Appendix TA - Z

MICROSIMULATION IMPACT

Microsimulation Report

DATE:	11 December 2020	**CONFIDENTIALITY:**	Public
SUBJECT:	London Resort Microsimulation Report		
PROJECT:	London Resort	**AUTHOR:**	Rares Ciurezu
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INTRODUCTION

This report includes the microsimulation modelling undertaken for the Transport Assessment (TA) and Environmental Statement (ES) in regard to the London Resort development located in the Swanscombe Peninsula. The microsimulation focussed on the Ebbsfleet Junction and its interaction with the A2, A2260 and the B259.

The operational model is developed in version 10 of PTV VISSIM software.

SCENARIOS TESTED

The scenarios tested are presented in Table 1 with the scenario name, description and the short name used to identify the scenario in the results section.

Table 1 – Scenarios List

Scenario	Description	Short Name
2023 Do Minimum	This is the Highways England (HE) baseline model derived from a 2016 base model.	23 DM
2023 Do Something	This is based on the 2023 Do-Minimum model with additional London Resort Construction car trips.	23 DS
2025 Do Minimum	This is the HE baseline model for 2025 derived from a 2016 base model and applied background growth.	25 DM
2025 Do Something	This is based on the 2025 Do-Minimum, additional highways design changes, additional background growth and London Resort first full year of opening trips.	25 DS
2029 Do Minimum	This is the HE baseline model for 2029 derived from a 2016 base model and applied background growth to the 2023 Do-Minimum. This scenario does not include Lower Thames Crossing.	29 DM
2029 Do Something	This is based on the 2029 Do-Minimum model, additional highways design changes, additional background growth and London Resort 2029 development flows. This scenario does not include Lower Thames Crossing.	29 DS

Scenario	Description	Short Name
2038 Do Minimum	This is the HE baseline model for 2038 derived from a 2016 base model. This scenario includes Lower Thames Crossing.	38 DM
2038 Do Minimum without Lower Thames Crossing	This is the HE baseline model for 2038 derived from a 2016 base model. This scenario does not include Lower Thames Crossing.	38 DM L
2038 Do Something	This is based on the 2038 Do-Minimum model, additional highways design changes, additional background growth and London Resort 2038 development flows. This scenario includes Lower Thames Crossing.	38 DS
2038 Do Something without Lower Thames Crossing	This is based on the 2038 Do-Minimum model, additional highways design changes, additional background growth and London Resort 2038 development flows. This scenario does not include Lower Thames Crossing.	38 DS L

MICROSIMULATION METHODOLOGY

The A2BE Operational VISSIM model from the Highways England's PCF Stage 3 onwards was developed by Atkins. Future year VISSIM models have been developed for each of the options using the calibrated and validated base VISSIM model. The A2 BE VISSIM model is static assignment model. The vehicle routings and demand have been obtained from the A2 Bean to Ebbsfleet SATURN strategic assignment models. In the PCF Stage 5 VISSIM model have been refined to incorporate the design changes.

As identified in the previous scenarios table, the 2023 and 2038 scenarios were provided, and were used as the baseline condition to compare to scenarios with London Resort trips.

Network Extent

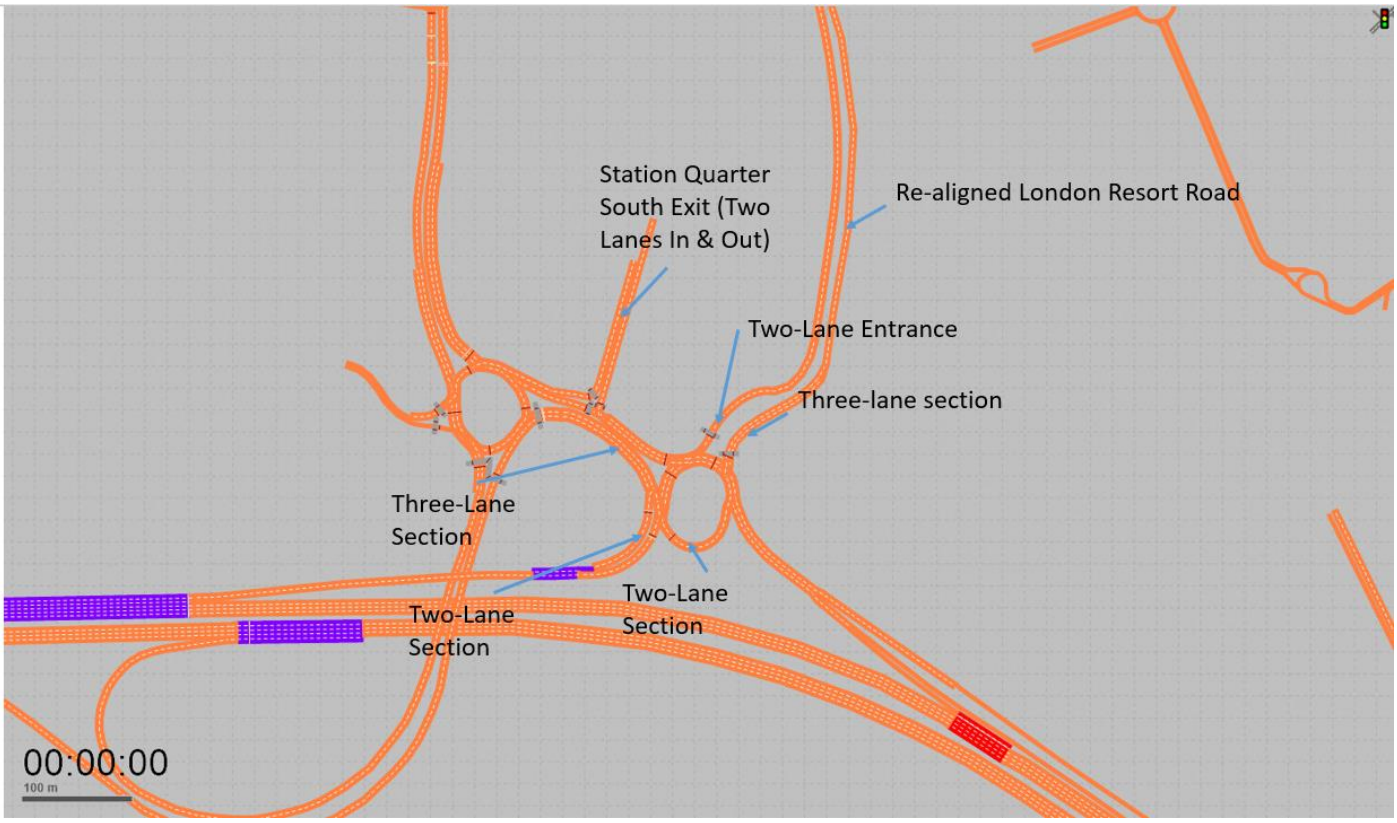
Figure 1 shows the network extent as in the baseline scenarios built for Highways England. This network extent was used for the baseline 23 DM and 38 DM scenarios and the 23 DS.

