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Client: Momentum Transport Planning

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Olympia – With CS9 – Revised Testing following TfL Audit

1. INTRODUCTION

This technical note (TN) details the VISSIM modelling undertaken for Momentum Transport Consultancy for the proposed Olympia Exhibition Centre development in Hammersmith, London.

The VISSIM modelling has been based on Transport for London's (TfL's) model of Hammersmith, which has been used to test the Cycle Superhighways proposals (CS9) in the area.

The model extents are shown in **Figure 1**.



Figure 1 – VISSIM Modelling Extents

This TN builds upon the following TNs:

- TN1 – which detailed initial VISSIM assessment for the Olympia development.
- TN2 – which detailed revised testing following changes to some of the flow assumptions and scenarios tested.

It should also be noted that all of the analysis and assessment detailed below *includes* the proposed CS9 improvements.

2. SCENARIOS MODELLED

As stated in TN2, the following scenarios have been tested as part of this VISSIM modelling exercise, as agreed with Momentum and TfL.

Table 1 – Modelled VISSIM Scenarios

Scenario		VISSIM Scenario No.
No.	Name	
1	Future Baseline (Existing TfL VISSIM model, including CS9 proposals)	19, 20
2a	Future Baseline + Proposed Blythe Road Signalisation	37, 38
3a	Future Baseline + Proposed Olympia Development	39, 40
4a	Future Baseline + Proposed Olympia Development + Proposed Blythe Road Signalisation	41, 42
5a	Future Baseline + Proposed Olympia Development + Proposed D-Gate Signalisation	43, 44
6a	Future Baseline + Proposed Olympia Development + Proposed Blythe Road Signalisation + Proposed D-Gate Signalisation	45, 46

It should be noted that, for the purposes of this TN, the following scenario has not been compared and analysed following agreement with Momentum:

- Scenario 2a – Future Baseline + Proposed Blythe Road Signalisation.

3. CHANGES TO MODEL

A comprehensive list of the modification files created and their associated details can be found in Section 3 in TN2.

This TN focuses on the audit comments made by TfL and the respective changes made to address them.

Comments from TfL were received on 3rd October 2018 via Claire Farrow and a follow-on response to these comments was sent from Multimodal to TfL on 5th October 2018 (see **Appendix A** for email chain). A further response from TfL was provided by TfL on 28th November 2018 and the following headings below detail further model changes to answer TfL's remaining queries.

1) D-Gate Flows appear incorrect – should there be 0 flows out in the AM peak?

Multimodal have discussed this query with Momentum Transport Planning and can confirm that the flows are 0 in the AM peak and 6 in the PM peak. The reasoning for this is stated below, from an email received from Momentum following their discussions with TfL (email from [REDACTED] p Multimodal sent on 30/11/18 at 09:19):

“Just to confirm on the modelled D-Gate flows (0 in and 0 out in the morning; 0 in and 6 out in the evening).

D-Gate is the exhibition visitor proposed car park access. Exhibition visitors have specific profiles linked to the opening and closing times of the shows which are outside of network peaks and specifically the peak hours modelled in VISSIM.

We agreed these profiles with the spatial team at TfL and it was also highlighted to the network performance team at the time of the modelling. You'll see in the attached email from July that the agreed trip generation methodology leads to zero arrivals for the AM peak and 3% departures for the PM evening (because the 3% is from 1700 and 1800 and our model is 1745-1845, we have 'pushed' the 3% into the model times to test a worst case). 181 spaces car park x 3% of departures = 6 vehicles out during the PM peak.”

Further details on the email exchanges regarding this query can be provided if necessary.

2) *Behaviour of Cyclists at D-Gate junction – very slow on exit?*

TfL's main query related to the link having different widths through the junction, which could have affected the behaviour. Multimodal have undertaken a review of the link structure and can confirm that the cycle links are the same width through D-Gate (when signalised). For the scenarios where D-Gate is priority controlled, the cycle link structure and behaviours have been kept consistent with TfL's 'Proposed AM/PM V2' models.

Our standard modelling methodology when working with pre-approved models is to make no changes to the model set-up, unless specifically instructed to do so and with solid, agreed reasoning. In keeping with this approach for the cyclist behaviour, no further changes have been made to the models and further advice is sought from TfL if changes are required above the approved 'Proposed AM/PM V2' models.

3) *North End Road cyclist numbers require attention – vary between scenarios?*

Following a review of the cyclist flows, Multimodal can confirm that Scenarios 3a and 5a have the correct cyclist flows. For Scenarios 4a and 6a, as a result of the closure of Munden Street to 'Entry Only' traffic, the vehicles which previously entered the network from this approach were reassigned to North End Road. However, a review of the calculation of these inputs has revealed an error in the number of cyclists calculated. The updated calculations for the North End Road vehicle inputs can be found in **Appendix B**, Modification Files 96 and 97 have been updated and the models have been re-run for new results.

4) *Northbound link at Munden Street – differences between scenarios?*

In scenarios 4a and 6a, this approach is 'Entry Only' in line with Momentum's mitigation proposals. This was confirmed by Momentum in an email from [REDACTED] on 24/07/18 at 12:52, which stated:

"...when Blythe road is signalised Munden Street becomes entry only from Hammersmith Road."

4. RESULTS

To compare the effects in the network of the various scenarios, the following outputs have been obtained as agreed with TfL:

- Journey Times (for General Traffic, Buses, Cyclists)
- Queue Lengths (Average Queues at each junction in the network)
- Saturation Flows (for each approach at each signalised junction in the network)
- Overall Network Performance

In line with previous CS9 modelling, the following random seeds have been run:

Table 2 – Random Seed Runs

Peak	AM	PM
Starting Seed	42	42
Increment	1	19
No. of Runs	20	20

Journey Times

Journey times 9000-9056 have been obtained for the same sections used in the CS9 assessment, as agreed with TfL. Numbers 200-202 have also been obtained following correspondence with TfL. For reference, the journey time sections are listed in **Table 3** and shown in **Figure 2**.

Table 3 – Journey Time Sections

No.	Journey Time	No.	Journey Time
9001	Sect 16 West to Holland Road	9049	North End Rd to Sect 16 West
9002	Holland Rd to Sect 16 West	9050	Sect 16 West to North End Rd Cyclists
9003	Sect 16 West to Holland Road Cyclists	9051	North End Rd to Sect 16 West Cyclists
9004	Holland Rd to Sect 16 West Cyclists	9055	EB_Olympia_Holland Road
9017	Sect 16 West to Olympia	9056	WB_Holland Road_Olympia
9018	Olympia to Sect 16 West	200	MM - NorthEndRd to HammRdEast
9019	Sect 16 West to Olympia Cyclists	201	MM - NorthEndRd to HammRdWest
9020	Olympia to Sect 16 West Cyclists	202	MM - NorthEndRd to HammRdWest (Cycles)
9048	Sect 16 West to North End Rd		

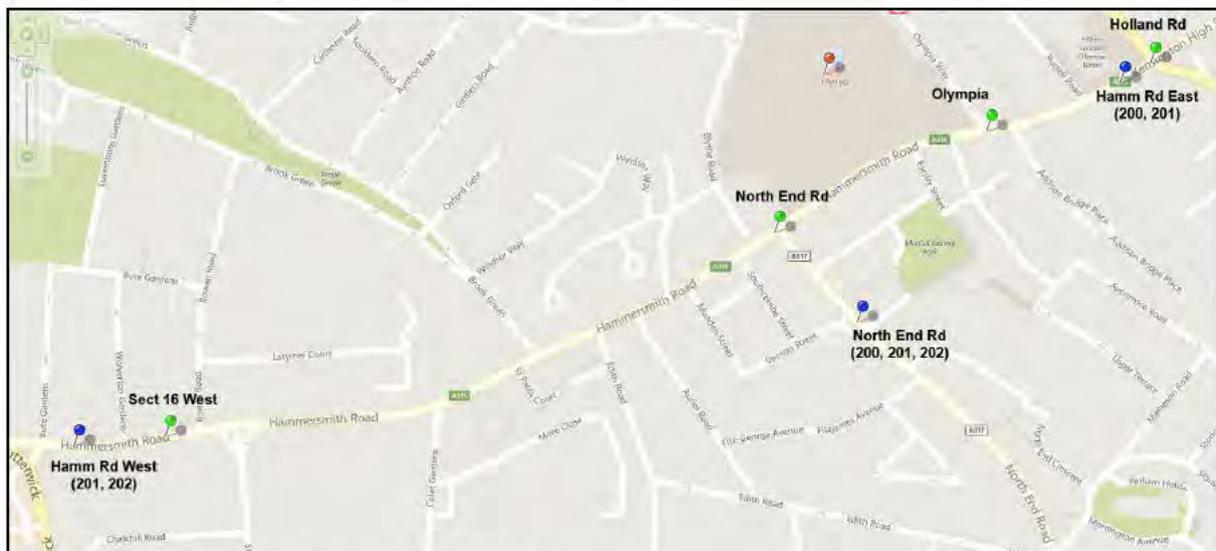


Figure 2 – Journey Time Marker Locations

The full set of AM and PM results are shown in **Tables 4 and 5**.

Table 4 – Journey Time Results – AM

AM PEAK (0745-0845)		Traffic					Traffic - Impact of Scenarios against CS9			
Journey Time Measurement		Average Journey Time (s)					Average Journey Time (s)			
No.	Name	SC1	SC3a	SC4a	SC5a	SC6a	SC3a	SC4a	SC5a	SC6a
9001	Sect 16 West to Holland Road	389	511	508	602	590	121	119	213	201
9002	Holland Rd to Sect 16 West	209	228	419	246	419	19	210	37	210
9003	Sect 16 West to Holland Road Cyclists	-	-	-	-	-	-	-	-	-
9004	Holland Rd to Sect 16 West Cyclists	-	-	-	-	-	-	-	-	-
9017	Sect 16 West to Olympia	311	441	454	545	540	130	143	234	229
9018	Olympia to Sect 16 West	177	194	329	205	331	17	152	28	154
9019	Sect 16 West to Olympia Cyclists	-	-	-	-	-	-	-	-	-
9020	Olympia to Sect 16 West Cyclists	-	-	-	-	-	-	-	-	-
9048	Sect 16 West to North End Rd	241	380	412	489	486	139	170	247	245
9049	North End Rd to Sect 16 West	-	-	201	-	206	-	-	-	-
9050	Sect 16 West to North End Rd Cyclists	-	-	-	-	-	-	-	-	-
9051	North End Rd to Sect 16 West Cyclists	-	-	-	-	-	-	-	-	-
9055	EB Olympia Holland Road	80	75	57	63	56	-5	-22	-17	-23
9056	WB Holland Road Olympia	32	33	92	40	90	1	60	8	58
200	MM - NorthEndRd to HammRdEast	480	467	471	462	485	-12	-9	-18	6
201	MM - NorthEndRd to HammRdWest	-	-	603	-	605	-	-	-	-
202	MM - NorthEndRd to HammRdWest (Cycles)	-	-	-	-	-	-	-	-	-

AM PEAK (0745-0845)		Buses					Buses - Impact of Scenarios against CS9			
Journey Time Measurement		Average Journey Time (s)					Average Journey Time (s)			
No.	Name	SC1	SC3a	SC4a	SC5a	SC6a	SC3a	SC4a	SC5a	SC6a
9001	Sect 16 West to Holland Road	444	527	518	614	603	83	74	170	160
9002	Holland Rd to Sect 16 West	259	272	456	295	462	13	198	36	203
9003	Sect 16 West to Holland Road Cyclists	-	-	-	-	-	-	-	-	-
9004	Holland Rd to Sect 16 West Cyclists	-	-	-	-	-	-	-	-	-
9017	Sect 16 West to Olympia	377	469	471	567	561	92	94	190	185
9018	Olympia to Sect 16 West	222	235	364	253	371	12	142	30	149
9019	Sect 16 West to Olympia Cyclists	-	-	-	-	-	-	-	-	-
9020	Olympia to Sect 16 West Cyclists	-	-	-	-	-	-	-	-	-
9048	Sect 16 West to North End Rd	291	398	414	489	485	107	124	198	194
9049	North End Rd to Sect 16 West	147	151	231	150	234	4	84	3	87
9050	Sect 16 West to North End Rd Cyclists	-	-	-	-	-	-	-	-	-
9051	North End Rd to Sect 16 West Cyclists	-	-	-	-	-	-	-	-	-
9055	EB Olympia Holland Road	67	60	48	52	50	-8	-20	-16	-17
9056	WB Holland Road Olympia	37	38	93	43	92	1	56	6	55
200	MM - NorthEndRd to HammRdEast	433	430	440	434	452	-4	7	1	19
201	MM - NorthEndRd to HammRdWest	509	498	630	512	629	-11	122	4	120
202	MM - NorthEndRd to HammRdWest (Cycles)	-	-	-	-	-	-	-	-	-

AM PEAK (0745-0845)		Cyclists					Cyclists - Impact of Scenarios against CS9			
Journey Time Measurement		Average Journey Time (s)					Average Journey Time (s)			
No.	Name	SC1	SC3a	SC4a	SC5a	SC6a	SC3a	SC4a	SC5a	SC6a
9001	Sect 16 West to Holland Road	-	-	-	-	-	-	-	-	-
9002	Holland Rd to Sect 16 West	-	-	-	-	-	-	-	-	-
9003	Sect 16 West to Holland Road Cyclists	317	319	720	533	771	2	403	216	454
9004	Holland Rd to Sect 16 West Cyclists	260	263	322	318	357	3	62	58	97
9017	Sect 16 West to Olympia	-	-	-	-	-	-	-	-	-
9018	Olympia to Sect 16 West	-	-	-	-	-	-	-	-	-
9019	Sect 16 West to Olympia Cyclists	259	262	677	487	728	3	418	228	469
9020	Olympia to Sect 16 West Cyclists	219	224	248	275	293	4	29	55	74
9048	Sect 16 West to North End Rd	-	-	-	-	-	-	-	-	-
9049	North End Rd to Sect 16 West	-	-	-	-	-	-	-	-	-
9050	Sect 16 West to North End Rd Cyclists	208	207	630	207	621	0	423	-1	414
9051	North End Rd to Sect 16 West Cyclists	172	181	176	175	184	9	4	2	12
9055	EB Olympia Holland Road	-	-	-	-	-	-	-	-	-
9056	WB Holland Road Olympia	39	39	67	41	61	0	28	2	21
200	MM - NorthEndRd to HammRdEast	258	255	247	497	326	-3	-11	239	68
201	MM - NorthEndRd to HammRdWest	-	-	-	-	-	-	-	-	-
202	MM - NorthEndRd to HammRdWest (Cycles)	348	354	353	353	363	6	5	5	15

