ITS Group

Economy Transport and Environment Department

Hampshire County Council

Hayling Island Mitigation Measures

A27 Langstone roundabout

Introduction

This report investigates highway improvement measures at A27 Langstone roundabout in Havant. It has been commissioned by Havant Borough Council in support of the Local Plan.

The existing and proposed layouts have been modelled using Linsig3 software. The model covers the four signalised arms of the A27 roundabout with Park Road South and Langstone Road.

A27 Langstone roundabout model

The proposals have been developed by Havant Borough Council and are outlined below.

Mitigation Measures – Park Road South would be widened from a 3 to 4 lane southbound entry on to roundabout. A southbound bus lane would be provided on the eastern circulatory section of the roundabout exiting on to Langstone Road. The layout is shown on diagram 1.

The base traffic data has been collected from a traffic survey undertaken on 12th September 2017. The Local Plan design year of 2036 has also been modelled. The 2036 flows have been extracted from the Systra macrosimulation traffic model for the Hayling Island and Havant areas.

The traffic flows used are shown in tables 1 to 4 below

2017 AM peak

	Park Road South	A27 East	Langstone Road	A27 West
Park Road South	0	181	238	332
A27 East	229	0	211	0
Langstone Road	345	259	0	735
A27 West	758	0	626	0
Total vehicles	3,914			

Table 1

2017 PM peak

	Park Road South	A27 East	Langstone Road	A27 West
Park Road South	0	296	399	481
A27 East	192	0	241	0
Langstone Road	295	220	0	653
A27 West	478	0	851	0
Total vehicles	4,106			

Table 2

2036 AM peak

	Park Road South	A27 East	Langstone Road	A27 West
Park Road South	0	202	217	349
A27 East	247	0	185	0
Langstone Road	380	239	0	787
A27 West	855	0	711	0
Total vehicles	4,172			

Table 3

2036 PM peak

	Park Road South	A27 East	Langstone Road	A27 West
Park Road South	0	352	418	521
A27 East	223	0	243	0
Langstone Road	276	207	0	623
A27 West	597	0	851	0
Total vehicles	4,311			

Table 4

The existing models are based on the current road layout and use geometrically calculated saturation flows. The 2017 AM and PM peaks have been modelled using the existing SCOOT timings which were operating at the roundabout in July 2019. The 2036 models have run with both the existing SCOOT timings and have also been optimised for comparison. The cycle times have remained the same (72 seconds) across all models for consistency.

The Existing and Mitigation Measures models have assumed that traffic is able to freely exit from all arms of the roundabout. This does not reflect the exit blocking which can regularly occur. Frequently in the summer PM peak period exit blocking occurs on the Langstone Road southbound exit towards Hayling Island. This has been reflected in the 'Existing sensitivity' and 'Mitigation Measures sensitivity' tests which replicate the effect of exit blocking towards Hayling Island. It has been modelled by reducing the PM peak saturation flows for the lanes directly and indirectly feeding on to the Langstone Road southbound exit. These saturation flows have been taken from a single observation during a PM peak in July 2019 when exit blocking occurred.

The modelling results for the 2017 and 2036 AM and PM peaks are shown in the tables 5 to 8 below.

2017 AM peak results

72 sec cycle time	Existing layout – existing timings		Mitigation Measures - existing timings		Mitigation Measures – optimised timings	
	MMQ	Delay	MMQ	Delay	MMQ	Delay
A27 eastbound off slip	17	0m 50s	17	0m 50s	8	0m 15s
Park Road South	5	0m 15s	3	0m 15s	3	0m 15s
PRC (%)	-4.1%		-4.2%		31.7%	
A27 westbound off slip	4	0m 25s	4	0m 25s	4	0m 35s
Langstone Road	9	0m 25s	9	0m 25s	4	0m 15s
PRC (%)	31.2%		36.6%		64.2%	
Total delay	47.06 hours		47.14 hours		28.40 hours	

Table 5

PRC - Practical Reserve Capacity

MMQ – Mean maximum queue length in vehicles

Total delay – Combined delay for all vehicles passing through the roundabout

2017 AM peak results summary

Based on the existing signal timings there would be virtually no difference in overall junction performance for general traffic with the introduction of the Mitigation Measures. However, with the signal timings optimised for the Mitigation Measures there would be notable improvements with both sides of the roundabout operating within capacity and around a 40% reduction in total vehicle delay. The results do not proportion the savings between the optimised timings and the Mitigation Measures.