Figure 1 – 2023 and 2038 Highways England Model (Ebbsfleet Valley Area)

CHANGES TO THE NETWORK EXTENT

In the Do-Something scenarios with London Resort development traffic, highway network changes at the Ebbsfleet Valley and A2 junction have taken place. No other physical infrastructure changes have taken place compared to the HE models. The changes made compared to the HE models are further presented in the network extent annotations below and the indicative design showing road lane allocations can be found in **Annex A**.

Figure 2 – Do-Something and London Resort Models Extent



Model Parameters

The assignment results reported from VISSIM model is based on the average of 10 simulation runs over 10 different random seeds starting from 10 to 100 with an increment of 10. The other model parameters include:

- Assignment: Static – routes and flows obtained from the Strategic model
- AM peak hours – 07:00 to 08:00
- PM peak hours – 17:00 to 18:00
- Warm-up period – 30 minutes
- Cool-down period – 30 minutes
- AM peak simulation time – 06:30 to 08:30
- PM peak simulation time – 16:30 to 18:30

Construction Scenario

CONSTRUCTION TRIPS

The 2023 DS (construction scenario) was derived from the 23 DM model and the spreadsheet strategic model built by WSP. The table below presents the total number of trips. The construction traffic is travelling via Thames Way and the A226 to the Swanscombe Peninsula, with trips generated from the eastern and western edge of the A2.

Table 2 – 2023 Construction Trips

	AM	PM
Arrivals	407	0
Departures	0	815

MODEL CHANGES AND UPDATES

The construction scenario uses the network extent from the Highways England VISSIM Model presented in Figure 1. Changes were also made to remove the signalised junction on the A2260 with the London Resort access road and removed any traffic associated with the development in the HE models that London Resort is replacing.

As a result of adding new construction traffic in 2023 on the A2260 towards Thames Gateway, the signal timings have been altered on the A226/A2260/Thames Way Junction in order to allow the construction traffic to flow through this junction. A missing signal head was also added for left turning traffic from the A2260 into Thames Way north, to prevent the free flow of traffic into a signalised pedestrian crossing and 'crashing' into conflicting traffic movements. This is one of a number of concerns with the inherited Atkins models, with further localised issues including driving behaviours, vehicle routings and signal timings being amended and adapted within our scenarios to meet traffic demands.

The construction scenarios include additional vehicle inputs and vehicle classes specifically for the construction traffic. Vehicle class 170 includes the new construction vehicles.

Do-Something and London Resort Scenario

DEVELOPMENT TRIPS

The first full opening year for London Resort was identified as 2025. The models with London Resort development trips were derived from the 2023 HE model and applied linear growth factors between the 2023 HE and 2038 HE VISSIM models to create the 2025 and 2029 future scenarios. As the table below identifies, the worst case 2038 PM model includes over 347 arrivals and 978 departures.

Table 3 – London Resort Development Trips

	AM	PM
2025 *Arrivals*	107	199
2025 Departures	20	499
2029 *Arrivals*	111	288
2029 Departures	26	679
2038 *Arrivals*	112	347
2038 Departures	26	978

MODEL CHANGES AND UPDATES

The Do-Something London Resort models use an updated network extent compared to the HE models and are built as per the network extent in Figure 2.

The London Resort development scenarios includes additional vehicle inputs and vehicle classes specifically for the construction traffic. Vehicle class 160 includes the new development vehicles.

The Station Quarter South (SQS) exit has been moved from being a priority junction on the London Resort road in the DM scenarios, to a signalised junction on the A2260 Spur road in the DS. Utilising data collection points, the same number of vehicles arriving and departing SQS has been applied to the 38 DS models for a fair comparison. This has been achieved by changing the signal timings for SQS to operate similarly as the priority junction on the London Resort road. Further details on SQS are provided later within this document.

