A37 Options and Feasibility Study

Scheme Testing Report – VISSIM

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Bath & North East Somerset Council

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1. Introduction

Jacobs has been commissioned by Bath & North East Somerset (B&NES) to test scheme option proposals for the A37 through Temple Cloud and Farrington Gurney in the microsimulation model previously prepared for this purpose. This specific testing has been used to inform the development of the 'short-listed' options by identifying the traffic impacts that are likely to result should they be implemented.

1.1 Purpose of report

This report presents the results of the option testing (short-listed options) in comparison to the base model. The performance of each option has been measured primarily in the form of:

- Journey times, which have been recorded over the same routes as used to validate the base model; and
- Queue lengths, which have been measured at relevant stop lines and give-way locations throughout the model.

1.2 Options

VISSIM was used to test the 'short-listed' options. The following two options were tested at the signalised junction between the A37 and A362 at Farrington Gurney:

- Option 3: Additional lane on the A37 southbound approach to the junction; and,
- Option 5: Compact roundabout to replace existing junction.

The following three options were tested for the 'narrow' section through Temple Cloud:

- Option 4: Signalled 'shuttle-working' with a controlled length of circa 117 metres;
- Option 8: Width restriction for larger vehicles. For the purposes of the model, it has been assumed that this would result in:
    - 20% of OGV1 (HGV-Rigid) vehicles using the A37 through Temple Cloud re-routing away the local area, so effectively disappearing from the model network under consideration;
    - 80% of OGV1 (HGV-Rigid) vehicles rerouting locally by means of the A39 Wells Road through Hallatrow, High Littleton and Farmborough; and,
    - All the larger OGV2 (HGV-Articulated) vehicles using the A37 through Temple Cloud again re-routing away the local area, so effectively disappearing from the model network under consideration.
- Option 9: Significantly cutting back of the high hedge / vegetation on the eastern side of the narrow section between The Laurels and No 1 Gillets Hill Lane to allow more effective use of the existing carriageway by HGVs. For the purposes of the VISSIM modelling it has been assumed that this could resolve all two-way passage issues except OGV2-OGV2 conflicts.

The options for the two locations were tested independently, i.e. when a Temple Cloud option was tested, the Farrington Gurney base model layout was used, and vice versa.

2. Farrington Gurney - A37/A362 Junction

2.1 Journey times

Average journey times for the three route sections approaching the junction have been compared for the AM peak, inter-peak and PM peak. The results are displayed in **Table 1**, **Table 2** and **Table 3**, respectively.

Table 1: AM peak hour average journey times (08:00 - 09:00)

Route	Link length	Journey time (s)		
		Base model	A37 SB Widening	Compact Roundabout
A37 southbound from Church Lane / Ham Lane to A362 Farrington Gurney Bypass	210 m	50.6	34.9 (-15.7)	33.2 (-16.3)
A37 northbound from Rush Hill to A362 Farrington Gurney Bypass	685 m	62.9	59.9 (-3.0)	51.3 (-11.6)
A362 westbound from Marsh Lane to A37	380 m	79.9	61.9 (-17.9)	33.9 (-46.0)

Table 2: Inter-peak average journey times (10:00 - 16:00)

Route	Link length	Journey time (s)		
		Base model	A37 SB Widening	Compact Roundabout
A37 southbound from Church Lane / Ham Lane to A362 Farrington Gurney Bypass	210 m	37.4	29.5 (-7.8)	31.7 (-5.7)
A37 northbound from Rush Hill to A362 Farrington Gurney Bypass	685 m	56.4	56.1 (-0.3)	48.6 (-7.8)
A362 westbound from Marsh Lane to A37	380 m	56.0	49.7 (-6.3)	30.8 (-25.3)

Table 3: PM peak average journey times (17:00- 18:00)

Route	Link length	Journey time (s)		
		Base model	A37 SB Widening	Compact Roundabout
A37 southbound from Church Lane / Ham Lane to A362 Farrington Gurney Bypass	210 m	48.8	34.6 (-14.1)	34.5 (-14.2)
A37 northbound from Rush Hill to A362 Farrington Gurney Bypass	685 m	63.5	61.4 (-2.1)	52.2 (-11.4)
A362 westbound from Marsh Lane to A37	380 m	83.8	66.7 (-17.1)	31.8 (-52.0)

Both options result in improvements to journey times on all approaches during all three periods.

The provision of an additional southbound lane on the A37 provides additional capacity through the junction and thus greatly improves the journey time on that approach. The change also 'frees- up' green time to be used by other phases, so there are also journey time improvements on the other two approaches. While the A37 northbound sees only a marginal improvement, there is a significant improvement to the A362 westbound.

