APPENDIX 5
Operational Junction Modelling Technical Note

1. INTRODUCTION

1.1. Background / Objectives

1.1.1. An assessment of operation of key junctions on the local highway network has been undertaken to demonstrate the impact of the HCCTP scheme on junction performance.

1.1.2. The following junctions have been considered in this note:

1) The proposed signal controlled junction between the CLR, A49 Edgar Street and Prior Street, at the western extent of the CLR. This junction is a new junction which will be delivered as part of the HCCTP scheme, and therefore has only been considered in scenarios which include the HCCTP. The proposed layout of the junction is shown in Drawing 1DMCXN018-P-009 (produced by Balfour Beatty Living Places) in Appendix 1;

2) The existing signal controlled junction between A465 Commercial Road, Station Approach and Stonebow Road, which will be modified and form the eastern extent of the CLR as part of the HCCTP scheme. This junction has been considered both in its existing form and in its form as proposed as part of the HCCTP scheme. The proposed layout of the junction is shown in Drawings 3512983U-PTR-011 and 012 in Appendix 1;

3) The existing signal controlled junction between A465 Commercial Road, A438 Bath Street and A438 Blueschool Street at Commercial Square, which will be modified as part of the HCCTP scheme. This junction has been considered both in its existing form and in its form as proposed as part of the HCCTP scheme. The proposed layout of the junction is shown in Drawing 3512983U-PTR-010 in Appendix 1; and

4) The existing signal controlled junction at Widemarsh Gate, between A438 Blueschool Street, B4359 Widemarsh Street, A438 Newmarket Street and Wall Street, which will be modified as part of the HCCTP scheme. This junction has been considered both in its existing form and in its form as proposed as part of the HCCTP scheme. The proposed layout of the junction is shown in Drawing 3512983U-PTR-009 in Appendix 1.

1.1.3. This note details the operational modelling that has been undertaken, including the methodology (**Section 2**), base year assessments (**Section 3**) future year assessments for each of the junctions (**Sections 4 – 7**), and an overall summary (**Section 8**).

2. METHODOLOGY

2.1. Software

2.1.1. The junctions listed in Paragraph 1.1.2 have been modelled using Linsig V3, the industry standard tool for assessing the operation of signal controlled junctions and networks of signal controlled junctions.

2.1.2. The junctions at either end of the CLR have been modelled as isolated junctions. The junctions at Commercial Square and the A438 / Widemarsh Street have been modelled in a network to better model the impact of queuing between the junctions.

2.1.3. The full Linsig model outputs have not been included in this note, but will be made available on request

2.2. General Approach

2.2.1. With the exception of the CLR / A49 Edgar Street / Prior Street, the existing layout of the junctions has been modelled, using existing survey data, and compared to queue survey data to provide confidence that the base models adequately reflect existing conditions at the junctions.

2.2.2. Traffic data for future assessment years has been extracted from the HCCTP Saturn model and used in the Do Minimum (DM) assessment, which assesses the impact of traffic growth due to committed schemes and developments, and Do Something (DS) assessment, which includes the HCCTP scheme, including the CLR and 800 residential units assumed to be unlocked by the delivery of the CLR.

2.2.3. It should be noted that the DS scenario used as the basis of the operation junction modelling, and specifically the inclusion of the 800 residential units which are proposed for the ESG regeneration area, represents a worst case scenario. Forecast years and time periods are consistent with the Saturn Model, and as such assessments have been undertaken for:

- Assessment years – 2017 and 2032; and
- Time periods – AM peak hour, 08:00-09:00 (AM); Inter-peak hour, 11:00-12:00 (IP); and PM peak hour, 17:00-18:00 (PM).

2.3. Traffic Surveys

2.3.1. The majority of survey data used in the operation modelling was collected by Herefordshire Council (HC) during November 2014 as a part of the baseline monitoring data as agreed in the HCCTP Monitoring & Evaluation Plan (October 2014).

2.3.2. In addition to the above, some additional surveys were undertaken to fill in any gaps in the data to fully inform and validate the base year models. These additional surveys were undertaken in January 2015 to provide traffic flow and queue data on Stonebow Road and on Wall Street.

2.3.3. The observed peak hours at each of the junctions has been derived from the survey data and are shown in Table 2-1.

2.3.4. The observed turning flows have been converted to passenger car units (pcu) for inputting into the operational modelling, using factors derived from the survey data and COBA pcu values. Base year turning movement diagrams, in pcu, are included in Appendix 5A, and queue survey data is included in Appendix 5B.

Table 2-1 – Junction Peak Hours

	AM Peak Hour	PM Peak Hour
A465 Commercial Rd / Station Approach / Stonebow Rd	08:30-09:30	16:45-17:45
Commercial Square & A438 / Blueschool St / Widemarsh St	08:00-09:00	16:45-17:45

2.4. Signal Data

2.4.1. The current traffic signal controller specifications have been obtained from HC for the existing signal controlled junctions. The specifications include the stage sequences, staging plans, intergreen data and phase delays. In addition, as the junctions are part of a SCOOT network, real-time data has been collated, including cycle time data and frequency of any on-demand stages.

3. BASE YEAR MODELS

3.1. A465 Commercial Road / Station Approach / Stonebow Road

3.1.1. As the junctions of A465 Commercial Road with Station Approach and Stonebow Road are controlled by a single signal controller, the junctions have been modelled together in Linsig. However, for ease of reporting, the results of the two junctions have been separated.

3.1.2. It should be noted that there is short section of Commercial Road between the two junctions (approximately 75m, and able to accommodate up to 20 pcu northbound and 6pcu southbound), and any queues which extend beyond this length have the potential to affect the operation of the upstream junction. Where applicable such instances are highlighted in red text in the results tables below.

3.1.3. Table 3-1 and Table 3-2 provide a summary of the Linsig results for the base year model for the A465 Commercial Road / Station Approach / Stonebow Road junction, and include the maximum degree of saturation (DoS) and total queue, in passenger car units (pcu) for a given approach arm. It should be noted that a signal controlled junction is typically regarded as being over capacity when the DoS exceeds 90% on any arm.

Table 3-1 – Base Year Model Results, A465 / Station Approach

Arm	AM Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
Station Approach	85.4%	9.4	78.7%	11.5
Commercial Rd (N)	87.0%	28.3	78.4%	18.1
Retail Park	14.7%	1.0	53.5%	3.9
Commercial Rd (S)	42.4%	9.6	72.3%	29.4

Table 3-2 – Base Year Model Results, A465 / Stonebow Road

Arm	AM Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
Petrol Filling Station	13.0%	1.1	13.8%	1.2
Commercial Rd (N)	49.2%	2.1	34.6%	3.8
Stonebow Rd	42.0%	2.6	74.9%	6.6
Commercial Rd (S)	44.6%	13.7	36.3%	14.7

3.1.4. The above tables show that the A465 Commercial Road / Station Approach / Stonebow Road junction currently operates within capacity in both the AM and PM peak hours, although the Commercial Road (N) approach to the Station Approach junction is nearing capacity, with a degree of saturation of 87.0% in the AM peak hour.

3.1.5. Table 3-3 shows a comparison of the modelled queues presented above against the observed queues at the junction, both with the average queue (recorded at five minute intervals over the peak hour) and the maximum queue over the peak hour.

3.1.6. The queue surveys at this junction included a survey on all arms of the Station Approach junction in November 2014, and in January 2015 on the Stonebow Road arm only. As such the surveys did not include a separate survey of each of the two stop line locations on the A465. However the survey of the Station Approach junction observed the total queue (i.e. the queue from the stop line at the Station Approach junction and the queue at the stop line at the Stonebow Road junction) when it extended back to and beyond the upstream stop line at the Stonebow Road junction. For the purpose of comparison with the observed queues the modelled queues have been presented in a similar way, however it should be noted that the two values are not directly comparable as the queue south of the Stonebow Road junction was only recorded when the queue from the Station Approach junction extended far enough back.

3.1.7. Similarly the queues on A465 southbound were observed at the Station Approach junction only, therefore the modelled queues are presented for this stop line only. As shown in Table 3-1 and Table 3-2 the modelled queues from the A465 / Stonebow Road junction were below the threshold (6 pcu) above which queues would extend back to and impact on the operation of the A465 Station Approach junction.

Table 3-3 – Modelled & Observed Queues Comparison, A465 / Station Approach / Stonebow Rd

Arm	AM Peak			PM Peak		
	Modelled MMQ (pcu)	Observed Mean Q (Vehicle No.)	Observed Max Q (Vehicle No.)	Modelled MMQ (pcu)	Observed Mean Q (Vehicle No.)	Observed Max Q (Vehicle No.)
Station Approach	9.4	8.8	15.0	11.5	13.8	20.0
Commercial Rd (N)	28.3	9.9	21.0	18.1	10.8	22.0
Retail Park	1.0	1.2	5.0	3.9	1.2	6.0
Commercial Rd (S)	23.3	6.1	11.0	44.1	17.1	31.0
Stonebow Rd	2.6	4.5	7.0	6.6	11.8	17.0
Petrol Filling Station	1.1	No survey	No survey	1.2	No survey	No survey

3.1.8. The base year model shows that the junction currently operates within capacity in both the AM and PM peak. The model results are broadly comparable with the queue survey results and therefore the model is considered to be representative of the actual performance of the junction. The main differences are A465 Commercial Road (S) arm, where the model queue is double the maximum observed in AM peak, and 25% longer than the maximum queue in the PM peak, but as noted above, due to the way the queues were observed on this approach, the queue surveys are likely to under estimate the queue in this approach. In addition, given the junction is part of a SCOOT network and has stages that run on demand which cannot be fully reflected in the Linsig model, the results are considered reasonable and robust.

3.2. Commercial Square

3.2.1. The junction of A465 Commercial Road / A438 Bath Street / A438 Blueschool Street has been modelled as part of the same model as the Widemarsh Gate junction, which is located approximately 250m to the west of Commercial Square. The junctions have been modelled together to fully model the interaction between the junctions, in terms of queuing between the junctions. It should be noted that the distance between the junctions is approximately 250m (and able to accommodate queues of approximately 80 pcu) and any queues which extend beyond this length have the potential to affect the operation of the upstream junction. Where applicable such instances are highlighted in red text in the results tables below.

3.2.2. Table 3-4 provides a summary of the Linsig results for the base year model for the Commercial Square junction, and includes the maximum degree of saturation (DoS) and total queue, in passenger car units (pcu) for a given approach arm.

Table 3-4 – Base Year Model Results, Commercial Square

Arm	AM Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
Commercial Rd (N)	87.8%	23.3	84.9%	22.3
Bath Street	76.9%	20.0	57.0%	11.3
Commercial Rd (S)	0.0%	0.0	0.0	0.0
Blueschool St	53.9%	32.2	50.4%	25.0

3.2.3. The above table shows that the Commercial Square junction currently operates within capacity in both the AM and PM peak hours, although the Commercial Road (N) approach is nearing capacity, with a degree of saturation of 87.8% in the AM peak hour and 84.9% in the PM peak hour.

3.2.4. Table 3-5 shows a comparison of the modelled queues presented above against the observed queues at the junction, both with the average queue (recorded at five minute intervals over the peak hour) and the maximum queue over the peak hour.

