SURREY
COUNTY COUNCIL

WOKING LOCAL PLAN

Potential Mitigation

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Prepared By: Print Phil Smith and Caroline Edgar

Authorised By: Print William Bryans

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CONTENTS

1 INTRODUCTION

1.1 Overview

1.1.1 In 2010, Surrey County Council (SCC) assisted Woking Borough Council (WBC) by undertaking a strategic transport assessment to inform their Local Plan Core Strategy. The strategic transport assessment was undertaken to support future development in the borough. In 2012, WBC adopted their Core Strategy.

1.1.2 Since the Core Strategy has been adopted, WBC identified specific locations for development. One aspect of this process focused on the potential release of green belt land. To assist with decision making regarding recommendations from the borough's Green Belt Boundary Review[1], SCC undertook further strategic transport modelling[2] in 2015, to specifically analyse potential green belt sites that were thought deliverable. Subsequent modelling[3] in 2016 was undertaken for an alternative greenbelt site in Woking.

1.1.3 This strategic modelling, associated with the Woking Local Plan and Greenbelt allocations, was undertaken in the **S**urrey's **In**tegrated **Tra**nsport **M**odel (SINTRAM). The results from the reports indicated that mitigation was required due to the forecast increases in flows on the surrounding network, as a result of the additional development.

1.1.4 As such, WBC requested SCC to undertake a study into potential mitigation options[4]. These mitigation schemes were focused on areas of the borough that are forecast to be most affected by the increased number of trips on the network resulting from the Local Plan scenarios.

1.1.5 At a meeting held with WBC and SCC on 6th May 2016, it was decided that potential mitigation schemes needed to be identified along the A245 corridor. This work was put on hold in July 2016 as a result of WBC needing to consider the possible alternative greenbelt site off Martyr's Lane (as detailed above). At a meeting on 2nd March this year, Transport Studies were requested to re-commence work on the mitigation studies for reporting in October

1.2 Objectives

1.2.1 This document has been produced in conjunction with the Local Plan documents listed above, in order to consider mitigation options for the borough of Woking. The overall aim of the project is to identify feasible proposals that could be included in the borough's Infrastructure Schedule and Infrastructure Delivery Plan and subsequently delivered should development proposals be progressed.

1.2.2 The main objectives of this study are to:

- Describe the areas that require mitigation;
- Assess (via further modelling) the mitigation schemes available; and
- Provide suggestions for mitigation within the borough of Woking.

[1] https://www.woking.gov.uk/planning/policy/ldfresearch/greenbeltreview

[2] Doc 01_Greenbelt Sensitivity Test Strategic Transport Assessment.pdf

[3] Doc04_Woking Greenbelt Sensitivity Test_Addendum Report_Scenario G & H - Iss 2.pdf

[4] S:\Project-current\3000 PROJECT NOS STARTING WTIH 3000\3613\53613T44_Woking Local Plan Mitigation\01 Documents\Doc02_WokingMitigation_StudyBrief.docx

2 KEY LOCATIONS

2.1.1 Three key locations on the road network have been studied in order to understand the existing traffic conditions, the future traffic conditions based on the Woking Local Plan scenarios and whether mitigation options can be developed for each location. These are:

1) A245 Parvis Road/Byfleet Road corridor;
2) A245 Byfleet Road junction with B365 Seven Hills Road; and
3) A245 Parvis Road junction with Camphill Road.

2.1.2 The three locations are shown in **Figure 2.1**.

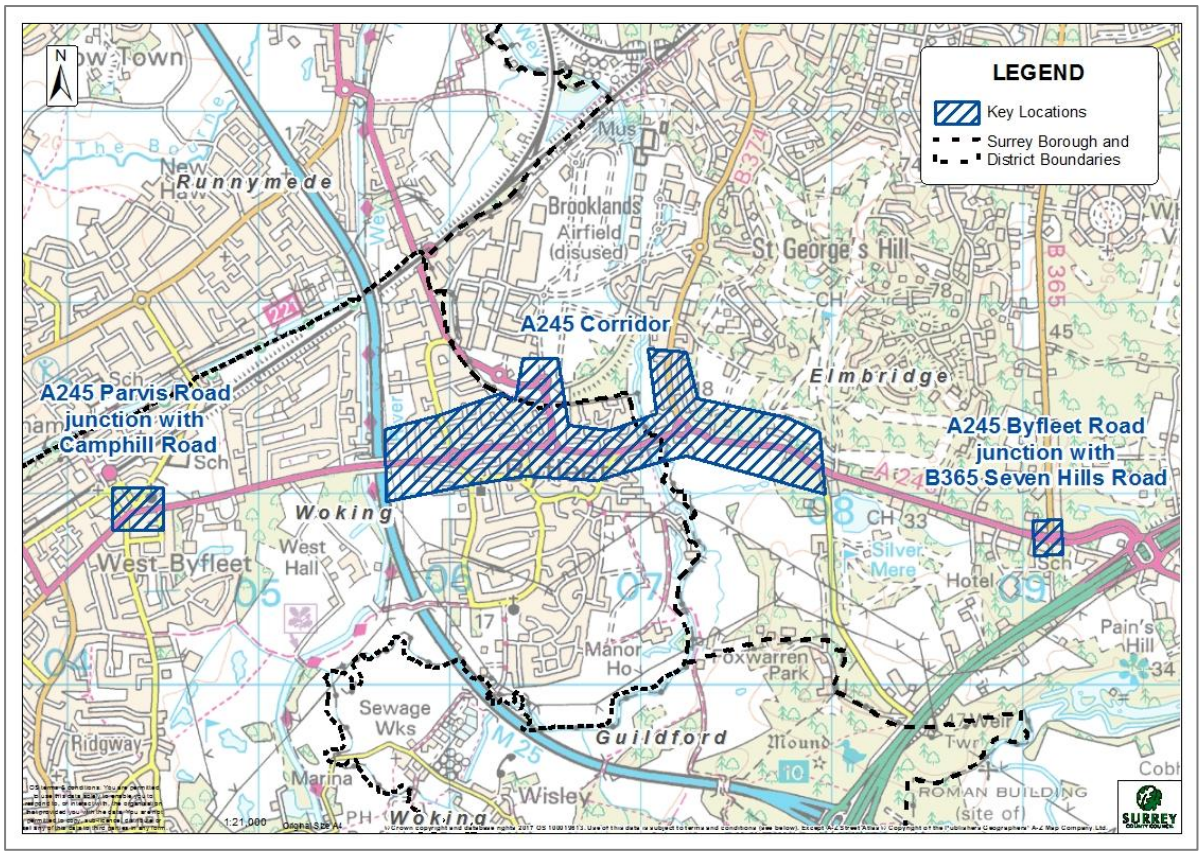


Figure 2.1: Key Locations

2.1.3 The evidence gathered to understand existing and future traffic conditions in these three areas is set out in the sections below.

2.1.4 Individual reports have been written for each location and have been included in this report as annexes.

3 EVIDENCE AND MODELLING

3.1 A245 Parvis Road/Byfleet Road corridor

3.1.1 The evidence base to understand traffic conditions on A245 Byfleet, Woking Paramics Discovery Model includes:

1) Paramics Discovery models (base model 2016, option tests 2026)
2) WSP Route Management Study (2002)

Paramics Discovery Model

3.1.2 A 2016 base model of the A245 corridor was created by Surrey County Council's Transport Studies team for the AM peak hour in microsimulation software called Paramics Discovery[5]. The base model simulates the current traffic conditions along the corridor and supports observed evidence that there is some congestion and queuing present, most notably along the A245 corridor itself in an eastbound direction with key congestion hotspots on A245 Byfleet Road eastbound and A245 Parvis Road at the approach to the junction with B3760 Chertsey Road.

3.1.3 An 'Option 1' test was run using vehicle flows increased to the level forecast for the year 2026 using factors derived from SINTRAM. Forecast flows are considered to be a worst case scenario as they are derived from Woking Local Plan model scenario F, which contains the highest number of dwellings on greenbelt land. The highway network in 'Option 1' is the same as the base model.

3.1.4 The forecast increase in flows in Option 1 has a considerable negative impact on the modelled network as a whole during the AM peak hour, with a large drop in the mean speed of vehicles, and a large increase in the mean travel time of vehicles on the network. The total delay on the network in Option 1 increases from the base by 62.5% and is the equivalent of an additional 7 days of delay.

3.1.5 The impact of the increased forecast flows in Option 1 on congestion appears to be most concentrated on B374 Brooklands Road southbound and A245 Parvis Road eastbound. Hotspot analysis on A245 Parvis Road eastbound indicates that the largest increases in journey time occur immediately prior to the A245 roundabout junction with B374 Brooklands Road and immediately prior to the roundabout junction with D3760 Chertsey Road. It should be noted that these characteristics already exist on-street and as shown in the modelling, are exacerbated by the increases in flows by 2026.

3.1.6 These junctions are considered to be operating poorly currently and with the forecast increased vehicle flows. At the Chertsey Road roundabout, the roundabout carriageway is not wide enough for two vehicles to navigate the junction in parallel; this causes unnecessary delay. The primary cause of congestion at the Brooklands Road roundabout is delay that resides outside of the model network on the A245 approach to the junction with B365 Seven Hills Road, this causes queuing back to the Brooklands Road roundabout. Further to this, often vehicles on B374 Brooklands Road southbound are unable to turn right onto A245 Parvis Road westbound due to vehicles queuing on the roundabout blocking the junction. This causes further delay on B374 Brooklands Road southbound.

[5] Please see LMVR for further details H:\Modelling\.paramics\53613T44_Woking Local Plan Paramics Discovery\01_Documents\Doc01_ByfleetParamicsDiscoveryLMVR_20170323_inc_appendices

3.1.7 Further modelling was undertaken to understand the impact of removing this delay that resides outside of the model network. This test found that congestion issues surrounding the A245 roundabout junction with B374 Brooklands Road improve dramatically when the delay is removed. The overall performance of the network is much better, demonstrated by improved network summary statistics when compared with Option 1. The journey times on B374 Brooklands Road southbound and A245 Byfleet Road eastbound are also reduced considerably. It should be noted that the congestion at D3760 Chertsey Road roundabout junction with A245 Parvis Road remains and there are other slight detrimental effects to the network, primarily an increase in queue length at D3760 Oyster Lane (south) northbound.

3.1.8 Overall, the modelling detailed above indicates that mitigation is required against the effect of the increase in flow forecast up to the year 2026. As the negative impacts of the Option 1 model are situated at either end of the A245 corridor (most notably at the D3760 Chertsey Road roundabout and the B374 Brooklands Road roundabout), it is suggested that potential mitigation options should be focussed at these locations.

3.1.9 For further detail on the impact of forecasting flows up to 2026 on the road network (Option 1) and the implications of removing the delay to vehicles on A245 Byfleet Road, please see **Annex A**.

WSP: A245/A320 Route Management Study (2002)[6]

3.1.10 SCC commissioned WSP to conduct a movement study on the A245 corridor, which was published in 2002. The study identifies that no ideal solution will be reached as the route is constrained by urban development. However, it is considered that a balance must be found between sustainable transport (i.e. implementing this without impeding other modes) and 'predict and provide'. Importantly, the report suggests several possible options to mitigate against increased vehicle journey times and congestion along the route.

3.1.11 As such, this report has been used as a resource to target and inform possible mitigation options for the A245 corridor. It is apparent that highway and traffic conditions may have changed considerably since the WSP report was published in 2002. Accordingly, mitigation presented in this summary that has been adapted from the proposals in the WSP report only relate to issues that have been identified as a current problem.

3.1.12 The report indicates that network conditions around the D3760 Chertsey Road roundabout junction with A245 Parvis Road were satisfactory at the time the report was published, with little queuing. It does however state that the right turn from A245 eastbound into Byfleet (via High Road) could be banned to improve the junction. Furthermore a lane going across the car park could be added to facilitate vehicles turning left to A245 Parvis Road westbound from High Road (which requires the war memorial to be moved).

3.1.13 The report states that the roundabout junction of Brooklands Road and A245 appears to work satisfactorily at the time the report was produced. It states that existing queues and delays seem to be related to the level of blocking back

[6] S:\Project-current\3000 PROJECT NOS STARTING WTIH 3000\3613\53613T36_Woking Local Plan Greenbelt Sensitivity Tests\04 Documents\01 WSP Route Management Study 2002\A245_A320_RouteManagementStudy_WSP_report_020802.pdf

through the junction experienced when vehicles heading east are unable to get around vehicles turning down side roads (such as Redhill Road) further along A245 Byfleet Road. As a possible solution to this issue, WSP propose restricting the right hand turn movement out of Redhill Road to allow space for a right hand turn lane on A245 Byfleet Road eastbound for vehicles turning into Redhill Road. This would prevent eastbound vehicles wanting to turn right down Redhill Road blocking vehicles behind them from continuing eastbound on A245.

3.1.14 The suggested improvements outlined above are restricted to targeted junction improvements only. For further information on suggested improvements to the A245 Corridor between Dartnell Park Road in the west and Redhill Road in the east, including consultation feedback and improvements for Non-Motorised Users (NMU) of the transport network, please see **Annex B**.

Further evidence collected

Redhill Road (MCTC)

3.1.1 As reported on in **section 3.1.15**, in order to better understand whether a change to the A245 junction with Redhill Road would be beneficial, a Manual Classified Turning Count (MCTC) was undertaken at the junction in September 2017, in order to quantify the demand for the right turn from A245 Byfleet Road to Redhill Road. The results of this survey are contained in **Annex C**.

3.1.2 The results of the MCTC indicate that although the Redhill Road junction does contribute to some of the delay to vehicles on A245 Byfleet Road eastbound, the demand for the right turn is fairly low (see **Annex C**) and that the delay appears to be caused further downstream at the junction with Seven Hills Road.

3.1.3 It is therefore suggested that although introducing a ghost right turn lane on A245 Byfleet Road eastbound would likely reduce some delay on the road, combating the cause of delay further downstream is likely to be the most effective course of action.

Brooklands Road roundabout site visits

3.1.4 Although the evidence in **section 3.1.10** indicates that the main cause of delay at the Brooklands Road roundabout is located downstream on A245 Byfleet Road eastbound (possibly the junction with B365 Seven Hills Road), site visits were undertaken to assess whether any other changes could be made at the roundabout junction of A245 and B374 Brooklands Road to improve efficiency.

3.1.5 Observations from the site visit (see **Annex D**) show that vehicles travelling on A245 eastbound often queue on the roundabout itself during peak times. Vehicles enter the roundabout but are unable to exit onto A245 Byfleet Road eastbound due to queues and therefore are stationary on the roundabout. This blocks vehicles on B374 Brooklands Road southbound from entering the roundabout and causes unnecessary delay to vehicles turning right from B374 Brooklands Road southbound to A245 Parvis Road westbound.

3.2 A245 Byfleet Road/B365 Seven Hills Road junction

3.2.1 The signalised junction of the A245 Byfleet Road junction with B365 Seven Hills Road (J510) has long been acknowledged as a congestion hotspot within Surrey (**Appendix I**). Modelling of the junction to establish a base was undertaken in the modelling package LinSig. This model showed that the junction was currently operating at or just above its capacity, and is reported on in detail in **Annex E**.

3.2.2 To understand the impact of future growth on the operation of the junction, forecast flows to 2026, based on the Local Plan scenarios, were added to the base model. The scenario (F) with the largest increase in flows was used as this was considered to be the worst case scenario. The model outputs showed a dramatic decline in junction performance. There was a very large increase in total delay, as well as increases in queues, which do extend back to upstream junctions, specifically the roundabout with the A3 northbound off-slip.

3.2.3 The modelling results show that the junction performance deteriorates considerably in Scenario F. As such, mitigation measures have been tested and these include alterations to the network and the signal timings, and are detailed in **section 3**.

3.3 A245 Parvis Road/Camphill Road junction

3.3.1 The signalised junction of A245 Parvis Road/Old Woking Road with Station Approach, Camphill Road and Pyrford Road (J401) was assessed as this was considered as another hotspot for delay on the network (**Appendix II**). In addition, a number of large developments[7] are proposed in the vicinity of the junction.

3.3.2 As such, a report was produced (**Annex F**) that considered all of the nearby Transport Assessments (TA) that have tested development flows on the signalised junction. Each of the TAs contains 'traffic impact' and 'mitigation' chapters in which the Camphill Road junction is mentioned. Further to the TAs, the study undertaken by WSP back in 2002, and mentioned in **section 3.1**, also considered this A245 junction. These reports all provide mitigation recommendations. In addition, LinSig modelling was undertaken in October 2016 by SCC, to understand the impact of various highway alterations on the network.

3.3.3 From the four Transport Assessments that directly model the signalised A245 Old Woking Road/Parvis Road/Camphill Road junction, as well as the WSP report and the modelling undertaken by SCC, the junction is shown to currently operate at or just below its capacity.

3.3.4 Nevertheless, with forecast traffic growth and specific residential and commercial developments proposed in the vicinity, the junction will operate over capacity in the near future. This shows that changes are required in order to mitigate against the cumulative impact of these developments.

[7] H:\Modelling\project\4C078001_A245ParvisRd_CamphillRd\02 Documents\WSP & planning app recommendations\Doc01_53613T44_A245ParvisRd_CamphillRd_Recommendations_appendices.pdf

4 MITIGATION OPTIONS

4.1.1 This section outlines the modelling undertaken to date and possible next steps that could be taken in order to inform mitigation strategies in the key locations.

4.2 A245 Parvis Road/Byfleet Road corridor

4.2.1 Microsimulation modelling of the road network with flows forecast up to the year 2026 has helped identify two key locations that are strongly impacted, and it is therefore considered that these are the target areas where mitigation should be considered. The details of potential mitigation options are outlined below, and are informed by the WSP A245 Movement Study (2002), the MCTC undertaken in September 2017 and site visit observations.

Chertsey Road roundabout

4.2.2 Both microsimulation modelling and the WSP Movement Study (2002) identify that the A245 roundabout junction with Chertsey Road is an area of congestion both now and in the future (i.e. by 2026). Modelling and site visits indicate that congestion is primarily on the A245 eastbound approach to the junction, however observations from site visits suggest that congestion can also be an issue on the A245 westbound approach to the junction. Although the specific mitigation proposals set out in the WSP movement study (including the movement of the War Memorial at the junction) might be considered unfeasible, there is a relatively large amount of land at the junction that could be available for expansion of the junction. It is considered that it is possible that increasing the circulatory carriageway so two parallel vehicles can navigate the junction at once could improve throughput of vehicles.

4.2.3 It is therefore suggested that further, more precise modelling of the effect of expanding the junction is required, in order to understand how altering the layout of the roundabout might improve traffic conditions. **Section 5.1** and **Annex G** set out the recommendation for further modelling work, specifically an ARCADY model, in order to assess the benefit of expanding the roundabout.

Brooklands Road roundabout

4.2.4 The microsimulation modelling identifies that a key cause of delay on the A245 corridor is located on the A245 eastbound, east of the roundabout junction with B374 Brooklands Road. It also identifies that if the cause of this delay were to be removed, there would be considerable benefits to the road network.

4.2.5 From the evidence in the WSP movement study, it is implied that the cause of the delay on A245 Byfleet Road eastbound is vehicles on A245 eastbound turning right onto Redhill Road and delaying vehicles behind them. However, the MCTC undertaken in September 2017 indicates that although Redhill Road is a source of delay, the main cause is the junction with the B365 Seven Hills Road further upstream (see **Annex D**). This evidence therefore suggests that targeting the delay further up the A245 eastbound is the primary option to mitigate against congestion on this section of the A245 eastbound. It should be noted that changes could also be made at the junction of A245 and Redhill Road in order to slightly reduce delay.

4.2.6 Evidence from site visits (**Annex D**) suggests that implementing “Keep Clear” signs on the roundabout carriageway would help to alleviate congestion

surrounding the A245 Brooklands Road junction. As set out above, "Keep Clear" markings will dissuade vehicles travelling eastbound on A245 from queuing on the roundabout itself and will allow vehicles on B374 Brooklands Road southbound wishing to turn right to enter the junction, rather than having to wait for an acceptable gap in the queue on the roundabout. It is expected that this will reduce queuing on B374 Brooklands Road and reduce delay.

4.3 A245 Byfleet Road/B365 Seven Hills Road junction

4.3.1 As stated in **section 2.3**, the forecast flows to 2026 caused large impacts at the junction, and specifically on the B365 Seven Hills Road (southbound) arm of the junction, which was most notably affected by the increase. As such, mitigation measures were focused on this arm of the junction to ensure that the effect of the large flow increases could be minimised.

4.3.2 Three mitigation measures were considered, the details of which are shown below in **Table 4.1.**

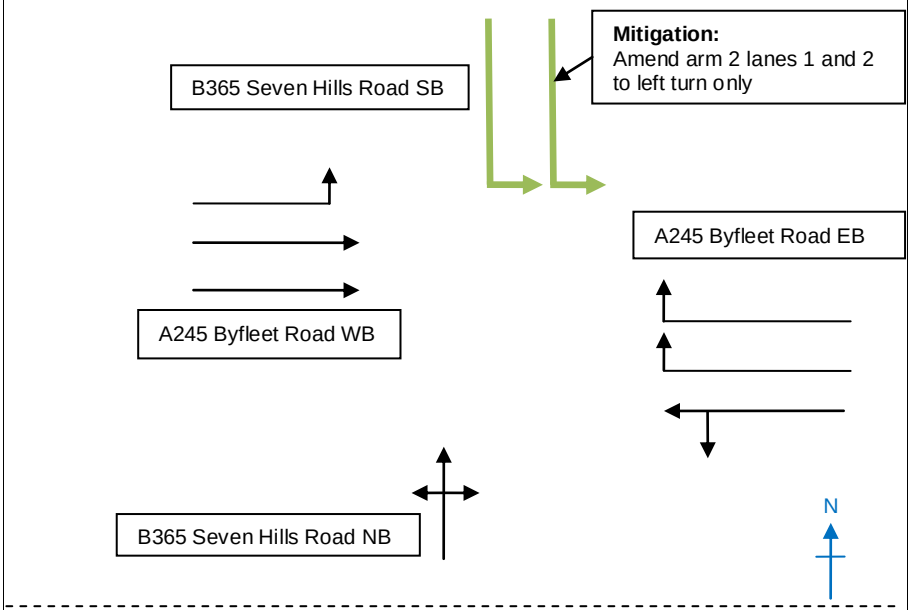
Model	Details
Mitigation Option 1a	➢ extension of lane length on B365 Seven Hills Road (southbound) left turn lane (arm 2 lane 1) from 26m to 120m
Mitigation Option 1b	➢ alteration of extended left turn lane (arm 2 lane 1) to left turn and ahead lane on B365 Seven Hills Road (southbound) ➢ alteration of right turn and ahead lane (arm 2 lane 2) to right turn only lane on the B365 Seven Hills Road (southbound)
Mitigation Option 2	➢ amend both lanes (arm 2 lanes 1 & 2) on B365 Seven Hills Road to left turn only towards Painshill ➢ remove stage 4 and alter stages 2 and 3 to increase green time across stages 1, 2 & 3.

Table 4.1: Mitigation options tested

4.3.3 It was found that both Mitigation Options 1a and 1b had very little impact on the junction itself. The results showed that it would continue to operate above capacity even when mitigation is in place on B365 Seven Hills Road (southbound).

4.3.4 Mitigation Option 2 involved banning the ahead and right turn movements out of B365 Seven Hills Road (north) and rationalisation of the signals from four stages to three to increase the green time to traffic. The alterations to the junction are shown in **Figure 4.1.**

Model	Mitigation Option applied
Mitigation Option 2	• Amend both lanes (arm 2 lanes 1 & 2) on B365 Seven Hills Road to left turn only towards Painshill • Remove stage 4 and alter stages 2 and 3 to increase green time across stages 1, 2 & 3.



Altered phasing and staging in Option 2

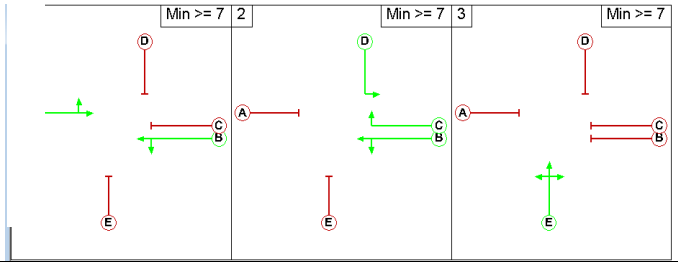


Figure 4.1: Mitigation Option 2 proposed design

4.3.5 As can be seen by the results in **Table 5.2** of **Annex E**, these alterations noticeably improve the junction performance. There is a 52% reduction in total delay which is just over half of the delay experienced in the 2026 Scenario F model, and there are large decreases in queue lengths on multiple arms of the junction.

4.3.6 It should be noted that there are a number of trips (right turn and straight ahead movements from the B365 Seven Hills Road southbound arm) that would be affected by this proposal. From the MCTC that was undertaken in October 2016, this would involve roughly 170 vehicles having to make a U-turn at the downstream Painshill junction, while the 2026 Scenario F would involve a greater number of U-turners (~250). The impact of these additional vehicles at the Painshill junction is expected to be minor but this would have to be tested and Highways England consulted. In addition, it would be necessary to close the gap opposite the school entrance.

4.3.7 Overall, it can be concluded from this model assessment that the signalised junction at the A245 Byfleet Road with the B365 Seven Hills Road is currently operating at or just above its capacity. However, the additional trips in the 2026 Scenario F generate a large detrimental impact at the junction. As such, mitigation measures are required to negate this impact. From the study, it is clear that Mitigation Option 2, with the two left turn only lanes and rationalisation of stages, is the preferred option. This mitigation brings the performance of the junction towards its current levels of operation.

4.3.8 It should also be acknowledged that work is currently on-going to ensure that these mitigation principles are compatible with the emerging Highways England proposals for the M25 junction 10 with the A3 interchange. This scheme specifically includes changes to the Painshill junction which is in the vicinity of the A245/B365 Seven Hills Road junction.

4.4 A245 Parvis Road/Camphill Road junction

4.4.1 **Section 3.3** shows that the A245 junction with Camphill Road is currently operating at its capacity and as such, mitigation is required. This will ensure that it is able to withstand the flow increases forecast in 2026 by the Greenbelt allocations in the Local Plan.

4.4.2 Having considered all of the recommendations from the TAs and the WSP document, it is also clear to see that there are physical capacity restraints at the junction, and therefore increasing its footprint to improve the capacity is not a viable option.

4.4.3 All of the reports that have been studied indicate that the signals should be upgraded beyond their current VA control to a system that continually optimises the stage timings on street. The reports studied suggest that either MOVA or UTC would be suitable.

4.4.4 At this stage, it is thought that upgrading the signals to MOVA control is the most appropriate method for mitigating against any future growth in the surrounding area. MOVA is preferred due to the cost implications of installing a UTC system and UTC is normally used for networks instead of single controller junctions, as per A245 Old Woking Road/Parvis Road/Camphill Road junction.

4.4.5 It is imperative that the upgrade to MOVA at the A245 Old Woking Road/Parvis Road/Camphill Road junction is accompanied by a full upgrade of the equipment, on-street validation, and regular monitoring of the site to ensure that MOVA is working as efficiently as possible.

5 FURTHER MODELLING REQUIRED

5.1 A245 Parvis Road/Byfleet Road Corridor

5.1.1 This section outlines the possible next steps that could be taken in order to inform possible mitigation strategies at locations where evidence suggests that mitigation against the forecast increase in traffic would be appropriate.

5.1.2 It is recommended that an ARCADY Model is built to test the proposal of the expansion of Chertsey Road roundabout (see **Annex G**).

6 SUMMARY AND CONCLUSIONS

6.1.1 This report was commissioned by Woking Borough Council in 2016 to investigate the opportunity for potential mitigation measures to accommodate proposed development growth in the east of Woking borough.

6.1.2 Three areas have been investigated as part of this mitigation study; A245 Parvis Road/Byfleet Road corridor, A245 Byfleet Road junction with B365 Seven Hills Road; and A245 Parvis Road junction with Camphill Road.

6.1.3 Multiple models have been built to obtain statistics on current levels of congestion, to understand the impact of 2026 forecast flows on the network and to identify potential mitigation options.

6.1.4 **Table 6.1** below summarises all of the different elements that have been modelled as part of this study and their associated mitigation proposal. **Appendix III** shows the location of the junctions and the potential improvements.

Element	Mitigation description	Associated annex	Further Actions?
Chertsey Road roundabout	Generate additional capacity by widening the carriageway on the roundabout to allow two vehicles to navigate the roundabout adjacent to one another	G	Model in ARCADY
Brooklands Road roundabout	'Keep Clear' box to improve southbound movement along Brooklands Road and reduce blocking on roundabout	D	
A245 j/w B365 Seven Hills Road	Mitigation Option 2 - two left turn only lanes and rationalisation of stages	E	Detailed design
A245 j/w Camphill Road	Full upgrade of signal equipment and conversion to MOVA	F	

Table 6.1 Summary of mitigation options

6.1.5 Finally, it should be noted that this report and the mitigation options presented focus solely on the benefit to vehicles. It is believed that Non-Motorised Users (NMU) should also be considered in the mitigation options taken forwards. This could be through improvements to bus services, cycle lanes or pedestrian facilities.

6.1.6 Overall, there are several key mitigation options that should be taken forwards to ensure that the network is able to cope with the flow increase forecast in 2026. It is recommended that they are considered in detail and then taken forwards to the Infrastructure Delivery Plan.

