A324 PIRBRIGHT ARCH, PIRBRIGHT

PROPOSED MODIFICATION TO TRAFFIC SIGNALS TO INCORPORATE CONTROLLED PEDESTRIAN CROSSING FACILITIES

TECHNICAL AND ENGINEERING APPRAISAL

Date: 1 February 2007

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CONTENTS

1 PURPOSE

1.1 This report considers options for and impacts of proposed improvements at the existing traffic signal controlled junction of A324 Pirbright Arch to provide a safer environment for pedestrians. It focuses on how the signal layout and existing method of control might be enhanced to include a controlled pedestrian stage and how latest Intelligent Transport Systems (ITS) technology might be deployed and integrated to compliment the modified system of control.

1.2 Legal constraints and requirements associated with the proposals will be advised along with the estimated implementation costs.

1.3 A comparison of the modelled impacts of the proposals on traffic flow and congestion in the area will also be provided.

2 LOCATION DETAILS

2.1 Pirbright Arch is a narrow “rail over road” brick-arch structure on the A324 Connaught Road just north of its junction with Dawney Hill and Gole Road. The arch provides a vehicular and pedestrian route between the communities of Brookwood and Pirbright which are effectively segregated by the railway.

2.2 The carriageway width between the walls of the arch is just 4.5 metres and due to the arch profile (signed headroom of 11ft 6ins) and the need to provide space for pedestrians on one side, the width allocated to vehicles is limited to 3.1 metres broadly in the centre of the arch. The space remaining has been divided to provide an edge margin on the east side of the arch of 0.6 metres and a 0.8 metre margin on the west side that also serves pedestrians.

2.3 The arch is just over 30 metres long and segregation of pedestrians and vehicles is only achieved with carriageway marking. Pedestrians therefore feel threatened by the close proximity of vehicular traffic when walking through the arch particularly as to pass another pedestrian requires that one party crosses into the area delineated for vehicles.

2.4 Traffic signals control vehicular movements at the junction of the A324 with Gole Road and restrict traffic travelling through the arch to alternate one-way operation. However, the traffic signal control does not include any specific facilities for pedestrians which adds to pedestrians’ feelings of vulnerability when walking through it. It is a matter of debate to what extent this might influence the pedestrian flows measured due to the possibility of suppressed demand due to the poor conditions for pedestrians.

3 SOURCE INFORMATION AND METHODOLOGY

3.1 The traffic and pedestrian flow information forming the basis of the operational and capacity assessment was collected in a survey on 14 September 2006. This was a 12 hour classified turning count which included pedestrian movements approaching and through the arch. The survey results are included in Appendix 1.

3.2 The current method of operation, site layout and current signal timings has been exported from the site layout drawing, controller configuration specification and Mova data set and Mova data log. The site layout drawing is included in Appendix 2.

3.3 The assessment of the operation of the current and modified signal arrangements have been assessed using Linsig as the study tool.

4 MODIFICATIONS TO LAYOUT AND OPERATION

4.1 In order to keep costs within affordable limits schemes requiring significant modification to the arch structure or the provision of a separate pedestrian tunnel have been excluded from this study. The proposals therefore concentrate upon modifying the operation of the traffic signals and the necessary changes to on-street signal equipment in order to provide a separate dedicated signal stage for pedestrians.

4.2 The proposed scheme is shown on Drawing No. 536001 01. It provides for:

- reconfiguration of the existing controller to provide a separate pedestrian stage.
- relocation of existing posts and erection of additional push-button units and pedestrian indicators.
- Kerbside call/cancel pedestrian indicators (as per Puffin type operation).
- Pedestrian on-crossing microwave vehicle detectors.
- Optionally, the provision of a Variable Message Sign (VMS) activated by the signal controller to advise pedestrian stage operating.
- Alteration to footways at each end of the arch to accommodate waiting pedestrians.
- Carriageway markings to improve delineation between pedestrians and vehicles and to encourage pedestrians to keep within their designated space.
- General upgrading and refurbishment of existing signs and carriageway markings

5 IMPACT ASSESSMENT – Option 1 (Modified signals)

5.1 Existing operation:

5.1.1 For the purpose of the assessment, the following peak hour stage sequence has been assumed:

STAGE 1: A324 Connaught Road
STAGE 2: Clearance (Stage 1 to Stage3)
STAGE 3: A324 Dawney Hill
STAGE 4: Gole Road
STAGE 5: Clearance (Stage 4 to Stage 1)

5.1.2 Due to long “Clearance” stages 2 and 5 above, the existing signals are operated on a cycle time of 120 seconds. The total effective green for the cycle is 80 seconds, which represents just 67% of the total cycle time.

