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MEMO

TO:	File
FROM:	Keyur Shah
DATE:	February 1, 2010
COPIES:	
OUR FILE:	W:\7k\7359 City Center BRT Functional Planning\7359.500 Transport\7359.505 Technical Memos\PM peak hour analysis\7359-ks-Memo-Revised Network Signal Configuration\7359-ks-Sce 7.doc
SUBJECT:	Afternoon peak hour traffic analysis for City Centre Mississauga BRT for Background Traffic (Existing Traffic + 30% Growth)

The memorandum presents the results of Traffic Analysis for the revised network configuration at Rathburn Road and City Centre Drive. As discussed in previous memorandum on dated October 26, 2009; Scenario 5.1 presents the Background traffic with the signalized intersection at Rathburn Road and Hammerson Drive was reanalyzed with revised network configuration at Rathburn Road and City Centre/ Centre View Drive Intersection. The revised BRT design used for this Scenario is presented in **Technical Appendix A**.

BRT Preliminary Design: In this Scenario 7.1 following road network changes were considered from the previous Scenario 5.1:

- Northbound left turn was closed for the general purpose traffic and only allowed for the buses. Hence, necessary traffic was redistribution based on existing traffic pattern. The revised traffic volume distribution was presented in **Technical Appendix B;**
- Mississauga Transit buses are assumed to enter to Rathburn Road and City Centre View Drive intersection from Highway 403 off-ramp. The BRT and Mississauga Transit buses assume to travel through on General Purpose Lane on Rathburn Road and then merge into BRT lane;
- The Westbound BRT bus station assume to shift to west of Rathburn Road and Station Gate intersection, which was previously designed at east of the intersection. Due to this change, the BRT buses were turning right to Station Gate Road were assumed to turn right on Duke of York Boulevard.
- Due to revised volume distribution, the southbound right turn traffic demand may increase significantly and therefore, it was assume to provide an extra storage lane of 35 to 40 m length for the southbound right turn traffic. This provision will increase the intersection capacity and reduce the delay to the all the movements.

Transit Network: The a.m. peak hour BRT and local bus operation assumptions were utilised for the p.m. peak hour VISSIM analysis.

Signal Timings: The revised traffic volumes were input into a Synchro model of the City Centre area and signal timings were optimized (presented in **Technical Appendix C**). For this Scenario, the following changes in the signal timing designed were considered:

- At Rathburn Road/ City Centre Drive, the eastbound and westbound left turn is assumed to travel in protected phase (instead of protected + permitted in Scenario 5.1) and the BRT buses are assume to travel in the same phase with eastbound through traffic.
- Similarly, at the Rathburn Road/ Hammerson Drive (Square-One North Entrance), the westbound left turn was assume to turn in protected phase and the BRT buses are assume to travel in the same phase with the eastbound through traffic.
- In this configuration the westbound BRT buses are not require to turn right at Rathburn Road/ Station Gate. Therefore, the dedicated phase for the BRT line is removed from this intersection and provided at the Rathburn Road/ Duke of York Boulevard intersection. The BRT buses is assumed to arrive at Rathburn Road/ Duke of York Boulevard intersection in a dedicated lane and travel to westbound through and westbound right.

Results: The results were simulated using VISSIM. The intersection Levels of Service (LOS) and Delay for Scenario 7.1 is presented in Table 1. The LOS and Queue Lengths for the critical movements at each intersection are also included. The overall intersection delays, level of service and queue length results are provided in the **Technical Appendix D**.

Table 1: Intersection Delay, LOS and Queue Length

	Overall Intersection		Critical Movement		
Intersection	Average Delay	LOS	Movement	LOS	Queue Length 95%
Rathburn Road at Duke of York Blvd.	44.2	D	WBT	D	186
Rathburn Road at City Center Transit Terminal	35.1	D	EBT/ NBL	C/F	188/ 69
Rathburn Road at Square One North Entrance	26.0	C	WBL	E	67
Rathburn Road at City Centre Drive	69.7	E	WBT	F	128
City Centre Drive at Square One West Entrance	31.5	C	EBL	E	83
Centre View Drive at Station Gate Road	0.8	A	NBL	D	7
Centre View Drive at Duke of York Blvd.	17.4	B	NBL	C	74
Square One West and DOY Blvd	15.0	B	WBL	D	49

BRT Travel Times

The BRT bus travel time results from Scenario 5 and Scenario 6 are summarized in Table 2, providing a summary of all BRT bus travel times going between points A and B (EB) and going between points B and A (WB). Point A is located on the Eastern edge of Station Gate Road on Rathburn Road. Point B is located on the Western edge of City Centre Drive on Rathburn Road. Figure 4 shows a VISSIM image indicating the placement of these points.