Table 3-5 – Modelled & Observed Queues Comparison, Commercial Square

Arm	AM Peak			PM Peak		
	Modelled MMQ (pcu)	Observed Mean Q (Vehicle No.)	Observed Max Q (Vehicle No.)	Modelled MMQ (pcu)	Observed Mean Q (Vehicle No.)	Observed Max Q (Vehicle No.)
Commercial Rd (N)	23.3	16.3	24.0	22.3	20.4	34.0
Bath Street	20.0	12.0	22.0	11.3	10.1	17.0
Commercial Rd (S)	0.0	0.0	0.0	0.0	0.0	0.0
Blueschool St	32.2	15.8	29.0	25.0	9.5	16.0

3.2.5. The base year model shows that the junction currently operates within capacity in both the AM and PM peak. The model results are broadly comparable with the queue survey results and therefore the model is considered to be representative of the actual performance of the junction. The main differences are on the A438 Blueschool Street arm, where the modelled queue is greater than the maximum observed queues in both peaks. However, given the junction is part of a SCOOT network and has stages that run on demand, the results are considered reasonable and robust.

3.3. Widemarsh Gate

3.3.1. The junction of A438 Blueschool Street / B4359 Widemarsh Street / A438 Newmarket Street / Wall Street at Widemarsh Gate has been modelled as part of the same model as the Commercial Square junction.

3.3.2. It should be noted that the distance between the junctions is approximately 250m, and is able to accommodate queues of lengths as stated in Paragraph 3.2.1. Also the Widemarsh Gate junction is located approximately 250m east of the A49 Edgar Street roundabout, with the capacity to store up to 85 pcus. Any queues which extend beyond these lengths have the potential to affect the operation of the upstream junction. Where applicable such instances are highlighted in red text in the results tables below.

3.3.3. Table 3-6 provides a summary of the Linsig results for the base year model for the Widemarsh Gate junction, and include the maximum degree of saturation (DoS) and total queue, in passenger car units (pcu) for a given approach arm.

Table 3-6 – Base Year Model Results, Widemarsh Gate

Arm	AM Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
Widemarsh St	99.3%	17.8	86.7%	16.9
Blueschool St	90.0%	27.0	84.7%	36.8
Wall St	4.5%	0.5	33.9%	5.1
Newmarket St	47.3%	48.0	43.9%	38.4

3.3.4. The above table shows that the Widemarsh Gate junction currently operates over capacity in the AM peak hour, and within capacity in the PM peak hour. In the AM peak hour the Widemarsh Street approach is over capacity with a DoS of 99.3%, and the A438 Blueschool Street is at capacity, with a DoS of 90.0%. Both of these arms are approaching capacity in the PM peak hour.

3.3.5. Table 3-7 shows a comparison of the modelled queues presented above against the observed queues at the junction, both with the average queue (recorded at five minute intervals over the peak hour) and the maximum queue over the peak hour.

Table 3-7 – Modelled & Observed Queues Comparison, Widemarsh Gate

Arm	AM Peak			PM Peak		
	Modelled MMQ (pcu)	Observed Mean Q (Vehicle No.)	Observed Max Q (Vehicle No.)	Modelled MMQ (pcu)	Observed Mean Q (Vehicle No.)	Observed Max Q (Vehicle No.)
Widemarsh St	17.8	15.0	20.0	16.9	18.6	21.0
Blueschool St	27.0	32.2	45.0	36.8	51.5	56.0
Wall St	0.5	0.9	3.0	5.1	7.5	16.0
Newmarket St	48.0	29.0	40.0	38.4	25.9	32.0

3.3.6. The base year model shows that the junction currently operates within capacity in both the AM and PM peak. The model results are broadly comparable with the queue survey results and therefore the model is considered to be representative of the actual performance of the junction. The main differences are on the A438 Blueschool Street arm, where the modelled queue is lower than the average observed queues in both peaks. However, given the junction is part of a SCOOT network and has stages that run on demand, the results are considered reasonable and robust.

4. FUTURE YEAR ASSESSMENTS – CLR / A49 EDGAR STREET

4.1.1. For the proposed CLR / A49 Edgar Street junction the junction has been tested to assess its capacity to accommodate flows associated with the full HCCTP scheme. The junction has been tested for the 2017 and 2032 DS scenarios only, as the junction will only exist as part of the proposed scheme.

4.1.2. The traffic flows used in the assessment have been extracted from the SATURN model for the scheme. The modelled flows are included in Appendix 5C.

Table 4-1 and

4.1.3. Table 4-2 provide a summary of the Linsig results for the 2017 and 2032 DS scenarios respectively.

4.1.4. The tables show that the proposed junction at the western end of the proposed City Link Road (CLR) is forecast to operate within capacity in both forecast years. The highest DoS is forecast to be in the 2032 AM peak on the A49 Edgar Street (N) arm, with a DoS of 81.5% and a queue of 26.2 pcu. The CLR approach is forecast to operate with significant spare capacity, with the maximum DoS on this arm being 38.8%, in the 2032 PM peak.

Table 4-1 – 2017 Forecast Year Model Results, CLR / A49 Edgar Street / Prior Street, with HCCTP

Arm	AM Peak		Inter Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
A49(N)	59.9%	13.7	55.9%	12.4	44.0%	7.7
CLR	15.3%	1.3	22.3%	2.1	12.0%	1.0
A49(S)	60.6%	8.8	52.8%	9.1	44.7%	7.6
Prior St	0.7%	0.0	0.3%	0.0	0.1%	0.0

Table 4-2 – 2032 Forecast Year Model Results, CLR / A49 Edgar Street / Prior Street, with HCCTP

Arm	AM Peak		Inter Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
A49(N)	81.5%	26.2	63.6%	15.3	60.1%	13.0
CLR	22.1%	1.9	3.8%	0.3	38.8%	3.3
A49(S)	43.1%	7.1	60.4%	9.8	48.6%	8.7
Prior St	0.8%	0.0	0.4%	0.0	0.1%	0.0

4.1.5. The above assessment shows that the proposed junction between the CLR, A49 Edgar Street and Prior Street is forecast to operate within capacity with the proposed HCCTP scheme in place. However as stated in Paragraph 2.2.3, the DS scenario which has been assessed here represents a worst case in terms of the assumed development, and therefore the junction is expected to operate better with the HCCTP scheme than the DS results presented above predict.

5. FUTURE YEAR ASSESSMENTS – A465 COMMERCIAL ROAD / STATION APPROACH / STONEBOW ROAD

5.1. Introduction

5.1.1. Using the base models discussed in Chapter 3, the impact of the proposed HCCTP scheme on the operation of the A465 Commercial Road / Station Approach and A465 Commercial Road / Station Approach junction has been considered.

5.1.2. The junctions have been assessed for the DM (i.e. without the proposed HCCTP scheme) and DS (i.e. with proposed HCCTP scheme) scenarios, for the forecast years of 2017 and 2032, and the AM peak, Inter peak (IP) and PM peak hours, with flows extracted from the SATURN model for the scheme. The modelled flows are included in Appendix 5C.

5.1.3. Although the A465 Commercial Road / Station Approach and A465 Commercial Road / Stonebow Road junctions have been modelled as a single junction, for ease of reporting, the results for each junction are presented separately.

5.1.4. As stated in Paragraph 3.1.1 the A465 carriageway between the two junctions has the capacity to accommodate queues of up to 20 pcu northbound and 6 pcu southbound in the existing and also the DM scenarios. With the changes to the junctions in the DS scenario the queue storage is reduced to 15 pcu northbound and 5 pcu southbound. Where forecast queues are predicted to exceed the queue storage capacity, such instances are highlighted in red text in the results tables below.

5.2. A465 Commercial Road / Station Approach

5.2.1. Table 5-1 and Table 5-2 provide a summary of the LINSIG results for the A465 Commercial Road / Station Approach junction, for the 2017 DM and DS scenarios respectively.

Table 5-1 – 2017 Forecast Year Model Results, A465 / Station Approach, DM

Arm	AM Peak		Inter Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
Station Approach	74.4%	4.6	94.7%	15.7	115.1%	95.6
Commercial Rd (N)	86.4%	31.8	95.7%	34.9	115.4%	89.9
Retail Park	2.1%	0.1	45.1%	3.2	24.7%	1.1
Commercial Rd (S)	51.1%	7.7	59.7%	16.0	79.2%	30.3

5.2.2. Table 5-1 shows that in the 2017 DM scenario the junction is forecast to operate over capacity in the IP and PM peak scenarios, with the Station Approach and Commercial Road (N) approaches being over capacity and having significant queues (approximately 100 pcu) on both arms.

Table 5-2 – 2017 Forecast Year Model Results, A465 / Station Approach, with HCCTP

Arm	AM Peak		Inter Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
Station Approach	33.9%	2.6	60.3%	5.2	92.5%	11.1
Commercial Rd (N)	79.4%	23.9	57.7%	10.6	79.7%	12.6
Retail Park	3.1%	0.2	52.3%	3.2	15.3%	0.0
Commercial Rd (S)	80.6%	19.3	60.3%	8.2	97.8%	33.7

5.2.3. Table 5-2 shows that in 2017 with the proposed HCCTP scheme, the junction is forecast to operate over capacity, but to a lesser extent than in the DM, and in the PM peak only. The maximum DoS and queues are reduced compared to the DM on Station Approach and Commercial Road (N). However, in the DS, Commercial Road (S) is also forecast to be over capacity; however the resultant increase in queuing is forecast to be minimal compared to the DM.

5.2.4. It should be noted that in both the DM and DS scenarios the forecast queue on the A465 Commercial Street (S) approach will extend back through the Stonebow Road junction to the south, in the PM peak hour. However, as was observed in the queue surveys undertaken (see Table 3-3) this situation currently occurs, and is only marginally worse in the DS scenario compared to the DM scenario.

5.2.5. Table 5-3 and Table 5-4 provide a summary of the results for the 2032 DM and DS scenarios respectively.

Table 5-3 – 2032 Forecast Year Model Results, A465 / Station Approach, DM

Arm	AM Peak		Inter Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
Station Approach	90.8%	8.1	113.2%	57.6	137.9%	185.5
Commercial Rd (N)	92.8%	37.6	114.6%	123.2	138.7%	202.5
Retail Park	2.6%	0.2	51.8%	3.8	28.9%	2.4
Commercial Rd (S)	56.7%	18.7	68.0%	19.0	68.9%	27.0

Table 5-4 – 2032 Forecast Year Model Results, A465 / Station Approach, with HCCTP

Arm	AM Peak		Inter Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
Station Approach	41.4%	3.1	65.1%	6.1	100.1%	12.0
Commercial Rd (N)	97.6%	31.7	89.7%	17.7	104.9%	32.0
Retail Park	3.7%	0.2	57.1%	3.4	20.9%	1.6
Commercial Rd (S)	97.0%	34.4	90.1%	17.3	105.7%	56.0

5.2.6. Table 5-3 shows that deterioration in performance is forecast between the 2017 and 2032 DM scenarios, as a result of background traffic growth assumptions. By 2032, the junction is forecast to operate over capacity in the AM, IP and PM peak periods, with significant queuing in the IP and PM peak period.

5.2.7. Table 5-4 shows improved junction performance, in comparison to the DM scenario, in the DS IP and PM peak hour with a significant reduction in queues on the Station Approach and Commercial Road (N) arms. In the DS, Commercial Road (S) is also forecast to be over capacity, with an increase in queue compared to the DM, but in the context of the significant reduction of queuing elsewhere at the junction this is not considered to be significant. The queues on Commercial Road (S) are considered further in Section 5.3.

5.2.8. Overall, the operation of the A465 Commercial Road / Station Approach junction is forecast to operate significantly better in 2017 with the proposed scheme than in the DM scenario. This is also the case in 2032, as the proposed scheme will significantly reduce queuing on Station Approach and Commercial Road (S), albeit with an increase in queuing on Commercial Road (S).