The compact roundabout option provides significant travel time improvements on all approaches. The improvement on the A37 southbound is similar to the widening option. However, the reductions in delay on the A37 northbound and A362 are much greater. Notably, the travel time on the A362 approach has been more than halved in both the AM and PM peaks.

2.2 Queues

Queues have been recorded from the simulations based on the maximum queue that occurs in each minute of the 12-hour model. **Table 4**, **Table 5** and **Table 6** show the 10-simulation average of the maximum queue observed on each approach in each hour of the model.

Table 4: A37 Southbound approach: Average maximum queue by hour

Hour	Base model	A37 southbound widening		Compact roundabout	
07:00 – 08:00	306 m	207 m	-32.3%	183 m	-40.2%
08:00 – 09:00	358 m	234 m	-34.6%	178 m	-50.3%
09:00 – 10:00	198 m	131 m	-33.8%	135 m	-31.8%
10:00 – 11:00	199 m	167 m	-16.1%	157 m	-21.1%
11:00 – 12:00	196 m	145 m	-26.0%	144 m	-26.5%
12:00 – 13:00	231 m	175 m	-24.2%	122 m	-47.2%
13:00 – 14:00	235 m	140 m	-40.4%	160 m	-31.9%
14:00 – 15:00	221 m	136 m	-38.4%	198 m	-10.4%
15:00 – 16:00	225 m	154 m	-31.5%	142 m	-36.9%
16:00 – 17:00	347 m	229 m	-34.0%	234 m	-32.5%
17:00 – 18:00	392 m	270 m	-31.1%	269 m	-31.4%
18:00 – 19:00	262 m	170 m	-35.1%	154 m	-41.2%

On the A37 southbound approach, the base model shows long maximum queues throughout the day. When this approach is widened, the maximum queues are reduced by a third in each peak. The compact roundabout option also results in significantly reduced maximum queues.

Table 5: A362 Westbound approach: Average maximum queue by hour

Hour	Base model	A37 southbound widening		Compact roundabout	
07:00 – 08:00	205 m	176 m	-14.1%	93 m	-54.6%
08:00 – 09:00	168 m	136 m	-19.0%	85 m	-49.4%
09:00 – 10:00	90 m	86 m	-4.4%	53 m	-41.1%
10:00 – 11:00	79 m	70 m	-11.4%	46 m	-41.8%

11:00 – 12:00	99 m	84 m	-15.2%	63 m	-36.4%
12:00 – 13:00	97 m	92 m	-5.2%	51 m	-47.4%
13:00 – 14:00	77 m	82 m	+6.5%	45 m	-41.6%
14:00 – 15:00	101 m	91 m	-9.9%	49 m	-51.5%
15:00 – 16:00	126 m	113 m	-10.3%	67 m	-46.8%
16:00 – 17:00	123 m	107 m	-13.0%	58 m	-52.8%
17:00 – 18:00	159 m	146 m	-8.2%	69 m	-56.6%
18:00 – 19:00	102 m	92 m	-9.8%	43 m	-57.8%

On the westbound A362, the base model shows that maximum queues are also reasonably long. With the widening on the A37 southbound, these queues generally decrease slightly (by up to 20%). In one hour, a higher maximum queue is observed than in the base model. With the compact roundabout, the maximum queues are notably decreased by between 36% to 58%.

Table 6: A37 Northbound approach: Average maximum queue by hour

Hour	Base model	A37 southbound widening		Compact roundabout	
07:00 – 08:00	200 m	199 m	-0.5%	175 m	-12.5%
08:00 – 09:00	152 m	146 m	-3.9%	127 m	-16.4%
09:00 – 10:00	129 m	111 m	-14.0%	81 m	-37.2%
10:00 – 11:00	104 m	88 m	-15.4%	80 m	-23.1%
11:00 – 12:00	112 m	100 m	-10.7%	85 m	-24.1%
12:00 – 13:00	96 m	102 m	+6.3%	76 m	-20.8%
13:00 – 14:00	127 m	145 m	+14.2%	98 m	-22.8%
14:00 – 15:00	137 m	155 m	+13.1%	113 m	-17.5%
15:00 – 16:00	123 m	123 m	0.0%	87 m	-29.3%
16:00 – 17:00	167 m	158 m	-5.4%	135 m	-19.2%
17:00 – 18:00	206 m	188 m	-8.7%	152 m	-26.2%
18:00 – 19:00	131 m	114 m	-13.0%	76 m	-42.0%

Like the other two approaches, the A37 northbound demonstrates long maximum queues throughout the duration of the base model. When the A37 southbound is widened, there is a slight improvement in the peaks, though this is not maintained through the inter-peak hours. As with the other two approaches, the compound roundabout provides a significant reduction to the maximum queues in all modelled hours.

In addition to these tables, minute-by-minute average maximum queue graphs have also been produced, and these can be found in **Appendix A**. These give more granularity to the data as they better convey whether maximum queues are the product of extended periods of delay or whether they are isolated events.