Table 5 – Journey Time Results – PM

PM PEAK (1745-1845)		Traffic					Traffic - Impact of Scenarios against CS9			
Journey Time Measurement		Average Journey Time (s)					Average Journey Time (s)			
No.	Name	SC1	SC3a	SC4a	SC5a	SC6a	SC3a	SC4a	SC5a	SC6a
9001	Sect 16 West to Holland Road	403	627	930	752	932	225	527	349	529
9002	Holland Rd to Sect 16 West	220	258	503	282	514	38	284	62	295
9003	Sect 16 West to Holland Road Cyclists	-	-	-	-	-	-	-	-	-
9004	Holland Rd to Sect 16 West Cyclists	-	-	-	-	-	-	-	-	-
9017	Sect 16 West to Olympia	319	571	891	701	894	252	572	383	575
9018	Olympia to Sect 16 West	186	219	368	226	380	33	182	39	194
9019	Sect 16 West to Olympia Cyclists	-	-	-	-	-	-	-	-	-
9020	Olympia to Sect 16 West Cyclists	-	-	-	-	-	-	-	-	-
9048	Sect 16 West to North End Rd	247	522	863	662	867	275	617	416	621
9049	North End Rd to Sect 16 West	-	-	198	-	196	-	-	-	-
9050	Sect 16 West to North End Rd Cyclists	-	-	-	-	-	-	-	-	-
9051	North End Rd to Sect 16 West Cyclists	-	-	-	-	-	-	-	-	-
9055	EB Olympia Holland Road	86	70	57	63	55	-16	-29	-23	-31
9056	WB Holland Road Olympia	34	38	148	59	147	4	114	25	113
200	MM - NorthEndRd to HammRdEast	413	374	373	382	368	-39	-40	-31	-45
201	MM - NorthEndRd to HammRdWest	-	-	502	-	500	-	-	-	-
202	MM - NorthEndRd to HammRdWest (Cycles)	-	-	-	-	-	-	-	-	-

PM PEAK (1745-1845)		Buses					Buses - Impact of Scenarios against CS9			
Journey Time Measurement		Average Journey Time (s)					Average Journey Time (s)			
No.	Name	SC1	SC3a	SC4a	SC5a	SC6a	SC3a	SC4a	SC5a	SC6a
9001	Sect 16 West to Holland Road	470	666	951	771	937	196	480	301	467
9002	Holland Rd to Sect 16 West	282	312	530	343	535	30	248	61	253
9003	Sect 16 West to Holland Road Cyclists	-	-	-	-	-	-	-	-	-
9004	Holland Rd to Sect 16 West Cyclists	-	-	-	-	-	-	-	-	-
9017	Sect 16 West to Olympia	402	631	933	752	924	229	531	350	523
9018	Olympia to Sect 16 West	246	272	404	290	409	26	158	45	163
9019	Sect 16 West to Olympia Cyclists	-	-	-	-	-	-	-	-	-
9020	Olympia to Sect 16 West Cyclists	-	-	-	-	-	-	-	-	-
9048	Sect 16 West to North End Rd	305	558	884	678	865	253	580	373	560
9049	North End Rd to Sect 16 West	155	168	229	158	227	13	74	3	72
9050	Sect 16 West to North End Rd Cyclists	-	-	-	-	-	-	-	-	-
9051	North End Rd to Sect 16 West Cyclists	-	-	-	-	-	-	-	-	-
9055	EB Olympia Holland Road	75	59	49	51	47	-16	-26	-23	-28
9056	WB Holland Road Olympia	37	41	142	57	142	4	106	20	105
200	MM - NorthEndRd to HammRdEast	397	370	383	373	365	-27	-14	-24	-32
201	MM - NorthEndRd to HammRdWest	471	478	565	490	558	7	94	19	87
202	MM - NorthEndRd to HammRdWest (Cycles)	-	-	-	-	-	-	-	-	-

PM PEAK (1745-1845)		Cyclists					Cyclists - Impact of Scenarios against CS9			
Journey Time Measurement		Average Journey Time (s)					Average Journey Time (s)			
No.	Name	SC1	SC3a	SC4a	SC5a	SC6a	SC3a	SC4a	SC5a	SC6a
9001	Sect 16 West to Holland Road	-	-	-	-	-	-	-	-	-
9002	Holland Rd to Sect 16 West	-	-	-	-	-	-	-	-	-
9003	Sect 16 West to Holland Road Cyclists	271	268	285	309	333	-4	14	38	62
9004	Holland Rd to Sect 16 West Cyclists	368	402	434	528	484	34	66	160	116
9017	Sect 16 West to Olympia	-	-	-	-	-	-	-	-	-
9018	Olympia to Sect 16 West	-	-	-	-	-	-	-	-	-
9019	Sect 16 West to Olympia Cyclists	218	218	240	260	284	0	22	41	66
9020	Olympia to Sect 16 West Cyclists	325	349	340	477	392	24	16	152	68
9048	Sect 16 West to North End Rd	-	-	-	-	-	-	-	-	-
9049	North End Rd to Sect 16 West	-	-	-	-	-	-	-	-	-
9050	Sect 16 West to North End Rd Cyclists	177	176	198	175	199	-1	21	-2	22
9051	North End Rd to Sect 16 West Cyclists	199	208	242	212	213	9	43	13	14
9055	EB Olympia Holland Road	-	-	-	-	-	-	-	-	-
9056	WB Holland Road Olympia	43	54	100	55	97	11	57	12	54
200	MM - NorthEndRd to HammRdEast	194	193	198	277	281	-1	4	83	87
201	MM - NorthEndRd to HammRdWest	-	-	-	-	-	-	-	-	-
202	MM - NorthEndRd to HammRdWest (Cycles)	332	350	388	352	352	18	56	20	21

AM Results

In the AM peak, **Table 4** shows that when comparing against SC1, SC3a has the least impact (adding Olympia development, no signalisation schemes) for all modes (general traffic, buses and cyclists). This seems to indicate that by reassigning traffic using Olympia Way to Blythe Road, the network journey times are affected, but not to the same degree as the other scenarios. The maximum increases are around 2 minutes for traffic and buses and 9 seconds for cyclists.

The introduction of signals at Blythe Road (SC4a), D-Gate (SC5a) or both junctions (SC6a) tends to have a greater impact on the journey times for all modes of travel. This is particularly noticeable for SC4a and SC6a for westbound journey times on Hammersmith Road (no's 9002, 9018), where increases of ~3.5 minutes were experienced for traffic and buses and 0.5-1.5 minutes for cyclists (no's 9004, 9020).

In an eastbound direction, SC6a experiences significant increases for cyclists (~7-8 minutes for no's 9003, 9019), with SC6a and SC5a having similar effects on general traffic and buses (3.5-4 minutes for no's 9001, 9017, 9048). SC4a had less of an impact on general traffic and buses (2-3 minutes), but similar impacts on cyclists as SC6a. SC5a had less of an impact on cyclists (max times of 1-3.5 minutes as opposed to 7-8 minutes).

From North End Road, the journey time impacts on traffic travelling eastbound are minimal, with SC3a, SC4a and SC5a all producing slight reductions in times of between ~10 and 20 seconds. SC6a has a slight increase in journey time (6 seconds). For buses, the biggest impacts are in SC4a and SC6a, where travelling westbound (no. 201), there are increases of ~2 minutes. Cyclists are most affected in SC5a, where there is an increase of nearly 4 minutes travelling eastbound (no. 200).

Across all the scenarios, there are some slight improvements (up to 23 seconds for SC6a) to general traffic and bus journey times for traffic travelling from Olympia to Holland Road (no. 9055). Travelling in the other direction (no. 9056), SC4a and SC6a have the biggest increases of 20-60 seconds across all modes of travel.

PM Results

In the PM peak, **Table 5** shows that all scenarios show increases in general traffic and bus journey times for eastbound and westbound routes on Hammersmith Road (no's 9001, 9002, 9017, 9018, 9048). The increases range from 30 seconds to 10 minutes for traffic and buses, with SC4a and SC6a the worst performing. For cyclists, SC3a shows similar or slightly improved times eastbound (No's 9003, 9019, 9050), with SC4a, SC5a and SC6a showing modest increases of 14 seconds to 1 minute. In a westbound direction (No. 9004, 9020), SC5a is the most noticeable, with increased times of ~3 minutes in comparison to ~30 seconds to 2 minutes for the other scenarios.

Journey times from North End Road travelling eastbound (No. 200) were found to be improved for all scenarios when considering general traffic and buses, with savings ranging from 14 – 45 seconds. In a westbound direction (No. 201), SC4a and SC6a had more of an impact on buses, with increases of around 1.5 minutes. For cyclists, the results were mixed. SC5a and SC6a had the biggest impact travelling eastbound (~1.5 minutes) and SC4a had the biggest impact travelling westbound (~1 minute).

Comparing the different scenarios, SC3a and SC5a appear to have the least impact on general traffic and buses times. For cyclists, SC3a has the least impact, following by SC4a and then SC6a and SC5a.

As in the AM peak, there are some slight improvements (up to 31 seconds for SC6a) to general traffic and bus journey times for traffic travelling from Olympia to Holland Road (no's 9055). Travelling in the other direction (No. 9056), SC3a and SC5a have the least impact on travel times, but these are all increased in comparison to the base case.

Queue Lengths

Average queue lengths have been obtained for the junctions listed below and shown in **Figure 3**:

- J1 – Hammersmith Rd / Avonmore Rd;
- J2 – Hammersmith Rd / North End Rd;
- J3 – Hammersmith Rd / Blythe Rd;
- J4 – Hammersmith Rd / Edith Rd;
- J5 – Hammersmith Rd / Brook Green;
- J6 – Hammersmith Rd / Shortlands;
- J7 – Hammersmith Rd / D-Gate;
- J8 – Kensington High St / Warwick Rd.

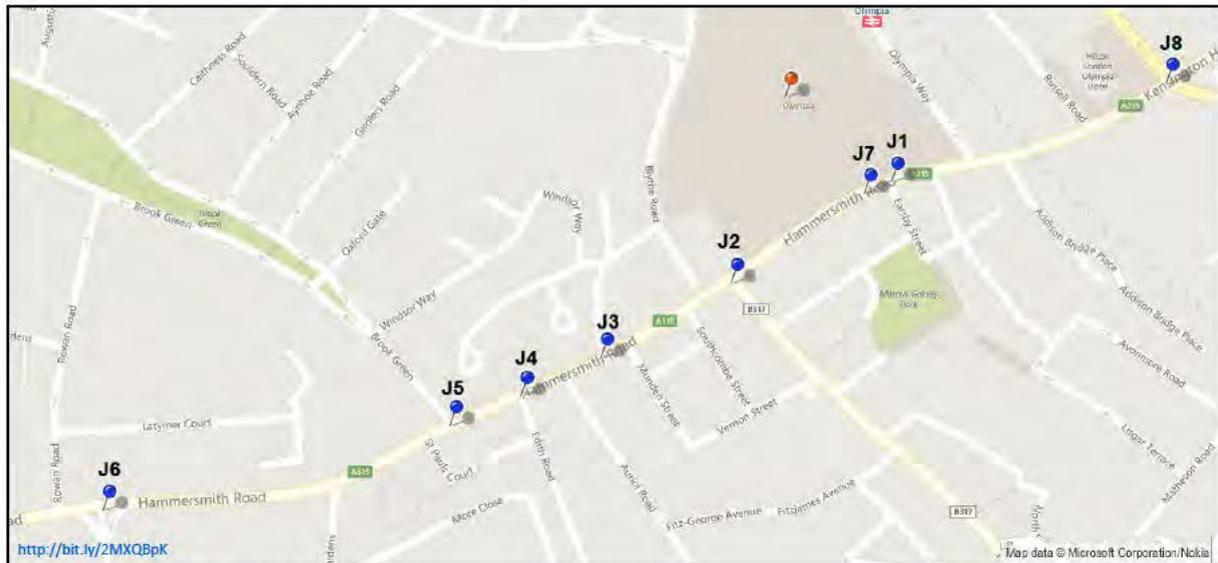


Figure 3 – Junctions Assessed

The comparisons for each junction are shown in **Figures 4-11** under the related sections.

J1 – Hammersmith Rd / Avonmore Rd



Figure 4 – Hammersmith Rd / Avonmore Rd Queue Comparisons

In the AM peak, the longest queues are on the Hammersmith Road East approach, with SC4a and SC6a (Blythe Road signalisation and both sets of signals) having the highest average queue lengths. Queues on Avonmore Road are the next longest and again, highest in SC4a and SC6a. Finally, the Hammersmith Road West approach has the lowest average queue lengths, with SC1 being the exception, which has longer queues.

The pattern of the queue results suggest that the introduction of the signals has a negative impact in the busier westbound direction, but a positive effect eastbound on Hammersmith Road.

In the PM peak, the Hammersmith Road East approach has the longest queues (~250m) in SC4a and SC6a. The queues plateau at this length which suggests that the queuing is back to the Kensington High St / Warwick Road junction for parts the PM peak period.

For the Hammersmith Road West approach, the average queue lengths are lower for all scenarios (compared to SC1), indicating some benefit with the signalisation proposals.

J2 – Hammersmith Rd / North End Rd



Figure 5 – Hammersmith Rd / North End Rd Queue Comparisons

In the AM peak, the North End Road approach queues reach as far back as the end of the link (~180m) and maintain this level throughout. This level of queuing is likely to result in latent demand on this approach, with vehicles not able to enter the network.

For the Hammersmith Road approaches, the results are mixed. On the East approach, SC3a and 5a have comparable queues with SC1, but SC4a and SC6a have much longer queues. However, for the West approach, SC4a and SC6a produce lower average queues (20-40m), with SC5a resulting in the highest average queue lengths (~80m). This suggests that the proposed signalisation of Blythe Road and D-Gate have mixed effects on this junction in the AM peak.

In the PM peak, the same effects are apparent as in the AM peak across all the approaches.

North End Road experiences a consistent queue of ~180m, reaching back as far as the end of the link and likely leading to latent demand from this approach as a result.

For the Hammersmith Road approaches, the East approach has longer queues in SC4a and SC6a (70-100m), with SC3a also experiencing higher queue lengths in this peak (~40m). SC5a has comparable queues with SC1, averaging out at ~30m in both scenarios.

For the West approach, the average queue lengths are higher for all scenarios, with SC4a and SC6a again having the shortest queues.

J3 – Hammersmith Rd / Blythe Rd



Figure 6 – Hammersmith Rd / Blythe Rd Queue Comparisons

In the AM peak, the average queues on Blythe Road are longest for SC6a (~90m), then SC4a (~75m) and then SC5a (~60m).

For the Hammersmith Road approaches, SC4a and 6a are significantly worse than the other scenarios for the East approach. As these scenarios propose signals on this approach, this would indicate the reason for the additional delay. For the West approach, the queue lengths for all the mitigation scenarios are similar, suggesting that there is not as much of an impact having signals on this approach (SC4a, SC5a and SC6a).

For Munden St, SC5a has the highest average queue lengths (~40m). SC4a and SC6a have no queues from this approach, as a result of the approach being closed, and traffic reassigned.

In the PM peak, the Blythe Road queues reach back to the start of the link for SC1, SC4a and SC5a (~110m). This occurs earlier in SC5a, indicating the likelihood of latent demand on this approach as a result. SC3a has the lowest queue lengths (~80m), with and SC6a having queues ~100m.

