

NOV 19 2008

November 17, 2008



DESIGN & CONST. DIVISION

DRAFT

REGION OF WATERLOO
ROUNABOUT FEASIBILITY
INITIAL SCREENING TOOL VERSION 1.0

The intent of this screening tool is to provide a relatively quick assessment of the feasibility of a modern roundabout at a particular intersection in comparison to other appropriate forms of traffic control or road improvements including auxiliary lanes, traffic control signals, four-way stop, etc. The intended outcome of this tool is to provide enough information to assist staff in deciding whether or not to proceed to an Intersection Control Study to further investigate in more detail the feasibility of a roundabout.

1) Project Name/File No.:

Hespeler Road at Maple Grove Road/Fisher Mills Road, City of Cambridge

2) Intersection Location

(Street/Road Names, distance from major intersection, etc.):

As above

3) Brief Description of Intersection

(Number of Legs, Lanes on each leg, total AADT, AADT on each road, etc. Attach or sketch diagram showing existing and horizon-year turning movements.):

Four leg intersection Total AADT – 19 995 (March 18/08)

Hespeler Road north leg – 6 lanes (10 748)

Hespeler Road south leg – 5 lanes (n/b channel) (16 159)

Maple Grove Road west leg – 4 lanes (e/b channel) (8 472)

Fisher Mills Road east leg – 3 lanes (4 611)

4) What operational problems are being experienced at this location?

**Existing LOS is ok



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- 5) Is it a new intersection or is it a retrofit of an existing intersection? If existing, what is the existing traffic control?

Existing

Traffic control signal with yield signs at channels

- 6) Is the intersection in the vicinity of a railroad crossing *or another intersection*? If so, how close and what type of traffic control exists at the adjacent intersection(s)? Will queues be a problem?

N/A

- 7) Would the intersection be located within a coordinated signal system?

No, it operates as an isolated intersection

- 8) Would the intersection be located on a Preferred Roundabout Corridor?

NO

- 9) Is the intersection located within a corridor that is scheduled for improvements in the 10 Year Transportation Capital Program? What is the ultimate cross-section of the approach roads?

Hespeler Road – Beaverdale Road/Queen Street to Guelph Avenue – Cold-in-place resurfacing and bicycle lane installation - 2017

Maple Grove Road – Hespeler Road to Speedsville Road – widening of existing two lanes - 2016



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- 10) What is the collision history of the intersection over the past five years? Is there a collision problem that needs to be addressed?

The 5-year collision history indicates that 49 collisions (11 injury collisions) have occurred at this intersection where 35 were expected. Further analysis did not identify any unusual collision patterns.

- 11) Are persons with disabilities or horse and buggies frequent users of this intersection?

N/A

- 12) What traditional road improvements are proposed for this intersection? (eg. traffic signals, all-way stop, auxiliary lanes, etc.)

Traffic Signal Major Modification 2009

Based on the 2019 counts provided by Transportation Planning, the following

auxiliary lanes and storage (based on 95%ile queues) will be required for the

signalized scenario:

NB dual LT lanes – 130m (Fully protected movement)

NBRT – 15m

SBLT – 7m

SBTH – An additional SBTH lane is required (3 total) due to protected NBLT

SBRT – 60m

EBLT – 90m

EBTH – 2 lanes

EBRT – free flow channelization required due to high volume

WBLT – 70m

WBTH and WBTH/RT required – WBTH/RT needs to be at least 60m

Existing and future Synchro analysis is attached.



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13) If traffic control signals are being considered, are the traffic signal warrants met for the horizon year?

N/A

14) What size of roundabout is being considered for this intersection? (eg. Single-lane, two-lane entry or three-lane entry?) Please attach a Traffic Flow Worksheet and lane configuration diagram. Please attach a sketch showing how a roundabout would "fit" into the right-of-way.

Based on the 2019 counts provided by Transportation Planning, the proposed roundabout will require three lane entries on the North, South and West approaches and a two lane entry on the East approach. ICD = ⁷⁵65m. A right turn bypass may be considered on the West approach for the high volumes of right turns in lieu of the third entry lane. Traffic Flow Worksheet and Rodel Analysis is attached.

