national highways

Lower Thames Crossing

9.15 Localised Traffic Modelling Appendix D – Manorway Forecasting Report

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Lower Thames Crossing

9.15 Localised Traffic Modelling Appendix D – Manorway Forecasting Report

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1 Introduction

1.1 Purpose of document

1.1.1 The purpose of this document is to present the findings from the traffic operation appraisal undertaken for the Manorway junction on the A13, A1014 The Manorway/ The Sorrells junction and Sorrells roundabout on the A1014, near DP World London Gateway port.

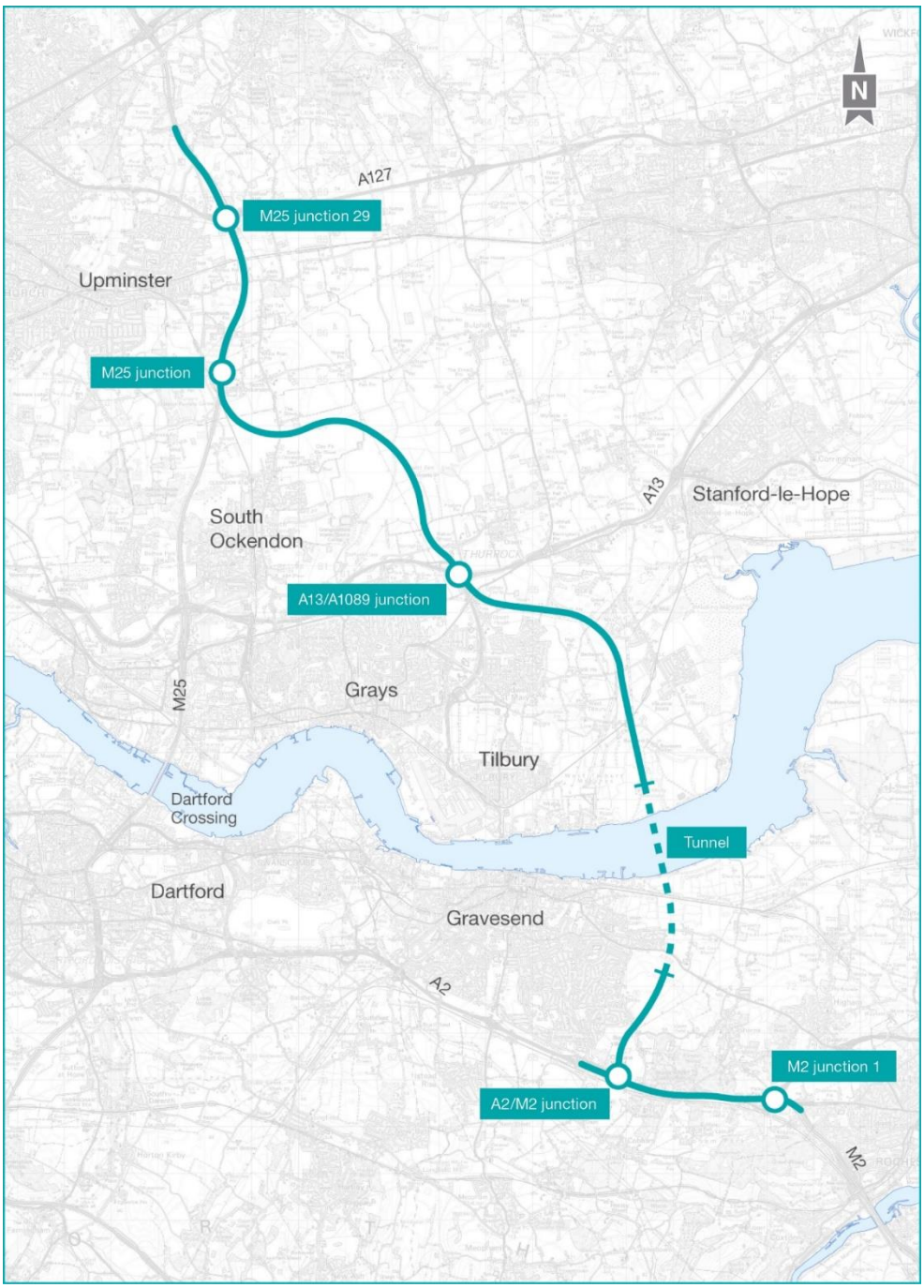
1.2 Modelling software

1.2.1 Road traffic micro-simulation models represent individual vehicles travelling within the road network, providing realistic driver behaviour such as lane changing and overtaking. The micro-simulation software selected for the Lower Thames Crossing is VISSIM. The model has been developed in VISSIM version 11 (SP14).

1.3 The Project

1.3.1 The A122 Lower Thames Crossing (the Project) would provide a connection between the A2 and M2 in Kent, east of Gravesend, crossing under the River Thames through a tunnel, before joining the M25 south of junction 29. The Project route is presented in Plate 1.1.

Plate 1.1 Lower Thames Crossing route



1.3.2 The A122 road would be approximately 23km long, 4.25km of which would be in tunnel. On the south side of the River Thames, the Project route would link the tunnel to the A2 and M2. On the north side, it would link to the A13 and junction 29 of the M25. The tunnel entrances would be located to the east of the village of Chalk on the south of the River Thames and to the west of East Tilbury on the north side.

1.3.3 Junctions are proposed at the following locations:

a. New junction with the A2 to the south-east of Gravesend
b. Modified junction with the A13/ A1089 in Thurrock
c. New junction with the M25 between junctions 29 and 30

1.3.4 To align with NPSNN policy and to help the Project meet the Scheme Objectives, it is proposed that road user charges would be levied. Vehicles would be charged for using the new tunnel.

1.3.5 The Project route would be three lanes in both directions, except for:

a. link roads

b. stretches of the carriageway through junctions

c. the southbound carriageway from the M25 to the junction with the A13/ A1089, which would be two lanes

1.3.6 In common with other A-roads, the A122 would operate with no hard shoulder but would feature a 1m hard strip on either side of the carriageway. It would also feature technology including stopped vehicle and incident detection, lane control, variable speed limits and electronic signage and signalling. Our A122 road design outside of the tunnel includes emergency areas spaced at intervals between 800 metres and 1.6km (less than one mile). The tunnel would include a range of enhanced systems and response measures instead of emergency areas.

1.3.7 The A122 would be classified as an ‘all-purpose trunk road’ with green signs. For the benefit of safety, walkers, cyclists, horse-riders and slow-moving vehicles would be prohibited from using it.

1.3.8 The Project would include adjustment to a number of side roads. There would also be changes to a number of public rights of way, used by walkers, cyclists, and horse riders. Construction of the Project would also require the installation and diversion of a number of utilities, including gas pipelines, overhead power lines and underground electricity cables, as well as water supplies and telecommunications assets and associated infrastructure.

1.3.9 The Project has been developed to avoid or minimise significant effects on the environment. Some of the measures adopted include landscaping, noise mitigation, green bridges, floodplain compensation, new areas of ecological habitat and two new parks.

1.4 Structure of this report

1.4.1 The report provides the methodology of the modelling process including:

a. Chapter 2: Modelling scope;

b. Chapter 3: VISSIM model development;

c. Chapter 4: Modelling results;

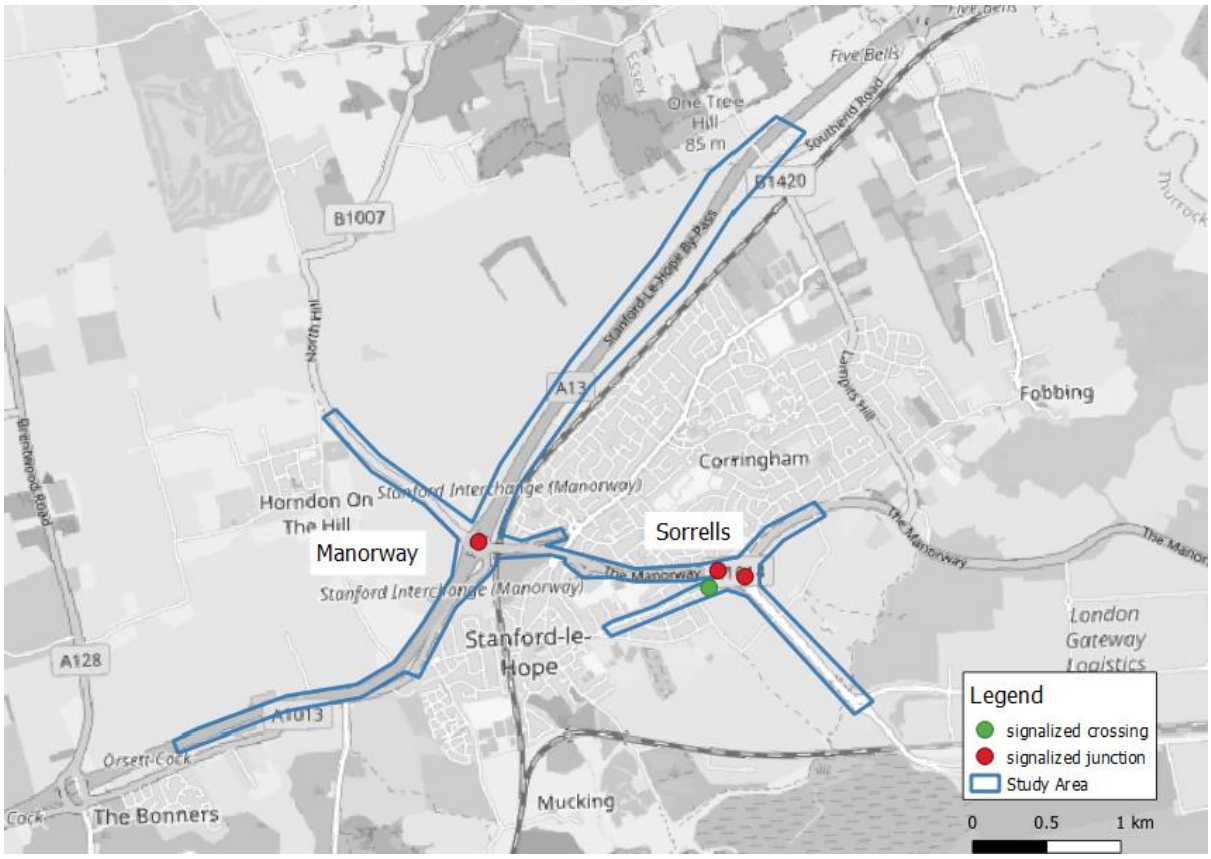
d. Chapter 5: Sensitivity tests; and

e. Chapter 6: Conclusion.

2 Modelling scope

2.1.1 The traffic operation study area is located north of Stanford-le-Hope and Plate 2.1 shows the extent of the study area covered by the VISSIM model. It includes three junctions and one signalised pedestrian crossing.

Plate 2.1 Traffic Operations Study Area



2.1.2 The list of junctions and the junction type included in the model is shown in Table 2.1 and Table 2.2 lists the standalone signalised pedestrian crossing included the model.

Table 2.1 Modelled Junctions and Junction Type

Nr	Junction	Junction Type
1	Manorway junction	Signalised junction
2	A1014 The Manorway/ The Sorrells	Signalised T-junction
3	Sorrells roundabout	Signalised roundabout

Table 2.2 Modelled Signalised Pedestrian Crossings

A	Pedestrian Crossings on Corringham Road (near Sorrells roundabout)

3 VISSIM model development

3.1 Technical guidance

3.1.1 The Department for Transport's (DfT) Transport Analysis Guidance (TAG) has little guidance specific to micro-simulation models. Therefore, in accordance with industry best practice, this operational appraisal references the Transport for London (TfL) modelling guidelines which cover micro-simulation models in detail, in particular:

a. Traffic Modelling Guidelines, TfL, Version 4.0 (September 2021); and

b. Model Auditing Process (MAP) – Traffic Schemes in London Urban Network, TfL, Version 3.5 (March 2017).

3.2 Network development

3.2.1 The Do Minimum (without the Project) and Do Something (with the Project) networks are the same, as there are no changes proposed to the network with the Project in operation.

3.2.2 The link structure for the network (Do Minimum and Do Something), including link lengths, connector turning movements, bus lanes and bus stop locations were coded using the latest available OS mapping, informed by online mapping.

3.2.3 Reduced speed areas were set up on all turning movements, with tighter turns having lower reduced speed values. Desired Speed decisions were used to set desired speeds on entry to the network and where there is a change in the posted speed limit. Vehicles attempt to travel in the model at this constant desired speed and will only adjust this speed if they approach a queue or are performing a lane change or enter a reduced speed area.

3.2.4 Priority rules have been used where one traffic movement has to give way to another traffic movement at priority junctions. The default values of a 5m headway and 3-second gap time were used.

3.2.5 Gap time and headway values were reviewed and updated as part of the model calibration process to replicate site conditions and these were then adjusted based upon considerations of geometry, position and the types of vehicles stopping. The gap times for heavy vehicles (buses and Heavy Goods Vehicles) are longer than for light vehicles (cars and Light Goods Vehicles). This reflects the fact that large vehicles have to wait for larger gaps in traffic than cars.

3.3 Signalised junctions and crossings

There are three signalised junctions in the study area and one signalised pedestrian crossing, as shown in Plate 2.1 and listed in Table 2.1 and

3.3.1 Table 2.2 respectively.

3.3.2 All signals within the VISSIM model were coded as fixed, apart from the one pedestrian crossing which was coded as demand dependant.

