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November 2023

London Luton Airport Expansion

Planning Inspectorate Scheme Ref: TR020001

Volume 8 Additional Submissions (Examination)

8.94 Applicant's Response to Issue Specific Hearing 4 Action 8: Off-site Highway Works

Infrastructure Planning (Examination Procedure) Rules 2010

Application Document Ref: TR020001/APP/8.94

The Planning Act 2008

The Infrastructure Planning (Examination Procedure) Rules 2010

London Luton Airport Expansion Development Consent Order 202x

8.94 APPLICANT'S RESPONSE TO ISSUE SPECIFIC HEARING 4 ACTION 8 - OFF-SITE HIGHWAY WORKS

Deadline:	Deadline 4
Planning Inspectorate Scheme Reference:	TR020001
Document Reference:	TR020001/APP/8.94
Author:	Luton Rising

Version	Date	Status of Version
Issue 1	November 2023	Additional Submission – Deadline 4

Contents

1 INTRODUCTION

1.1.1 This note has been prepared to address the action requested by the Examining Authority (ExA) following the Issue Specific Hearing (ISH) 4 on Traffic and Transport on the 28 September 2023. The request was raised on the **ExA's Action Points for ISH 4 [EV9-007]**and is referred to as 'Action 8' as follows:

1.1.2 "*For each junction of the proposed off-site highways works produce a simplified table which provides a summary detailing the queue lengths, delay and ratio flow to capacity for three scenarios of:*
1. without proposed development
2. with proposed development (and no junction improvements)
3. and then with proposed development and the proposed highway improvements.
This will need to be done for each of the assessment phases."

1.2 Background Context to the Development of the Off-site Highway Mitigation Measures

1.2.1 The proposed locations of the off-site highway mitigation schemes are shown in **Appendix A** of the **Transport Assessment Appendices- Part 1 of 3 [APP-200]. Section 4** of the **Transport Assessment [APP-203, AS-123, APP-205, APP-206]** sets out (para 4.2.4) that highway interventions have been identified in conjunction with the local highway authorities in order to provide mitigation for the increased volumes of traffic on roads in the locality of the airport and the corridor to the M1.

1.2.2 Luton Local Plan Policy LLP31A(i) states that *"the Council will work with its partners, agencies and developers to deliver: reduced congestion around the town centre and key strategic routes including seeking to deliver targeted road and junction improvements needed to accommodate Luton's growth including strategic and local improvements to address cross boundary growth while promoting sustainable modes of transport."*

1.2.3 London Luton Airport Policy LLP31D adds *"Support for the continued economic success of London Luton Airport as a transport hub (policy LLP6) will be delivered through: measures to ensure there is capacity at strategically important junctions"*

1.2.4 The mitigation measures have therefore been developed on the main access routes into the airport, and further supported by additional locations identified through the on-going engagement which has occurred with other highway authorities with regard to the impacts of the scheme. The designs of the proposed off-site mitigation measures were developed using an iterative process, being informed by the strategic modelling, Vissim modelling and local junction modelling where appropriate.