Lower Thames Crossing

It is assumed that the Lower Thames Crossing (LTC) is not open until 2029. In our assessments, the 29 DM and 29 DS are tested without LTC, whilst the LTC in place for the 38 DM and 38 DS models, with the exception of the sensitivity tests without LTC (38 DM L and 38 DS L).

MODEL CHANGES AND UPDATES

There are no physical infrastructure changes to the VISSIM model as a result of the LTC, as this is not included in the model extent.

The vehicle inputs have been changed for background lights and heavies in the 38 DM L and 38 DS L which are without LTC. The background traffic is assumed to be the same between the DM and the DS. The percentage increase in Table 4 is derived using the WSP strategic model used for London Resort using the one-way flow hourly output to compare the difference between the strategic model scenarios in 2038 with and without LTC.

The heavies percentage increase is derived from the WSP strategic model used for London Resort using the daily HGV percentages and comparing it to the VISSIM HGV percentage in background traffic. As a result of the western edge of the A2 (Eastbound Traffic) in the VISSIM model having a higher HGV percentage in the 38 DM and 38 DS, no HGV growth is applied in the AM.

This is a worst-case scenario without LTC as a result of not removing any additional local trips from the north and south in the model extent.

Table 4 – Lower Thames Crossing Flow Input Changes to create without LTC 2038 models (DM 38 L & DS 38 L)

	VISSIM Input ID	Lights Percentage Growth %		Heavies Percentage Growth %	
		AM	PM	AM	PM
Eastern edge of the A2 (Westbound Traffic)	118 & 218	17.6%	5.7%	1.1%	4.6%
Western edge of the A2 (Eastbound Traffic)	101 & 201	16.7%	1.8%	0%	2.2%

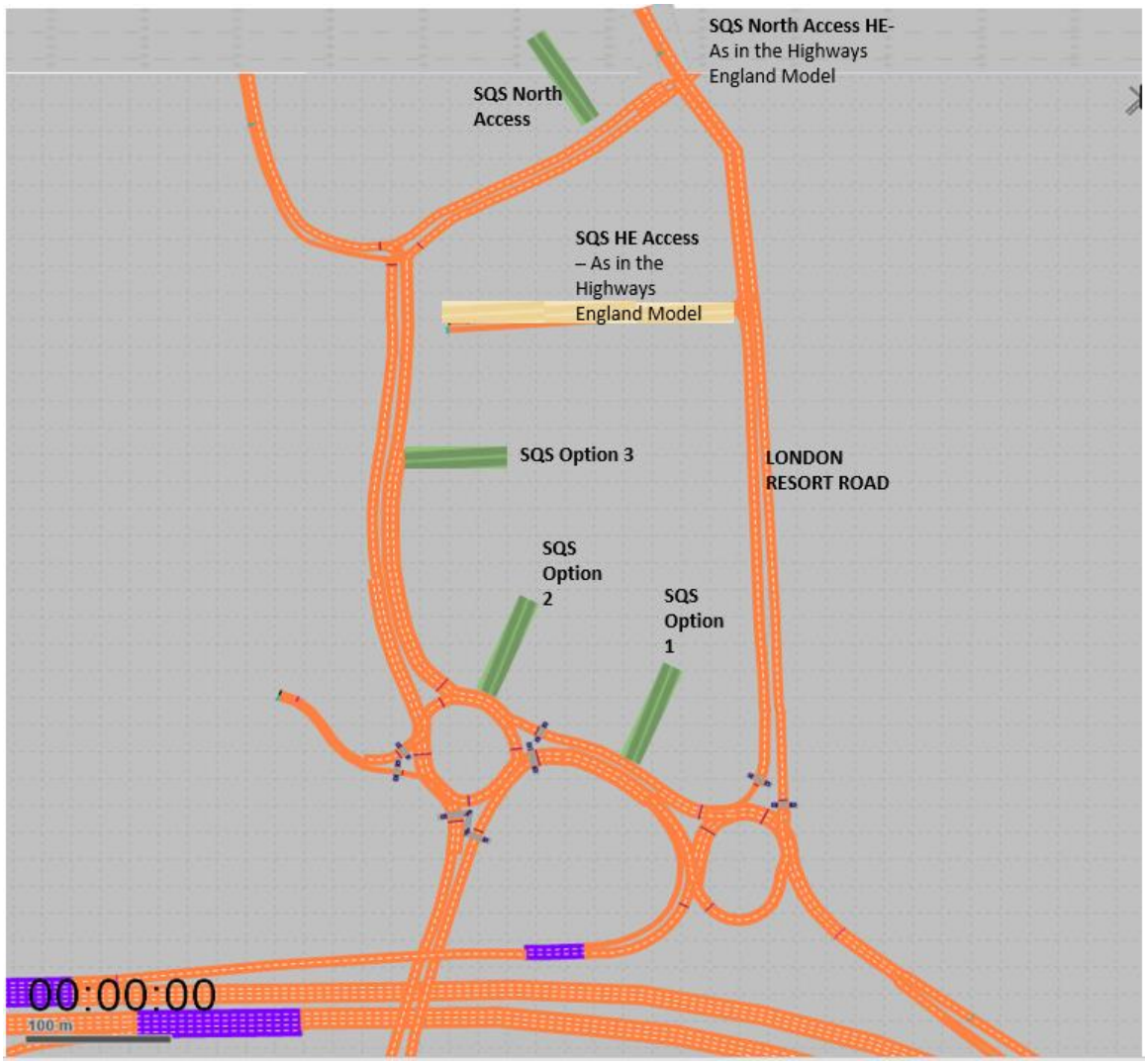
Station Quarter South

Station Quarter South (SQS) is a large development in the vicinity of the two A2 Ebbsfleet access roundabouts, as shown in Figure 3.