15) 20-Year Life Cycle Cost Estimate

Injury Collision Cost (ICC): \$30 000.00

Discount Rate: (i): 0.06

20 YEAR LIFE-CYCLE COST COMPARISON		
Cost Item	Other Traffic Control	Roundabout
Implementation Cost	\$ 1.0 million	\$ 2.0 million
Injury Collision Cost (Present Value)	\$ 757,000.00 (Based on historical 5-year injury collisions at this intersection)	\$ 189,250.00
Total Life Cycle Cost	X 1.75 million	Y 2.2 million

Notes:

- Implementation Cost

- = sum of costs for construction, property utility relocations, illumination, engineering (20%), contingency (20%) and maintenance (5%);
- Present Value of 20 Year Injury Collision Cost
= expected annual collision frequency x ICC $((1 + i)^{20} - 1) / i(1+i)^{20}$
- Monte Carlo Analysis may be required. If so, a range for the implementation cost (i.e. 10%, 50%, 90% probability) is required



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Conclusions and Recommendation.

PROCEED TO ICS

Lanes, Volumes, Timings
954: Maple Grove Rd & Hespeler Rd

Existing
Timing Plan: AM Peak



Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑	↗	↖	↑↑	↗
Volume (vph)	46	34	159	142	139	13	245	448	28	3	432	81
Ideal Flow (vphpl)	1775	1900	1750	1775	1650	1000	1775	1900	1750	1775	1900	1750
Storage Length (m)	50.0		45.0	63.0		0.0	200.0		90.0	120.0		50.0
Storage Lanes	1		1	1		0	1		1	1		1
Taper Length (m)	7.5		7.5	7.5		7.5	7.5		7.5	7.5		7.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Ped Bike Factor	1.00				1.00				0.97	1.00		
Frts			0.850		0.988				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1332	1762	1044	1624	1574	0	1375	3017	1355	1705	3067	1419
Flt Permitted	0.597			0.732			0.350			0.470		
Satd. Flow (perm)	836	1762	1044	1251	1574	0	507	3017	1320	841	3067	1419
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			177		4				31			90
Link Speed (k/h)		70			50			80			80	
Link Distance (m)		745.0			596.6			332.4			453.5	
Travel Time (s)		38.3			43.0			15.0			20.4	
Confl. Peds. (#/hr)	1					1			2	2		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	28%	9%	44%	5%	5%	0%	24%	21%	11%	0%	19%	6%
Adj. Flow (vph)	51	38	177	158	154	14	272	498	31	3	480	90
Shared Lane Traffic (%)												
Lane Group Flow (vph)	51	38	177	158	168	0	272	498	31	3	480	90
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.08	0.99	1.10	1.08	1.18	2.14	1.08	0.99	1.10	1.08	0.99	1.10
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm		Perm	Perm			pm+pt		Perm	Perm		Perm
Protected Phases		8			4		1	6			2	
Permitted Phases	8		8	4			6		6	2		2
Detector Phase	8	8	8	4	4		1	6	6	2	2	2
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0		8.0	20.0	20.0	20.0	20.0	20.0
Minimum Split (s)	36.8	36.8	36.8	36.8	36.8		13.0	27.9	27.9	27.9	27.9	27.9
Total Split (s)	36.8	36.8	36.8	36.8	36.8	0.0	25.0	82.9	82.9	57.9	57.9	57.9
Total Split (%)	30.7%	30.7%	30.7%	30.7%	30.7%	0.0%	20.9%	69.3%	69.3%	48.4%	48.4%	48.4%
Maximum Green (s)	30.0	30.0	30.0	30.0	30.0		20.0	75.0	75.0	50.0	50.0	50.0
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5		3.0	5.9	5.9	5.9	5.9	5.9
All-Red Time (s)	2.3	2.3	2.3	2.3	2.3		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.8	-2.8	-2.8	-2.8	-2.8	-1.0	-1.0	-3.9	-3.9	-3.9	-3.9	-3.9
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag							Lead			Lag	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		4.0	4.5	4.5	4.5	4.5	4.5