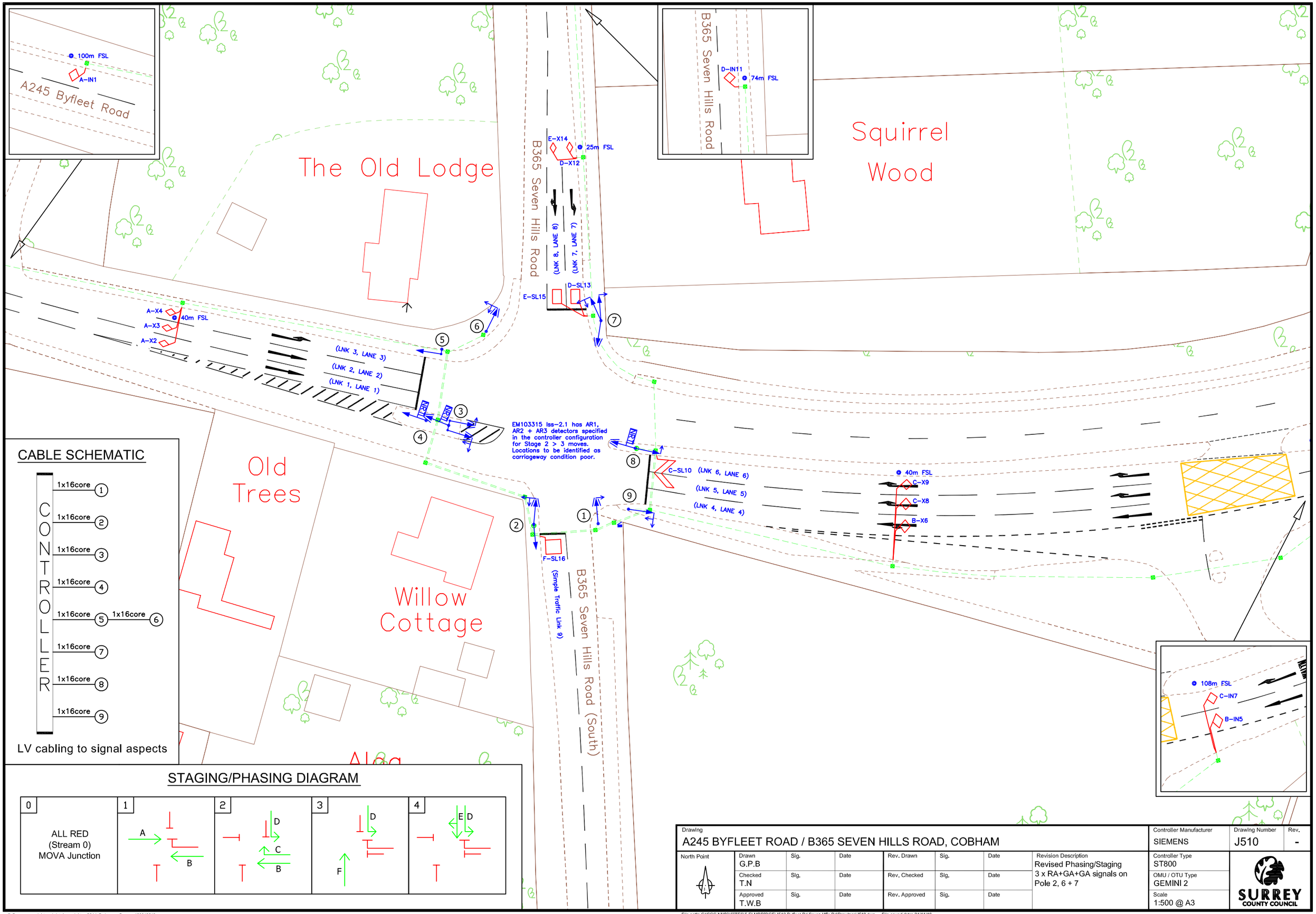
APPENDICES

Appendix I: A245 Byfleet Road/B365 Seven Hills Road (J510)

Appendix II: A245 Parvis Road/Camphill Road (J401)

Appendix III: Potential mitigation scheme locations

Appendix I



CABLE SCHEMATIC

CONTROLLER

- 1 — 1x16core
- 2 — 1x16core
- 3 — 1x16core
- 4 — 1x16core
- 5 — 1x16core
- 6 — 1x16core
- 7 — 1x16core
- 8 — 1x16core
- 9 — 1x16core

LV cabling to signal aspects

STAGING/PHASING DIAGRAM

Drawing: A245 BYFLEET ROAD / B365 SEVEN HILLS ROAD, COBHAM							Controller Manufacturer: SIEMENS; Drawing Number: J510; Rev.: -
North Point	Drawn: G.P.B	Sig.	Date	Rev. Drawn	Sig.	Date	Revision Description: Revised Phasing/Staging 3 x RA+GA+GA signals on Pole 2, 6 + 7
	Checked: T.N	Sig.	Date	Rev. Checked	Sig.	Date	Controller Type: ST800; OMU / OTU Type: GEMINI 2
	Approved: T.W.B	Sig.	Date	Rev. Approved	Sig.	Date	Scale: 1:500 @ A3

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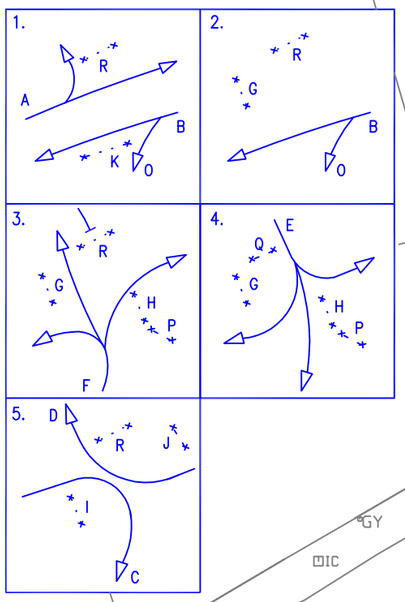
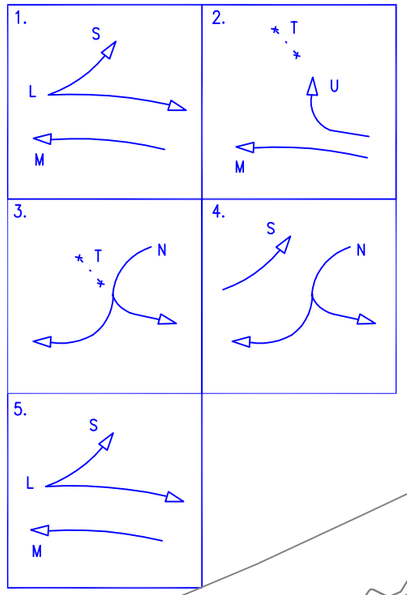
File path: G:\SCC NMIC\SITES\5 ELMBRIDGE\J510 Byfleet Rd Seven Hills Rd\Drawings\J510.dwg File saved date: 24/11/16

Appendix II

STAGE DIAGRAM



STAGE DIAGRAM



CABLE SCHEMATIC

CONTROLLER

- 20c: 1 — 20c: 2 — 12c: 4 — EXISTING RUN
- 20c: 3 — EXISTING RUN
- 20c: 6 — 20c: 7 — EXISTING RUN
- 20c: 9 — 16c: 10 — EXISTING RUN; 12c: 8 — EXISTING RUN
- 20c: 12 — 16c: 11 — EXISTING RUN
- 16c: 14 — 16c: 13 — NEW RUN

CONTROLLER

- 16c: 15 — 16c: 16 — 8c: 19 — EXISTING RUN; 8c: 17 — 8c: 18 — EXISTING RUN
- 16c: 20 — 8c: 21 — EXISTING RUN
- 16c: 24 — 16c: 23 — 22 — NEW RUN
- 2 × 16c: 5 — 16c: 25 — NEW RUN
- 16c: 27 — 16c: 26 — NEW RUN

NOTE: All existing Push Button Units connected to Low Voltage Transformers on signal heads. All new Push Button Units likewise.

Drawing: A245/C130 OLD WOKING ROAD/CAMPHILL ROAD, WEST BYFLEET

North Point	Manufacturer	Scale	Drawn	Sig.	Date	Drawing No.
N	MICROSENSE	1:500 @ A3	EJS			0600/T/J401D
	Controller Type: SENTINEL		Checked: TAS	Sig.	Date	
	Dimming: NONE		Approved: GRB	Sig.	Date	Classification: RECORD; Date Revised: 21.11.95

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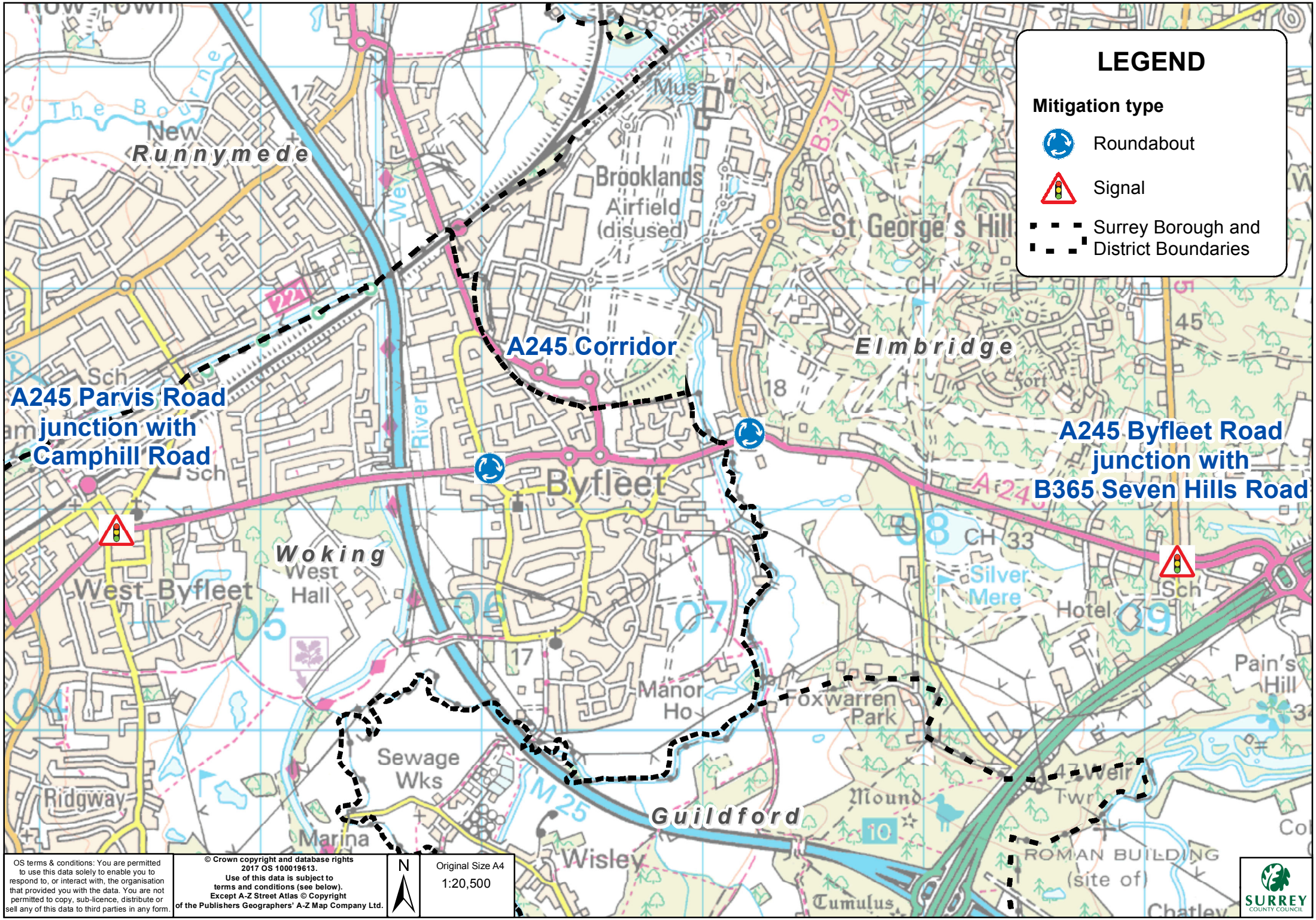
Appendix III


LEGEND
Mitigation type
Roundabout
Signal
Surrey Borough and District Boundaries
A245 Parvis Road junction with Camphill Road
A245 Corridor
A245 Byfleet Road junction with B365 Seven Hills Road
New Runnymede
Brooklands Airfield (disused)
St George's Hill
Elmbridge
Byfleet
West Byfleet
Woking
Guildford
Wisley
Ridgway
Marina
Sewage Wks
Manor Ho
Foxwarren Park
Silver Mere
Hotel
Pain's Hill
Mound
ROMAN BUILDING (site of)
Tumulus
Chatley
The Bourne
River Wey
M25
B374
A245
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SURREY COUNTY COUNCIL

ANNEXES

Annex A: Paramics Discovery Microsimulation report

Annex B: WSP Movement Study

Annex C: Redhill Road MCTC survey

Annex D: B374 Brooklands Road site visit notes

Annex E: A245 Byfleet Road/B365 Seven Hills Road modelling report

Annex F: A245 Parvis Road/Camphill Road recommendations

Annex G: ARCADY proposal

Annex A

SURREY
COUNTY COUNCIL

A245 WOKING PARAMICS DISCOVERY MODEL

Microsimulation Modelling: Option Tests

Project Title: A245 Byfleet Paramics Discovery Model

Document Title: Microsimulation Modelling: Option Tests

Client Reference:

Date: 17 July 2017

Prepared By: Print Phil Smith

Sign

Authorised By: Print Abigail Hardie

Sign

Amendment List

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CONTENTS

1 INTRODUCTION

1.1 Background

1.1.1 Surrey County Council is reviewing the impact of Woking Borough's Local Plan on the road network in Byfleet. The area of interest is the A245 corridor between D3757 Dartnell Park Road in the west and A245 Byfleet Road in the east, including several of the adjoining roads. In order to assess the impact of future developments and population growth in the area on the road network, as well as to inform possible mitigation options, a microsimulation model has been used.

1.1.2 The predicted increase in trips is derived from the SCC Surrey County **S**trategic **In**tegrated **Tra**nsport **M**odel (SINTRAM). This report focuses on identifying the impact that this increase in trips has on the section of road network that is of interest. At this stage, no option testing has been undertaken for mitigation. This report describes the modelling undertaken.

1.2 Aim and Overview

1.2.1 The aim of this study is to assess the traffic impacts on the road network related to future growth in the Woking Borough and Byfleet area. The impacts of growth up to the year 2026 shall be assessed and no changes to the road network will be made.

2 BASE MODEL

2.1.1 The A245 Byfleet Paramics Discovery base model was developed by Surrey County Council (Transport Studies Team) in 2017; this is an AM peak hour model with a base year of 2016. The development of the base model in accordance with the DfT guidelines is set out in "*A245 Byfleet Paramics Discovery Mode LMVR*" (document number 53613T44/01[1]).

2.1.2 The option scenarios have been developed from a direct copy of the base model.

2.2 Modelling Program

2.2.1 For this study Paramics Discovery (**Pa**rallel **mic**roscopic **s**imulation) modelling program version 16.0 was used.

2.2.2 S-Paramics is an internationally recognised traffic flow modelling program developed by SIAS. It simulates the individual components of traffic flow and congestion, and presents its output as a real-time visual display for traffic management and highway network design.

2.2.3 Paramics Discovery is the successor to the original S-Paramics software.

2.3 Time Period

2.3.1 The base model was developed to consider the highway conditions for an average weekday AM. The modelled time period of the base model is the AM peak period (07:00 – 10:00), with a validated peak hour of 08:00 – 09:00.

[1] H:\Modelling\.paramics\53613T44_Woking Local Plan Paramics Discovery\01_Documents\ Doc01_ByfleetParamicsDiscoveryLMVR_20170323_inc_appendices.pdf

3 OPTION MODELS

3.1 Option 1: 2026 Forecast

3.1.1 Option 1 refers to the increase of trips up to a level that is forecast for 2026. The purpose of this is to quantify the impact this increase has on the road network, in order to inform whether mitigation might be required.

3.1.2 The modelled demand is a "worst case scenario", where the highest number of greenbelt dwellings have been built.

Highway Alterations

3.1.3 No highway alterations were made in the modelling of Option 1, therefore the modelled network in Option 1 is exactly the same as the base model.

Forecasting

3.1.4 Forecasting was undertaken to create the demand matrices for Option 1. The modelled demand matrices in Option 1 are the matrices used in the base model, but with a factor applied.

3.1.5 In order to establish a growth factor for use in the Paramics Discovery Model, Scenario F within the SINTRAM Local Plan model was used. Scenario F within the SINTRAM Local Plan model was used in 2016 to undertake greenbelt sensitivity tests[2] and contains the highest number of greenbelt dwellings, focussed in West Byfleet. Scenario F is therefore considered a worst case scenario.

3.1.6 Within the SINTRAM model, a cordon was created reflecting the extent of the Paramics model network. Cordon matrices were extracted from the base and Scenario F variants and the total trip ends were used to calculate growth between 2005 and 2026. This growth was then pro-rated to obtain a growth factor for the period 2016 – 2026 to be applied to the appropriate Paramics base demand matrix, this growth factor is shown in **Table 3.1** below.

3.1.7 Separate growth factors were calculated for 'Cars/LGVs', 'HGVs' and 'All Vehicles'. It was decided to use the 'Cars/LGVs' factor only, as applying this factor to the appropriate matrix was found to create the greatest overall increase in flows; using the 'Cars/LGVs' growth factor was therefore considered to be the worst case scenario. The resulting matrices are the 2026 'Scenario F' Paramics Matrices i.e. the do-something[3].

[2] S:\Project-current\3000 PROJECT NOS STARTING WTIH 3000\3613\53613T36_Woking Local Plan Greenbelt Sensitivity Tests\04 Documents\Doc 01_Greenbelt Sensitivity Test Strategic Transport Assessment

[3] For further detail regarding the SINTRAM modelling undertaken please refer to '*Forecast from County Strategic Model_v1.xlsx*' at 'H:\Modelling\.paramics\53613T44_Woking Local Plan Paramics Discovery\03_Forecasting'

	Average hourly flow AM peak period (07:00 – 10:00)
2005	5878
2026	6926
Growth Factor 2005 - 2026	1.178
Total Growth	17.8%
Annual Growth	0.0085
Growth pro-rated for period 2016 - 2026	0.0849
Growth Factor 2016 - 2026	**1.085**

Table 3.1 – Calculation of growth factor

3.2 Option 2: 2026 Forecast Sensitivity Test

3.2.1 Option 2: 2026 sensitivity test refers to the increase of trips up to a level forecast for the year 2026, with the removal of "link end speeds" from 3 specific links in the model. This is in order to quantify the effect these link end speeds have on the road network.

3.2.2 The link end speeds were coded into the base model and Option 1 models in order to ensure modelled journey times on A245 Byfleet Road eastbound reflected observed journey time values. The observed journey time values on this road were relatively high: vehicles often travelled below the 30mph speed limit, and queuing was often observed. This was considered to be due to a cause of delay that exists outside of the modelled network, on the approach to Seven Hills Road. The main cause of delay is thought to be the fact that the road bends and reduces in width after the B374 Brooklands Road roundabout, coupled with the presence of side roads and driveways adjoining the road that vehicles turn into, which hold up other traffic (for further detail please see the base model LMVR[4]).

3.2.3 This sensitivity test aims to improve understanding about how delay on the network created by impedances outside of the model network (i.e. the congestion on A245 Byfleet Road eastbound) is affecting the efficiency of the roundabout junction of B374 Brooklands Road and A245. Modelling the A245 Byfleet Road without additional delay will inform as to whether mitigation at the B374 Brooklands Road/A245 roundabout is required, or if an intervention would be better targeted at the causes of the delay on A245 Byfleet Road.

Highway alterations

3.2.4 The link end speed values on 3 links within the model were changed as set out in the table below.

	Link end speed value change	
Link	**From**	**To**
15:95y	5mph	None
95y:96z	5mph	None
96z:16	5mph	None

Table 3.2 – Changes to model links

3.2.5 No other changes were made to the highway network.

[4] H:\Modelling\.paramics\53613T44_Woking Local Plan Paramics Discovery\01_Documents\Doc01_ByfleetParamicsDiscoveryLMVR_20170323

Forecasting

3.2.6 The demand matrices used in this sensitivity test were the same as in Option 1.

4 RESULTS AND ANALYSIS

4.1.1 Random numbers govern many aspects of microsimulation modelling, such as the allocation of certain types of driver behaviour to a particular vehicle and the time at which the vehicle is released onto the modelled network. Each time the model is simulated, a unique stream of random numbers is applied, with each different random number generating a different output. This makes the simulation more authentic, because in reality traffic flow is not the same, at the same time, everyday. For this reason, the model was seeded with a value of 0 which ensure that this occurs.

4.1.2 Each model was run 15 times to capture this daily variation in traffic flow. The presented results are an average of the runs undertaken for the AM peak hour (08:00 – 09:00).

4.1.3 It should be noted that both the Paramics Discovery base model and option tests use precise demand. Precise demand attempts to release the exact number of vehicles in each 5-minute interval as defined in the models matrix and profiles, and is therefore suited to validation purposes, whereas stochastic demand calculates the probability of release each second and is applied each second of the 5-minute release interval. Stochastic release gives much greater variability and is therefore more realistic and suited for option testing. Under normal circumstances, option tests would be modelled with stochastic demand in line with best practice; however in this circumstance precise demand has been used, as stochastic demand modelling is currently not possible in Paramics Discovery 16.0.

Model Stability

4.1.4 Best practice usually dictates that a model assignment stability tool is used to provide an indication of the stability of the model outcomes between consecutive runs. In this circumstance the Assignment Stability tool was not used to determine this, as the model runs extracted from Paramics Discovery models are not currently compatible with the software.

4.1.5 Due to the relatively small size of the modelled network, it is considered that not using the Assignment Stability tool to indicate the stability of the model outcomes will not affect the conclusions of the study.

4.2 Model Observations

Option 1

4.2.1 During observations of model runs it is noted that considerable congestion occurs on B374 Brooklands Road southbound, as well as on C250 High Road (west) northbound. This is considered to be far above that observed in the base model.

4.2.2 It is observed that this congestion on B374 Brooklands Road southbound and C250 High Road (west) northbound results in the presence of a large number of unreleased vehicles at Zone 9 – B374 Brooklands Road (approx. 208 vehicles) and Zone 3 – C250 High Road (west) (approx. 96 vehicles) respectively at the end of the modelled peak hour, as they are unable to enter the model network (see **Appendix I** for a map of model zones).

4.2.3 It is observed that the queuing that occurs on A245 Byfleet Road eastbound in the base model is further exaggerated in the Option 1 model.

4.2.4 Unreleased vehicles also build up intermittently during the peak hour at Zone 1 – A245 Parvis Road (maximum of approx. 70 vehicles) and Zone 5 – D3760 Oyster Lane (south) (maximum of approx. 20 vehicles). This is due to congestion building up on A245 Parvis Road eastbound and D3760 Oyster Lane (south) northbound at various times throughout the peak hour.

4.2.5 The congestion on A245 Parvis Road eastbound prior to D3760 Chertsey Road is considered to occur due to the roundabout junction of D3760 Chertsey Road, C250 High Road (west) and A245 Parvis Road acting as an impedance to vehicles, causing them to slow considerably as they gap search prior to entering the junction.

4.2.6 The congestion on D3760 Oyster Lane (south) northbound is considered to occur due to the roundabout junction of D3760 Oyster Lane and A245 Parvis Road. Congestion is thought to build up on D3760 Oyster Lane (south) northbound due to the increased flow on A245 Parvis Road westbound reducing the available gaps for vehicles to enter the junction, coupled with increased flows coming from Zone 5 (please see **Section 4.7** for further detail on flow statistics).

4.2.7 As detailed in the base model LMVR[5], it has been observed on-street that the A245 Byfleet Road eastbound is often congested during the AM peak beyond the Brooklands Road roundabout, and traffic speeds are considerably lower than the 30mph speed limit. The cause of this delay is thought to exist further downstream on A245 Byfleet Road eastbound, outside of the modelled network. As such, reduced link end speeds have been used to replicate the level of delay on A245 Byfleet Road eastbound in both the base and Option 1 models. Overall it is thought that the cause of delay, which resides outside of the modelled network, is likely to be the most dominant influence on congestion on roads adjoining A245 Byfleet Road. As such, modelled conditions on these roads should be interpreted with caution, whilst bearing in mind the presence of external influences.

Option 2

4.2.8 During observations of model runs it is noted that the operation of the roundabout junction of B374 Brooklands Road and A245 appears much improved in comparison to the Option 1 test model, with minimal to no queuing on any approach to the junction.

4.2.9 The roundabout junction of D370 Chertsey Road, C250 High Road (east) and A245 Parvis Road appears to be operating in a similar manner to in the Option 1 model, with congestion occurring on all arms throughout the AM peak hour.

4.2.10 The congestion at this junction results in a large number of unreleased vehicles building up in Zone 3 (approx. 200 vehicles) during the modelled peak hour, as vehicles are unable to find an adequate gap to enter the junction. It is thought this could be due to the increased flow of vehicles navigating the A245 Parvis Road westbound as a result of the reduced congestion at the B374 Brooklands Road roundabout with the A245 (see **Section 4.7**).

[5] H:\Modelling\.paramics\53613T44_Woking Local Plan Paramics Discovery\01_Documents\Doc01_ByfleetParamicsDiscoveryLMVR_20170323.pdf

4.2.11 There is also a build up in the number of unreleased vehicles at zones 1 and 2, where vehicles queuing back from the junction prevent further vehicles from entering the network.

4.2.12 It is also clear that there is a high level of congestion on the D3760 Oyster Lane (south) northbound approach to the roundabout junction with A245 Parvis Road, as traffic builds periodically throughout the modelled AM peak hour. It is thought this is caused by vehicles being unable to enter the junction due to the increase in flow on the A245 Parvis Road eastbound resulting from the reduced congestion at the B374 Brooklands Road roundabout (see **Section 4.7**).

4.3 Network Summary Statistics

Option 1

4.3.1 Network summary statistics for the base and option tests are presented in **Table 4.1**. The results indicate the delay and average network conditions for the Option 1 scenario across the entire model network. Comparisons with the base model are made for the AM peak hour (08:00 - 09:00).

4.3.2 The network summary statistics presented below indicate a large difference in the total network delay, mean speed and mean travel time between the AM peak hour for the base and the Option 1 scenario. The summary statistics refer to all links in the model network.

4.3.3 In the AM peak hour, mean travel time in Option 1 increased by a considerable amount, 60%, in comparison to the base. Total network delay increased by 62.5% (the equivalent of an additional 7 days) and mean speed experienced a 38.4% decrease (the equivalent of a mean fall in speed of 8.5km/hr per vehicle). These statistics indicate that the increased flows in Option 1 (2026 forecast year) have a considerable impact on the modelled network in the AM peak hour.

4.3.4 It is important to note that total demand (07:00 - 10:00) figures have been taken from the demand matrices, whereas total no. of completed trips (08:00 - 09:00) figures are an average taken directly from the model and represent the number of trips completed within the hour. It should be recognised that the absolute difference between the total number of trips for the base model and Option 1 is a relatively low figure (86 trips) because there are a high number of unreleased vehicles present in the Option 1 scenario (approx. 96 vehicles at Zone 3 and approx. 208 vehicles at Zone 9) that are unable to enter the network due to limited capacity on the roads.

Option 2

4.3.5 Network statistic results for the sensitivity test show that the removal of the impedance to vehicles on A245 Byfleet Road has a considerable beneficial impact on the operation of the network when compared to the option 1 scenario.

4.3.6 The number of completed trips increases (3.8%), as does the total distance travelled (6.7%) and the mean distance travelled (2.8%). Critically the mean speed of vehicles on the network increases by 21.5%, the equivalent of a 4.75 km/hr increase.

4.3.7 In addition, the total network delay decreases by 33.7% (the equivalent of a reduction of 4 days worth of delay) and the mean travel time per vehicle drops by 1 minute 2 seconds (37.8%).

4.3.8 These results suggest that a large proportion of the delay incurred on the network is caused by the impedance to vehicles that occurs on A245 Byfleet Road eastbound, and indicates that resolving this impedance would be hugely beneficial to the road network in the modelled area.

	Statistic	Base Model	Option 1	*Absolute difference from Base*	*Relative difference from Base*	Option 2: Sensitivity Test	*Absolute difference from Option 1*	*Relative difference from Option 1*
AM peak period 07:00 - 10:00	Total demand (07:00 - 10:00)	17509	18936	*1,427*	*8.2%*	18936	*0*	*0.0%*
AM Peak Hour 08:00 - 09:00	Total no. of completed trips	5,675	5,762	*86*	*1.5%*	5977	*215*	*3.8%*
	Total network delay (days)	10.77	17.50	*7*	*62.5%*	14	*-4*	*-33.7%*
	Total distance travelled (km)	5,715	5,724	*9*	*0.2%*	6105	*381*	*6.7%*
	Mean speed (km/hr)	22.1	13.6	*-8.50*	*-38.4%*	18.39	*4.75*	*21.5%*
	Mean Travel Time (mm:ss)	02:44	04:22	*01:38*	*60.0%*	03:21	-01:02	*-37.8%*
	Mean distance (km)	1.01	0.99	*-0.01*	*-1.3%*	1	*0.03*	*2.8%*

Table 4.1: AM network summary statistics

4.4 Journey Times

4.4.1 Journey times were collected on seven routes through the area. **Appendix II** shows the comparisons between the journey times extracted from the base and option models.

4.4.2 In graphs such as those in **Appendix II**, where confidence intervals overlap, this indicates that the journey times cannot be considered to be different at the 95% statistical significance level. Where this occurs it cannot be confirmed whether the difference in average journey time is due to simple daily variation in traffic conditions, or the impact of any changes in the model.

4.4.3 **Table 4.2** indicates the percentage difference in each journey time between the option test and the base model as well as whether that result is statistically significant.

4.4.4 In the option tests for the AM peak hour, the results are mixed with some journey time routes showing no statistically significant difference from the base and others where journey time increases are statistically significant.

4.4.5 When analysing journey times it is important to note that any changes are purely related to the section of travel stated. It is important to consider that the journey times presented in the results are only one part of a larger journey.

4.4.6 **Appendix III** shows a diagram of the journey time routes.

Road	Description	Route Section*	Base Model - AM			Option 1 - AM					Option 2: Sensitivity Test - AM				
			Average	Lower 95%	Upper 95%	Average	Lower 95%	Upper 95%	% difference from base	Statistically significant?	Average	Lower 95%	Upper 95%	% difference from option 1	Statistically significant?
A245 Parvis Road/Byfleet Road	Eastbound	Between D3757 Dartnell Park Road and B366 Redhill Road (A to H)	364	358	369	424	416	431	17%	✓	264	261	267	-38%	✓
A245 Byfleet Road/Parvis Road	Westbound	Between B366 Redhill Road and D3757 Dartnell Park Road (H to A)	193	191	194	197	193	200	2%	×	201	198	203	2%	×
B374 Brooklands Road	Northbound	Between A245 and X7941 The Fairway (G to I)	28	28	28	28	28	28	0%	×	28	28	28	0%	×
B374 Brooklands Road	Southbound	Between X7941 The Fairway and A245 (I to G)	78	54	101	378	371	385	387%	✓	37	36	39	-90%	✓
A318	Northbound	Between A245 Parvis Road and X318 Tesco roundabout (D to K)	31	30	31	32	32	33	5%	✓	33	32	34	2%	×
A318	Southbound	Between X318 Tesco roundabout and A245 Parvis Road (K to D)	52	51	53	56	55	57	8%	✓	58	56	60	3%	×
C250 High Road (east)	Northbound	Between D772 Grasmere Way and A245 Parvis Road (L to F)	35	33	38	41	38	44	16%	×	49	44	53	18%	×

*Please refer to the diagram in **Appendix III** for the routes specified

Table 4.2: AM peak hour (08:00 – 09:00) average journey times (seconds)

Option 1

4.4.7 As shown in **Table 4.2**, in the AM peak hour the largest statistically significant increase in average journey time between the base and Option 1 was on B374 Brooklands Road southbound, with an increase of 387% (300 seconds) for the whole route. From model observations it is considered that the primary cause of this increase in journey time is a build up of congestion on B374 Brooklands Road southbound immediately prior to the roundabout junction with A245, resulting from an inability for vehicles to enter the junction due to queuing back onto the junction from A245 Byfleet Road eastbound.

