Shephall View	30			**S1/S2**	2125
Ferrier Road	40			**S1/S2**	2112
Land South Of A602(pt)	300			**S1/S2**	2101
Land at Todds Green	3			**S1/S2**	2128
Amenity Space	4			**S1/S2**	3121
	11			**S1/S2**	2130
	11			**S1/S2**	3118
Elmes Arcade	12			**S1/S2**	3120
Used Car Lot	13			**S1/S2**	3151
Scout Hut, Drakes Dr	14			**S1/S2**	3135
Kenilworth Close NC	20			**S1/S2**	2102
Esso Garage	22			**S1/S2**	3121
Snooker Club	22			**S1/S2**	3118
Broad Hall Centre and adjacent amenity land	32			**S1/S2**	3145
Thomas Alleyne	35			**S1/S2**	3120
Ambulance and Fire Station	44			**S1/S2**	3108
The Glebe NC	45			**S1/S2**	2113
Southern Car Park	46			**S1/S2**	3120
Vincent Court+	50			**S1/S2**	2128
Chells Manor NC	65			**S1/S2**	2115
Canterbury Way NC	72			**S1/S2**	2121
The Hyde NC	73			**S1/S2**	3144
Collenswood School	89			**S1/S2**	3142
Saffron Ground	89			**S1/S2**	3120
Lonsdale School	92			**S1/S2**	3130
Land Off A602	100			**S1/S2**	2101
Longfield Fire and Rescue Centre	107			**S1/S2**	3160
Antelope House	121			**S1/S2**	3120
Town Centre Regen. Site	125			**S1/S2**	3122
The Valley School	130			**S1/S2**	3148
The Forum Car Park	150			**S1/S2**	3109
The Forum Retail Units	150			**S1/S2**	3109
Southgate Site	150			**S1/S2**	3122

Site Location/Name	Dwellings	Use	Floorspace (Sq.ms)	Scenario	SHUM Zone
Central Library & PCT Services	150			S1/S2	3122
The Oval NC	169			S1/S2	2117
Silkin Plaza	350			S1/S2	3112
A1		A1	114	S1/S2	3120
B1		B1	46679	S1/S2	3117
B1		B1	10059	S1/S2	3113
A1		A1	4928	S1/S2	3133
B1		B1	1586	S1/S2	3116
A1		A1	3289	S1/S2	3133
B8		B8	2083	S1/S2	3114
A1		A1	3659	S1/S2	3125
A1		A1	697	S1/S2	3124
B2		B2	854	S1/S2	3114
B8		B8	855	S1/S2	3114
B1		B1	700	S1/S2	1301
B2		B2	2219	S1/S2	4315
B1		B1	-1249	S1/S2	2307
B2		B2	-624	S1/S2	2307
A1		A1	4659	S1/S2	2307
A1		A1	2201	S1/S2	2307
B1		B1	109	S1/S2	4304
B1		B1	2180	S1/S2	2307
B1		B1	88	S1/S2	4315
B1		B1	55	S1/S2	4306
A4		A4	33	S1/S2	4310
A3		A3	120	S1/S2	2307
A1		A1	441	S1/S2	4315
B8		B8	42	S1/S2	4315
B1		B1	95	S1/S2	4315
B1		B1	106	S1/S2	4315
B2		B2	106	S1/S2	4315
B8		B8	106	S1/S2	4315
B2		B2	983	S1/S2	2313
B2		B2	99	S1/S2	4315
B2		B2	431	S1/S2	4315
B2		B2	200	S1/S2	3219
B1		B1	862	S1/S2	4315
A4		A4	217	S1/S2	3314
B1		B1	691	S1/S2	3217
B1		B1	170	S1/S2	3305
B1		B1	475	S1/S2	3218
B2		B2	475	S1/S2	3218
B8		B8	475	S1/S2	3218
B8		B8	751	S1/S2	2310
B8		B8	119	S1/S2	2310
B2		B2	572	S1/S2	2313
B8		B8	500	S1/S2	2313
B1		B1	100	S1/S2	2206
A4		A4	47	S1/S2	4315
B1		B1	34	S1/S2	4315
Meeting House, Meeting House Lane	3.5			S1/S2	4315
31a Hitchin Street, and the Maltings, Park Lane	7			S1/S2	4315
Land at, Icknield Way	15			S1/S2	4315
78-80 Icknield Way	7.5			S1/S2	4315
Orchard and Anvil, Nightingale Road	6			S1/S2	3213

Site Location/Name	Dwellings	Use	Floorspace (Sq.ms)	Scenario	SHUM Zone
Former Petrol Station, Wratten Road West	2			S1/S2	3204
Former Lisles, Old Park Road	20			S1/S2	3202
Data Centre, Cooks Way	35			S1/S2	3234
Lyon Court, Walsworth Road	35			S1/S2	3212
Nat West, Hermitage Road	14			S1/S2	3208
Land at and around, Churchgate	61			S1/S2	3207
Post Office, Hermitage Road	12			S1/S2	3208
22, Bridge Street	12			S1/S2	3204
Land off, Hine Way	5			S1/S2	3201
Former bus depot, Fishponds Road	29			S1/S2	3214
Neighbourhood centre and adjoining properties, John Barker Place	20			S1/S2	3201
Industrial area, Cooks Way	29			S1/S2	3234
Probyn House, Lloyd Way	5.5			S1/S2	4304
Library and museum site, Gernon Road	12			S1/S2	2307
The Wynd	70			S1/S2	2307
Westbury School, West View	19			S1/S2	4303
opp 382-392, Icknield Way	25			S1/S2	4310
St Michael's House, 105, Norton Way South	14			S1/S2	2307
Ivel Court, Radburn Way	59			S1/S2	2308
Land at, Birds Hill	50			S1/S2	2310
Garage, Station Road	10			S1/S2	2307
Arena Parade, Arena Parade	15			S1/S2	2307
Heath House, Princes Mews	7			S1/S2	4315
Land Adj 51 Melbourn Road	2			S1/S2	4315
Land at, Lumen Road	37.5			S1/S2	4315
Agricultural supplier, Garden Walk	28			S1/S2	4315
The Warren Car Park, London Road	17.5			S1/S2	4315
Industrial estate, Lower Gower Road	12.5			S1/S2	4315
former Priory Cinema, Newmarket Road	7			S1/S2	4315
r/o 67 Station Road, Ashwell Street	1.5			S1/S2	4315
Land adj. 7, Green Lane	2			S1/S2	4315
61, Station Road	10			S1/S2	4315
Land off, Yeomanry Drive	7.5			S1/S2	4315
East of, Clothall Common	20			S1/S2	4315
Land off, Clothall Road, Baldock (Clothall parish)	130			S1/S2	4315
Land north of Bygrave Road (Bygrave parish)	70			S1/S2	4315
South of, Clothall Common, Baldock (Clothall parish)	137.5			S1/S2	4315
r/o, Clare Crescent	10.5			S1/S2	4315
Land at Bygrave Road	30			S1/S2	4315

