Report

Pump Lane and Lower Rainham Transport Impact Appraisal Addendum 3 (Additional A2 mitigations results)

On behalf of Medway Council

Sweco UK Limited
4th Floor, Radcliffe House
Blenheim Court
Solihull, B91 2AA
+44 121 711 6600

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Reg. Office Address:
Sweco UK Limited
Grove House
Mansion Gate Drive
Leeds, LS7 4DN
+44 113 262 0000

Reg. No.: 2888385
Reg. Office: Leeds

www.sweco.co.uk

Sweco UK Limited
4th Floor, Radcliffe House
Blenheim Court
Solihull, B91 2AA
+44 121 711 6600

Alkis Papadoulis
Transport Modeller

alkis.papadoulis@sweco.co.uk

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1 Introduction

This report is an addendum to the "Pump Lane and Lower Rainham Transport Impact Appraisal Report" produced by Sweco in October 2020 **[CD12.1]**. It is the third addendum. The first addendum was produced by Sweco in December 2020 **[CD12.3]**, and the second was produced by Sweco in January 2021 **[CD12.2]**. It should be read together with those reports. The three reports mentioned above, as well as this report, include the mitigations originally proposed by the Appellant. These mitigations included the following:

- Improvements at Yokosuka Way-Lower Rainham Road roundabout east arm (introduction of an additional lane)
- Several improvements at A2-Bloors Lane junction (introduction of additional lanes in the A2 eastbound)
- Signal control shuttle at Pump Lane

More details about these mitigations can be found in CD12.1.

This further addendum was produced as a result of the inquiry document entitled "A2 Junction operation review" which was prepared by Simon Tucker on behalf of David Tucker Associates (DTA) for the appellant. This document was submitted on the 23rd of February 2021, part way through the original Inquiry dates and just before the highway modelling evidence was to be heard. Following confirmation from the appellants that they wished to rely on this additional mitigation notwithstanding the lateness of its introduction, the Inquiry was adjourned in order that the additional mitigation could be factored into the Medway Aimsun Model (MAM).

The aforementioned document proposed several additional mitigation schemes along the A2 corridor in Medway, namely:

- Toucan crossing configuration east of Bowaters Roundabout
- Bowaters roundabout signalisation
- Will Adams roundabout lane markings and additional lane
- Otterham Quay lane junction signalisation

These additional mitigations will be presented in detail in the sections below.

After a meeting between Sweco, Medway Council, Paul Basham Associates and DTA on the 24th of February, it was agreed that the additional A2 mitigations needed to be tested in the Medway Aimsun Model (MAM) in a new set of 2028 and 2037 scenarios, in order for Medway Council to be able to understand their effect on the traffic impact from the Pump Lane development. Table 1 presents the scenarios which include the additional proposed mitigations (2A, 3A, 5A, 6A) and also lists the scenarios examined in CD12.2 and CD12.3.

Table 1 LRR Scenarios examined in this report

LRR Scenario	Assessment Year	Trip rates for development at Pump Lane	Development zone used	Additional A2 mitigations
2	2037	MAM Trip rates	Standalone development zone	No
2A	2037	MAM Trip rates	Standalone development zone	Yes
3	2037	Developer Trip rates	Standalone development zone	No
3A	2037	Developer Trip rates	Standalone development zone	Yes
5	2028	MAM Trip rates	Standalone development zone	No
5A	2028	MAM Trip rates	Standalone development zone	Yes
6	2028	Developer Trip rates	Standalone development zone	No
6A	2028	Developer Trip rates	Standalone development zone	Yes

This report will present the results of the scenarios above and compare them with the scenarios without the additional A2 mitigations from Sweco's December 2020 and January 2021 reports (i.e. Scenarios 2, 3, 5 and 6) and the reference case for the corresponding assessment year.

2 Model amendments

The additional mitigation modelled in the new scenarios (Scenarios 2A, 3A, 5A, 6A) presented in this report are the following:

i. Toucan crossing configuration east of Bowaters Roundabout

The proposed scheme is presented in the figure below which is extracted from document 20230-17b which was an appendix to the A2 Junction operation review document, produced by DTA. The mitigation includes the introduction of a refuge island in the A2, which allows the pedestrians to cross the A2 in two stages. Additionally, in this scheme the number of lanes is doubled and tapered down to the west of the crossing.

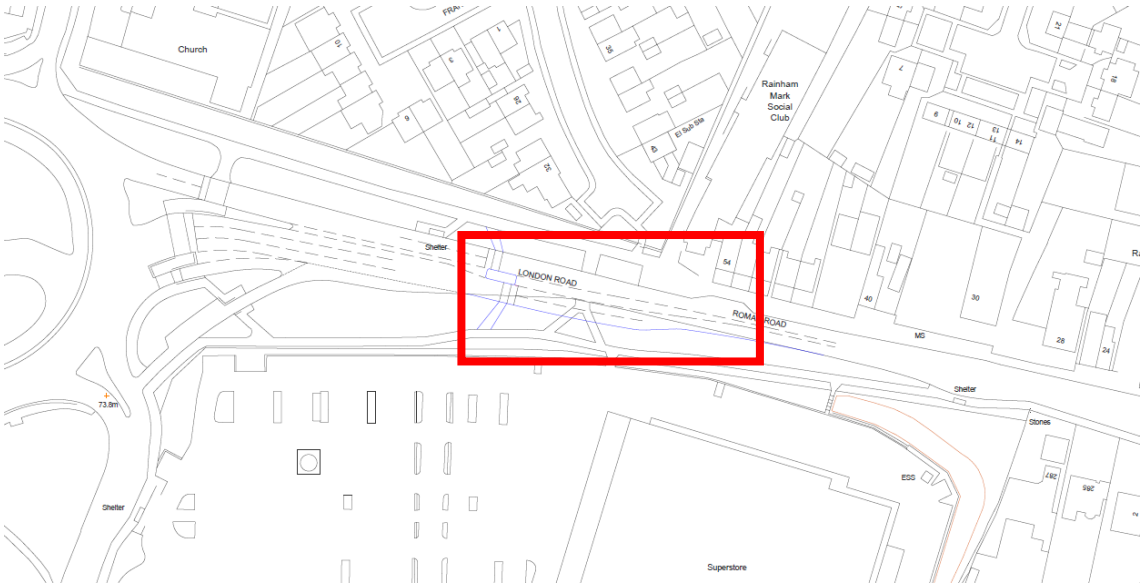


Figure 1 Toucan crossing mitigation east of Bowaters roundabout

This proposed scheme was coded in the MAM as shown in Figure 2.

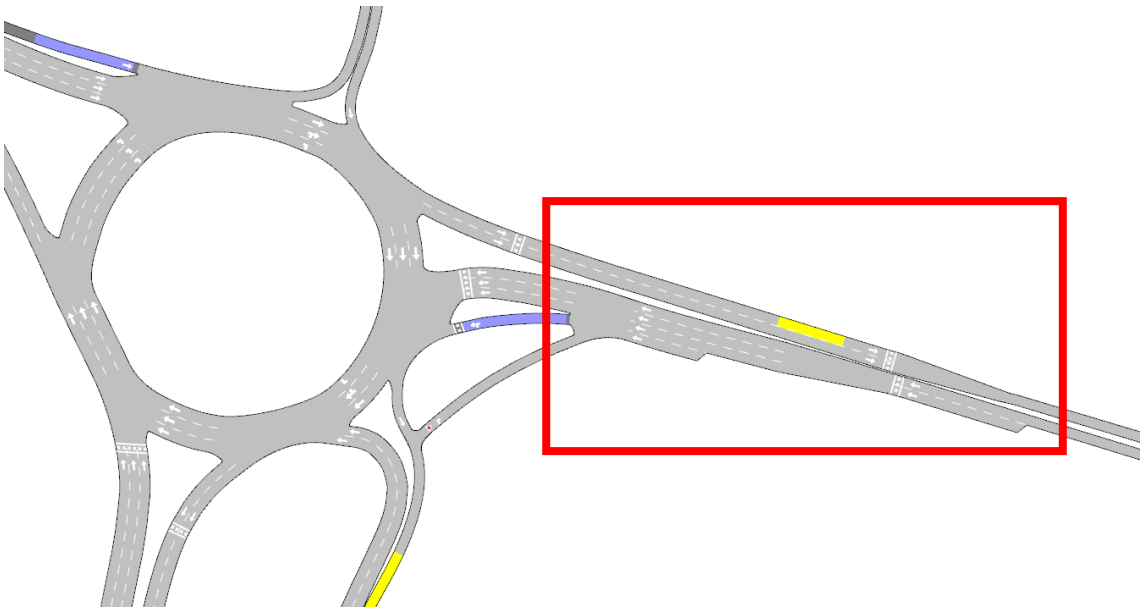


Figure 2 Toucan crossing mitigation scheme east of Bowaters roundabout in Medway Aimsun model

ii. Bowaters Roundabout signalisation

The signal timings in Bowaters roundabout in the Medway Aimsun model were updated to match the Linsig signal timings provided by DTA on the 28th of February 2021.. A different signal control plan was provided for each future year scenario (LRR Scenario 2 and Scenario 3 for 2037 and LRR Scenario 5 and Scenario 6 for 2028). The signal timings provided by DTA were

coded in the MAM for each node of the roundabout for all the additional mitigations scenarios (2A, 3A, 5A, 6A). The signal timings were not updated for the reference case scenarios as no new optimised signal timings were provided by the appellant.

iii. Will Adams roundabout lane markings and additional lane

The proposed mitigation for Will Adams roundabout outlined in the "A2 Junction operation review" document included the update of the lane markings on the eastern approach to the roundabout, as well as the introduction of an additional lane on the southern section of the roundabout to match the northern section; both with three lanes (see Figure 3) . The proposed lane markings were updated in the MAM to reflect these proposed modifications. More specifically, the lane markings were changed (outermost to innermost) from: left and ahead, ahead only, ahead and right; to: left and ahead, ahead only ,and right only.

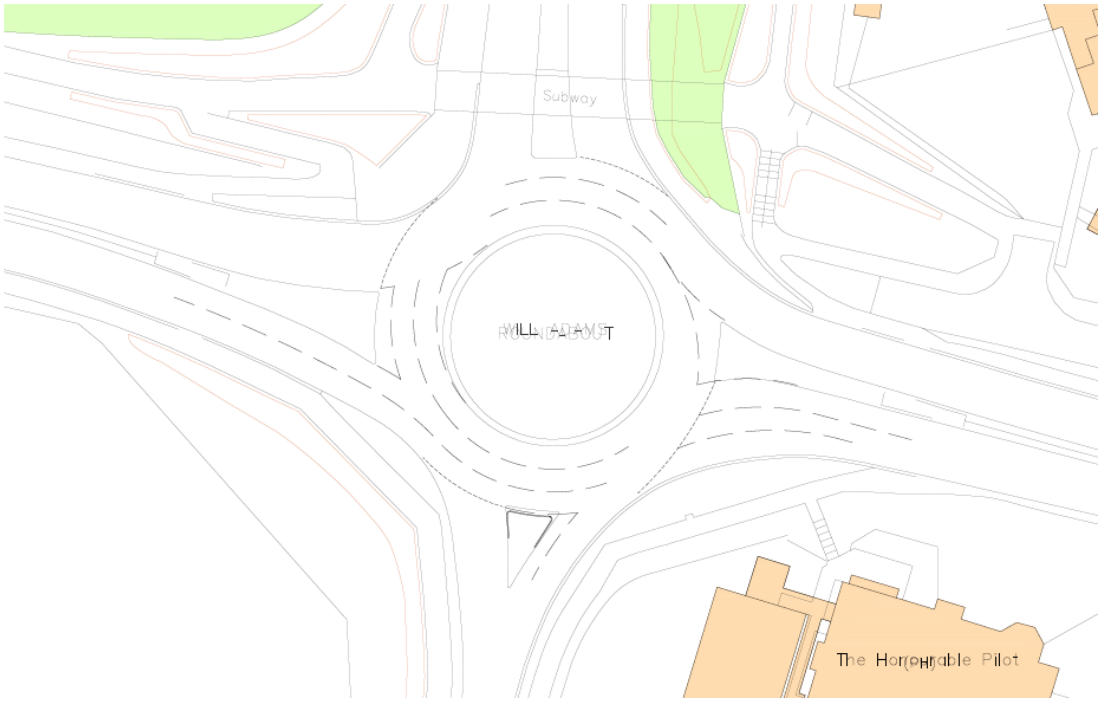


Figure 3 Will Adams roundabout mitigation scheme

iv. Otterham Quay Lane signalisation

The appellants also provided the signal timings that were used in their Linsig model of Otterham Quay Lane junction. After comparing the signal timings used originally in the MAM scenarios 2, 3, 5 and 6 with the signal timings provided by the appellants, it was decided that since the signal timings did not have fundamental differences in terms of signal phases, the signal timings provided by the appellants should be used for the purpose of this report for consistency purposes. The signal timings were extracted from the Linsig models for the development and reference case scenarios.

3 Results

3.1 Subnetwork 2

3.1.1 Subnetwork 2 Statistics

The Subnetwork 2 statistics for the 2028 and 2037 AM peak are presented in Table 3 and Table 4 for scenarios 5a and 6a and 2a and 3a respectively. The PM peak results are presented in Table 5 and Table 6 accordingly. The results show that travel time, delay and mean queue (average number of queued vehicles across the whole of the subnetwork) increase in all scenarios where the development is present compared to the reference case. This increase is lower in scenarios 3 and 6 which contain the developer demand compared to scenarios 2 and 5 accordingly (Strategic model demand) due to the lower demand (see Table 2).

Table 2 Trip generation for the proposed Pump Lane development

Demand	AM Peak			PM Peak		
	In	Out	Total	In	Out	Total
DTA trip generation	187	398	585	365	193	558
MAM trip generation	175	624	799	497	306	803

When comparing the results to the results presented in the Lower Rainham Report Addendum (2037 results) and Lower Rainham Report Addendum 2 (2028 results) the following conclusions can be drawn:

- In 2028 AM, there is still a substantial increase in travel time, delay and mean queue as a result of the Pump Lane development (i.e when compared to reference case). The additional A2 mitigations only have a small positive effect when comparing to the scenarios without the additional A2 mitigations.
- In 2037 AM a similar effect is observed. There is still a substantial increase in the travel time, delay and mean queue when comparing the development scenarios with the reference case, albeit there is a slight reduction in travel time, delay and mean queue between the 2037 scenarios 2 and 3 (without additional A2 mitigations) and the 2037 scenarios 2A and 3A (with the additional A2 mitigations).
- In 2028 PM, there is again a substantial increase in subnetwork mean queue, travel time and delay when comparing the development scenarios and the reference cases. However, in the PM peak the additional A2 mitigations worsen the situation still further. When comparing the scenarios without the additional A2 mitigations with the scenarios with the additional A2 mitigations, it is observed that travel time, delay and mean queue all increase in the scenarios with the additional A2 mitigations.

  Two contributory factors for this increase have been identified:

- Firstly, due to the mitigations on Will Adams roundabout, there is an increase in flow on the A2 leading to increased delays in that section of the corridor.
- The second contributory factor is the difference in signalisation on the Bowaters Roundabout. After comparing the signal plan for Bowaters roundabout at the segment of the roundabout shown in Figure 4, it is observed that the signal timings provided by DTA give at least 5% less green time to the Bowaters roundabout eastbound traffic stream when compared to the original signal timings of MAM for scenarios 2, 3, 5 and 6. These revised signal timings ultimately cause higher delays and additional queuing at Bowaters roundabout which blocks back to the A2. This can be seen in Figure 5 and Figure 6. Figure 5 and Figure 6 present the traffic conditions along the A2 and Ito way at 17:45, for the scenarios 5A and 5 accordingly. It can be observed that in Figure 6 the queue along the A2 has blocked back further up Ito Way and on the A2 has reached the Woodlands Road/Rotary Gardens junction.

