



BSP Consulting

A38-A50 BURNASTON CROSS

DEVELOPMENT IMPACT ASSESSMENT





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DEVELOPMENT IMPACT ASSESSMENT

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1 INTRODUCTION

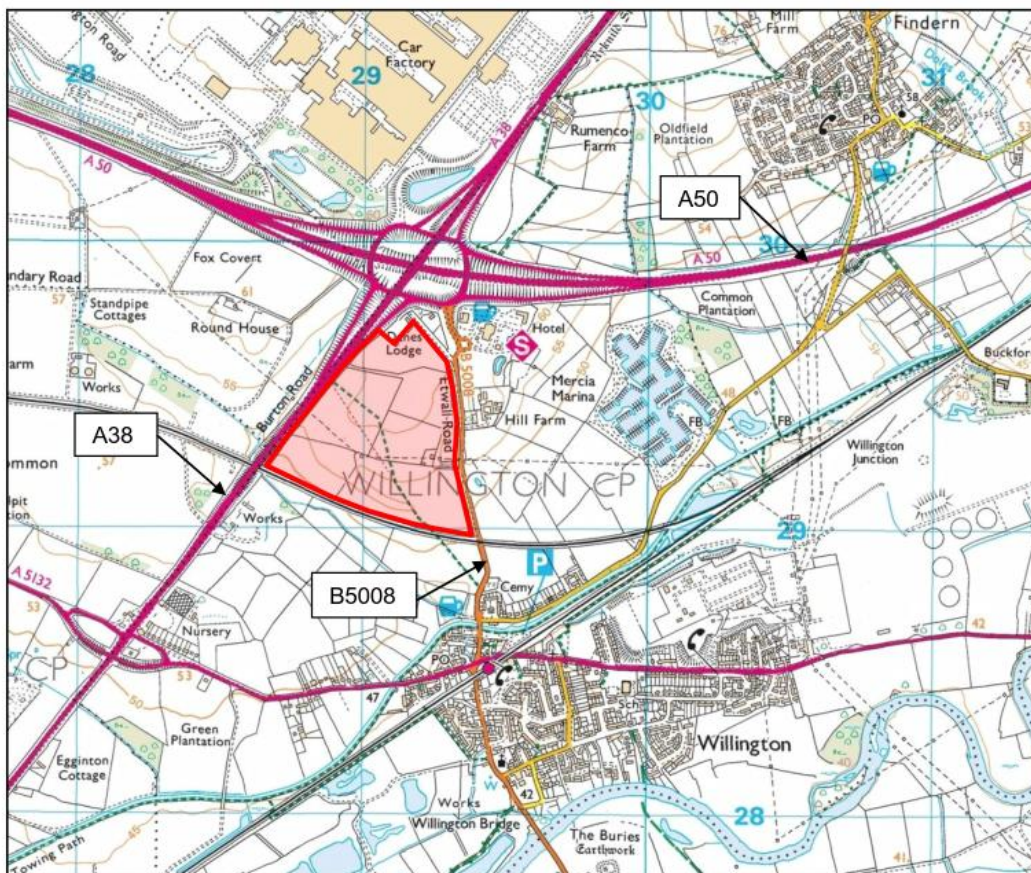
1.1 BACKGROUND

WSP has been commissioned by BSP Consulting to undertake a traffic impact assessment of the proposed mixed-use development at Burnaston Cross nr Willington in South Derbyshire which will form part of the Transport Assessment for the development.

BSP Consulting have been instructed to prepare a Transport Assessment (TA) and Framework Travel Plan (FTP) to accompany the planning application for development proposals. BSP held initial scoping discussions with Highways England (HE) and Derbyshire County Council (DCC), scoping note submitted 5th March 2018.

The development site is situated just south of Junction 4 of the A50 where it meets the A38, known as Toyota Island. The Toyota factory is on the opposite side of the A50. The site is approximately 500m north of the village of Willington. It is a greenfield site, bounded by an access road to Danes Lodge -which is to be retained, to the north, a railway line to the south, the B5008 to the east and the A38 to the west. The approximate site area and location is shown in Figure 1.

Figure 1 Site location



As part of the current planning application, the developer requires a Traffic Impact Assessment using the Highways England approved, A38-A50 Toyota Island, VISSIM model developed by AECOM in 2016.

1.2 PURPOSE OF THE REPORT

The purpose of this report is to assess the impact of the implementation of the new development by comparing the A50-A38 junction performance in both the Do Minimum scenario (Base traffic + Committed Developments traffic) and Do Something scenario (Base traffic + Committed Developments traffic + Assessed development traffic). In order to carry out the traffic impact analysis the following scenarios will be tested:

- 2025 with Committed Development (Do Minimum scenario)
- 2025 With Committed Development and Assessed Development (Do Something scenario)
- 2025 With Committed and Assessed Developments and Mitigation Scheme (Mitigation Scheme Scenario)

2 BASE YEAR

The VISSIM modelling work undertaken by WSP was based on the Highways England approved model built by AECOM in December 2016.

The model development was in line with the DMRB and WebTAG Unit M3.1 guidance and detailed in the Local Model Validation Report (LMVR) supplied with the model files. This process ensured that the base year (2016) model accurately represented the existing traffic conditions.

The model scope includes the junctions A38/A50/B5008 Toyota Island and B5008 Etwall Road Services Roundabout. The model extent is shown in Figure 2.

Figure 2 Model extent with zone numbers



The model was developed for two time periods in the base year (2016). Each of these simulation periods represent the 2016 observed traffic on the highway network:

- AM Peak Period 07:00-09:00
 - o AM Peak Hour 07:30-8:30
- PM Peak Period 15:30-17:30
 - o PM Peak Hour 16:00-17:00

On receipt of the approved VISSIM model we were advised that no changes should be made to the model other than the addition of traffic demand matrices to support testing of the development scenarios. This practice has been followed other than to include additional Travel Time markers in the model to support data collection from model runs to match observed data collected from site visits. The base year matrices can be found in Appendix A.

3 FORECAST YEAR

3.1 TRAFFIC DEMAND

3.1.1 MATRIX DERIVATION

The forecast year was assessed using the base model with forecast traffic for 2025.

BSP provided traffic flow matrices for Committed Development traffic and Assessed Development traffic.

Based on this information matrices for the DM and DS scenarios were derived using BSP's matrix derivation methodology for AM and PM peaks, splitting the traffic into Light Vehicles and Heavy Vehicles traffic to be consistent with the base model.

The 2025 base matrices were derived using growth factors provided by BSP, which were based on TEMPro and are shown in Table 1.

Table 1 – TEMPro Growth Factors

Period		TEMPro Growth Factor
2016 - 2018	AM	1.0380
	PM	1.0395
2018 - 2025	AM	1.1090
	PM	1.1084

Once the base matrices were derived, the committed development matrices were added to them in order to derive the DM matrices. For the calculation of DS matrices, the Assessed Development matrices were added to the DM matrices which in summary would be the sum of base, committed development and assessed development traffics. Both the Committed Development and Assessed Development traffic flows can be found in Appendix B and Appendix C respectively.

In order to derive the Warm-up and Cool-down periods matrices for DM and DS, both AM peak and PM peak, the TEMPro Growth Factors mentioned above were applied to the Base Warm-up and Cool-down periods.

All the DM and DS matrices for 2025 are included in Appendix D.

3.1.2 SUMMARY OF DEVELOPMENT TRIPS

The development at Burnaston Cross nr Willington will generate 189 trips during AM Peak and 136 in PM Peak. The impact on the access point to the A38-A50 junction will be higher during PM peak with 118 vehicles using the B5008 entry. The distribution of the development flows is shown in Figure 3 for AM Peak and on Figure 4 for PM Peak.

Figure 3 Development Trips AM

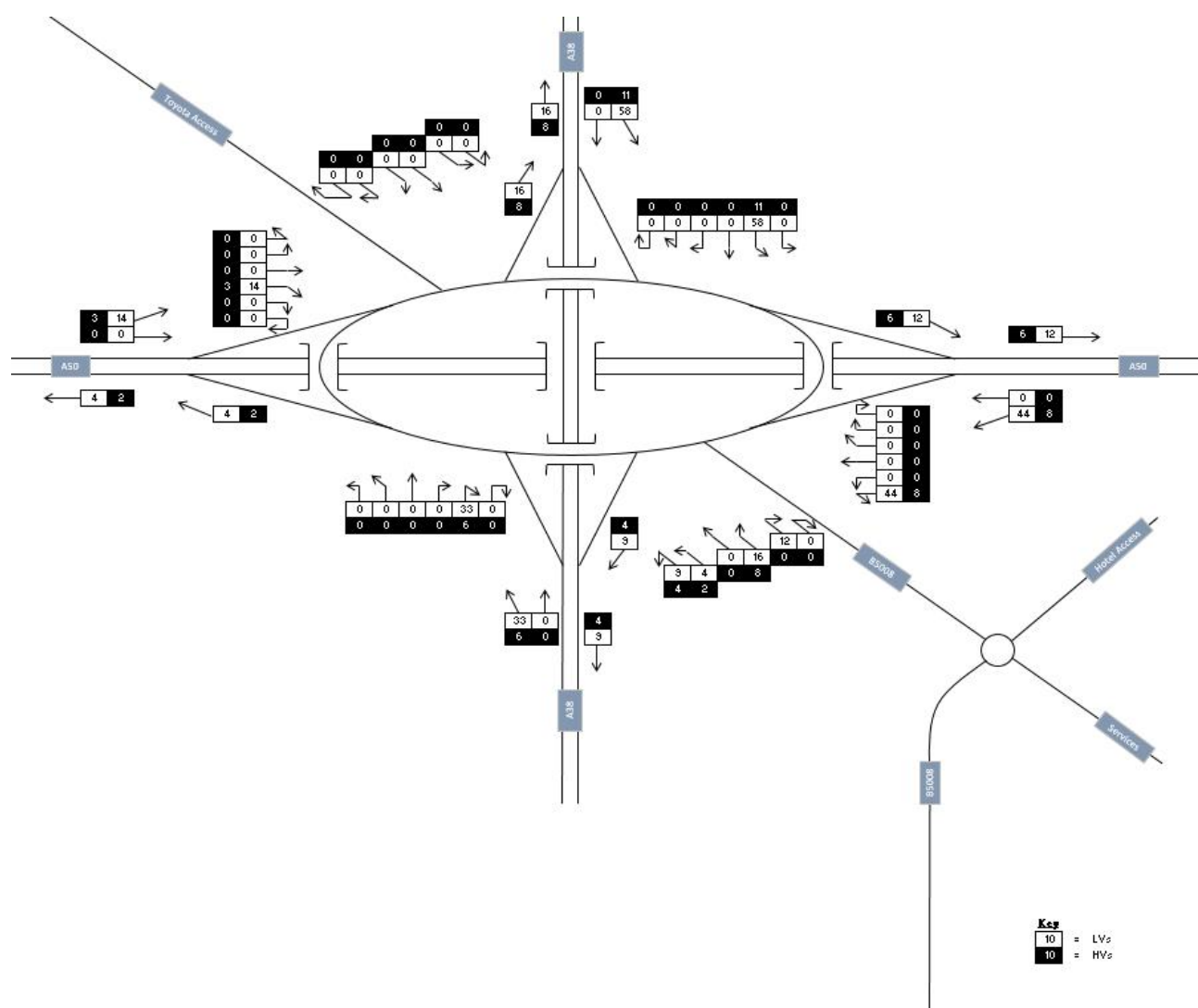
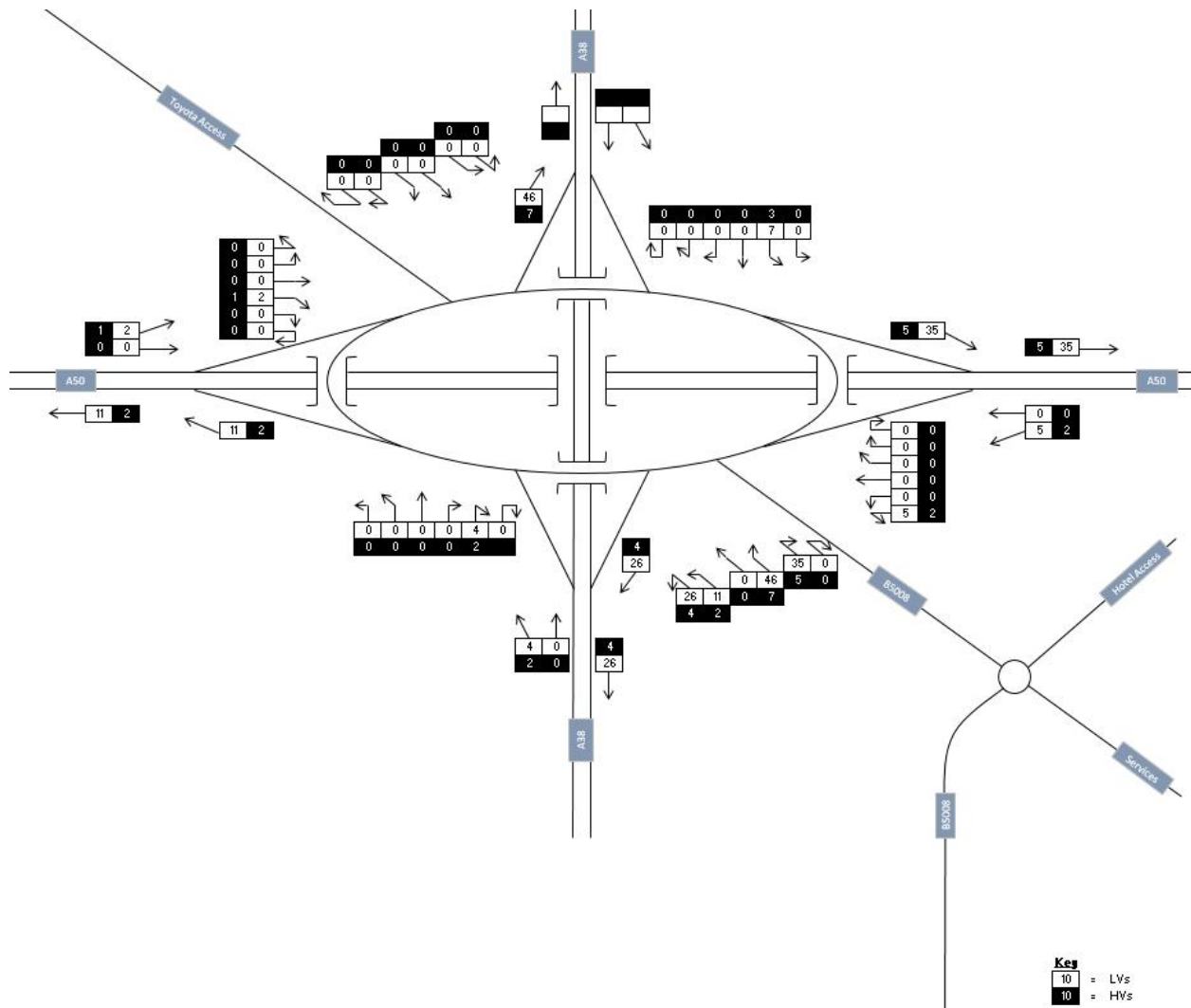


Figure 4 Development Trips PM



3.1.3 TRAFFIC CONTRIBUTION COMPARISON

In order to see what is the level of contribution of the Assessed Development to the total demand, a comparison between the Background Growth, Committed Developments and Assessed Development traffics has been carried out and is displayed in Table 2 for 2025, which is the year of completion of the Assessed Development.

Table 2 – 2025 Traffic contribution comparison

		Additions (veh)				Additions (%)			
	2016 Traffic	Background Growth to 2025	Committed development	Assessed Development	Total	Background Growth to 2025	Committed development	Assessed Development	Total
AM	10955	1656	902	190	2748	15.1%	8.2%	1.7%	25.1%
PM	10383	1580	964	136	2680	15.2%	9.3%	1.3%	25.8%

As it can be seen in the previous table, the increase of traffic due to the Assessed Development is minor in comparison with both the Committed Developments and Background Growth traffics.

If we compare the traffic in the DM and DS scenarios, as shown in Table 3, it is obvious that the difference due to the inclusion of the Assessed Development is insignificant.

Table 3 – Scenario Traffic Comparison - 2025

2025 Scenario Traffic Comparison			
	DM	DS	Diff
AM	13513	13703	1.41%
PM	12927	13063	1.05%

3.2 MODEL RUNS

Both the DM and DS models were run for convergence up to a maximum of 50 times using random seed 42 which is considered optimal due to its neutrality. Following the methodology recommended by PTV in the document “*Dynamic Assignment Tips*” as suggested by AECOM, the model has been run starting with a 5% demand of traffic and increasing by 5% over subsequent iterations up to the drop in performance at which the increase of the demand would be stopped for following runs to use the percentage of demand achieved. Subsequent runs have used 75% and 70% of the demand for the AM and PM respectively until convergence was reached. The 2025 model convergence values achieved and used for the extraction of outputs are highlighted in Table 4 which displays the share of converged paths for the last 4 runs of each scenario.

Table 4 - Convergence

Scenario	Run	Share of Converged Paths	Run	Share of Converged Paths	Run	Share of Converged Paths	Run	Share of Converged Paths
DM AM	28	100.0%	29	97.3%	30	97.3%	31	97.3%
DM PM	17	97.3%	18	100.0%	19	100.0%	20	100.0%
DS AM	39	97.3%	40	100.0%	41	100.0%	42	97.3%
DS PM	21	100.0%	22	97.3%	23	100.0%	24	100.0%

All the models were run 10 times at 100% demand for results using random seed 42 for the first run and a successive seed increment of 1 for the subsequent runs.

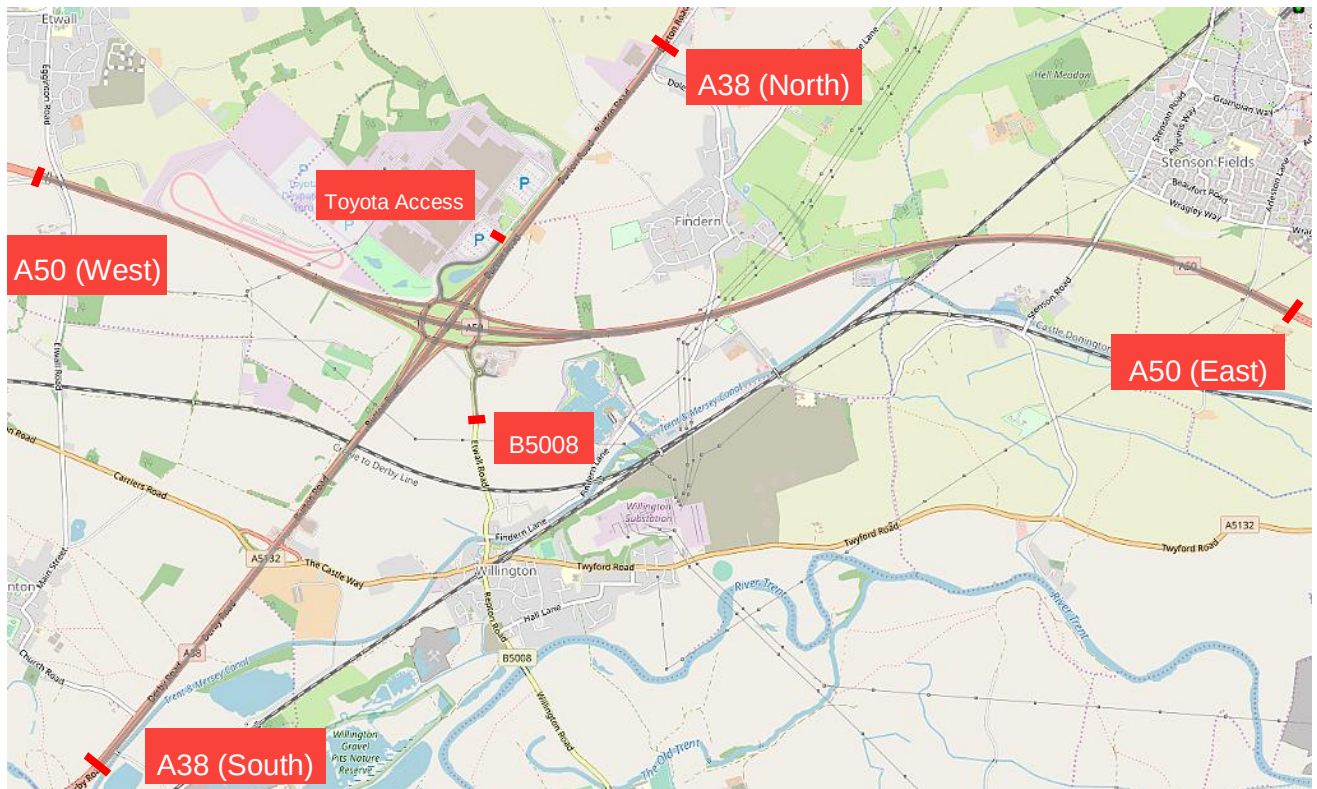
It is worth mentioning that due to the congestion experienced in the model, which has been increased significantly from the base scenario to the DM scenario, there is suppressed demand that couldn't be loaded into the network in both DM and DS scenarios.

3.2.1 JOURNEY TIME RESULTS

To assess the impact of the development traffic, queue length and journey time data were collected from both the DM and DS models. Detailed Journey Time and Queue Length data are included in Appendix E and Appendix F respectively.

Location of journey time markers is shown in Figure 5.