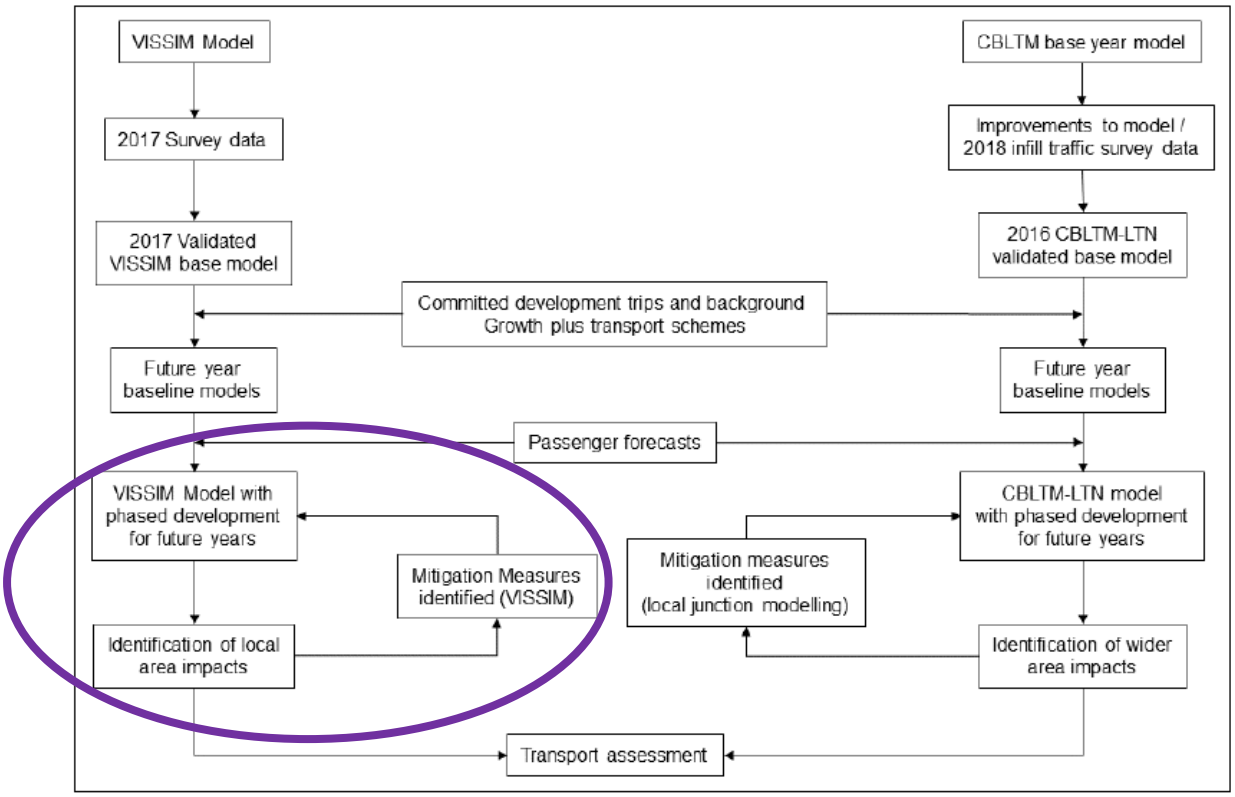
1.2.5 Key information which was used in the development of the locations was an understanding of key routes to and from the airport and passenger trip distribution - related to Civil Aviation Authority (CAA) passenger data - together with an understanding of existing areas of congestion and delay.

1.2.6 A collaborative approach to understanding the impacts and the development of the mitigation measures was taken alongside the responsible highway authorities (including National Highways, Luton Borough Council, Hertfordshire County Council and Central Bedfordshire Council). The locations and associated designs were shared with National Highways and the host and highway authorities as part of workshops and progress meetings.

1.3 Modelling Methodology and the Development of Mitigation

1.3.1 **Figure 9.1** (extract below) of the **Transport Assessment [APP-205]** sets out the modelling approach which has informed the development of the mitigation measures.

Figure 9.1: Modelling methodology



1.3.2 As set out in **Chapter 9** of the **Transport Assessment [APP-205]**, two transport models were developed to primarily understand the impacts of the proposed development. These were supplemented where required by further standalone junction models. The following section explains the use of the two main models in developing the mitigation proposals.

1.4 London Luton Airport Vissim Model

1.4.1 The key objective of the Vissim model was to provide a detailed assessment of the road network operation and impact of the Proposed Development in the area local to the airport. Vissim is a powerful tool which enables a network of junctions to be modelled in far greater detail that strategic models, and the interaction between junctions to be better understood than standalone models. Vissim produces a number of parameters which are used in developing an understanding of the network and include network performance statistics (including network delays, average speeds and unreleased vehicles), journey times and junction performance (in terms of level of service, queues and delays – it is noted that Vissim models do not produce a ratio of flow to capacity). In addition, Vissim provides a visual representation of the operation of the network during the modelled period (i.e., across the peak hour) and these parameters and visual representations of the network enable an understanding of areas of the network where the model may experience specific delays or congestion.

1.4.2 Vissim models are particularly useful in modelling congested road networks, due to their ability to simulate traffic delays and queueing conditions at interchanges, roundabouts, signal controlled junctions, and for corridors where traffic signals at successive junctions are coordinated. In congested networks, Vissim models usually show

significant levels of delay and/or unreleased demand (i.e. vehicles which are unable to enter the model due to congestion) as was the case for the Luton DCO Vissim model (see **Table 10.30** of the **Transport Assessment [APP-205])**. Where there are significant levels of delay and/or unreleased demand in the future baseline, it is often not possible or practicable to produce meaningful outputs which show the additional demand associated with a development but no mitigation, since all that the model will do is add to the level of unreleased demand of the network rather than the individual performance of the junction.