5.2.9. However as stated in Paragraph 2.2.3, the DS scenario which has been assessed here represents a worst case in terms of the assumed development, and therefore the junction is expected to operate better with the HCCTP scheme than the DS results presented above predict.

5.3. A465 Commercial Road / Stonebow Road

5.3.1. Table 5-5 and Table 5-6 provide a summary of the A465 Commercial Road / Stonebow Road junction Linsig results for the 2017 DM and DS scenarios respectively.

Table 5-5 – 2017 Forecast Year Model Results, A465 / Stonebow Road, DM

Arm	AM Peak		Inter Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
Petrol Filling Station	0.0%	0.0	0.0%	0.0	0.0%	0.0
Commercial Rd (N)	52.5%	3.8	47.1%	9.3	41.7%	10.2
Stonebow Rd	26.3%	1.6	56.5%	4.0	101.0%	19.0
Commercial Rd (S)	46.1%	16.9	40.7%	11.9	28.6%	11.2

Table 5-6 – 2017 Forecast Year Model Results, A465 / Stonebow Road, with HCCTP

Arm	AM Peak		Inter Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
Petrol Filling Station	0.0%	0.0	0.0%	0.0	0.0%	0.0
Commercial Rd (N)	38.2%	0.6	29.2%	0.2	31.7%	3.0
Stonebow Rd	42.6%	2.4	48.9%	2.6	98.4%	15.9
Commercial Rd (S)	50.2%	10.2	31.6%	4.6	44.6%	9.3

5.3.2. Table 5-5 shows that in the 2017 DM scenario the A465 Commercial Road / Stonebow Road junction is forecast to operate over capacity in the PM Peak, however the only approach which is over capacity is the Stonebow Road approach, with a resulting queue of 19.0 pcu. It should be noted that in the queue on Commercial Road (N) is forecast to extend back to the Station Approach junction, which will further add to the DM queues at that junction (as reported in Table 5-1).

5.3.3. Table 5-6 shows in 2017 with the proposed scheme the operation of the junction is forecast to improve compared to the DM scenario, with slightly reduced DoS on Stonebow Road, and slight improvements across the junction. The queues on the Commercial Road (N) can be accommodated between the Stonebow Road junction and the Station Approach junction and so will not further add to the queues at the Station Approach junction.

5.3.4. It should be noted that the queues forecast on the Commercial Road (S) approach to this junction are in addition to queues extending back through the junction from the Station Approach junction. A comparison of the total queuing on the A465 Commercial northbound carriageway (i.e. including both the queues on the Commercial Road (S) approach at the Station Road junction and the Stonebow Road junction) is presented in Table 5-7 below. The table shows that in terms of total queuing on Commercial Road northbound the forecast queues with the proposed scheme are broadly similar to the DM, with a slightly longer queue in the AM and PM peak hours, and with a reduced queue in the inter period.

Table 5-7 – Comparison of total queues on A465 Commercial Road northbound, in 2017

Time Period	Queue	2017 DM	2017 DS
AM	Station Approach, A465(S) stopline	7.7 pcu	19.3 pcu
	Stonebow Road, A465(S) stopline	16.9 pcu	10.2 pcu
	Total queue	**24.6 pcu**	**29.5 pcu**
IP	Station Approach, A465(S) stopline	16.0 pcu	8.2 pcu
	Stonebow Road, A465(S) stopline	11.9 pcu	4.6 pcu
	Total queue	**27.9 pcu**	**12.8 pcu**
PM	Station Approach, A465(S) stopline	30.3 pcu	33.7 pcu
	Stonebow Road, A465(S) stopline	11.2 pcu	9.3 pcu
	Total queue	**41.5**	**43.0 pcu**

5.3.5. Table 5-8 and Table 5-9 provide a summary of the Linsig results for the 2032 DM and DS scenarios respectively.

Table 5-8 – 2032 Forecast Year Model Results, A465 / Stonebow Road, DM

Arm	AM Peak		Inter Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
Petrol Filling Station	0.0%	0.0	0.0%	0.0	0.0%	0.0
Commercial Rd (N)	56.8%	3.9	50.2%	12.6	42.0%	8.6
Stonebow Rd	29.4%	1.7	67.5%	5.4	110.4%	38.3
Commercial Rd (S)	48.6%	18.4	43.9%	14.0	26.3%	10.0

Table 5-9 – 2032 Forecast Year Model Results, A465 / Stonebow Road, with HCCTP

Arm	AM Peak		Inter Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
Petrol Filling Station	0.0%	0.0	0.0%	0.0	0.0%	0.0
Commercial Rd (N)	38.6%	0.7	32.0%	2.5	35.5%	3.9
Stonebow Rd	47.6%	2.7	56.0%	3.0	103.9%	22.6
Commercial Rd (S)	62.7%	15.9	44.5%	7.6	48.7%	10.6

5.3.6. Table 5-8 shows that the A465 Commercial Road / Stonebow Road junction will operate over capacity in the 2032 DM, with the forecast operation slightly worse than the 2017 DM, as a result of increases in background traffic. The forecast queuing is broadly similar to the 2017 DM, but with the exception of a doubling of queue on Stonebow Road, to 38 pcu. Queues on the Commercial Road (N) arm are still forecast to extend back to the Station Approach junction, but to a slightly lesser extent than the 2017 DM.

5.3.7. Table 5-9 shows that the junction is forecast to operate better in 2032 with the proposed scheme than in the DM scenario, with reduced queues on all arms in all time periods tested.

5.3.8. As discussed above in relation to the 2017 assessment, the queues forecast on the Commercial Road (S) approach to this junction are in addition to queues extending back through the junction from the Station Approach junction. A comparison of the total queuing on the A465 Commercial northbound carriageway is presented in Table 5-10 below. The table shows that in terms of total queuing on Commercial Road northbound the forecast queues with the proposed scheme in 2032 are increased in both the AM and the PM peak hours compared to the DM, with a maximum total queue of 66.6pcu forecast for the PM peak. The queues in the inter peak are forecast to be shorter in the DS than the DM.

Table 5-10 – Comparison of total queues on A465 Commercial Road northbound, in 2032

Time Period	Queue	2032 DM	2032 DS
AM	Station Approach, A465(S) stopline	18.7 pcu	34.4 pcu
	Stonebow Road, A465(S) stopline	18.4 pcu	15.9 pcu
	Total queue	**37.1 pcu**	**50.3 pcu**
IP	Station Approach, A465(S) stopline	19.0 pcu	17.3 pcu
	Stonebow Road, A465(S) stopline	14.0 pcu	7.6 pcu
	Total queue	**33.0 pcu**	**24.9 pcu**
PM	Station Approach, A465(S) stopline	27.0 pcu	56.0 pcu
	Stonebow Road, A465(S) stopline	10.0 pcu	10.6 pcu
	Total queue	**37.0 pcu**	**66.6 pcu**

5.3.9. Overall, the A465 Commercial Road / Stonebow Road junction is forecast to operate better than the DM scenario in both 2017 and 2032 with the proposed scheme. In both the DM and DS scenarios for both years the junction is forecast to operate over capacity due to the Stonebow Road approach only, the other arms are within capacity in all scenarios tested. However the proposed scheme will result in an increase in total queue on the A465 northbound carriageway.

5.3.10. However as stated in Paragraph 2.2.3, the DS scenario which has been assessed here represents a worst case in terms of the assumed development, and therefore the junction is expected to operate better with the HCCTP scheme than the DS results presented above predict.

6. FUTURE YEAR ASSESSMENTS – COMMERCIAL SQUARE

6.1.1. Using the base models discussed in Chapter 3, the impact of the proposed HCCTP scheme on the operation of the Commercial Square junction has been considered

6.1.2. The junctions have been assessed for the DM and DS (i.e. with proposed HCCTP scheme), for the forecast years of 2017 and 2032, and the AM peak, Inter peak (IP) and PM peak hours, with flows extracted from the SATURN model for the scheme. The modelled flows are included in Appendix 5C.

6.1.3. Although the Commercial Square and Widemarsh Gate junctions have been modelled together, for ease of reporting, the results for each junction are presented separately. The assessment of the Widemarsh Gate junction is discussed in Chapter 7.

6.1.4. As stated in Paragraph 3.2.1 the A465 carriageway between the two junctions has the capacity to accommodate queues of approximately 80 pcu in the existing and also the DM scenarios. With the changes to the junctions and Blueschool Street itself in the DS scenario, the queue storage is reduced to approximately 40pcu. Where forecast queues are predicted to exceed the queue storage capacity, such instances are highlighted in red text in the results tables below

6.1.5. Table 6-1 and Table 6-2 provide a summary of the Linsig results for the 2017 DM and DS scenarios respectively.

Table 6-1 – 2017 Forecast Year Model Results, Commercial Square, DM

Arm	AM Peak		Inter Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
Commercial Rd (N)	71.3%	15.5	86.4%	17.7	111.6%	75.7
Bath Street	83.5%	26.3	108.9%	64.3	114.4%	65.9
Commercial Rd (S)	0.0%	0.0	0.0%	0.0	0.0%	0.0
Blueschool St	49.9%	15.2	63.9%	19.7	44.8%	16.9

6.1.6. Table 6-1 shows that the Commercial Square junction is forecast to be over capacity in the 2017 DM scenario, with the Bath Street approach being over capacity in the inter peak and PM peak periods, and the Commercial Road (N) approach being over capacity in the PM peak period. The longest queues are forecast on Commercial Road, of 75.7 pcu and on Bath Street, of 65.9 pcu, both in the PM peak period.

Table 6-2 – 2017 Forecast Year Model Results, Commercial Square, with HCCTP

Arm	AM Peak		Inter Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
Commercial Rd (N)	86.4%	12.1	85.7%	13.1	62.7%	9.2
Bath Street	69.9%	13.6	118.7%	61.5	105.6%	34.5
Commercial Rd (S)	0.0%	0.0	0.0%	0.0	0.0%	0.0
Blueschool St	89.1%	16.1	71.7%	23.6	64.7%	7.0

6.1.7. Table 6-2 shows that the junction is forecast to operate better with the proposed scheme in 2017, with generally reduced queues on all approaches, and particularly on Bath Street and Commercial Road (N) in the PM peak.

6.1.8. Table 6-3 and Table 6-4 provide a summary of the results for the 2032 DM and DS scenarios respectively.

6.1.9. Table 6-3 shows that the Commercial Square junction is forecast to operate significantly over capacity in the DM scenario in 2032, as a result of increased background traffic. The Bath Street approach is forecast to be over capacity in all time periods and significantly so in the inter peak and PM peak periods, with significant resulting queues. Commercial Road (N) is forecast to be operate slightly over capacity in the inter peak, and significantly over capacity in the PM peak, again with significant queuing. In practice it is unlikely that queues would reach the lengths predicted by the model as drivers would alter travel patterns to avoid such queues and delays.

Table 6-3 – 2032 Forecast Year Model Results, Commercial Square, DM

Arm	AM Peak		Inter Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
Commercial Rd (N)	82.5%	19.9	91.1%	24.6	116.3%	192.2
Bath Street	115.8%	143.0	154.2%	228.2	215.2%	375.1
Commercial Rd (S)	0.0%	0.0	0.0%	0.0	0.0%	0.0
Blueschool St	65.0%	18.1	83.8%	17.0	33.8%	14.0

6.1.10. Table 6-4 shows that the junction is forecast to operate better with the proposed scheme than the DM scenario in 2032 in the inter peak and PM peak periods, but the junction is still forecast to operate significantly over capacity, particularly on Bath Street, in all time periods assessed. The DS is forecast to significantly reduce queues on Commercial Road (N) in the PM peak period.