Lanes, Volumes, Timings
954: Maple Grove Rd & Hespeler Rd

Existing
Timing Plan: PM Peak



Lane Configurations	↖	↑	↗	↖	↗	↖	↗	↖	↗	↖	↗	↖
Volume (vph)	121	215	443	92	106	4	348	491	157	12	546	88
Ideal Flow (vphpl)	1775	1900	1750	1775	1650	1000	1775	1900	1750	1775	1900	1750
Storage Length (m)	50.0		45.0	63.0		0.0	200.0		90.0	120.0		50.0
Storage Lanes	1		1	1		0	1		1	1		1
Taper Length (m)	7.5		7.5	7.5		7.5	7.5		7.5	7.5		7.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Ped Bike Factor	1.00		0.99	1.00	1.00							
Frt			0.850		0.995				0.850			0.850
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1639	1865	1319	1624	1600	0	1421	3202	1446	1705	3318	1367
Fit Permitted	0.668			0.457			0.266			0.448		
Satd. Flow (perm)	1151	1865	1302	781	1600	0	398	3202	1446	804	3318	1367
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			445		1				174			98
Link Speed (k/h)		70			50			80			80	
Link Distance (m)		745.0			596.6			332.4			453.5	
Travel Time (s)		38.3			43.0			15.0			20.4	
Confl. Peds. (#/hr)	2		1	1		2						
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	4%	3%	14%	5%	3%	25%	20%	14%	4%	0%	10%	10%
Adj. Flow (vph)	134	239	492	102	118	4	387	546	174	13	607	98
Shared Lane Traffic (%)												
Lane Group Flow (vph)	134	239	492	102	122	0	387	546	174	13	607	98
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.08	0.99	1.10	1.08	1.18	2.14	1.08	0.99	1.10	1.08	0.99	1.10
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm		Perm	Perm			pm+pt		Perm	Perm		Perm
Protected Phases		8			4		1	6			2	
Permitted Phases	8		8	4			6		6	2		2
Detector Phase	8	8	8	4	4		1	6	6	2	2	2
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0		8.0	20.0	20.0	20.0	20.0	20.0
Minimum Split (s)	36.8	36.8	36.8	36.8	36.8		13.0	27.9	27.9	27.9	27.9	27.9
Total Split (s)	36.8	36.8	36.8	36.8	36.8	0.0	25.0	82.9	82.9	57.9	57.9	57.9
Total Split (%)	30.7%	30.7%	30.7%	30.7%	30.7%	0.0%	20.9%	69.3%	69.3%	48.4%	48.4%	48.4%
Maximum Green (s)	30.0	30.0	30.0	30.0	30.0		20.0	75.0	75.0	50.0	50.0	50.0
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5		3.0	5.9	5.9	5.9	5.9	5.9
All-Red Time (s)	2.3	2.3	2.3	2.3	2.3		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.8	-2.8	-2.8	-2.8	-2.8	-1.0	-1.0	-3.9	-3.9	-3.9	-3.9	-3.9
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag							Lead			Lag	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		4.0	4.5	4.5	4.5	4.5	4.5

