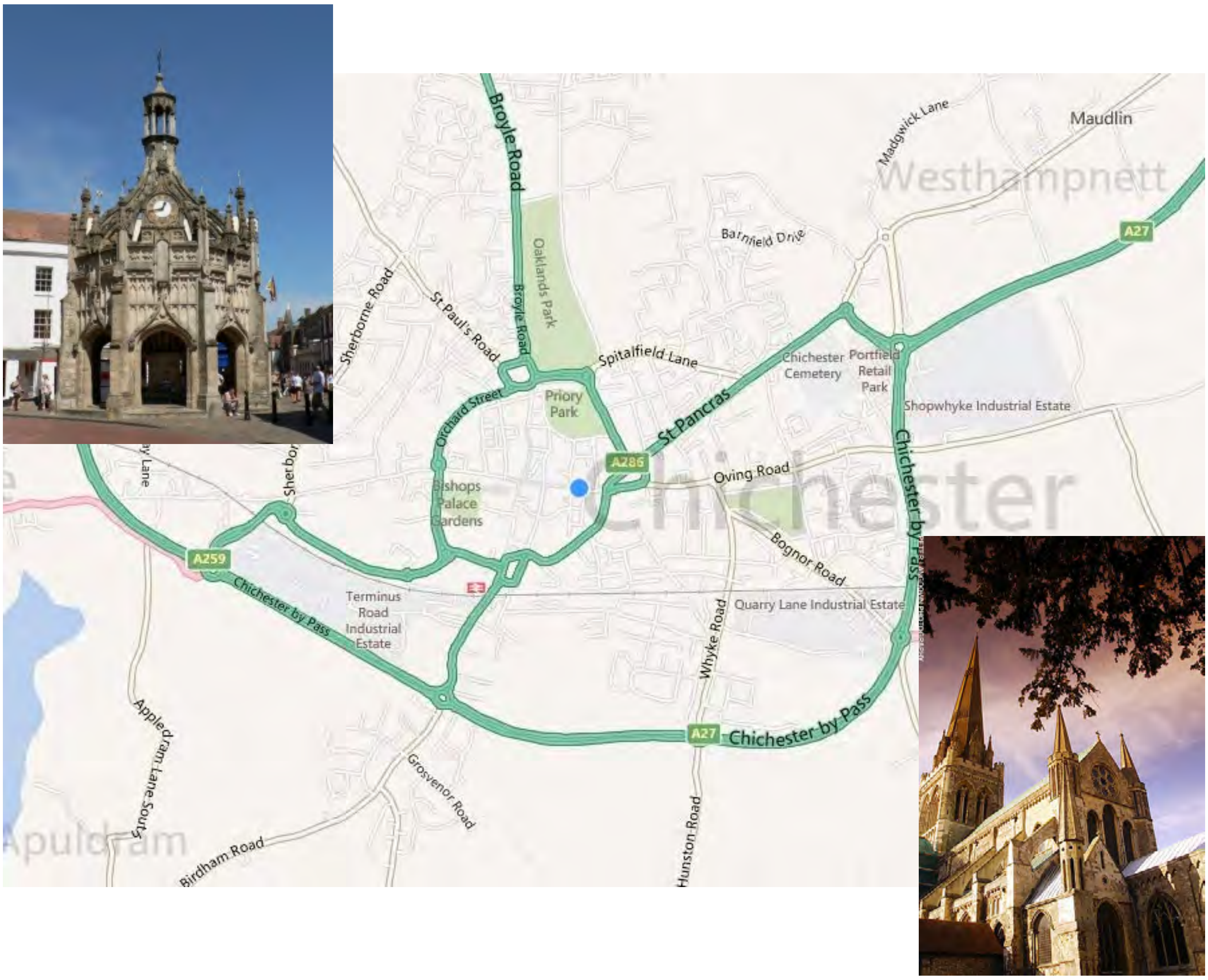
Chichester District Council – Local Plan

Transport Study of Strategic Development Options and Sustainable Transport Measures



FINAL REPORT - APPENDICES

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Appendix A Committed and Non Strategic Housing Allocation

Table A Committed Housing Developments

Development Scenarios (South of District)	SE Plan housing target (355 homes/yr)	Max housing target (440 homes/yr)	Preferred Option Mar 2013
Current housing commitment	1,990	1,990	1,990
Non-Strategic Allocations			
Chichester City (built-up area)			
Zone 8 (Housing sites identified in Chi City North Development Brief)	90	180	100
Zones 1-7, 9-58 (housing to be apportioned equally between zones)	210	240	235
Chichester City sub-total	300	420	335
Southbourne			
Zone 73	175	250	400
East Wittering & Bracklesham			
Zone 63	240	340	130
Selsey			
Zone 65 (Selsey North)	50	100	195
Zone 66 (Selsey South)	50	50	45
Selsey sub-total	100	150	240
Tangmere (non-strategic)			
Zone 84	75	100	20
Elsewhere in South of District			
Zone 58 (Stockbridge)			58
Zone 59 (Hunston)	23	33	35
Zone 60 (Apuldram & Donnington)	17	22	6
Zone 61 (Birdham)	23	33	65
Zone 62 (West Wittering)	23	33	70
Zone 64 (Sidlesham)	17	22	5
Zone 67 (Fishbourne East)	23	33	65
Zone 68 (Fishbourne West)	23	33	5
Zone 69 (Broadbridge & Bosham rural area)	17	22	35
Zone 70 (Bosham village)	23	33	35
Zone 71 (Chidham & Hambrook)	17	22	35
Zone 72 (West Thorney)			0
Zone 75 (Westbourne)	23	33	45
Zone 81 (Westhampnett)	23	33	10
Zone 82 (Oving)	17	22	5
Zone 83 (North Mundham & Runcton)	23	33	35
Zone 87 (Boxgrove)	23	33	35
Elsewhere in South of District sub-total	310	440	544
Sub-Total	*1,200*	*1,700*	*1,669*

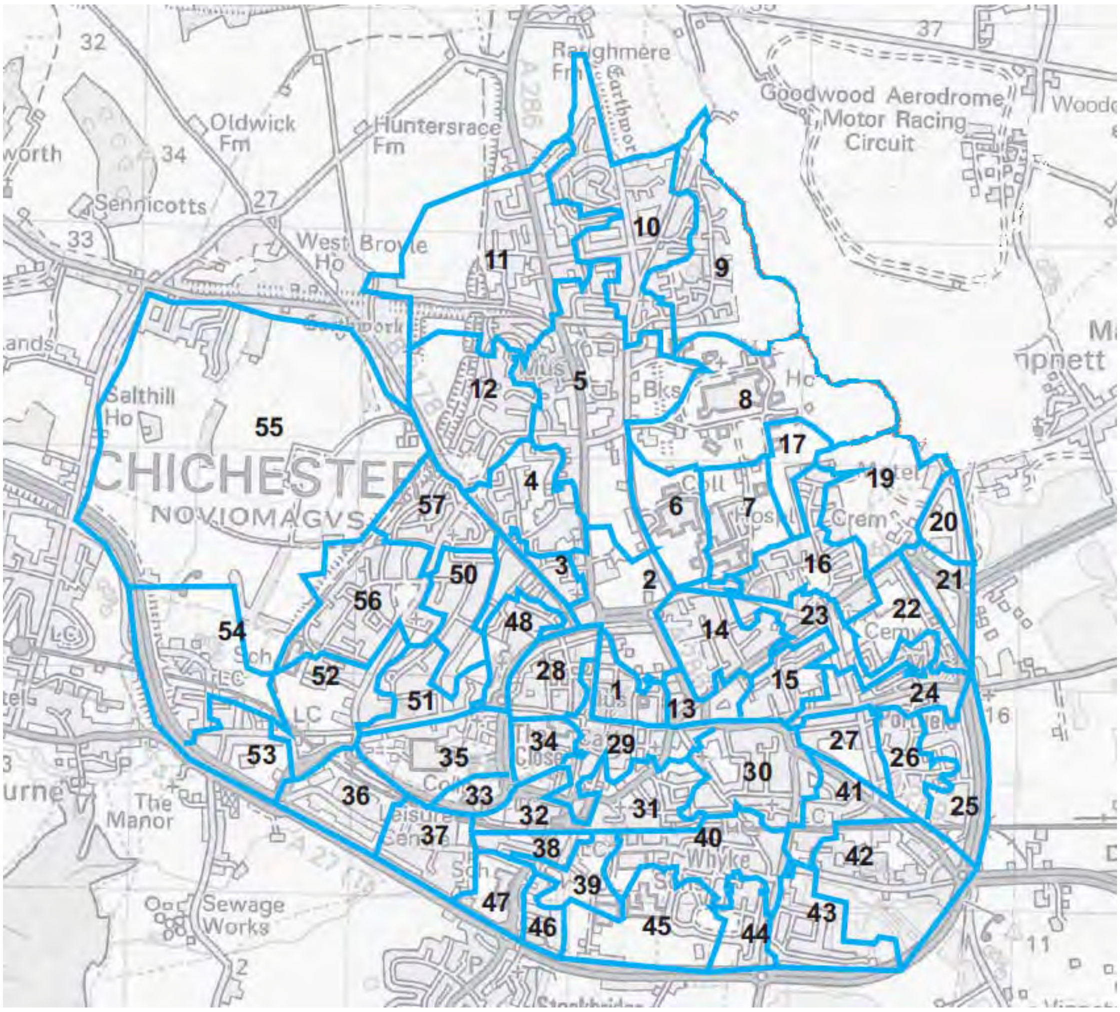

Figure A CATM zones in Chichester

Zone	Key sites	District		Housing
1		Chichester	Chichester Dev	90
4		West Ward	Chichester Dev	4
5	Rousillon Barracks	Chichester	Chichester Dev	244
7		Chichester	Chichester Dev	0
8	Graylingwell	Chichester	Chichester Dev	593
10		Chichester	Chichester Dev	22
11		Chichester	Chichester Dev	26
13		Chichester	Chichester Dev	92
14		Chichester	Chichester Dev	85
15		Chichester	Chichester Dev	4
17		Chichester	Chichester Dev	5
18		Chichester	Chichester Dev	34
19		Chichester	Chichester Dev	46
21		Chichester	Chichester Dev	0
22		East Ward	Chichester Dev	16
23		Chichester	Chichester Dev	3
24		Chichester	Chichester Dev	4
26		Chichester	Chichester Dev	3
28		Chichester	Chichester Dev	30
29		Chichester	Chichester Dev	33
30		Chichester	Chichester Dev	39
31		Chichester	Chichester Dev	25
32		Chichester	Chichester Dev	1
34		Chichester	Chichester Dev	0
41		Chichester	Chichester Dev	57
42		Chichester	Chichester Dev	1
44		Chichester	Chichester Dev	67
46		Chichester	Chichester Dev	109
51		Chichester	Chichester Dev	2
54		Chichester	Chichester Dev	86
55		Chichester	Chichester Dev	2
56		Chichester	Chichester Dev	6
58		Donnington	Chichester Rural Dev	35
59		Hunston	Chichester Rural Dev	10
60		Appledram	Chichester Rural Dev	17
61		Birdham	Chichester Rural Dev	50
62		East Wittering	East Wittering Dev	35
63		East Wittering	East Wittering Dev	42
64		Sidlesham	Chichester Rural Dev	11
65		Selsey	Selsey Dev	12
66		Selsey	Selsey Dev	42
67		Fishbourne	Chichester Rural Dev	29
68		Fishbourne	Chichester Rural Dev	13
69		Bosham	Chichester Rural Dev	3
70		Bosham	Chichester Rural Dev	24
71		Chidham	Chichester Rural Dev	7
73		Southbourne	Chichester Rural Dev	141
74		Funtington	Chichester Rural Dev	24
75		Westbourne	Chichester Rural Dev	45
76		Compton	Chichester Rural Dev	3
77		Westbourne	Chichester Rural Dev	2
78		Funtington	Chichester Rural Dev	48
79		Lavant	Chichester Rural Dev	48
80		West Dean	Chichester Rural Dev	18
81		Westhampnett	Chichester Rural Dev	51
82		Oving	Chichester Rural Dev	6
83		North Mundham	Chichester Rural Dev	9
84		Tangmere	Tangmere Dev	322
87		Eartham/Boxgrove/East Dean	Chichester Rural Dev	11
88		Eartham/Boxgrove/East Dean	Arun Rural Dev	2
91		Ford	Arun Rural Dev	93
92		Barnham/Eastergate/Westegate	Arun Rural Dev	46
136		North West Bognor Regis	Bognor Regis Dev	0
141		Bognor Regis urban area (Bersted)	Bognor Regis Dev	662
146		Bognor Regis urban area (Bersted)	Bognor Regis Dev	21
147		Bognor Regis urban area (Bersted)	Bognor Regis Dev	11
148		Bognor Regis urban area (Bersted)	Bognor Regis Dev	6
151		Bognor Regis urban area (Felpham)	Bognor Regis Dev	489
153		Bognor Regis urban area (Felpham)	Bognor Regis Dev	6
169		West Marden	Petersfield Dev	11
170		Harting	South Harting Dev	37
171		Midhurst	Midhurst Dev	612
174		Petowrth/Kirdford	Petworth Dev	176
175		Easebourne	Easebourne Dev	23
177		Easebourne	Billingshurst Dev	66
184		Littlehampton urban area + Ferring (Toddington)	Littlehampton urban area + Ferring (Toddington) Dev	1162
185		Angmering/Arundel	Angmering/Arundel Dev	117
186		Angmering/Arundel	Angmering/Arundel Dev	4
194		Southwick	East Grinstead Dev	6
197		Southwick	Chichester Dev	44
BRUA		Bognor Regis urban area	Bognor Regis Dev	466

Table B Committed Housing Developments

Appendix B Detailed Model Output

1.1 Non Mitigation Scenarios

Development Scenarios (South of District)	Low housing target			High housing target					Max housing target	
	1A	1B	1C	2A	2B	2C	2D	2E	3A	3B
Shopwyke	600	600	500	600	600	600	500	-	600	600
North East of Chichester (Westhampnett)	500	-	850	1,000	500	-	1,400	1,367	1,400	1,400
Tangmere	800	800	500	1,500	1,500	1,500	1,000	1,567	-	1,600
West of Chichester	-	500	500	-	500	1,000	1,600	1,566	1,600	1,600
Total Strategic sites	**1,900**	**1,900**	**2,350**	**3,100**	**3,100**	**3,100**	**4,500**	**4,500**	**3,600**	**5,200**
Total Non Strategic Sites	**1,350**	**1,350**	**900**	**2,300**	**2,300**	**2,300**	**900**	**900**	**2,500**	**900**
Additional employment floor space (sq.m)	**65,000**	**65,000**	**65,000**	**108,000**	**108,000**	**108,000**	**108,000**	**108,000**	**122,000**	**122,000**

Table C Housing numbers for development sites

The higher relative sub-totals in Option 1C, 2D and 3B are made possible by the non-strategic housing quantum being reduced pro rata.

1.2 Average Trip Length from each Strategic Site

Time Period	Tangmere	West of Chichester	North East Chichester (Westh'nett)	Shopwyke
AM	24	9	12	15
PM	23	8	11	14

Table D Average Trip Length (km) – Maximum Housing with A27 Mitigation

1.3 Journey Times across Chichester

The following tables show the journey times for no mitigation and with mitigation scenarios for the AM and PM peak hour.

																Mitigation		Mitigation & Smarter Choices	
			Base 2009	2031 Baseline	2031 Non Strategic Low	2031 Non Strategic High	1A	1B	1C	2A	2B	2C	2D	2E	3A	3B	SE Plan	Maximum	SE Plan	Maximum
1	A27 Tangmere to Fishbourne	WB	11.0	12.4	12.4	12.0	13.0	13.0	13.2	13.1	13.0	13.1	13.8	14.1	13.0	14.2	13.3	13.6	12.8	13.2
2	A27 Fishbourne to Tangmere	EB	11.2	14.0	14.0	14.0	14.6	14.6	14.4	14.9	15.0	15.1	15.5	15.7	15.4	16.0	12.0	12.2	12.1	12.2
3	A259/B2178 Drayton to West Broyle	NB	15.7	20.9	21.4	21.4	23.0	23.6	23.3	24.2	23.9	24.2	25.0	24.3	24.8	25.4	23.9	24.9	20.9	22.2
4	A259/B2178 West Broyle to Drayton	SB	12.7	15.5	15.5	15.5	16.1	16.2	16.3	16.3	16.3	16.3	17.0	16.6	17.2	17.2	18.0	18.2	15.6	16.0
5	B2145 Hunston to Whyke	NB	9.7	13.6	14.8	16.0	17.4	17.3	16.7	18.1	18.2	18.5	18.6	18.1	20.0	19.5	13.5	13.4	12.0	12.3
6	B2145 Whyke to Hunston	SB	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.5	5.4	5.4	5.5	5.8	5.9	5.5	5.6
7	A286 Birdham Road to Lavant	NB	17.0	20.7	21.9	23.1	23.9	23.9	23.4	24.6	24.8	25.2	25.1	24.9	27.0	25.2	21.2	21.5	19.2	19.3
8	A286 Lavant to Birdham Road	SB	15.7	16.7	16.6	16.6	17.2	17.5	17.4	17.7	17.6	17.6	18.4	18.2	18.2	18.7	17.8	18.1	16.0	16.4
9	A259/A285 Fishbourne to Portfield	EB	15.5	19.3	19.3	19.8	19.8	20.0	19.8	20.1	20.1	20.4	20.4	20.3	21.0	20.7	18.6	18.9	15.6	16.0
10	A259/A285 Portfield to Fishbourne	WB	11.9	14.3	14.1	14.1	15.1	15.1	15.1	15.5	15.4	15.6	16.4	15.8	15.8	16.6	16.7	17.0	15.2	15.7
	%age Difference from Baseline																			
1	A27 Tangmere to Fishbourne	WB			0.8%	-2.6%	5.3%	4.9%	6.7%	6.1%	5.5%	6.4%	11.5%	14.0%	5.5%	15.1%	8.0%	9.9%	3.4%	6.8%
2	A27 Fishbourne to Tangmere	EB			0.2%	0.3%	4.2%	4.5%	3.3%	6.7%	7.2%	8.3%	11.0%	12.5%	9.9%	14.6%	-13.9%	-12.8%	-13.5%	-12.8%
3	A259/B2178 Drayton to West Broyle	NB			2.1%	2.3%	10.0%	13.0%	11.3%	15.6%	14.3%	15.5%	19.5%	15.9%	18.4%	21.1%	14.2%	19.1%	0.0%	5.8%
4	A259/B2178 West Broyle to Drayton	SB			0.3%	0.1%	3.7%	4.2%	4.8%	5.0%	5.4%	5.0%	9.5%	6.8%	11.0%	10.9%	16.0%	17.5%	0.5%	3.4%
5	B2145 Hunston to Whyke	NB			9.0%	17.9%	27.6%	27.4%	22.7%	33.3%	33.7%	36.0%	36.9%	32.8%	47.3%	43.2%	-0.5%	-1.9%	-11.5%	-9.8%
6	B2145 Whyke to Hunston	SB			0.0%	0.0%	1.4%	1.3%	1.4%	1.7%	1.4%	1.3%	2.0%	0.8%	1.0%	2.6%	9.2%	9.6%	3.6%	3.8%
7	A286 Birdham Road to Lavant	NB			5.9%	11.9%	15.5%	15.8%	13.1%	19.1%	20.3%	22.1%	21.3%	20.3%	30.6%	21.9%	2.5%	4.2%	-7.2%	-6.6%
8	A286 Lavant to Birdham Road	SB			-0.8%	-0.9%	2.9%	4.8%	4.2%	5.5%	5.1%	5.3%	9.8%	9.1%	8.8%	11.6%	6.5%	8.3%	-4.6%	-2.3%
9	A259/A285 Fishbourne to Portfield	EB			0.2%	2.4%	2.8%	3.9%	2.5%	4.3%	4.1%	5.5%	5.8%	5.2%	8.8%	7.5%	-3.5%	-1.9%	-18.9%	-16.9%
10	A259/A285 Portfield to Fishbourne	WB			-1.4%	-1.7%	5.6%	5.5%	5.0%	8.0%	7.6%	8.8%	14.7%	10.5%	9.8%	15.5%	16.6%	18.6%	6.2%	9.8%
	Difference from Baseline																			
1	A27 Tangmere to Fishbourne	WB			0.1	-0.3	0.7	0.6	0.8	0.8	0.7	0.8	1.4	1.7	0.7	1.9	1.0	1.2	0.4	0.8
2	A27 Fishbourne to Tangmere	EB			0.0	0.0	0.6	0.6	0.5	0.9	1.0	1.2	1.5	1.7	1.4	2.0	-2.0	-1.8	-1.9	-1.8
3	A259/B2178 Drayton to West Broyle	NB			0.4	0.5	2.1	2.7	2.4	3.3	3.0	3.2	4.1	3.3	3.9	4.4	3.0	4.0	-0.0	1.2
4	A259/B2178 West Broyle to Drayton	SB			0.0	0.0	0.6	0.7	0.7	0.8	0.8	0.8	1.5	1.1	1.7	1.7	2.5	2.7	0.1	0.5
5	B2145 Hunston to Whyke	NB			1.2	2.4	3.8	3.7	3.1	4.5	4.6	4.9	5.0	4.5	6.4	5.9	-0.1	-0.3	-1.6	-1.3
6	B2145 Whyke to Hunston	SB			0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.5	0.5	0.2	0.2
7	A286 Birdham Road to Lavant	NB			1.2	2.5	3.2	3.3	2.7	3.9	4.2	4.6	4.4	4.2	6.3	4.5	0.5	0.9	-1.5	-1.4
8	A286 Lavant to Birdham Road	SB			-0.1	-0.2	0.5	0.8	0.7	0.9	0.9	0.9	1.6	1.5	1.5	1.9	1.1	1.4	-0.8	-0.4
9	A259/A285 Fishbourne to Portfield	EB			0.0	0.5	0.5	0.7	0.5	0.8	0.8	1.1	1.1	1.0	1.7	1.4	-0.7	-0.4	-3.7	-3.3
10	A259/A285 Portfield to Fishbourne	WB			-0.2	-0.2	0.8	0.8	0.7	1.2	1.1	1.3	2.1	1.5	1.4	2.2	2.4	2.7	0.9	1.4