Table 6-4 – 2032 Forecast Year Model Results, Commercial Square, with HCCTP

Arm	AM Peak		Inter Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
Commercial Rd (N)	86.9%	12.2	114.0%	61.4	57.3%	7.6
Bath Street	149.3%	224.8	140.4%	181.6	140.7%	130.9
Commercial Rd (S)	0.0%	0.0	0.0%	0.0	0.0%	0.0
Blueschool St	74.2%	15.6	74.5%	26.3	92.8%	16.5

6.1.11. Overall, the Commercial Square junction is forecast to be significantly over capacity in all scenarios tested in 2017 and 2032. However the proposed scheme is forecast to improve the operation of the junction in 2017, with reduced queues on all approaches, and in 2032 improvements are forecast in the inter peak and PM peak periods, although the performance in the AM peak deteriorates.

6.1.12. It should be noted that the long queues forecast on Commercial Road (N) in some scenarios and on Bath Street in most scenarios are as a result of queuing from the Widemarsh Gate junction to the west (and discussed in Section 7). The Linsig model is ensuring queues from the Widemarsh Gate junction can be accommodated on the A438 between the junctions, but as a result of that, additional queues are occurring on Commercial Road (N) and Bath Street.

6.1.13. However as stated in Paragraph 2.2.3, the DS scenario which has been assessed here represents a worst case in terms of the assumed development, and therefore the junction is expected to operate better with the HCCTP scheme than the DS results presented above predict.

7. FUTURE YEAR ASSESSMENTS – WIDEMARSH GATE

7.1.1. Using the base models discussed in Chapter 3, the impact of the proposed HCCTP scheme on the operation of the Widemarsh Gate junction has been considered.

7.1.2. The junction has been assessed for the DM and DS (i.e. with proposed HCCTP scheme), for the forecast years of 2017 and 2032, and the AM peak, Inter peak (IP) and PM peak hours, with flows extracted from the SATURN model for the scheme. The modelled flows are included in Appendix 5C.

7.1.3. Although the Commercial Square and Widemarsh Gate junctions have been modelled together, for ease of reporting, the results for each junction are presented separately, with the Commercial Square junction being discussed in the previous chapter of this report.

7.1.4. It should be noted that the distance between the junctions is approximately 250m, but changes to the junctions and Blueschool Street itself reduce the queue storage capacity between the junctions as stated in Paragraph 6.1.4. In addition the queue storage between the junction and the A49 Edgar Street roundabout is reduced to 42 pcu. Where forecast queues are predicted to exceed the queue storage capacity, such instances are highlighted in red text in the results tables below

7.1.5. Table 7-1 and Table 7-2 provide a summary of the Linsig results for the 2017 DM and DS scenarios respectively.

7.1.6. Table 7-1 shows that the Widemarsh Gate junction is forecast to operate over capacity in 2017 in the DM scenario, with the Widemarsh Street and Blueschool Street approaches being over capacity in both the AM and PM peak periods, albeit in the AM peak period the junction is only forecast to be slight over capacity. Despite operating over capacity the forecast queues on the A438 arms are not significant as they can be accommodated within the link between the junction and the A49 Edgar Street roundabout to the west and the Commercial Square junction to the east.

Table 7-1 – 2017 Forecast Year Model Results, Widemarsh Gate, DM

Arm	AM Peak		Inter Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
Widemarsh St	94.6%	7.6	85.8%	8.3	104.1%	12.5
Blueschool St	90.1%	28.3	70.5%	30.2	102.4%	36.1
Wall St	26.1%	2.8	64.5%	8.5	77.6%	8.5
Newmarket St	58.6%	51.7	82.2%	46.6	75.0%	54.2

Table 7-2 – 2017 Forecast Year Model Results, Widemarsh Gate, with HCCTP

Arm	AM Peak		Inter Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
Widemarsh St	44.1%	2.3	82.0%	5.6	67.5%	4.9
Blueschool St	85.3%	38.4	76.7%	23.8	72.2%	32.8
Wall St	60.8%	3.1	116.9%	41.6	110.8%	20.4
Newmarket St	69.7%	21.7	54.1%	13.5	41.7%	10.9

7.1.7. Table 7-2 shows that the junction is forecast to generally operate similarly with the proposed scheme as in the DM scenario in 2017, particularly in the AM and PM peak hours. The forecast queues on the A438 Newmarket Street approach are reduced, but with a small increase in queues on A438 Blueschool Street in the AM peak, and a larger increase on Wall Street in the inter peak and PM peak periods. The Wall Street approach is the only approach over capacity, and is over capacity in the inter peak and PM peak periods.

7.1.8. Table 7-3 and Table 7-4 provide a summary of the results for the 2032 DM and DS scenarios respectively.

Table 7-3 – 2032 Forecast Year Model Results, Widemarsh Gate, DM

Arm	AM Peak		Inter Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
Widemarsh St	112.0%	15.1	106.7%	22.3	121.8%	22.5
Blueschool St	113.6%	49.5	117.4%	69.9	103.1%	33.3
Wall St	35.2%	3.6	89.5%	14.2	101.2%	16.7
Newmarket St	60.3%	56.4	83.5%	52.0	57.5%	32.1

7.1.9. Table 7-3 shows that the Widemarsh Gate junction is forecast to operate over capacity in the 2032 DM scenario, and the increase in background traffic between 2017 and 2032 means the junction is more over capacity than in the 2017 DM scenario.

Table 7-4 – 2032 Forecast Year Model Results, Widemarsh Gate, with HCCTP

Arm	AM Peak		Inter Peak		PM Peak	
	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)	Maximum DoS	Modelled MMQ (pcu)
Widemarsh St	68.0%	4.0	163.8%	68.9	63.0%	4.7
Blueschool St	91.2%	27.5	81.9%	30.2	73.6%	34.1
Wall St	73.2%	4.1	131.5%	69.3	112.8%	24.0
Newmarket St	69.5%	22.8	63.5%	17.0	53.1%	12.8

7.1.10. Table 7-4 shows that, with the proposed scheme, the operation of the junction is forecast to improve compared to the DM in 2032, particularly in the AM and PM peak periods. The junction is forecast to be fractionally over capacity in the AM peak due to the DoS exceeding 90% on the Blueschool Street approach. In the PM peak, Wall Street is the only approach over capacity, with a DoS of 112.8%, and a resulting queue of 24.0 pcu. However in the inter peak period the junction is forecast to operate worse in the DS than in the DM, with the Widemarsh Street and Wall Street approaches being significantly over capacity and long queues of approximately 70 pcu on both approaches.

7.1.11. Further investigation of these results show that the forecast flows in the HHCTP Saturn model on the A438 Blueschool Street and the Wall Street approaches are considerably greater in the IP than in the AM or PM peak hours, with a 35% increase in total junction entry flow compared to the AM and PM.

7.1.12. Overall the Widemarsh Gate junction is forecast to operate slightly over capacity in 2017 and 2032 DS in the AM and PM peaks, but better than the DM. In the inter peak DS scenario, queues on Wall Street (2017 and 2032) and Widemarsh Street (2032 only) are forecast to increase in length compared to the DM, with queues of up to 70 pcu.

7.1.13. However as stated in Paragraph 2.2.3, the DS scenario which has been assessed here represents a worst case in terms of the assumed development, and therefore the junction is expected to operate better with the HCCTP scheme than the DS results presented above predict.

8. SUMMARY

8.1.1. An assessment of the operation of key junctions on the Hereford City local road network has been undertaken. Existing junctions at A465 Commercial Road / Station Approach / Stonebow Road, Commercial Square and Widemarsh Gate have been considered for base, DM and DS scenarios. The proposed junction between the CLR and A49 Prior Street has also been considered in terms of DS operation only.

8.1.2. The three existing junctions have been modelled for a 2014 base year, based on traffic survey data, and validated against queue survey data. All three junctions are signal controlled and have been modelled in LinSig, using data taken from the signal specification reports and outputs from the SCOOT system.

8.1.3. For all future year assessments the traffic flows were taken from the HCCTP Saturn model, for 2017 and 2032, DM and DS, AM peak, Inter peak and PM peak scenarios. The assessments are based on a DM with no development in the ESG area and a DS with the HCCTP scheme and 800 residential units in the ESG. The inclusion of the 800 residential units which are proposed for the ESG regeneration area, represents a worst case scenario. It is expected that as the ESG regeneration is implemented, the promoting developers will identify the additional (to HCCTP) transport infrastructure that will be required to mitigate the adverse impacts of their development generated travel demand.

8.1.4. All forecast year assessments (DM and DS) have been optimised within Linsig.

8.1.5. To summarise the results presented in this technical note:

- **A49 / Edgar Street / CLR Junction**
  - Forecast to operate within capacity in all scenarios (time periods for both 2017 and 2032);
- **Commercial Road / Station Approach / Stonebow Road Junctions**
  - Forecast to operate better in the DS than the DM for all scenarios but for AM peak 2032. For the majority of the scenarios, both DM and DS are operating over capacity.
- **Commercial Square**
  - Forecast to operate better overall in DS than DM, but both DM and DS are significantly over capacity in most scenarios. Long queues form in both DS and DM on Bath Street and Commercial Road (N) as a result of queuing between Widemarsh Street junction and Commercial Square.
- **Widemarsh Gate**
  - Forecast to generally operate better in the DS on Widemarsh St, Blueschool Street, Newmarket Street, Commercial Road and Bath Street, but with longer queues on Wall Street.

8.1.6. Overall, it is considered that the existing junctions assessed above will operate better with the HCCTP scheme than in the DM scenario. For each junction there are certain time periods which are an exception to the above, but overall it is considered that the junctions will operate better with the HCCTP scheme in place than without it.

8.1.7. The proposed junction between the CLR and A49 Edgar Street is forecast to operate within capacity in all scenarios tested.

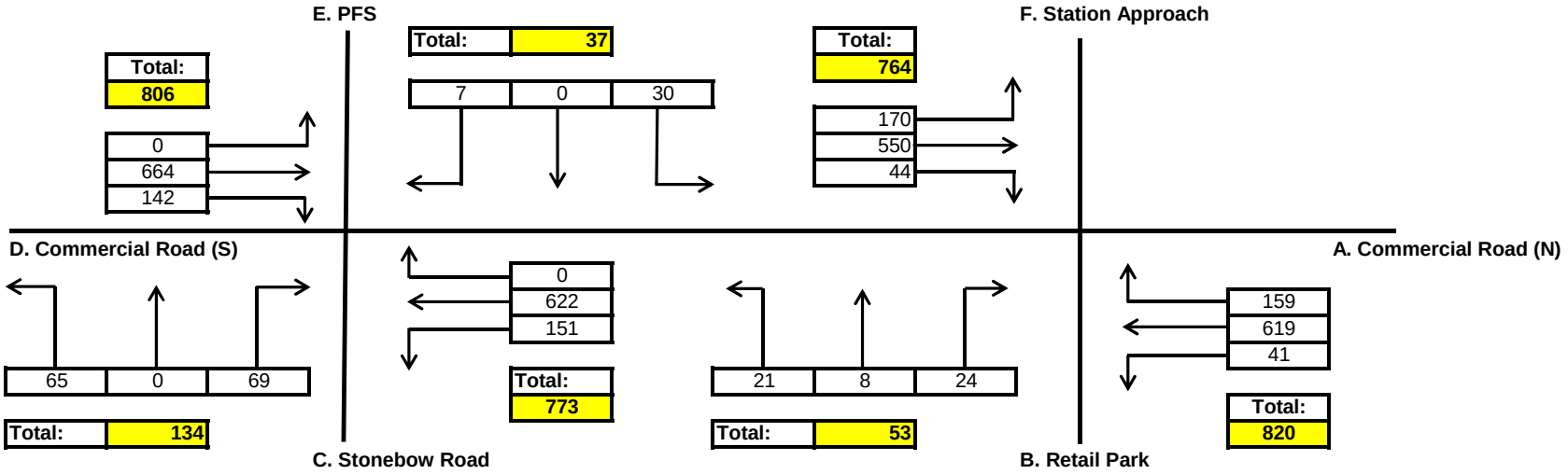
8.1.8. The DS scenario which has been assessed here represents a worst case in terms of the assumed development, and therefore the junctions are expected to operate better with the HCCTP scheme than the DS results presented in this technical note predict.