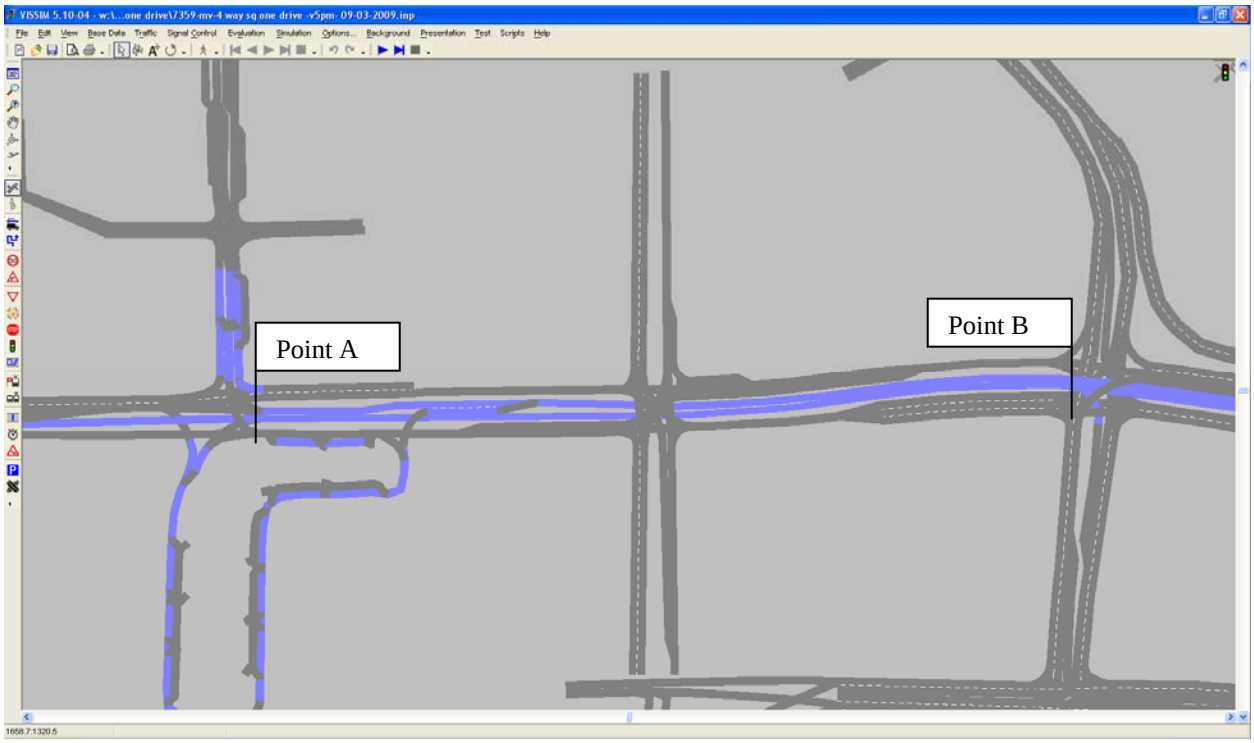


Figure 1: BRT Travel Time Point

Table 2: Summary of BRT Bus Travel Times between Points A and B (EB) and Points B and A (WB)

Movements	EB- BRT buses	WB BRT buses	WBL Buses (Mississauga transit entering to Station)	EBGPL (Travel time on EB GPL)	WBGPL (Travel time on WB GPL)
Travel Time Segment	1	2	5	3	4
Hourly Volume (vph)	39	18	36	609	834
Travel Time (Sec)	74*	29	60	66	75

* - This travel time includes 51 seconds of travel time + 20 seconds of dwelling time for bus stopping at EB BRT stop.

Conclusion:

