enterprisemouchel

A3 Beechcroft Drive Gap Study

Feasibility Study Report

June 2010

Produced for
Highways Agency

Prepared by
[redacted]

Enterprise House
Albany Place
Welwyn Garden City
Hertfordshire
AL7 1HX

T [redacted]
E [redacted]

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Executive Summary

This report has been prepared on behalf of the Highways Agency (HA) to assess a proposal to close the central reserve gap opposite Beechcroft Drive on the A3 and also to evaluate the feasibility of providing a diverge taper on its Northbound (NB) approach. This proposal is part of the HA's A3 Route Performance Strategy to improve safety by removing and managing sub standard accesses at heavily trafficked sections of the A3.

Existing information within the study area was gathered. This included traffic and collision data. A topographic survey of the site area was undertaken, and additional information was also gathered from site visits. These were then analysed in accordance with the Design Manual for Roads and Bridges (DMRB) and other relevant standards and specifications.

Analysis of the collision data demonstrates that during the 5-year period to December 2008, 14 collisions occurred within a 300m radius of the study area. Five collisions were related to vehicles using the central reserve gap and only one collision related to NB vehicles turning left into Beechcroft Drive. Therefore, the closure of the gap and provision of a diverge taper will respectively save 5 collisions and 1 collision every 5 years.

There will no major constraints with the provision of a compliant gap closure. Revised traffic signs and road markings would be incorporated to inform drivers of the closed gap and increase their awareness of the new layout of the site. However there are constraints with the provision of a compliant diverge taper. These constraints include land-take, likely environmental impacts from the construction and safety implications.

The Project Appraisal Report (PAR) produced for the proposed gap closure solution gives a First Year Rate of Return (FYRR) of 38.4% based on an estimated scheme cost of £102.309.96.

The provision of a diverge taper is not recommended due to the adverse economic benefits and the safety implications due to the location of the taper. As previously mentioned, only 1 collision will be saved as a result of implementing this proposal and the construction cost could be in excess of £250,000.

It is recommended that the proposed solution for the gap closure be taken forward and the provision of a diverge taper be discounted.

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1 Introduction

1.1 Background

The removal and management of sub standard accesses at heavily trafficked sections on the A3 has been identified as part of the Highways Agency (HA) A3 Route Performance Strategy. The Annual Safety Monitoring Report produced in 2006 ranked the A3 Beechcroft Drive the 19th accident cluster site within the Area 3 network. Additionally, the 2009 Area 3 Safety Action Plan ranks the A3 Guildford 5th in collision cluster sites, which also includes the junction at Beechcroft Drive. This makes the site a priority for safety improvement measures to be implemented.

EnterpriseMouchel (EM), the current HA Area 3 Managing Agent Contractor (MAC), undertook a review of the handover information provided by the previous agent, Mott MacDonald. This assessment resulted in the production of the A3 Beechcroft Drive Gap Study Position Statement Report (dated March 2009), which provides a preliminary investigation into proposals for the closure of the central reserve gap and the provision of a diverge taper on the northbound approach to facilitate safer turning manoeuvres.

Also in March 2009, EM carried out works at this location as part of the recommendations set out in the previous agent's report "A3 Guildford-Ripley Accident Investigation Study". Works included the replacement/upgrade of warning signs, application of high friction surfacing and general vegetation clearance.

A meeting between EM and the HA was held in May 2009 to discuss the Position Statement and agree the way forward in relation to the recommendations set out within the report. This has resulted in the commissioning of this report.

1.2 Aims and Objectives

The purpose of this report is to investigate in detail the proposal to close the central reserve gap at the A3 Beechcroft Drive and the feasibility of providing a diverge taper on the northbound section of the study area. This will be done by assessing the improvement options in terms of the economical benefits, safety effects and environmental impacts.

1.3 Report Structure

The report has been structured in the following manner:

- Chapter 2 describes the area of interest and examines the road layout and relevant highway features;
- Chapter 3 focuses on the existing situation by analysing surveyed information such as the traffic data, and other related information;
- Chapter 4 identifies the improvement options; and
- Chapter 5 finalises the report with the conclusions and recommendations based on the improvement options and the Project Appraisal Report (PAR) of the preferred option.

2 Study Area

2.1 Description of Study Area

The study area is situated in the south east of England on the A3 Guildford and Godalming Bypass Road. It is to the south-west of the town of Guildford, which is within the county of Surrey. The A3 trunk road is part of the Strategic Road Network, and is one of the core national routes to the M25 motorway which is approximately 10 miles from the study area.