APPENDIX 5A

Base Year Turning Movement Diagrams (in PCUs)

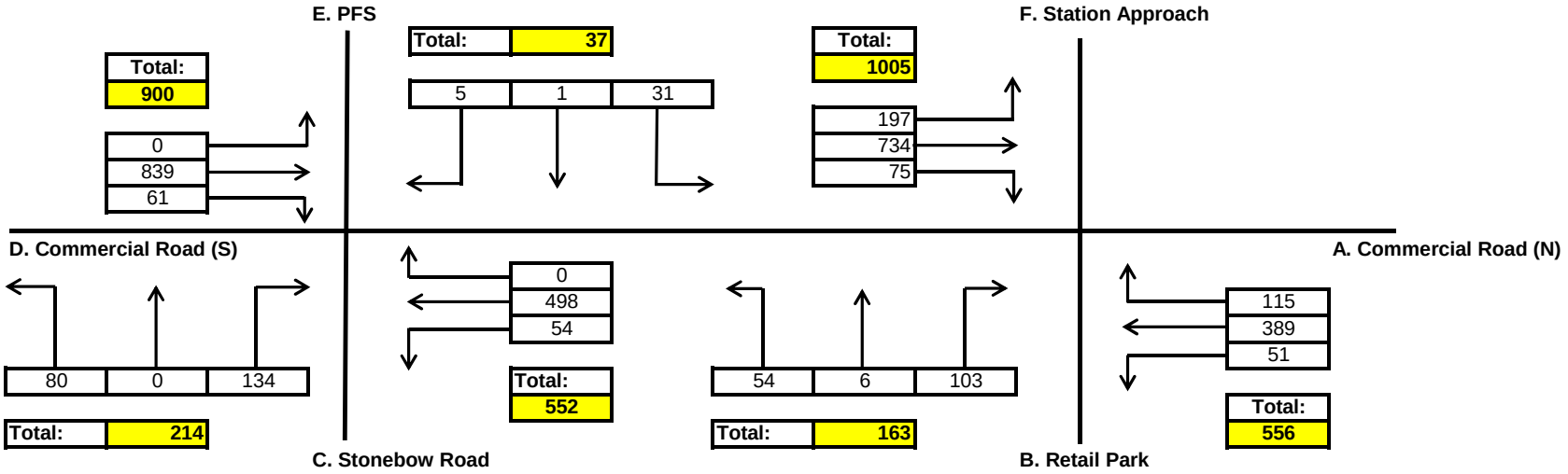
Turning Count Diagram: A465 Commercial Road / Station Approach / Stonebow Road

2014 AM Peak (08:30-09:30) PCU



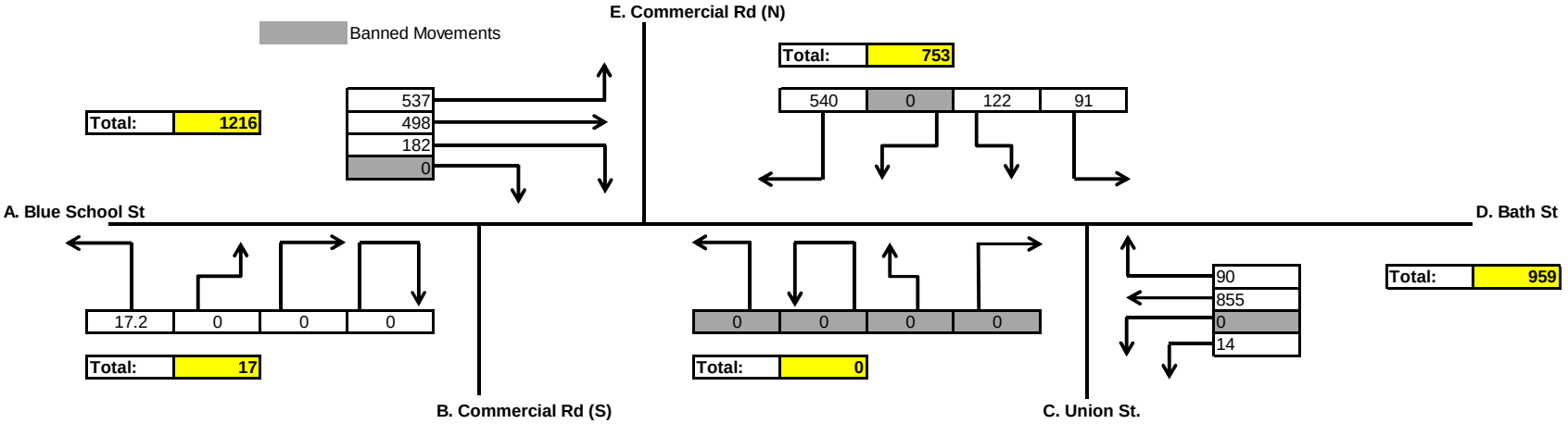
Turning Count Diagram: A465 Commercial Road / Station Approach / Stonebow Road

2014 PM Peak (16:45-17:45) PCU



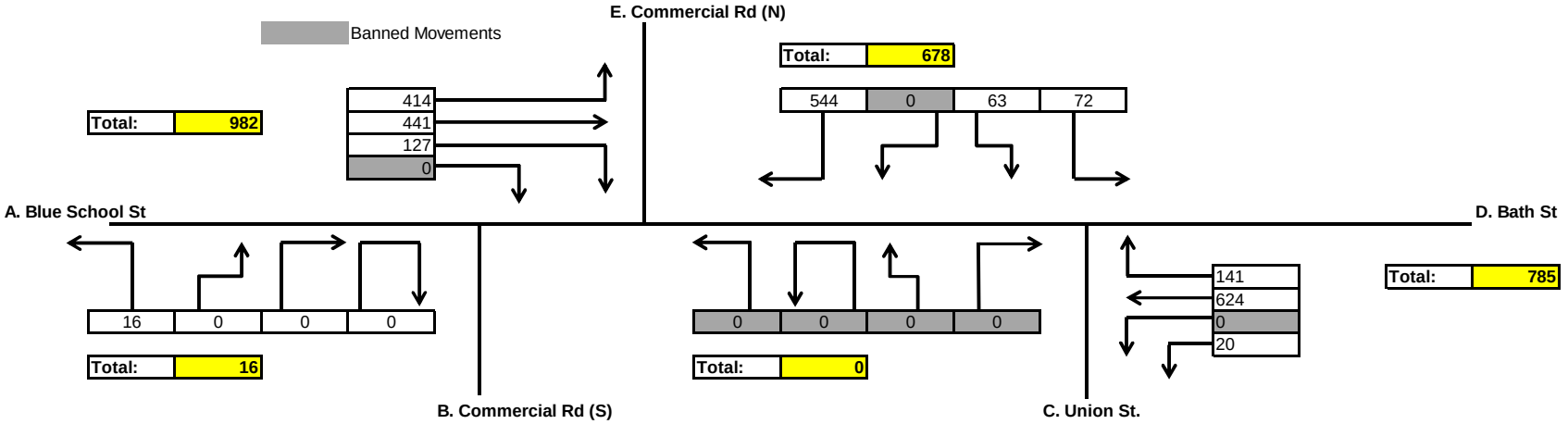
Turning Count Diagram: A438 / A465 Commercial Square

2014 AM Peak (08:00-09:00) PCU



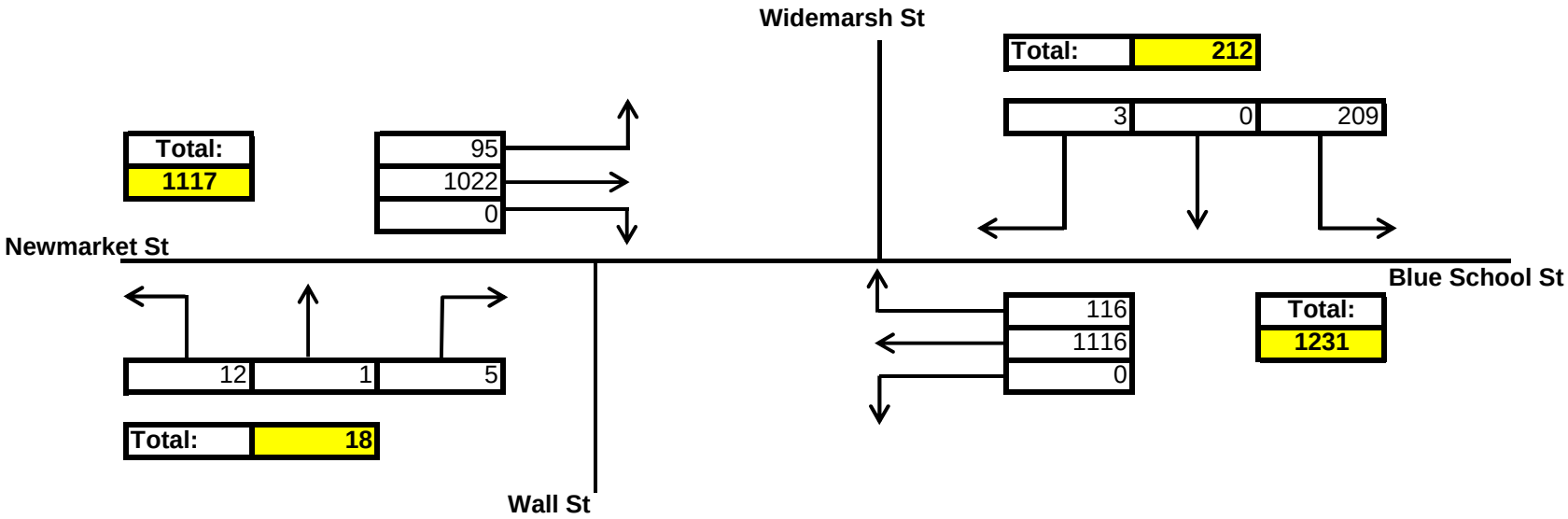
Turning Count Diagram: A438 / A465 Commercial Square