Figure 5 Location of markers to collect journey time



A summary of the journey time comparison between DM and DS for 2025 AM and PM are displayed in Table 5 and Table 6 respectively.

Regarding the AM peak, the highest increase forecast belongs to Route 23 (from A38NB to B5008 SB) with 27.5%. Among the 36 routes, 18 (50%) show reductions in travel time, 7 of them (19.4%) show an increase that is lower than 5% and only 11 journey times (30.6%) are extended by more than 5%. The highest rise in journey times comes from turning movements from both the A50 WB and A38 NB.

Table 5 – Journey Time Results – 2025 AM

	From	To	2025 DM AM	2025 DS AM	Difference	Diff (%)
Route 1	A38 SB (North)	A50 EB (East)	599	570	-29	-4.9%
Route 2	A38 SB (North)	B5008 SB	467	445	-23	-4.9%
Route 3	A38 SB (North)	A38 SB (South)	296	287	-8	-2.8%
Route 4	A38 SB (North)	A50 WB (West)	467	445	-22	-4.7%
Route 5	A38 SB (North)	Toyota Access NB	413	397	-17	-4.0%
Route 6	A38 SB (North)	A38 NB (North)	437	430	-7	-1.7%
Route 7	A50 WB (East)	B5008 SB	288	329	40	14.0%
Route 8	A50 WB (East)	A38 SB (South)	386	431	45	11.6%
Route 9	A50 WB (East)	A50 WB (West)	269	270	1	0.2%
Route 10	A50 WB (East)	Toyota Access NB	321	357	36	11.3%
Route 11	A50 WB (East)	A38 NB (North)	368	408	39	10.7%
Route 12	A50 WB (East)	A50 EB (East)	492	535	43	8.8%
Route 13	B5008 NB	A38 SB (South)	411	407	-4	-1.0%
Route 14	B5008 NB	A50 WB (West)	427	392	-34	-8.1%
Route 15	B5008 NB	Toyota Access NB	403	360	-43	-10.7%
Route 16	B5008 NB	A38 NB (North)	477	442	-35	-7.2%
Route 17	B5008 NB	A50 EB (East)	583	548	-35	-6.0%
Route 18	B5008 NB	B5008 SB	158	157	-1	-0.4%
Route 19	A38 NB (South)	A50 WB (West)	576	655	79	13.7%
Route 20	A38 NB (South)	Toyota Access NB	547	630	84	15.3%
Route 21	A38 NB (South)	A38 NB (North)	285	342	57	20.0%
Route 22	A38 NB (South)	A50 EB (East)	772	849	76	9.9%
Route 23	A38 NB (South)	B5008 SB	586	747	161	27.5%
Route 24	A38 NB (South)	A38 SB (South)	754	830	76	10.0%
Route 25	A50 EB (West)	Toyota Access NB	818	829	11	1.4%
Route 26	A50 EB (West)	A38 NB (North)	882	895	13	1.5%
Route 27	A50 EB (West)	A50 EB (East)	332	341	9	2.7%
Route 28	A50 EB (West)	B5008 SB	748	752	4	0.5%
Route 29	A50 EB (West)	A38 SB (South)	875	867	-8	-0.9%
Route 30	A50 EB (West)	A50 WB (West)	913	808	-105	-11.5%
Route 31	Toyota Access SB	A38 NB (North)	126	125	-1	-1.1%
Route 32	Toyota Access SB	A50 EB (East)	271	271	-1	-0.2%
Route 33	Toyota Access SB	B5008 SB	134	134	0	0.4%
Route 34	Toyota Access SB	A38 SB (South)	243	239	-4	-1.5%
Route 35	Toyota Access SB	A50 WB (West)	233	228	-5	-2.1%
Route 36	Toyota Access SB	Toyota Access NB	191	197	6	3.1%
Total difference					400	2.4%

In terms of the PM peak, the highest increase is 17.3% shown by Route 30 (from A50 EB to A50 WB) followed by Route 15 (from B5008 NB to Toyota Access NB) with 16%. Out of 36 routes, 8 (22.2%) show reductions in journey times, 16 of them (44.4%) show an increase lower than 5%, 3 routes (8.3%) journey times are extended by 5% to 10% and the rest of them (25%) show an increment between 10% and 17.3%. Most of the routes effected with an increase of the journey time belong to turning movements from A50 EB and B5008 NB.

Table 6 – Journey Time Results – 2025 PM

	From	To	2025 DM PM	2025 DS PM	Difference	Diff (%)
Route 1	A38 SB (North)	A50 EB (East)	943	939	-4	-0.4%
Route 2	A38 SB (North)	B5008 SB	812	803	-9	-1.1%
Route 3	A38 SB (North)	A38 SB (South)	418	418	1	0.1%
Route 4	A38 SB (North)	A50 WB (West)	714	720	6	0.8%
Route 5	A38 SB (North)	Toyota Access NB	626	654	28	4.5%
Route 6	A38 SB (North)	A38 NB (North)	705	700	-6	-0.8%
Route 7	A50 WB (East)	B5008 SB	261	258	-3	-1.1%
Route 8	A50 WB (East)	A38 SB (South)	355	352	-3	-0.9%
Route 9	A50 WB (East)	A50 WB (West)	268	268	0	0.1%
Route 10	A50 WB (East)	Toyota Access NB	298	298	0	-0.1%
Route 11	A50 WB (East)	A38 NB (North)	352	350	-2	-0.6%
Route 12	A50 WB (East)	A50 EB (East)	465	468	3	0.6%
Route 13	B5008 NB	A38 SB (South)	179	197	18	10.0%
Route 14	B5008 NB	A50 WB (West)	168	186	18	10.7%
Route 15	B5008 NB	Toyota Access NB	136	158	22	16.0%
Route 16	B5008 NB	A38 NB (North)	228	258	30	13.1%
Route 17	B5008 NB	A50 EB (East)	338	367	29	8.6%
Route 18	B5008 NB	B5008 SB	50	51	1	2.2%
Route 19	A38 NB (South)	A50 WB (West)	243	254	11	4.5%
Route 20	A38 NB (South)	Toyota Access NB	214	231	18	8.3%
Route 21	A38 NB (South)	A38 NB (North)	185	185	0	0.0%
Route 22	A38 NB (South)	A50 EB (East)	372	386	14	3.7%
Route 23	A38 NB (South)	B5008 SB	251	264	13	5.0%
Route 24	A38 NB (South)	A38 SB (South)	345	357	12	3.4%
Route 25	A50 EB (West)	Toyota Access NB	523	601	78	15.0%
Route 26	A50 EB (West)	A38 NB (North)	597	667	70	11.8%
Route 27	A50 EB (West)	A50 EB (East)	274	285	11	3.9%
Route 28	A50 EB (West)	B5008 SB	447	518	71	15.9%
Route 29	A50 EB (West)	A38 SB (South)	569	632	63	11.1%
Route 30	A50 EB (West)	A50 WB (West)	501	587	87	17.3%
Route 31	Toyota Access SB	A38 NB (North)	611	633	22	3.6%
Route 32	Toyota Access SB	A50 EB (East)	814	833	19	2.3%
Route 33	Toyota Access SB	B5008 SB	715	736	21	2.9%
Route 34	Toyota Access SB	A38 SB (South)	784	793	9	1.1%

	From	To	2025 DM PM	2025 DS PM	Difference	Diff (%)
Route 35	Toyota Access SB	A50 WB (West)	776	782	6	0.8%
Route 36	Toyota Access SB	Toyota Access NB	725	830	105	14.4%
Total difference					756	4.6%

In summary, results for 2025 indicate a slight overall increase in journey times in DS compared to DM. The additional trips generated from the assessed development will cause 1.6% average increase in journey time in AM peak and 6.4% in PM peak.

3.2.2 DELAYS

The delay experienced by vehicle has been analysed in both the DM and DS in order to see the effect of the inclusion of the assessed development. The comparison between both scenarios in both AM and PM is displayed in Figure 6 and Figure 7 respectively.

Figure 6 Delay difference per vehicle in the AM [seconds]

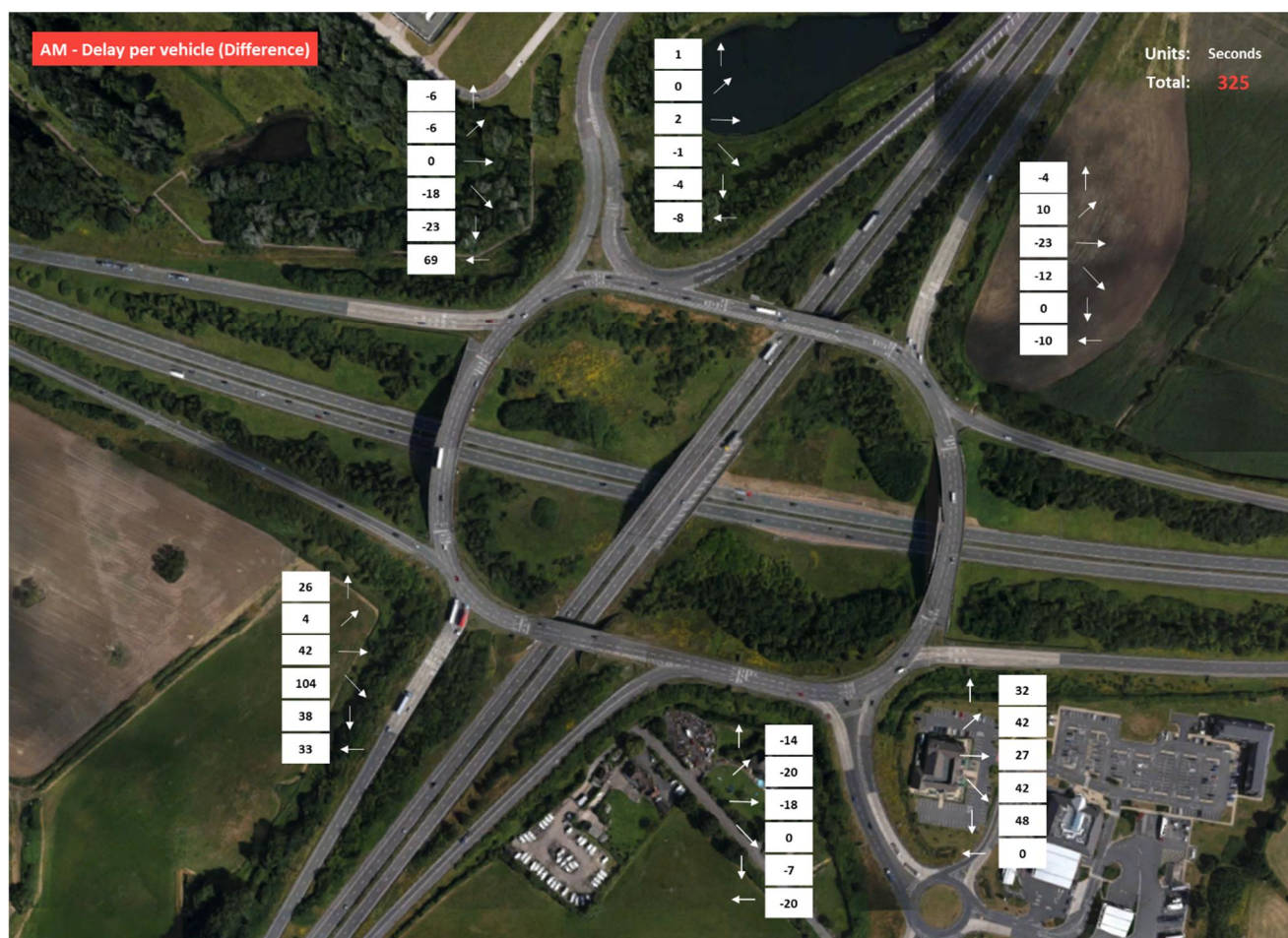


Figure 7 Delay difference per vehicle in the PM [seconds]

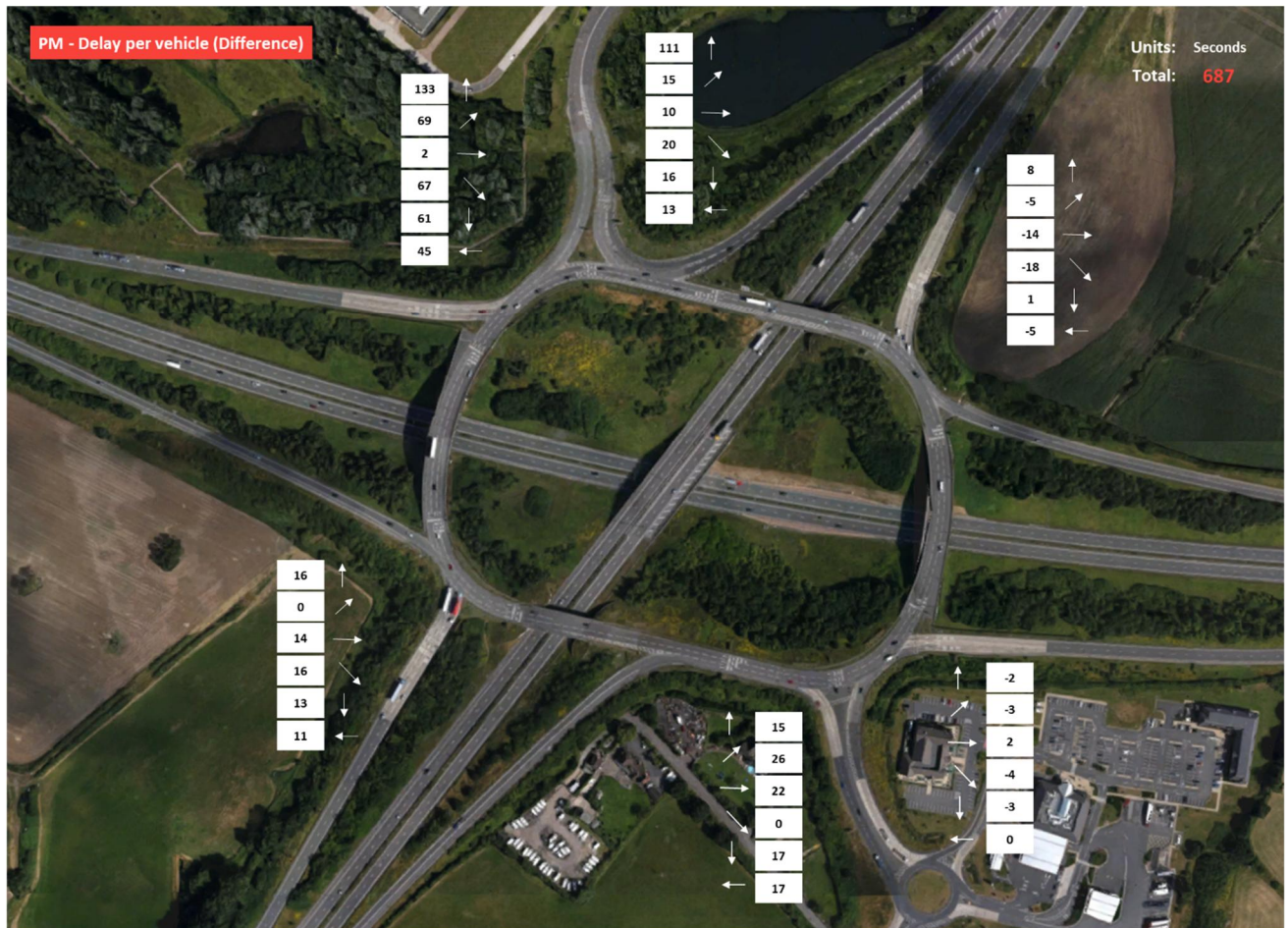


Table 7 summarises the values of the delay per vehicle for each period and scenario. The values displayed show that there is a slight increase on total delay in both time periods of DS with respect to DM, being the PM more effected than the AM. In the AM, the highest relative increase on delay is 70.4%, shown in route 10, which corresponds to those trips from the A50 WB to Toyota Access NB. On the other hand, the PM highest relative increase is forecast to correspond to route 13 (78.3%) from B5008 NB to A38 SB.

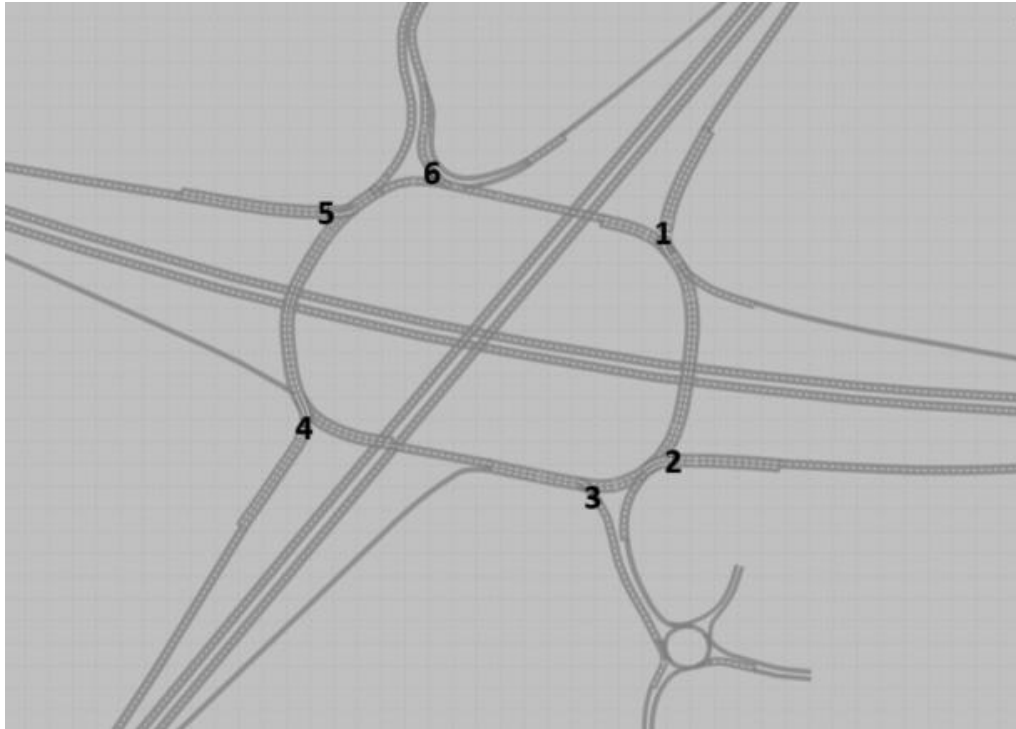
Table 7 – Delay per vehicle [seconds] – Comparison 2025

	AM				PM			
	2025 DM	2025 DS	Diff	Diff (%)	2025 DM	2025 DS	Diff	Diff (%)
Route 1	238	215	-23	-9.7%	495	481	-14	-2.9%
Route 2	207	195	-12	-5.9%	443	425	-18	-4.1%
Route 3	15	15	0	-2.1%	29	30	1	1.8%
Route 4	132	122	-10	-7.6%	254	249	-5	-1.9%
Route 5	91	87	-4	-4.3%	207	215	8	4.0%
Route 6	99	110	10	10.5%	249	244	-5	-2.0%
Route 7	68	111	42	61.9%	43	39	-4	-8.8%
Route 8	77	125	48	61.7%	47	44	-3	-6.9%
Route 9	1	2	0	42.9%	1	1	0	3.0%
Route 10	46	78	32	70.4%	26	24	-2	-9.3%
Route 11	67	110	42	62.8%	50	48	-3	-5.4%
Route 12	74	101	27	36.7%	40	42	2	5.6%
Route 13	149	142	-7	-4.7%	22	39	17	78.3%
Route 14	163	143	-20	-12.2%	24	41	17	69.3%
Route 15	152	138	-14	-9.4%	23	38	15	64.5%
Route 16	201	181	-20	-10.1%	82	108	26	31.3%
Route 17	193	174	-18	-9.6%	77	99	22	28.4%
Route 18	0	0	0	0.0%	0	0	0	0.0%
Route 19	255	287	33	12.9%	39	50	11	27.7%
Route 20	238	264	26	11.0%	28	44	16	56.8%
Route 21	14	18	4	28.8%	2	1	0	-8.8%
Route 22	339	381	42	12.3%	37	52	14	38.5%
Route 23	286	390	104	36.3%	38	53	16	41.7%
Route 24	362	400	38	10.5%	41	54	13	32.4%
Route 25	634	629	-6	-0.9%	373	506	133	35.5%
Route 26	699	693	-6	-0.9%	397	466	69	17.4%
Route 27	16	16	0	0.2%	5	8	2	47.6%
Route 28	545	527	-18	-3.4%	265	332	67	25.3%
Route 29	629	606	-23	-3.7%	315	375	61	19.3%
Route 30	520	590	69	13.3%	296	341	45	15.2%
Route 31	3	3	0	-3.7%	254	269	15	6.0%
Route 32	23	25	2	7.4%	399	410	10	2.5%
Route 33	18	17	-1	-5.1%	395	416	20	5.2%
Route 34	36	31	-4	-12.3%	402	418	16	4.1%
Route 35	41	33	-8	-20.5%	411	424	13	3.2%
Route 36	13	14	1	11.0%	391	502	111	28.4%
Total diff			325	4.9%			687	11.1%

3.2.3 QUEUE LENGTH RESULTS

In terms of queue lengths, Figure 8 shows the location of the queue length counters. Queue lengths are measured from the location of the counters upstream to the edge of the network.

Figure 8 Queue counters location



The data displayed in Table 8 indicates that by 2025, in the AM both maximum and average queue lengths for the DS scenario are forecast to be similar to DM with the exception of the A50 WB approach (Queue 2), which shows an increase of circa 261m and 127m of the maximum and average queue lengths respectively and the A38 NB (Queue 4) on a lower scale.