Table E Journey Times for all Scenarios – AM Peak Hour

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			Base 2009	2031 Baseline	2031 Non Strategic Low	2031 Non Strategic High	1A	1B	1C	2A	2B	2C	2D	2E	3A	3B	Mitigation SE Plan	Mitigation Maximum	Mitigation & Smarter Choices SE Plan	Mitigation & Smarter Choices Maximum
1	A27 Tangmere to Fishbourne	WB	13.0	12.8	12.4	12.0	14.4	14.2	14.2	14.7	14.7	14.5	14.9	14.1	14.7	15.1	13.7	13.7	13.3	13.6
2	A27 Fishbourne to Tangmere	EB	10.5	14.9	14.0	14.0	15.6	15.6	15.5	16.2	16.1	16.0	16.1	16.1	16.3	16.4	13.0	13.1	12.5	12.7
3	A259/B2178 Drayton to West Broyle	NB	18.4	31.7	21.4	21.4	33.5	33.5	34.0	34.9	34.3	34.2	35.6	36.5	34.9	36.9	32.5	34.3	26.3	27.3
4	A259/B2178 West Broyle to Drayton	SB	16.6	22.9	15.5	15.5	24.6	24.6	24.2	24.1	24.4	24.1	23.5	23.0	23.1	23.9	21.2	21.5	19.5	19.0
5	B2145 Hunston to Whyke	NB	6.0	8.9	14.8	16.0	10.5	10.5	9.9	11.2	11.1	11.1	10.7	12.3	11.2	11.3	6.5	7.2	6.1	6.2
6	B2145 Whyke to Hunston	SB	8.0	9.9	5.4	5.4	10.3	10.3	10.3	9.7	9.7	9.7	10.5	11.4	9.7	11.2	5.7	5.7	5.7	5.7
7	A286 Birdham Road to Lavant	NB	12.4	19.8	21.9	23.1	21.9	22.4	22.3	22.4	23.3	23.3	23.9	24.0	24.4	24.2	17.2	19.0	13.7	15.7
8	A286 Lavant to Birdham Road	SB	18.5	27.4	16.6	16.6	28.2	28.3	28.4	28.7	28.9	28.7	29.2	29.3	29.6	29.9	21.5	22.6	18.7	19.1
9	A259/A285 Fishbourne to Portfield	EB	14.9	25.7	19.3	19.8	26.4	26.5	26.6	26.8	27.0	26.3	27.2	28.0	27.3	27.9	20.2	21.2	16.7	17.5
10	A259/A285 Portfield to Fishbourne	WB	17.7	26.0	14.1	14.1	26.7	26.5	27.0	27.2	27.2	26.5	27.2	27.6	27.0	27.5	24.3	26.3	17.3	19.6
	%age Difference from Baseline																			
1	A27 Tangmere to Fishbourne	WB			-3.1%	-6.3%	12.1%	10.8%	10.4%	14.5%	14.1%	13.0%	15.7%	9.6%	14.6%	17.5%	6.8%	7.0%	3.9%	6.1%
2	A27 Fishbourne to Tangmere	EB			-6.0%	-5.9%	4.8%	4.5%	4.2%	8.6%	7.9%	7.3%	7.8%	7.8%	9.3%	9.8%	-12.6%	-11.8%	-16.0%	-14.8%
3	A259/B2178 Drayton to West Broyle	NB			-32.5%	-32.4%	5.9%	5.8%	7.2%	10.2%	8.2%	8.0%	12.3%	15.2%	10.2%	16.6%	2.5%	8.3%	-17.0%	-13.7%
4	A259/B2178 West Broyle to Drayton	SB			-32.2%	-32.3%	7.2%	7.5%	5.7%	5.0%	6.5%	5.1%	2.6%	0.5%	0.7%	4.3%	-7.7%	-6.2%	-14.9%	-17.1%
5	B2145 Hunston to Whyke	NB			66.9%	80.6%	18.6%	17.6%	11.4%	25.5%	25.1%	25.2%	19.9%	38.9%	25.6%	27.2%	-26.9%	-19.5%	-31.6%	-30.4%
6	B2145 Whyke to Hunston	SB			-46.0%	-46.0%	3.7%	3.7%	4.1%	-2.4%	-1.8%	-2.7%	5.5%	14.4%	-2.4%	12.6%	-42.5%	-42.3%	-42.6%	-42.6%
7	A286 Birdham Road to Lavant	NB			10.3%	16.6%	10.6%	12.9%	12.2%	13.1%	17.5%	17.7%	20.3%	21.1%	22.8%	22.2%	-13.4%	-4.1%	-31.0%	-21.0%
8	A286 Lavant to Birdham Road	SB			-39.4%	-39.5%	2.8%	3.5%	3.9%	4.8%	5.4%	4.7%	6.5%	7.1%	7.9%	9.1%	-21.5%	-17.7%	-31.8%	-30.2%
9	A259/A285 Fishbourne to Portfield	EB			-24.8%	-23.1%	2.6%	3.1%	3.4%	4.2%	5.0%	2.5%	5.9%	9.0%	6.3%	8.5%	-21.5%	-17.5%	-35.0%	-32.0%
10	A259/A285 Portfield to Fishbourne	WB			-45.5%	-45.7%	2.7%	2.2%	3.8%	4.9%	4.6%	2.0%	4.8%	6.3%	4.1%	6.0%	-6.4%	1.2%	-33.2%	-24.4%
	Difference from Baseline																			
1	A27 Tangmere to Fishbourne	WB			-0.4	-0.8	1.6	1.4	1.3	1.9	1.8	1.7	2.0	1.2	1.9	2.2	0.9	0.9	0.5	0.8
2	A27 Fishbourne to Tangmere	EB			-0.9	-0.9	0.7	0.7	0.6	1.3	1.2	1.1	1.2	1.2	1.4	1.5	-1.9	-1.8	-2.4	-2.2
3	A259/B2178 Drayton to West Broyle	NB			-10.3	-10.3	1.9	1.8	2.3	3.2	2.6	2.5	3.9	4.8	3.2	5.3	0.8	2.6	-5.4	-4.3
4	A259/B2178 West Broyle to Drayton	SB			-7.4	-7.4	1.7	1.7	1.3	1.2	1.5	1.2	0.6	0.1	0.2	1.0	-1.8	-1.4	-3.4	-3.9
5	B2145 Hunston to Whyke	NB			5.9	7.2	1.6	1.6	1.0	2.3	2.2	2.2	1.8	3.5	2.3	2.4	-2.4	-1.7	-2.8	-2.7
6	B2145 Whyke to Hunston	SB			-4.6	-4.6	0.4	0.4	0.4	-0.2	-0.2	-0.3	0.5	1.4	-0.2	1.2	-4.2	-4.2	-4.2	-4.2
7	A286 Birdham Road to Lavant	NB			2.0	3.3	2.1	2.6	2.4	2.6	3.5	3.5	4.0	4.2	4.5	4.4	-2.7	-0.8	-6.2	-4.2
8	A286 Lavant to Birdham Road	SB			-10.8	-10.8	0.8	1.0	1.1	1.3	1.5	1.3	1.8	1.9	2.2	2.5	-5.9	-4.8	-8.7	-8.3
9	A259/A285 Fishbourne to Portfield	EB			-6.4	-5.9	0.7	0.8	0.9	1.1	1.3	0.6	1.5	2.3	1.6	2.2	-5.5	-4.5	-9.0	-8.2
10	A259/A285 Portfield to Fishbourne	WB			-11.8	-11.9	0.7	0.6	1.0	1.3	1.2	0.5	1.2	1.6	1.1	1.6	-1.7	0.3	-8.6	-6.3