Site Location/Name	Dwellings	Use	Floorspace (Sq.ms)	Scenario	SHUM Zone
Land at, North Road, Baldock (Bygrave parish)	52.5			S1/S2	4315
Land south of, Bygrave Road (Bygrave parish)	94			S1/S2	4306
Land off, Windmill Close	5.5			S1/S2	4315
Land North of, Windmill Close	6			S1/S2	4315
Land off, Cambridge Road	6.5			S1/S2	4315
Millers Close, Picknage Road	1.5			S1/S2	4315
Land NE of, The Close	48			S1/S2	1301
Playing Field, Benslow Lane (upper)	42			S1/S2	3230
r/o Fieldfares, Benslow Lane	8			S1/S2	3230
Land at, Lucas Lane	26			S1/S2	5204
r/o The Aspens, 46, Wymondley Road	10			S1/S2	2205
Top Field, Fishponds Road (east)	26			S1/S2	3215
Land off, Duncots Close	9			S1/S2	3314
Land at, Hall Lane	18			S1/S2	4304
Land west of, Hall Lane	8.5			S1/S2	4304
Land north of, High Street	6.5			S1/S2	4304
Land off, Lloyd Way	15			S1/S2	4304
Land west of Western Way	28			S1/S2	2311
Land north of former Norton School, Norton Road	56			S1/S2	2311
Land off Radburn Way	37			S1/S2	2308
Land west of Western Way	106			S1/S2	2311
r/o 14-30, High Street	14			S1/S2	2302
Allotment Gardens, Luton Road	48			S1/S2	2302
Farmyard, Brickyard Lane	10			S1/S2	4315
Land at, Blacksmiths Lane	10.5			S1/S2	4315
Ivy Farm, Baldock Road	20.5			S1/S2	4315
Land north of, Betjeman Road	50			S1/S2	4315
Land north of, Coombelands Road	28			S1/S2	4315
Royston FC, Garden Walk	22			S1/S2	4315
Land north of, Lindsay Close	50			S1/S2	4315
Land east of, Thackeray Close	11.5			S1/S2	4315
Land north of The Crescent, London Road	10			S1/S2	3305
Land off Sycamore Close	19			S1/S2	2206
Land south of, High Street, Whitwell	44			S1/S2	2304
6 Claybush Road, Ashwell, SG7 5RA	0.5			S1/S2	4315
15 High Street, Ashwell, Baldock, SG7 5NL	0.5			S1/S2	4315
Land at 22 Lucas Lane, Ashwell, Baldock, SG7 5LN	0.5			S1/S2	4315
Land rear of 45 and 47, Chiltern Road, Baldock, SG7	2			S1/S2	4315
Tranters Yard, Whitehorse	1			S1/S2	4315

Site Location/Name	Dwellings	Use	Floorspace (Sq.ms)	Scenario	SHUM Zone
Street, Baldock, SG7 6QF					
Garages At Womback Yard Rear Of 25 And 23, Whitehorse Street, Baldock, SG7	1.5			**S1/S2**	4315
Beech Ridge Lodge, Woodland Way, Baldock, SG7 6LF	6			**S1/S2**	4315
Baldock Railway Station, Station Road, Baldock, SG7 5BU	5.5			**S1/S2**	4315
36 Salisbury Road, Baldock, SG7 5BZ	2			**S1/S2**	4315
72 & 74 South Road, Baldock, SG7 6BZ	5			**S1/S2**	4315
Land At The Rear Of, California, Baldock, SG7 6NU	5			**S1/S2**	4315
Land Between, 10 and 19, Roman Lane, Baldock, SG7	1			**S1/S2**	4315
Barn r/o Elms Farm, 57 High Street, Barkway, Royston, SG8 8EB	0.5			**S1/S2**	4315
Land At Wheatsheaf Meadow, Barkway	5			**S1/S2**	4315
Land at September Cottage, High Street, Barley, Royston, SG8 8JA	2			**S1/S2**	4315
76 Ashwell Road, Bygrave, SG7 5EA	0			**S1/S2**	4306
Codicote Innovation Centre, St Albans Road, Codicote, SG4 8WH	1			**S1/S2**	1301
10 Oakhill Drive, Welwyn, AL6 9NW	0			**S1/S2**	1301
Amberwell, Pottersheath Road, Codicote, AL6 9SY	1			**S1/S2**	1301
Old Orchard, Danesbury Park Road, Pottersheath, Welwyn, AL6 9SH	1			**S1/S2**	1301
Danesbury Hill House, Codicote Road, Welwyn, AL6 9NF	0			**S1/S2**	4303
Fairfield, Kimpton Road, Oakhills, Welwyn, AL6 9NN	1			**S1/S2**	1301
18 High Street, Graveley, SG4 7LB	4			**S1/S2**	3306
Manor Farm, Riding School, Church Lane, Graveley, Hitchin	2			**S1/S2**	3202
Arbtree Farm, Ashwell Road, Hinxworth, SG7 5HT	0.5			**S1/S2**	4306
R/O Arcade Walk, Paynes Park, Hitchin	3			**S1/S2**	3205
North Herts College, Willian Road, Hitchin, SG4 0UJ	71			**S1/S2**	3225
Brookers Yard And Suzuki And Peter Fish Premises Off, Paynes Park, Hitchin, SG5	33			**S1/S2**	3206

Site Location/Name	Dwellings	Use	Floorspace (Sq.ms)	Scenario	SHUM Zone
63 Walsworth Road, Hitchin, SG4 9SX	12			S1/S2	3213
Land To The Rear Of And Including 134 To 150 Evens, Grove Road, Hitchin, SG4	3			S1/S2	3218
Land At, 50-58 Strathmore Avenue, Hitchin, SG5 1ST	9			S1/S2	2201
Land adjacent to 11 Lindsay Avenue, Hitchin, SG4 9JA	1			S1/S2	2205
Land rear of 26 & 28 Wymondley Road and adjacent to, 24 The Chilterns, Hitchin, SG4	2			S1/S2	2205
Swiss RE office car park, Old Charlton Road, Hitchin, SG5	6			S1/S2	3203
5 Wymondley Close, Hitchin, SG4 9PW	0			S1/S2	3212
14a, 15 and 16 Bancroft, Hitchin, SG5	4			S1/S2	3208
43 Byron Close, Hitchin, SG4 0QS	1			S1/S2	3227
Rear Of, 93 Bancroft, Hitchin	3			S1/S2	3209
Land to r/o 22 Bancroft, Hitchin, SG5 1JW	3			S1/S2	3214
13 Hermitage Road, Hitchin, SG5 1BT	2			S1/S2	3209
Land Adjacent To The Larches, Standhill Road, Hitchin	2			S1/S2	2207
Land East of Cooks Way, Hitchin	4			S1/S2	3234
34a Woolgrove Road, Hitchin, SG4 0AT	2			S1/S2	3224
204 Westmill Road, Hitchin, SG5 2SQ	3			S1/S2	3201
10 Newlands Lane, Hitchin, SG4 9AY	0			S1/S2	2206
Land adjacent to 8 and 9 Times Close, Hitchin, SG5 2UT	2			S1/S2	3201
105 Bancroft, Hitchin, SG5 1NB	1			S1/S2	3209
30 & 31 Tristram Road and Land to r/o 25-31 Tristram Road, Hitchin	15			S1/S2	3223
34-36 Walsworth Road, Hitchin, SG4	2			S1/S2	3213
Data Centre, Units 6 And 7, Sharps Way, Hitchin, SG4 0JA	32			S1/S2	3234
Land To The Rear Of 54, Wymondley Road, Hitchin	4			S1/S2	2205
Former Grove Road Nurseries, 20-34 Grove Road, Hitchin, SG5 1SE	23			S1/S2	3213
Land rear of 83-84, Tilehouse Street, Hitchin, SG5	3			S1/S2	3206
6 Willian Road, Hitchin,	1			S1/S2	3225