5.1.3 The full Linsig output for the existing case is shown in Appendix 4

5.2 Proposed operation:

The additional pedestrian stage has been calculated to require 40 seconds, which for the purposes of the capacity assessment the stage and associated clearance period is additional “lost time” in the signal cycle.

5.2.1 For the purposes of assessing the effects of adding a pedestrian crossing stage to the signal sequence and to provide a sensitivity test, three scenarios have been considered using cycle times of 120 seconds, 140 seconds, and 160 seconds. This is to demonstrate the impact on traffic capacity of:

i) absorbing the full 40 seconds “lost time” attributable to the pedestrian stage into the existing signal cycle
ii) increasing the cycle time by 50% of the additional “lost time” attributable to the pedestrian stage
iii) Increasing the cycle time by 100% of the additional “lost time” attributable to the pedestrian stage

5.2.2 For each of he above scenarios, the total effective green time has been calculated to be 33 seconds, 53 seconds and 73 seconds representing 28%, 38% and 46% for each of the respective signal cycles considered. This illustrates the considerable reduction in the proportion of effective green resulting from the additional pedestrian stage when considered with the value of 67% in 4.1.2 above for the existing layout and operation.

5.3 Summary of modelled scenarios

5.3.1 There is a presumption in the Linsig assessment that the pedestrian stage would be demanded in each signal cycle. This is likely to be the case in the morning when the pedestrian and vehicle peak periods coincide. This is less likely for the evening peak period, but pedestrian activity is still considered sufficient to have a significant impact on traffic congestion and delay in the area.

5.3.2 A summary of queues and delays predicted by the Linsig models for the existing signal operation and each scheme scenario in 5.2.1 above is shown in Appendix 4 Table 1. This demonstrates clearly that providing a separate pedestrian crossing stage severely reduces the "Reserve Capacity below its current operating levels and predicting a considerable increase in peak hour traffic queues and delays.

5.3.3 Trend Graphs of "Reserve Capacity" for the existing and modified junction are shown in Appendix 4 Tables 2 and 3. Table 3 in particular shows how the Reserve Capacity for the modified junction continues to improve as the cycle time is increased. Also that it would continue to do so beyond the 160 second cycle time modelled. However in absolute terms the graph is demonstrating that the Reserve Capacity is flattening off at around -90% and that very little improvement could be expected beyond a cycle time of 160 seconds.

5.3.4 Clearly in all scenarios, the additional pedestrian stage would have a severe impact on current levels of traffic congestion with large increases in both queues and delays predicted based on current traffic flows during both morning and evening peak periods. Also, that to achieve anything worthwhile by way of mitigation would require the system to operate above a cycle time of 160 seconds.

6 APPROVALS AND RELEVANT LEGISLATION

6.1 Informal consultation with the Department of Transport (DfT) on Option 1 has been positive and indications are that Option 1 would be acceptable in principle. However the supplementary VMS signing and method of control is not specifically prescribed in current regulations and control equipment specifications.

6.2 Further consultation with the DfT will be required during detailed design to agree the details of the control and integration of the VMS. This innovative approach to solving what is an uncommon challenge may require specific Site Approval from the Department for Transport.

6.3 Option 2 is compliant with current national guidance, standards and specifications and is unlikely to require any site-specific approvals from the DfT.

7 FINANCIAL IMPLICATIONS

7.1 **Option 1 –** Including “controlled” pedestrian crossing.

	£
Works:	
Footway works (inc. dropped kerb, tactile paving and ramps)	30,000
Drainage	5,000
Additional duct infrastructure	15,000
Supply and install traffic signal street furniture	8,000
Supply and install VMS and cable to controller	12,000
Carriageway markings and signing	4,000
Traffic Management	6,000
	80,000
Engineering fees	
Consultation	5,000
Design	10,000
Safety Audit	5,000
Site supervision and commission (Client)	2,000
Site Supervision (Constructor)	4,000
	26,000
Sub Total	106,000
Contingencies (10%)	10,600
Total	**116,600**

7.2 **Option 2 –** Excluding “controlled” pedestrian crossing.

