Report

Pump Lane and Lower Rainham Transport Impact Appraisal Addendum – Interim report (2037 results)

On behalf of Medway Council

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

16/12/2020
Project Reference: [0]
Document Reference: [3]
Revision: [1]
Prepared For: Medway Council

Status / Revisions

Rev.	Date	Reason for issue	Prepared		Reviewed		Approved	
[1]	16.12.2020	First Draft	AP	16.12.2020	DH	17.12.2020	AG	18.12.2020

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

Table of contents

Table of figures

Table of Tables

Appendices

1 Introduction

This report is an addendum to the “Pump Lane and Lower Rainham Transport Impact Appraisal Report” produced by Sweco in October 2020. This report was produced as a result of the discussions between Medway Council and the developer. As a result of these discussions, several additional modelling scenarios were developed and are presented below. The following sections present the amendments to the model, the demand used for each scenario and the results from the microsimulation for the selected subnetworks around the development area.

2 Model amendments

The two main differences between the modelling undertaken in this report and the previous report are:

i) The trip rates used for the demand to and from the development area and
ii) The centroid configuration around the development area.

2.1 Development Demand

The development demand as calculated by the developer along with the demand calculated by Sweco is presented in Table 1. It is observed that the demand calculated by the developer is 26% (214 two-way trips) and 31% (245 (two-way trips) lower than the strategic model demand that Sweco calculated in the AM and PM scenarios accordingly. The trip rates used to derive the strategic model demand have been presented in detail in the previous report and technical notes produced by Sweco (Note name “Pump_Farm_Lower_Rainham_ref_MC. 19.1566_Sweco_Response.docx on the 10th of December 2020).

This report will present the results of an Aimsun scenario using the demand calculated by the developer.

Table 1 Development demand

Demand	AM Peak			PM Peak		
	In	Out	Total	In	Out	Total
Developer Demand	187	398	585	365	193	558
Strategic Model Demand	175	624	799	497	306	803

2.2 Development zone configuration

The second issue around the modelling of the development area in the previous report, was the fact that the demand of the development zone was added on top of an existing centroid (Aimsun vehicle input and output) which included the demand of the reference case scenario and had a connection to Lower Bloors Lane as shown in Figure 1.

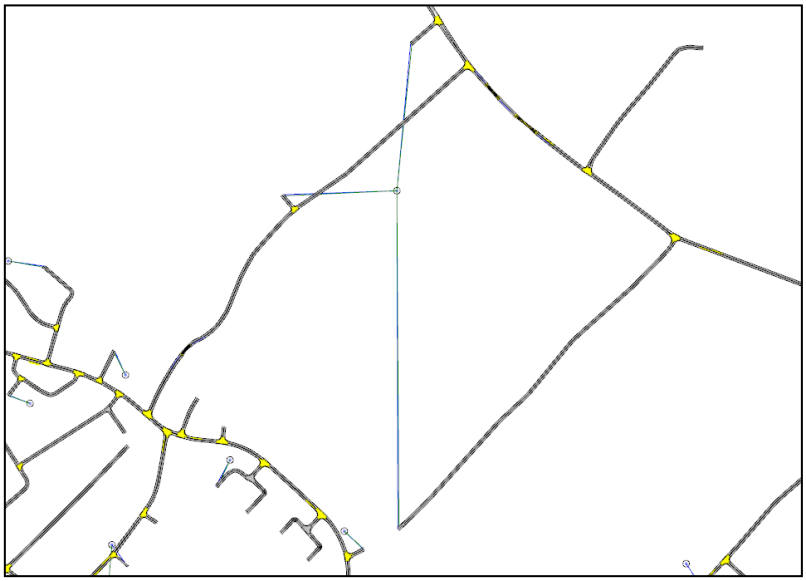

Figure 1 Original report development zone configuration in Aimsun

This report will present the results of the following new additional scenarios:

A) The **LRR Scenario 1** where the demand of the development is still added on top of the reference case demand in the same centroid, but the centroid connection to Lower Bloors Lane is removed, because, as proved by the select link analysis plots provided together with the previous report, the reference case traffic was not using the centroid connection to Lower Bloors Lane. The LRR Scenario 1 configuration is shown in Figure 2 (LRR Scenario 1)

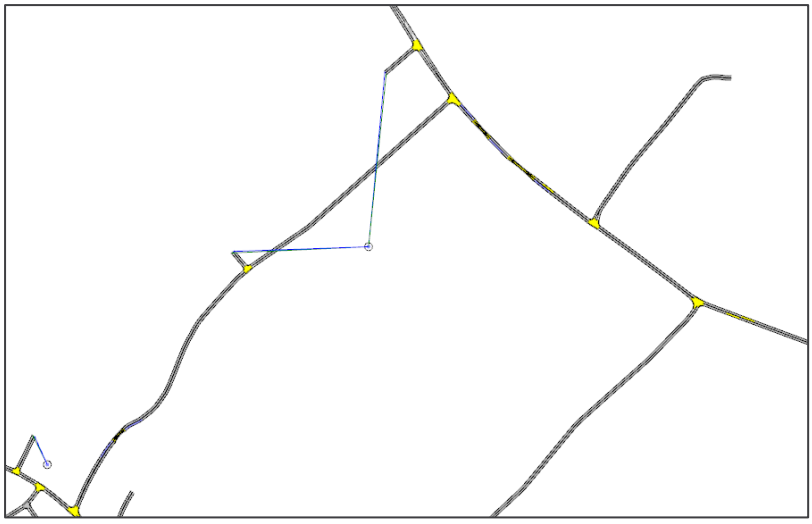

Figure 2 LRR Scenario 1 development zone configuration in Aimsun

B) The **LRR Scenario 2** and **LRR Scenario 3** where the demand of the development is assigned to a new standalone development zone (centroid), solely used for the modelling of the development, as shown in Figure 3. In Scenario 2, the development strategic model demand is used, while in Scenario 3, the developer demand is used.

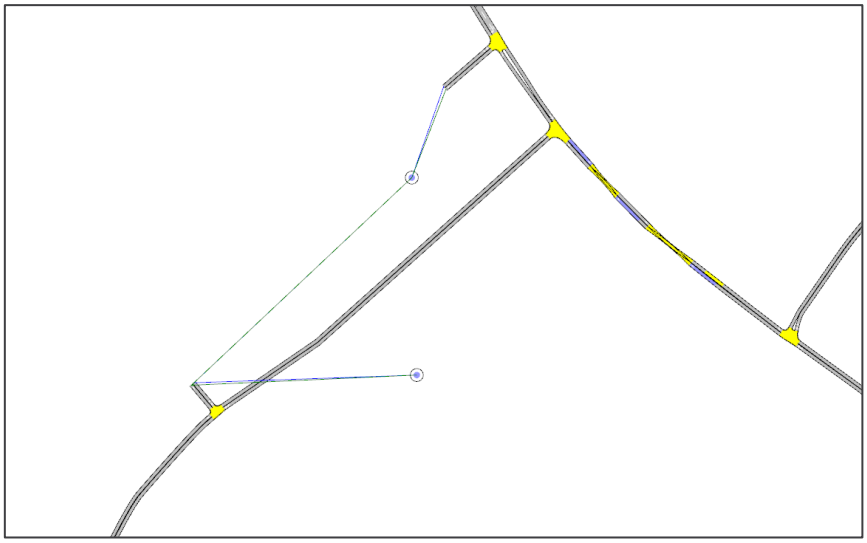

Figure 3 LRR Scenario 2 and 3 development zone configuration in Aimsun

2.3 Scenarios

The scenarios produced as a result of the aforementioned model amendments are presented in Table 2. This report will also repeat the Sensitivity test 1 results from the previous report, to provide a more comprehensive comparison.

