

Project: Land South of Tilden Gill Road, Tenterden
Prepared by: Mark Fitzgerald
Approved by: Steve Giles
Date: 07/08/2018

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1.0 Introduction

- 1.1 Motion has been instructed by 127 Consultancies Ltd to undertake a review of junction capacity modelling at the Ashford Road/Beacon Oak Road in Tenterden.
- 1.2 Planning permission was granted (reference 14/01420/AS) at appeal for land south of Tilden Gill Road, Tenterden to provide up to 100 residential dwellings. As part of the planning permission, a mitigation measure is to be provided at the Ashford Road/Beacon Oak Road junction to upgrade it from a priority junction operation to a roundabout junction. Condition 8 of the appeal report states that:

"No dwelling shall be occupied until the roundabout at the junction of Ashford Road and Beacon Oak Road, referred to in section 15 of the Statement of Common Ground between the appellant and the Local Highway Authority, has been completed."
- 1.3 A planning application has been submitted to Ashford Borough Council (reference 18/00858/AS) to vary Condition 8 of the planning permission, proposing to alter the Ashford Road/Beacon Oak Road mitigation scheme from a roundabout junction to a traffic signal junction.
- 1.4 This Technical Note scrutinises the junction capacity modelling undertaken to accompany this application and contained within the 'Ashford Road/Beacon Oak Road Outline Junction Design Report' prepared by WSP in May 2018.
- 1.5 It is noted that in July 2018 a revised version of the WSP report was submitted to address comments raised by the Highway Officer at Kent County Council, with both the KCC comments and updated WSP report available on the Ashford Planning Portal. Within this report, the traffic signal junction design has been amended to widen the right turning lane facility from 2.2 metres to 2.61 metres and the Northbound lane widened to 3.2 metres from 3.06 metres. It is noted that the traffic modelling has not been updated between schemes and that the analysis described within this report is based on the previous version of the drawing (within the May 2018 report) due to the absence of scale bars and title blocks within the updated drawings.

2.0 Junction Capacity Modelling

Traffic Flows

- 2.1 A review of the traffic survey information contained within Appendix B of the WSP report has been undertaken and indicates that the traffic flows contained within the flow diagrams (Appendix C of the WSP report) appear accurate.
- 2.2 The WSP report states that TEMPro factors have been obtained for the Ashford District for minor rural road car drivers. However, given the location of the development site, i.e. to the south east of Tenterden, and the junction under assessment, which is located to the north of the town centre and south of St Michaels 'suburb' along the A28 Ashford Road, use of the rural category within TEMPro is questionable. TEMPro version 7.2 enables growth rates to be calculated based on Census mid-layer super output areas (MSOAs); the site is located within the Ashford 013 and 014 MSOAs. The car driver growth factor accounting for all areas and road types averaged between the 013 and 014 areas would be 1.0891 in the weekday morning and 1.0907 in the weekday evening peak hour.
- 2.3 It is noted that the weekday morning peak hour growth factor is below the 1.0893 stated within the WSP report, though the weekday evening peak hour growth factor is higher than the 1.0902 assessed by WSP. Nevertheless, it is considered that this increase of 0.0005 is unlikely to impact on the capacity of the junction, resulting in minimal changes to the traffic flows presented.
- 2.4 On this basis, the traffic flows modelled within the WSP assessment are regarded as acceptable.

Modelling Geometries

- 2.5 To assess the modelling geometries used within the assessment, WSP drawing 6107-WSP-00-XX-DR-TP-0007 P01 has been used. By printing this drawing at the appropriate scale, the drawing geometries can be checked and compared to the dimensions included within the plan. The revised drawing appended to the July 2018 submission cannot accurately be scaled because it is an extract of the full drawing, thereby removing the title block and scale.
- 2.6 It is noted that all lane widths and turning radii input to the model are similar to those values shown on the plan, hence for the purposes of this analysis the WSP input figures are used. Since the values are considered acceptable on the May 2018 version of the plan, it is assumed that they remain acceptable on the July 2018 version of the plan, although the absence of a scale bar makes any measurements from the revised plan impossible with the expected degree of accuracy.

Model Set Up

- 2.7 The LinSig model presented within Appendix G of the WSP report appears to replicate accurately the junction arrangement. Each arm is considered to have one lane, with additional storage in front of the stopline for right turners into Beacon Oak Road from Ashford Road (South).
- 2.8 Within the network layout diagram, it is noted that no pedestrian phases have been physically input to the model, though the required pedestrian intergreens and phases have been included.
- 2.9 It is noted that the geometries stated on the WSP drawing have not been included as the lane widths within the LinSig file. For example, Beacon Oak Road is dimensioned with a lane width of 3.64 metres though the model output file shows a width of 3.87 metres.
- 2.10 Whilst checking the modelling inputs, a review of the calculated junction intergreens has been undertaken. Measuring the conflict points between phases produces a number of differences between those stated within the WSP LinSig outputs and those measured from the plan, specifically relating to the pedestrian phases. TAL 5/05 indicates that the intergreen for a pedestrian phase terminating and a traffic phase starting would be the crossing distance divided by 1.2 (crossing speed in m/s) plus two seconds. Table 1 below summarises the intergreen values used within the WSP modelling, with suggested alternative values provided in red where calculated.