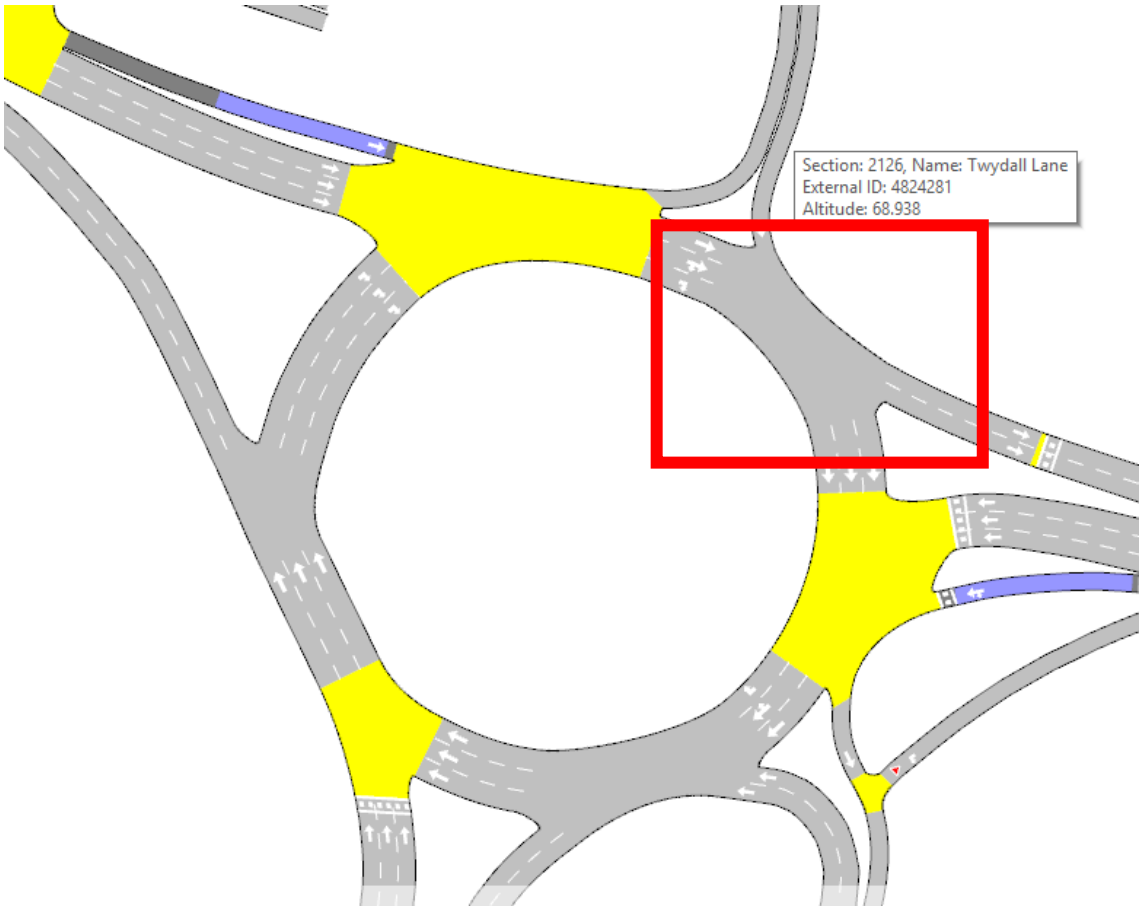


Figure 4 Bowaters Roundabout detail

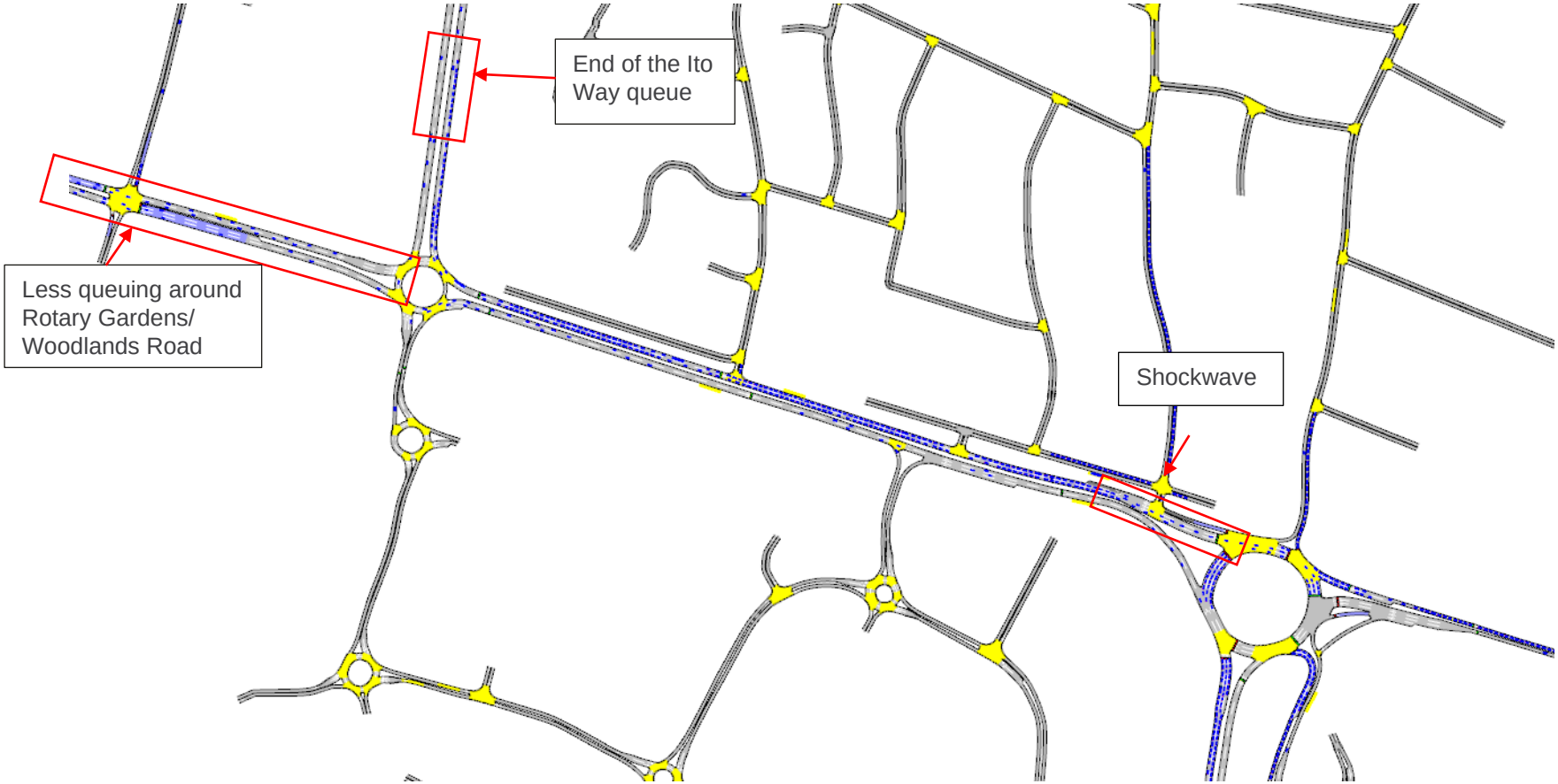


Figure 5 Screenshot of Subnetwork 2 Scenario 5 PM at 17:45

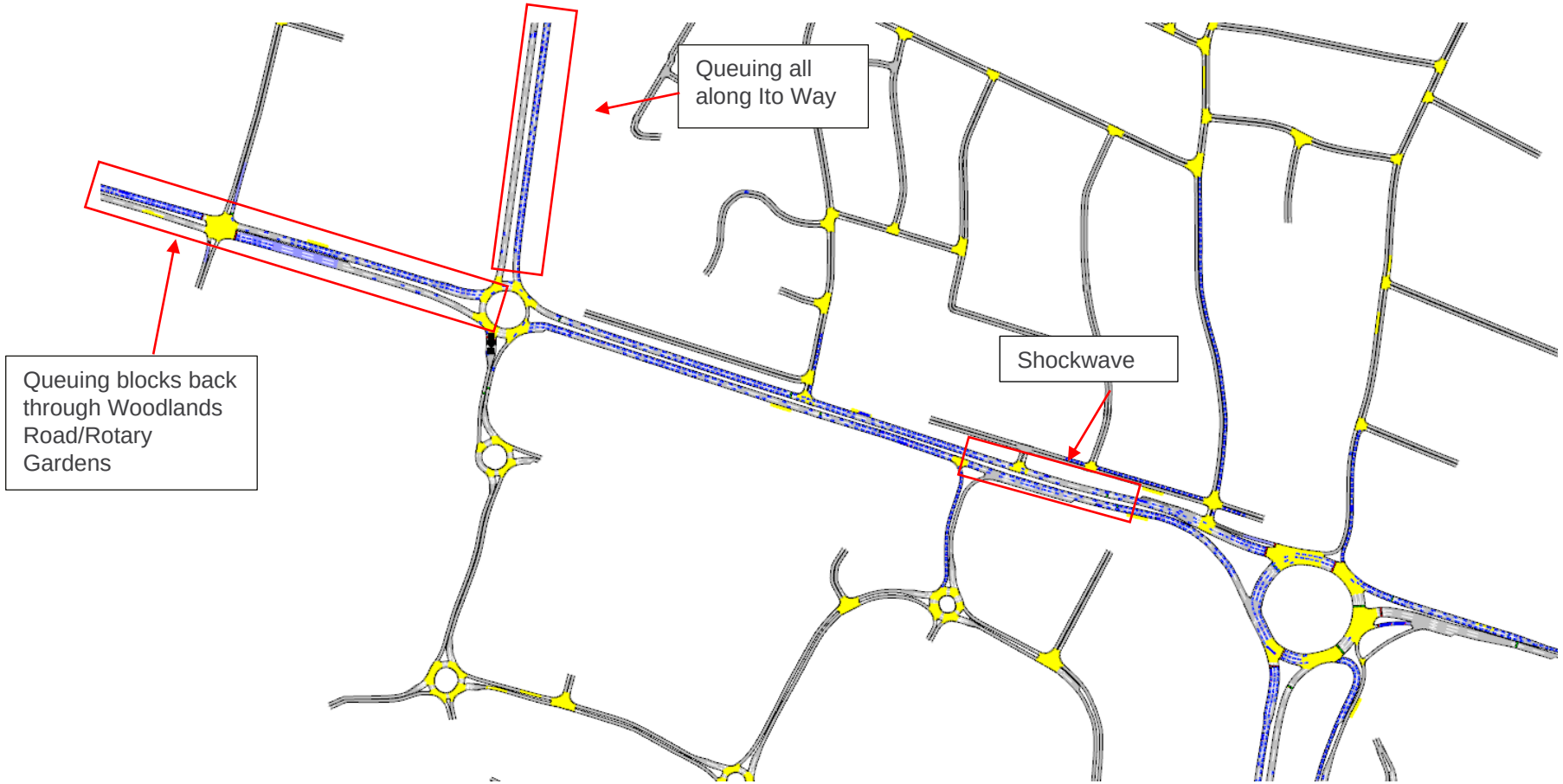


Figure 6 Screenshot of Subnetwork 2 Scenario 5A PM at 17:45

- In 2037 PM there is once again a substantial increase in subnetwork mean queue, travel time and delay when comparing the development scenarios and the reference cases. There is also, again, an increase in travel time, delay and queue is observed in the scenarios with the additional A2 mitigations. This can be attributed again to the two contributory factors mentioned above.

Table 3 Subnetwork 2 Statistics 2028 AM Peak

Statistic	AM Peak (0800 to 0900)					
	Units	2028 Rainham RC	LRR Scenario 5	LRR Scenario 6	LRR Scenario 5A	LRR Scenario 6A
Travel Time	sec/km	193	246	246	240	238
Delay	sec/km	119	173	173	168	165
Mean Queue	vehicles	489	861	854	853	846

Table 4 Subnetwork 2 Statistics 2037 AM Peak

Statistic	AM Peak (0800 to 0900)					
	Units	2037 Rainham RC	LRR Scenario 2	LRR Scenario 3	LRR Scenario 2A	LRR Scenario 3A
Travel Time	sec/km	193	248	253	251	249
Delay	sec/km	120	175	181	178	176
Mean Queue	vehicles	503	890	905	923	922

Table 5 Subnetwork 2 Statistics 2028 PM Peak

Statistic	PM Peak (1700 to 1800)					
	Units	2028 Rainham RC	LRR Scenario 5	LRR Scenario 6	LRR Scenario 5A	LRR Scenario 6A
Travel Time	sec/km	165	206	206	226	211
Delay	sec/km	93	134	133	154	139
Mean Queue	vehicles	284	557	563	728	608

Table 6 Subnetwork 2 Statistics 2037 PM Peak

Statistic	PM Peak (1700 to 1800)					
	Units	2037 Rainham RC	LRR Scenario 2	LRR Scenario 3	LRR Scenario 2A	LRR Scenario 3A
Travel Time	sec/km	171	206	204	269	265
Delay	sec/km	98	133	132	198	192
Mean Queue	veh	325	563	556	1,120	1,101

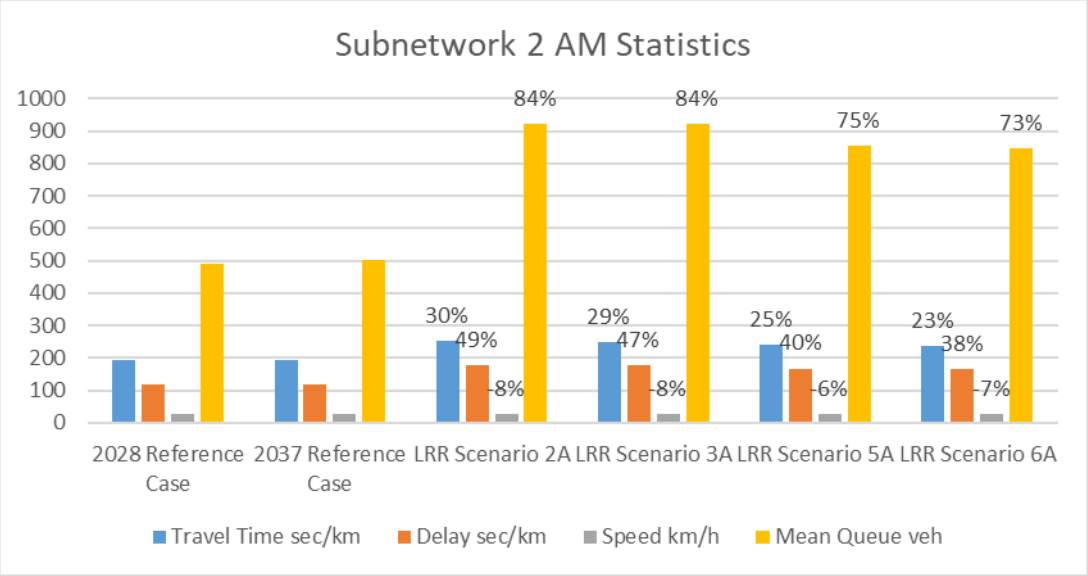


Figure 7 Subnetwork 2 AM Statistics

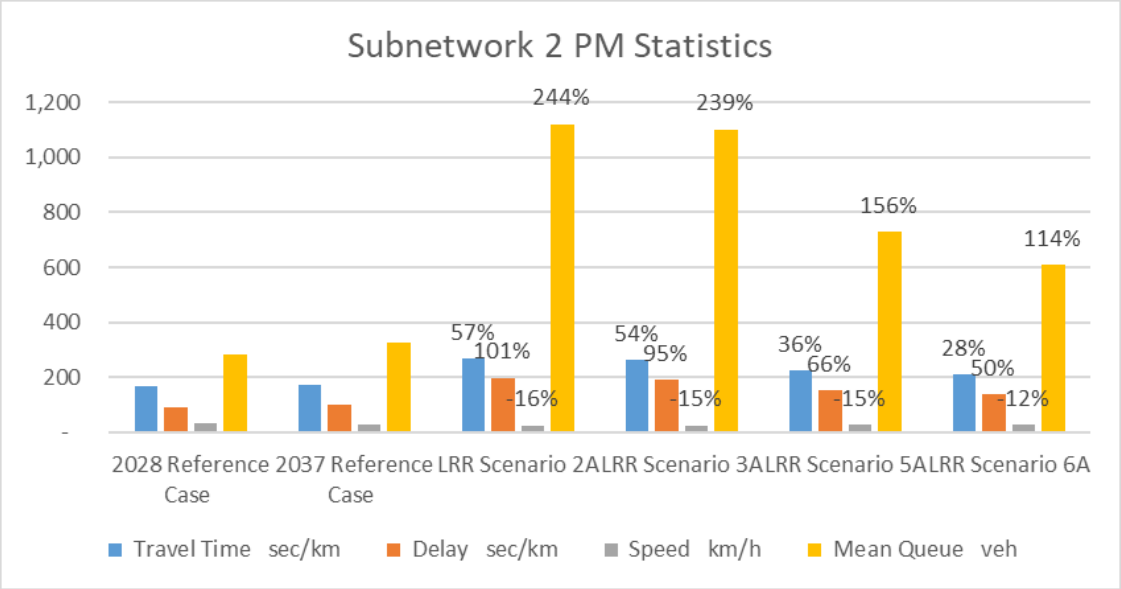


Figure 8 Subnetwork 2 PM Statistics

The percentage increase in the subnetworks statistics when compared to the relevant reference case are presented in Figure 7 and Figure 8. The large increase in average queue in the PM Scenarios can be observed in Figure 8, where it ranges between 114% - 156% in the 2028 scenarios when comparing to the 2028 reference case and 239-244% in the 2037 scenarios compared to the 2037 reference case.