For the Hammersmith Road approaches, the results are mixed. On the East approach, SC4a and SC6a have the longest queues (as in the AM peak). For the West approach, the queue lengths are all similar at ~80m. This suggests that the queues reach back to the Edith Road junction on a consistent basis throughout the PM peak, except for the future baseline scenario (SC1).

On Munden St, the same results are apparent in the PM peak as the AM peak.

J4 – Hammersmith Rd / Edith Rd



Figure 7 – Hammersmith Rd / Edith Rd Queue Comparisons

In the AM peak, the queue lengths on the Hammersmith Road East approach are higher for SC5a and SC3a, with SC4a and SC6a having lower queue lengths than SC1. For the West approach, the queue lengths and profiles are more consistent between SC3a, SC4a and SC6a. SC5a has the longest average queues (~50m) and SC1 has the shortest (~5m).

For Edith Road, the queue lengths for all scenarios are minimal, at ~5m throughout the AM peak period.

In the PM peak, the Hammersmith Road East approach follows a similar pattern as the AM peak, with SC4a and SC6a having the lowest queue lengths and SC3a and SC5a having the highest. This suggests a benefit with the Blythe Road signals. For the West approach, the average queue lengths are higher than in the AM peak, with SC3a, SC4a, SC5a and SC6a experiencing the larger queues (55-65m on average). Scenarios with queues over 50m suggest an interaction with the Brook Green junction, which is ~50m away from the Edith Road junction.

For Edith Road, the average queue lengths are again minimal for all scenarios, averaging out at around 5m.

J5 – Hammersmith Rd / Brook Green



Figure 8 – Hammersmith Rd / Brook Green Queue Comparisons

In the AM peak, the Brook Green approach has the longest queues in SC5a (peaking at ~50m), with the remaining scenarios having the lowest queues at around 20m. This suggests some benefit with the Blythe Road signals in place.

For the Hammersmith Road approaches, the results are mixed. For the East approach, the queues for all scenarios are minimal at ~15m. However, for the West approach, the average queue lengths plateau at ~300m for all scenarios (except the future baseline – SC1). This suggests heavy queuing which reaches back beyond the Shortlands junction.

In the PM peak, the queues on Brook Green for SC3a and SC5a reach back to the start of the link (~140m) and remain at that level for the whole peak period. This is likely to lead to latent demand on this approach as a result. SC4a and SC6a have queues that build, but only reach up to 75m.

For the Hammersmith Road approaches in the PM peak, the same effects are present as in the AM peak. For the East approach, the queue lengths are slightly higher on average (at around 30-40m). For the West approach, the significant queuing is again present, maintaining a length of 300m, suggesting downstream queuing beyond the Shortlands junction. The exception is the future baseline (SC1), which has average queuing around 40m.

J6 – Hammersmith Rd / Shortlands



Figure 9 – Hammersmith Rd / Shortlands Queue Comparisons

In the AM peak, the Hammersmith Road East approach has queues up to 20-30m for all scenarios.

For Hammersmith Road West, the queues for SC4a, SC5a and SC6a scenarios reach back as far as the end of the link (~180m). This occurs earlier in the peak for SC6a and SC5a, with latent demand likely as a result. Queues for SC3a increase as the peak progresses, but do not reach as far (~160m).

For the Shortlands approach, the queues are minimal for all scenarios, averaging around 10m.

In the PM peak, both Hammersmith Road approaches experience the same levels of queuing. For the East approach, all scenarios have average queue lengths of 20-30m. For the West approach, the queue lengths for SC4a and SC6a rise to 180m and plateau, suggesting latent demand also likely from this approach. SC5a and SC3a have lower average queue lengths, of up to 160m and 110m respectively.

The average queues on the Shortlands approach are minimal, averaging around 5m for all scenarios.

J7 – Hammersmith Rd / D-Gate



Figure 10 – Hammersmith Rd / D-Gate Queue Comparisons

In the AM peak, queues on the D-Gate approach are minimal, with very little traffic exiting this approach.

On the Hammersmith Road East approach, the introduction of signals at Blythe Road, D-Gate or both (SC4a, SC5a, SC6a) increases the queue lengths on this approach. SC4a and SC6a provide the biggest increase with queues averaging 40-50m. On the West approach, SC5a and SC6a have the longest queues (~70m), with SC3a reaching 60m in length and SC4a averaging ~40m. This indicates that the introduction of signals at D-Gate does have an effect. SC1 has no queue lengths as this junction was not included within the future baseline scenario.

In the PM peak, the D-Gate queues are minimal, replicating the AM performance.

For Hammersmith Road, the East approach has higher average queue lengths with SC4a and SC6a the longest (~60-70m). SC5a has average queues up to 35m in length, whilst SC3a has the lowest (~10m). For the West approach, SC5a and SC6a have the longest queues (40-50m), with SC3a having the lowest queue lengths with the Olympia development included.

J8 – Kensington High St / Warwick Rd



Figure 11 – Kensington High St / Warwick Rd Queue Comparisons

In the AM peak, all scenarios have a consistent average queue length and profile on the Kensington High Street East approach.

For Kensington High St West, SC1 is the worst performing, with average queues reaching ~140m at their peak. The scenarios with the proposed signals (SC4a, SC5a and SC6a) produce the lower queue lengths, likely due to traffic being held up further downstream in the network.

On Warwick Road, the approach queuing is consistent for all scenarios, with an eventual build up to ~90m as queues reach back from the Avonmore Road junction.

In the PM peak, there are big differences in queuing on the Kensington High St East approach. SC4a and 6a have queues which build back to the start of the link (~340m). This is likely due to queuing back at the Avonmore Road junction (see **Figure 4**) and will likely lead to latent demand on this approach in these scenarios. SC3a and SC5a have much lower queuing levels, averaging 20-40m.

For the West approach of Kensington High St, the queuing profiles are similar to the AM peak, with SC1 producing the highest average queue lengths (~100m). The other scenarios have smaller queues, suggesting traffic is being held up further downstream for SC4a, SC5a and SC6a.

The Warwick Road approach queuing is fairly consistent for SC6, 7, 8 and 9, with an eventual build up to ~150m as queues reach back from the Avonmore Road junction.

Saturation Flows

Saturation flows have been obtained at the following signalised junctions as listed below and shown in **Figure 3**:

- J2 – Hammersmith Rd / North End Rd;
- J3 – Hammersmith Rd / Blythe Rd;
- J4 – Hammersmith Rd / Edith Rd;
- J5 – Hammersmith Rd / Brook Green;
- J6 – Hammersmith Rd / Shortlands;
- J7 – Hammersmith Rd / D-Gate;
- J8 – Kensington High St / Warwick Rd.

The results of the AM and PM comparisons are shown in **Tables 6 and 7**, which have been based on the following Saturation Flow criteria from TfL’s ‘VISSIM Saturation Flow Tool (see **Figure 12**). The criteria has been based on the TfL Guidance Notes, with adjustments made to the ‘General Parameters’ section to obtain as many readings as possible from the VISSIM results.

Tool Settings for Saturation Flow Measurement

General Parameters:

Number of vehicles across stopline to ignore at start of green	<input type="text" value="2"/>
Minimum number of vehicles required in a single measurement	<input type="text" value="6"/>
Minimum number of measurements for average sat flow calculation	<input type="text" value="5"/>
Global PCU Factor (adjust for specific links on survey/results sheets)	<input type="text" value="1.00"/>

Time Parameters:

Include measurements from time	<input type="text" value="0"/> s
Disregard measurements after time	<input type="text" value="7200"/> s

End of Saturation:

End of saturation is assumed when any of the following occur (tick as appropriate):

- Headway is greater than s
- Increase between successive headways exceeds %
- (Max headway + min headway) greater than

Do not assume the above values are 'standard' values which are correct in all cases. They must be tested for suitability on a variety of links in the network concerned, and adjusted as necessary.

Test these settings on an individual Axx/Dis file
(Select Axx file)

Run with these settings on multiple Axx/Dis files
(Select VISSIM model file)

Clear Survey Data

Clear Results Data

Figure 12 – Saturation Flow Criteria for TfL’s VISSIM Saturation Flow Tool

Table 6 – Saturation Flow Comparisons – AM Peak

AM PEAK (0745-0845)											
Junction		From	Saturation Flows (pcu/hr)					% Difference to SC1			
No.	Name		SC1	SC3a	SC4a	SC5a	SC6a	SC3a	SC4a	SC5a	SC6a
2	Hamm Rd / North End Rd	Hamm Rd East	1700	1745	1689	1728	1695	3%	-1%	2%	0%
		North End Rd	1470	1491	1495	1499	1483	1%	2%	2%	1%
		Hamm Rd West	1675	1764	1857	1801	1829	5%	11%	7%	9%
3	Blythe Rd / Hamm Rd	Blythe Rd - LT	-	-	-	-	-	-	-	-	-
		Blythe Rd - RT	-	-	-	-	-	-	-	-	-
		Hamm Rd East	-	-	1627	-	1609	-	-	-	-
		Munden St	-	-	-	-	-	-	-	-	-
		Hamm Rd West	-	-	1771	-	1757	-	-	-	-
4	Hamm Rd / Edith Rd	Hamm Rd East	1921	1894	1880	1922	1813	-1%	-2%	0%	-6%
		Edith Rd	-	-	-	-	-	-	-	-	-
		Hamm Rd West	1918	1861	1846	1778	1827	-3%	-4%	-7%	-5%
5	Brook Green / Hamm Rd	Brook Green - LT	-	-	-	-	-	-	-	-	-
		Brook Green - RT	-	-	-	-	-	-	-	-	-
		Hamm Rd East	-	-	-	-	-	-	-	-	-
		Hamm Rd West	-	-	-	-	-	-	-	-	-
6	Hamm Rd / Shortlands	Hamm Rd East	2032	2022	2040	2024	2034	0%	0%	0%	0%
		Shortlands	-	-	-	-	-	-	-	-	-
		Hamm Rd West	1805	1769	1790	1781	1788	-2%	-1%	-1%	-1%
7	D-Gate / Hamm Rd	D-Gate	-	-	-	-	-	-	-	-	-
		Hamm Rd East	-	-	-	1767	1758	-	-	-	-
		Hamm Rd West	-	-	-	2040	2025	-	-	-	-
8	Holland Rd / Kensington High St / Warwick Rd	Kens. High St East - Ahead	-	-	-	-	-	-	-	-	-
		Kens. High St East - Ahead	-	-	-	-	-	-	-	-	-
		Kens. High St East - Right	-	-	-	-	-	-	-	-	-
		Warwick Rd - Ahead	1759	1757	1754	1760	1753	0%	0%	0%	0%
		Warwick Rd - Ahead	1784	1776	1773	1775	1779	0%	-1%	0%	0%
		Warwick Rd - LT	-	-	-	-	-	-	-	-	-
		Kens. High St West - Ahead	-	-	-	-	-	-	-	-	-
Kens. High St West - Ahead	1797	1802	1762	1766	1704	0%	-2%	-2%	-5%		
Kens. High St West - LT	-	-	-	-	-	-	-	-	-		

From **Table 6**, the main junctions affected in a negative way by the proposals are the Hammersmith Road junction with Edith Road, with decreases in saturation flows of 3-7%.

At the North End Road junction, there are some benefits over SC1, with saturation flow increases up to 11% for the Hammersmith Road West approach in SC4a. This appears to suggest that the signals are improving the flow eastbound on Hammersmith Road through this section of the network.

Comparing the different scenarios, SC3a shows the least variance in saturation flow, with the percentage changes ranging from +5% to -3%. SC4a, SC5a and SC6a show more variance, with ranges of +11% to -4%, +7% to -7% and +9% to -6% respectively.

For the Shortlands and Kensington High St junctions, the saturation flow changes were minimal between the scenarios. The only approach of note is the High Street West approach at the Kensington High Street junction, where SC4a, SC5a and SC6a had decreases of 2%, 2% and 5% respectively.

There were a large number of stop-lines where saturation flows could not be obtained. This was due to the outputs from VISSIM not satisfying the criteria as shown in **Figure 12**.

Table 7 – Saturation Flow Comparisons – PM Peak

PM PEAK (1745-1845)											
Junction		From	Saturation Flows (pcu/hr)					% Difference to SC1			
No.	Name		SC1	SC3a	SC4a	SC5a	SC6a	SC3a	SC4a	SC5a	SC6a
2	Hamm Rd / North End Rd	Hamm Rd East	1715	1731	1669	1731	1678	1%	-3%	1%	-2%
		North End Rd	1432	1438	1403	1434	1414	0%	-2%	0%	-1%
		Hamm Rd West	1552	1698	1701	1794	1805	9%	10%	16%	16%
3	Blythe Rd / Hamm Rd	Blythe Rd - LT	-	-	-	-	-	-	-	-	-
		Blythe Rd - RT	-	-	-	-	-	-	-	-	-
		Hamm Rd East	-	-	1572	-	1555	-	-	-	-
		Munden St	-	-	-	-	-	-	-	-	-
		Hamm Rd West	-	-	1747	-	1776	-	-	-	-
4	Hamm Rd / Edith Rd	Hamm Rd East	1962	1853	1860	1860	1906	-6%	-5%	-5%	-3%
		Edith Rd	-	-	-	-	-	-	-	-	-
		Hamm Rd West	1949	1742	1599	1793	1612	-11%	-18%	-8%	-17%
5	Brook Green / Hamm Rd	Brook Green - LT	1526	1506	1506	1546	1528	-1%	-1%	1%	0%
		Brook Green - RT	-	-	-	-	-	-	-	-	-
		Hamm Rd East	-	-	-	-	-	-	-	-	-
		Hamm Rd West	-	-	1932	-	-	-	-	-	-
6	Hamm Rd / Shortlands	Hamm Rd East	1986	1989	2033	1982	2027	0%	2%	0%	2%
		Shortlands	-	-	-	-	-	-	-	-	-
		Hamm Rd West	-	1743	-	1751	-	-	-	-	-
7	D-Gate / Hamm Rd	D-Gate	-	-	-	-	-	-	-	-	-
		Hamm Rd East	-	-	-	1766	1737	-	-	-	-
		Hamm Rd West	-	-	-	1960	1961	-	-	-	-
8	Holland Rd / Kensington High St / Warwick Rd	Kens. High St East - Ahead	-	-	-	-	-	-	-	-	-
		Kens. High St East - Ahead	1817	1924	1767	1830	1815	6%	-3%	1%	0%
		Kens. High St East - Right	-	-	-	-	-	-	-	-	-
		Warwick Rd - Ahead	1801	1802	1799	1802	1809	0%	0%	0%	0%
		Warwick Rd - Ahead	1837	1838	1842	1831	1827	0%	0%	0%	-1%
		Warwick Rd - LT	-	-	-	-	-	-	-	-	-
		Kens. High St West - Ahead	-	-	-	-	-	-	-	-	-
		Kens. High St West - Ahead	-	-	-	1679	-	-	-	-	-
Kens. High St West - LT	-	-	-	-	-	-	-	-	-		

From **Table 7**, there is much more variance in the saturation flow, with higher percentage differences than in the AM peak data.