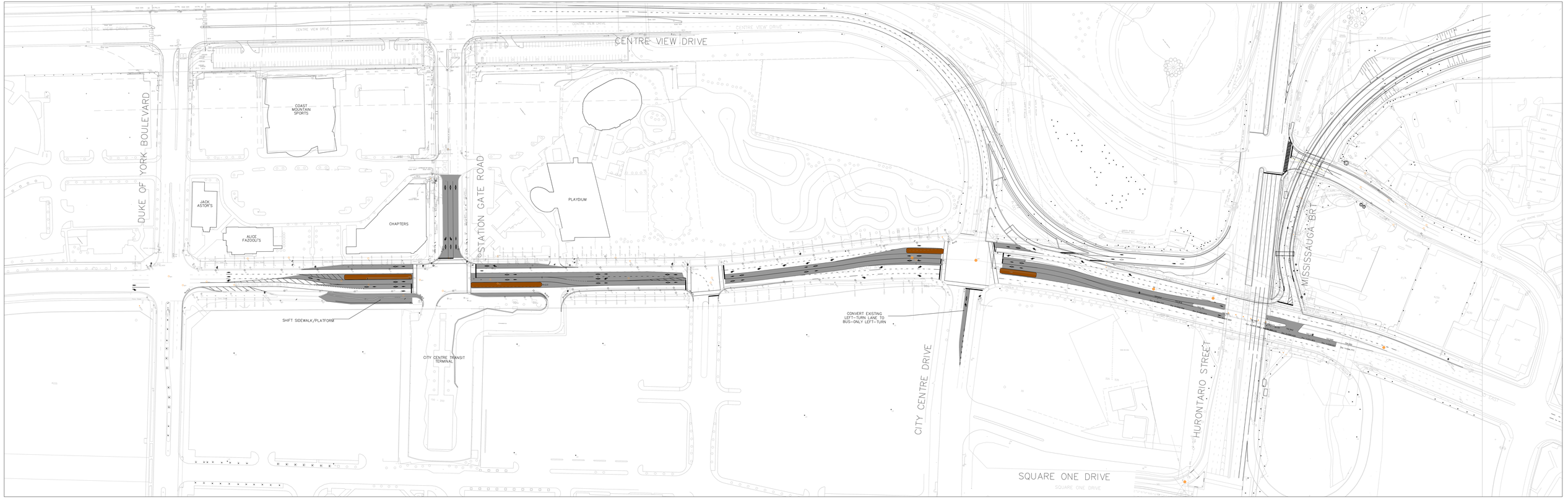
This analysis results shows that revised signal timing plans without dedicated phase for BRT line and protected left turn at Rathburn Road / City Centre View Drive and Rathburn Road / Hammerson Drive will provide almost same overall level of service to the intersection though it will reduce the travel time of BRT lines significantly.

The buses entering from the Highway 403 off ramp will reduce the overall intersection capacity at the Rathburn Road / City Centre Drive intersection and it increase the conflict with westbound through and westbound right turning traffic. It is advisable to conduct the detailed safety review for this proposed bus route from Highway 403 off-ramp to Rathburn Road.

The provision of extra right turn storage lane will ease the traffic congestion at Rathburn Road/ Duke of York Boulevard intersection.