3.1.2 Subnetwork 2 Junctions Level of Service

Table 7, Table 8.Table 9 and Table 10 present the Level of Service results for key junctions in Subnetwork 2. The location of each junction and roundabout is shown in Figure 9.

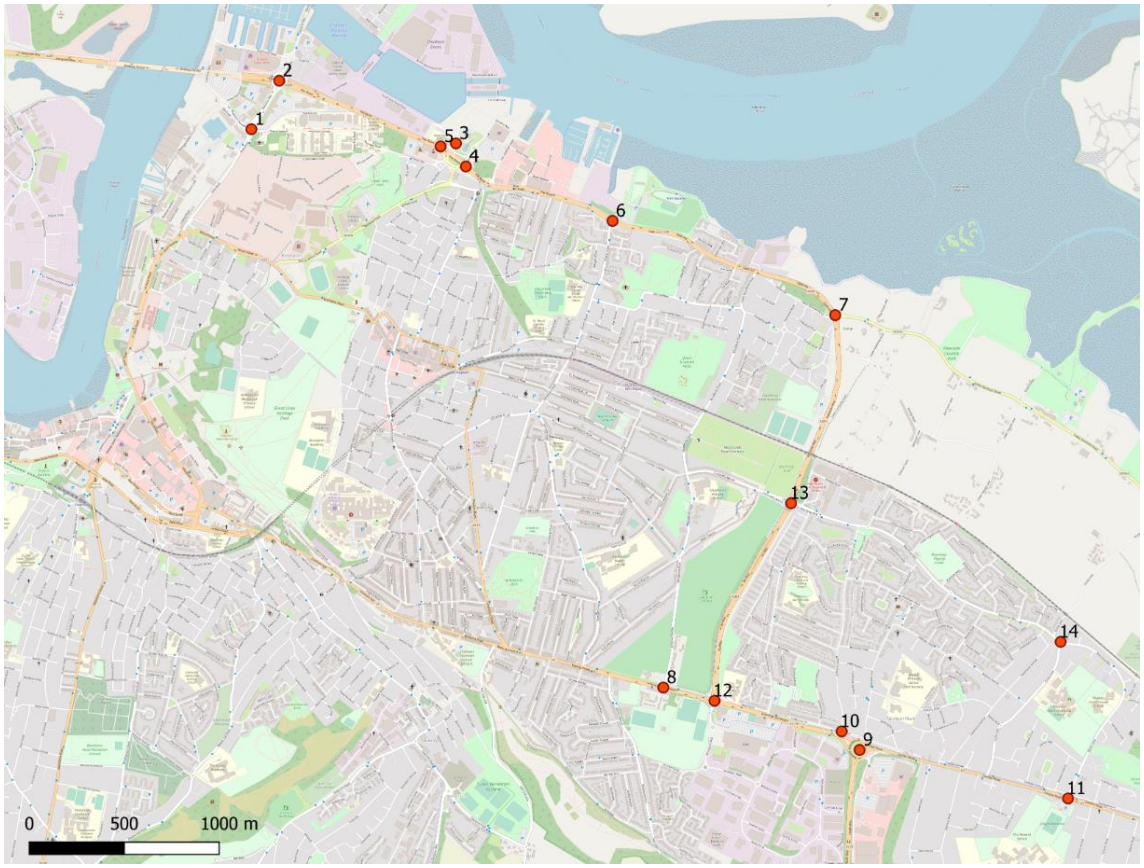


Figure 9 Subnetwork 2 Junctions and Roundabouts

The main differences and comments in terms of junction/roundabout level of service between the scenarios with and without the additional A2 mitigations are discussed below:

- 2028 AM: No significant difference or improvement is observed in the scenarios with the additional A2 mitigations when compared with the results of scenarios 5 and 6. The small improvement observed in subnetwork statistics did not shift the level of service of the key problematic junctions along the A2.
- 2037 AM: No significant difference or improvement is observed in the scenarios with the mitigations when compared with the results of scenarios 2 and 3. The small improvement forecast in the subnetwork statistics did not shift the level of service of the key problematic junctions along the A2.
- 2028 PM: The most significant difference between scenarios 5 and 5A is the shift of level of service the A2 (Rotary Gardens / Woodlands Road / Sovereign Boulevard) junction (Junction 8) from E (scenario 5) to F (scenario 5A). This is caused due by the queuing, which is initially formed along the A2, that worsened with the new signal plan at Bowaters roundabout. This queue ultimately reaches Woodlands Road/Rotary Gardens and causes the functionality of this roundabout to break. This effect can also be noticed in Figure 6 when compared with Figure 5.

- 2037 PM: Same as the 2028 PM scenario, the level of service at the A2 (Rotary Gardens / Woodlands Road / Sovereign Boulevard) junction (Junction 8) shifts to LoS F in the 2A and 3A scenarios for the reasons mentioned above. When comparing the flow plots between scenario 3 and 3A, one can observe increased traffic flow around this specific junction that is caused due to the additional A2 mitigations, especially the increases in capacity in Will Adams roundabout and east of Bowaters roundabout. The mitigations are making the junctions more attractive to vehicles, however, the A2 (Rotary Gardens / Woodlands Road / Sovereign Boulevard Junction) cannot accommodate this increase in flow.

Table 7 Subnetwork 2 Junction Level of Service AM Peak 2028 with mitigations

Junction	ID	Ref 2028 AM	LRR Scenario 5	LRR Scenario 6	LRR Scenario 5A	LRR Scenario 6A
Pembroke/Dock Road/Western Avenue/ Maritime Way Roundabout	**1**	C	C	C	C	C
A289 (Pier Road/ Maritime Way Roundabout)	**2**	C	C	C	C	C
A289 (Pier Road / Gillingham Gate Road)	**3**	D	D	D	D	D
A289 Pier Road / Gillingham Gate Road West	**4**	D	E	E	E	E
A289 Pier Road / Gillingham Gate Road East	**5**	C	C	C	C	C
A289 Pier Road / Church Street / Strand Junction	**6**	C	C	C	C	C
A289 (Yokosuka Way Roundabout)	**7**	F	F	F	F	F
A2 (Rotary Gardens / Woodlands Road / Sovereign Boulevard Junction)	**8**	D	F	F	F	F
A2 (Bowater Roundabout)	**9**	B	F	F	F	F
Eastcourt Lane / South Avenue	**10**	F	F	F	F	F
A2 (London Road / Bloors Lane Junction)	**11**	D	D	D	D	D
A289 (Ito Way / Sovereign Boulevard)	**12**	A	F	F	F	F
A2 (Yokosuka / Ito / Beechings Way Roundabout)	**13**	A	A	A	A	A
A2 / Pump Lane	**14**	A	E	E	E	E

Table 8 Subnetwork 2 Junction Level of Service AM Peak 2037 with mitigations

Junction	ID	Ref 2037 AM	LRR Scenario 2	LRR Scenario 3	LRR Scenario 2A	LRR Scenario 3A
Pembroke/Dock Road/Western Avenue/ Maritime Way Roundabout	1	C	C	C	C	C
A289 (Pier Road/ Maritime Way Roundabout)	2	C	C	C	C	C
A289 (Pier Road / Gillingham Gate Road)	3	D	D	D	D	D
A289 Pier Road / Gillingham Gate Road West	4	D	E	E	E	E
A289 Pier Road / Gillingham Gate Road East	5	C	C	C	C	C
A289 Pier Road / Church Street / Strand Junction	6	C	C	C	C	C
A289 (Yokosuka Way Roundabout)	7	F	F	F	F	F
A2 (Rotary Gardens / Woodlands Road / Sovereign Boulevard Junction)	8	D	F	F	F	F
A2 (Bowater Roundabout)	9	C	F	F	F	F
Eastcourt Lane / South Avenue	10	F	F	F	F	F
A2 (London Road / Bloors Lane Junction)	11	D	D	D	D	D
A289 (Ito Way / Sovereign Boulevard)	12	B	F	F	F	F
A2 (Yokosuka / Ito / Beechings Way Roundabout)	13	A	A	A	A	A
A2 / Pump Lane	14	A	E	E	E	E

Table 9 Subnetwork 2 Junction Level of Service PM Peak 2028

Junction	ID	Ref 2028 PM	LRR Scenario 5	LRR Scenario 6	LRR Scenario 5A	LRR Scenario 6A
Pembroke/Dock Road/Western Avenue/ Maritime Way Roundabout	1	A	A	A	A	A
A289 (Pier Road/ Maritime Way Roundabout)	2	C	F	F	F	F
A289 (Pier Road / Gillingham Gate Road)	3	D	E	D	E	D
A289 Pier Road / Gillingham Gate Road West	4	D	F	F	F	F
A289 Pier Road / Gillingham Gate Road East	5	B	C	C	C	C
A289 Pier Road / Church Street / Strand Junction	6	B	C	C	C	C
A289 (Yokosuka Way Roundabout)	7	A	A	A	A	A
A2 (Rotary Gardens / Woodlands Road / Sovereign Boulevard Junction)	8	C	E	E	F	E
A2 (Bowater Roundabout)	9	D	F	F	F	F
Eastcourt Lane / South Avenue	10	D	F	F	F	F
A2 (London Road / Bloors Lane Junction)	11	C	D	D	D	D
A289 (Ito Way / Sovereign Boulevard)	12	A	A	A	A	A
A2 (Yokosuka / Ito / Beechings Way Roundabout)	13	A	A	A	A	A

A2 / Pump Lane	**14**	A	D	D	E	D

Table 10 Subnetwork 2 Junction Level of Service PM Peak 2037

Junction	ID	Ref 2037 PM	LRR Scenario 2	LRR Scenario 3	LRR Scenario 2A	LRR Scenario 3A
Pembroke/Dock Road/Western Avenue/ Maritime Way Roundabout	**1**	A	B	B	B	B
A289 (Pier Road/ Maritime Way Roundabout)	**2**	E	F	F	F	F
A289 (Pier Road / Gillingham Gate Road)	**3**	D	E	E	E	E
A289 Pier Road / Gillingham Gate Road West	**4**	E	F	F	F	F
A289 Pier Road / Gillingham Gate Road East	**5**	B	C	C	C	C
A289 Pier Road / Church Street / Strand Junction	**6**	C	C	C	C	C
A289 (Yokosuka Way Roundabout)	**7**	A	A	A	A	A
A2 (Rotary Gardens / Woodlands Road / Sovereign Boulevard Junction)	**8**	C	E	E	F	F
A2 (Bowater Roundabout)	**9**	D	F	F	F	F
Eastcourt Lane / South Avenue	**10**	D	F	F	F	F
A2 (London Road / Bloors Lane Junction)	**11**	C	D	D	E	E
A289 (Ito Way / Sovereign Boulevard)	**12**	A	B	B	B	B
A2 (Yokosuka / Ito / Beechings Way Roundabout)	**13**	A	A	A	A	A
A2 / Pump Lane	**14**	A	D	D	E	E

3.1.3 Subnetwork 2 Path travel time

Figure 10 shows the journey time routes analysed in subnetwork 2, while Table 11, Table 12, Table 13 and Table 14 present the travel time results for the 2028, 2037 assessment years for the AM and PM Peaks accordingly. When comparing the results of scenarios 2A, 3A, 5A and 6A with scenarios 2, 3, 5 and 6 the following conclusions can be drawn:

- In the AM scenarios:
    - Westbound - In both assessment years there is a significant increase in travel times on the westbound routes along the A2 (A278 (Hoath Way) to A289 (Church Street) and A2 (Sovereign Boulevard to Watling Road) in the scenarios with the additional mitigations. After examining the simulation video and delay plots for the scenarios with the additional A2 mitigations it can be seen that the new proposed lane markings in Will Adams roundabout are not improving traffic conditions. This is because the new lane markings reduce capacity for vehicles going straight ahead westbound on the A2 at Will Adams roundabout, causing large queues in the middle lane which cannot enter the short nearside lane on the eastern arm of the roundabout. This can be observed once again in Figure 6 when compared to Figure 5.

- Eastbound - All the other path travel times in the AM scenarios show a small improvement due to the optimised signal timings provided by DTA. It should be noted however, that compared to the reference case, scenarios 2a, 3a, 5a and 6a still result in a significant increase in travel times along the A2.

- In the PM scenarios:
  - Westbound - There is an increase in travel times on all westbound paths with the additional A2 mitigation scenarios (2A, 3A, 5A, 6A) compared to scenarios without the mitigations (2, 3, 5 and 6). This can be attributed to the lane marking changes at Will Adams roundabout, as described above.
  - Eastbound – There is an increase in travel time on eastbound paths with the additional A2 mitigations, due to the 5% less green time for the Bowaters eastbound traffic stream.