Site Location/Name	Dwellings	Use	Floorspace (Sq.ms)	Scenario	SHUM Zone
SG4 0LW					
66b Dacre Road, Hitchin, SG5 1QL	1			**S1/S2**	3213
39 Grays Lane, Hitchin, SG5 2HH	1			**S1/S2**	3202
Manley Bungalow, Pirton Road, Hitchin, SG5 2ES	0			**S1/S2**	5204
2 and 3-4 High Street, Hitchin, SG5 1BH	6			**S1/S2**	3206
Land adjacent to 27 Oakfield Avenue, Hitchin, SG4 9JD	1			**S1/S2**	2205
Former Chapel, Caldicott Centre, Highbury Road, Hitchin	1			**S1/S2**	3211
The Wishing Well, 181 Stevenage Road, Hitchin, SG4 9EA	2			**S1/S2**	2205
19 Latchmore Close, Hitchin, SG4 9DE	2			**S1/S2**	2207
42 Walsworth Road, Hitchin, SG4 9SU	4			**S1/S2**	3213
22 Bancroft, Hitchin, SG5 1JW	1			**S1/S2**	3214
6 Grove Road, Hitchin, SG5 1SE	2			**S1/S2**	3213
4 Water Lane, Hitchin, SG5 1TX	2			**S1/S2**	3221
Jubilee House, 13 Fishponds Road, Hitchin SG5 1NR,	8			**S1/S2**	3221
239 Cambridge Road, Hitchin, SG4 0JS	1			**S1/S2**	3223
Highover Cottages, Highover Way, Hitchin, SG4 0RQ	1			**S1/S2**	3223
101A Bancroft, Hitchin	0			**S1/S2**	3209
9-10 Bearton Road, Hitchin, SG5 1UB	4			**S1/S2**	3221
84a Tilehouse Street, Hitchin, SG5 2DY	1			**S1/S2**	3206
Land adjacent to 181 Stevenage Road, Hitchin, SG4 9EA	1			**S1/S2**	2205
271 Bedford Road, Hitchin, SG5 2UQ	7			**S1/S2**	3201
Flat 1, 30 Sun Street, Hitchin, SG5 1AH	1			**S1/S2**	3206
40 Queen Street, Hitchin, SG4 9TS	1			**S1/S2**	2207
Land Adjacent Orchard Cottage, Pirton Road, Holwell	3			**S1/S2**	3313
1-2 Rands Close, Holwell Road, Holwell, Hitchin, SG5 3SZ	0			**S1/S2**	3313
Colindale, Pirton Road, Holwell, Hitchin, SG5 3SS	0			**S1/S2**	3313
Land To Rear Of 2 4 6 8 10, Holwell Road, Holwell	1			**S1/S2**	3313
New Ramerwick Farm, Bedford Road, Ickleford,	0			**S1/S2**	3313

Site Location/Name	Dwellings	Use	Floorspace (Sq.ms)	Scenario	SHUM Zone
Hitchin, SG5 3RU					
Lower Heath Farm, Therfield Road, Odsey, Baldock, SG7 6SE	0.5			**S1/S2**	4315
123 High Street, Kimpton, SG4 8QN	0.5			**S1/S2**	4304
72a High Street, Kimpton, SG4 8QW	0.5			**S1/S2**	4304
Ramridge Farm, Luton Road, Kimpton, SG4 8HB	1			**S1/S2**	4304
64 Kimpton Road, Blackmore End, Herts, AL4 8LH	0.5			**S1/S2**	4304
5 Blackmore Way, Blackmore End, St Albans, AL4 8LJ	0.5			**S1/S2**	4304
Kimpton Methodist Church, The Green, Kimpton, Hitchin, SG4 8RZ	0.5			**S1/S2**	4304
Rudwick Hall, Barley Beans Road, Peters Green, Luton, LU2	1			**S1/S2**	4304
45 High Street, Kimpton, Hitchin, SG4 8RA	0			**S1/S2**	4304
16 Kimpton Road, Kimpton, St Albans, AL4 8LD	0			**S1/S2**	4304
Heath Farm, The Heath, Breachwood Green, SG4 8PJ	1.5			**S1/S2**	4310
Bury Cottage, Church Road, King's Walden, Hitchin, SG4 8JU	1			**S1/S2**	2303
9 Watton Road, Knebworth, SG3 6AH	1			**S1/S2**	1303
15 Gun Lane, Knebworth, SG3 6BH	1			**S1/S2**	1303
146 Park Lane, Old Knebworth, SG3 6PP	1			**S1/S2**	1302
Park Lodge Cottage, Park Lane, Old Knebworth, SG3 6PP	0			**S1/S2**	1302
Minsden Farm, Hitchwood Lane, Preston, Hitchin, SG4 7RY	1			**S1/S2**	2303
Former Skill Centre (Also Known As Land At), Pixmore Avenue, Letchworth Garden City	103			**S1/S2**	2310
Land at Former Skill Centre, Pixmore Avenue, Letchworth Garden City	15			**S1/S2**	2310
Land off Cade Close, Letchworth Garden City, SG6	60			**S1/S2**	2313
Former Neosid Site, Icknield Way, Letchworth Garden City, SG6 4AS	65			**S1/S2**	2310
61-63, Leys Avenue, Letchworth Garden City, SG6	1			**S1/S2**	2307
Land Adjoining, 21 Leys Avenue, Letchworth	8			**S1/S2**	2307