APPENDIX A

PRELIMINARY DESIGN PLAN FOR PROPOSED BRT FACILITY

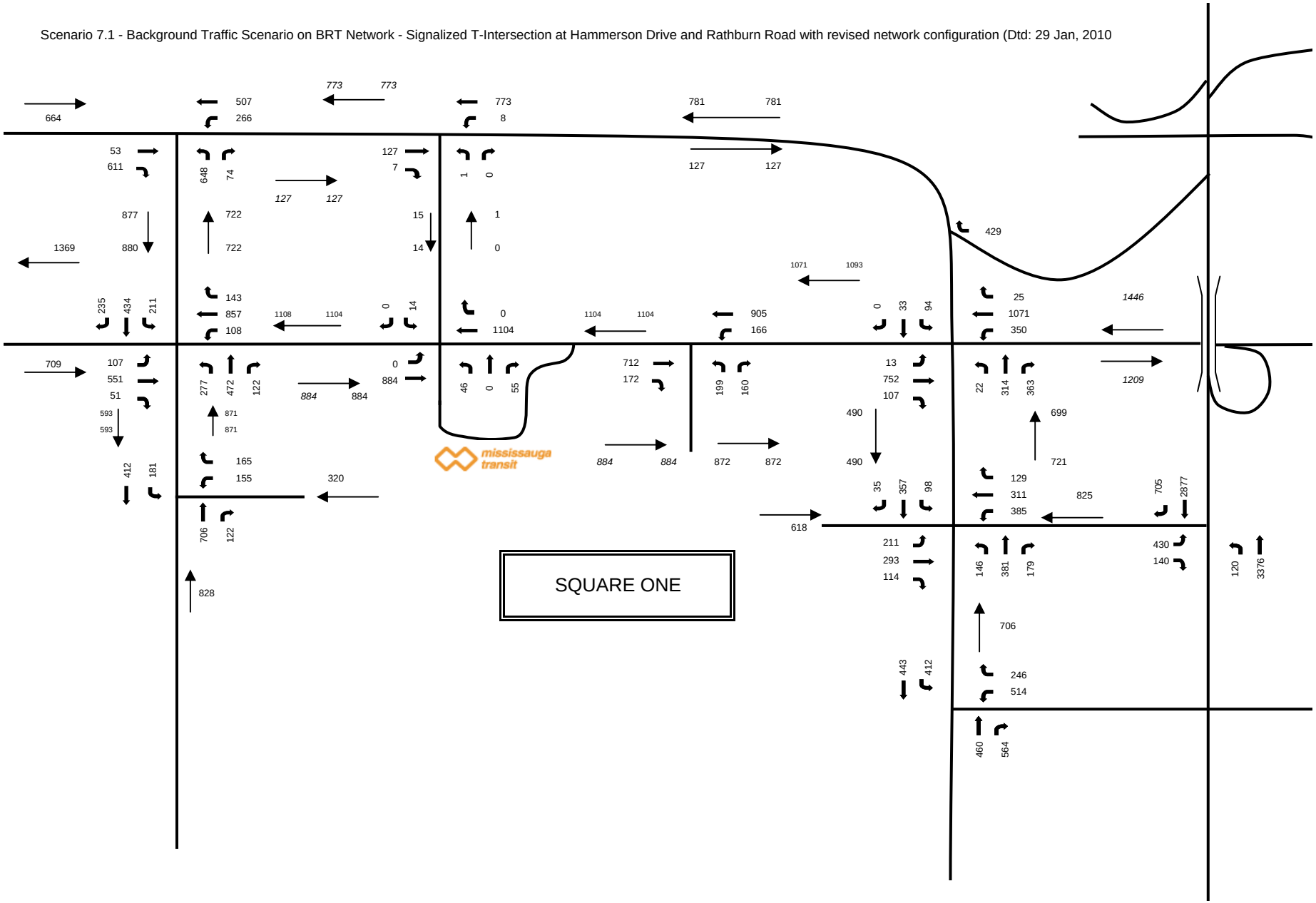

CENTRE VIEW DRIVE
DUKE OF YORK BOULEVARD
COAST MOUNTAIN SPORTS
JACK ASTOR'S
ALICE FAZOOLI'S
CHAPTERS
STATION GATE ROAD
PLAYDIUM
SHIFT SIDEWALK/PLATFORM
CITY CENTRE TRANSIT TERMINAL
CONVERT EXISTING LEFT-TURN LANE TO BUS-ONLY LEFT-TURN
CITY CENTRE DRIVE
SQUARE ONE DRIVE
HURONTARIO STREET
MISSISSAUGA BRT

Scale 1:500

APPENDIX B

VOLUME DISTRIBUTION FOR SCENARIO 7.1

Scenario 7.1 - Background Traffic Scenario on BRT Network - Signalized T-Intersection at Hammerson Drive and Rathburn Road with revised network configuration (Dtd: 29 Jan, 2010



APPENDIX C

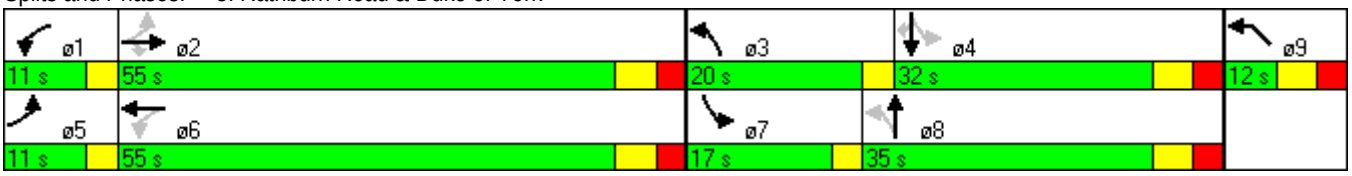
SYNCHRO OUTPUT- FUTURE SIGNAL TIMINGS

Lane Group	EBL	EBT	EBR2	WBL	WBT	NBL	NBT	SBL2	SBT	SBR	NWL
Lane Configurations											
Volume (vph)	82	424	39	83	673	213	363	162	334	186	20
Turn Type	pm+pt		Perm	pm+pt		pm+pt		pm+pt		Perm	
Protected Phases	5	2		1	6	3	8	7	4		9
Permitted Phases	2		2	6		8		4		4	
Detector Phase	5	2	2	1	6	3	8	7	4	4	9
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	11.0	23.0	23.0	11.0	23.0	11.0	23.0	11.0	23.0	23.0	11.0
Total Split (s)	11.0	55.0	55.0	11.0	55.0	20.0	35.0	17.0	32.0	32.0	12.0
Total Split (%)	8.5%	42.3%	42.3%	8.5%	42.3%	15.4%	26.9%	13.1%	24.6%	24.6%	9.2%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0	4.0	4.0
All-Red Time (s)	0.0	3.0	3.0	0.0	3.0	0.0	3.0	0.0	3.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	7.0	7.0	3.0	7.0	3.0	7.0	3.0	7.0	7.0	7.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag	
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	Min	None	Min	Min	None
Act Effct Green (s)	63.2	51.4	51.4	63.1	51.3	48.3	27.3	42.3	24.3	24.3	5.2
Actuated g/C Ratio	0.49	0.40	0.40	0.49	0.39	0.37	0.21	0.33	0.19	0.19	0.04
v/c Ratio	0.63	0.81	0.08	0.52	0.79	0.86	0.89	0.87	0.71	0.58	0.61
Control Delay	35.0	45.9	10.2	25.2	40.1	49.9	59.4	60.9	54.5	19.6	95.6
Queue Delay	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.0	45.9	10.2	25.2	40.6	49.9	59.4	60.9	54.5	19.6	95.6
LOS	C	D	B	C	D	D	E	E	D	B	F
Approach Delay		41.7			39.2		56.4		46.5		95.6
Approach LOS		D			D		E		D		F