Phase	A	B	C	D	E	F
A	-	5	-	5	9 (8)	8 (7)
B	5	-	5	8 (7)	8 (7)	5
C	-	5	-	9 (8)	5	9 (7)
D	7 (9)	7 (9)	7 (9)	-	-	-
E	7 (10)	7 (10)	7 (10)	-	-	-
F	8 (10)	8 (10)	8 (10)	-	-	-

Table 2.1: Intergreen Values

- 2.11 To provide a robust assessment, both intergreen values have been assessed below to identify the capacity impacts on the operation of the junction.

Modelling Outputs

- 2.12 Modelling of the junction has been undertaken using LinSig Version 3 software. Two versions of the LinSig file have been created, one replicating the WSP assessment and one utilising the alternative geometries as listed on the WSP scheme drawing and the alternative intergreen matrix suggested in Table 2.1 above. Table 2.2 summarises the weekday morning peak hour junction operation, with Table 2.3 summarising the weekday evening peak hour scenarios. The LinSig outputs are included for reference at [Appendix A](#).

Arm	WSP Assessment Replication		Alternative Assessment	
	Degree of Saturation (%)	MMQ (PCU)	Degree of Saturation (%)	MMQ (PCU)
Ashford Road (North)	79.8	23.3	81.1	23.9
Beacon Oak Road	79.1	12.3	80.0	12.4
Ashford Road (South)	71.0	13.1	72.9	13.5

Table 2.2: Weekday Morning Peak Hour LinSig Comparison

Arm	WSP Assessment Replication		Alternative Assessment	
	Degree of Saturation (%)	MMQ (PCU)	Degree of Saturation (%)	MMQ (PCU)
Ashford Road (North)	70.9	18.1	72.1	18.4
Beacon Oak Road	69.9	9.3	70.7	9.4
Ashford Road (South)	66.6	15.0	69.4	15.5

Table 2.3: Weekday Evening Peak Hour LinSig Comparison

- 2.13 Tables 2.2 and 2.3 indicate that the alternative lane widths and intergreens increase the maximum degree of saturation from 79.8% on the Ashford Road (North) arm during the weekday morning peak hour to 81.1%. The impacts on queueing are considered to be minimal, with a maximum increase of 0.6 PCU on the Ashford Road (North) arm during the weekday morning peak hour.
- 2.14 On the basis of the above, the junction is considered to operate within capacity, with all observed queues predicted to pass through the junction each cycle.

3.0 Conclusion

- 3.1 Whilst several potential discrepancies can be identified in the WSP modelling assessment, it is considered that the junction would operate within capacity, indicating a maximum degree of saturation of 81.1%. Queues are expected to dissipate each cycle.