The surrounding area is urban in nature with the Surrey Research Park, Royal Surrey County Hospital and University of Surrey in close proximity located approximately 1.5 miles to the north of study area. The geometric layout of the road is a rural all purpose mainline.

There are residential and commercial accesses within the study area. The residential accesses are on Beechcroft Drive and Manor Way. The commercial accesses are adjacent to the Southbound (SB) carriageway of the A3, where there is a golf shop and a car accident repair centre. There is also a footbridge to the north of the study area, which provides a link between Beechcroft Drive and Manor Park. Additionally, there is a public footpath through the fields north of Beechcroft Drive. Figures 1 and 2 show the study area relative to the surrounding area.

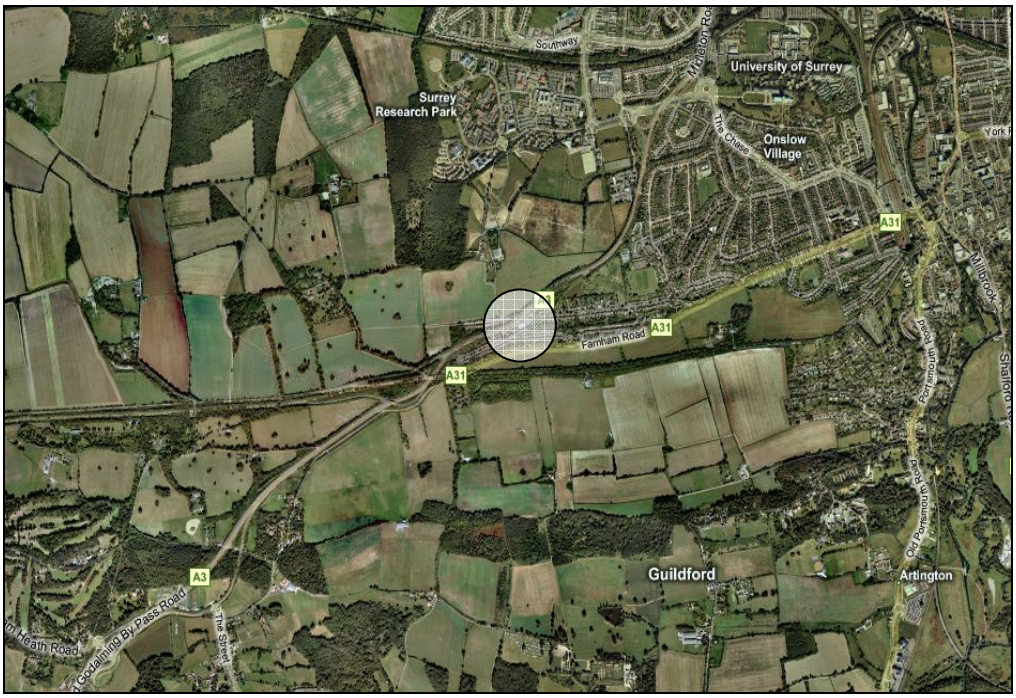

Figure 1 - Aerial map of scheme location with surrounding areas

Figure 2 - Close map view of scheme location

2.2 Existing Layout of Study Area

The A3 Northbound (NB) carriageway has two lanes on a downhill gradient with hardstrips on the near and far side. There is a direct access into Beechcroft Drive from the NB carriageway. The NB carriageway verge on the approach to the access is on a steep downhill slope whilst the verge north of the access is flat with a footway connecting pedestrians to the footbridge. There is also an access into the fields from a footpath connected to the footway.

The SB carriageway of the A3 has two lanes on an uphill gradient with hardstrips on the far and near side. There is a diverge lane on the off side, providing right turn access into Beechcroft Drive through the gap in the central reserve. The diverge lane is 120m long tapering to 3.5m wide. U-turn movements are prohibited at this location. The near side also has a taper for vehicular access to the golf shop. A footway is also present for pedestrians to access the footbridge, golf shop and the car accident repair centre.

The access resides on a lower elevation which has a negative effect on the visibility sightlines in the vertical plane for observing vehicles on the A3 NB approach. Visibility to the north of the access is sufficient for left turning vehicles from Beechcroft Drive onto the A3.

The horizontal geometry of the road limits the visibility for vehicles approaching on the NB carriageway. As a result, a ‘Concealed Entrance’ warning sign has been installed on the approach to the access.

To the north of the access the central reserve is partially hardened but mainly grassed. To the south of the access, the central reserve is paved with a vertical concrete barrier (VCB) in position.