Table F Journey Times for all Scenarios – PM Peak Hour

1.4 Traffic flow to / from the Strategic Sites

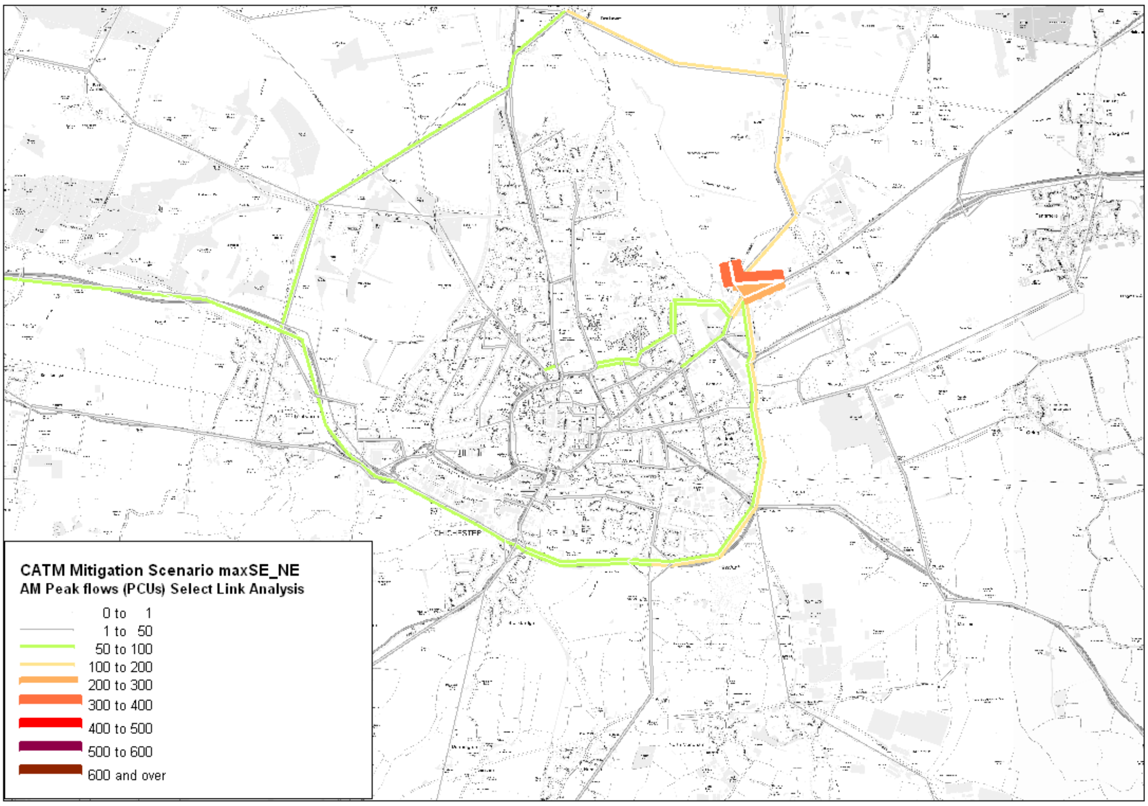


Figure B Routes to/from NE of Chichester (Westhampnett) – AM Peak Hour

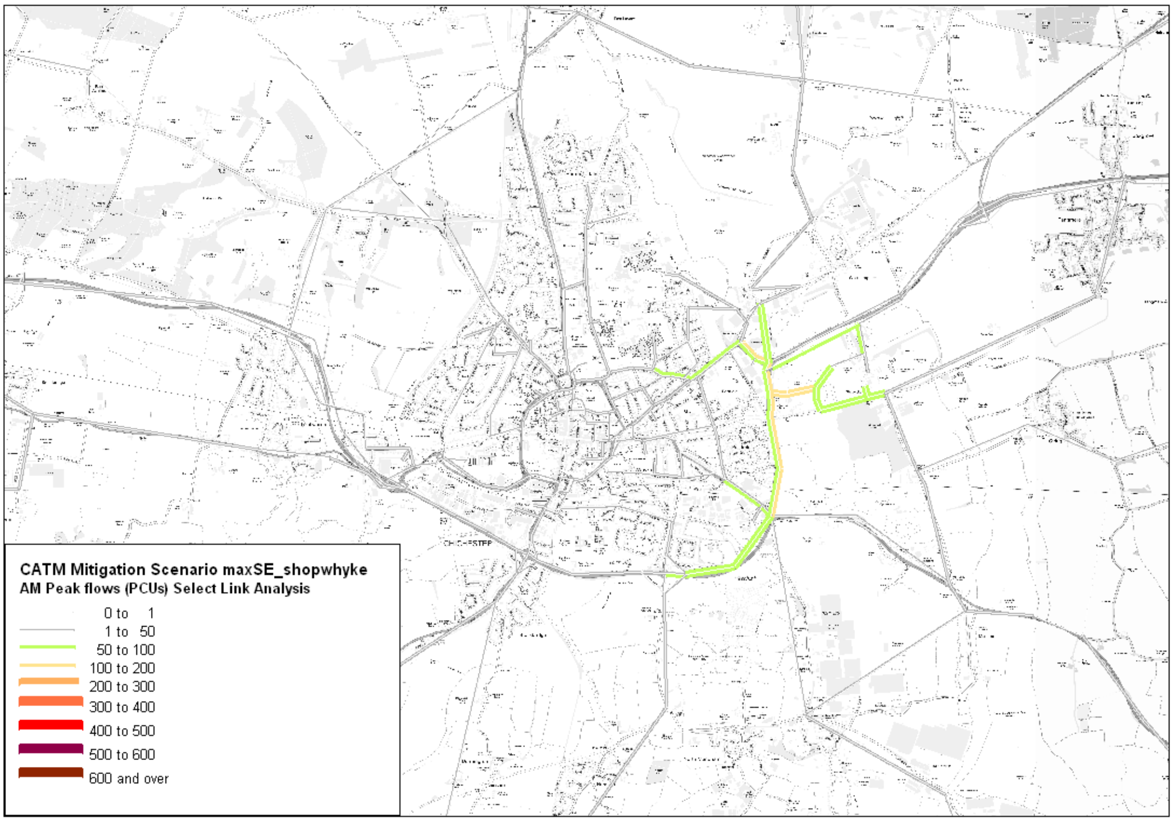


Figure C Routes to/from Shopwyke– AM Peak Hour

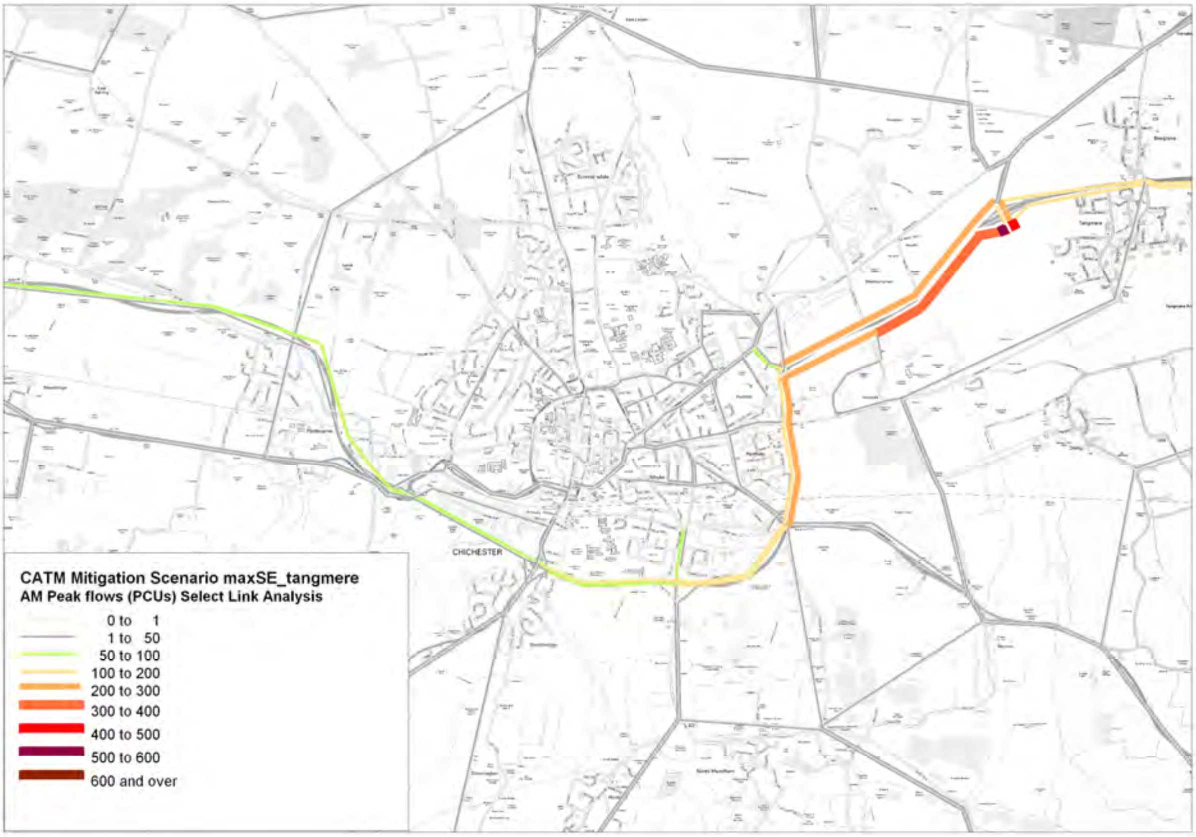


Figure D Routes to/from Tangmere– AM Peak Hour

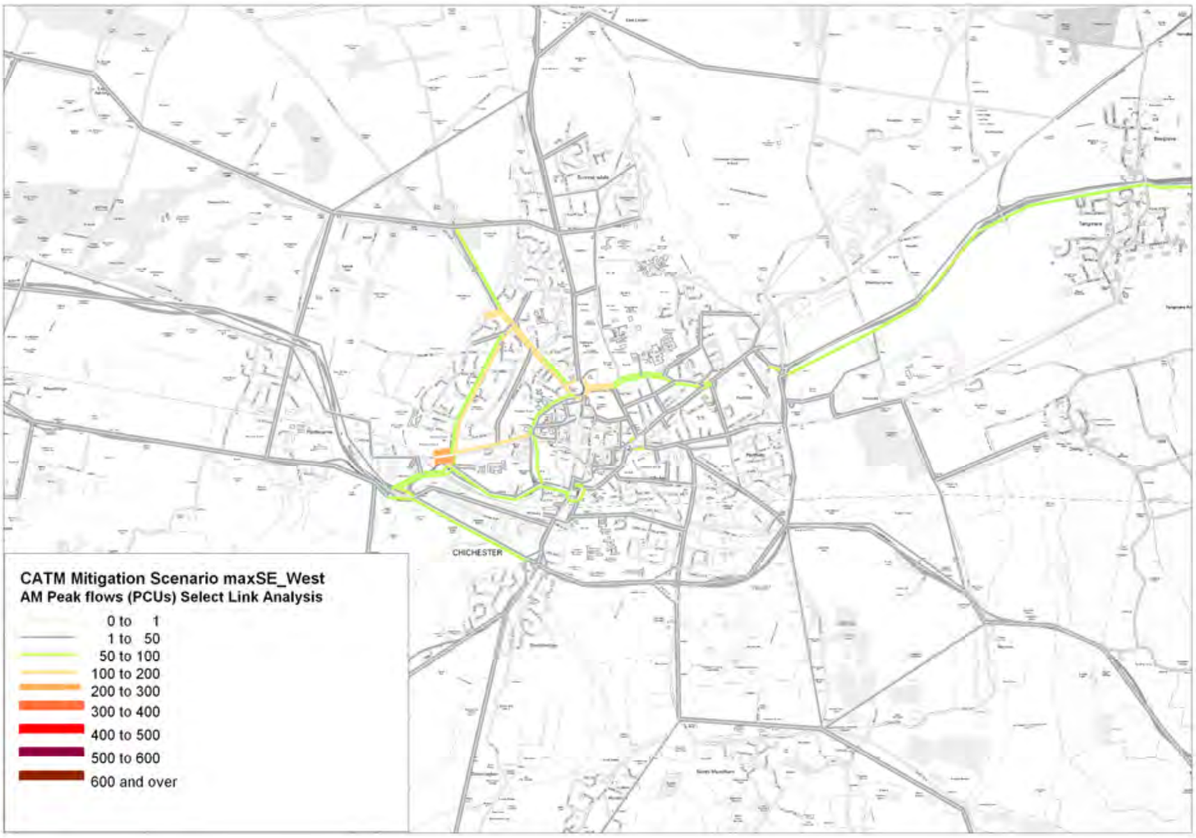


Figure E Routes to/from West of Chichester– AM Peak Hour

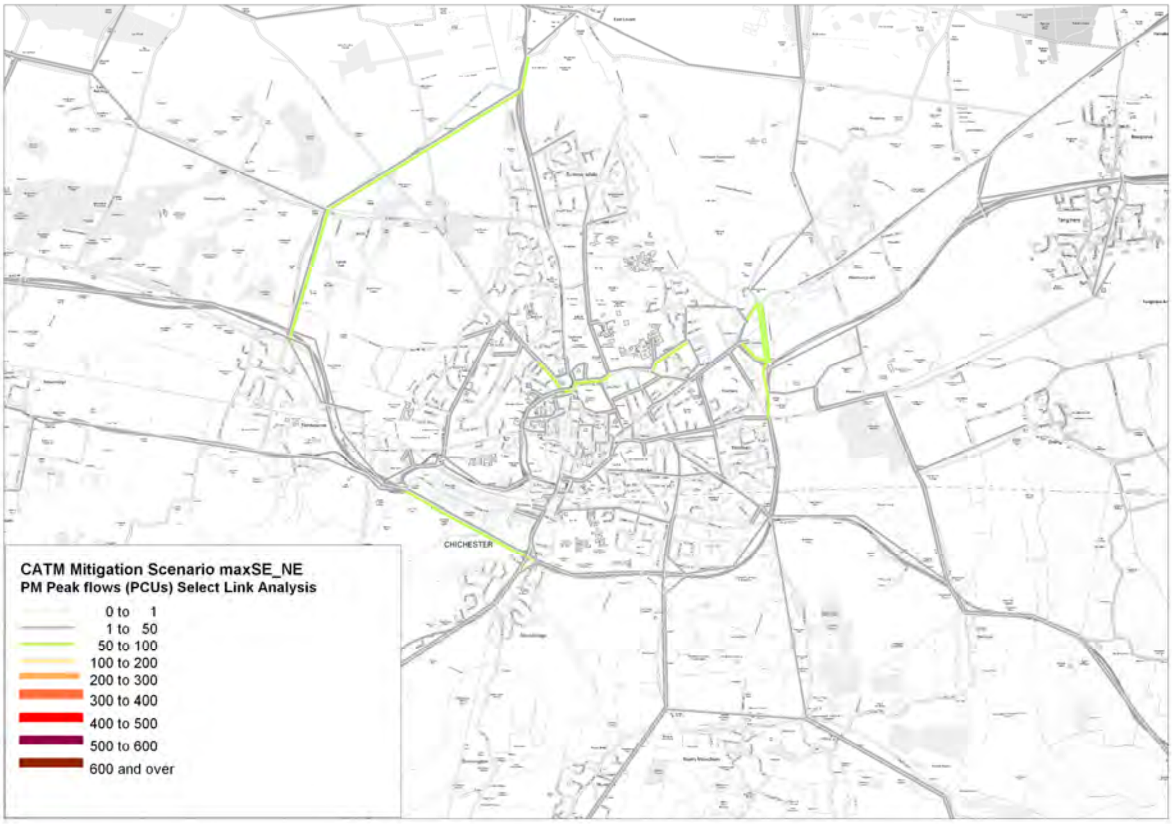


Figure F Routes to/from NE of Chichester (Westhampnett) – PM Peak Hour

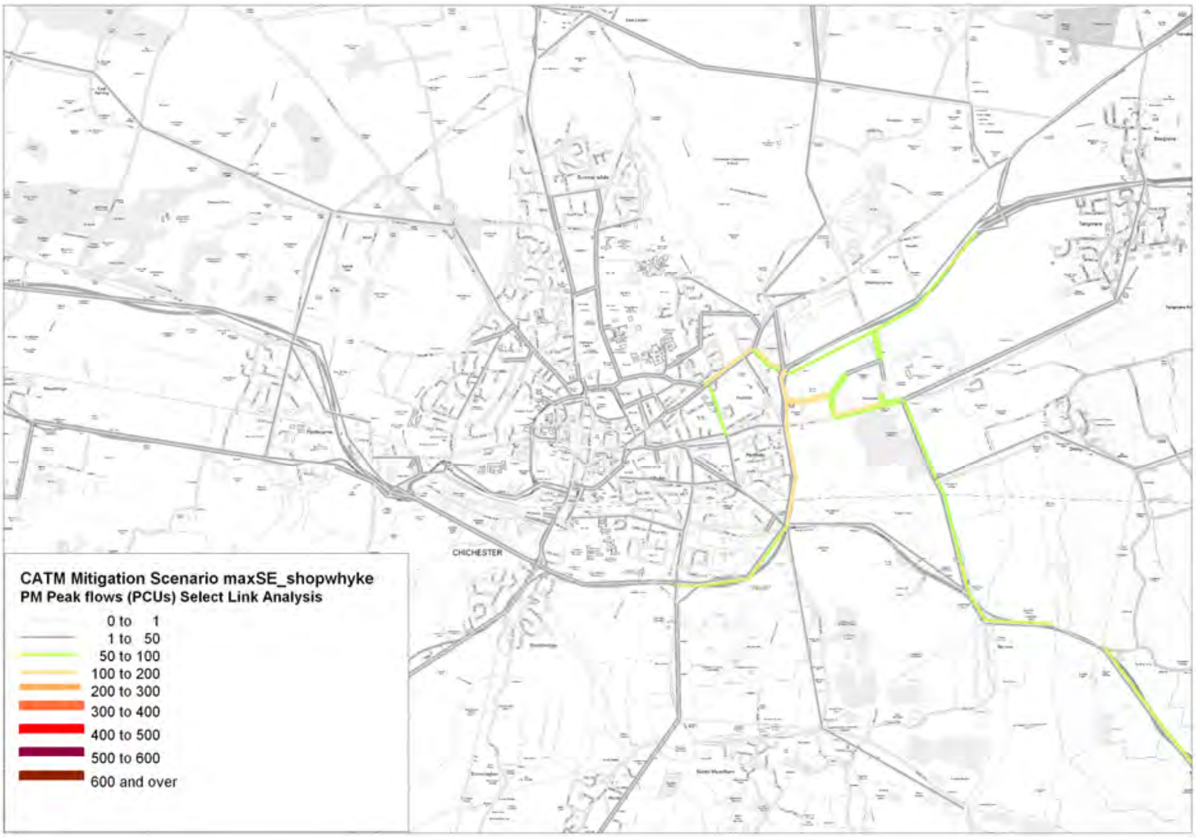


Figure G Routes to/from Shopwyke – PM Peak Hour

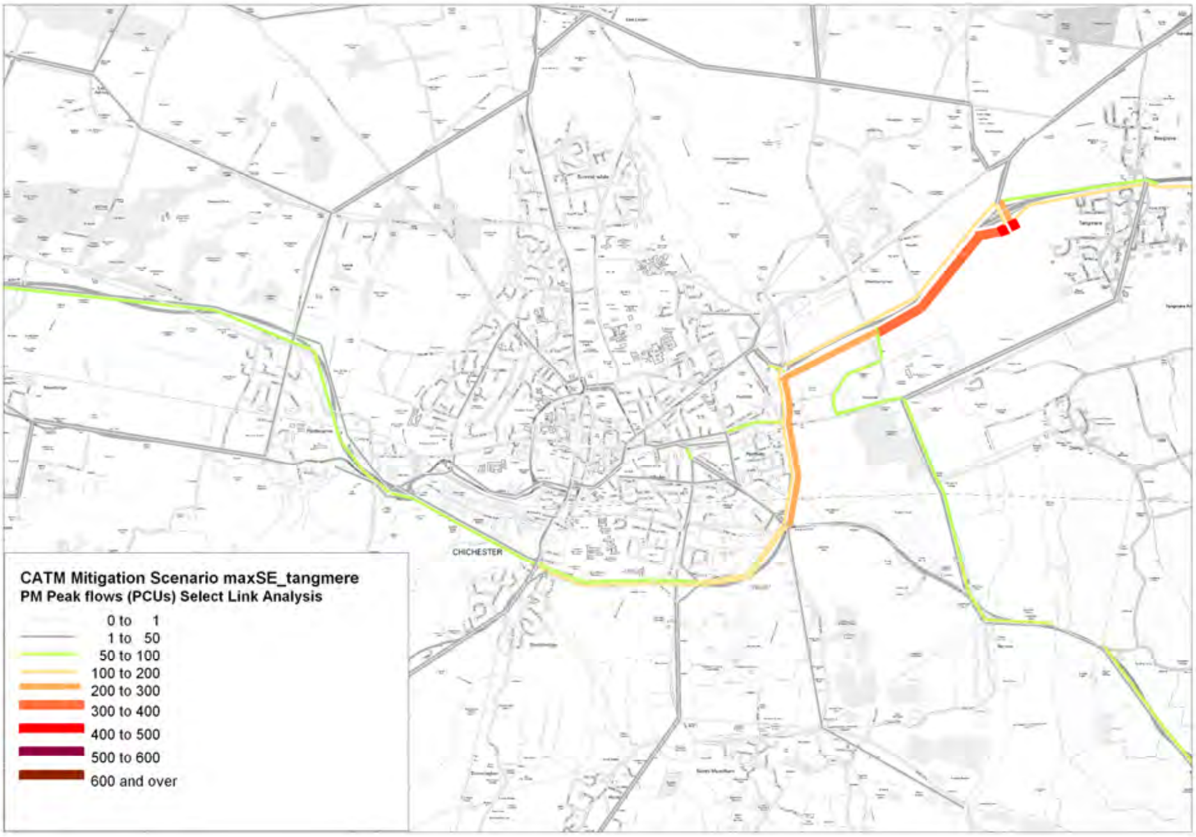


Figure H Routes to/from Tangmere– PM Peak Hour

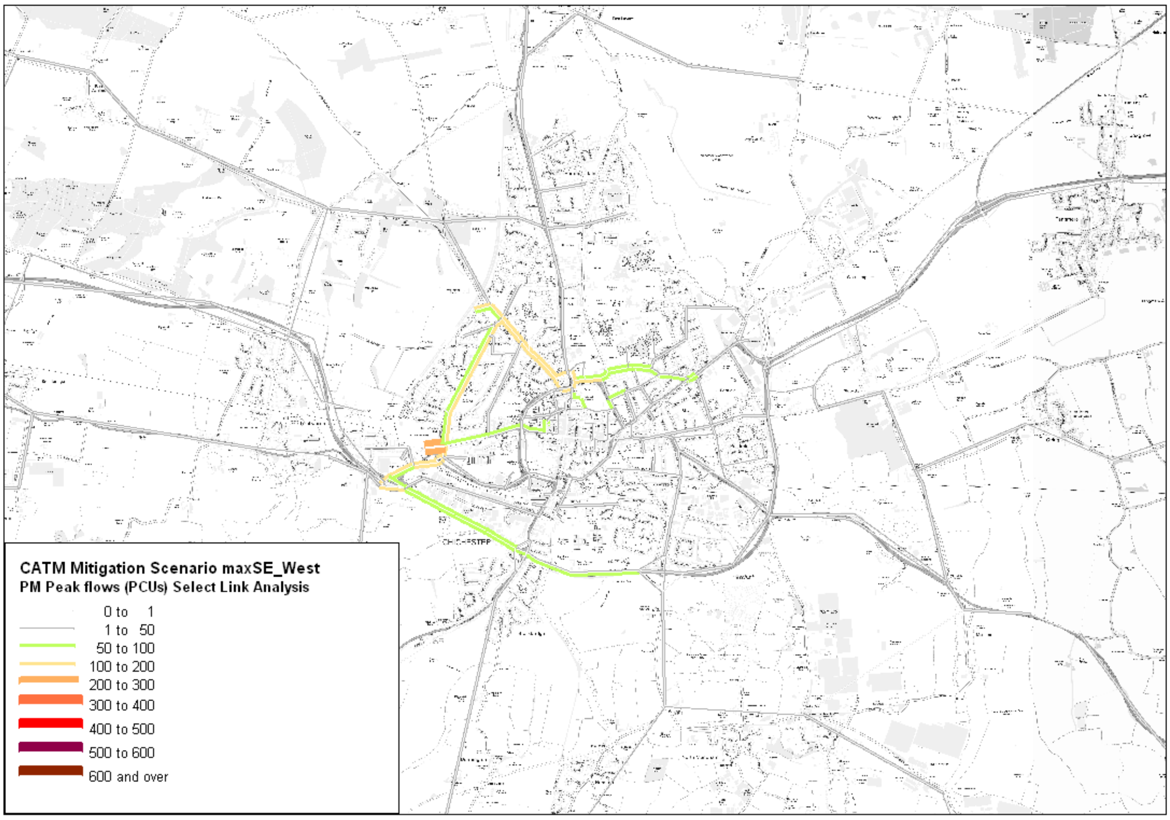


Figure I Routes to/from West of Chichester – PM Peak Hour

Appendix C Key features of the CATM Model

1.1 Overall Model Structure

CATM is a multi-modal demand model that incorporates a public transport assignment model (in CUBE TRIPS software) and a highway assignment model (in SATURN software).

The demand model is undertaken in CUBE TRIPS and takes a trip-end/car availability model as a starting point. The trip-end data is consistent with TEMPRO version 6.2. A “choice model” is then used to provide destination choice and then mode-choice segmented by car-available and non car-available trips based on costs from the assignment models. These matrices are then converted to peak hour, and from persons to vehicles for assignment. The model process is iterative so that the choice model and travel costs are in convergence.

External trips (those with both trip ends outside the Study area) and Goods Vehicle trips are represented by matrices separate from the modal split and distribution models within CATM.

A description of the base year (2003) model development and structure can be found in the Chichester Area Transport Model, Model Validation Report (MVA Consultancy Aug. 2006. This was updated to a 2009 base year as described in Chapter 3.

A full description of the previous forecasting approach is contained in the CATM Demand Model & Forecast Report (Phase 1c), produced by the MVA Consultancy in Sept. 2006.

The agreed approach for this update was to update the highway matrices to reflect the latest development assumptions and improvement schemes. Changes in forecast assumptions from those in the previous forecasts were identified, and the forecast highway matrices were adjusted accordingly. The full CATM model was not re-run.

1.2 Highway model validation

The CATM base year was originally validated to the year 2003. The highway model was then updated by Jacobs to a base year of 2009 using link count data (for 2009) on key cordons inside and outside the A27 Chichester Bypass and journey time survey data along the A27. The modelled turning movements were reviewed against historical turning movement surveys (from 2003) and found to be robust.

1.3 Model Coverage

The overall coverage of CATM is shown in *Figure J* , and the highway model area of interest is shown in *Figure K*. The green links are the SATURN simulation area, and the black links are buffer (speed-flow) links.

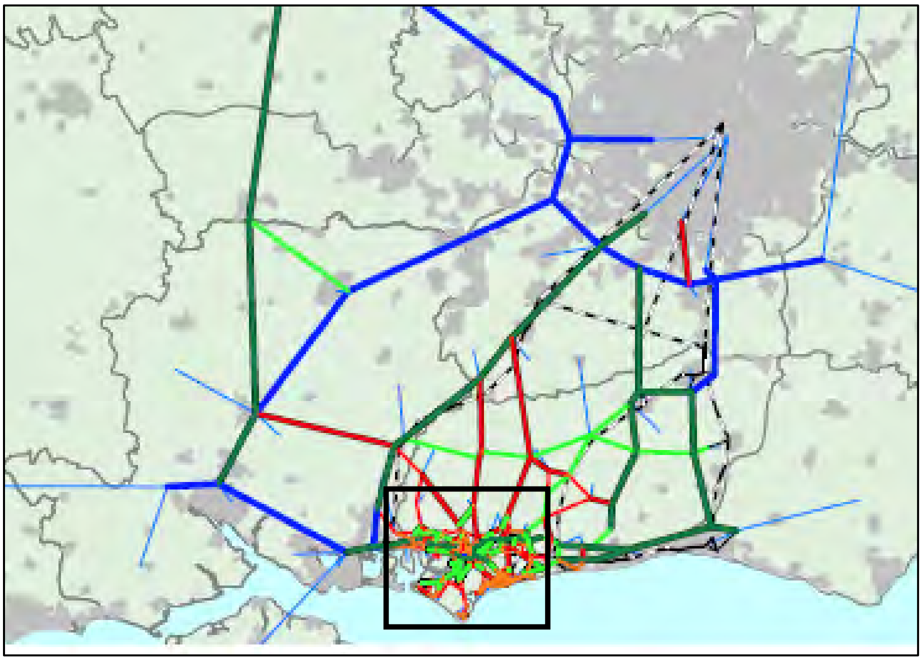


Figure J CATM Regional Coverage

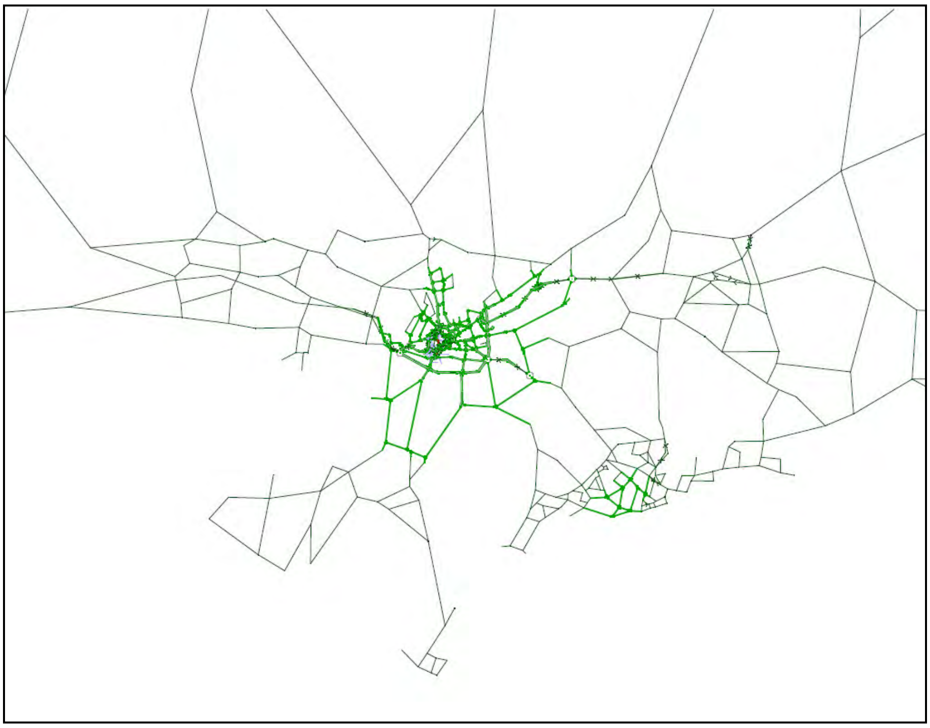


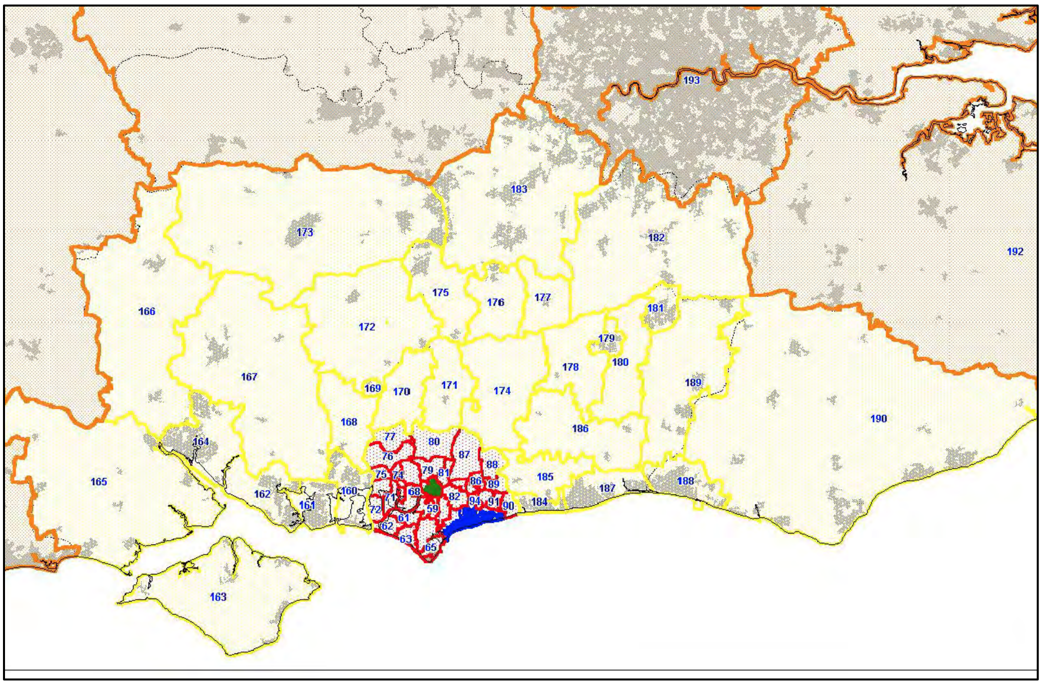
Figure K CATM Highway Network and Simulation Area

Figure L   CATM Highway Network - Chichester

1.4 Model Zoning System

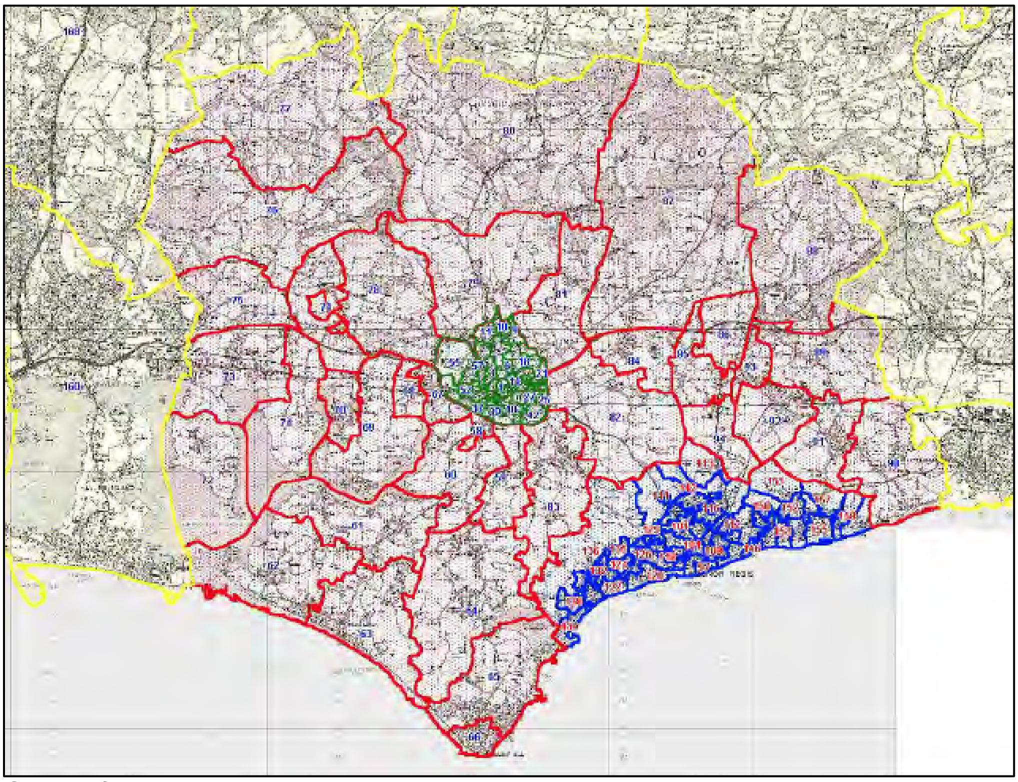
The CATM zoning system is shown in *Figure M* and *Figure N* for the South East and the Study Area respectively. The Study Area comprises zones 1-159 plus some zones used to represent specific (future) developments numbered 196 to 210.