Appendix A

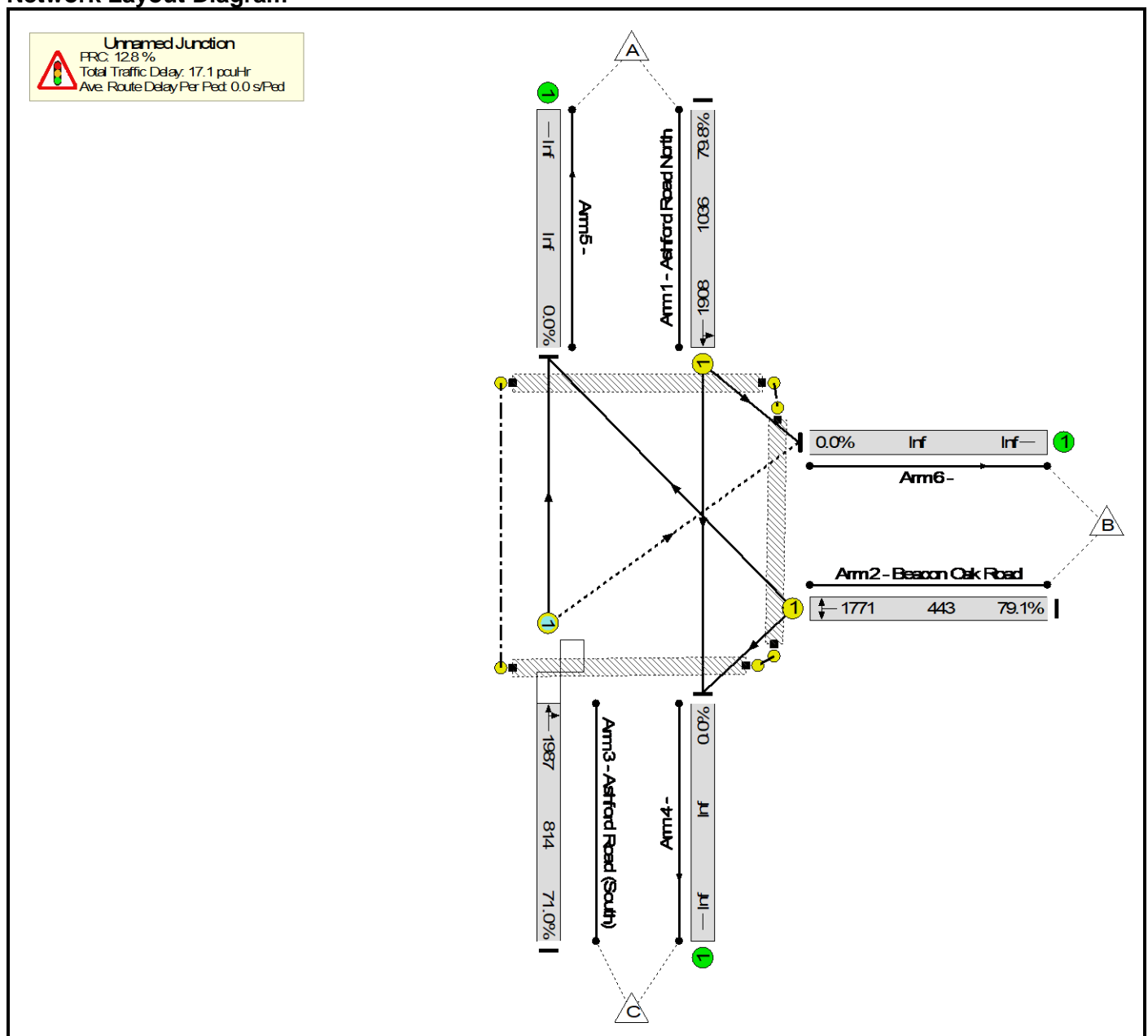
LinSig Outputs

WSP Modelling Output Replication
WSP Modelling Output Replication

User and Project Details

Project:	Proposed Signal Junction Design Review
Title:	Ashford Road/Beacon Oak Road
Location:	
Additional detail:	
File name:	L01-Ashford Road Beacon Oak Road LinSig 2018-08-02.lsg3x
Author:	
Company:	Motion
Address:	

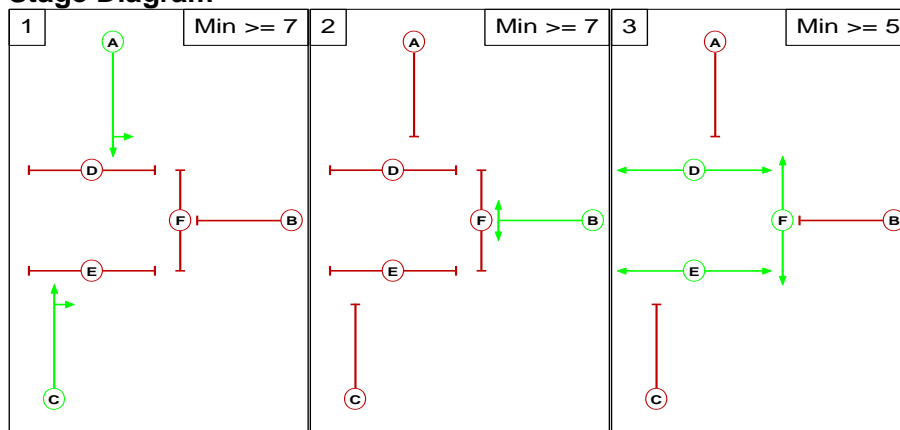
Scenario 1: '2023 with Development AM' (FG1: '2023 with Development AM', Plan 1: 'Network Control Plan 1')
Network Layout Diagram



Phase Intergreens Matrix

Terminating Phase	Starting Phase						
		A	B	C	D	E	F
	A		5	-	5	9	8
	B	5		5	8	8	5
	C	-	5		9	5	9
	D	7	7	7		-	-
	E	7	7	7	-		-
	F	8	8	8	-	-	

Stage Diagram



Lane Saturation Flows

Junction: Unnamed Junction								
Lane	Lane Width (m)	Gradient	Nearside Lane	Allowed Turns	Turning Radius (m)	Turning Prop.	Sat Flow (PCU/Hr)	Flared Sat Flow (PCU/Hr)
1/1 (Ashford Road North)	3.25	0.00	Y	Arm 4 Ahead	Inf	72.9 %	1908	1908
				Arm 6 Left	24.00	27.1 %		
2/1 (Beacon Oak Road)	3.87	0.00	Y	Arm 4 Left	9.00	29.1 %	1771	1771
				Arm 5 Right	13.00	70.9 %		
3/1 (Ashford Road (South))	4.11	0.00	Y	Arm 5 Ahead	Inf	87.0 %	1987	1987
				Arm 6 Right	9.80	13.0 %		
4/1				Infinite Saturation Flow			Inf	Inf
5/1				Infinite Saturation Flow			Inf	Inf
6/1				Infinite Saturation Flow			Inf	Inf