Figure 3 shows a photograph of the existing layout of the study area.

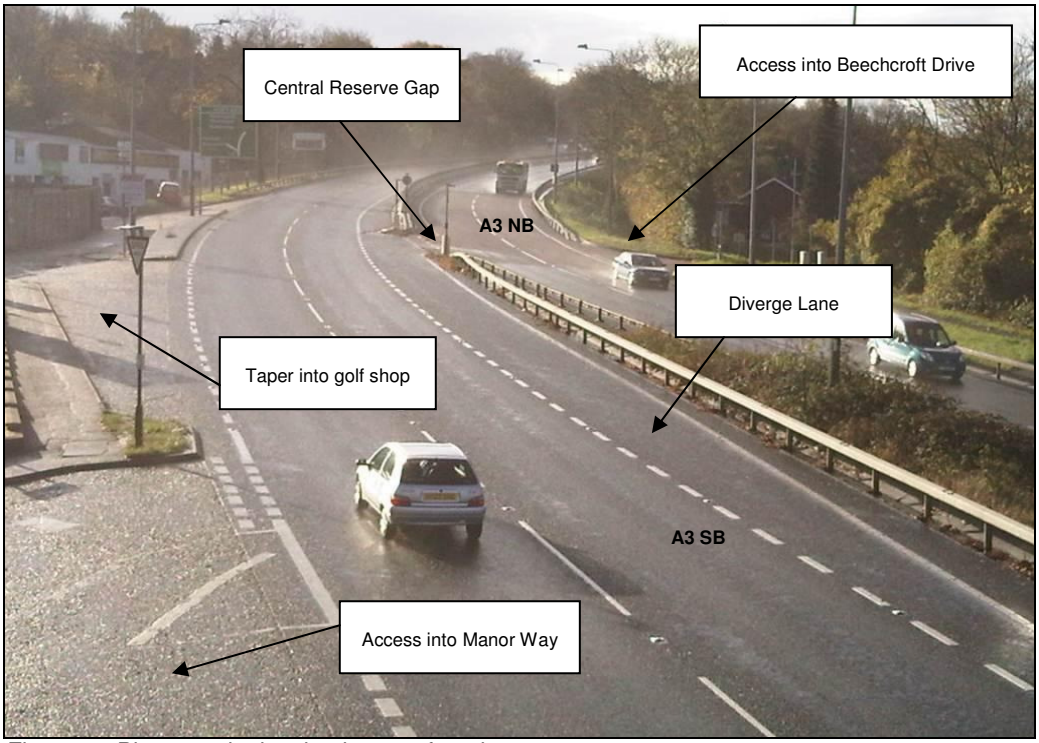

Figure 3 - Photograph showing layout of study area

3 Analysis of Data

3.1 Traffic Data

The primary source of traffic data is the HA's traffic database, TRADS, which forms part of the Traffic Information System, HATRIS. The traffic data has been reviewed for both the NB and SB carriageways of the study area with emphasis on the traffic flows, traffic speed and evaluation of traffic characteristics.

Figure 4 - Map showing location of count sites

Figure 4 above shows the approximate locations of the traffic count sites. The traffic count sites numbers for the NB are 311, 30012801 and 30012802, whilst site numbers for the SB are 312, 30012799 and 30012800.

The analysis of the traffic data has been carried out by obtaining the Annual Average Daily Traffic (AADT) flow, Peak Hourly flow, and Percentage of Heavy Goods Vehicles (HGVs). The mean average and the 85th percentile (85th %ile) speeds have also been obtained.

The Congestion Reference Flow (CRF) has been calculated for each direction (named directional CRF) to give an indication of existing congestion in either direction. The directional CRF (dCRF) gives an estimate of the AADT flow at which the link in each direction is likely to be congested in the peak periods on an average day. Congestion is defined as the situation when the hourly demand traffic exceeds the maximum sustainable hourly throughput of the link as described in DMRB TA 46/97.

In accordance with the DMRB TA 23/81, the 30th highest hourly flow has also been obtained in order to gain a suitable Design Reference Flow (DRF) for an urban area, as using the peak hourly flow may prove uneconomically viable.

The scheme opening year has been estimated to be 2011. The design year has thus been taken to be 2026. Growth factors obtained from the Department for Transport's (DfT) Road Transport Forecast (RTF) 2008 have been used to forecast the expected traffic flows for the opening and design years.

3.1.1 Northbound Traffic Data

The graph in figure 5 is a graph showing the traffic flow pattern on the NB carriageway of the A3 in the vicinity of the study area on a typical day. The peak periods occur between 06.00am and 09.00am in the morning and between 5.00pm and 7.00pm in the evening.