1.4.3 As such, and as shown in **Figure 9.1**, mitigation measures are developed in an iterative fashion where mitigation can then be targeted to address congestion 'hot-spots' to unlock the network in an iterative manner. In such networks, when considering the effectiveness of mitigation, it is appropriate to consider the network performance as well as individual junction performance with the aim of ensuring that the network performance is no worse than the without development scenario.

1.4.4 In addition to the above, Phase 2a and Phase 2b of the Proposed Development include the Airport Access Road (AAR) as an integral part of the development proposals. The AAR is therefore an embedded mitigation without which Phase 2a and Phase 2b of the Proposed Development could not proceed. The inclusion of AAR means that the consideration of impacts at network level, which considers the impacts of traffic rerouting, provide a far better representation of the impact of the scheme rather than isolating the performance to individual junctions to develop the further mitigation.

1.4.5 The DCO Transport Assessment therefore did not produce a without mitigation scenario for reporting given that the output would not have been representative of the real impact on any junction. For the reasons set out above, it is not possible to meaningfully provide the individual junction parameters requested by the ExA for those junctions modelled within the Vissim model area.

1.4.6 In considering the impacts of the development on junctions within the Vissim model area, the most appropriate parameters for consideration should be the network performance parameters which provide an overview of how the network of junctions work together and then the junction performance. For reference purposes, network performance parameters for the three assessment phases can be found in **Chapter 10** of the **Transport Assessment [APP-205]** at:

a. Table 10.56 and Table 10.57 (2027 AM and PM peaks respectively)
b. Table 10.80 and Table 10.81 (2039 AM and PM peaks respectively)
c. Table 10.108 and Table 10.109 (2043 AM and PM peaks respectively)

1.4.7 The tables show the significant improvement in network performance particularly during the PM peak.

1.4.8 **Chapter 10** of the **Transport Assessment [APP-205]** also provides the individual junction performance. A summary of the junction performance is included at:

a. Table 10.78 (2027)
b. Table 10.107 (2039)
c. Table 10.136 (2043)

1.4.9 With respect to the Vissim modelling, para 10.3.205 of the **Transport Assessment [APP-205]** concludes *"the network would generally operate with free flow or stable conditions and would be broadly similar in Assessment Phase 2b and the future baseline. The Proposed Development in Assessment Phase 2b and associated junction*

mitigations are not considered to have a significant adverse impact on the operation of the highway network."

1.5 CBLTM-LTN Strategic Model

1.5.1 In addition to the various junctions assessed within the Vissim model, the strategic CBLTM-LTN model was developed and run to consider the wider implications of the proposed development. Whilst the model covers a large geographic area, the strategic model provides a valuable tool to consider wider effects of background growth, changes in transport infrastructure and development impacts. The model enables redistribution effects of all of these changes to be understood as the model allows for dynamic reassignment. The model also provides an overview of the change in performance of individual junctions to be understood from which more detailed models can be developed where necessary.

1.5.2 As part of the iterative model development, the understanding of the main access routes for airport related traffic, and on-going discussions with the highway authorities, locations of particular concern were identified and investigated further. These included:

a. A602 Park Way/A602 Stevenage Road/B656 Hitchin Hill/B656 London Road/Gosmore Road roundabout;
b. A505 Upper Tilehouse Street/A505 Paynes Park/A602 Park Way roundabout;
c. A505 Offley Road/Pirton Road/A505 Upper Tilehouse Street/Wratten Road West mini roundabout;
d. A1081 London Road/Newlands Road priority junction;
e. B4540 Church Road/Newlands Road priority junction;
f. Newlands Road/Luton Road/Farley Hill priority junction;
g. Luton Road/Chaul End Road priority junction; and
h. Chaul End Road/Hatters Way signalised junction.

1.5.3 This approach was considered appropriate as it focusses on the areas of 'likely' impact for the Proposed Development rather than an approach where the mitigation is developed for locations to address wider redistribution – ie, the aim being to provide the capacity on the key corridors to reduce redistribution.

1.5.4 These junctions are reported in **Chapter 10** of the **Transport Assessment [APP-205].** Where appropriate, individual standalone junction models were developed to provide a detailed understanding of the impacts of the proposed development. These were assessed using standalone software packages including Arcady, Picady and LinSig, which report queue lengths, delay and Degree of Saturation (DoS) or RFC values. As a result of the modelling, mitigation measures were developed for the following junctions only:

- A602 Park Way/A602 Stevenage Road/B656 Hitchin Hill/B656 London Road/Gosmore Road roundabout;
- A505 Upper Tilehouse Street/A505 Paynes Park/A602 Park Way roundabout;
- A505 Offley Road/Pirton Road/A505 Upper Tilehouse Street/Wratten Road West mini roundabout.