Site Location/Name	Dwellings	Use	Floorspace (Sq.ms)	Scenario	SHUM Zone
Garden City, SG6					
Land at 39 Kimberley, Letchworth Garden City, SG6 4RB	2			**S1/S2**	2311
16b Leys Avenue, Letchworth Garden City, SG6 3EU	1			**S1/S2**	2307
Land at The Old Grammar School, Broadway, Letchworth Garden City, SG6 3PS	8			**S1/S2**	2307
121-123 Norton Way South, Letchworth Garden City, SG6 1NZ	4			**S1/S2**	2307
Natwest, Station Place, Letchworth Garden City, SG6 3AQ	3			**S1/S2**	2307
1 Northfields, Letchworth Garden City, SG6 4RJ	1			**S1/S2**	2311
Land At Broadwater Dale Garages, Broadwater Dale, Letchworth Garden City	10			**S1/S2**	2307
Sollershott Hall, Sollershott East, Letchworth Garden City, SG6 3PL	3			**S1/S2**	2307
50c Station Road, Letchworth Garden City, SG6 3BE	2			**S1/S2**	2307
Former Neosid Site, Icknield Way, Letchworth Garden City, SG6 4AS	1			**S1/S2**	2310
Arunbank, Alington Lane, Letchworth Garden City, SG6 3NE	1			**S1/S2**	2305
25-59 Odd and 28-38 evens Elmtree Avenue and land South West of Elmtree Avenue, Cockernhoe, LU2	1			**S1/S2**	4310
The Lawns, High Street, Offley, SG5 3AN	4			**S1/S2**	2302
The Piggeries, Radwell Lane, Radwell, SG7	0.5			**S1/S2**	4306
Radwell Grange Farm Barns, Great North Road 2, Radwell, Baldock	2			**S1/S2**	4306
Land adjacent to Village Hall, Radwell Lane, Radwell	2			**S1/S2**	4306
Dental surgery, 29-31 High Street, Royston	0.5			**S1/S2**	4315
Ling Dynamic Systems Ltd, Baldock Road, Royston, SG8 5BQ	30.5			**S1/S2**	4315
Land Rear of, White Bear PH, 53 Kneesworth Street, Royston, SG8	0.5			**S1/S2**	4315
Land Adjacent To, 26 Morton Street, Royston, SG8	0.5			**S1/S2**	4315
Land to the Rear of 4 Kneesworth Street, Royston, SG8 5AA	2.5			**S1/S2**	4315

Site Location/Name	Dwellings	Use	Floorspace (Sq.ms)	Scenario	SHUM Zone
12 Stamford Avenue, Royston, SG8 7DD	0.5			S1/S2	4315
39-41 Upper King Street, Royston, SG8 9AZ	1			S1/S2	4315
5 Church Lane, Royston, SG8 9LG	1			S1/S2	4315
65 Garden Walk, Royston, SG8 7JE	1			S1/S2	4315
71 Melbourn Road, Royston, SG8 7DG	0.5			S1/S2	4315
39 Old North Road, Royston, SG8 5EJ	0.5			S1/S2	4315
Carrington House, 37 Upper King Street, Royston, SG8 9AZ	0.5			S1/S2	4315
Heath Works, Baldock Road, Royston, SG8 5BQ	26			S1/S2	4315
25 High Street, Royston, SG8 9AA	0.5			S1/S2	4315
The Old Bakehouse, Upper King Street, Royston	0.5			S1/S2	4315
8 Lower Gower Road, Royston, SG8 5EA	0.5			S1/S2	4315
7 Melbourn Road, Royston, SG8 7DB	0.5			S1/S2	4315
2 Angel Pavement, Royston, SG8 9AS	1			S1/S2	4315
Land at 62 Green Drift, Royston, SG8 5BX	0.5			S1/S2	4315
Rear of, 31 Priory Close, Royston, SG8 7DU	0.5			S1/S2	4315
70 Heathfield Road, Royston	0.5			S1/S2	4315
27 Heathfield, Royston, SG8 5BN	1			S1/S2	4315
Land Between And In The Gardens Of 31 And 33, Mill Road, Royston, SG8 7AQ	0.5			S1/S2	4315
Ivy Farm, Baldock Road, Royston, SG8 9NU	40.5			S1/S2	4315
Land corner of Dark Lane and Payne End (adjacent to 27 Dark Lane), Sandon, SG9	3			S1/S2	4315
Land At Partridge Hall Farm, Church End Green, Sandon	0.5			S1/S2	4306
Land adjacent to The Forge, Rushden Road, Sandon, Buntingford, SG9 0QS	0.5			S1/S2	4315
Tollington, Preston Road, Gosmore, SG4 7QP	1			S1/S2	3305
Pound Farm, London Road, St Ippolyts, Hitchin, SG4 7NE	1			S1/S2	2206
Land adjacent to Little Court and Oakdene, London Road, St Ippolyts, Hitchin, SG4 7NE	1			S1/S2	2206
Plots 1, 2, 3 & 8 Cressmans Corner, Lilley Bottom Road, Whitwell,	3			S1/S2	2304

Site Location/Name	Dwellings	Use	Floorspace (Sq.ms)	Scenario	SHUM Zone
SG4					
Land and Outbuildings at, Stagenhoe Farm, Stagenhoe Park, St Paul's Walden, SG4	0			**S1/S2**	2304
Hoo End, Whitwell, Hitchin, SG4 8HJ	1			**S1/S2**	2304
Hoo End Farm, The Holt, Kimpton, Hitchin, SG4 8HG	1			**S1/S2**	2304
28 High Street, Whitwell, Hitchin, SG4 8AG	1			**S1/S2**	2304
Land Adjacent Oakwood House, Pedlars Lane, Therfield, Royston	0.5			**S1/S2**	4315
Five House Cottages, Sandon Road, Therfield, SG8 9RE	0			**S1/S2**	4315
Heatherset, Police Row, Therfield, SG8 9QE	1			**S1/S2**	4315
Land at Manor Farm, Damask Green Road, Weston, Hitchin, SG4	1			**S1/S2**	1306
Garthlands, Maiden Street, Weston, SG4 7AA	0			**S1/S2**	1306
Garthlands, Maiden Street, Weston, Hitchin, SG4 7AA	1			**S1/S2**	1306
Land Adjacent Keepers Cottage, Warrens Green Lane, Weston	0			**S1/S2**	1306
Land Adjacent, The Green Man, Hitchin Road, Wymondley, Hitchin	6			**S1/S2**	3301
Small site allowances-Hitchin	300			**S1/S2**	Numerous locations
Small site allowances-Letchworth	100			**S1/S2**	Numerous locations
Small site allowances-Baldock	50			**S1/S2**	4315
Small site allowances-Royston	50			**S1/S2**	4315
Component H (NHDC Housing Assessment)					
SW Hitchin (of which no more than 6000 would be complete before 2031)	6000			**S1/S2**	5204,5205, 5206,5207, 5208
Stevenage Borough Capacity					
Employment			**10,000**	**S2**	5126
Housing Allocation	1,200			**S2**	5126
Housing Allocation for Stevenage extension – SBC (North Stevenage)	600			**S2**	5107

Note: Any housing development, allocated to a SHUM zone in the 4000 series (i.e. 4310), has been halved to account for only 50% of the trip demand generated by the development entering the modelled study area. The 4000 series represent locations outside of the modelled area.

Appendix D – Scheme Proforma's

Location	A1(M) Junction 8 / A602 Roundabout
Reference	HM1

Description of Problem

The modelling has highlighted that an approach to the roundabout operates at the design capacity during a particular peak period, causing congestion and delay on the approach. The approach is the A1(M) southbound offslip and circulating approach on the roundabout.

The junction of the A602 / A1(M) Junction 8 southbound offslip has queuing traffic on both arms because the junction cannot accommodate the level of traffic demand. The junction operates at capacity during the morning peak, which causes traffic to queue back on both approaches. The offslip approach is two lanes and can accommodate the level of traffic demand, but the capacity for this arm is restricted by the signal timings. Due to a high level of traffic on both arms, it is difficult to provide adequate capacity for both approaches, thus junction delay and queuing occurs. The impact of queuing traffic along the approach from the southbound offslip, has the potential to cause safety issues on the mainline A1(M) flow, if the traffic queues back this far.