Table 2 Additional Pump Lane development evaluation scenarios

Scenario No	Year	Trip rates for development at Pump Lane (centroid 442792)	Development zone used	Centroid Configuration
RC37	2037	N/A	N/A	N/A
Sensitivity test 1	2037	Strategic Model Trip rates	Existing strategic zone	Three access points
LRR Scenario 1	2037	Strategic Model Trip rates	Existing strategic zone	Two access points
LRR Scenario 2	2037	Strategic Model Trip rates	Standalone development zone	Two access points
LRR Scenario 3	2037	Developer Trip rates	Standalone development zone	Two access points

2.4 Additional output analysis

In addition to the results provided in the previous report produced by Sweco, this report will present the following additional results:

- Three additional junctions have been added to the Level of Service results presented in this report to provide a direct comparison between the results presented in the developer's report and Sweco's report. The methodology used to calculate the Level of Service results has been analysed in the original report.
- The travel time results for several key paths in the three subnetworks around the development area are presented in this report in order to underline the impacts of the development on traffic. The travel times have been extracted both for the reference case and the new additional scenarios. In order to calculate the travel time for the paths, the appropriate Subpaths have been defined in the Aimsun model, by selecting the corresponding sections for each of them. The path travel time results shown in the following subnetwork sections will also show the absolute difference and percent difference compared to the reference case scenario.

3 Results

3.1 Subnetwork 2

Initially, the Subnetwork 2 statistics for AM and PM peak times are presented in Table 3 and Table 4 accordingly. A large increase in average travel time, delay and queue is observed between the 2037 Reference case and the scenarios including the development (Sensitivity test 1, LRR Scenarios 1,2 and 3). Consequently, a decrease in average speed is observed between the reference case and the development scenarios. It needs to be underlined that the difference in travel time, delay, speed and mean queue between the development scenarios is small and can be attributed to the stochasticity of the microsimulation. For example, the difference in travel time between LRR Scenario 2 and 3 is 5 seconds per kilometer which can be considered negligible. The percent change for each statistic is presented graphically in Figure 4 and Figure 5 for the AM and PM peak times accordingly.

Table 3 Subnetwork 2 Statistics AM peak

Statistic	AM Peak (0800 to 0900)					
	Units	2037 RC	Sensitivity test 1	LRR Scenario 1	LRR Scenario 2	LRR Scenario 3
Travel Time	sec/km	193	244	254	253	253
Delay	sec/km	120	172	181	181	181
Speed	km/h	28.1	27.0	26.2	26	26.4
Mean Queue	veh	503	860	919	929	905

Table 4 Subnetwork 2 Statistics PM Peak

Statistic	PM Peak (1700 to 1800)					
	Units	2037 RC	Sensitivity test 1	LRR Scenario 1	LRR Scenario 2	LRR Scenario 3
Travel Time	sec/km	171	210	207	206	204
Delay	sec/km	98	138	135	133	132
Speed	km/h	30.4	27.0	27.3	27	27.6
Mean Queue	veh	325	581	571	563	556

