Walsall Town Centre Ring Road Modelling Report 2016

Strategic Transportation

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Version 3

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Approved	MC

Walsall Council

Contents

Section 1

1.1 Introduction

Indicative ring road layouts have been put forward that will aim to improve the operational efficiency of the Ring Road. These indicative layouts have been tested in the Town Centre Traffic Model which is validated to a 2016 base year. This report will present the results comparing the results of the proposed changes with the base year for both the AM and PM peak periods.

As part of the indicative layouts Mellish Roundabout has been included. There are 3 indicative designs for Mellish Roundabout which has been assessed individually with the other sections of the indicative layouts. These three designs are listed within the body of this report and are known as the do-minimum, do-something 1 and do-something 2 (see table 1).

1.2 Evaluation Outputs

For the TCTM four different types of evaluation outputs have been used to test model performance. These are as follows:

- Queue lengths
- Journey times
- Network delay
- Average speeds

Queue lengths have three different measurements which are; average queue lengths, maximum queue lengths and queue stops. Average queue lengths take the average queue length across the modelled period. Maximum queue length is the farthest extent of the queue reached during the modelled period. Queue stops are the amount of stops at a queue length counter. For each of these a record is taken once a vehicle has reached a standstill therefore this output does not take into account slow moving traffic.

Journey times are the time taken to reach point B from point A. These are manually entered into the network. For consistency both the AM and PM have the same Journey time points. Only the major routes have been chosen through the network. The points can be seen in chapter 2.2.

1.3 Indicative Ring Road Layouts

A number of indicative ring road layout improvements aimed at increasing capacity and reducing journey times have been discussed. The indicative layouts will aid in future proofing a number of sites in the town centre. It must be noted that the layouts listed in table 1 are indicative at this stage and subject to further approval and further design therefore it must be noted that these **are not** final designs. The details of each indicative layout can be seen in the table below:

Junction	Indicative Ring Road Layout Description
Green Lane/Blue Lane	Pedestrian crossing and signal staging improvements.
Stafford Street/Littleton Street	Pedestrian crossing and signal staging improvements.
Wisemore/Littleton Street	Pedestrian crossing improvements.
Littleton Street/Tesco Access	Junction layout alteration.
Littleton Street Hatherton Street	Junction layout and pedestrian crossing alterations.
Mellish Roundabout Do-minimum	Roundabout lining alterations.
Mellish Roundabout Do-something 1	Roundabout layout alterations and lining alterations.
Mellish Roundabout Do-something 2	Roundabout changed to a signalised junction.

Table 1: Indicative ring road layout descriptions.

Section 2 Results

2.1 Queue Results

This section will analyse and compare queue length results for each scenario and the base year. The table will cover all three queue length measurements while the charts will cover average queue lengths. Additional queue lengths that are not listed in the table are included within the body of the text for analytical purposes.

Within the results section reference is made to the DM and two DS scenarios. The difference between the scenarios is the Mellish Island layout where all the other ring road indicative layouts remain the same.

2.1.1 Queue Counter Locations

The red line denotes where the queue was measured from for each queue count. The numbers refer to the results tables and charts within this section.