2014 PM Peak (16:45-17:45) PCU



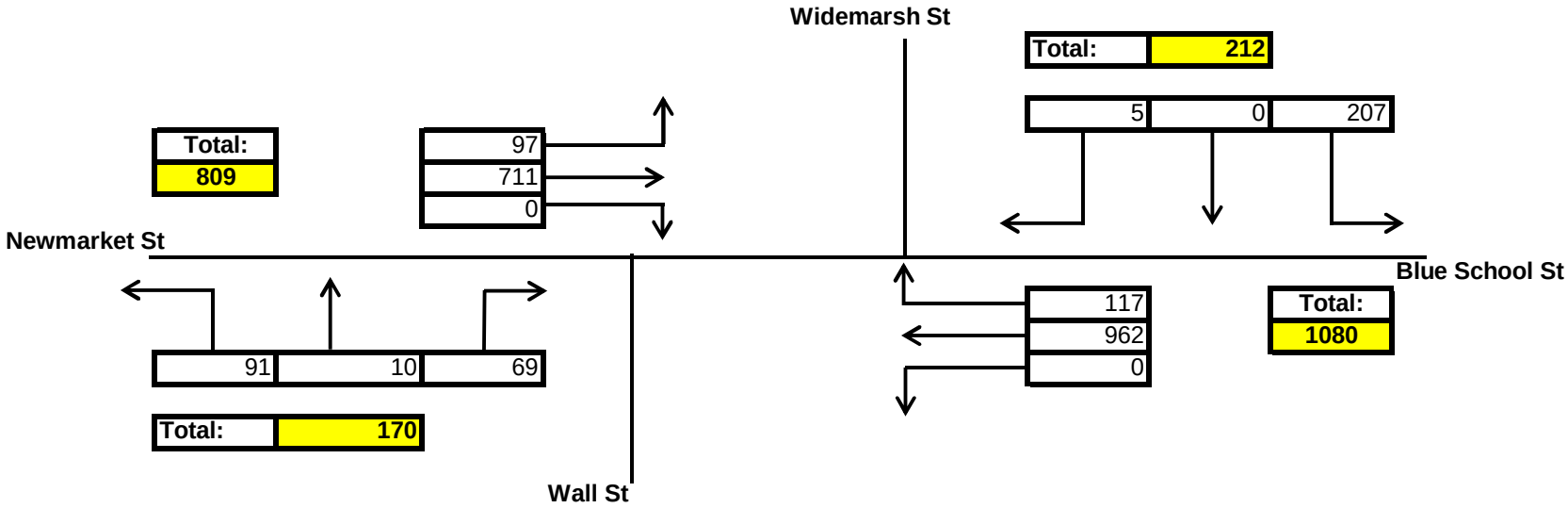
Turning Count Diagram: A438 / Widemarsh Gate

2014 AM Peak (08:00-09:00) PCU



Turning Count Diagram: A438 / Widemarsh Gate

2014 PM Peak (16:45-17:45) PCU



APPENDIX 5B

Summary of Queue Surveys

Summary of Queue Survey: A465 / Station Approach

AM Peak hour 08:30-09:30

	Station Approach			Commercial Road (S)					Retail Park			Commercial Road (N)			Stonebow Road		
TIME	LANE 1	LANE 2	**Total**	LANE 1	LANE 2	LANE 3	LANE 4	Total	LANE 1	LANE 2	**Total**	LANE 1	LANE 2	Total	LANE 1	LANE 2	Total
08:35	5	4	**9**	3	3	1	0	**7**	1	1	**2**	20	1	**21**	3	1	**4**
08:40	5	4	**9**	0	3	1	0	**4**	0	0	**0**	0	2	**2**	2	1	**3**
08:45	0	0	**0**	0	5	5	1	**11**	0	0	**0**	15	1	**16**	4	3	**7**
08:50	10	5	**15**	0	7	0	1	**8**	0	0	**0**	0	2	**2**	2	2	**4**
08:55	1	4	**5**	1	2	0	0	**3**	3	2	**5**	15	2	**17**	1	3	**4**
09:00	8	7	**15**	0	1	1	2	**4**	1	0	**1**	0	8	**8**	1	2	**3**
09:05	5	3	**8**	1	2	0	2	**5**	0	2	**2**	10	0	**10**	4	3	**7**
09:10	2	6	**8**	0	4	1	1	**6**	0	1	**1**	0	3	**3**	1	1	**2**
09:15	4	2	**6**	1	4	1	0	**6**	1	0	**1**	10	4	**14**	2	3	**5**
09:20	7	8	**15**	2	5	0	0	**7**	0	1	**1**	0	10	**10**	2	2	**4**
09:25	5	2	**7**	2	6	2	0	**10**	0	0	**0**	12	1	**13**	3	3	**6**
09:30	5	4	**9**	0	0	0	2	**2**	0	1	**1**	0	3	**3**	2	3	**5**
Average:	4.8	4.1	8.8	0.8	3.5	1.0	0.8	6.1	0.5	0.7	1.2	6.8	3.1	9.9	2.3	2.3	4.5
	10	8	15	3	7	5	2	11	3	2	5	20	10	21	4	3	7

PM Peak hour 16:45-17:45

	Station Approach			Commercial Road (S)					Retail Park			Commercial Road (N)			Stonebow Road		
TIME	LANE 1	LANE 2	**Total**	LANE 1	LANE 2	LANE 3	LANE 4	Total	LANE 1	LANE 2	Total	LANE 1	LANE 2	Total	LANE 1	LANE 2	Total
16:50	8	5	**13**	2	5	1	1	**9**	0	0	0	20	2	**22**	4	12	**16**
16:55	9	4	**13**	0	2	0	2	**4**	1	4	5	0	3	**3**	4	13	**17**
17:00	11	3	**14**	1	7	4	2	**14**	0	0	0	3	0	**3**	6	8	**14**
17:05	14	4	**18**	3	6	2	0	**11**	0	0	0	0	1	**1**	3	12	**15**
17:10	14	1	**15**	2	9	2	3	**16**	0	0	0	20	1	**21**	3	8	**11**
17:15	10	2	**12**	3	7	2	0	**12**	1	2	3	0	4	**4**	3	10	**13**
17:20	3	0	**3**	1	10	5	1	**17**	0	0	0	5	4	**9**	6	10	**16**
17:25	10	5	**15**	1	13	11	3	**28**	1	5	6	0	2	**2**	3	11	**14**
17:30	14	6	**20**	2	12	9	3	**26**	0	0	0	10	2	**12**	4	5	**9**
17:35	8	4	**12**	2	15	12	2	**31**	0	0	0	17	1	**18**	4	2	**6**
17:40	14	5	**19**	3	13	9	1	**26**	0	0	0	20	0	**20**	2	3	**5**
17:45	7	5	**12**	0	8	1	2	**11**	0	0	0	12	3	**15**	1	5	**6**
Average:	10.2	3.7	13.8	1.7	8.9	4.8	1.7	17.1	0.3	0.9	1.2	8.9	1.9	10.8	3.6	8.3	11.8
	14	6	20	3	15	12	3	31	1	5	6	20	4	22	6	13	17

Summary of Queue Surveys: A438 / A465 Commercial Square

AM Peak hour: 08:00-09:00

	Blue School St				Commercial Rd (S)		Union St		Bath Street				Commercial Rd (N)			
TIME	LANE 1	LANE 2	LANE 3	**Total**	LANE 1	**Total**	LANE 1	**Total**	LANE 1	LANE 2	LANE 3	**Total**	LANE 1	LANE 2	LANE 3	**Total**
08:05	2	3	2	**7**	0	**0**	0	**0**	10	10	2	**22**	5	5	4	**14**
08:10	5	12	12	**29**	0	**0**	0	**0**	6	6	0	**12**	3	6	4	**13**
08:15	8	8	4	**20**	0	**0**	0	**0**	7	10	1	**18**	1	6	4	**11**
08:20	10	8	5	**23**	0	**0**	0	**0**	0	0	0	**0**	4	6	4	**14**
08:25	12	12	1	**25**	0	**0**	0	**0**	6	5	1	**12**	6	5	5	**16**
08:30	5	5	5	**15**	0	**0**	0	**0**	0	3	2	**5**	3	8	5	**16**
08:35	1	0	0	**1**	0	**0**	0	**0**	10	12	0	**22**	1	8	4	**13**
08:40	2	3	4	**9**	0	**0**	0	**0**	1	6	0	**7**	4	3	8	**15**
08:45	2	4	3	**9**	0	**0**	0	**0**	2	5	2	**9**	6	3	8	**17**
08:50	2	6	1	**9**	0	**0**	0	**0**	3	8	0	**11**	2	12	10	**24**
08:55	5	8	4	**17**	0	**0**	0	**0**	2	10	0	**12**	3	10	10	**23**
09:00	12	12	1	**25**	0	**0**	0	**0**	4	10	0	**14**	5	7	7	**19**
Average	5.5	6.8	3.5	15.8	0.0	0.0	0.0	0.0	4.3	7.1	0.7	12.0	3.6	6.6	6.1	16.3
	12	12	12	29	0	0	0	0	10	12	2	22	6	12	10	24

PM Peak hour: 16:45-17:45

	Blue School St				Commercial Rd (S)		Union St		Bath Street				Commercial Rd (N)			
TIME	LANE 1	LANE 2	LANE 3	**Total**	LANE 1	**Total**	LANE 1	**Total**	LANE 1	LANE 2	LANE 3	**Total**	LANE 1	LANE 2	LANE 3	**Total**
16:50	0	3	4	**7**	0	**0**	0	**0**	1	2	1	**4**	2	11	7	**20**
16:55	3	4	8	**15**	0	**0**	0	**0**	7	5	2	**14**	1	21	12	**34**
17:00	0	6	5	**11**	0	**0**	0	**0**	0	4	6	**10**	3	18	10	**31**
17:05	4	5	4	**13**	0	**0**	0	**0**	3	0	5	**8**	2	3	20	**25**
17:10	0	4	2	**6**	0	**0**	0	**0**	6	6	0	**12**	4	8	17	**29**
17:15	0	7	0	**7**	0	**0**	0	**0**	5	11	0	**16**	4	8	17	**29**
17:20	6	10	0	**16**	0	**0**	0	**0**	5	12	0	**17**	3	6	7	**16**
17:25	3	3	2	**8**	0	**0**	0	**0**	5	6	5	**16**	1	6	4	**11**
17:30	1	5	0	**6**	0	**0**	0	**0**	2	5	0	**7**	2	3	5	**10**
17:35	0	2	3	**5**	0	**0**	0	**0**	0	1	0	**1**	4	3	5	**12**
17:40	8	8	0	**16**	0	**0**	0	**0**	4	6	1	**11**	4	6	8	**18**
17:45	1	3	0	**4**	0	**0**	0	**0**	2	1	2	**5**	5	3	2	**10**
Average	2.2	5.0	2.3	9.5	0.0	0.0	0.0	0.0	3.3	4.9	1.8	10.1	2.9	8.0	9.5	20.4
	8	10	8	16	0	0	0	0	7	12	6	17	5	21	20	34

Summary of Queue Survey: A438 / Widemarsh Gate

AM Peak hour: 08:00-09:00

	Widemarsh St (N)		Newmarket St			Widemarsh St (S)		Blue School St				Wall St	
TIME	LANE 1	**Total**	LANE 1	LANE 2	Total	LANE 1	Total	LANE 1	LANE 2	LANE 3	Total	LANE 1	Total
08:05	12	**12**	19	10	29	0	0	25	20	0	45	3	3
08:10	14	**14**	19	12	31	0	0	10	13	0	23	1	1
08:15	12	**12**	23	12	35	0	0	18	15	3	36	1	1
08:20	20	**20**	8	9	17	0	0	23	21	1	45	0	0
08:25	19	**19**	9	16	25	0	0	15	18	5	38	1	1
08:30	12	**12**	20	20	40	0	0	20	17	1	38	0	0
08:35	12	**12**	17	17	34	0	0	17	4	3	24	1	1
08:40	10	**10**	19	12	31	0	0	11	5	1	17	0	0
08:45	12	**12**	20	4	24	0	0	9	11	0	20	0	0
08:50	17	**17**	20	19	39	0	0	15	11	4	30	0	0
08:55	20	**20**	8	17	25	0	0	22	10	2	34	2	2
09:00	20	**20**	7	11	18	0	0	20	11	5	36	2	2
Average	15.0	15.0	15.8	13.3	29.0	0.0	0.0	17.1	13.0	2.1	32.2	0.9	0.9
	20	20	23	20	40	0	0	25	21	5	45	3	3