The Hammersmith Road West approach at the Edith Road junction is most affected, particularly in SC4a and SC6a, where there is an 18% and 17% reduction in saturation flow. In terms of positive impacts, the Hammersmith Road West approach in SC5a and SC6a has saturation flows which increase by 16%. As in the AM peak, this may be due to the signals at Blythe Road, which is having a positive impact on the eastbound movement in this section of the network.

When comparing the different scenarios, SC3a shows the least variety of saturation flow changes (+9% to -11%), followed by SC5a (+16% to -8%). SC6a performs slightly better than SC4a (+16% to -17% compared to +10% to -18%), indicating that having both set of signals is a slightly better option than just having the Blythe Road signals in terms of vehicle throughput.

There were a large number of stop-lines where saturation flows could not be obtained, similar to the AM peak. This was due to the outputs from VISSIM not satisfying the criteria as shown in **Figure 12**.

Overall Network Performance

The overall network performance of the scenarios has been compared, to give an overall picture of how the different networks perform in terms of average delay, average speed and latent demand and delay.

The AM and PM results are shown in **Tables 8 and 9**.

Table 8 – Network Performance Comparisons – AM Peak

NETWORK PERFORMANCE								
AM Peak (0745-0845)								
Scenario	Average Delay (s)			Average Speed (mph)			Latent Delay (hrs)	Latent Demand
	No.	Traffic	Buses	Cyclists	Traffic	Buses	Cyclists	All Vehs
1	136	214	154	9	7	9	1	62
3a	160	252	155	8	6	9	2	79
4a	210	335	383	7	5	5	5	216
5a	188	292	283	7	6	6	2	128
6a	222	359	411	7	5	4	5	250

NETWORK PERFORMANCE - comparison vs. SC1								
AM Peak (0745-0845)								
Scenario	Average Delay (s)			Average Speed (mph)			Latent Delay (hrs)	Latent Demand
	No.	Traffic	Buses	Cyclists	Traffic	Buses	Cyclists	All Vehs
3a	24	38	1	-1	-1	0	0	17
4a	74	120	230	-2	-2	-5	3	155
5a	52	78	129	-2	-1	-3	1	67
6a	86	145	258	-3	-2	-5	4	188

**Some values different due to rounding in Excel*

In the AM peak, it can be seen that in terms of average delay, SC4a and 6a have the biggest impact compared to SC1. SC3a has minimal impact and SC5a is the better performing of the three mitigation scenarios (SC4a, SC5a and SC6a). Buses and cyclists are most affected, which may be due to the changes made in introducing signals at Blythe Road and a combination of Blythe Road and D-Gate signals.

This trend is repeated for the average speed comparisons, where the network speeds are lower for SC4a and 6a. This is particularly of note for cyclists, which are likely to have been affected by additional signals holding them within the network.

In terms of latent demand and associated latent delay, all of the scenarios show an increase over SC1. SC3a performs the best with only a slight increase, whilst SC6a shows the greatest impact. As with the other results, SC5a (D-Gate signals only) is the better performing of the three mitigation options, with 67 unreleased vehicles within the network during the peak period (compared to 155 and 188 vehicles in SC4a and SC6a).

Table 9 – Network Performance Comparisons – PM Peak

NETWORK PERFORMANCE								
PM Peak (1745-1845)								
Scenario	Average Delay (s)			Average Speed (mph)			Latent Delay (hrs)	Latent Demand
	No.	Traffic	Buses	Cyclists	Traffic	Buses	Cyclists	All Vehs
1	134	219	165	9	7	8	1	37
3a	169	296	189	8	6	8	1	78
4a	274	554	329	5	3	5	6	336
5a	198	346	262	7	5	6	3	165
6a	273	540	348	5	3	5	6	345

NETWORK PERFORMANCE - comparison vs. SC1								
PM Peak (1745-1845)								
Scenario	Average Delay (s)			Average Speed (mph)			Latent Delay (hrs)	Latent Demand
	No.	Traffic	Buses	Cyclists	Traffic	Buses	Cyclists	All Vehs
3a	35	77	24	-1	-2	-1	0	41
4a	141	335	164	-4	-4	-3	5	299
5a	65	127	97	-2	-2	-2	2	128
6a	139	321	182	-4	-4	-4	5	308

*Some values different due to rounding in Excel

In comparison to the AM peak, the average delay per vehicle is higher for all scenarios, indicating a more congested network. As a result of the congestion, the increases in average delays for all scenarios are much higher than in the AM peak. Comparing the scenarios to SC1, SC3a is again the scenario with the least impact and SC5a gives the more favourable results out of the mitigation scenarios. Scenarios 4a and 6a have the greatest impact, with both adding around 5 minutes of delay to Buses and 3 minutes to Cyclists within the peak hour.

Due to the more congested network, the average speeds of the different modes are also lower in comparison to the AM peak. SC4a and SC6a affect speeds the most, with general traffic and buses particularly affected by the signals proposed. SC3a performs slightly better than SC5a, particularly against Traffic and Cyclist speeds.

In terms of latent demand and associated latent delay, all of the scenarios show an increase over SC1. Comparing the scenarios, SC3a has the least impact, whilst SC4a and SC6a has the greatest overall impact. As with the other results, SC5a (D-Gate signals only) is the better performing of the three mitigation options, with 128 unreleased vehicles within the network during the peak period.

5. SUMMARY & CONCLUSIONS

This technical note (TN) details the VISSIM modelling undertaken for Momentum Transport Consultancy for the proposed Olympia Exhibition Centre development in Hammersmith, London.

The VISSIM modelling has been based on Transport for London's (TfL's) model of Hammersmith, which has been used to test the Cycle Superhighways proposals (CS9) in the area.

This TN builds upon TN2, which detailed revised testing following changes to the flow assumptions and scenarios modelled. Since that submission, TfL have provided audit comments on the modelling and this note addresses the model changes and the updated results.

The modelling scenarios tested and analysed in this TN were as follows:

- Scenario 1 – Future Baseline
- Scenario 3a – Future Baseline + Proposed Olympia Development
- Scenario 4a – Future Baseline + Proposed Olympia Development + Proposed Blythe Road Signalisation
- Scenario 5a – Future Baseline + Proposed Olympia Development + Proposed D-Gate Signalisation
- Scenario 6a – Future Baseline + Proposed Olympia Development + Proposed Blythe Road Signalisation + Proposed D-Gate Signalisation

To compare the effects in the network of the various scenarios, the following outputs have been obtained as agreed with TfL:

- Journey Times (for General Traffic, Buses, Cyclists)
- Queue Lengths (Average Queues at each junction in the network)
- Saturation Flows (for each approach at each signalised junction in the network)
- Overall Network Performance

From the results collected, in terms of traffic related performance and impact, there was no scenario which clearly and conclusively showed comparability with SC1 across all of the results collected.

From a network performance and journey time perspective, SC3a and SC5a appear to perform better than SC4a and SC6a, but these still result in a worsened level of performance against SC1 overall. For queue lengths and saturation flows, the results are much more varied. The different scenarios have advantages and disadvantages over SC1 and each other, depending on the junction and approach considered. This makes it difficult to draw suitable conclusions as to which scenario gives the better performance overall from a traffic modelling perspective.

Further consideration should be given to the pros and cons of the proposals against other external factors (such as safety of all road users), to identify the preferred scenario against a wider range of criteria.

Appendix A – TfL Audit Comments & Responses

From: [Farrow Claire \(ST\)](#)
To: [REDACTED]
Cc: [Burman Thomas](#); [Greenland Adam](#); [Bottoms Joseph](#); [Miklasz Michal](#); [REDACTED]; [REDACTED]
Subject: RE: Olympia models - comments
Date: 28 November 2018 16:18:05
Attachments: [image001.png](#)
[image008.png](#)

Hi [REDACTED],

Please see below for my comments in red (both with and without CS9 – please scroll all the way to the end).

Any questions please let me know.

Kind regards,

Claire Farrow

Principal Network Manager – West (A4)

Network Performance – Delivery

My usual hours are 07:30-16:45 Monday & Tuesday, 08:30-16:15 Wednesday

 TRANSPORT FOR LONDON

Surface Transport | Network Management Directorate

Palestra House | 3rd floor – Zone 3B3 | 197 Blackfriars Road | London SE1 8NJ

[REDACTED] | E: claire.farrow [REDACTED]

From: [REDACTED] [mailto:[REDACTED]@multimodaluk.com]
Sent: 01 November 2018 10:29
To: Farrow Claire (ST)
Cc: [Burman Thomas](#); [Greenland Adam](#); [Bottoms Joseph](#); [Miklasz Michal](#); [REDACTED]; [REDACTED]
Subject: RE: Olympia models - comments

Hi Claire,

Please see response below on the latest modelling comments.

[D-Gate Flows](#)

Response previously provided in email to Claire Farrow on 05/10/18 at 12:33 – flows based on numbers provided by Momentum. **Is it possible momentum are incorrect? It seems unlikely there would be 0 flow out of D-gate so this can be raised with Momentum.**

[Cyclist Numbers on North End Road](#)

Response previously provided in email to Claire Farrow on 05/10/18 at 12:33 – issue acknowledged and to be corrected in revised modelling. **Ok.**

[Scenario 3a & 4a – Cyclist Behaviour](#)

The behaviour at the bus stops on eastbound exit of both D-Gate and Blythe Road has been based on the bus stop behaviour on Link 29 in TfL's approved 'Future Base AM/PM' models (SC16 & 17). This was to ensure consistency with TfL's approved modelling.

At the time, we did try using 'Urban (motorised)' in line with the bus stop behaviour on Link 16 in TfL's approved 'Future Base AM/PM' models, but recall this showed similar issues. As a result, we opted for the specific bus stop behaviour to match TfL's models. **I think the behaviour was not so much the concern here but rather the width of the cycle track being inconsistent causing some issues as cyclists merge.**

Further advice is sought from TfL on this comment if changes are required above the approved 'Future Base AM/PM' models. We would also need to include our Client, Momentum, in these discussions as these

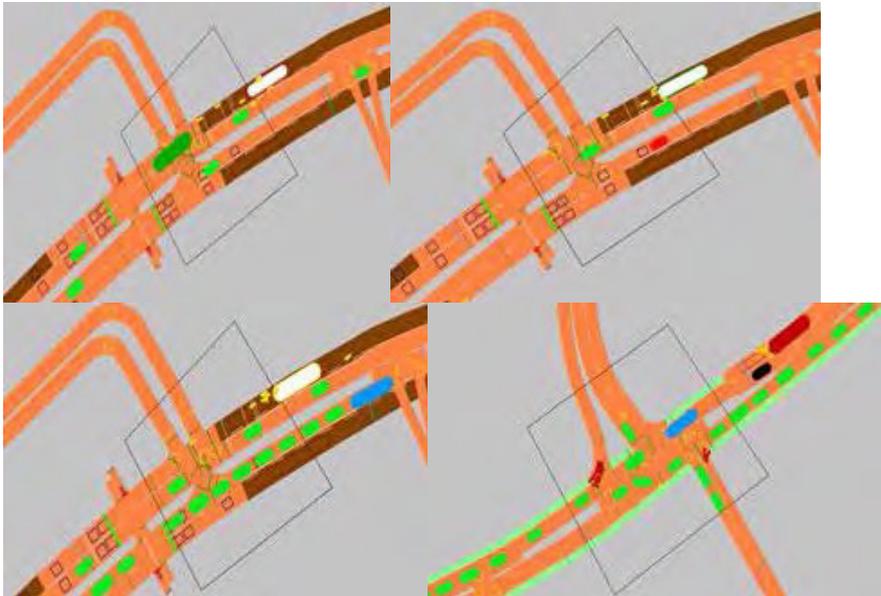
comments for scenario 6a but these will be with you by the end of next week. I thought I would send you these in the meantime. Quite a few of the comments are similar to those we had for the with CS9 scenarios and I know you have already provided a response to those. We will start going through those now while we await your response to the below comments. We will get back to you on all your responses for all scenarios once we have received them.

-
As in the with CS9 scenario:

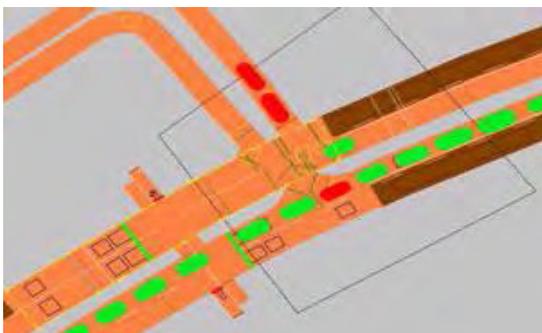
- D-gate lack of flows?
- Cyclist numbers on North End Road query?

-
Scenario 3a & 4a:

AM – cyclists stuck behind buses at bus stop on eastbound exit of both D-gate and Blythe Road junctions – some turn left around the bus, some turn right. Behaviour seems a bit erratic/unrealistic?



PM – took a very long time for vehicles leaving D-gate to get out



Scenario 5a:

D-gate:

3 stages, less efficient than stand-alone crossing with give-way junction

- Main road
- Peds
- Side Road

The following Priority Rules do not affect any vehicle types as follows

- 1304
- 1305
- 1306
- 1307

Fairly large input flows during last 1800 seconds of model run during warm-down period, seems a bit strange.

Thanks.

Kind regards,

Claire Farrow

Principal Network Manager – West (A4)

Network Performance – Delivery

My usual hours are 07:30-16:45 Monday & Tuesday, 08:30-16:15 Wednesday

 **TRANSPORT FOR LONDON**

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██████████ | E: claire.farrow@multimodaluk.com ██████████

From: ██████████ [<mailto:██████████@multimodaluk.com>]

Sent: 18 October 2018 11:04

To: Farrow Claire (ST)

Subject: RE: Olympia models - comments

Hi Claire,

Thanks for the email and the update, much appreciated.

Kind regards,

██████████

██████████ | Transport Modelling | Associate



Telephone: ██████████

Mobile: ██████████

Email: ██████████ [@multimodaluk.com](mailto:██████████@multimodaluk.com)

From: Farrow Claire (ST) <Claire.Farrow@multimodaluk.com>

Sent: 17 October 2018 16:43

To: ██████████ <██████████@multimodaluk.com>

Cc: Miklasz Michal <MichalMiklasz@multimodaluk.com>; Burman Thomas <ThomasBurman@multimodaluk.com>; Greenland

Adam <AdamGreenland@multimodaluk.com>; Bottoms Joseph <BottomsJoseph@multimodaluk.com>; ██████████

<██████████@multimodaluk.com>; ██████████ <██████████@momentum-transport.com>

Subject: RE: Olympia models - comments

Hi [REDACTED],

Apologies for the delay in replying.

Yes we will get you our comments in the next 2 weeks on the 'without' CS9 scenarios and also address the comments on 'with' CS9 scenarios below.

Progressing with any revised modelling once you have received all comments for all scenarios is fine.

Thanks.