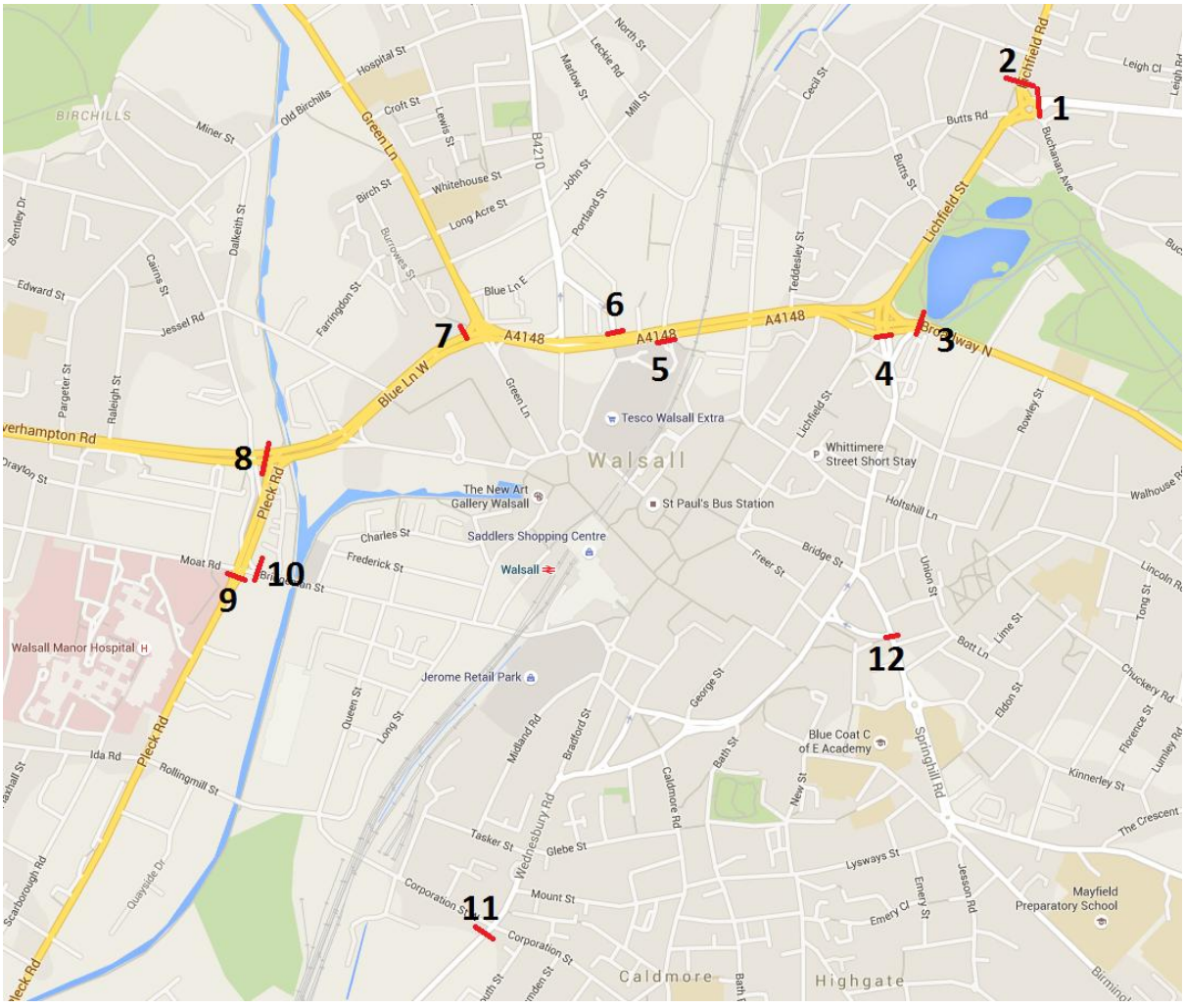

Figure 6: Queue counter locations

2.1.2 AM Queue Results

		Existing			DM			DS1			DS2		
	Map Ref	**Q Avg (m)**	**Q Max (m)**	**Q Stops (veh)**	**Q Avg (m)**	**Q Max (m)**	**Q Stops (veh)**	**Q Avg (m)**	**Q Max (m)**	**Q Stops (veh)**	**Q Avg (m)**	**Q Max (m)**	**Q Stops (veh)**
Mellish Road	1	123	299	206	21	161	182	57	269	272	22	106	174
Lichfield Road	2	43	230	288	7	95	127	9	98	172	30	191	221
Broadway North	3	250	364	665	249	362	660	232	364	664	234	364	643
Lower Rushall	4	26	116	126	26	116	126	26	116	126	26	116	126
Wisemore	5	8	32	50	7	30	47	6	26	46	7	31	49
Stafford Street	6	259	322	693	265	322	702	273	323	656	277	322	626
Blue Lane	7	301	353	1479	292	353	1324	291	353	1314	284	353	1406
Wolverhampton Road	8	144	344	610	131	344	611	138	344	584	139	341	645
Pleck Road	9	130	441	545	46	156	352	65	267	401	82	395	439
Bridgeman Street	10	91	303	290	90	303	292	90	304	292	91	303	292
Wednesbury Road	11	23	136	217	23	136	217	23	136	217	23	136	217
Ablewell Street	12	18	74	273	18	74	273	18	74	273	18	74	273

Table 2: AM queue results 08:00 – 09:30.