1.5.5 Standalone junction modelling for two junctions in Caddington (the Newlands Road/Luton Road/Farley Hill priority junction and the Luton Road/Chaul End Road priority junction) was also included within **Chapter 10** of the **Transport Assessment**

[APP-205]. At the time of submission of the application for development consent, (February 2023), there was no mitigation proposed at the two Caddington junctions. The strategic modelling forecast that delays at the Caddington junctions would be low in the Future Baseline and that the delays would remain within the reported bandwidths with the Proposed Development in place. The strategic modelling outcomes were discussed with Central Bedfordshire Council and further information on the Proposed Development impacts in 2043, with Assessment Phase 2b were provided. This showed that the existing junctions would be operating at capacity in 2043 for the Future Baseline scenarios, and whilst the addition of Proposed Development flows would worsen junction delays, the provision of additional capacity at these locations could have the effect of drawing additional traffic onto these routes. Discussions are ongoing between the Applicant and Central Bedfordshire Council with regard to the residual impacts at these locations.

1.5.6 As with the Vissim model, the **Transport Assessment [APP-205]** only reports to future baseline (without development) and with development and with mitigation scenarios.

1.5.7 In order to address the ExA request forming **Action 8**, the three junctions located within Hitchin are represented within this note to include the scenario where the proposed development is included but with no highway mitigation. These Existing Junctions 'with Proposed Development' scenarios are modelled using traffic flows extracted from the CBLTN-LTN Proposed Mitigation 'with Proposed Development' strategic model runs, as for previously explained reasons no strategic model run is available for the existing highway network 'with Proposed Development' traffic flows. As such, for the analysis of the Existing Junctions 'with Proposed Development' modelled scenarios, traffic flows were taken from the Proposed Mitigation 'with Proposed Development' strategic model run.

1.5.8 This approach means that the traffic flows used in the Existing Junctions 'with Proposed Development' scenarios will not have taken into consideration any dynamic reassignment of trips resulting from the lack of proposed highway mitigation, which in some cases results in the 'with development' scenarios reporting a reduction in traffic flows in certain periods.

1.5.9 The following section of the report therefore provides the ExA with the information requested for the following junctions:

a. A602 Park Way/A602 Stevenage Road/B656 Hitchin Hill/B656 London Road/Gosmore Road roundabout.
b. A505 Upper Tilehouse Street/A505 Paynes Park/A602 Park Way roundabout; and
c. A505 Offley Road/Pirton Road/A505 Upper Tilehouse Street/Wratten Road West mini roundabout.

2 MODELLING RESULTS

2.1 2027 Assessment Phase 1

2.1.1 The following table summarises the operation of the A602 Park Way / A602 Stevenage Road / B656 Hitchin Hill / B656 London Road / Gosmore Road roundabout for the Existing Junction 'without Proposed Development', and Existing Junction 'with Proposed Development' flow sets, at Assessment Phase 1 (21.5mppa).

2.1.2 No assessment has been undertaken for the Proposed Mitigation 'with Proposed Development' scenario at Assessment Phase 1, as the Hitchin mitigation schemes are not proposed to be provided until Assessment Phase 2a.

Table 1: 2027 Assessment Phase 1 - A602 Park Way / A602 Stevenage Road / B656 Hitchin Hill /B656 London Road / Gosmore Road roundabout

Arm	AM Peak					
	Existing Junction (Future Baseline)			Existing Junction (with Proposed Development)		
	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)
A602 Park Way	1376	-	299	1375	-	280
Hitchin Hill	446	-	4	437	-	4
A602 Stevenage Road	1096	-	245	1087	-	240
B656 London Road	206	-	1	204	-	1
Gosmore Road	108	-	0	108	-	0
Average Junction Delay (seconds)	707			681		
	PM Peak					
A602 Park Way	1180	-	130	1189	-	139
Hitchin Hill	634	-	24	611	-	21
A602 Stevenage Road	1082	-	274	1084	-	274
B656 London Road	284	-	1	287	-	1
Gosmore Road	71	-	0	71	-	0
Average Junction Delay (seconds)	532			545		

* This junction has been modelled in lane simulation mode to better represent lane usage. ARCADY does not report RFC values when using lane simulation.