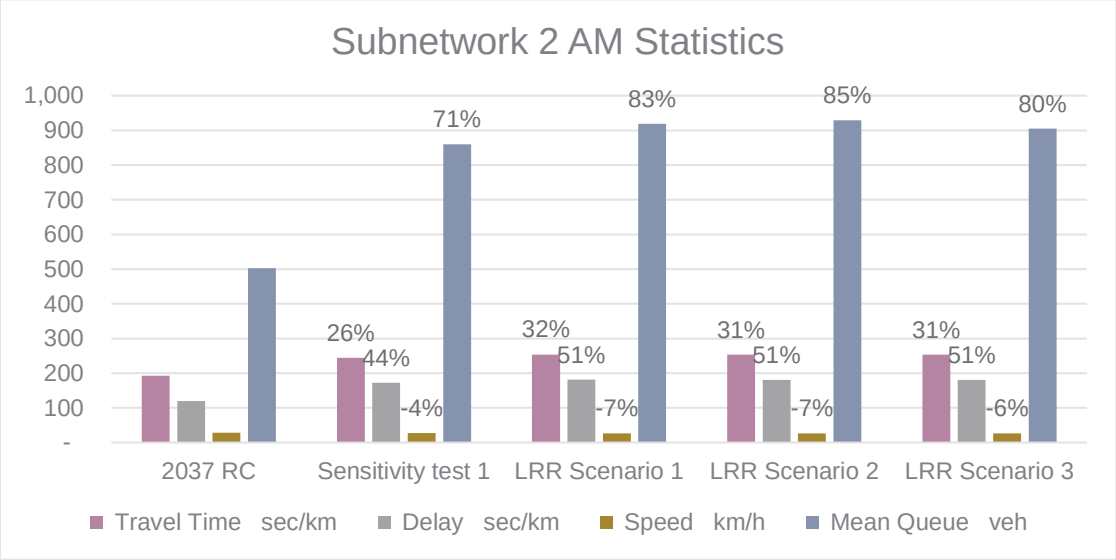

Figure 4 Subnetwork 2 AM Statistics

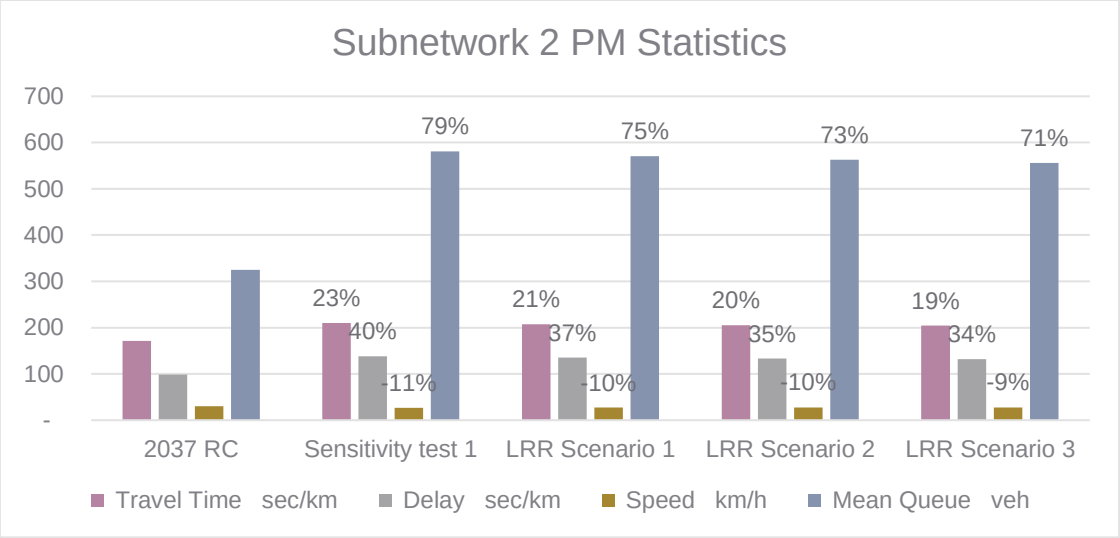

Figure 5 Subnetwork 2 PM Statistics

Table 5 and Table 6 present the Level of Service results for key junctions in Subnetwork 2. The location of each junction and roundabout is shown in Figure 6.

Figure 6 Subnetwork 2 Junctions and Roundabouts

It is observed that:

- Junctions number 8, 9 and 12 Level of Service goes to F where the demand of the junction exceeds capacity, in the AM scenarios where the development is present
- Junctions number 2, 4 ,9 and 10 Level of Service goes to F in the PM scenarios where the development is present
- Very small to no change is observed between the development scenarios (Sensitivity test 1, LRR Scenarios 1, 2 and 3)

Table 5 Subnetwork 2 Junction Level of Service AM Peak

Junction	ID	Ref AM	Sensitivity test 1	LRR Scenario 1	LRR Scenario 2	LRR Scenario 3
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	D	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	E	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 6 Subnetwork 2 Junction Level of Service PM Peak

Junction	ID	Ref PM	Sensitivity test 1	LRR Scenario 1	LRR Scenario 2	LRR Scenario 3
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	D	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	E	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	B	B	B	B
A2 (Yokosuka / Ito / Beechings Way Roundabout)	13	A	A	A	A	A
A2 / Pump Lane	14	A	D	D	D	D

Figure 7 shows the paths analysed in terms of travel time in subnetwork 7, while Table 7 and Table 8 present the path travel time results for the AM and PM Peak periods accordingly. The most outstanding difference is observed in:

- A289 (Church Street) to A278 (Hoath Way) and A2 (Watling to Sovereign Boulevard) where the travel time increases by 14-16% and 22-25% accordingly in the AM scenarios. This increase is around 3 minutes for Path 1 and 4-5 minutes for Path 4. It is considered a significant increase.

- A289 (Church Street) to A278 (Hoath Way) and A278 (Hoath Way) to A289 (Church Street) where the travel time increases by 28 to 41% and 48 to 49% accordingly in the PM scenarios. This increase is around 3 minutes and 3-4 minutes accordingly and can be considered significant.
- The differences between the path travel time results of the development scenarios are considered small and can be attributed to the stochasticity (randomness) of the microsimulation.

Figure 7 Subnetwork 2 Paths

Table 7 Subnetwork 2 Path travel time AM Peak

Path	ID	2037 Reference Case AM	LRR Scenario 1 (sec)			LRR Scenario 2 (sec)			LRR Scenario 3 (sec)		
			Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
A289 (Church Street) to A278 (Hoath Way)	1	1,275	1,456	181	14%	1,483	208	16%	1,475	200	16%
A278 (Hoath Way) to A289	2	605	630	25	4%	685	80	13%	653	48	8%

(Church Street)											
A2 (Sovereign Boulevard to Watling Road)	3	403	425	22	5%	433	30	8%	430	27	7%
A2 (Watling to Sovereign Boulevard)	4	1,235	1,517	282	23%	1,548	313	25%	1,512	277	22%
A289 (Church Street to Lower Rainham)	5	141	140	- 1	-1%	141	0	0%	141	0	0%
A289 (Lower Rainham to Church Street)	6	123	132	9	7%	127	4	2%	123	0	0%

Table 8 Subnetwork 2 Path travel time PM Peak

Path	ID	2037 Reference Case PM	LRR Scenario 1 (sec)			LRR Scenario 2 (sec)			LRR Scenario 3 (sec)		
			Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
A289 (Church Street) to A278 (Hoath Way)	1	562	719	157	28%	791	229	41%	786	224	40%
A278 (Hoath Way) to A289 (Church Street)	2	403	599	196	49%	597	194	48%	595	192	48%
A2 (Sovereign Boulevard to Watling Road)	3	405	407	2	0%	407	2	1%	405	-	0%
A2 (Watling to Sovereign Boulevard)	4	746	808	62	8%	870	124	17%	865	119	16%
A289 (Church Street to Lower Rainham)	5	157	166	9	6%	168	11	7%	163	6	4%
A289 (Lower Rainham to Church Street)	6	125	123	-2	-2%	124	- 1	-1%	123	-2	-2%

3.1.1 Subnetwork 2 Summary

Initially, the subnetwork 2 statistics results showed that traffic conditions in the subnetwork deteriorate in all the scenarios where the development exists, and a substantial increase in delay, travel time and queue is observed between those scenarios and the reference case. The difference between the scenarios using the strategic model demand and the scenarios using the developer demand seems to be small compared to the difference between the reference case and the development scenarios.

Additionally, Junction level of service results showed that the demand for Junctions number 8, 9 and 12 Level of Service exceeds capacity in the AM development scenarios. In the PM development scenarios, the demand for Junctions number 2, 4 ,9 and 10 exceeds capacity. Very small to no change is observed between the development scenarios in terms of Junction Level of Service.

Finally, path travel time results underlined that the travel time for paths A289 (Church Street) to A278 (Hoath Way) and A2 (Watling to Sovereign Boulevard) in the AM peak and paths A289 (Church Street) to A278 (Hoath Way) and A278 (Hoath Way) to A289 (Church Street) in the PM peak increases substantially between the 2037 case scenario and the development scenarios. Again, the travel times results seemed to not show significant differences among the development scenarios.

3.2 Subnetwork 3

Initially, the Subnetwork 3 statistics for AM and PM peak times are presented in Table 9 and Table 10 accordingly. It is observed that even though there is not a big increase between reference case and Sensitivity 1 scenario, an more substantial increase in average travel time, delay and queue is observed between the 2037 Reference case/Sensitivity 1 and the three new additional LRR scenarios including the development (LRR Scenarios 1,2 and 3). Consequently, a decrease in average speed is observed between the reference case and the development scenarios. It needs to be underlined that the difference in travel time, delay, speed and mean queue between the three new LRR scenarios is small and can be attributed to the stochasticity of the microsimulation. For example, the difference in travel time between LRR Scenario 1 and 3 is 5 seconds per kilometer in the AM peak scenario which can be considered negligible. The percent change for each statistic is presented graphically in Figure 8 and Figure 9 for the AM and PM peak times accordingly.