Initially in the HE models, SQS was accessed via a priority junction on the London Resort road. As part of the modelling work for London Resort, a variety of options were tested. Option 1 & 2 were the most feasible whilst Option 3 was removed as a result of not being possible due to the vertical alignment.

Whilst undertaking the microsimulation modelling it was highlighted that for Option 2 it was uncertain whether it would be feasible to provide an additional arm on what would become a five-arm roundabout. Although the microsimulation modelling showed an improvement in queues on the A2260 for Option 2, this option was removed on the basis of both design feasibility as well as operational concerns due to potential queuing back onto the circulatory as a result of minimal stacking capacity from the pedestrian crossing on the exit in Option 2.

Figure 3 – Station Quarter South Access Options including Highways England Options



Initially when undertaking the microsimulation for SQS Option 1 as a signalised junction, problems with traffic arrivals at SQS emerged due to having only one lane access, similar to how HE modelled the SQS access on the London Resort Road. Following consultation with our design team, the design was changed to include two lanes in and two lanes out, as well as creating an island for pedestrians crossing at this junction. This is presented in Figure 4. As a result of these changes, SQS traffic performed similarly if not better than in the HE option. This is included in all DS models from 2025 to 2038.

Figure 4 – Station Quarter South Preferred South Access Option 1

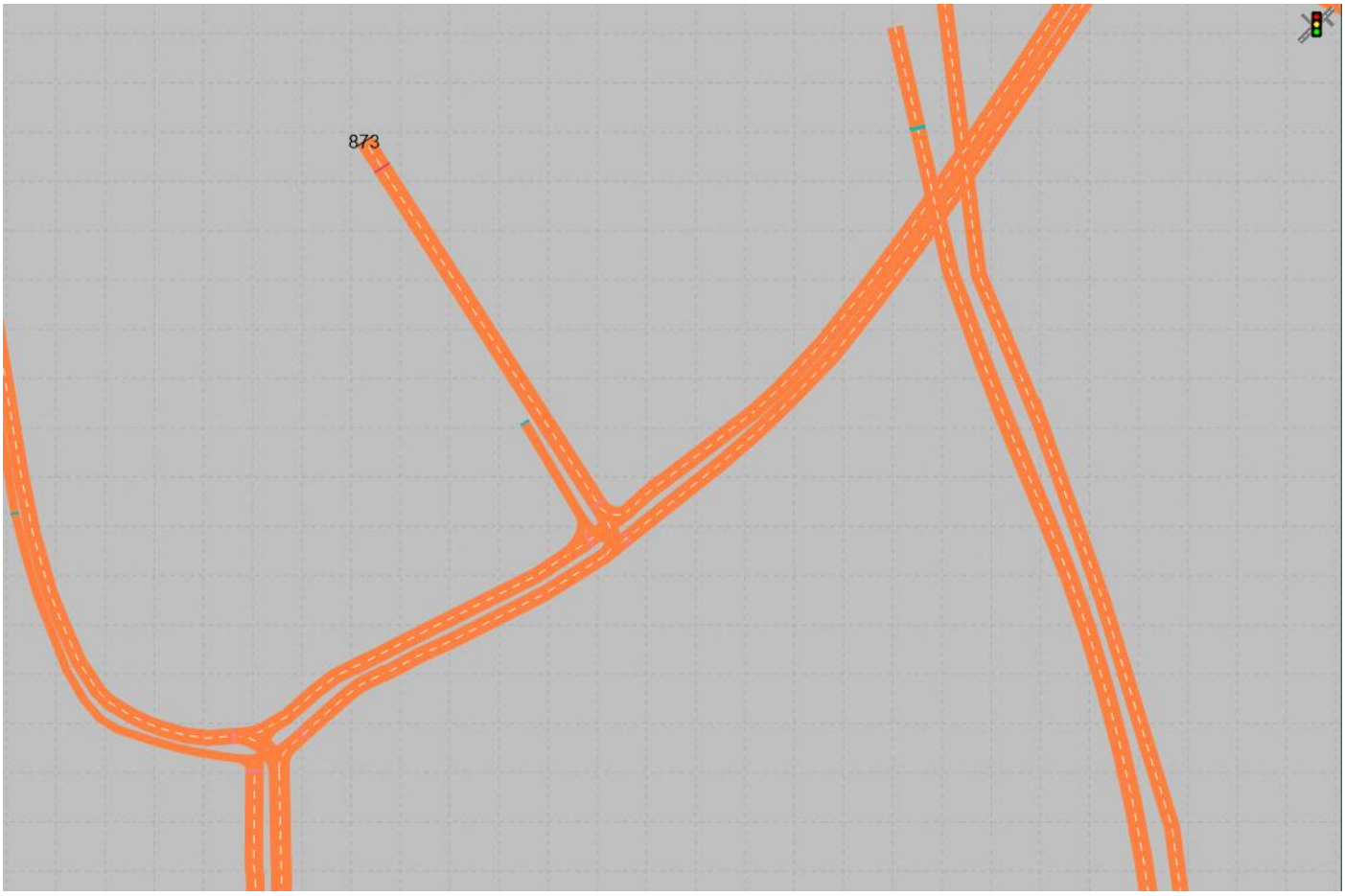
Table 5 – Station Quarter South Calculated Proportions from the Transport Assessment