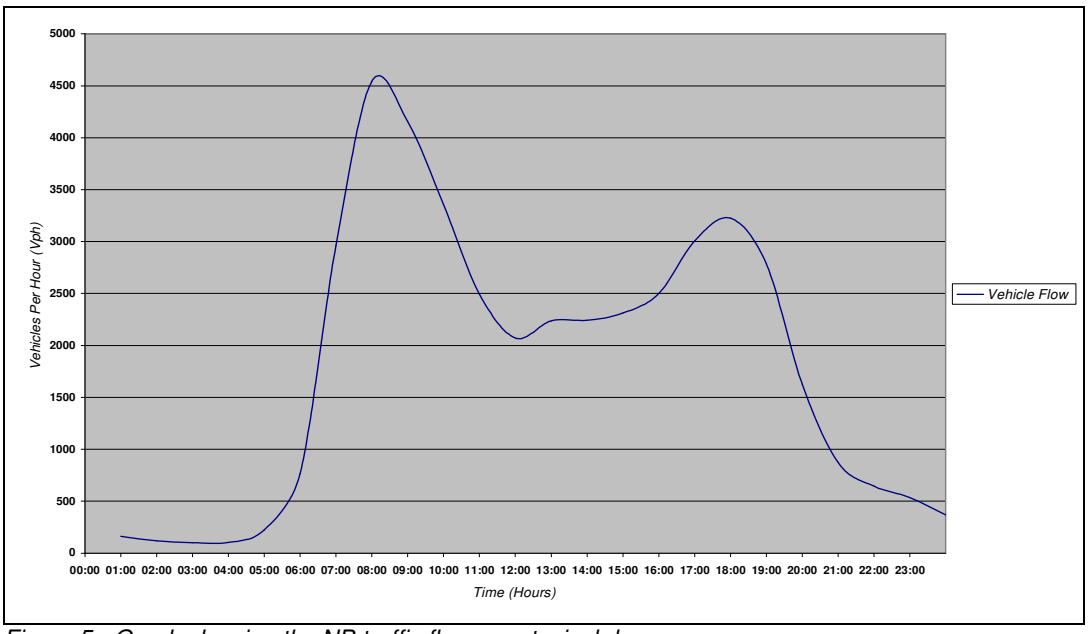

Figure 5 - Graph showing the NB traffic flow on a typical day

AADT	Peak Hour Flow	Peak Time	30th Highest Hourly Flow	30th Time Period
41208	4773	08.00am	4541	08.00am
%HGVs(>5.2m)	**dCRF**	**Stress Factor**	**2011 Hourly Flow**	**2026 Hourly Flow**
8.3	34593	1.19	4627	6011

Table 1 - NB traffic flow figures obtained and calculated from the traffic data

The peak hour occurs in the morning at 08.00am with a traffic flow of 4,773 vehicles per hour (vph) as shown below in Table 1. The table also shows that the dCRF is lower than the AADT, indicating that congestion is likely to occur on the link, resulting in a stress factor of 1.19. It can be assumed from the graph that congestion occurs during the morning peak period, where traffic flows exceed the theoretical design capacity of 1600 vehicles per hour (vph) per lane in accordance with DMRB TD22/06.