Stage Timings


Stage	1	2	3
Duration	62	28	5
Change Point	0	70	103

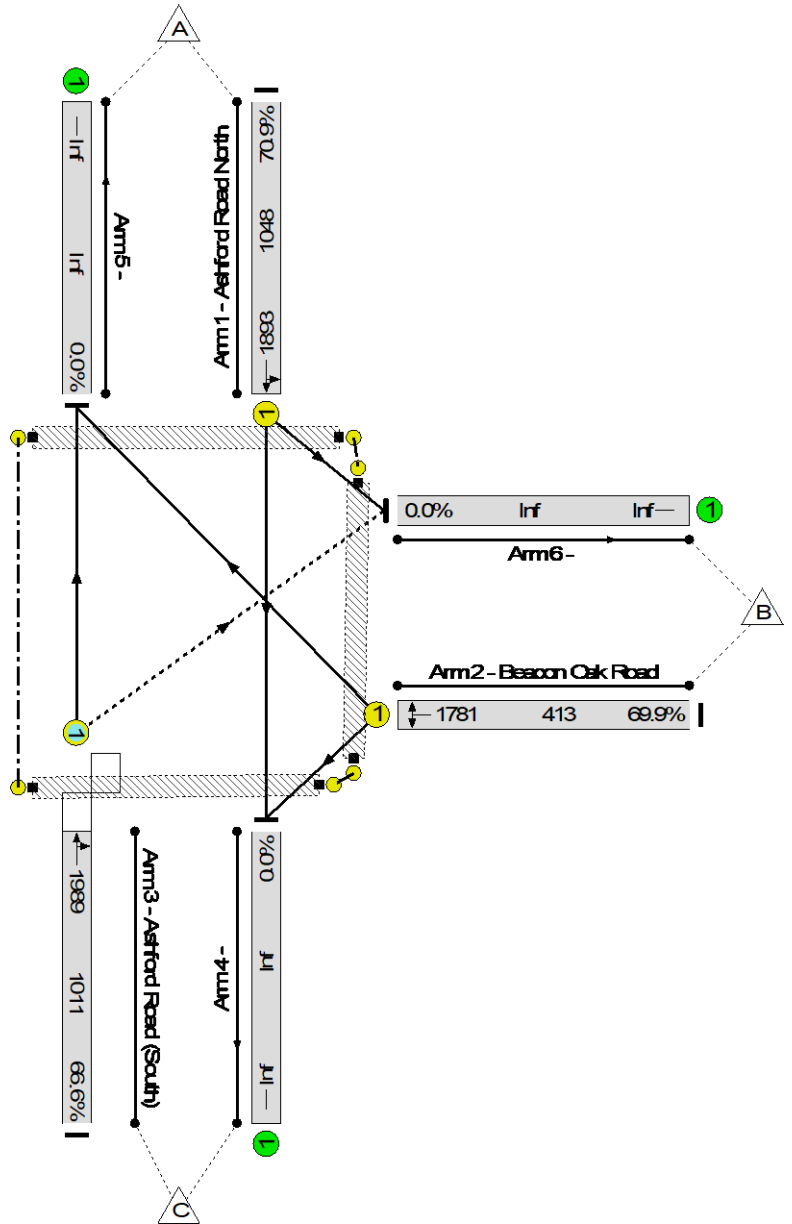
WSP Modelling Output Replication

Network Results

Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)
Network: Ashford Road/Beacon Oak Road	-	-	-		-	-	-	-	-	-	79.8%	74	0	1	17.1	-	-
Unnamed Junction	-	-	-		-	-	-	-	-	-	79.8%	74	0	1	17.1	-	-
1/1	Ashford Road North Ahead Left	U	A		1	62	-	827	1908	1036	79.8%	-	-	-	6.8	29.8	23.3
2/1	Beacon Oak Road Left Right	U	B		1	28	-	350	1771	443	79.1%	-	-	-	5.8	59.3	12.3
3/1	Ashford Road (South) Ahead Right	O	C		1	62	-	578	1987	814	71.0%	74	0	1	4.5	27.9	13.1
Ped Link: P1	Ashford Road (North) Peds	-	D		1	5	-	0	-	0	0.0%	-	-	-	-	-	-
Ped Link: P2	Beacon Oak Road Peds	-	F		1	8	-	0	-	0	0.0%	-	-	-	-	-	-
Ped Link: P3	Ashford Road (South) Peds	-	E		1	5	-	0	-	0	0.0%	-	-	-	-	-	-
		C1			PRC for Signalled Lanes (%): 12.8		12.8	Total Delay for Signalled Lanes (pcuHr): 17.10				17.10	Cycle Time (s): 116				
					PRC Over All Lanes (%): 12.8			Total Delay Over All Lanes(pcuHr): 17.10									