Lanes, Volumes, Timings
954: Maple Grove Rd & Hespeler Rd

2019 Future
Timing Plan: AM Peak



Link Group	EBL	EBT	EBP	WBL	WBT	WBP	WBR	WBL	WBT	WBP	WBR	WBR
Lane Configurations	↖	↗	↖	↖	↗	↖	↗	↖	↗	↖	↗	↖
Volume (vph)	95	110	313	216	466	21	785	769	76	17	703	267
Ideal Flow (vphpl)	1775	1900	1750	1775	1775	1000	1775	1900	1750	1775	1900	1750
Storage Length (m)	50.0		45.0	63.0		0.0	200.0		90.0	120.0		50.0
Storage Lanes	1		1	1		0	2		1	1		1
Taper Length (m)	7.5		7.5	7.5		7.5	7.5		7.5	7.5		7.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	0.95	0.97	0.95	1.00	1.00	0.91	1.00
Ped Bike Factor	1.00				1.00				0.98	1.00		
Frt			0.850		0.994				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1332	3349	1044	1624	3233	0	2667	3017	1355	1705	4407	1419
Flt Permitted	0.320			0.682			-0.950			0.360		
Satd. Flow (perm)	448	3349	1044	1166	3233	0	2667	3017	1334	645	4407	1419
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			313		4				76			93
Link Speed (k/h)		70			50			80			80	
Link Distance (m)		746.8			596.6			332.4			453.5	
Travel Time (s)		38.4			43.0			15.0			20.4	
Confl. Peds. (#/hr)	1					1			2	2		
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	28%	9%	44%	5%	5%	0%	24%	21%	11%	0%	19%	6%
Adj. Flow (vph)	95	110	313	216	466	21	785	769	76	17	703	267
Shared Lane Traffic (%)												
Lane Group Flow (vph)	95	110	313	216	487	0	785	769	76	17	703	267
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			7.4			7.4	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.08	0.99	1.10	1.08	1.08	2.14	1.08	0.99	1.10	1.08	0.99	1.10
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm		Free	Perm			Prot		Perm	pm+pt		Perm
Protected Phases		8			4		1	6		5	2	
Permitted Phases	8		Free	4					6	2		2
Detector Phase	8	8		4	4		1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		8.0	20.0	20.0	8.0	20.0	20.0
Minimum Split (s)	36.8	36.8		36.8	36.8		13.0	27.9	27.9	13.0	27.9	27.9
Total Split (s)	38.0	38.0	0.0	38.0	38.0	0.0	35.0	59.0	59.0	13.0	37.0	37.0
Total Split (%)	34.5%	34.5%	0.0%	34.5%	34.5%	0.0%	31.8%	53.6%	53.6%	11.8%	33.6%	33.6%
Maximum Green (s)	31.2	31.2		31.2	31.2		30.0	51.1	51.1	8.0	29.1	29.1
Yellow Time (s)	4.5	4.5		4.5	4.5		3.0	5.9	5.9	3.0	5.9	5.9
All-Red Time (s)	2.3	2.3		2.3	2.3		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.8	-2.8	-2.8	-2.8	-2.8	-1.0	-1.0	-3.9	-3.9	-1.0	-3.9	-3.9
Total Lost Time (s)	4.0	4.0	1.2	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?								Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0		4.0	4.5	4.5	3.0	4.5	4.5