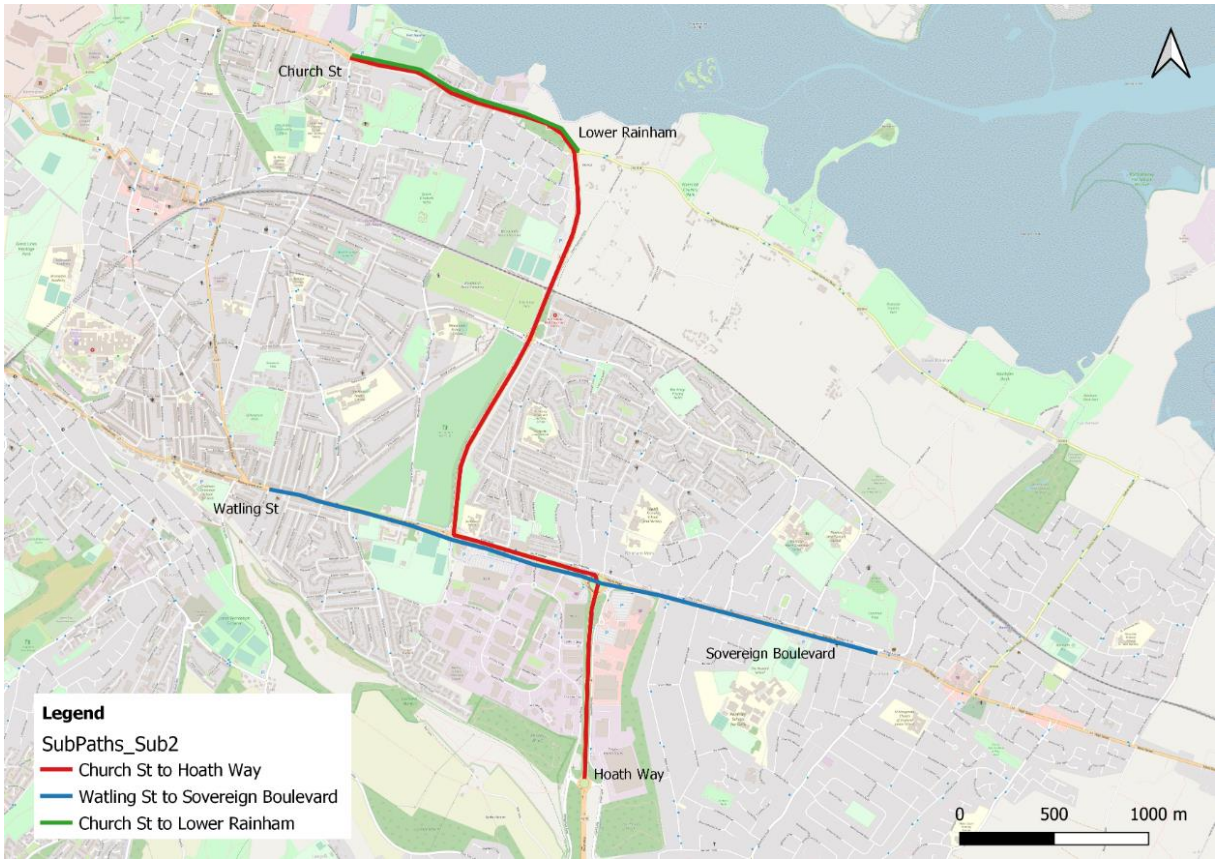


Figure 10 Subnetwork 2 Paths

Table 11 Subnetwork 2 Path travel time AM Peak 2028

Path	2028 Reference Case AM (sec)	LRR Scenario 5 (sec)			LRR Scenario 6 (sec)			LRR Scenario 5A (sec)			LRR Scenario 6A (sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
A289 (Church Street) to A278 (Hoath Way)	800	1,400	601	75%	1,330	530	66%	1,141	341	43%	1,019	219	27%
A278 (Hoath Way) to A289 (Church Street)	604	639	35	6%	615	11	2%	879	275	46%	832	228	38%
A2 WB (Sovereign Boulevard to Watling Road)	400	427	27	7%	426	26	6%	745	345	86%	721	321	80%
A2 EB (Watling to Sovereign Boulevard)	672	1,456	784	117%	1,433	760	113%	1,382	709	105%	1,273	601	89%
A289 (Church Street to Lower Rainham)	140	141	1	1%	139	-1	-1%	142	2	2%	140	0	0%
A289 (Lower Rainham to Church Street)	121	124	3	2%	123	2	2%	123	2	2%	121	-	0%

Table 12 Subnetwork 2 Path travel time AM Peak 2037

Path	2037 Reference Case AM (sec)	LRR Scenario 2 (sec)			LRR Scenario 3 (sec)			LRR Scenario 2A (sec)			LRR Scenario 3A (sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
A289 (Church Street) to A278 (Hoath Way)	1,275	1,483	208	16%	1,475	200	16%	1,304	29	2%	1,298	23	2%
A278 (Hoath Way) to A289 (Church Street)	605	685	80	13%	653	48	8%	969	364	60%	904	299	49%
A2 WB (Sovereign Boulevard to Watling Road)	403	433	30	7%	430	27	7%	744	341	85%	705	302	75%
A2 EB (Watling to Sovereign Boulevard)	1,235	1,548	313	25%	1,512	277	22%	1,390	155	13%	1,363	128	10%
A289 (Church Street to Lower Rainham)	141	141	-	0%	141	-	0%	155	14	10%	154	13	9%
A289 (Lower Rainham to Church Street)	123	127	4	3%	123	-	0%	128	5	4%	124	1	1%

Table 13 Subnetwork 2 Path travel time PM Peak 2028

Path	2028 Reference Case PM (sec)	LRR Scenario 5 (sec)			LRR Scenario 6 (sec)			LRR Scenario 5A (sec)			LRR Scenario 6A (sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
A289 (Church Street) to A278 (Hoath Way)	565	778	213	38%	740	175	31%	961	396	70%	740	175	31%
A278 (Hoath Way) to A289 (Church Street)	402	576	174	43%	552	150	37%	866	464	116%	809	407	101%
A2 WB (Sovereign Boulevard to Watling Road)	384	399	15	4%	396	12	3%	738	354	92%	702	318	83%
A2 EB (Watling to Sovereign Boulevard)	423	845	422	100%	821	398	94%	982	559	132%	926	503	119%
A289 (Church Street to Lower Rainham)	156	163	7	5%	160	3	2%	159	3	2%	158	2	1%
A289 (Lower Rainham to Church Street)	119	122	3	3%	122	3	2%	122	3	3%	121	2	2%

Table 14 Subnetwork 2 Path travel time PM Peak 2037

Path	2037 Reference Case PM (sec)	LRR Scenario 2 (sec)			LRR Scenario 3 (sec)			LRR Scenario 2A (sec)			LRR Scenario 3A (sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
A289 (Church Street) to A278 (Hoath Way)	562	791	229	41%	786	224	40%	1,098	536	95%	1,079	517	92%
A278 (Hoath Way) to A289 (Church Street)	403	597	194	48%	595	192	48%	896	493	122%	844	441	109%
A2 WB (Sovereign Boulevard to Watling Road)	405	407	2	0%	405	-	0%	792	387	96%	765	360	89%
A2 EB (Watling to Sovereign Boulevard)	746	870	124	17%	865	119	16%	1,078	332	45%	1,057	311	42%
A289 (Church Street to Lower Rainham)	157	168	11	7%	163	6	4%	163	6	4%	160	3	2%
A289 (Lower Rainham to Church Street)	125	124	-1	-1%	123	-2	-2%	139	14	11%	132	7	6%

3.1.4 Subnetwork 2 Summary

The subnetwork 2 statistics show traffic conditions in subnetwork 2 deteriorate in all scenarios with the additional mitigations compared to the reference case. When comparing the scenarios with the additional A2 mitigations (2a, 3a, 5a, 6a) with the scenarios without the additional A2

mitigations (2, 3, 5, 6) presented in previous reports (Lower Rainham Report Addendum (2037 results) and Lower Rainham Report Addendum 2 (2028 results)) it was observed that in the AM scenarios, there is a small improvement in terms of travel time, delay and mean queue in the subnetwork. However, in the PM scenarios, there is an increase in travel time, delay and mean queue in the subnetwork. The reason for this increase became more evident when examining the travel time and level of service results for the subnetwork.

The new signal plan offers 5% less green time in the PM scenarios in the part of the roundabout shown in Figure 4, hence causing larger queues on the A2 eastbound. In addition to that, the new lane markings in Will Adams Roundabout removes capacity for the vehicles that want to go straight ahead on the A2 westbound causing longer queues on the A2 westbound direction. This effect is clearly shown in the path travel time results both in the AM and PM peak scenarios (see Table 11, Table 12, Table 13 and Table 14).

The level of service outputs revealed a new issue at the A2 (Rotary Gardens / Woodlands Road / Sovereign Boulevard) junction in the PM scenarios. The shorter green time in Bowaters Roundabout, causes longer queues along the A2 which with the additional mitigations reach the Rotary Gardens junction, causing significant delays.

Overall, the additional A2 mitigations did not show any significant improvement. The junctions that had a level of service F in the scenarios with the Pump Lane development present, remained problematic. On the other hand, a new issue arose on the A2 (Rotary Gardens / Woodlands Road / Sovereign Boulevard) junction in the PM scenarios due to the new signal timings at Bowaters Roundabout.

3.2 Subnetwork 3

3.2.1 Subnetwork 3 Statistics

The subnetwork 3 statistics are presented in Table 15, Table 16, Table 17 and Table 18, for the assessment years 2028 and 2037 for the AM and PM Peaks. When comparing the results of scenarios 5A and 6A with the reference case, a large increase in average travel time, delay and speed is forecast.

Additionally, when comparing the results of the additional A2 mitigation scenarios (5A and 6A) with the scenarios 5 and 6 presented in the two previous Sweco reports, again an increase in average travel time, delay and mean queue are forecast despite the use of DTA's proposed traffic signal timings for Otterham Quay Lane.

Table 15 Subnetwork 3 Statistics AM Peak 2028

Statistic	AM Peak (0800 to 0900)					
	Units	2028 Rainham RC	LRR Scenario 5	LRR Scenario 6	LRR Scenario 5A	LRR Scenario 6A
Travel Time	sec/km	233	252	245	345	339
Delay	sec/km	147	166	160	259	253
Mean Queue	veh	58	75	70	133	130

Table 16 Subnetwork 3 Statistics AM Peak 2037

Statistic	AM Peak (0800 to 0900)					
	Units	2037 Rainham RC	LRR Scenario 2	LRR Scenario 3	LRR Scenario 2A	LRR Scenario 3A
Travel Time	sec/km	246	259	255	347	344
Delay	sec/km	159	174	169	261	259
Mean Queue	veh	63	79	77	137	135

Table 17 Subnetwork 3 Statistics PM Peak 2028

Statistic	PM Peak (1700 to 1800)					
	Units	2028 Rainham RC	LRR Scenario 5	LRR Scenario 6	LRR Scenario 5A	LRR Scenario 6A
Travel Time	sec/km	272	287	277	354	353
Delay	sec/km	186	201	192	269	267
Mean Queue	veh	73	97	95	139	140

Table 18 Subnetwork 3 Statistics PM Peak 2037

Statistic	PM Peak (1700 to 1800)					
	Units	2037 Rainham RC	LRR Scenario 2	LRR Scenario 3	LRR Scenario 2A	LRR Scenario 3A
Travel Time	sec/km	327	294	288	380	366
Delay	sec/km	241	209	202	295	280
Mean Queue	veh	72	105	97	151	145

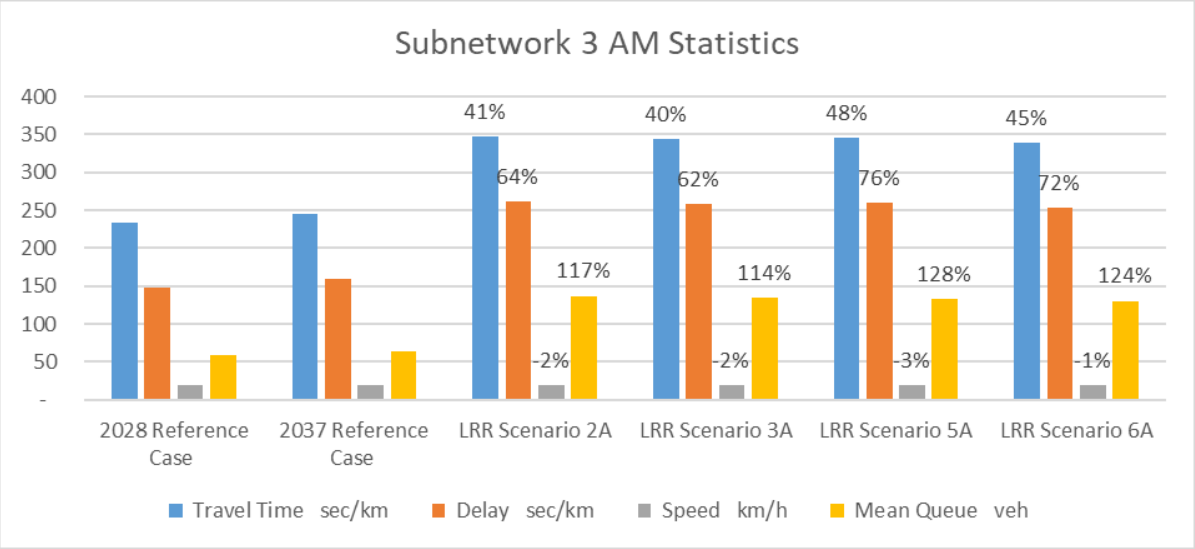


Figure 11 Subnetwork 3 AM Statistics change compared to the corresponding reference case

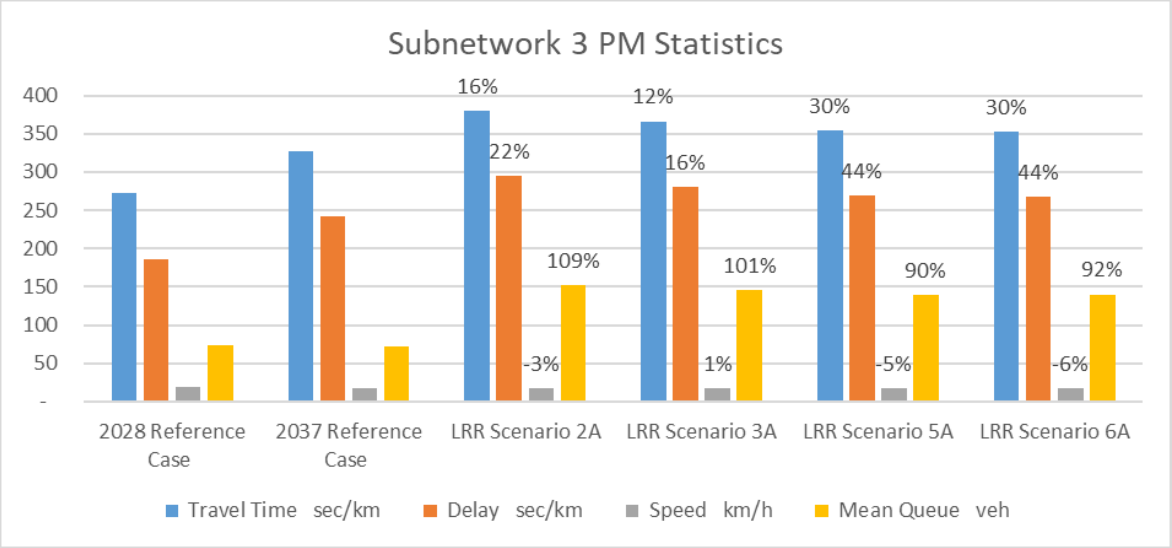


Figure 12 Subnetwork 3 AM Statistics change compared to the corresponding reference case

3.2.2 Subnetwork 3 Junctions level of service

The location of the junctions analysed for subnetwork 3 is shown in Figure 13. The level of service of the junctions is presented in Table 19, Table 20, Table 21 and Table 22 No significant difference is observed in Subnetwork 3 junctions' level of service as a result of the additional A2 mitigations.

Figure 13 Subnetwork 3 Junctions and Roundabouts

Table 19 Subnetwork 3 Junction Level of Service AM Peak 2028

Junction	ID	2028 RC AM	LRR Scenario 5	LRR Scenario 6	LRR Scenario 5A	LRR Scenario 6A
A2 (Mierscourt Road_High Street Junction)	**1**	C	E	E	E	E
Otterham Quay Lane_Meresborough	**2**	D	F	F	F	F
Sovereign Bd & Maidstone Rd	**3**	C	D	D	D	D
Sovereign Bd & Station Rd	**4**	C	D	D	D	D

Table 20 Subnetwork 3 Junction Level of Service AM Peak 2037

Junction	ID	2037 RC AM	LRR Scenario 2	LRR Scenario 3	LRR Scenario 2A	LRR Scenario 3A
A2 (Mierscourt Road_High Street Junction)	**1**	C	E	E	E	E
Otterham Quay Lane_Meresborough	**2**	D	F	F	F	F
Sovereign Bd & Maidstone Rd	**3**	C	D	D	D	D
Sovereign Bd & Station Rd	**4**	C	D	D	D	D

Table 21 Subnetwork 3 Junction Level of Service PM Peak 2028

Junction	ID	2028 RC PM	LRR Scenario 5	LRR Scenario 6	LRR Scenario 5A	LRR Scenario 6A
Mierscourt Road_High Street Junction	**1**	D	E	E	E	E
Otterham Quay Lane_Meresborough	**2**	D	F	F	F	F
Sovereign Bd & Maidstone Rd	**3**	C	D	D	D	D
Sovereign Bd & Station Rd	**4**	C	D	D	D	D

Table 22 Subnetwork 3 Junction Level of Service PM Peak 2037

Junction	ID	2037 RC PM	LRR Scenario 2	LRR Scenario 3	LRR Scenario 2A	LRR Scenario 3A
Mierscourt Road_High Street Junction	**1**	D	E	E	E	E
Otterham Quay Lane_Meresborough	**2**	D	F	F	F	F
Sovereign Bd & Maidstone Rd	**3**	C	C	C	D	D
Sovereign Bd & Station Rd	**4**	C	E	D	D	D

3.2.3 Subnetwork 3 path travel time

Finally, the subnetwork 3 path travel time results are presented in Table 23, Table 24 and Table 25, Table 26 for the AM peak and PM peak scenarios accordingly. The location of the paths is shown below.