Kind regards,

Claire Farrow

Principal Network Manager – West (A4)

Network Performance – Delivery

My usual hours are 07:30-16:45 Monday & Tuesday, 08:30-16:15 Wednesday

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Surface Transport | Network Management Directorate

Palestra House | 3rd floor – Zone 3B3 | 197 Blackfriars Road | London SE1 8NJ

[REDACTED] | E: [claire.farrow](mailto:claire.farrow@transportforlondon.gov.uk) [REDACTED]

From: [REDACTED] [[mailto:\[REDACTED\]@multimodaluk.com](mailto:[REDACTED]@multimodaluk.com)]

Sent: 11 October 2018 13:56

To: Farrow Claire (ST)

Cc: Miklasz Michal; Burman Thomas; Greenland Adam; Bottoms Joseph; [REDACTED]; [REDACTED]

Subject: RE: Olympia models - comments

Hi Claire,

Further to my email below, I just wanted to check if we are due to be receiving further model audit comments for the Olympia modelling?

I only ask as the response below acknowledges the need for revised testing, but wanted to ensure you were not awaiting this updated modelling before providing any further audit comments? Our assumption was that we would receive all audit comments for the 'With' and 'Without' CS9 testing before progressing with the revised modelling.

Hope that makes sense and thanks in advance.

Kind regards,

[REDACTED]

[REDACTED] | Transport Modelling | Associate



Telephone: [REDACTED]

Mobile: [REDACTED]

Email: [REDACTED] [multimodaluk.com](mailto:[REDACTED]@multimodaluk.com)

From: [REDACTED]
Sent: 05 October 2018 12:33
To: 'Farrow Claire (ST)' <[Claire.Farrow@\[REDACTED\]](mailto:Claire.Farrow@[REDACTED])>
Cc: Miklasz Michal <[MichalMiklasz@\[REDACTED\]](mailto:MichalMiklasz@[REDACTED])>; Burman Thomas <[ThomasBurman@\[REDACTED\]](mailto:ThomasBurman@[REDACTED])>; Greenland Adam <[AdamGreenland@\[REDACTED\]](mailto:AdamGreenland@[REDACTED])>; Bottoms Joseph <[JosephBottoms@\[REDACTED\]](mailto:JosephBottoms@[REDACTED])>; [REDACTED] <[\[REDACTED\]@multimodaluk.com](mailto:[REDACTED]@multimodaluk.com)>; [REDACTED] <[\[REDACTED\]@momentum-transport.com](mailto:[REDACTED]@momentum-transport.com)>
Subject: RE: Olympia models - comments

Hi Claire,

Thanks for your email.

I have provided some responses below on your comments.

[Westbound approach at D-gate junction](#)

A separate document has been attached showing the differences in the network layout between the scenarios in the location. It can be seen from the proposals for Scenarios 3a and 4a that a two-lane approach would not be representative of what is proposed. **Ok.**

[D-Gate Flows](#)

These values are correct and based on proposed development flows provided by Momentum. Appendix A of Multimodal's TN titled '180802 03541 MM TN2 -C- Revised Olympia Proposal Testing' provides the flow diagram. **Is it possible momentum are incorrect? It seems unlikely there would be 0 flow out of D-gate so this can be raised with Momentum.**

[D-Gate Split Phasing](#)

Split phasing of Phases A and B was a follow on from initial mitigation testing that had a separate right turn stage into D-Gate. However, revisions to the mitigation meant that this separate stage was no longer required, but the separate phases remained.

-
The comment on the PUA file is acknowledged and Phase A should start at 16s instead of 12s. However, this is unlikely to change the modelled results given the low flows into D-Gate and vehicles driving towards a priority rule to give-way to on-coming traffic.

The split phasing at Blythe Road for Phases C and D is also carried through from initial mitigation testing and has no impact on the revised mitigation results.

Ok.

[Cyclist Behaviour](#)

From a review of the link structure, the cycle links are the same width through D-Gate (when signalised). For the scenarios where D-Gate is priority controlled, the cycle link structure and behaviours have been kept consistent with TfL's 'Proposed AM/PM V2' models. **I think the behaviour was not so much the concern here but rather the width of the cycle track being inconsistent causing some issues as cyclists merge.**

Further advice is sought from TfL on this comment if changes are required above the approved 'Proposed AM/PM V2' models. We would also need to include our Client, Momentum, in these discussions as these changes are considered 'out of scope'. It was always our intention to keep the cyclist behaviour and set-up consistent with the approved TfL models.

[Cyclist Numbers](#)

Scenarios 3a and 5a have the correct cyclist flows. For Scenarios 4a and 6a, as a result of the closure of

Munden Street to 'Entry Only' traffic, the vehicles which previously entered the network from this approach were reassigned to North End Road. However, a review of the calculation of these inputs has revealed an error in the number of cyclists calculated and the models will need to be re-run for Scenarios 4a and 6a. **Ok.**

Northbound Link on Munden Road

In scenarios 4a and 6a, this approach is 'Entry Only' in line with Momentum's mitigation proposals. This was confirmed by Momentum, but unfortunately not updated on the drawing at the time of issuing the VISSIM models. Scenario 5a should have Munden Street attached to the network in the models that were submitted. **Ok – will this be updated?**

Priority Rules

This warning appears due to the way in which the different scenarios read the modifications in VISSIM's Scenario Manager. Rather than take out the priority rules, to then add them back in later on, these have simply been made to apply to no vehicle types. This was for Scenarios 5a and 6a, where the exit to D-Gate was replaced from a priority controlled exit to a signalised exit (which no longer needed the priority rules). **Ok.**

Hope this all helps and make senses. However, if anything is unclear, please get in touch.

Kind regards,

█

█ | Transport Modelling | Associate



Telephone: █

Mobile: █

Email: █ [multimodaluk.com](mailto:█@multimodaluk.com)

From: Farrow Claire (ST) <Claire.Farrow@█.multimodaluk.com>

Sent: 03 October 2018 16:04

To: █ <█@multimodaluk.com>

Cc: Miklasz Michal <MichalMiklasz@█.multimodaluk.com>; Burman Thomas <ThomasBurman@█.multimodaluk.com>; Greenland Adam <AdamGreenland@█.multimodaluk.com>; Bottoms Joseph <JosephBottoms@█.multimodaluk.com>

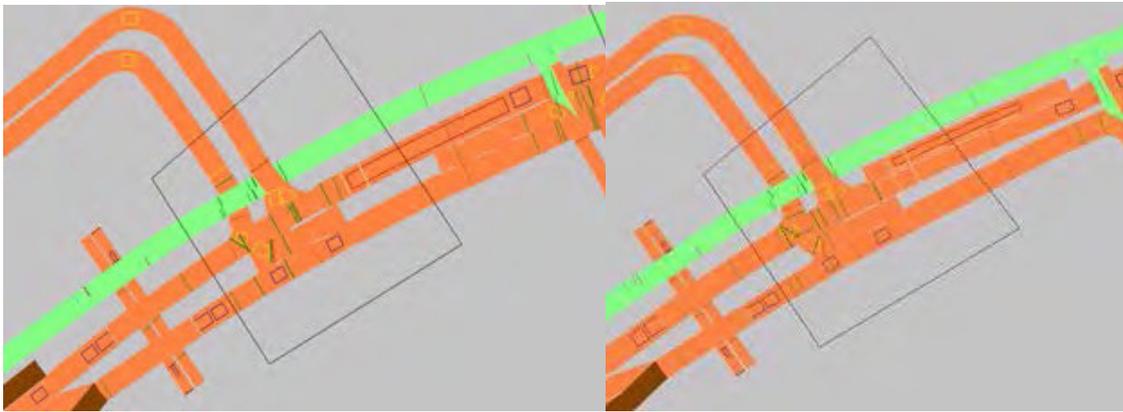
Subject: Olympia models - comments

Hi █

Please see below for comments on Olympia models – with CS9 scenarios.

- Westbound approach at D-gate junction: On signalised scenarios 5a and 6a westbound has a 2 lane approach from Earsby Road as per design. In 3a however it goes from 2 lanes to 1 lane and back to 2. In 4a it is 1 lane until close to the stopline when it becomes 2 lanes. All the designs suggest this westbound section should be 2 lanes from Earsby Road up to the stopline. According to the drawing lane 1 should be ahead and right turn but appears to be only right turn in the model.

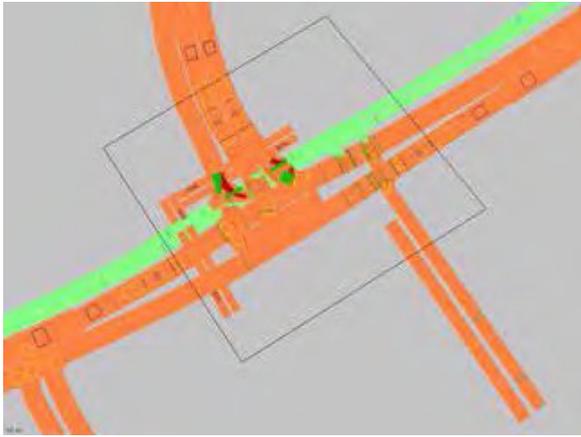
3a: 4a:



- D-gate: No flow in the AM models for D-gate input, and only 6pcu in the PM – is this correct?
- Is split phasing of movements necessary for phases A & B at the D-gate? This seems to imply that right turners would get a full green when opposed by ahead traffic (phase C) and therefore creating a conflict. They should presumably run together as one phase with right turners gap accepting until westbound traffic is stopped. An error in PUA file – westbound RT lane signalled in different phase and receives green before both ahead movements.
 - \$INTERSTAGE
 - INTERSTAGE_number : 10
 - Length [s] : 16
 - From stage : 4
 - To stage : 1
 - \$
 - F -127 0
 - G -127 0
 - A 12 127
 - B 16 127
 - C 16 127

A similar situation also exists with phases C & D on Blythe Rd (without the obvious opposing phase).

- Behaviour of cyclists at D-gate junction very slow on exit of junction. It could be that the width of the cycle track is inconsistent, this can cause stuttering behaviour as the cyclists “merge” – this should be dealt with by changing the cycle track width gradually with multiple links, rather than over a connector between a wide link and a narrow link
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- Northbound link on Munden Road (opposite Blythe Road): In scenarios 4a, 5a, and 6a this link is not attached to the network (no connector), according to the drawing this should have a stopline set back followed by a give way to get onto Hammersmith Road. Only in 3a has this link been connected to network but presumably it should be in all scenarios.



- Priority rules – these rules were highlighted by VISSIM because they do not affect any vehicle types:
 - Rule 152
 - Rule 153
 - Rule 155
 - Rule 156

If you have any questions please let me know.

Kind regards,

Claire Farrow

Principal Network Manager – West (A4)

Network Performance – Delivery

My usual hours are 07:30-16:45 Monday & Tuesday, 08:30-16:15 Wednesday

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Surface Transport | Network Management Directorate

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Tel: [REDACTED] | E: claire.farrow@tfl.gov.uk [REDACTED]

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From: [REDACTED]
To: [REDACTED]
Subject: FW: Olympia models - comments
Date: 04 October 2018 12:35:00
Attachments: [image001.png](#)
[image005.png](#)
[181004 Response to Tfl Comments.docx](#)

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Thanks for your email.

I have provided some responses on the comments below.

[Westbound approach at D-gate junction](#)

A separate document has been attached showing the differences in the network layout between the scenarios in the location. It can be seen from the proposals for Scenarios 3a and 4a that a two-lane approach would not be representative of what is proposed.

It should also be noted that for Scenarios 5a and 6a, the off-side lane travelling Westbound should be 'Right Turn' only, rather than 'Ahead and Right' as shown in the drawing. This 'Right Turn' only lane is what has been modelled in initial LINSIG models to inform the signal plans.

[D-Gate Flows](#)

These values are correct and based on proposed development flows provided by Momentum. Appendix A of Multimodal's TN titled '*180802 03541 MM TN2 -C- Revised Olympia Proposal Testing*' provides the flow diagram.

[D-Gate Split Phasing](#)

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Hope this all helps and make senses. However, if anything is unclear, please get in touch.

Kind regards,

█

█ | Transport Modelling | Associate



Telephone: █
Mobile: █
Email: █ multimodaluk.com

From: Farrow Claire (ST) <Claire.Farrow █>

Sent: 03 October 2018 16:04

To: █ <█@multimodaluk.com>

Cc: Miklasz Michal <MichalMiklasz █>; Burman Thomas <ThomasBurman █>; Greenland Adam <AdamGreenland █>; Bottoms Joseph <JosephBottoms █>

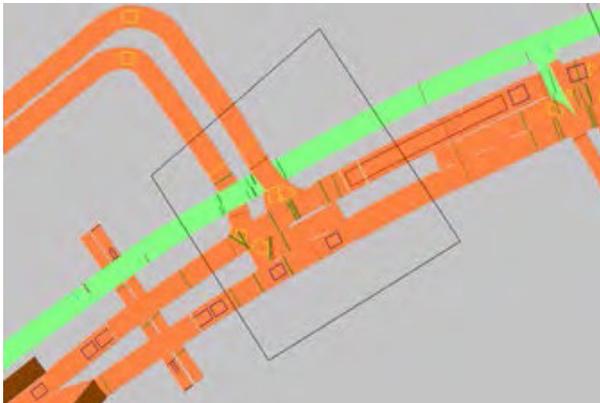
Subject: Olympia models - comments

Hi █

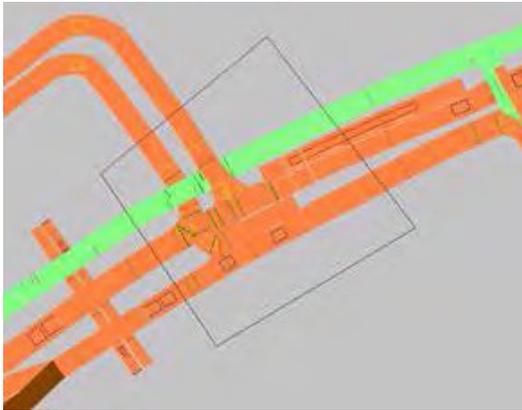
Please see below for comments on Olympia models – with CS9 scenarios.

- Westbound approach at D-gate junction: On signalised scenarios 5a and 6a westbound has a 2 lane approach from Earsby Road as per design. In 3a however it goes from 2 lanes to 1 lane and back to 2. In 4a it is 1 lane until close to the stopline when it becomes 2 lanes. All the designs suggest this westbound section should be 2 lanes from Earsby Road up to the stopline. According to the drawing lane 1 should be ahead and right turn but appears to be only right turn in the model.

3a:



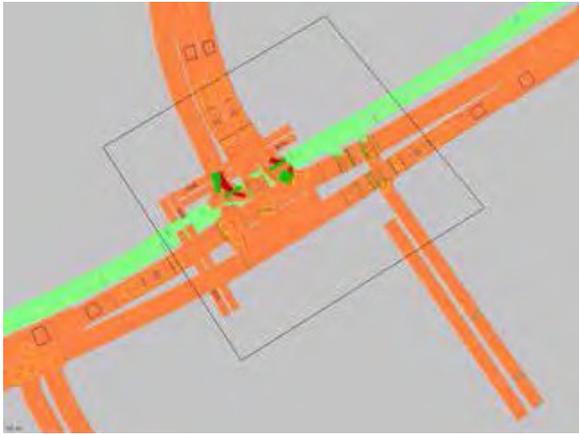
4a:



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 - C 16 127

A similar situation also exists with phases C & D on Blythe Rd (without the obvious opposing phase).