Table 8 – Queue Length Results – 2025 AM

	2025 AM							
	DM		DS		Difference		Difference (%)	
	Max	Average	Max	Average	Max	Average	Max	Average
Queue 1	1904	1257	1905	1252	1	-4	0.0%	-0.4%
Queue 2	359	200	620	327	261	127	72.8%	63.4%
Queue 3	421	311	422	314	0	3	0.0%	0.9%
Queue 4	2734	1535	2986	1838	252	303	9.2%	19.7%
Queue 5	2421	1293	2423	1308	2	15	0.1%	1.2%
Queue 6	26	20	23	19	-3	-1	-10.3%	-5.1%

In terms of the PM, as shown in Table 9, the highest increase from DM to DS corresponds to the maximum queue length of the A38 NB approach (Queue 4) and the most pronounced decrease is forecast to be seen on the A50 WB approach (Queue 2) when it comes to maximum queue length. In reference to average queue lengths for this period, the approaches A38 NB (Queue 4), B5008 NB (Queue 3) and A50 EB (Queue 5) show increases of 15m, 22m and 186m respectively whereas the rest of the approaches show almost no change when compared to DM scenario.

Table 9 - Queue Length Results – 2025 PM

	2025 PM							
	DM		DS		Difference		Difference (%)	
	Max	Average	Max	Average	Max	Average	Max	Average
Queue 1	1905	1400	1902	1410	-3	10	-0.2%	0.7%
Queue 2	170	106	138	106	-32	0	-18.6%	0.1%
Queue 3	137	100	160	122	22	22	16.3%	22.5%
Queue 4	87	62	118	77	32	15	36.6%	24.9%
Queue 5	1996	853	2309	1039	312	186	15.6%	21.8%
Queue 6	596	421	596	422	0	1	0.0%	0.3%

3.2.4 NETWORK STATISTICS

As it can be seen in Table 10 the Do Something scenario show slight increases in both the suppressed demand and delay as well as in the Total Travel Time in the whole network.

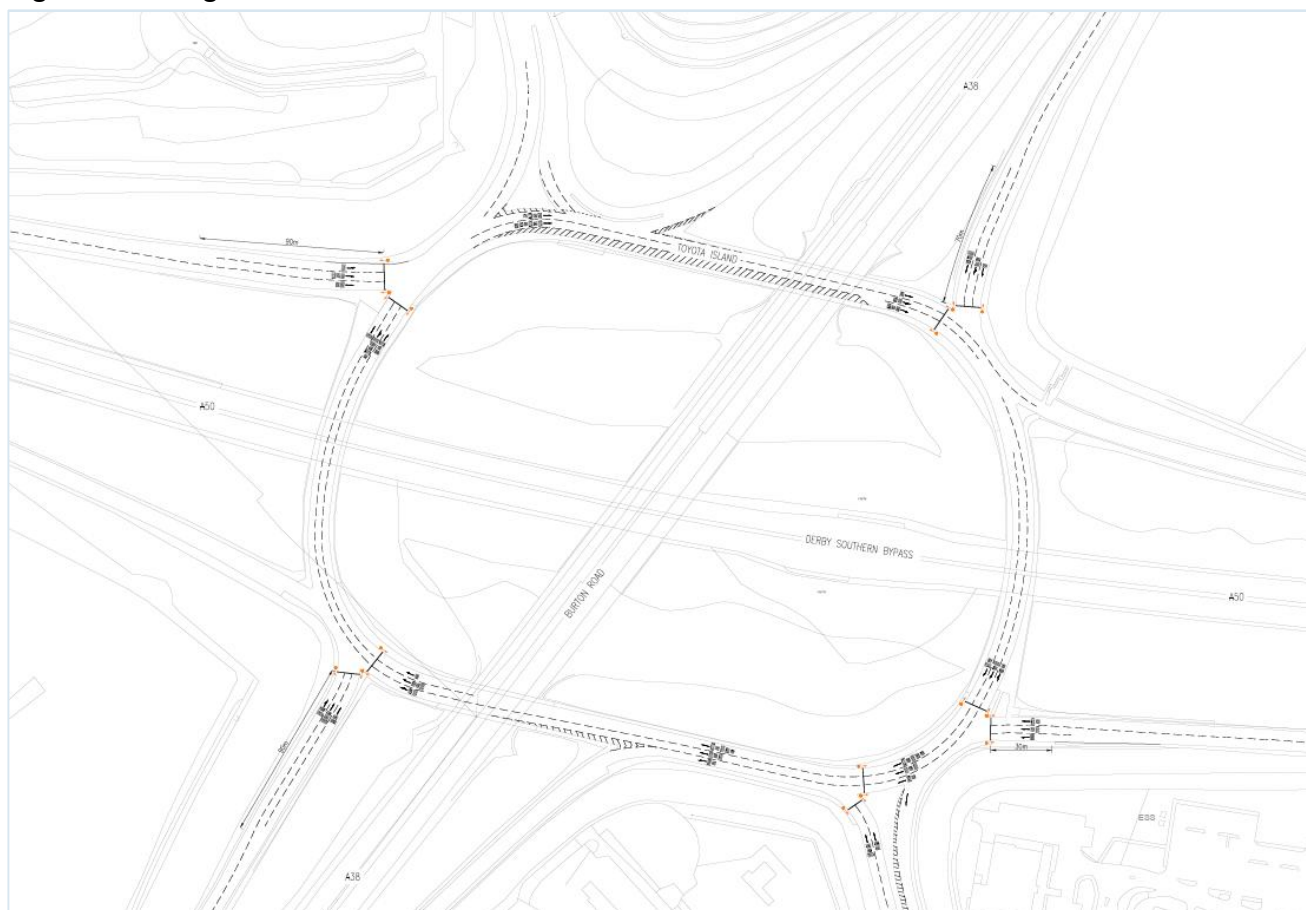
Table 10 - Network Statistics

	AM DM	AM DS	AM Diff	PM DM	PM DS	PM Diff
Supressed demand (Average) [Vehicles]	1073	1079	6	1370	1433	63
Delay (Average) [Seconds]	174	194	19	142	150	9
Travel Time (Total) [Seconds]	5107985	5340392	232407	4336654	4473984	137329

4 MITIGATION SCHEME

In order to improve the operational performance of the junction once the development is in place an initial draft of a mitigation scheme has been designed. This scheme consists on the signalisation of 5 out of the 6 arms of the junction and the change of some lane allocations. Further detail on this is provided in the drawing 70046897-GA-001 P01 captured below and included in Appendix I.

Figure 9 – Mitigation Scheme



The performance of the scheme has been assessed through Vissim modelling and the results are discussed in the following subchapters. It is important to mention that the amount of time invested on the refinement of the scheme at this stage has been kept proportionate to the impact of the development on the performance of the already congested junction, meaning that further refinement should be carried out – with the inclusion of Microprocessor Optimised Vehicle Actuation (MOVA), for instance - in order to go ahead with the scheme.

4.1.1 JOURNEY TIME RESULTS

The results displayed in Table 11 forecast that in the AM the journey times would be decreased overall by 28.2% with the partial signalisation of the junction and, whereas some movements would experience an increase in travel time, most of them would see their journeys reduced.

Table 11 - Mitigation Journey Time Results - 2025 AM

	From	To	2025 DM AM	2025 DS AM	Difference	Diff (%)
Route 1	A38 SB (North)	A50 EB (East)	599	551	-48	-8.0%
Route 2	A38 SB (North)	B5008 SB	467	564	97	20.7%
Route 3	A38 SB (North)	A38 SB (South)	296	274	-22	-7.4%
Route 4	A38 SB (North)	A50 WB (West)	467	529	62	13.3%
Route 5	A38 SB (North)	Toyota Access NB	413	482	68	16.5%
Route 6	A38 SB (North)	A38 NB (North)	437	496	59	13.6%
Route 7	A50 WB (East)	B5008 SB	288	286	-3	-0.9%
Route 8	A50 WB (East)	A38 SB (South)	386	385	-1	-0.2%
Route 9	A50 WB (East)	A50 WB (West)	269	270	1	0.3%
Route 10	A50 WB (East)	Toyota Access NB	321	366	45	13.9%
Route 11	A50 WB (East)	A38 NB (North)	368	404	36	9.6%
Route 12	A50 WB (East)	A50 EB (East)	492	412	-80	-16.3%
Route 13	B5008 NB	A38 SB (South)	411	216	-195	-47.6%
Route 14	B5008 NB	A50 WB (West)	427	199	-228	-53.4%
Route 15	B5008 NB	Toyota Access NB	403	177	-226	-56.0%
Route 16	B5008 NB	A38 NB (North)	477	272	-204	-42.9%
Route 17	B5008 NB	A50 EB (East)	583	394	-189	-32.5%
Route 18	B5008 NB	B5008 SB	158	59	-99	-62.5%
Route 19	A38 NB (South)	A50 WB (West)	576	257	-319	-55.4%
Route 20	A38 NB (South)	Toyota Access NB	547	219	-328	-60.0%
Route 21	A38 NB (South)	A38 NB (North)	285	189	-96	-33.7%
Route 22	A38 NB (South)	A50 EB (East)	772	442	-330	-42.7%
Route 23	A38 NB (South)	B5008 SB	586	446	-140	-23.9%
Route 24	A38 NB (South)	A38 SB (South)	754	551	-203	-26.9%
Route 25	A50 EB (West)	Toyota Access NB	818	176	-642	-78.5%
Route 26	A50 EB (West)	A38 NB (North)	882	237	-645	-73.1%
Route 27	A50 EB (West)	A50 EB (East)	332	267	-65	-19.6%
Route 28	A50 EB (West)	B5008 SB	748	400	-349	-46.6%
Route 29	A50 EB (West)	A38 SB (South)	875	489	-386	-44.1%
Route 30	A50 EB (West)	A50 WB (West)	913	197	-716	-78.4%
Route 31	Toyota Access SB	A38 NB (North)	126	122	-5	-3.6%
Route 32	Toyota Access SB	A50 EB (East)	271	298	27	9.9%

	From	To	2025 DM AM	2025 DS AM	Difference	Diff (%)
Route 33	Toyota Access SB	B5008 SB	134	309	175	131.4%
Route 34	Toyota Access SB	A38 SB (South)	243	417	175	71.9%
Route 35	Toyota Access SB	A50 WB (West)	233	433	200	85.6%
Route 36	Toyota Access SB	Toyota Access NB	191	93	-98	-51.5%
Total difference					-4673	-28.2%

The journey time results for the PM, as can be seen in the Table 12, show also an overall reduction but on a lower scale, with a total of 5.3% decrease.

Table 12 - Mitigation Journey Time Results - 2025 PM

	From	To	2025 DM PM	2025 DS PM	Difference	Diff (%)
Route 1	A38 SB (North)	A50 EB (East)	943	296	-647	-68.6%
Route 2	A38 SB (North)	B5008 SB	812	247	-565	-69.5%
Route 3	A38 SB (North)	A38 SB (South)	418	188	-229	-54.9%
Route 4	A38 SB (North)	A50 WB (West)	714	375	-339	-47.4%
Route 5	A38 SB (North)	Toyota Access NB	626	376	-249	-39.8%
Route 6	A38 SB (North)	A38 NB (North)	705	437	-269	-38.1%
Route 7	A50 WB (East)	B5008 SB	261	466	205	78.8%
Route 8	A50 WB (East)	A38 SB (South)	355	541	185	52.2%
Route 9	A50 WB (East)	A50 WB (West)	268	269	1	0.4%
Route 10	A50 WB (East)	Toyota Access NB	298	460	161	54.1%
Route 11	A50 WB (East)	A38 NB (North)	352	599	247	70.0%
Route 12	A50 WB (East)	A50 EB (East)	465	697	233	50.0%
Route 13	B5008 NB	A38 SB (South)	179	243	64	35.8%
Route 14	B5008 NB	A50 WB (West)	168	263	95	56.7%
Route 15	B5008 NB	Toyota Access NB	136	266	130	95.3%
Route 16	B5008 NB	A38 NB (North)	228	419	191	83.7%
Route 17	B5008 NB	A50 EB (East)	338	536	198	58.6%
Route 18	B5008 NB	B5008 SB	50	81	31	62.4%
Route 19	A38 NB (South)	A50 WB (West)	243	245	1	0.5%
Route 20	A38 NB (South)	Toyota Access NB	214	259	45	21.0%
Route 21	A38 NB (South)	A38 NB (North)	185	185	0	0.0%
Route 22	A38 NB (South)	A50 EB (East)	372	473	101	27.1%

	From	To	2025 DM PM	2025 DS PM	Difference	Diff (%)
Route 23	A38 NB (South)	B5008 SB	251	416	164	65.5%
Route 24	A38 NB (South)	A38 SB (South)	345	499	153	44.4%
Route 25	A50 EB (West)	Toyota Access NB	523	182	-341	-65.1%
Route 26	A50 EB (West)	A38 NB (North)	597	251	-345	-57.9%
Route 27	A50 EB (West)	A50 EB (East)	274	267	-7	-2.6%
Route 28	A50 EB (West)	B5008 SB	447	375	-72	-16.2%
Route 29	A50 EB (West)	A38 SB (South)	569	471	-98	-17.2%
Route 30	A50 EB (West)	A50 WB (West)	501	519	18	3.6%
Route 31	Toyota Access SB	A38 NB (North)	611	442	-169	-27.6%
Route 32	Toyota Access SB	A50 EB (East)	814	770	-44	-5.5%
Route 33	Toyota Access SB	B5008 SB	715	858	143	20.0%
Route 34	Toyota Access SB	A38 SB (South)	784	876	92	11.7%
Route 35	Toyota Access SB	A50 WB (West)	776	906	131	16.9%
Route 36	Toyota Access SB	Toyota Access NB	725	647	-78	-10.8%
Total difference					-863	-5.3%

It is worth noting here, in both peaks, certain movements / routes through the junction do experience an increase in journey time as a result of the introduction of signals at five nodes of the roundabout. For some of the movements, e.g. right turns and u-turns, this means that there could be three or four signal controlled stoplines to pass through, therefore an increase in journey time once entering the junction is to be expected. With the implementation of signals it is about trying to address the delay issues on the approach to the junction such that the overall trip journey time can see an improvement.

4.1.2 DELAYS

Table 13 shows that the AM is forecast to decrease the delay at the junction by 34% overall, however, the PM would see the delay increased by 21% mainly due to the A38 SB arm. Nevertheless, it is considered that the use of MOVA would potentially optimise the performance of the junction and in particular the performance of the A38 SB, A50 WB and B5008 NB arms resulting in a decrease of the delay compared to the Do Minimum scenario.

Table 13 - Delay per vehicle [seconds] - Mitigation Comparison

	AM				PM			
	2025 DM	2025 DS	Diff	Diff (%)	2025 DM	2025 DS	Diff	Diff (%)
Route 1	238	219	-19	-8.0%	495	47	-448	-90.5%
Route 2	207	364	156	75.4%	443	113	-330	-74.4%

	AM				PM			
	2025 DM	2025 DS	Diff	Diff (%)	2025 DM	2025 DS	Diff	Diff (%)
Route 3	15	12	-3	-17.0%	29	1	-28	-95.3%
Route 4	132	233	101	76.5%	254	171	-82	-32.5%
Route 5	91	207	116	127.7%	207	190	-17	-8.1%
Route 6	99	230	131	131.8%	249	263	14	5.8%
Route 7	68	71	3	4.7%	43	248	205	479.4%
Route 8	77	77	0	0.1%	47	239	192	406.6%
Route 9	1	1	0	13.4%	1	2	1	78.8%
Route 10	46	91	45	97.8%	26	192	165	632.9%
Route 11	67	106	39	57.2%	50	302	252	501.7%
Route 12	74	138	64	86.5%	40	277	238	596.9%
Route 13	149	51	-98	-65.9%	22	61	39	176.1%
Route 14	163	56	-107	-65.9%	24	94	70	291.6%
Route 15	152	60	-92	-60.5%	23	124	101	440.5%
Route 16	201	127	-75	-37.0%	82	252	170	206.5%
Route 17	193	132	-61	-31.7%	77	258	180	232.9%
Route 18	0	0	0	0.0%	0	0	0	0.0%
Route 19	255	50	-205	-80.3%	39	40	1	2.2%
Route 20	238	43	-195	-82.1%	28	86	58	206.4%
Route 21	14	3	-11	-75.7%	2	1	0	-7.5%
Route 22	339	105	-234	-69.0%	37	141	104	277.5%
Route 23	286	254	-32	-11.3%	38	205	168	447.1%
Route 24	362	266	-96	-26.6%	41	210	169	413.9%
Route 25	634	42	-592	-93.3%	373	45	-328	-87.9%
Route 26	699	57	-642	-91.8%	397	71	-326	-82.1%
Route 27	16	1	-14	-91.7%	5	1	-4	-76.8%
Route 28	545	220	-325	-59.6%	265	199	-66	-24.8%
Route 29	629	239	-390	-62.0%	315	209	-105	-33.5%
Route 30	520	144	-376	-72.3%	296	268	-28	-9.5%
Route 31	3	2	-1	-24.0%	254	148	-106	-41.7%
Route 32	23	64	41	181.8%	399	372	-27	-6.7%
Route 33	18	150	133	754.6%	395	600	205	51.8%
Route 34	36	215	179	501.9%	402	548	146	36.3%

	AM				PM			
	2025 DM	2025 DS	Diff	Diff (%)	2025 DM	2025 DS	Diff	Diff (%)
Route 35	41	208	166	401.6%	411	583	172	41.9%
Route 36	13	146	133	1033.4%	391	928	537	137.5%
Total diff			-2259	-34.0%			1293	20.9%

4.1.3 QUEUE LENGTH RESULTS

In regard to the queue length results, in the AM 3 out of the 6 arms show a significant improvement whereas only the A50 WB (Queue 2) is forecast to show a minor increase of the queue length.

Table 14 - Mitigation Queue Length Results – 2025 AM

	2025 AM							
	DM		DS		Difference		Difference (%)	
	Max	Average	Max	Average	Max	Average	Max	Average
Queue 1	1904	1257	1905	1204	0	-52	0.0%	-4.2%
Queue 2	359	200	458	234	99	34	27.4%	16.9%
Queue 3	421	311	170	102	-251	-208	-59.5%	-67.0%
Queue 4	2734	1535	159	99	-2575	-1437	-94.2%	-93.6%
Queue 5	2421	1293	428	168	-1993	-1125	-82.3%	-87.0%
Queue 6	26	20	31	21	5	1	19.0%	2.7%

As for the PM peak, the A50 WB arm (Queue 2) shows a big increase in queue length, however, as mentioned previously, the use of MOVA would potentially improve this situation by the optimisation of the use of the green time at each of the arms.

Table 15 - Mitigation Queue Length Results - 2025 PM

	2025 PM							
	DM		DS		Difference		Difference (%)	
	Max	Average	Max	Average	Max	Average	Max	Average
Queue 1	1905	1400	153	103	-1752	-1296	-91.9%	-92.6%
Queue 2	170	106	1502	619	1332	513	784.2%	486.3%
Queue 3	137	100	273	174	135	74	98.5%	74.0%
Queue 4	87	62	122	74	35	12	40.9%	20.0%
Queue 5	1996	853	277	147	-1720	-706	-86.1%	-82.8%
Queue 6	596	421	597	413	1	-8	0.2%	-2.0%

4.1.4 NETWORK STATISTICS

Based on the network statistics taken out of the model – see Table 16 - in the AM, the introduction of the scheme results in an increased throughput at the junction through a reduction in suppressed demand of approximately 500 vehicles. Therefore, the morning peak is forecast to see a general reduction in queue length and in the number of vehicles left outside the modelled network at the end of the simulated time period. This results in a reduced average delay per vehicle of 90 seconds.

In the same way, the PM is forecast to see an increased throughput due to the reduction in suppressed demand of circa 1,200 vehicles. The overall junction improvement results in a reduced average delay per vehicle of 40 about seconds. These results show that at an overall junction level the mitigation scheme is delivering betterment over and above the impact of the proposed scheme.

Table 16 - Mitigation Network Statistics

	AM DM	AM DS	AM Diff	PM DM	PM DS	PM Diff
Supressed demand (Average) [Vehicles]	1073	506	-567	1370	75	-1295
Delay (Average) [Seconds]	174	84	-90	142	100	-42
Travel Time (Total) [Seconds]	5107985	4129912	-978073	4336654	4142212	-194443

5 CONCLUSION

This report outlines the assessment of the impact that a new mixed-use development would have on the A50-A38 junction performance. A Highways England approved base model developed by AECOM has been used to test both the Do Minimum and Do Something scenarios, representing without and with development scenarios, for 2025. The traffic flows used for this assessment have been provided by BSP Consulting.

Both the DM and DS models were run up to a maximum of 50 times for convergence with all of them achieving a 100% share of converged paths.

The modelling results show that the A50-A38 junction will be subject to a significant increase in traffic demand in 2025 due to the traffic growth and the inclusion of committed developments traffic. The impact is such that it is expected that mitigation to accommodate this growth would be required.

Regarding the comparison between Do Minimum and Do Something, the junction would experience a minor increase in both journey times and queue lengths once the assessed development was built which would have a further negative impact on the junction operational performance. The impact of this development is exacerbated by the lack of a mitigation scheme for the background growth and committed development.