2.1.3 PM Queue Results

		Existing			DM			DS1			DS2		
	Map Ref	**Q Avg (m)**	**Q Max (m)**	**Q Stops (veh)**	**Q Avg (m)**	**Q Max (m)**	**Q Stops (veh)**	**Q Avg (m)**	**Q Max (m)**	**Q Stops (veh)**	**Q Avg (m)**	**Q Max (m)**	**Q Stops (veh)**
Mellish Road	1	8	61	187	9	70	142	17	96	199	17	89	159
Lichfield Road	2	2	67	100	2	56	84	4	58	72	17	129	136
Broadway North	3	72	350	412	72	350	412	72	350	414	72	350	412
Lower Rushall	4	20	87	101	20	87	101	20	87	101	20	87	101
Wisemore	5	18	42	95	11	67	84	13	66	83	16	85	89
Stafford Street	6	178	322	639	263	318	645	270	322	624	257	320	644
Blue Lane	7	299	353	1499	280	353	1464	186	352	1118	188	348	1090
Wolverhampton Road	8	248	342	919	40	189	375	25	88	251	25	88	251
Pleck Road	9	49	198	331	25	120	258	25	113	245	25	120	242
Bridgeman Street	10	304	327	739	304	327	746	304	327	774	304	327	774
Wednesbury Road	11	19	136	210	19	136	210	19	136	210	19	136	210
Ablewell Street	12	17	72	254	17	72	254	17	72	254	17	72	254

Table 3: PM queue results 16:00 – 17:30.