As **Figure A.1** shows, the base model demonstrates persistent queueing on the A37 southbound approach to the junction. The average maximum queue is consistently above 100 metres throughout both peaks, and at times exceeds 200 metres. Both the A37 southbound widening option and the compact roundabout option demonstrate improvement over the base model. The results for these two options are generally comparable.

The compact roundabout exhibits slightly less queueing in the inter-peak period, though it also shows slightly more in the PM peak hour.

Figure A.2 indicates that the queueing on the A37 northbound approach is much less than that on the A37 southbound approach. In the base model, the queues only occasionally extend to more than 100 metres. The A37 southbound widening option provides only a slight reduction in queue lengths on account of more green time being available for this arm. The compact roundabout option shows the least queueing, showing a small but discernible improvement.

As **Figure A.3** shows, the queueing on the A362 in the base model falls somewhere between the levels seen on the other two approaches. There is an extended period in the AM peak where the average maximum queue is more than 100 metres. Again, the A37 southbound widening option provides only a slight improvement on account of more green time being available. Conversely, the compact roundabout option shows a significant improvement. In this option, the peak hour queues are only marginally longer than the inter-peak queues.

3. Temple Cloud

3.1 Journey times

Average journey times on approaches leading up to and through the narrow section in Temple Cloud have been compared in both the northbound and southbound directions for the AM peak, interpeak and PM peak. The results are displayed in **Table 7**, **Table 8** and **Table 9**, respectively.

Table 7: AM peak hour average journey times (08:00 - 09:00)

Route	Link length	Journey time (s)			
		Base model	Shuttle Signals	Width Restriction	Vegetation Trimming
A37 southbound from Cholwell Fam to Temple Inn Lane	496 m	40.8	44.2 (+3.4)	39.5 (-1.3)	40.8 (0.0)
A37 southbound from Temple Inn Lane to Cameley Road	389 m	41.1	93.3 (+52.2)	35.4 (-5.7)	38.0 (-3.2)
A37 northbound from A39 Wells Road to Cameley Road	1064 m	87.3	238.9 (+151.5)	70.6 (-16.8)	76.7 (-10.6)
A37 northbound from Cameley Road to Temple Inn Lane	398 m	41.4	52.4 (+11.0)	35.9 (-5.4)	39.3 (-2.1)

Table 8: Inter-peak hour average journey times (10:00 - 16:00)

Route	Link length	Journey time (s)			
		Base model	Shuttle Signals	Width Restriction	Vegetation Trimming
A37 southbound from Cholwell Fam to Temple Inn Lane	496 m	40.3	41.2 (+0.9)	39.2 (-1.1)	40.3 (0.0)
A37 southbound from Temple Inn Lane to Cameley Road	389 m	40.6	67.9 (+27.2)	35.3 (-5.3)	37.7 (-2.9)
A37 northbound from A39 Wells Road to Cameley Road	1064 m	83.8	102.3 (+18.5)	70.3 (-13.5)	78.9 (-4.9)
A37 northbound from Cameley Road to Temple Inn Lane	398 m	41.7	51.1 (+9.4)	34.7 (-7.0)	39.4 (-2.2)

Table 9: PM peak hour average journey times (17:00 – 18:00)

Route	Link length	Journey time (s)			
		Base model	Shuttle Signals	Width Restriction	Vegetation Trimming
A37 southbound from Cholwell Fam to Temple Inn Lane	496 m	41.1	58.7 (+17.7)	40.4 (-0.7)	41.0 (-0.1)
A37 southbound from Temple Inn Lane to Cameley Road	389 m	39.1	105.3 (+66.2)	36.2 (-2.9)	37.0 (-2.1)
A37 northbound from A39 Wells Road to Cameley Road	1064 m	79.1	268.7 (+189.6)	71.9 (-7.2)	76.3 (-2.7)
A37 northbound from Cameley Road to Temple Inn Lane	398 m	40.2	55.3 (+15.1)	37.3 (-2.9)	39.7 (-0.4)

Based on these results, the effects of each option can be summarised:

- The shuttle signals option results in a very large increase in average travel time relative to the base model. In the peaks, this increase averages up to several minutes of extra delay, particularly for the northbound direction in the PM peak;
- The vegetation trimming option results in a slight improvement in travel time during all periods and in both directions. This is most significant in the AM peak, particularly for the northbound direction with an average time saving of 12.7 seconds; and
- The width restriction option results in an improvement in travel time during all periods and in both directions. Again, this is most significant in the AM peak in the northbound direction with an average time saving of 22.2 seconds per trip.