The modelling does not quantify separately any benefits which may be accrued by buses using the southbound bus lane.

2017 AM peak conclusions

Based on the results for the Mitigation Measures alone there are minimal delay or queue savings. However, when combined with the optimisation of the signal timings there are clear benefits to be achieved in the 2017 AM peak.

2017 PM peak results

72 sec cycle time	Existing layout – existing timings		Mitigation Measures – existing timings		Mitigation Measures – optimised timings		Existing layout – sensitivity test - existing timings		Mitigation Measures – sensitivity test - existing timings		Mitigation Measures – sensitivity test - optimised timings	
	MMQ	Delay	MMQ	Delay	MMQ	Delay	MMQ	Delay	MMQ	Delay	MMQ	Delay
A27 eastbound off slip	10	1m 45s	17	0m 40s	8	0m 10s	24	1m 45s	62	3m 40s	7	0m 15s
Park Road South	26	0m 20s	3	0m 10s	5	0m 15s	147	12m 15s	5	3m 55s	7	0m 20s
PRC (%)	-12.4%		-1.7%		43.7%		-75.9%		-63.7%		-12.4%	
A27 westbound off slip	5	0m 30s	5	0m 30s	5	0m 40s	22	4m 20s	15	0m 10s	11	2m 0s
Langstone Road	13	0m 50s	4	0m 10s	5	0m 10s	12	0m 50s	4	1m 10s	6	0m 15s
PRC (%)	-1.0%		32.0%		35.5%		-23.0%		-17.9%		-12.4%	
Total delay	65.21 hrs		44.44 hrs		32.19 hrs		225.13 hrs		537.59hrs		87.65 hrs	

Table 6

2017 PM peak results summary

When the model has been tested assuming that all exits are free flowing the Mitigation Measures would produce benefits with the existing signal timings. This would accrue total delay savings of around a third compared with the existing layout. With the signal timings optimised further savings could be achieved with total delay reducing by 50% compared with the existing 2017 PM. Both the north and south sides would operate with a high degree of spare capacity with average delay reductions on most approaches.

The network has also been sensitivity tested to reflect the existing network congestion which can occur during the PM peak. This is predominantly the blocking back which extends from Langstone Road northwards on to and around the eastern and northern parts of the roundabout. Naturally the level of overall network delay is considerably higher compared with the previous tests.

The existing layout sensitivity model shows considerable delays on the A27 westbound off slip, Park Road South and to a lesser extent the A27 eastbound off slip. Introducing the Mitigation Measures appears to rebalance the delays across the arms even with the current timings maintained. While average delays and queuing would reduce on Park Road South this would be to the detriment of the A27 eastbound off slip road. This option would produce the highest level of overall junction delay. With the signal timings optimised the Mitigation Measures would achieve substantial improvements in terms of average delays on most arms which is reflected in the lowest level of total delay (around 60% reduction on existing levels) of the three sensitivity tests.

2017 PM peak conclusions

With exit blocking conditions alleviated the Mitigation Measures would produce notable benefits for Park Road South over the existing layout even with the current signal timings maintained. Further performance benefits could be achieved for the overall roundabout should the signal timings also be optimised.

Should the PM peak exit blocking persist the sensitivity tests show that the Mitigation Measures would require the signal timings to be optimised to achieve a reduction in total vehicle delay over the existing layout. However, even without changing the signal timings, under the sensitivity test the Mitigation Measures would provide notable benefits to the Park Road South approach in the 2017 PM peak although this would be to at the expense of the A27 eastbound off slip road.

2036 AM peak results

72 sec cycle time	Existing layout – existing timings		Existing layout – optimised timings		Mitigation Measures – existing timings		Mitigation Measures – optimised timings	
	MMQ	Delay	MMQ	Delay	MMQ	Delay	MMQ	Delay
A27 eastbound off slip	101	5m 45s	13	0m 15s	101	5m 40s	10	0m 10s
Park Road South	4	0m 15s	4	0m 15s	3	0m 15s	2	0m 20s
PRC (%)	-32.6%		16.7%		-31.9%		25.8%	
A27 westbound off slip	4	0m 25s	4	0m 35s	4	0m 25s	4	0m 35s
Langstone Road	9	0m 30s	5	0m 10s	11	0m 30s	5	0m 10s
PRC (%)	32.7%		54.6%		19.4%		59.9%	
Total delay	130.11 hours		32.39 hours		129.16 hours		31.67 hours	

Table 7

2036 AM peak results summary

Projecting ahead to the 2036 AM peak with the existing timings running the average queue length on the A27 eastbound off slip road would increase by around 5 times of its 2017 length. Queuing on the other arms would be largely unchanged between 2017 and 2036 in the AM. The introduction of the Mitigation Measures to the existing timings would produce a marginal improvement at the roundabout in the 2036 AM peak compared with the existing layout.