2.1.4 AM Queue Results Chart

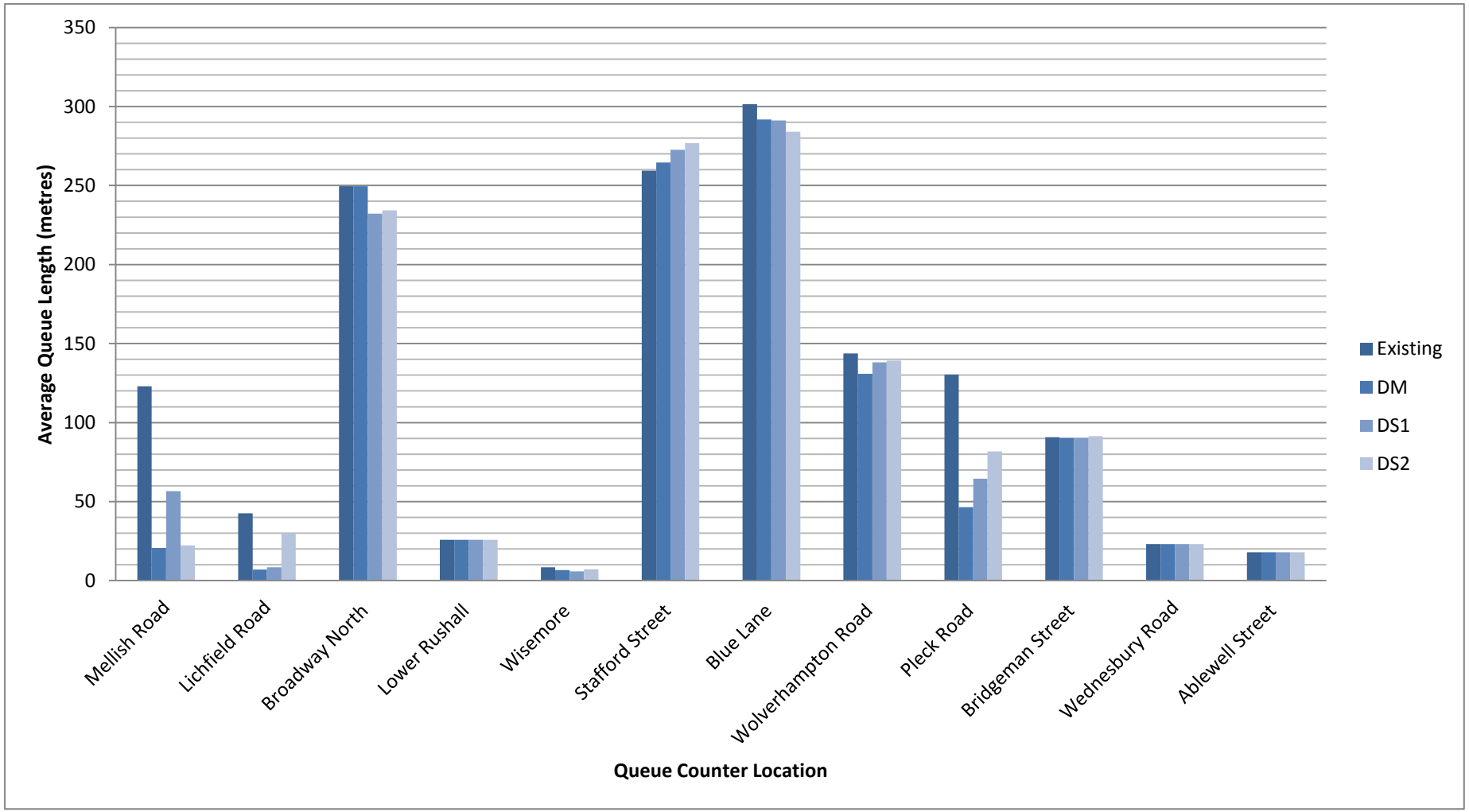

Chart 1: AM average queue lengths 08:00 – 09:30.