Network Layout Diagram

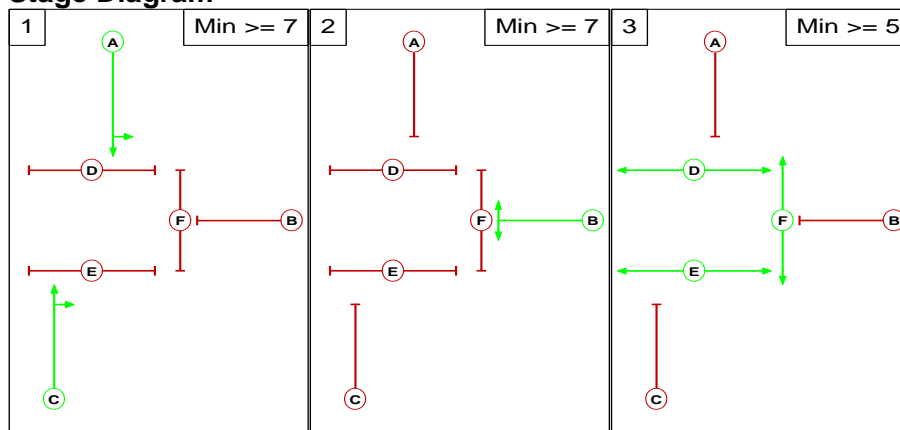

Unnamed Junction
 FRC: 28.9%
 Total Traffic Delay: 13.8 pcuHr
 Ave. Route Delay Per Ped: 0.0 sPed



Phase Intergreens Matrix

Terminating Phase	Starting Phase						
		A	B	C	D	E	F
	A		5	-	5	9	8
	B	5		5	8	8	5
	C	-	5		9	5	9
	D	7	7	7		-	-
	E	7	7	7	-		-
	F	8	8	8	-	-	

Stage Diagram



Lane Saturation Flows

Junction: Unnamed Junction								
Lane	Lane Width (m)	Gradient	Nearside Lane	Allowed Turns	Turning Radius (m)	Turning Prop.	Sat Flow (PCU/Hr)	Flared Sat Flow (PCU/Hr)
1/1 (Ashford Road North)	3.25	0.00	Y	Arm 4 Ahead	Inf	60.7 %	1893	1893
				Arm 6 Left	24.00	39.3 %		
2/1 (Beacon Oak Road)	3.87	0.00	Y	Arm 4 Left	9.00	17.3 %	1781	1781
				Arm 5 Right	13.00	82.7 %		
3/1 (Ashford Road (South))	4.11	0.00	Y	Arm 5 Ahead	Inf	87.7 %	1989	1989
				Arm 6 Right	9.80	12.3 %		
4/1				Infinite Saturation Flow			Inf	Inf
5/1				Infinite Saturation Flow			Inf	Inf
6/1				Infinite Saturation Flow			Inf	Inf