	SQN	SQS
AM IN	54%	46%
AM OUT	41%	59%
PM IN	43%	57%
PM OUT	52%	48%

Note: SQN = Station Quarter South (North Access)
SQS = Station Quarter South (South Access)

Figure 5 presents the SQS north access in the centre of the A2260 as part of the sensitivity test.

Figure 5 – Station Quarter South (North Access) VISSIM Junction



Growth

The HE baseline 23 DM and 38 DM scenarios are based on Road Traffic Forecasts 2018 (RTF18)[1]. The background growth applied to the VISSIM inputs is presented in the Table 6. The growth was calculated using the vehicle inputs from the 23 DM and 38 DM models utilising the linear growth methodology. As can

[1] https://www.gov.uk/government/publications/road-traffic-forecasts-2018

be identified in the table below, in the AM there is a growth of 16.7% between 23 DM and 38 DM (approx. 1.1% per annum) and 18.7% in the PM (approx. 1.25% per annum).

In the 2029 scenario, 6.7% growth (AM) and 7.5% growth (PM) has been applied to all background traffic inputs between 2023 and 2038. All other inputs with negative growth or no change have been kept the same between 2025 and 2029 as a result of the Lower Thames Crossing coming into place in 2026 which will see a reduction in traffic on the A2 primarily.

Table 6 – Linear Growth VISSIM (Derived from 2023 HE and 2038 HE models)

Scenario	Growth	
	AM	PM
2023 DM to 2038 DM	16.7%	18.7%
2023 DM to 2025 DM	2.2%	2.5%
2023 DM to 2029 DM	6.7%	7.5%
2023 DM 2038 DM	16.7%	18.7%

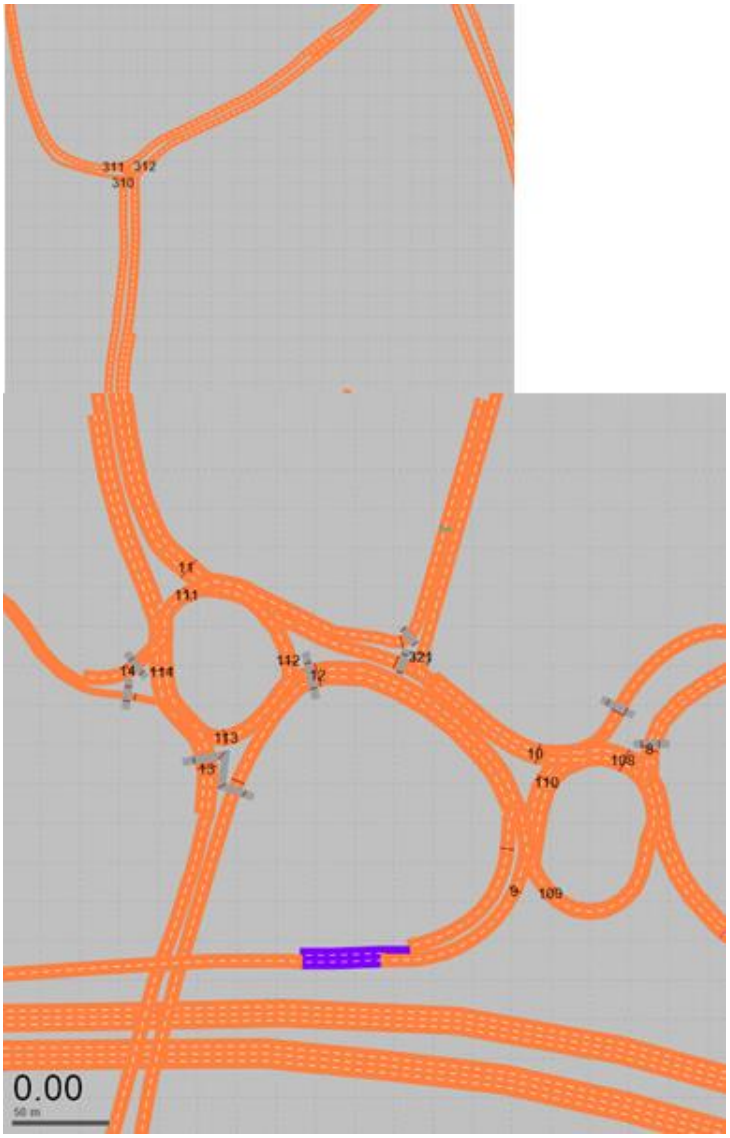
RESULTS

This section looks at the results from the microsimulation model for the key junctions in the Ebbsfleet Valley and Swanscombe area.

Queues

The figure below shows the queue counter locations in diagrammatic format, with the two southern roundabouts at Ebbsfleet Valley and the northern three arms junction at the A2260/B259 Swanscombe.