3.3.3 Intergreens were calculated and signal timings were optimised in relation to the traffic flows at the junctions.

3.3.4 All relevant PUA (interstage) files and VAP (controller logic) files accompany the VISSIM models.

3.4 Traffic signals optimisation

3.4.1 The operation of traffic signals in the Do Minimum and Do Something network were initially optimised using LinSIG models and then further fine-tuned in VISSIM to reflect the small changes in demand and arrival pattern of vehicles in the 15-minute intervals.

3.4.2 A cycle time of 60 seconds was used in the DM and DS models.

3.5 Traffic demand matrices

3.5.1 The model contains three vehicle classes:

a. Cars;

b. Light Goods Vehicles (LGVs); and

c. Heavy Goods Vehicles (HGVs).

3.5.2 The hourly matrices for cars, LGVs and HGVs were prepared using the actual flows directly from a cordon from the Project's transport model (the Lower Thames Area Model (LTAM) of the study area.

3.6 Public transport

3.6.1 The following bus routes have been included in the model:

a. 100

b. 27

c. Z4

3.6.2 Bus routes were coded separately from general traffic. They were coded using the VISSIM public transport lines feature, with a public transport line set up for each bus route. Bus route and frequency information was derived from publicly available bus timetable information. For all bus routes and bus stops, a dwell time of 10 seconds with a two second standard deviation has been modelled.

3.6.3 A summary of the modelled bus routes and their frequency is presented in Table 3.1.

Table 3.1 Modelled Bus Routes and Frequency

Bus Route	AM (07:00 – 08:00)	PM (17:00 – 18:00)
100 (EB)	4 per hour	4 per hour
100 (WB)	4 per hour	4 per hour
27 (EB)	1 per hour	1 per hour
27 (WB)	1 per hour	1 per hour

Bus Route	AM (07:00 – 08:00)	PM (17:00 – 18:00)
Z4 (EB)	1 per hour	1 per hour
Z4 (WB)	1 per hour	1 per hour

3.7 Traffic assignment

3.7.1 The traffic is assigned using 'dynamic assignment'. Origin-Destination (OD) matrices are used to connect all zones in the model area. As there is no route choice in the model, each OD pair has a unique route and converging the models was not required. Each model has 10x10 matrices for the warm-up period and the peak hour.

3.8 Number of random seed records

3.8.1 Traffic conditions are variable and this affects:

a. **Overall traffic volumes,** accounted for in VISSIM by selecting a representative peak hour.

b. **Random Driver Behaviours,** with traffic conditions varying day-to-day as a result of random driver behaviours such as speed selection, lane changing, route choice and bus dwell times. The stochastic micro-simulation traffic model in VISSIM attempts to replicate this day-to-day random variability by altering individual driver decisions based on random numbers. The set of random numbers is generated from an initial 'seed' value specified at the start of a simulation run. A single set of random numbers, generated by a single seed value, therefore represents one potential outcome, or one particular day of traffic operation. The actual value of the seed has no significance, however the seeds for different runs must be different from each other in order to produce different outcomes. Based on industry best practice and modelling guidelines, the recommended number of random seed runs is a minimum of 20 (TfL Traffic Modelling Guidelines, Version 4.0).

3.8.2 Model outputs based on 20 runs with different random seeds were considered adequate for the Manorway operational appraisal. This is also consistent with the other VISSIM models developed for the Project.