4.4.8 A245 eastbound also has one of the largest increases in average journey time in Option 1, with a total increase of 17% (60 seconds) from the base. Please see **Section 4.5** below for further detail as to where along the route key journey time increases occur.

4.4.9 There are statistically significant but minor increases to journey times on A318 northbound and southbound of 5% (2 seconds) and 8% (5 seconds) respectively.

4.4.10 There are no decreases in average journey time during the AM peak hour.

Option 2

4.4.11 As shown in Table 4.2, the sensitivity test results show a significant reduction in journey times from the option 1 model for A245 Parvis Road/Byfleet Road eastbound (-38%) and for B374 Brooklands Road southbound (-90%). This implies that removing the cause of the delay on A245 Byfleet Road eastbound results in a significant benefit to journey times on these routes.

4.4.12 None of the other changes to journey times are statistically significant.

4.5 Journey Times: Hotspots

4.5.1 Some of the journey time routes within the model are made up of several short links between key junctions. The journey time of these shorter links has been analysed to indicate, in finer detail than the full journey time route analysis, where on the network the major differences between the base model and the option test occur.

Option 1

4.5.2 Journey time route sections with a notable difference between the base model and Option 1 include A245 Parvis Road eastbound both immediately prior to the A245 junction with B374 Brooklands Road (section F-G), with a difference of 31 seconds and at the far west of the model (section A-B), with a difference of 12 seconds (see **Figure 4.1** and **Table 4.3** below.

Option 2

4.5.3 The Option 2 sensitivity test journey time for A245 Parvis Road eastbound deviates most considerably from option 1 in segments F to G (-33 seconds) and G to H (-129 seconds). This equates to a total reduction in journey time of 162 seconds (2 minutes 42 seconds) from the option 1 model.

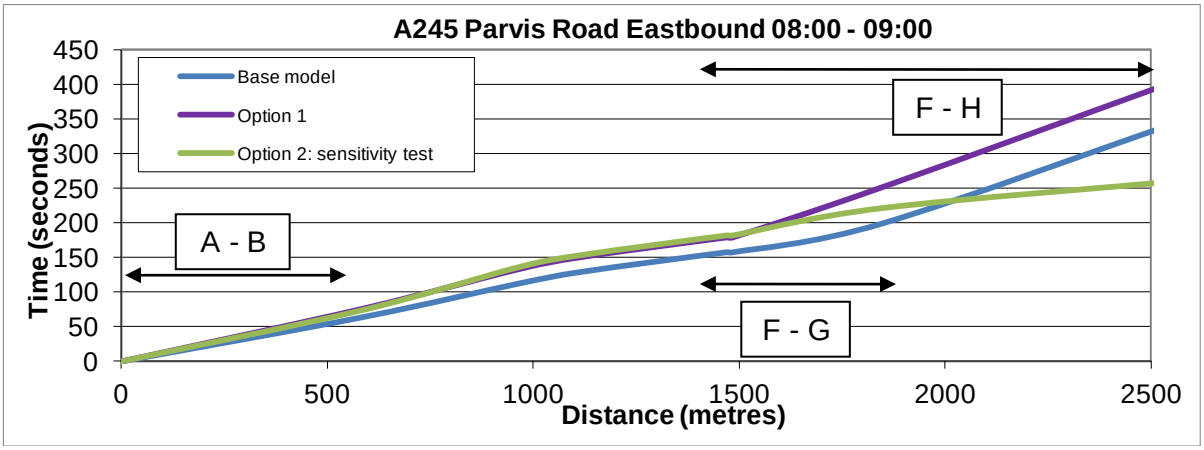


Figure 4.1 – Journey time graph for A245 eastbound

	Cumulative Distance (m)	Base model	Option 1		Option 2	
			Time (secs)	Absolute difference from base	Time (secs)	Absolute difference from Option 1
Start	0	0	0	0	0	0
A – B	584	64	76	12	74	-2
B – C	965	49	57	9	62	5
C – D	1119	17	18	1	18	0
D – E	1468	28	28	0	28	0
E – F	1485	0	0	0	0	0
F – G	1850	42	73	31	40	-33
G – H	2652	164	172	8	43	-129

Table 4.3 – Journey times for A245 eastbound

4.5.4 Please see **Appendix III** for a map detailing the locations of journey time routes and **Appendix IV** for journey time hotspot information for all journey time routes.

4.6 Queue Lengths

4.6.1 Queue lengths indicate the number of vehicles present on the approach to a junction waiting to enter that junction. The length of a queue is a good indication of a junction's efficiency, and whether the junction set up is appropriate for the level of vehicle flow passing through it.

4.6.2 Queue routes were set up in the model to understand the length of the average queue along specific routes in the model (shown in **Appendix V**). The results in **Table 4.4** show a comparison of average queue length between Option 1 and the base model. All values shown are rounded.

4.6.3 Note that in the base model queue lengths were not validated, therefore results outlined here should be interpreted with caution. Although the absolute values themselves may not be indicative of on-street conditions, the relative change between the base model and the Option 1 scenario can still be considered indicative of changes to traffic on the network that result up to the forecast year 2026.

Route ID	Route Name	Base model	Option 1			Option 2: Sensitivity Test		
		Queue length (m)	Queue length (m)	*Absolute change from Base (metres)*	*Percentage change from Base*	Queue length (m)	*Absolute change from option 1*	*Percentage change from option 1*
1	A245 Parvis Road eastbound approach to j/w D3760 Chertsey Road	34	38	*4*	*12%*	38	*-1*	*-2%*
2	A245 Parvis Road eastbound approach to j/w D3760 Oyster Lane	54	73	*19*	*34%*	80	*7*	*9%*
3	A245 Parvis Road eastbound approach to j/w A318 Sopwith Drive	17	19	*3*	*17%*	19	*0*	*0%*
4	A318 Sopwith Drive northbound approach to j/w A318 Barnes Wallis Drive	20	23	*3*	*13%*	24	*1*	*3%*
5	A318 Barnes Wallis Drive eastbound approach to j/w A318 Sopwith Drive	23	28	*4*	*18%*	27	*-1*	*-3%*
6	A318 Sopwith Drive southbound approach to j/w A245 Parvis Road	22	23	*1*	*4%*	24	*1*	*5%*
7	A245 Parvis Road eastbound approach to j/w B374 Brooklands Road	31	47	*16*	*52%*	31	*-16*	*-33%*
8	B374 Brooklands Road southbound approach to j/w A245 Parvis Road	28	100	*71*	*251%*	10	*-90*	*-90%*
9	A245 Byfleet Road westbound approach to j/w B374 Brooklands Road	19	19	*0*	*1%*	19	*-1*	*-4%*
10	High Road northbound approach to j/w A245 Parvis Road	22	25	*3*	*13%*	26	*1*	*5%*
11	A245 Parvis Rd westbound approach to j/w A318 Sopwith Drive	16	17	*2*	*11%*	18	*1*	*5%*
12	D3760 Oyster Lane (south) northbound approach to j/w A245 Parvis Road	29	34	*5*	*17%*	57	*23*	*69%*
13	A245 Parvis Road westbound approach to j/w D3760 Chertsey Road	29	32	*3*	*9%*	40	*8*	*26%*
14	C250 High Road (west) northbound approach to j/w A245 Parvis Road	53	59	*6*	*11%*	66	*7*	*12%*
15	D3760 Chertsey Road southbound approach to j/w A245 Parvis Road	24	38	14	58%	47	9	24%
16	D3760 Oyster Lane (north) southbound approach to j/w A245 Parvis Road	18	21	3	15%	21	0	0%
17	X318 Sopwith Drive southbound approach to j/w A318	18	19	0	2%	18	0	-3%

Table 4.4 – AM peak hour average queue lengths on routes

Option 1

4.6.4 **Table 4.4** indicates the change in average queue lengths between the base model and Option 1. It is apparent from the results that there is an increase in average queue length on all queue routes measured.

4.6.5 The results indicate that there are key locations where the Option 1 scenario has a critical impact on average queue lengths. There is a considerable increase (>50%) in average queue lengths on three routes: on A245 Parvis Road eastbound approach to junction with B374 Brooklands Road (route ID 7), on B374 Brooklands Road southbound approach to junction with A245 Parvis Road (route ID 8) and on D3760 Chertsey Road southbound approach to junction with A245 Parvis Road (route ID 15).

4.6.6 The largest increase in queue length in the model is located at the B374 Brooklands Road junction with A245 Parvis Road/Byfleet Road, where the B374 Brooklands Road southbound approach (route ID 8) has an absolute increase of 71m. This equates to a percentage increase of 251%. At the same junction, the A245 Parvis Road eastbound approach has a substantial increase in queue length of 16m (52%). These large increases in queue length can, in part, be attributed to the increases in flow (see **Section 4.7**) putting pressure on the junction; however these changes are also considered to be due to increased queuing on A245 Byfleet Road eastbound that extends back to the junction of A245 and B374 Brooklands Road.

4.6.7 There is also a notable increase in average queue length on A245 Parvis Road eastbound on the approach to the junction with D3760 Oyster Lane (19m or 34%).

Option 2

4.6.8 **Table 4.4** also indicates the change in average queue lengths between Option 1 and Option 2.

4.6.9 It is apparent from the results that there is a beneficial impact to queue lengths on several routes, most notably focused on routes adjoining the B374 Brooklands Road roundabout. Here, the average queue length on A245 Parvis Road eastbound approach to the roundabout decreases by 33% and the B374 Brooklands Road southbound approach to the roundabout decreases by 90%. This is thought to be because more vehicles are able to get through the roundabout junction due to the removal of the impedance to vehicles on A245 Byfleet Road eastbound.

4.6.10 There are also detrimental impacts to queue lengths on specific routes in the model. These appear to be focused on side roads that adjoin the A245 corridor. For example, queue lengths on D3760 Oyster Lane northbound approach to the roundabout junction with A245 increase from the option 1 test by 69% and queue lengths on D3760 Chertsey Road southbound approach to roundabout junction with A245 increase by 26%. It is considered that this is because of reduced gap seeking opportunities along the A245 corridor caused by changes in flows, which impedes vehicles from turning on to the A245 corridor from adjoining side roads.

4.6.11 These results indicate that the removal of the impedance to vehicles on A245 Byfleet Road has a beneficial impact to queue lengths around the B374 Brooklands Road roundabout, however, that the resulting changes to flow along the A245 corridor make it more difficult for vehicles on roads adjoining the A245 corridor to turn onto the A245.

4.7 Flows

Option 1

4.7.1 Flows at each junction were extracted from the Option 1 model and compared with those for the base model. Please see **Appendix VI** for all flow figures.

4.7.2 The number of vehicles making each movement at all junctions in the Option 1 model is generally between 0 and 10% greater than in the base model. This is thought to be reasonable considering the Option 1 Car and LGV matrix is a factor of 1.085 greater than the base model Car and LGV matrix (see **Table 3.1**).

4.7.3 The exception to this is for movements exiting B374 Brooklands Road southbound, where the number of vehicles turning out of the road falls by up to 17% in each direction. This is thought to be because vehicles are prevented from entering the junction due to increased vehicles queuing on A245 Byfleet Road eastbound, as this queuing extends back to the junction of B374 Brooklands Road and the A245.

Option 2

4.7.4 Flows at each junction were extracted from the Option 2 model and compared with those for the Option 1 model. Please see **Appendix VI** for all flow figures.

4.7.5 Flow increases in comparison to Option 1 at the B374 Brooklands Road roundabout junction with A245, where the B374 Brooklands Road southbound flow increases by 22% turning right to A245 westbound and 28% turning left to A245 eastbound. This has a knock-on influence on flow along the westbound A245 corridor, where on the A245 Parvis Road westbound approach to the roundabout junction with Oyster Lane and the roundabout junction with Chertsey Road flow increases by 8% in both instances.

4.7.6 Flow decreases in comparison to the Option 1 model at the High Road northbound approach to the roundabout junction with the A245 Parvis Road. All movements exiting onto the junction experience a decrease in flow of between 11% and 13%. This indicates vehicles are having increased difficulty exiting the road onto the junction, possibly due to reduced gap seeking opportunities.

5 SUMMARY

5.1.1 The work undertaken in the option test modelling of the A245 corridor through Byfleet involves the forecasting of flows up to the year 2026 (Option 1) and the forecasting of flows up to the year 2026 with reduced link end speeds on A245 Byfleet Road eastbound removed (Option 2: sensitivity test).

5.1.2 The forecast flows used in both option tests are considered to be a worst case scenario, as the factor used to calculate these flows is derived from a SINTRAM 2026 model scenario (Scenario F) with the highest number of greenbelt dwellings, focussed in West Byfleet.

5.1.3 The forecast increase in flows in Option 1 show a considerable negative impact on the modelled network as a whole, with an overall 38.4% drop in the mean speed of vehicles (this equates to a 8.5km/hr decrease) and a 60% increase in the mean travel time of vehicles on the network (this equates to a mean increase in travel time of 1 minute and 38 seconds per vehicle). The total delay on the network in Option 1 increases from the base by 62.5% and is the equivalent of an additional 7 days of delay.

5.1.4 In Option 2, network summary statistics are much improved compared with Option 1. There is a 33.7% reduction in total network delay (the equivalent to 4 days) from that seen in option 1, there is a 37.8% reduction in mean travel time (the equivalent of 1 minute 2 seconds) and a 21.5% increase in mean speed (the equivalent of a 4.75km/h increase).

5.1.5 From observations of the model, the impact of the increased forecast flows in Option 1 on congestion appears to be most concentrated on B374 Brooklands Road southbound and A245 Parvis Road eastbound. This is confirmed by analysis of vehicle journey times. B374 Brooklands Road southbound journey time has a total increase of 387% (the equivalent of 300 seconds, or 5 minutes). A245 Parvis Road/Byfleet Road eastbound journey time has a total increase of 17% (the equivalent of 60 seconds). From analysing journey time hotspots, it is apparent that a large portion of this increase in journey time on the A245 eastbound occurs prior to the junction with B374 Brooklands Road and prior to the junction with D3760 Chertsey Road.

5.1.6 In Option 2, observations of the model show that congestion at the B274 Brooklands Road roundabout with A245 is much reduced when compared with the Option 1 model, though the congestion at D3760 Chertsey Road roundabout junction with A245 Parvis road remains present. This is further evidenced by analysis of journey time routes: B374 Brooklands Road southbound has an improvement in journey time from Option 1 of 90% (341 seconds) and A245 Parvis Road eastbound has an improvement of 38% (160 seconds). Journey time hotspot analysis reveals that the majority of the improvement to the A245 eastbound journey time route occurs between the junction with D3771 Green Lane and the eastern edge of the modelled network (just prior to B366 Redhill Road).

5.1.7 Queue route data in Option 1 also suggests there to be a large increase in congestion on B374 Brooklands Road southbound, with an increase of 251%. Other routes that also experience large increases in queue length are A245 Parvis Road eastbound, prior to the D3760 Oyster Lane roundabout (34% increase) and prior to the B374 Brooklands Road roundabout (52% increase), as well as the D3760 Chertsey Road southbound approach to the roundabout junction with A245 Parvis Road (58% increase).

5.1.8 Similarly to other stated results, queue route data indicates that the removal of the impedance to vehicles on the A245 Byfleet Road eastbound has a beneficial impact on queue lengths on B374 Brooklands Road southbound (90% reduction from Option 1) and A245 Parvis Road eastbound prior to the B374 Brooklands Road roundabout (33% reduction from Option 1). Queue routes do indicate however, that some queue lengths in Option 2 increase above the lengths seen in the Option 1 test: D3760 Oyster Lane has a 69% increase.

6 CONCLUSION

6.1.1 Overall, the results show that the increase in flows forecast for the year 2026 has a considerable negative impact on the modelled network. These negative impacts are located around the A245 Parvis Road/Byfleet Road corridor, and are particularly focused on the A245 roundabout junction with D3760 Chertsey Road and the A245 roundabout junction with B374 Byfleet Road.

6.1.2 The Option 2 sensitivity test indicates that congestion issues surrounding the A245 roundabout junction with B374 Brooklands Road improve dramatically with the removal of the impedance to vehicle speeds on the A245 Byfleet Road eastbound.

The overall performance of the modelled network is also much better with the impedance on A245 Byfleet Road eastbound removed.

6.1.3 However, it should be noted that there are detrimental effects associated with the removal of the reduced link end speeds, such as the increased queue length at D3760 Oyster Lane (south) northbound.

6.1.4 It is considered that Option 1 indicates that mitigation is required against the effect of the increase in flow forecast up to the year 2026. It is therefore recommended that further study into possible mitigation measures is undertaken. As the negative impacts of the Option 1 model are situated at junctions on the A245 corridor (D370 Chertsey Road roundabout and B374 Brooklands Road roundabout), it is suggested that potential mitigation options should be focussed at these locations.

6.1.5 The Option 2 test indicates that removing the impedance to vehicle speeds on A245 Byfleet Road eastbound would improve overall modelled network performance and the journey times for specific routes. It is therefore considered that mitigation against the effect of increased flows up to the year 2026 on the roundabout junction of A245 and B374 Brooklands Road should focus on removing or reducing the impedance to vehicle speeds on A245 Byfleet Road eastbound downstream of the roundabout.