	£
Works:	
Footway works (inc. dropped kerb, tactile paving and ramps)	30,000
Drainage	5,000
Carriageway markings and signing	4,000
Traffic Management	6,000
	45,000
Engineering fees	
Consultation	5,000
Design	8,000
Safety Audit	5,000
Site supervision and commission (Client)	2,000
Site Supervision (Constructor)	4,000
	24,000
Sub Total	69,000
Contingencies (10%)	6,900
Total	**75,900**

8 CONCLUSION

8.1 Pedestrian Environment (See Appendix 1 - Surveys)

8.1.1 Pedestrian flow in the area and particularly through the Pirbright Arch are light even at peak periods with maximum values recorded of just 20 and 29 morning and evening respectively. It should however be noted that the afternoon figure occurs at school time, about an hour before the evening traffic peak period. It has been suggested that due to the perceived dangers of walking through the arch, some pedestrians prefer to use alternative routes or travel by car. It is possible therefore that improved facilities could lead to an interest in pedestrian traffic through the arch.

8.1.2 Pedestrians walking through the arch are encouraged to use the 0.8 metre edge margin provided on the west side of Connaught Road, but there is insufficient width for construction of a formal footway particularly as it could not accommodate two pedestrians passing. As it is, when this occurs there is no alternative to one party stepping into the designated carriageway as gaps in traffic permit in order to pass by. A kerbed footway would present a significant trip hazard.

8.1.3 The route through the arch is clearly unsuited to shared pedestrian and vehicular use and pedestrians feel extremely vulnerable when walking though it. Conditions are largely only sustainable due to the very low pedestrian usage.

8.1.4 There is little doubt that pedestrian safety would be improved by the provision of a controlled pedestrian stage through the arch (Option 1) for those prepared to wait for the pedestrian stage to appear. The pedestrian crossing signals associated with a controlled crossing are not mandatory and pedestrians would therefore not be required to wait for the “Green Man” pedestrian stage when all vehicular movements would be stopped. Anyone walking through the arch during a vehicular stage is likely to be at greater risk as motorists would be less likely to expect to encounter a pedestrian in the arch during a vehicle stage.

8.1.5 Regrettably, experience suggests that with such high signal cycle times the delay to pedestrians would be so great that many would be likely to walk through the arch arch during a vehicle stage rather than wait for the pedestrian stage to appear.

8.1.6 An anticipated high incidence of non-compliance should be taken into consideration when considering the benefits of the additional pedestrian stage against the disbenefits in terms of additional traffic delay which is predicted by the Linsig model.

8.1.7 Option 2 provides the benefits of improved waiting areas for pedestrians at either end of the Arch and a more clearly defined area for vehicles entering and passing through the arch. It would have no adverse impacts on the overall performance and capacity of the existing traffic signals. Whilst not removing the much criticised shared usage through the arch, it is considered to represent a significant improvement for pedestrians over the current conditions.

8.2 Traffic Flow and Junction Capacity

8.2.1 The existing traffic signals are operating just over capacity during peak periods due mainly to the considerable “Lost time” required to provide the necessary clearance periods through the arch or competing traffic demands. But, peak hour traffic flows are relative light and congestion and delay is just about manageable.

8.2.2 The addition of a pedestrian stage severely reduces the %effective green time available for each traffic stream per cycle. The effects on the capacity of the junction are very severe fro example during the morning peak period decreasing the Reserve Capacity from its current (–14.5%) to (-167%), (-97%) and (-67%) at 120second, 140 second and 160 second cycle times.

8.2.3 It follows as the Linsig assessment has demonstrated, that traffic queues and delays would greatly increase, creating considerable local congestion and “peak spreading”. There is also a risk of deterioration of safety and the environment on local less suitable roads due to traffic diverting to avoid the congestion at Pirbright Arch.

8.2.4 It is essential that should Option 1 (which incorporates the controlled pedestrian stage into the traffic signal operation) be implemented, the severe traffic congestion predicted is understood by all stakeholders and full consultation prior to detail design is recommended.