Figure 14 Subnetwork 3 Paths

When observing the results in Table 23, Table 24, Table 25 and Table 26, an overall improvement in travel time is observed with the additional A2 mitigation (2A, 3A, 5A, 6A) compared to the scenarios without the additional A2 mitigations (2, 3, 5 and 6). This improvement is attributed to the fact that the signal timings provided by the DTA for Otterham Quay lane junction give approximately 10% more green time for the A2 signal phase than the signal timings used originally in the MAM. However, this improvement comes with a consequence. For the Otterham Quay lane junction, the delay in Meresborough Road arm is increased due to the new signal timings which give these roads 10% less green time (see for example Figure 16 and Figure 15). This increase in delay in the north-south direction of the junction ultimately keeps the LoS as F for the scenarios with the additional A2 mitigations (2A, 3A, 5A, 6A), despite the improvement along the A2. This increase in delay on the side roads of the A2 due to the new signal plan and additional A2 traffic contributes to the overall deterioration of the subnetwork 3 statistics (mean queue, travel time and delay).

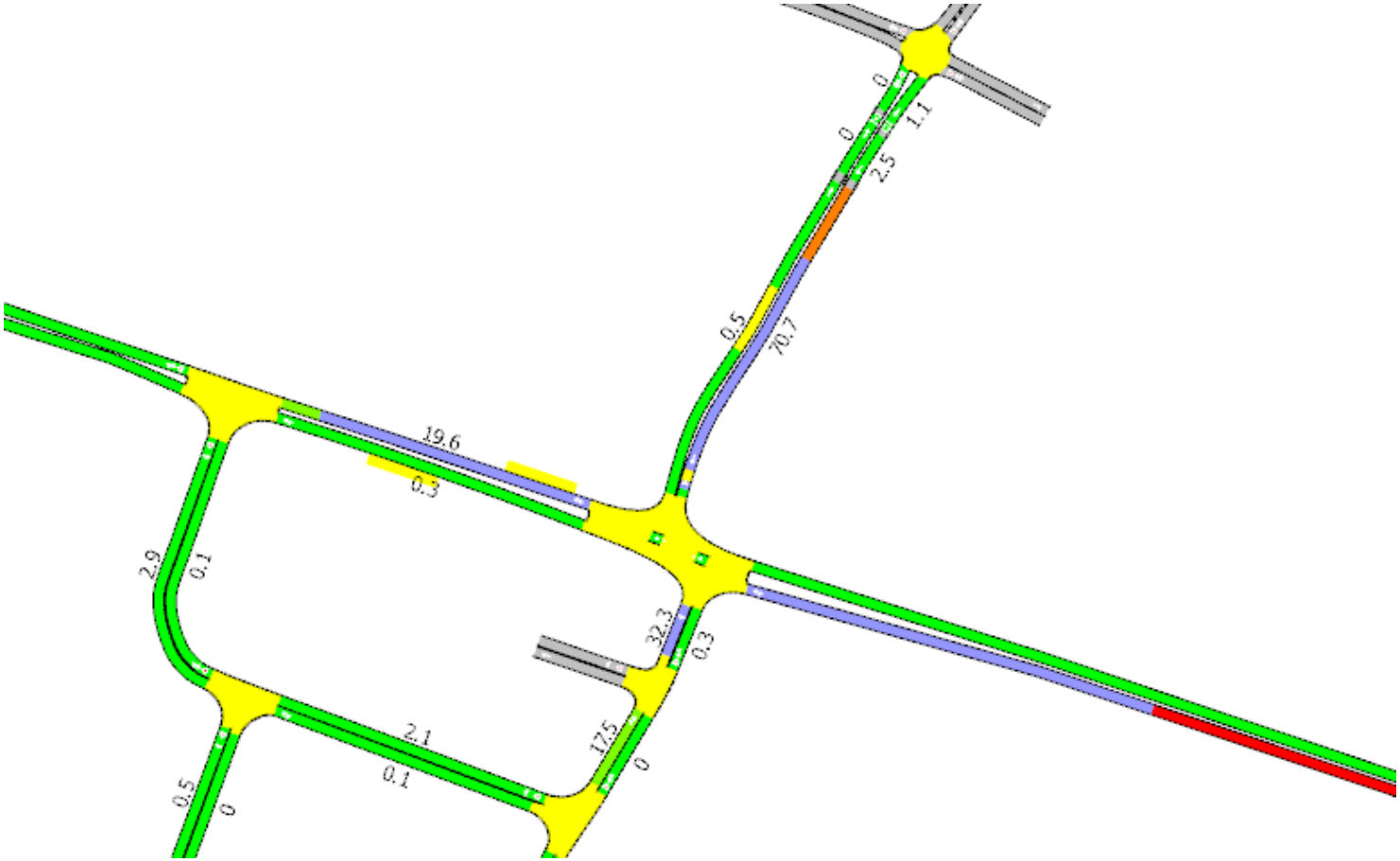


Figure 15 Delay in seconds around A2/Otterham Quay Lane junction (Scenario 6 -AM)

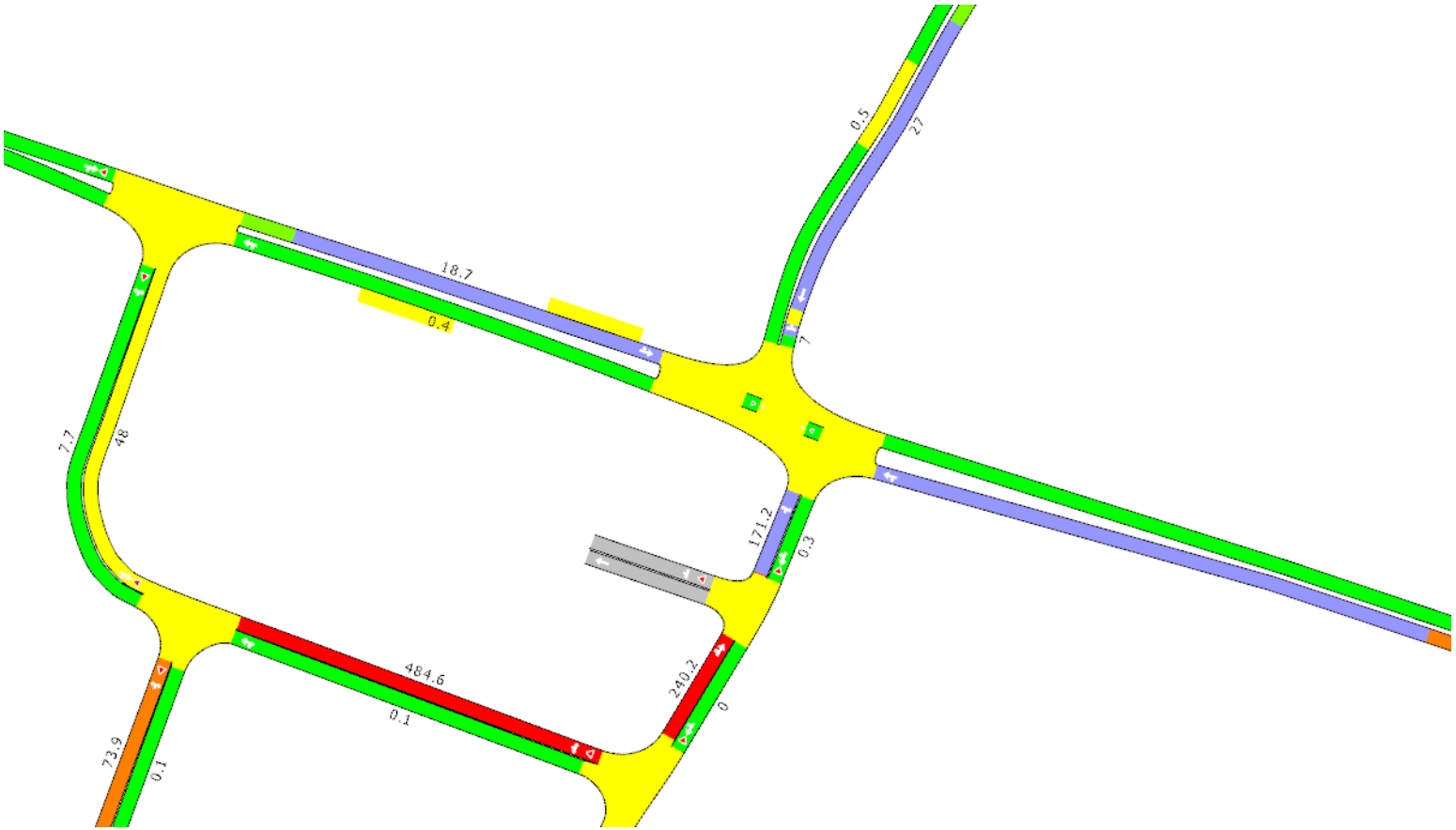


Figure 16 Delay in seconds around A2/Otterham Quay lane junction (scenario 6A - AM)

Table 23 Subnetwork 3 Path travel time AM Peak 2028

Path	2028 Reference Case AM	LRR Scenario 5 (sec)			LRR Scenario 6 (sec)			LRR Scenario5A (sec)			LRR Scenario 6A (sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
A2 (Moor Street to Sovereign Boulevard)	423	674	251	59%	619	196	46%	445	22	5%	431	8	2%
A2 (Sovereign Boulevard to Moor Street)	316	341	25	8%	336	20	6%	347	31	10%	331	15	5%

Table 24 Subnetwork 3 Path travel time AM Peak 2037

Path	2037 Reference Case AM	LRR Scenario 2 (sec)			LRR Scenario 3 (sec)			LRR Scenario 2A (sec)			LRR Scenario 3A (sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
A2 (Moor Street to Sovereign Boulevard)	449	684	235	52%	679	131	24%	521	72	16%	490	41	9%
A2 (Sovereign Boulevard to Moor Street)	326	341	15	5%	351	30	9%	339	13	4%	330	4	1%

Table 25 Subnetwork 3 Path travel time PM Peak 2028

Path	2028 Reference Case PM	LRR Scenario 5 (sec)			LRR Scenario 6 (sec)			LRR Scenario5A (sec)			LRR Scenario 6A (sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
A2 (Moor Street to Sovereign Boulevard)	395	734	339	86%	734	339	86%	428	34	9%	403	8	2%
A2 (Sovereign Boulevard to Moor Street)	342	423	81	24%	419	77	23%	414	72	21%	411	69	20%

Table 26 Subnetwork 3 Path travel time PM Peak 2037

Path	2037 Reference Case PM	LRR Scenario 2 (sec)			LRR Scenario 3 (sec)			LRR Scenario 2A (sec)			LRR Scenario 3A (sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
A2 (Moor Street to Sovereign Boulevard)	428	776	348	81%	761	278	58%	463	35	8%	459	31	7%
A2 (Sovereign Boulevard to Moor Street)	376	438	62	16%	426	31	8%	436	60	15%	422	46	12%

3.2.4 Subnetwork 3 Summary

The overall subnetwork 3 statistics showed that there is an increase in travel time, delay and mean queue between scenarios 2A, 3A, 5A, 6A and the corresponding reference case. When comparing scenarios 2A, 3A, 5A and 6A to the scenarios without the additional A2 mitigations, namely scenarios 2, 3, 5 and 6 presented in the previous Sweco reports, an increase in subnetwork travel times, queues and delays is observed.

The travel time results show the travel time for the A2 corridor alonein subnetwork 3 decreases with the additional A2 mitigation when compared to the scenarios without the additional mitigations, due to the longer green time allocated to the A2 signal phase in Otterham Quay lane junction. However, the A2 travel time still increases when compared to the reference case. Furthermore this increase in green time along the A2, increases the delay and queues in Otterham Quay Lane and Meresborough Road links. In this way, the level of service for Otterham Quay lane junction remained F, and the overall subnetwork queue, travel time and delay increases.

This result proves that it is not a prioritising vehicles on the A2 does not solve the highway capacity issues identified. It just serves to cause the capacity issues to be experienced at other locations in the subnetwork, especially side roads onto the A2. Indeed, as the overall subnetwork statistics demonstrates, the proposed solution to the capacity issues experience on the A2 actually worsens the situation when the subnetwork is considered as a whole. This underscores the importance of taking a holistic approach.

3.3 Subnetwork 7

3.3.1 Subnetwork 7 Statistics

The Subnetwork 7 statistics for 2028 and 2037 AM and PM peaks are presented in Table 27, Table 28, Table 29 and Table 30 for each modelled scenario. It is observed that there is a large increase in queuing in the AM scenarios between reference case and all the scenarios where the development is present (LRR Scenarios 5, 5A, 6 and 6A). This increase is mainly attributed to the large increase in flow on the Lower Rainham Road westbound , which is also demonstrated by the travel time results of this subnetwork below The additional queues formed along the Lower Rainham Road westbound increases the travel time for vehicles traversing this link. This is why in the AM scenarios there is a large increase in journey time on the Lower Rainham Road westbound, caused by the additional development traffic.

When comparing the results of the additional A2 mitigation scenarios (2A, 3A, 5A, 6A) with the results of the scenarios without the additional A2 mitigations (2, 3, 5, 6) presented in the two previous Lower Rainham Report Addendums produced by Sweco, a small decrease in subnetwork 7 travel time, delay and queue is observed that can be attributed to the re-routing of traffic from Lower Rainham Road to the A2.

Table 27 Subnetwork 7 Statistics AM Peak 2028

Statistic	AM Peak (0800 to 0900)					
	Units	2028 Rainham RC	LRR Scenario 5	LRR Scenario 6	LRR Scenario 5A	LRR Scenario 6A
Travel Time	sec/km	139	163	158	151	150
Delay	sec/km	59	83	78	71	70
Mean Queue	veh	54	157	136	141	125

Table 28 Subnetwork 7 Statistics AM Peak 2037

Statistic	AM Peak (0800 to 0900)					
	Units	2037 Rainham RC	LRR Scenario 2	LRR Scenario 3	LRR Scenario 2A	LRR Scenario 3A
Travel Time	sec/km	140	162	162	161	154
Delay	sec/km	61	82	82	81	74
Mean Queue	veh	57	169	143	155	129

Table 29 Subnetwork 7 Statistics PM Peak 2028

Statistic	PM Peak (1700 to 1800)					
	Units	2028 Rainham RC	LRR Scenario 5	LRR Scenario 6	LRR Scenario 5A	LRR Scenario 6A
Travel Time	sec/km	125	153	152	137	131
Delay	sec/km	44	72	71	56	50
Mean Queue	veh	28	61	59	45	37

Table 30 Subnetwork 7 Statistics PM Peak 2037

Statistic	PM Peak (1700 to 1800)					
	Units	2037 Rainham RC	LRR Scenario 2	LRR Scenario 3	LRR Scenario 2A	LRR Scenario 3A
Travel Time	sec/km	123	154	154	139	133
Delay	sec/km	42	73	74	58	52
Mean Queue	veh	28	63	62	47	40