7 APPENDICES

Appendix I: Map of model zones

Appendix II: Journey times

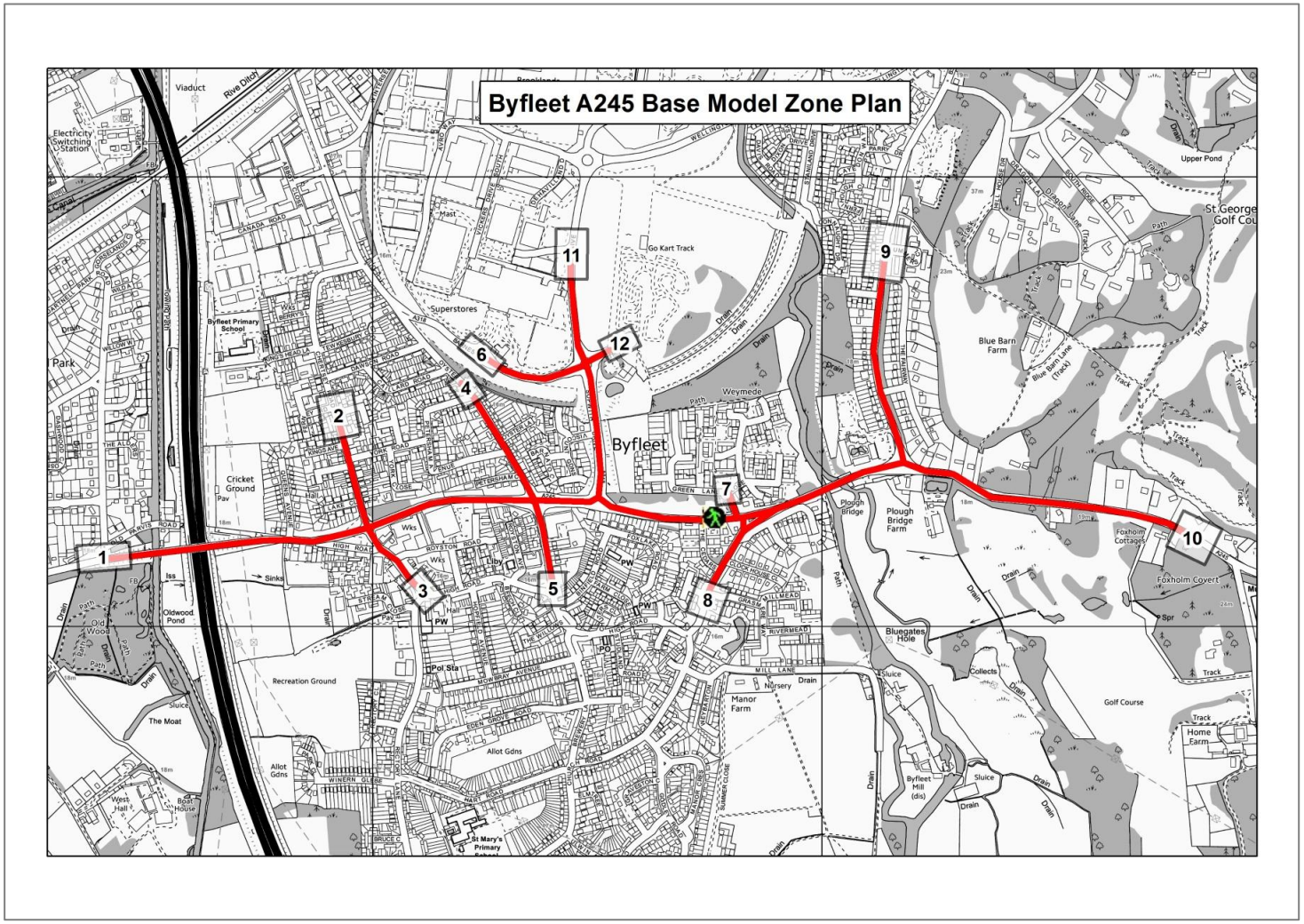
Appendix III: Journey time routes

Appendix IV: Journey time routes – Hotspots

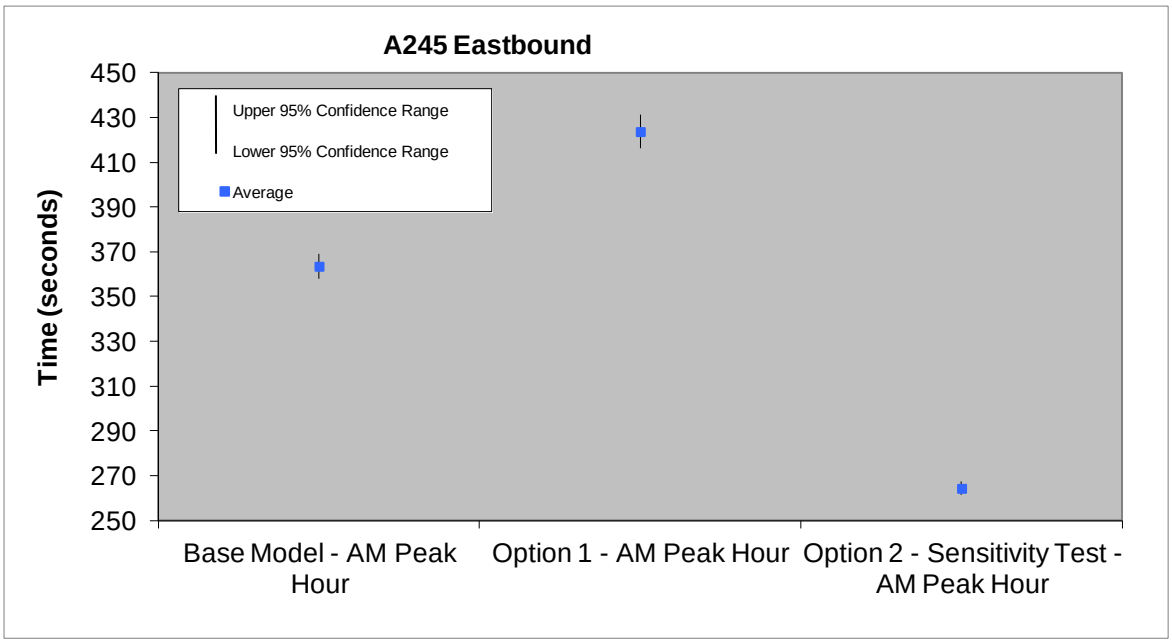
Appendix V: Queue routes in the model

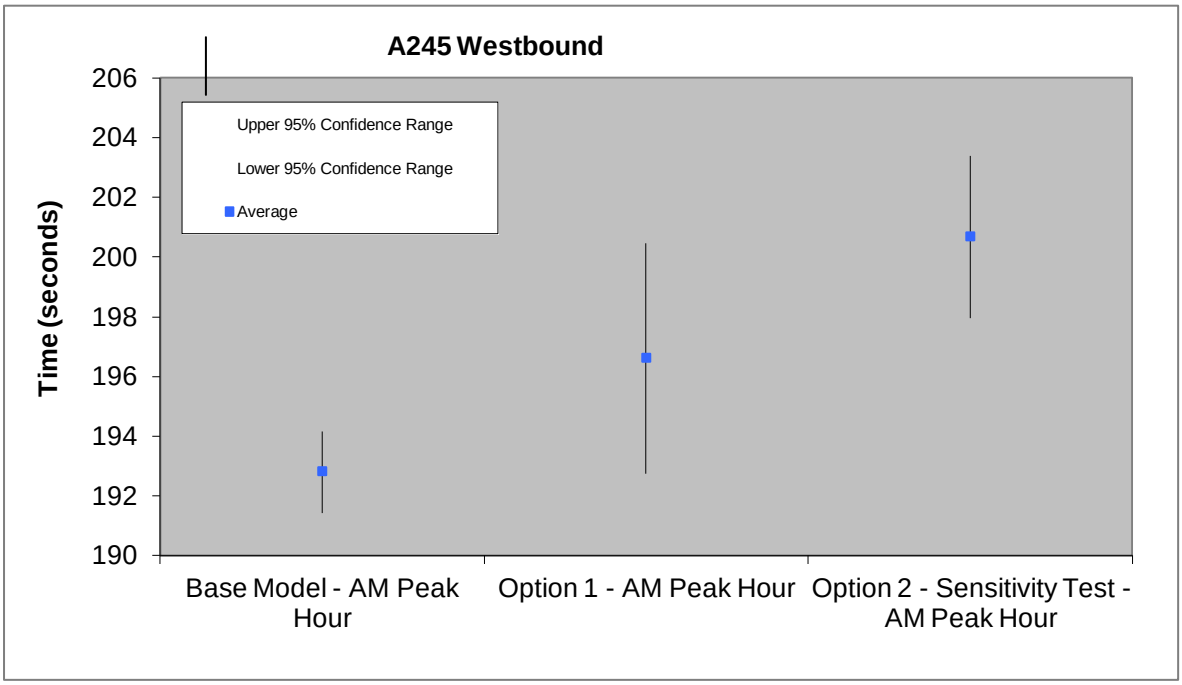
Appendix VI: Flow figures and diagrams

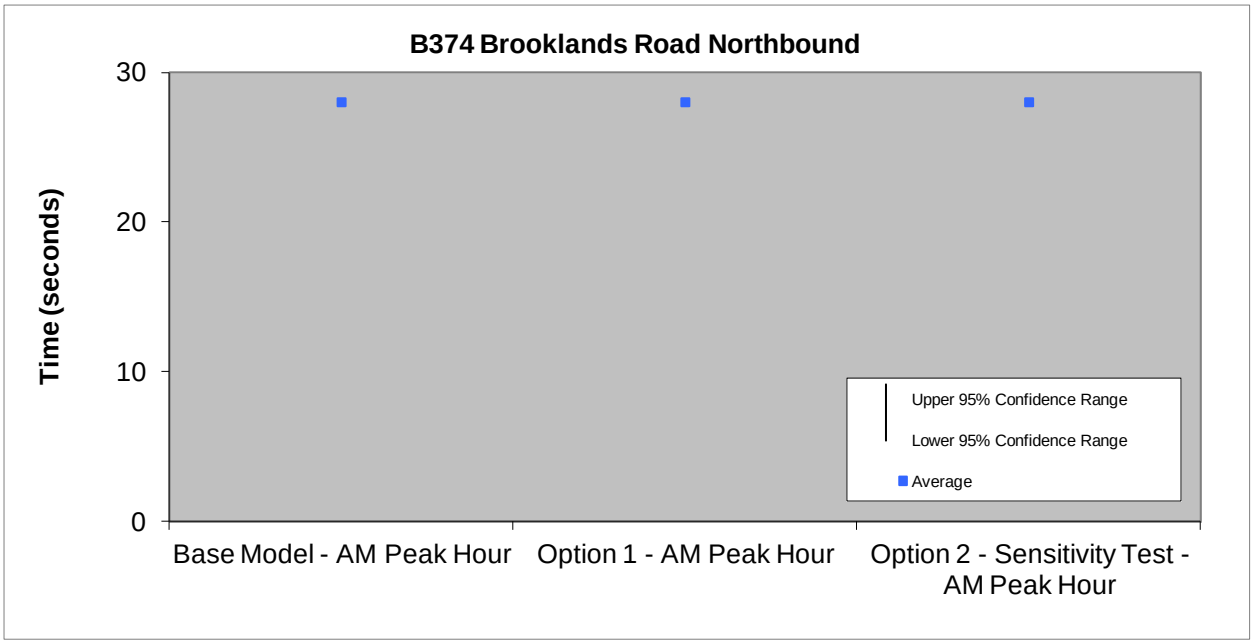
7.1 Appendix I: Map of model zones

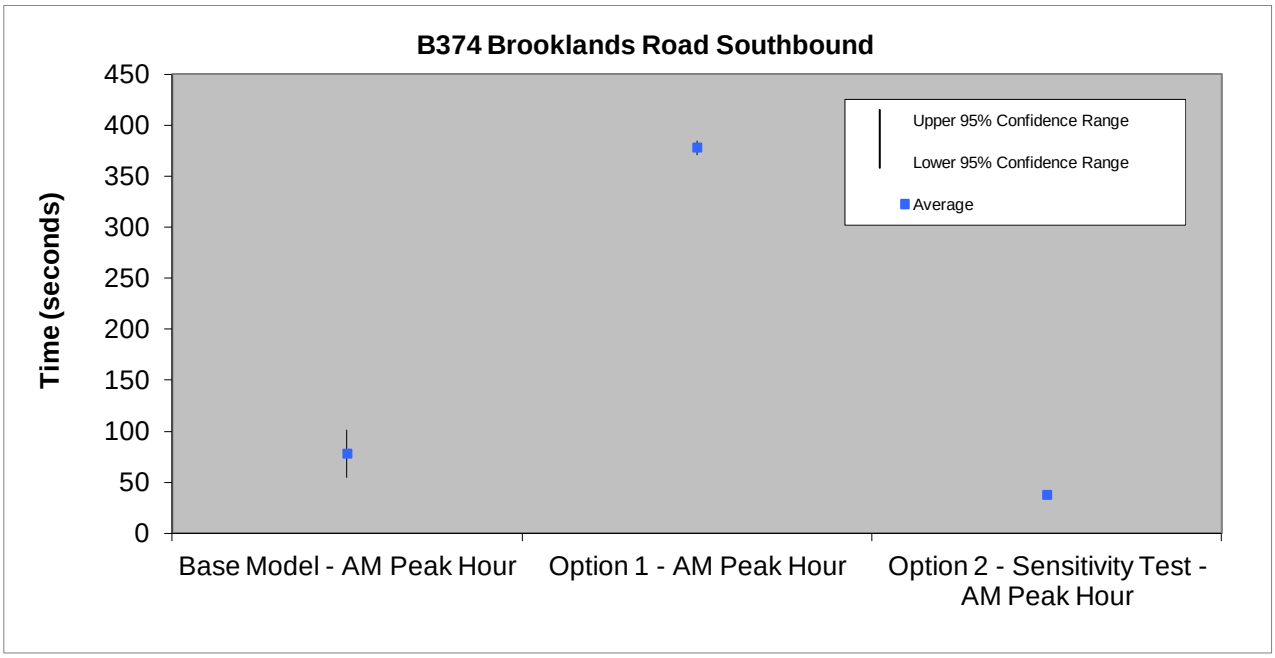


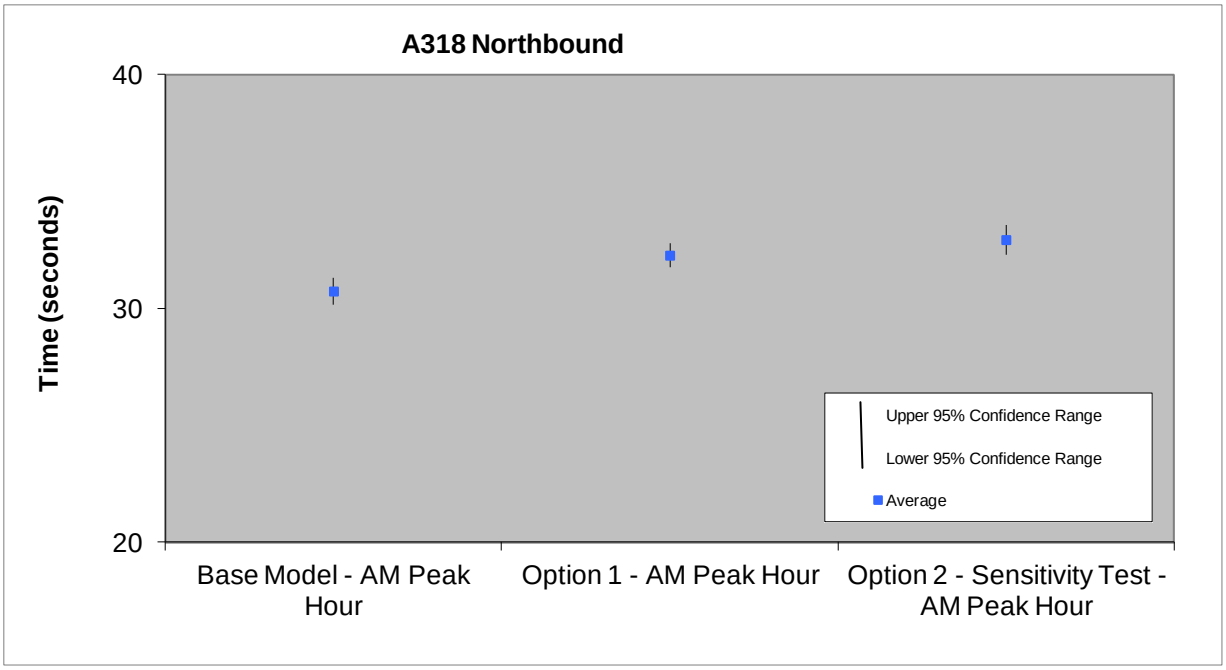
7.2 Appendix II: Journey Times

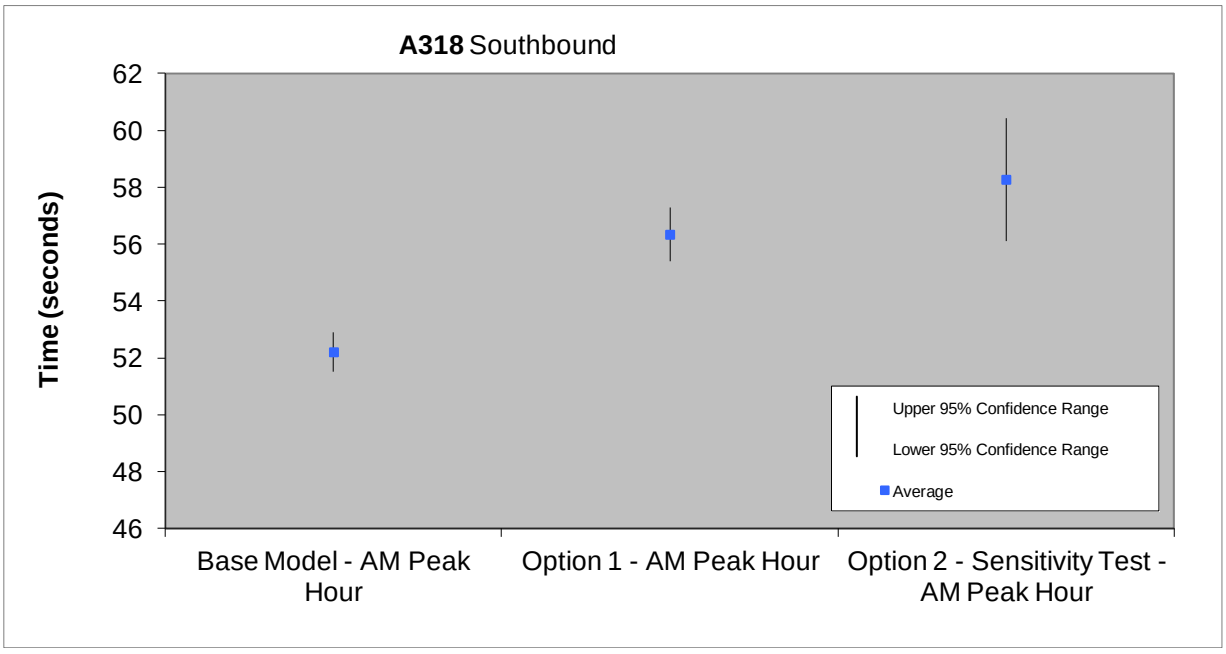


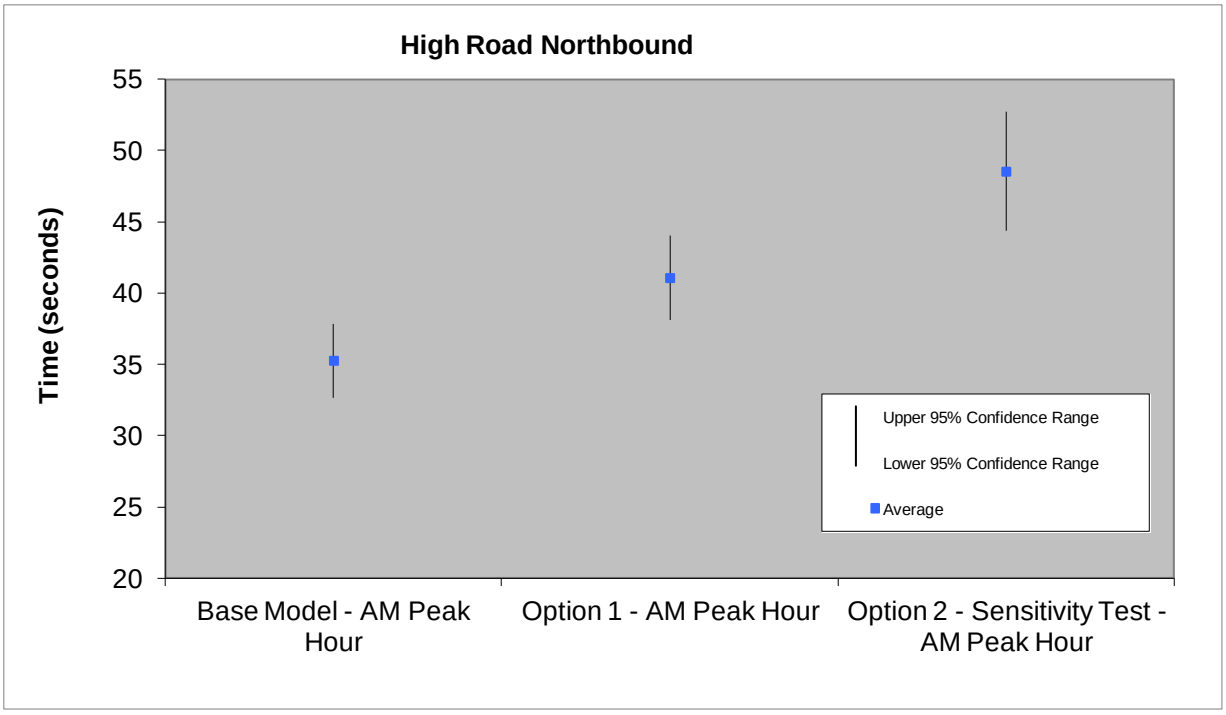



B374 Brooklands Road Northbound
Time (seconds)
30
20
10
0
Upper 95% Confidence Range
Lower 95% Confidence Range
Average
Base Model - AM Peak Hour
Option 1 - AM Peak Hour
Option 2 - Sensitivity Test - AM Peak Hour

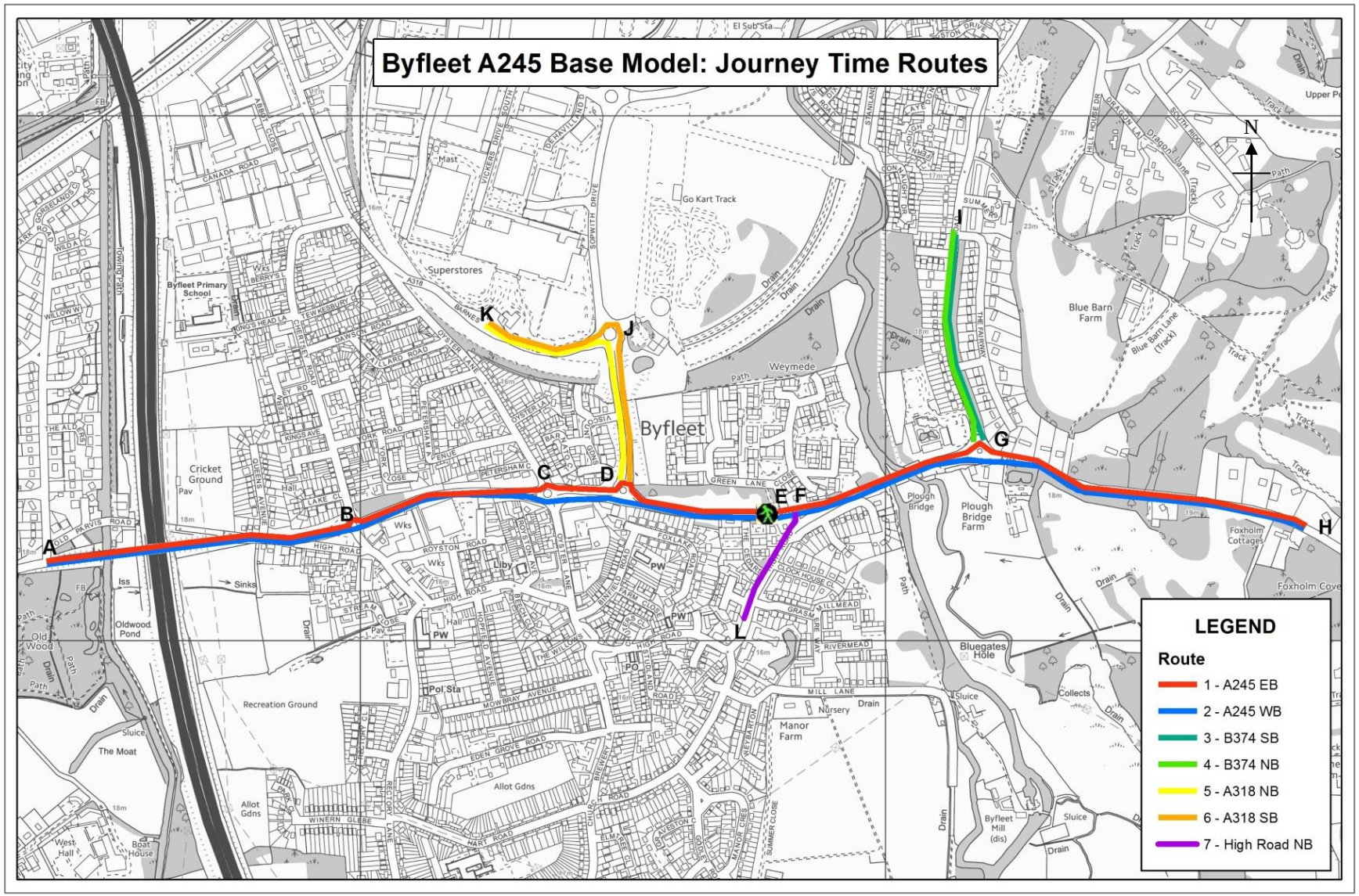

B374 Brooklands Road Southbound
Time (seconds)
450
400
350
300
250
200
150
100
50
0
Upper 95% Confidence Range
Lower 95% Confidence Range
Average
Base Model - AM Peak Hour
Option 1 - AM Peak Hour
Option 2 - Sensitivity Test - AM Peak Hour


A318 Northbound
Time (seconds)
40
30
20
Upper 95% Confidence Range
Lower 95% Confidence Range
Average
Base Model - AM Peak Hour
Option 1 - AM Peak Hour
Option 2 - Sensitivity Test - AM Peak Hour

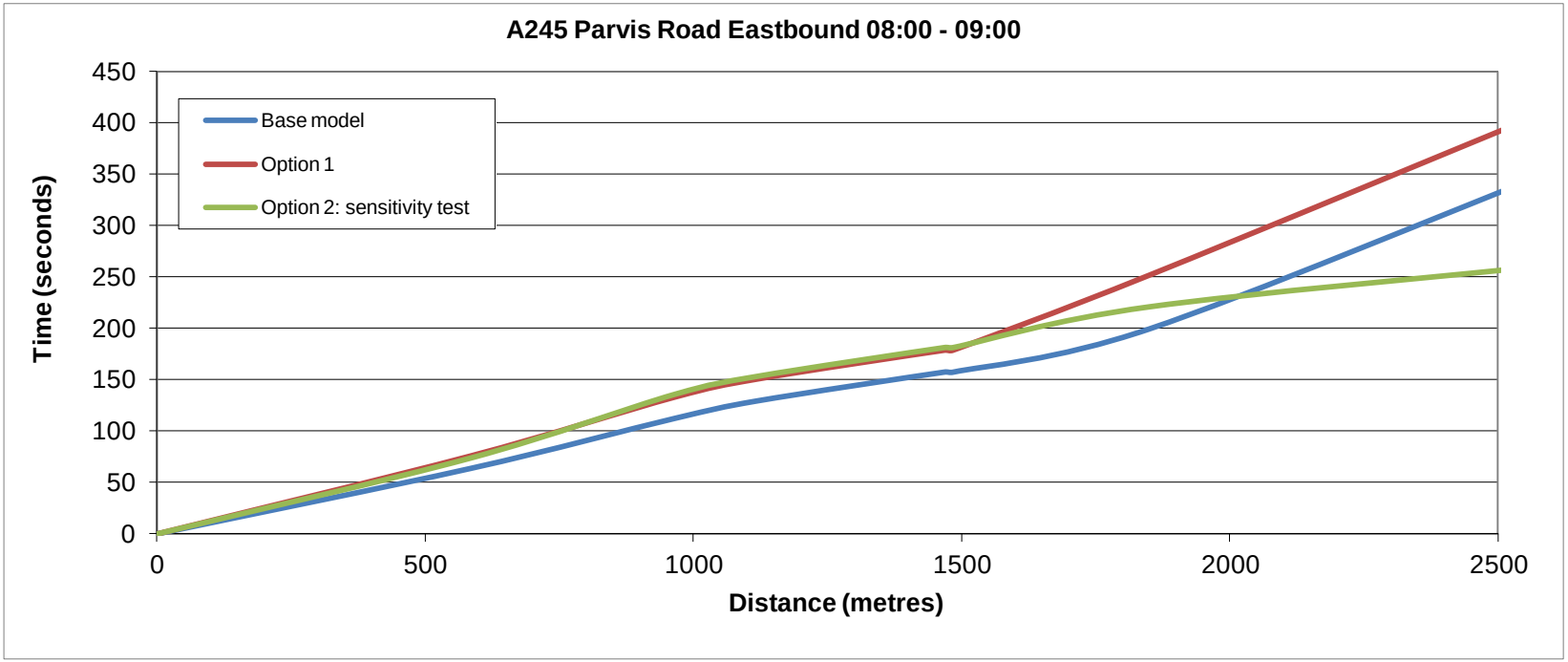

A318 Southbound
Time (seconds)
62
60
58
56
54
52
50
48
46
Upper 95% Confidence Range
Lower 95% Confidence Range
Average
Base Model - AM Peak Hour
Option 1 - AM Peak Hour
Option 2 - Sensitivity Test - AM Peak Hour


High Road Northbound
Time (seconds)
55
50
45
40
35
30
25
20
Upper 95% Confidence Range
Lower 95% Confidence Range
Average
Base Model - AM Peak Hour
Option 1 - AM Peak Hour
Option 2 - Sensitivity Test - AM Peak Hour

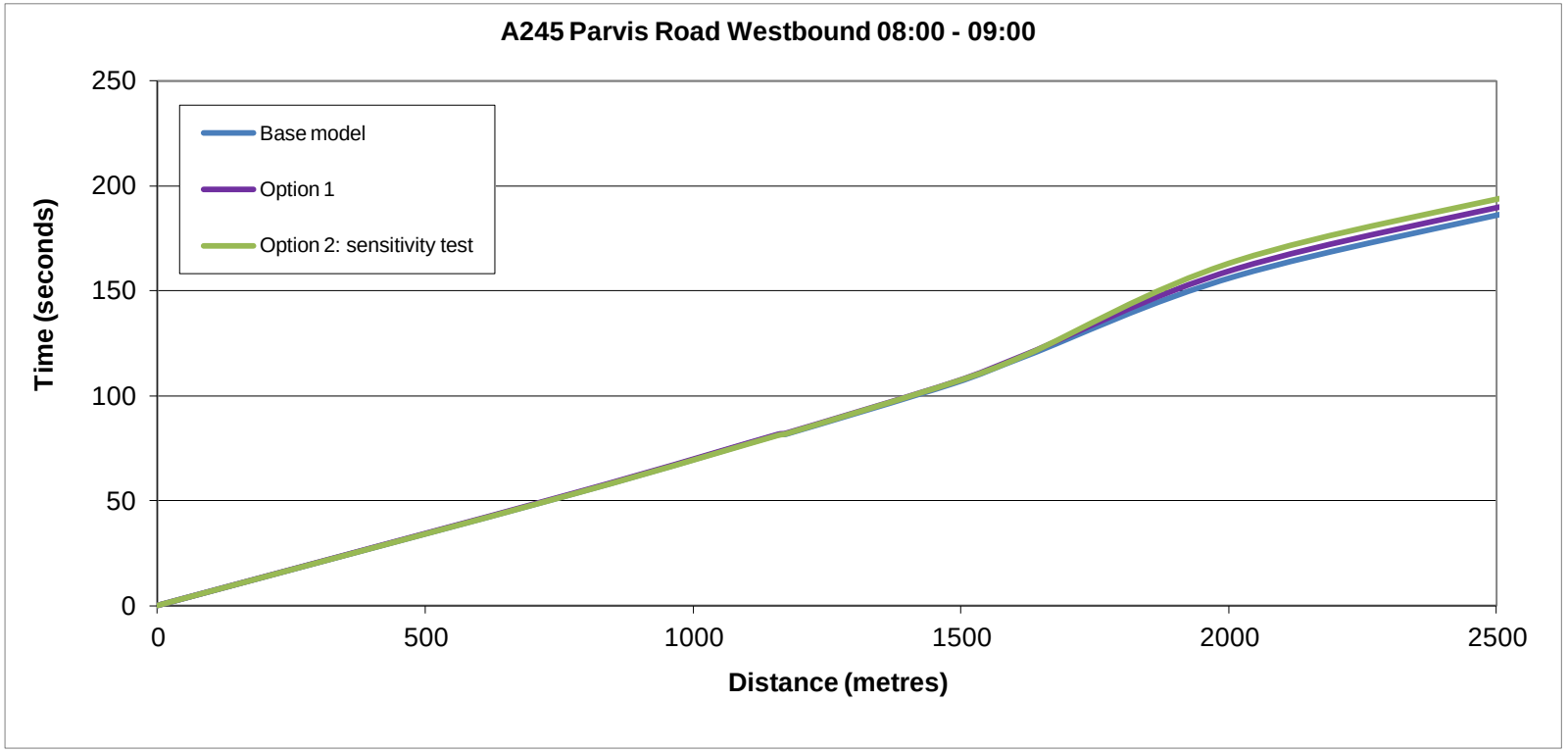
7.3 Appendix III: Journey Time Routes



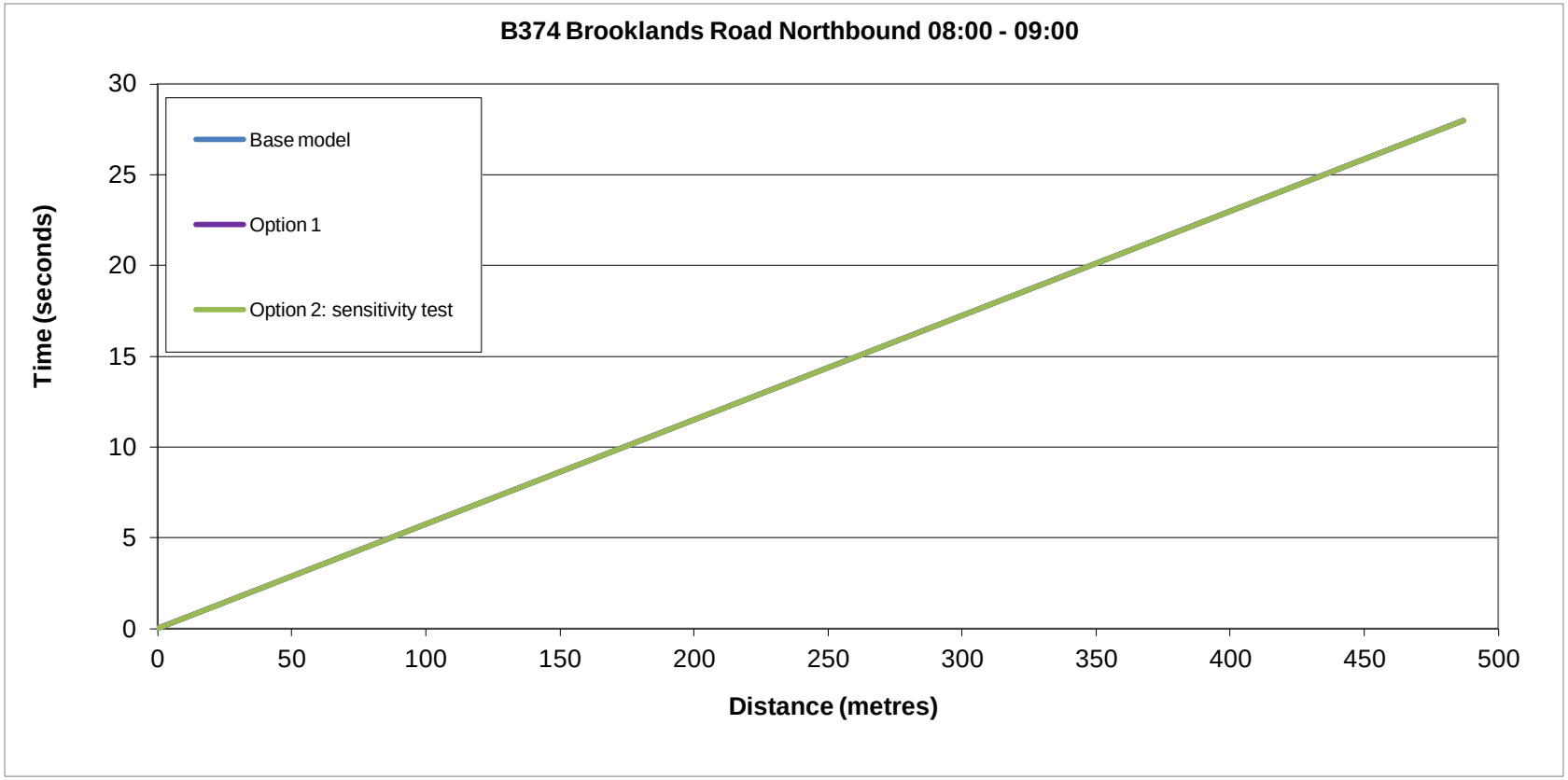
7.4 Appendix IV: Journey Time Routes - Hotspots



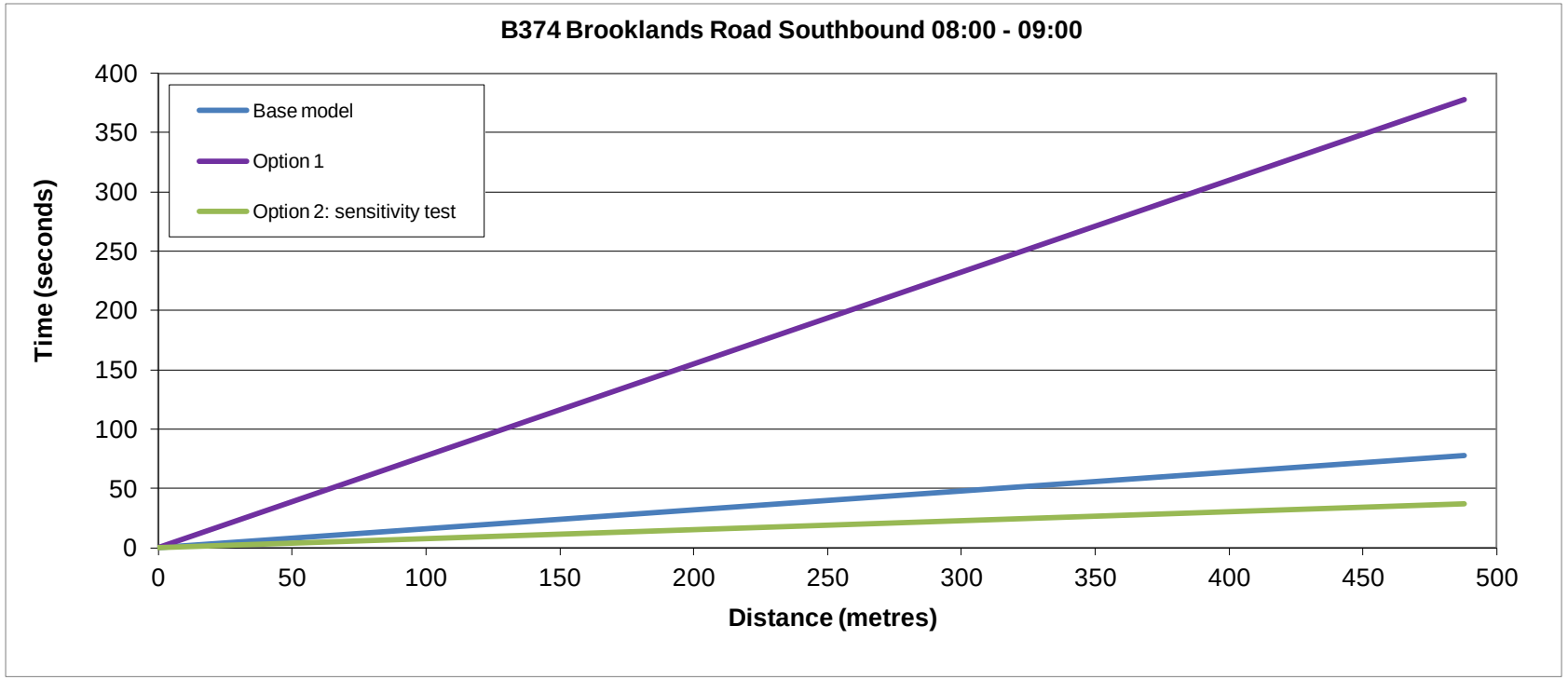
	Cumulative Distance (m)	Base model	Option 1		Option 2	
			Time (secs)	Absolute difference from base	Time (secs)	Absolute difference from Option 1
Start	0	0	0	0	0	0
A - B	584	64	76	12	74	-2
B - C	965	49	57	9	62	5
C - D	1119	17	18	1	18	0
D - E	1468	28	28	0	28	0
E - F	1485	0	0	0	0	0
F - G	1850	42	73	31	40	-33
G - H	2652	164	172	8	43	-129