Figure M   CATM Zoning System – South East



Source: Chichester Area Transport Model, Model Validation Report. Aug. 2006

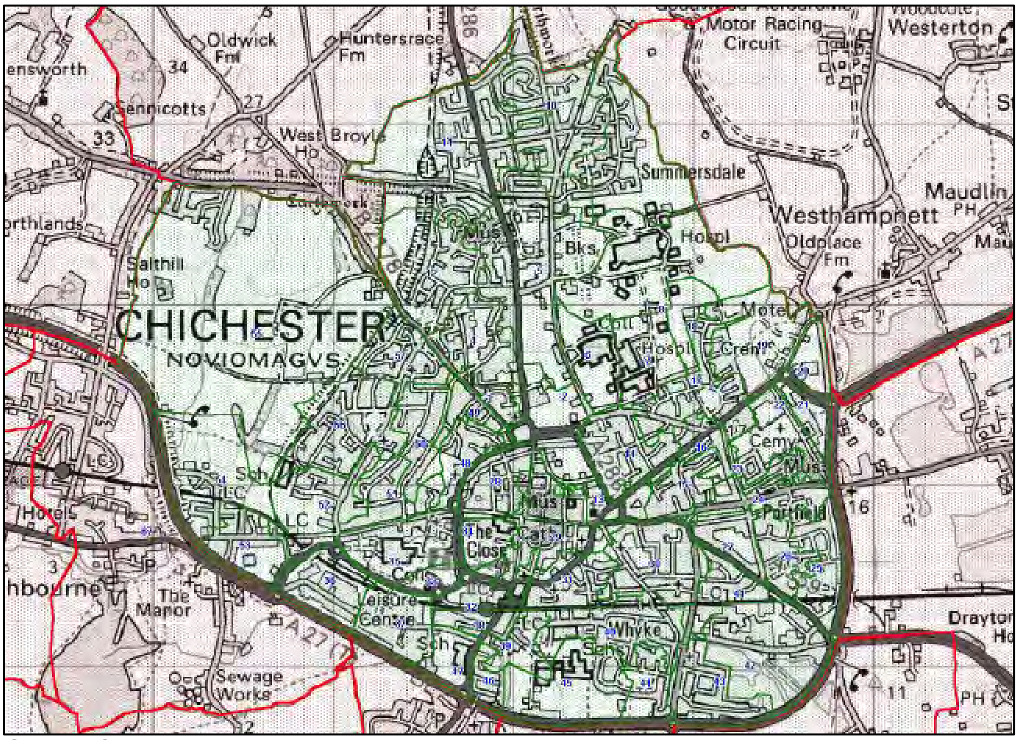
Figure N CATM Zoning System – Study Area



Source: Chichester Area Transport Model, Model Validation Report. Aug. 2006

The CATM zoning system for the Chichester area is shown in *Figure O* and the detailed zoning system is focused on the area within the A27 Chichester Bypass.

Figure O CATM Zoning System – Chichester



Source: Chichester Area Transport Model, Model Validation Report. Aug. 2006

1.5 Time Period Definition

The peak hour assignments are based on the maximum one hour flows within the three hour periods 0700-1000 and 1600-1900.

The Inter peak represents the average flows 1000-1600 but has not been updated as part of this study.

1.6 Vehicle Class Definition

The model includes 2 assignment (user) classes – Light (UC1) and Heavy (UC2). Light vehicles include cars and LGVs. Bus vehicles are represented as fixed route pre-loads.

The model used a passenger car unit (PCU) factor of 2.0 for Heavy Vehicles and Buses and 1.0 for Light Vehicles.

The model assignment is in units of PCUs and then outputs can be converted back to vehicles using the PCU factor.

Appendix D CATM Highway Model Validation

1.7 Overview

The methodology underpinning CATM is set out in the initial model development reports produced in 2006. At that time, the multi-modal transport model was updated and the highway model was validated to 2003 traffic flow data.

The model was subsequently re-calibrated and re-validated to the observed 2008/9 traffic flows. Link flow validation and journey time validation was undertaken as documented in the Jacobs Report "Validation to Present Day of the Chichester Area Traffic Model" (Ref B0497800-R-017-B-CATM-2009-Validation, September 2009). For the main junctions along the Chichester Bypass, the modelled turning movements were reviewed against historical turning movement surveys (from 2003) and found to be robust. The model re-validation was approved by the Highways Agency in September 2009.

As part of this study, the 2009 highway model was subject to a local re-validation to address an issue of excessive U-turning traffic at Fishbourne roundabout. The observed dataset for the re-validation was unchanged from the above report.

The summary results are presented in *Figure P* and indicate that the re-validation was successful at this aggregate level with a higher proportion of links and screenlines achieving the DMRB criterion, and no adverse impact on the journey time validation.

Figure P Summary of Revised Validation (2009)

Validation Criteria	Target Threshold	September 2009		Revised Model	
		AM	PM	AM	PM
Screenline Validation					
GEH 4 or less	All / Nearly all	75%	88%	88%	88%
Within 5%		6 of 8	4 of 8	6 of 8	4 of 8
Link Validation					
GEH 5 or less	85% of links	85%	83%	90%	83%
Within DMRB Criteria (varies by flow level)		83%	83%	88%	88%
Journey Time Validation					
DMRB Compliant (Within 15% or 1 minute)	85%	8 of 8	4 of 8	8 of 8	4 of 8
Maximum % Difference	n/a	-15%	-22%	-15%	-22%

Note: DMRB screenline validation criterion refers to those with 5 or more links. For CATM, 6 of 8 screenlines have only 3 or 4 links.

1.8 Level of Validation and Implications for model use

Note that the 2009 model validation is intended to demonstrate that the overall transport model is robust, and that flows on the main corridors are well-represented.

Note however that the validation is not intended to ensure that local turning movements at **all** junctions are robust. Specific local area reviews are recommended to collect turning movement survey data to confirm the validity of the model in that area.

Appendix E Baseline Trip Matrices

1.9 Introduction

This chapter describes how the revised development data was used to produce 2031 Baseline trip matrices.

1.10 Approach to Trip End Growth Forecasts, 2009 to 2031

The forecasts from TEMPRO were used as the basis for producing aggregate trip end growth.

Different growth factors were taken by TEMPRO by district and for with and without new developments. Within each district for the zones where there were new developments the TEMPRO growth was distributed between zones in line with latest development forecasts provided by the Chichester and Arun District Councils.

In detail the procedure to obtain updated trip end forecasts for 2016 was as follows:

1. For each district, in TEMPRO, set housing and jobs to be constant between 2009 and 2016. Determine the growth rate for 2009-2016 and apply this growth rate to all zones for which no new developments;
2. Adjust the housing growth assumptions in TEMPRO to reflect the forecasts of housing growth 2009-2016 as supplied by Chichester and Arun District Councils. These adjusted TEMPRO rates for each district were then applied to zones which have new developments;
3. The new development related trips were then redistributed in each district based on the number of new developments in each zone;
4. Finally the zonal no development and new development growth in trips were added to the 2009 trip ends.

As the majority of development data provided by the District Councils covered the period to 2016, trip ends for 2031 were obtained by applying unadjusted TEMPRO growth (version 6.2) growth forecasts 2016-2031 directly to the new 2016 trip ends.

1.11 Forecast Trip End Growth from 2009

The input to CATM consists of trip ends specified for each zone in the Study area. They are defined for four trip purposes;

- Home Based Work (HBW)
- Home Based Shopping and Personal Business (HBSP)
- Home Based Education and Social (HBES)
- Non-Home Based (NHB).

For each purpose and for each zone, trip generations for car available and no car available households, and trip attractions are defined. The revised housing assumptions were used to update the 2031 forecasts of highway trip generations. These are shown in the following table.

Figure Q CATM Growth in 12-hour Highway Trip Ends, 2009 to 2031

	Purpose	2009	2031	Growth
Generation (Car Available)	HBW	127,392	155,419	22%
	HBSP	104,073	134,251	29%
	HBES	87,332	106,901	22%
	NBH	86,072	100.424	17%
	Total	404,868	496,995	23%
Generation (No Car Available)	HBW	848	1,031	22%
	HBSP	1,881	2,420	29%
	HBES	1,338	1,627	22%
	NBH	688	802	17%
	Total	4,756	5,864	23%
Attractions	HBW	119,386	141,769	19%
	HBSP	103,456	129,397	25%
	HBES	87,695	95,956	9%
	NBH	87,061	102,133	17%
	Total	397,598	469,254	18%

1.12 Light Vehicle Peak Hour Matrices

The light vehicle peak hour matrices were created by applying the zonal level change in trip ends to the matrices created from the previous run of CATM forecasts.

This was done by calculating the percentage change in Car Available generations for each zone (i.e. new forecast / old forecast) and applying this to the previous forecast of new trips (i.e. 2031 matrix minus 2009 matrix), to produce a revised "new trip" matrix. The revised new trip matrix was then added to the 2009 matrix to obtain the revised 2031 matrix.

This method ensures that the level of growth in the previous forecasts is maintained, but that the revised development assumptions are reflected in the changed distribution of this growth.

Figure R summarises the growth in the Light Vehicle trip matrices which is around 21%-22% for 2031.

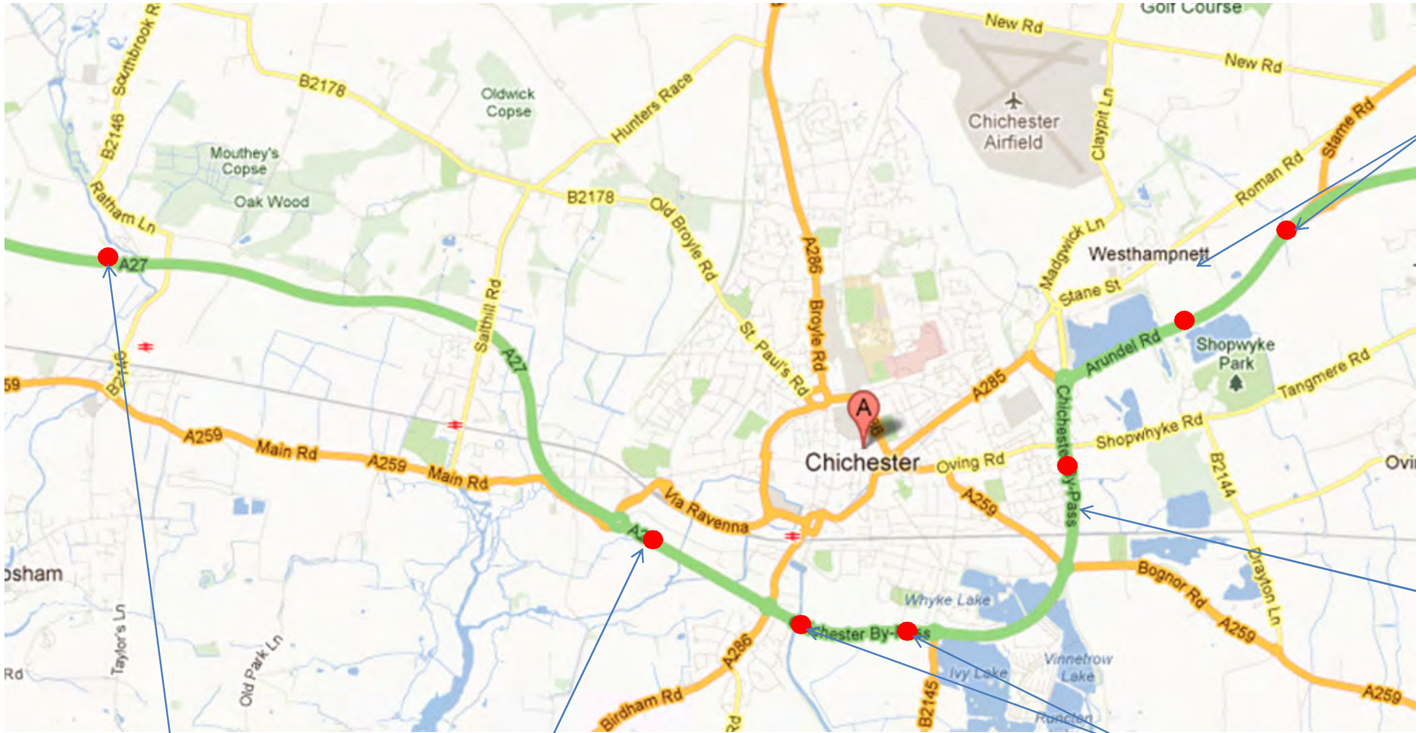
Figure R Growth in CATM Light Vehicle Trip Matrices, 2009 to 2031

	Trips (vehicles/hour)		
	AM	IP	PM
2009	34,648	28,283	36,292
2031 Baseline	42,044	34,325	44,291
Difference from 2009			
2031 Baseline	7,396	6,042	7,999
Percentage Difference from 2009			
2031 Baseline	21.3%	21.4%	22.0%

Appendix F Summer Time Traffic Levels in Chichester

JACOBS

Trads Count Sites Near Chichester

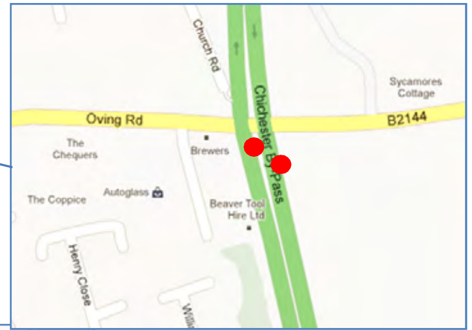


Site No: 30013126

WB, A27, TMU site 5754/1 on A27 WB between A285 Chicheste

Site No: 30013127

EB, A27, TMU site 5753/1 on A27 EB between A285 Chichester



Site No: 5248

WB, A27, Portfield

Site No: 5249

EB, A27, Portfield

Site No: 30012753

A27 eastbound between A259 near

Emsworth and A259 near Chichester

Site No: 5211

WB, A27, Chichester

Site No : 5212

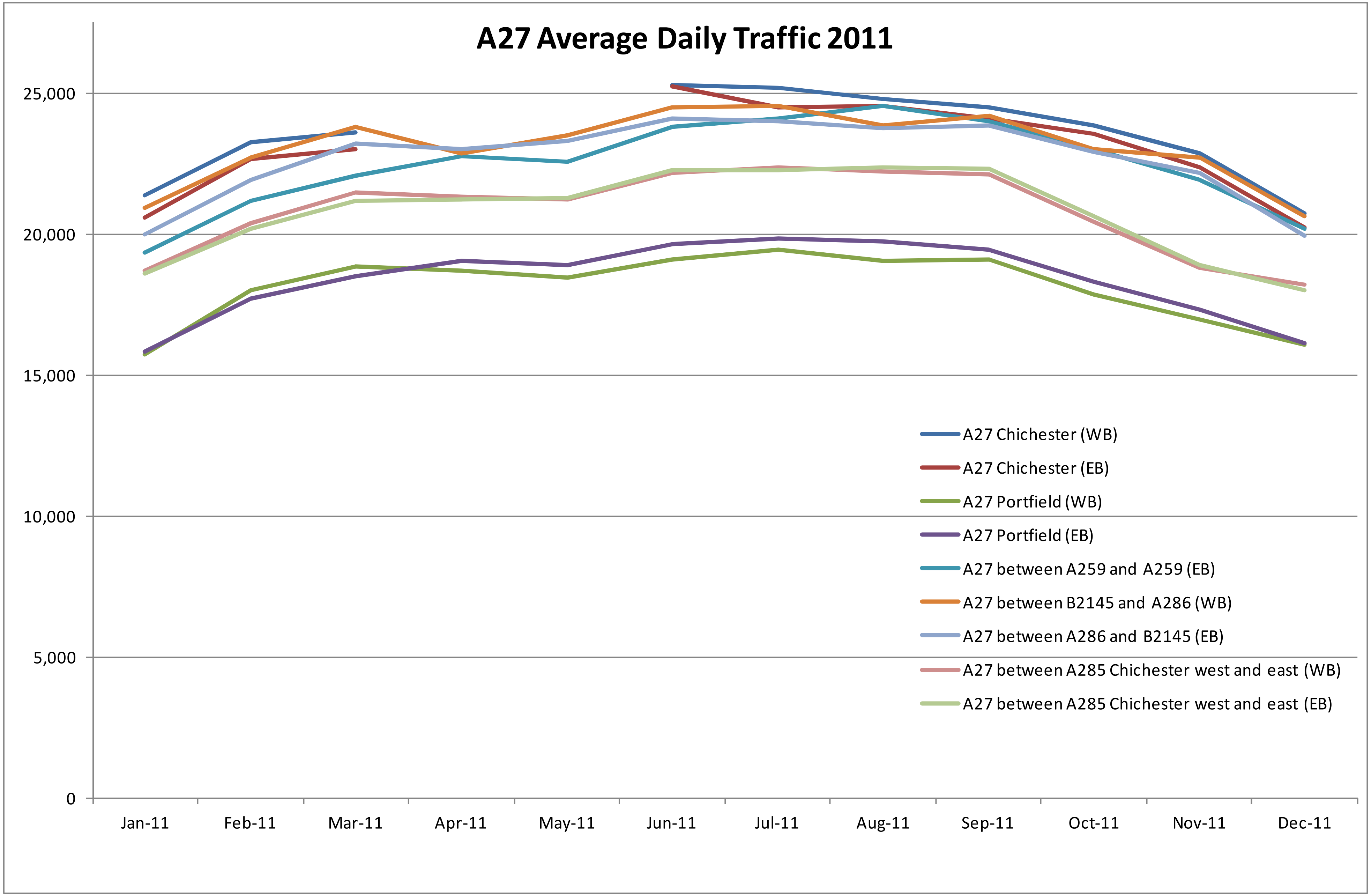
EB, A27, Chichester

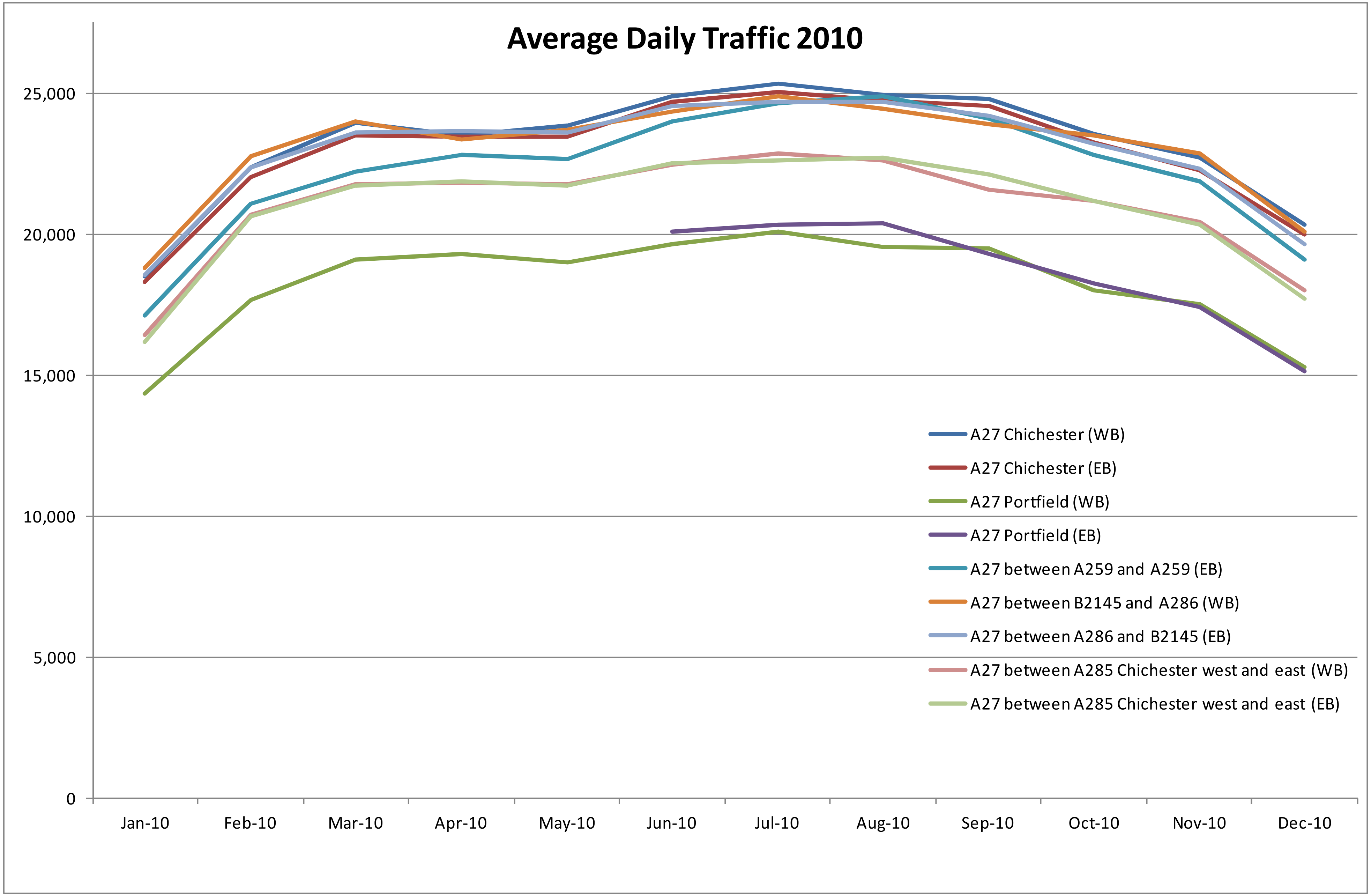
Site No: 3003116

WB, A27, TMU site 5752/1 on A27 westbound between B2145 and A286

Site No: 3003117

EB, A27, TMU site 5751/1 on A27 eastbound between A286 and B2145


A27 Average Daily Traffic 2011
25,000
20,000
15,000
10,000
5,000
0
Jan-11
Feb-11
Mar-11
Apr-11
May-11
Jun-11
Jul-11
Aug-11
Sep-11
Oct-11
Nov-11
Dec-11
A27 Chichester (WB)
A27 Chichester (EB)
A27 Portfield (WB)
A27 Portfield (EB)
A27 between A259 and A259 (EB)
A27 between B2145 and A286 (WB)
A27 between A286 and B2145 (EB)
A27 between A285 Chichester west and east (WB)
A27 between A285 Chichester west and east (EB)



Average Daily Traffic 2010
25,000
20,000
15,000
10,000
5,000
0
Jan-10
Feb-10
Mar-10
Apr-10
May-10
Jun-10
Jul-10
Aug-10
Sep-10
Oct-10
Nov-10
Dec-10
A27 Chichester (WB)
A27 Chichester (EB)
A27 Portfield (WB)
A27 Portfield (EB)
A27 between A259 and A259 (EB)
A27 between B2145 and A286 (WB)
A27 between A286 and B2145 (EB)
A27 between A285 Chichester west and east (WB)
A27 between A285 Chichester west and east (EB)