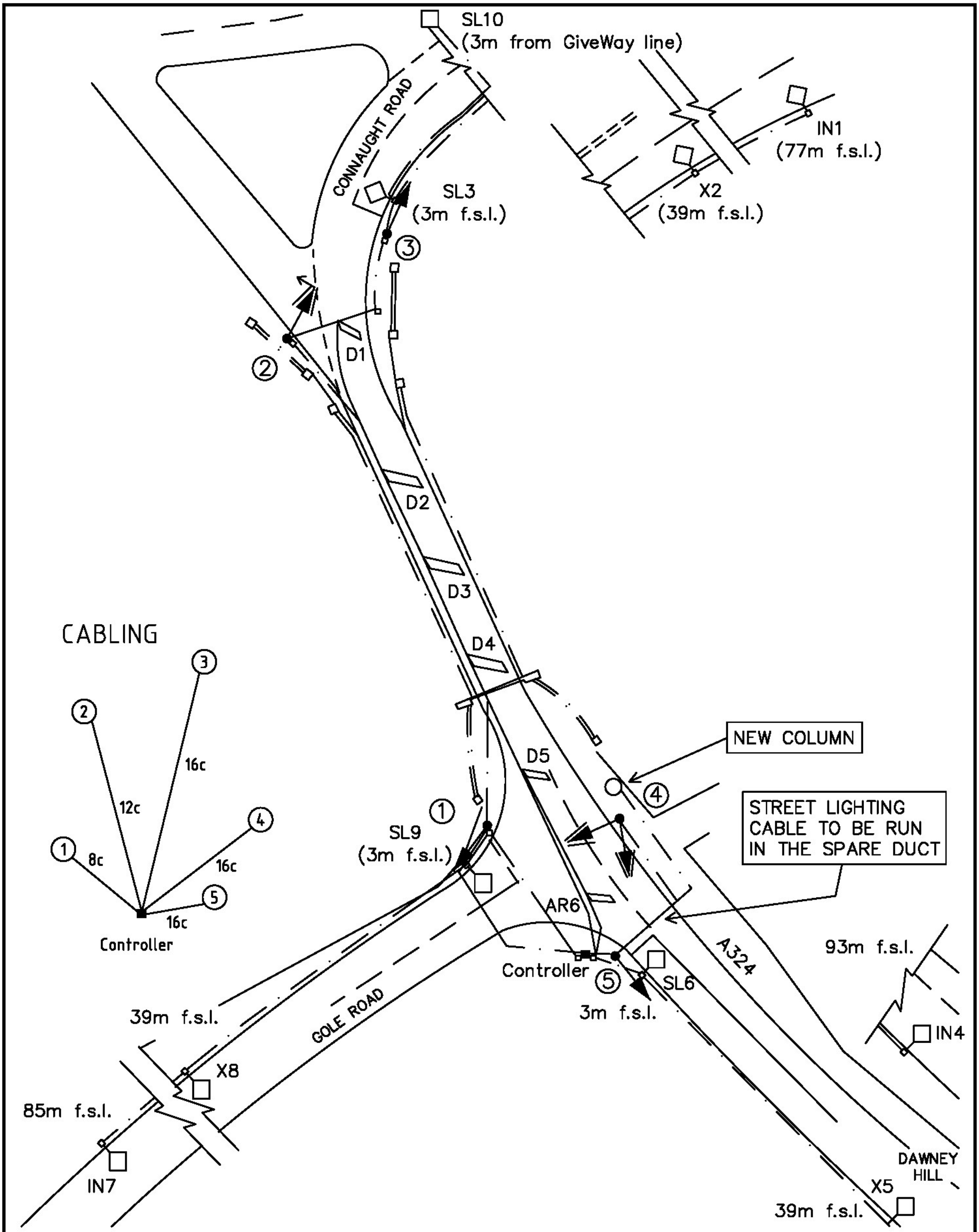
8.2.5 As stated in 8.1.7 above, Option 2 would have no detrimental impact on the current method of operation and capacity of the existing traffic signals. This would be a worthwhile proposal to implement should the disadvantages of Option 1 be considered unsustainable.