Intersection Summary

Cycle Length: 130
Actuated Cycle Length: 130
Offset: 114 (88%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 46.2 Intersection LOS: D
Intersection Capacity Utilization 91.1% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 3: Rathburn Road & Duke of York

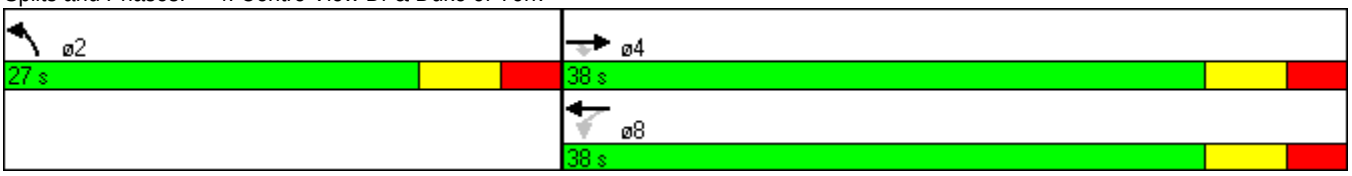


Lane Group	EBT	EBR	WBL	WBT	NBL
Lane Configurations					
Volume (vph)	41	470	212	393	498
Turn Type		Perm	Perm		
Protected Phases	4			8	2
Permitted Phases		4	8		
Detector Phase	4	4	8	8	2
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	23.0	23.0	23.0	23.0	23.0
Total Split (s)	38.0	38.0	38.0	38.0	27.0
Total Split (%)	58.5%	58.5%	58.5%	58.5%	41.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.0	7.0	7.0	7.0	7.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	C-Max	C-Max	None	None	Min
Act Effct Green (s)	32.6	32.6	32.6	32.6	18.4
Actuated g/C Ratio	0.50	0.50	0.50	0.50	0.28
v/c Ratio	0.03	0.59	0.44	0.31	0.79
Control Delay	9.0	3.4	18.5	14.7	36.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	9.0	3.4	18.5	14.7	36.5
LOS	A	A	B	B	D
Approach Delay	3.9			16.0	36.5
Approach LOS	A			B	D

Intersection Summary

Cycle Length: 65
Actuated Cycle Length: 65
Offset: 0 (0%), Referenced to phase 4:EBT, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 19.1 Intersection LOS: B
Intersection Capacity Utilization 64.8% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 4: Centre View Dr & Duke of York



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations										
Volume (vph)	10	579	269	824	19	15	276	279	72	25
Turn Type	Prot		Prot		Perm	pm+pt		Perm	pm+pt	
Protected Phases	5	2	1	6		3	8		7	4
Permitted Phases					6	8		8	4	
Detector Phase	5	2	1	6	6	3	8	8	7	4
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	23.0	11.0	23.0	23.0	11.0	23.0	23.0	7.0	19.0
Total Split (s)	10.0	53.0	38.0	81.0	81.0	11.0	32.0	32.0	7.0	28.0
Total Split (%)	7.7%	40.8%	29.2%	62.3%	62.3%	8.5%	24.6%	24.6%	5.4%	21.5%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	2.0	3.0	2.0	3.0	3.0	0.0	3.0	3.0	0.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	7.0	5.0	7.0	7.0	4.0	7.0	7.0	3.0	7.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	Max	Max	None	None	None	None	None
Act Effct Green (s)	5.0	48.4	30.6	80.0	80.0	34.4	25.0	25.0	31.9	25.5
Actuated g/C Ratio	0.04	0.37	0.24	0.62	0.62	0.26	0.19	0.19	0.25	0.20
v/c Ratio	0.20	0.71	0.90	1.00	0.03	0.06	1.08	0.64	0.86	0.05
Control Delay	69.0	27.3	73.2	53.2	6.8	42.2	118.6	17.4	96.2	45.6
Queue Delay	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0
Total Delay	69.0	27.5	73.2	53.2	6.8	42.2	118.6	18.1	96.2	45.6
LOS	E	C	E	D	A	D	F	B	F	D
Approach Delay		28.1		57.3			67.4			83.2
Approach LOS		C		E			E			F

Intersection Summary

Cycle Length: 130
Actuated Cycle Length: 130
Offset: 0 (0%), Referenced to phase 2:EBT, Start of Green, Master Intersection
Natural Cycle: 150
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.08
Intersection Signal Delay: 52.7 Intersection LOS: D
Intersection Capacity Utilization 102.9% ICU Level of Service G
Analysis Period (min) 15