A27 Daily average Traffic by month

Site Name	Site No	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10
A27 Chichester (WB)	**5211**	18,517	22,357	23,942	23,519	23,875	24,875	25,356	24,942	24,787	23,547	22,703	20,312
A27 Chichester (EB)	**5212**	18,290	21,997	23,486	23,432	23,468	24,681	25,062	24,727	24,545	23,253	22,258	20,001
A27 Portfield (WB)	**5248**	14,325	17,638	19,098	19,290	19,017	19,628	20,105	19,564	19,475	17,990	17,518	15,261
A27 Portfield (EB)	**5249**						20,098	20,354	20,377	19,272	18,242	17,390	15,131
A27 between A259 and A259 (EB)	**30012753**	17,102	21,080	22,198	22,829	22,638	24,001	24,636	24,874	24,087	22,816	21,872	19,106
A27 between B2145 and A286 (WB)	**30013116**	18,800	22,756	23,998	23,372	23,679	24,335	24,892	24,454	23,921	23,485	22,847	20,098
A27 between A286 and B2145 (EB)	**30013117**	18,541	22,355	23,594	23,638	23,583	24,542	24,693	24,682	24,218	23,227	22,298	19,658
A27 between A285 Chichester west and east (WB)	**30013126**	16,400	20,702	21,776	21,815	21,759	22,462	22,864	22,613	21,562	21,155	20,445	18,027
A27 between A285 Chichester west and east (EB)	**30013127**	16,154	20,634	21,711	21,881	21,703	22,528	22,590	22,724	22,111	21,172	20,344	17,718

%age Diff from Yearly Average

Site Name	Site No	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11
A27 Chichester (WB)	**5211**	-20%	-4%	3%	1%	3%	7%	9%	7%	7%	1%	-2%	-13%
A27 Chichester (EB)	**5212**	-20%	-4%	2%	2%	2%	8%	9%	8%	7%	1%	-3%	-13%
A27 Portfield (WB)	**5248**	-21%	-3%	5%	6%	4%	8%	10%	7%	7%	-1%	-4%	-16%
A27 Portfield (EB)	**5249**						8%	9%	9%	3%	-2%	-7%	-19%
A27 between A259 and A259 (EB)	**30012753**	-23%	-5%	0%	3%	2%	8%	11%	12%	8%	2%	-2%	-14%
A27 between B2145 and A286 (WB)	**30013116**	-18%	-1%	4%	1%	3%	6%	8%	6%	4%	2%	-1%	-13%
A27 between A286 and B2145 (EB)	**30013117**	-19%	-2%	3%	3%	3%	7%	8%	8%	6%	1%	-3%	-14%
A27 between A285 Chichester west and east (WB)	**30013126**	-22%	-1%	4%	4%	4%	7%	9%	8%	3%	1%	-2%	-14%
A27 between A285 Chichester west and east (EB)	**30013127**	-23%	-1%	4%	4%	4%	8%	8%	9%	6%	1%	-3%	-15%

A27 Daily average Traffic by month

Site Name	Site No	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11
A27 Chichester (WB)	**5211**	21,366	23,274	23,581			25,311	25,165	24,797	24,489	23,841	22,880	20,735
A27 Chichester (EB)	**5212**	20,586	22,684	23,031			25,222	24,487	24,549	24,082	23,537	22,353	20,258
A27 Portfield (WB)	**5248**	15,711	18,005	18,827	18,695	18,472	19,084	19,451	19,055	19,085	17,871	16,963	16,064
A27 Portfield (EB)	**5249**	15,836	17,735	18,513	19,061	18,905	19,658	19,851	19,735	19,421	18,294	17,292	16,140
A27 between A259 and A259 (EB)	**30012753**	19,323	21,163	22,085	22,769	22,562	23,777	24,090	24,557	23,983	22,986	21,940	20,163
A27 between B2145 and A286 (WB)	**30013116**	20,943	22,712	23,824	22,868	23,484	24,471	24,540	23,830	24,203	22,990	22,688	20,654
A27 between A286 and B2145 (EB)	**30013117**	20,005	21,941	23,211	23,013	23,313	24,077	23,994	23,731	23,868	22,901	22,185	19,937
A27 between A285 Chichester west and east (WB)	**30013126**	18,678	20,402	21,492	21,343	21,251	22,174	22,382	22,221	22,122	20,454	18,806	18,199
A27 between A285 Chichester west and east (EB)	**30013127**	18,581	20,190	21,189	21,208	21,265	22,277	22,264	22,379	22,316	20,650	18,915	18,020

%age Diff from Yearly Average

Site Name	Site No	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11
A27 Chichester (WB)	**5211**	-9%	-1%	0%			8%	7%	5%	4%	1%	-3%	-12%
A27 Chichester (EB)	**5212**	-11%	-2%	0%			9%	6%	6%	4%	2%	-3%	-12%
A27 Portfield (WB)	**5248**	-13%	-1%	4%	3%	2%	5%	7%	5%	5%	-1%	-6%	-11%
A27 Portfield (EB)	**5249**	-14%	-3%	1%	4%	3%	7%	8%	7%	6%	0%	-6%	-12%
A27 between A259 and A259 (EB)	**30012753**	-14%	-6%	-2%	1%	1%	6%	7%	9%	7%	2%	-2%	-10%
A27 between B2145 and A286 (WB)	**30013116**	-9%	-2%	3%	-1%	2%	6%	6%	3%	5%	0%	-2%	-11%
A27 between A286 and B2145 (EB)	**30013117**	-12%	-3%	2%	1%	3%	6%	6%	5%	5%	1%	-2%	-12%
A27 between A285 Chichester west and east (WB)	**30013126**	-10%	-2%	3%	3%	2%	7%	8%	7%	6%	-2%	-10%	-12%
A27 between A285 Chichester west and east (EB)	**30013127**	-11%	-3%	2%	2%	2%	7%	7%	8%	7%	-1%	-9%	-13%

Chichester Local Roads - Average 12hr Weekday Count		Yearly	July/August	%age Summer flow diff. from average
Site Number: 00000215	A259 BOGNOR REGIS, CHICHESTER RD. (Elbridge Farm) - Northbound	9,753	9,910	2%
	A259 BOGNOR REGIS, CHICHESTER RD. (Elbridge Farm) - Southbound	9,358	9,396	0%
Site Number: 00005031	A259 CHICHESTER, BOGNOR RD 15M E. OF QUARRY LA. - Eastbound I/Lane	5,732	5,548	-3%
	A259 CHICHESTER, BOGNOR RD 15M E. OF QUARRY LA. - Westbound	5,964	5,922	-1%
Site Number: 00005028	A259 CHICHESTER, VIA RAVENNA W. OF WESTGATE LEISUR - Eastbound	7,585	7,545	-1%
	A259 CHICHESTER, VIA RAVENNA W. OF WESTGATE LEISUR - Westbound	6,909	6,765	-2%
Site Number: 00000208	A259 FISHBOURNE, JUST WEST OF ROUNDABOUT - Eastbound	5,720	5,971	4%
	A259 FISHBOURNE, JUST WEST OF ROUNDABOUT - Westbound	5,607	5,720	2%
Site Number: 00005034	A285 CHICHESTER, WESTHAMPNETT RD W. OF IND. EST. - Eastbound	9,156	9,303	2%
	A285 CHICHESTER, WESTHAMPNETT RD W. OF IND. EST. - Westbound	9,622	10,066	5%
Site Number: 00000459	A285 DUNCTON, OUTSIDE DOGKENNEL COTTAGES - Northbound	2,381	2,538	7%
	A285 DUNCTON, OUTSIDE DOGKENNEL COTTAGES - Southbound	2,442	2,607	7%
Site Number: 00005283	A286 CHICHESTER, ST. PANCRAS (Jct. Newpark Rd.) - Northbound	5,626	5,567	-1%
	A286 CHICHESTER, ST. PANCRAS (Jct. Newpark Rd.) - North Eastbound	6,817	6,834	0%
Site Number: 00005131	A286 CHICHESTER, ORCHARD STREET BY NO.67 - Northbound	6,519	6,362	-2%
	A286 CHICHESTER, ORCHARD STREET BY NO.67 - Southbound	7,099	6,945	-2%
Site Number: 00000461	A286 BIRDHAM, SOUTH OF MANHOOD END FARM - Northbound	6,584	7,488	14%
	A286 BIRDHAM, SOUTH OF MANHOOD END FARM - Southbound	6,571	7,545	15%
Site Number: 00005133	A286 CHICHESTER, STOCKBRIDGE, BIRDHAM RD O/S 53 - Eastbound	5,092	5,827	14%
	A286 CHICHESTER, STOCKBRIDGE, BIRDHAM RD O/S 53 - Westbound	4,973	5,603	13%
Site Number: 00000494	A286 MID LAVANT, SOUTH OF POOK LANE - Northbound	4,862	5,080	4%
	A286 MID LAVANT, SOUTH OF POOK LANE - Southbound	5,072	5,260	4%
Site Number: 00000024	A286 WEST DEAN, THE GRINCH TO TOWN LA. - Eastbound	2,182	2,386	9%
	A286 WEST DEAN, THE GRINCH TO TOWN LA. - Westbound	2,365	2,547	8%
Site Number: 00005032	B2144 CHICHESTER, OVING RD E. OF CHARLES AVE - Eastbound	3,209	3,279	2%
	B2144 CHICHESTER, OVING RD E. OF CHARLES AVE - Westbound	2,661	2,740	3%
Site Number: 00003901	B2145 CHICHESTER, WHYKE RD S. OF LANGDALE AVE. - Northbound	3,674	3,713	1%
	B2145 CHICHESTER, WHYKE RD S. OF LANGDALE AVE. - Southbound	3,529	3,627	3%
Site Number: 00000672	B2145 SIDLESHAM NORTH OF KEYNOR LANE - Northbound	5,711	6,183	8%
	B2145 SIDLESHAM NORTH OF KEYNOR LANE - Southbound	5,625	6,137	9%
Site Number: 00000697	B2178 WEST BROYLE OLD BROYLE RD. W. OF PINE GROVE - Eastbound	3,933	3,876	-1%
	B2178 WEST BROYLE OLD BROYLE RD. W. OF PINE GROVE - Westbound	4,040	4,096	1%
Site Number: 00005132	B2201 CHICHESTER, STOCKBRIDGE, SELSEY RD STH OF 47 - Northbound	2,304	2,451	6%
	B2201 CHICHESTER, STOCKBRIDGE, SELSEY RD STH OF 47 - Southbound	2,175	2,323	7%
Site Number: 00005025	CHICHESTER, COLLEGE LA JUST N. OF FOOTBALL GROUND - Northbound	2,774	2,404	-13%
	CHICHESTER, COLLEGE LA JUST N. OF FOOTBALL GROUND - Southbound	2,086	1,684	-19%
Site Number: 00005029	CHICHESTER, TERMINUS RD (E. of Fishbourne R'Abt) - Eastbound	2,704	2,681	-1%
	CHICHESTER, TERMINUS RD (E. of Fishbourne R'Abt) - Westbound	2,234	2,267	1%
Site Number: 00005027	B2178 CHICHESTER, ST PAUL'S RD. O/P No.55 - Northbound	5,681	5,635	-1%
	B2178 CHICHESTER, ST PAUL'S RD. O/P No.55 - Southbound	5,464	5,384	-1%
Site Number: 00005033	CHICHESTER, WESTGATE E. OF HENTY GRDS. O/P NO.27 - Eastbound	2,355	2,237	-5%
	CHICHESTER, WESTGATE E. OF HENTY GRDS. O/P NO.27 - Westbound	2,331	2,227	-4%
Site Number: 00004221	CHICHESTER WESTHAMPNETT, STAINE ST. (By Council De - Eastbound	2,995	3,056	2%
	CHICHESTER WESTHAMPNETT, STAINE ST. (By Council De - Westbound	2,836	2,906	2%
Site Number: 00004448	RUNCTON, LAGNESS RD. / PAGHAM RD. (Just E. of Broo - Eastbound	7,081	7,169	1%
	RUNCTON, LAGNESS RD. / PAGHAM RD. (Just E. of Broo - Westbound	6,716	6,872	2%
Site Number: 00000664	B2141 CHILGROVE, CHILGROVE RD. O/S WELLDOWN FARM - Northbound	1,493	1,561	5%
	B2141 CHILGROVE, CHILGROVE RD. O/S WELLDOWN FARM - Southbound	1,588	1,681	6%
Site Number: 00005030	A286 CHICHESTER, STOCKBRIDGE RD N. OF SOUTH BANK - Northbound	4,978	5,033	1%
	A286 CHICHESTER, STOCKBRIDGE RD N. OF SOUTH BANK - Southbound	4,568	4,539	-1%
Site Number: 00005026	A286 CHICHESTER, BROYLE RD JUST N. OF THE BELL INN - Northbound	4,488	4,663	4%
	A286 CHICHESTER, BROYLE RD JUST N. OF THE BELL INN - Southbound	5,114	5,246	3%
	Total	248,338	254,405	2%

Table G Local Road Traffic Counts – 2011 – Total Vehicles

Appendix G Capacity Assessments of Strategic Development Options

HIGHWAYS AGENCY

TECHNICAL NOTE

CHICHESTER LOCAL PLAN – CAPACITY ASSSESSMENTS OF STRATEGIC DEVELOPMENT OPTIONS (MITIGATION RUNS)

8TH JANUARY 2013
PROJECT: 3511134PA-PTG/267.6

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Agreed by	Paul Gebbett	January 2013
Approved for Issue	Nigel Walkden	January 2013
Distribution		January 2013

1 INTRODUCTION

1.1 Background

1.1.1 This Technical Note contains details of a further study carried out to assess the capacity of proposed mitigation measures at six junctions on the A27 Chichester Bypass.

1.1.2 An earlier study, reported in Technical Note 02 (3511134MG-PTG/267.3/TN02), reached the following main conclusions.

- With optimised signal timings at the proposed Whyke and Stockbridge junctions, shorter average eastbound delays were predicted for the overall A27 mainline route than with the baseline scenario. Westbound delays, however, would be longer.
- By weighting the signals at both junctions in favour of the A27 route, shorter A27 delays could be achieved in both directions, than with the baseline scenario. Thus, in terms of A27 delays, full mitigation could be achieved along the overall route by the proposed mitigation measures with both development flow scenarios.
- Problems were identified, however, with long delays and queues on some of the A27 left and right turn movements at these three junctions. In some cases, these queues would inevitably constrain, and increase delays, on the A27 ahead movements. Thus, any proposed mitigation measures would need to ensure that there would be sufficient stacking space to accommodate any A27 left or right turn queues, without constraining the ahead movements.
- Also, weighting the signals at the Whyke and Stockbridge junctions, also significantly increased delays on the side roads.

1.2 New Study Brief

1.2.1 On 12th December 2012, the Highways Agency (HA) asked Parsons Brinkerhoff (PB) to carry out a further assessment of the Whyke, Stockbridge and Fishbourne junctions as follows.

- To model a modified scenario at the Whyke and Stockbridge signalled roundabouts with two lane right turns (or if impracticable extended right turn flare) using LinSig. As previously, mitigation need not be achieved at the junctions themselves, but it needs to be considered from the point of view of all six A27 junctions in Chichester with regards to through traffic compared to the baseline (whilst not causing detriment to side road delays compared to the baseline scenario in 2031).
- For the Fishbourne Roundabout:
  - a) assess the potential improvements discussed in the capacity assessment Technical Note 2 (v7) Para 8.7.3;
  - b) assess the benefits of the A27 westbound centre lane being both for ahead and left turners onto the circulatory section of the hamburger with the potential addition of a 1-2 vehicle flare (in addition to the slip road).

1.2.2 The discussed potential improvements mentioned above were as follows:

- the absence of internal stop-lines on the three side roads reduces capacity because of need for long inter-greens. Stop-lines should be implemented;
- lane drops and lane gains could be considered at some internal nodes and spiral markings could achieve better lane utilisation and discipline.
- consideration could be given to operating Terminus Road and Fishbourne Road, with give-way entries.

1.3 Traffic Flows

1.3.1 The same following flow scenarios as in the previous study were modelled:

- 2031 Baseline AM peak;
- 2031 Baseline PM peak;
- 2031 SE AM peak (South East Plan Housing Target Total);
- 2031 SE PM peak(South East Plan Housing Target Total);
- 2031 Max SE AM peak (Maximum Housing Target Total);
- 2031 Max SE PM Peak (Maximum Housing Target Total).

2 MODELLING METHODOLOGY

2.1 ARCADY Modelling

2.1.1 ARCADY results for the uncontrolled roundabout, baseline (Do Nothing) and mitigation layouts, as reported in Technical Note 02, were used in the present study. The one exception was the Bognor roundabout mitigation layout, which underwent a further sensitivity test for the two AM peak development flow scenarios. The results of these tests were used in the present assessment, and are contained in Section 3 of this Technical Note.

2.2 LinSig Modelling

General

2.2.1 LinSig v3 was used to model the revised Whyke, Stockbridge and Fishbourne junction mitigation layouts. The results of the Oving Road models recorded in Technical Note 02, remained unchanged.

2.2.2 The LinSig models for the three revised junctions were also amended in order to more accurately assess the overall delays on each approach arm, and for the individual A27 ahead movements through each junction.

2.2.3 It should be borne in mind that it is not possible to model a long lane and its associated flared turning lane, in isolation from one other. Traffic conditions in each inevitably impact upon the other both in terms of increased queues and delays. Notwithstanding this, LinSig can still generate delay and queue predictions for each lane.

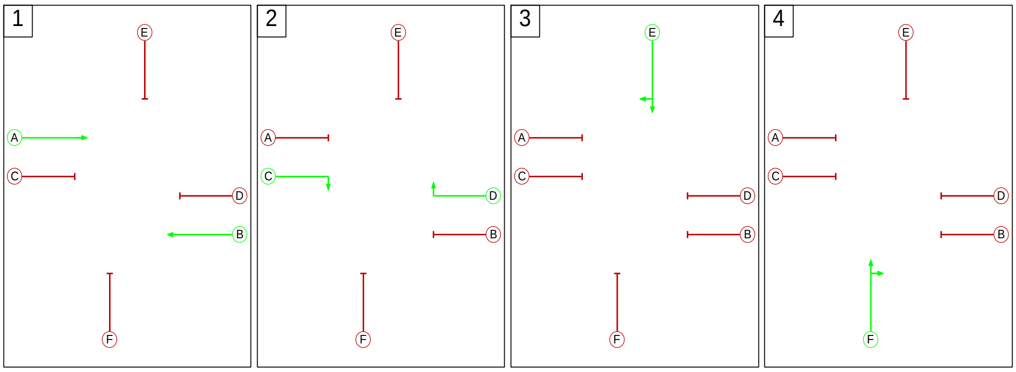
2.2.4 Prior to each model optimisation run, the LinSig delay based traffic assignment model was run. This assessed the likely delays on each route through the junction and, where possible, reassigned traffic from one route to another, in order to achieve more balanced route delays. Thus, for example, where an excessive right-turn bay queue was causing delays in the adjacent A27 lane 2 ahead traffic, LinSig was able to reassign traffic to lane 1, in order to balance the delays between the two ahead lanes. By this means, LinSig was able to predict the impact of turning bays on A27 ahead traffic and, by reassigning traffic, represent lane changing behaviour where delays and queues were unbalanced.

2.2.5 The queue and delay results generated by LinSig, were analysed in the in assessment. It should be borne in mind, however, that LinSig calculates mean values for the modelled period whilst in reality, on links which are over-saturated, queues and delays would tend to increase with time. In these cases, LinSig will significantly underestimate the queues and delays which would actually be experienced on site, particularly towards the end of the modelled period.

Whyke Junction

2.2.6 Whyke Junction was modelled with the same four stages used in the earlier study, as shown in Figure 2.1. Phase A controls the A27 eastbound ahead movement.

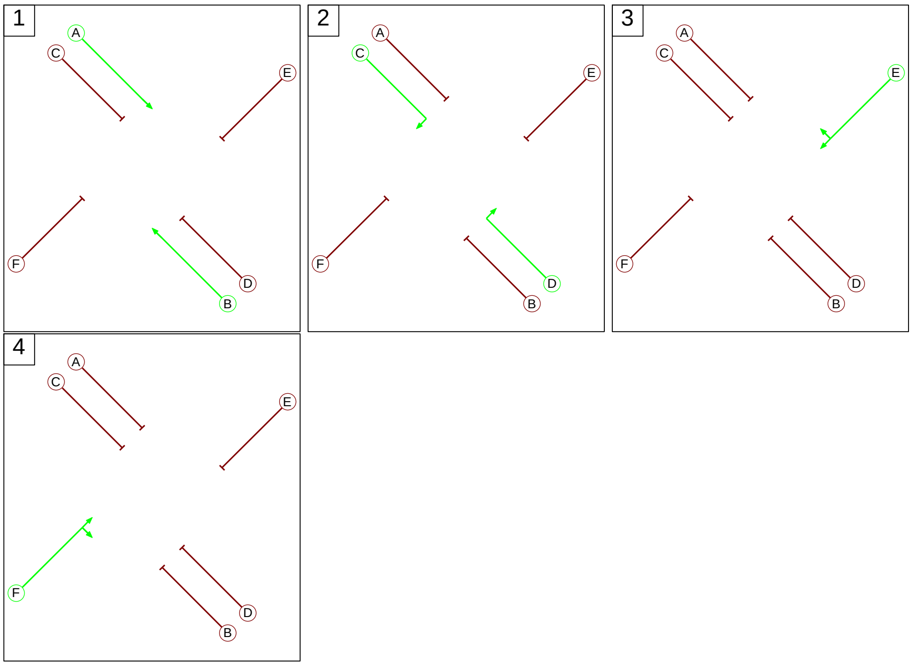
Figure 2.1: Whyke Junction Mitigation Model Stage Sequence



Stockbridge Junction

2.2.7 The Stockbridge Junction Mitigation model was also modelled with the same four stages used in the earlier study, as shown in Figure 2.2. Phase A controls the A27 eastbound ahead movement.