APPENDICES

APPENDIX 1
Traffic surveys

APPENDIX 2

Existing layout and operation (Site Layout Drawing 066/T/750D)



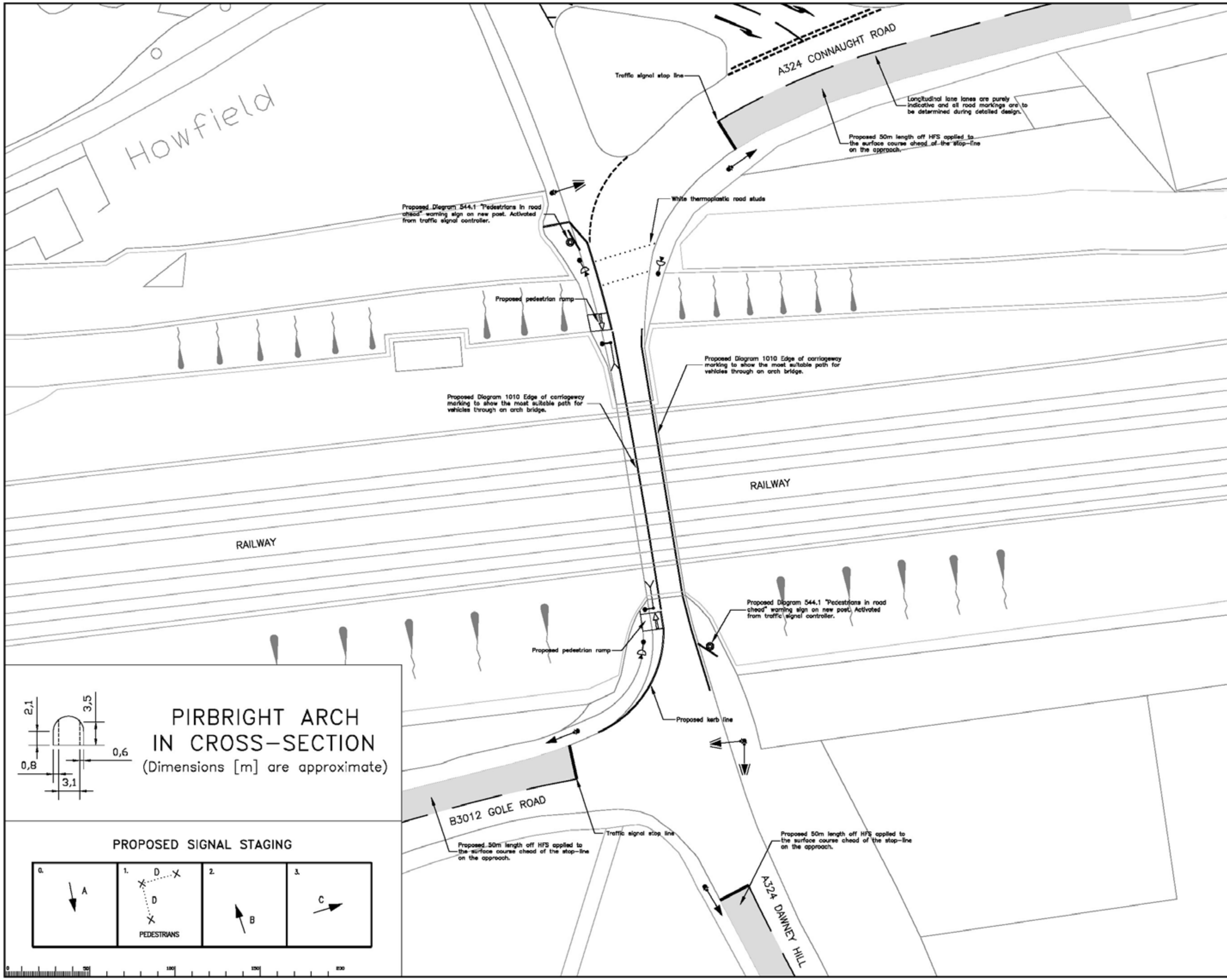
Drawing
A324/ B3012 PIRBRIGHT ARCH
CONNAUGHT ROAD, DAWNEY HILL

North Point	Manufacturer	Drawn	Sig.	Date	Drawing No.		
	SIEMENS	M.G.			0600/T/J750D		
	Cont'r Type: ST800	Checked: T.A.S.	Sig.	Date	Classification	Scale	Date Revised
	Dimming: NONE	Approved: G.R.B.	Sig.	Date	RECORD	1:500 APPROX.	17.03.03

SURREY
COUNTY COUNCIL
Sustainable Development
Head of Transportation:
C.M.Findlay,
B.Sc., M.Sc., C.Eng., F.I.C.E.