In view of the obtained results, it is evident that with the forecast background traffic growth and assumed committed development, the A50-A38 junction is forecast to be significantly over capacity and require intervention / mitigation works. The assessed development has a small contributing factor to the junction being over capacity, therefore mitigation measures will be required to mitigate the impact of the assessed development solely to bring the junction back to the operational conditions shown without the development in place.

Further assessment of the operational performance of the junction was carried out through the proposal of an initial draft of a mitigation scheme. The results taken out of the appraisal of such mitigation scheme show the potential for performance improvement achievable through the signalisation of 5 arms and change of some lane allocations.

The mitigation scheme demonstrates improved vehicle throughput in both modelled periods, a reduction in average delay experienced per vehicle in both modelled periods and an average reduction in journey times through the junction.

It is noted that the current assessment has been undertaken based on fixed time operation of the traffic signals. Should the mitigation scheme be implemented, it is a standard requirement for this type of junction to use of Microprocessor Optimised Vehicle Actuation (MOVA). However, it was agreed that MOVA could be added by Highways England if the proposed mitigation scheme already offered network benefits without MOVA and the cost of the additional equipment made the mitigation scheme no longer proportionate to the impact of the development traffic. If the mitigation scheme is accepted and taken forwards, further modelling can be undertaken to support design and assessment of the MOVA operation.

Appendix A

BASE FLOWS **wsp**

2016 AM Peak

LVs

	1	2	3	4	5	6	
1	11	466	260	1575	204	47	2563
2	394	3	44	759	1062	52	2314
3	282	70	15	8	212	21	608
4	1652	683	1	10	169	31	2546
5	190	1377	127	149	0	43	1886
6	18	11	9	10	4	1	53
	2547	2610	456	2511	1651	195	9970

HVs

	1	2	3	4	5	6	
1	2	8	11	135	10	3	169
2	8	1	8	62	157	5	241
3	5	7	0	0	2	0	14
4	166	65	0	1	64	2	298
5	23	157	7	53	1	2	243
6	5	3	0	7	5	0	20
	209	241	26	258	239	12	985

2016 PM Peak

LVs

	1	2	3	4	5	6	
1	11	347	209	1639	153	6	2365
2	293	8	90	556	1101	10	2058
3	256	47	17	16	76	9	421
4	1390	518	3	5	197	6	2119
5	225	1134	148	116	1	10	1634
6	323	227	115	153	68	1	887
	2498	2281	582	2485	1596	42	9484

HVs

	1	2	3	4	5	6	
1	0	13	0	149	10	1	173
2	15	8	0	52	150	0	225
3	14	0	0	0	0	0	14
4	131	39	16	0	50	1	237
5	22	169	0	45	7	4	247
6	0	2	0	1	0	0	3
	182	231	16	247	217	6	899

Appendix B

wsp
COMMITTED DEVELOPMENT FLOWS

2025 AM Peak

LVs:

	1	2	3	4	5	6	
1	0	108	0	119	92	0	319
2	51	0	0	37	155	0	243
3	0	0	0	0	0	0	0
4	16	7	0	0	70	0	92
5	12	145	0	78	0	0	234
6	0	0	0	0	0	0	0
	79	259	0	234	317	0	889

HVs

	1	2	3	4	5	6	
1	0	2	0	2	1	0	5
2	1	0	0	1	2	0	4
3	0	0	0	0	0	0	0
4	0	0	0	0	1	0	1
5	0	2	0	1	0	0	4
6	0	0	0	0	0	0	0
	1	4	0	4	5	0	14

2025 PM Peak

LVs:

	1	2	3	4	5	6	
1	0	106	0	51	40	0	197
2	99	0	0	23	121	0	243
3	0	0	0	0	0	0	0
4	88	58	0	0	58	0	205
5	68	163	0	74	0	0	305
6	0	0	0	0	0	0	0
	255	327	0	148	219	0	950

HVs

	1	2	3	4	5	6	
1	0	2	0	1	1	0	3
2	2	0	0	0	2	0	4
3	0	0	0	0	0	0	0
4	1	1	0	0	1	0	3
5	1	3	0	1	0	0	5
6	0	0	0	0	0	0	0
	4	5	0	2	3	0	15

Appendix C

DEVELOPMENT FLOWS 

2025 AM Peak

LVs:

	1	2	3	4	5	6	
1	0	0	47	0	0	0	47
2	0	0	36	0	0	0	36
3	8	6	0	5	2	0	21
4	0	0	27	0	0	0	27
5	0	0	11	0	0	0	11
6	0	0	0	0	0	0	0
	8	6	121	5	2	0	142

HVs:

	1	2	3	4	5	6	
1	0	0	11	0	0	0	11
2	0	0	8	0	0	0	8
3	8	6	0	4	2	0	20
4	0	0	6	0	0	0	6
5	0	0	3	0	0	0	3
6	0	0	0	0	0	0	0
	8	6	28	4	2	0	48

2025 PM Peak

LVs

	1	2	3	4	5	6	
1	0	0	4	0	0	0	4
2	0	0	3	0	0	0	3
3	39	30	0	22	9	0	100
4	0	0	2	0	0	0	2
5	0	0	1	0	0	0	1
6	0	0	0	0	0	0	0
	39	30	10	22	9	0	110

HVs

	1	2	3	4	5	6	
1	0	0	3	0	0	0	3
2	0	0	2	0	0	0	2
3	7	5	0	4	2	0	18
4	0	0	2	0	0	0	2
5	0	0	1	0	0	0	1
6	0	0	0	0	0	0	0
	7	5	8	4	2	0	26

Appendix D

DM AND DS FLOWS

wsp

DM 2025 AM

LVs

	1	2	3	4	5	6	
1	13	644	299	1932	327	54	3270
2	505	3	51	911	1378	60	2907
3	325	81	17	9	244	24	700
4	1917	793	1	12	264	36	3023
5	230	1730	146	249	0	49	2405
6	21	13	10	12	5	1	61
	3011	3263	525	3124	2218	224	12365

HGs

	1	2	3	4	5	6	
1	2	11	13	157	13	3	199
2	10	1	9	72	183	6	281
3	6	8	0	0	2	0	16
4	191	75	0	1	75	2	344
5	27	183	8	62	1	2	283
6	6	3	0	8	6	0	23
	242	281	30	301	280	14	1148

DM 2025 PM

LVs

	1	2	3	4	5	6	
1	13	506	241	1940	216	7	2922
2	437	9	104	664	1390	12	2615
3	295	54	20	18	88	10	485
4	1690	655	3	6	285	7	2646
5	327	1470	171	207	1	12	2187
6	372	262	133	176	78	1	1022
	3133	2955	671	3012	2058	48	11877

HGs

	1	2	3	4	5	6	
1	0	17	0	172	12	1	202
2	19	9	0	60	175	0	263
3	16	0	0	0	0	0	16
4	152	46	18	0	59	1	276
5	26	197	0	53	8	5	289
6	0	2	0	1	0	0	3
	214	271	18	287	253	7	1050

DS 2025 AM

LVs

	1	2	3	4	5	6	
1	13	644	346	1932	327	54	3317
2	505	3	87	911	1378	60	2943
3	333	87	17	14	246	24	721
4	1917	793	28	12	264	36	3050
5	230	1730	157	249	0	49	2416
6	21	13	10	12	5	1	61
	3019	3269	646	3129	2220	224	12507

HGs

	1	2	3	4	5	6	
1	2	11	24	157	13	3	210
2	10	1	17	72	183	6	289
3	14	14	0	4	4	0	36
4	191	75	6	1	75	2	350
5	27	183	11	62	1	2	286
6	6	3	0	8	6	0	23
	250	287	58	305	282	14	1196

DS 2025 PM

LVs

	1	2	3	4	5	6	
1	13	506	245	1940	216	7	2926
2	437	9	107	664	1390	12	2618
3	334	84	20	40	97	10	585
4	1690	655	5	6	285	7	2648
5	327	1470	172	207	1	12	2188
6	372	262	133	176	78	1	1022
	3172	2985	681	3034	2067	48	11987

HGs

	1	2	3	4	5	6	
1	0	17	3	172	12	1	205
2	19	9	2	60	175	0	265
3	23	5	0	4	2	0	34
4	152	46	20	0	59	1	278
5	26	197	1	53	8	5	290
6	0	2	0	1	0	0	3
	221	276	26	291	255	7	1076

Appendix E

JOURNEY TIME RESULTS



AM

	Time Period	2025 DM AM	2025 DS AM	Difference	Diff (%)
Route 1	07:30 - 07:45	348	352	4	1.1%
Route 2	07:30 - 07:45	227	247	20	8.8%
Route 3	07:30 - 07:45	190	190	0	-0.2%
Route 4	07:30 - 07:45	266	276	9	3.5%
Route 5	07:30 - 07:45	210	221	11	5.3%
Route 6	07:30 - 07:45	264	258	-6	-2.4%
Route 7	07:30 - 07:45	276	292	16	5.7%
Route 8	07:30 - 07:45	367	379	13	3.4%
Route 9	07:30 - 07:45	269	270	0	0.1%
Route 10	07:30 - 07:45	303	314	11	3.6%
Route 11	07:30 - 07:45	350	365	15	4.1%
Route 12	07:30 - 07:45	490	515	25	5.2%
Route 13	07:30 - 07:45	232	295	63	27.4%
Route 14	07:30 - 07:45	245	265	19	7.9%
Route 15	07:30 - 07:45	203	228	25	12.2%
Route 16	07:30 - 07:45	301	318	17	5.7%
Route 17	07:30 - 07:45	410	421	11	2.6%
Route 18	07:30 - 07:45	78	97	19	24.8%
Route 19	07:30 - 07:45	421	432	11	2.7%
Route 20	07:30 - 07:45	378	384	6	1.7%
Route 21	07:30 - 07:45	198	203	5	2.3%
Route 22	07:30 - 07:45	597	596	-1	-0.2%
Route 23	07:30 - 07:45	240	533	293	122.1%
Route 24	07:30 - 07:45	593	586	-7	-1.2%
Route 25	07:30 - 07:45	377	347	-30	-8.0%
Route 26	07:30 - 07:45	430	416	-14	-3.2%
Route 27	07:30 - 07:45	267	267	0	0.0%
Route 28	07:30 - 07:45	344	334	-10	-2.9%
Route 29	07:30 - 07:45	468	468	1	0.1%
Route 30	07:30 - 07:45	446	509	63	14.1%
Route 31	07:30 - 07:45	123	124	0	0.3%
Route 32	07:30 - 07:45	269	267	-2	-0.8%
Route 33	07:30 - 07:45	133	130	-2	-1.8%
Route 34	07:30 - 07:45	232	233	0	0.1%
Route 35	07:30 - 07:45	237	230	-6	-2.7%
Route 36	07:30 - 07:45	186	181	-4	-2.3%
Route 1	07:45 - 08:00	549	563	14	2.5%
Route 2	07:45 - 08:00	440	452	12	2.8%
Route 3	07:45 - 08:00	251	258	7	2.8%
Route 4	07:45 - 08:00	423	435	12	2.9%
Route 5	07:45 - 08:00	370	397	27	7.2%
Route 6	07:45 - 08:00	405	420	15	3.7%

	Time Period	2025 DM AM	2025 DS AM	Difference	Diff (%)
Route 7	07:45 - 08:00	292	329	37	12.6%
Route 8	07:45 - 08:00	383	433	50	13.1%
Route 9	07:45 - 08:00	270	270	0	0.0%
Route 10	07:45 - 08:00	324	355	30	9.3%
Route 11	07:45 - 08:00	365	403	38	10.5%
Route 12	07:45 - 08:00	486	523	37	7.7%
Route 13	07:45 - 08:00	375	384	9	2.5%
Route 14	07:45 - 08:00	385	376	-9	-2.3%
Route 15	07:45 - 08:00	353	360	7	2.0%
Route 16	07:45 - 08:00	437	424	-13	-2.9%
Route 17	07:45 - 08:00	538	532	-7	-1.2%
Route 18	07:45 - 08:00	137	143	6	4.6%
Route 19	07:45 - 08:00	543	581	38	6.9%
Route 20	07:45 - 08:00	506	573	67	13.2%
Route 21	07:45 - 08:00	255	287	32	12.3%
Route 22	07:45 - 08:00	739	774	35	4.8%
Route 23	07:45 - 08:00	599	652	53	8.8%
Route 24	07:45 - 08:00	719	741	23	3.2%
Route 25	07:45 - 08:00	655	613	-42	-6.4%
Route 26	07:45 - 08:00	716	682	-34	-4.8%
Route 27	07:45 - 08:00	270	273	3	1.1%
Route 28	07:45 - 08:00	610	591	-19	-3.1%
Route 29	07:45 - 08:00	731	696	-35	-4.8%
Route 30	07:45 - 08:00	894	525	-368	-41.2%
Route 31	07:45 - 08:00	126	124	-2	-1.3%
Route 32	07:45 - 08:00	272	272	0	0.0%
Route 33	07:45 - 08:00	133	134	1	0.6%
Route 34	07:45 - 08:00	243	237	-6	-2.5%
Route 35	07:45 - 08:00	236	236	1	0.3%
Route 36	07:45 - 08:00	243	256	13	5.5%
Route 1	08:00 - 08:15	730	707	-24	-3.3%
Route 2	08:00 - 08:15	589	565	-24	-4.1%
Route 3	08:00 - 08:15	357	365	7	2.1%
Route 4	08:00 - 08:15	578	556	-22	-3.9%
Route 5	08:00 - 08:15	519	512	-8	-1.5%
Route 6	08:00 - 08:15	490	538	48	9.9%
Route 7	08:00 - 08:15	292	335	43	14.8%
Route 8	08:00 - 08:15	401	444	44	10.9%
Route 9	08:00 - 08:15	269	269	0	0.0%
Route 10	08:00 - 08:15	329	369	40	12.1%
Route 11	08:00 - 08:15	379	419	40	10.6%
Route 12	08:00 - 08:15	493	543	50	10.2%
Route 13	08:00 - 08:15	505	485	-21	-4.1%
Route 14	08:00 - 08:15	522	461	-61	-11.7%

	Time Period	2025 DM AM	2025 DS AM	Difference	Diff (%)
Route 15	08:00 - 08:15	503	425	-78	-15.5%
Route 16	08:00 - 08:15	565	509	-56	-9.9%
Route 17	08:00 - 08:15	658	607	-51	-7.8%
Route 18	08:00 - 08:15	190	196	7	3.6%
Route 19	08:00 - 08:15	645	762	117	18.1%
Route 20	08:00 - 08:15	625	719	94	15.0%
Route 21	08:00 - 08:15	337	414	77	22.8%
Route 22	08:00 - 08:15	846	952	106	12.5%
Route 23	08:00 - 08:15	674	857	182	27.0%
Route 24	08:00 - 08:15	823	944	122	14.8%
Route 25	08:00 - 08:15	995	1014	18	1.8%
Route 26	08:00 - 08:15	1060	1076	16	1.5%
Route 27	08:00 - 08:15	310	328	18	5.7%
Route 28	08:00 - 08:15	888	884	-4	-0.5%
Route 29	08:00 - 08:15	1015	990	-26	-2.5%
Route 30	08:00 - 08:15	1074	882	-192	-17.9%
Route 31	08:00 - 08:15	130	128	-2	-1.8%
Route 32	08:00 - 08:15	271	271	0	0.1%
Route 33	08:00 - 08:15	133	135	1	1.0%
Route 34	08:00 - 08:15	240	233	-7	-2.7%
Route 35	08:00 - 08:15	236	224	-12	-4.9%
Route 36	08:00 - 08:15	130	133	3	2.4%
Route 1	08:15 - 08:30	768	658	-110	-14.3%
Route 2	08:15 - 08:30	613	514	-99	-16.2%
Route 3	08:15 - 08:30	384	336	-48	-12.4%
Route 4	08:15 - 08:30	601	515	-87	-14.4%
Route 5	08:15 - 08:30	554	457	-97	-17.5%
Route 6	08:15 - 08:30	588	501	-86	-14.7%
Route 7	08:15 - 08:30	293	359	66	22.5%
Route 8	08:15 - 08:30	394	467	73	18.5%
Route 9	08:15 - 08:30	269	271	2	0.9%
Route 10	08:15 - 08:30	327	391	64	19.5%
Route 11	08:15 - 08:30	380	444	65	17.0%
Route 12	08:15 - 08:30	499	560	61	12.2%
Route 13	08:15 - 08:30	532	463	-69	-13.0%
Route 14	08:15 - 08:30	556	468	-88	-15.8%
Route 15	08:15 - 08:30	555	429	-126	-22.7%
Route 16	08:15 - 08:30	603	517	-87	-14.4%
Route 17	08:15 - 08:30	726	633	-93	-12.8%
Route 18	08:15 - 08:30	228	193	-35	-15.3%
Route 19	08:15 - 08:30	696	846	151	21.7%
Route 20	08:15 - 08:30	678	845	167	24.7%
Route 21	08:15 - 08:30	349	464	115	32.9%
Route 22	08:15 - 08:30	907	1073	166	18.2%

	Time Period	2025 DM AM	2025 DS AM	Difference	Diff (%)
Route 23	08:15 - 08:30	829	946	117	14.1%
Route 24	08:15 - 08:30	883	1047	165	18.7%
Route 25	08:15 - 08:30	1244	1344	100	8.0%
Route 26	08:15 - 08:30	1322	1408	86	6.5%
Route 27	08:15 - 08:30	482	497	15	3.1%
Route 28	08:15 - 08:30	1150	1197	47	4.1%
Route 29	08:15 - 08:30	1287	1316	29	2.2%
Route 30	08:15 - 08:30	1239	1315	76	6.1%
Route 31	08:15 - 08:30	127	125	-2	-1.4%
Route 32	08:15 - 08:30	273	273	0	-0.1%
Route 33	08:15 - 08:30	135	137	2	1.5%
Route 34	08:15 - 08:30	255	254	-2	-0.7%
Route 35	08:15 - 08:30	225	223	-2	-0.9%
Route 36	08:15 - 08:30	207	219	12	5.7%

PM

	Time Period	2025 DM PM	2025 DS PM	Difference	Diff (%)
Route 1	16:00 - 16:15	578	582	5	0.8%
Route 2	16:00 - 16:15	492	498	6	1.1%
Route 3	16:00 - 16:15	203	209	6	2.9%
Route 4	16:00 - 16:15	390	398	8	1.9%
Route 5	16:00 - 16:15	315	362	47	15.0%
Route 6	16:00 - 16:15	401	411	10	2.4%
Route 7	16:00 - 16:15	278	275	-3	-1.0%
Route 8	16:00 - 16:15	372	367	-5	-1.4%
Route 9	16:00 - 16:15	268	268	0	0.0%
Route 10	16:00 - 16:15	316	309	-6	-2.0%
Route 11	16:00 - 16:15	361	358	-3	-0.8%
Route 12	16:00 - 16:15	454	478	25	5.4%
Route 13	16:00 - 16:15	176	183	7	4.1%
Route 14	16:00 - 16:15	167	173	6	3.7%
Route 15	16:00 - 16:15	131	142	12	9.0%
Route 16	16:00 - 16:15	206	222	15	7.4%
Route 17	16:00 - 16:15	313	329	15	4.9%
Route 18	16:00 - 16:15	51	49	-2	-3.0%
Route 19	16:00 - 16:15	238	245	7	2.8%
Route 20	16:00 - 16:15	205	222	17	8.3%
Route 21	16:00 - 16:15	185	185	0	0.0%
Route 22	16:00 - 16:15	363	366	3	0.9%
Route 23	16:00 - 16:15	247	250	3	1.2%
Route 24	16:00 - 16:15	328	337	9	2.7%
Route 25	16:00 - 16:15	180	190	9	5.2%
Route 26	16:00 - 16:15	242	249	7	2.8%
Route 27	16:00 - 16:15	266	266	0	0.0%
Route 28	16:00 - 16:15	213	214	1	0.5%
Route 29	16:00 - 16:15	323	325	1	0.4%
Route 30	16:00 - 16:15	296	305	9	3.1%
Route 31	16:00 - 16:15	173	165	-8	-4.7%
Route 32	16:00 - 16:15	332	324	-8	-2.4%
Route 33	16:00 - 16:15	244	237	-6	-2.6%
Route 34	16:00 - 16:15	309	301	-9	-2.8%
Route 35	16:00 - 16:15	296	289	-7	-2.3%
Route 36	16:00 - 16:15	259	253	-6	-2.3%
Route 1	16:15 - 16:30	787	819	32	4.0%
Route 2	16:15 - 16:30	667	687	20	3.0%
Route 3	16:15 - 16:30	301	347	47	15.5%
Route 4	16:15 - 16:30	592	631	39	6.6%
Route 5	16:15 - 16:30	507	564	56	11.1%
Route 6	16:15 - 16:30	583	594	11	1.8%