Splits and Phases: 8: Rathburn Road & Centre View Dr

Lane Group	EBT	WBT	NBL	NBR	SBL
Lane Configurations					
Volume (vph)	680	866	35	42	11
Turn Type			custom	custom	Perm
Protected Phases	2	6			
Permitted Phases			8	8	4
Detector Phase	2	6	8	8	4
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	27.0	27.0	20.0	20.0	23.0
Total Split (s)	107.0	107.0	23.0	23.0	23.0
Total Split (%)	82.3%	82.3%	17.7%	17.7%	17.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.0	7.0	7.0	7.0	7.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	C-Max	C-Max	None	None	None
Act Effct Green (s)	110.1	110.1	9.8	9.8	9.8
Actuated g/C Ratio	0.85	0.85	0.08	0.08	0.08
v/c Ratio	0.60	0.77	0.46	0.34	0.12
Control Delay	4.4	5.9	69.9	18.5	56.1
Queue Delay	0.2	0.0	0.0	0.0	0.0
Total Delay	4.6	6.0	69.9	18.5	56.1
LOS	A	A	E	B	E
Approach Delay	4.6	6.0			
Approach LOS	A	A			

Intersection Summary

Cycle Length: 130
Actuated Cycle Length: 130
Offset: 93 (72%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 7.4 Intersection LOS: A
Intersection Capacity Utilization 78.4% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 11: Rathburn Rd & Station Gate Rd

Lane Group	EBT	WBT	ø8
Lane Configurations			
Volume (vph)	98	606	
Turn Type			
Protected Phases	2	6	8
Permitted Phases			
Detector Phase	2	6	
Switch Phase			
Minimum Initial (s)	4.0	4.0	4.0
Minimum Split (s)	23.0	23.0	23.0
Total Split (s)	42.0	42.0	23.0
Total Split (%)	64.6%	64.6%	35%
Yellow Time (s)	4.0	4.0	4.0
All-Red Time (s)	3.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	
Total Lost Time (s)	7.0	7.0	
Lead/Lag			
Lead-Lag Optimize?			
Recall Mode	C-Max	C-Max	Min
Act Effct Green (s)	45.5	45.5	
Actuated g/C Ratio	0.70	0.70	
v/c Ratio	0.06	0.34	
Control Delay	3.2	3.4	
Queue Delay	0.0	0.0	
Total Delay	3.2	3.4	
LOS	A	A	
Approach Delay	3.2	3.4	
Approach LOS	A	A	

Intersection Summary	
Cycle Length: 65	
Actuated Cycle Length: 65	
Offset: 35 (54%), Referenced to phase 2:EBT and 6:WBTL, Start of Green	
Natural Cycle: 50	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.34	
Intersection Signal Delay: 3.4	Intersection LOS: A
Intersection Capacity Utilization 27.6%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 12: Centre View Dr & Station Gate Rd

Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Configurations					
Volume (vph)	548	127	715	153	123
Turn Type		Prot			Prot
Protected Phases	2	1	6	8	8
Permitted Phases					
Detector Phase	2	1	6	8	8
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	23.0	11.0	23.0	23.0	23.0
Total Split (s)	83.0	20.0	103.0	27.0	27.0
Total Split (%)	63.8%	15.4%	79.2%	20.8%	20.8%
Yellow Time (s)	4.0	3.0	4.0	4.0	4.0
All-Red Time (s)	3.0	0.0	3.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.0	3.0	7.0	7.0	7.0
Lead/Lag	Lag	Lead			
Lead-Lag Optimize?					
Recall Mode	C-Min	None	C-Max	None	None
Act Effct Green (s)	78.5	15.9	97.4	18.6	18.6
Actuated g/C Ratio	0.60	0.12	0.75	0.14	0.14
v/c Ratio	0.86	0.82	0.72	0.84	0.46
Control Delay	23.1	78.5	6.3	81.5	11.0
Queue Delay	0.4	0.0	0.5	0.0	0.0
Total Delay	23.5	78.5	6.8	81.5	11.0
LOS	C	E	A	F	B
Approach Delay	23.5		17.6	50.0	
Approach LOS	C		B	D	

Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 104 (80%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 24.8	Intersection LOS: C
Intersection Capacity Utilization 83.1%	ICU Level of Service E
Analysis Period (min) 15	

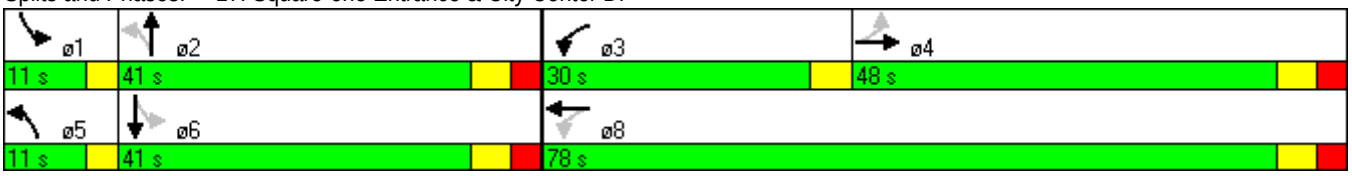
Splits and Phases: 14: Rathburn Road & Hammerson Dr