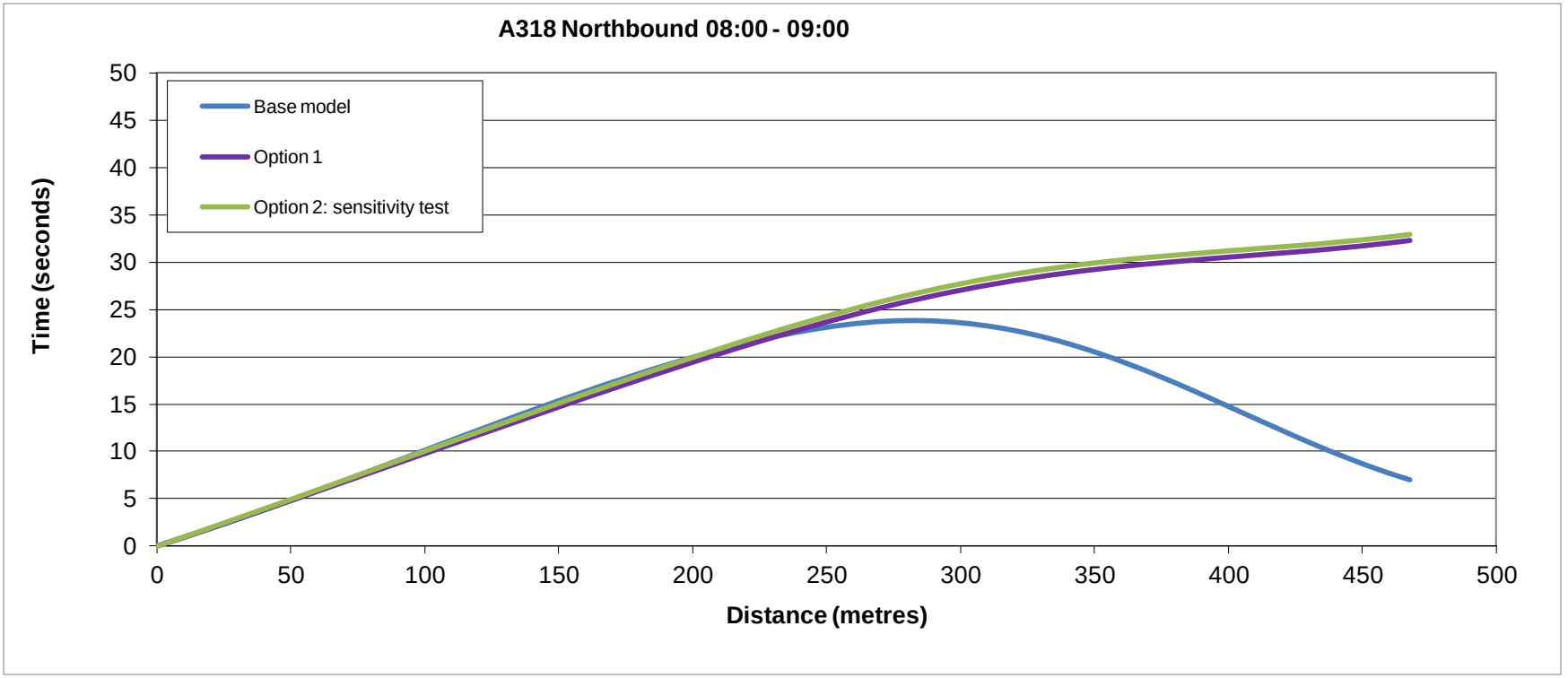
	Cumulative Distance (m)	Base model	Option 1		Option 2	
			Time (secs)	Absolute difference from base	Time (secs)	Absolute difference from Option 1
Start	0	0	0	0	0	0
H - G	777	53	54	0	53	0
G - F	1157	28	28	0	28	0
F - E	1174	0	1	0	1	0
E - D	1486	24	24	0	24	0
D - C	1623	13	14	0	13	0
C - B	2015	38	41	3	45	4
B - A	2621	36	36	0	36	0



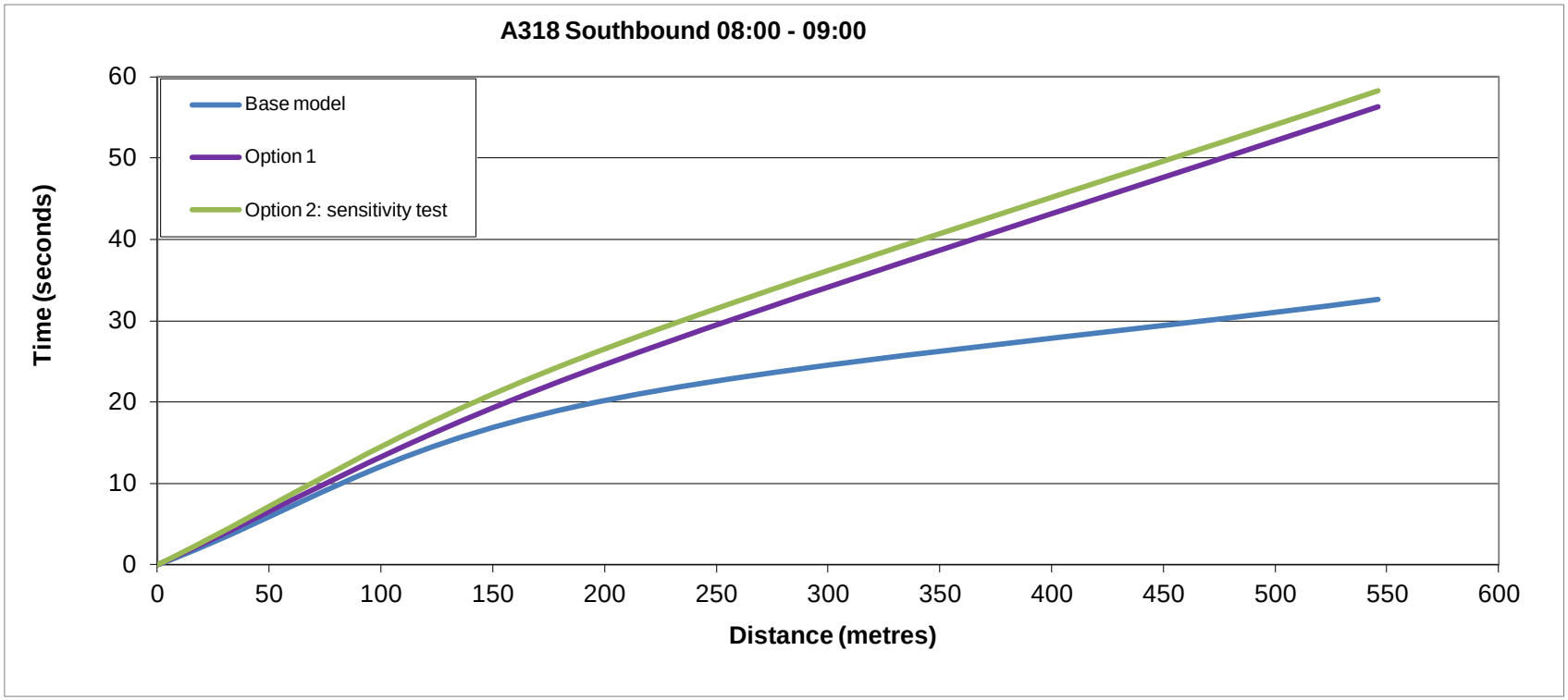
	Cumulative Distance (m)	Base model	Option 1		Option 2	
			Time (secs)	Absolute difference from base	Time (secs)	Absolute difference from Option 1
Start	0	0	0	0	0	0
G - I	487	28	28	0	28	0



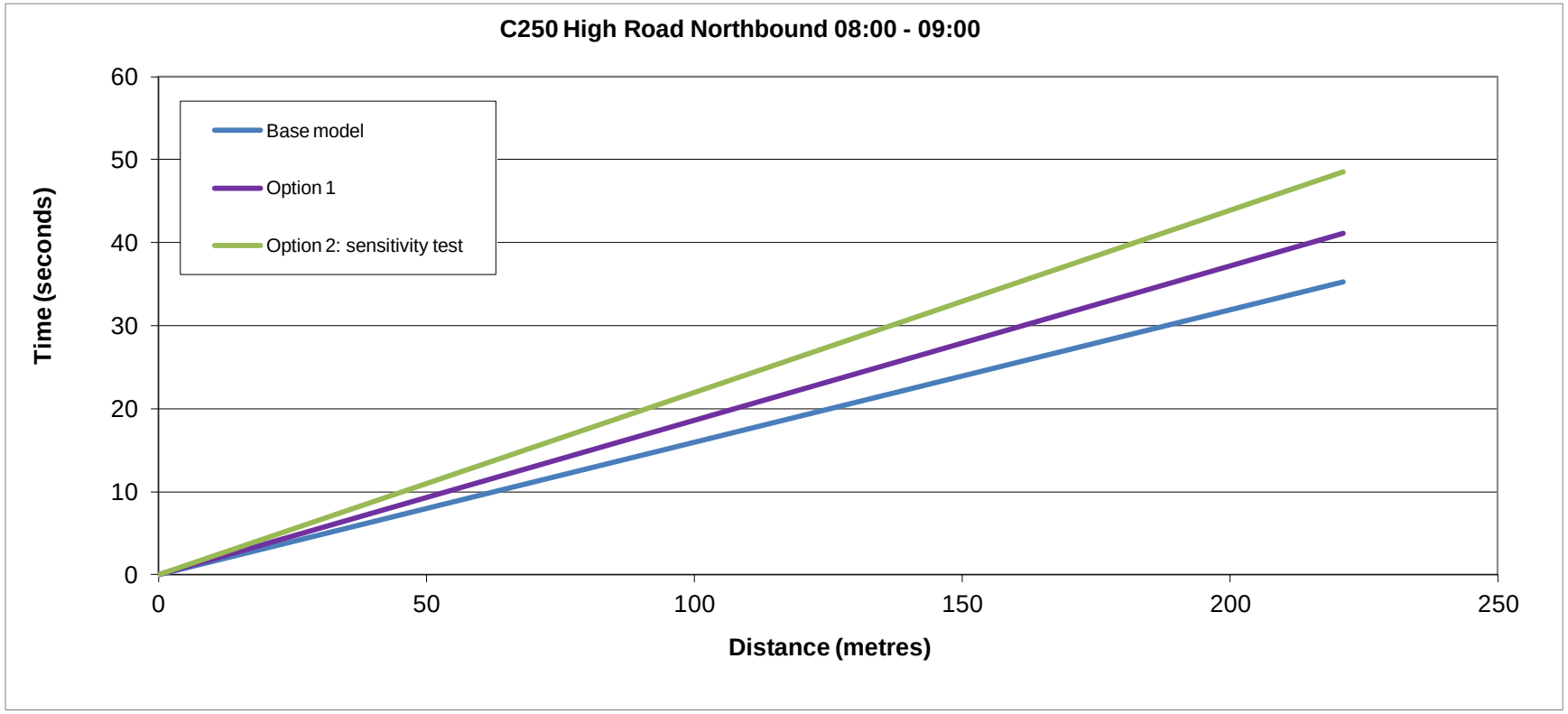
	Cumulative Distance (m)	Base model	Option 1		Option 2	
			Time (secs)	Absolute difference from base	Time (secs)	Absolute difference from Option 1
Start	0	0	0	0	0	0
I - G	488	78	378	300	37	-341



	Cumulative Distance (m)	Base model	Option 1		Option 2	
			Time (secs)	Absolute difference from base	Time (secs)	Absolute difference from Option 1
Start	0	0	0	0	0	0
D - J	272	24	25	2	26	1
J - K	468	7	7	0	7	0

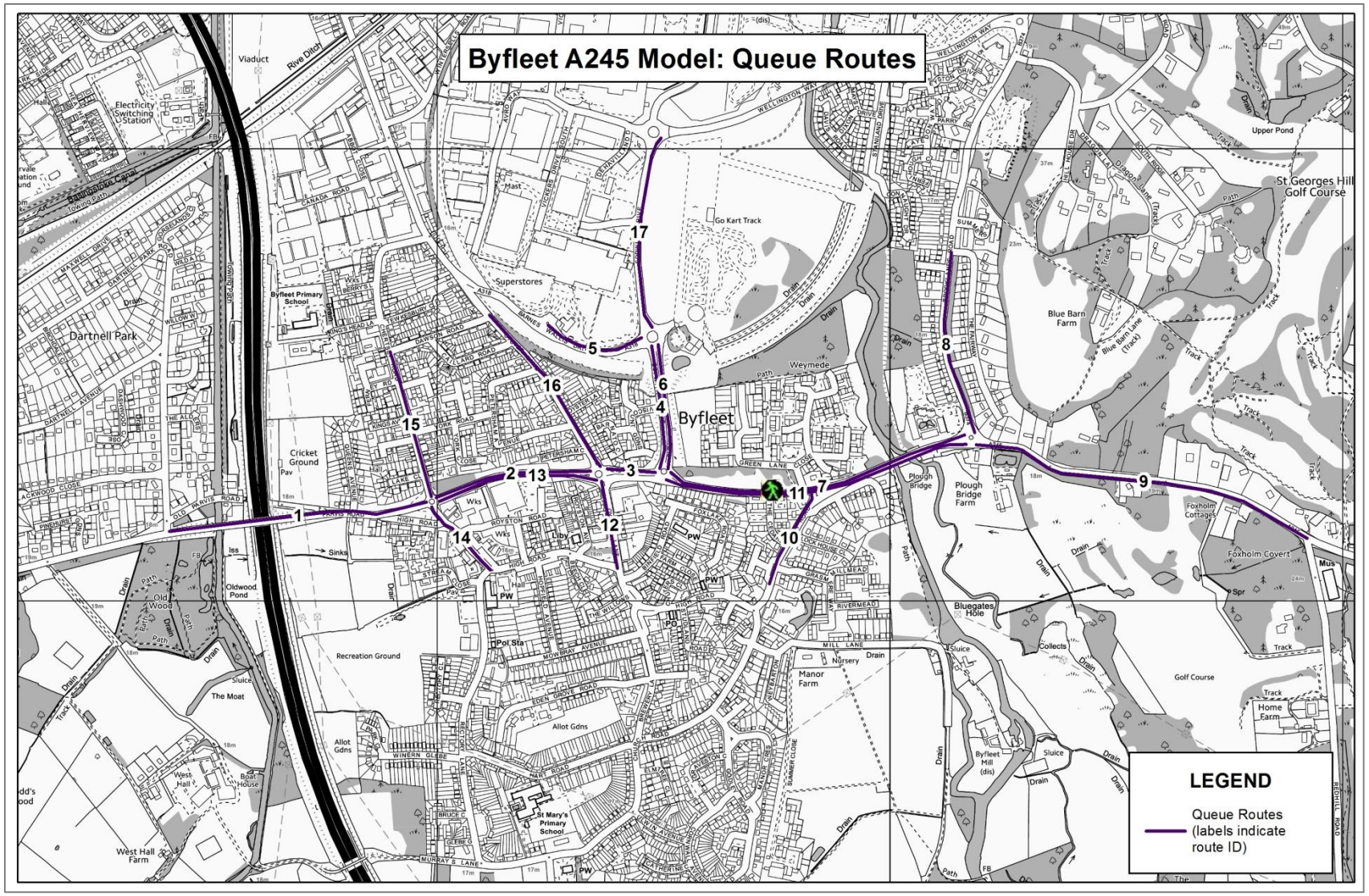


	Cumulative Distance (m)	Base model	Option 1		Option 2	
			Time (secs)	Absolute difference from base	Time (secs)	Absolute difference from Option 1
Start	0	0	0	0	0	0
K - J	188	20	23	4	25	2
J - D	546	33	33	0	33	0



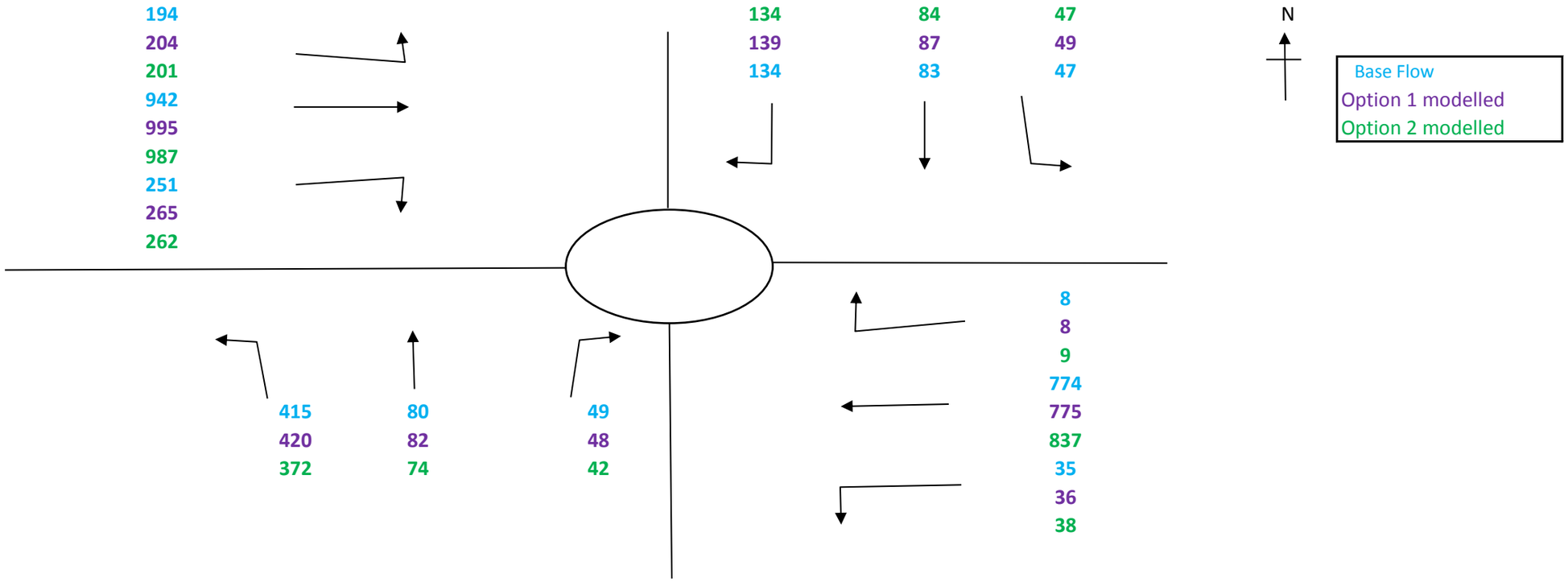
	Cumulative Distance (m)	Base model	Option 1		Option 2	
			Time (secs)	Absolute difference from base	Time (secs)	Absolute difference from Option 1
Start	0	0	0	0	0	0
L - F	221	35	41	6	49	7

7.5 Appendix V: Queue routes in the model



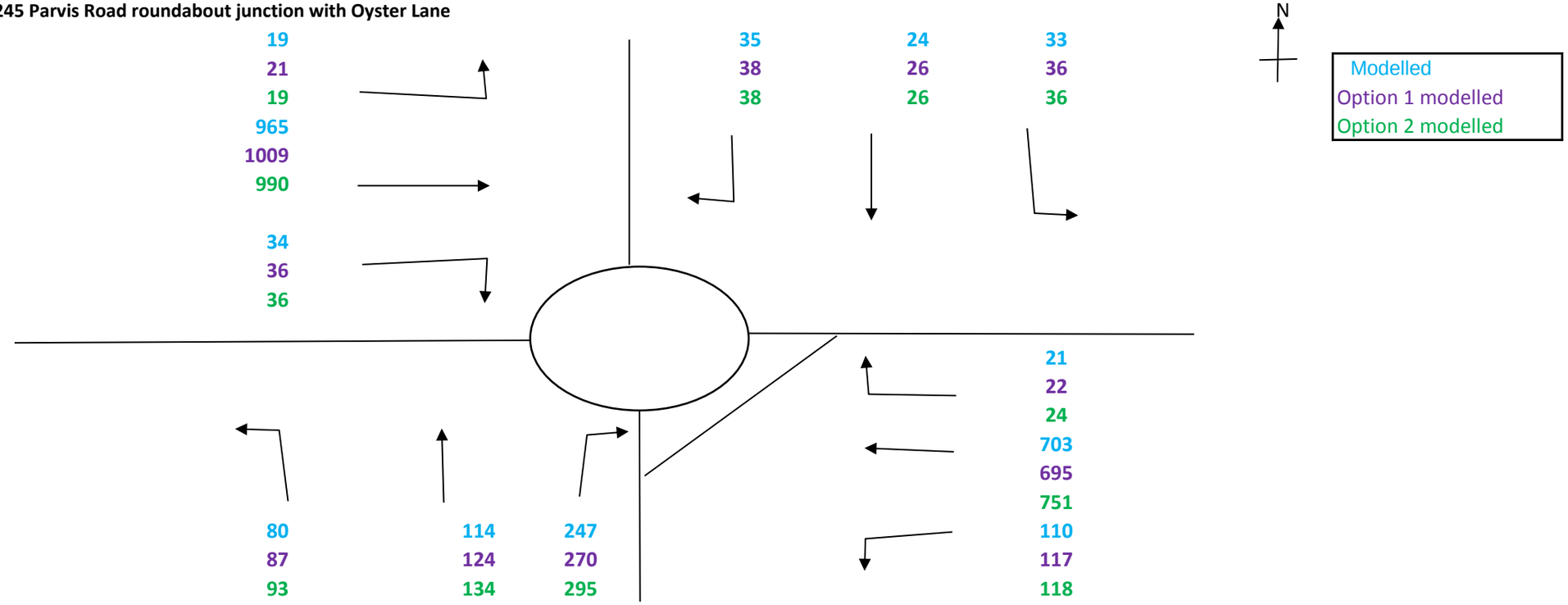
7.6 Appendix VI: Flow diagrams

1 A245 Parvis Road roundabout junction with Chertsey Road and High Road



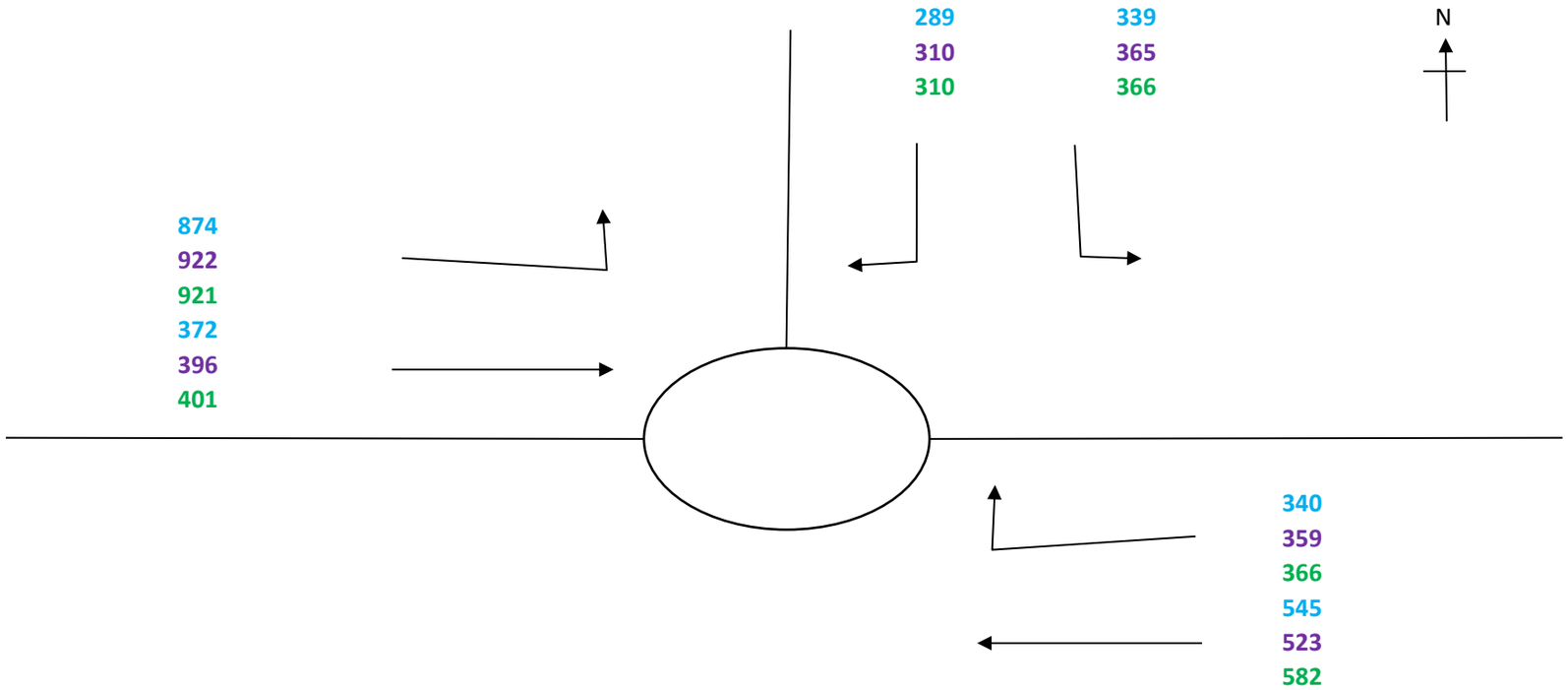
Description	Movement	Base Flow	OPTION 1			OPTION 2		
			Modelled Flow	Diff. From base	% Diff	Modelled Flow	Diff. From option 1	% Diff
A245 Parvis Road (EB)	Left to Chertsey Road	194	204	11	6%	201	-3	-1%
A245 Parvis Road (EB)	Ahead to A245 Parvis Road	942	995	52	6%	987	-8	-1%
A245 Parvis Road (EB)	Right to High Road	251	265	14	6%	262	-3	-1%
Chertsey Road (SB)	Left to A245 Parvis Road (EB)	47	49	2	4%	47	-2	-3%
Chertsey Road (SB)	Ahead to High Road	83	87	3	4%	84	-3	-3%
Chertsey Road (SB)	Right to A245 Parvis Road (WB)	134	139	5	4%	134	-5	-3%
A245 Parvis Road (WB)	Left to High Road	35	36	0	0%	38	2	6%
A245 Parvis Road (WB)	Ahead to A245 Parvis Road	774	775	1	0%	837	62	8%
A245 Parvis Road (WB)	Right to Chertsey Road	8	8	1	8%	9	0	6%
High Road (NB)	Left to A245 Parvis Road (WB)	415	420	5	1%	372	-49	-12%
High Road (NB)	Ahead to Chertsey Road	80	82	2	2%	74	-9	-11%
High Road (NB)	Right to A245 Parvis Road (EB)	49	48	-1	-1%	42	-6	-13%

2 A245 Parvis Road roundabout junction with Oyster Lane



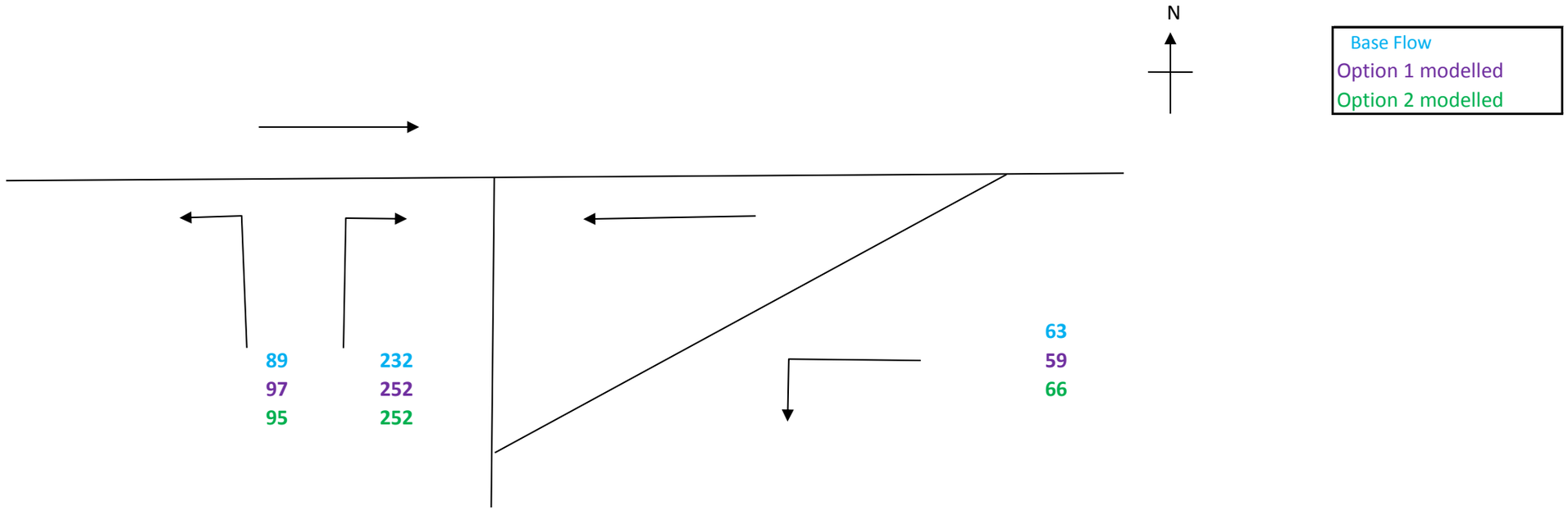
Description	Movement	Base Flow	OPTION 1			OPTION 2		
			Modelled Flow	Diff. From base	% Diff	Modelled Flow	Diff. From option 1	% Diff
A245 Parvis Road (EB)	Left to Oyster Lane (NB)	19	21	2	10%	19	-1	-7%
A245 Parvis Road (EB)	Ahead to A245 Parvis Road	965	1009	44	5%	990	-20	-2%
A245 Parvis Road (EB)	Right to Oyster Lane (SB)	34	36	2	5%	36	-1	-1%
Oyster Lane (SB)	Left to A245 Parvis Road (EB)	33	36	3	9%	36	0	-1%
Oyster Lane (SB)	Ahead to Oyster Lane (SB)	24	26	2	9%	26	0	0%
Oyster Lane (SB)	Right to A245 Parvis Road (WB)	35	38	3	10%	38	0	0%
A245 Parvis Road (WB)	Left to Oyster Lane (SB)	110	117	7	6%	118	1	1%
A245 Parvis Road (WB)	Ahead to A245 Parvis Road (WB)	703	695	-8	-1%	751	56	8%
A245 Parvis Road (WB)	Right to Oyster Lane (NB)	21	22	0	2%	24	2	8%
Oyster Lane (NB)	Left to A245 Parvis Road (WB)	80	87	7	9%	93	6	7%
Oyster Lane (NB)	Ahead to Oyster Lane (NB)	114	124	10	9%	134	10	8%
Oyster Lane (NB)	Right to A245 Parvis Road (EB)	247	270	23	9%	295	25	9%