Stage Timings

Stage	1	2	3
Duration	61	25	5
Change Point	0	69	99

WSP Modelling Output Replication

Network Results

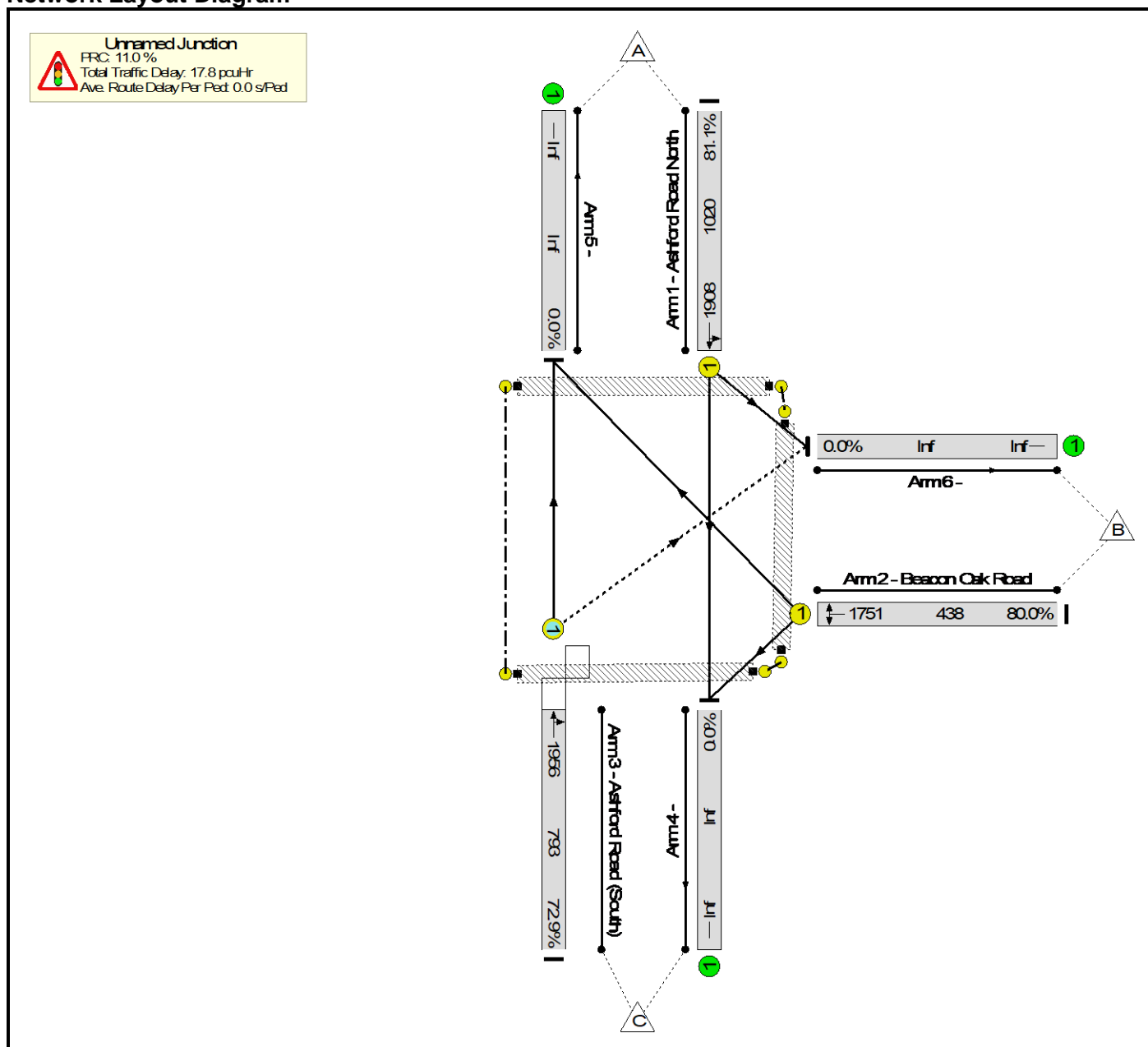
Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)				
Network: Ashford Road/Beacon Oak Road	-	-	-		-	-	-	-	-	-	70.9%	82	0	1	13.8	-	-				
Unnamed Junction	-	-	-		-	-	-	-	-	-	70.9%	82	0	1	13.8	-	-				
1/1	Ashford Road North Ahead Left	U	A		1	61	-	743	1893	1048	70.9%	-	-	-	5.0	24.2	18.1				
2/1	Beacon Oak Road Left Right	U	B		1	25	-	289	1781	413	69.9%	-	-	-	4.3	53.6	9.3				
3/1	Ashford Road (South) Ahead Right	O	C		1	61	-	674	1989	1011	66.6%	82	0	1	4.5	24.2	15.0				
Ped Link: P1	Ashford Road (North) Peds	-	D		1	5	-	0	-	0	0.0%	-	-	-	-	-	-				
Ped Link: P2	Beacon Oak Road Peds	-	F		1	8	-	0	-	0	0.0%	-	-	-	-	-	-				
Ped Link: P3	Ashford Road (South) Peds	-	E		1	5	-	0	-	0	0.0%	-	-	-	-	-	-				
C1		PRC for Signalled Lanes (%):		26.9		Total Delay for Signalled Lanes (pcuHr):		13.84		Cycle Time (s):		112		PRC Over All Lanes (%):		26.9		Total Delay Over All Lanes(pcuHr):		13.84	

Ashford Road/Beacon Oak Road Assessment - Alternative Intergreens
Ashford Road/Beacon Oak Road Assessment - Alternative Intergreens

User and Project Details

Project:	Proposed Signal Junction Design Review
Title:	Ashford Road/Beacon Oak Road
Location:	
Additional detail:	
File name:	L02-Ashford Road Beacon Oak Road LinSig MF Intergreens 2018-08-02.lsg3x
Author:	
Company:	Motion
Address:	

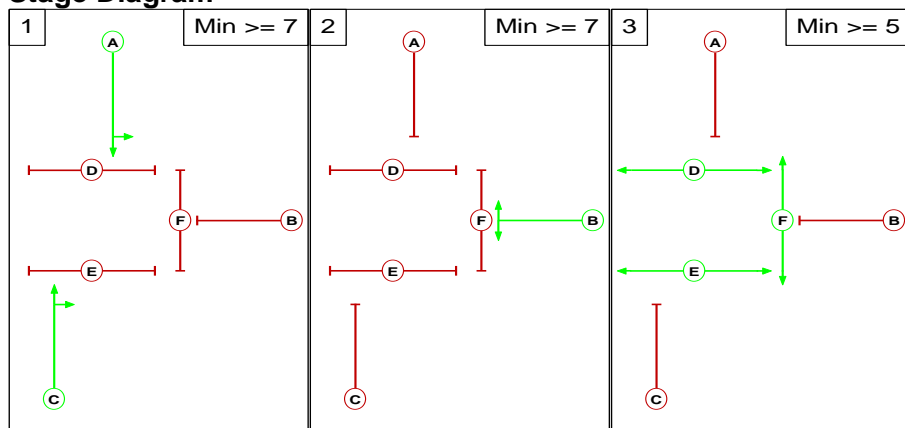
Scenario 1: '2023 with Development AM' (FG1: '2023 with Development AM', Plan 1: 'Network Control Plan 1')
Network Layout Diagram



Phase Intergreens Matrix

Terminating Phase	Starting Phase					
	A	B	C	D	E	F
A	-	5	-	5	8	7
B	5	-	5	7	7	5
C	-	5	-	8	5	7
D	9	9	9	-	-	-
E	10	10	10	-	-	-
F	10	10	10	-	-	-

