

Project	South Caldecotte		
Document Number	SCD-BWB-GEN-XX-RP-TR-013_TN	BWB Ref	NTS2682
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Checked	Vibeeshan Devaharan	Revision	P1
Approved	Matthew Addison	Date	14/05/2020

1 Introduction

- 1.1 BWB Consulting Ltd (BWB) has been appointed by HB (South Caldecotte) Ltd (the Applicant) to produce a microsimulation traffic model of the A5 junction, also known as Kelly's Kitchen Roundabout, in support of an outline planning application for an employment development. The site is located to the west of V10 Brickhill Street in Danesborough & Walton, Milton Keynes.
- 1.2 A copy of the VISSIM base model as well as the forecast year scenarios was submitted to HE on 16th December 2019 for AECOM to review. Subsequently, comments were received from Highways England (HE) on 29th January 2020 requesting changes to the future year scenarios to provide a robust model for analysis.
- 1.3 BWB submitted the revised forecast VISSIM model to HE on 4th February 2020, for further review by AECOM. Thereafter, a response was received from HE on 20th March 2020 requesting additional changes to the model to provide a robust model for analysis in the future year scenarios.
- 1.4 A video conference meeting between HE, AECOM, BWB and the Applicant was held on 26th March 2020 in order to address the remaining VISSIM model issues. Following this, BWB produced a Technical Note (SCD-BWB-GEN-XX-RP-TR-010_Forecast Model TN-S2-P1) outlining the changes made to the forecast VISSIM model following the meeting, including updated results in relation to the impact on the A5 Kelly's Kitchen Roundabout.
- 1.5 AECOM responded on behalf on HE on 24th April 2020 in Technical Note 10. They agreed that the forecast VISSIM model was coded correctly, however they disagreed with the interpretation of the modelling results. Whilst AECOM agreed that the previous proposed mitigations did offset the overall increase in delay resulting from the proposed development trips in both peak hours, they considered the impact on queuing on the A5 south arm (northbound approach) to be severe.
- 1.6 AECOM recommended that further measures be sought to ensure that the impact of the proposed development of the A5 northbound approach not be severe. They suggested that this could be potentially demonstrated through the optimisation of signal timings in addition to the mitigation measures outlines in BWB technical note SCD-BWB-GEN-XX-RP-TR-010_Forecast Model TN-S2-P1.
- 1.7 In response to the above, this note sets out further measures that have been considered in order to offset the proposed development impacts.

2 Signal Optimisation

- 2.1 As recommended by AECOM, an initial modelling exercise was undertaken to optimise signal timings to distribute the significant improvement in journey times achieved on the A5 North arm to other arms.
- 2.2 To effectively be able to distribute the signal timing improvement benefit of A5 North arm to the A5 South arm, the South Stream 1 VAP was amended slightly to a detector with port number 70 to the model. This would assist in controlling internal queues in the circulatory. The location of the detector is illustrated in **Figure 1** below.