2.1.3 **Table 1** shows that in Assessment Phase 1 the Proposed Development would have minimal impact on the performance of the junction.

2.1.4 The following table summarises the operation of the Upper Tilehouse Street / Paynes Park / A602 Park Way roundabout for the Existing Junction 'without Proposed Development' and Existing Junction 'with Proposed Development' at Assessment Phase 1 (21.5mppa).

2.1.5 No assessment has been undertaken for the Proposed Mitigation 'with Proposed Development' scenario at Assessment Phase 1, as the Hitchin mitigation schemes are not proposed to be provided until Assessment Phase 2a.

Table 2: 2027 Assessment Phase 1- Upper Tilehouse Street / Paynes Park / A602 Park Way roundabout

Arm	AM Peak					
	Existing Junction (Future Baseline)			Existing Junction (with Proposed Development)		
	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)
Upper Tilehouse Street	1118	0.78	4	1136	0.80	4
Paynes Park	955	0.43	1	949	0.43	1
A602 Park Way	643	0.46	1	645	0.46	1
Average Junction Delay (seconds)	7			7		
	PM Peak					
Upper Tilehouse Street	972	0.74	3	983	0.75	3
Paynes Park	1021	0.43	1	1024	0.43	1
A602 Park Way	795	0.59	2	792	0.59	1
Average Junction Delay (seconds)	6			6		

2.1.6 **Table 2** shows that in Assessment Phase 1 the Proposed Development would have minimal impact on the performance of the junction.

2.1.7 The following table summarises the operation of the A505 Offley Road / Pirton Road / Upper Tilehouse Street / Wratten Road West roundabout for the Existing Junction 'without Proposed Development' and Existing Junction 'with Proposed Development' at Assessment Phase 1 (21.5mppa).

2.1.8 No assessment has been undertaken for the Proposed Mitigation 'with Proposed Development' scenario at Assessment Phase 1, as the Hitchin mitigation schemes are not proposed to be provided until Assessment Phase 2a.

Table 3: 2027 Assessment Phase 1- A505 Offley Road / Pirton Road / Upper Tilehouse Street / Wratten Road roundabout

Arm	AM Peak					
	Existing Junction (Future Baseline)			Existing Junction (with Proposed Development)		
	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)
A505 Offley Road	564	0.90	7	581	0.93	9
Pirton Road	517	0.95	10	518	0.97	12
Upper Tilehouse Street	706	0.75	3	694	0.73	3
Wratten Road West	15*	0.04	0	15	0.04	0
Average Junction Delay (seconds)	40			46		
	PM Peak					
A505 Offley Road	544	0.93	9	554	0.94	10
Pirton Road	396	0.71	2	398	0.72	2
Upper Tilehouse Street	757	0.80	4	752	0.79	4
Wratten Road West	15*	0.04	0	15*	0.04	0
Average Junction Delay (seconds)	31			33		

* The CBLTM-LTN did not include a traffic flow for Wratten Road West as it is a minor road. A nominal flow of 15 PCUs arriving and departing Wratten Road West has been included in the junction model.

2.1.9 **Table 3** shows that in Assessment Phase 1 the Proposed Development would have minimal impact on the performance of the junction.

2.2 2039 Assessment Phase 2a

2.2.1 The following table summarises the operation of the A602 Park Way / A602 Stevenage Road / B656 Hitchin Hill / B656 London Road / Gosmore Road roundabout for the Existing Junction 'without Proposed Development', Existing Junction 'with Proposed Development' and Proposed Mitigation 'with Proposed Development' flow sets, at Assessment Phase 2a (27mppa).

Table 4: 2039 Assessment Phase 2a- A602 Park Way / A602 Stevenage Road / B656 Hitchin Hill / B656 London Road / Gosmore Road roundabout

Arm	AM Peak								
	Existing Junction (Future Baseline)			Existing Junction (with Proposed Development)			Proposed Junction (with Proposed Development)		
	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)
A602 Park Way	1398	-	340	1343	-	295	1343	-	114
Hitchin Hill	423	-	4	468	-	4	468	-	3
A602 Stevenage Road	1114	-	287	1119	-	194	1119	-	120
B656 London Road	259	-	1	263	-	1	263	-	1
Gosmore Road	115	-	0	115	-	0	115	-	0
Average Junction Delay (seconds)	795			617			263		
	PM Peak								
A602 Park Way	1241	-	159	1281	-	215	1281	-	63
Hitchin Hill	578	-	15	549	-	6	549	-	5
A602 Stevenage Road	1090	-	290	1156	-	317	1156	-	236

Arm	AM Peak								
	Existing Junction (Future Baseline)			Existing Junction (with Proposed Development)			Proposed Junction (with Proposed Development)		
	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)
B656 London Road	337	-	1	319	-	1	319	-	1
Gosmore Road	75	-	0	77	-	0	77	-	0
Average Junction Delay (seconds)	572			663			349		

* This junction has been modelled in lane simulation mode to better represent lane usage. ARCADY does not report RFC values when using lane simulation.