With the signal timings optimised the junction performance would improve significantly on the A27 eastbound off slip road. Based on the existing layout a 75% reduction in total vehicle delay at the roundabout could be achieved. With the implementation of the Mitigation Measures further improvements in queuing are predicted on A27 eastbound off slip road and Park Road South. Overall the Mitigation Measures would improve total vehicle delay by a further 2%.

2036 AM peak conclusions

Notable improvements could be achieved in the 2036 AM peak with the optimisation of the existing timings. The Mitigation Measures are predicted to bring further levels of improvement. Any separate quantifiable benefits for buses are unknown during this period.

2036 PM peak results

72 sec cycle time	Existing layout – existing timings		Existing layout – optimised timings		Mitigation Measures – optimised timings		Existing layout – sensitivity test - existing timings		Existing layout – sensitivity test – optimised timings		Mitigation Measures – sensitivity test - optimised timings	
	MMQ	Delay	MMQ	Delay	MMQ	Delay	MMQ	Delay	MMQ	Delay	MMQ	Delay
A27 eastbound off slip	13	0m 20s	11	0m 15s	7	0m 10s	64	3m 45s	15	0m 25s	9	0m 15s
Park Road South	75	5m 0s	10	0m 20s	6	0m 15s	176	13m 20s	62	4m 10s	8	0m 20s
PRC (%)	-28.9%		24.9%		36.9%		-85.7%		-30.8%		-14.5%	
A27 westbound off slip	5	0m 30s	5	0m 40s	5	0m 35s	15	3m 0s	11	2m 0s	15	3m 10s
Langstone Road	10	0m 50s	5	0m 15s	6	0m 15s	10	0m 50s	5	0m 15s	6	0m 15s
PRC (%)	7.9%		35.1%		44.9%		-15.4%		-9.8%		-16.3%	
Total delay	113.26 hrs		36.33 hrs		33.51 hrs		310.91 hrs		172.79 hrs		97.05 hrs	

Table 8

2036 PM peak results summary

In the absence of any exit blocking and based on the existing layout and signal timings, the queue on Park Road South would increase threefold between 2017 and 2036 in the PM peak. Smaller increases in queuing would occur on the A27 eastbound off slip road and Langstone Road over the same period. Overall the total vehicle delay would increase by around 75% between 2017 and 2036 without any interventions.

With just the signal timings optimised on the existing layout queuing would reduce on most arms but particularly on Park Road South. The total vehicle delay would fall by almost 70% with the timings optimised. Further reductions in queuing would occur on Park Road South and A27 eastbound off slip road with both the Mitigation Measures and timings optimised. This would achieve just over a 70% reduction in overall delay compared with the existing layout and timings. It would improve the existing layout (timings optimised) by around 8% in terms of total vehicle delay.

Should exit blocking still occur (sensitivity tests), the optimised timings show good levels of improvements in junction performance. By optimising the signal timings significant reductions in queuing are predicted on both Park Road South and A27 eastbound off slip road. Queuing on Park Road South would be around 62% lower with average delay savings of approximately 9 minutes per vehicle. Significant improvements are also predicted on the A27 eastbound off slip road.

Implementing the Mitigation Measures would see even further benefits. Park Road South queuing would reduce by over 90% with average delay savings of 13 minutes per vehicle when compared with the existing layout and timings. The Mitigation Measures would also bring notable improvements to queuing and delays on the A27 eastbound off slip road. Overall the total vehicle

delay would reduce by around 68% when compared with the existing layout and signal timings. When comparing the Mitigation Measures with simply optimising the existing signal timings the total delays would reduce by 44%.

2036 PM peak conclusions

There are clear benefits in terms of improved junction performance to be achieved with the timings optimised in the 2036 PM peak. The greatest benefits would be accrued should the exit blocking situation remain on Langstone Road southbound and with the Mitigation Measures implemented.