4 Modelling results

4.1 Journey times

4.1.1 Eight key routes were identified for which journey time results were collected. The eight routes are listed below:

a. Route 1: A13 South to A13 North

b. Route 2: A13 North to A13 South

c. Route 3: A13 South to Port Access

d. Route 4: Port Access to A13 South

e. Route 5: A13 North to Port Access

f. Route 6: Port Access to A13 North

g. Route 7: B1007 to Port Access

h. Route 8: Port Access to B1007

4.1.2 The routes are shown schematically in the maps in Plate 4.1 to Plate 4.4.

Plate 4.1 Journey time routes 1 and 2

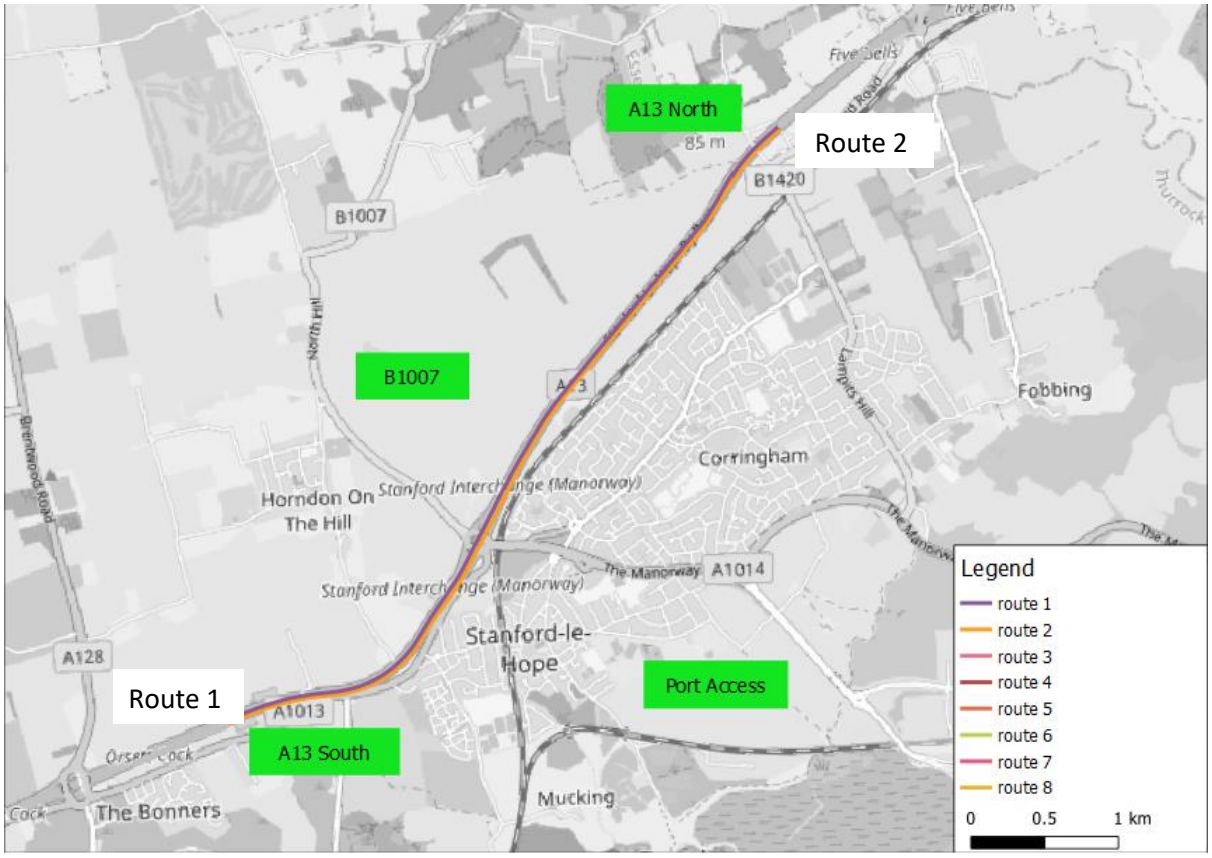


Plate 4.2 Journey time routes 3 and 4

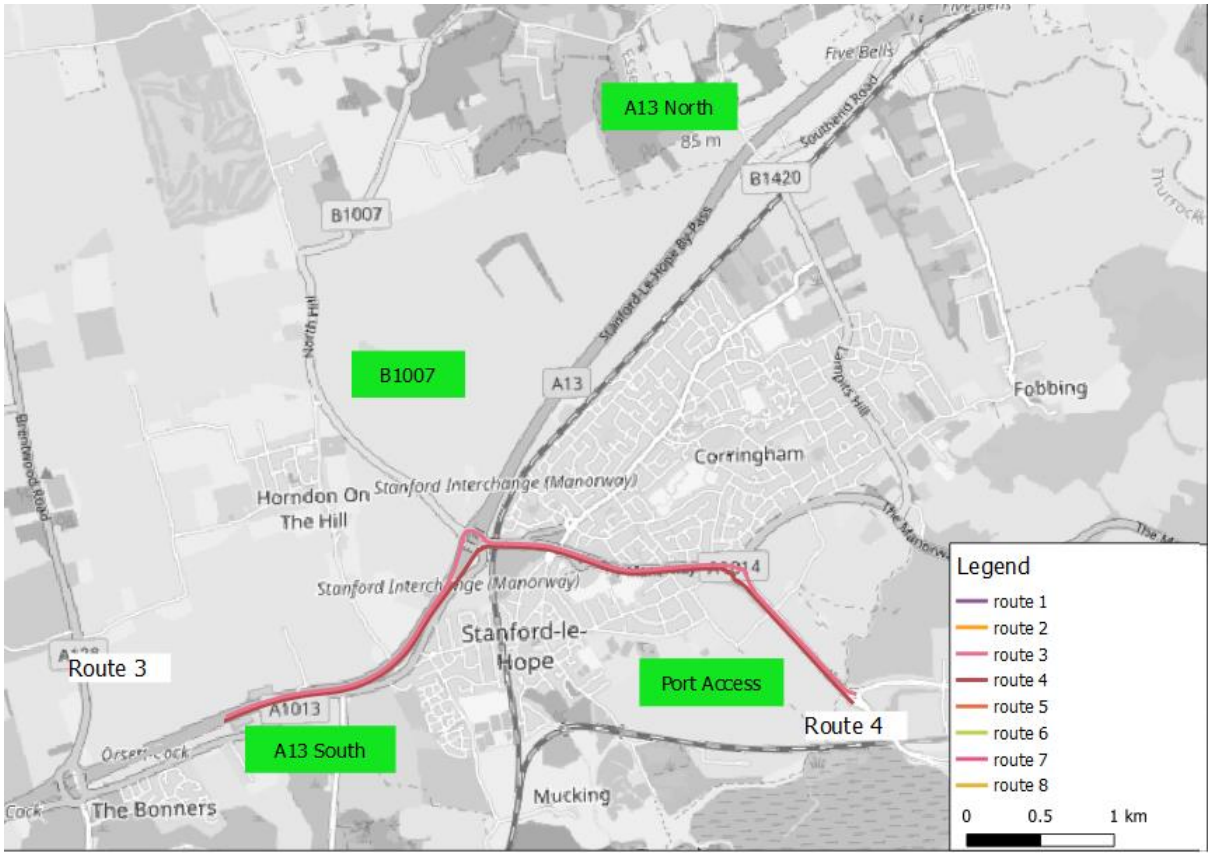


Plate 4.3 Journey time routes 5 and 6

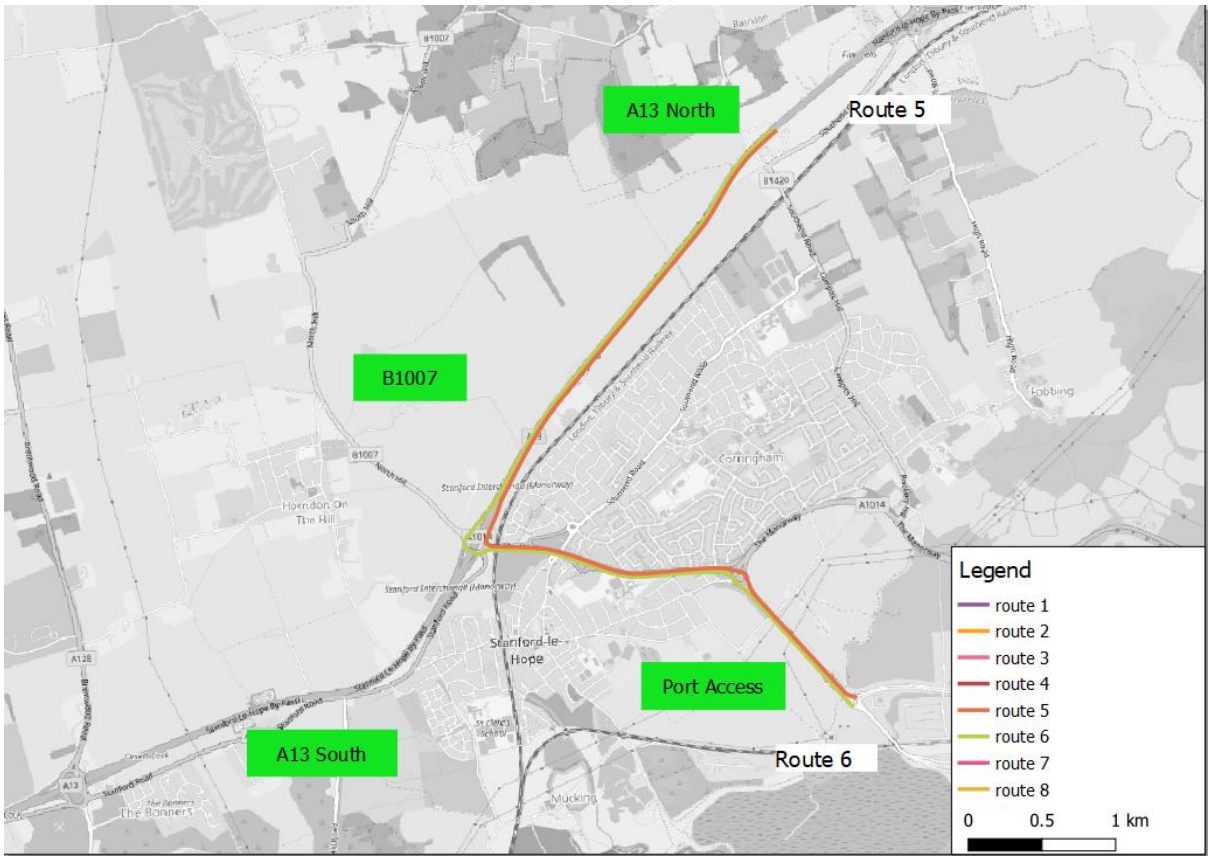
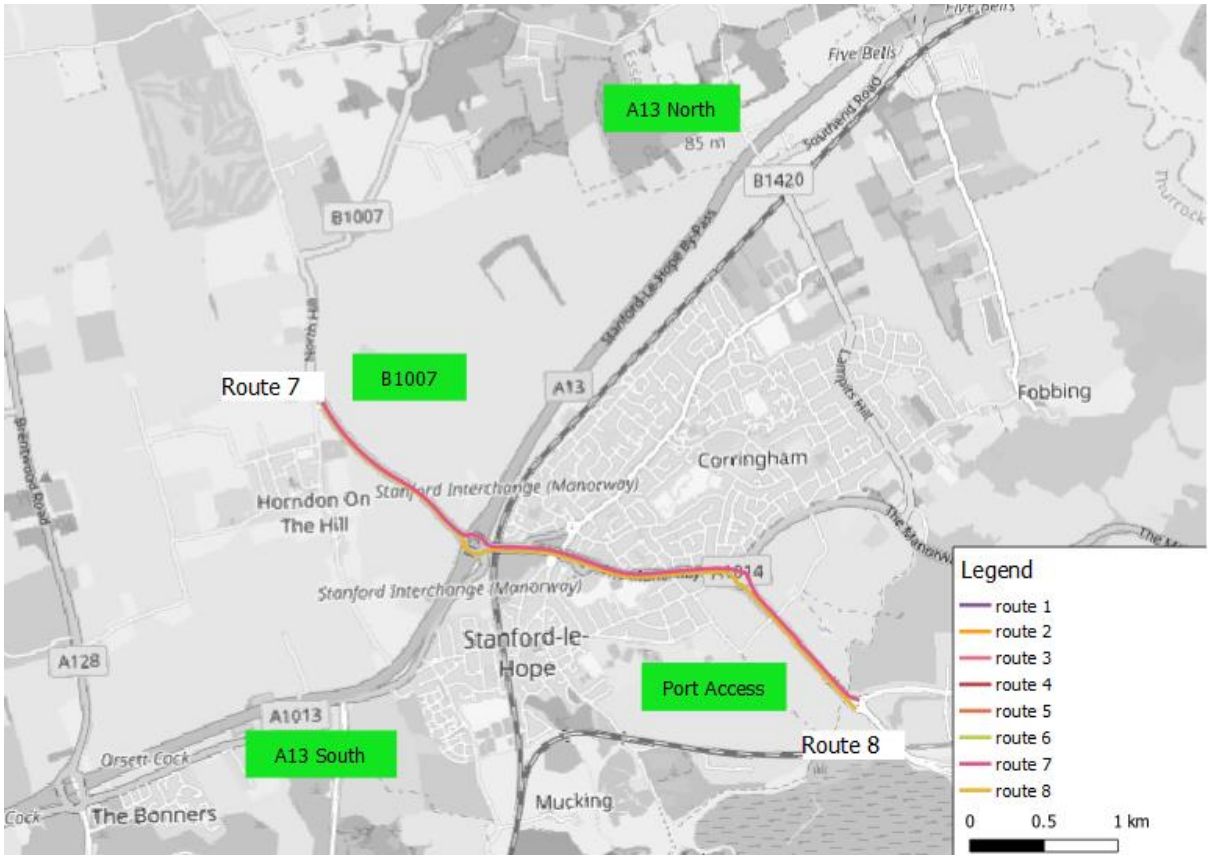


Plate 4.4 Journey time routes 7 and 8



4.1.3 The journey time comparisons between the Do Minimum (without the Project) and Do Something (with the Project) scenarios for the opening year 2030 and design year 2045 in the AM and PM peaks, are presented in Table 4.1 and Table 4.2 respectively.

Table 4.1 Journey times DM v DS – AM Peak

	Journey Times [s]					
	Do-Minimum		Do-Something		Difference (DS-DM)	
Route	**2030 AM**	**2045 AM**	**2030 AM**	**2045 AM**	**2030 AM**	**2045 AM**
1. A13 South to A13 North	103	105	104	106	2	1
2. A13 North to A13 South	111	114	126	135	15	21
3. A13 South to Port Access	238	240	244	242	7	2
4. Port Access to A13 South	225	221	231	239	5	18
5. A13 North to Port Access	205	206	207	213	2	7
6. Port Access to A13 North	258	265	258	264	-1	-2
7. B1007 to Port Access	205	208	209	207	4	0
8. Port Access to B1007	207	202	204	207	-2	5

4.1.4 In the AM peak the model predicts a journey time increase on the A13 southbound of 15 seconds in 2030 and 21 seconds in 2045. The journey time from the Port access to the A13 south is also predicted to increase by 18 seconds in 2045. The rest of the routes show journey time differences of less than 10 seconds.

Table 4.2 Journey times DM v DS – PM Peak

	Journey Times [s]					
	Do-Minimum		Do-Something		Difference (DS-DM)	
Route	**2030 PM**	**2045 PM**	**2030 PM**	**2045 PM**	**2030 PM**	**2045 PM**
1. A13 South to A13 North	105	105	106	110	2	5
2. A13 North to A13 South	104	109	116	140	13	31
3. A13 South to Port Access	240	242	238	246	-2	3
4. Port Access to A13 South	217	224	232	246	15	22
5. A13 North to Port Access	204	206	207	221	3	15
6. Port Access to A13 North	282	290	276	281	-6	-9
7. B1007 to Port Access	206	211	203	203	-4	-8
8. Port Access to B1007	210	213	216	220	6	7

4.1.5 In the PM peak the model predicts a journey time increase on the A13 southbound of 13 seconds in 2030 and 31 seconds in 2045. The journey time from the Port access to the A13 south is also predicted to increase by 15 seconds and 22 seconds in 2030 and 2045 respectively. Additionally, the journey time from the A13 North to the Port access is forecast to increase by 15 seconds. The rest of the routes show journey time differences of less than 10 seconds.

4.2 Queue length results

4.2.1 Queue length results have been collected for all junction approaches. The locations of queue counters at the Manorway junction are shown in Plate 4.5, and Plate 4.6 shows the locations of queue counters on the A1014 The Manorway and at Sorrells roundabout.

Plate 4.5 Queue counters – Manorway roundabout

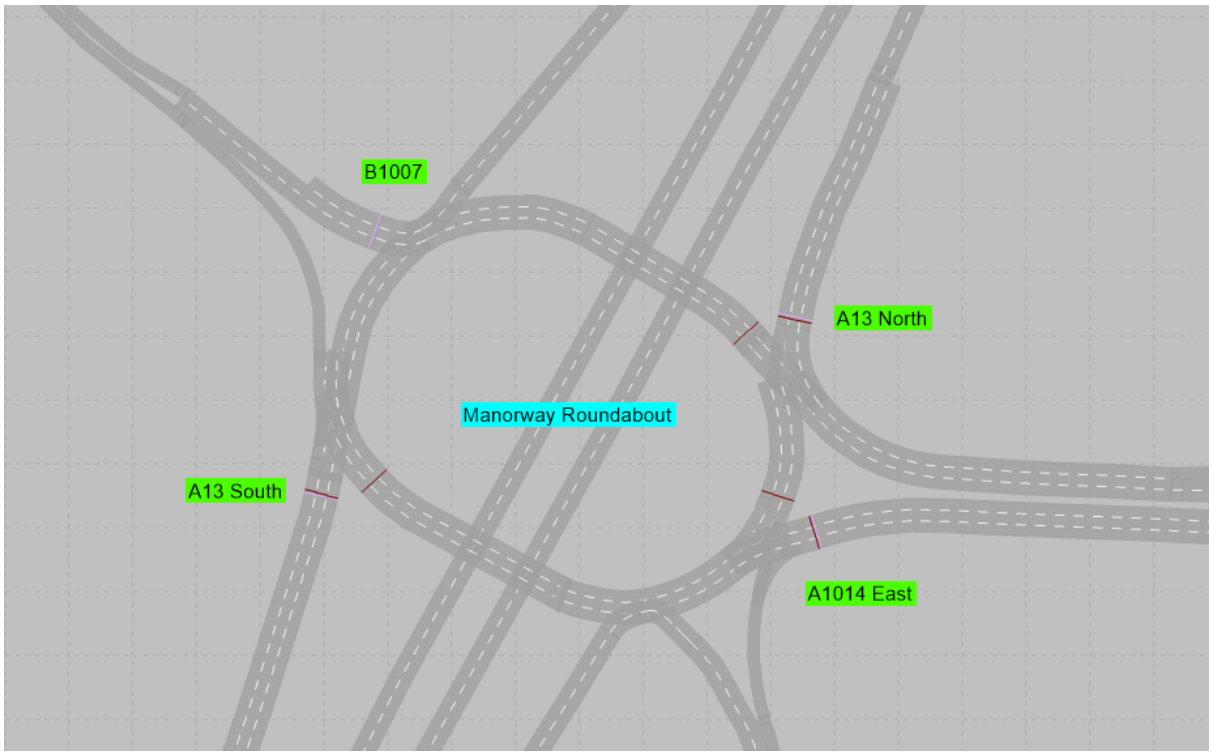
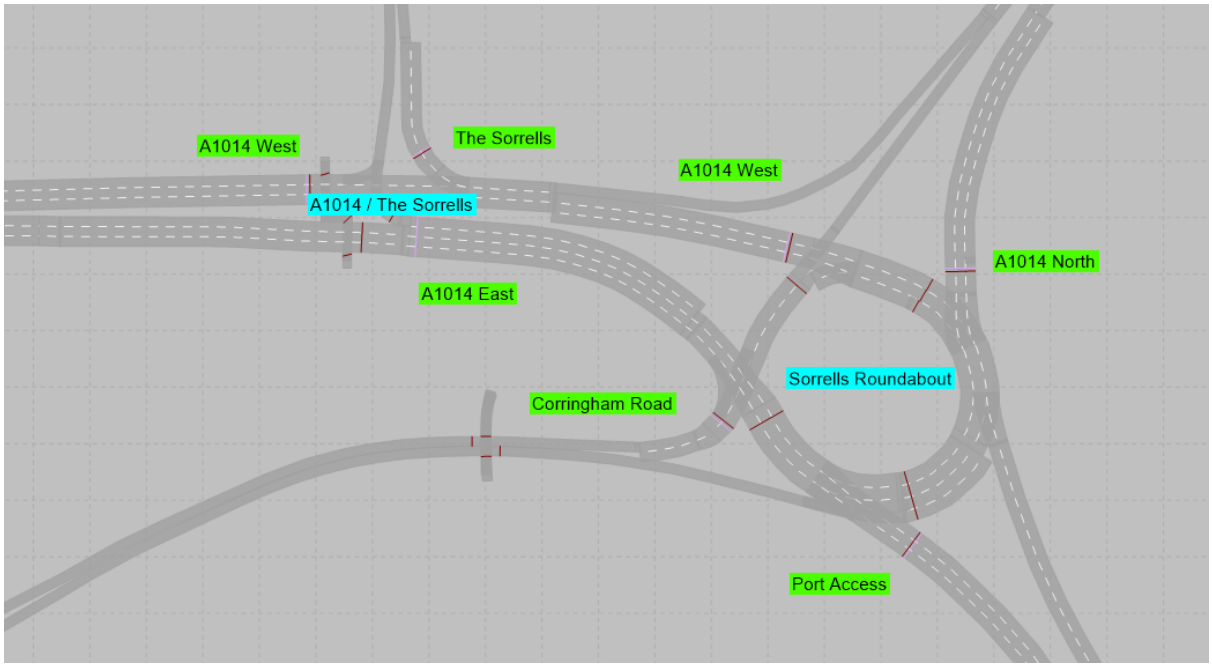


Plate 4.6 Queue counters – A1014 The Manorway, The Sorrels & Sorrells roundabout



4.2.2 Queue counters have been located at the stop lines of each approach in the model. VISSIM considers a vehicle to be in a queue when its speed drops below 5kph and to have left a queue when its speed increases above 10kph and stops measuring the queue when there is a gap of more than 20m between two individual vehicles.

4.2.3 The queue length results from the 2030 and 2045 model runs are presented in Plate 4.7 and Plate 4.8 respectively. The graphs show the Mean Max Queue (MMQ) results which is the average of the maximum queue on each approach in 5-minute intervals.

4.2.4 The results indicate similar levels of queuing between Do Minimum (without the Project) and Do Something (with the Project) scenarios, with differences of less than four vehicles predicted at each of the individual approaches of all the three modelled junctions.