Stage Diagram



Lane Saturation Flows

Junction: Unnamed Junction								
Lane	Lane Width (m)	Gradient	Nearside Lane	Allowed Turns	Turning Radius (m)	Turning Prop.	Sat Flow (PCU/Hr)	Flared Sat Flow (PCU/Hr)
1/1 (Ashford Road North)	3.25	0.00	Y	Arm 4 Ahead	Inf	72.9 %	1908	1908
				Arm 6 Left	24.00	27.1 %		
2/1 (Beacon Oak Road)	3.64	0.00	Y	Arm 4 Left	9.00	29.1 %	1751	1751
				Arm 5 Right	13.00	70.9 %		
3/1 (Ashford Road (South))	3.80	0.00	Y	Arm 5 Ahead	Inf	87.0 %	1956	1956
				Arm 6 Right	9.80	13.0 %		
4/1				Infinite Saturation Flow			Inf	Inf
5/1				Infinite Saturation Flow			Inf	Inf
6/1				Infinite Saturation Flow			Inf	Inf

Stage Timings


Stage	1	2	3
Duration	61	28	5
Change Point	0	71	104

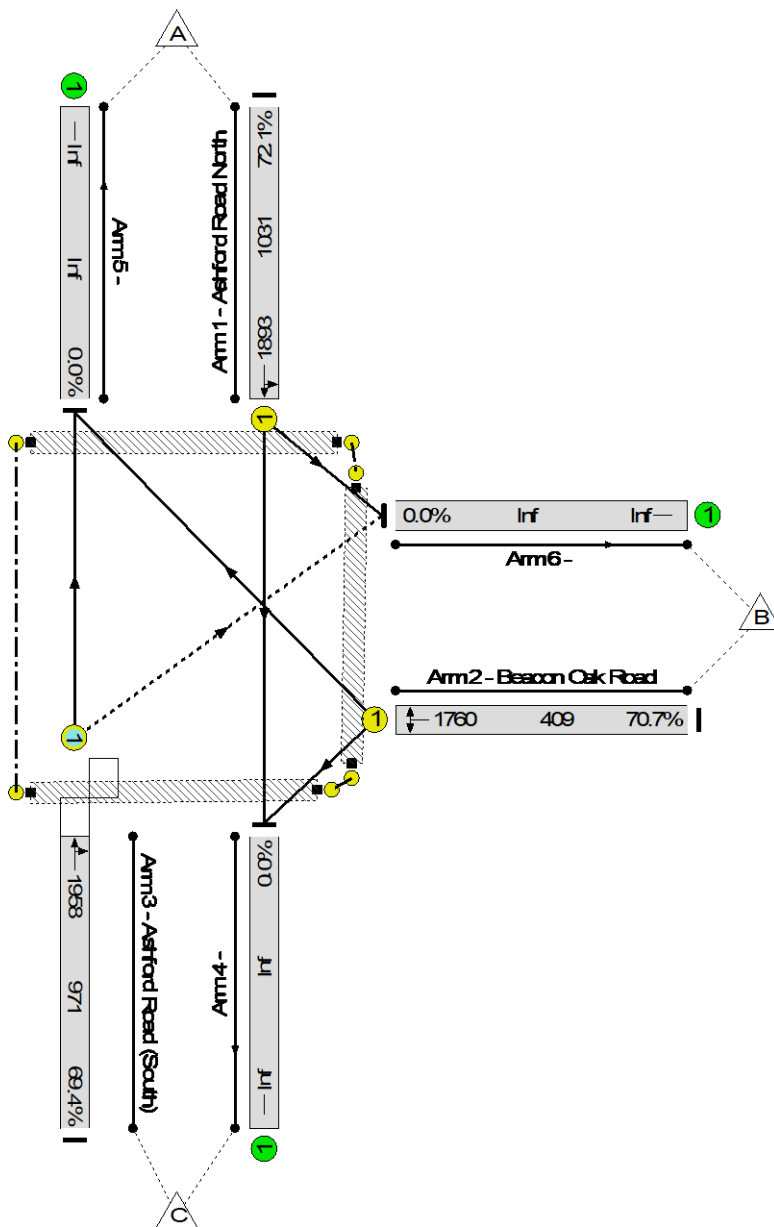
Ashford Road/Beacon Oak Road Assessment - Alternative Intergreens

Network Results

Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)		
Network: Ashford Road/Beacon Oak Road	-	-	-		-	-	-	-	-	-	81.1%	74	0	1	17.8	-	-		
Unnamed Junction	-	-	-		-	-	-	-	-	-	81.1%	74	0	1	17.8	-	-		
1/1	Ashford Road North Ahead Left	U	A		1	61	-	827	1908	1020	81.1%	-	-	-	7.2	31.3	23.9		
2/1	Beacon Oak Road Left Right	U	B		1	28	-	350	1751	438	80.0%	-	-	-	5.9	60.4	12.4		
3/1	Ashford Road (South) Ahead Right	O	C		1	61	-	578	1956	793	72.9%	74	0	1	4.7	29.5	13.5		
Ped Link: P1	Ashford Road (North) Peds	-	D		1	5	-	0	-	0	0.0%	-	-	-	-	-	-		
Ped Link: P2	Beacon Oak Road Peds	-	F		1	7	-	0	-	0	0.0%	-	-	-	-	-	-		
Ped Link: P3	Ashford Road (South) Peds	-	E		1	5	-	0	-	0	0.0%	-	-	-	-	-	-		
C1		PRC for Signalled Lanes (%):		11.0		PRC Over All Lanes (%):		11.0		Total Delay for Signalled Lanes (pcuHr):		17.81		Total Delay Over All Lanes(pcuHr):		17.81		Cycle Time (s): 116	