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- Priority rules – these rules were highlighted by VISSIM because they do not affect any vehicle types:
 - Rule 152
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 - Rule 155
 - Rule 156

If you have any questions please let me know.

Kind regards,

Claire Farrow

Principal Network Manager – West (A4)

Network Performance – Delivery

My usual hours are 07:30-16:45 Monday & Tuesday, 08:30-16:15 Wednesday

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██████████ | E: claire.farrow ██████████

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1) Westbound approach at D-Gate

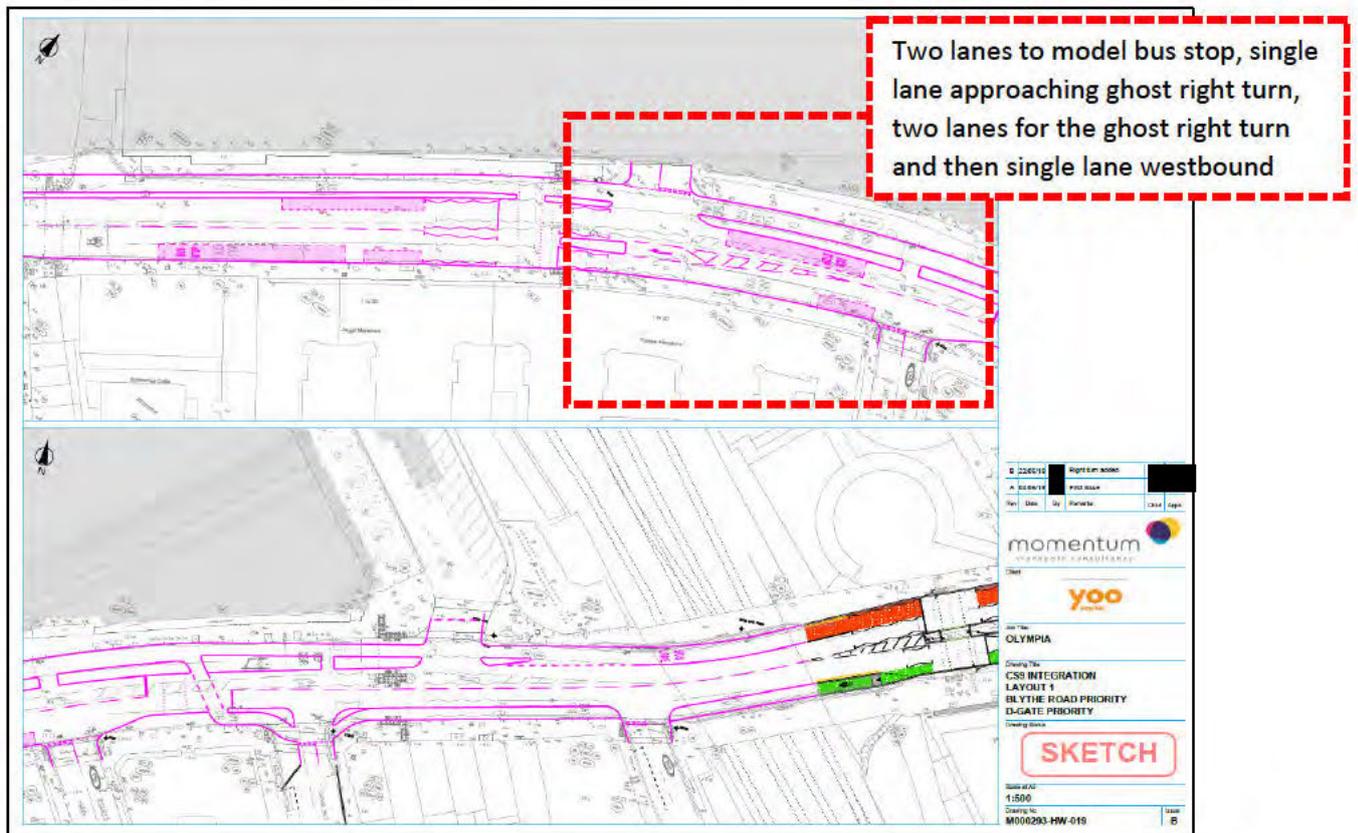
Sketches received from Momentum below show layouts of Westbound approach to D-Gate for the four different scenarios (highlighted in red boxes).

Scenarios 3a and 4a have a different road layout to Scenarios 5a and 6a, which is why the link structure is different.

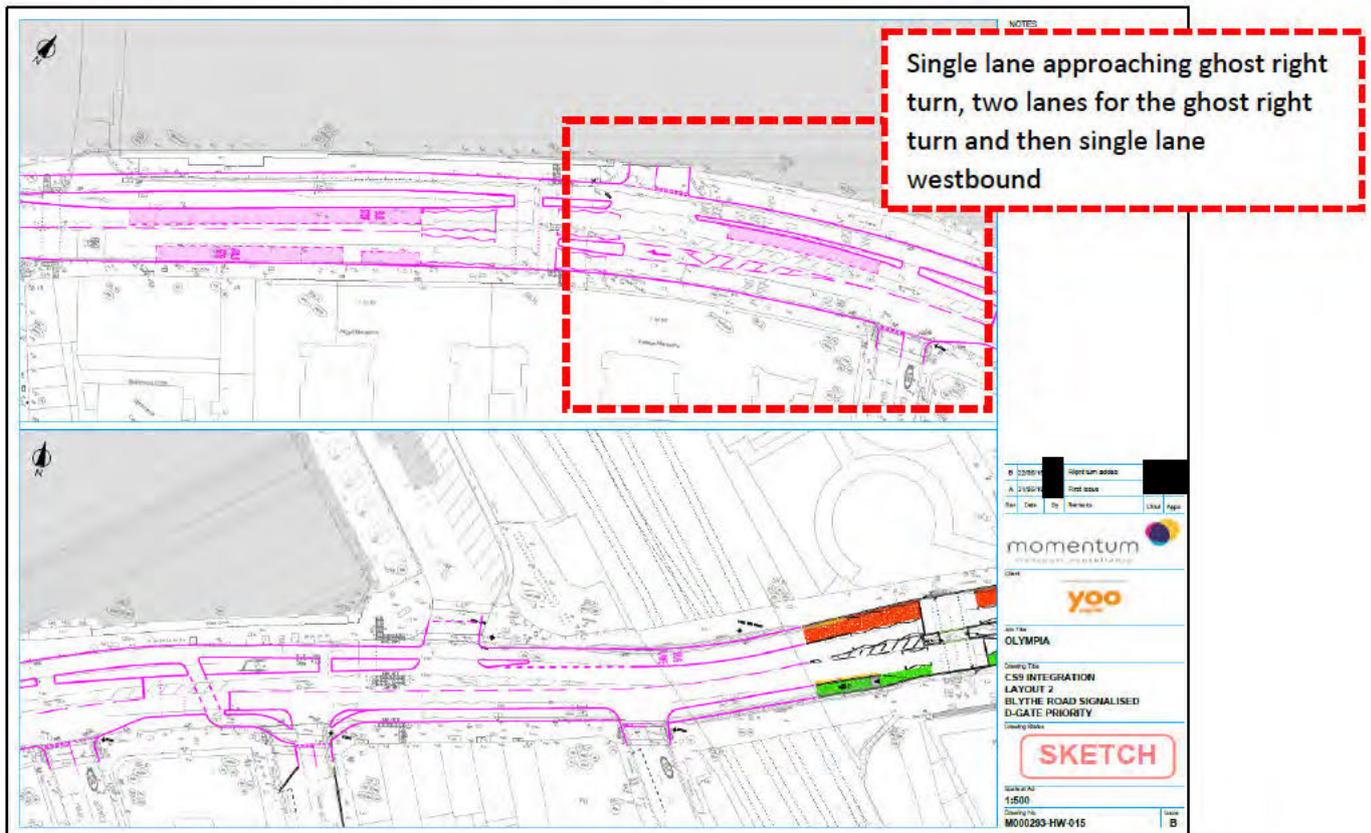
In Scenario 3a, the bus stop remains so the two-lane section includes for this before reducing to a single lane, two lanes for the ghost right turn and then a single lane that follows.

In Scenario 4a, the bus stop is relocated so a single lane is modelled up to the ghost right turn lane, before two lanes model the ghost right turn and a single lane then follows.

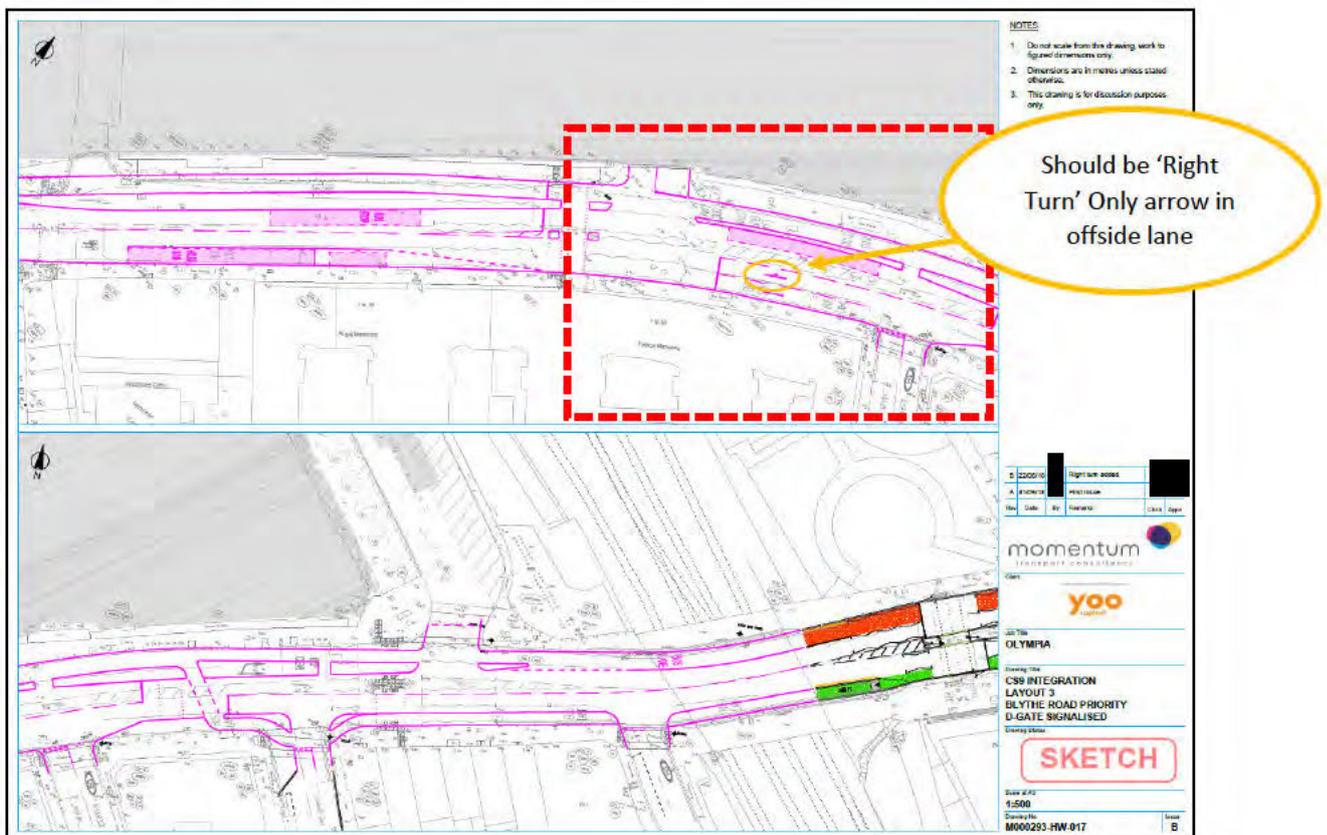
SC3a – Blythe Rd Priority, D-Gate Priority (with CS9)



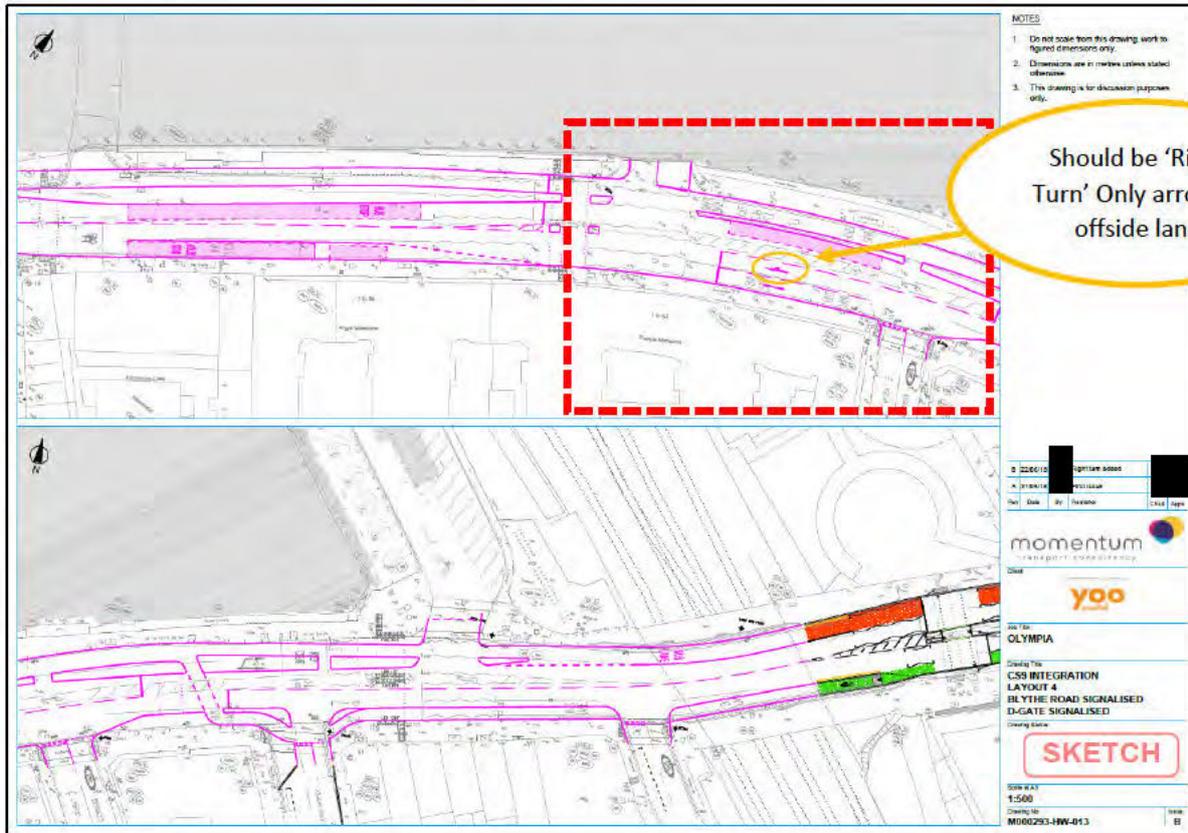
SC4a – Blythe Rd Signalised, D-Gate Priority (with CS9)