Plate 4.7 Mean Max Queue - 2030

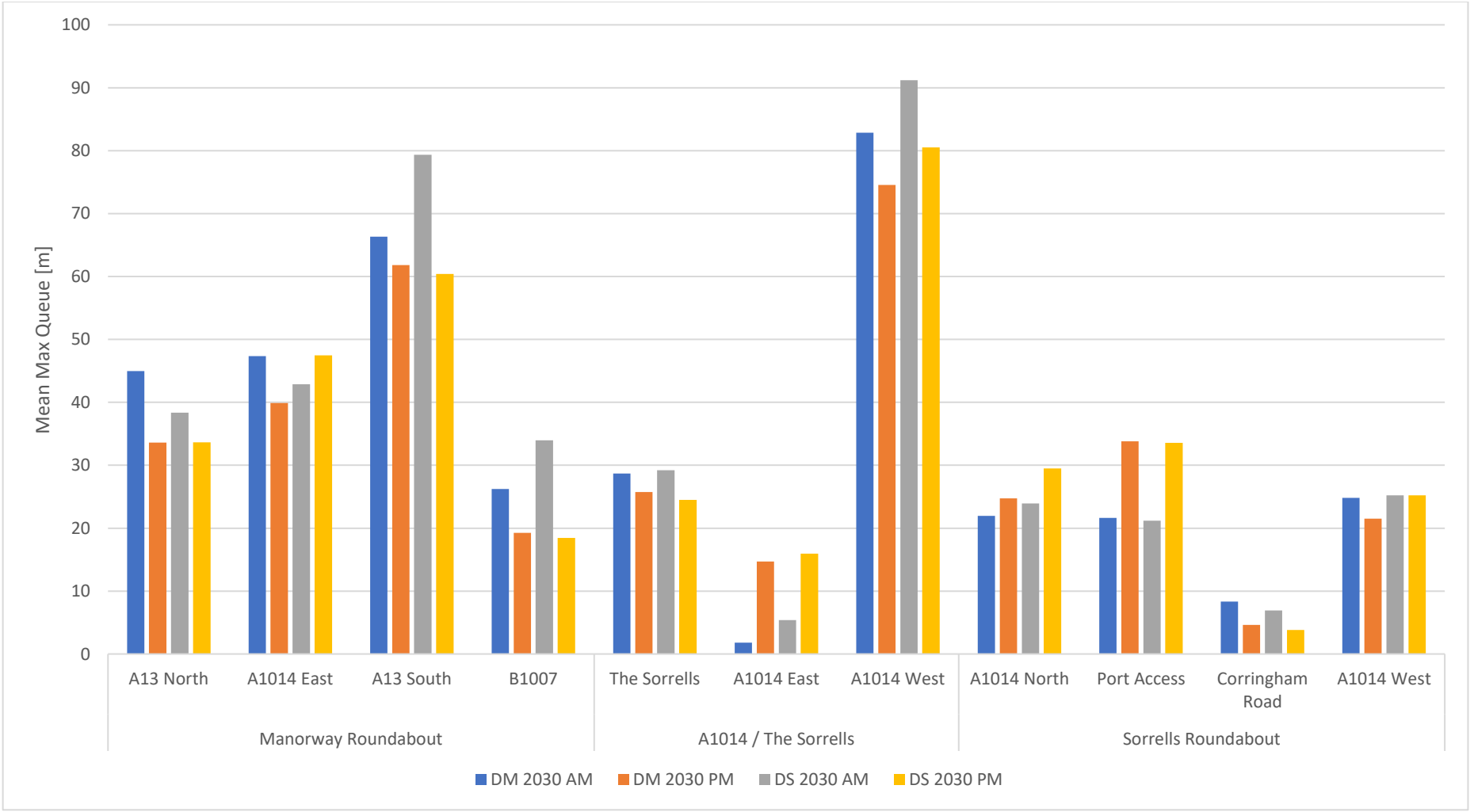
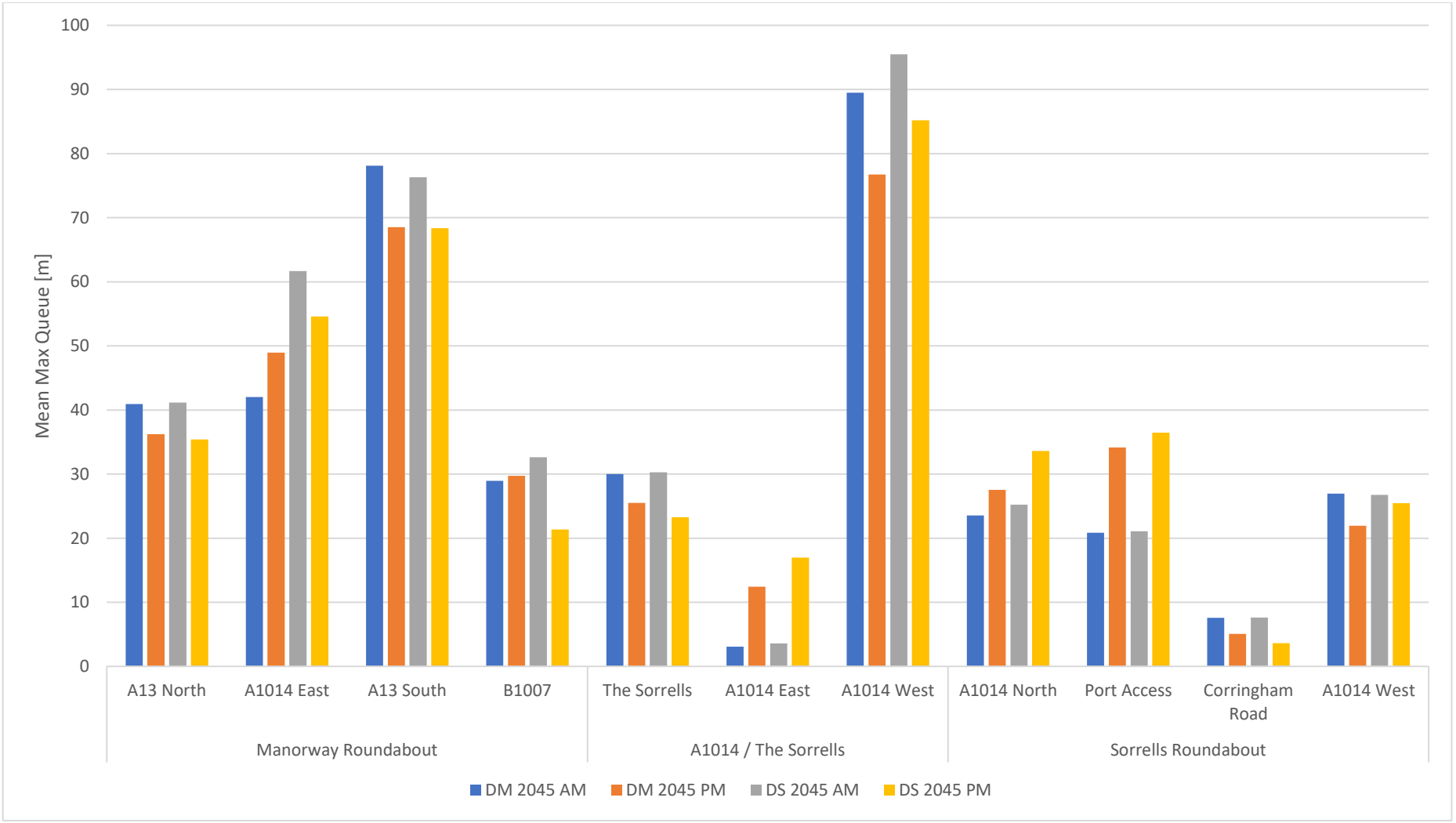


Plate 4.8 Mean Max Queue - 2045



4.3 Junction results

4.3.1 The node evaluation or predicted performance results at junctions for the 2030 Do Minimum and Do Something, and 2045 Do Minimum and Do Something scenarios, are shown in Table 4.3 and Table 4.4 respectively, and have been measured in terms of the difference (with the Project minus without the Project) of the following:

a. Predicted total hourly throughput flow in vehicles;

b. Average delay in seconds for each route from an approach; and

c. Average approach delay which is the average of all delays originating from the approach along all possible routes.

4.3.2 The average values for flows and delays are the weighted average of all 20 random seed runs.

Table 4.3 Flows and Delays for 2030

			DM 2030 AM		DM 2030 PM		DS 2030 AM		DS 2030 PM		AM Difference		PM Difference	
Junction	**Approach**	**To**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**
Manorway Junction	A13 North (off-slip)	A13 North (on-slip)	0	0	0	0	0	0	0	0	0	0	0	0
		A1014 East	371	21.7	353	19.4	313	20.7	294	21.7	-58	-1	-59	2.3
		A1013 South	71	30.2	91	30.7	86	37	106	33.6	15	6.8	15	2.9
		B1007 West	15	48.6	11	50.5	11	49.2	10	55.8	-4	0.6	-1	5.3
		Average approach delay										**2.2**		**3.5**
	A1014 East	A1014 East	0	0	0	0	0	0	0	0	0	0	0	0
		A1013 South	34	7.7	77	4.8	33	6.3	72	5.2	-1	-1.5	-5	0.5
		A13 South (on-slip)	1012	7.8	1206	4.6	1295	6.3	1628	5.7	283	-1.4	422	1.1
		B1007 West	81	12.1	428	14.6	75	12.8	351	19.5	-6	0.7	-77	4.9
		A13 North (on-slip)	418	14	563	13.9	365	13.1	228	16	-53	-0.9	-335	2.1
		Average approach delay										**-0.8**		**2.1**
	A1013 South	A1013 South	0	0	0	0	0	0	0	0	0	0	0	0
		A13 South (on-slip)	0	0	0	0	83	7.9	120	10.2	83	7.9	120	10.2

			DM 2030 AM		DM 2030 PM		DS 2030 AM		DS 2030 PM		AM Difference		PM Difference	
Junction	**Approach**	**To**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**
		B1007 West	38	17.5	74	24.5	31	20.7	107	33.7	-7	3.2	33	9.2
		A13 North (on-slip)	255	24.9	176	30.6	199	31.5	47	33.2	-56	6.6	-129	2.6
		A1014 East	77	29.9	31	34.1	80	35.2	46	35.1	3	5.2	15	1
		Average approach delay										**5.7**		**5.7**
	A13 South (off-slip)	A13 South (on-slip)	0	0	0	0	35	48.3	27	41.9	35	48.3	27	41.9
		B1007 West	408	13.9	452	14.5	415	13.9	408	10.2	7	-0.1	-44	-4.3
		A1014 East	1101	17.9	1012	17.6	1266	22.4	1197	13.8	165	4.5	185	-3.8
		A1013 South	0	0	0	0	0	0	0	0	0	0	0	0
		Average approach delay										**17.6**		**11.2**
	B1007 West	B1007 West	0	0	0	0	0	0	0	0	0	0	0	0
		A13 North (on-slip)	24	4.9	25	5.3	23	4.8	18	3.7	-1	-0.1	-7	-1.6
		A1014 East	184	11.9	257	12.4	69	12.1	225	8.9	-115	0.1	-32	-3.5
		A1013 South	50	42.3	30	41.2	41	48.7	45	36.6	-9	6.5	15	-4.5
		A13 South (on-slip)	318	39.8	209	40.3	443	45.3	237	34.7	125	5.5	28	-5.6

			DM 2030 AM		DM 2030 PM		DS 2030 AM		DS 2030 PM		AM Difference		PM Difference	
Junction	**Approach**	**To**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**
		Average approach delay										**3**		**-3.8**
A1014 / The Sorrells	The Sorrels	A1014 East	191	21.7	171	20.4	198	20.6	175	19.3	7	-1.2	4	-1.1
		Average approach delay										**-1.2**		**-1.1**
	A1014 East	A1014 West	907	1.2	1727	4.9	965	3.6	1671	5	58	2.4	-56	0.1
		The Sorrels	15	19.1	66	18.6	14	18.2	88	18.7	-1	-0.9	22	0.1
		Average approach delay										**0.8**		**0.1**
	A1014 West	The Sorrels	59	13.1	189	14.1	60	14.4	163	15.5	1	1.3	-26	1.4
		A1014 East	1347	10.4	739	11.2	1354	11.3	865	12.8	7	0.9	126	1.6
		Average approach delay										**1.1**		**1.5**
Sorrells roundabout	A1014 North	A1014 North	15	14.8	32	22.4	15	20.8	104	27.4	0	6	72	5
		Port Access	66	9.5	15	8	123	10.1	14	8.7	57	0.6	-1	0.8
		Corringham Rd	19	9	29	10.8	18	11.8	27	12.3	-1	2.8	-2	1.5
		A1014 West	487	10.7	773	19.3	547	18.4	796	20.6	60	7.7	23	1.3

			DM 2030 AM		DM 2030 PM		DS 2030 AM		DS 2030 PM		AM Difference		PM Difference	
Junction	**Approach**	**To**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**
		Average approach delay										**4.3**		**2.1**
	Port access	Port Access	0	0	0	0	0	0	0	0	0	0	0	0
		Corringham Rd	4	8.3	29	8.3	4	8.1	28	8.1	0	-0.2	-1	-0.2
		A1014 West	283	16.9	861	11.4	283	10.2	812	11.5	0	-6.7	-49	0.1
		A1014 North	16	28.7	40	24.4	16	24.2	87	26.4	0	-4.5	47	2
		Average approach delay										**-3.8**		**0.6**
	Corringham Road	Corringham Rd	0	0	0	0	0	0	0	0	0	0	0	0
		A1014 West	9	10.2	13	9.8	9	9.5	10	8.4	0	-0.7	-3	-1.4
		A1014 North	37	21.8	13	22.6	37	21	12	19.9	0	-0.9	-1	-2.7
		Port Access	22	29.6	2	33.5	20	33.3	2	32.4	-2	3.7	0	-1.1
		Average approach delay										**0.7**		**-1.7**
	A1014 West	A1014 West	144	24.7	149	38.6	140	33.4	144	38.9	-4	8.7	-5	0.4
		A1014 North	618	0.9	400	0.6	689	0.9	527	0.8	71	0.1	127	0.1
		Port Access	763	5	313	5	710	5.1	316	5	-53	0.1	3	-0.1
		Corringham Rd	13	28.6	47	18	12	29.8	52	18.8	-1	1.1	5	0.9