Figure 6 – Queues



The results in the table below show the queue results in the AM. The queues are representative between the 38 DM and the 38 DS, with the A2 Eastbound Off-slip showing a considerably smaller queue in 38 DS as a result of the highway improvements with the two lane dedicated signalised left turn into Ebbsfleet Valley. The Station Quarter South exit queue in 38 DS is high as a result of the large vehicle input in the 2038 forecast year, however this traffic experiences less delay once out of the Station Quarter South development when compared to the DM models. This is due to the traffic being stationary in a long queue where queue counter 8 is located, and there being significant latent demand on the previous access (i.e. traffic unable to get onto the road network). The 23 DS including the construction traffic has a slight impact on queue counter 12, as a result of trips going towards A2260 and Thames Way. This is highlighted in queue counter 310 experiencing 108m of queue. However, this can be mitigated by signal timing optimisation during the construction year at the B259/A2260 junction.

The 38 DM L scenario without LTC experiences large queueing as a result of increased demand on the A2 and large queues occur on queue counter 9 A2 Eastbound off-slip. Queue counter 9 is already a problem in

38 DM, and with the addition of this extra traffic it causes further issues. The A2 Eastbound off-slip queue is mitigated in the 38 DS scenarios as a result of the junction improvements.

Table 7 – Average Queue Length (Metres) Results AM Period (0800-0900)

Queue Counter Number Average Queue Length (Metres)	23 DM	23 DS	25 DM	25 DS	29 DM	29 DS	38 DM	38 DM L	38 DS	38 DS L
8 – London Resort Road	X	X	X	5.6	X	5.7	X	X	7.8	7.2
9 – A2 Eastbound Off-Slip	46.1	30.7	44.8	28.8	48.9	37.1	127.5	438.6	38.2	41.1
10 - A2260 Spur Road Eastbound to East Roundabout	12.8	15.9	12.7	24.1	12.9	22.9	27.7	29.7	42.0	45.5
11 - A2260 Southbound to West Roundabout	24.9	16.3	26.2	21.8	32.8	22.3	34.5	34.9	35.8	33.5
12 - A2260 Spur Road Westbound to West Roundabout	11.1	41.6	10.9	33.4	7.0	48.6	10.6	9.8	48.3	53.9
13 - A2 Westbound Off-slip	26.4	24.8	27.0	27.5	27.5	30.9	35.6	40.8	29.5	30.4
14 – Ackers Drive	15.6	15.8	15.7	21.1	15.7	23.4	23.0	22.4	38.9	48.5
108 - East Roundabout North Stop Line	20.4	21.6	21.0	20.6	22.7	22.6	31.7	30.9	22.2	22.6
109 - East Roundabout South Stop Line	4.2	3.9	5.1	10.0	3.3	9.9	13.4	13.5	20.5	20.1
110 - East Roundabout East Stop Line	4.6	1.3	4.1	2.2	10.9	4.1	55.5	58.9	4.5	4.8
310 - A2260 Northbound	45.2	108.3	45.9	67.7	51.6	72.3	65.1	74.4	69.2	76.6
311 - B259	41.8	45.4	42.4	42.4	43.1	44.7	75.7	75.6	74.9	70.3
312 - A2260 Ebbsfleet Gateway Southbound	46.0	48.2	45.0	47.7	45.8	49.9	52.3	53.6	57.6	56.9
321 - Station Quarter South Exit onto A2260 Spur Road	X	X	X	16.2	X	16.4	X	X	134.8	127.8

X = No Traffic travelling on the LR in the scenario and no Station Quarter South Exit onto A2260

The PM queue results are presented in the table below. In the 23 DS which includes the construction traffic has a slight impact on A2260 Southbound to West Roundabout (11), however the queue is not significant to cause operational problems at the Ebbesfleet Valley roundabouts. A2260 Ebbesfleet Gateway Southbound (312) experiences queues larger in 23 DS than the 23 DM by approximately 50m. Due to the high construction traffic using the Thames Way/A2260 strategic route, this queue not significant and is only 39m longer than the worst case 38 DM.

In 38 DS queue counter for London Resort road (8) experiences minor queues of 60m long, with further queues on East Roundabout South Stop Line (109) for the circulatory of 44m which is lower than the link length of 88m, ensuring no blocking back onto the roundabout exit for A2 Eastbound on-slip (9).

The 38 DS L scenario without LTC experiences larger queues on London Resort road (8) when compared to the 38 DS as a result of queues at A2260 Spur Road Westbound (12) experiencing queues of 130m from the additional demand of both lights and heavies from the A2 Eastbound direction.

Table 8 - Average Queue Length (Metres) Results PM Period (1700-1800)