2.2.2 **Table 4** shows that there is predicted to be extensive queuing on both the A602 approaches to the roundabout in the 2039 Future Baseline and in both the AM and PM peak hour. The length of the queues on the A602 indicates that there would be capacity problems in the 2039 Future Baseline.

2.2.3 The addition of 'with Proposed Development' flows to the existing junction layout does not have a material effect to the junction operation in the AM peak, however in the PM peak the addition of 'with Proposed Development' flows to the existing junction would result in a worsening of the junction operation, with increases to queues on both arms of the A602.

2.2.4 The results of the Proposed Junction 'with Proposed Development' analysis show that the proposed mitigation scheme improves the overall junction operation in both the AM and PM to a point beyond the existing junction 'future baseline' operation, and therefore mitigates the impact of the airport traffic.

2.2.5 The following table summarises the operation of the Upper Tilehouse Street / Paynes Park / A602 Park Way roundabout for the Existing Junction 'without Proposed Development', Existing Junction 'with Proposed Development' and Proposed Mitigation 'with Proposed Development' flow sets, at Assessment Phase 2a (27mppa).

Table 5: 2039 Assessment Phase 2a- Upper Tilehouse Street / Paynes Park / A602 Park Way roundabout

Arm	AM Peak								
	Existing Junction (Future Baseline)			Existing Junction (with Proposed Development)			Proposed Junction (with Proposed Development)		
	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)
Upper Tilehouse Street	1345	0.95	15	1219	0.89	8	1219	0.87	7
Paynes Park	895	0.44	1	1379	0.59	2	1379	0.59	2
A602 Park Way	670	0.48	1	560	0.51	1	560	0.45	1
Average Junction Delay (seconds)	20			11			10		
	PM Peak								
Upper Tilehouse Street	1159	0.85	6	1186	0.95	13	1186	0.93	11
Paynes Park	1006	0.43	1	1410	0.60	2	1410	0.60	2
A602 Park Way	761	0.56	1	726	0.66	2	726	0.59	1
Average Junction Delay (seconds)	9			17			14		

2.2.6 **Table 5** shows that by 2039, growth in traffic would lead to the existing roundabout Future Baseline scenario operating above its capacity in the AM peak hour and at capacity in the PM peak hour. The addition of 'with Proposed Development' flows to the existing junction shows that the junction would operate at or above its theoretical capacity threshold in the AM and PM peak hour.

2.2.7 The analysis shows that the proposed junction mitigation would reduce the queue lengths and average junction delay with the Proposed Development in place, to a lower level to the Future Baseline in the AM peak. In the PM peak, while queues along Upper Tilehouse Street are marginally longer than the Future Baseline, average delay at the junction is only slightly increased.

2.2.8 The following table summarises the operation of the A505 Offley Road / Pirton Road / Upper Tilehouse Street / Wratten Road West roundabout for the Existing Junction 'without Proposed Development', Existing Junction 'with Proposed Development' and Proposed Mitigation 'with Proposed Development' flow sets, at Assessment Phase 2a (27mppa).

Table 6: 2039 Assessment Phase 2a- A505 Offley Road / Pirton Road / Upper Tilehouse Street / Wratten Road roundabout

Arm	AM Peak								
	Existing Junction (Future Baseline)			Existing Junction (with Proposed Development)			Proposed Junction (with Proposed Development)		
	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)
A505 Offley Road	837	1.33	139	579	0.90	7	579	0.87	6
Pirton Road	475	0.95	11	600	1.12	43	600	1.12	43
Upper Tilehouse Street	730	0.77	3	975	1.03	32	975	0.79	4
Wratten Road West	15*	0.04	0	15*	0.05	0	15*	0.06	0
Average Junction Delay (seconds)	296			118			76		
	PM Peak								
A505 Offley Road	664	1.18	62	681	1.20	70	681	1.16	60
Pirton Road	462	0.85	5	471	0.87	6	471	0.89	7
Upper Tilehouse Street	795	0.84	5	949	1.00	23	949	0.77	3
Wratten Road West	15*	0.04	0	15*	0.05	0	15*	0.06	0

Arm	AM Peak								
	Existing Junction (Future Baseline)			Existing Junction (with Proposed Development)			Proposed Junction (with Proposed Development)		
	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)
Average Junction Delay (seconds)	120			164			103		

* The CBLTM-LTN did not include a traffic flow for Wratten Road West as it is a minor road. A nominal flow of 15 PCUs arriving and departing Wratten Road West has been included in the junction model.