			DM 2030 AM		DM 2030 PM		DS 2030 AM		DS 2030 PM		AM Difference		PM Difference	
Junction	**Approach**	**To**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**
		Average approach delay										**2.5**		**0.3**

Table 4.4 Flows and Delays for 2045

			DM 2045 AM		DM 2045 PM		DS 2045 AM		DS 2045 PM		AM Difference		PM Difference	
Junction	**Approach**	**To**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**
Manorway Roundabout	A13 North (off-slip)	A13 North (on-slip)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		A1014 East	386	21.2	387	19.3	301	23.6	228	25.8	-85	2.5	-159	6.6
		A1013 South	89	32.0	108	32.6	106	31.8	98	33.1	17	-0.2	-10	0.6
		B1007 West	16	50.1	13	50.8	8	48.1	8	49.5	-8	-2.0	-5	-1.3
		Average approach delay										**0.1**		**2.0**
	A1014 East	A1014 East	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		A1013 South	41	6.0	100	5.7	47	8.9	109	6.5	6	2.8	9	0.8
		A13 South (on-slip)	1136	6.1	1300	5.7	1436	8.3	1704	6.9	300	2.2	404	1.2
		B1007 West	112	12.8	508	16.6	139	15.2	448	20.8	27	2.4	-60	4.2
		A13 North (on-slip)	397	13.4	558	15.4	233	13.3	93	17.5	-164	-0.1	-465	2.1
		Average approach delay										**1.8**		**2.1**
	A1013 South	A1013 South	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		A13 South (on-slip)	0	0.0	0	0.0	86	9.0	95	11.4	86	9.0	95	11.4
		B1007 West	51	17.6	91	27.1	58	26.2	111	32.3	7	8.6	20	5.1

			DM 2045 AM		DM 2045 PM		DS 2045 AM		DS 2045 PM		AM Difference		PM Difference	
Junction	**Approach**	**To**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**
		A13 North (on-slip)	307	31.2	119	32.0	154	32.2	41	29.7	-153	1.0	-78	-2.3
		A1014 East	98	37.6	39	34.7	86	34.7	80	30.8	-12	-2.9	41	-3.9
		Average approach delay										**3.9**		**2.6**
	A13 South (off-slip)	A13 South (on-slip)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		B1007 West	481	14.5	438	14.4	360	11.4	416	11.8	-121	-3.1	-22	-2.6
		A1014 East	1196	19.3	1123	19.2	1381	20.2	1258	16.6	185	0.9	135	-2.7
		A1013 South	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		Average approach delay										**-1.1**		**-2.6**
	B1007 West	B1007 West	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		A13 North (on-slip)	29	5.8	28	6.1	23	4.2	17	3.5	-6	-1.6	-11	-2.6
		A1014 East	126	12.1	237	14.2	76	10.8	312	7.9	-50	-1.2	75	-6.3
		A1013 South	48	43.8	39	45.2	53	41.3	75	31.1	5	-2.5	36	-14.1
		A13 South (on-slip)	352	41.7	237	43.3	464	39.1	229	30.6	112	-2.7	-8	-12.8
		Average approach delay										**-2.0**		**-8.9**

			DM 2045 AM		DM 2045 PM		DS 2045 AM		DS 2045 PM		AM Difference		PM Difference	
Junction	**Approach**	**To**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**
A1014 / The Sorrells	The Sorrells	A1014 East	205	21.0	171	20.0	212	20.9	171	19.1	7	-0.1	0	-0.9
		Average approach delay										**-0.1**		**-0.9**
	A1014 East	A1014 West	950	3.0	1810	4.6	983	3.0	1654	5.1	33	0.0	-156	0.4
		The Sorrells	14	17.9	63	18.9	13	18.7	97	18.4	-1	0.8	34	-0.5
		Average approach delay										**0.4**		**0.0**
	A1014 West	The Sorrells	60	13.0	190	14.5	60	11.1	153	16.7	0	-2.0	-37	2.2
		A1014 East	1375	10.5	841	11.6	1488	9.5	1016	13.9	113	-1.0	175	2.3
		Average approach delay										**-1.5**		**2.2**
Sorrells Roundabout	A1014 North	A1014 North	16	20.1	33	25.6	44	21.1	158	27.6	28	1.0	125	2.0
		Port Access	86	9.5	15	8.0	107	9.7	14	9.0	21	0.2	-1	1.0
		Corringham Rd	22	11.5	31	12.4	19	11.8	28	11.6	-3	0.3	-3	-0.8
		A1014 West	532	17.6	854	20.2	559	17.6	842	19.9	27	0.1	-12	-0.3
		Average approach delay										**0.4**		**0.5**
	Port Access	Port Access	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

			DM 2045 AM		DM 2045 PM		DS 2045 AM		DS 2045 PM		AM Difference		PM Difference	
Junction	**Approach**	**To**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**
		Corringham Rd	4	8.1	28	8.6	3	9.4	28	8.5	-1	1.2	0	-0.1
		A1014 West	282	10.0	858	11.7	284	10.8	768	12.8	2	0.7	-90	1.1
		A1014 North	16	20.6	41	17.9	15	20.7	128	29.3	-1	0.1	87	11.4
		Average approach delay										**0.7**		**4.1**
	Corringham Rd	Corringham Rd	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		A1014 West	9	8.9	13	8.6	9	10.4	9	9.4	0	1.6	-4	0.7
		A1014 North	39	22.8	16	24.6	37	23.3	9	20.9	-2	0.5	-7	-3.7
		Port Access	21	33.1	2	39.0	20	33.4	2	32.5	-1	0.2	0	-6.5
		Average approach delay										**0.8**		**-3.2**
	A1014 West	A1014 West	141	34.6	150	37.1	145	34.6	136	39.1	4	0.0	-14	2.0
		A1014 North	697	1.0	439	0.7	803	1.0	613	0.9	106	0.1	174	0.2
		Port Access	729	5.9	303	6.5	706	6.1	307	5.0	-23	0.2	4	-1.5
		Corringham Rd	13	29.4	119	16.6	45	17.4	131	17.6	32	-12.0	12	1.0
		Average approach delay										**-2.9**		**0.4**

4.3.3 The junction results indicate similar levels of delay between the Do Minimum and Do Something scenarios for the 2030 and 2045 future years, in the AM and PM peak periods for the listed routes at the junctions.

4.3.4 In 2030 the modelling predicts that at the Manorway junction the A13 South approach (off-slip) would experience an increase in average approach delay of approx. 18 seconds in the AM and approx. 12 seconds in the PM. The respective average approach delays on all the other approaches vary between a maximum increase of approx. six seconds and a maximum reduction of approx. four seconds.

4.3.5 At the A1014 The Manorway/ The Sorrells junction in 2030, the respective average approach delays vary between a maximum increase of approx. two seconds and a maximum reduction of approx. two seconds. At Sorrells roundabout it varies between a maximum of five seconds increase and a maximum of four seconds reduction.

4.3.6 In 2045 the modelling predicts that at the Manorway roundabout the A1013 approach would experience an increase in average approach delay of approx. four seconds in the AM and approx. three seconds in the PM. The respective average approach delays on all the other approaches vary between a maximum increase of approx. two to three seconds and a maximum reduction of approx. eight to nine seconds.

4.3.7 At the A1014 The Manorway/ The Sorrells junction in 2045, the respective average approach delays vary between a maximum increase of approx. three seconds and a maximum reduction of approx. two seconds. At Sorrells roundabout it varies between a maximum of five seconds increase and a maximum of four seconds reduction.

5 Sensitivity tests

5.1 Introduction

5.1.1 As shown in the modelling results analysis in the previous chapter, the VISSIM modelling is not predicting any noticeable changes to the delays with the introduction of the Project. Particularly in 2045 on the A13 North on-slip (northbound on-slip) the model predicts free-flow conditions both in the Do Minimum (without the Project) and Do Something (with the Project) scenarios, as shown in the relative delay plots in Plate A.7 and Plate A.8 in Appendix A.

5.1.2 The LTAM in 2045 however, as shown in Plate 5.1 and Plate 5.2 respectively, predicts additional delays of 65s in the AM Peak and 210s in the PM peak with the introduction of the Project compared to without the Project.

Plate 5.1 LTAM 2045 DS v DM Delay Difference – AM Peak

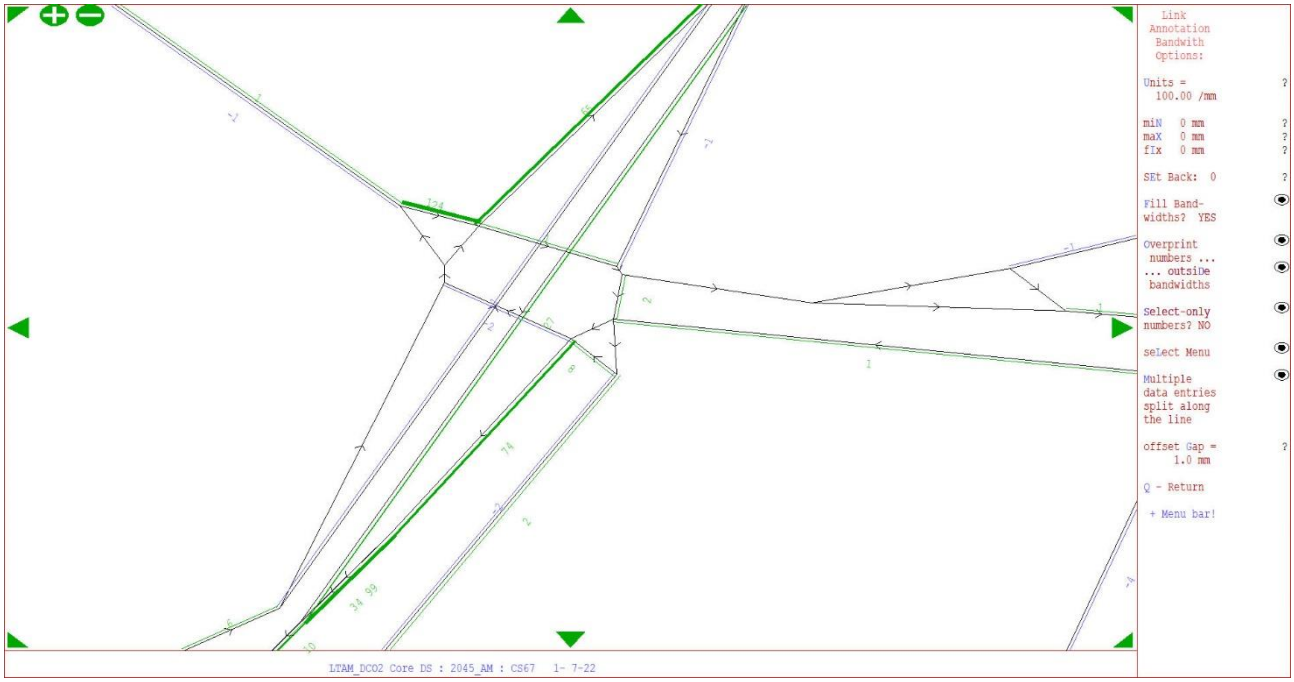
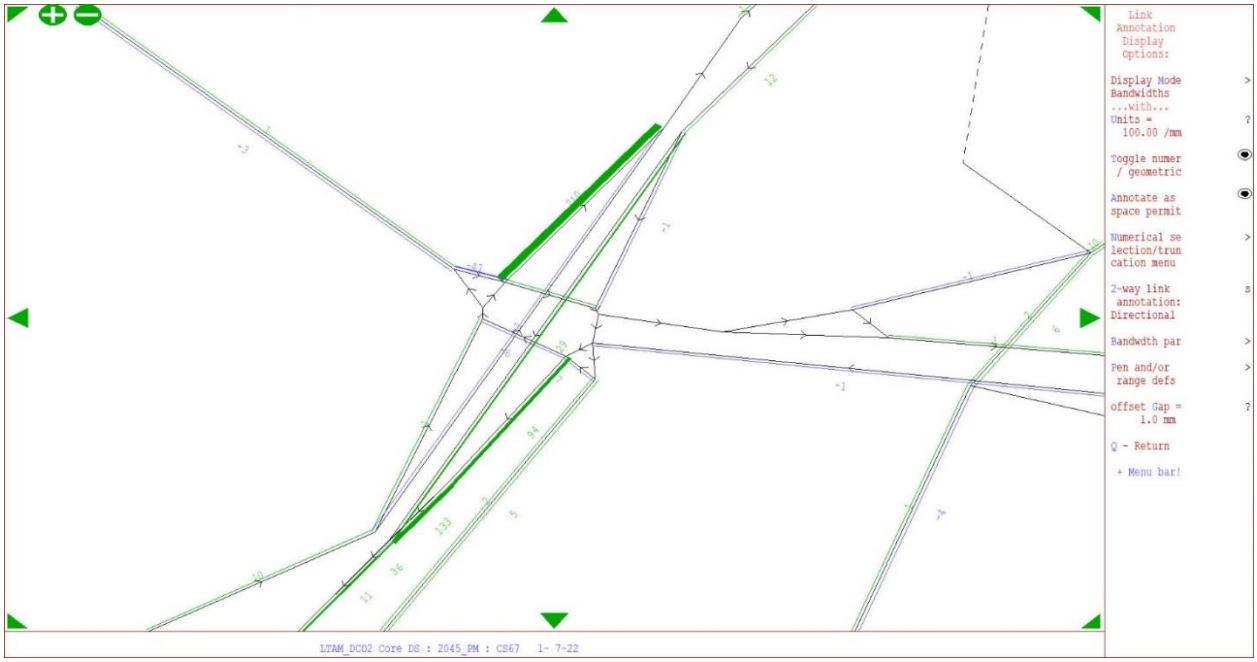


Plate 5.2 LTAM 2045 DS v DM Delay Difference – PM Peak



5.1.3 These delays on the A13 North on-slip suppress the flows accessing the A13 northbound via the slip road. Plate 5.3 and Plate 5.4 show the flow differences between Do Minimum and Do Something scenarios on A13 North on-slip specifically – the LTAM 2045 forecast shows approx. 400 less Passenger Car Units (PCU) in the AM peak and approx. 550 less PCUs in the PM peak in the Do Something model compared to the Do Minimum model.