SC5a - Blythe Rd Priority, D-Gate Signalised (with CS9)



SC6a - Blythe Rd and D-Gate Signalised (with CS9)



Should be 'Right Turn' Only arrow in offside lane

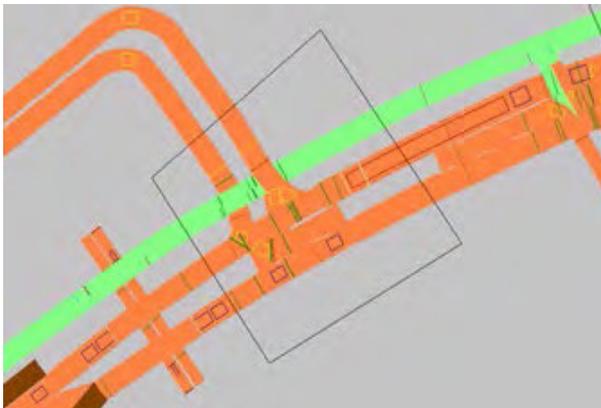
From: [Farrow Claire \(ST\)](#)
To: [REDACTED]
Cc: [Miklasz Michal](#); [Burman Thomas](#); [Greenland Adam](#); [Bottoms Joseph](#)
Subject: Olympia models - comments
Date: 03 October 2018 16:04:03
Attachments: [image001.png](#)

Hi [REDACTED]

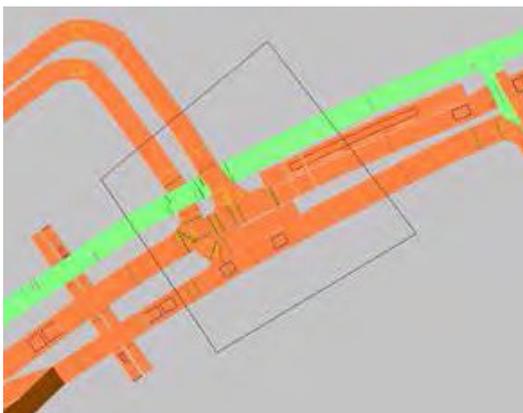
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3a:



4a:

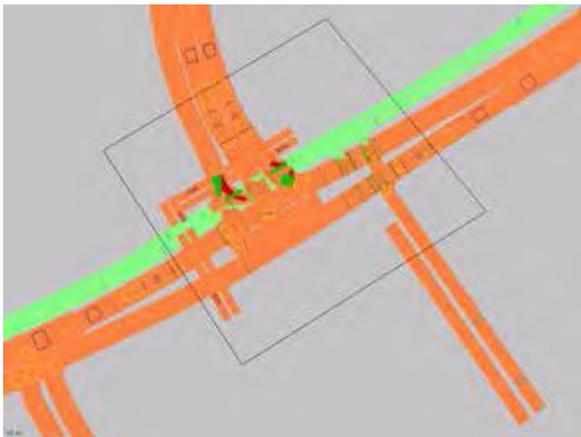


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 - \$INTERSTAGE
 - INTERSTAGE_number : 10
 - Length [s] : 16
 - From stage : 4
 - To stage : 1
 - \$
 - F -127 0

▪ G	-127	0
▪ A	12	127
▪ B	16	127
▪ C	16	127

A similar situation also exists with phases C & D on Blythe Rd (without the obvious opposing phase).

- Behaviour of cyclists at D-gate junction very slow on exit of junction. It could be that the width of the cycle track is inconsistent, this can cause stuttering behaviour as the cyclists “merge” – this should be dealt with by changing the cycle track width gradually with multiple links, rather than over a connector between a wide link and a narrow link
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If you have any questions please let me know.

Kind regards,

Claire Farrow

Principal Network Manager – West (A4)

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My usual hours are 07:30-16:45 Monday & Tuesday, 08:30-16:15 Wednesday

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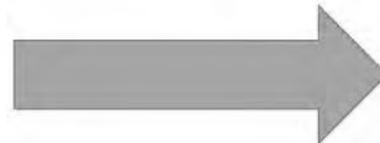
Appendix B – Munden Street to North End Road Input Calculations

WITH CS9 - VEH INPUTS - AM

Proposed AMV2 Flows

No.	Name	Link	Volume										Veh Composition
			0	900	1800	2700	3600	4500	5400	6300	6900	7500	
1	Kensington High St East - Cars	103	482	510	680	431	376	396	453	506	11	Cars - 30mph	
2	Kensington High St East - HGVs	103	51	26	53	25	15	59	76	268	21	HGV - 30mph	
3	Kensington High St East - Cyclists	103	16	27	64	43	59	112	107	155	50	Cyclists	
4	Kensington High St East - LGVs	103	0	0	0	0	0	0	0	0	60	LGV	
5	Kensington High St East - Coaches	103	0	0	0	0	0	0	0	0	70	Coach	
6	Kensington High St East - Taxis	103	3	18	27	12	11	32	12	32	80	Taxi	
7	Kensington High St East - Motorbikes	103	0	0	0	0	0	0	0	0	31	Motorbikes - 30mph	
8	Warwick Road - Cars	104	793	695	766	681	715	939	661	843	11	Cars - 30mph	
9	Warwick Road - HGVs	104	16	182	26	36	51	188	29	15	21	HGV - 30mph	
10	Warwick Road - Cyclists	104	64	107	107	70	54	70	123	102	50	Cyclists	
11	Warwick Road - LGVs	104	0	0	0	0	0	0	0	0	60	LGV	
12	Warwick Road - Coaches	104	0	0	0	0	0	0	0	0	70	Coach	
13	Warwick Road - Taxis	104	9	21	0	0	4	5	0	6	80	Taxi	
14	Warwick Road - Motorbikes	104	0	0	0	0	0	0	0	0	31	Motorbikes - 30mph	
15	Avonmore Road - Motorbikes	61	0	0	0	0	0	0	0	0	31	Motorbikes - 30mph	
16	Avonmore Road - Taxis	61	0	0	16	8	0	0	16	8	80	Taxi	
17	Avonmore Road - Coaches	61	0	0	0	0	0	0	0	0	70	Coach	
18	Avonmore Road - LGVs	61	0	0	0	0	0	0	0	0	60	LGV	
19	Avonmore Road - Cyclists	61	21	27	5	27	54	32	32	16	50	Cyclists	
20	Avonmore Road - HGVs	61	48	0	48	0	0	0	48	0	21	HGV - 30mph	
21	Avonmore Road - Cars	61	39	45	121	148	103	88	69	97	11	Cars - 30mph	
22	North End Road - Cars	51	229	241	217	217	265	223	235	211	11	Cars - 30mph	
23	North End Road - HGVs	51	1	3	1	0	1	3	2	0	21	HGV - 30mph	
24	North End Road - Cyclists	51	16	37	16	32	32	21	37	16	50	Cyclists	
25	North End Road - LGVs	51	0	0	0	0	0	0	0	0	60	LGV	
26	North End Road - Coaches	51	0	0	0	0	0	0	0	0	70	Coach	
27	North End Road - Taxis	51	0	54	54	163	0	0	109	0	80	Taxi	
28	North End Road - Motorbikes	51	0	0	0	0	0	0	0	0	31	Motorbikes - 30mph	
29	Munden Street - Motorbikes	70	0	0	0	0	0	0	0	0	31	Motorbikes - 30mph	
30	Munden Street - Taxis	70	5	5	5	5	5	5	5	5	80	Taxi	
31	Munden Street - Coaches	70	0	0	0	0	0	0	0	0	70	Coach	
32	Munden Street - LGVs	70	0	0	0	0	0	0	0	0	60	LGV	
33	Munden Street - Cyclists	70	0	5	5	5	0	11	0	0	50	Cyclists	
34	Munden Street - HGVs	70	2	2	2	2	2	2	2	2	21	HGV - 30mph	
35	Munden Street - Cars	70	18	55	100	73	109	46	118	36	11	Cars - 30mph	
36	Blythe Road - Cars	22	100	131	169	230	177	188	146	192	11	Cars - 30mph	
37	Blythe Road - HGVs	22	0	3	5	8	3	0	5	3	21	HGV - 30mph	
38	Blythe Road - Cyclists	22	0	5	5	5	32	16	21	27	50	Cyclists	
39	Blythe Road - LGVs	22	0	0	0	0	0	0	0	0	60	LGV	
40	Blythe Road - Coaches	22	0	0	0	0	0	0	0	0	70	Coach	
41	Blythe Road - Taxis	22	8	0	3	0	0	11	6	17	80	Taxi	
42	Blythe Road - Motorbikes	22	0	0	0	0	0	0	0	0	31	Motorbikes - 30mph	
43	Edith Road - Motorbikes	44	0	0	0	0	0	0	0	0	31	Motorbikes - 30mph	
44	Edith Road - Taxis	44	1	1	1	1	1	1	1	1	80	Taxi	
45	Edith Road - Coaches	44	0	0	0	0	0	0	0	0	70	Coach	
46	Edith Road - LGVs	44	0	0	0	0	0	0	0	0	60	LGV	
47	Edith Road - Cyclists	44	16	11	32	59	48	43	59	64	50	Cyclists	
48	Edith Road - HGVs	44	0	0	21	0	0	0	42	21	21	HGV - 30mph	
49	Edith Road - Cars	44	40	18	37	34	35	44	28	25	11	Cars - 30mph	
50	Brook Green - Cars	7	134	144	183	229	158	146	119	146	11	Cars - 30mph	
51	Brook Green - HGVs	7	4	9	4	4	9	4	0	4	21	HGV - 30mph	
52	Brook Green - Cyclists	7	27	21	21	37	48	27	16	64	50	Cyclists	
53	Brook Green - LGVs	7	0	0	0	0	0	0	0	0	60	LGV	
54	Brook Green - Coaches	7	0	0	0	0	0	0	0	0	70	Coach	
55	Brook Green - Taxis	7	0	0	22	7	7	0	15	7	80	Taxi	
56	Brook Green - Motorbikes	7	0	0	0	0	0	0	0	0	31	Motorbikes - 30mph	
57	Shortlands - Motorbikes	94	0	0	0	0	0	0	0	0	31	Motorbikes - 30mph	
58	Shortlands - Taxis	94	0	6	0	0	32	0	6	80	Taxi		
59	Shortlands - Coaches	94	0	0	0	0	0	0	0	0	70	Coach	
60	Shortlands - LGVs	94	0	0	0	0	0	0	0	0	60	LGV	
61	Shortlands - Cyclists	94	11	5	0	11	5	5	5	16	50	Cyclists	
62	Shortlands - HGVs	94	0	21	21	21	0	21	41	21	21	HGV - 30mph	
63	Shortlands - Cars	94	7	7	8	10	6	6	6	5	11	Cars - 30mph	
64	Hammersmith Road West - Cars	1	230	315	330	386	437	360	308	319	11	Cars - 30mph	
65	Hammersmith Road West - HGVs	1	11	34	22	22	11	67	22	21	21	HGV - 30mph	
66	Hammersmith Road West - Cyclists	167	327	369	375	401	418	487	353	236	50	Cyclists	
67	Hammersmith Road West - LGVs	1	0	0	0	0	0	0	0	0	60	LGV	
68	Hammersmith Road West - Coaches	1	0	0	0	0	0	0	0	0	70	Coach	
69	Hammersmith Road West - Taxis	1	21	38	34	26	56	43	38	30	80	Taxi	
70	Hammersmith Road West - Motorbikes	1	0	0	0	0	0	0	0	0	31	Motorbikes - 30mph	
1000	East of Shortlands - NB	38	16	4	12	68	104	76	72	120	40	Pedestrians	
1001	East of Shortlands - SB	40	20	16	16	24	24	44	32	40	40	Pedestrians	
1002	East of Collet Gardens - NB	41	0	0	28	20	32	28	32	20	40	Pedestrians	
1003	East of Collet Gardens - SB	55	8	12	24	28	44	92	84	32	40	Pedestrians	
1004	West of Earsby Street - SB	116	16	24	45	45	45	45	45	45	40	Pedestrians	
1005	West of Earsby Street - NB	115	20	16	45	45	45	45	45	45	40	Pedestrians	
1006	West of Russell Road - SB	118	68	52	112	80	120	136	156	76	40	Pedestrians	
1007	West of Russell Road - NB	117	32	24	44	36	28	52	84	72	40	Pedestrians	
1102	Brook Green - Crossing 1	100	9	9	35	35	35	35	9	9	40	Pedestrians	
1106	Edith Road - Crossing 1	112	8	33	100	100	100	100	8	8	40	Pedestrians	
1108	Warwick Road - Crossing 1	131	6	6	26	26	26	26	6	6	40	Pedestrians	
1109	Warwick Road - Crossing 2	135	8	8	33	33	33	33	8	8	40	Pedestrians	
1110	North End Road - Crossing 1	120	9	9	37	37	37	37	9	9	40	Pedestrians	
1111	Olympia Way	126	42	42	84	84	84	84	42	42	40	Pedestrians	
1115	S Arm of Shortlands - WB	193	16	4	12	68	104	76	72	120	40	Pedestrians	
1116	S Arm of Shortlands - EB	192	20	16	16	24	24	44	32	40	40	Pedestrians	
1121	Colet Gardens - Taxi	88	0.157277	0.157277	0.157277	0.157277	0.157277	0.157277	0.157277	0.157277	80	Taxi	
1125	Warwick Road - Crossing 3	128	6	6	26	26	26	26	6	6	40	Pedestrians	

Reassigning traffic entering network from Munden St to North End Rd as a result of proposed mitigation