Figure 2.2: Stockbridge Junction Mitigation Model Stage Sequence

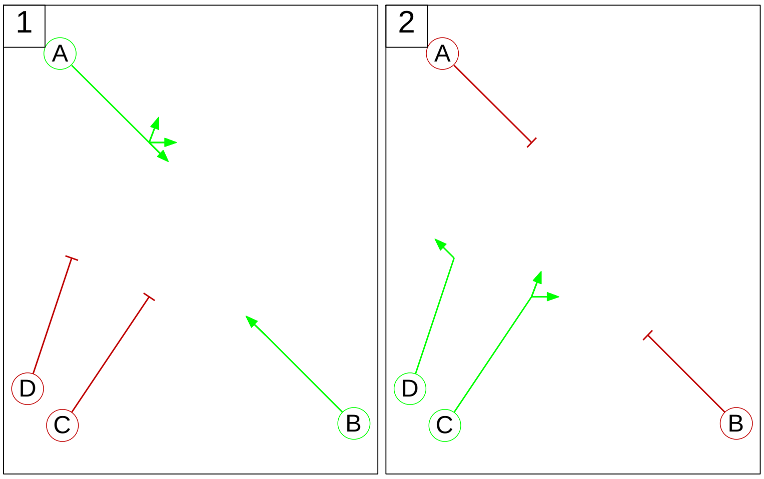


Fishbourne Roundabout

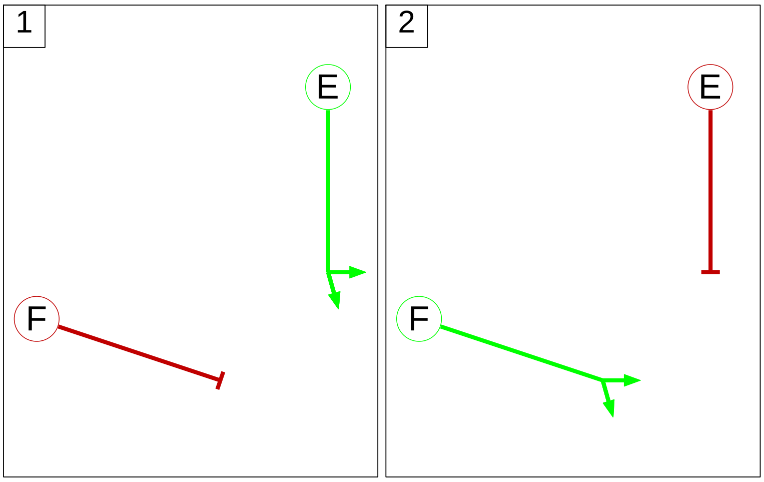
2.2.8 The Fishbourne roundabout Mitigation model was modelled with a revised stage sequence as shown in Figure 2.3. Stage stream 1 controls the A27 west node (phase A is the A27 eastbound movement), stream 2 the Cathedral Way node (phase E is the cathedral Way entry) and stream 3 the A27 east node (phase G is the A27 westbound movement).

Figure 2.3: Fishbourne Roundabout Mitigation Model Revised Stage Sequence

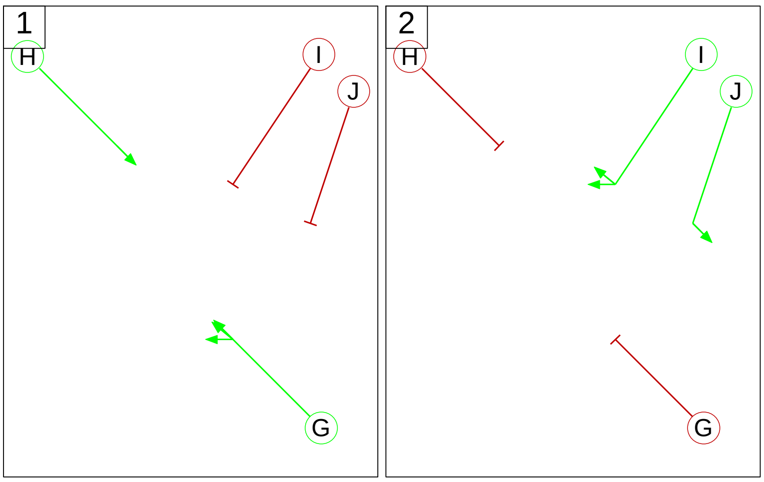
Stage Stream 1 (West Node)



Stage Stream: 2 (Cathedral Way Node)



Stage Stream: 3 (East Node)



3 BOGNOR ROUNDABOUT ADDITIONAL SENSITIVITY TEST RESULTS

3.1 Introduction

3.1.1 The earlier mitigation tests for Bognor Roundabout had assumed full use of the A27 (N) arm entry width. An analysis of the SE and Max SE Plan flows shows that in the AM peak, there are virtually no left turners from A27 (N) to A259 (E). The mitigation layout assumes that lane 1 on the A27 (N) arm is a dedicated lane for traffic turning left to the A259. Thus, assuming that the ahead traffic would use the full entry width when in reality they would only use lanes 2 and 3, would overestimate the capacity of the A27 (N) arm. As there are considerable left turners in the PM peak, the issue is limited to the AM peak. A further sensitivity test was run for the AM peak, which assumes a reduced width of the A27 (N) entry width to two lanes.

3.2 Results

3.2.1 The results are shown in Tables 3.1 for the SE Plan flows and Max SE Plan flows in the AM peak.

Table 3.1: Bognor Roundabout (Mitigation) Layout ARCADY Results (2031 SE & 2031 Max SE AM Flows) (DMRB Compliance- 8.3m)

Junction Link	2031 AM Peak (SE Flows)			2031 AM Peak (Max SE Flows)		
	RFC	Max Avg Queue (PCU)	Max Avg Delay/PCU (mins)	RFC	Max Avg Queue (PCU)	Max Avg Delay/PCU (mins)
A-A27(N) Chichester By-Pass	**1.565**	695.5	19.93	**1.432**	549.1	14.73
B-A259(E) Bognor Road	0.419	0.7	0.09	0.403	0.7	0.08
C-Vinnetrow Road (exit only)						
D-A27(S) Chichester By-Pass	**1.096**	128.0	3.47	**1.106**	138.6	2.76
E-A259(W) Bognor Road	0.707	2.4	0.18	0.513	1.0	0.11

4 WHYKE JUNCTION REVISED MITIGATION LAYOUT

4.1 Introduction

4.1.1 Whyke junction was re-modelled with the development flow scenarios. The new mitigation layout assumed that each A27 right turn would comprise a two-lane bay about 100m in length, rather than a single lane bay used in the earlier study.

4.1.2 Each model was assessed with optimised and weighted signal timings as follows:

- optimised scenarios. The LinSig model was allowed to optimise the signal timings, without the use of any stop or delay weightings, or queue penalties;
- weighted scenarios. The signal split timings were manually adjusted so that the predicted side road delays were no longer that than the equivalent delays in the baseline scenario.

4.2 Results

4.2.1 The results for the optimised and weighted scenarios for the AM and PM peak periods are shown in Figures 4.1 and 4.2 respectively. In each graph, the columns represent the average delay per PCU for all vehicles entering at each junction arm, as follows:

- red columns show the average delays for the baseline scenario;
- blue columns show delays with the 2031 SE flows. Dark blue is with optimised signal timings and light blue with weighted timings;
- green columns show delays with the 2031 Max SE flows. Dark green is with optimised signal timings and light green with weighted timings.

Figure 4.1: Whyke Junction Average Delays (AM Peak)

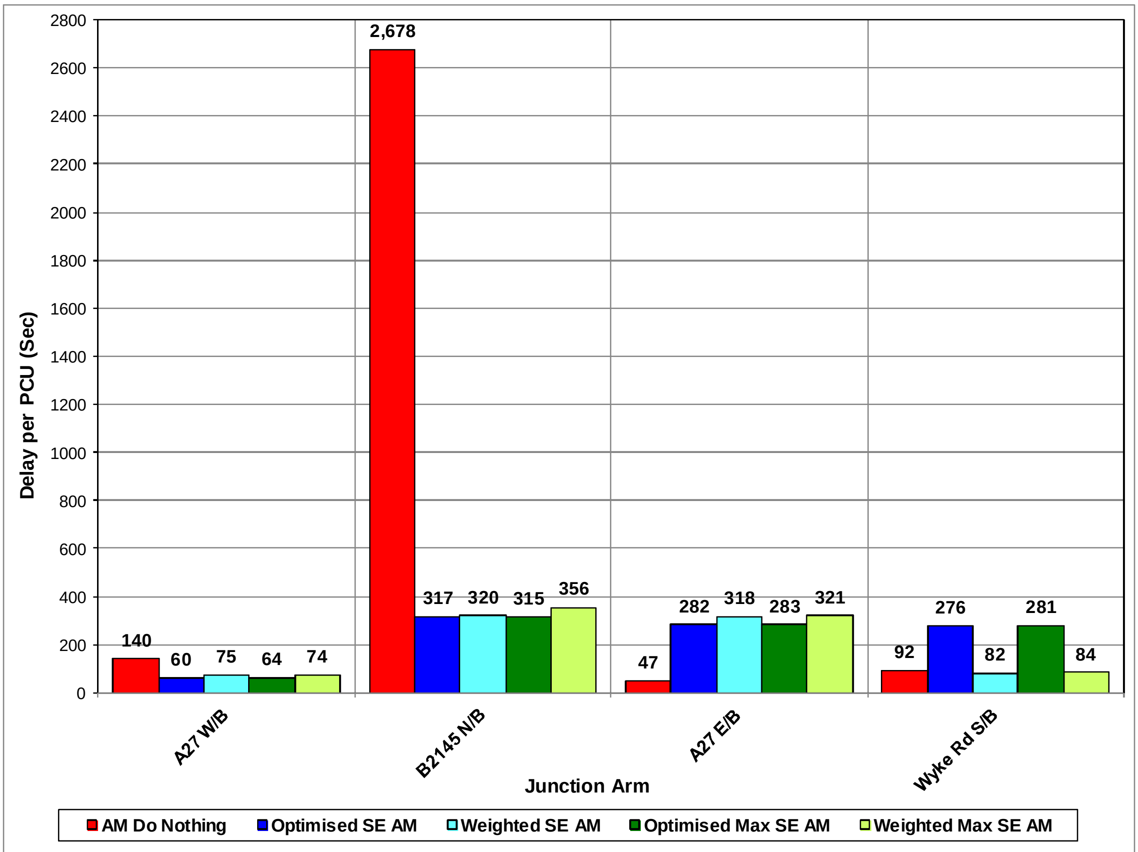
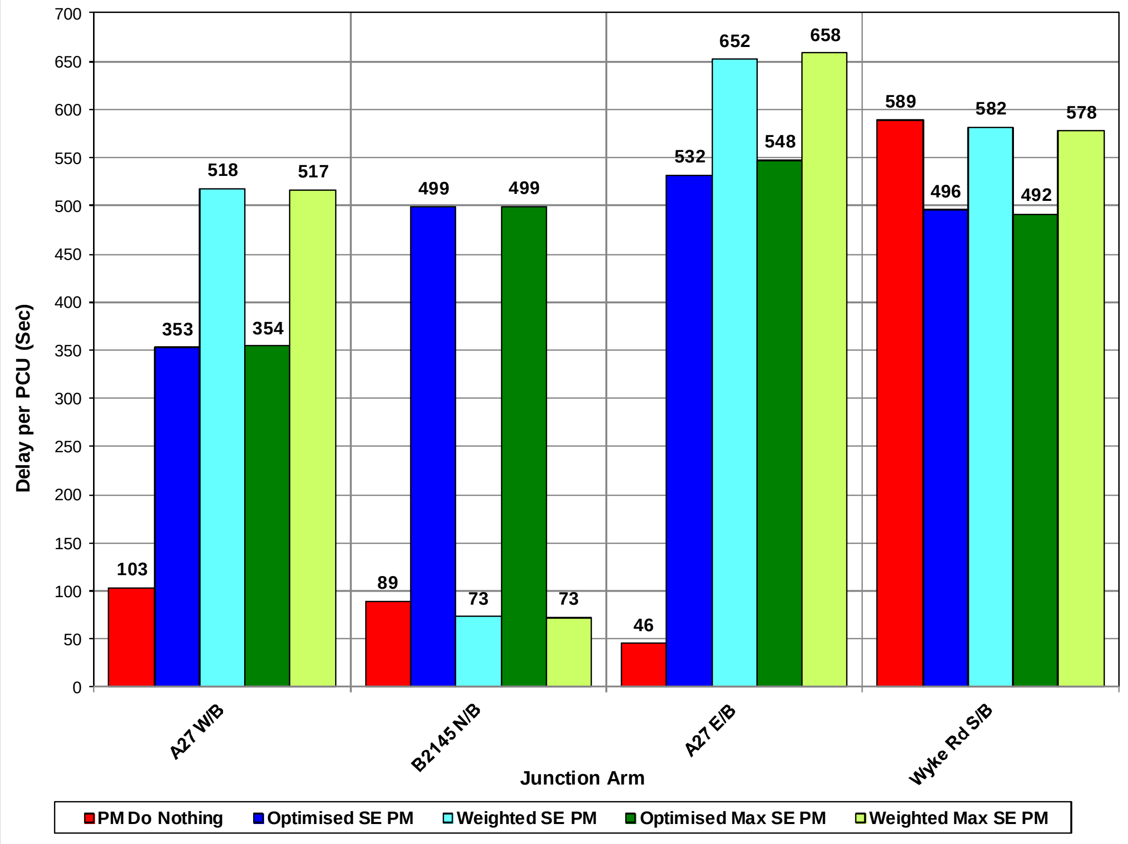


Figure 4.2: Whyke Junction Average Delays (PM Peak)



AM Peak Results Analysis

4.2.2 The AM peak results show that, with the optimised signal timings (dark blue and dark green columns), the A27 westbound and B2145 northbound arms had shorter delays than in the case of the baseline scenario. The A27 eastbound and Whyke Road (southbound) arms, however, had longer delays.

4.2.3 With the weighted signal timings (light blue and light green columns), both side roads, as required, achieved delays no longer than the baseline scenario. The A27 westbound arm had increased delays which were still, however, shorter than the baseline scenario. The A27 eastbound delays also increased.

PM Peak Results Analysis

4.2.4 With the optimised signal timings, the A27 westbound, B2145 northbound and A27 eastbound arms suffered longer delays than the baseline scenario. Only the Whyke road (southbound) arm achieved shorter delays.

4.2.5 With weighted timings, both the B2145 northbound and Whyke Road (southbound) arms achieved shorter delays than the baseline scenario. The two A27 arms, however, suffered increased delays.

4.3 A27 Right Turn Capacity (Weighted Signal Time Scenarios)

4.3.1 The AM peak results predicted that A27 eastbound right turn traffic would be constrained from entering the two-lane right turn bay by adjacent A27 ahead movement queues. The bay, however, would operate within capacity, whether or not the full demand flow reached the stop-line. Westbound, there was no constraint to traffic entering the right turn bay, which also operated within capacity. Thus, in the AM peak, the A27 ahead traffic would not be significantly constrained by right turn traffic queues, although, potentially, there would be a reduction in flow across the stop-line (later in the green period) due to right turn vehicles queuing upstream of the bay entry.

4.3.2 In the PM peak period, vehicles on both right turns were constrained from entering their respective bays by A27 ahead queues. The eastbound right turn movement had insufficient capacity even with the reduced flow and this would be exacerbated if the bay were extended, because more of the demand flows would be able to reach the stop-line. Right turn queues could then extend back into lane 2 thus constraining, and increasing delays to, A27 ahead traffic. The westbound right turn movement operated within capacity and would do so even if the full demand flow were allowed through.

5 STOCKBRIDGE JUNCTION REVISED MITIGATION LAYOUT

5.1 Introduction

5.1.1 Stockbridge junction was re-modelled with similar changes to those made for Whyke junction, with each A27 right turn comprising a two-lane bay about 100m long, rather than a single lane bay used in the earlier study.

5.1.2 Both optimised and weighted signal timing scenarios were modelled.

5.2 Results

5.2.1 The results for the optimised and weighted scenarios for the AM and PM peak periods are shown in Figures 5.1 and 5.2 respectively. In each graph, the columns represent the average delay per PCU for all vehicles entering at each junction arm, for the same scenarios as in the Whyke junction model.

Figure 5.1: Stockbridge Junction Average Delays (AM Peak)

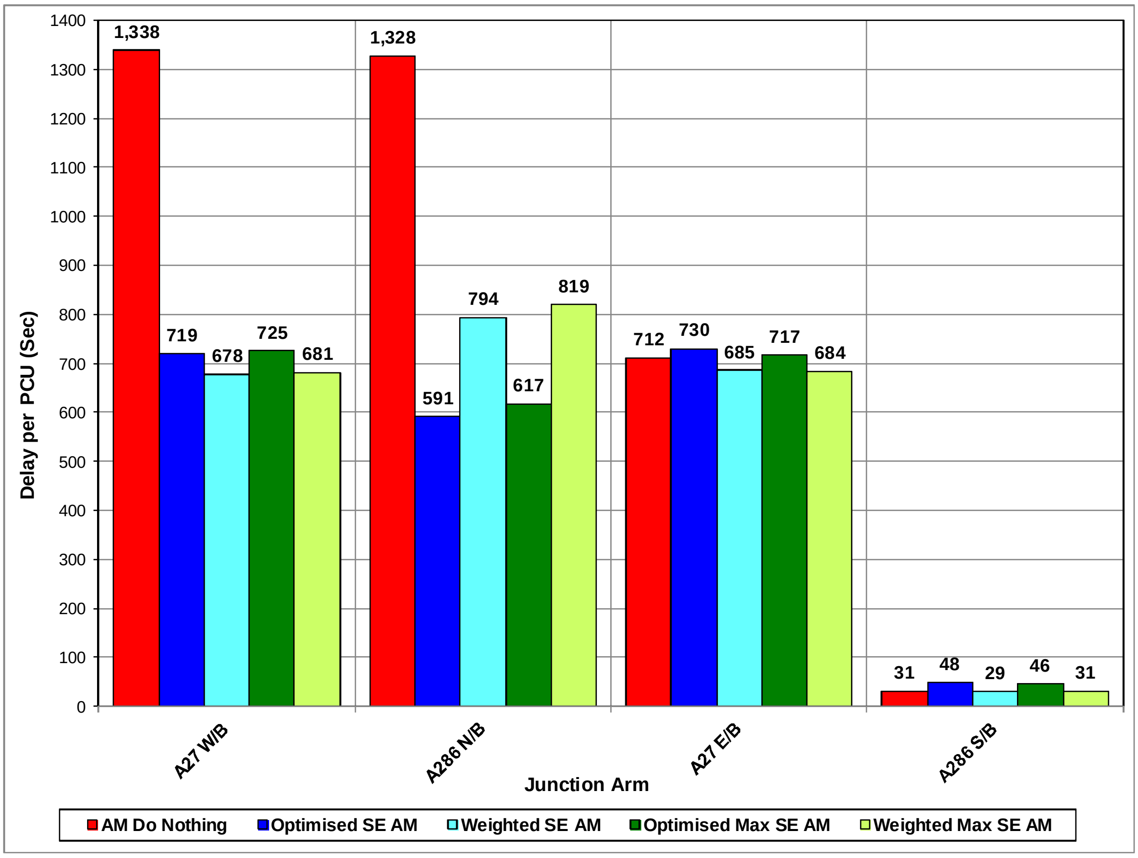
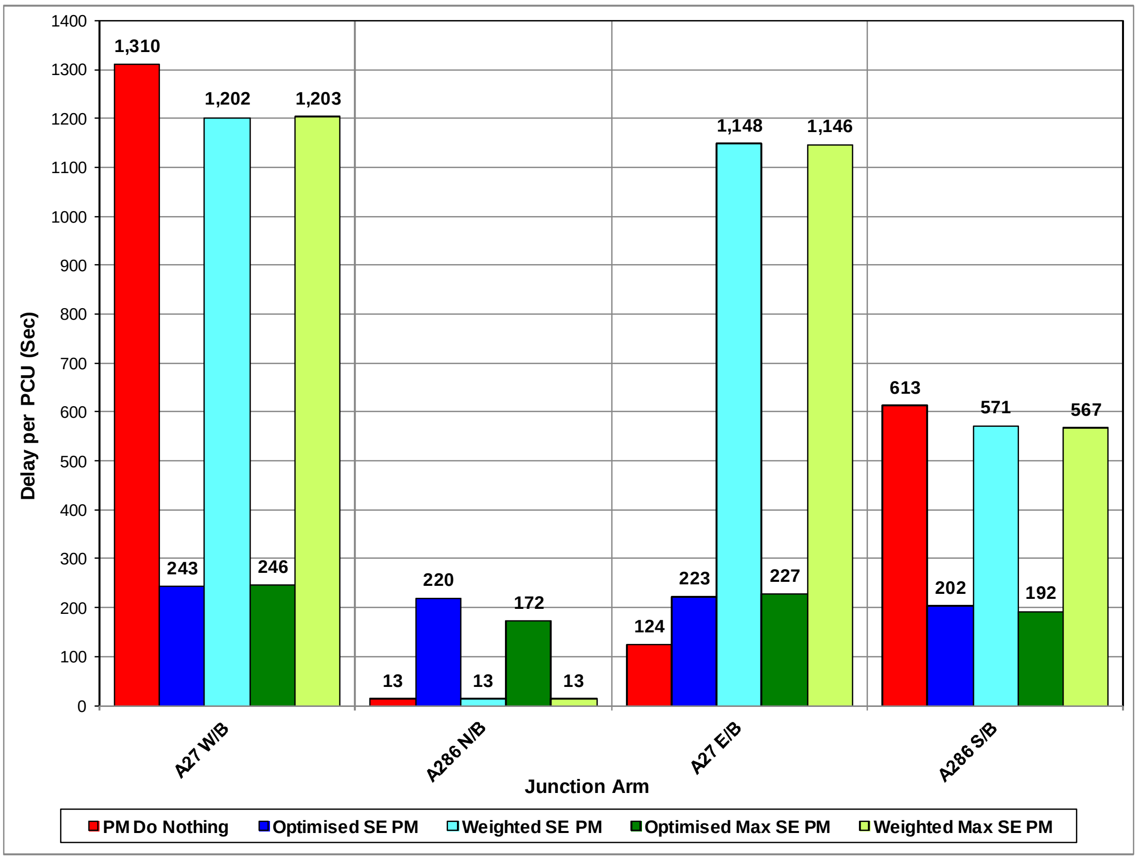


Figure 5.2: Stockbridge Junction Average Delays (PM Peak)



<u>AM Peak Results Analysis</u>

5.2.2 The AM peak results show that, with the optimised signal timings, the A27 westbound and A286 northbound arms achieved shorter delays than the baseline scenario. The A27 eastbound and A286 southbound arms, however, had slightly longer delays.

5.2.3 With the weighted timings, there was spare green time on the A286 southbound arm, which could be allocated to the other arms as required. This was sufficient to achieve delays no greater than the baseline scenario, on all four arms.

<u>PM Peak Results Analysis</u>

5.2.4 With the optimised signal timings, the A27 westbound and A286 southbound arms achieved shorter delays than the baseline scenario. The A286 northbound and A27 eastbound arms, however, suffered longer delays.