Figure 17 Subnetwork 7 Statistics AM

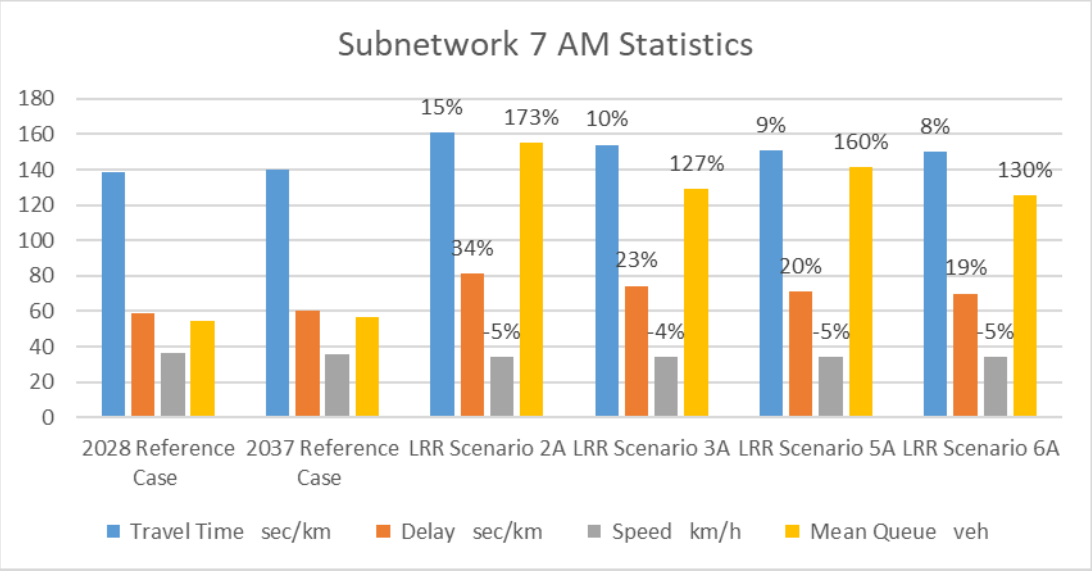
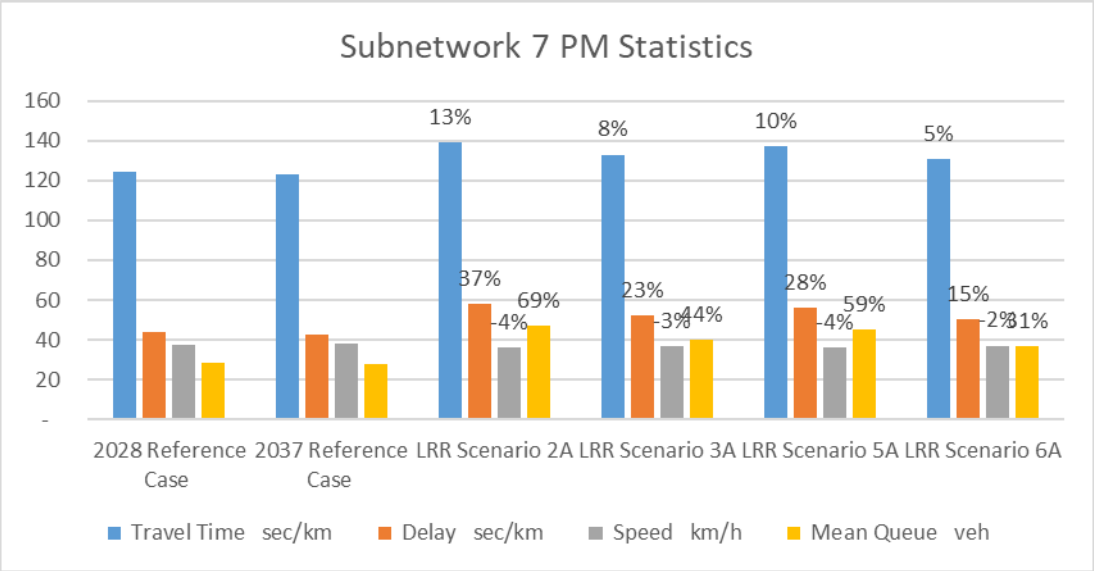


Figure 18 Subnetwork 7 Statistics PM



3.3.2 Subnetwork 7 Junctions Level of service

Table 31, Table 32, Table 33 and Table 34 present the Level of Service results for key junctions in Subnetwork 7 for 2028 and 2037 AM and PM peaks. The location of each junction and roundabout is shown in Figure 19.

Figure 19 Subnetwork 7 Junctions and Roundabouts

The level of service results are consistent across the reference case and development scenarios. This can be attributed to the fact that subnetwork 7 is less congested overall compared to the other two subnetworks (2 and 3) presented above. There is no substantial difference between the 2028 results and the 2037 results. There is also no difference between the scenarios with and without the mitigations.

Table 31 Subnetwork 7 Junction Level of Service AM Peak 2028

Junction	ID	Ref 2028 AM	LRR Scenario 5	LRR Scenario 6	LRR Scenario 5A	LRR Scenario 6A
B2004 Lower Rainham Road / Pump Lane	**1**	A	A	A	A	A
Beechings Way / Pump Lane (North)	**2**	A	A	A	A	A
Beechings Way / Pump Lane (South)	**3**	A	A	A	A	A
B2004 Lower Rainham Road / Berengrave Lane	**4**	C	C	C	C	C
B2004 Lower Rainham Road / B2004 Station Road	**5**	A	A	A	A	A
Lower Rainham Road / Otterham Quay Lane	**6**	A	A	A	A	A

Table 32 Subnetwork 7 Junction Level of Service AM Peak 2037

Junction	ID	Ref 2037 AM	LRR Scenario 2	LRR Scenario 3	LRR Scenario 2A	LRR Scenario 3A
B2004 Lower Rainham Road / Pump Lane	**1**	A	B	A	A	A
Beechings Way / Pump Lane (North)	**2**	A	A	A	A	A
Beechings Way / Pump Lane (South)	**3**	A	A	A	A	A
B2004 Lower Rainham Road / Berengrave Lane	**4**	C	D	C	C	C
B2004 Lower Rainham Road / B2004 Station Road	**5**	A	A	A	A	A
Lower Rainham Road / Otterham Quay Lane	**6**	A	A	A	A	A

Table 33 Subnetwork 7 Junction Level of Service PM Peak 2028

Junction	ID	Ref 2028 PM	LRR Scenario 5	LRR Scenario 6	LRR Scenario 5A	LRR Scenario 6A
B2004 Lower Rainham Road / Pump Lane	**1**	A	A	A	A	A
Beechings Way / Pump Lane (North)	**2**	A	A	A	A	A
Beechings Way / Pump Lane (South)	**3**	A	A	A	A	A
B2004 Lower Rainham Road / Berengrave Lane	**4**	C	C	C	C	C
B2004 Lower Rainham Road / B2004 Station Road	**5**	A	A	A	A	A
Lower Rainham Road / Otterham Quay Lane	**6**	A	A	A	A	A

Table 34 Subnetwork 7 Junction Level of Service PM Peak 2037

Junction	ID	Ref 2037 PM	LRR Scenario 2	LRR Scenario 3	LRR Scenario 2A	LRR Scenario 3A
B2004 Lower Rainham Road / Pump Lane	**1**	A	A	A	A	A
Beechings Way / Pump Lane (North)	**2**	A	A	A	A	A
Beechings Way / Pump Lane (South)	**3**	A	A	A	A	A
B2004 Lower Rainham Road / Berengrave Lane	**4**	C	C	C	C	C
B2004 Lower Rainham Road / B2004 Station Road	**5**	A	A	A	A	A
Lower Rainham Road / Otterham Quay Lane	**6**	A	A	A	A	A

3.3.3 Subnetwork 7 Path travel time

Finally, Figure 20 shows the location of paths analysed in subnetwork 7, while Table 35, Table 36, Table 37 and Table 38 present the travel time results for 2028 and 2037 AM and PM peak scenarios. As discussed above, the most important point to be noted from these tables is the increase in the travel time for Lower Rainham Road Westbound, where the travel time increases

by 112% to 154% between the Reference case and the development scenarios with the mitigations. This increase equates to approximately 10 minutes of additional travel time on Lower Rainham Road Westbound. This issue had been highlighted in all Sweco reports (October 2020, December 2020 and January 2021). The additional A2 mitigations has not remedied this problem caused by the Pump Lane development. This result should be considered with the Junction Level of Service results presented in Subnetwork 2 for A289 (Yokosuka Way Roundabout – junction 7) which has a level of service F for all AM scenarios, including Reference case (see Table 7 and Table 8). It is clear that this roundabout, despite all the additional A2 mitigation schemes applied in the new scenarios, is already too congested and cannot accommodate the demand from the development.

Figure 20 Subnetwork 7 Paths

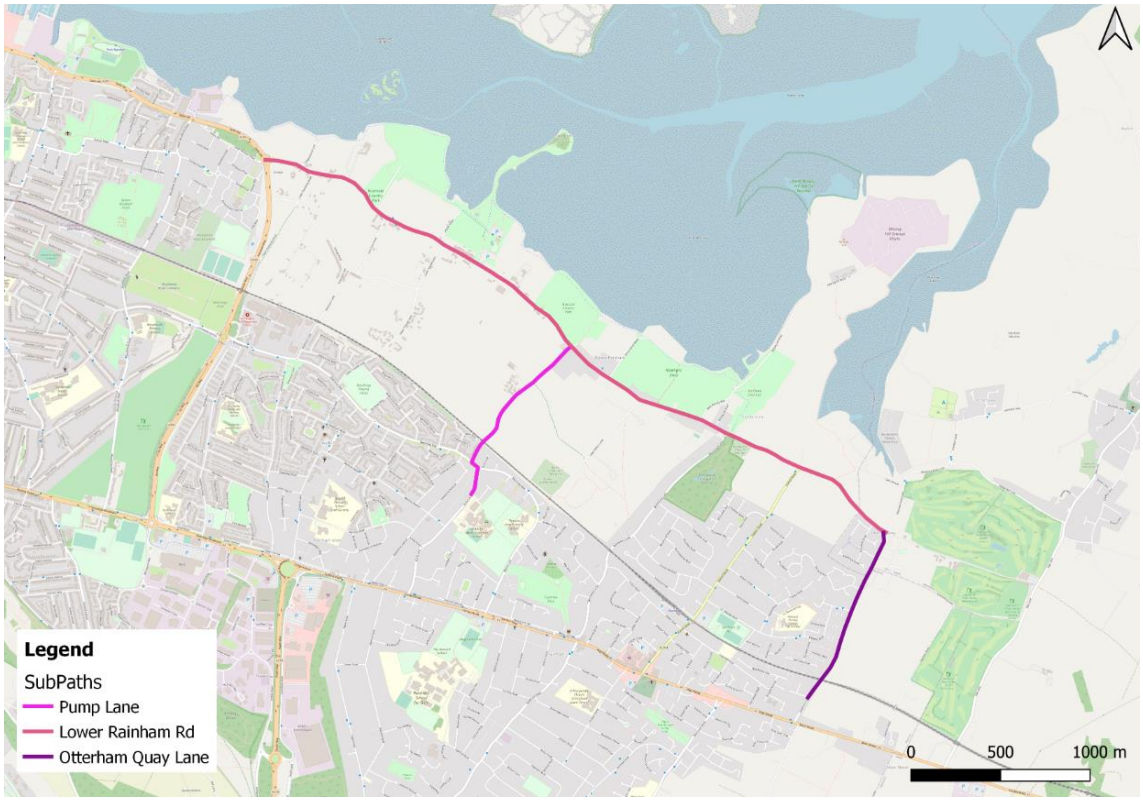


Table 35 Subnetwork 7 Path travel time AM Peak 2028

Path	2028 Reference Case AM	LRR Scenario 5 (sec)			LRR Scenario 6 (sec)			LRR Scenario5A (sec)			LRR Scenario 6A (sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff

Pump Lane NB	80	113	33	41%	102	22	27%	126	46	58%	111	31	38%
Pump Lane SB	86	95	9	10%	95	9	10%	109	23	26%	108	21	25%
B2004 (Lower Rainham Road) WB	429	1,098	669	156%	992	563	131%	1,090	661	154%	976	546	127%
B2004 (Lower Rainham Road) EB	450	459	9	2%	452	2	0%	461	11	2%	453	2	0%
Otterham Quay Lane NB	99	100	1	1%	100	1	1%	100	1	1%	99	-	0%
Otterham Quay Lane SB	98	98	-	0%	98	-	0%	102	4	4%	99	1	1%

Table 36 Subnetwork 7 Path travel time AM Peak 2037

Path	2037 Reference Case AM	LRR Scenario 2 (sec)			LRR Scenario 3 (sec)			LRR Scenario 2A (sec)			LRR Scenario 3A (sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
Pump Lane NB	90	131	41	46%	113	23	26%	119	29	32%	118	28	31%
Pump Lane SB	87	96	9	10%	95	8	9%	108	21	25%	106	19	22%
B2004 (Lower Rainham Road) WB	462	1,167	705	153%	1,014	552	119%	1,117	655	142%	978	516	112%
B2004 (Lower Rainham Road) EB	477	478	1	0%	462	-15	-3%	485	8	2%	480	3	1%
Otterham Quay Lane NB	99	101	2	2%	101	2	2%	102	3	3%	100	1	1%
Otterham Quay Lane SB	99	98	-1	-1%	98	-1	-1%	109	-	0%	101	-	0%

Table 37 Subnetwork 7 Path travel time PM Peak 2028

Path	2028 Reference Case PM	LRR Scenario 5 (sec)			LRR Scenario 6 (sec)			LRR Scenario5A (sec)			LRR Scenario 6A (sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
Pump Lane NB	78	102	24	31%	102	24	31%	115	38	48%	110	33	42%
Pump Lane SB	72	93	21	29%	91	19	26%	109	37	51%	105	33	45%

B2004 (Lower Rainham Road) WB	401	451	50	12%	454	53	13%	450	49	12%	449	48	12%
B2004 (Lower Rainham Road) EB	423	432	9	2%	429	6	1%	437	14	3%	432	9	2%
Otterham Quay Lane NB	98	99	1	1%	99	1	1%	98	0	0%	98	-	0%
Otterham Quay Lane SB	98	98	-	0%	99	1	1%	99	1	1%	98	-	0%

Table 38 Subnetwork 7 Path travel time PM Peak 2037

Path	2037 Reference Case PM	LRR Scenario 2 (sec)			LRR Scenario 3 (sec)			LRR Scenario 2A (sec)			LRR Scenario 3A (sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
Pump Lane NB	84	104	20	24%	100	16	19%	115	31	37%	111	27	32%
Pump Lane SB	79	94	15	19%	95	16	20%	112	33	42%	108	29	37%
B2004 (Lower Rainham Road) WB	437	456	19	4%	450	13	3%	455	18	4%	451	55	13%
B2004 (Lower Rainham Road) EB	460	433	-27	-6%	430	-30	-7%	486	26	6%	481	21	5%
Otterham Quay Lane NB	99	100	1	1%	100	1	1%	99	0	0%	99	0	0%
Otterham Quay Lane SB	98	99	1	1%	98	-	0%	106	8	8%	100	2	2%

3.3.4 Subnetwork 7 Summary

The subnetwork 7 statistics results showed that despite the additional mitigations on the A2 there is still a large increase in queue, as well as increases in travel time and delay in this subnetwork compared to the reference case, which is mainly observed on Lower Rainham Road westbound close to Yokosuka way roundabout.

The junctions analysed in subnetwork 7 do not show any problematic junctions. However, the travel time results indicated that Lower Rainham Road westbound direction shows a large increase in travel time (approximately 10-11 minutes) between the reference case and the development scenarios in the AM peak. These results should be combined with the A289/Yokosuka Way roundabout results presented in Subnetwork 2 where, despite all the mitigation, the level of service indicates that the demand at this roundabout exceeds capacity

even in the reference case. This problem has been underlined in all Sweco (October 2020, December 2020 and January 2021) reports.

4 Summary

This report presented the results of a new set of scenarios which included additional mitigations proposed by the appellants in the CD24 “A2 Junction Operation Review”. These mitigations consisted of the following changes to the road network:

- The introduction of a refuge island in the A2, east of Bowaters roundabout which allowed the pedestrians to cross the A2 in two stages. Additionally, in this scheme the number of lanes was doubled and tapered down to the west of the crossing.
- The signal timings in Bowaters roundabout in the Medway Aimsun model were updated to match the Linsig signal timings provided by DTA acting on behalf of the appellant. A different signal control plan was provided for each future year scenario (LRR Scenario2 and Scenario 3 for 2037 and LRR Scenario 5 and Scenario 6 for 2028). The signal timings were coded in Aimsun for each node of the roundabout for all the scenarios.
- Change of the lane markings on the eastern approach of Will Adams roundabout and the introduction of an additional lane in the southern section of the roundabout to match the northern section; both three lanes circulating (see Figure 3). More specifically, the lane markings were changed (nearside to offside) from left and ahead; ahead only; ahead and right, to left and ahead; ahead only and right only.
- The signal timings provided by DTA for Otterham Quay lane were used for the modelling work outlined in this report for consistency purposes. The signal timings were extracted from the Linsig models provided by DTA for the development and reference case scenarios.