3.2 Queues

As for the A37 / A362 junction, queues have been recorded from the simulations based on the maximum queue that occurs in each minute of the 12-hour model. **Table 10** and **Table 1**1 show the 10-simulation average of the maximum queue observed in either direction in each hour of the model. These queues are measured from the points where most vehicles were observed to give way during site visits, or the stop lines in the case of the shuttle signals option.

Table 10: A37 southbound: Average maximum queue by hour

Hour	Base model	Shuttle signals		Width restriction		Vegetation trimming	
07:00 – 08:00	433 m	732 m	+69.1%	116 m	-73.2%	263 m	-39.3%
08:00 – 09:00	327 m	755 m	+130.9%	78 m	-76.1%	167 m	-48.9%
09:00 – 10:00	235 m	316 m	+34.5%	32 m	-86.4%	214 m	-8.9%
10:00 – 11:00	158 m	190 m	+20.3%	45 m	-71.5%	130 m	-17.7%

11:00 – 12:00	273 m	262 m	-4.0%	37 m	-86.4%	206 m	-24.5%
12:00 – 13:00	173 m	206 m	+19.1%	48 m	-72.3%	150 m	-13.3%
13:00 – 14:00	212 m	215 m	+1.4%	51 m	-75.9%	170 m	-19.8%
14:00 – 15:00	236 m	269 m	+14.0%	31 m	-86.9%	187 m	-20.8%
15:00 – 16:00	234 m	288 m	+23.1%	46 m	-80.3%	220 m	-6.0%
16:00 – 17:00	209 m	376 m	+79.9%	54 m	-74.2%	198 m	-5.3%
17:00 – 18:00	219 m	742 m	+238.8%	39 m	-82.2%	167 m	-23.7%
18:00 – 19:00	147 m	720 m	+389.8%	33 m	-77.6%	95 m	-35.4%

Table 11: A37 northbound: Average maximum queues by queue

Hour	Base model	Shuttle signals		Width restriction		Vegetation trimming	
07:00 – 08:00	143 m	340 m	+137.8%	0 m	-100.0%	78 m	-45.5%
08:00 – 09:00	153 m	345 m	+125.5%	15 m	-90.2%	85 m	-44.4%
09:00 – 10:00	107 m	210 m	+96.3%	0 m	-100.0%	70 m	-34.6%
10:00 – 11:00	111 m	149 m	+34.2%	4 m	-96.4%	72 m	-35.1%
11:00 – 12:00	116 m	143 m	+23.3%	0 m	-100.0%	62 m	-46.6%
12:00 – 13:00	123 m	156 m	+26.8%	0 m	-100.0%	83 m	-32.5%
13:00 – 14:00	118 m	176 m	+49.2%	0 m	-100.0%	69 m	-41.5%
14:00 – 15:00	121 m	190 m	+57.0%	0 m	-100.0%	73 m	-39.7%
15:00 – 16:00	114 m	222 m	+94.7%	0 m	-100.0%	75 m	-34.2%
16:00 – 17:00	119 m	314 m	+163.9%	0 m	-100.0%	53 m	-55.5%
17:00 – 18:00	149 m	498 m	+234.2%	2 m	-98.7%	63 m	-57.7%

18:00 – 19:00	85 m	274 m	+222.4%	0 m	-100.0%	24 m	-71.8%

The hourly average maximum queues in the base model are high in both directions, but particularly southbound. It was noted in the Local Model Validation Report (LMVR) for the base model that the queueing tends to be more severe in the southbound direction than in the northbound direction, and that this was qualitatively supported by site observations. A possible reason for this difference is that southbound vehicles have a longer field of vision approaching the narrow section, and thus more opportunity to give way. Furthermore, the presence of the filling station, signalised crossing and junction with Temple Inn Lane at the top of the hill may increase the severity of queues by disrupting traffic flows.

Relative to the base model, the following can be observed from the option testing:

- The shuttle signals option results in very large increases in average maximum queue length. In the PM peak, this increase is several times the base model lengths;
- The width restrictions result in the maximum queues being cut by 70% or more in the southbound direction and largely removed in the northbound direction; and
- Significant cut-back of the high hedge to remove highway encroachment results in the maximum queues being significantly reduced. This effect is most apparent in the peaks and especially in the northbound direction.

The minute-by-minute average maximum queue graphs for the narrow section are in **Appendix A**.

Figure A.4 compares the queues in the southbound direction. This supports Table 10 above in showing:

- The base model has long maximum queues in the AM peak in particular, which persist over long periods. These are generally reduced throughout the rest of the day, though there are frequent ‘spikes’ as HGV conflicts create temporary queuing which then decays. It is notable that this graph does not, at first glance, appear to reflect the Table 10 results in the PM peak. This is because conflicts are rarer in this period (due to lower HGV numbers), but when there is a conflict, that conflict is more severe due to the high traffic flows;
- The ‘shuttle signals’ option results in average maximum queues that are significantly longer throughout both peak periods. The queuing is significantly shorter during the inter-peak period, though the queues frequently spike as a result of specific conflict events;
- The vegetation cut-back option shows minimal queuing throughout the model period, except for occasional ‘spikes’ as a result of specific conflict events. When these ‘spikes’ appear, they show roughly the same queue lengths as indicated in the base mode; and.
- The width restriction option shows minimal queuing throughout the entire model period. The model ‘spikes’ occasionally in line with the other options, but these ‘spikes’ reveal a much lower queue length occurrence than indicated in the base model.