Mitigation Proposal Details

To address this problem, the (A1(M) southbound offslip) approach onto the roundabout should be widened to provide an additional lane at the junction stopline. The roundabout has sufficient capacity to accommodate widening as the roundabout is designed with three lanes circulating. Allowing three lanes of traffic to enter the roundabout from both approaches would increase the junction throughput, providing an improved balance of movements and signal timings.

Outline Cost Analysis

The cost estimate for delivery excludes the following:

- Legal Costs
- Landscaping Design
- Statutory Undertakers design fee.
- Statutory Undertakers diversion and or protection costs.
- Third Party Ground Investigation costs. Trial Pits and Geotechnical surveying will be supplied by third parties.
- Traffic Regulation Orders & any associated consultation (TRO's).
- 3rd Party Land acquisition costs and accommodation works costs.
- Dedication of Land, Land to be passed over to the council as highway.
- Contract documentation for appointment of the preferred contractor, as this is being progressed by others.
- Tendering of the works
- Site support fees during the construction period, this will be included within a later fee proposal, if required.

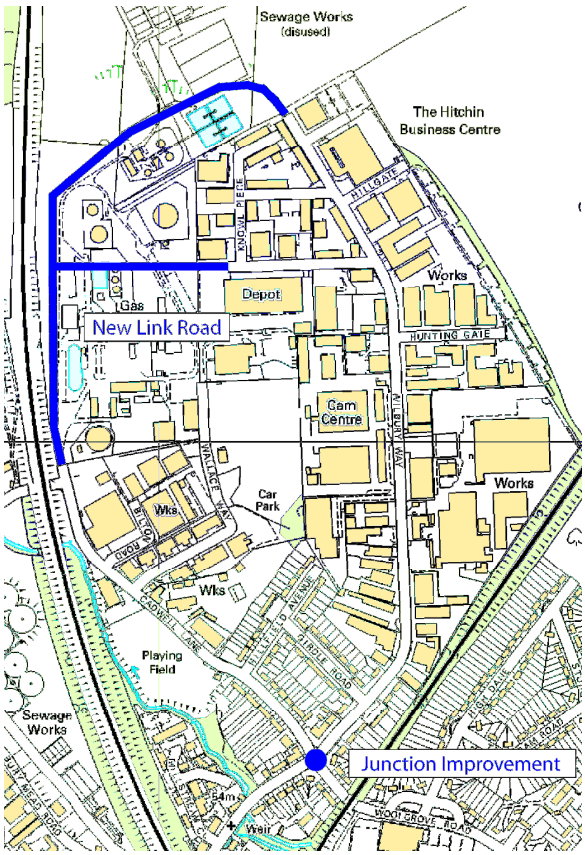
Cost for Delivery	£386,000

Location	Hitchin Industrial Area – Cadwell Lane/Grove Road/Wilbury Way/Woolgrove Road Junction
Reference	HM5.1

Description of Problem

The Cadwell Lane signalised junction at the entry to the industrial area is problematic as it does not have sufficient capacity to accommodate the future year level of growth, causing delay and queuing on the approaches to and from the industrial area. This junction currently experiences delay and congestion, under current operating conditions, with the increase in demand in and around the area, exacerbating the issue.

Mitigation Proposal Details



To provide sufficient network capacity to accommodate the future year level of demand, it is proposed that the highway network in the industrial area should be connected at the northern end to provide relief within the industrial area and balance the demand on the approaches to the Cadwell Lane junction. It is proposed that Wilbury Way is connected to Cadwell Lane to the north of the industrial area, along with extending Knowl Piece to provide a road link to Cadwell Lane.

In additional to connecting the industrial area, the junction of Cadwell Lane / Grove Road will be improved. The improvement consists of reallocating lanes to maximise capacity whilst banning right turning movements from Grove Road to Woolgrove Road and also from Wilbury Way to Cadwell Lane where there is no current demand. It has been assumed that no widening is undertaken, however, observations indicate that increasing the radius and widening the turn from Grove Road into Cadwell Lane would enable traffic to travel through the junction at a slightly increased speed and therefore improve the capacity of the junction by increasing the potential throughput of traffic. It is not expected that this would have any detrimental impact on safety at the junction but this will need to be assessed fully during any detailed design phase of scheme development.

Although the junction model does not represent the behaviour, it is also anticipated that improvements would be derived by:

- Introducing demand responsive pedestrian phases.
- Operating the junction under a MOVA signal control system.
- Providing minimal widening to improve the amount of non-blocking right turn storage from Cadwell Lane and to improve the radius for vehicles turning into Cadwell Lane.

Outline Cost Analysis

The cost estimate for delivery excludes the following:

- Legal Costs
- Landscaping Design
- Statutory Undertakers design fee.
- Statutory Undertakers diversion and or protection costs.
- Third Party Ground Investigation costs. Trial Pits and Geotechnical surveying will be supplied by third parties.
- Traffic Regulation Orders & any associated consultation (TRO's).
- 3rd Party Land acquisition costs and accommodation works costs.
- Dedication of Land, Land to be passed over to the council as highway.
- Contract documentation for appointment of the preferred contractor, as this is being progressed by others.
- Tendering of the works
- Site support fees during the construction period, this will be included within a later fee proposal, if required.

Initial costs for implementing this junction have been estimated at £5.8 million. These costs were based on a construction year of 2021 accounting for inflation, with the breakdown of the costs outlined in more detail.

Works Element	**Estimated Cost**	**Notes**
Construction Items	£2,440,000	
Allowances for Design Fees	£488,000	20% of the construction items
Allowances for Preliminaries	£366,000	15% of the construction items
Allowances for Supervision	£244,000	10% of the construction items
Allowances for Utilities / Electricals	£488,000	20% of the construction items
Sub-Total for allowances and construction items	*£4,026,000*	
Optimism Bias	£1,812,000	45% of sub-total
Cost for Delivery	£5,838,000	2021 Construction Year

Location	A505 Cambridge Road / Woolgrove Road / Willian Road
Reference	HM5.2

Description of Problem

This signalised junction is location on the main route between Hitchin and Letchworth, and is a problem junction for traffic travelling west-east. It also provides access to and from the approach for the industrial area, so has conflicting turning movements.

As well as the location of the junction as a gateway to and from Hitchin and the industrial area, the junction is problematic as it does not have sufficient capacity to accommodate the future year level of growth. This causes delay and queuing on the approaches to and from Hitchin town centre and the industrial area. The model forecast that this junction will experience delay and congestion, under future operating conditions, with the increase in demand and pressure in and around the area, exacerbating the issue.

Mitigation Proposal Details

To provide sufficient network capacity to accommodate the future year level of demand, it is proposed that the junction of will be improved by changing the operation of the signal control system. The MOVA (Microprocessor Optimised Vehicle Actuation) signal control system is a more efficient form of control able to deliver substantially reduced delays without the need for regular re-setting of the signal timings.

MOVA is a sophisticated strategy using the computing power of microprocessors to assess the best signal timings, given the physical layout of the junction, the signal stages available and the traffic conditions at the time. The system will generate its own signal timings cycle-by-cycle, varying continuously with traffic conditions, both in the short term (hour to hour, day to day) and in the long term following annual trends and longer term traffic growth.