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	162	225	296	239	112	292	75	275
Turn Type	Perm		pm+pt		pm+pt		pm+pt	
Protected Phases		4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	23.0	23.0	11.0	23.0	11.0	23.0	11.0	23.0
Total Split (s)	48.0	48.0	30.0	78.0	11.0	41.0	11.0	41.0
Total Split (%)	36.9%	36.9%	23.1%	60.0%	8.5%	31.5%	8.5%	31.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	3.0	3.0	0.0	3.0	0.0	3.0	0.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.0	7.0	4.0	7.0	3.0	7.0	3.0	7.0
Lead/Lag	Lag	Lag	Lead		Lead	Lag	Lead	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	C-Min	None	C-Min
Act Effct Green (s)		39.8	70.4	67.4	52.6	48.6		36.8
Actuated g/C Ratio		0.31	0.54	0.52	0.40	0.37		0.28
v/c Ratio		0.91	0.88	0.26	0.50	0.46		0.75
Control Delay		60.0	40.6	14.4	33.2	29.8		25.5
Queue Delay		0.0	0.0	0.0	0.0	0.0		0.0
Total Delay		60.0	40.6	14.4	33.2	29.8		25.5
LOS		E	D	B	C	C		C
Approach Delay		60.0		26.6		30.5		25.5
Approach LOS		E		C		C		C

Intersection Summary

Cycle Length: 130
Actuated Cycle Length: 130
Offset: 104 (80%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 35.3 Intersection LOS: D
Intersection Capacity Utilization 92.6% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 17: Square-one Entrance & City Center Dr

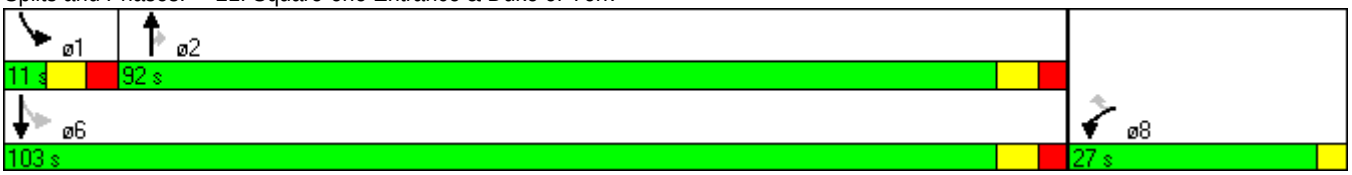


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	119	127	543	94	139	317
Turn Type		Perm		Perm	pm+pt	
Protected Phases	8		2		1	6
Permitted Phases		8		2	6	
Detector Phase	8	8	2	2	1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	23.0	23.0	23.0	23.0	11.0	23.0
Total Split (s)	27.0	27.0	92.0	92.0	11.0	103.0
Total Split (%)	20.8%	20.8%	70.8%	70.8%	8.5%	79.2%
Yellow Time (s)	3.0	3.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	0.0	3.0	3.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	3.0	7.0	7.0	7.0	7.0
Lead/Lag			Lag	Lag	Lead	
Lead-Lag Optimize?			Yes	Yes	Yes	
Recall Mode	None	None	C-Max	C-Max	None	C-Max
Act Effct Green (s)	17.4	17.4	102.6	102.6		102.6
Actuated g/C Ratio	0.13	0.13	0.79	0.79		0.79
v/c Ratio	0.70	0.48	0.52	0.10		0.39
Control Delay	68.7	11.1	6.9	0.9		7.8
Queue Delay	0.0	0.0	0.0	0.0		0.0
Total Delay	68.7	11.1	6.9	0.9		7.8
LOS	E	B	A	A		A
Approach Delay	39.0		6.0			7.8
Approach LOS	D		A			A

Intersection Summary

Cycle Length: 130
Actuated Cycle Length: 130
Offset: 24 (18%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.70
Intersection Signal Delay: 12.7 Intersection LOS: B
Intersection Capacity Utilization 77.4% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 21: Square-one Entrance & Duke of York



APPENDIX D

INTERSECTION ANALYSIS RESULTS – VISSIM

Operational Anaylsis
Level of Service, Vehicle Delay, Queue
2031 PM Peak Hour Analysis
Scenario 7.1 - Background Traffic Scenario (Existing Traffic + 30% Growth) on BRT Network - Signalized Intersection at Hammerson Drive and Rathburn Road with Revised Bus Movement

Rathburn Road at Duke of York Blvd.				Control Type:	Signalized												
Movements	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Bus WBT	Bus-WBR			OVERALL
Travel Time Segment	601	602	603	604	605	606	607	608	609	610	611	612	613	614			
Queue Counter	601	602	602	604	605	605	607	608	608	610	611	611	613	613			
Hourly Volume (vph)	109	550	55	107	807	128	254	451	128	213	404	238	3	14			3444
Vehicle Delay (s)	35	47	55	54	35	32	44	48	49	78	54	15	101	94			44.24
Queue Length 95th (m)	27	107	107	98	186	186	73	121	121	101	90	90	26	26			
Level of Service (LOS)	C	D	D	D	D	C	D	D	D	E	D	B	F	F			**D**