Network Layout Diagram

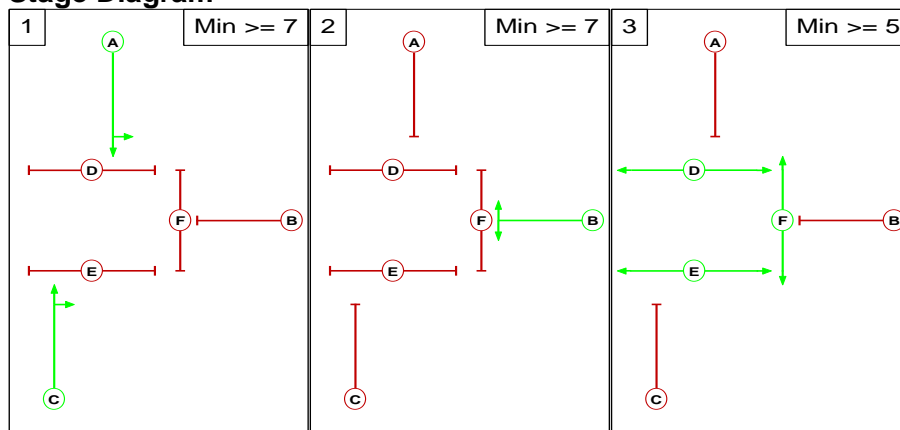

Unnamed Junction
 FRC: 24.9%
 Total Traffic Delay: 14.4 pcu/Hr
 Ave. Route Delay Per Ped: 0.0 s/Ped



Phase Intergreens Matrix

Terminating Phase	Starting Phase						
		A	B	C	D	E	F
	A		5	-	5	8	7
	B	5		5	7	7	5
	C	-	5		8	5	7
	D	9	9	9		-	-
	E	10	10	10	-		-
	F	10	10	10	-	-	

Stage Diagram



Lane Saturation Flows

Junction: Unnamed Junction								
Lane	Lane Width (m)	Gradient	Nearside Lane	Allowed Turns	Turning Radius (m)	Turning Prop.	Sat Flow (PCU/Hr)	Flared Sat Flow (PCU/Hr)
1/1 (Ashford Road North)	3.25	0.00	Y	Arm 4 Ahead	Inf	60.7 %	1893	1893
				Arm 6 Left	24.00	39.3 %		
2/1 (Beacon Oak Road)	3.64	0.00	Y	Arm 4 Left	9.00	17.3 %	1760	1760
				Arm 5 Right	13.00	82.7 %		
3/1 (Ashford Road (South))	3.80	0.00	Y	Arm 5 Ahead	Inf	87.7 %	1958	1958
				Arm 6 Right	9.80	12.3 %		
4/1				Infinite Saturation Flow			Inf	Inf
5/1				Infinite Saturation Flow			Inf	Inf
6/1				Infinite Saturation Flow			Inf	Inf

Stage Timings

Stage	1	2	3
Duration	60	25	5
Change Point	0	70	100

Ashford Road/Beacon Oak Road Assessment - Alternative Intergreens

Network Results

Item	Lane Description	Lane Type	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Mean Max Queue (pcu)		
Network: Ashford Road/Beacon Oak Road	-	-	-		-	-	-	-	-	-	72.1%	82	0	1	14.4	-	-		
Unnamed Junction	-	-	-		-	-	-	-	-	-	72.1%	82	0	1	14.4	-	-		
1/1	Ashford Road North Ahead Left	U	A		1	60	-	743	1893	1031	72.1%	-	-	-	5.2	25.3	18.4		
2/1	Beacon Oak Road Left Right	U	B		1	25	-	289	1760	409	70.7%	-	-	-	4.4	54.3	9.4		
3/1	Ashford Road (South) Ahead Right	O	C		1	60	-	674	1958	971	69.4%	82	0	1	4.8	25.8	15.5		
Ped Link: P1	Ashford Road (North) Peds	-	D		1	5	-	0	-	0	0.0%	-	-	-	-	-	-		
Ped Link: P2	Beacon Oak Road Peds	-	F		1	7	-	0	-	0	0.0%	-	-	-	-	-	-		
Ped Link: P3	Ashford Road (South) Peds	-	E		1	5	-	0	-	0	0.0%	-	-	-	-	-	-		
C1		PRC for Signalled Lanes (%):		24.9		PRC Over All Lanes (%):		24.9		Total Delay for Signalled Lanes (pcuHr):		14.41		Total Delay Over All Lanes(pcuHr):		14.41		Cycle Time (s): 112	