2.2.9 **Table 6** shows that the existing roundabout would be operating above its theoretical capacity threshold in the Future Baseline 2039 AM and PM peak hour. The addition of 'with Proposed Development' flows to the existing junction shows that the junction would operate above its theoretical capacity threshold in the AM and PM peak hour, like in the Future Baseline, albeit with minor improvements in the AM peak as a result of traffic rerouting reflected in the strategic model.

2.2.10 The analysis shows that the proposed junction mitigation would generally reduce the queue lengths and average junction delay with the Proposed Development in place, to a similar level to that predicted for the Future Baseline in the PM peak. In the AM peak, while queues along Pirton Road are longer than the Future Baseline, average delay at the junction is reduced through improvements to queuing along A505 Offley Road.

2.3 2043 Assessment Phase 2b

2.3.1 The following table summarises the operation of the A602 Park Way / A602 Stevenage Road / B656 Hitchin Hill / B656 London Road / Gosmore Road roundabout for the Existing Junction 'without Proposed Development', Existing Junction 'with Proposed Development' and Proposed Mitigation 'with Proposed Development' flow sets, at Assessment Phase 2b (32mppa).

Table 7: 2043 Assessment Phase 2b- A602 Park Way / A602 Stevenage Road / B656 Hitchin Hill / B656 London Road / Gosmore Road roundabout

Arm	AM Peak								
	Existing Junction (Future Baseline)			Existing Junction (with Proposed Development)			Proposed Junction (with Proposed Development)		
	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)
A602 Park Way	1397	-	345	1359	-	342	1359	-	137
Hitchin Hill	433	-	5	462	-	4	462	-	3
A602 Stevenage Road	1126	-	292	1150	-	236	1150	-	157
B656 London Road	283	-	1	307	-	1	307	-	1
Gosmore Road	119	-	0	120	-	0	120	-	0
Average Junction Delay (seconds)	807			715			342		
	PM Peak								
A602 Park Way	1249	-	184	1312	-	234	1312	-	73
Hitchin Hill	578	-	13	527	-	5	527	-	4
A602 Stevenage Road	1114	-	300	1160	-	319	1160	-	233

Arm	AM Peak								
	Existing Junction (Future Baseline)			Existing Junction (with Proposed Development)			Proposed Junction (with Proposed Development)		
	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)
B656 London Road	303	-	1	334	-	1	334	-	1
Gosmore Road	78	-	0	78	-	0	78	-	0
Average Junction Delay (seconds)	617			684			347		

* This junction has been modelled in lane simulation mode to better represent lane usage. ARCADY does not report RFC values when using lane simulation.

2.3.2 **Table 7** shows that there is predicted to be extensive queuing on both the A602 approaches to the roundabout in the 2043 Future Baseline and in both the AM and PM peak hour. The length of the queues on the A602 indicates that there would be capacity problems in the 2043 Future Baseline, with the addition of 'with Proposed Development' flows resulting in relatively minor increases to queuing and delay in the PM peak.

2.3.3 The analysis shows that the junction improvement would reduce the queue lengths and average junction delay with the Proposed Development in place, to a level lower than that predicted for the Future Baseline in the AM and PM peak. The Proposed Development and associated junction mitigation are not considered to have an adverse impact on the operation of the junction.

2.3.4 The following table summarises the operation of the Upper Tilehouse Street / Paynes Park / A602 Park Way roundabout for the Existing Junction 'without Proposed Development', Existing Junction 'with Proposed Development' and Proposed Mitigation 'with Proposed Development' flow sets, at Assessment Phase 2b (32mppa).