The results of the new modelling scenarios which included the proposed mitigations did not show any significant improvement for the key problematic junctions and journey times routes. More specifically:

- The junctions that were shown to be highly congested in the two previous Sweco reports (December 2020 and January 2021 reports) remained highly congested in this report as well. In addition, in this report a new issue arose at the A2 (Rotary Gardens / Woodlands Road / Sovereign Boulevard) junction in the PM scenarios. The shorter green time at Bowaters Roundabout provided with the new signal plan at that roundabout caused longer queues along the A2 which in the mitigations scenarios reach the Rotary Gardens junction, causing significant delays.
- The paths that showed high increases in travel times with Pump Lane development in the two previous Sweco reports (December 2020 and January 2021 reports) remained problematic in the scenarios with the additional A2 mitigations.
    - More specifically, in Subnetwork 2, in both assessment years there was an increase in travel times on the westbound routes along the A2 (A278 (Hoath Way) to A289 (Church Street) and A2 (Sovereign Boulevard to Watling Road). After looking at the simulation video and examining the delay plots for the scenarios with the additional A2 mitigations it was concluded that the new proposed lane markings on Will Adams roundabout are not improving traffic conditions. This is because the new lane markings reduce capacity for vehicles going straight ahead on the A2 westbound at Will Adams roundabout causing

large queues in the middle lane which cannot enter the short near side lane on the eastern arm of the roundabout. Finally, in the PM scenarios the new signal plans provided less green time on the eastbound section of the Bowaters signalised roundabout area, which led to longer eastbound queues along the A2, ultimately increasing travel times along the corridor

- In Subnetwork 3, due to the additional A2 mitigations there was a decrease in travel times along the A2 with the new signal plan at the Otterham Quay lane/A2 junction, as it was prioritising A2 movements. However, this resulted in increased delays and queues on Otterham Quay Lane and Meresborough Road. It also resulted in increased in the overall subnetwork queue, travel time and delay statistic. This observation underlined that it is not appropriate to prioritise a single specific movement at a particular junction, as the subnetwork is highly congested overall and therefore a more holistic approach is needed.
- In Subnetwork 7, a large increase in travel time was observed on Lower Rainham Road westbound which is due to the additional Pump Lane development demand

In summary, the MAM modelling has shown that the proposed additional A2 mitigations would not result in an overall improvement in traffic operations on the road network impacted by the development.

- The new lane markings at Will Adams Roundabout decreased the capacity for the westbound movement at this roundabout, causing longer queues on the eastern approach.
- The new signal plan at Bowaters Roundabout gave less green time to the eastbound traffic stream, increasing queues and delays along the A2 between Bowaters and Will Adams roundabouts which blocked back to the A2/Rotary Gardens / Woodlands Road / Sovereign Boulevard junction increasing its level of service to F.
- The new signal plan for Otterham Quay lane, prioritised the A2 westbound and eastbound traffic streams, reducing travel times along the A2. However, this caused increased delays for the northbound and southbound traffic streams. Overall, the level of service of this junction remained F. The net impact of prioritising the A2 worsened the subnetwork 3 mean queue, travel time and delay as a whole.
- The new configuration at the toucan crossing east of Bowaters roundabout did not show any significant improvement either at Bowaters Roundabout or for the A2 in general.

Appendix A – Detailed Subnetwork Statistics

Subnetwork 2

Statistic	Units	AM Peak (0800 to 0900)				
		2028 Rainham RC	LRR Scenario 5	LRR Scenario 6	LRR Scenario 5A	LRR Scenario 6A
Travel Time	sec/km	193	246	246	240	238
Delay	sec/km	119	173	173	168	165
Flow	veh/h	11,316	11,361	11,344	11,384	11,376
Speed	km/h	28	27	26	26	26
Stop Time	sec/km	106	160	159	153	150
Mean Queue	veh	489	861	854	853	846
Mean Virtual Queue	veh	144	580	505	503	452
Waiting Time in Virtual Queue	sec	45	180	156	156	139
Total Statistics						
Total Travelled Time	h	2,206	2,943	2,938	2,967	2,969
Total Travelled Distance	km	52,485	52,915	52,897	53,159	53,271
Average travel time per vehicle	s/veh	351	466	466	469	470
Total Waiting Time in Virtual Queue	h	2	567	492	492	441
Total travel time including virtual queue	h	2,207	3,510	3,430	3,458	3,410
Total Queue	veh	633	1,441	1,359	1,356	1,297
Throughput						
Vehicles Out	veh	22,633	22,722	22,688	22,769	22,751
Vehicles In	veh	6	6	6	6	6
Vehicles Waiting to Enter	veh	-	-	-	-	-
Total	veh	22,639	22,727	22,694	22,775	22,757
Vehicles In and Waiting to Enter	veh	6	6	6	6	6

Statistic	PM Peak (1700 to 1800)					
	Units	2028 Rainham RC	LRR Scenario 5	LRR Scenario 6	LRR Scenario 5A	LRR Scenario 6A
Travel Time	sec/km	165	206	206	226	211
Delay	sec/km	93	134	133	154	139
Flow	veh/h	10,877	11,336	11,260	11,268	11,236
Speed	km/h	31	28	28	27	27
Stop Time	sec/km	81	120	119	139	125
Mean Queue	veh	284	557	563	728	608
Mean Virtual Queue	veh	169	290	290	295	325
Waiting Time in Virtual Queue	sec	56	91	91	93	102
Total Statistics						
Total Travelled Time	h	1,693	2,377	2,367	2,713	2,478
Total Travelled Distance	km	50,297	53,343	52,722	52,853	52,876
Average travel time per vehicle	s/veh	280	377	378	433	397
Total Waiting Time in Virtual Queue	h	3	7	7	8	9
Total travel time including virtual queue	h	1,696	2,384	2,375	2,721	2,487
Total Queue	veh	453	848	853	1,024	933
Throughput						
Vehicles Out	veh	21,753	22,672	22,519	22,537	22,472
Vehicles In	veh	6	6	6	6	6
Vehicles Waiting to Enter	veh	-	-	-	-	-
Total	veh	21,759	22,678	22,525	22,543	22,478
Vehicles In and Waiting to Enter	veh	6	6	6	6	6

Statistic	AM Peak (0800 to 0900)					
	Units	2037 Rainham RC	LRR Scenario 2	LRR Scenario 3	LRR Scenario 2A	LRR Scenario 3A
Travel Time	sec/km	193	253	253	251	249
Delay	sec/km	120	181	181	178	176
Flow	veh/h	11,266	11,391	11,359	11,421	11,387
Speed	km/h	28	27	26	26	26
Stop Time	sec/km	107	161	167	164	161
Mean Queue	veh	503	929	905	923	922
Mean Virtual Queue	veh	146	578	577	542	529
Waiting Time in Virtual Queue	sec	46	178	178	167	164
Total Statistics						
Total Travelled Time	h	2,236	3,013	3,039	3,132	3,105
Total Travelled Distance	km	52,434	53,544	53,336	53,960	53,325
Average travel time per vehicle	s/veh	357	476	482	494	491
Total Waiting Time in Virtual Queue	h	143	564	562	530	518
Total travel time including virtual queue	h	2,379	3,577	3,601	3,663	3,623
Total Queue	veh	648	1,467	1,482	1,465	1,452
Throughput						
Vehicles Out	veh	22,531	22,783	22,719	22,841	22,774
Vehicles In	veh	6	6	6	6	6
Vehicles Waiting to Enter	veh	-	-	-	-	-
Total	veh	22,538	22,789	22,725	22,847	22,780
Vehicles In and Waiting to Enter	veh	6	6	6	6	6

Statistic	PM Peak (1700 to 1800)					
	Units	2037 Rainham RC	LRR Scenario 2	LRR Scenario 3	LRR Scenario 2A	LRR Scenario 3A
Travel Time	sec/km	171	206	204	269	265
Delay	sec/km	98	133	132	198	192
Flow	veh/h	11,124	11,557	11,349	11,354	11,210
Speed	km/h	30	28	28	26	26
Stop Time	sec/km	87	116	118	179	178

Mean Queue	veh	325	563	556	1,120	1,101
Mean Virtual Queue	veh	180	300	271	433	432
Waiting Time in Virtual Queue	sec	58	92	85	129	129
Total Statistics						
Total Travelled Time	h	1,817	2,354	2,371	3,323	3,324
Total Travelled Distance	km	51,350	54,242	53,371	52,483	51,602
Average travel time per vehicle	s/veh	294	367	376	541	534
Total Waiting Time in Virtual Queue	h	3	8	6	15	15
Total travel time including virtual queue	h	1,820	2,362	2,378	3,341	3,343
Total Queue	veh	505	835	826	1,556	1,532
Throughput						
Vehicles Out	veh	22,247	23,115	22,697	22,707	22,420
Vehicles In	veh	6	6	6	35	72
Vehicles Waiting to Enter	veh	-	-	-	3	3
Total	veh	22,253	23,121	22,703	22,745	22,494
Vehicles In and Waiting to Enter	veh	6	6	6	38	75

Subnetwork 3

Statistic	Units	AM Peak (0800 to 0900)				
		2028 Rainham RC	LRR Scenario 5	LRR Scenario 6	LRR Scenario 5A	LRR Scenario 6A
Travel Time	sec/km	233	252	245	345	339
Delay	sec/km	147	166	160	259	253
Flow	veh/h	2,467	2,486	2,493	2,443	2,439
Speed	km/h	19	20	20	19	19
Stop Time	sec/km	133	150	144	243	237
Mean Queue	veh	58	75	70	133	130
Mean Virtual Queue	veh	4	39	35	39	55
Waiting Time in Virtual Queue	sec	6	57	51	31	43
Total Statistics						
Total Travelled Time	h	226	266	254	340	329
Total Travelled Distance	km	3,602	3,764	3,740	3,666	3,654
Average travel time per vehicle	s/veh	165	192	184	250	243

Total Waiting Time in Virtual Queue	h	0	1	1	0	1
Total travel time including virtual queue	h	226	266	255	340	333
Total Queue	veh	62	114	105	172	186
Throughput						
Vehicles Out	veh	4,934	4,973	4,987	4,886	4,879
Vehicles In	veh	2	1	2	59	70
Vehicles Waiting to Enter	veh	-	-	-	0	6
Total	veh	4,936	4,974	4,988	4,946	4,954
Vehicles In and Waiting to Enter	veh	2	1	2	59	76

Statistic	**PM Peak (1700 to 1800)**					
	Units	2028 Rainham RC	**LRR Scenario 5**	**LRR Scenario 6**	**LRR Scenario 5A**	**LRR Scenario 6A**
Travel Time	sec/km	272	287	277	354	353
Delay	sec/km	186	201	192	269	267
Flow	veh/h	2,488	2,578	2,579	2,517	2,556
Speed	km/h	19	18	18	18	17
Stop Time	sec/km	171	184	175	252	250
Mean Queue	veh	73	97	95	139	140
Mean Virtual Queue	veh	4	51	57	108	95
Waiting Time in Virtual Queue	sec	6	71	80	66	68
Total Statistics						
Total Travelled Time	h	245	321	319	382	391
Total Travelled Distance	km	3,802	4,076	4,103	3,952	4,027
Average travel time per vehicle	s/veh	177	224	223	273	276
Total Waiting Time in Virtual Queue	h	0	1	1	2	2
Total travel time including virtual queue	h	245	322	321	405	405
Total Queue	veh	72	147	152	247	235
Throughput						
Vehicles Out	veh	4,973	5,156	5,157	5,035	5,113
Vehicles In	veh	2	2	2	75	76
Vehicles Waiting to Enter	veh	-	-	-	50	24
Total	veh	4,975	5,158	5,159	5,160	5,212

Vehicles In and Waiting to Enter	veh	2	2	2	125	100

Statistic	AM Peak (0800 to 0900)					
	Units	2037 Rainham RC	LRR Scenario 2	LRR Scenario 3	LRR Scenario 2A	LRR Scenario 3A
Travel Time	sec/km	246	259	255	347	344
Delay	sec/km	159	174	169	261	259
Flow	veh/h	2,465	2,533	2,523	2,476	2,461
Speed	km/h	19	19	19	19	19
Stop Time	sec/km	145	158	153	245	243
Mean Queue	veh	63	79	77	137	135
Mean Virtual Queue	veh	4	44	40	58	67
Waiting Time in Virtual Queue	sec	7	63	57	51	48
Total Statistics						
Total Travelled Time	h	236	276	271	347	340
Total Travelled Distance	km	3,594	3,842	3,802	3,740	3,696
Average travel time per vehicle	s/veh	173	196	193	252	249
Total Waiting Time in Virtual Queue	h	0	1	1	1	1
Total travel time including virtual queue	h	236	277	271	350	347
Total Queue	veh	68	123	117	195	202
Throughput						
Vehicles Out	veh	4,930	5,066	5,047	4,951	4,923
Vehicles In	veh	1	1	2	67	75
Vehicles Waiting to Enter	veh	-	-	-	4	12
Total	veh	4,931	5,067	5,048	5,022	5,009
Vehicles In and Waiting to Enter	veh	1	1	2	71	87

Statistic	PM Peak (1700 to 1800)					
	Units	2037 Rainham RC	LRR Scenario 2	LRR Scenario 3	LRR Scenario 2A	LRR Scenario 3A
Travel Time	sec/km	327	294	288	380	366
Delay	sec/km	241	209	202	295	280
Flow	veh/h	2,535	2,645	2,615	2,571	2,543

Speed	km/h	17	18	18	17	17
Stop Time	sec/km	224	191	185	277	263
Mean Queue	veh	72	105	97	151	145
Mean Virtual Queue	veh	12	80	62	154	148
Waiting Time in Virtual Queue	sec	16	109	85	86	76
Total Statistics						
Total Travelled Time	h	328	341	322	414	396
Total Travelled Distance	km	3,900	4,193	4,094	4,044	3,958
Average travel time per vehicle	s/veh	233	232	221	290	280
Total Waiting Time in Virtual Queue	h	0	2	1	4	3
Total travel time including virtual queue	h	328	344	323	455	434
Total Queue	veh	121	184	159	306	293
Throughput						
Vehicles Out	veh	5,070	5,291	5,229	5,142	5,086
Vehicles In	veh	2	2	2	78	77
Vehicles Waiting to Enter	veh	-	-	-	93	95
Total	veh	5,072	5,292	5,231	5,313	5,258
Vehicles In and Waiting to Enter	veh	2	2	2	171	172

Subnetwork 7

Statistic		AM Peak (0800 to 0900)				
	Units	2028 Rainham RC	LRR Scenario 5	LRR Scenario 6	LRR Scenario 5A	LRR Scenario 6A
Travel Time	sec/km	139	163	158	151	150
Delay	sec/km	59	83	78	71	70
Flow	veh/h	5,898	6,168	6,076	6,144	6,065
Speed	km/h	36	34	34	34	34
Stop Time	sec/km	50	71	67	60	59
Mean Queue	veh	54	157	136	141	125
Mean Virtual Queue	veh	5	48	21	88	76
Waiting Time in Virtual Queue	sec	3	27	12	42	33
Total Statistics						
Total Travelled Time	h	437	700	643	663	619

Total Travelled Distance	km	12,956	14,160	13,770	14,063	13,738
Average travel time per vehicle	s/veh	133	204	190	194	184
Total Waiting Time in Virtual Queue	h	0	0	0	1	1
Total travel time including virtual queue	h	437	700	643	683	644
Total Queue	veh	60	205	157	230	202
Throughput						
Vehicles Out	veh	11,796	12,336	12,152	12,288	12,130
Vehicles In	veh	2	2	2	7	7
Vehicles Waiting to Enter	veh	-	-	-	23	33
Total	veh	11,798	12,338	12,154	12,318	12,170
Vehicles In and Waiting to Enter	veh	2	2	2	30	40