Similarly, **Figure A.5** compares the queues in the northbound direction:

- The base model shows relatively short average maximum queues throughout the 12-hour model and are relatively consistent throughout the day. The minute-by-minute average maximum queue lengths are much shorter than the hourly averages in Table 11, indicating that queueing here is only sporadic, but that when it does occur the queues are substantial;
- The ‘shuttle signals’ option again shows the same effect as in the southbound direction, with consistently long maximum queues throughout the day, but in the peak periods in particular;
- The vegetation cut-back option shows a reduction on the base model queue levels. Though there is often some queueing, the predicted queues are not as long as those in the ‘base-line’; and
- The width restriction option results in next to no queuing at any time, with only a handful of instances throughout the day. When queues do form, they are short and only momentary.

4. Summary

The short-listed options for the A37 in Temple Cloud and Farrington Gurney have been tested in VISSIM, with the travel time and queue length data compared with the validated base model.

The results for the A37 / A362 junction in Farrington Gurney show that:

- Option 3 (additional lane on the A37 southbound approach) has a significant positive effect in reducing travel times and queuing on the A37 southbound, with minor benefits on the two other arms; and
- Option 5 (compact roundabout) has a significant positive effect in reducing travel times and queuing on all three arms.

The results for the narrow section in Temple Cloud show that:

- Option 4 (signalled 'shuttle working') has a very significant negative effect as it makes travel times and queues considerably longer in all weekday hours modelled (7:00 am to 7:00 pm). As such, this option is not considered further in subsequent air quality modelling;
- Option 8 (width restriction for larger vehicles) has, not unexpectedly, a significant positive effect through Temple Cloud as it removes most of the vehicles (HGVs) that cause the present two-way passage conflicts in the narrow section. However, this scenario has been modelled with little consideration as to where affected HGVs would re-route and what effect they may have on those other roads. In other words, the VISSIM modelling is necessarily local to the part of the A37 under consideration and does not seek to mimic strategic HGV movements along the A37 corridor and surrounding routes. Actual HGV Origin-Destination (O-D data) would be needed to understand this, with ANPR data of limited value; and
- Option 9 (cutting back of the high hedge / vegetation) has a minor positive effect on travel times and delay as it reduces the number of HGV conflicts occurring. However, these conflicts cannot be entirely removed by simple vegetation removal/cutting-back, and the VISSIM results suggesting that these could still occur with some frequency. As such this option, whilst an improvement, could remain highly susceptible to queuing 'spikes' when those conflicts do materialise.