Table 9 Subnetwork 3 Statistics AM Peak

Statistic	AM Peak (0800 to 0900)					
	Units	2037 RC	Sensitivity test 1	LRR Scenario 1	LRR Scenario 2	LRR Scenario 3
Travel Time	sec/km	247	248	260	259	255
Delay	sec/km	161	162	174	174	169
Speed	km/h	18.7	20.0	19.0	18.8	19.2
Mean Queue	veh	66	72	80	79	77

Table 10 Subnetwork 3 Statistics PM Peak

Statistic	PM Peak (1700 to 1800)					
	Units	2037 RC	Sensitivity test 1	LRR Scenario 1	LRR Scenario 2	LRR Scenario 3
Travel Time	sec/km	272	284	296	294	288
Delay	sec/km	186	199	211	209	202
Speed	km/h	18.0	18.0	17.5	17.6	18.0
Mean Queue	veh	72	96	104	105	97

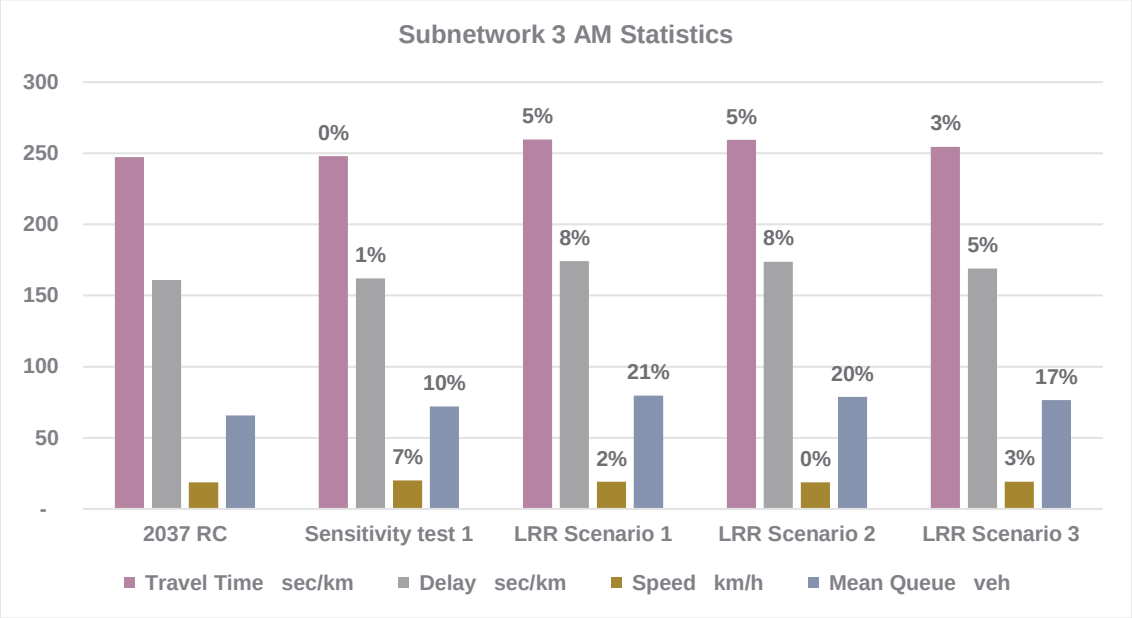

Figure 8 Subnetwork 3 Statistics AM

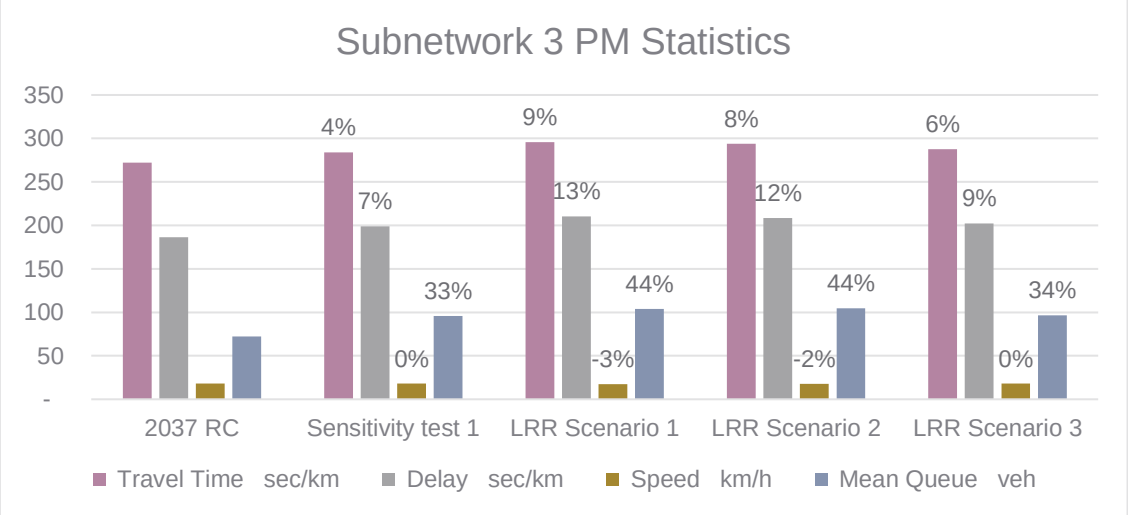

Figure 9 Subnetwork 3 Statistics PM

Table 11 and Table 12 present the Level of Service results for key junctions in Subnetwork 3. The location of each junction and roundabout is shown in Figure 10.