	Time Period	2025 DM PM	2025 DS PM	Difference	Diff (%)
Route 7	16:15 - 16:30	259	255	-5	-1.8%
Route 8	16:15 - 16:30	356	351	-6	-1.6%
Route 9	16:15 - 16:30	269	269	0	0.0%
Route 10	16:15 - 16:30	292	299	7	2.3%
Route 11	16:15 - 16:30	356	352	-4	-1.2%
Route 12	16:15 - 16:30	477	469	-8	-1.7%
Route 13	16:15 - 16:30	175	194	19	10.8%
Route 14	16:15 - 16:30	168	184	16	9.5%
Route 15	16:15 - 16:30	129	154	25	19.5%
Route 16	16:15 - 16:30	227	263	37	16.1%
Route 17	16:15 - 16:30	333	376	42	12.7%
Route 18	16:15 - 16:30	49	51	2	4.0%
Route 19	16:15 - 16:30	243	264	21	8.5%
Route 20	16:15 - 16:30	220	238	18	8.3%
Route 21	16:15 - 16:30	186	186	0	0.0%
Route 22	16:15 - 16:30	376	404	28	7.6%
Route 23	16:15 - 16:30	247	279	32	12.9%
Route 24	16:15 - 16:30	351	364	13	3.8%
Route 25	16:15 - 16:30	399	371	-27	-6.9%
Route 26	16:15 - 16:30	462	461	-1	-0.2%
Route 27	16:15 - 16:30	266	266	0	0.0%
Route 28	16:15 - 16:30	376	397	21	5.5%
Route 29	16:15 - 16:30	500	497	-3	-0.6%
Route 30	16:15 - 16:30	410	451	41	10.1%
Route 31	16:15 - 16:30	571	587	16	2.8%
Route 32	16:15 - 16:30	731	745	14	1.9%
Route 33	16:15 - 16:30	663	667	4	0.6%
Route 34	16:15 - 16:30	697	717	20	2.9%
Route 35	16:15 - 16:30	711	724	13	1.9%
Route 36	16:15 - 16:30	648	728	80	12.3%
Route 1	16:30 - 16:45	1082	1103	20	1.9%
Route 2	16:30 - 16:45	940	948	8	0.8%
Route 3	16:30 - 16:45	530	516	-13	-2.5%
Route 4	16:30 - 16:45	851	890	40	4.6%
Route 5	16:30 - 16:45	792	810	18	2.3%
Route 6	16:30 - 16:45	802	827	25	3.2%
Route 7	16:30 - 16:45	253	250	-4	-1.4%
Route 8	16:30 - 16:45	347	347	0	0.1%
Route 9	16:30 - 16:45	268	268	0	0.1%
Route 10	16:30 - 16:45	292	300	8	2.7%
Route 11	16:30 - 16:45	349	346	-3	-0.9%
Route 12	16:30 - 16:45	471	467	-4	-0.9%
Route 13	16:30 - 16:45	185	198	13	7.0%
Route 14	16:30 - 16:45	169	186	17	9.9%

	Time Period	2025 DM PM	2025 DS PM	Difference	Diff (%)
Route 15	16:30 - 16:45	147	164	17	11.7%
Route 16	16:30 - 16:45	240	271	32	13.2%
Route 17	16:30 - 16:45	361	381	20	5.5%
Route 18	16:30 - 16:45	50	52	2	4.3%
Route 19	16:30 - 16:45	247	255	8	3.2%
Route 20	16:30 - 16:45	215	215	0	0.1%
Route 21	16:30 - 16:45	185	186	0	0.1%
Route 22	16:30 - 16:45	376	388	12	3.1%
Route 23	16:30 - 16:45	251	263	12	4.8%
Route 24	16:30 - 16:45	344	354	10	2.9%
Route 25	16:30 - 16:45	630	751	121	19.1%
Route 26	16:30 - 16:45	667	791	124	18.6%
Route 27	16:30 - 16:45	268	274	6	2.2%
Route 28	16:30 - 16:45	511	611	100	19.6%
Route 29	16:30 - 16:45	637	724	87	13.7%
Route 30	16:30 - 16:45	567	666	99	17.5%
Route 31	16:30 - 16:45	868	903	36	4.1%
Route 32	16:30 - 16:45	1095	1126	31	2.8%
Route 33	16:30 - 16:45	975	1007	31	3.2%
Route 34	16:30 - 16:45	1060	1089	29	2.7%
Route 35	16:30 - 16:45	1058	1083	25	2.4%
Route 36	16:30 - 16:45	971	1216	245	25.2%
Route 1	16:45 - 17:00	1325	1253	-72	-5.5%
Route 2	16:45 - 17:00	1147	1078	-69	-6.0%
Route 3	16:45 - 17:00	638	601	-37	-5.7%
Route 4	16:45 - 17:00	1024	961	-63	-6.2%
Route 5	16:45 - 17:00	888	879	-9	-1.0%
Route 6	16:45 - 17:00	1036	967	-69	-6.6%
Route 7	16:45 - 17:00	253	252	-1	-0.4%
Route 8	16:45 - 17:00	345	344	-2	-0.5%
Route 9	16:45 - 17:00	268	268	1	0.2%
Route 10	16:45 - 17:00	292	283	-10	-3.3%
Route 11	16:45 - 17:00	344	345	1	0.3%
Route 12	16:45 - 17:00	458	456	-1	-0.3%
Route 13	16:45 - 17:00	179	211	32	18.0%
Route 14	16:45 - 17:00	167	200	33	19.9%
Route 15	16:45 - 17:00	138	171	33	23.9%
Route 16	16:45 - 17:00	239	275	36	14.9%
Route 17	16:45 - 17:00	343	381	38	11.0%
Route 18	16:45 - 17:00	49	50	2	3.7%
Route 19	16:45 - 17:00	244	253	8	3.4%
Route 20	16:45 - 17:00	214	250	35	16.5%
Route 21	16:45 - 17:00	186	185	-1	-0.3%
Route 22	16:45 - 17:00	375	387	12	3.2%

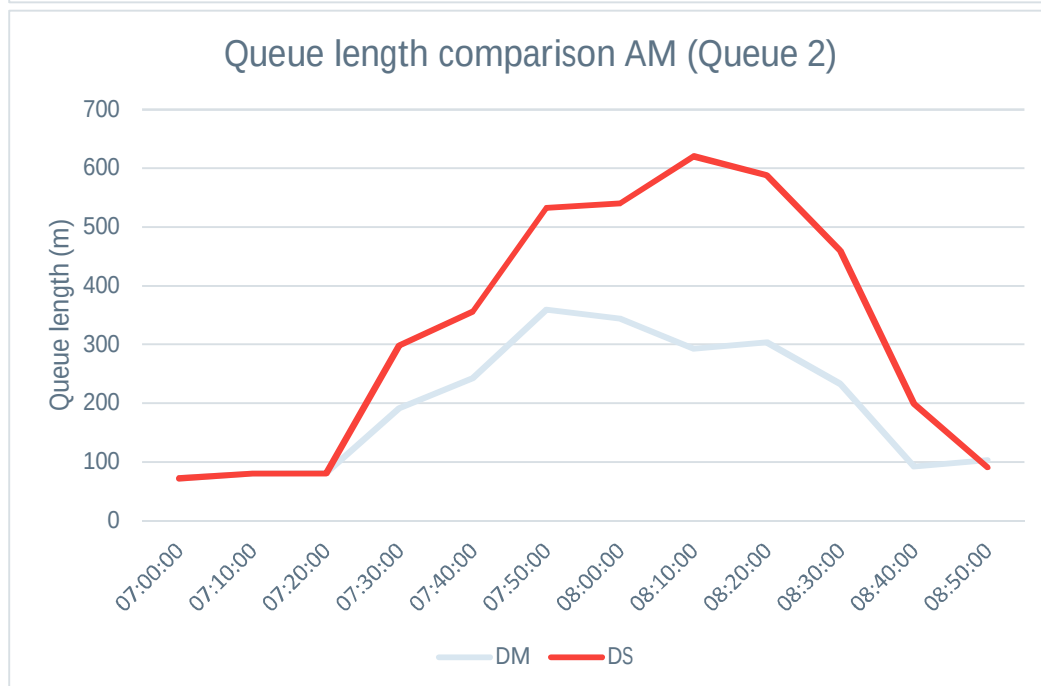
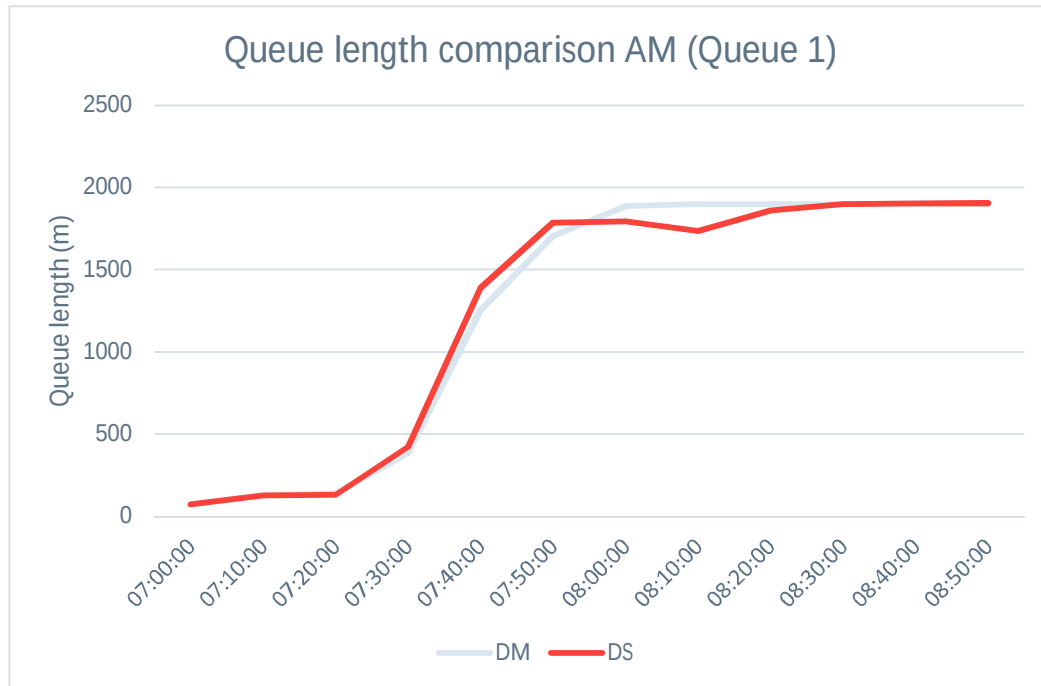
	Time Period	2025 DM PM	2025 DS PM	Difference	Diff (%)
Route 23	16:45 - 17:00	260	263	3	1.3%
Route 24	16:45 - 17:00	358	372	14	4.1%
Route 25	16:45 - 17:00	884	1094	210	23.8%
Route 26	16:45 - 17:00	1015	1167	152	14.9%
Route 27	16:45 - 17:00	295	332	37	12.5%
Route 28	16:45 - 17:00	687	849	162	23.5%
Route 29	16:45 - 17:00	817	983	166	20.4%
Route 30	16:45 - 17:00	729	927	197	27.1%
Route 31	16:45 - 17:00	832	877	44	5.3%
Route 32	16:45 - 17:00	1100	1138	38	3.5%
Route 33	16:45 - 17:00	978	1032	54	5.5%
Route 34	16:45 - 17:00	1071	1067	-4	-0.4%
Route 35	16:45 - 17:00	1037	1030	-7	-0.7%
Route 36	16:45 - 17:00	1023	1123	100	9.8%

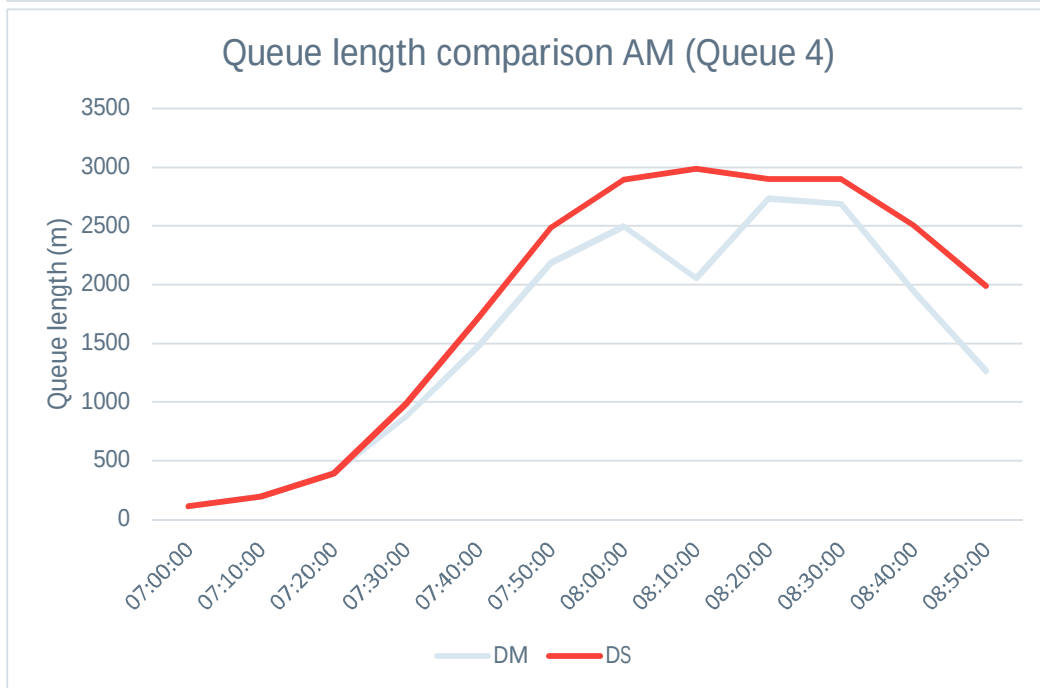
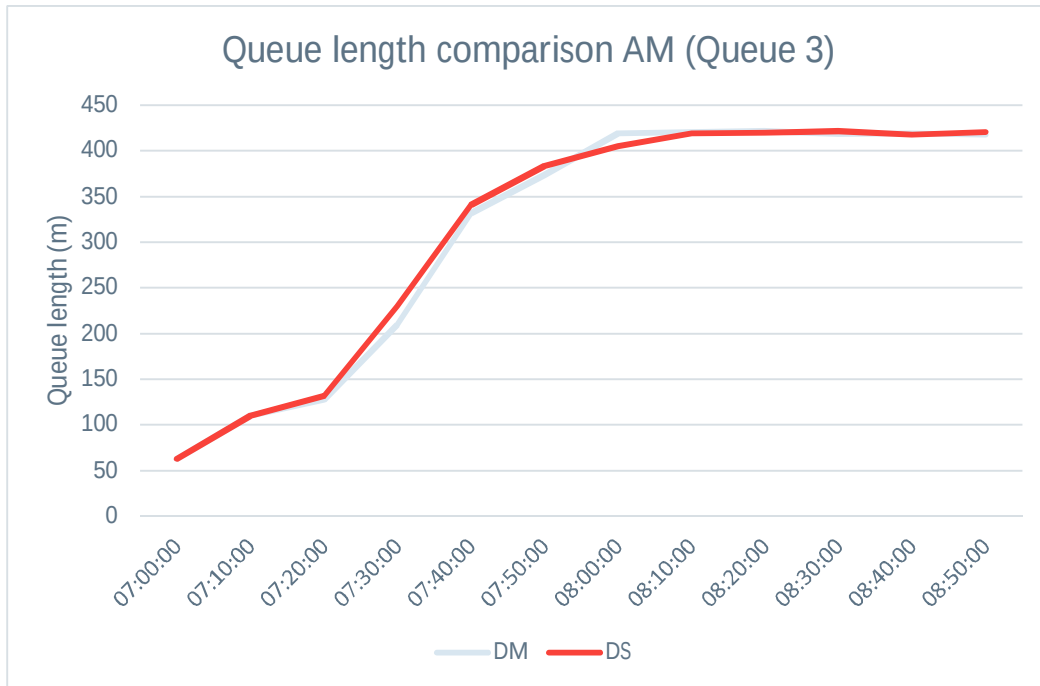
Appendix F

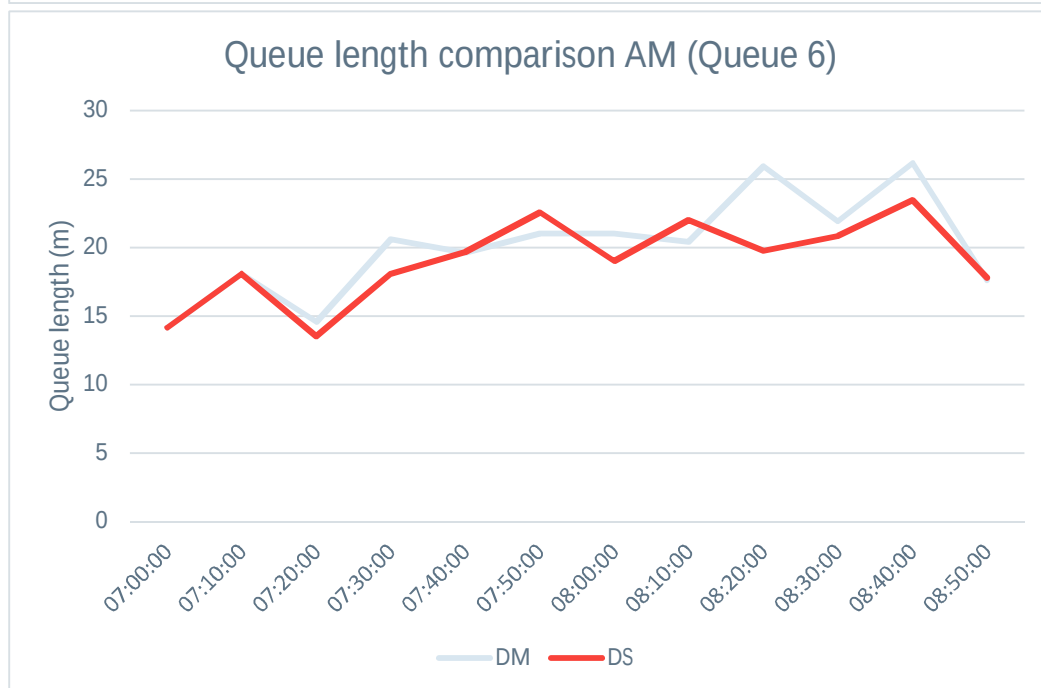
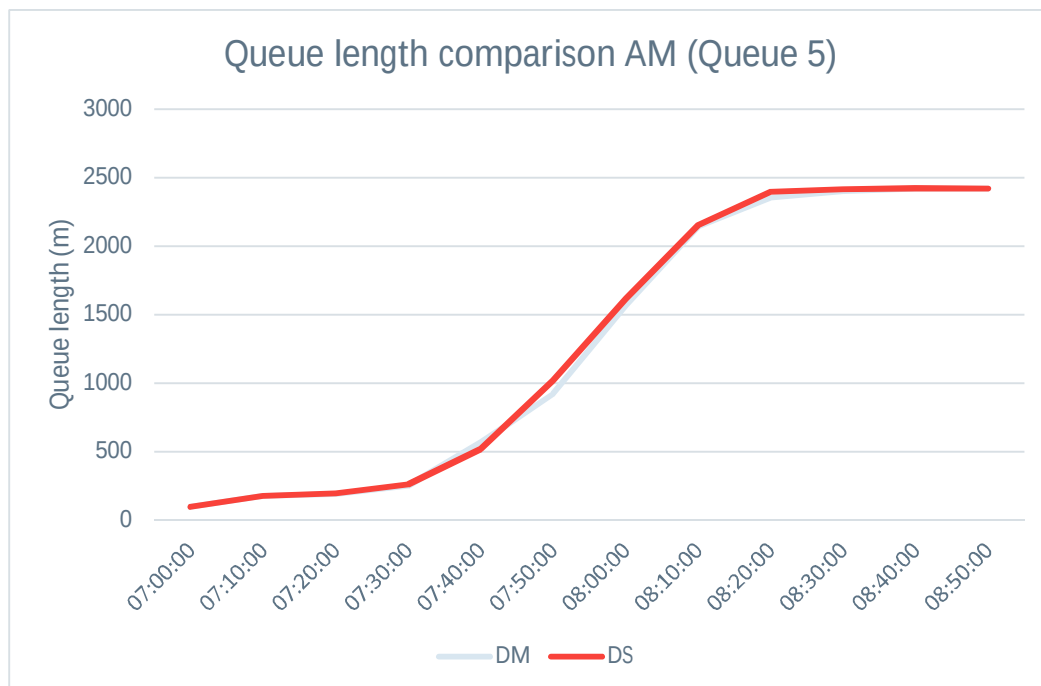
wsj