Figure 1: Detector 70 Location within VISSIM Model

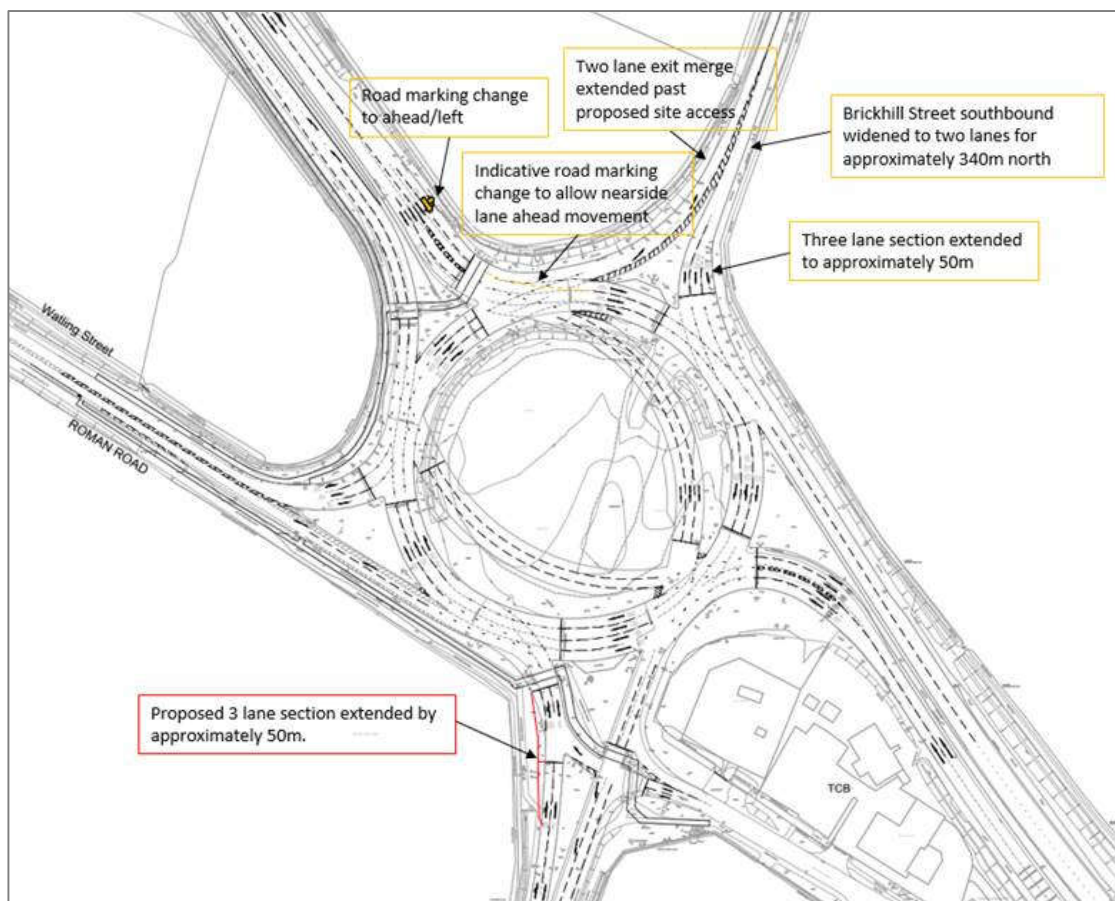


- 2.3 The VAP was also amended to allow Stage 3 to run minimum green. Subsequently the amended VAP has been applied to all future year modelling scenarios with the original minimum green of 7 seconds and maximum green of 120 seconds for all stages. However, in the mitigation scenarios, the maximum green of Stage 3 has been reduced to 7 seconds at A5 Southbound Circulatory movement to distribute the benefits in journey time improvement of A5 North onto A5 South.
- 2.4 Subsequently, this resulted in a betterment/minimal increase in journey times along both A5 Northern and Southern approach arms. However, an increase in delay was still noted along A4146 which have been discussed in further detail in the next section.

3 Further Physical Mitigation Model Results

- 3.1 In light of the above, BWB has considered further physical mitigation at the A5 Kelly's Kitchen Roundabout.
- 3.2 Again, this has been considered in the form of upgrades/amendments to the existing S278 scheme for the A5 Kelly's Kitchen Roundabout.
- 3.3 The proposed improvements are shown indicatively on **Figure 2** below. The improvements outlined in yellow were included in the original BWB mitigation scheme and the improvement outlined in red is associated with the A4146 approach and represents an additional mitigation proposal.

Figure 2: Mitigation Measures Proposed at A5 Kelly's Kitchen Roundabout



- 3.4 The impact of the total combined mitigation measures indicated above is considered in this note.

Journey Times through Network

- 3.5 A summary of the average and cumulative journey times through each arm of the junction is presented in **Table 1** for the various assessment scenarios during both the weekday morning and evening peak hours.