Appendix A. Minute-by-minute average queue graphs

Figure A.1: A37 / A362 junction average maximum queue: A37 southbound approach

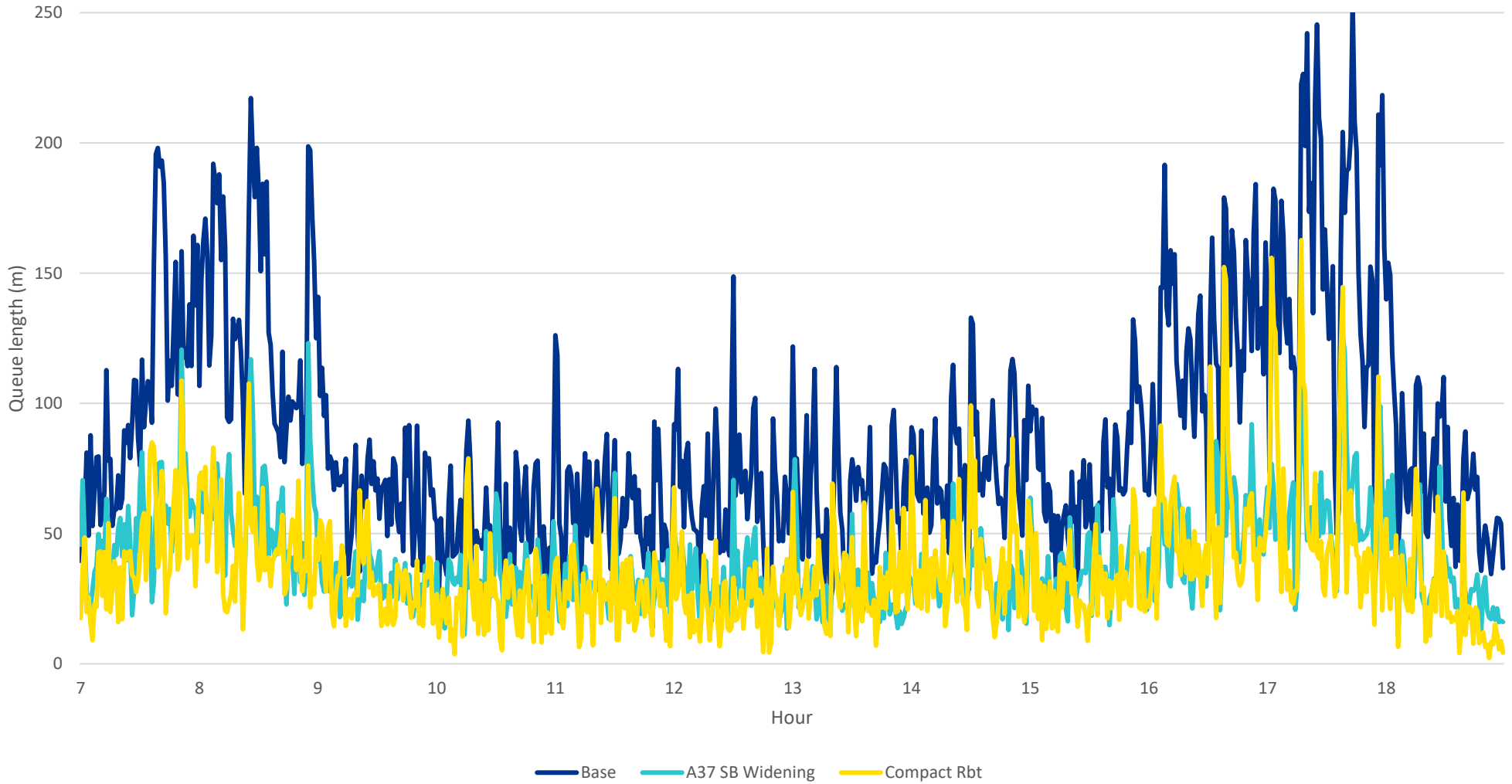