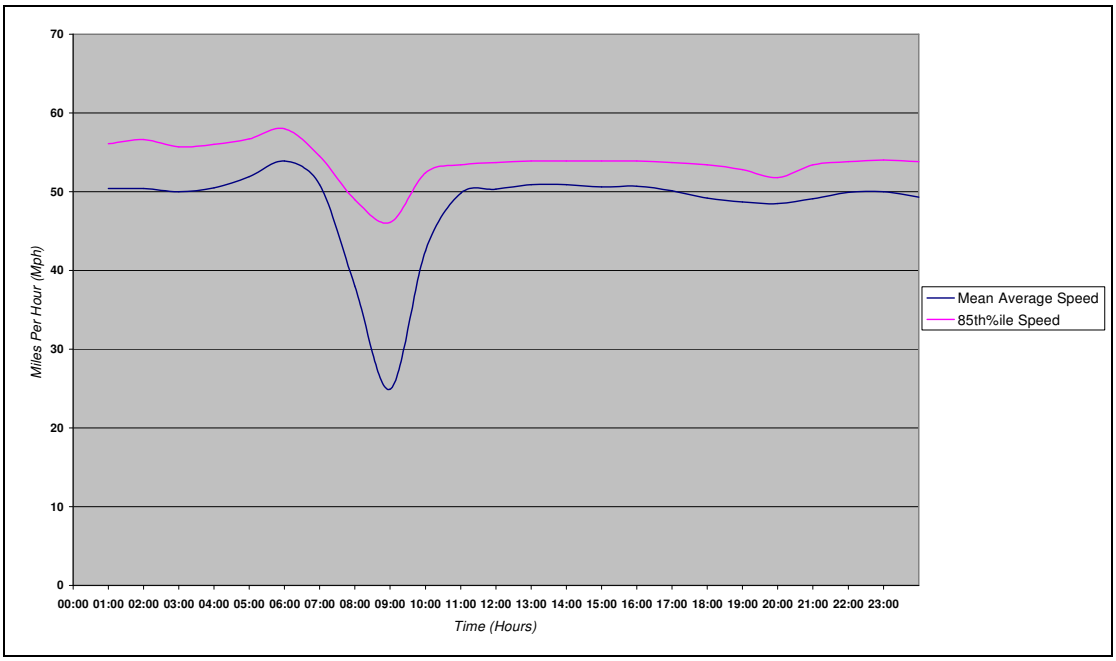

Figure 6 - Graph showing the NB mean average and 85th percentile speed

Direction	Speed Limit (Mph)	Mean Average Speed (Mph)	Mean Average Speed Time	85th %ile Speed (Mph)	85th %ile Speed Time	Peak Hour Mean Average Speed	Peak Hour 85th %ile Speed (Mph)
Northbound	50	53.9	06.00am	58.0	06.00am	38.0	49.0

Table 2 - NB traffic speed figures obtained from the traffic data

Figure 6 is a graph of the traffic speed showing the mean average and 85th percentile speeds. The graph indicates that the highest 85th percentile and mean average speeds occur in the morning between)5.00am and 06.00am with speeds of 58mph and 53.9mph respectively as shown in Table 2. Both these speeds indicate that most vehicles maintain speeds between 50mph and 60mph.

During the peak hour, from 08.00am to 09.00am, the mean average speed is 38mph which is lower than the speed limit as shown in the Table 2. The 85th percentile speed during the peak hour is 49mph which is close to the speed limit.

A review of the speed graph relative to the traffic flow indicates that the mean average speed begins to decrease between 06.00am and 09.00am as the traffic flow increases. This may be a result of peak travel and it can be assumed throughout this period that the density increases but does not reach “jam density” for vehicles to “stop and go”. It can also be assumed that congestion is experienced as vehicles “slow and go” as a result of an increase in density.

3.1.2 Southbound Traffic Data

The graph in Figure 7 shows the traffic flow pattern on the SB carriageway of the A3 in the vicinity of the study area on a typical day. The peak periods occur between 07.00am and 9.00am in the morning and between 5.00pm and 7.00pm in the evening.