3 A245 Parvis Road roundabout junction with A318 Sopwith Drive



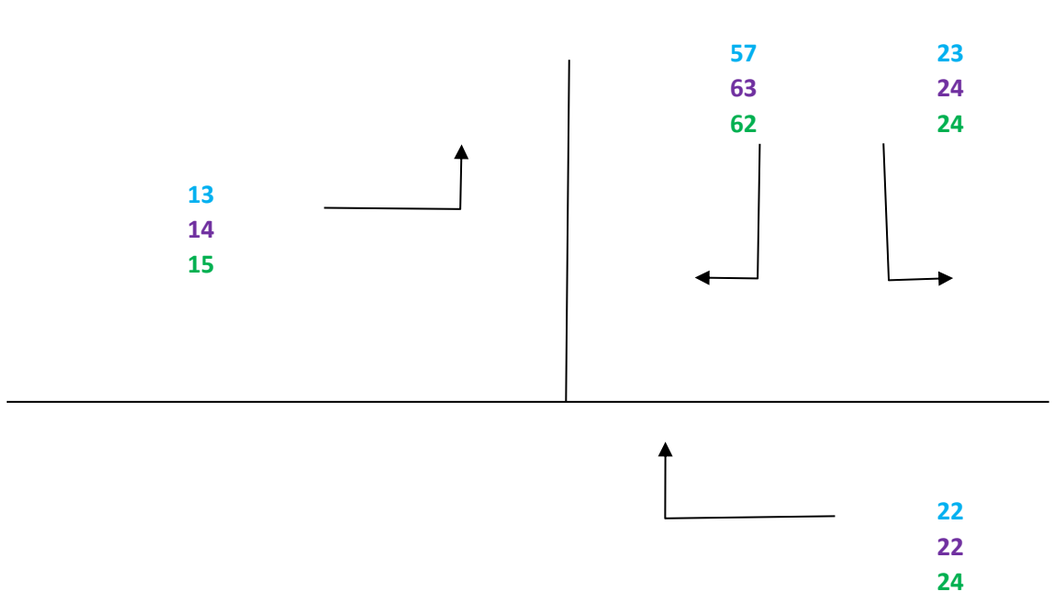
Description	Movement	Base Flow	OPTION 1			OPTION 2		
			Modelled Flow	Diff. From base	% Diff	Modelled Flow	Diff. From option 1	% Diff
A245 Parvis Road (EB)	Left to A318 Sopwith Drive	874	922	49	6%	921	-2	0%
A245 Parvis Road (EB)	Ahead to A245 Parvis Road (EB)	372	396	24	7%	401	5	1%
A318 Sopwith Drive	Left to A245 Parvis Road (EB)	339	365	26	8%	366	2	0%
A318 Sopwith Drive	Right to A245 Parvis Road (WB)	289	310	21	7%	310	1	0%
A245 Parvis Road (WB)	Ahead to A245 Parvis Road (WB)	545	523	-22	-4%	582	58	11%
A245 Parvis Road (WB)	Right to A318 Sopwith Drive	340	359	18	5%	366	7	2%

4 A245 Parvis Road junction with High Road



Description	Movement	Base Flow	OPTION 1			OPTION 2		
			Modelled Flow	Diff. From base	% Diff	Modelled Flow	Diff. From option 1	% Diff
A245 Parvis Road (WB)	Left to High Road (SB)	63	59	-4	-7%	66	8	13%
High Road	Left to A245 Parvis Road (WB)	89	97	7	8%	95	-1	-1%
High Road	Right to A245 Parvis Road (EB)	232	252	20	8%	252	1	0%

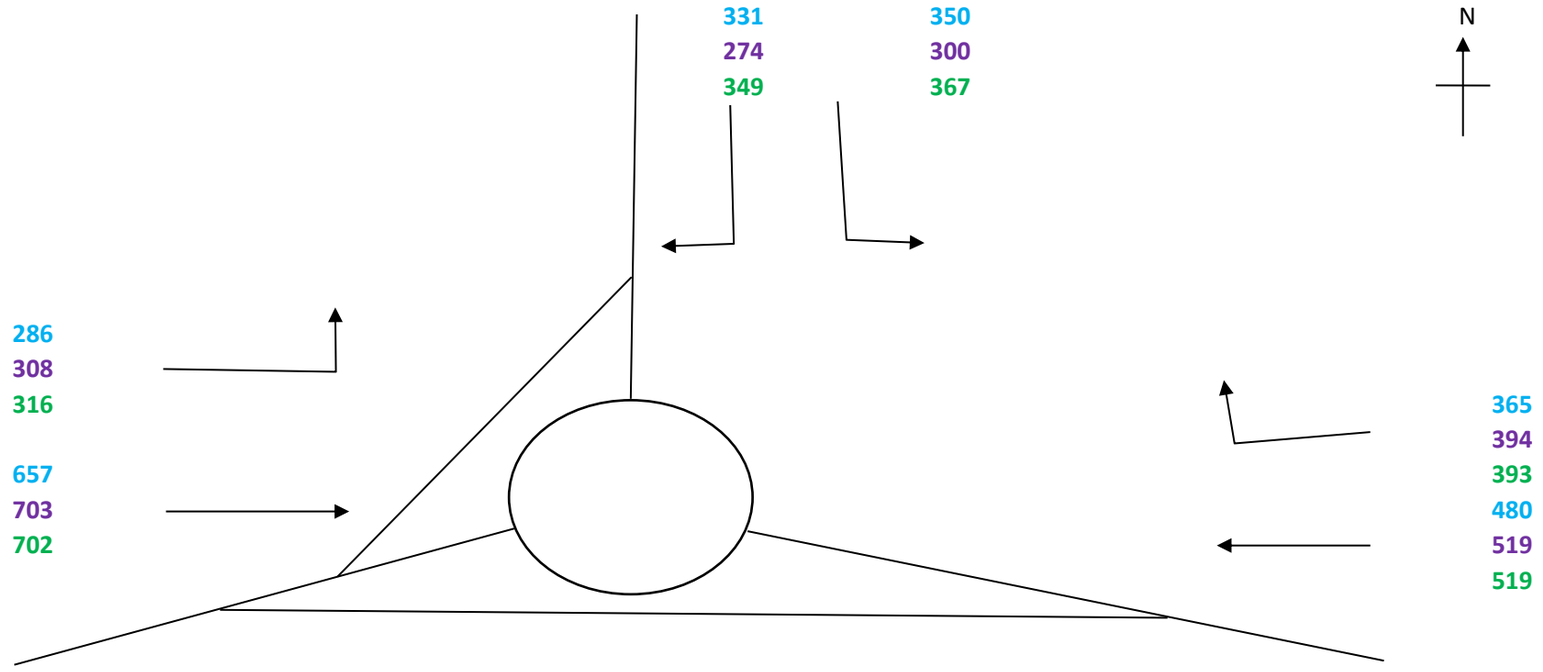
5 A245 Parvis Road junction with Green Lane



Base Flow
Option 1 modelled
Option 2 modelled

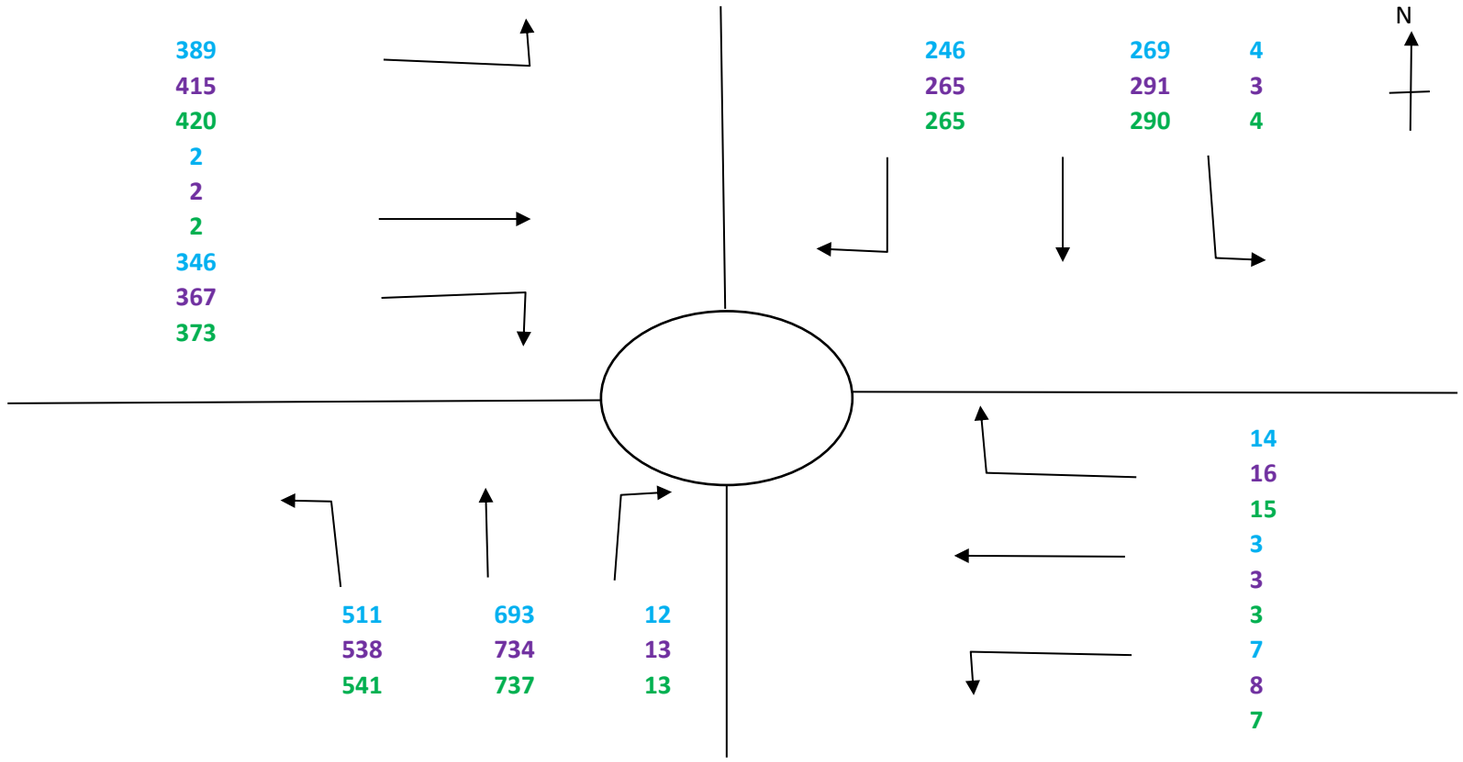
Description	Movement	Base Flow	OPTION 1			OPTION 2		
			Modelled Flow	Diff. From base	% Diff	Modelled Flow	Diff. From option 1	% Diff
Green Lane	Left to A245 Parvis Road (EB)	23	24	2	7%	24	0	1%
Green Lane	Right to A245 Parvis Road (WB)	57	63	6	10%	62	0	-1%
Parvis Road (EB)	Left to Green Lane	13	14	1	4%	15	1	5%
Parvis Road (WB)	Right to Green Lane	22	22	1	4%	24	2	7%

6 A245 Parvis Road roundabout junction with B374 Brooklands Road and A245 Byfleet Road



Description	Movement	Base Flow	OPTION 1			OPTION 2		
			Modelled Flow	Diff. From base	% Diff	Modelled Flow	Diff. From option 1	% Diff
A245 Parvis Road (EB)	Left to B374 Brooklands Road	286	308	23	8%	316	7	2%
A245 Parvis Road (EB)	Ahead to A245 Byfleet Road	657	703	46	7%	702	-1	0%
B374 Brooklands Road (SB)	Left to A245 Byfleet Road	350	300	-49	-14%	367	67	22%
B374 Brooklands Road (SB)	Right to A245 Parvis Road	331	274	-57	-17%	349	75	28%
A245 Byfleet Road (WB)	Left to A245 Parvis Road	480	519	39	8%	519	0	0%
A245 Byfleet Road (WB)	Right to B374 Brooklands Road	365	394	29	8%	393	-1	0%

7 A318 Barnes Wallis Drive roundabout junction with Sopwith Drive, A318 Sopwith Drive and Car Park



Base Flow
Option 1 modelled
Option 2 modelled

Description	Movement	Base Flow	OPTION 1			OPTION 2		
			Modelled Flow	Diff. From base	% Diff	Modelled Flow	Diff. From option 1	% Diff
A318 Barnes Wallis Drive	Left to Sopwith Drive	389	415	26	7%	420	5	1%
A318 Barnes Wallis Drive	Ahead to Car Park	2	2	0	0%	2	0	22%
A318 Barnes Wallis Drive	Right to A318 Sopwith Drive	346	367	21	6%	373	6	2%
Sopwith Drive	Left to Car Park	4	3	0	-9%	4	0	10%
Sopwith Drive	Ahead to A318 Sopwith drive	269	291	22	8%	290	-1	0%
Sopwith Drive	Right to A318 Barnes Wallis Drive	246	265	19	8%	265	1	0%
Car Park	Left to A318 Sopwith Drive	14	16	2	11%	15	0	-2%
Car Park	Ahead to A318 Barnes Wallis Drive	3	3	0	4%	3	0	-8%
Car Park	Right to Sopwith Drive	7	8	1	11%	7	0	-3%
A318 Sopwith Drive	Left to A318 Barnes Wallis Drive	511	538	28	5%	541	3	1%
A318 Sopwith Drive	Ahead to Sopwith Drive	693	734	40	6%	737	3	0%
A318 Sopwith Drive	Right to Car Park	12	13	0	2%	13	0	0%

Annex B

SURREY
COUNTY COUNCIL

WOKING LOCAL PLAN

Mitigation:
WSP Route Management Study Summary

Project Title: Woking Local Plan

Document Title: Mitigation: WSP A245/A320 Route Management Study Summary (2002)

Client Reference:

Date: 01 September 2017

Prepared By: Print Phil Smith

Authorised By: Print William Bryans

Amendment List

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CONTENTS

1 INTRODUCTION

1.1.1 SCC commissioned WSP to conduct a route management study on the A245 and A320 corridor, which was published in 2002. This document summarises the findings contained in this WSP report. It seeks to identify possible improvements that could be made to transport along the corridor to mitigate against increased congestion and increased journey times, brought about by increasing demand.

2 OVERVIEW

2.1.1 The report by WSP indicates that no ideal solution will be reached as the A245 route in question is constrained by urban development. It is recommended that a balance is found between encouraging sustainable transport (aiming to implement this without impeding other modes) and "predict and provide" (although the report indicates that there is a bad track record of implementing this successfully). Importantly, the report suggests several possible improvements to mitigate against increased journey times and congestion along the route, although it should be noted that highway and traffic conditions may have changed considerably since the WSP report was published in 2002.

2.1.2 Key elements of the suggested improvements:

1. Targeted junction improvements to reduce traffic delay;
2. Increased efficiency of buses (due to reduced traffic delay and new fitted transponders);
3. Improved quality of buses (low floor, modern interior);
4. Improved junction layout to assist cyclist and pedestrians. This will be tied in with continuous high quality route provision;
5. Improved station facilities; and
6. SCC working with local employers (Brooklands Business park & Sheerwater Business Park) to employ a 'joined up' approach, to provide more sustainable and less car intensive systems of travel.

3 CONSULTATION RESULTS

3.1.1 Public concerns identified include the opinion that a lot of congestion is caused by school run traffic and that there is poor provision of public transport. Concern was also raised regarding the impact of further development along the route, the speed of vehicles along the route, and whether traffic signals were working as well as they should be. The public also expressed the desire for Redhill Road to be reopened as access to and from the A3.

3.1.2 Suggested improvements to the transport network from residents included the use of "quiet" road surfacing, enhancement of cycle facilities and the restriction of HGV movements in the area.

4 ISSUES AT KEY JUNCTIONS ON A245 CORRIDOR

4.1 A245 Parvis Road junction with Chertsey Road/High road

4.1.1 The report indicates that the junction operates satisfactorily at the time the report was produced, with little queuing present. It does however state that improvements may be required in the future, and proposes a mitigation option (see **Section 6**).

4.2 A245 Parvis Road junction with Oyster Lane

4.2.1 The report indicates that this junction operates well below capacity at the time the report was produced.

4.3 A245 Parvis Road junction with Brooklands Road

4.3.1 The report states that the roundabout junction of Brooklands Road and A245 appears to work satisfactorily at the time the report was produced. It states that existing queues and delays seem to be related to the level of blocking back through the junction experienced when vehicles heading east are unable to get around vehicles turning down side roads (such as Redhill Road) further along A245 Byfleet Road.

5 OTHER ISSUES

5.1.1 The report identifies that rail stations have poor accessibility for disabled users. There is also poor provision of parking facilities for both cycles and cars.

5.1.2 WSP identify that the cycle routes that exist along the corridor lack continuity. This is a potential area for improvement and could encourage modal shift.

5.1.3 The report states that the route runs through predominantly urban area but there are some local and national designations. The Sheerwater Estate is identified in the report as being a deprived area.

5.1.4 The corridor contains a mixed level of provision and access to services, including post offices, local retail and shops, however some areas have no provision, which increases the need to travel by car.

6 PROPOSED ROAD/JUNCTION IMPROVEMENTS

6.1.1 As highway and traffic conditions may have changed considerably since the WSP report was published in 2002, the proposed junction improvements presented in this summary that have been adapted from the proposals in the WSP report only relate to issues that have been identified as a current problem.

6.2 A245 Parvis Road junction with Chertsey Road

6.2.1 The report indicates that network conditions around the D3760 Chertsey Road roundabout junction with A245 Parvis Road were satisfactory at the time the report was published, with little queuing. It does however state that the right turn from A245 eastbound into Byfleet (via High Road) could be banned to improve the junction. Furthermore a lane going across the car park could be added to facilitate vehicles turning left to A245 Parvis Road westbound from High Road (which requires the war memorial to be moved).

6.3 A245 junction with B374 Brooklands Road

6.3.1 The report states that the roundabout junction of Brooklands Road and A245 appears to work satisfactorily at the time the report was produced. It states that existing queues and delays seem to be related to the level of blocking back through the junction experienced when vehicles heading east are unable to get around vehicles turning down side roads (such as Redhill Road) further along A245 Byfleet Road. As a possible solution to this issue, WSP propose restricting

the right hand turn movement out of Redhill Road to allow space for a right hand turn lane on A245 Byfleet Road eastbound for vehicles turning into Redhill Road. This would prevent eastbound vehicles wanting to turn right down Redhill Road blocking vehicles behind them from continuing eastbound on A245.

7 PROPOSED IMPROVEMENTS FOR OTHER MODES

7.1 Walking/Cycling Proposals

7.1.1 WSP suggest creating a shared use route on southern side of A245 between Seven Hills Road and Brooklands Road to encourage cycle trips along this route. The report also suggests other improvements for non-motorised modes outside of the A245 corridor.

7.2 Bus Proposals

7.2.1 WSP identify the need for there to be a more regular and direct service along the route, in order for the bus to be an attractive alternative to the car. The bus could also be encouraged as a mode of transport by improving waiting facilities and providing modern buses with low floors to increase their appeal.

Annex C

Annex C: Redhill Road Manual Classified Turning Count

1 INTRODUCTION

1.1.1 This document has been produced to understand the impact of right turn movements from the A245 Byfleet Road eastbound to Redhill Road on delay on the A245 eastbound.

2 MANUAL CLASSIFIED TURNING COUNT (MCTC) DATA

2.1.1 Data from the MCTC indicates vehicles turning right down Redhill Road make up a small proportion (5%) of the total number of vehicles navigating A245 Byfleet Road eastbound during the AM peak period (0700 - 1000). The proportion of vehicles making this movement in the PM peak hour (1600 – 1900) is also low (4%).

2.1.2 It should be noted that the number of vehicles exiting Redhill Road is also fairly low during both the AM and PM peak periods (121 and 247 vehicles respectively). Queuing vehicles on A245 eastbound were observed stopping to let vehicles turning right out of Redhill Road, however as the number of vehicles exiting the road is low, it is thought that the delay caused by this is likely to be low.

2.1.3 **Appendix I** shows data from the MCTC.

3 ADDITIONAL DATA

3.1.1 In addition to the classified counts of vehicle movements, additional information detailing the queuing situation at the junction was recorded.

3.1.2 The details of the data collected is set out as follows: each time a vehicle turned right from A245 Byfleet Road eastbound to Redhill Road, the time this turn was made was recorded, as well as the length of time the vehicle stopped to make the turn. The length of queue that formed behind the vehicle was noted.

3.1.3 A queue often formed on A245 eastbound coming back from Seven Hills Road that reached Redhill Road. When a vehicle turned down Redhill Road, it was observed that a gap would form between the last vehicle in the queue back from Seven Hills Road and the vehicle wanting to turn right down Redhill Road. This gap distance was also recorded. Where the queue from Seven Hills Road did not reach the Redhill Road junction, no gap distance was recorded.

3.1.4 The data is presented below in **Table 2.1**.

	Average queue caused by each right turning vehicle	Average wait time per vehicle	Gap to Seven Hills Road
0700 to 0800	66.3	12.6	120.0
0800 to 0900	65.0	16.4	311.7
0900 to 1000	96.1	15.8	200.0
1000 to 1100	39.3	11.9	N/A
1100 to 1200	33.8	9.0	N/A
1200 to 1300	36.3	15.3	N/A
1300 to 1400	31.5	9.6	N/A
1400 to 1500	49.4	16.5	90.0
1500 to 1600	64.4	15.4	N/A
1600 to 1700	32.5	14.2	62.5
1700 to 1800	132.5	14.1	93.3
1800 to 1900	95.0	14.3	36.7

Table 2.1: Queuing data for junction of A245 Byfleet Road and Redhill Road

3.1.5 When the queue reaching back from Seven Hills Road passed Redhill Road, the distance the queue reached back past Redhill Road was recorded. Note that in cases where the queue stretched out of sight a maximum distance of 300m was recorded in the AM and 170m in the PM (due to a reduction in visibility because of the weather). This data is shown in **Table 2.2**.

Hour	Average Length (m)
07:00	83
08:00	199
09:00	43
10:00	0
11:00	0
12:00	0
13:00	0
14:00	14
15:00	30
16:00	124
17:00	156
18:00	43

Table 2.2: Average queue length

4 SUMMARY

4.1.1 The data in this short document shows that although the Redhill Road junction does contribute to some of the delay to vehicles on A245 Byfleet Road eastbound, the demand for the right turn is fairly low and that the delay appears to be caused further downstream at the junction with the B365 Seven Hills Road.

APPENDIX I: MCTC data

Start time	End time	From A245 Road westbound			From Redhill Road			From A245 Byfleet Road eastbound			Junction	Proportion of vehicles on A245 eastbound that turn right onto Redhill Road%
		Left	Ahead	Total	Left	Right	Total	Ahead	Right	Total	Total	
0700	0800	29	1211	1240	7	18	25	830	34	864	2129	4%
0800	0900	40	1202	1242	25	15	40	696	45	741	2023	6%
0900	1000	96	1093	1189	36	20	56	726	48	774	2019	6%
0700	**1000**	**165**	**3506**	**3671**	**68**	**53**	**121**	**2252**	**127**	**2379**	**6171**	**5%**
1600	1700	46	777	823	29	43	72	697	24	721	1616	3%
1700	1800	43	865	908	43	44	87	817	36	853	1848	4%
1800	1900	65	788	853	46	42	88	792	41	833	1774	5%
1600	**1900**	**154**	**2430**	**2584**	**118**	**129**	**247**	**2306**	**101**	**2407**	**5238**	**4%**

Annex D

B374 Brooklands Road roundabout junction with A245 Parvis Road and A245 Byfleet Road site visit

1. Background information

1.1. A site visit was undertaken on 14/09/2017 to the roundabout junction of A245 Parvis Road, B374 Brooklands Road and A245 Byfleet Road. Observations of vehicles were made at this roundabout in order to understand the nature of vehicle behaviour at the junction.

1.2. It is known that this junction is highly congested during peak times, this visit therefore sought to identify what the causes of this congestion could be and to inform possible interventions to improve the traffic flow and behaviour in the area.

1.3. Observations were made during the AM peak (07:00 to 9:00), Inter peak (12:15) and PM peak (16:00 to 18:00).

2. Site information

2.1. **Figure 2.1** below displays the junction in question.

Figure 2.1 – Plan of B374 Brooklands Road roundabout junction with A245 Parvis Road/Byfleet Road

3. Observations

3.1. Observations made on the day of the site visit are set out in the tables below.

AM Peak	
Time	**Observations**
0700	• On the A245 Parvis Road eastbound entrance to the roundabout, the far right lane is not being used, only the jet lane (left turn) and middle lane (right turn). This results in some queuing back from the give way line (approx. 4 to 5 vehicles). • Lane discipline on the roundabout is extremely poor. Vehicles take the shortest, straightest path (when turning right from Parvis Road to Byfleet Road), starting in the left lane (for turning right) and then hugging the side of the roundabout rather than using the whole carriageway. This leads to vehicles not using both lanes for turning right.
0720	• Roundabout exit onto A245 Byfleet road eastbound is clear, and so is the exit onto Brooklands Road northbound, but there is still some queuing on A245 Parvis Road eastbound entrance to the roundabout, implying that the roundabout is the cause of some delay.
0730	• Queuing located on A245 Byfleet Road eastbound now extends back to the roundabout exit, and causes further queuing on A245 Parvis Road eastbound at the entrance to the roundabout. • At this point there is no queue on B374 Brooklands Road southbound or northbound.
0740	• A245 Parvis Road eastbound entrance to the roundabout, the queue here extends back to the pedestrian crossing near to Green Lane.
0745	• Queuing is observed on the roundabout itself: vehicles travelling from Parvis Road to Byfleet Road pull onto the roundabout when the exit is not clear. • Vehicles on the roundabout either block Brooklands Road southbound (right turn to Parvis Road) or block vehicles travelling from Byfleet Road to Brooklands Road. • When vehicles sitting on the roundabout block the movement of other vehicles, they are forced to manoeuvre to a different position on the roundabout to allow vehicles to pass. This creates a risk of collisions. • This also results in vehicles that are attempting to exit onto Byfleet Road, merging with vehicles coming from Brooklands Road SB turning left onto Byfleet Road. Up to 3 vehicles can sit side by side attempting to merge whilst exiting onto Byfleet Road eastbound.
0800	<u>Walked up Byfleet Road towards Redhill Road</u> • Observations at the Redhill Road junction with the A245 indicate that the primary cause of congestion resides further east on the carriageway (presumably Seven Hills Road), rather than Redhill Road right turn delay being the cause. • Queuing stretches back from the east on A245 towards Redhill Road, presumably caused by Seven Hills Road junction. • Vehicles find it difficult to exit Redhill Road, especially when turning right. This leads to slow moving vehicles travelling eastbound on A245 stopping to let out vehicles on Redhill Road. This creates some delay. • Vehicles turning right from A245 eastbound to Redhill Road find it difficult to gap seek to make the turn. This leads to them stopping and waiting, preventing vehicles wanting to continue on A245 eastbound from proceeding. This also creates some delay. • It is noted that the stop start behaviour found on the A245 at the Redhill Road junction does add additional delay to vehicles travelling eastbound on the A245.

AM Peak	
Time	**Observations**
	Where before vehicles were crawling, the junction causes vehicles to stop, which ripples back down towards the Brooklands Road roundabout. • It is therefore considered that whilst the Redhill Road junction does add delay to the A245 eastbound, currently this is outweighed by the delay created further east on the A245.
0805	<u>Back at B374 Brooklands Road roundabout</u> • It is noted that there are many large HGVs on the A245. • At this point traffic is at a near standstill on A245 EB. • LGVs and HGVs were observed sitting on the roundabout and blocking the Brooklands Road entrance to/ exit from the roundabout. • Vehicles are now using all available lanes on the A245 Parvis Road eastbound entrance to the roundabout (8 vehicles in the left lane, 4 vehicles in the right lane).  

AM Peak	
Time	**Observations**
0815	• Brooklands Road southbound is now queuing on the approach to the roundabout, in addition to queues on Parvis Road eastbound and Byfleet Road eastbound. • Again, vehicles are stopping on the roundabout. A few of these vehicles are sitting in or move into, positions that allow right turning vehicles from Brooklands Road southbound to enter the roundabout and make the turn. Note that some vehicles are reversing on the roundabout or moving into strange positions in order to let these vehicles pass. • It was observed that 3 vehicles were attempting to merge into the one exit lane (on Byfleet Road eastbound) on a few occasions, this caused conflict and aggressive driving. • It was observed that vehicles on Brooklands Road southbound on occasion used the left and middle lane to turn left onto Byfleet Road eastbound. This caused conflict and aggressive behaviour and driving. • Vehicles on Parvis Road eastbound are still using two lanes to turn onto Byfleet Road eastbound.
0820	• Vehicles are queuing on A245 eastbound, including on the roundabout. This blocks right-turning vehicles going from Byfleet Road to Brooklands Road. This would be prevented if a keep clear sign or no entry box were present. • Lane discipline on the roundabout is extremely poor. This is true during free flow conditions as well as congested conditions. Occasionally vehicles use both lanes to turn right, but this varies. Vehicle positioning on the roundabout when queuing also varies. 
0830	• Eastbound queue on A245 extends all the way back to Sopwith Drive roundabout.
0840	• Flow has improved slightly.
0850	• Flow is much improved, mostly due to traffic on Byfleet Road eastbound moving much faster.

Inter peak	
Time	**Observations**
1215	• High number of LGVs noted to be on the A245 corridor, but little congestion. • No or very little queuing, almost free flow conditions

Evening Peak	
Time	**Observations**
1550	• Some queuing on A245 eastbound from Redhill Road to Seven Hills Road. • 'Moving' from Redhill Road to Seven Hills Road eastbound, but 'slow moving' from Brooklands Road to Redhill Road eastbound.
1600	• Almost free flow conditions present at the Brooklands Road roundabout though Byfleet Road eastbound is becoming more congested, with slower moving traffic
1635	• Traffic is moving in a similar way to in the AM peak, with Byfleet Road eastbound having on/off congestion which can build up quite quickly. • Google maps indicates the same conditions as we are seeing on street, with queuing all the way up to Seven Hills Road. • Google also indicates flow moving traffic further west on the A245 corridor  16:31 Brooklands Road roundabout, taken from Brooklands Road with Parvis Road to the right

Evening Peak	
Time	**Observations**
	 16:32 Brooklands Road Roundabout, facing A245 Byfleet Road, with Brooklands Road to the left
1640	• Vehicles reversing on the roundabout to allow other vehicles to turn into/out of Brooklands Road. • Slow moving vehicles leads to strange and potentially dangerous driver behaviour on the roundabout, with vehicles positioned in unexpected places on the roundabout.
1645	• Sporadic queuing on Brooklands Road. • It is considered that traffic entering the roundabout from A245 Parvis Road eastbound, travelling to A245 Byfleet Road cannot see whether the roundabout exit is clear or not. This might explain why vehicles end up queueing on the roundabout.  16:47 Picture taken from Byfleet Road roundabout exit looking back to Parvis Road. No clear line of sight from roundabout exit back to Parvis Road entrance to the junction.