2.1.5 PM Queue Results Chart

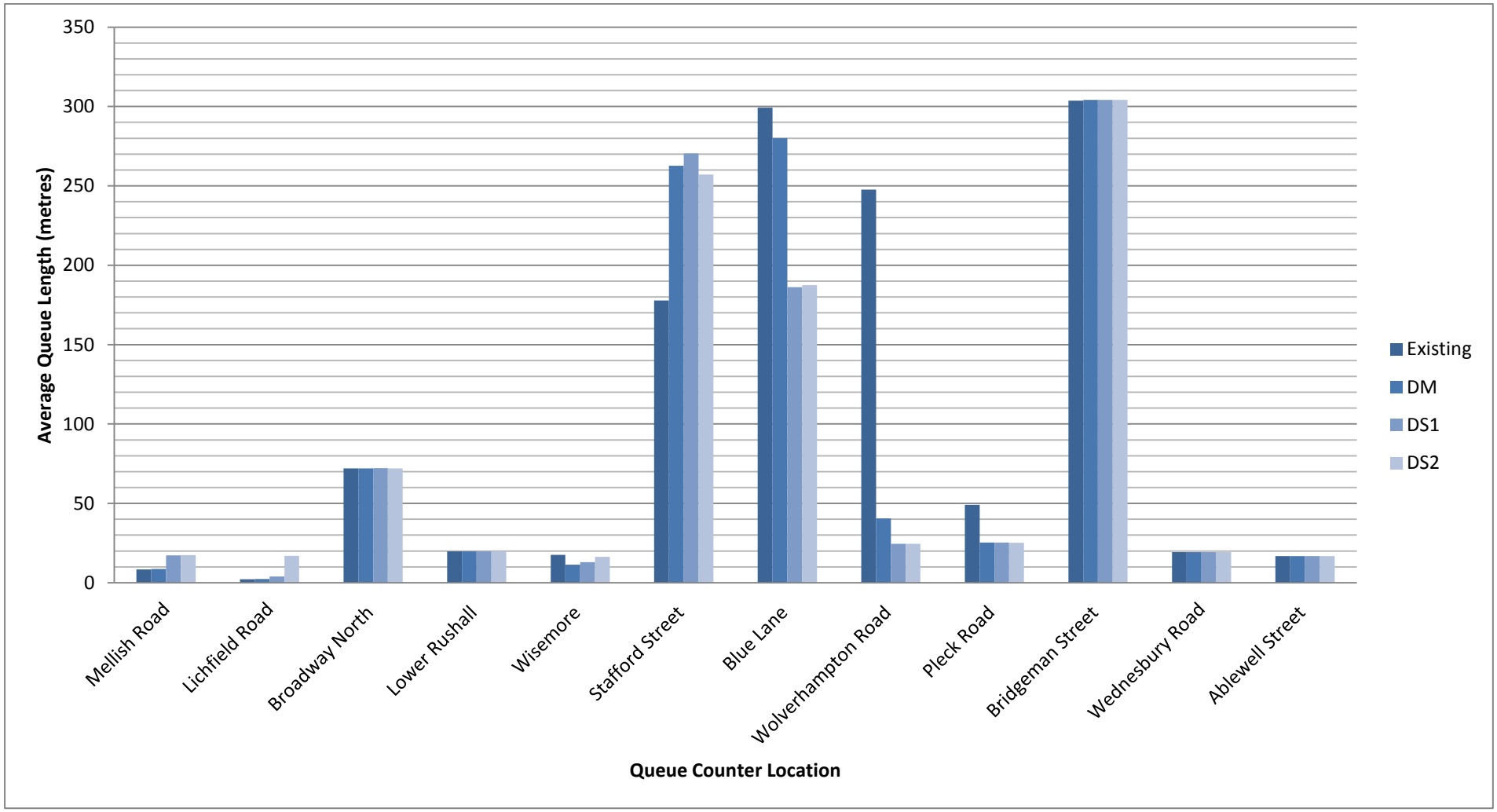

Chart 2: PM average queue lengths 16:00 – 17:30.

2.1.6 AM Queue Results Analysis

The highest reduction in queue length across the AM period was recorded at Mellish Road where the do-minimum scenario recorded a 100 metre reduction in average queue lengths (the equivalent of 20 vehicles). A similar result was recorded for the do-something 2. The second highest reduction in queue length was recorded on the Pleck Road where the do minimum recorded a decrease of 84 metres. From model observations the decrease is caused by additional capacity from the Blue Lane/Green Lane junction which is reflected in the decreased queue lengths at the Blue Lane/Green Lane junction. The only recorded increase from the reference case was recorded on Stafford Street where the DS2 recorded the highest increase from the reference case albeit only by the equivalent of 2 vehicles.

The do minimum scenario for Mellish Island provides the highest capacity benefit in the AM with the average queue length reducing by 100 meters for the Mellish Rd arm and 40 metres for the Lichfield Road arm. This demonstrates that the do minimum provides the highest level of capacity increase at the lowest cost. While the queue lengths demonstrate a reduction in queue lengths it must be noted that the queue counters only record stopped vehicles where model observations suggest that queues are still present but moving slowly.

2.1.7 PM Queue Results Analysis

The highest reduction in queue length was recorded on the Wolverhampton Road at the Wolverhampton Road/Pleck Road junction for traffic heading eastbound where both the DS1 and DS2 recorded a reduction of 223 metres and the DM recorded a reduction of 208 metres. Model observations indicate that the queue build up on the Blue Lane/Green Lane junction decreased as a result of the interventions which allowed more traffic to be discharged from Wolverhampton Road. The evaluation period was extended to capture the queue build up from the Blue Lane/Green Lane junction. The increased evaluation period covered an extra 15 minutes. The increased queue length resulted in the average queue length increasing to 100 metres indicating that the Blue Lane/Green Lane junction reaches a point where the traffic will block back to the Wolverhampton Road. For the same period the evaluation period extension test was carried out on the reference case which recorded an increase of 2 vehicles for the average queue length demonstrating that the block back effect from Blue Lane/Green Lane is consistent throughout the modelling period for the reference case.

The second highest decrease in average queue lengths was recorded at the Blue Lane/Green Lane junction for the DS1 and DS2 scenarios where the queue decreased by 113 metres (the equivalent of 22 vehicles). This reduction is reflective of the additional capacity created for the traffic heading eastbound from the Wolverhampton Road for the DS and DM scenarios. The DM did not provide as much capacity benefit as the DS1 and DS2 indicating that the average queues on Lichfield Street on the approach to the Mellish Island are longer than the two DS scenarios causing an increase in traffic down Lichfield Street subsequently slowing the release of traffic from the ring road onto Lichfield Street. The third highest decrease was recorded on the Pleck Road where the DM and both DS scenarios recorded a reduction of 24 metres (the equivalent of 5 vehicles).

The only increase was recorded on Day Street with average queue lengths increased by an average of 80 metres (the equivalent of 16 vehicles). This queue increased for both peaks where model observations showed that traffic turning left from Day Street onto the ring road was being restricted by queues blocking back through the junctions from the Arboretum junction.

2.2 Journey Time Results

This section will analyse the journey time results for the DM and both DS scenarios comparing the results to the reference case.