APPENDIX 3

Proposed Layouts and operation
Option 1 (Drg No 53625001 01)
Option 2 (Drg No 53625001 02)



Notes

LEGEND

- Three aspect signal with primary visor
- Three aspect signal with secondary visor
- Two aspect nearside pedestrian signals with separate push button (p.b)
- On–crossing detector with extension bracket

Rev					
Drawn + Sig.	Date	Check + Sig.	Date	Appro + Sig.	Date

Amendments

File Name
S:\project-current\3625\CAD-Drawings\3625_01.dwg

Project
A324/B3012
PIRBRIGHT ARCH
CONNAUGHT ROAD
DAWNEY HILL

Drawing
PROPOSED TRAFFIC SIGNAL
MODIFICATION
(PEDESTRIAN STAGE)

North point

Scale: 1:200[APPROX]

Drawn	G.P.B	Sig.		Date	23/01/2007
Checked by originator	C.J.F	Sig.		Date	24/01/2007
Approved	C.J.F	Sig.		Date	24/01/2007

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Sustainable Development

Project No. 53625001
Contract Sheet No. -
Drawing No. 3625/01
Rev.
Classification: PRESENTATION

02 Feb.07 – 10:37am

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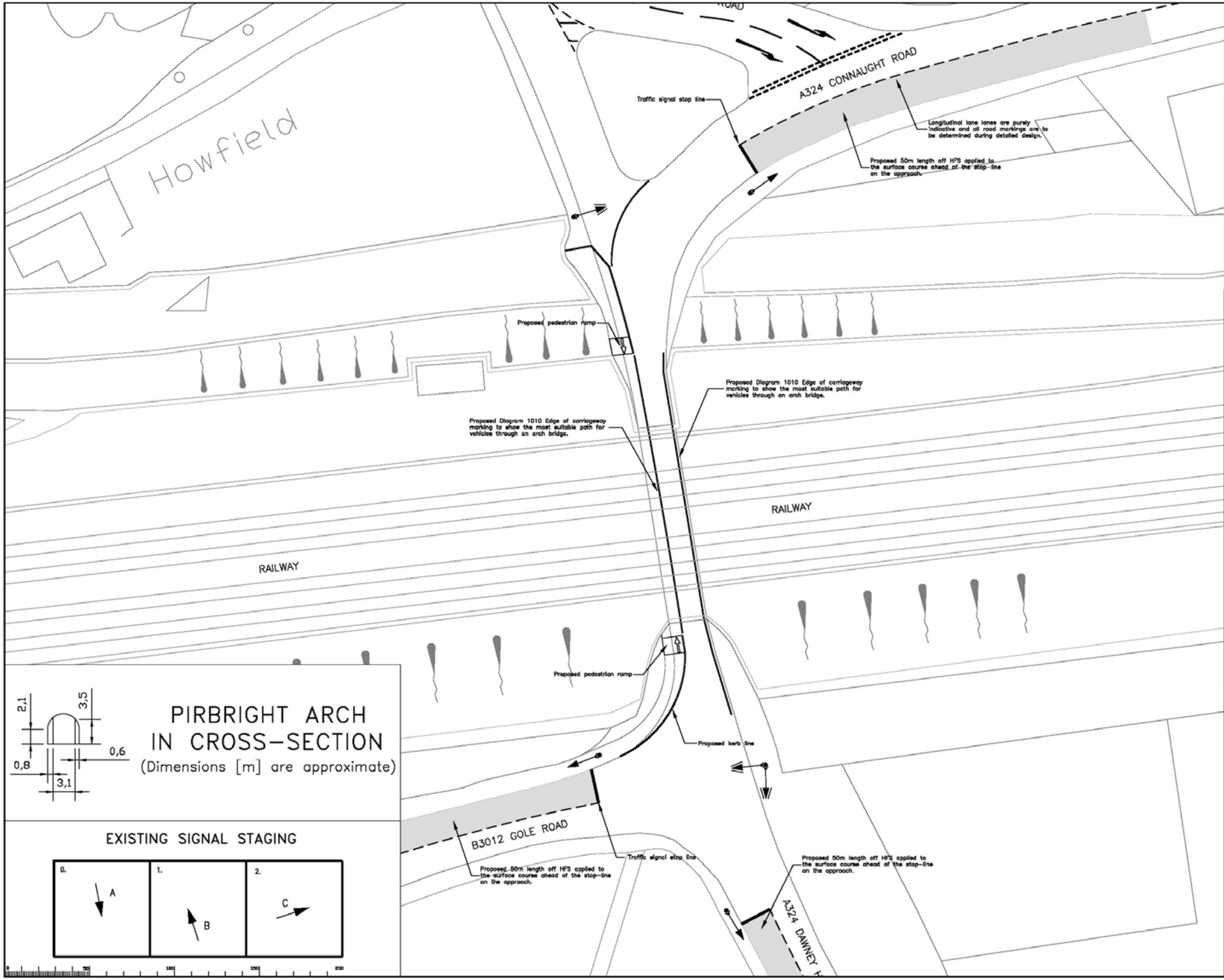