Plate 5.3 LTAM 2045 DS v DM Flow Difference – AM Peak

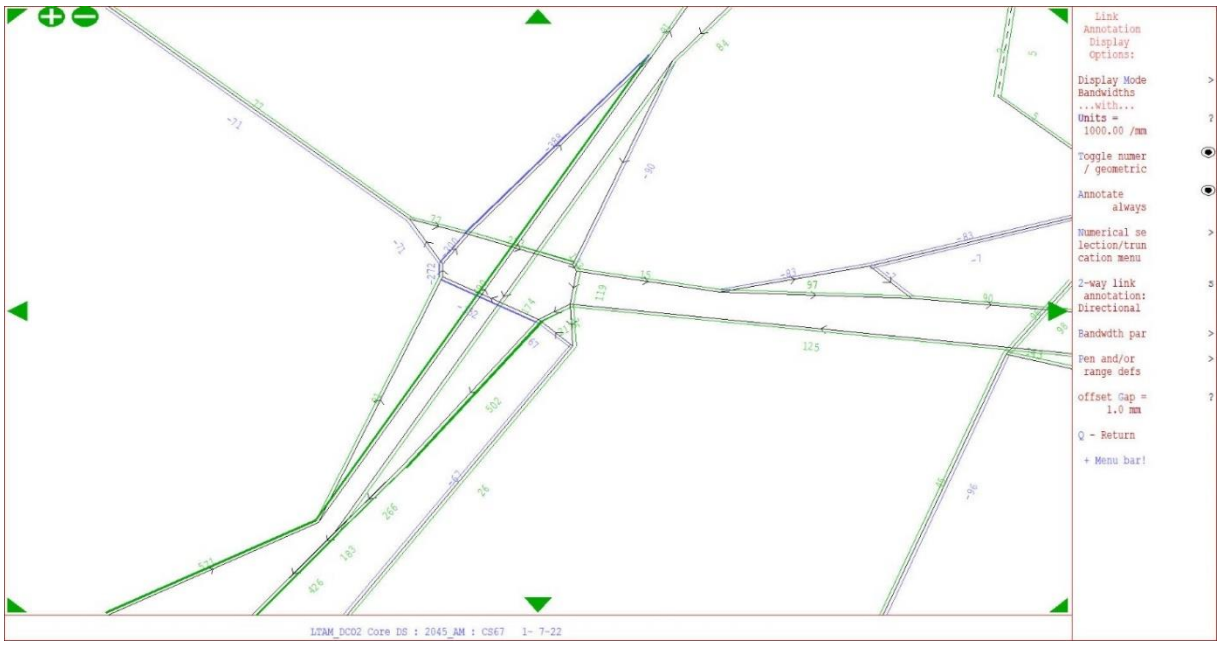
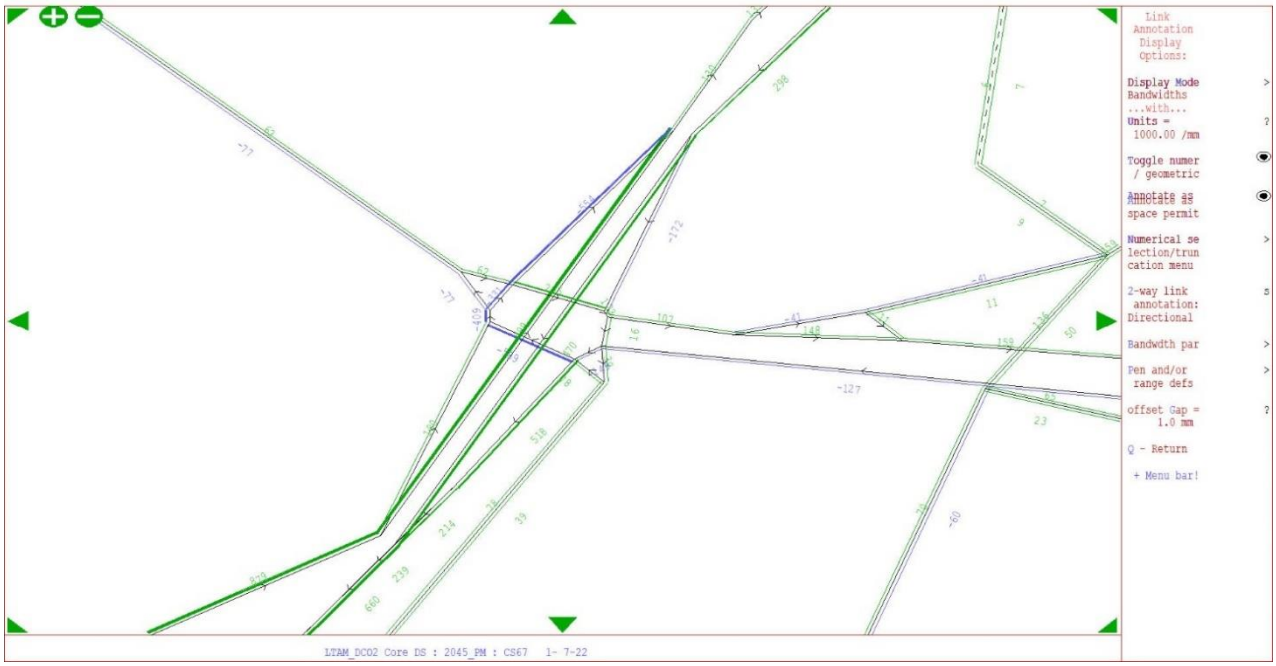


Plate 5.4 LTAM 2045 DS v DM Flow Difference – PM Peak



5.1.4 The traffic suppression in the LTAM is caused by the delays observed on the A13 North on-slip, which leads to traffic seeking alternative routes. Since VISSIM is not predicting similar delays on the slip road, it can be anticipated that more traffic would use the slip road to access the A13 northbound.

5.1.5 Therefore, a number of sensitivity tests were carried out, incrementally increasing the traffic volume on the A13 North on-slip. The additional flows were applied as a proportion of the flow difference between the Do Minimum and Do Something scenarios on the A13 North on-slip, distributed to originate proportionally from all zones.

5.1.6 The additional traffic was implemented only for cars as the flow differences in LGVs and HGVs between the Do Minimum and Do Something scenarios were negligible, indicating that it is the cars that mainly reroute to avoid the delay on the A13 North on-slip.

5.1.7 The sensitivity modelling scenarios tested are summarised below:

a. DS 2045 AM +35% (approx. +130 PCUs)

b. DS 2045 AM +70% (approx. +275 PCUs)

c. DS 2045 PM +25% (approx. +150 PCUs)

d. DS 2045 PM +50% (approx. +250 PCUs)

e. DS 2045 PM +70% (approx. +400 PCUs)

5.1.8 This analysis has only been carried out for the design year 2045 as the forecast flows are higher, giving an upper limit.

5.2 Journey time results

5.2.1 The journey time results for the eight key routes as defined in Section 4.1 and shown in Plate 5.5, are summarised in Table 5.1 and Table 5.2 for the AM and PM peaks respectively.

Plate 5.5 Key 8 Journey Time Routes

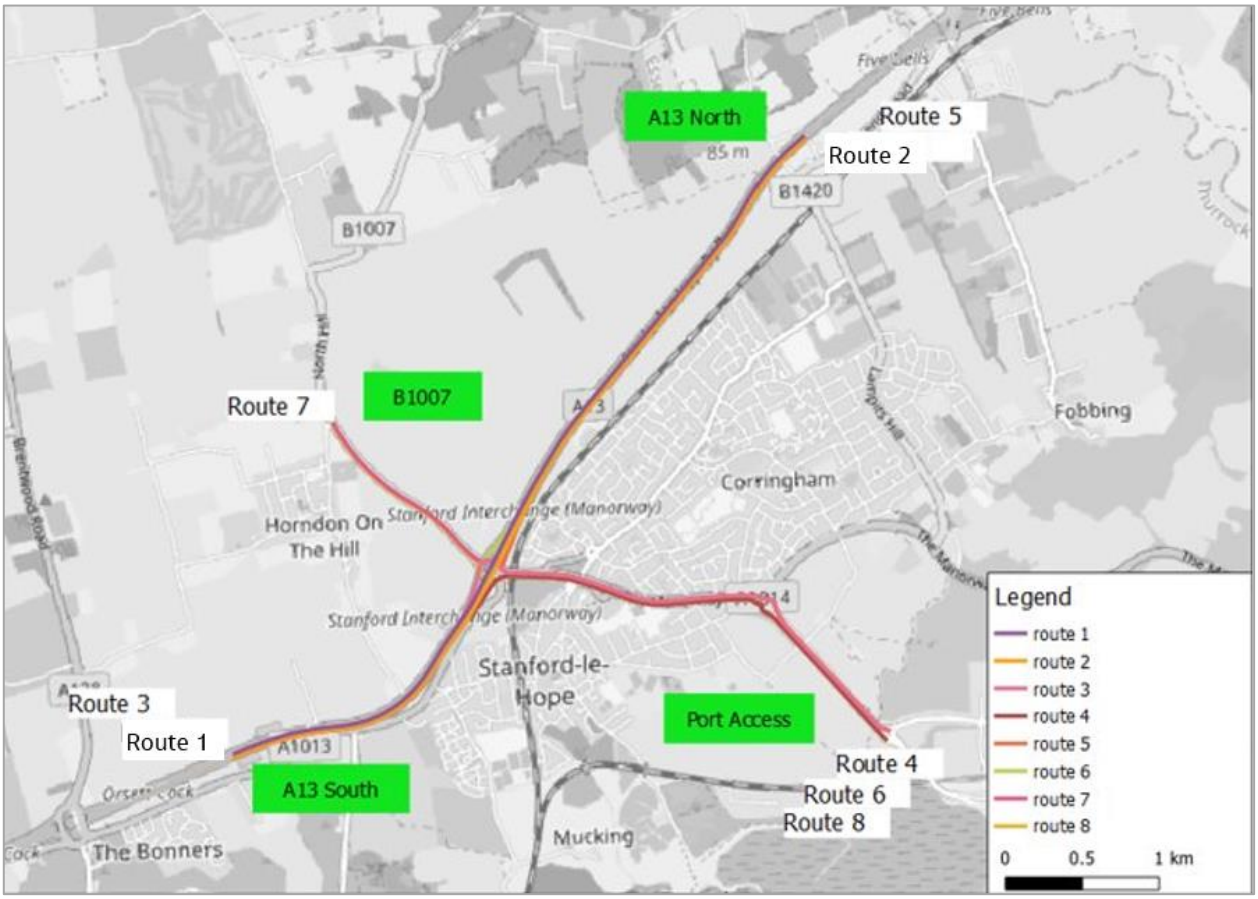


Table 5.1 Journey times – 2045 AM

	Journey Times [s]						
	Core Scenarios		Sensitivity Test		Difference		
Route	DM 2045 AM	DS 2045 AM	DS 2045 AM +35%	DS 2045 AM +70%	DS 2045 AM	DS 2045 AM +35%	DS 2045 AM +70%
1. A13 South to A13 North	105	106	106	108	1	1	3
2. A13 North to A13 South	114	135	135	131	21	21	17
3. A13 South to Port Access	240	242	243	246	2	2	6
4. Port Access to A13 South	221	239	239	240	18	18	19

	Journey Times [s]						
	Core Scenarios		Sensitivity Test		Difference		
Route	DM 2045 AM	DS 2045 AM	DS 2045 AM +35%	DS 2045 AM +70%	DS 2045 AM	DS 2045 AM +35%	DS 2045 AM +70%
5. A13 North to Port Access	206	213	213	211	7	7	6
6. Port Access to A13 North	265	264	262	386	-2	-4	121
7. B1007 to Port Access	208	207	208	259	0	0	52
8. Port Access to B1007	202	207	207	215	5	5	13

5.2.2 Table 5.1 shows the journey time results in the AM peak comparing the Do Minimum with the core Do Something, with the +35% Do Something sensitivity test and with the +70% Do Something sensitivity test.

5.2.3 The results indicate that the addition of the approx. 130 PCUs (in the Do Something +35% modelling scenario) has negligible changes to the journey times.

5.2.4 Doubling the amount of additional traffic (in the Do Something +70% modelling scenario) the journey time increases noticeably on route 6 (from the Port access to the A13 North on-slip) by approx. 2 minutes, as vehicles are queueing on A13 North on-slip to access the A13 northbound. This is shown in the relative delay plot in Plate A.9. Noticeable delay is also observed on route 7 (from the B1007 to the Port Access) as the queue on A13 North on-slip is blocking back to the Manorway roundabout.