PM Peak hour: 16:45-17:45

	Widemarsh St (N)		Newmarket St			Widemarsh St (S)		Blue School St				Wall St	
TIME	LANE 1	**Total**	LANE 1	LANE 2	Total	LANE 1	Total	LANE 1	LANE 2	LANE 3	Total	LANE 1	Total
16:50	16	**16**	16	10	26	0	0	25	25	2	52	16	16
16:55	18	**18**	17	5	22	0	0	25	25	0	50	15	15
17:00	19	**19**	15	17	32	0	0	25	25	3	53	5	5
17:05	19	**19**	17	9	26	0	0	25	25	3	53	5	5
17:10	20	**20**	17	6	23	0	0	25	25	0	50	5	5
17:15	21	**21**	14	8	22	0	0	25	25	1	51	8	8
17:20	20	**20**	12	8	20	0	0	25	25	2	52	6	6
17:25	21	**21**	12	17	29	0	0	25	25	6	56	7	7
17:30	20	**20**	17	13	30	0	0	25	25	0	50	8	8
17:35	19	**19**	17	13	30	0	0	25	25	1	51	7	7
17:40	18	**18**	16	10	26	0	0	25	25	0	50	3	3
17:45	11	**11**	16	9	25	0	0	25	25	0	50	5	5
Average	18.6	18.6	15.5	10.4	25.9	0.0	0.0	25.0	25.0	1.5	51.5	7.5	7.5
	21	21	17	17	32	0	0	25	25	6	56	16	16

Please note that the Widemarsh St queues have been extracted from a different queue survey (one conducted by Traffic Survey Partners on 12/11/2014 because the original survey the queue survey data for Widemarsh St (N) showed zero queues, which were not reflected on-site.

APPENDIX 5C

SATURN Modelled Flows

A49 / Prior Street - Modelled Flows (in PCU) (from HCCTP Saturn Model)

2017 DS AM - A49/Prior St

	A	B	C	D	TOTAL
A: A49(N)	0	128	722	0	850
B: CLR	0	0	52	0	52
C: A49(S)	713	66	0	15	794
D: Prior St	0	0	0	0	0
TOTAL	713	195	774	15	1696

2017 DS IP - A49/Prior St

	A	B	C	D	TOTAL
A: A49(N)	0	26	730	0	756
B: CLR	0	0	116	0	116
C: A49(S)	666	99	0	7	772
D: Prior St	0	0	0	0	0
TOTAL	666	125	846	7	1644

2017 DS PM - A49/Prior St

	A	B	C	D	TOTAL
A: A49(N)	0	79	549	0	628
B: CLR	0	0	39	0	39
C: A49(S)	658	25	0	3	685
D: Prior St	0	0	0	0	0
TOTAL	658	103	588	3	1352

2032 DS AM - A49/Prior St

	A	B	C	D	TOTAL
A: A49(N)	0	129	1069	0	1198
B: CLR	0	0	87	0	87
C: A49(S)	620	24	0	16	660
D: Prior St	0	0	0	0	0
TOTAL	620	153	1156	16	1945

2032 DS IP - A49/Prior St

	A	B	C	D	TOTAL
A: A49(N)	0	28	887	0	916
B: CLR	0	0	12	0	12
C: A49(S)	742	74	0	9	826
D: Prior St	0	0	0	0	0
TOTAL	742	102	899	9	1753

2032 DS PM - A49/Prior St

	A	B	C	D	TOTAL
A: A49(N)	0	279	553	0	833
B: CLR	0	0	185	0	185
C: A49(S)	723	21	0	2	746
D: Prior St	0	0	0	0	0
TOTAL	723	300	738	2	1764

A465 / Station Approach / Stonebow Road - Modelled Flows (in PCU) (from HCCTP Saturn Model)

2017 DM AM - A465 / Station Approach & A465 / Stonebow Rd

	A	B	C	D	E	F	Tot:
A: Commercial Rd (N)	0	2	272	494	0	102	871
B: Retail Park	3	0	0	4	0	0	8
C: Stonebow Rd	40	0	0	38	0	4	81
D: Commercial Rd (S)	558	2	135	0	0	280	975
E: PFS	0	0	0	0	0	0	0
F: Station Approach	91	0	0	43	0	0	135
Tot:	692	5	408	579	0	386	2070

2017 DM IP - A465 / Station Approach & A465 / Stonebow Rd

	A	B	C	D	E	F	Tot:
A: Commercial Rd (N)	0	80	89	475	0	157	801
B: Retail Park	44	0	13	74	0	0	130
C: Stonebow Rd	47	0	0	106	0	0	154
D: Commercial Rd (S)	407	34	13	0	0	283	736
E: PFS	0	0	0	0	0	0	0
F: Station Approach	260	2	1	91	0	0	355
Tot:	757	117	115	746	0	440	2176

2017 DM PM - A465 / Station Approach & A465 / Stonebow Rd

	A	B	C	D	E	F	Tot:
A: Commercial Rd (N)	0	30	81	461	0	105	678
B: Retail Park	47	0	0	20	0	1	68
C: Stonebow Rd	172	0	0	135	0	0	307
D: Commercial Rd (S)	588	8	13	0	0	122	731
E: PFS	0	0	0	0	0	0	0
F: Station Approach	513	1	19	175	0	0	707
Tot:	1320	39	113	792	0	228	2492

2017 DS AM - A465 / Station Approach & A465 / Stonebow Rd

	A	B	C	D	E	F	Tot:
A: Commercial Rd (N)	0	1	195	377	0	426	999
B: Retail Park	3	0	0	1	0	4	8
C: Stonebow Rd	28	0	0	16	0	38	81
D: Commercial Rd (S)	400	2	154	0	0	150	706
E: PFS	0	0	0	0	0	0	0
F: Station Approach	92	2	59	7	0	0	162
Tot:	523	5	408	402	0	618	1956

2017 DS IP - A465 / Station Approach & A465 / Stonebow Rd

	A	B	C	D	E	F	Tot:
A: Commercial Rd (N)	0	53	65	310	0	317	745
B: Retail Park	18	0	13	8	0	91	131
C: Stonebow Rd	25	0	0	91	0	40	156
D: Commercial Rd (S)	295	22	12	0	0	57	386
E: PFS	0	0	0	0	0	0	0
F: Station Approach	196	42	25	41	0	0	304
Tot:	535	117	115	450	0	505	1722

2017 DS PM - A465 / Station Approach & A465 / Stonebow Rd

	A	B	C	D	E	F	Tot:
A: Commercial Rd (N)	0	29	78	238	0	359	704
B: Retail Park	30	0	0	7	0	31	69
C: Stonebow Rd	235	0	0	32	0	25	291
D: Commercial Rd (S)	454	8	15	0	0	92	569
E: PFS	0	0	0	0	0	0	0
F: Station Approach	246	1	13	159	0	0	419
Tot:	965	38	106	436	0	507	2052

2032 DM AM - A465 / Station Approach & A465 / Stonebow Rd

	A	B	C	D	E	F	Tot:
A: Commercial Rd (N)	0	3	279	534	0	103	920
B: Retail Park	5	0	0	4	0	0	10
C: Stonebow Rd	44	0	0	47	0	4	95
D: Commercial Rd (S)	644	4	101	0	0	301	1050
E: PFS	0	0	0	0	0	0	0
F: Station Approach	125	0	1	63	0	0	189
Tot:	818	8	381	649	0	408	2264

2032 DM IP - A465 / Station Approach & A465 / Stonebow Rd

	A	B	C	D	E	F	Tot:
A: Commercial Rd (N)	0	93	109	566	0	178	947
B: Retail Park	52	0	12	88	0	0	152
C: Stonebow Rd	66	0	0	123	0	0	190
D: Commercial Rd (S)	438	40	17	0	0	345	840
E: PFS	0	0	0	0	0	0	0
F: Station Approach	319	3	2	116	0	0	440
Tot:	876	136	140	894	0	523	2569

2032 DM PM - A465 / Station Approach & A465 / Stonebow Rd

	A	B	C	D	E	F	Tot:
A: Commercial Rd (N)	0	34	100	614	0	113	861
B: Retail Park	56	0	0	19	0	1	76
C: Stonebow Rd	187	0	0	151	0	0	339
D: Commercial Rd (S)	505	7	11	0	0	139	662
E: PFS	0	0	0	0	0	0	0
F: Station Approach	592	1	17	163	0	0	773
Tot:	1340	42	128	947	0	254	2710

2032 DS AM - A465 / Station Approach & A465 / Stonebow Rd

	A	B	C	D	E	F	Tot:
A: Commercial Rd (N)	0	1	195	369	0	447	1012
B: Retail Park	4	0	0	1	0	5	10
C: Stonebow Rd	26	0	0	24	0	46	95
D: Commercial Rd (S)	443	3	113	0	0	328	887
E: PFS	0	0	0	0	0	0	0
F: Station Approach	101	3	70	10	0	0	185
Tot:	574	8	378	404	0	825	2190

2032 DS IP - A465 / Station Approach & A465 / Stonebow Rd

	A	B	C	D	E	F	Tot:
A: Commercial Rd (N)	0	70	98	268	0	494	930
B: Retail Park	37	0	12	75	0	29	153
C: Stonebow Rd	56	0	0	91	0	45	193
D: Commercial Rd (S)	387	25	15	0	0	106	534
E: PFS	0	0	0	0	0	0	0
F: Station Approach	225	41	15	36	0	0	318
Tot:	706	136	140	470	0	674	2127

2032 DS PM - A465 / Station Approach & A465 / Stonebow Rd

	A	B	C	D	E	F	Tot:
A: Commercial Rd (N)	0	35	101	240	0	434	810
B: Retail Park	55	0	0	7	0	14	77
C: Stonebow Rd	279	0	0	32	0	13	324
D: Commercial Rd (S)	482	4	11	0	0	115	613
E: PFS	0	0	0	0	0	0	0
F: Station Approach	208	4	11	187	0	0	410
Tot:	1024	43	124	466	0	577	2234

Commercial Square and Widemarsh Gate - Modelled Flows (in PCU) (from HCCTP Saturn Model)

2017 DM AM - Newmarket St

	A	B	C	D	E	F	G	H	I	J	Tot.
A: Commercial Rd (N)	0	47	137	0	47	0	56	69	242	19	617
B: Bath St	136	0	2	0	43	0	66	76	558	240	1122
C: Union St	0	0	0	0	0	0	0	0	0	0	0
D: Commercial Rd (S)	0	0	0	0	0	0	0	0	0	0	0
E: Mayford (Entrance)	0	0	0	0	0	0	5	0	20	0	25
F: Mayford Street	0	0	0	0	0	0	3	0	15	0	19
G: Widemarsh St (S)	0	0	0	0	0	0	0	0	0	0	0
H: Wall St	44	12	0	0	0	0	0	0	23	19	98
I: Newmarket St	510	328	215	0	0	0	0	0	0	5	1058
J: Widemarsh St	1	89	18	0	0	0	3	0	0	0	111
Tot.	691	475	371	0	91	0	134	145	859	283	3048