AM results

Location	*Reference Case*	*Do Minimum*	*Do Something 1*	*Do Something 2*
Mellish Road - Wolverhampton Road	06:44	05:10	06:06	05:10
Wolverhampton Road - Mellish Road	18:29	15:24	16:32	19:25
Lichfield Road - Green Lane	05:36	04:40	04:46	04:59
Green Lane - Lichfield Road	11:50	11:16	12:58	12:16
Pleck Road - Wolverhampton Road	05:06	03:46	04:01	05:30
Wolverhampton Road - Green Lane	04:18	03:31	04:12	04:47
Green Lane - Wolverhampton Road	02:50	02:39	02:43	02:46

Table 4: Journey time results presented in minutes and seconds for the AM (08:00 – 09:30).

PM results

Location	*Reference Case*	*Do Minimum*	*Do Something 1*	*Do Something 2*
Mellish Road - Wolverhampton Road	05:51	05:20	05:45	05:15
Wolverhampton Road - Mellish Road	20:36	14:48	12:07	12:56
Lichfield Road - Green Lane	05:03	05:08	04:41	04:46
Green Lane - Lichfield Road	11:45	11:46	10:39	10:58
Pleck Road - Wolverhampton Road	04:10	03:24	03:45	03:37
Wolverhampton Road - Green Lane	05:51	03:49	03:45	03:44
Green Lane - Wolverhampton Road	03:05	02:55	03:04	02:58

Table 5: Journey time results presented in minutes and seconds for the PM (16:00 – 17:30).

2.2.1 Journey Time Results Analysis

AM

The largest journey time reduction was recorded between Wolverhampton Road and Mellish Road for the DM scenario where a reduction of 3 minutes was recorded. The DS2 scenario increased the journey time by just less than a minute. The second highest reduction was recorded in the DS1 scenario for the movement between Wolverhampton Road and Mellish Road. For the AM the eastbound direction on the ring road is the most improved with regards to reduced journey times with improvements between Wolverhampton Road – Mellish Road and Green Lane - Lichfield Road.

PM

The largest journey time reduction was recorded between Wolverhampton Road and Mellish Road where the journey time decreased by just over 5 minutes for the DM and 6 minutes for the DS1 and DS2. The second highest reduction was recorded between Wolverhampton Road and Green Lane with a reduction of just over 2 minutes. Both these results demonstrate that the eastbound

movement between Wolverhampton Road and the Mellish Island benefits the most from the indicative layouts. Apart from the aforementioned journey time improvements the other results did not demonstrate any noticeable savings indicating that other parts of the network are not negatively or positively improved with the indicative layouts.

2.3 Average Network Delay

This section will present and analyse total network delay which is recorded in seconds. The average delay is measured as an average of each individual network vehicle that has stopped at any point during the journey.

2.3.1 Average Network Delay Results

AM

2016	DM	DS1	DS2
224	193	205	208

Table 6: AM (08:00 – 09:30) average network delay results in seconds

PM

2016	DM	DS1	DS2
199	177	161	161

Table 7: PM (16:00 – 17:30) average network delay results in seconds

2.3.2 Average Network Delay Analysis

AM

All scenarios have decreased the average delay demonstrating a positive impact from the intervention of the indicative layouts. The DM provided the highest decrease from the base year with a reduction in average delay of 31 seconds.

PM

The PM also recorded a reduction in average vehicle delay demonstrating a positive impact for the intervention of the proposals for the PM. Both DS scenarios provided the highest reduction of vehicle delay where both reduced by 38 seconds and the DM recording a reduction of 21 seconds.

2.4 Average Speed

This section will present the average speed across the network. The average speed is recorded in Km/hr. It must be noted that this is reported as an average, individual links or junctions are likely to report different speed levels nevertheless average speed is still an indicator of the level of congestion.

2.4.1 Average Speed Results

AM

2016	DM	DS1	DS2
12	14	13	13

Table 8: AM (08:00 – 09:30) average speed results in Km/hr

PM

2016	DM	DS1	DS2
13	14	15	15

Table 9: PM (16:00 – 17:30) average speed results in Km/hr

2.4.2 Average Speed Analysis

AM

Average speed has increased for all scenarios from the reference case (2016) with the DM reporting the highest increase of 2 Km/hr and the other two DS scenarios reporting an increase of 1Km/hr. The increase is marginal but demonstrates a level of capacity increase through the indicative layouts.