Notes

Rev					
Drawn + Sig.	Date	Check + Sig.	Date	Appro + Sig.	Date
Rev					
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Rev					
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Rev					
Drawn + Sig.	Date	Check + Sig.	Date	Appro + Sig.	Date

Amendments

File Name
S:\project-current\3625\CAD-Drawings\3625_02.dwg

Project
A324/B3012
PIRBRIGHT ARCH
CONNAUGHT ROAD
DAWNEY HILL

Drawing
PROPOSED KERB LINE
MODIFICATION
(EXISTING SIGNAL LAYOUT)

North point

Scale
1:200[APPROX]

Drawn	G.P.B	Sig.		Date	23/01/2007
Checked by originator	C.J.F	Sig.		Date	24/01/2007
Approved	C.J.F	Sig.		Date	24/01/2007

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Project No. 53625001
Contract Sheet No. -
Drawing No. 3625/02
Rev.
Classification PRESENTATION

A1

APPENDIX 4

Capacity Assessment – Queues and Delays

LINSIG results for Pirbright Arch

AM Peak									
LINK DESCRIPTION	**Flows /hr**	**Average Queue (veh)**				**Average Delay (min/veh)**			
		Existing at 120 sec Cycle Time (PRC= -14.5%)	**Proposed at 120 sec Cycle Time (PRC= -167.2%)**	**Proposed at 140 sec Cycle Time (PRC= -96.9 %)**	**Proposed at 160 sec Cycle Time (PRC= -67.0%)**	**Existing at 120 sec Cycle Time (PRC=-14.5%)**	**Proposed at 120 sec Cycle Time (PRC= -167.2%)**	**Proposed at 140 sec Cycle Time (PRC= -96.9%)**	**Proposed at 160 sec Cycle Time (PRC= -67.0%)**
Connaught Road	417	21	159	95	67	2	22	13	8
Dawney Hill	288	16	97	68	47	2	19	13	9
Gole Road	511	25	197	115	85	2	22	12	9

PM Peak									
LINK DESCRIPTION	**Flows/ hr**	**Average Queue (veh)**				**Average Delay (min/veh)**			
		Existing at 120 sec Cycle Time (PRC= -5.0%)	**Proposed at 120 sec Cycle Time (PRC= -149.4%)**	**Proposed at 140 sec Cycle Time (PRC= -83.7%)**	**Proposed at 160 sec Cycle Time (PRC= -52.7%)**	**Existing at 120 sec Cycle Time (PRC= -5.0%)**	**Proposed at 120 sec Cycle Time (PRC= -149.4%)**	**Proposed at 140 sec Cycle Time (PRC= -83.7%)**	**Proposed at 160 sec Cycle Time (PRC= -52.7%)**
Connaught Road	496	17	156	100	67	1.4	18	11	7
Dawney Hill	312	13	101	57	43	1.7	18	10	7
Gole Road	318	13	111	64	44	1.7	20	11	7