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Synchro 7 - Report

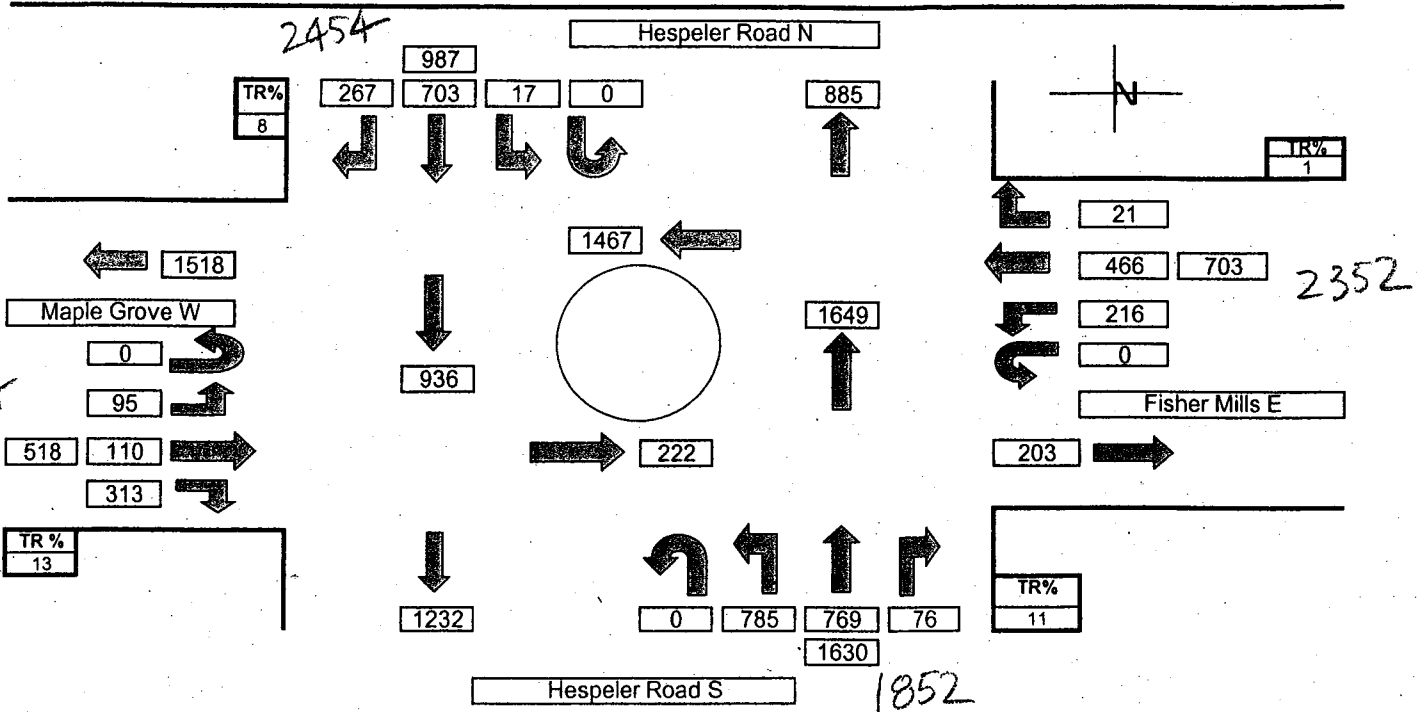
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Lanes, Volumes, Timings
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2019 Future
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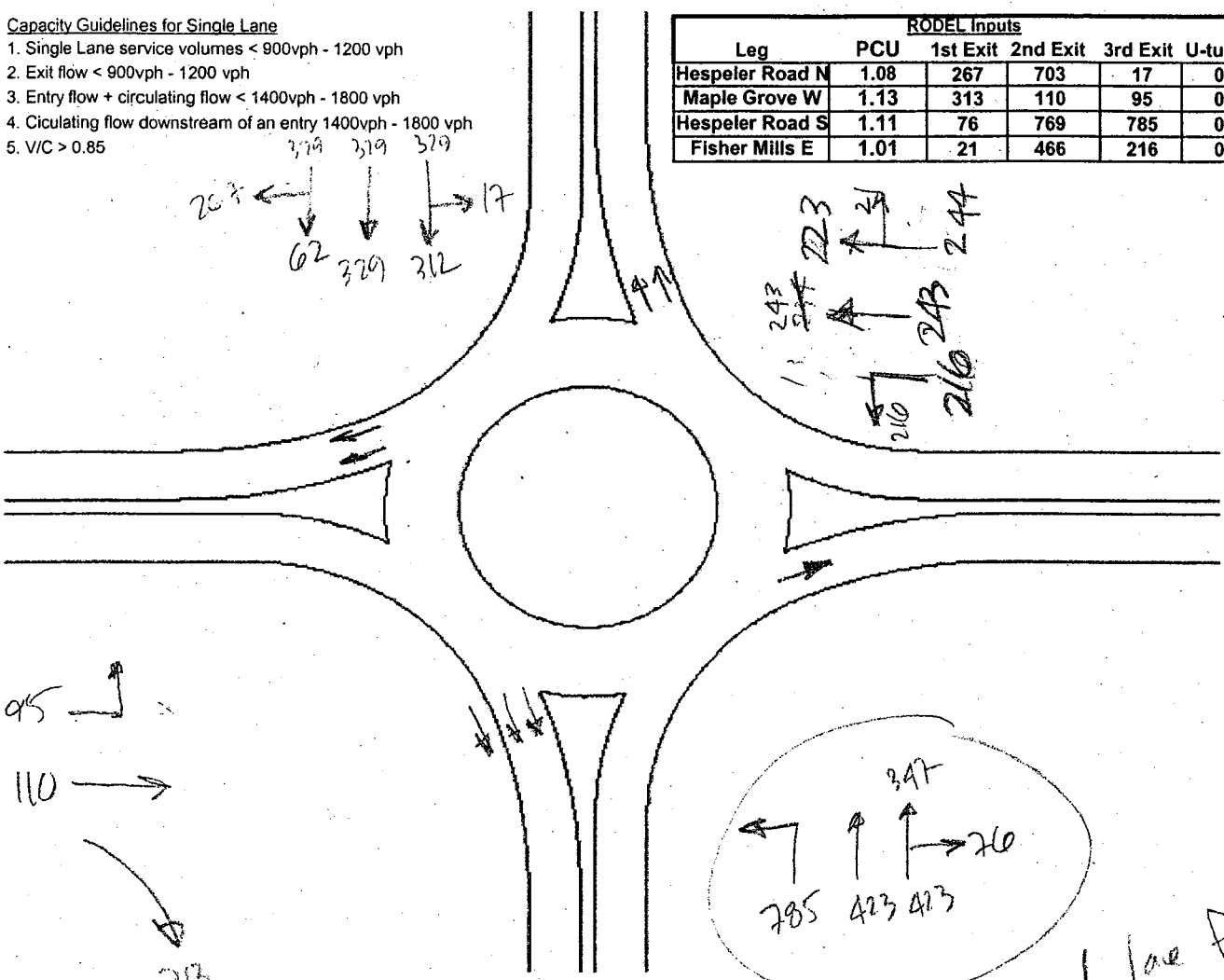
Link Group	EB	EBT	EBR	WB	WBT	WBR	NB	NE	NBT	NBR	SB	SBR
Lane Configurations	↖	↕	↗	↖	↕	↗	↖	↕	↗	↖	↕	↗
Volume (vph)	237	470	839	160	245	9	593	849	251	27	860	156
Ideal Flow (vphpl)	1775	1900	1750	1775	1775	1000	1775	1900	1750	1775	1900	1750
Storage Length (m)	50.0		45.0	63.0		0.0	200.0		90.0	120.0		50.0
Storage Lanes	1		1	1		0	2		1	1		1
Taper Length (m)	7.5		7.5	7.5		7.5	7.5		7.5	7.5		7.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	0.95	0.97	0.95	1.00	1.00	0.91	1.00
Ped Bike Factor	1.00		0.99	1.00	1.00							
Frt			0.850		0.995				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1639	3544	1319	1624	3268	0	2756	3202	1446	1705	4768	1367
Flt Permitted	0.560			0.364			0.950			0.333		
Satd. Flow (perm)	965	3544	1303	622	3268	0	2756	3202	1446	598	4768	1367
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			521		3				251			156
Link Speed (k/h)		70			50			80			80	
Link Distance (m)		746.8			596.6			332.4			453.5	
Travel Time (s)		38.4			43.0			15.0			20.4	
Confl. Peds. (#/hr)	2		1	1		2						