Evening Peak	
Time	**Observations**
	 16:48 Brooklands Road roundabout, taken facing A245 Parvis Road with Brooklands Road on the right
1650	• Extensive queuing on Parvis Road eastbound back from the roundabout, with queues reaching back to the bridge over the river. • At this time there is also extensive queuing on Brooklands Road, back past the bus stop and around the corner out of sight. • The majority of vehicles entering the roundabout from Brooklands Road southbound appear to be turning left. The large number of vehicles queuing to turn left reaches back to the point where the road becomes single lane, and therefore the queuing prevents right turners from proceeding to the roundabout.
1700	• There are some slow moving vehicles on Parvis Road westbound • Vehicles turning left from Brooklands Road to Byfleet Road were observed using the middle lane and left lane to turn left, when the middle lane is formally marked as a right turn lane. This misuse of lane provoked aggressive driver behaviour, including use of the horn and vehicles in the correct lane refusing to concede space for other vehicles to merge.
1705	• There is extensive queuing on A245 Parvis Road eastbound. • Many construction vehicles have been observed - cement mixers etc. • Where vehicles on A245 are queuing across the roundabout, right of way becomes driver discretion when vehicles on the roundabout are stationary. This leads to some driver confusion and creates the potential for shunts. • There are also extensive queues on Brooklands Road southbound, beyond line of sight. • Aggressive driver behaviours have also been observed when merging onto the exit onto Byfleet Road.
1710	• The queuing on Brooklands Road southbound is considered significantly worse than was observed in the AM.
1715	• Queuing on Parvis Road eastbound prior to the roundabout is back to Sopwith Drive roundabout.
1725	• Still extensive queuing on A245 eastbound back towards Sopwith Drive. • Vehicles are mostly single occupancy.

Evening Peak	
Time	**Observations**
	 17:25 Brooklands Road southbound, taken facing north
1735	• Conditions are the same as above
1745	• Traffic is extremely slow, and nearly at a standstill on A245 eastbound • Conditions on the A245 westbound are fast moving at the Brooklands Road roundabout • There is extensive queuing present on Brooklands Road southbound  17:41 Brooklands Road roundabout, from Brooklands Road central island facing south

Evening Peak	
Time	**Observations**
	 Taken from Brooklands Road facing south towards roundabout
1755	• Still queuing on A245 eastbound • Queues exist on A245 westbound, extending from the west back to the pedestrian crossing. • It was noted that in both directions on the A245, although the carriageway is officially marked as single lane, it is used as though there are two lanes in congested time periods. When this was observed, it was also seen that some vehicles mount the pavement where the carriageway is not wide enough for two vehicles.

4. Further questions

- **What are the accident statistics for this roundabout? Is there a high number of shunts?**
  If this information is thought ot be required it can be obtained from SCC's Road Safety team.
- **Counts - are there more people leaving Brooklands/Byfleet using A245 Byfleet Road eastbound in the morning or in the evening, as on the day of the site visit queues appeared worse in the evening?**
  From studying the MCTCNT undertaken at this roundabout in November 2016, it appears that there is a far greater number of vehicles exiting the roundabout on to A245 Byfleet Road eastbound in the PM peak (16:00 to 19:00) (total of 2557 vehicles) than in the AM peak (07:00 to 19:00) (total of 1730 vehicles). This implies there is a tidal flow of traffic, and would explain why the traffic conditions on the day of the site visit appeared worse in the evening peak than in the morning peak.

5. Summary

5.1.1. The key observations from site visits are as follows:

1) Lane discipline on the roundabout is extremely poor, with inconsistent use of all lanes and carriageway available. This can lead to driver confusion and inefficiency.
2) Queueing was often observed on the roundabout carriageway itself. This blocked vehicles on B374 Brooklands Road southbound from turning right to A245 Parvis Road westbound and also blocked vehicles on A245 Byfleet Road westbound from turning right to B374 Brooklands Road. This created queues and introduced unnecessary additional delay.
3) Stationary vehicles on the roundabout often had to manoeuvre to get out of the way of other vehicles, this created risk of shunts.
4) During peak times, up to 3 vehicles attempted to merge in to a single lane exit from the roundabout onto A245 Byfleet Road eastbound. This caused aggressive behaviour, use of the horn and conflict between vehicles.

5.1.2. Evidence suggests that implementing “Keep Clear” signs on the roundabout carriageway would help to alleviate congestion surrounding the A245 Brooklands Road junction. “Keep Clear” markings will prevent vehicles travelling eastbound on A245 from queuing on the roundabout itself and will allow vehicles on B374 Brooklands Road southbound wishing to turn right to enter the junction, rather than having to wait for an acceptable gap in the queue on the roundabout. It is expected that this will reduce queuing on B374 Brooklands Road and reduce delay.

Annex E

A245 BYFLEET ROAD JUNCTION WITH B365 SEVEN HILLS ROAD

MITIGATION OPTIONS

1 INTRODUCTION

1.1.1 In November 2016, Surrey County Council's (SCC) Transport Studies team were asked to model the impact of Woking's Local Plan and Greenbelt proposals and possible mitigation options at the signalised junction of the A245 Byfleet Road and B365 Seven Hills Road (J510).

1.1.2 The purpose of this whole project was to initially understand the impact of Woking's Local Plan scenarios on the junction itself and then to test several mitigation options to understand whether the impact of the increases in flow by 2026 could be alleviated.

1.1.3 To quantify the impact of the planned growth as proposed in Woking's Local Plan, forecasting to 2026 was undertaken, and the new flows fed into the model. The scenario (F) with the largest increase in flow was taken forwards to test mitigation options against, as this was considered to be the worst case scenario.

1.1.4 This report outlines the methodologies used to forecast to 2026 and model the existing junction, as well as detailing the scenarios and mitigation tested. It also discusses the results from the modelling and draws conclusions on the preferred mitigation option at the A245 Byfleet Road/B365 Seven Hills Road signalised junction.

2 METHODOLOGY

2.1.1 The modelling package LinSig has been used for this assessment (version 3.2.22). LinSig is a UK industry standard software package, developed by JCT Consultancy Ltd, for the assessment and design of traffic signal junctions.

2.1.2 The LinSig model used for this project was built from scratch. All network geometries were measured from site drawings and all signal information was taken from the controller specification. The 2016 Base model was built and then audited by a member of the Transport Studies team.

2.1.3 Once this was approved, revised flows for the 2026 forecast year were inserted into the model. These forecast flows were calculated using the strategic county model. The model used was Surrey's Integrated Transport Model (SINTRAM 5.0.34; Woking Greenfield SINTRAM model_140115).

2.1.4 As the SINTRAM modelled AM peak hour is 08:00 – 09:00, a factor was required to convert the SINTRAM flows to the LinSig modelled AM peak hour (07:30 – 08:30). Using Automatic Traffic Counts (ATC) and extracted flow data from SINTRAM, the factor was created and used in the forecasting for the 2026 scenarios.

2.1.5 Three flow matrices were taken forwards as part of the forecasting to 2026, based on the Woking Local Plan scenarios[1]; 2026 Do Minimum, 2026 Scenario A and 2026 Scenario F. The details of these are shown in **Table 2.1** below.

[1] S:\Project-current\3000 PROJECT NOS STARTING WTIH 3000\3613\53613T36_Woking Local Plan Greenbelt Sensitivity Tests\04 Documents\ Doc 01_Greenbelt Sensitivity Test Strategic Transport Assessment.pdf

Scenario	Description of matrix
2026 Do Minimum	Includes background growth (changes in demographics and car ownership between 2016 and 2026) in Woking
2026 Scenario A	Includes committed developments only in the borough of Woking to the forecast year of 2026
2026 Scenario F	Includes 2026 Scenario B (all commercial & residential developments outside and within the borough of Woking to the forecast year of 2026), **plus** 592 residential dwellings on green belt land at West Byfleet

Table 2.1: Forecast scenarios and matrices

2.1.6 As Scenario F was considered to be the worst case scenario with the highest planned growth proposed by Woking Borough Council in the Local Plan, it was taken forwards to test mitigation measures against.

2.1.7 A detailed description of the methodology used was compiled by Transport Studies in March 2017[2].

2.1.8 The mitigation measures that were tested included alterations to the phasing and staging and to the network. These are detailed in **section 4**.

2.1.9 The modelled time period is as follows: weekday AM peak hour (07:30 - 08:30). This time period represents the worst case scenario, when the highest flows at the junction were recorded. This was based on observed traffic counts collected in October 2016.

2.1.10 All observed traffic and forecast flows were converted into Passenger Car Units (PCU) following the methodology outlined by Kimber *et al.* (1982)[3] in RR67.

3 SCENARIOS

3.1.1 Multiple LinSig models have been used in this project to evaluate the impact of the forecast flows and mitigation options. **Appendix I** shows all of the models that were tested as part of this project.

3.1.2 The 2016 Base model replicates the existing layout and controller specification, as supplied by the Traffic Signals team. The layout can be found in **Appendix II**.

3.1.3 A copy of the 2016 Base model was taken to generate the 2026 forecast model. The model reflects the existing layout (as shown in **Appendix II**) with additional trips associated with nearby committed and proposed developments within three scenarios. The base matrix and the additional trips in the revised matrices are all shown in **Appendix III**.

3.1.4 A copy of the 2026 forecast model with the Scenario F matrix was used to build the three 2026 mitigation models. As stated previously Scenario F was taken forwards as it is considered to be the worst case, with the highest planned growth. The results in **section 5** also show that the junction performance deteriorates considerably in Scenario F. As such, mitigation measures have been tested and these include alterations to the network and the signal timings, and are detailed in **section 4**.

3.1.5 Across all models and scenarios, the cycle times have been kept the same to ensure that the models are consistent, and therefore comparable.

[2] S:\Project-current\3000 PROJECT NOS STARTING WTIH 3000\3613\53613T44 A245 with B365 Seven Hills\01 Documents\ Modelling Summary Note. 2026 forecast scenarios.docx

[3] Kimber, R. M. et al., 1982. Saturation flows at traffic signal junctions: studies on test track and public roads, Institute of Electrical Engineers Conference on Road Traffic Signalling.

3.1.6 There are some limitations to using LinSig as it models signals on fixed time and is therefore unable to directly model the on street Microprocessor Optimised Vehicle Actuation (MOVA) operated junction. MOVA adapts the timings of signals to maximise the capacity of the junction. As a result, the model will represent the 'worst case scenario' as the signals are likely to operate more efficiently on street than in the LinSig model. This is due to the adaptive technology within the signals.

4 MITIGATION

4.1.1 Mitigation options were necessary due to the high levels of delay experienced in the 2026 forecast model (Scenario F). The capacity of the junction was greatly reduced in the AM peak hour and therefore the performance of the junction was poor. This indicated that alterations to the junction were required to ensure that some of the planned growth from the Woking Local Plan could be mitigated.

4.1.2 The options presented below were derived from detailed analysis of the results, specifically to understand where the largest amounts of delay occurred, and which arms of the junction had the largest increases in flow. In addition, discussions with colleagues and recommendations from previous reports were taken into consideration[4].

4.1.3 The 2026 Scenario F model showed that the capacity and efficiency of the junction was reduced. The junction becomes oversaturated and queues extend to upstream junctions. Full details of the model outputs are shown in **section 5**.

4.1.4 Furthermore, as shown in **Appendix III**, the matrices show that there is a large increase in flows as a result of Scenario F. The largest increase is from B365 Seven Hills Road northbound, but this is not considered to be too detrimental to the operation of the junction as the flows on this arm are very low in comparison to all others. However, the most noticeable percentage increase (45%) in flow in this matrix is found on the B365 Seven Hills Road southbound arm of the junction (zone C). There are also large increases in flows from both arms of the A245 Byfleet Road (zone A and B). This is shown in **Table 4.1** below.

Absolute (and percentage) change					
		To			
		A	B	C	D
From	A	-	237 (25%)	40 (27%)	0
	B	330 (29%)	-	207 (29%)	7 (30%)
	C	75 (45%)	298 (45%)	-	2 (45%)
	D	14 (127%)	18 (127%)	6 (127%)	-

Table 4.1: Absolute (and percentage) change in flows between model zones

NB: Zone A = A245 Byfleet Road eastbound, Zone B = A245 Byfleet Road westbound, Zone C = B365 Seven Hills Road southbound and Zone D = B365 Seven Hills Road northbound

4.1.5 As such, mitigation measures were required to reduce the impact of the additional trips, with some mitigation measures focussed on the B365 Seven Hills Road

[4] S:\Project-current\3000 PROJECT NOS STARTING WTIH 3000\3613\53613T36_Woking Local Plan Greenbelt Sensitivity Tests\04 Documents\A245_A320_RouteManagementStudy_WSP_report_020802

(southbound) arm of the junction to ensure that the effect of the large flow increases could be minimised.

4.1.6 Three mitigation measures were considered and diagrams of each of the options can be found in **Appendix IV**. Details of the mitigation measures are shown below in **Table 4.2**.

Model	Details
Mitigation Option 1a	➢ extension of lane length on B365 Seven Hills Road (southbound) left turn lane (arm 2 lane 1) from 26m to 120m
Mitigation Option 1b	➢ alteration of extended left turn lane (arm 2 lane 1) to left turn and ahead lane on B365 Seven Hills Road (southbound) ➢ alteration of right turn and ahead lane (arm 2 lane 2) to right turn only lane on the B365 Seven Hills Road (southbound)
Mitigation Option 2	➢ amend both lanes (arm 2 lanes 1 & 2) on B365 Seven Hills Road to left turn only towards Painshill ➢ remove stage 4 and alter stages 2 and 3 to increase green time across stages 1, 2 & 3.

Table 4.2: Mitigation measures tested and analysed

4.1.7 For Option 2, it should be noted that trips going directly from B365 Seven Hills Road (North) to B365 Seven Hills Road (South) and the A245 Byfleet Road (westbound) have been redistributed within the matrix. In this study, it is expected that they will use the roundabout at Painshill with the A245 and the A3 to turn around and re-enter the junction. However, in reality, it is expected that some vehicles may re-route away from the junction if this change is implemented. As such, this model is considered to be a worst case scenario, as the vehicles are counted twice; once leaving the model area towards Painshill and once entering the model area to go to their destination.

4.1.8 There were several mitigation options that were tested but not included in the analysis as they had very little impact on the junction results, and therefore offered no relief from the impact of the additional trips. These included increasing the lane lengths of the A245 Byfleet Road eastbound and westbound. This was done to increase the storage of vehicles before the stopline. An additional exit lane and merge on the B365 Seven Hills Road (travelling northbound) was tested to improve the flow of right turning vehicles from A245 Byfleet Road (westbound).

4.1.9 As these options did not provide any benefit to the junction in terms of network statistics, they were not analysed further. Only mitigation options that show reduced delay and junction saturation levels have been taken forward to the analysis of results. Separate models were built for each mitigation option as shown in **Appendix I**.

5 RESULTS

5.1 Introduction

5.1.1 Results from the modelled options (base model, 2026 Scenario F and three mitigation options) are presented in this section. Metrics presented include the Practical Reserve Capacity (PRC) which is a measure of the amount that traffic can grow before practical capacity (100%) of the junction is reached. A positive PRC value indicates that there is spare capacity available, whilst a negative PRC value shows the degree of overload at the junction.

5.1.2 Other related metrics used to consider junction performance are the total delay in PCU per hour, Degree of Saturation (DoS) and the Mean Max Queue (MMQ). DoS is the ratio of demand flow to the maximum flow that can cross the stopline from a specific approach. A practical operating level of 90% is considered acceptable, therefore an approach with a degree of saturation greater than 100% is said to be 'over-saturated'. MMQ gives the length of the longest queue at the junction in PCU. As such, these values have been multiplied by 5.75m, the average length of a vehicle with gaps either side, to generate an estimate of the actual length in metres.

5.1.3 As mentioned above, the MOVA control of the signalised junction means that the model outputs will appear to be worse than the current conditions on street. As such, the results and analysis presented in **section 5.2** will focus on the percentage changes in junction performance between the 2026 Scenario F model and the option tests, rather than the specific values presented.

5.2 Junction results

5.2.1 **Table 5.1** shows the models, scenarios, stage sequences and cycle times for each model type as described in **sections 3 & 4**.

5.2.2 **Table 5.2** presents the results from each model along with the percentage change in reference to the 2026 Scenario F model. The PRC and Total delay values are provided for the whole model, while the DoS and MMQ values present the results for the maximum value across the network.

5.2.3 In this instance, the maximum queue occurs on the same arm in each of the models. The arm with the maximum value is the A245 Byfleet Road westbound lane 1 (left and ahead movement).

Model	Model description	Scenario number	Traffic flow data	Stage sequence	Cycle time
2016 Base	Base model - existing layout	1	AM peak hour - 2016 observed flows	1,2,3,4	114
2026 Scenario F	2026 forecast model - existing layout	5	AM peak hour - 2026 forecast flows (scenario F)	1,2,3,4	114
2026 Mitigation Option 1a	2026 forecast model - revised layout Opt 1a	5	AM peak hour - 2026 forecast flows (scenario F)	1,2,3,4	114
2026 Mitigation Option 1b	2026 forecast model - revised layout Opt 1b	5	AM peak hour - 2026 forecast flows (scenario F)	1,2,3,4	114
2026 Mitigation Option 2	2026 forecast model - revised layout Opt 2	5	AM peak hour - 2026 forecast flows (scenario F)	1,2,3	114

Table 5.1: Modelled scenarios with cycle times

	MODELS							
	2016 Base	**2026 Scenario F**	**Option 1a**	**Option 1b**	**Option 2**	**Option 1a**	**Option 1b**	**Option 2**
Time period	**PRC (%) value**					**Percentage change from 2026 Scenario F**		
07:30 - 08:30	-8.7	-48.5	-34.7	-34.5	-22.8	28%	29%	53%
Time period	**Total Delay (PCU/Hr)**					**Percentage change from 2026 Scenario F**		
07:30 - 08:30	56.0	524.4	341.3	337.9	251.2	-35%	-36%	-52%
Time period	**DoS (%)**					**Percentage change from 2026 Scenario F**		
07:30 - 08:30	97.9	133.7	121.2	121.0	110.5	-9%	-9%	-17%
Time period	**MMQ (PCU)**					**Percentage change from 2026 Scenario F**		
07:30 - 08:30	45.9	247.5	187.6	179.1	147.7	-24%	-28%	-40%
Time period	**MMQ (m)**					**Percentage change from 2026 Scenario F**		
07:30 - 08:30	263.9	1423.1	1078.7	1029.8	849.3	as above		

Table 5.2: AM peak hour (07:30 – 08:30) results summary with percentage change

5.3 Results discussion

5.3.1 The 2016 Base model outputs in **Table 5.2** show that the junction is currently congested with a negative PRC value and a high DoS, above the recommended 90% threshold. There are also considerable levels of delay at the junction, with a total delay value of roughly 56 PCU/hr in the AM peak period, and some queueing at the junction. In this model, no queues extend back to upstream junctions. These results show that the junction operates just over its practical capacity under the current conditions.

5.3.2 When the additional trips associated with the Woking Local Plan and Greenbelt allocations are included (Scenario F), the model outputs show a dramatic decline in junction performance. There is a very large increase in total delay from 56 PCU/hr to 524 PCU/hr. This occurs alongside a large increase in the DoS to 134% and increases in queues, which do extend back to upstream junctions, specifically the roundabout with the A3 northbound off-slip.

5.3.3 These increases in delay and oversaturation are all as expected from the increases in flows on all arms in this scenario as shown in **Table 4.1**. The most notable increase in queue length is on the B365 Seven Hills Road southbound from 160m in the 2016 Base model to 1.2km in the 2026 Scenario F model.

5.3.4 To understand the impact of the mitigation options, all of the model outputs have been compared back to the 2026 Scenario F model, as shown in **Table 5.2**.

5.3.5 Comparisons between the 2026 Scenario F and the Mitigation Option 1a show that the extension of the left turn lane on the B365 Seven Hills Road southbound does improve the operation of the junction, as it increases the storage capacity. This is shown in the 28% increase in the PRC value, and by a 35% reduction in total delay to 341.3 PCU/hr. There is also an improvement (9% reduction) in the DoS to 121% and a considerable reduction in queue lengths on the network. The MMQ values also show a decrease in lengths between the two models. Specifically, there is also a reduction in the queue length on the B365 Seven Hills Road southbound from 1.2km in the 2026 Scenario F model down to 240m in the Mitigation Option 1a model. This shows that the alteration made to the junction has had a positive impact on this arm.

5.3.6 Despite the alteration to the network, the junction still operates over its capacity and the results show that delay, saturation levels and the queues are far greater than the 2016 Base model performance.

5.3.7 The Mitigation Option 1b model compared against the 2026 Scenario F model, shows very little change from the Mitigation Option 1a model. Most percentage changes are very similar, especially the DoS, which remains the same at 9%. The PRC also remains at -35% and the reduction in total delay is roughly 3 PCU/hr. This shows that the additional highway alterations made to the junction in Mitigation Option1b have little or no impact on the results. Again, this junction is projected to operate above capacity even when mitigation is in place on B365 Seven Hills Road.

5.3.8 Mitigation Option 2 involved banning the ahead and right turn movements out of B365 Seven Hills Road (north) and rationalisation of the signals from four stages to three to increase the green time to traffic. As can be seen by the results, these alterations noticeably improve the junction performance. The PRC value increases by 53%, to -22.8%. There is a 52% reduction in total delay to 251.2 PCU/hr which is just over half of the delay experienced in the 2026 Scenario F model statistics.

5.3.9 Furthermore, the DoS reduces to 110.5%, which equates to a 17% reduction from the 2026 Scenario F model results. The Mean Max Queue result presents the same pattern as above, with a 40% decrease in queue length down to 849m on the A245 Byfleet Road (westbound). There is also a decrease in queue lengths on the B365 Seven Hills Road, from 1.2km in the 2026 Scenario F model to 570m in the Mitigation Option 2 model.

5.3.10 Overall, these results show that the junction is currently operating at or just above its capacity, but that by 2026, the additional trips from Scenario F have a very detrimental impact on the performance of the junction. The mitigation measures all show improvements in the operation of the junction, but the Mitigation Option 2 model has the greatest impact. The Option 2 results show a considerable improvement to the junction as the results are roughly half of the 2026 Scenario F model levels. The highway improvements help to negate the additional traffic in the 2026 forecast year (and specifically in Scenario F).

6 OVERVIEW AND CONCLUSIONS

6.1.1 The modelling undertaken for this study looks at the impact of the additional trips associated with the Woking Local Plan on the signalised junction of the A245 Byfleet Road with B365 Seven Hills Road. This study also considers potential mitigation options to try to negate the impact of the increased traffic flows.

6.1.2 The study involved the use of forecast flows to 2026 from SINTRAM, for various scenarios from Woking's Local Plan. Scenario F, specifically associated with Woking's Greenbelt allocations, was considered to be the worst case scenario with the highest planned growth. As such, this scenario was taken forwards to test mitigation measures against. Three options were tested using the flows from Scenario F, to understand whether the additional delays to traffic could be mitigated against.

6.1.3 The model outputs indicate that currently the junction is operating at or just above its practical capacity, but when the 2026 forecast flows are added to the model, the performance of the junction decreases dramatically. There are large increases in delay and queues and the junction is said to be oversaturated, with a DoS of 134%.

6.1.4 The mitigation measures focus on the B365 Seven Hills Road southbound arm of the junction as this had the most notable increase in flow as a result of the Local Plan development. All of the mitigation options have been compared back to the 2026 Scenario F model. Mitigation Option 1a involves increasing the capacity of the left turn lane southbound, and shows a considerable improvement in PRC, delay, DoS and queue length. Despite the alterations, the junction still operates well over its capacity and the summary statistics are far greater than those for the 2016 Base model. Mitigation Option 1b, which includes alterations to the lane movements, shows very little change compared to Mitigation Option 1a.

6.1.5 However, Mitigation Option 2 drastically improves the performance of the junction, by halving the 2026 levels of delay. This option involves converting the existing lanes on the B365 Seven Hills Road (North) into two left turn only lanes towards Painshill, and the removal of a signal stage to improve the efficiency. The DoS sits at 111% and the PRC is reduced by 53%.

6.1.6 This junction currently operates on MOVA, whereas LinSig models fixed time, and therefore represents the worst case scenario. Furthermore, if alterations are made to the junction as a result of this mitigation proposal, it is imperative that the signals

are validated on-street to ensure that the cycle time and stage timings are at their most efficient.

6.1.7 Overall, it can be concluded from this model assessment that the signalised junction at the A245 Byfleet Road with the B365 Seven Hills Road is currently operating at or just above its capacity. However, the additional trips in the 2026 Scenario F generate a large detrimental impact at the junction. As such, mitigation measures are required to negate this impact. From the study, it is clear that Mitigation Option 2, with the two left turn only lanes and rationalisation of stages, is the preferred option. This mitigation brings the performance of the junction towards its current levels of operation.

Appendices

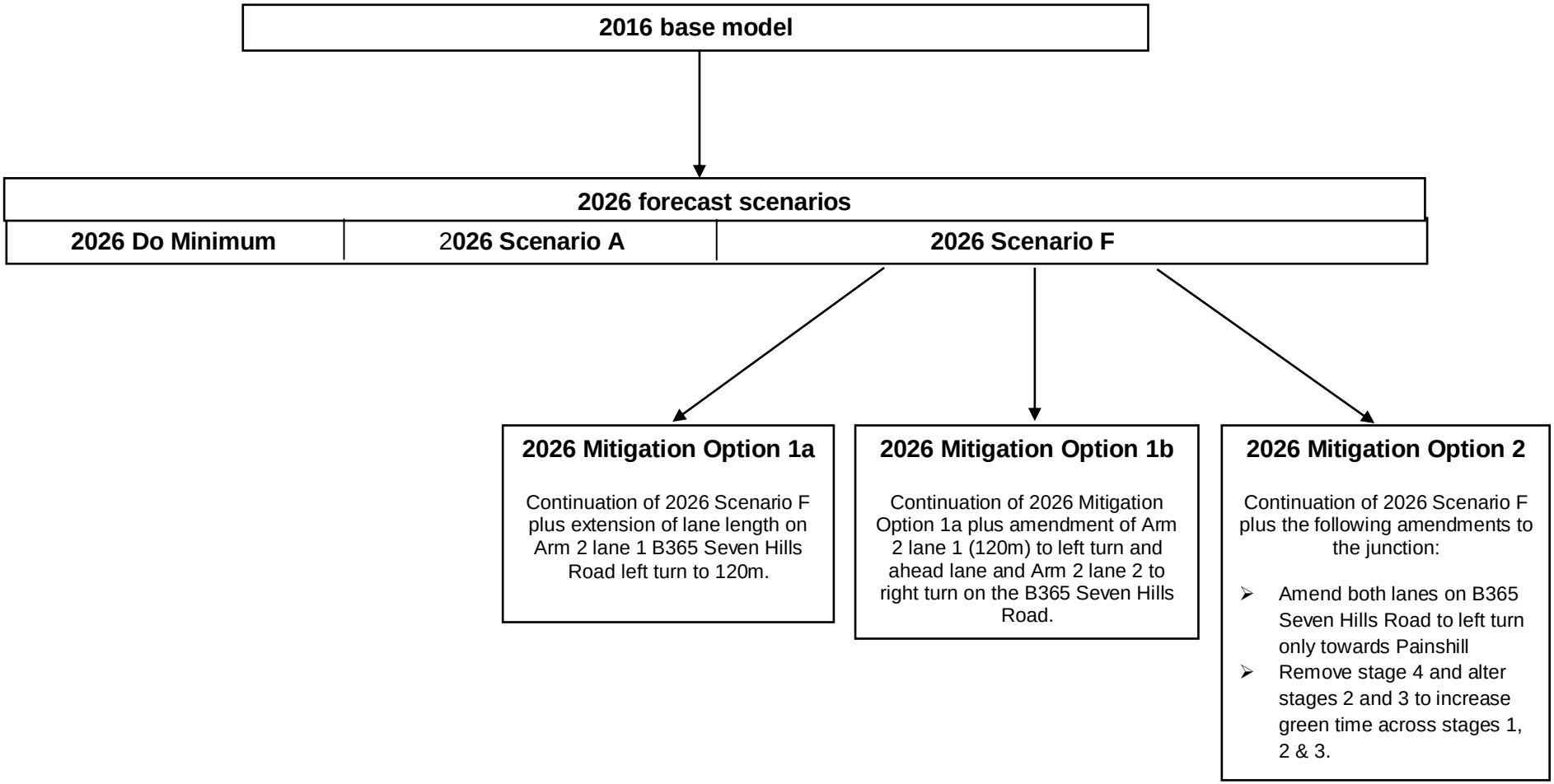
Appendix I: Outline of scenarios

Appendix II: Existing layout (J510)

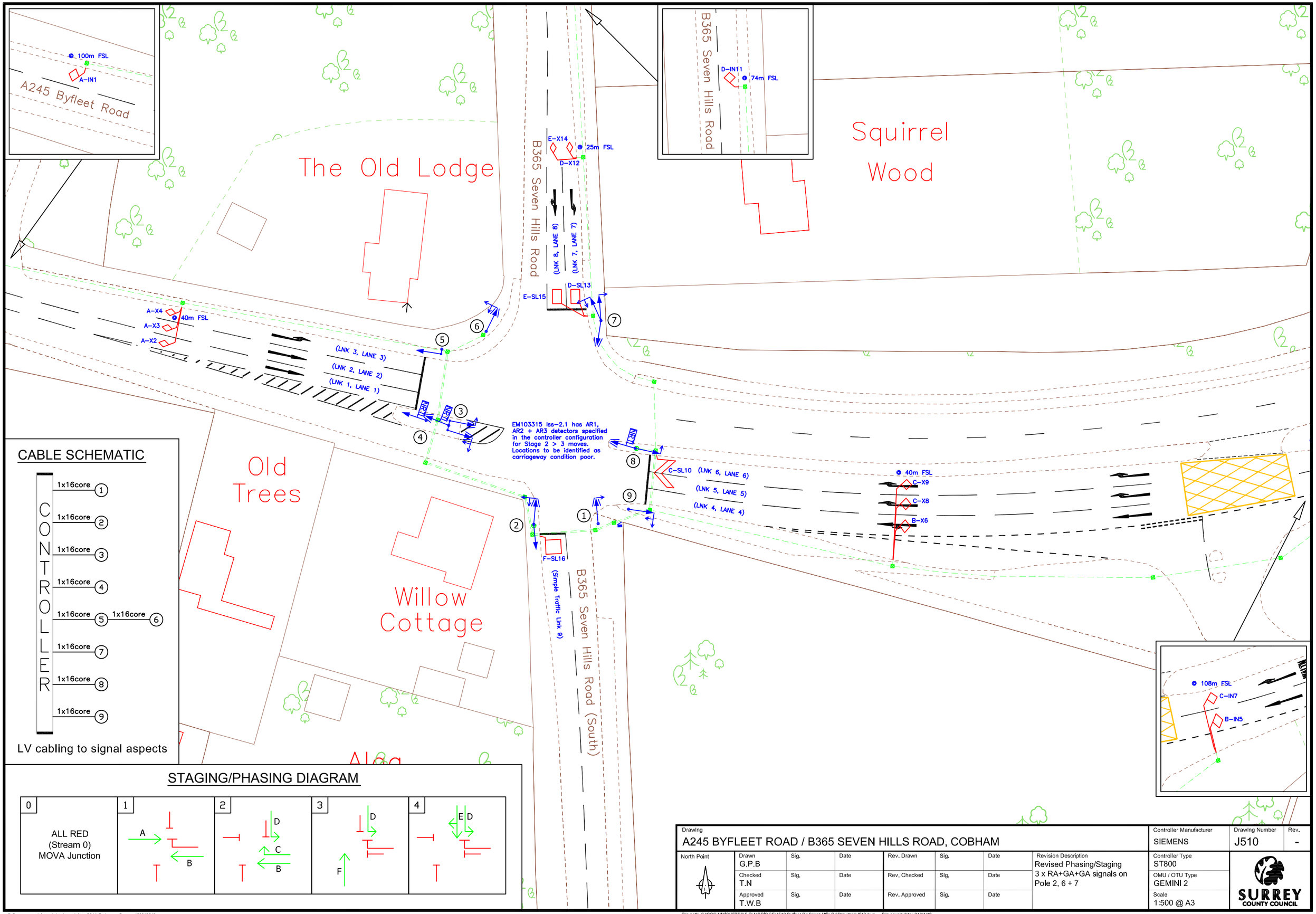
Appendix III: Matrices from all models

Appendix IV: Mitigation measures diagrams

Appendix I: Outline of scenarios


2016 base model
2026 forecast scenarios
2026 Do Minimum
2026 Scenario A
2026 Scenario F
2026 Mitigation Option 1a
Continuation of 2026 Scenario F plus extension of lane length on Arm 2 lane 1 B365 Seven Hills Road left turn to 120m.
2026 Mitigation Option 1b
Continuation of 2026 Mitigation Option 1a plus amendment of Arm 2 lane 1 (120m) to left turn and ahead lane and Arm 2 lane 2 to right turn on the B365 Seven Hills Road.
2026 Mitigation Option 2
Continuation of 2026 Scenario F plus the following amendments to the junction:
Amend both lanes on B365 Seven Hills Road to left turn only towards Painshill
Remove stage 4 and alter stages 2 and 3 to increase green time across stages 1, 2 & 3.