Table 5.2 Journey times – 2045 PM

	Journey Times [s]								
	Core Scenarios		Sensitivity Test			Difference			
Route	DM 2045 PM	DS 2045 PM	DS 2045 PM +25%	DS 2045 PM +50%	DS 2045 PM +70%	DS 2045 PM	DS 2045 PM +25%	DS 2045 PM +50%	DS 2045 PM +70%
1. A13 South to A13 North	105	110	109	111	112	5	4	6	7
2. A13 North to A13 South	109	140	133	133	131	31	24	25	22
3. A13 South to Port Access	242	246	244	246	257	3	2	4	15

	Journey Times [s]								
	Core Scenarios		Sensitivity Test			Difference			
Route	**DM 2045 PM**	**DS 2045 PM**	**DS 2045 PM +25%**	**DS 2045 PM +50%**	**DS 2045 PM +70%**	**DS 2045 PM**	**DS 2045 PM +25%**	**DS 2045 PM +50%**	**DS 2045 PM +70%**
4. Port Access to A13 South	224	246	247	248	328	22	24	25	104
5. A13 North to Port Access	206	221	218	219	215	15	12	13	9
6. Port Access to A13 North	290	281	289	423	726	-9	-1	133	436
7. B1007 to Port Access	211	203	204	225	304	-8	-8	14	93
8. Port Access to B1007	213	220	221	223	332	7	8	10	119

5.2.5 In the PM peak, three sensitivity tests have been carried out, adding approx. 150, 250 and 400 PCUs respectively to the core Do Something flows.

5.2.6 In the Do Something +25% modelling scenario the results are similar to the core Do Something scenario, while in the Do Something +50% modelling scenario there is a noticeable journey time increase in route 6 of more than two minutes. Similar to the AM peak the additional traffic on the A13 North on-slip is causing the delay. This is shown in the relative delay plot in Appendix A.

5.2.7 In the final sensitivity test, the Do Something +70% modelling scenario, the delay increases, with route 6 showing an increase in journey time compared to the Do Minimum scenario of over seven minutes, while routes 7 and 8 (from the Port Access to the B1007 and vice versa) also show journey time increases of approx. one and a half minutes and approx. two minutes respectively. This occurs as the queue on the A13 North on-slip blocks back to Manorway junction. This is demonstrated in the relative delay plot in Plate A.13.

5.2.8 The queue and delay results for all the sensitivity tests are shown in Appendix B.

6 Conclusions

6.1.1 This report describes the development of the 2030 and 2045 Do Minimum (without the Project) and Do Something (with the Project) VISSIM operational assessment of the Manorway study area, which includes the Manorway junction.

6.1.2 The results of the models are analysed in comparison, evaluating the impact of the introduction of the Project on network traffic conditions.

6.1.3 The journey time results show modest journey time increases on the A13 southbound mainline and the A13 southbound on-slip in 2030 and 2045, in both the AM and PM peak hours. The journey time from the A13 southbound off-slip to the London Gateway port access also increases in 2045 in the PM peak hour by 15 seconds. All other routes show little journey time changes.

6.1.4 The LTAM forecasts a diversion of some traffic that wishes to use the A13 northbound on-slip to access the A13 mainline due to predicted congestion in the model – the LTAM 2045 forecast diverts approximately 400 Passenger Car Units (PCUs) or cars in the AM peak and approximately 550 PCUs (cars) in the PM peak.

6.1.5 However, the VISSIM modelling predicts that the slip road is not congested and can accommodate more traffic using the slip road to access the A13 northbound mainline.

6.1.6 A series of sensitivity tests (in VISSIM) have been carried out to introduce additional traffic on the A13 North on-slip in the Do Something scenario.

6.1.7 The sensitivity tests carried out (for 2045 only) show that adding 275 PCUs in the AM peak and 250 PCUs in the PM peak results in the slip road operating at capacity with delays of similar magnitude as suggested in the LTAM. This is less than the LTAM predicted diverted traffic from the A13 North on-slip (LTAM 2045 Do Minimum – Do Something forecast).

References

Transport for London (September 2021). Traffic Modelling Guidelines Version 4.0.

https://content.tfl.gov.uk/traffic-modelling-guidelines.pdf

Transport for London (March 2017). Model Auditing Process (MAP) Version 3.5. Engineer Guide for Design Engineer (DE), Checking Engineer (CE) and Model Auditing Engineer (MAE).

https://content.tfl.gov.uk/map-v3-5-engineer-guide.pdf

Glossary

Term	Explanation
ANPR	Automatic Number Plate Recognition
ATC	Automatic Traffic Count
DCO	Development Consent Order - Means of obtaining permission for developments categorised as Nationally Significant Infrastructure Projects (NSIPs)
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges: A comprehensive manual which contains requirements, advice and other published documents relating to works on motorway and all-purpose trunk roads for which one of the Overseeing Organisations (National Highways, Transport Scotland, the Welsh Government or the Department for Regional Development (Northern Ireland)) is the highway authority. For the Lower Thames Crossing, the Overseeing Organisation is National Highways.
Do Minimum	A future year scenario which includes changes to the road network and planned development that is forecast to go ahead, but not the Lower Thames Crossing.
Do Something	A future year scenario which includes changes to the road network and planned development that is forecast to go ahead, and the Lower Thames Crossing.
EB	Eastbound
GEH	A formula used to compare two traffic volumes, named after its originator, Geoff E. Havers. It is similar to a chi-squared test.
HGV	Heavy Goods Vehicle
LGV	Light Goods Vehicle
LinSig	A Design and Assessment Tool for Traffic Signal Junctions and Urban Networks
LMVR	Local Model Validation Report
LTC	Lower Thames Crossing
NB	Northbound
OS	Ordnance Survey
PTV	German for Planning Transport and Traffic Software package
SATURN	Simulation and Assignment of Traffic to Urban Networks
SB	Southbound
TAG	Transport Analysis Guidance published by DfT
TfL	Transport for London - The integrated body responsible for London's transport system

Term	Explanation
VISSIM	Micro-simulation software developed by PTV. Verkehr In Städten - SIMulationsmodell (German for "Traffic in cities - simulation model)
WB	Westbound