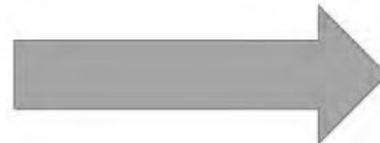
No.	Name	Link	Volume										Veh Composition
			0	900	1800	2700	3600	4500	5400	6300	6900	7500	
1	Kensington High St East - Cars	103	482	510	680	431	376	396	453	506	11	Cars - 30mph	
2	Kensington High St East - HGVs	103	51	26	53	25	15	59	76	268	21	HGV - 30mph	
3	Kensington High St East - Cyclists	103	16	27	64	43	59	112	107	155	50	Cyclists	
4	Kensington High St East - LGVs	103	0	0	0	0	0	0	0	0	60	LGV	
5	Kensington High St East - Coaches	103	0	0	0	0	0	0	0	0	70	Coach	
6	Kensington High St East - Taxis	103	3	18	27	12	11	32	12	32	80	Taxi	
7	Kensington High St East - Motorbikes	103	0	0	0	0	0	0	0	0	31	Motorbikes - 30mph	
8	Warwick Road - Cars	104	793	695	766	681	715	939	661	843	11	Cars - 30mph	
9	Warwick Road - HGVs	104	16	182	26	36	51	188	29	15	21	HGV - 30mph	
10	Warwick Road - Cyclists	104	64	107	107	70	54	70	123	102	50	Cyclists	
11	Warwick Road - LGVs	104	0	0	0	0	0	0	0	0	60	LGV	
12	Warwick Road - Coaches	104	0	0	0	0	0	0	0	0	70	Coach	
13	Warwick Road - Taxis	104	9	21	0	0	4	5	0	6	80	Taxi	
14	Warwick Road - Motorbikes	104	0	0	0	0	0	0	0	0	31	Motorbikes - 30mph	
15	Avonmore Road - Motorbikes	61	0	0	0	0	0	0	0	0	31	Motorbikes - 30mph	
16	Avonmore Road - Taxis	61	0	0	16	8	0	0	16	8	80	Taxi	
17	Avonmore Road - Coaches	61	0	0	0	0	0	0	0	0	70	Coach	
18	Avonmore Road - LGVs	61	0	0	0	0	0	0	0	0	60	LGV	
19	Avonmore Road - Cyclists	61	21	27	5	27	54	32	32	16	50	Cyclists	
20	Avonmore Road - HGVs	61	48	0	48	0	0	0	48	0	21	HGV - 30mph	
21	Avonmore Road - Cars	61	39	45	121	148	103	88	69	97	11	Cars - 30mph	
22	North End Road - Cars	51	247	296	317	290	375	269	354	247	11	Cars - 30mph	
23	North End Road - HGVs	51	3	5	3	2	3	5	4	2	21	HGV - 30mph	
24	North End Road - Cyclists	51	16	43	21	37	32	32	37	16	50	Cyclists	
25	North End Road - LGVs	51	0	0	0	0	0	0	0	0	60	LGV	
26	North End Road - Coaches	51	0	0	0	0	0	0	0	0	70	Coach	
27	North End Road - Taxis	51	5	59	59	168	5	5	114	5	80	Taxi	
28	North End Road - Motorbikes	51	0	0	0	0	0	0	0	0	31	Motorbikes - 30mph	
29	Munden Street - Motorbikes	70	0	0	0	0	0	0	0	0	31	Motorbikes - 30mph	
30	Munden Street - Taxis	70	0	0	0	0	0	0	0	0	80	Taxi	
31	Munden Street - Coaches	70											

WITH CS9 - VEH INPUTS - PM

Proposed PM V2 Flows

No.	Name	Link	Volume										Veh Composition
			0	900	1800	2700	3600	4500	5400	6300	7200	8100	
1	Kensington High St East - Cars	103	478	550	503	576	625	580	445	445	11	Cars - 30mph	
2	Kensington High St East - HGVs	103	4	4	0	17	17	61	52	113	21	HGV - 30mph	
3	Kensington High St East - Cyclists	103	214	187	273	412	482	498	359	359	50	Cyclists	
4	Kensington High St East - LGVs	103	0	0	0	0	0	0	0	0	0	60 LGV	
5	Kensington High St East - Coaches	103	0	0	0	0	0	0	0	0	0	70 Coach	
6	Kensington High St East - Taxis	103	32	18	38	36	46	41	29	29	80	Taxi	
7	Kensington High St East - Motorbikes	103	0	0	0	0	0	0	0	0	0	31 Motorbikes - 30mph	
8	Warwick Road - Cars	104	578	731	914	995	675	1226	788	788	11	Cars - 30mph	
9	Warwick Road - HGVs	104	28	15	21	20	11	8	4	4	21	HGV - 30mph	
10	Warwick Road - Cyclists	104	43	70	43	70	43	54	75	75	50	Cyclists	
11	Warwick Road - LGVs	104	0	0	0	0	0	0	0	0	0	60 LGV	
12	Warwick Road - Coaches	104	0	0	0	0	0	0	0	0	0	70 Coach	
13	Warwick Road - Taxis	104	21	10	3	11	6	7	2	2	80	Taxi	
14	Warwick Road - Motorbikes	104	0	0	0	0	0	0	0	0	0	31 Motorbikes - 30mph	
15	Avonmore Road - Motorbikes	61	0	0	0	0	0	0	0	0	0	31 Motorbikes - 30mph	
16	Avonmore Road - Taxis	61	8	0	8	16	16	0	8	8	80	Taxi	
17	Avonmore Road - Coaches	61	0	0	0	0	0	0	0	0	0	70 Coach	
18	Avonmore Road - LGVs	61	0	0	0	0	0	0	0	0	0	60 LGV	
19	Avonmore Road - Cyclists	61	21	11	16	27	16	16	27	27	50	Cyclists	
20	Avonmore Road - HGVs	61	12	0	12	0	0	0	12	0	21	HGV - 30mph	
21	Avonmore Road - Cars	61	105	174	139	160	181	167	98	98	11	Cars - 30mph	
22	North End Road - Cars	51	248	258	268	273	298	197	222	222	11	Cars - 30mph	
23	North End Road - HGVs	51	38	96	19	19	38	19	77	0	21	HGV - 30mph	
24	North End Road - Cyclists	51	16	21	27	21	16	21	27	27	50	Cyclists	
25	North End Road - LGVs	51	0	0	0	0	0	0	0	0	0	60 LGV	
26	North End Road - Coaches	51	0	0	0	0	0	0	0	0	0	70 Coach	
27	North End Road - Taxis	51	18	6	9	9	9	12	6	6	80	Taxi	
28	North End Road - Motorbikes	51	0	0	0	0	0	0	0	0	0	31 Motorbikes - 30mph	
29	Munden Street - Motorbikes	70	0	0	0	0	0	0	0	0	0	31 Motorbikes - 30mph	
30	Munden Street - Taxis	70	3	3	3	3	3	3	3	3	80	Taxi	
31	Munden Street - Coaches	70	0	0	0	0	0	0	0	0	0	70 Coach	
32	Munden Street - LGVs	70	0	0	0	0	0	0	0	0	0	60 LGV	
33	Munden Street - Cyclists	70	0	5	5	5	5	11	0	0	50	Cyclists	
34	Munden Street - HGVs	70	0	0	0	0	0	0	0	0	21	HGV - 30mph	
35	Munden Street - Cars	70	64	38	77	45	108	38	51	51	11	Cars - 30mph	
36	Blythe Road - Cars	22	189	145	195	172	185	192	205	205	11	Cars - 30mph	
37	Blythe Road - HGVs	22	0	5	10	5	5	0	10	5	21	HGV - 30mph	
38	Blythe Road - Cyclists	22	5	11	21	11	21	21	21	21	50	Cyclists	
39	Blythe Road - LGVs	22	0	0	0	0	0	0	0	0	0	60 LGV	
40	Blythe Road - Coaches	22	0	0	0	0	0	0	0	0	0	70 Coach	
41	Blythe Road - Taxis	22	43	55	36	49	43	36	55	55	80	Taxi	
42	Blythe Road - Motorbikes	22	0	0	0	0	0	0	0	0	0	31 Motorbikes - 30mph	
43	Edith Road - Motorbikes	44	0	0	0	0	0	0	0	0	0	31 Motorbikes - 30mph	
44	Edith Road - Taxis	44	0	0	2	0	2	0	2	2	80	Taxi	
45	Edith Road - Coaches	44	0	0	0	0	0	0	0	0	0	70 Coach	
46	Edith Road - LGVs	44	0	0	0	0	0	0	0	0	0	60 LGV	
47	Edith Road - Cyclists	44	37	21	27	11	37	21	32	32	50	Cyclists	
48	Edith Road - HGVs	44	0	0	12	0	0	0	24	12	21	HGV - 30mph	
49	Edith Road - Cars	44	65	76	81	33	43	71	95	95	11	Cars - 30mph	
50	Brook Green - Cars	7	225	184	271	285	285	280	239	239	11	Cars - 30mph	
51	Brook Green - HGVs	7	6	11	6	6	11	6	6	6	21	HGV - 30mph	
52	Brook Green - Cyclists	7	32	27	37	27	32	5	27	27	50	Cyclists	
53	Brook Green - LGVs	7	0	0	0	0	0	0	0	0	0	60 LGV	
54	Brook Green - Coaches	7	0	0	0	0	0	0	0	0	0	70 Coach	
55	Brook Green - Taxis	7	58	39	39	19	39	39	78	78	80	Taxi	
56	Brook Green - Motorbikes	7	0	0	0	0	0	0	0	0	0	31 Motorbikes - 30mph	
57	Shortlands - Motorbikes	94	0	0	0	0	0	0	0	0	0	31 Motorbikes - 30mph	
58	Shortlands - Taxis	94	1	1	0	1	6	3	3	3	80	Taxi	
59	Shortlands - Coaches	94	0	0	0	0	0	0	0	0	0	70 Coach	
60	Shortlands - LGVs	94	0	0	0	0	0	0	0	0	0	60 LGV	
61	Shortlands - Cyclists	94	16	37	16	5	5	5	21	21	50	Cyclists	
62	Shortlands - HGVs	94	0	0	0	0	0	0	0	0	0	21 HGV - 30mph	
63	Shortlands - Cars	94	9	15	13	10	11	10	12	12	11	Cars - 30mph	
64	Hammersmith Road West - Cars	1	185	198	257	219	236	209	185	185	11	Cars - 30mph	
65	Hammersmith Road West - HGVs	1	6	19	13	13	6	38	13	13	21	HGV - 30mph	
66	Hammersmith Road West - Cyclists	167	70	75	128	118	80	43	48	48	50	Cyclists	
67	Hammersmith Road West - LGVs	1	0	0	0	0	0	0	0	0	0	60 LGV	
68	Hammersmith Road West - Coaches	1	0	0	0	0	0	0	0	0	0	70 Coach	
69	Hammersmith Road West - Taxis	1	10	14	58	29	48	34	24	24	80	Taxi	
70	Hammersmith Road West - Motorbikes	1	0	0	0	0	0	0	0	0	0	31 Motorbikes - 30mph	
1000	East of Shortlands - NB	38	28	32	60	108	116	28	52	52	40	Pedestrians	
1001	East of Shortlands - SB	40	40	92	52	112	52	36	16	16	40	Pedestrians	
1002	East of Collet Gardens - NB	41	48	60	48	44	72	48	24	24	40	Pedestrians	
1003	East of Collet Gardens - SB	55	64	36	24	28	24	44	12	12	40	Pedestrians	
1004	West of Earsby Street - SB	116	132	76	132	108	76	64	104	104	40	Pedestrians	
1005	West of Earsby Street - NB	115	56	64	36	128	28	104	44	44	40	Pedestrians	
1006	West of Russell Road - SB	118	32	48	88	72	24	48	32	32	40	Pedestrians	
1007	West of Russell Road - NB	117	128	96	120	180	112	140	52	52	40	Pedestrians	
1102	Brook Green - Crossing 1	100	10	10	38	38	38	38	10	10	40	Pedestrians	
1106	Edith Road - Crossing 1	112	8	8	32	32	32	32	8	8	40	Pedestrians	
1108	Warwick Road - Crossing 1	131	9	9	37	37	37	37	9	9	40	Pedestrians	
1109	Warwick Road - Crossing 2	135	10	10	41	41	41	41	10	10	40	Pedestrians	
1110	North End Road - Crossing 1	120	9	9	37	37	37	37	9	9	40	Pedestrians	
1111	Olympia Way	126	42	42	84	84	84	84	42	42	40	Pedestrians	
1115	S Arm of Shortlands - WB	193	28	32	60	108	116	28	52	52	40	Pedestrians	
1116	S Arm of Shortlands - EB	192	40	92	52	112	52	36	16	16	40	Pedestrians	
1122	Colet Gardens - Taxi	88	15,721	15,721	15,721	15,721	15,721	15,721	15,721	15,721	80	Taxi	
1125	Warwick Road - Crossing 3	128	6	6	26	26	26	26	6	6	40	Pedestrians	

Reassigning traffic entering network from Munden St to North End Rd as a result of proposed mitigation



No.	Name	Link	Volume										Veh Composition
			0	900	1800	2700	3600	4500	5400	6300	7200	8100	
1	Kensington High St East - Cars	103	478	550	503	576	625	580	445	445	11	Cars - 30mph	
2	Kensington High St East - HGVs	103	4	4	0	17	17	61	52	113	21	HGV - 30mph	
3	Kensington High St East - Cyclists	103	214	187	273	412	482	498	359	359	50	Cyclists	
4	Kensington High St East - LGVs	103	0	0	0	0	0	0	0	0	0	60 LGV	
5	Kensington High St East - Coaches	103	0	0	0	0	0	0	0	0	0	70 Coach	
6	Kensington High St East - Taxis	103	32	18	38	36	46	41	29	29	80	Taxi	
7	Kensington High St East - Motorbikes	103	0	0	0	0	0	0	0	0	0	31 Motorbikes - 30mph	
8	Warwick Road - Cars	104	578	731	914	995	675	1226	788	788	11	Cars - 30mph	
9	Warwick Road - HGVs	104	28	15	21	20	11	8	4	4	21	HGV - 30mph	
10	Warwick Road - Cyclists	104	43	70	43	70	43	54	75	75	50	Cyclists	
11	Warwick Road - LGVs	104	0	0	0	0	0	0	0	0	0	60 LGV	
12	Warwick Road - Coaches	104	0	0	0	0	0	0	0	0	0	70 Coach	
13	Warwick Road - Taxis	104	21	10	3	11	6	7	2	2	80	Taxi	
14	Warwick Road - Motorbikes	104	0	0	0	0	0	0	0	0	0	31 Motorbikes - 30mph	
15	Avonmore Road - Motorbikes	61	0	0	0	0	0	0	0	0	0	31 Motorbikes - 30mph	
16	Avonmore Road - Taxis	61	8	0	8	16	16	0	8	8	80	Taxi	
17	Avonmore Road - Coaches	61	0	0	0	0	0	0	0	0	0	70 Coach	
18	Avonmore Road - LGVs	61	0	0	0	0	0	0	0	0	0	60 LGV	
19	Avonmore Road - Cyclists	61	21	11	16	27	16	16	27	27	50	Cyclists	
20	Avonmore Road - HGVs	61	12	0	12	0	0	0	12	0	21	HGV - 30mph	
21	Avonmore Road - Cars	61	105	174	139	160	181	167	98	98	11	Cars - 30mph	
22	North End Road - Cars	51	311	296	344	318	407	235	273	273	11	Cars - 30mph	
23	North End Road - HGVs	51	38	96	19	19	38	19	77	0	21	HGV - 30mph	
24	North End Road - Cyclists	51	16	27	32	27	21	32	27	27	50	Cyclists	
25	North End Road - LGVs	51	0	0	0	0	0	0	0	0	0	60 LGV	
26	North End Road - Coaches	51	0	0	0	0	0	0	0	0	0	70 Coach	
27	North End Road - Taxis	51	21	9	12	12	12	15	9	9	80	Taxi	
28	North End Road - Motorbikes	51	0	0	0	0	0	0	0	0	0	31 Motorbikes - 30mph	
29	Munden Street - Motorbikes	70	0	0	0	0	0	0	0	0	0	31 Motorbikes - 30mph	
30	Munden Street - Taxis	70	0										