Appendix II: Existing layout (J510)



CABLE SCHEMATIC

CONTROLLER

- 1 — 1x16core
- 2 — 1x16core
- 3 — 1x16core
- 4 — 1x16core
- 5 — 1x16core
- 6 — 1x16core
- 7 — 1x16core
- 8 — 1x16core
- 9 — 1x16core

LV cabling to signal aspects

STAGING/PHASING DIAGRAM

Drawing: A245 BYFLEET ROAD / B365 SEVEN HILLS ROAD, COBHAM							Controller Manufacturer: SIEMENS; Drawing Number: J510; Rev.: -
North Point	Drawn: G.P.B	Sig.	Date	Rev. Drawn	Sig.	Date	Revision Description: Revised Phasing/Staging 3 x RA+GA+GA signals on Pole 2, 6 + 7
	Checked: T.N	Sig.	Date	Rev. Checked	Sig.	Date	Controller Type: ST800; OMU / OTU Type: GEMINI 2
	Approved: T.W.B	Sig.	Date	Rev. Approved	Sig.	Date	Scale: 1:500 @ A3

SURREY COUNTY COUNCIL

File path: G:\SCC NMIC\SITES\5 ELMBRIDGE\J510 Byfleet Rd Seven Hills Rd\Drawings\J510.dwg File saved date: 24/11/16

Appendix III: Matrices from all models

2016 Base - AM peak hour

		Destination - TO			
		A	**B**	**C**	**D**
Origin - FROM	**A**	0	830	149	0
	B	1124	0	704	22
	C	168	668	0	5
	D	11	14	5	0

2026 Do Minimum Scenario - AM peak hour

		Destination - TO			
		A	**B**	**C**	**D**
Origin - FROM	**A**	0	1033	184	0
	B	1346	0	843	26
	C	235	935	0	7
	D	24	30	11	0

2026 Scenario A - AM peak hour

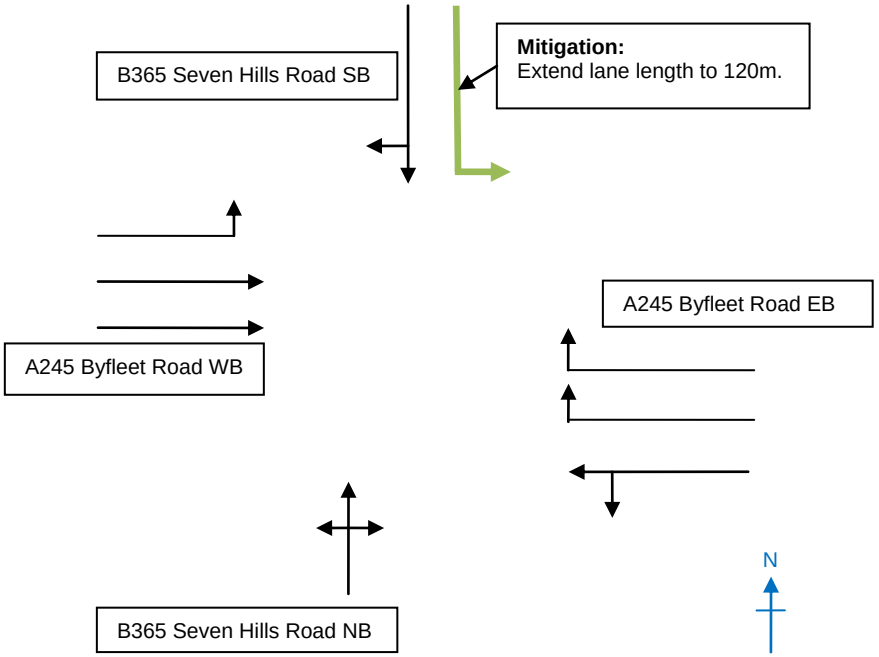
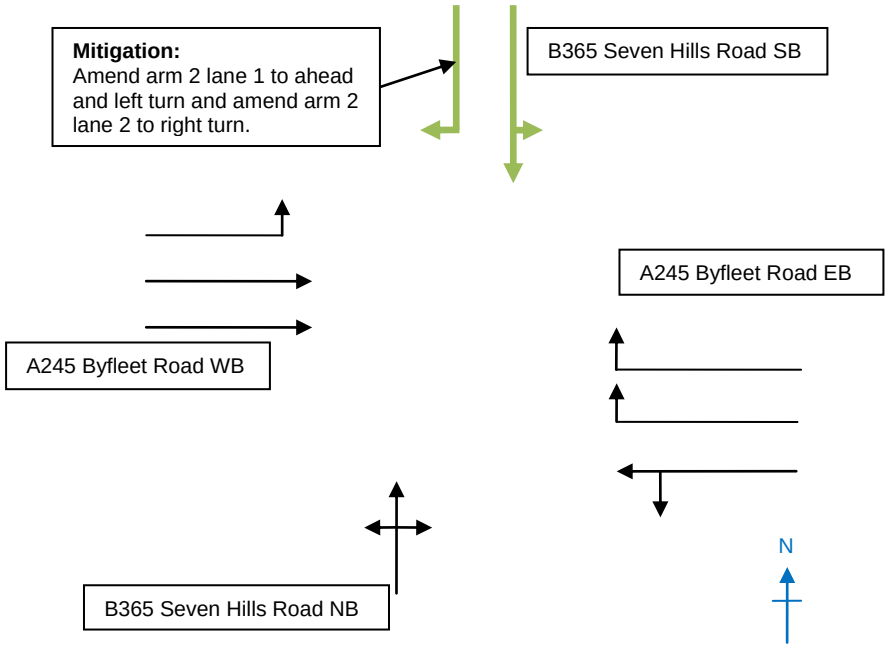
		Destination - TO			
		A	**B**	**C**	**D**
Origin - FROM	**A**	0	1011	180	0
	B	1381	0	865	27
	C	242	964	0	7
	D	24	31	11	0

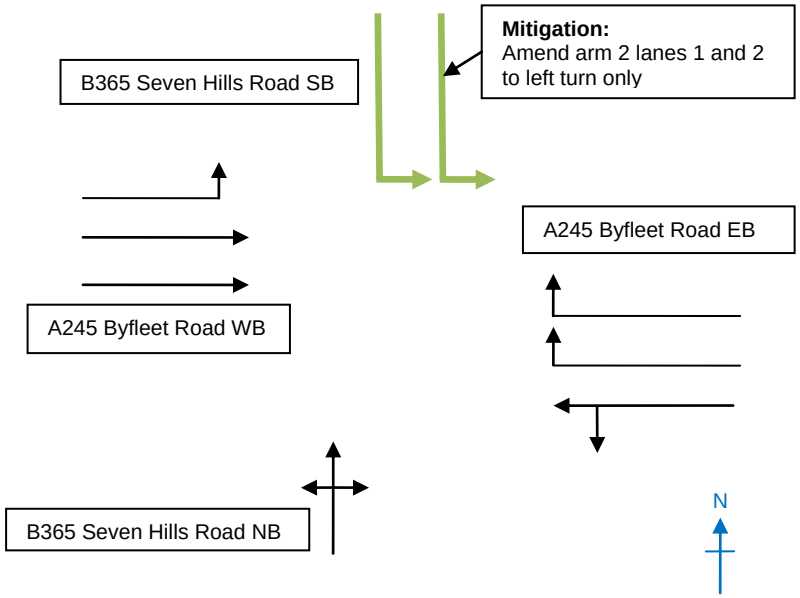
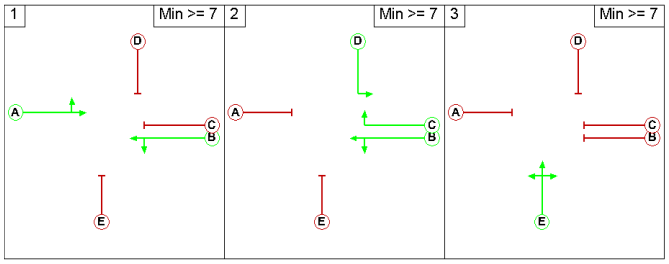
2026 Scenario F - AM peak hour

		Destination - TO			
		A	**B**	**C**	**D**
Origin - FROM	**A**	0	1066	190	0
	B	1454	0	911	29
	C	243	966	0	7
	D	25	32	11	0

NB: results have been presented and analysed for the 2016 Base and 2026 Scenario F models, but the Do Minimum and Scenario A matrices have been presented above to show the progression from the 2016 observed flows to Scenario F flows.

Appendix IV: Mitigation measures diagrams

Model	Mitigation applied
Mitigation Option 1a	• Extension of lane length on B365 Seven Hills Road (southbound) left turn lane (arm 2 lane 1) from 26m to 120m. 
Mitigation Option 1b	• Alteration of extended left turn lane (arm 2 lane 1) to left turn and ahead lane on B365 Seven Hills Road (southbound) • Alteration of right turn and ahead lane (arm 2 lane 2) to right turn only lane on the B365 Seven Hills Road (southbound) 

Model	Mitigation Option applied
Mitigation Option 2	• Amend both lanes (arm 2 lanes 1 & 2) on B365 Seven Hills Road to left turn only towards Painshill • Remove stage 4 and alter stages 2 and 3 to increase green time across stages 1, 2 & 3.  Altered phasing and staging in Option 2 

Annex F

A245 PARVIS ROAD JUNCTION WITH CAMPHILL ROAD

MITIGATION OPTIONS

1 INTRODUCTION

1.1.1 This document has been produced to aid the Woking Local Plan mitigation options. The requirement for mitigation against the highway impacts of the Woking Local Plan has been identified from strategic modelling carried out by SCC in early 2017. This borough-wide modelling was associated with the Woking Local Plan and Greenbelt allocations and was undertaken in the Surrey's Integrated Transport Model (SINTRAM).

1.1.2 This report considers all of the Transport Assessments (TA) that have tested development flows on the signalised junction of A245 Parvis Road/Old Woking Road with Station Approach, Camphill Road and Pyrford Road (J401). The existing layout of the junction is shown in **Appendix I**.

1.1.3 Each of the TAs contains 'traffic impact' and 'mitigation' chapters in which this junction is mentioned. These mitigation sections have been identified and the conclusions drawn from each are presented in this document.

1.1.4 Further to the TAs, there was a study undertaken by WSP back in 2002, which considered this A245 junction in a wider study called 'A245 and A320 Route Management Study'[1]. This document also has mitigation measures that are also presented in this document.

2 DOCUMENTS

2.1 Transport Assessments

2.1.1 There have been four Transport Assessments that have specifically assessed this junction.

2.1.2 The four TAs and details of their developments are shown in **Table 2.1** below. Their locations around the junction in question are shown in **Appendix II**.

Application year	Application	Details
2014	West Byfleet Junior School	• Infant school expansion: from 180 to 270 pupils; and • Junior school expansion: from 240 to 360 pupils.
2014	Tins Wood	• 592 residential units.
2015	Broadoaks	• Up to 157 residential units; and • New independent secondary school (910 pupils).
2017	Sheer House	• New retail, restaurants and office space; • Up to 255 residential units; and • Community spaces.

Table 2.1: Related Transport Assessments

[1] S:\Project-current\3000 PROJECT NOS STARTING WTIH 3000\3613\53613T36_Woking Local Plan Greenbelt Sensitivity Tests\04 Documents\A245_A320_RouteManagementStudy_WSP_report_020802

2.2 A245 & A320 Route Management Study

2.2.1 The document summarises the study undertaken by WSP to develop a route management strategy for the A245 and A320 between Woking and Painshill on the A3.

2.2.2 The study included analysis of survey data, identification of congestion hotspots, data from consultations with stakeholders and residents and the proposal of various mitigation schemes.

3 MITIGATION MEASURES

3.1 West Byfleet Junior School[2]

3.1.1 This application states that currently all roads surrounding the school are operating under capacity and will generally continue to do so in the future, despite the school expansion.

3.1.2 From link capacity assessments, the report notes that the only road that may be adversely affected by the expansion plans is the A245 Parvis Road/Old Woking Road. As such, a LinSig model was built of the junction (J401) and a technical note[3] was produced on the model outputs.

3.1.3 The LinSig modelling package has been used for this assessment (and others). LinSig is a UK industry standard software package, developed by JCT Consultancy Ltd, for the assessment and design of traffic signal junctions.

3.1.4 The technical note states that the junction is 'currently operating very close to capacity[4] and will operate over capacity in 2020 due to the expected traffic growth.' However, as the additional traffic growth from the school expansion at the junction is minimal, no mitigation options involving changes to the road network were suggested as part of this Transport Assessment.

3.2 Tins Wood[5]

3.2.1 This application states that the A245 Parvis Road/Old Woking Road/Camphill Road junction is over capacity, and that when growth to 2029 and the 592 proposed residential units are added, the junction operates considerably over capacity.

3.2.2 The 'Highway Impact' section of the report notes that the general traffic growth to 2029 has a greater impact than the additional trips as a result of the proposed residential units.

3.2.3 However, the report does suggest a mitigation option for the junction. It notes that despite the limited land availability surrounding the junction for increased physical capacity, optimisation of the current signal timings could help to increase the capacity of the junction.

[2] I:\EAI\PD all\TDP\04-Woking\Planning Apps\2014\Wo14-0573 WByInfants+Junior School\ Jun14 WBy Sch Expand TA final.pdf

[3] I:\EAI\PD all\TDP\04-Woking\Planning Apps\2014\Wo14-0573 WByInfants+Junior School\ Jun14 WBy Sch Expand Modelling Technical Note.pdf

[4] Capacity is defined as 'a measure of how much traffic can pass through a junction in a given time'.

[5] I:\EAI\PD all\TDP\04-Woking\Pre Planning\2014\West Hall (Tins Wood) off A245 Parvis Road WByfleet (TDP-Wo-Pre-14-0007)\tech info folder\ TransportAssessmentV8.0.pdf

3.3 Broadoaks[6]

3.3.1 This application, specifically the link capacity assessments, shows that the A245 Parvis Road is at its theoretical capacity. Following modelling using LinSig, it states that once the traffic growth to 2020 and the additional school traffic are applied, the junction operates over its capacity in both the AM and PM peak hours.

3.3.2 The report notes that currently the junction operates under VA control, with the fall back option of 'fixed time'. Although not explicitly stated, the report does make the suggestion that the signals could be upgraded to Urban Traffic Control (UTC) to improve the performance of the junction.

3.4 Sheer House[7]

3.4.1 As with all of the other TAs above, the signalised junction of the A245 Parvis Road/Old Woking Road/Camphill Road was modelled using LinSig. The results for the existing situation show that the junction currently operates within capacity, with queues forming on some approaches.

3.4.2 As with all of the other results listed above, the traffic growth and the additional development traffic mean that in future years, the junction will operate at capacity, with large increases in queues.

3.4.3 The report states that despite the junction operating at capacity with additional queuing, 'capacity enhancements are not deemed necessary as a result of the proposed development'. The report however goes on to note that introducing a traffic control system, such as UTC, is likely to increase capacity at the junction.

3.5 A245 & A320 Route Management Study

3.5.1 In the report, many roads and junctions were considered along the A245 and A320 corridors, including Martyrs Lane, Woodham Lane/Sheerwater Road junction, Sopwith Drive junction and Brooklands Road junction. Another junction that was investigated was Byfleet Corner, namely the signalised junction of A245 Parvis Road/Old Woking Road with Station Approach, Camphill Road and Pyrford Road.

3.5.2 The A245 between Old Woking Road and Broadoaks was identified as one of the 'most heavily congested areas' within the study. This section includes the Byfleet Corner junction, which was said to 'operate at a low level of efficiency'. In addition, it was recognised that there was no provision for pedestrians.

3.5.3 As such, suggestions were made for the junction itself, specifically the addition of new formal pedestrian crossing facilities. Furthermore, the report proposes that the efficiency of the junction could potentially improved by a 'rationalisation of the operation' of the signals, and altering the alignment of lanes and phases. This could involve the conversion from the existing Vehicle Actuation (VA) control to Microprocessor Optimised Vehicle Actuation (MOVA) control.

[6] I:\EAI\PD all\TDP\04-Woking\Planning Apps\2015\2015-0987 Broadoaks\TA\ PLAN_2015_0987-TRANSPORT_ASSESSMENT-353378.pdf

[7] I:\EAI\PD all\TDP\04-Woking\Planning Apps\2017\2017-0128 Sheer Hse, WByfleet\ PLAN_2017_0128-ES_VOLUME_3_-_TRANSPORT_ASSESSMENT.pdf

4 OTHER MODELLING

4.1 Surrey County Council (SCC)

4.1.1 Modelling was undertaken in October 2016 by SCC, to understand the impact of highway alterations on the network. As before, LinSig traffic modelling software was used in this study. Following the model development and analysis of the results, a technical summary note was produced[8].

4.1.2 The network changes were comprised of introducing controlled staggered pedestrian facilities across Camphill Road, reducing the number of approach lanes on Camphill Road and introducing a dedicated right turn lane with a full phase from A245 Parvis Road to Camphill Road.

4.1.3 The modelling concluded that the existing junction is operating at or just over capacity. It was shown that the proposed changes to the network will have a detrimental impact on the efficiency of the junction. The overall junction statistics indicate deterioration in junction performance in both time periods, but especially in the AM peak hour, due to the addition of the right turn lane and the formal pedestrian facilities.

4.1.4 It was also concluded that the cycle time of the signals was a considerable factor in the poor results. As such, it is suggested that a sensitivity test of an increased cycle time could be undertaken to understand whether this would improve the junction performance.

5 CONCLUSIONS

5.1.1 From the four Transport Assessments that directly model the signalised A245 Old Woking Road/Parvis Road/Camphill Road junction, as well as the WSP report and the modelling undertaken by SCC, the junction is shown to currently operate at or just below its capacity.

5.1.2 Nevertheless, with forecast traffic growth and specific residential and commercial developments proposed in the vicinity, the junction will begin to operate over capacity in the near future. This shows that changes are required in order to mitigate against the cumulative impact of these developments.

5.1.3 Having considered all of the recommendations from the TAs and the WSP document, it is also clear to see that there are physical capacity restraints, and therefore increasing the footprint of the junction to improve the capacity is not a viable option

5.1.4 The general consensus from all reports shows that the signals need to be upgraded beyond their current VA control to a system that continually optimises the stage timings on street. The reports studied suggest that either MOVA or UTC would be suitable.

5.1.5 At this stage, it is thought that upgrading the signals to MOVA control is the most appropriate method for mitigating against any future growth in the surrounding area. MOVA is preferred due to the cost implications of installing a UTC system and UTC is normally used for networks instead of single controller junctions, as per A245 Old Woking Road/Parvis Road/Camphill Road junction.

[8] H:\Modelling\project\4C078001_A245ParvisRd_CamphillRd\02 Documents\ Doc01_4C078001_A245ParvisRd_CamphillRd_Modelling Overview.pdf

5.1.6 It is imperative that the upgrade to MOVA at the A245 Old Woking Road/Parvis Road/Camphill Road junction is accompanied by a full upgrade of the equipment, on-street validation, and regular monitoring of the site to ensure that MOVA is working as efficiently as possible.

5.1.7 Finally, it should be noted that this report and the mitigation option presented focuses solely on the benefit to vehicles. It is believed that Non-Motorised Users (NMU) should also be considered in the mitigation options taken forwards. This could be through improvements to bus services, cycles lanes or pedestrian facilities.

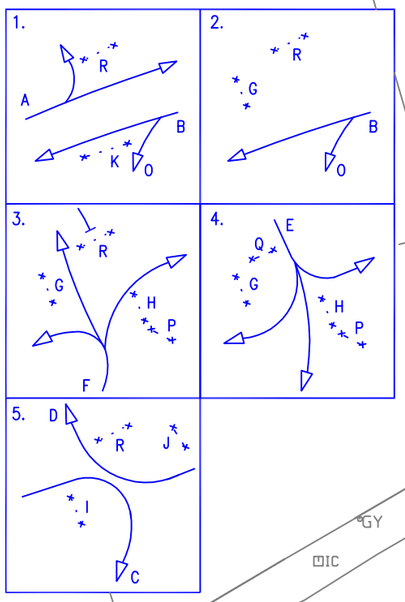
Appendices

Appendix I: Existing layout (J401)

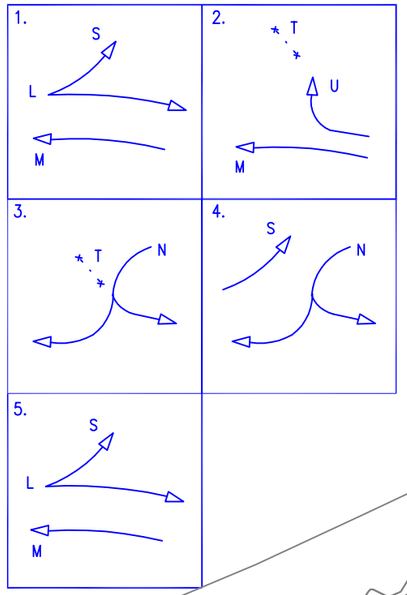
Appendix II: Developments in the vicinity of the junction

Appendix I: Existing layout (J401)

STAGE DIAGRAM



STAGE DIAGRAM



CABLE SCHEMATIC

CONTROLLER

- 20c: 1 — 20c: 2 — 12c: 4 — EXISTING RUN
- 20c: 3 — EXISTING RUN
- 20c: 6 — 20c: 7 — EXISTING RUN
- 20c: 9 — 16c: 10 — EXISTING RUN; 12c: 8 — EXISTING RUN
- 20c: 12 — 16c: 11 — EXISTING RUN
- 16c: 14 — 16c: 13 — NEW RUN

CONTROLLER

- 16c: 15 — 16c: 16 — 8c: 19 — EXISTING RUN; 8c: 17 — 8c: 18 — EXISTING RUN
- 16c: 20 — 8c: 21 — EXISTING RUN
- 16c: 24 — 16c: 23 — 22 — NEW RUN
- 2 × 16c: 5 — 16c: 25 — NEW RUN
- 16c: 27 — 16c: 26 — NEW RUN

NOTE: All existing Push Button Units connected to Low Voltage Transformers on signal heads. All new Push Button Units likewise.

Drawing: A245/C130 OLD WOKING ROAD/CAMPHILL ROAD, WEST BYFLEET

North Point	Manufacturer	Scale	Drawn	Sig.	Date	Drawing No.
N	MICROSENSE	1:500 @ A3	EJS			0600/T/J401D
	Controller Type: SENTINEL		Checked: TAS	Sig.	Date	
	Dimming: NONE		Approved: GRB	Sig.	Date	Classification: RECORD; Date Revised: 21.11.95

SURREY COUNTY COUNCIL

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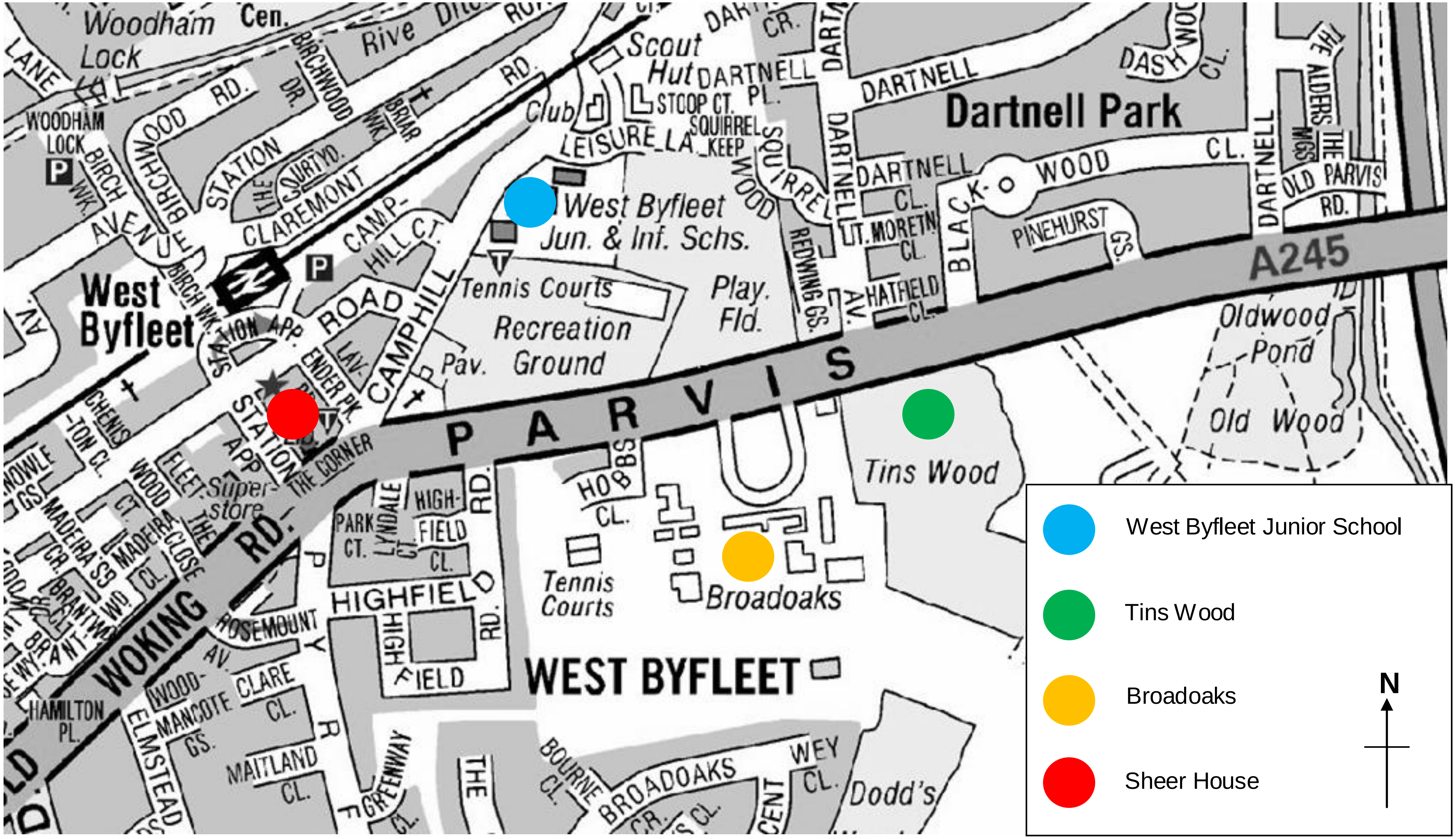
Appendix II: Developments in the vicinity of the junction


West Byfleet Junior School
Tins Wood
Broadoaks
Sheer House
N
Dartnell Park
West Byfleet
WEST BYFLEET
PARVIS
A245
Recreation Ground
Tins Wood
Broadoaks
Oldwood Pond
Old Wood
West Byfleet Jun. & Inf. Schs.
WOKING RD.

Annex G

ARCADY model of Chertsey Road/A245 roundabout

This document contains the reasoning for developing a new full roundabout design (complying with DMRB standards) for the junction of A245 Parvis Road and Chertsey Road.

- Modelling of the A245 corridor through Byfleet and the adjacent roads with flows forecast for up to 2026 indicates that Chertsey Road roundabout junction with A245 Parvis Road is a point of high congestion[1].
- It is recommended that the effect of the increase in flows is mitigated against, as modelled congestion is at a level that would be disruptive to road users.
- It is suggested that mitigation options are investigated to understand how to reduce the congestion forecast. It is considered that increasing capacity at the roundabout could improve the through flow of vehicles at the junction. This could be tested using ARCADY junction modelling software.
- It is suggested that capacity at the roundabout could be increased by widening the carriageway on the roundabout to allow two vehicles to navigate the roundabout adjacent to one another, as currently there is not enough space to do this. It is also thought that adjusting the flare lengths would improve throughput of vehicles at the junction.
- It is recommended that a design for a full sized roundabout at the junction of Chertsey Road and A245 Parvis Road, with the above improvements, is developed (preferably to meet the DMRB standards). This new layout can then be tested in Junctions 9 to understand whether increasing the size and capacity of the roundabout has a mitigating effect on the increased traffic flows. A base model could be created of the existing layout using maps and/or photographs; this would enable comparison of the two layouts.

[1] H:\Modelling\.paramics\53613T44_Woking Local Plan Paramics Discovery\01_Documents\Doc02_OptionTests_17072017.pdf