Mitigation Measures summary

There is a good level of benefit predicted from the Mitigation Measures in the 2017 AM peak although this relies on the signal timings being optimised. In the 2036 AM peak optimising the signal timings provide strong improvements which are enhanced further with the Mitigation Measures.

In the 2017 PM peak the Mitigation Measures show an improved junction performance over the existing layout. These are increased further with the signal timings optimised.

Projecting ahead to the 2036 PM peak, on the basis that exit blocking on to the Langstone Road exit remains (sensitivity tests), the Mitigation Measures would provide strong benefits over the existing layout. Even with the signal timings optimised there would be clearly demonstrable further improvements over the existing layout.

Should the above PM peak exit blocking conditions be resolved the Mitigation Measures would still achieve a high level of improvement on Park Road South with smaller reductions on A27 eastbound off slip road and Langstone Road. In this situation the Mitigation Measures would provide benefit compared with simply optimising the timings on the existing layout.

Jonathan Mundy

ITS Group

Hampshire County Council

27th January 2020

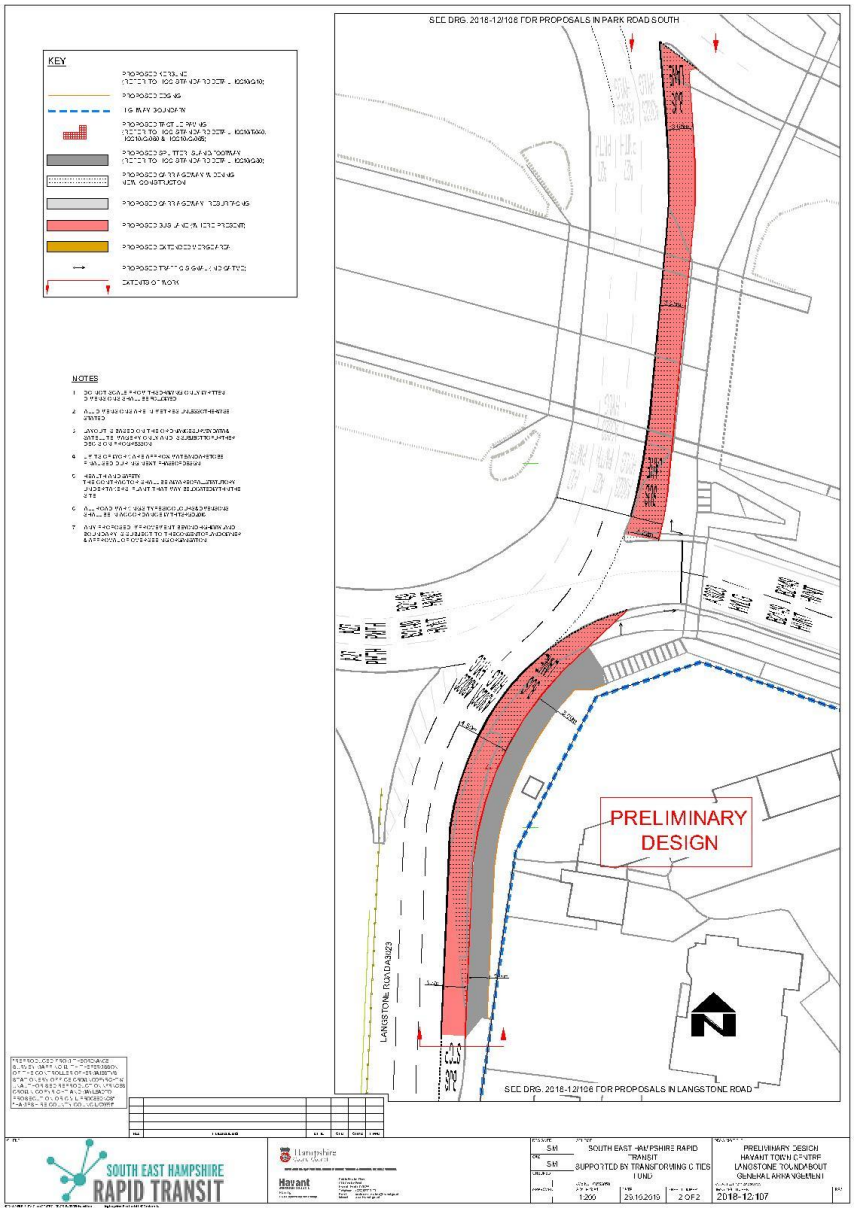

Diagram 1

Langstone roundabout proposed bus lanes