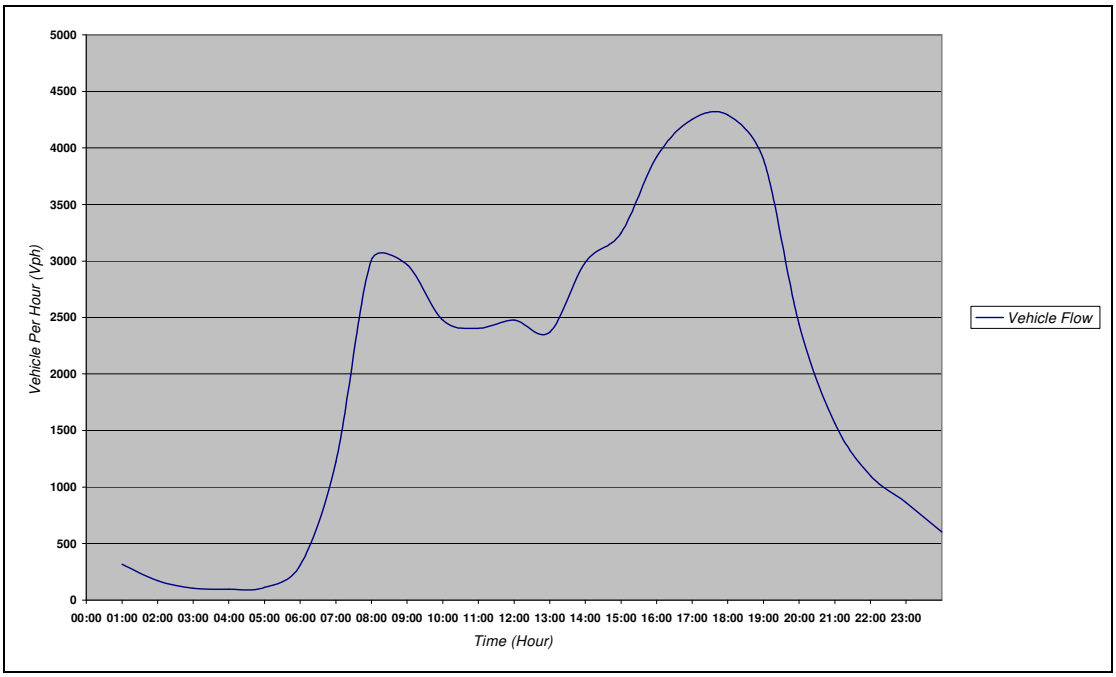

Figure 7 - Graph showing the SB traffic flow on a typical day

AADT	Peak Hour Flow	Peak Time	30th Highest Hourly Flow	30th Time Period
42096	4429	18.00pm	4292	18.00pm
%HGVs(>5.2m)	**dCRF**	**Stress Factor**	**2010 Hourly Flow**	**2025 Hourly Flow**
5.7	40590	1.04	4374	5682

Table 3 - SB traffic flow figures obtained and calculated from the traffic data

The peak hour flow occurs within the evening period at 18.00pm with a traffic flow of 4,429 vph as shown in Table 3. The table also shows that the dCRF is lower than the AADT, indicating that congestion is likely to occur on the SB link in the PM peak; resulting in a stress factor value of 1.04. This stress factor value indicates that the level of service and safety needed on this link is lower than the requirement set in DMRB TD22/06.

Figure 8 is a graph of the traffic speed showing the mean average and 85th percentile speeds. The graph indicates that the highest 85th percentile and mean average speed occur in the morning between 04.00am and 05.00am with speeds of 56.6mph and 64.1mph respectively as shown in Table 4.

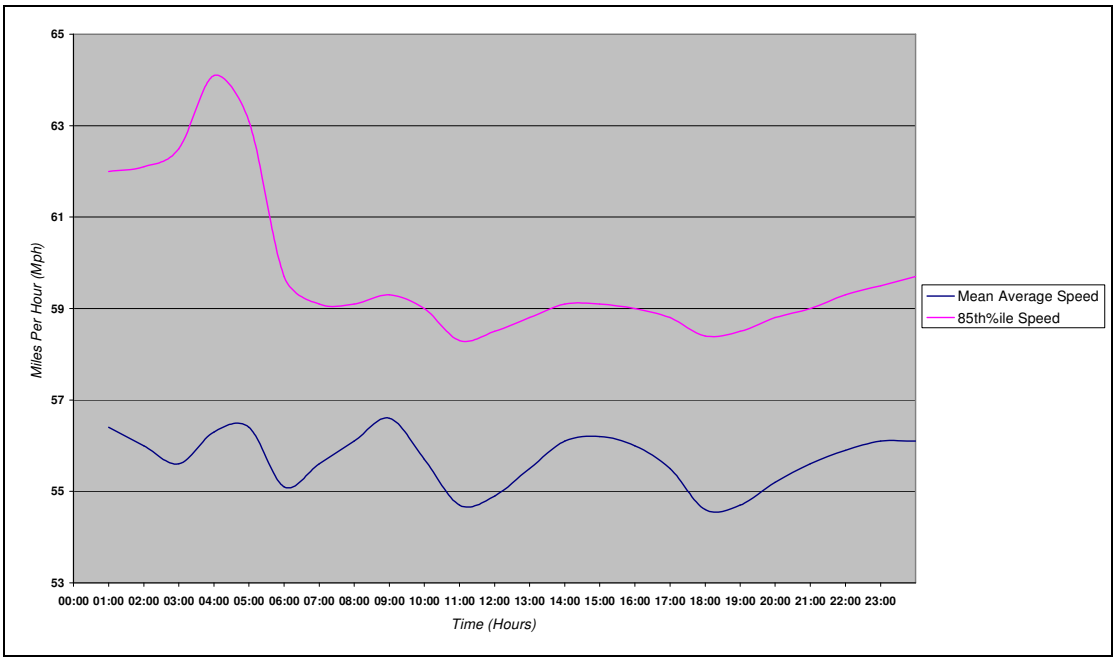

Figure 8 - Graph showing the SB mean average and 85th percentile speed

Direction	Speed Limit (Mph)	Mean Average Speed (Mph)	Mean Average Speed Time	85th %ile Speed (Mph)	85th %ile Speed Time	Peak Hour Mean Average Speed	Peak Hour 85th %ile Speed (Mph)
Southbound	50	56.6	09.00am	64.1	04.00am	54.6	58.4

Table 4 - SB traffic speed figures obtained from the traffic data

During the PM peak hour from 18.00am to 19.00am, the mean average speed is 54.6mph which is higher than the speed limit as shown in Table 4. The 85th percentile speed is 58.4mph which is also higher than the speed limit.