5.2.5 With weighted timings, delays on both side roads were no greater than the baseline scenario. Both A27 arms suffered increased delays, however, although the A27 westbound arm still had shorter delays.

5.3 A27 Right Turn Capacity (Weighted Signal Time Scenarios)

5.3.1 In all flow scenarios, traffic would be constrained from entering both right-turn bays by the A27 ahead queues.

5.3.2 In the AM peak period, both right turn movements operated with spare capacity, and would still do so, even if the full demand flows reached the stop-lines.

5.3.3 In the PM peak period, the right turn (stage 2) green times were much shorter than in the AM peak. Both movements still had spare capacity, although this was only because of the reduced flow caused by the upstream constraints. They would both have insufficient capacity if the full demand flows were to reach the stop-lines.

5.3.4 Lengthening the right turn bays could increase the vehicle flows reaching the right turn bay stop-lines. It is possible that some benefit could be obtained in the case of the westbound bay since, even with the full PM peak demand flow, the degree of saturation would still only be about 95%. Nevertheless, there could still be the risk that longer queues would be generated, which could block the A27 ahead lane 2.

5.3.5 If the full demand flow reached the eastbound bay it would be heavily oversaturated, leading to long queues which could block lane 2. Also, additional green time could only be provided for the right turn movements by reducing it for the A27 ahead movements.

6 FISHBOURNE JUNCTION REVISED MITIGATION LAYOUT

6.1 Introduction

6.1.1 The following changes were made to the Fishbourne mitigation layout.

- The Terminus Road and Fishbourne Road arms were modelled with give-way entries, instead of being signalled.
- Cathedral Way retained a signalled entry, but an opposing, internal stop-line was added.
- The left turns on to the A27 were signalled.
- A circulatory lane drop was used, leading to A27 eastbound, because of the relatively high left-turn demand flow. The adjacent circulatory movement across the A27, was reduced to two lanes.
- A lane gain was implemented at the Fishbourne Road node.
- A lane drop and gain was also introduced at the Terminus Road node.
- The left turn to A27 westbound was via a flared lane, which could be blocked by queues on the adjacent circulatory lane 1. Three circulatory lanes were retained at the A27 northwest node.

6.1.2 It was considered whether or not there would be any benefit in allowing eastbound and westbound traffic, turning left into the roundabout from the A27, to use not only the lane 1 flare, but also to share the middle lane with the ahead traffic. Given that in each flow scenario, the left turn flows were less than a third of the total A27 approach flows, however, it is believed that there would be no capacity benefit (see also Section 6.3 of this Technical Note).

6.1.3 The junction scenarios were modelled with optimised signal timings only.

6.2 Results

6.2.1 The results for the AM and PM peak periods are shown in Figures 6.1 and 6.2 respectively. The columns represent the average delay per PCU for all traffic movements through the junction from each arm, as follows:

- red columns show the delays for the baseline scenario;
- blue columns show delays with the 2031 SE flows;
- green columns show delays with the 2031 Max SE flows.

Figure 6.1: Fishbourne Junction Average Delays (AM Peak)

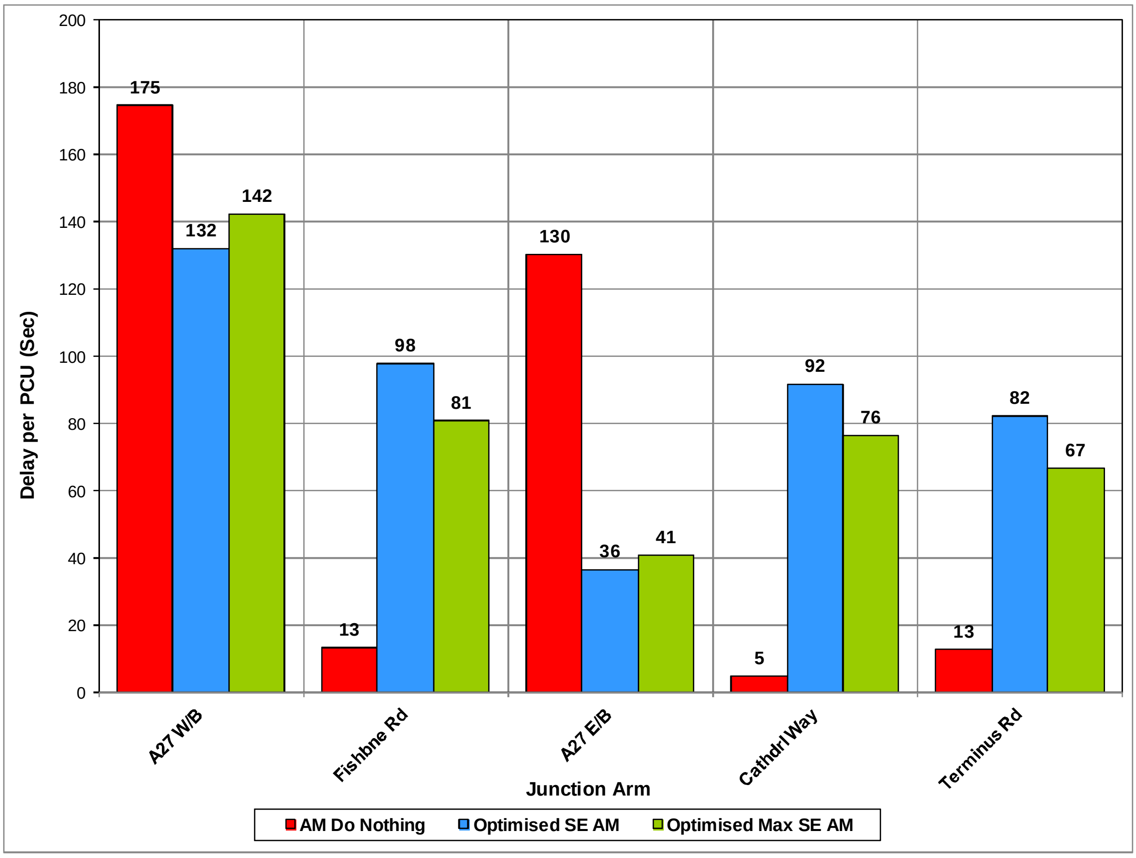
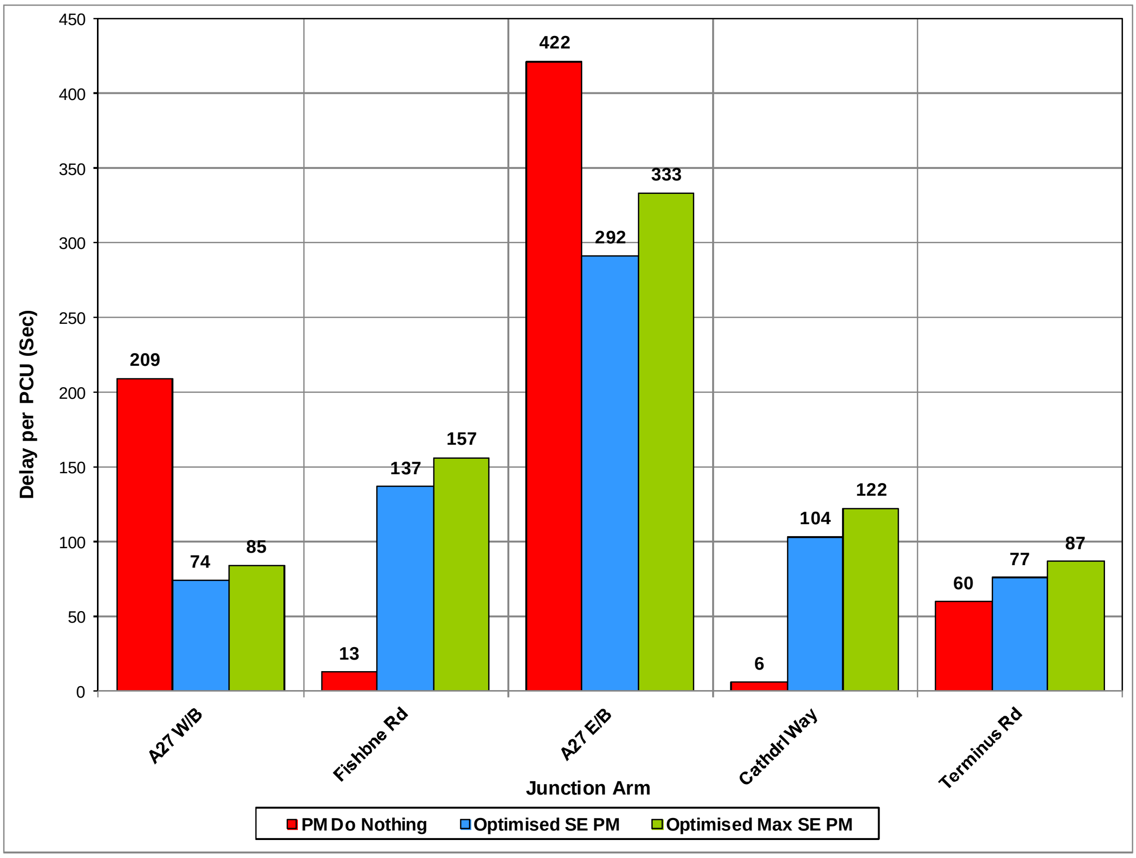


Figure 6.2: Fishbourne Junction Average Delays (PM Peak)



Results Analysis

6.2.2 The results for both peak periods predict similar outcomes. Average delays for all traffic entering the junction from the A27 arms, are shorter than in baseline scenario. Vehicles entering from the three side road arms, however, suffer longer delays. In all cases, the Max SE scenario traffic has slightly longer delays than the SE traffic.

6.3 A27 Turning Movement Capacities

6.3.1 In the AM peak period, A27 westbound traffic was slightly constrained from entering the turning bay (leading to the roundabout circulatory), by the A27 ahead queues. There were no constraints to the eastbound turning bay.

6.3.2 The westbound bay operated slightly over capacity. If the full demand flows were able to reach the stop-line, the performance would be even worse, with an estimated degree of saturation of 95%. The eastbound left turn would have spare capacity whether or not the full demand flows reached the stop-line.

6.3.3 In the PM peak period, westbound turning bay traffic was not constrained by the A27 ahead queues, whilst eastbound traffic was slightly constrained. Both left A27 turns operated with spare capacity and would still do so, even if any upstream constraints were removed.

6.3.4 It is believed that there would be no benefit in allowing traffic to enter the turning bays from lane 2, as well as lane 1. This is because, with the modelled layout, the ahead lanes tended to have less capacity than the bays in any case and allowing the bay traffic to share lane 2 would only exacerbate A27 ahead movement delays. In any case, since the general level of constraint was low, probably due to both movements running in the same phase (i.e. queues concurrently building and discharging), lengthening the bays would not significantly ameliorate A27 ahead traffic delays.

7 A27 ROUTE DELAYS

7.1 Introduction

7.1.1 The A27 ahead movement delays at each junction were calculated from the results reported in Technical Note 02, where relevant, and from the new results reported in Sections 3 to 6 of the present Technical Note. In the case of the Whyke and Stockbridge junctions, the new, weighted signal results were used.

7.1.2 The individual A27 ahead movement delays at each were then summed in order to calculate the overall A27 route delays through all six junctions.

7.1.3 Finally, the overall route delays in each direction were summed to calculate average delays for vehicles making two-way trips in both directions through the junctions.

7.2 A27 Delays at Each Junction

Results

7.2.1 Figures 7.1 to 7.4 contain the predicted A27 ahead traffic delays at each junction, for each direction and peak period. The columns represent the average delay per PCU, as follows:

- red columns show the delays for the baseline scenario;
- blue columns show delays with the 2031 SE flows;
- green columns show delays with the 2031 Max SE flows.

Figure 7.1: A27 Delays at Each Junction (Westbound AM Peak)

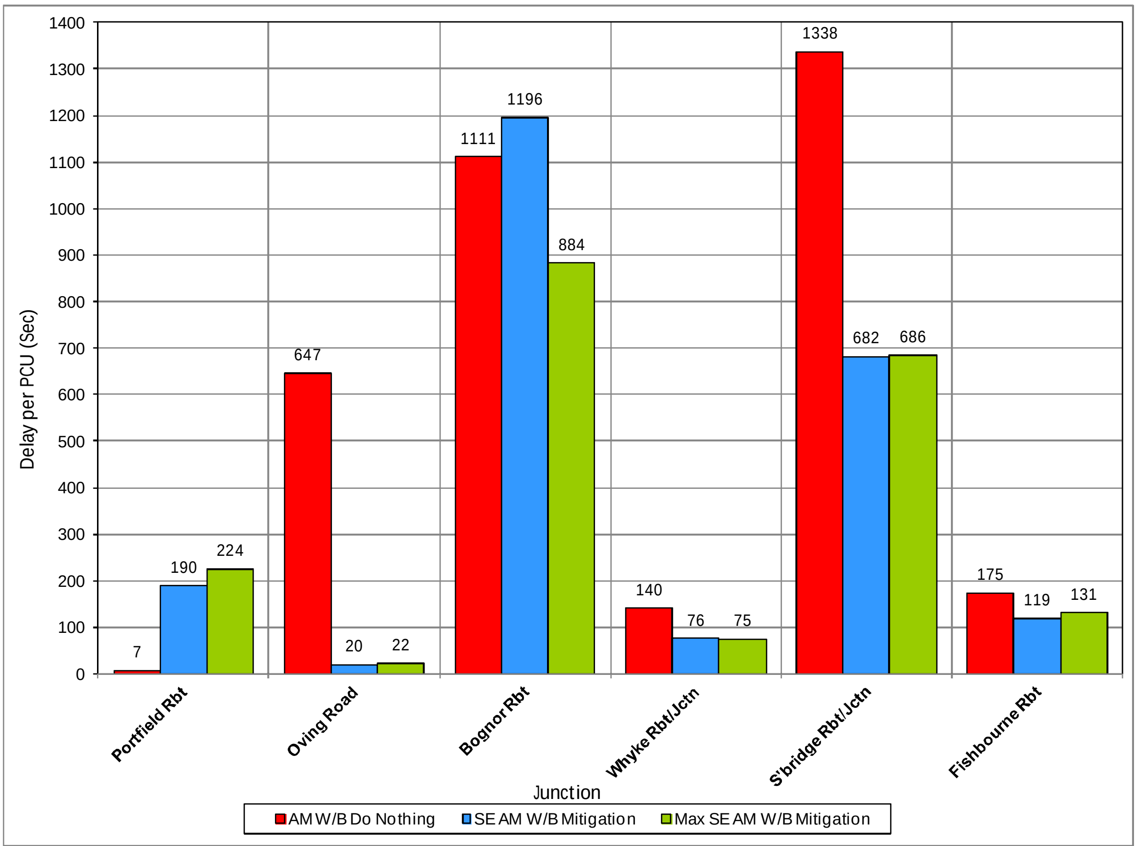


Figure 7.2: A27 Delays at Each Junction (Eastbound AM Peak)

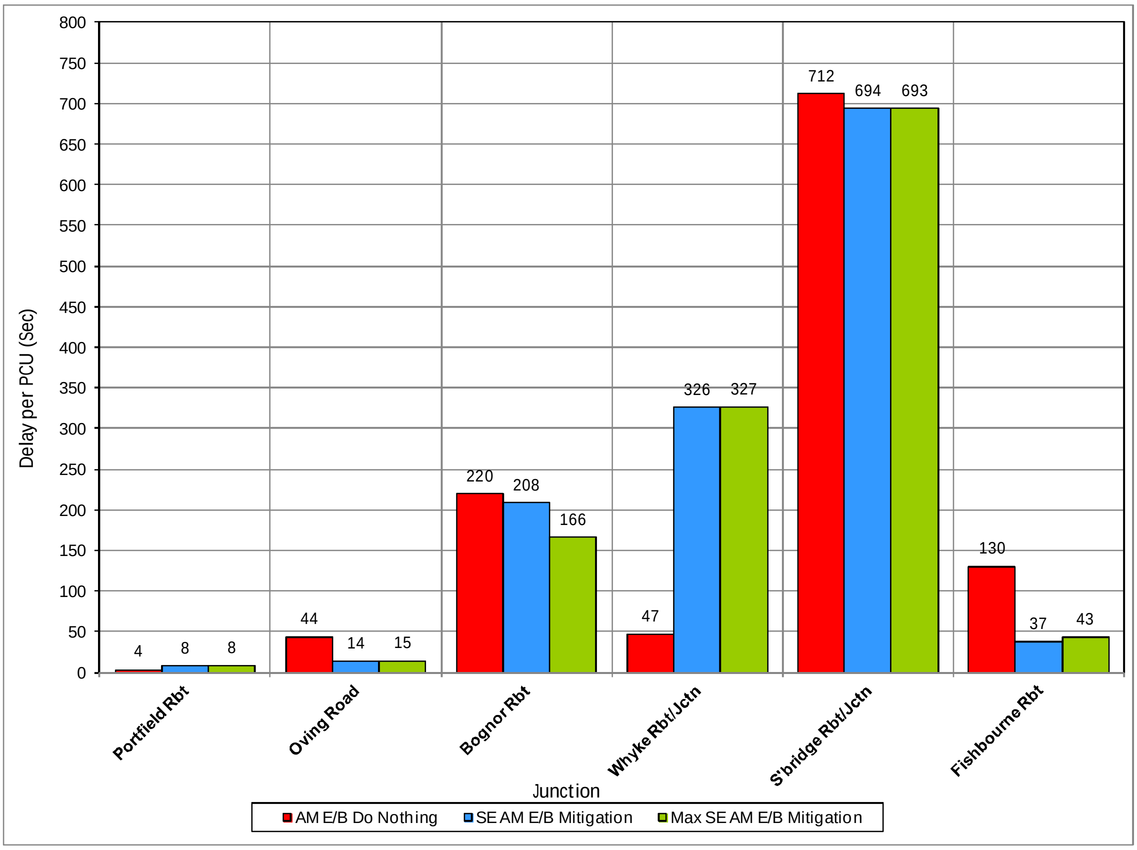


Figure 7.3: A27 Delays at Each Junction (Westbound PM Peak)

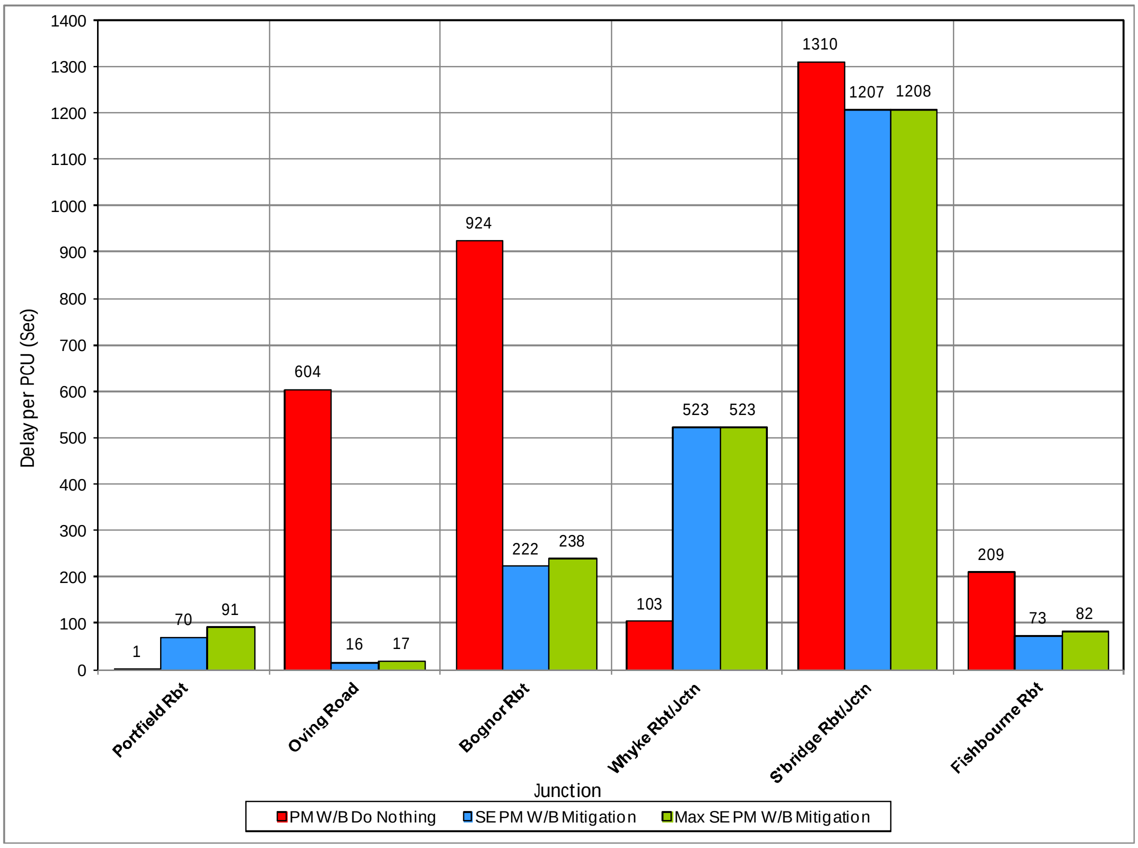
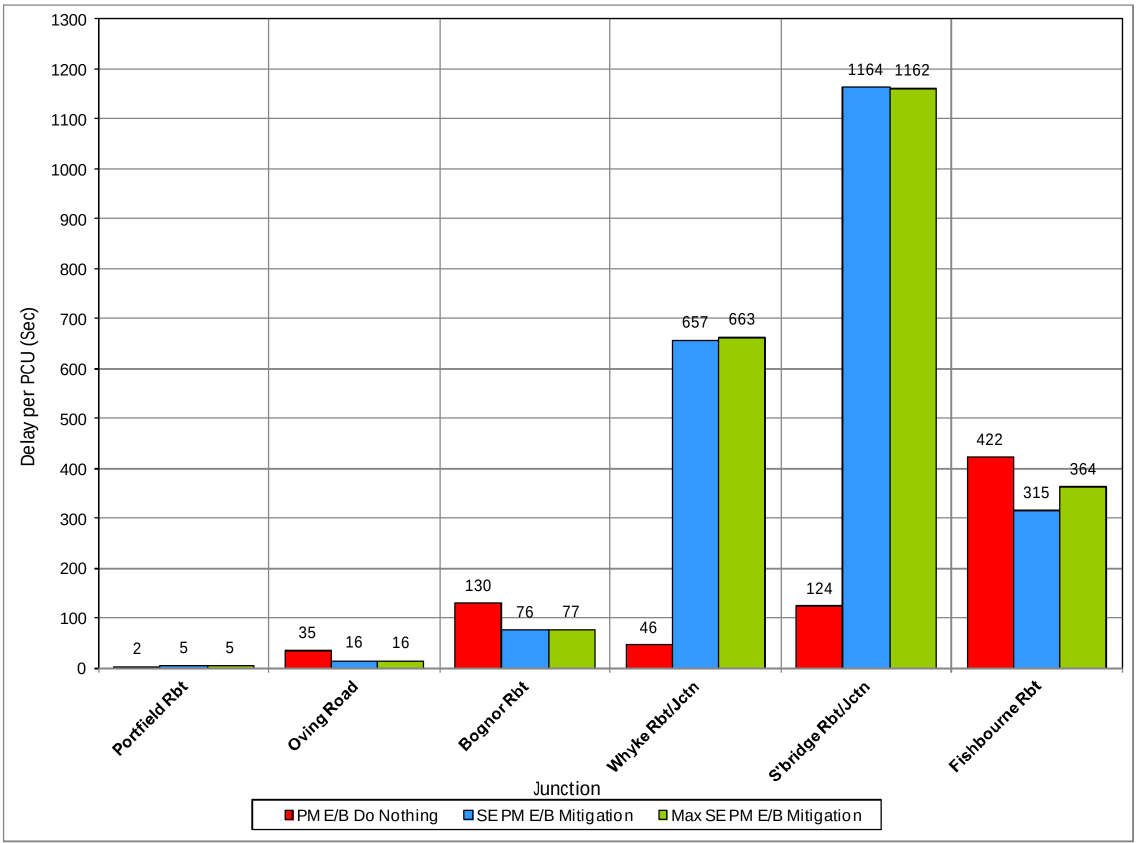


Figure 7.4: A27 Delays at Each Junction (Eastbound PM Peak)



Results Analysis

7.2.2 Average delays at Portfield roundabout were longer than in the baseline scenarios, in both directions and peak periods. This was not unexpected as no mitigation measures are proposed for this junction.