Figure A.2: A37 / A362 junction average maximum queue: A37 northbound approach

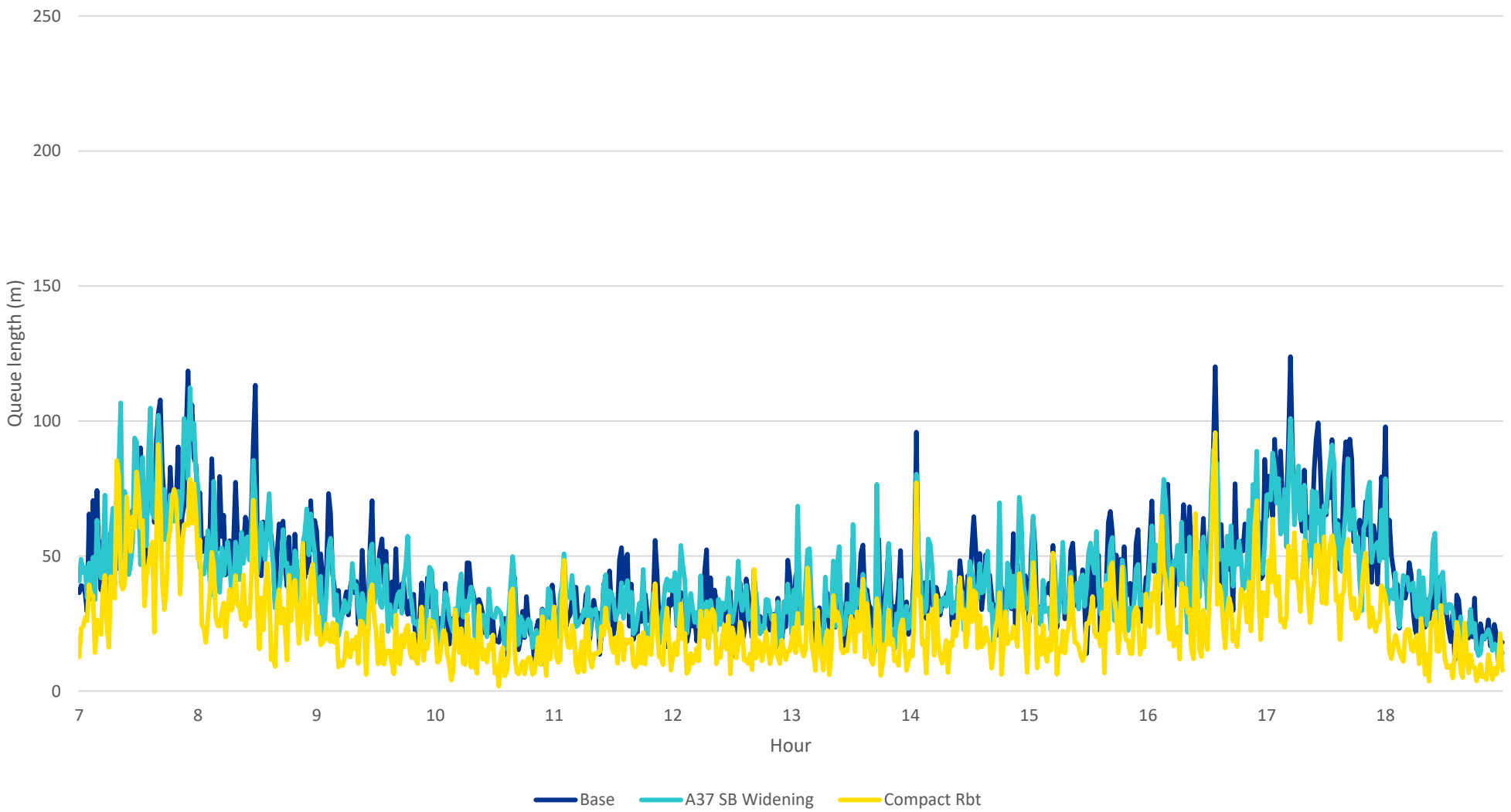

Figure A.3: A37 / A362 junction average maximum queue: A362 westbound approach