From the graph, it is evident that the mean average speed throughout the day is approximately 56mph with no significant reduction in speed during peak period. It can be assumed that the density is zero resulting in vehicles travelling at a desired free flow speed.

3.1.3 Beechcroft Drive Traffic Data

The total traffic flow in and out of Beechcroft Drive has been estimated to be 168 vehicles AADT, based on an assumption of 8 vehicular movements per day for each of the 21 properties on Beechcroft Drive.

This gives an average estimate of 84 vehicles emerging from and returning to Beechcroft Drive. It has been assumed for the purpose of this study that all these vehicles utilise the gap to return to Beechcroft Drive. This is however likely to be an overestimation as some vehicles will be gaining entry from the northbound carriageway.

3.2 Collision Data

A Collision Analysis report has been produced for the purpose of this study set (see Appendix A) The analysis indicates that a total of 14 collisions occurred during the 5-year period to 31st December 2008 within a 300m radius of the

study area. Out of the 14 collisions, 5 were related to the central reserve gap. There was only one collision related to vehicles turning into Beechcroft Drive from the NB carriageway.

The collision analysis report recommends the implementation of the gap closure, which will save the 5 collisions related to vehicles using the central reserve gap. The provision of a diverge taper for the NB section may save the collision related to NB vehicles turning into Beechcroft Drive.

3.3 Non-Motorised Users (NMU)

An NMU context report has also been produced for the purpose of this study (see Appendix B). The context report reviews the existing NMU facilities within the study area.

The NMU auditor has recommended that an audit is carried out during the preliminary design, detail design and post-construction stage of the scheme.

The project sponsor has however requested that the audits are carried out only at preliminary design and post-construction stages of the scheme due to the small nature of the scheme.

3.4 Road Safety Audit

A stage 1 Road Safety Audit (RSA) has been completed for the preferred gap closure option. A draft report on the audit has been completed (see Appendix G).

3.5 Environmental Implication Assessment

An environmental implication assessment has been carried out as part of the study. The proposal to close the gap will have no impact on the environment. However if a diverge taper is to be provided, further assessment of the likely environmental impacts would be required.

The findings from the assessment are detailed in the Environmental Implication Form (EIF) (see Appendix C).

3.6 Utilities

As part of a site visit on the 29th June 2009, a number of utility services were established. Notices of planned works have been sent to the necessary statutory undertakers.

3.7 Stakeholders

Surrey County Council and Surrey Police have been informed about the proposals within this study. Further consultation will occur at the start of the detailed design stage.

4 Proposed Solution

As described in Chapter 1, the purpose of this report is to investigate the closure of the central reserve gap opposite Beechcroft Drive on the A3 and the feasibility of providing a diverge taper on the NB approach to Beechcroft Drive. This is part of the safety remedial measures on the Area 3 road network..

This chapter provides details of the proposed option for the central reserve gap closure and diverge taper.

4.1 Gap Closure

The closure of the central reserve gap at the A3 Beechcroft Drive will be beneficial in providing “Safer Roads” as part of the HA’s objectives. The Collision Analysis Report in Appendix A illustrates that closing the gap will improve safety within the study area. Traffic signs will be installed to ensure that drivers are informed about the gap closure.

However, closure of the gap will increase travel times for vehicular traffic wanting to turn right into Beechcroft Drive from the A3 SB carriageway. There will be an average journey time increase of 5 minutes due to an additional travelling distance of 6 kilometres through the B3000 junction.

This has been revised from the estimated journey time of 6 minutes stated in the Position Statement. This revision is based on the consideration of a 1 minute delay for SB vehicles turning right into Beechcroft Drive through the central reserve gap. Closing the gap will remove this time delay and provide an overall additional journey time of 5 minutes instead of 6 minutes.

Drawing number 3/000010/DR/000/010 in Appendix D shows the diversion route to be utilised by vehicular traffic wanting to turn right. Additional traffic signs will be installed as part of the proposed gap closure (see Drawing number 3/000010/DR/000/011).