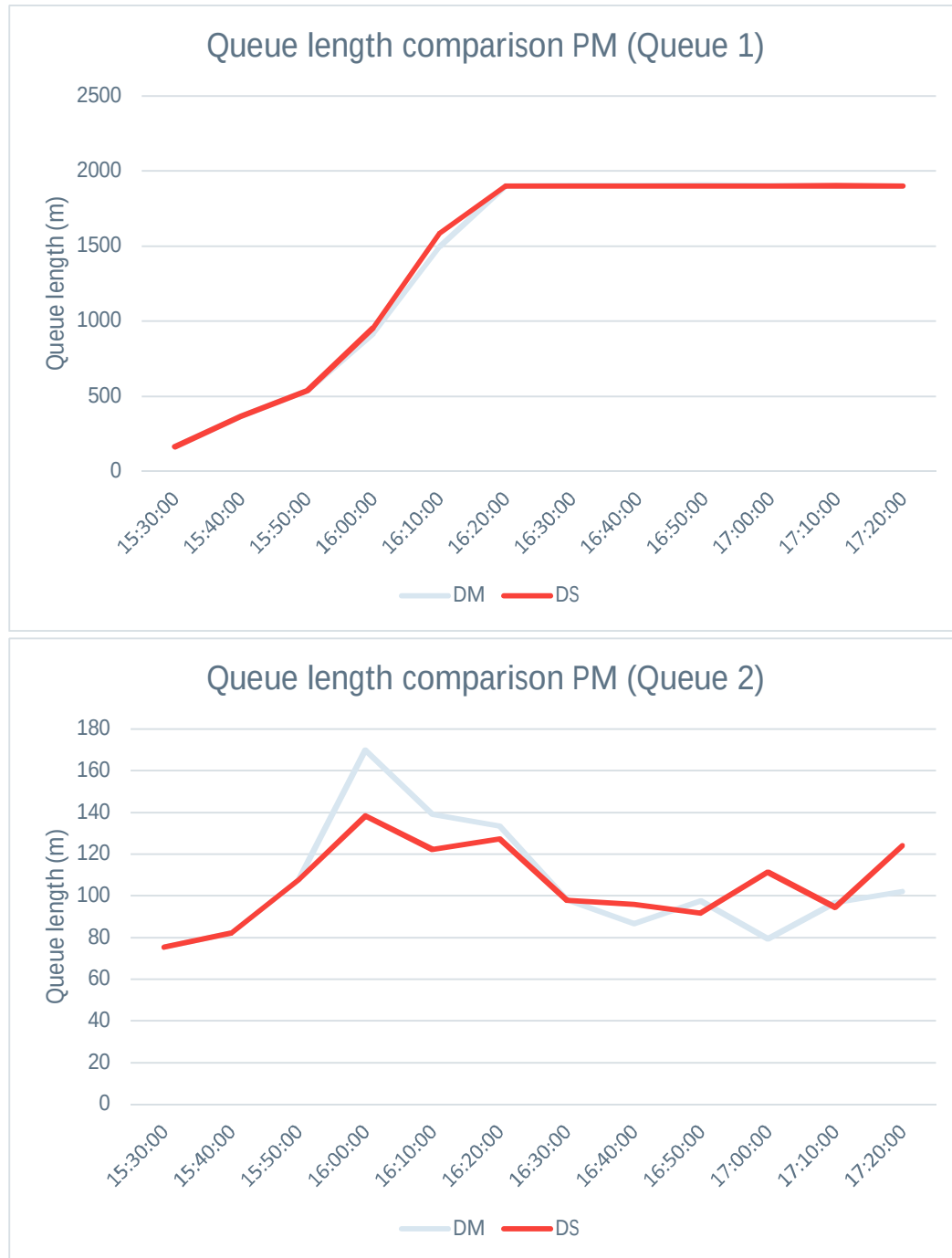
QUEUE LENGTH SUMMARY

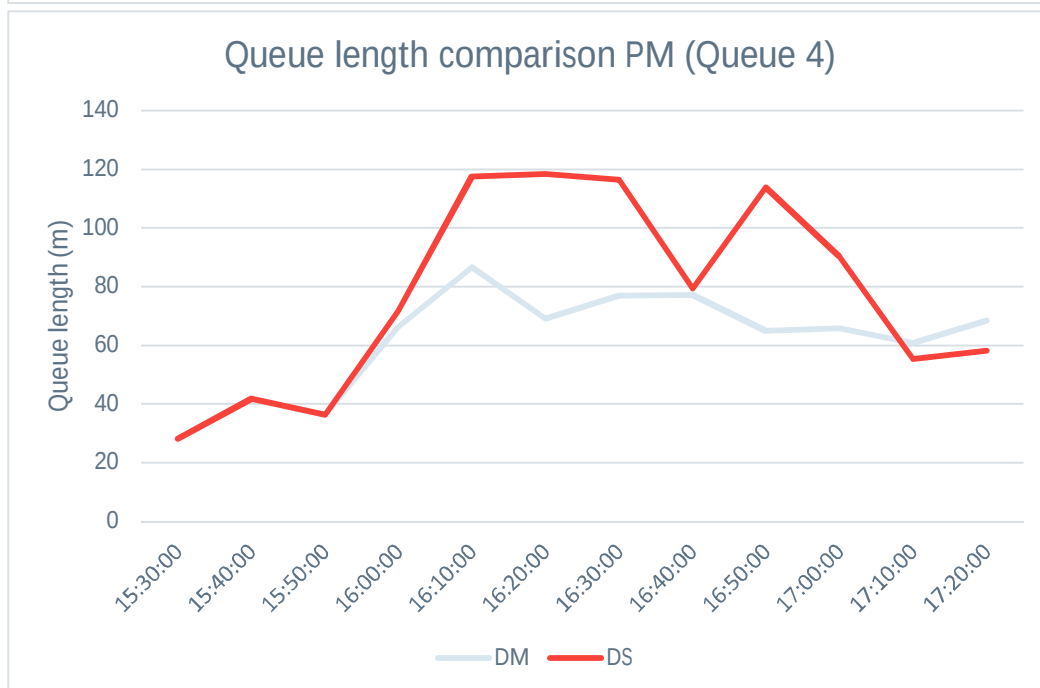
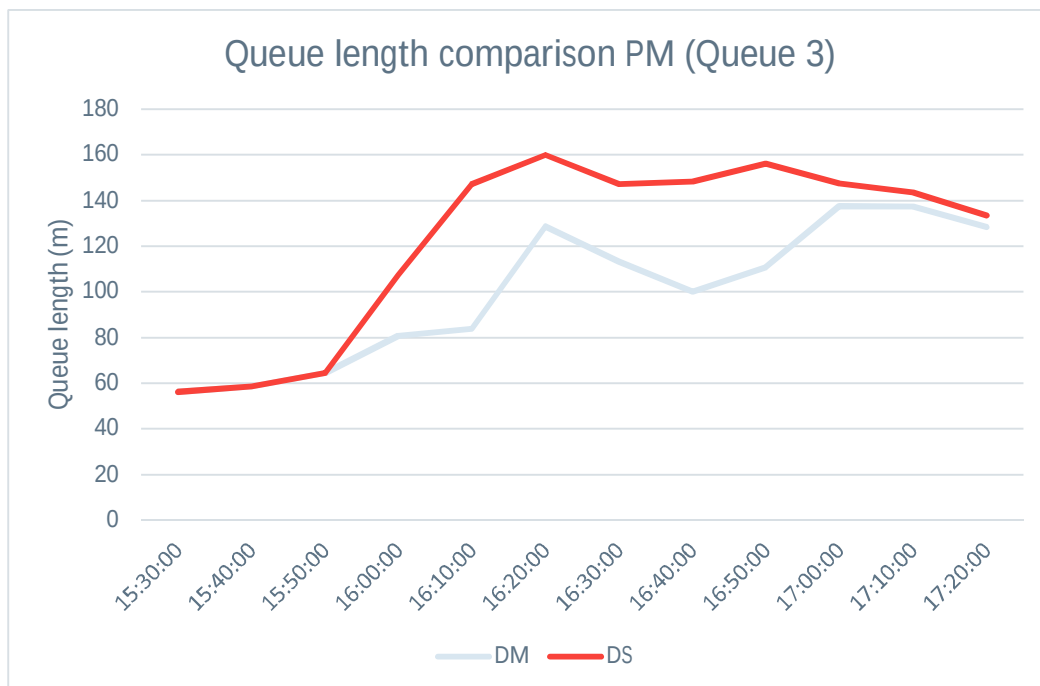
Queue Length Results 2025

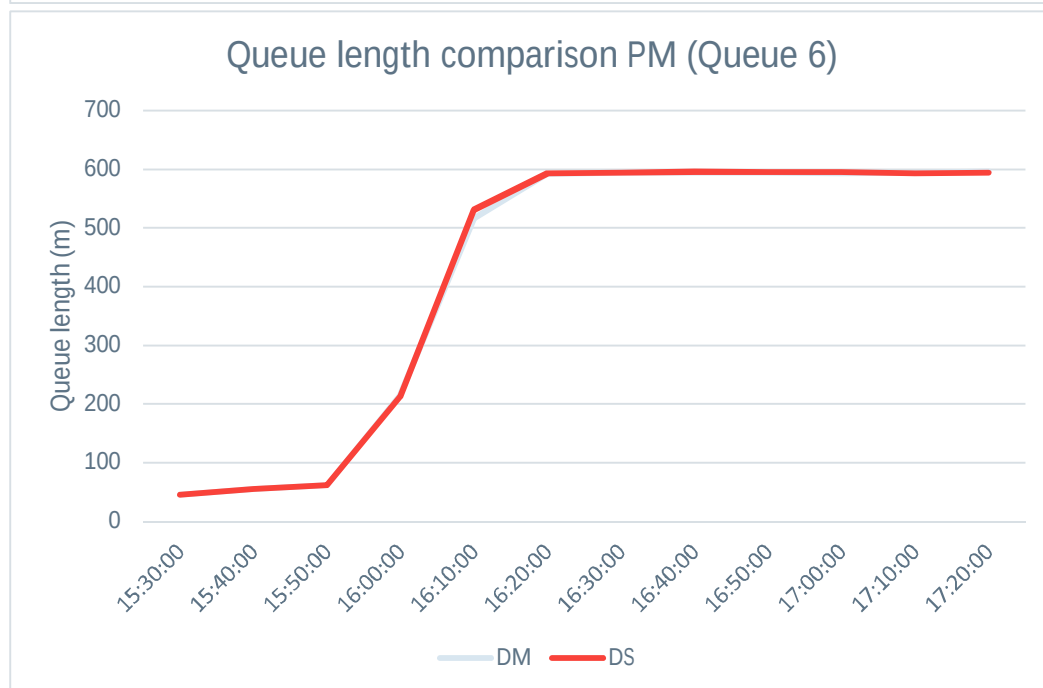
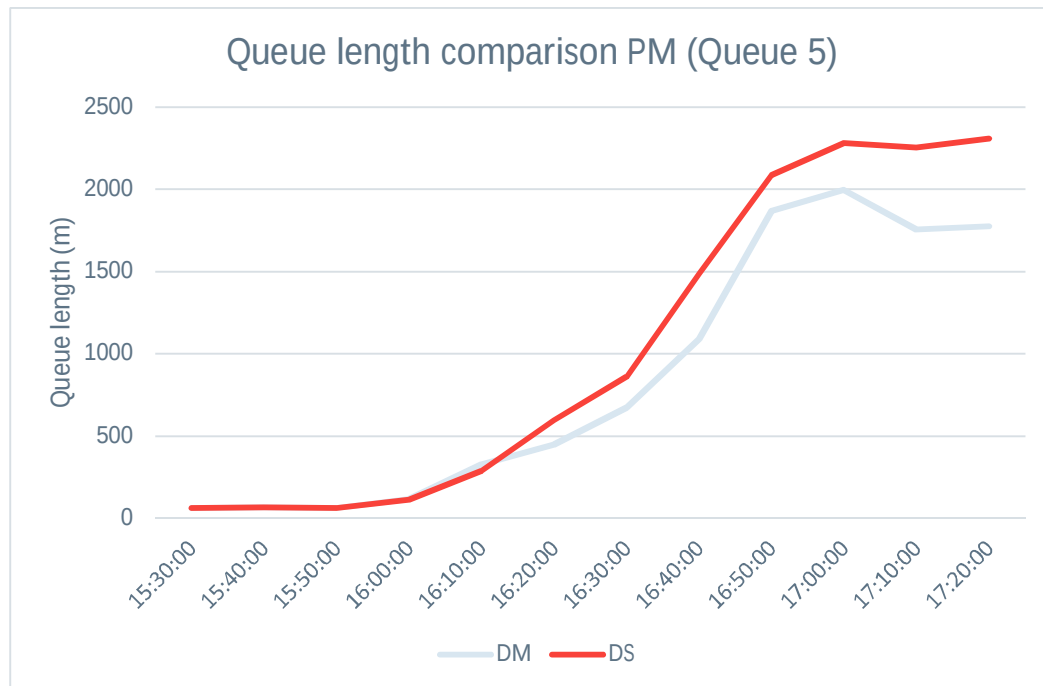












Appendix G



MITIGATION JOURNEY TIME
RESULTS

AM

	Time Period	2025 DM AM	2025 DS AM	Difference	Diff (%)
Route 1	07:30 - 07:45	348	352	5	1.4%
Route 2	07:30 - 07:45	227	280	53	23.3%
Route 3	07:30 - 07:45	190	189	-1	-0.7%
Route 4	07:30 - 07:45	266	334	68	25.4%
Route 5	07:30 - 07:45	210	301	91	43.3%
Route 6	07:30 - 07:45	264	283	19	7.1%
Route 7	07:30 - 07:45	276	249	-28	-10.0%
Route 8	07:30 - 07:45	367	348	-19	-5.1%
Route 9	07:30 - 07:45	269	271	1	0.5%
Route 10	07:30 - 07:45	303	354	51	16.8%
Route 11	07:30 - 07:45	350	383	32	9.2%
Route 12	07:30 - 07:45	490	0	-490	-100.0%
Route 13	07:30 - 07:45	232	213	-19	-8.3%
Route 14	07:30 - 07:45	245	197	-49	-19.9%
Route 15	07:30 - 07:45	203	171	-32	-15.6%
Route 16	07:30 - 07:45	301	261	-40	-13.3%
Route 17	07:30 - 07:45	410	341	-70	-17.0%
Route 18	07:30 - 07:45	78	69	-9	-11.1%
Route 19	07:30 - 07:45	421	256	-165	-39.1%
Route 20	07:30 - 07:45	378	215	-162	-42.9%
Route 21	07:30 - 07:45	198	190	-8	-3.9%
Route 22	07:30 - 07:45	597	408	-189	-31.6%
Route 23	07:30 - 07:45	240	352	112	46.7%
Route 24	07:30 - 07:45	593	473	-120	-20.3%
Route 25	07:30 - 07:45	377	176	-202	-53.5%
Route 26	07:30 - 07:45	430	214	-217	-50.3%
Route 27	07:30 - 07:45	267	266	-1	-0.3%
Route 28	07:30 - 07:45	344	293	-51	-14.9%
Route 29	07:30 - 07:45	468	401	-67	-14.4%
Route 30	07:30 - 07:45	446	401	-45	-10.1%
Route 31	07:30 - 07:45	123	122	-1	-1.0%
Route 32	07:30 - 07:45	269	258	-12	-4.4%
Route 33	07:30 - 07:45	133	239	106	80.3%
Route 34	07:30 - 07:45	232	345	112	48.3%
Route 35	07:30 - 07:45	237	352	115	48.7%
Route 36	07:30 - 07:45	186	0	-186	-100.0%
Route 1	07:45 - 08:00	549	473	-77	-14.0%
Route 2	07:45 - 08:00	440	478	38	8.5%
Route 3	07:45 - 08:00	251	212	-40	-15.8%
Route 4	07:45 - 08:00	423	447	24	5.6%

	Time Period	2025 DM AM	2025 DS AM	Difference	Diff (%)
Route 5	07:45 - 08:00	370	382	11	3.1%
Route 6	07:45 - 08:00	405	410	5	1.2%
Route 7	07:45 - 08:00	292	267	-25	-8.6%
Route 8	07:45 - 08:00	383	364	-19	-4.9%
Route 9	07:45 - 08:00	270	270	0	0.1%
Route 10	07:45 - 08:00	324	351	27	8.3%
Route 11	07:45 - 08:00	365	396	31	8.6%
Route 12	07:45 - 08:00	486	481	-5	-1.1%
Route 13	07:45 - 08:00	375	241	-134	-35.8%
Route 14	07:45 - 08:00	385	192	-193	-50.2%
Route 15	07:45 - 08:00	353	173	-180	-51.1%
Route 16	07:45 - 08:00	437	265	-172	-39.5%
Route 17	07:45 - 08:00	538	394	-144	-26.7%
Route 18	07:45 - 08:00	137	54	-83	-60.8%
Route 19	07:45 - 08:00	543	255	-288	-53.0%
Route 20	07:45 - 08:00	506	216	-291	-57.4%
Route 21	07:45 - 08:00	255	189	-67	-26.1%
Route 22	07:45 - 08:00	739	421	-318	-43.0%
Route 23	07:45 - 08:00	599	383	-215	-36.0%
Route 24	07:45 - 08:00	719	485	-234	-32.6%
Route 25	07:45 - 08:00	655	166	-488	-74.6%
Route 26	07:45 - 08:00	716	222	-494	-69.0%
Route 27	07:45 - 08:00	270	266	-4	-1.5%
Route 28	07:45 - 08:00	610	348	-263	-43.0%
Route 29	07:45 - 08:00	731	442	-288	-39.5%
Route 30	07:45 - 08:00	894	389	-505	-56.5%
Route 31	07:45 - 08:00	126	122	-4	-2.9%
Route 32	07:45 - 08:00	272	287	15	5.5%
Route 33	07:45 - 08:00	133	233	100	75.0%
Route 34	07:45 - 08:00	243	372	129	52.8%
Route 35	07:45 - 08:00	236	415	179	76.0%
Route 36	07:45 - 08:00	243	371	129	53.1%
Route 1	08:00 - 08:15	730	582	-148	-20.3%
Route 2	08:00 - 08:15	589	636	47	8.0%
Route 3	08:00 - 08:15	357	285	-72	-20.2%
Route 4	08:00 - 08:15	578	573	-5	-0.9%
Route 5	08:00 - 08:15	519	550	30	5.8%
Route 6	08:00 - 08:15	490	557	67	13.7%
Route 7	08:00 - 08:15	292	293	1	0.4%
Route 8	08:00 - 08:15	401	389	-12	-2.9%
Route 9	08:00 - 08:15	269	269	0	0.0%
Route 10	08:00 - 08:15	329	366	38	11.4%

	Time Period	2025 DM AM	2025 DS AM	Difference	Diff (%)
Route 11	08:00 - 08:15	379	400	21	5.6%
Route 12	08:00 - 08:15	493	526	33	6.7%
Route 13	08:00 - 08:15	505	195	-311	-61.5%
Route 14	08:00 - 08:15	522	196	-326	-62.5%
Route 15	08:00 - 08:15	503	170	-334	-66.3%
Route 16	08:00 - 08:15	565	258	-307	-54.3%
Route 17	08:00 - 08:15	658	381	-276	-42.0%
Route 18	08:00 - 08:15	190	56	-134	-70.5%
Route 19	08:00 - 08:15	645	253	-392	-60.8%
Route 20	08:00 - 08:15	625	212	-414	-66.1%
Route 21	08:00 - 08:15	337	186	-151	-44.7%
Route 22	08:00 - 08:15	846	445	-401	-47.4%
Route 23	08:00 - 08:15	674	469	-206	-30.5%
Route 24	08:00 - 08:15	823	575	-247	-30.1%
Route 25	08:00 - 08:15	995	166	-829	-83.3%
Route 26	08:00 - 08:15	1060	213	-847	-79.9%
Route 27	08:00 - 08:15	310	269	-41	-13.2%
Route 28	08:00 - 08:15	888	404	-484	-54.5%
Route 29	08:00 - 08:15	1015	490	-525	-51.7%
Route 30	08:00 - 08:15	1074	0	-1074	-100.0%
Route 31	08:00 - 08:15	130	111	-19	-14.6%
Route 32	08:00 - 08:15	271	292	21	7.9%
Route 33	08:00 - 08:15	133	325	191	143.3%
Route 34	08:00 - 08:15	240	427	187	77.8%
Route 35	08:00 - 08:15	236	443	207	87.9%
Route 36	08:00 - 08:15	130	0	-130	-100.0%
Route 1	08:15 - 08:30	768	796	29	3.7%
Route 2	08:15 - 08:30	613	863	250	40.8%
Route 3	08:15 - 08:30	384	410	26	6.8%
Route 4	08:15 - 08:30	601	764	163	27.1%
Route 5	08:15 - 08:30	554	694	140	25.3%
Route 6	08:15 - 08:30	588	734	147	25.0%
Route 7	08:15 - 08:30	293	335	41	14.1%
Route 8	08:15 - 08:30	394	441	47	11.8%
Route 9	08:15 - 08:30	269	270	1	0.4%
Route 10	08:15 - 08:30	327	391	63	19.3%
Route 11	08:15 - 08:30	380	437	57	15.1%
Route 12	08:15 - 08:30	499	641	142	28.4%
Route 13	08:15 - 08:30	532	215	-318	-59.7%
Route 14	08:15 - 08:30	556	212	-344	-61.9%
Route 15	08:15 - 08:30	555	196	-359	-64.6%
Route 16	08:15 - 08:30	603	305	-298	-49.5%

	Time Period	2025 DM AM	2025 DS AM	Difference	Diff (%)
Route 17	08:15 - 08:30	726	459	-267	-36.8%
Route 18	08:15 - 08:30	228	58	-170	-74.5%
Route 19	08:15 - 08:30	696	263	-433	-62.2%
Route 20	08:15 - 08:30	678	231	-446	-65.9%
Route 21	08:15 - 08:30	349	190	-159	-45.6%
Route 22	08:15 - 08:30	907	495	-413	-45.5%
Route 23	08:15 - 08:30	829	579	-250	-30.2%
Route 24	08:15 - 08:30	883	672	-211	-23.9%
Route 25	08:15 - 08:30	1244	195	-1049	-84.4%
Route 26	08:15 - 08:30	1322	301	-1021	-77.3%
Route 27	08:15 - 08:30	482	267	-215	-44.6%
Route 28	08:15 - 08:30	1150	553	-597	-51.9%
Route 29	08:15 - 08:30	1287	624	-663	-51.5%
Route 30	08:15 - 08:30	1239	0	-1239	-100.0%
Route 31	08:15 - 08:30	127	132	6	4.4%
Route 32	08:15 - 08:30	273	357	83	30.5%
Route 33	08:15 - 08:30	135	439	304	225.5%
Route 34	08:15 - 08:30	255	526	271	106.0%
Route 35	08:15 - 08:30	225	522	297	132.2%
Route 36	08:15 - 08:30	207	0	-207	-100.0%