Rathburn Road at City Center Transit Terminal				Control Type:	Signalized												
Movements	EBT	EBBusT	WBT	WBBusL	WBBusT	WBBusR		NBBusL	NBusR	SBBusL		SBBusR					OVERALL
Travel Time Segment	702	703	705	704	711	706		707	708	709		710					
Queue Counter	702	703	705	704	706	706		707	708	709		710					
Hourly Volume (vph)	842	5	1018	73	18	0		31	65	30		0					2082
Vehicle Delay (s)	38	12	28	31	9	0		96	67	93		0					35.07
Queue Length 95th (m)	287	0	188	36	0	0		69	67	22		22					
Level of Service (LOS)	D	B	C	C	A			F	E	F							**D**

Rathburn Road at Square One North Entrance				Control Type:	Signalized												
Movements		EBT	EBR	WBL	WBT		NBL		NBR								OVERALL
Travel Time Segment		802	803	804	805		807		809								
Queue Counter		802	802	804	805		807		807								
Hourly Volume (vph)		747	169	136	870		199		163								2284
Vehicle Delay (s)		15	15	67	26		54		22								26.03
Queue Length 95th (m)		189	189	63	168		52		52								
Level of Service (LOS)		B	B	E	C		D		C								**C**

Rathburn Road at City Centre Drive				Control Type:	Signalized												
Movements	EBL	EBT	EBR	WBL1	WBT1	WBR1	NBL	NBT	NBR	SBL	SBT	SBR	WBBusT	EBBusT			OVERALL
Travel Time Segment	901	902	903	904	905	906	907	908	909	910	911	912	913	917			
Queue Counter	902	902	902	904	905	905	907	908	908	910	911	911	913	914			
Hourly Volume (vph)	13	756	139	305	974	28	28	309	391	90	30	0	26	40			3129
Vehicle Delay (s)	69	23	20	113	101	74	71	71	52	172	41	0	30	15			69.69
Queue Length 95th (m)	98	98	98	128	405	405	24	123	123	75	7	7	21	18			
Level of Service (LOS)	E	C	C	F	F	E	E	E	D	F	D		C	B			**E**

City Centre Drive at Square One West Entrance				Control Type:	Signalized												
Movements	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR					OVERALL
Travel Time Segment	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112					
Queue Counter	1101	1101	1101	1104	1104	1106	1107	1108	1108	1110	1110	1110					
Hourly Volume (vph)	189	289	116	364	321	136	144	390	177	88	357	32					2603
Vehicle Delay (s)	57	48	39	31	21	24	28	35	33	24	16	13					31.53
Queue Length 95th (m)	83	83	83	79	45	45	30	75	75	19	34	34					
Level of Service (LOS)	E	D	D	C	C	C	C	D	C	C	B	B					**C**

Centre View Drive at Station Gate Road					Control Type:	Signalized												
Movements		EBT	EBR	WBL	WBT		NBL		NBR									OVERALL
Travel Time Segment		1201	1202	1203	1204		1205		1206									
Queue Counter		1201	1201	1203	1203		1205		1206									
Hourly Volume (vph)		126	35	3	772		3		0									939
Vehicle Delay (s)		1	2	4	1		53		0									0.81
Queue Length 95th (m)		0	0	0	0		7		0									
Level of Service (LOS)		A	A	A	A		D											**A**

Centre View Drive at Duke of York Blvd.					Control Type:	Signalized												
Movements		EBT	EBR	WBL	WBT		NBL		NBR									OVERALL
Travel Time Segment		1301	1302	1303	1304		1305		1306									
Queue Counter		1301	1301	1303	1303		1305		1305									
Hourly Volume (vph)		85	597	277	501		632		74									2166
Vehicle Delay (s)		11	16	18	14		22		19									17.41
Queue Length 95th (m)		67	67	38	38		74		74									
Level of Service (LOS)		B	B	B	B		C		B									**B**

Square One Drive at Duke of York Blvd.					Control Type:	Signalized												
Movements		SBT	SBL		WBL	WBR		NBR	NBT									OVERALL
Travel Time Segment		1452	1453		1451	1450		1455	1454									
Queue Counter		1452	1453		1450	1450		1455	1455									
Hourly Volume (vph)		406	163		151	160		0	707									1587
Vehicle Delay (s)		7	20		51	11		8	12									15.02
Queue Length 95th (m)		24	29		49	49		49	49									
Level of Service (LOS)		A	B		D	B		A	B									**B**

BRT Lane - Rathburn																		
Movements		EBBus	WBBus	WBBusL	EBGPL	WBGPL												OVERALL
Travel Time Segment		1	2	5	3	4												
Hourly Volume (vph)		39	18	36	609	834												1536
Travel Time (Sec)		74	29	60	66	75												