The proposed option for closing the gap is by widening the central reserve. This option introduces a wider central reserve area by making use of the existing NB off-side diverge taper. The existing kerb and drainage channel will be re-aligned with gullies installed and a new 1m off-side hardstrip will be introduced. The new traffic signs and road markings will be implemented.

The required Vehicle Restraint System (VRS) will be connected between the existing VCB and the steel barrier in order for the central reserve gap to be closed. Drawing number 3/000010/DR/000/002 in Appendix D shows this proposal.

A safety review of this option indicated that there will be no increased risk to road users by implementing this option. Any associated risks will be limited with the provision of appropriate traffic signs and road markings to inform drivers about the new road layout and gap closure. Drawing number 3/000010/SK/000/001 shows the proposed locations of the appropriate traffic signs and road markings for this option.

The Temporary Traffic Management (TTM) proposed for construction of this option will be narrow lanes. The estimated cost in constructing this option is £102,309.96.

4.2 Diverge Taper

Closure of the gap will prevent right turn access into Beechcroft Drive, which will in turn increase the volume of left turning traffic. The provision of a diverge taper on the NB approach to Beechcroft Drive will allow safer entry from the NB carriageway. However the steep embankment will require extensive earthworks and drainage construction to facilitate implementation of the taper.

Even though the downhill gradient on the NB approach to Beechcroft Drive is greater than 4%, which is another criteria within TD41/95 of the DMRB for the provision of a diverge taper, this may however be omitted if site constraints do not permit its provision, as observed at this location. Paragraph 2.33 of TD41/95 states that diverge tapers “shall not be provided where an existing direct access in on the inside of a sharp curve as traffic in the diverging lane could adversely affect visibility for drivers emerging from the access or access road.” Therefore the provision of a diverge taper is not feasible due to the safety implications.

5 Conclusion and Recommendations

During the study, information has been gathered regarding the collision history, traffic flow and speed and highway geometry of the study area. There has also been consultation with specialist teams and analyses of a number of options for closing the central reserve gap and providing a diverge taper at Beechcroft Drive.

From the information received, the proposed solution for the gap closure will be progressed as the preferred option, which involves widening the central reserve. As a result a Project Appraisal Report (PAR) has been produced for this option and it is in Appendix F of this report.

The PAR summarises the environmental and economic impact of the preferred option in relation to smaller trunk road schemes. In the case of this study, a Short PAR has been produced detailing the requirements of the project and the economic benefits.

The economic assessment of the preferred option shows that the collision benefit gives a First Year Rate of Return (FYRR) of 55.6% (£91,140) and the journey time dis-benefit gives a FYRR of -17.2% (-£28,185.04). This gives an overall FYRR of 38.4% (£62,955) on an estimated scheme cost of £102,309.96. This estimate is based on the preliminary design using rates from Spons Civil Engineering and Highway Works Price Book 2009 and similar schemes. Appendix E shows a copy of the bill of quantities that was produced to determine the estimated scheme cost.

Subject to the economic benefits of the preferred option and the information received from carrying out the analysis of the improvements options, it is recommended that the proposed gap closure solution be taken forward. It is considered unfeasible to provide the diverge taper due to the adverse economic benefit, environmental impact, layout constraints and safety implications.

6 References

Books

- Design Manual for Roads and Bridges (DMRB)
- Manual of Contract Documents for Highway Works (MCHW)
- Traffic Signs Manual (TSM)
- Traffic Signs Regulations and General Directions (TSRGD) 2002
- Spons Civil Engineering and Highway Works Price Book 2009

Website

- Fred L. Hall. (1992). *Traffic Flow Theory - Traffic Stream Characteristics.* Available: http://www.tfhrc.gov/its/tft/tft.htm. Last accessed October 2009.
- Martin Rogers. (2003). *Highway Engineering.* Available: http://books.google.co.uk/books?id=L7y8bCRbT1gC&pg=PA74&lpg=PA74&dq=speed+density,+vehicles+per+kilometre&source=bl&ots=XvsJRWJeLG&sig=mVKuZdczTWPdZbg0Cn5b9PYbtyk&hl=en&ei=no7USujAG8rTlAe44oWpCg&sa=X&. Last accessed November 2009

Appendix A

Collision Analysis Report

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Appendix B

NMU Context Report

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Appendix C

Environmental Implication Form

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Appendix D

Proposed Solution

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Appendix E

Bills of Quantities – Proposed Gap Closure

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Appendix F

Project Appraisal Report (PAR) – Proposed Gap Closure

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Appendix G

Stage 1 Road Safety Audit Report

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