Appendix A – Relative delay plots

Plate A.1 DM 2030 AM

Plate A.2 DM 2030 PM

Plate A.3 DM 2045 AM

Plate A.4 DM 2045 PM

Plate A.5 DS 2030 AM

Plate A.6 DS 2030 PM

Plate A.7 DS 2045 AM

Plate A.8 DS 2045 PM

Plate A.9 Sensitivity Test DS 2045 AM +35%

Plate A.10 Sensitivity Test DS 2045 AM +70%

Plate A.11 Sensitivity Test DS 2045 PM +25%

Plate A.12 Sensitivity Test DS 2045 PM +50%

Plate A.13 Sensitivity Test DS 2045 PM +70%

Appendix B – Sensitivity tests queue and junction results

Plate B.1 Sensitivity Tests – Mean Max Queue AM Peak

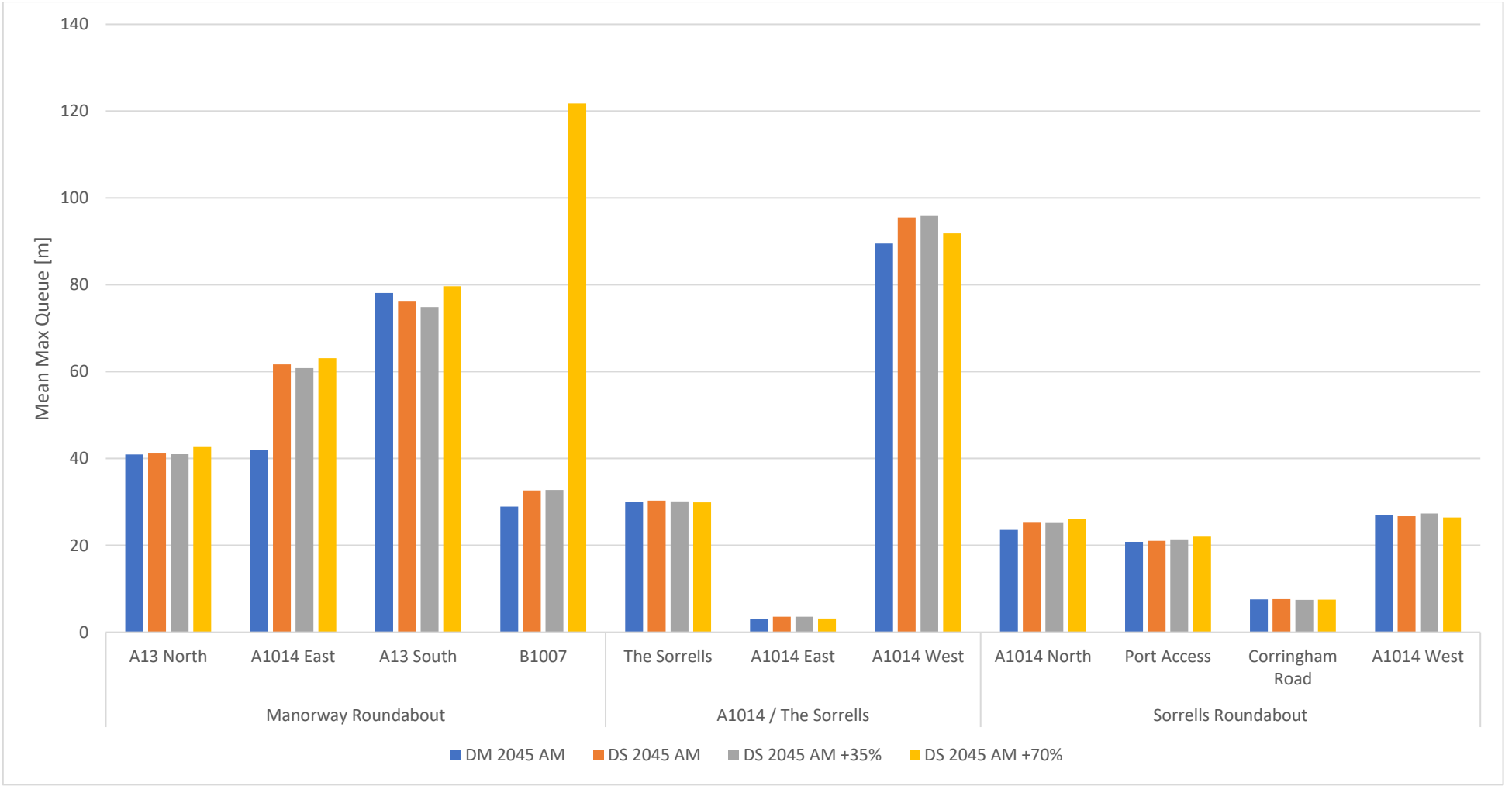


Plate B.2 Sensitivity Tests – Mean Max Queue PM Peak

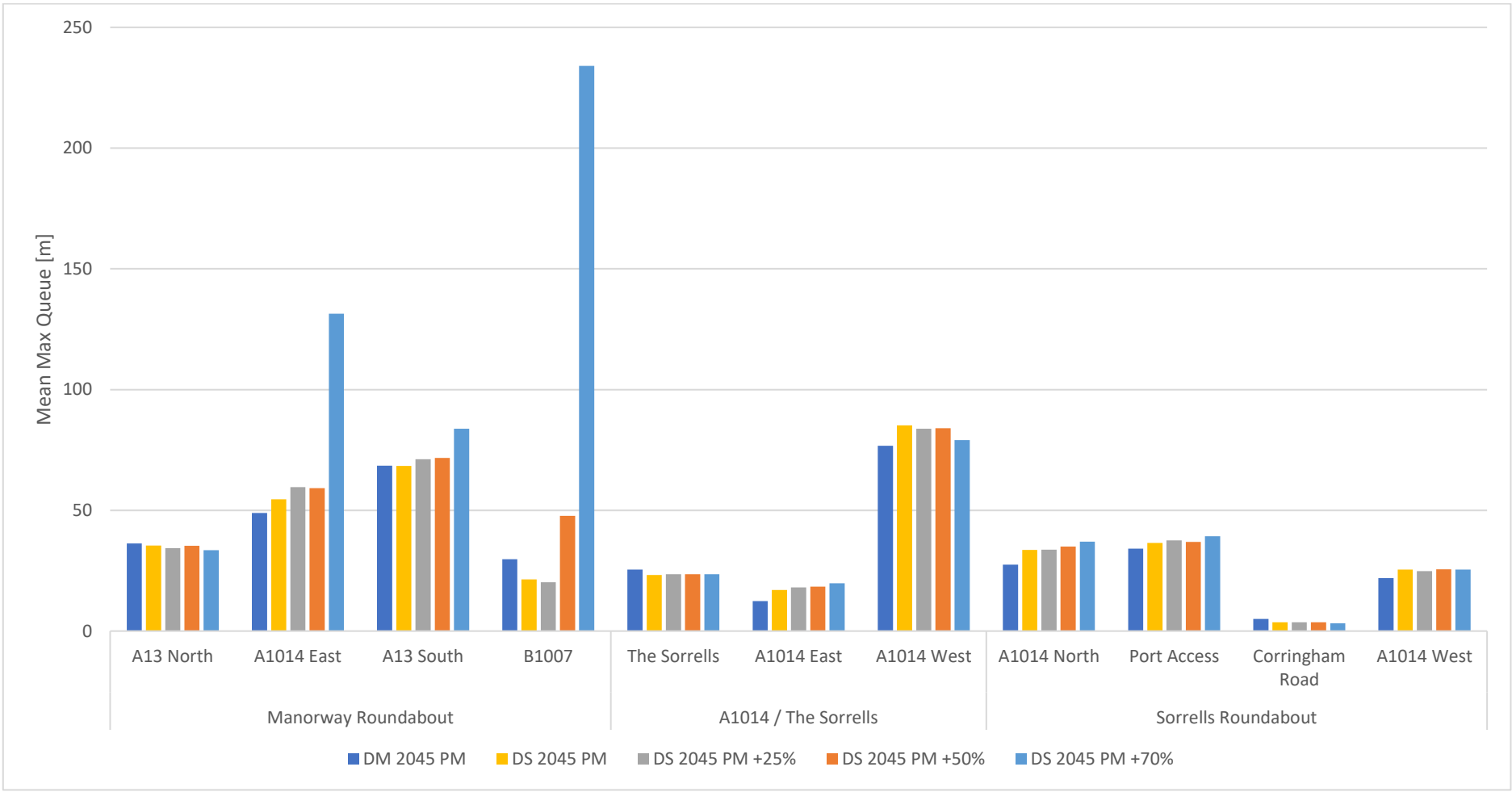


Table B.1 Sensitivity Tests Flows and Delays – 2045 AM

											Difference with DM					
			DM 2045 AM		DS 2045 AM		DS 2045 AM +35%		DS 2045 AM +70%		DS 2045 AM		DS 2045 AM +35%		DS 2045 AM +70%	
Junction	**Approach**	**To**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**
Manorway junction	A13 North (off-slip)	A13 North (on - slip)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		A1014 East	386	21.2	301	23.6	301	23.6	302	24.1	-85	2.5	-85	2.4	-84	2.9
		A1013 South	89	32.0	106	31.8	106	31.5	107	32.0	17	-0.2	17	-0.5	18	-0.1
		B1007 West	16	50.1	8	48.1	8	48.5	8	42.0	-8	-2.0	-8	-1.6	-8	-8.1
	A1014 East	A1014 East	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		A1013 South	41	6.0	47	8.9	47	8.7	47	9.3	6	2.8	6	2.6	6	3.3
		A13 South (on - slip)	1136	6.1	1436	8.3	1436	8.3	1426	9.7	300	2.2	300	2.2	290	3.6
		B1007 West	112	12.8	139	15.2	139	15.1	139	21.9	27	2.4	27	2.3	27	9.1
		A13 North (on - slip)	397	13.4	233	13.3	232	13.4	352	50.1	-164	-0.1	-165	0.1	-45	36.8
	A1013 South	A1013 South	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		A13 South (on slip)	0	0.0	86	9.0	85	8.9	86	10.3	86	9.0	85	8.9	86	10.3
		B1007 West	51	17.6	58	26.2	58	26.8	57	28.6	7	8.6	7	9.3	6	11.0
		A13 North (on - slip)	307	31.2	154	32.2	154	32.4	288	70.7	-153	1.0	-153	1.2	-19	39.5

											Difference with DM					
			DM 2045 AM		DS 2045 AM		DS 2045 AM +35%		DS 2045 AM +70%		DS 2045 AM		DS 2045 AM +35%		DS 2045 AM +70%	
Junction	Approach	To	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)
		A1014 East	98	37.6	86	34.7	86	34.6	84	63.1	-12	-2.9	-12	-3.0	-14	25.5
	A13 South (off-slip)	A13 South (on-slip)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		B1007 West	481	14.5	360	11.4	360	11.5	362	12.0	-121	-3.1	-121	-3.0	-119	-2.5
		A1014 East	1196	19.3	1381	20.2	1381	20.4	1369	24.8	185	0.9	185	1.1	173	5.5
		A1013 South	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	B1007 West	B1007 West	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		A13 North (on-slip)	29	5.8	23	4.2	23	4.4	22	28.7	-6	-1.6	-6	-1.4	-7	22.9
		A1014 East	126	12.1	76	10.8	76	11.0	60	28.2	-50	-1.2	-50	-1.0	-66	16.2
		A1013 South	48	43.8	53	41.3	53	41.6	39	64.8	5	-2.5	5	-2.3	-9	20.9
		A13 South (on-slip)	352	41.7	464	39.1	463	39.3	359	79.7	112	-2.7	111	-2.5	7	37.9

											Difference with DM					
			DM 2045 AM		DS 2045 AM		DS 2045 AM +35%		DS 2045 AM +70%		DS 2045 AM		DS 2045 AM +35%		DS 2045 AM +70%	
Junction	**Approach**	**To**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**
A1014 / The Sorrells	The Sorrels	A1014 East	205	21.0	212	20.9	211	21.0	211	20.7	7	-0.1	6	0.0	6	-0.3
	A1014 East	A1014 West	950	3.0	983	3.0	983	3.0	1020	3.0	33	0.0	33	0.0	70	0.0
		The Sorrels	14	17.9	13	18.7	13	18.8	13	18.9	-1	0.8	-1	0.8	-1	0.9
	A1014 West	The Sorrels	60	13.0	60	11.1	59	11.1	59	10.6	0	-2.0	-1	-1.9	-1	-2.4
		A1014 East	1375	10.5	1488	9.5	1488	9.6	1471	9.3	113	-1.0	113	-0.9	96	-1.2
Sorrells roundabout	A1014 North	A1014 North	16	20.1	44	21.1	44	21.5	45	21.5	28	1.0	28	1.4	29	1.4
		Port Access	86	9.5	107	9.7	107	9.8	108	10.0	21	0.2	21	0.3	22	0.5
		Corringham Rd	22	11.5	19	11.8	19	11.6	20	12.0	-3	0.3	-3	0.1	-2	0.5
		A1014 West	532	17.6	559	17.6	559	17.6	590	17.8	27	0.1	27	0.1	58	0.2
	Port Access	Port Access	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		Corringham Rd	4	8.1	3	9.4	3	8.7	3	10.0	-1	1.2	-1	0.6	-1	1.8
		A1014 West	282	10.0	284	10.8	284	10.8	290	11.1	2	0.7	2	0.8	8	1.1
		A1014 North	16	20.6	15	20.7	15	21.3	16	20.9	-1	0.1	-1	0.6	0	0.2
	Corringham Road	Corringham Rd	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		A1014 West	9	8.9	9	10.4	9	10.2	9	9.6	0	1.6	0	1.3	0	0.7
		A1014 North	39	22.8	37	23.3	37	23.3	37	23.3	-2	0.5	-2	0.5	-2	0.5
		Port Access	21	33.1	20	33.4	20	33.4	20	33.4	-1	0.2	-1	0.3	-1	0.3
	A1014 West	A1014 West	141	34.6	145	34.6	144	34.3	145	34.4	4	0.0	3	-0.3	4	-0.2

											Difference with DM					
			DM 2045 AM		DS 2045 AM		DS 2045 AM +35%		DS 2045 AM +70%		DS 2045 AM		DS 2045 AM +35%		DS 2045 AM +70%	
Junction	Approach	To	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)
		A1014 North	697	1.0	803	1.0	803	1.1	795	1.0	106	0.1	106	0.1	98	0.0
		Port Access	729	5.9	706	6.1	706	6.2	695	6.1	-23	0.2	-23	0.3	-34	0.2
		Corringham Rd	13	29.4	45	17.4	44	17.7	43	17.5	32	-12.0	31	-11.7	30	-11.9

Table B.2 Sensitivity Tests Flows and Delays – 2045 PM

												Difference with DM							
			DM 2045 PM		DS 2045 PM		DS 2045 PM +25%		DS 2045 PM +50%		DS 2045 PM +70%		DS 2045 PM		DS 2045 PM +25%		DS 2045 PM +50%		DS 2045 PM +70%	
Junction	Approach	To	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)
Manorway junction	A13 North (off-slip)	A13 North (on-slip)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		A1014 East	387	19.3	228	25.8	229	25.8	229	26.2	229	24.9	-159	6.6	-158	6.5	-158	7.0	-158	5.6
		A1013 South	108	32.6	98	33.1	98	32.2	98	32.8	99	34.0	-10	0.6	-10	-0.3	-10	0.3	-9	1.5
		B1007 West	13	50.8	8	49.5	8	44.6	9	47.7	8	86.9	-5	-1.3	-5	-6.2	-4	-3.0	-5	36.2
	A1014 East	A1014 East	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		A1013 South	100	5.7	109	6.5	109	6.8	109	6.9	96	15.5	9	0.8	9	1.1	9	1.2	-4	9.7
		A13 South (on-slip)	1300	5.7	1704	6.9	1704	7.3	1703	7.4	1497	20.0	404	1.2	404	1.6	403	1.7	197	14.4

													Difference with DM							
			DM 2045 PM		DS 2045 PM		DS 2045 PM +25%		DS 2045 PM +50%		DS 2045 PM +70%		DS 2045 PM		DS 2045 PM +25%		DS 2045 PM +50%		DS 2045 PM +70%	
Junction	Approach	To	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)	Flow (veh)	Delay (s)
		B1007 West	508	16.6	448	20.8	449	21.2	448	21.9	375	72.6	-60	4.2	-59	4.7	-60	5.4	-133	56.0
		A13 North (on-slip)	558	15.4	93	17.5	206	18.7	312	35.3	344	187.8	-465	2.1	-352	3.3	-246	19.9	-214	172.4
	A1013 South	A1013 South	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		A13 South (on-slip)	0	0.0	95	11.4	95	12.1	94	13.0	94	18.4	95	11.4	95	12.1	94	13.0	94	18.4
		B1007 West	91	27.1	111	32.3	112	32.4	112	33.0	109	50.5	20	5.1	21	5.2	21	5.9	18	23.4
		A13 North (on-slip)	119	32.0	41	29.7	40	30.0	64	46.5	75	208.8	-78	-2.3	-79	-2.0	-55	14.5	-44	176.8
		A1014 East	39	34.7	80	30.8	80	31.1	80	38.8	69	167.7	41	-3.9	41	-3.6	41	4.1	30	132.9
	A13 South (off-slip)	A13 South (on-slip)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		B1007 West	438	14.4	416	11.8	418	11.8	418	12.0	416	13.4	-22	-2.6	-20	-2.6	-20	-2.4	-22	-1.0
		A1014 East	1123	19.2	1258	16.6	1263	16.7	1260	19.1	1252	31.7	135	-2.7	140	-2.6	137	-0.1	129	12.5
		A1013 South	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	B1007 West	B1007 West	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		A13 North (on-slip)	28	6.1	17	3.5	10	3.8	15	25.7	10	111.8	-11	-2.6	-18	-2.3	-13	19.6	-18	105.7
		A1014 East	237	14.2	312	7.9	313	8.3	288	20.0	152	66.3	75	-6.3	76	-5.8	51	5.8	-85	52.1
		A1013 South	39	45.2	75	31.1	75	32.6	68	44.7	34	80.7	36	-14.1	36	-12.5	29	-0.4	-5	35.5
		A13 South (on-slip)	237	43.3	229	30.6	229	32.2	209	42.7	108	97.3	-8	-12.8	-8	-11.1	-28	-0.7	-129	53.9

													Difference with DM							
			DM 2045 PM		DS 2045 PM		DS 2045 PM +25%		DS 2045 PM +50%		DS 2045 PM +70%		DS 2045 PM		DS 2045 PM +25%		DS 2045 PM +50%		DS 2045 PM +70%	
Junction	**Approach**	**To**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**	**Flow (veh)**	**Delay (s)**
A1014 / The Sorrells	The Sorrels	A1014 East	171	20.0	171	19.1	172	19.1	173	19.3	174	19.0	0	-0.9	1	-0.9	2	-0.8	3	-1.0
	A1014 East	A1014 West	1810	4.6	1654	5.1	1734	5.2	1814	5.4	1891	5.8	-156	0.4	-76	0.6	4	0.7	81	1.1
		The Sorrels	63	18.9	97	18.4	97	18.5	96	17.8	97	18.5	34	-0.5	34	-0.4	33	-1.1	34	-0.5
	A1014 West	The Sorrels	190	14.5	153	16.7	153	16.2	149	16.0	143	14.7	-37	2.2	-37	1.7	-41	1.5	-47	0.2
		A1014 East	841	11.6	1016	13.9	1017	13.8	1013	13.6	968	12.4	175	2.3	176	2.2	172	2.1	127	0.8
Sorrells roundabout	A1014 North	A1014 North	33	25.6	158	27.6	159	28.3	160	30.2	161	32.1	125	2.0	126	2.7	127	4.6	128	6.5
		Port Access	15	8.0	14	9.0	15	9.1	15	9.4	15	9.2	-1	1.0	0	1.1	0	1.3	0	1.2
		Corringham Rd	31	12.4	28	11.6	28	12.2	28	12.0	28	12.2	-3	-0.8	-3	-0.2	-3	-0.4	-3	-0.2
		A1014 West	854	20.2	842	19.9	888	20.2	933	20.7	978	21.6	-12	-0.3	34	0.0	79	0.6	124	1.5
	Port Access	Port Access	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		Corringham Rd	28	8.6	28	8.5	27	9.0	28	8.9	27	9.0	0	-0.1	-1	0.4	0	0.3	-1	0.4
		A1014 West	858	11.7	768	12.8	802	13.2	835	13.7	869	14.6	-90	1.1	-56	1.5	-23	2.0	11	2.9
		A1014 North	41	17.9	128	29.3	128	30.0	128	30.3	128	30.6	87	11.4	87	12.1	87	12.3	87	12.7
	Corringham Road	Corringham Rd	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
		A1014 West	13	8.6	9	9.4	8	9.7	8	8.7	8	9.4	-4	0.7	-5	1.1	-5	0.0	-5	0.8
		A1014 North	16	24.6	9	20.9	10	22.4	10	21.3	10	20.1	-7	-3.7	-6	-2.2	-6	-3.3	-6	-4.5

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