PM

	Time Period	2025 DM PM	2025 DS PM	Difference	Diff (%)
Route 1	16:00 - 16:15	578	292	-286	-49.5%
Route 2	16:00 - 16:15	492	248	-245	-49.7%
Route 3	16:00 - 16:15	203	189	-14	-7.0%
Route 4	16:00 - 16:15	390	363	-27	-6.9%
Route 5	16:00 - 16:15	315	309	-6	-1.8%
Route 6	16:00 - 16:15	401	325	-75	-18.8%
Route 7	16:00 - 16:15	278	342	64	23.0%
Route 8	16:00 - 16:15	372	420	47	12.8%
Route 9	16:00 - 16:15	268	269	0	0.1%
Route 10	16:00 - 16:15	316	358	42	13.4%
Route 11	16:00 - 16:15	361	425	63	17.6%
Route 12	16:00 - 16:15	454	561	108	23.8%
Route 13	16:00 - 16:15	176	189	13	7.2%
Route 14	16:00 - 16:15	167	205	38	22.5%
Route 15	16:00 - 16:15	131	168	38	29.0%
Route 16	16:00 - 16:15	206	261	54	26.4%
Route 17	16:00 - 16:15	313	399	85	27.3%
Route 18	16:00 - 16:15	51	50	-1	-1.5%
Route 19	16:00 - 16:15	238	243	5	2.2%
Route 20	16:00 - 16:15	205	225	19	9.4%
Route 21	16:00 - 16:15	185	185	0	0.1%
Route 22	16:00 - 16:15	363	440	77	21.3%
Route 23	16:00 - 16:15	247	382	135	54.9%
Route 24	16:00 - 16:15	328	493	165	50.1%
Route 25	16:00 - 16:15	180	172	-8	-4.7%
Route 26	16:00 - 16:15	242	229	-13	-5.4%
Route 27	16:00 - 16:15	266	266	0	0.1%
Route 28	16:00 - 16:15	213	350	136	63.8%
Route 29	16:00 - 16:15	323	452	129	39.9%
Route 30	16:00 - 16:15	296	482	186	62.6%
Route 31	16:00 - 16:15	173	155	-18	-10.2%
Route 32	16:00 - 16:15	332	340	8	2.3%
Route 33	16:00 - 16:15	244	399	156	63.8%
Route 34	16:00 - 16:15	309	473	164	52.9%
Route 35	16:00 - 16:15	296	499	202	68.2%
Route 36	16:00 - 16:15	259	0	-259	-100.0%
Route 1	16:15 - 16:30	787	297	-490	-62.2%
Route 2	16:15 - 16:30	667	245	-422	-63.3%
Route 3	16:15 - 16:30	301	188	-112	-37.4%
Route 4	16:15 - 16:30	592	380	-212	-35.8%

	Time Period	2025 DM PM	2025 DS PM	Difference	Diff (%)
Route 5	16:15 - 16:30	507	357	-151	-29.7%
Route 6	16:15 - 16:30	583	435	-149	-25.5%
Route 7	16:15 - 16:30	259	428	168	65.0%
Route 8	16:15 - 16:30	356	505	149	41.8%
Route 9	16:15 - 16:30	269	269	0	0.1%
Route 10	16:15 - 16:30	292	388	96	32.8%
Route 11	16:15 - 16:30	356	548	193	54.2%
Route 12	16:15 - 16:30	477	646	169	35.4%
Route 13	16:15 - 16:30	175	213	38	21.6%
Route 14	16:15 - 16:30	168	231	62	37.1%
Route 15	16:15 - 16:30	129	208	79	61.1%
Route 16	16:15 - 16:30	227	387	160	70.7%
Route 17	16:15 - 16:30	333	500	167	50.0%
Route 18	16:15 - 16:30	49	65	16	31.5%
Route 19	16:15 - 16:30	243	243	0	0.0%
Route 20	16:15 - 16:30	220	241	21	9.5%
Route 21	16:15 - 16:30	186	186	0	0.1%
Route 22	16:15 - 16:30	376	479	104	27.7%
Route 23	16:15 - 16:30	247	425	178	72.2%
Route 24	16:15 - 16:30	351	492	141	40.1%
Route 25	16:15 - 16:30	399	179	-219	-55.0%
Route 26	16:15 - 16:30	462	246	-216	-46.8%
Route 27	16:15 - 16:30	266	267	0	0.1%
Route 28	16:15 - 16:30	376	368	-8	-2.2%
Route 29	16:15 - 16:30	500	460	-40	-8.0%
Route 30	16:15 - 16:30	410	505	95	23.1%
Route 31	16:15 - 16:30	571	361	-211	-36.9%
Route 32	16:15 - 16:30	731	576	-154	-21.1%
Route 33	16:15 - 16:30	663	730	67	10.2%
Route 34	16:15 - 16:30	697	709	12	1.8%
Route 35	16:15 - 16:30	711	734	23	3.2%
Route 36	16:15 - 16:30	648	876	227	35.1%
Route 1	16:30 - 16:45	1082	295	-787	-72.7%
Route 2	16:30 - 16:45	940	245	-695	-74.0%
Route 3	16:30 - 16:45	530	188	-341	-64.4%
Route 4	16:30 - 16:45	851	373	-478	-56.2%
Route 5	16:30 - 16:45	792	426	-366	-46.2%
Route 6	16:30 - 16:45	802	472	-329	-41.1%
Route 7	16:30 - 16:45	253	503	250	98.6%
Route 8	16:30 - 16:45	347	574	228	65.7%
Route 9	16:30 - 16:45	268	268	0	0.2%
Route 10	16:30 - 16:45	292	519	227	77.6%

	Time Period	2025 DM PM	2025 DS PM	Difference	Diff (%)
Route 11	16:30 - 16:45	349	649	300	86.1%
Route 12	16:30 - 16:45	471	730	259	54.9%
Route 13	16:30 - 16:45	185	270	85	45.9%
Route 14	16:30 - 16:45	169	295	126	74.5%
Route 15	16:30 - 16:45	147	328	181	123.6%
Route 16	16:30 - 16:45	240	482	242	101.2%
Route 17	16:30 - 16:45	361	577	216	59.8%
Route 18	16:30 - 16:45	50	102	53	105.7%
Route 19	16:30 - 16:45	247	244	-3	-1.1%
Route 20	16:30 - 16:45	215	284	69	32.0%
Route 21	16:30 - 16:45	185	186	0	0.2%
Route 22	16:30 - 16:45	376	478	101	26.9%
Route 23	16:30 - 16:45	251	423	172	68.3%
Route 24	16:30 - 16:45	344	507	163	47.3%
Route 25	16:30 - 16:45	630	189	-442	-70.0%
Route 26	16:30 - 16:45	667	254	-413	-62.0%
Route 27	16:30 - 16:45	268	267	-1	-0.4%
Route 28	16:30 - 16:45	511	366	-144	-28.3%
Route 29	16:30 - 16:45	637	462	-175	-27.5%
Route 30	16:30 - 16:45	567	524	-43	-7.6%
Route 31	16:30 - 16:45	868	593	-274	-31.6%
Route 32	16:30 - 16:45	1095	977	-119	-10.8%
Route 33	16:30 - 16:45	975	1078	103	10.5%
Route 34	16:30 - 16:45	1060	1067	7	0.7%
Route 35	16:30 - 16:45	1058	1119	61	5.8%
Route 36	16:30 - 16:45	971	0	-971	-100.0%
Route 1	16:45 - 17:00	1325	301	-1025	-77.3%
Route 2	16:45 - 17:00	1147	251	-896	-78.1%
Route 3	16:45 - 17:00	638	188	-450	-70.5%
Route 4	16:45 - 17:00	1024	385	-638	-62.4%
Route 5	16:45 - 17:00	888	414	-474	-53.4%
Route 6	16:45 - 17:00	1036	514	-522	-50.4%
Route 7	16:45 - 17:00	253	593	340	134.3%
Route 8	16:45 - 17:00	345	663	318	92.0%
Route 9	16:45 - 17:00	268	271	3	1.3%
Route 10	16:45 - 17:00	292	573	281	96.0%
Route 11	16:45 - 17:00	344	774	431	125.3%
Route 12	16:45 - 17:00	458	853	395	86.3%
Route 13	16:45 - 17:00	179	300	121	67.5%
Route 14	16:45 - 17:00	167	322	155	92.8%
Route 15	16:45 - 17:00	138	359	221	159.7%
Route 16	16:45 - 17:00	239	545	306	127.9%

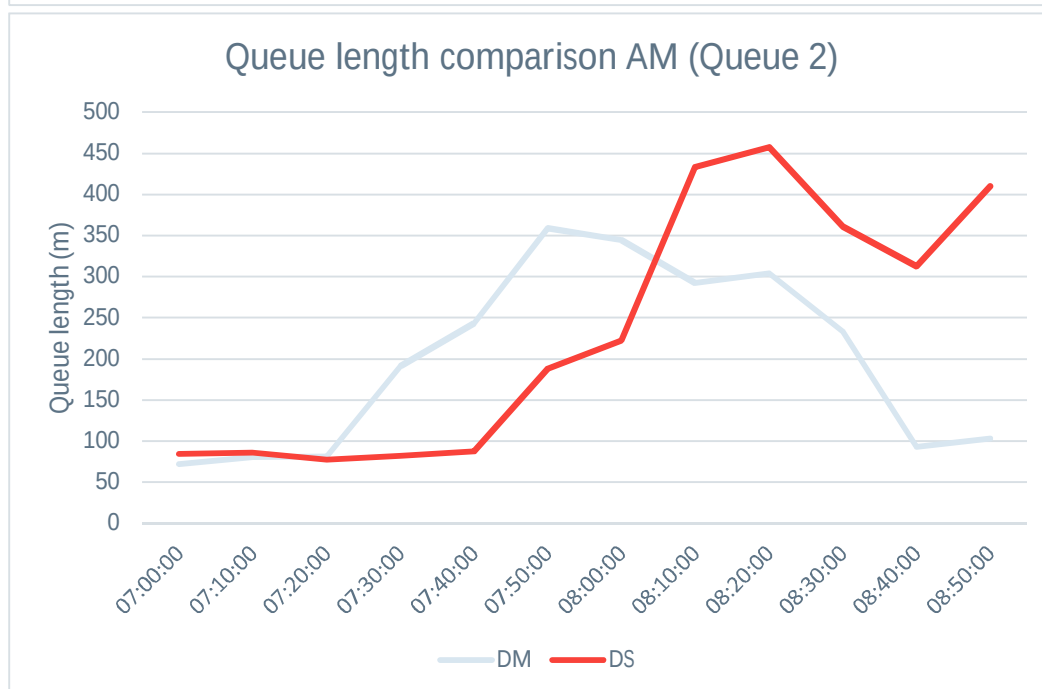
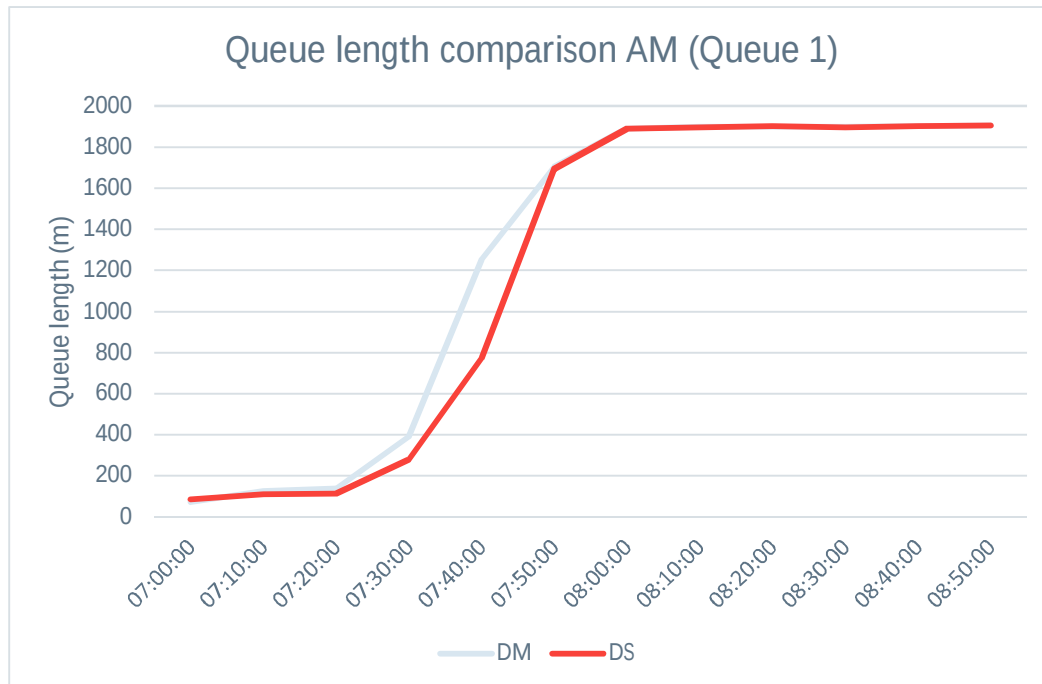
	Time Period	2025 DM PM	2025 DS PM	Difference	Diff (%)
Route 17	16:45 - 17:00	343	667	324	94.5%
Route 18	16:45 - 17:00	49	105	57	116.6%
Route 19	16:45 - 17:00	244	247	2	1.0%
Route 20	16:45 - 17:00	214	285	71	32.9%
Route 21	16:45 - 17:00	186	185	0	-0.2%
Route 22	16:45 - 17:00	375	496	121	32.2%
Route 23	16:45 - 17:00	260	433	173	66.5%
Route 24	16:45 - 17:00	358	503	145	40.6%
Route 25	16:45 - 17:00	884	190	-694	-78.5%
Route 26	16:45 - 17:00	1015	276	-739	-72.8%
Route 27	16:45 - 17:00	295	267	-28	-9.6%
Route 28	16:45 - 17:00	687	414	-273	-39.7%
Route 29	16:45 - 17:00	817	512	-305	-37.4%
Route 30	16:45 - 17:00	729	565	-165	-22.6%
Route 31	16:45 - 17:00	832	660	-173	-20.8%
Route 32	16:45 - 17:00	1100	1187	87	7.9%
Route 33	16:45 - 17:00	978	1225	246	25.2%
Route 34	16:45 - 17:00	1071	1254	184	17.1%
Route 35	16:45 - 17:00	1037	1274	237	22.8%
Route 36	16:45 - 17:00	1023	1713	690	67.4%

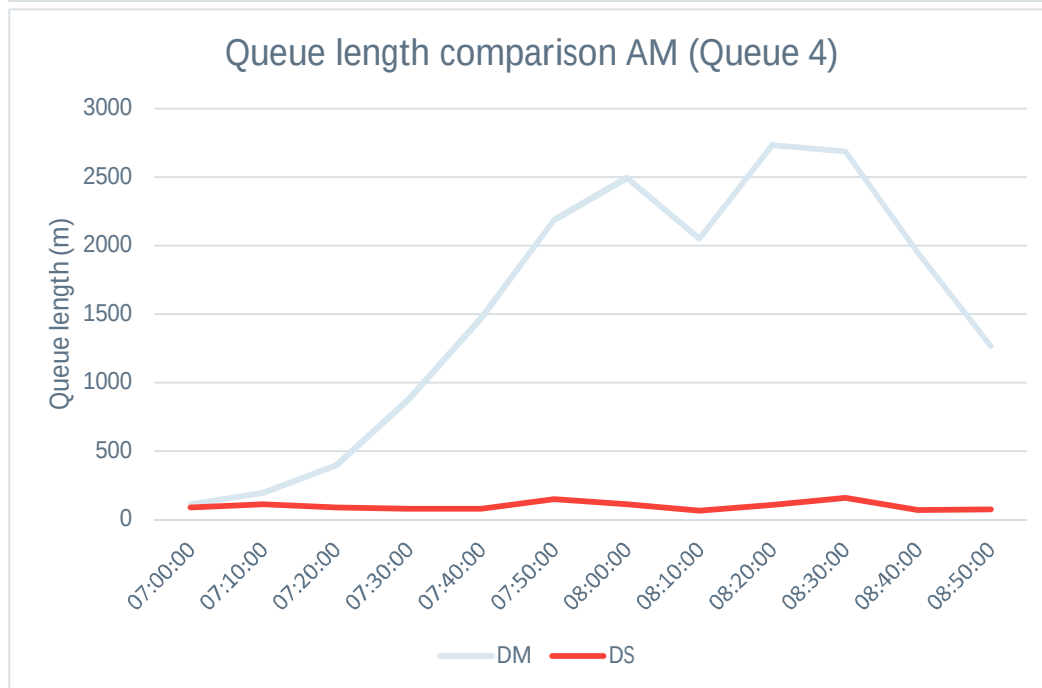
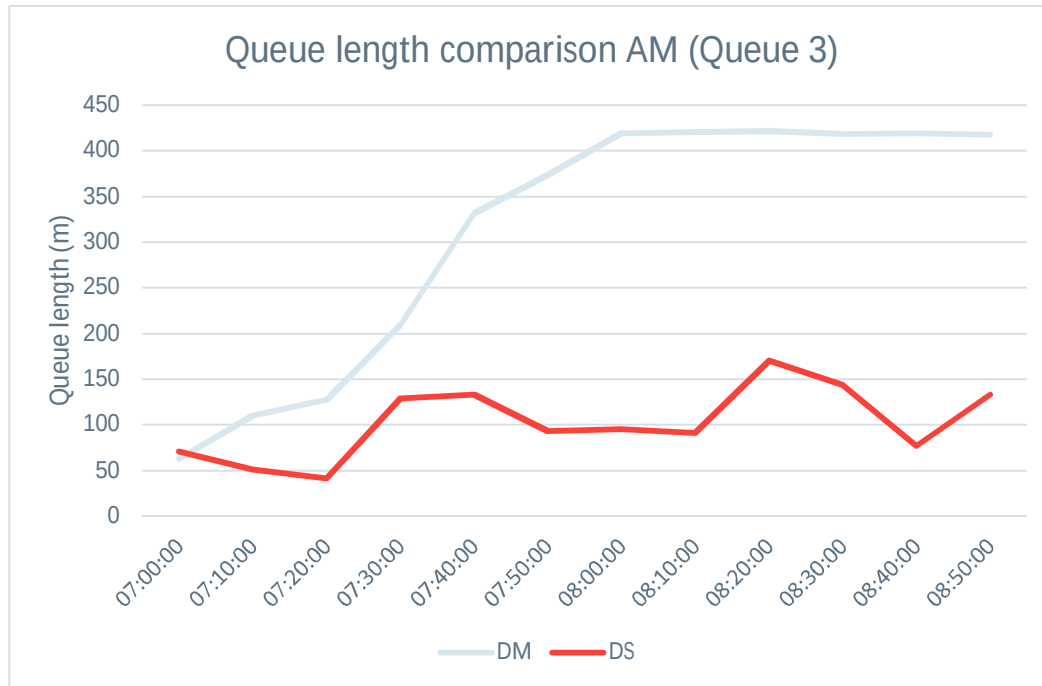
Appendix H

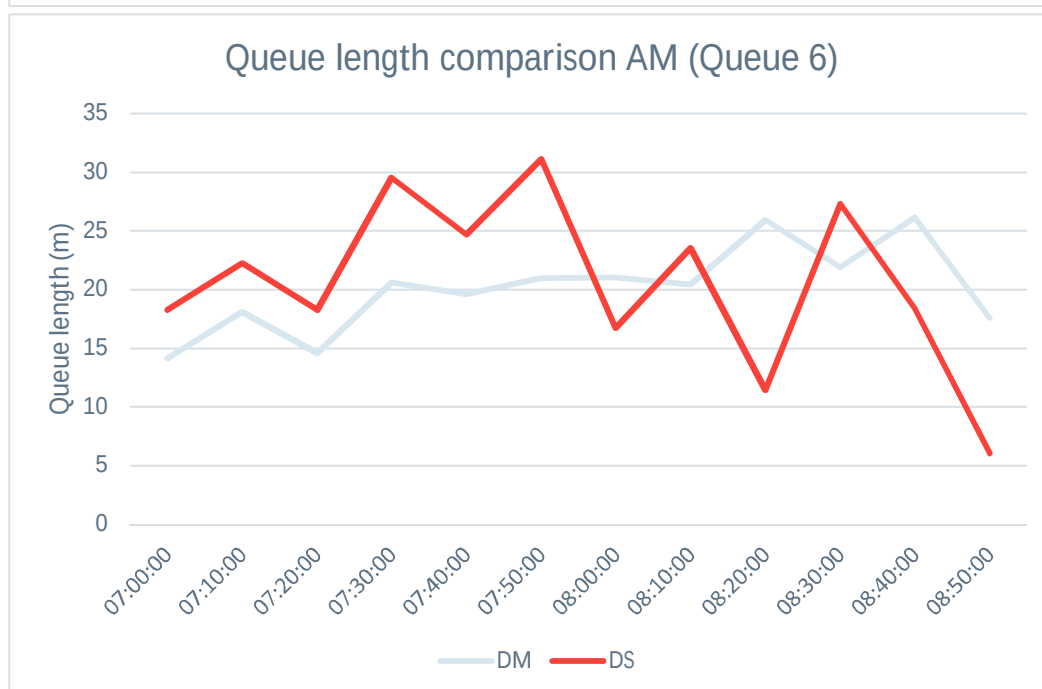
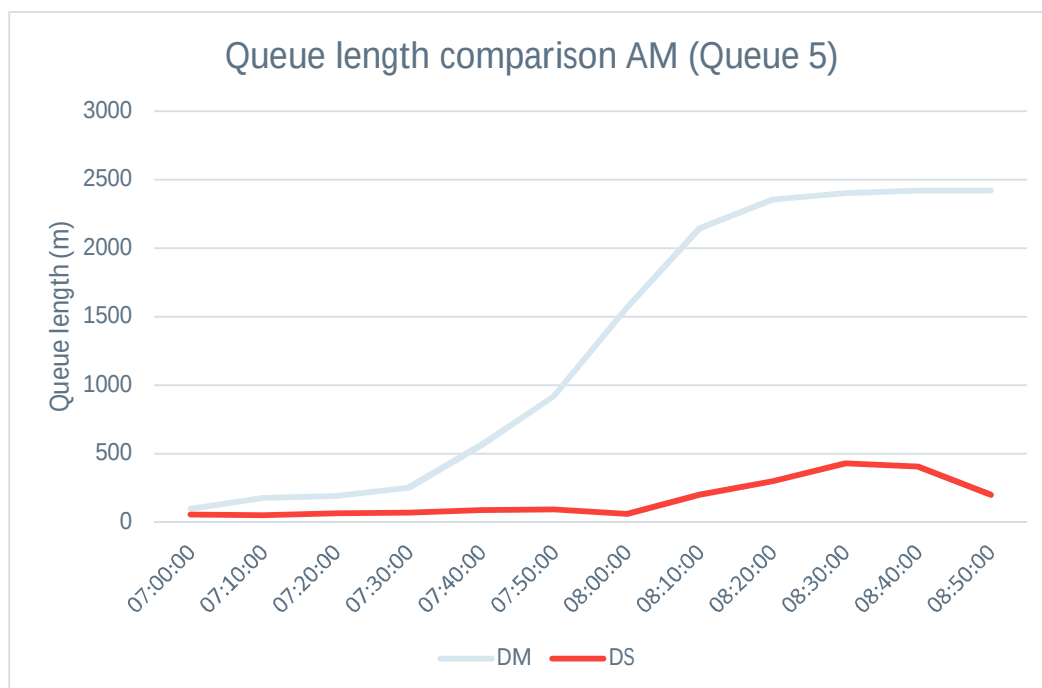