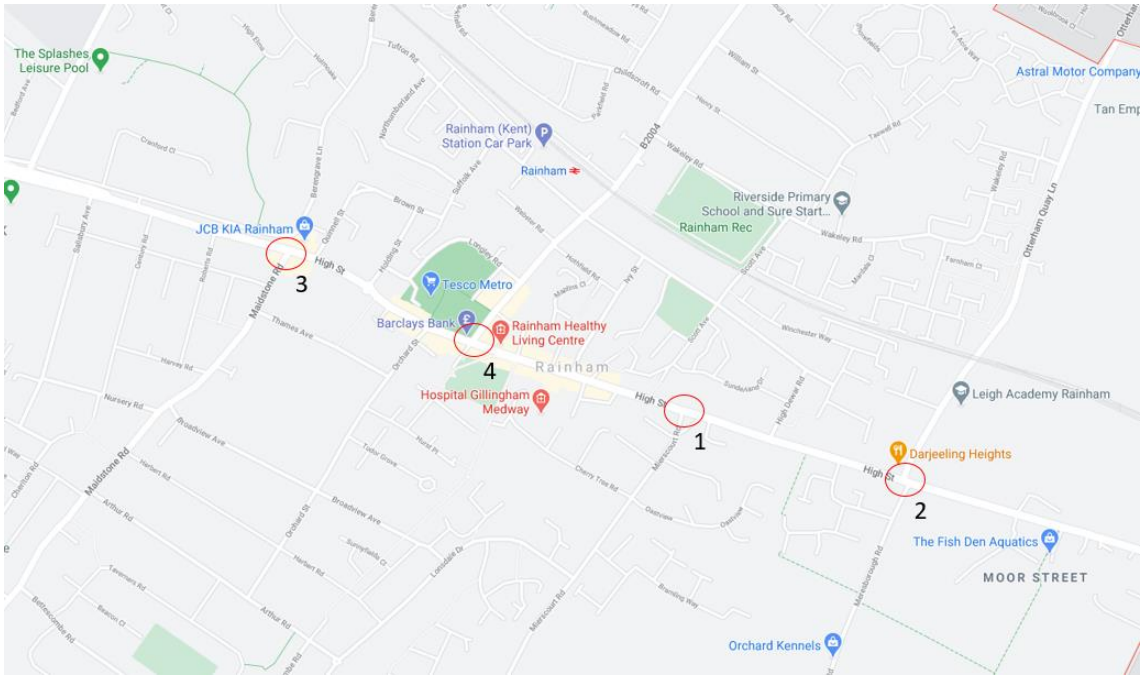

Figure 10 Subnetwork 3 Junctions and Roundabouts

It is observed that the demand at Junction 2 (A2 (Otterham Quay Lane/Merersborough Road) in the new LRR scenarios exceeds capacity, an effect which is not present in the reference case scenario. A small increase from D to E is observed between LRR Scenario 1 and LRR Scenario 2 in Junction 4 in the PM scenario but the demand does not exceed capacity in either of them. The results between the new LRR scenarios do not show any other difference than the one mentioned above.

Table 11 Subnetwork 3 Junction Level of Service AM

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

Table 12 Subnetwork 3 Junction Level of Service PM

Junction	ID	2037 RC PM	Sensitivity test 1	LRR Scenario 1 PM	LRR Scenario 2 PM	LRR Scenario 3 PM
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	C	C

Sovereign Bd & Station Rd	**4**	C	D	D	E	D

Finally, Figure 11 shows the location of the subnetwork 3 paths which is analysed in terms of travel time, while the travel time results are presented in Table 13 and Table 14 for the AM peak and PM peak scenarios accordingly. A large increase is observed for the path A2 (Moor Street to Sovereign Boulevard) in both the AM and the PM peak scenarios. More specifically, in the PM peak scenario travel time for the A2 corridor (WB) is increased by 271 (56%) to 293 (61%) seconds which is approximately 5 minutes.

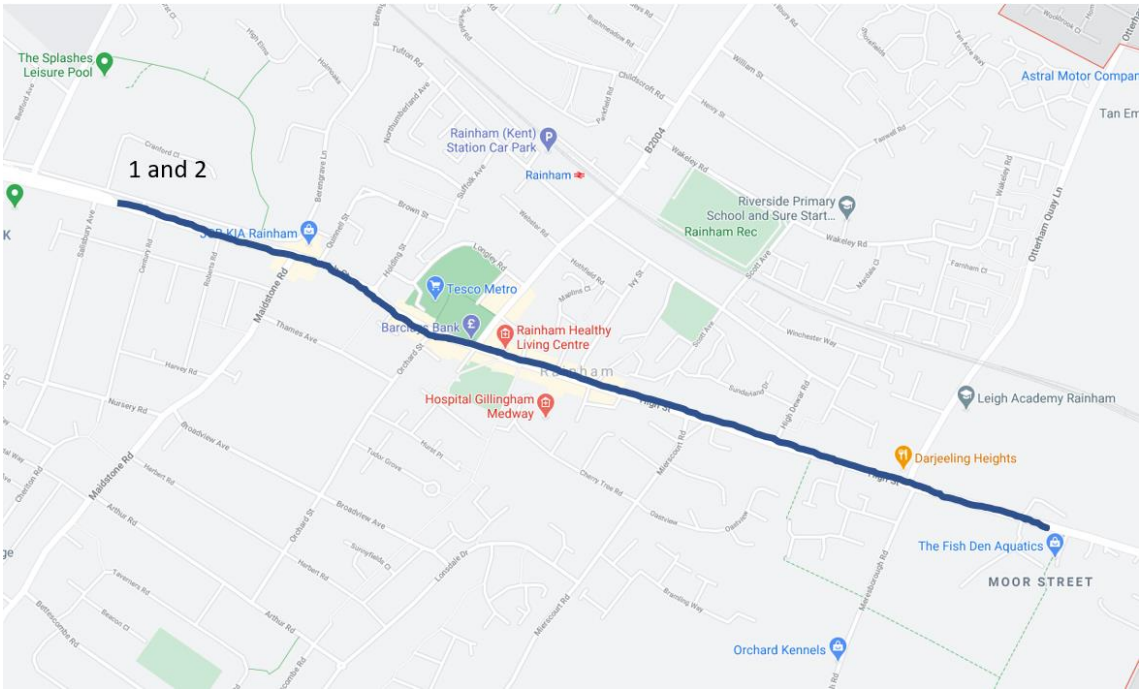

Figure 11 Subnetwork 3 Paths

Table 13 Subnetwork 3 Path travel time AM

Path	ID	2037 Reference Case AM	LRR Scenario 1 (sec)			LRR Scenario 2 (sec)			LRR Scenario 3 (sec)		
			Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
A2 (Moor Street to Sovereign Boulevard)	1	548	667	119	22%	684	136	25%	679	131	24%
A2 (Sovereign Boulevard to Moor Street)	2	321	340	19	6%	341	20	6%	351	30	9%

Table 14 Subnetwork 3 Path travel time PM

Path	ID	2037 Reference Case PM	LRR Scenario 1 (sec)			LRR Scenario 2 (sec)			LRR Scenario 3 (sec)		
			Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
A2 (Moor Street to Sovereign Boulevard)	1	483	754	271	56%	776	293	61%	761	278	58%
A2 (Sovereign Boulevard to Moor Street)	2	395	446	51	13%	438	43	11%	426	31	8%

3.2.1 Subnetwork 3 Summary

Initially, the subnetwork average statistics showed that even though there is not a big increase between reference case and Sensitivity 1 scenario, a more substantial increase in average travel time, delay and queue is observed between the 2037 Reference case/Sensitivity 1 and the three new additional LRR scenarios including the development (LRR Scenarios 1,2 and 3). This can be attributed to the fact that since the traffic now does not enter through Lower Bloors lane, it selects alternative routes to reach its destination ultimately worsening traffic conditions in the portion of the A2 included in subnetwork 3.

Furthermore, demand at Junction 2 (A2 (Otterham Quay Lane/Merersborough Road) in the new LRR scenarios exceeds capacity, an effect which is not present in the reference case scenario. Finally, an increase of 2 and 5 minutes (56% and 61% accordingly) is observed for A2 (Moor Street to Sovereign Boulevard) in subnetwork 3 in both the AM and the PM peak scenarios. Overall, no substantial difference was observed between the results of the new LRR scenarios.