7.2.3 Oving Road junction achieved shorter delays than the baseline scenarios, in all four cases. These reductions are much more significant in the westbound direction.

7.2.4 With the SE flows, the Bognor roundabout suffered longer delays than the baseline. in the westbound AM peak scenario (Figure 7.1). In the other three scenarios shorter delays were achieved. With the Max SE flows it had shorter delays in all four scenarios.

7.2.5 With both development flows, Whyke junction had shorter delays than the baseline, in the westbound AM peak scenario (Figure 7.1). Delays were longer in the other three scenarios.

7.2.6 Stockbridge junction achieved shorter delays than the baseline in the AM peak scenarios (Figures 7.1 and 7.2), as well as in the westbound PM peak scenarios (Figure 7.3). Delays were significantly longer, however, in both eastbound PM peak scenarios (Figure 7.4).

7.2.7 The proposed Fishbourne roundabout achieved shorter delays than the baseline scenario, in all four scenarios. In each case, delays with the Max SE flows were slightly longer than those with SE flows.

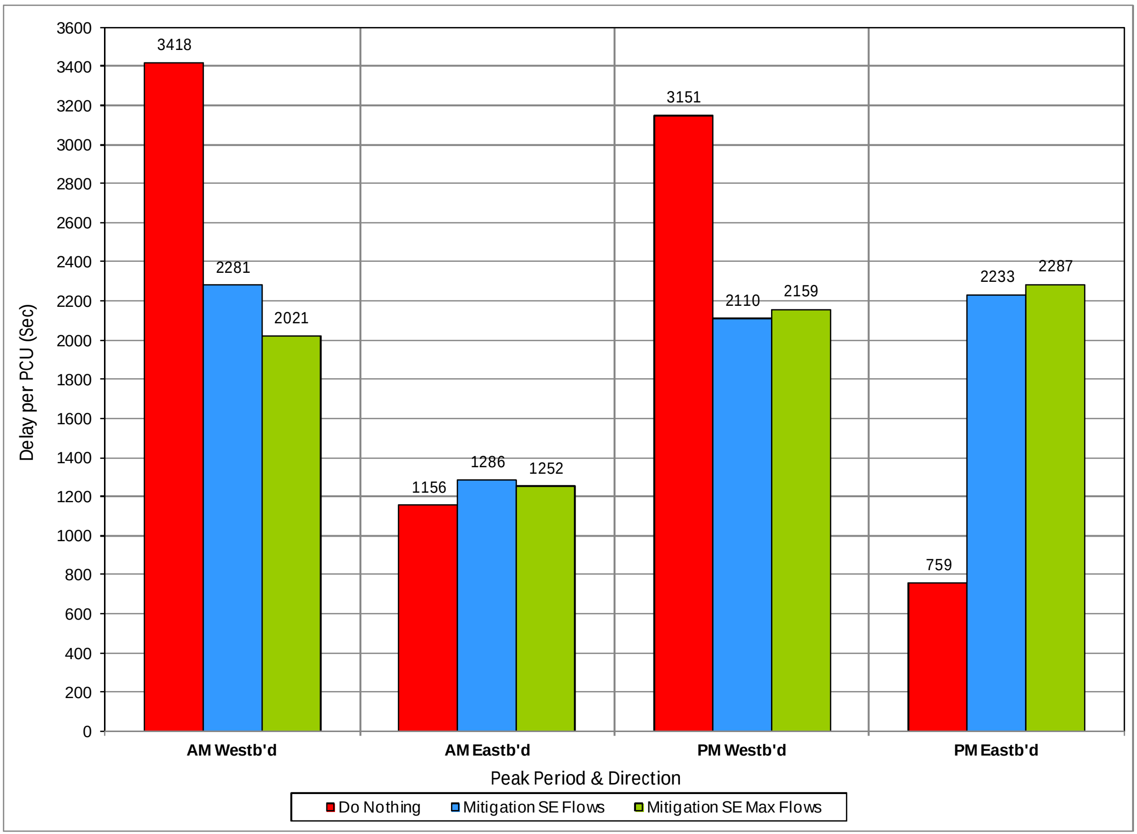
7.3 Overall A27 Route Delays (Each Direction)

7.3.1 The individual junction delays recorded in Section 7.2, were summed in order to estimate the overall route delays for each direction and peak period.

Results

7.3.2 Figure 7.5 contains the individual eastbound and westbound results for the baseline, SE and Max SE scenarios, in each peak period.

Figure 7.5: Overall A27 Route Delays (Each Period and Direction)



Results Analysis

7.3.3 The results predict that the A27 westbound delays through all six junctions, would be shorter than the baseline scenarios in both peak periods. In the eastbound direction, however, delays would be longer in both periods.

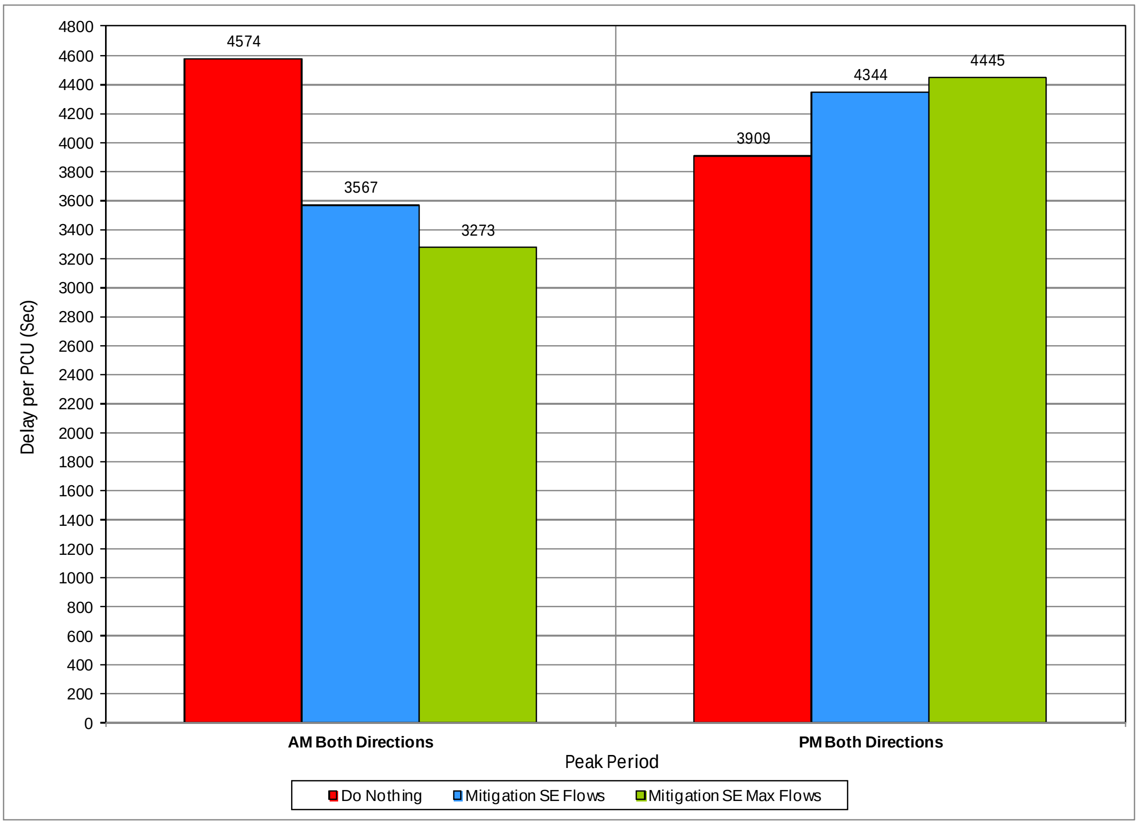
7.4 Overall A27 Route Delays (Two-way Trip for Each Peak Period)

7.4.1 The eastbound and westbound delays recorded in Section 7.3, were summed to estimate the delays for two-way, eastbound/westbound trips in each peak period.

Results

7.4.2 Figure 7.6 contains the route delay results.

Figure 7.6: Overall A27 Route Delays Two-way Trips (AM and PM Peak)



<u>Results Analysis</u>

7.4.3 Figure 7.6 shows that in the AM peak period, the predicted delays would be shorter than the baseline scenario, whilst in the PM peak they would be longer.

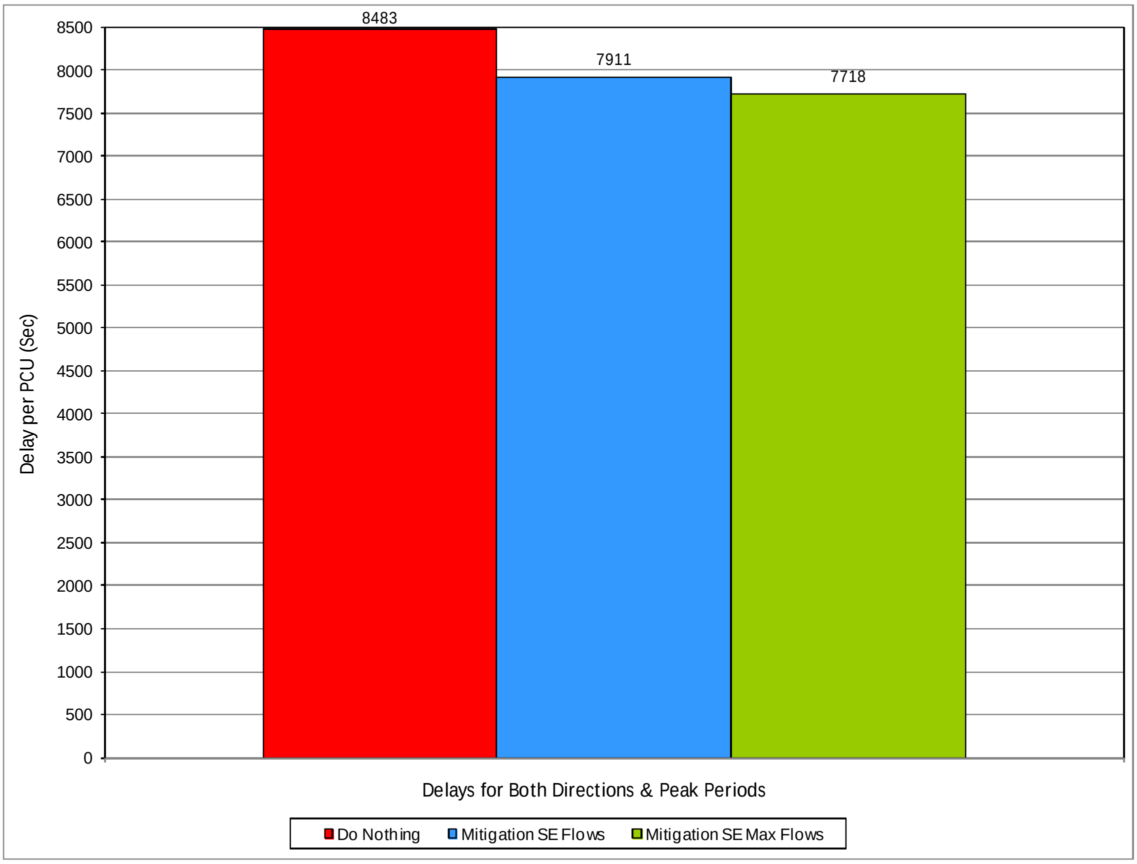
7.5 Overall A27 Route Delays (Two-way Trip Over Both Peak Periods)

7.5.1 Finally, the two-way AM and PM peak delays recorded in Section 7.4, were summed to estimate the delays for two-way, eastbound/westbound trips over both peak periods.

<u>Results</u>

7.5.2 Figure 7.7 contains the delay results.

Figure 7.7: Overall A27 Route Delays Two-way Trips (Both Periods Together)



Results Analysis

7.5.3 Figure 7.7 shows that with two-way trips over both peak periods, the predicted A27 route delays would be shorter in both 2031 development flow scenarios, than in the baseline scenario.

8 CONCLUSIONS

8.1 Introduction

8.1.1 This study has assessed the impact of the 2031 SE and Max SE flow scenarios, on A27 mainline delays between the Portfield and Fishbourne junctions. The same flow scenarios were used as in Technical Note 02.

8.1.2 Changes were also made to mitigation layouts of three of the six junctions as part of the study.

8.2 Assessed Junctions

8.2.1 Four of the six junctions were reassessed:

- the Bognor roundabout mitigation layout was re-modelled, to take account of the very low A27 North left turn movement in the AM peak;
- a revised Whyke junction mitigation layout was re-modelled, with two-lane A27 right turn bays. The green split signal timings were initially optimised. They were then also manually weighted so that side road delays were no worse than those in the baseline scenarios;
- a revised Stockbridge junction mitigation layout was also re-modelled with two-lane A27 right turn bays. Signal timing were initially optimised, and then weighted for the reason given above.
- a revised Fishbourne junction mitigation layout was also modelled, incorporating recommendations made in Technical Note 02. Optimised signal timings only were modelled.

8.2.2 Consideration of whether or not any of the revised layouts would be viable was beyond the scope of this study.

8.2.3 The LinSig models for the Whyke, Stockbridge and Fishbourne junctions were amended in order to more accurately assess the turning movement interactions on each approach arm.

8.3 Bognor Roundabout Results

8.3.1 The new results for the AM peak development flow scenarios were used to assess the overall A27 route delays.

8.4 Whyke Junction Results

8.4.1 AM peak, A27 westbound delays were shorter than in the baseline scenario. Eastbound delays, however, were longer.

8.4.2 PM peak, A27 westbound and eastbound delays were longer than in the baseline scenario.

8.4.3 In three of the four development flow scenarios (weighted signal timings), A27 traffic was constrained from entering the right turn bays by the ahead queues. It is possible that extending the westbound bay could reduce the level of constraint in the PM peak (there was no constraint in the AM peak), although it probably would not give significant benefit since, given the low degree of saturation, the bay queues would be unlikely to extend back into lane 2 in any case. Extending the eastbound bay would not improve matters because the over-saturated PM right turn movement would cause longer queues, which would be even more likely to extend back into, and block, lane 2.

8.4.4 Whilst A27 right turn queues would probably not be accommodated within the 100m, two-lane right turn bays with all flow scenarios, it is concluded that the increased stacking room would be acceptable in terms of the overall impact upon A27 ahead movement delays. The main factor contributing to these delays would then be the level of capacity at the A27 ahead stop-lines.

8.5 Stockbridge Junction Results

8.5.1 AM peak, A27 westbound delays were shorter than the baseline scenario. Eastbound delays were shorter only with the weighted signal timings.

8.5.2 PM peak, A27 westbound delays were shorter than in the baseline scenario, but eastbound delays were longer, significantly so with weighted signal timings.

8.5.3 With weighted signal timings, A27 traffic was constrained from entering the right turn bays in all four development flow scenarios. Lengthening the bays could reduce these constraints and both right turns would still have spare capacity in the AM peak. It is doubtful if this would bring any benefit since, as matters stood in the models, the bay queues did not constrain lane 2. In the PM peak period, extending the bays could result in insufficient capacity if the full demand flow could then reach the stop-line. This could then cause longer bay queues which would be more likely to block lane 2.

8.5.4 As in the case of Whyke junction, it is concluded that 100m two-lane right turn bays on the A27 arms would be acceptable in terms of the overall impact upon A27 ahead movement delays. The main factor contributing to these delays would then be the level of capacity at the A27 ahead stop-lines.

8.6 Fishbourne Hamburger Roundabout Results

8.6.1 Delays were calculated for all traffic movements through the junction, entering from each arm.

8.6.2 The results for both peak periods predicted similar outcomes. Both A27 arms had shorter average delays than in the baseline scenario. The three side roads, however, suffered longer delays.

8.6.3 It remains to be seen if the Fishbourne roundabout would also be capable of achieving shorter delays for traffic entering on all five arms.

8.6.4 It is concluded that allowing traffic to enter the A27 nearside turning bays from lane 2 as well as lane 1, would be unlikely to bring any additional benefit to the A27 ahead movement delays. The main influence on these delays is the level of capacity at the A27 ahead stop-lines.

8.7 Overall A27 Route Delays

8.7.1 The results were used to calculate the average delays per PCU for A27 ahead traffic only, through each of the six junctions. Table 8.1 contains a comparison of average delays at each junction for each peak period, direction and development flow scenario. Each cell is derived by subtracting the baseline delays from the equivalent development flow delays. Positive values (emboldened and underlined) thus indicate where development flow delays are longer than the baseline delays. Total route delay differences for each scenario are also included (italicised).

Table 8.1: A27 Route Delays at Each Junction, Compared with Baseline Delays

Roundabout / Signalled Junction	Delay Differences (Sec/PCU) AM Peak				Delay Differences (Sec/PCU) PM Peak			
	Westbound		Eastbound		Westbound		Eastbound	
	SE	Max SE	SE	Max SE	SE	Max SE	SE	Max SE
Portfield	**182**	**217**	**4**	**5**	**70**	**90**	**3**	**3**
Oving Road	-627	-625	-31	-30	-588	-587	-20	-20
Bognor	**85**	-227	-11	-54	-702	-686	-54	-53
Whyke	-65	-66	**279**	**280**	**420**	**420**	**612**	**617**
Stockbridge	-656	-653	-18	-18	-103	-102	**1040**	**1039**
Fishbourne	-56	-44	-93	-87	-137	-127	-107	-58
Total Route	*-1137*	*-1397*	***130***	***96***	*-1040*	*-992*	***1475***	***1528***

8.7.2 Portfield roundabout is the worst performing junction in the two AM peak, westbound scenarios, whilst Whyke junction is the worst performer in the AM peak eastbound and PM peak westbound scenarios. Stockbridge junction is the worst performer in the two PM peak eastbound scenarios.

8.7.3 The totals at the bottom of the table indicate that all four westbound scenarios would achieve mitigation, in terms of overall A27 route delays through all six junctions. Mitigation is not achieved by the eastbound scenarios.

8.7.4 The eastbound and westbound delays for each scenario were summed, in order to estimate delays for two-way, (eastbound and westbound) trips. The AM peak, westbound delay benefits were more than adequate to compensate for the longer eastbound delays, indicating that mitigation would probably be achieved for AM peak, two-way trips. In the PM peak, however, the longer eastbound delays outweigh the shorter westbound delays and thus mitigation would probably not be achieved for two-way trips. Looking at Table 8.1 again, it can be seen that the Stockbridge junction delays (in the PM, eastbound scenarios) are the main cause of this failure to mitigate the development flows, although Whyke's contribution is also significant.

8.7.5 It is clear that the revised Whyke and Stockbridge mitigation layouts would still have significant detrimental impact upon the A27 route delays in some scenarios. It is suggested that the main reason for this is the lack of A27 ahead movement stop-line capacity at each junction, caused mainly by the need for a four-stage signal cycle.

8.7.6 Finally, the AM and PM two-way trip delays were combined to give average two-way trip delays over both periods (effectively the total average delay for a vehicle making a two-way trip in the AM peak and then another in the PM peak). In this case, both development flow scenarios achieved lower overall delays than in the case of the Baseline scenario.

8.8 Recommendations

8.8.1 It is recommended that the proposed mitigation layouts, for the Whyke and Stockbridge junctions, should be amended so that the A27 right turn bays comprise two short lanes of at least 100m in length.

8.8.2 The following changes to the Fishbourne roundabout mitigation layout are recommended.

- The Terminus Road and Fishbourne Road arms should have give-way entries.
- Cathedral Way should have an opposing, internal stop-line.

- The left turns on to the A27 should be signalled.
- Lane drops and gains should be introduced:
  - a lane drop at the left turn to A27 eastbound;
  - a lane gain at the Fishbourne Road node;
  - a lane drop and gain at the Terminus Road node.

Further investigation of Fishbourne junction layout scenarios was beyond the scope of this study.

8.8.3 Any measures to further reduce overall A27 route delays through the Whyke, Stockbridge and Fishbourne junctions, should focus on improving the capacity of the A27 ahead movement stop-lines.

8.8.4 Although there are still reservations concerning the predicted peak eastbound delays to A27 route traffic through all six junctions (particularly in the case of Stockbridge junction in the PM peak period), at this stage there is sufficient evidence to suggest that the mitigation layouts assessed in this study (and their associated costs) would be of sufficient overall magnitude to mitigate the impacts of both 2031 development flow scenarios.