Queue Counter Number Average Queue Length (Metres)	23 DM	23 DS	25 DM	25 DS	29 DM	29 DS	38 DM	38 DM L	38 DS	38 DS L
8 – London Resort Road	X	X	X	27.1	X	31.6	X	X	60.0	119.5
9 – A2 Eastbound Off-Slip	57.4	52.2	48.0	30.0	70.6	45.9	99.9	111.1	81.1	103.5
10 - A2260 Spur Road Eastbound to East Roundabout	36.8	52.7	37.0	26.7	27.4	24.2	27.8	26.8	39.6	42.6
11 - A2260 Southbound to West Roundabout	25.4	58.3	26.5	18.6	26.2	15.8	23.3	23.5	23.1	24.0
12 - A2260 Spur Road Westbound to West Roundabout	20.4	26.5	19.8	38.7	15.9	57.8	30.0	30.1	92.1	130.8
13 - A2 Westbound Off-slip	18.6	16.1	18.9	18.7	16.9	35.9	35.9	36.6	37.2	38.0
14 – Ackers Drive	10.7	10.6	10.8	18.5	12.5	27.4	17.2	17.1	24.5	28.4
108 - East Roundabout North Stop Line	28.8	29.6	25.4	24.9	47.2	36.4	42.4	42.8	33.1	36.8
109 - East Roundabout South Stop Line	5.8	9.6	7.2	36.1	0.4	10.9	23.1	25.4	44.3	59.7
110 - East Roundabout East Stop Line	14.5	11.1	9.6	2.7	45.8	22.3	46.5	48.1	44.3	44.8
310 - A2260 Northbound	45.1	60.9	46.8	63.8	46.4	104.8	103.5	113.6	107.5	113.1
311 - B259	39.6	44.3	40.0	32.7	49.2	39.9	61.5	61.5	60.8	60.8
312 - A2260 Ebbesfleet Gateway Southbound	61.6	112.5	63.6	41.5	53.1	54.0	74.0	72.5	83.8	89.8
321 - Station Quarter South Exit onto A2260 Spur Road	X	X	X	13.8	X	13.5	X	X	180.2	180.2

X = No Traffic travelling on the LR in the scenario and no Station Quarter South Exit onto A2260

Journey Time

This section presents the journey time results. The routes are listed below, with some variation in length shown as a result of the realignment of the London Resort access road resulting in a slightly longer route.

Table 9 – Journey Time Lengths

Journey Route	Highways England Baseline Models Routes meters	London Resort Routes meters
773 - A2 Eastbound	2,502	2,502
774 - A2 Westbound	2,064	2,064
775 - London Resort to A2 Eastbound	1,924	2,030
776 - A2 Westbound to London Resort	2,438	2,815
777 - London Resort to A2 Westbound	2,510	2,838
778 - A2 Eastbound to London Resort	2,091	2,243
TWA2WB - Thames Way to A2 Westbound	4,144	4,144
A2EBTW - Eastbound Off-slip to Thames Way	1,491	1,495

In the AM, the A2 Westbound journey time to London Resort is higher as a result of more opposing traffic exiting Station Quarter South development between the two Ebbsfleet Valley roundabouts. The 23 DS model sees an increase in the traffic travelling northbound towards Thames Way via the A2260 and from the A2 Eastbound Off-slip, however this is lower than the 29 DS. The high journey time for the A2 Eastbound Off-slip to Thames Way in 29 DS is as a result of the A2 Eastbound delays from the high background traffic growth, which is rectified in 38 DS as a result of Lower Thames Crossing being built. The overall journey route is also higher for any London Resort routes in the 38 DS model, approximately 400m as a result of re-aligning the resort road as per the highway design.

In the 38 DM L there is an increase in the journey time on the A2 Eastbound to London Resort due to an increase in traffic on the A2 in the scenario without LTC. This is mitigated in the 38 DS models as a result of junction improvements. There is also an increase in the 38 DS L for A2 Eastbound Off-slip to Thames Way as a result of more traffic on the A2 Eastbound and combined with a high proportion of traffic U-turning from SQS which does not occur in the 38 DM L as a result of queueing at A2260 Spur Road Westbound (counter 12).

Table 10 – Journey Times AM Period (0700-0800) in Seconds

Route Name	23 DM	23 DS	25 DM	25 DS	29 DM	29 DS	38 DM	38 DM L	38 DS	38 DS L
773 - A2 Eastbound	93	100	93	93	93	107	91	93	91	92
774 - A2 Westbound	142	142	143	142	145	145	135	141	134	140
775 – London Resort to A2 Eastbound	133	x	136	110	130	98	238	315	105	105
776 - A2 Westbound to London Resort	187	x	187	250	189	243	194	197	242	269

Route Name	23 DM	23 DS	25 DM	25 DS	29 DM	29 DS	38 DM	38 DM L	38 DS	38 DS L
777 - London Resort to A2 Westbound	166	x	166	171	168	171	172	175	170	179
778 - A2 Eastbound to London Resort	138	x	137	100	141	98	170	283	98	99
Thames Way to A2 Westbound	305	306	304	299	310	314	310	311	301	305
A2 Eastbound Off-slip to Thames Way	249	340	253	274	247	368	257	258	278	292

X = No Traffic travelling to LR in the 23 DS (London Resort Construction scenario).

The PM journey time results presented below show that the 38 DS model has little impact on the A2 eastbound and westbound mainline traffic. The A2 Westbound journey time to London Resort is higher as a result of the previously mentioned changes in link lengths between the two models as a result of re-aligning the resort road and this is accredited to an increase in opposing traffic movements between the two Ebbsfleet Valley roundabouts.