TABLE 1
LINSIG SUMMARY TABLE
DELAYS AND QUEUES

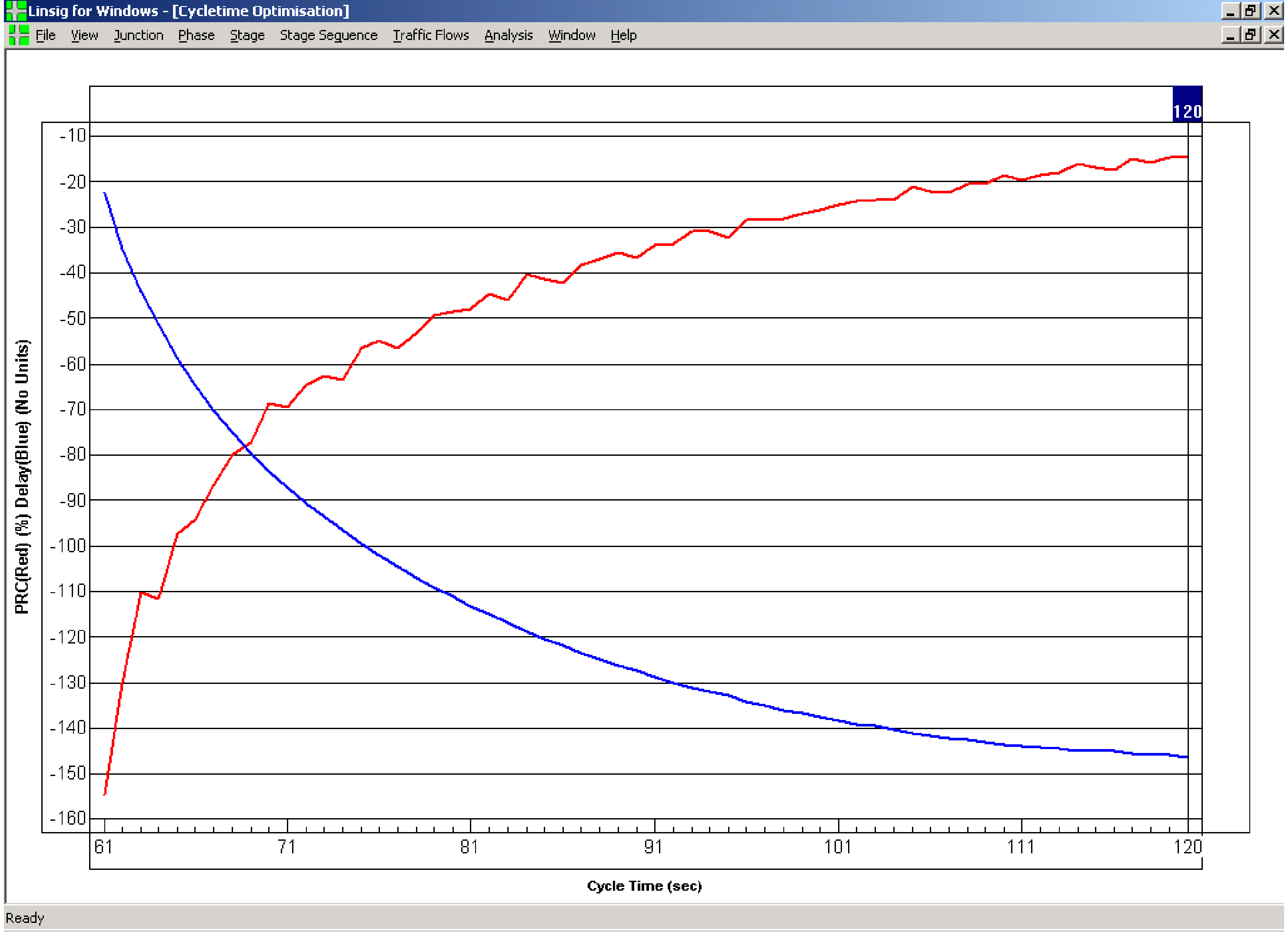

TABLE 2
A324 PIRBRIGHT ARCH
EXISTING LAYOUT AND OPERATION
CYCLE TIME/RESERVE CAPACITY TREND GRAPH

TABLE 3
A324 PIRBRIGHT ARCH
PROPOSED LAYOUT AND OPERATION
CYCLE TIME/RESERVE CAPACITY TREND GRAPH