Table 1: Cumulative Journey Time (in seconds) Comparison 2023 without and with mitigation

	AM										PM									
	2023 DM	2023 DS	2023 DS + Mit	2023 DS - 2023 DM	2023 DS + Mit - 2023 DM	2031 DM	2031 DS	2031 DS + Mit	2031 DS - 2031 DM	2031 DS + Mit - 2031 DM	2023 DM	2023 DS	2023 DS + Mit	2023 DS - 2023 DM	2023 DS + Mit - 2023 DM	2031 DM	2031 DS	2031 DS + Mit	2031 DS - 2031 DM	2031 DS + Mit - 2031 DM
Brickhill Street	99	100	101	1	2	99	99	101	0	1	100	103	104	3	4	101	103	105	2	4
A5 South	100	105	93	5	-8	135	146	134	11	-1	38	39	39	1	1	39	39	39	0	0
A4146	273	330	276	57	3	294	353	280	58	-14	158	209	163	51	5	230	284	212	55	-17
Wattling Street	74	75	73	1	-2	86	115	80	29	-6	73	68	68	-5	-4	79	83	80	4	1
A5 North	459	471	326	11	-134	521	507	464	-14	-57	562	572	278	10	-284	593	582	350	-11	-243
Cumulative JT	1006	1081	868	75	-138	1135	1220	1058	85	-77	931	991	653	60	-278	1042	1092	786	50	-255

- 3.6 The highlighted columns show the impact of the proposed mitigation on journey times through the junction during the morning and evening peak hours respectively, in the 2023 opening year scenario.
- 3.7 As can be seen, without any of the proposed mitigation, the development would result in cumulative increases in journey times across the network of 75 seconds and 60 seconds during the weekday morning and evening peak hours respectively. However, with the mitigation proposals, there would be an overall cumulative decrease in journey times by 138 seconds and 278 seconds respectively.
- 3.8 In the future year (2031), the junction would also experience significant reduction in journey times as a result of the mitigation proposals.

Overall Network Performance

- 3.9 Further to the above, the overall network performance of the junction has been analysed. This is presented in **Table 2** below.

Table 2: Overall Network Performance

	AM				PM			
	Delay (s)	Speed (mph)	Veh Arr	Latent Demand	Delay (s)	Speed (mph)	Veh Arr	Latent Demand
2023 Base	209	14	6645	1118	198	15	6268	926
2023 Base + Dev	218	13	6832	1469	202	14	6469	1148
2023 Base + Dev + Mitigation	170	16	7380	956	145	18	7224	154
2031 Base	243	12	6762	1757	212	14	6416	1588
2031 Base + Dev	255	12	6909	2127	213	14	6603	1832
2031 Base + Dev + Mitigation	221	13	7450	1526	172	16	7379	762

- 3.10 As shown, the mitigation proposals would benefit the overall performance of the network significantly, with reductions in delay and increases in average vehicle speeds during both the both the weekday morning and even peak hours.

Queuing on Approaches

- 3.11 In order to demonstrate that the proposed mitigation would be beneficial both in terms of reducing delay *and* queuing, the results have been extracted for average and maximum queues on approaches as well.
- 3.12 **Table 3** provides a comparison of the difference in average queues (PCUs) on all approach arms to the junction in the peak hours at both 2023 and 2031.

Table 3: Average Queue Comparison (PCU)

Average Queue (PCU)							
Queue Counter	Approach arm	2023 AM DM	2023 AM DS	Difference	2023 PM DM	2023 PM DS	Difference
1	Brickhill Street	1	1	0	1	1	0
2	A5 South	47	44	-3	2	2	0
3	A4146	71	71	0	43	43	0
4	Wattling Street	4	3	-1	4	3	-1
5	A5 North	85	77	-8	85	70	-15