3.3 Subnetwork 7

Initially, the Subnetwork 7 statistics for AM and PM peak times are presented in Table 15 and Table 16 accordingly. It is observed that even though there is an increase in travel time, delay and queue between reference case and all the scenarios where the development is present (Sensitivity 1, LRR Scenario 1,2 and 3), the results between the development scenarios do not show big fluctuations. The statistics results are presented graphically in Figure 12 and Figure 13. It is observed that in the scenarios where the development is present, the travel time remains almost constant in the PM Peak scenarios.

Table 15 Subnetwork 7 Statistics AM Peak

Statistic	AM Peak (0800 to 0900)					
	Units	2037 RC	Sensitivity test 1	LRR Scenario 1	LRR Scenario 2	LRR Scenario 3
Travel Time	sec/km	140	162	172	162	162
Delay	sec/km	61	82	93	82	82
Speed	km/h	35.7	34.0	33.6	34.0	34.2

Mean Queue	veh	57	155	159	169	143

Table 16 Subnetwork 7 Statistics PM Peak

Statistic	PM Peak (1700 to 1800)					
	Units	2037 RC	Sensitivity test 1	LRR Scenario 1	LRR Scenario 2	LRR Scenario 3
Travel Time	sec/km	123	154	153	154	154
Delay	sec/km	42	74	72	73	74
Speed	km/h	37.9	36.0	36.0	36.0	36.0
Mean Queue	veh	28	68	62	63	62

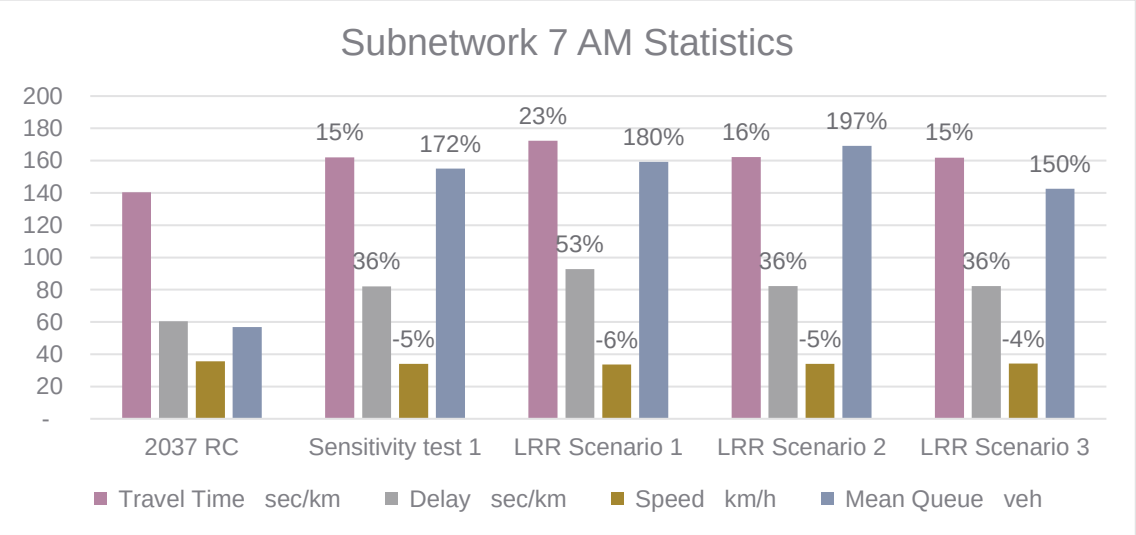

Figure 12 Subnetwork 7 Statistics AM

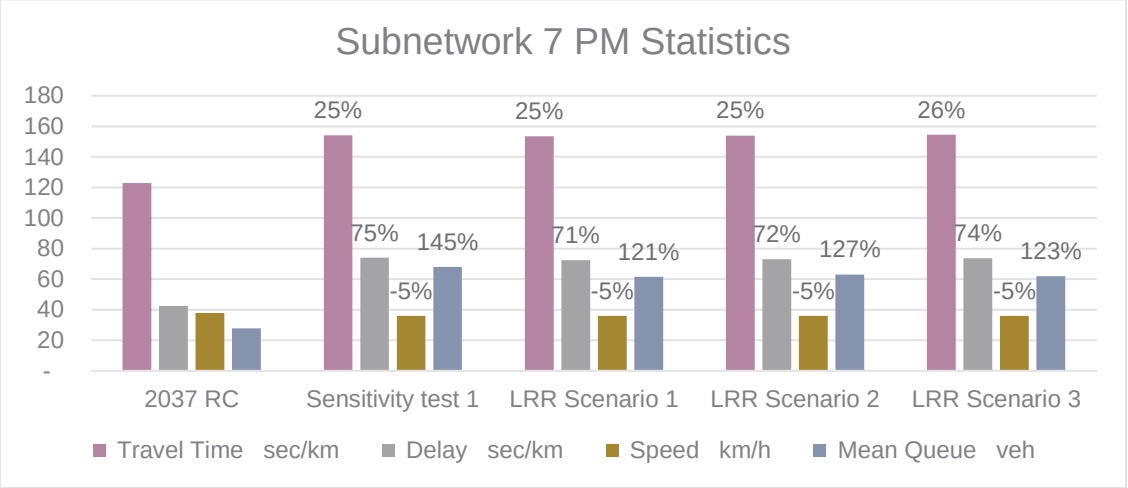

Figure 13 Subnetwork 7 Statistics PM

Table 17 and Table 18 present the Level of Service results for key junctions in Subnetwork 7. The location of each junction and roundabout is shown in Figure 14.

Figure 14 Subnetwork 7 Junctions and Roundabouts

The level of service results are more or less consistent across the reference case and development scenarios. A small difference is observed in Scenario 2 in Junctions 1 and 4, but it needs to be underlined that the demand does not exceed capacity in any scenario. Except this, there is no other difference between the development scenarios.

Table 17 Subnetwork 7 Junction Level of Service AM Peak

Junction	ID	Reference Case AM	Sensitivity test 1	Scenario 1 AM	Scenario 2 AM	Scenario 3 AM
B2004 Lower Rainham Road / Pump Lane	1	A	A	A	B	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	D	C
B2004 Lower Rainham Road / B2004 Station Road	5	A	A	A	A	A
B2004 Lower Rainham Road / Otterham Quay Lane	6	A	A	A	A	A

Table 18 Subnetwork 7 Junction Level of Service PM Peak

Junction	ID	Reference Case PM	Sensitivity test 1	Scenario 1 PM	Scenario 2 PM	Scenario 3 PM
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

Finally, Figure 15 shows the location of paths analysed in subnetwork 7, while Table 19 and Table 20 present the travel time results. The most outstanding finding from these tables is the increase in the travel time for Lower Rainham Road Westbound, where the travel time increases by 119% to 153% between the Reference case and the development scenarios. This increase can be translated to 10 minutes increase in travel time for this specific path. This issue had been underlined in the original Sweco report, using the V/C plots around in the Lower Rainham Road westbound direction. Even though an increase in travel time in Pump Lane (both directions is observed, it is not as significant as the increase in Lower Rainham Road. This result should be combined with the Junction Level of Service results presented in Subnetwork 2 for A289 (Yokosuka Way Roundabout) which has a level of service F for all AM scenarios, including Reference case. It is clear that this roundabout, despite the mitigation scheme applied in the development scenarios, cannot accommodate the demand from the development.