This junction would be an ideal candidate for MOVA control as it is forecast to be a site that would suffer from prolonged periods of congestion in the future. MOVA performs particularly, and appears to give above average benefits at smaller heavily congested junctions, which this location is. This innovative method of signal control can reduce delays and accident levels. Evidence has shown that MOVA can reduce delays by an average of 13%, compared with conventional signal controls.

MOVA has two operational modes; the first deals with uncongested conditions, the second with situations when the junction becomes overloaded/congested with large queues on one or more approaches. This form of operation would be suited to this junction location, when congestion occurs during the busy peak periods, and the junction is uncongested at other times.

It has been assumed that no widening is undertaken at the junction, as it is understood that there is no room to extend beyond the current highway boundary.

Outline Cost Analysis

The cost estimate for delivery excludes the following:

- Legal Costs
- Landscaping Design
- Statutory Undertakers design fee.
- Statutory Undertakers diversion and or protection costs.
- Third Party Ground Investigation costs. Trial Pits and Geotechnical surveying will be supplied by third parties.
- Traffic Regulation Orders & any associated consultation (TRO's).

- 3rd Party Land acquisition costs and accommodation works costs.
- Dedication of Land, Land to be passed over to the council as highway.
- Contract documentation for appointment of the preferred contractor, as this is being progressed by others.
- Tendering of the works
- Site support fees during the construction period, this will be included within a later fee proposal, if required.

Initial costs for implementing this junction have been estimated at £320,000. These costs were based on a construction year of 2021 accounting for inflation, with the breakdown of the costs outlined in more detail.

Works Element	**Estimated Cost**	**Notes**
Construction Items	£135,000	
Allowances for Design Fees	£27,000	20% of the construction items
Allowances for Preliminaries	£20,000	15% of the construction items
Allowances for Supervision	£14,000	10% of the construction items
Allowances for Utilities / Electricals	£27,000	20% of the construction items
Sub-Total for allowances and construction items	*£223,000*	
Optimism Bias	£100,000	45% of sub-total
Cost for Delivery	£323,000	2021 Construction Year

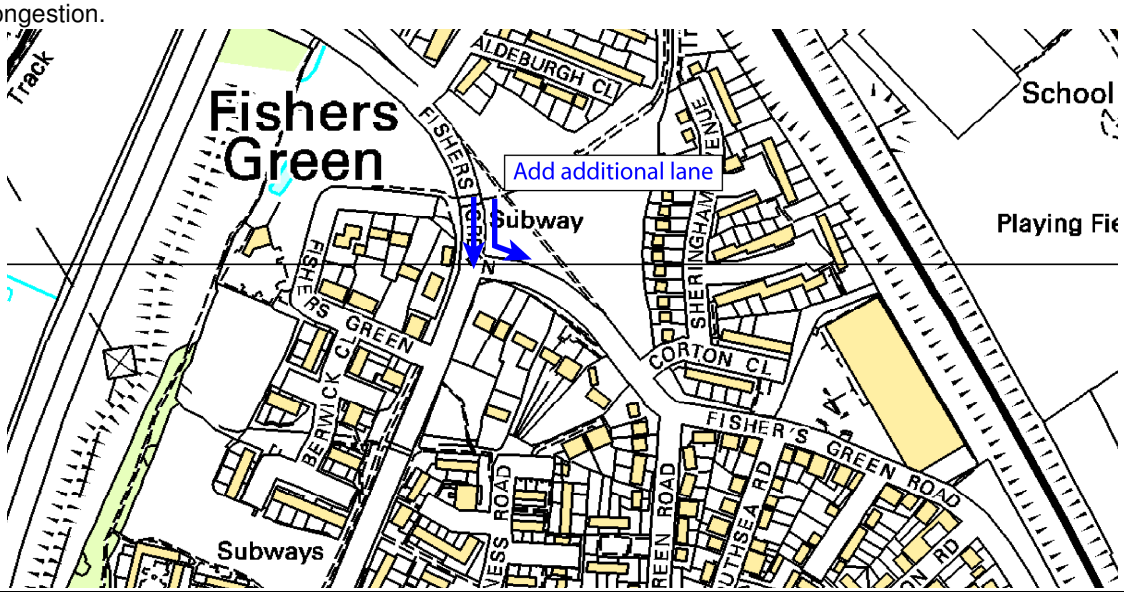
Location	Fishers Green Road / Clovelly Way
Reference	HM7

Description of Problem

At the junction of Fishers Green Road and Clovelly Way, the north approach (which carries traffic travelling southbound to enter Stevenage) is operating at the design capacity in the morning peak. This causes a breakdown in traffic flow and delay and congestion along the link on the approach to the junction.

Mitigation Proposal Details

The proposed improvement is to widen the northern approach to the junction, to allow two lanes for southbound traffic. The bridge across the A1(M) restricts widening the entire section of Fishers Green Road between Chantry Lane and Clovelly Way but widening the approach to provide an additional left lane for left turning traffic, will provide some additional capacity on the approach, helping to relive congestion.



Outline Cost Analysis

The cost estimate for delivery excludes the following:

- Legal Costs
- Landscaping Design
- Statutory Undertakers design fee.
- Statutory Undertakers diversion and or protection costs.
- Third Party Ground Investigation costs. Trial Pits and Geotechnical surveying will be supplied by third parties.
- Traffic Regulation Orders & any associated consultation (TRO's).
- 3rd Party Land acquisition costs and accommodation works costs.
- Dedication of Land, Land to be passed over to the council as highway.
- Contract documentation for appointment of the preferred contractor, as this is being progressed by others.
- Tendering of the works
- Site support fees during the construction period, this will be included within a later fee proposal, if required.

Initial costs for implementing this junction have been estimated at £62,000. These costs were based on a construction year of 2021 accounting for inflation, with the breakdown of the costs outlined in more detail.		
Works Element	**Estimated Cost**	**Notes**
Construction Items	£25,500	
Allowances for Supervision	£5,000	20% of the construction items
Allowances for Utilities / Electricals	£4,000	15% of the construction items
Sub-Total for allowances and construction items	£3,000	10% of the construction items
Optimism Bias	£5,000	20% of the construction items
	£42,500	
Cost for Delivery	£19,000	45% of sub-total
	£61,500	2021 Construction Year

Location	A1(M) Junction 7
Reference	HM9

Description of Problem

In the future year, the A1(M) which provides a spine through the study area experiences more traffic demand and thus congestion. There is an increase in demand to enter and exit the A1(M), particularly at Junction 7, south of Stevenage. At this location, the A1(M) mainline, and on and off slip roads identified as experiencing congestion thus effecting the flow on the mainline and local network are:

1. A1(M) Junction 7 northbound onslip
2. A1(M) Junction 7 southbound offslip and slip road to the roundabout
3. A1(M) Junction 7 northbound mainline and offslip

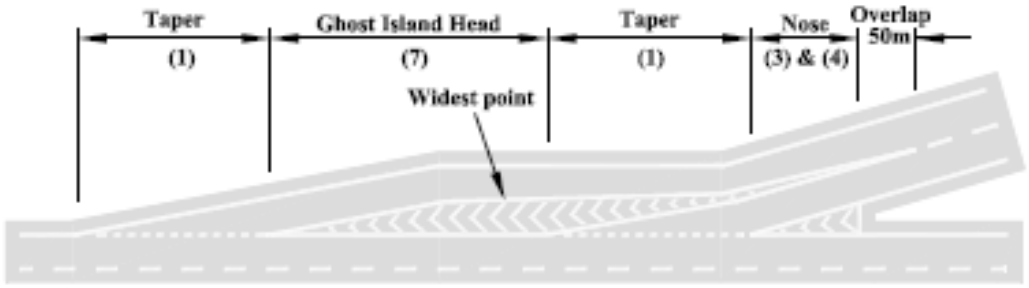
Mitigation Proposal Details

The mitigation proposals at this location involve a combination of improvements, for the different locations.