Table 8: 2043 Assessment Phase 2b- Upper Tilehouse Street / Paynes Park / A602 Park Way roundabout

Arm	AM Peak								
	Existing Junction (Future Baseline)			Existing Junction (with Proposed Development)			Proposed Junction (with Proposed Development)		
	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)
Upper Tilehouse Street	1360	0.97	18	1290	0.93	12	1290	0.92	10
Paynes Park	898	0.44	1	1315	0.58	2	1315	0.58	2
A602 Park Way	675	0.49	1	589	0.53	1	589	0.47	1
Average Junction Delay (seconds)	23			16			13		
	PM Peak								
Upper Tilehouse Street	1200	0.87	6	1271	0.98	21	1271	0.96	16
Paynes Park	1001	0.43	1	1389	0.60	2	1389	0.60	2
A602 Park Way	742	0.56	1	711	0.63	2	711	0.56	1
Average Junction Delay (seconds)	10			24			20		

2.3.5 **Table 8** shows that the existing roundabout would be operating above its theoretical capacity threshold in the Future Baseline 2043 AM and PM peak hour. The addition of 'with Proposed Development' flows to the existing junction would increase queuing and delay in the PM peak, although traffic rerouting means that the impact in the AM peak is negligible with a slight reduction in queues along Upper Tilehouse Street.

2.3.6 In the AM peak, the operation of the improved junction with the Proposed Development in place would be better than in the Future Baseline. In the PM peak the junction operation would be worse than in the Future Baseline with the Upper Tilehouse Street approach operating at capacity. However, the queue length would not block back to any other junctions, the average junction delay remains relatively small and overall average delays are not materially worse than those experienced in the future baseline AM peak hour.

2.3.7 The following table summarises the operation of the A505 Offley Road / Pirton Road / Upper Tilehouse Street / Wratten Road West roundabout for the Existing Junction 'without Proposed Development', Existing Junction 'with Proposed Development' and Proposed Mitigation 'with Proposed Development' flow sets, at Assessment Phase 2b (32mppa).

Table 9: 2043 Assessment Phase 2b- A505 Offley Road / Pirton Road / Upper Tilehouse Street / Wratten Road roundabout

Arm	AM Peak								
	Existing Junction (Future Baseline)			Existing Junction (with Proposed Development)			Proposed Junction (with Proposed Development)		
	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)	Demand (PCUs)	RFC	Queue (PCUs)
A505 Offley Road	894	1.41	189	603	0.93	10	603	0.91	8
Pirton Road	436	0.88	6	646	1.24	74	646	1.24	75
Upper Tilehouse Street	748	0.79	4	997	1.05	41	997	0.81	4
Wratten Road West	15*	0.04	0	15*	0.05	0	15*	0.06	0
Average Junction Delay (seconds)	389			183			131		
	PM Peak								
A505 Offley Road	678	1.20	70	752	1.33	124	752	1.29	104
Pirton Road	489	0.90	7	486	0.90	7	486	0.92	8
Upper Tilehouse Street	834	0.88	7	960	1.01	27	960	0.78	3
Wratten Road West	15*	0.04	0	15*	0.05	0	15*	0.06	0
Average Junction Delay (seconds)	140			273			198		

* The CBLTM-LTN did not include a traffic flow for Wratten Road West as it is a minor road. A nominal flow of 15 PCUs arriving and departing Wratten Road West has been included in the junction model.

2.3.8 **Table 9** shows that the existing roundabout would be operating above its theoretical capacity threshold in the Future Baseline 2043 AM and PM peak hour with issues on the A505 Offley Road in particular. The addition of the 'with Proposed Development' flows to the existing junction indicates a worsening of junction operation in the PM peak, with queuing on Offley Road particularly affected.

2.3.9 The analysis shows that the proposed junction 'with Proposed Development' flows would operate above its theoretical capacity threshold in the AM and PM peak hour, like in the future baseline. The operation of the proposed junction would be improved in the AM peak hour despite the increase in total traffic, as rerouting results in less traffic on the A505 Offley Road. In the PM peak hour, the junction operation would be worsened with the maximum RFC and average junction delay increased.

2.3.10 The junction location is constrained by properties on all sides and options to add further mitigation are limited. When the increased impact in the PM peak hour is balanced against the improvement in the AM peak hour, the overall impact is not considered to materially worsen the performance of the junction in Assessment Phase 2b.

3 SUMMARY AND CONCLUSION

3.1.1 This report has sought to respond to the ExA request for additional standalone modelling information relating to the proposed off-site highway mitigation works. The note initially provided the context of the modelling undertaken, and where possible has provided the information requested by the ExA.

3.1.2 The modelling included within the report continues to show the benefits of the proposed off-site works in mitigating the impacts of the Proposed Development.