Figure 15 Subnetwork 7 Paths

Table 19 Subnetwork 7 Path travel time AM Peak

Path	ID	2037 Reference Case AM	LRR Scenario 1 (sec)			LRR Scenario 2 (sec)			LRR Scenario 3 (sec)		
			Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
Pump Lane NB	1	90	100	10	11%	131	41	46%	113	23	26%
Pump Lane SB	2	87	94	7	8%	96	9	10%	95	8	9%
B2004 (Lower Rainham Road) WB	3	462	1,049	587	127%	1,167	705	153%	1,014	552	119%
B2004 (Lower Rainham Road) EB	4	477	451	-26	-5%	478	1	0%	462	-15	-3%
Otterham Quay Lane NB	5	99	100	1	1%	101	2	2%	101	2	2%

Otterham Quay Lane SB	6	99	106	7	7%	98	-1	-1%	98	-1	-1%

Table 20 Subnetwork 7 Path travel time PM Peak

Path	ID	2037 Reference Case PM	LRR Scenario 1 (sec)			LRR Scenario 2 (sec)			LRR Scenario 3 (sec)		
			Value	Abs Diff	% Diff	Value	Abs Diff	% Diff	Value	Abs Diff	% Diff
Pump Lane NB	1	84	102	18	21%	104	20	24%	100	16	19%
Pump Lane SB	2	79	92	13	16%	94	15	19%	95	16	20%
B2004 (Lower Rainham Road) WB	3	437	449	12	3%	456	19	4%	450	13	3%
B2004 (Lower Rainham Road) EB	4	460	430	- 30	-7%	433	-27	-6%	430	- 30	-7%
Otterham Quay Lane NB	5	99	100	1	1%	100	1	1%	100	1	1%
Otterham Quay Lane SB	6	98	99	1	1%	99	1	1%	98	-	0%

3.3.1 Subnetwork 7 Summary

The subnetwork 7 statistics results showed that even though there is an increase in travel time, delay and queue between the reference case and the development scenarios, the results between development scenarios do not differ significantly.

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 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 the mitigation scheme, the level of service indicates that the demand in this roundabout exceeds capacity even in the reference case.

4 Summary

This report presented the results of a new set of additional modelling scenarios around the development area in Pump Lane in Lower Rainham. These scenarios examined the sensitivity between different centroid configurations and trip rates, employed by the strategic model developed by Sweco and the developer.

The results showed that there is no improvement in terms of congestion between the results provided in the development scenario (Sensitivity 1 scenario) presented in the previous Sweco report in October 2020 and the new LRR scenarios 1, 2 and 3 examined in this report. On the other hand, the new scenarios revealed a new issue in the A2 (Otterham Quay Lane_Meresborough Road) Junction in Subnetwork 3 that can be attributed to the re-routing of the demand due to the loss of the connection to Lower Bloors Lane. The junctions that were proven problematic in the previous Sweco report, remain problematic in the new LRR Scenarios.

When comparing LRR Scenarios 1 and 2 with LRR Scenario 3 where the developer trip rates are used, no significant difference in terms of congestion hotspots can be observed. The problems in the road network underlined in the previous Sweco report remain, despite the reduction in the development demand.

More specifically, the results showed the issues in the following road network elements:

Junctions

The following junctions reach level of service F in the AM Scenarios:

- A2 (Rotary Gardens / Woodlands Road / Sovereign Boulevard Junction)
- A2 (Bowater Roundabout)
- A289 (Ito Way / Sovereign Boulevard)
- A2 (Otterham Quay Lane / Merersborough Road)

The following junctions reach level of service F in the PM Scenarios:

- A289 (Pier Road / Maritime Way Roundabout)
- A289 Pier Road / Gillingham Gate Road West
- A2 (Bowater Roundabout)
- Eastcourt Lane / South Avenue
- A2 (Otterham Quay Lane / Merersborough Road)

In all the aforementioned junctions the demand exceeds capacity in the corresponding peak development scenario. This practically means that the functionality of the junction breaks, ultimately causing long queues and additional delays.

Path travel time

The following paths show significant increase in travel time:

- Lower Rainham Road westbound direction shows a large increase in travel time (approximately 10 minutes) between the reference case and the development scenarios in the AM peak.
- A2 (Moor Street to Sovereign Boulevard) in subnetwork 3 shows an increase of 2 and 5 minutes (56% and 61% accordingly) in the AM and the PM peak scenarios accordingly.
- Paths A289 (Church Street) to A278 (Hoath Way) and A2 (Watling to Sovereign Boulevard) in the AM peak show a substantial increase in travel time in subnetwork 2
- Paths A289 (Church Street) to A278 (Hoath Way) and A278 (Hoath Way) to A289 (Church Street) show a substantial increase in travel time in subnetwork 2 in the PM peak

Appendix A – Detailed Subnetwork Statistics

Subnetwork 2 Statistics	AM Peak (0800 to 0900)					
	Units	2037 RC	Sensitivity test 1	LRR Scenario 1	LRR Scenario 2	LRR Scenario 3
Travel Time	sec/km	193	244	254	248	253
Delay	sec/km	120	172	181	175	181
Flow	veh/h	11,266	11,380	11,407	11,391	11,359
Speed	km/h	28	27	26	27	26
Stop Time	sec/km	107	158	167	161	167
Mean Queue	veh	503	860	919	890	905
Mean Virtual Queue	veh	146	574	608	578	577
Waiting Time in Virtual Queue	sec	46	178	188	178	178
Total Statistics						
Total Travelled Time	h	2,236	2,951	3,087	3,013	3,039
Total Travelled Distance	km	52,434	53,374	53,762	53,544	53,336
Average travel time per vehicle	s/veh	357	467	487	476	482
Total Waiting Time in Virtual Queue	h	143	561	594	564	562
Total travel time including virtual queue	h	2,379	3,512	3,681	3,577	3,601
Total Queue	veh	648	1,435	1,527	1,467	1,482
Throughput						
Vehicles Out	veh	22,531	22,761	22,813	22,783	22,719
Vehicles In	veh	6	7	6	6	6
Vehicles Waiting to Enter	veh	-	-	-	-	-
Total	veh	22,538	22,768	22,819	22,789	22,725
Vehicles In and Waiting to Enter	veh	6	7	6	6	6