Statistic	**PM Peak (1700 to 1800)**					
	Units	2028 Rainham RC	**LRR Scenario 5**	**LRR Scenario 6**	**LRR Scenario 5A**	**LRR Scenario 6A**
Travel Time	sec/km	125	153	152	137	131
Delay	sec/km	44	72	71	56	50
Flow	veh/h	5,438	5,935	5,800	5,934	5,796
Speed	km/h	38	36	36	36	37
Stop Time	sec/km	36	62	61	47	42
Mean Queue	veh	28	61	59	45	37
Mean Virtual Queue	veh	2	46	50	33	41
Waiting Time in Virtual Queue	sec	1	28	31	20	24
Total Statistics						
Total Travelled Time	h	352	453	443	418	388
Total Travelled Distance	km	11,886	12,996	12,708	12,974	12,581
Average travel time per vehicle	s/veh	116	137	138	127	121
Total Waiting Time in Virtual Queue	h	0	0	0	0	0
Total travel time including virtual queue	h	352	453	444	419	391
Total Queue	veh	30	106	110	78	78
Throughput						
Vehicles Out	veh	10,876	11,870	11,600	11,868	11,592
Vehicles In	veh	2	2	2	2	3

Vehicles Waiting to Enter	veh	-	-	-	0	3
Total	veh	10,878	11,872	11,602	11,871	11,597
Vehicles In and Waiting to Enter	veh	2	2	2	3	6

Statistic	AM Peak (0800 to 0900)					
	Units	2037 Rainham RC	LRR Scenario 2	LRR Scenario 3	LRR Scenario 2A	LRR Scenario 3A
Travel Time	sec/km	140	162	162	161	154
Delay	sec/km	61	82	82	81	74
Flow	veh/h	5,853	6,200	6,106	6,214	6,086
Speed	km/h	36	34	34	34	34
Stop Time	sec/km	51	71	71	69	63
Mean Queue	veh	57	169	143	155	129
Mean Virtual Queue	veh	4	57	37	115	82
Waiting Time in Virtual Queue	sec	2	32	22	54	34
Total Statistics						
Total Travelled Time	h	445	733	662	698	629
Total Travelled Distance	km	13,043	14,443	13,913	14,268	13,799
Average travel time per vehicle	s/veh	137	213	195	202	186
Total Waiting Time in Virtual Queue	h	0	-	-	2	1
Total travel time including virtual queue	h	445	734	662	725	656
Total Queue	veh	61	226	179	270	211
Throughput						
Vehicles Out	veh	11,705	12,400	12,211	12,428	12,172
Vehicles In	veh	2	2	2	7	7
Vehicles Waiting to Enter	veh	-	-	-	31	38
Total	veh	11,707	12,402	12,213	12,466	12,216
Vehicles In and Waiting to Enter	veh	2	2	2	38	45

Statistic	PM Peak (1700 to 1800)					
	Units	2037 Rainham RC	LRR Scenario 2	LRR Scenario 3	LRR Scenario 2A	LRR Scenario 3A
Travel Time	sec/km	123	154	154	139	133
Delay	sec/km	42	73	74	58	52

Flow	veh/h	5,542	6,016	5,937	6,006	5,917
Speed	km/h	38	36	36	36	37
Stop Time	sec/km	35	63	64	49	44
Mean Queue	veh	28	63	62	47	40
Mean Virtual Queue	veh	2	50	47	47	47
Waiting Time in Virtual Queue	sec	1	30	29	25	25
Total Statistics						
Total Travelled Time	h	358	461	451	423	402
Total Travelled Distance	km	12,201	13,155	12,847	13,055	12,839
Average travel time per vehicle	s/veh	116	138	137	127	122
Total Waiting Time in Virtual Queue	h	0	-	-	0	0
Total travel time including virtual queue	h	358	462	451	428	408
Total Queue	veh	30	113	109	93	87
Throughput						
Vehicles Out	veh	11,084	12,032	11,874	12,011	11,833
Vehicles In	veh	2	2	2	6	6
Vehicles Waiting to Enter	veh	-	-	-	5	6
Total	veh	11,086	12,033	11,876	12,022	11,846
Vehicles In and Waiting to Enter	veh	2	2	2	11	12

Appendix B – Macro model Flow Plots

The macro model flow plots are included in the PDF attachments in the “Flow_plots.zip” folder.

Appendix C – Macro model Select link analysis plots

The select link analysis plots for the centroid containing the demand of the development are included in the PDF files of the “SLA_plots.zip” folder.

Appendix D – Macro model section V/C plots

The section V/C plots are included in the PDF files of the “VC_sections.zip” folder.

Appendix E – Macro model turn V/C plots

The turn V/C plots are included in the PDF files of the “VC_turns.zip” folder.

Appendix F – Micro model section delay plots

The turn V/C plots are included in the PDF files of the “Simulated Delays.zip” folder.

Appendix G – Path travel times in seconds and minute

Subnetwork 2 2028 AM

Path	2028 Reference Case AM	LRR Scenario 5 (min:sec)			LRR Scenario 6 (min:sec)			LRR Scenario 5A (min:sec)			LRR Scenario 6A (min:sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
A289 (Church Street) to A278 (Hoath Way)	13:20	23:20	10:00	75%	22:10	08:50	66%	19:01	05:41	43%	16:59	03:39	27%
A278 (Hoath Way) to A289 (Church Street)	10:04	10:39	00:35	6%	10:15	00:11	2%	14:39	04:35	46%	13:52	03:48	38%
A2 (Sovereign Boulevard to Watling Road)	06:40	07:07	00:27	7%	07:05	00:25	6%	12:25	05:45	86%	12:01	05:21	80%
A2 (Watling to Sovereign Boulevard)	11:12	24:16	13:04	117%	23:53	12:41	113%	23:02	11:50	106%	21:13	10:01	89%
A289 (Church Street to Lower Rainham)	02:20	02:21	00:01	1%	02:19	00:00	-1%	02:22	00:02	1%	02:20	00:00	0%
A289 (Lower Rainham to Church Street)	02:01	02:04	00:03	2%	02:03	00:02	2%	02:03	00:02	2%	02:01	00:00	0%

Subnetwork 2 2037 AM

Path	2037 Reference Case AM	LRR Scenario 2 (min:sec)			LRR Scenario 3 (min:sec)			LRR Scenario 2A (min:sec)			LRR Scenario 3A (min:sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
A289 (Church Street) to A278 (Hoath Way)	21:15	24:43	03:28	16%	24:35	03:20	16%	21:44	00:29	2%	21:38	00:23	2%
A278 (Hoath Way) to A289 (Church Street)	10:05	11:25	01:20	13%	10:53	00:48	8%	16:09	06:04	60%	15:04	04:59	49%
A2 (Sovereign Boulevard to Watling Road)	06:43	07:13	00:30	7%	07:10	00:27	7%	12:24	05:41	85%	11:45	05:02	75%
A2 (Watling to Sovereign Boulevard)	20:35	25:48	05:13	25%	25:12	04:37	22%	23:10	02:35	13%	22:43	02:08	10%
A289 (Church Street to Lower Rainham)	02:21	02:21	00:00	0%	02:21	00:00	0%	02:35	00:14	10%	02:34	00:13	9%
A289 (Lower Rainham to Church Street)	02:03	02:07	00:04	3%	02:03	00:00	0%	02:08	00:05	4%	02:04	00:01	1%

Subnetwork 2 2028 PM

Path	2028 Reference Case PM	LRR Scenario 5 (min:sec)			LRR Scenario 6 (min:sec)			LRR Scenario 5A (min:sec)			LRR Scenario 6A (min:sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
A289 (Church Street) to A278 (Hoath Way)	09:25	12:58	03:33	38%	12:20	02:55	31%	16:01	06:36	70%	12:20	02:55	31%
A278 (Hoath Way) to A289 (Church Street)	06:42	09:36	02:54	43%	09:12	02:30	37%	14:26	07:44	115%	13:29	06:47	101%
A2 (Sovereign Boulevard to Watling Road)	06:24	06:39	00:15	4%	06:36	00:12	3%	12:18	05:54	92%	11:42	05:18	83%
A2 (Watling to Sovereign Boulevard)	07:03	14:05	07:02	100%	13:41	06:38	94%	16:22	09:19	132%	15:26	08:23	119%
A289 (Church Street to Lower Rainham)	02:36	02:43	00:07	4%	02:40	00:04	3%	02:39	00:03	2%	02:38	00:02	1%
A289 (Lower Rainham to Church Street)	01:59	02:02	00:03	3%	02:02	00:03	3%	02:02	00:03	3%	02:01	00:02	2%

Subnetwork 2 2037 PM

Path	2037 Reference Case PM	LRR Scenario 2 (min:sec)			LRR Scenario 3 (min:sec)			LRR Scenario 2A (min:sec)			LRR Scenario 3A (min:sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
A289 (Church Street) to A278 (Hoath Way)	09:22	13:11	03:49	41%	13:06	03:44	40%	18:18	08:56	95%	17:59	08:37	92%
A278 (Hoath Way) to A289 (Church Street)	06:43	09:57	03:14	48%	09:55	03:12	48%	14:56	08:13	122%	14:04	07:21	109%
A2 (Sovereign Boulevard to Watling Road)	06:45	06:47	00:02	0%	06:45	00:00	0%	13:12	06:27	96%	12:45	06:00	89%
A2 (Watling to Sovereign Boulevard)	12:26	14:30	02:04	17%	14:25	01:59	16%	17:58	05:32	45%	17:37	05:11	42%
A289 (Church Street to Lower Rainham)	02:37	02:48	00:11	7%	02:43	00:06	4%	02:43	00:06	4%	02:40	00:03	2%
A289 (Lower Rainham to Church Street)	02:05	02:04	00:00	0%	02:03	00:00	0%	02:19	00:14	11%	02:12	00:07	6%

Path	2028 Reference Case AM	LRR Scenario 5 (min:sec)			LRR Scenario 6 (min:sec)			LRR Scenario 5A (min:sec)			LRR Scenario 6A (min:sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
A2 (Moor Street to Sovereign Boulevard)	07:03	11:14	04:11	59%	10:19	03:16	46%	07:25	00:22	5%	07:11	00:08	2%
A2 (Sovereign Boulevard to Moor Street)	05:16	05:41	00:25	8%	05:36	00:20	6%	05:47	00:31	10%	05:31	00:15	5%

Path	2028 Reference Case PM	LRR Scenario 5 (min:sec)			LRR Scenario 6 (min:sec)			LRR Scenario 5A (min:sec)			LRR Scenario 6A (min:sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
A2 (Moor Street to Sovereign Boulevard)	06:35	12:14	05:39	86%	12:14	05:39	86%	07:08	00:33	8%	06:43	00:08	2%
A2 (Sovereign Boulevard to Moor Street)	05:42	07:03	01:21	24%	06:59	01:17	23%	06:54	01:12	21%	06:51	01:09	20%

Path	2037 Reference Case AM	LRR Scenario 2 (min:sec)			LRR Scenario 3 (min:sec)			LRR Scenario 2A (min:sec)			LRR Scenario 3A (min:sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
A2 (Moor Street to Sovereign Boulevard)	07:29	11:24	03:55	52%	11:19	02:11	24%	08:41	01:12	16%	08:10	00:41	9%
A2 (Sovereign Boulevard to Moor Street)	05:26	05:41	00:15	5%	05:51	00:30	9%	05:39	00:13	4%	05:30	00:04	1%

Path	2037 Reference Case PM	LRR Scenario 2 (min:sec)			LRR Scenario 3 (min:sec)			LRR Scenario 2A (min:sec)			LRR Scenario 3A (min:sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
A2 (Moor Street to Sovereign Boulevard)	07:08	12:56	05:48	81%	12:41	04:38	58%	07:43	00:35	8%	07:39	00:31	7%
A2 (Sovereign Boulevard to Moor Street)	06:16	07:18	01:02	16%	07:06	00:31	8%	07:36	01:20	21%	07:02	00:46	12%

Subnetwork 7 2028 AM and PM

Path	2028 Reference Case AM	LRR Scenario 5 (min:sec)			LRR Scenario 6 (min:sec)			LRR Scenario 5A (min:sec)			LRR Scenario 6A (min:sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
Pump Lane NB	01:20	01:53	00:33	41%	01:42	00:22	28%	02:06	00:46	58%	01:51	00:31	39%
Pump Lane SB	01:26	01:35	00:09	10%	01:35	00:09	10%	01:49	00:23	27%	01:48	00:22	26%
B2004 (Lower Rainham Road) WB	07:09	18:18	11:09	156%	16:32	09:23	131%	18:10	11:01	154%	16:16	09:07	128%
B2004 (Lower Rainham Road) EB	07:30	07:39	00:09	2%	07:32	00:02	0%	07:41	00:11	2%	07:33	00:03	1%
Otterham Quay Lane NB	01:39	01:40	00:01	1%	01:40	00:01	1%	01:40	00:01	1%	01:39	00:00	0%
Otterham Quay Lane SB	01:38	01:38	00:00	0%	01:38	00:00	0%	01:42	00:04	4%	01:39	00:01	1%

Path	2028 Reference Case PM	LRR Scenario 5 (min:sec)			LRR Scenario 6 (min:sec)			LRR Scenario 5A (min:sec)			LRR Scenario 6A (min:sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
Pump Lane NB	01:18	01:42	00:24	31%	01:42	00:24	31%	01:55	00:37	47%	01:50	00:32	41%
Pump Lane SB	01:12	01:33	00:21	29%	01:31	00:19	26%	01:49	00:37	51%	01:45	00:33	46%
B2004 (Lower Rainham Road) WB	06:41	07:31	00:50	12%	07:34	00:53	13%	07:30	00:49	12%	07:29	00:48	12%
B2004 (Lower Rainham Road) EB	07:03	07:12	00:09	2%	07:09	00:06	1%	07:17	00:14	3%	07:12	00:09	2%
Otterham Quay Lane NB	01:38	01:39	00:01	1%	01:39	00:01	1%	01:38	00:00	0%	01:38	00:00	0%
Otterham Quay Lane SB	01:38	01:38	00:00	0%	01:39	00:01	1%	01:39	00:01	1%	01:38	00:00	0%

Subnetwork 7 2037 AM and PM

Path	2037 Reference Case AM	LRR Scenario 2 (min:sec)			LRR Scenario 3 (min:sec)			LRR Scenario 2A (min:sec)			LRR Scenario 3A (min:sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
Pump Lane NB	01:30	02:11	00:41	46%	01:53	00:23	26%	01:59	00:29	32%	01:58	00:28	31%
Pump Lane SB	01:27	01:36	00:09	10%	01:35	00:08	9%	01:48	00:21	24%	01:46	00:19	22%
B2004 (Lower Rainham Road) WB	07:42	19:27	11:45	153%	16:54	09:12	119%	18:37	10:55	142%	16:18	08:36	112%
B2004 (Lower Rainham Road) EB	07:57	07:58	00:01	0%	07:42	00:00	-3%	08:05	00:08	2%	08:00	00:03	1%
Otterham Quay Lane NB	01:39	01:41	00:02	2%	01:41	00:02	2%	01:42	00:03	3%	01:40	00:01	1%
Otterham Quay Lane SB	01:39	01:38	00:00	-1%	01:38	00:00	-1%	01:49	00:00	0%	01:41	00:00	0%

Path	2037 Reference Case PM	LRR Scenario 2 (min:sec)			LRR Scenario 3 (min:sec)			LRR Scenario 2A (min:sec)			LRR Scenario 3A (min:sec)		
		Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
Pump Lane NB	01:24	01:44	00:20	24%	01:40	00:16	19%	01:55	00:31	37%	01:51	00:27	32%
Pump Lane SB	01:19	01:34	00:15	19%	01:35	00:16	20%	01:52	00:33	42%	01:48	00:29	37%
B2004 (Lower Rainham Road) WB	07:17	07:36	00:19	4%	07:30	00:13	3%	07:35	00:18	4%	07:31	00:55	13%
B2004 (Lower Rainham Road) EB	07:40	07:13	00:00	-6%	07:10	00:00	-7%	08:06	00:26	6%	08:01	00:21	5%
Otterham Quay Lane NB	01:39	01:40	00:01	1%	01:40	00:01	1%	01:39	00:00	0%	01:39	00:00	0%
Otterham Quay Lane SB	01:38	01:39	00:01	1%	01:38	00:00	0%	01:46	00:08	8%	01:40	00:02	2%