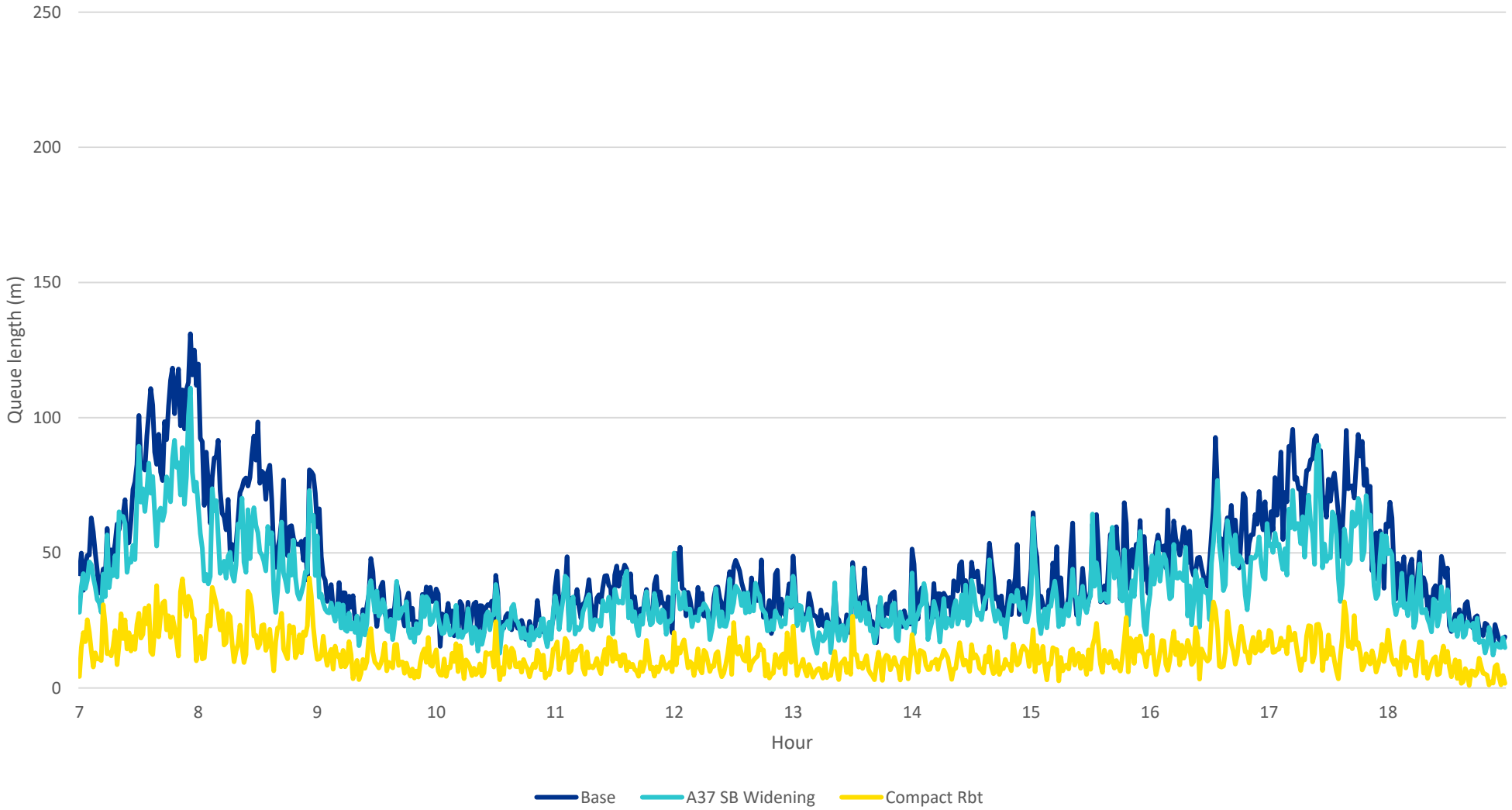

Figure A.4: Temple Cloud average maximum queue: A37 southbound

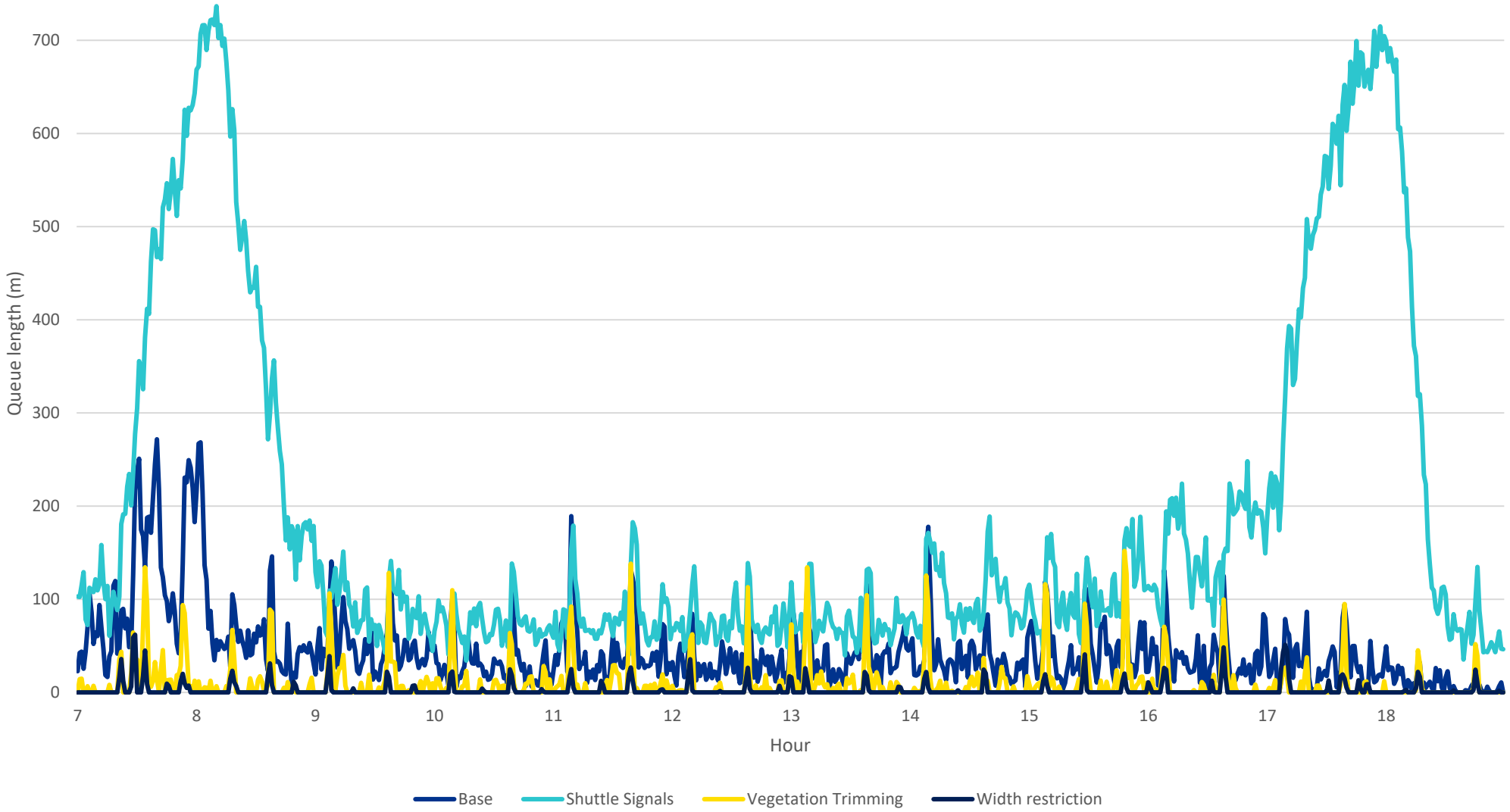

Figure A.5: Temple Cloud average maximum queue: A37 northbound