Average Queue (PCU)							
Queue Counter	Approach arm	2031 AM DM	2031 AM DS	Difference	2031 PM DM	2031 PM DS	Difference
1	Brickhill Street	1	1	0	1	2	1
2	A5 South	71	67	-4	2	2	0
3	A4146	73	72	-1	65	58	-7
4	Wattling Street	6	5	-1	6	6	0
5	A5 North	85	81	-4	86	79	-7

- 3.13 The results demonstrate that the mitigation proposals would not result in any increases in the average queuing in either of the peak hours in 2023. The bottom part of the table also shows that this would continue to be the case in 2031, which is an added benefit.
- 3.14 For completeness, **Table 4** provides a comparison of the difference in maximum queues (PCUs) forming on all approach arms to the junction in the peak hours at both 2023 and 2031.

Table 4: Maximum Queue Comparison (PCU)

Max Queue (PCU)							
Queue Counter	Approach arm	2023 AM DM	2023 AM DS	Difference	2023 PM DM	2023 PM DS	Difference
1	Brickhill Street	7	9	2	7	9	2
2	A5 South	88	85	-3	11	10	-1
3	A4146	89	89	0	89	89	0
4	Wattling Street	21	21	0	30	26	-4
5	A5 North	90	90	0	90	89	-1

Max Queue (PCU)							
Queue Counter	Approach arm	2031 AM DM	2031 AM DS	Difference	2031 PM DM	2031 PM DS	Difference
1	Brickhill Street	7	9	2	8	10	2
2	A5 South	89	89	0	12	12	0
3	A4146	89	89	0	89	89	0
4	Wattling Street	31	28	-3	36	35	-1
5	A5 North	90	90	0	90	89	-1

- 3.15 The results demonstrate that the mitigation proposals would offset increases in maximum queues on all approach arms in 2023 except for the Brickhill Street approach, which includes an increase of 2 PCUs to the maximum queue in both the morning and evening peak hours. The level of additional queuing is considered immaterial in the context of the benefits to the wider operation of the junction.