Subnetwork 2 Statistics	PM Peak (1700 to 1800)					
	Units	2037 Rainham RC	Sensitivity test 1	LRR Scenario 1	LRR Scenario 2	LRR Scenario 3
Travel Time	sec/km	171	210	207	202	204
Delay	sec/km	98	138	135	130	132

Flow	veh/h	11,124	11,495	11,546	11,557	11,349
Speed	km/h	30	27	27	28	28
Stop Time	sec/km	87	124	121	116	118
Mean Queue	veh	325	581	571	535	556
Mean Virtual Queue	veh	180	342	310	300	271
Waiting Time in Virtual Queue	sec	58	105	95	92	85
Total Statistics						
Total Travelled Time	h	1,817	2,445	2,430	2,354	2,371
Total Travelled Distance	km	51,350	53,893	54,173	54,242	53,371
Average travel time per vehicle	s/veh	294	383	379	367	376
Total Waiting Time in Virtual Queue	h	3	10	8	8	6
Total travel time including virtual queue	h	1,820	2,455	2,438	2,362	2,378
Total Queue	veh	505	924	880	835	826
Throughput						
Vehicles Out	veh	22,247	22,990	23,092	23,115	22,697
Vehicles In	veh	6	6	6	6	6
Vehicles Waiting to Enter	veh	-	-	-	-	-
Total	veh	22,253	22,996	23,098	23,121	22,703
Vehicles In and Waiting to Enter	veh	6	6	6	6	6

Subnetwork 3 Statistics	**AM Peak (0800 to 0900)**					
	Units	2037 Reference Case	Sensitivity test 1	LRR Scenario 1	LRR Scenario 2	LRR Scenario 3
Travel Time	sec/km	247	248	260	259	255
Delay	sec/km	161	162	174	174	169
Flow	veh/h	2,475	2,502	2,550	2,533	2,523
Speed	km/h	19	20	19	19	19
Stop Time	sec/km	146	146	158	158	153
Mean Queue	veh	66	72	80	79	77
Mean Virtual Queue	veh	8	43	64	44	40
Waiting Time in Virtual Queue	sec	12	62	91	63	57

Total Statistics						
Total Travelled Time	h	242	260	280	276	271
Total Travelled Distance	km	3,607	3,785	3,881	3,842	3,802
Average travel time per vehicle	s/veh	176	187	198	196	193
Total Waiting Time in Virtual Queue	h	-	1	2	1	1
Total travel time including virtual queue	h	242	261	282	277	271
Total Queue	veh	74	115	144	123	117
Throughput						
Vehicles Out	veh	4,950	5,005	5,101	5,066	5,047
Vehicles In	veh	1	1	1	1	2
Vehicles Waiting to Enter	veh	-	-	-	-	-
Total	veh	4,952	5,006	5,102	5,067	5,048
Vehicles In and Waiting to Enter	veh	1	1	1	1	2

Subnetwork 3 Statistics	PM Peak (1700 to 1800)					
	Units	2037 Reference Case	Sensitivity test 1	LRR Scenario 1	LRR Scenario 2	LRR Scenario 3
Travel Time	sec/km	272	284	296	294	288
Delay	sec/km	186	199	211	209	202
Flow	veh/h	2,529	2,649	2,654	2,645	2,615
Speed	km/h	18	18	18	18	18
Stop Time	sec/km	171	182	193	191	185
Mean Queue	veh	72	96	104	105	97
Mean Virtual Queue	veh	12	127	58	80	62
Waiting Time in Virtual Queue	sec	16	173	79	109	85
Total Statistics						
Total Travelled Time	h	264	324	341	341	322
Total Travelled Distance	km	3,896	4,165	4,199	4,193	4,094
Average travel time per vehicle	s/veh	188	220	232	232	221
Total Waiting Time in Virtual Queue	h	-	6	1	2	1
Total travel time including virtual queue	h	264	330	343	344	323
Total Queue	veh	84	223	162	184	159

Throughput						
Vehicles Out	veh	5,058	5,297	5,308	5,291	5,229
Vehicles In	veh	2	2	2	2	2
Vehicles Waiting to Enter	veh	-	-	-	-	-
Total	veh	5,060	5,299	5,310	5,292	5,231
Vehicles In and Waiting to Enter	veh	2	2	2	2	2

Subnetwork 7 Statistics	Units	AM Peak (0800 to 0900) 2037 Reference Case	Sensitivity test 1	LRR Scenario 1	LRR Scenario 2	LRR Scenario 3
Travel Time	sec/km	140	162	172	162	162
Delay	sec/km	61	82	93	82	82
Flow	veh/h	5,853	6,170	6,377	6,200	6,106
Speed	km/h	36	34	34	34	34
Stop Time	sec/km	51	70	81	71	71
Mean Queue	veh	57	155	159	169	143
Mean Virtual Queue	veh	4	69	132	57	37
Waiting Time in Virtual Queue	sec	2	39	74	32	22
Total Statistics						
Total Travelled Time	h	445	701	712	733	662
Total Travelled Distance	km	13,043	14,357	14,396	14,443	13,913
Average travel time per vehicle	s/veh	137	205	201	213	195
Total Waiting Time in Virtual Queue	h	-	1	3	-	-
Total travel time including virtual queue	h	445	702	715	734	662
Total Queue	veh	61	224	291	226	179
Throughput						
Vehicles Out	veh	11,705	12,340	12,753	12,400	12,211
Vehicles In	veh	2	2	2	2	2
Vehicles Waiting to Enter	veh	-	-	-	-	-
Total	veh	11,707	12,342	12,755	12,402	12,213
Vehicles In and Waiting to Enter	veh	2	2	2	2	2

Subnetwork 7Statistics	Units	PM Peak (1700 to 1800) 2037 Reference Case	Sensitivity test 1	LRR Scenario 1	LRR Scenario 2	LRR Scenario 3
Travel Time	sec/km	123	154	153	154	154

Delay	sec/km	42	74	72	73	74
Flow	veh/h	5,542	5,964	5,980	6,016	5,937
Speed	km/h	38	36	36	36	36
Stop Time	sec/km	35	64	63	63	64
Mean Queue	veh	28	68	62	63	62
Mean Virtual Queue	veh	2	87	38	50	47
Waiting Time in Virtual Queue	sec	1	53	23	30	29
Total Statistics						
Total Travelled Time	h	358	484	452	461	451
Total Travelled Distance	km	12,201	13,572	12,940	13,155	12,847
Average travel time per vehicle	s/veh	116	146	136	138	137
Total Waiting Time in Virtual Queue	h	-	1	-	-	-
Total travel time including virtual queue	h	358	486	453	462	451
Total Queue	veh	30	155	100	113	109
Throughput						
Vehicles Out	veh	11,084	11,927	11,960	12,032	11,874
Vehicles In	veh	2	2	2	2	2
Vehicles Waiting to Enter	veh	-	-	-	-	-
Total	veh	11,086	11,929	11,962	12,033	11,876
Vehicles In and Waiting to Enter	veh	2	2	2	2	2

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.