The improvements to increase the capacity of the slip roads are to provide additional lanes to merge onto and diverge from the mainline A1(M) at the locations identified.

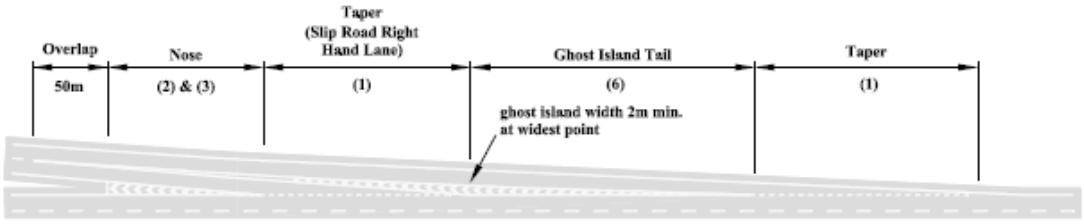
- HM9.1: A1(M) Junction 7 Northbound Onslip – extend the two lane slip road to merge onto the motorway mainline using a Ghost Island merge layout.
- HM9.2: A1(M) Junction 7 Southbound Offslip – provide two lane diverge in the form of a Ghost Island to the slip road.
- HM9.3: A1(M) Junction 7 Northbound Offslip – provide a dedicated diverge lane from the A1(M) mainline. This will be delivered in tandem with the other improvement identified at HM9.3.

At Junction 7, the merge to, and diverge from the mainline flow is to be two lanes, using ghost island merges and diverges. Examples merge and diverges using Ghost Islands are shown.



(i) Ghost Island Diverge

Source: DMRB Volume 6, Section 2 Road Geometry Junctions



C – Ghost Island Merge

(Only used where design flows on mainline are light, there are 3 lanes or more on mainline and merging flow is over one lane capacity, see paragraph 2.30).

Source: DMRB Volume 6, Section 2 Road Geometry Junctions

In addition to the improvements to the slip roads at the above locations, further improvements to be delivered at A1(M) Junction 7 are identified:

- HM9.2: A1(M) Junction 7 Southbound Offslip (roundabout approach)
  - i. Widen the slip road approach to the roundabout, to provide an additional lane at the junction stopline.
  - ii. Re-define the lane allocation at the GSK junction (to the east of A1(M)), to allow two lanes northbound, two lanes eastbound on the west approach. Allow two lanes northbound from the south approach.
- HM9.3: A1(M) Junction 7 Northbound mainline (from Junction 6) – extend hard shoulder running to allow additional capacity northbound up to Junction 7, with a dedicated offslip lane for Junction 7 (as discussed above).

A1(M) Junction Northbound Onslip / Offslip – Highways Agency pinch point scheme

The modelling has identified that two of the three slip roads at Junction 7 identified for some form of improvement, to ease congestion at this location at in the northbound direction. Existing studies on the A1(M) have previously indentified these two slip roads, as a potential for possible future congestion. There is a Highways Agency pinch point scheme that has investigated potential improvements at these locations but it is not expected to be delivered before 2015. Details of these pinch point proposals are not available in the public domain. Therefore, if further investigation is required into the impact of the Local Plan in the future, these proposals may be available and should be sought.

In summary, the mitigation proposals at this location include a number of improvements for each individual location:

- HM9.1: A1(M) Junction 7 Northbound Onslip
  - i. Extend the two lane slip road to merge onto the motorway mainline using a ghost island merge layout.
- HM9.2: A1(M) Junction 7 Southbound Offslip (roundabout approach)
  - i. Provide a two lane diverge from the A1(M) mainline to the slip road, in the form of a ghost island diverge.
  - ii. Widen the slip road approach to the roundabout, to provide three lanes at the junction stopline.
  - iii. Re-define the lane allocation at the GSK junction (to the east of A1(M)). Allow two lanes northbound, two lanes eastbound on the west approach. Allow two lanes northbound from the south approach.
- HM9.3: A1(M) Junction 7 Northbound mainline (from Junction 6)
  - i. Extend hard shoulder running to allow additional capacity northbound, from Potters Heath up to Junction 7.
  - ii. Provide a dedicated diverge lane from the A1(M) mainline. This should be delivered in tandem with the other improvement identified at HM9.3.

Outline Cost Analysis

The cost estimate for delivery excludes the following:

- Legal Costs
- Landscaping Design
- Statutory Undertakers design fee.
- Statutory Undertakers diversion and or protection costs.
- Third Party Ground Investigation costs. Trial Pits and Geotechnical surveying will be supplied by third parties.
- Traffic Regulation Orders & any associated consultation (TRO's).
- 3rd Party Land acquisition costs and accommodation works costs.

• Dedication of Land, Land to be passed over to the council as highway. • Contract documentation for appointment of the preferred contractor, as this is being progressed by others. • Tendering of the works • Site support fees during the construction period, this will be included within a later fee proposal, if required. Initial costs for implementing this junction have been estimated at £8,000,000 without hard shoulder running. Hard shoulder running from Junction 6 adds an additional £20 million. These costs were based on a construction year of 2021 accounting for inflation, with the breakdown of the costs outlined in more detail.	
Cost for Delivery (for HM9.1 or HM9.2)	£8,000,000
Cost for Delivery (for HM9.3)	£20,000,000

Location	A602 Hitchin Road / A1072 Gunnels Wood Road Roundabout
Reference	HM10

Description of Problem

The modelling has highlighted that two approaches to the roundabout operate at, or above the design capacity, causing congestion and delay on the approaches. The approaches are:

1. A602 north approach (southbound) / A1072 circulating approach
2. A1072 east approach (westbound) / A1072 circulating approach

The junction of the A602 / A1072 has southbound traffic queuing on the north approach because the junction cannot accommodate the level of traffic demand wishing to enter the north of Stevenage. This junction operates at capacity during the morning and evening peak. The volume of demand from the north travelling into Stevenage has a knock-on impact on the east approach (from the A1072), causing westbound traffic to queue in the morning peak due to inadequate capacity to accommodate both movements at this junction.

The roundabout currently has part time signals in place, which are operational during busy periods, to ensure a balanced movement of flow on all approaches. The location of the junction also posses difficulties for any highway expansion. The existing structure of the roundabout is raised above a shared pedestrian / cycle path, so the highway boundary is constrained and there is not much, if any scope for widening the roundabout without considerable construction.