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	4%	3%	14%	5%	3%	25%	20%	14%	4%	0%	10%	10%
Adj. Flow (vph)	237	470	839	160	245	9	593	849	251	27	860	156
Shared Lane Traffic (%)												
Lane Group Flow (vph)	237	470	839	160	254	0	593	849	251	27	860	156
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			7.4			7.4	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.08	0.99	1.10	1.08	1.08	2.14	1.08	0.99	1.10	1.08	0.99	1.10
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm		Free	Perm			Prot		Perm	pm+pt		Perm
Protected Phases		8			4		1	6		5	2	
Permitted Phases	8		Free	4				6	6	2		2
Detector Phase	8	8		4	4		1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		8.0	20.0	20.0	8.0	20.0	20.0
Minimum Split (s)	36.8	36.8		36.8	36.8		13.0	27.9	27.9	13.0	27.9	27.9
Total Split (s)	38.0	38.0	0.0	38.0	38.0	0.0	34.0	59.0	59.0	13.0	38.0	38.0
Total Split (%)	34.5%	34.5%	0.0%	34.5%	34.5%	0.0%	30.9%	53.6%	53.6%	11.8%	34.5%	34.5%
Maximum Green (s)	31.2	31.2		31.2	31.2		29.0	51.1	51.1	8.0	30.1	30.1
Yellow Time (s)	4.5	4.5		4.5	4.5		3.0	5.9	5.9	3.0	5.9	5.9
All-Red Time (s)	2.3	2.3		2.3	2.3		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.8	-2.8	-2.8	-2.8	-2.8	-1.0	-1.0	-3.9	-3.9	-1.0	-3.9	-3.9
Total Lost Time (s)	4.0	4.0	1.2	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?								Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0		4.0	4.5	4.5	3.0	4.5	4.5