2017 DM IP - Newmarket St

	A	B	C	D	E	F	G	H	I	J	Tot.
A: Commercial Rd (N)	0	73	142	0	172	0	0	57	365	21	829
B: Bath St	88	0	20	0	90	0	0	6	511	175	889
C: Union St	0	0	0	0	0	0	0	0	0	0	0
D: Commercial Rd (S)	0	0	0	0	0	0	0	0	0	0	0
E: Mayford (Entrance)	0	0	0	0	0	0	0	0	83	62	145
F: Mayford Street	0	0	0	0	0	0	0	0	90	26	116
G: Widemarsh St (S)	0	0	0	0	0	0	0	0	0	0	0
H: Wall St	45	76	1	0	0	0	0	0	227	21	370
I: Newmarket St	447	303	104	0	0	0	0	0	0	26	881
J: Widemarsh St	26	90	118	0	0	0	0	0	0	0	235
Tot.	607	543	385	0	262	0	0	63	1276	329	3465

2017 DM PM - Newmarket St

	A	B	C	D	E	F	G	H	I	J	Tot.
A: Commercial Rd (N)	0	64	103	0	9	0	22	110	567	46	921
B: Bath St	56	0	5	0	24	0	36	17	587	132	857
C: Union St	0	0	0	0	0	0	0	0	0	0	0
D: Commercial Rd (S)	0	0	0	0	0	0	0	0	0	0	0
E: Mayford (Entrance)	0	0	0	0	0	0	49	0	105	0	154
F: Mayford Street	0	0	0	0	0	0	8	0	17	0	25
G: Widemarsh St (S)	0	0	0	0	0	0	0	0	0	0	0
H: Wall St	58	48	23	0	0	0	0	0	67	20	217
I: Newmarket St	470	293	86	0	0	0	0	0	0	1	850
J: Widemarsh St	2	82	12	0	0	0	46	0	0	0	142
Tot.	586	487	229	0	33	0	162	127	1343	199	3167

2017 DS AM - Newmarket St

	A	B	C	D	E	F	G	H	I	J	Tot.
A: Commercial Rd (N)	0	76	164	0	55	0	54	55	119	2	527
B: Bath St	78	0	0	0	7	0	79	88	540	229	1020
C: Union St	0	0	0	0	0	0	0	0	0	0	0
D: Commercial Rd (S)	0	0	0	0	0	0	0	0	0	0	0
E: Mayford (Entrance)	1	0	1	0	0	0	9	0	2	16	29
F: Mayford Street	0	0	0	0	0	0	0	0	14	2	16
G: Widemarsh St (S)	0	0	0	0	0	0	0	0	0	0	0
H: Wall St	31	12	0	0	0	0	0	0	24	31	98
I: Newmarket St	217	227	78	0	0	9	0	0	0	9	540
J: Widemarsh St	0	60	3	0	0	1	16	0	0	0	81
Tot.	327	375	246	0	62	10	159	143	699	289	2310

2017 DS IP - Newmarket St

	A	B	C	D	E	F	G	H	I	J	Tot.
A: Commercial Rd (N)	0	61	169	0	135	0	0	48	146	0	560
B: Bath St	68	0	20	0	60	0	0	6	520	132	806
C: Union St	0	0	0	0	0	0	0	0	0	0	0
D: Commercial Rd (S)	0	0	0	0	0	0	0	0	0	0	0
E: Mayford (Entrance)	11	38	0	0	0	0	0	0	72	23	145
F: Mayford Street	0	0	0	0	0	0	0	0	97	17	114
G: Widemarsh St (S)	0	0	0	0	0	0	0	0	0	0	0
H: Wall St	12	57	1	0	0	0	0	0	249	56	375
I: Newmarket St	51	299	58	0	0	29	0	8	0	36	482
J: Widemarsh St	0	60	59	0	0	27	0	0	0	0	146
Tot.	142	515	307	0	195	56	0	62	1083	266	2627

2017 DS PM - Newmarket St

	A	B	C	D	E	F	G	H	I	J	Tot.
A: Commercial Rd (N)	9	160	141	0	9	0	20	70	271	1	672
B: Bath St	35	0	5	0	19	0	45	39	561	17	721
C: Union St	0	0	0	0	0	0	0	0	0	0	0
D: Commercial Rd (S)	0	0	0	0	0	0	0	0	0	0	0
E: Mayford (Entrance)	13	38	3	0	0	0	3	0	75	21	152
F: Mayford Street	0	0	0	0	0	0	0	0	20	2	22
G: Widemarsh St (S)	0	0	0	0	0	0	0	0	0	0	0
H: Wall St	53	48	29	0	0	0	0	0	74	14	217
I: Newmarket St	151	73	32	0	0	1	0	7	0	1	264
J: Widemarsh St	0	0	0	0	0	0	162	0	0	0	162
Tot.	253	319	209	0	28	1	229	115	1001	54	2210

2032 DM AM - Newmarket St

	A	B	C	D	E	F	G	H	I	J	Tot.
A: Commercial Rd (N)	0	48	138	0	61	0	56	76	289	27	696
B: Bath St	135	0	2	0	57	0	100	68	746	284	1391
C: Union St	0	0	0	0	0	0	0	0	0	0	0
D: Commercial Rd (S)	0	0	0	0	0	0	0	0	0	0	0
E: Mayford (Entrance)	0	0	0	0	0	0	16	0	37	0	53
F: Mayford Street	0	0	0	0	0	0	6	0	20	0	25
G: Widemarsh St (S)	0	0	0	0	0	0	0	0	0	0	0
H: Wall St	54	16	0	0	0	0	0	0	28	20	118
I: Newmarket St	523	470	237	0	0	0	0	0	0	5	1236
J: Widemarsh St	2	101	28	0	0	0	0	0	0	0	132
Tot.	715	636	406	0	118	0	178	144	1119	336	3651

2032 DM IP - Newmarket St

	A	B	C	D	E	F	G	H	I	J	Tot.
A: Commercial Rd (N)	0	67	160	0	255	0	0	53	407	36	979
B: Bath St	129	0	16	0	146	0	0	44	608	237	1180
C: Union St	0	0	0	0	0	0	0	0	0	0	0
D: Commercial Rd (S)	0	0	0	0	0	0	0	0	0	0	0
E: Mayford (Entrance)	0	0	0	0	0	0	0	0	165	91	257
F: Mayford Street	0	0	0	0	0	0	0	0	128	35	163
G: Widemarsh St (S)	0	0	0	0	0	0	0	0	0	0	0
H: Wall St	53	136	1	0	0	0	0	0	230	24	445
I: Newmarket St	418	424	125	0	0	0	0	0	0	31	998
J: Widemarsh St	77	90	124	0	0	0	0	0	0	0	291
Tot.	678	717	426	0	402	0	0	98	1538	454	4313

2032 DM PM - Newmarket St

	A	B	C	D	E	F	G	H	I	J	Tot.
A: Commercial Rd (N)	0	65	122	0	24	0	83	100	634	46	1074
B: Bath St	77	0	3	0	57	0	70	39	736	199	1181
C: Union St	0	0	0	0	0	0	0	0	0	0	0
D: Commercial Rd (S)	0	0	0	0	0	0	0	0	0	0	0
E: Mayford (Entrance)	0	0	0	0	0	0	101	0	175	2	278
F: Mayford Street	0	0	0	0	0	0	15	0	17	0	33
G: Widemarsh St (S)	0	0	0	0	0	0	0	0	0	0	0
H: Wall St	59	73	1	0	0	0	0	0	78	30	242
I: Newmarket St	349	111	56	0	0	0	0	0	0	10	526
J: Widemarsh St	2	47	6	0	0	0	98	0	0	0	152
Tot.	488	296	187	0	81	0	368	139	1639	287	3486

2032 DS AM - Newmarket St

	A	B	C	D	E	F	G	H	I	J	Tot.
A: Commercial Rd (N)	0	77	196	0	74	0	35	60	108	1	553
B: Bath St	190	0	0	0	9	0	109	86	618	187	1198
C: Union St	0	0	0	0	0	0	0	0	0	0	0
D: Commercial Rd (S)	0	0	0	0	0	0	0	0	0	0	0
E: Mayford (Entrance)	2	1	1	0	0	0	13	0	0	30	54
F: Mayford Street	0	0	0	0	0	0	0	0	19	3	21
G: Widemarsh St (S)	0	0	0	0	0	0	0	0	0	0	0
H: Wall St	41	16	0	0	0	0	0	0	35	26	118
I: Newmarket St	229	260	108	0	0	8	0	0	0	1	607
J: Widemarsh St	0	95	7	0	0	1	20	0	0	0	123
Tot.	462	450	312	0	84	9	176	147	786	247	2674

2032 DS IP - Newmarket St

	A	B	C	D	E	F	G	H	I	J	Tot.
A: Commercial Rd (N)	0	67	256	0	169	0	0	38	149	0	679
B: Bath St	71	0	12	0	141	0	0	35	643	148	1050
C: Union St	0	0	0	0	0	0	0	0	0	0	0
D: Commercial Rd (S)	0	0	0	0	0	0	0	0	0	0	0
E: Mayford (Entrance)	17	72	0	0	0	0	0	0	111	33	234
F: Mayford Street	0	0	0	0	0	0	0	0	133	27	160
G: Widemarsh St (S)	0	0	0	0	0	0	0	0	0	0	0
H: Wall St	15	120	1	0	0	0	0	0	257	53	445
I: Newmarket St	115	301	70	0	0	35	0	8	0	21	549
J: Widemarsh St	0	44	19	0	0	40	0	6	181	0	290
Tot.	217	604	358	0	309	75	0	88	1475	282	3408

2032 DS PM - Newmarket St

	A	B	C	D	E	F	G	H	I	J	Tot.
A: Commercial Rd (N)	0	176	156	0	17	0	8	45	176	2	580
B: Bath St	26	0	0	0	66	0	67	65	726	6	956
C: Union St	0	0	0	0	0	0	0	0	0	0	0
D: Commercial Rd (S)	0	0	0	0	0	0	0	0	0	0	0
E: Mayford (Entrance)	22	77	2	0	0	0	11	0	130	39	281
F: Mayford Street	0	0	0	0	0	0	0	0	29	3	31
G: Widemarsh St (S)	0	0	0	0	0	0	0	0	0	0	0
H: Wall St	23	109	1	0	0	0	0	0	94	15	242
I: Newmarket St	136	105	39	0	0	2	0	5	0	5	293
J: Widemarsh St	0	25	2	0	0	0	132	1	2	0	162
Tot.	207	491	199	0	83	3	219	116	1156	70	2544

Note 1: Movements from Zone F to Zones A and B (on SATURN) do a U-turn at the A49 Edgar Street Roundabout (outside of the modelled junction network on LinSig). The Matrices have been altered to reflect this by re-recording movements from Zone F to Zones A and B as flows from Zone F to I and then flows from Zone I to Zones A and B. This process was also done for the DM scenarios for flows going from Zone E to Zones A and B.

Note 2: Movements from Zones I and J to Zone E (on SATURN) turn right into Union St, left into Gaol St and then double back via the Symonds St junction (outside of the modelled junction network on LinSig). The matrices have been altered to reflect this by re-recording movements from Zones I and J to Zone E as flows from Zones I and J to Zone C and then flows from Zone B to Zone E. This process was also done for the DM scenarios for flows going from Zone I to H, Zone J to I, and Zone J to H.