Mitigation Proposal Details

To address this problem, it would be proposed that, if possible, the two approaches are widened to provide an additional lane at the junction stopline, for the approaching arm. Allowing three lanes of traffic to enter the roundabout would increase the junction throughput, providing an improved balance of movements and signal timings.

If widening is not possible, without considerable earthworks and construction, a solution should be sought to improve the balance and operation of the signal timings and any minor alignment improvements that could be made within the existing highway boundary. The junctions could be improved by changing the operation of the signal control system. The MOVA (Microprocessor Optimised Vehicle Actuation) signal control system is a more efficient form of control, able to deliver substantially reduced delays without the need for regular re-setting of the signal timings.

This location would be a prime candidate for conversion to MOVA controls, as it is expected to experience high flows, and is a large, complex junction which is expected to suffer from periods of congestion in the future.

As discussed in HM5.2, MOVA is extremely flexible, and the signal timings can vary widely as the traffic conditions change. A MOVA form of signal control can reduce delays and accident levels. Evidence has shown that MOVA can reduce delays by an average of 13% over conventional forms of signal control.

MOVA has two operational modes; the first deals with uncongested conditions, the second with situations when the junction becomes overloaded/congested with large queues on one or more approaches. MOVA determines which mode is appropriate and which approach(es), if any, are overloaded. This type of operation would be ideal at this location, as flows and congestion conditions would vary during the day.

For the purposes of this exercise, it has been assumed that widening at the junction is not possible. Therefore, the cost estimate provided is based on the second mitigation proposal, of installing MOVA.

Outline Cost Analysis

The cost estimate for delivery excludes the following:

- Legal Costs
- Landscaping Design
- Statutory Undertakers design fee.
- Statutory Undertakers diversion and or protection costs.
- Third Party Ground Investigation costs. Trial Pits and Geotechnical surveying will be supplied by third parties.
- Traffic Regulation Orders & any associated consultation (TRO's).
- 3rd Party Land acquisition costs and accommodation works costs.
- Dedication of Land, Land to be passed over to the council as highway.
- Contract documentation for appointment of the preferred contractor, as this is being progressed by others.
- Tendering of the works
- Site support fees during the construction period, this will be included within a later fee proposal, if required.

Initial costs for implementing this junction have been estimated at £480,000. These costs were based on a construction year of 2021 accounting for inflation, with the breakdown of the costs outlined in more detail.

Works Element	**Estimated Cost**	**Notes**
Construction Items	£200,000	
Allowances for Traffic Management	£40,000	20% of the construction items
Allowances for Preliminaries	£30,000	15% of the construction items
Allowances for Supervision	£20,000	10% of the construction items
Allowances for Utilities / Electricals	£40,000	20% of the construction items
Sub-Total for allowances and construction items	*£330,000*	
Optimism Bias	£149,000	45% of sub-total
Cost for Delivery	**£479,000**	**2021 Construction Year**

Location	A602 Broadhall Way / A602 Monkswood Way
Reference	HM11

Description of Problem

This roundabout is located on the A602 Broadhall Way which is the main route leading to junction 7 of the A1(M), and is a problem junction for traffic travelling from the east in the AM peak and from the west in the PM peak.

The junction is problematic as it does not have sufficient capacity to accommodate the future year level of growth. This causes delay and queuing on the westbound and eastbound approaches. The model forecast that this junction will experience delay and congestion, under future operating conditions, with the increase in demand and pressure in and around the area, exacerbating the issue.

Mitigation Proposal Details

To provide sufficient network capacity to accommodate the future year level of demand, it is proposed that the junction of will be improved by implementing signals at the junction. Due to the daily tidal changes in demand at the different approach arms, the MOVA (Microprocessor Optimised Vehicle Actuation) signal control system is a more efficient form of control able to deliver substantially reduced delays without the need for regular re-setting of the signal timings.

MOVA is a sophisticated strategy using the computing power of microprocessors to assess the best signal timings, given the physical layout of the junction, the signal stages available and the traffic conditions at the time. The system will generate its own signal timings cycle-by-cycle, varying continuously with traffic conditions, both in the short term (hour to hour, day to day) and in the long term following annual trends and longer term traffic growth.

This junction would be an ideal candidate for MOVA control as it is forecast to be a site that would suffer from prolonged periods of congestion in the future. MOVA performs particularly, and appears to give above average benefits at smaller heavily congested junctions, which this location is. This innovative method of signal control can reduce delays and accident levels. Evidence has shown that MOVA can reduce delays by an average of 13%, compared with conventional signal controls.

MOVA has two operational modes; the first deals with uncongested conditions, the second with situations when the junction becomes overloaded/congested with large queues on one or more approaches. This form of operation would be suited to this junction location, when congestion occurs during the busy peak periods, and the junction is uncongested at other times.

It has been assumed that no widening is undertaken at the junction, as it is understood that there is no room to extend beyond the current highway boundary at this elevated junction.

Outline Cost Analysis

The cost estimate for delivery excludes the following:

- Legal Costs
- Landscaping Design
- Statutory Undertakers design fee.
- Statutory Undertakers diversion and or protection costs.
- Third Party Ground Investigation costs. Trial Pits and Geotechnical surveying will be supplied by third parties.
- Traffic Regulation Orders & any associated consultation (TRO's).
- 3rd Party Land acquisition costs and accommodation works costs.

- Dedication of Land, Land to be passed over to the council as highway.
- Contract documentation for appointment of the preferred contractor, as this is being progressed by others.
- Tendering of the works
- Site support fees during the construction period, this will be included within a later fee proposal, if required.

Initial costs for implementing this junction have been estimated at £320,000. These costs were based on a construction year of 2021 accounting for inflation, with the breakdown of the costs outlined in more detail.

Works Element	**Estimated Cost**	**Notes**
Construction Items	£135,000	
Allowances for Design Fees	£27,000	20% of the construction items
Allowances for Preliminaries	£20,000	15% of the construction items
Allowances for Supervision	£14,000	10% of the construction items
Allowances for Utilities / Electricals	£27,000	20% of the construction items
Sub-Total for allowances and construction items	*£223,000*	
Optimism Bias	£100,000	45% of sub-total
Cost for Delivery	£323,000	2021 Construction Year

Appendix E – Caveat associated with scheme costing

Cost estimates, and preliminary designs, are fruitful grounds for disputes, AECOM has included in its Delegations of Authority the requirement for a Risk Assessment and prior AECOM approval to contract where pre-tender design is to be used for quantity take off and/or relied upon by the developer/contractor for finance/tender pricing unless there is an indemnity or waiver obviating AECOM from liability in respect of such quantities/reliance.

Accordingly, in any appointment where we are required to provide a cost estimate or to produce a preliminary/initial design that will be used for cost purposes it needs to be made clear that the pre-tender designs [and estimates] are not fully detailed, that they will need to be developed, revised and refined during the detailed design phase, and, therefore, any quantity [or value] shown or included in or derived from such pre-designs are indicative only.

Where such caveats and express exclusion cannot be incorporated a decision needs to be carefully made, in the first instance, as to whether AECOM can commit to the obligation/risk and the appropriate approval needs to be obtained from AECOM in accordance with the Delegations of Authority prior to contract.