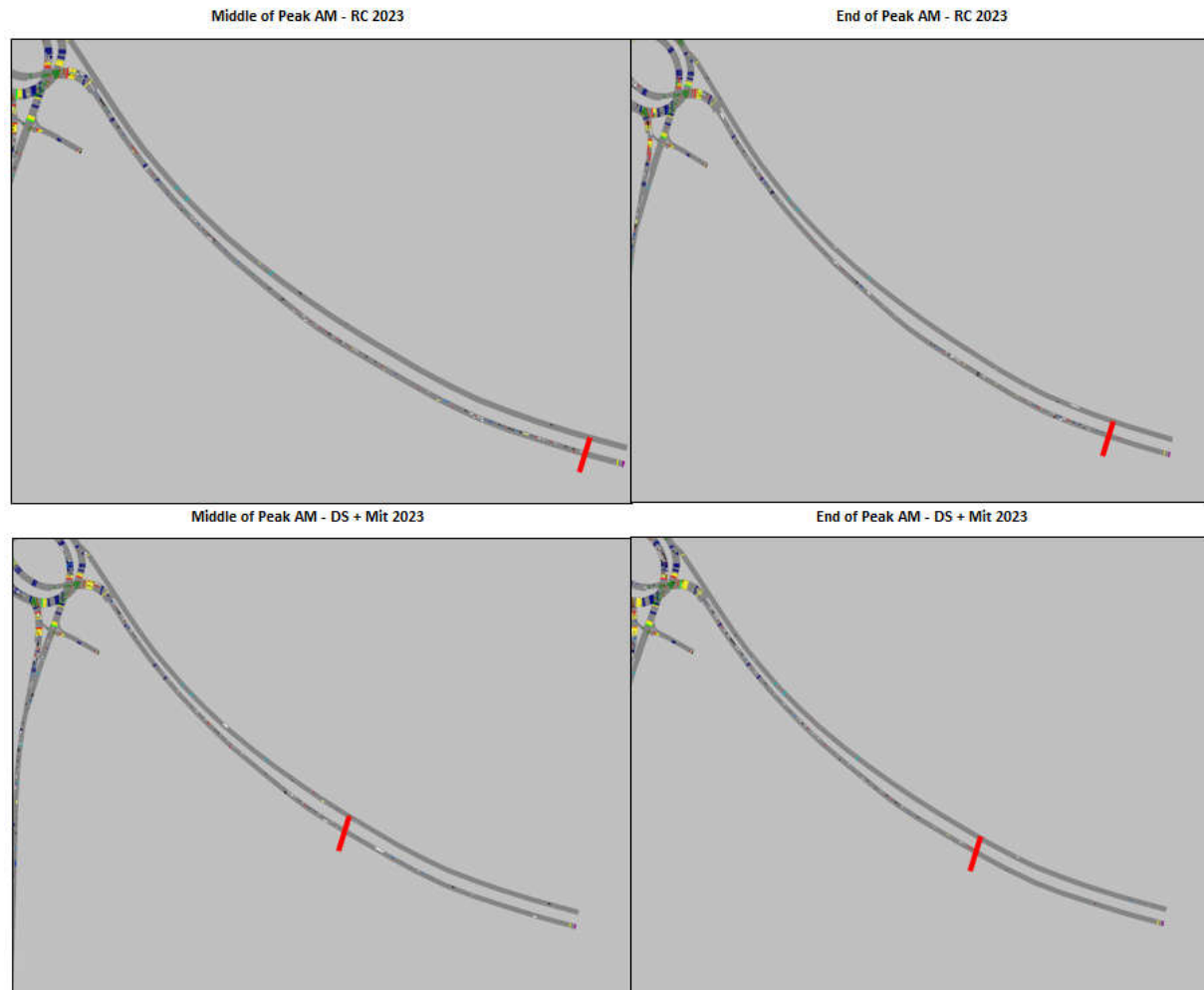
- 3.16 In addition to the above and in order to provide a direct comparison to the queuing observation screenshots from the VISSIM model presented by AECOM in TN10, BWB has extracted similar screenshots with the additional mitigation in place.
- 3.17 The VISSIM model alters the arrival pattern for every run (seed) of the model and therefore it was not considered appropriate to compare the first run of each modelling scenario. Instead, the journey time for each run to A5 South was examined and is summarised in **Table 5** below.

Table 5: Journey Time to A5 South 'Give Way'

Simulation Run	Journey Time (seconds)	
	2023 RC AM	2023 DS + Mit AM
1	104	111
2	138	104
3	116	100
4	117	106
5	71	69
6	94	91
7	87	90
8	76	80
9	84	83
10	118	92
Average	100	93
Standard deviation	22	13
Minimum	71	69
Maximum	138	111

- 3.18 As shown in Table 5, a comparison of the first run would naturally indicate that the mitigation scenario runs worse, however when all ten simulation runs are compared it can be seen that the with mitigation scenario operates slightly better than the reference case scenario.
- 3.19 Therefore, instead of comparing the first run of each scenario, the worst-case simulation run has been compared instead i.e. Simulation Run 2 for 'Reference Case' (RC) scenario and Simulation Run 1 for the 'Do Something + Mitigation' (DS + Mit) scenario. This is illustrated in the screenshots presented in **Figure 3** below.

Figure 3: 2023 AM Peak Model Observations



3.20 Again, the results indicate a betterment in queuing along the A5 S arm in the DS+Mit scenario.

4 Conclusion

- 4.1 In response to Technical Note 10 produced by AECOM on behalf of HE, BWB has investigated further measures to reduce the impact of the proposed development on the operation of the A5 Kelly's Kitchen Roundabout in 2023.
- 4.2 The VISSIM modelling results demonstrate that the mitigation proposals would adequately offset the impact of the proposed development at the year of opening. In addition to this, the modelling results also show that the proposed mitigation measures would also offset the impact of the proposed development in the 2031 future year assessment.