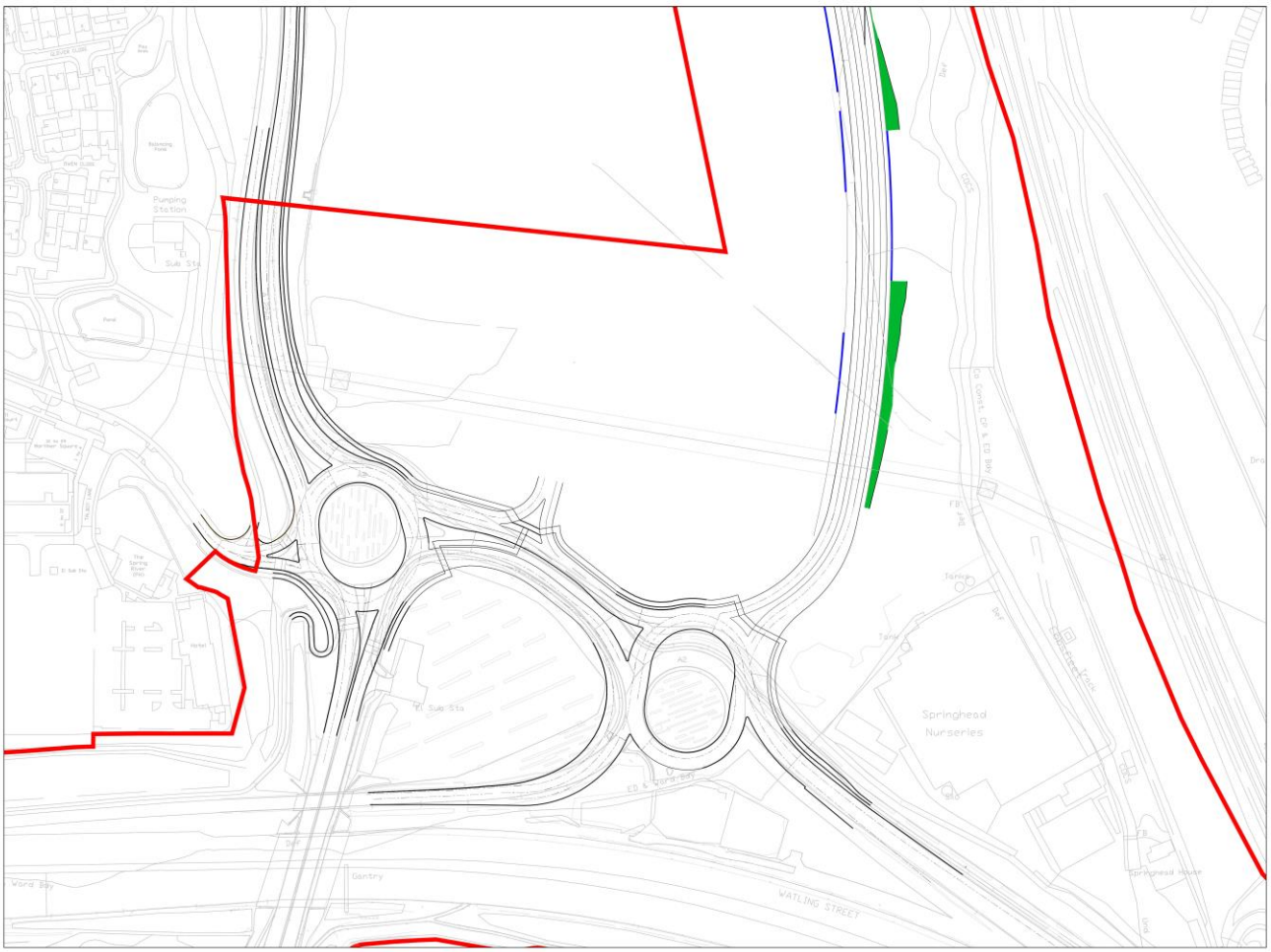
In the 38 DM there is a decrease in the journey time from London Resort to A2 Eastbound compared to the 38 DM L as a result of junction improvements. There is a slight increase in the A2 Westbound to London Resort in 38 DS models as a result of additional traffic on the A2 and London Resort development trips.

Table 11 - Journey Times PM Period (1700-1800) in Seconds

Route Name	23 DM	23 DS	25 DM	25 DS	29 DM	29 DS	38 DM	38 DM L	38 DS	38 DS L
773 - A2 Eastbound	97	97	96	96	97	94	94	94	94	94
774 - A2 Westbound	77	78	78	78	78	77	77	77	77	78
775 – London Resort to A2 Eastbound	153	x	135	104	133	102	195	316	117	142
776 - A2 Westbound to London Resort	157	x	156	202	158	192	165	164	202	209
777 - London Resort to A2 Westbound	188	x	189	176	188	172	176	176	204	263
778 - A2 Eastbound to London Resort	141	x	138	98	162	115	160	163	132	143
Thames Way to A2 Westbound	303	308	304	284	307	286	308	306	308	313
A2 Eastbound Off-slip to Thames Way	233	242	226	251	215	261	224	223	283	304

X = No Traffic travelling to LR in the 23 DS (London Resort Construction scenario).

ANNEX A - EBBSFLEET VALLEY AND A2 ROUNDABOUTS INDICATIVE LANE DRAWINGS


Pumping Station
Springhead Nurseries
WATLING STREET
Gantry

ANNEX B – Journey Time Routes Diagram

TWA2WB - Thames Way to A2 Westbound
A2EBTW - Eastbound Off-slip to Thames Way
773 - A2 Eastbound
774 - A2 Westbound
775 - London Resort to A2 Eastbound
776 - A2 Westbound to London Resort
777 - London Resort to A2 Westbound
778 - A2 Eastbound to London Resort