PM

Both DS scenarios have increased by 2 km/hr from the reference case and the DM scenario by 1km/hr. The increases in average speed are similar to the AM results that they are marginal but demonstrated that the DS scenarios both increase average network speed indicating a capacity benefit through the indicative layouts.

Section 3 Conclusion

3.1 Report Headlines

- All scenarios reduce average queue lengths on the Mellish Road and Lichfield Road arms of the Mellish Island for both the AM and PM peak with the biggest reductions being recorded in the AM where congestion is higher than the PM.

- Mellish Island has wider impacts to the operation of the ring road with average queue lengths varying between the scenarios. This is most notable at the Blue Lane/Green Lane junction where both DS scenarios recorded a 100 metre reduction in average queue length in the PM.

- Journey times are relatively consistent across all the scenarios with particular movements reporting more notable reduced journey times such as the movement between Wolverhampton Road and Mellish Road (east bound) in both peaks.

- Average delay for the AM and PM reduced across all scenarios demonstrating the indicative layouts provide a level of capacity benefit. The average speed results reflect this with marginal increases to average speeds across all scenarios.

3.2 Conclusion

The ring road indicative layouts have been tested in VISSIM to understand the cumulative traffic effects of the interventions. The results demonstrate that the indicative layouts have a degree of capacity improvement with notable reductions in average queues and journey times. The results demonstrate that the Mellish Island proposals have a wider impact to the operation of the ring road with recorded results varying across the scenarios for other sections of the ring road. In both peaks the indicative layouts have increased average queue lengths on Stafford Street with the impact being more in the PM. The reductions in journey times for both eastbound and westbound movements demonstrate a reduction in congestion for that section of the ring road. The journey time reduction is most notable in the PM period.

The Mellish Island reported some of the highest reductions for both the Lichfield Road and Mellish Road arms for the AM evaluation period with the DM recording reductions albeit marginal when compared with the DS1 and DS2. The most notable queue differences in the PM were recorded on the Wolverhampton Road on the approach to the Pleck Road/Wolverhampton Road junction. As the results reported a significant reduction a further test was carried out that expanded the length of the evaluation period which indicated that there is still a queue reduction it is just taking longer to build up because of the congestion from the Green Lane/Blue Lane junction and the subsequent queue displacement allowing for more stacking capacity at the Blue Lane/Green Lane junction during the evaluation period.

The journey times for both peak periods across all scenarios is reduced for the east and west bound movements along the ring road between the Mellish Island and the Wolverhampton Road at the Wolverhampton/Pleck Road junctions. The most notable changes are east bound movements indicating the indicative layouts provide a level of capacity benefit.

Network delay results across all scenarios for both peaks demonstrate a level of capacity benefit with the DM providing a 31 second average delay decrease. These results are reflected with average speeds marginally increasing across the scenarios for each peak period.

The average speed results and the average network delay results indicate a slight difference in performance across the scenarios. The AM demonstrates that the DM scenario performs slightly better while both DS scenarios perform slightly better in the slightly less congested PM peak period.

The indicative layouts have been tested with Mellish roundabout to demonstrate that the junction has wider impacts to the performance of the ring road which is evident from the results. The purpose of this report was not to determine which indicative layout for Mellish operates the most efficiently, it was to determine if any change to junction layouts and signal programs would create capacity relief. As a further measure and a stand alone assessment Mellish will be tested in isolation to determine which layout provides the highest level of capacity relief. From a modelling perspective this will include adjusting priority rules to model different behaviours for each Mellish layout. It can be deduced from the results that the indicative layouts on the ring road provide a level of capacity relief albeit not a significant improvement. It must be noted though that the level of intervention is relatively small scale therefore any additional capacity created from the indicative layouts without extensive land take should be explored. Further work is required on the feasibility of the indicative layouts. The additional work required could include;

- Further indicative layout work to reach a preliminary design.
- Cost – benefit analysis work to ensure any developed schemes would provide value for money.
- The deliverability of each indicative layout needs to be explored in more detail from constructability and an implementation perspective.
- Stakeholder consultation will have to be undertaken to ensure that these indicative layouts are acceptable with regards to the general public and any affected stakeholders.
- A further detailed assessment of Mellish Roundabout to ensure a high level of modelling accuracy before progression of a final option.