MITIGATION QUEUE LENGTH
SUMMARY

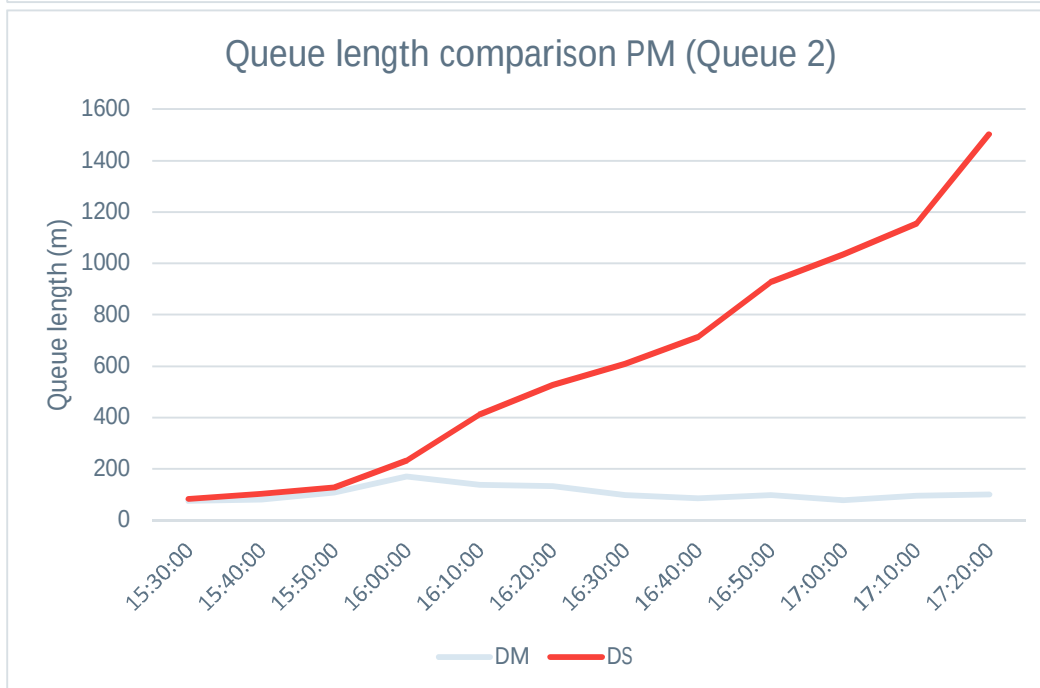
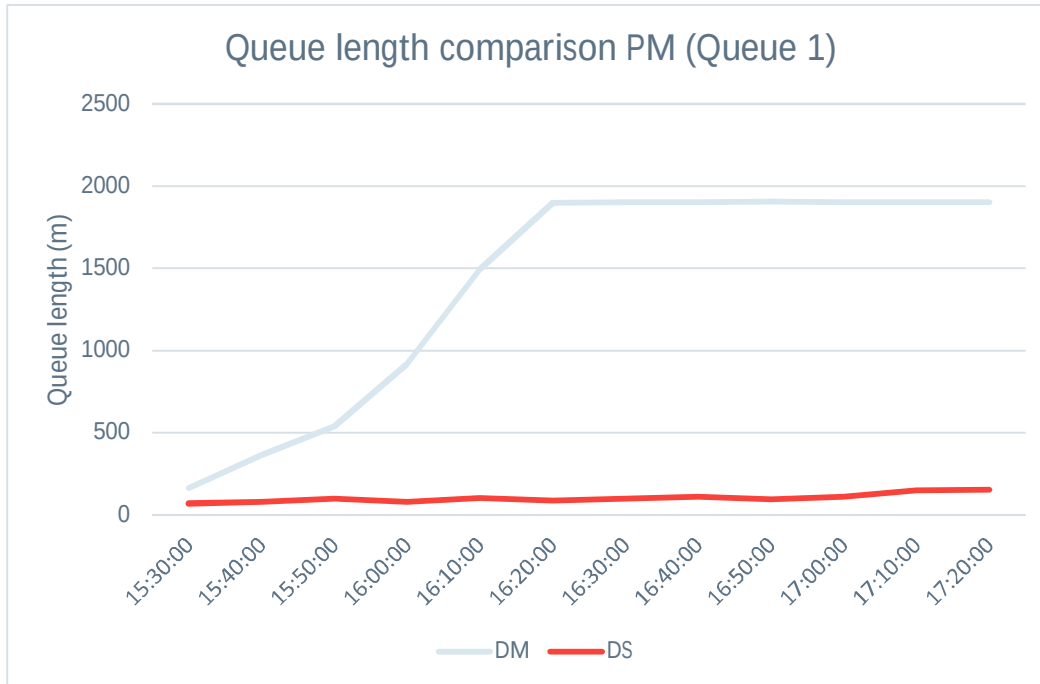
AM

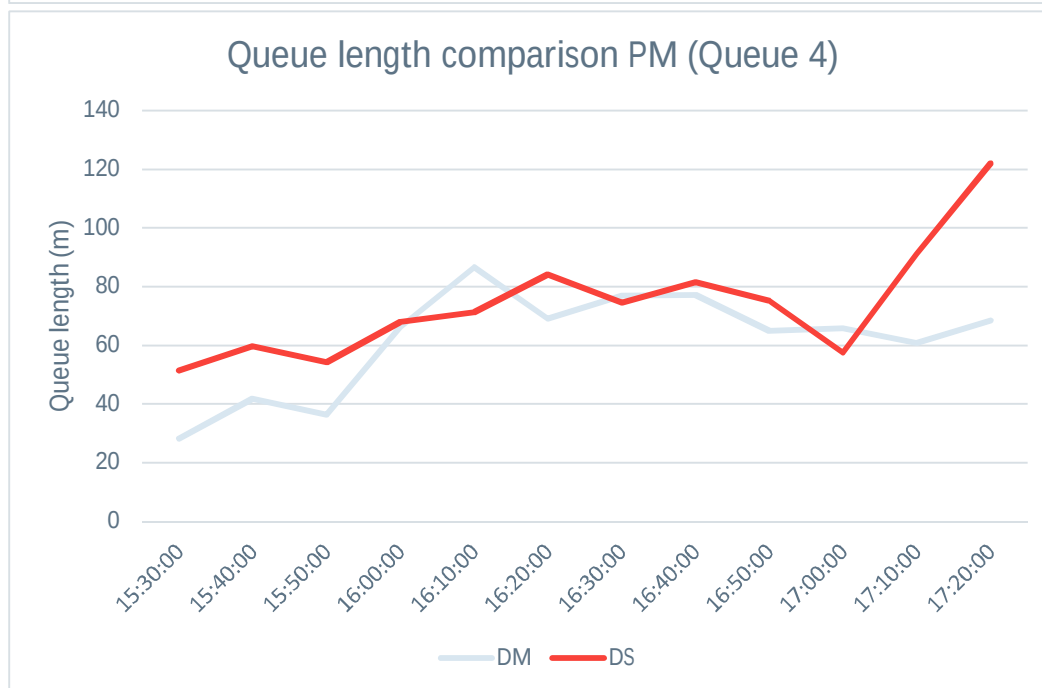
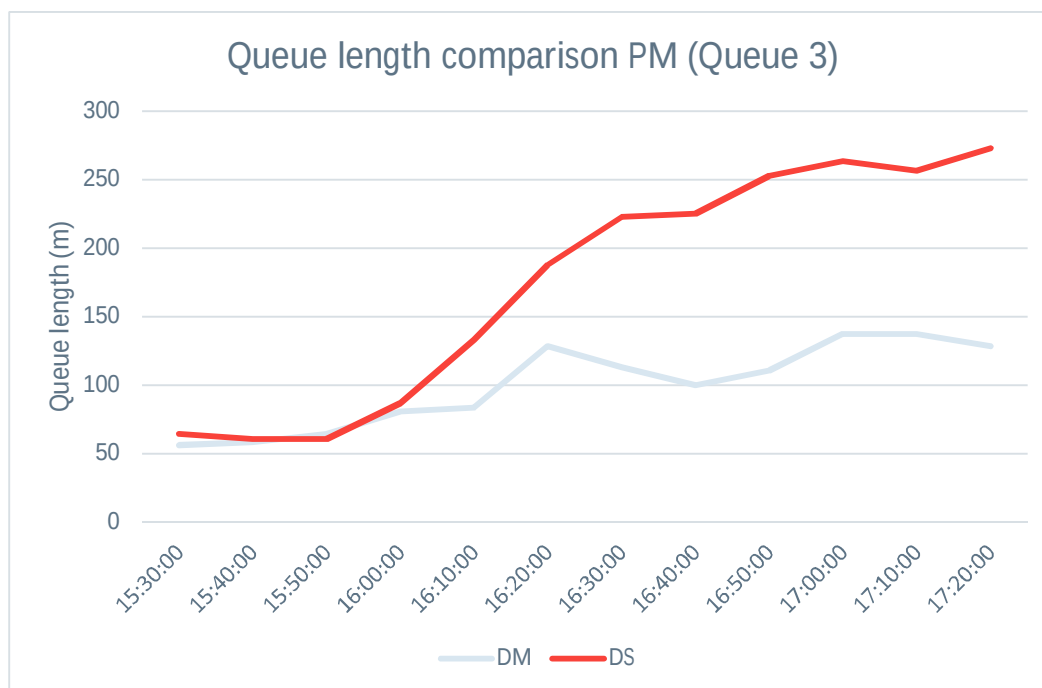


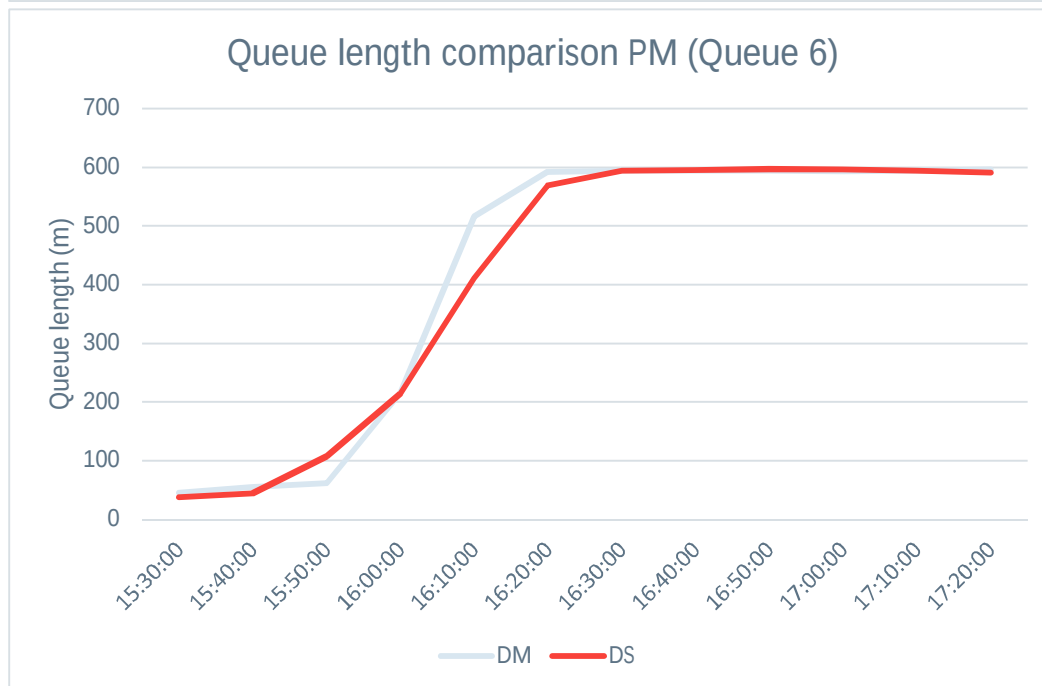
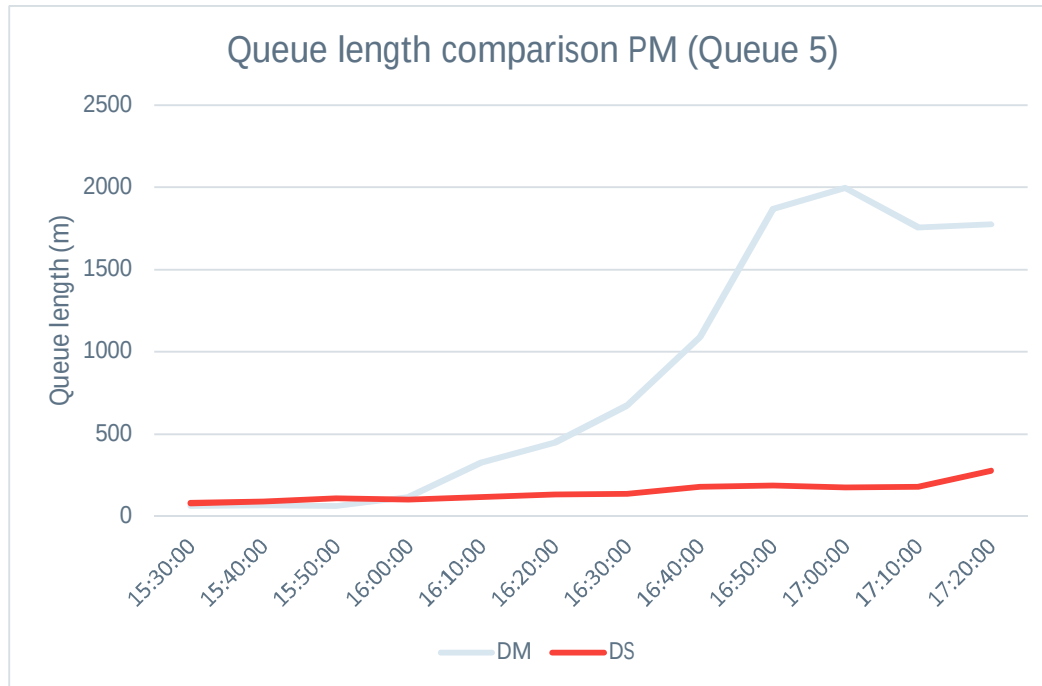




PM

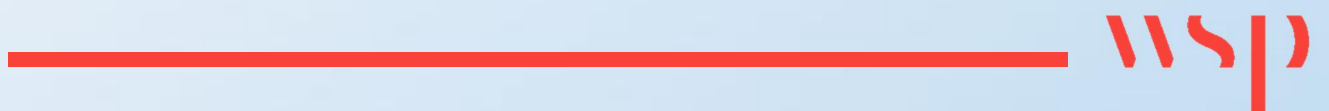


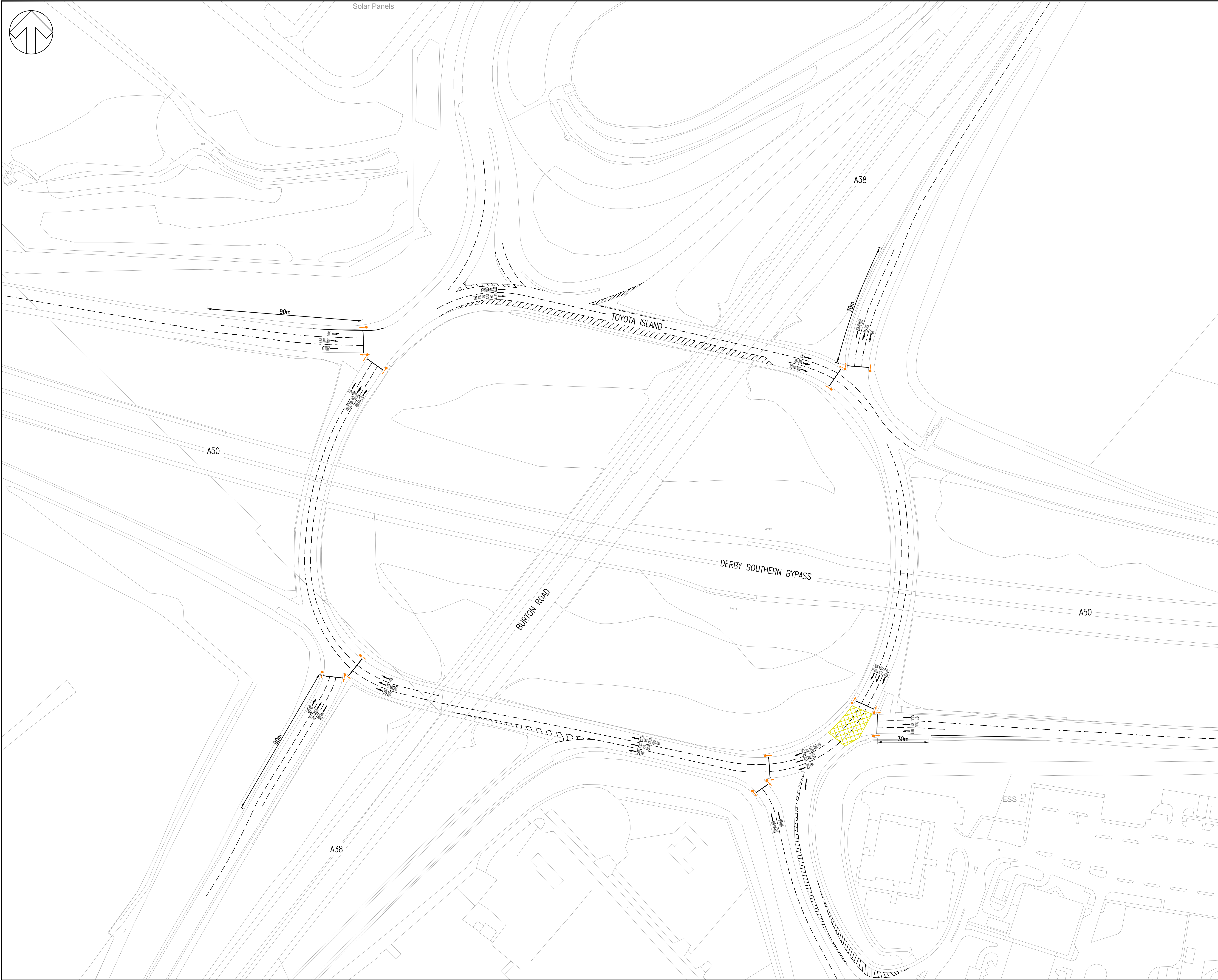




Appendix I

MITIGATION SCHEME





File name: \\UK-WSP\GROUP\COMMON\DATA\PROJECTS\70046897-GA-001\DWG, printed on 22 November 2018 15:59:13, by Douglas, Kieran

DO NOT SCALE

KEY

 INDICATIVE TRAFFIC SIGNAL POLE LOCATION

P02	22/11/2018	KD	YELLOW BOX MARKING ADDED	DP	AC
P01	12/11/2018	KD	FIRST ISSUE	DP	AC
REV	DATE	BY	DESCRIPTION	CHK	APP

DRAWING STATUS:

S0 - WORK IN PROGRESS



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wsp.com

CLIENT:

BRACKLEY PROPERTY DEVELOPMENTS

SITE/PROJECT:

A50/A38
JUNCTION MITIGATION SCHEME

TITLE:

PROPOSED INDUSTRIAL DEVELOPMENT
AT BURNASTON CROSS/WILLINGTON

SCALE @ A1:	CHECKED:	APPROVED:		
1:1000	DB	AR		
PROJECT NO:	DESIGNED:	DRAWN:	DATE:	
70046897	ER	KD	November 18	
DRAWING No:				REV:
70046897-GA-001				P02

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