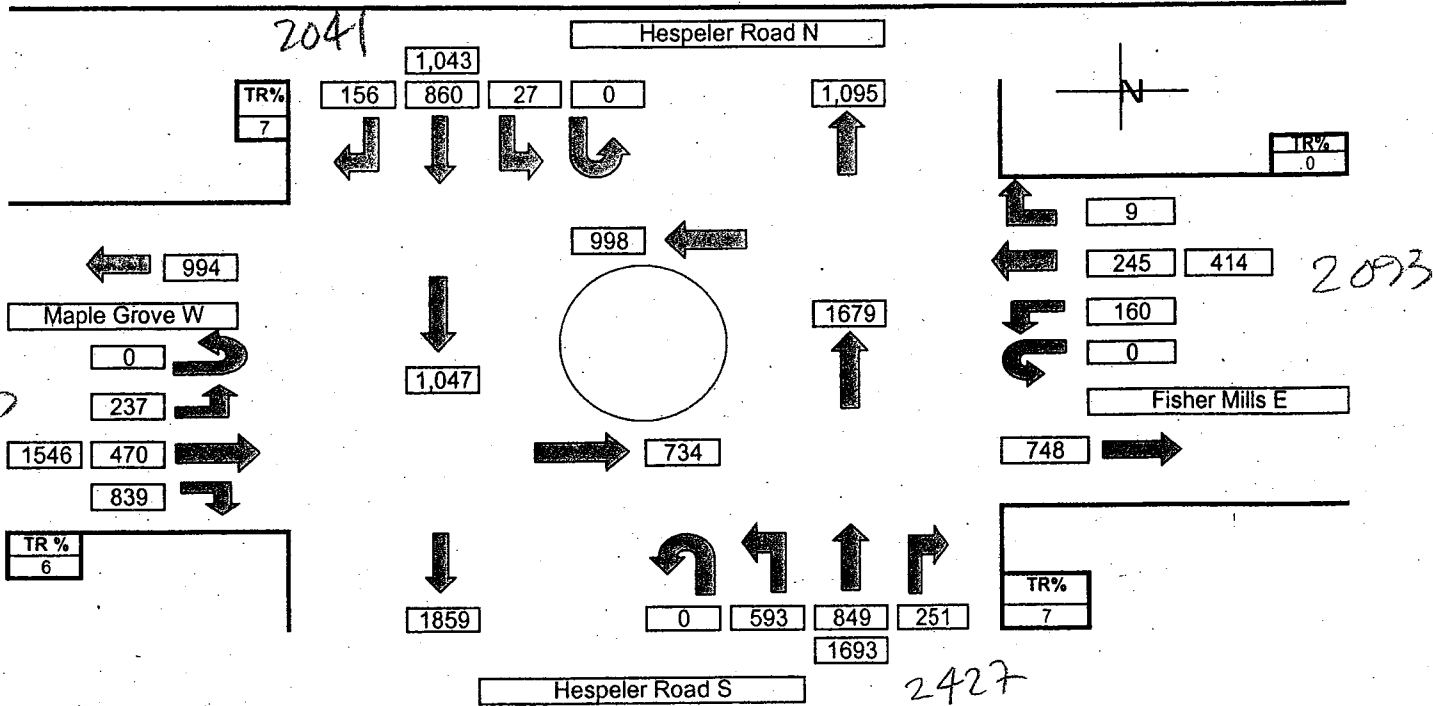
Capacity Guidelines for Single Lane

1. Single Lane service volumes < 900vph - 1200 vph
2. Exit flow < 900vph - 1200 vph
3. Entry flow + circulating flow < 1400vph - 1800 vph
4. Circulating flow downstream of an entry 1400vph - 1800 vph
5. V/C > 0.85

Leg	RODEL Inputs				
	PCU	1st Exit	2nd Exit	3rd Exit	U-turn
Hespeler Road N	1.08	267	703	17	0
Maple Grove W	1.13	313	110	95	0
Hespeler Road S	1.11	76	769	785	0
Fisher Mills E	1.01	21	466	216	0



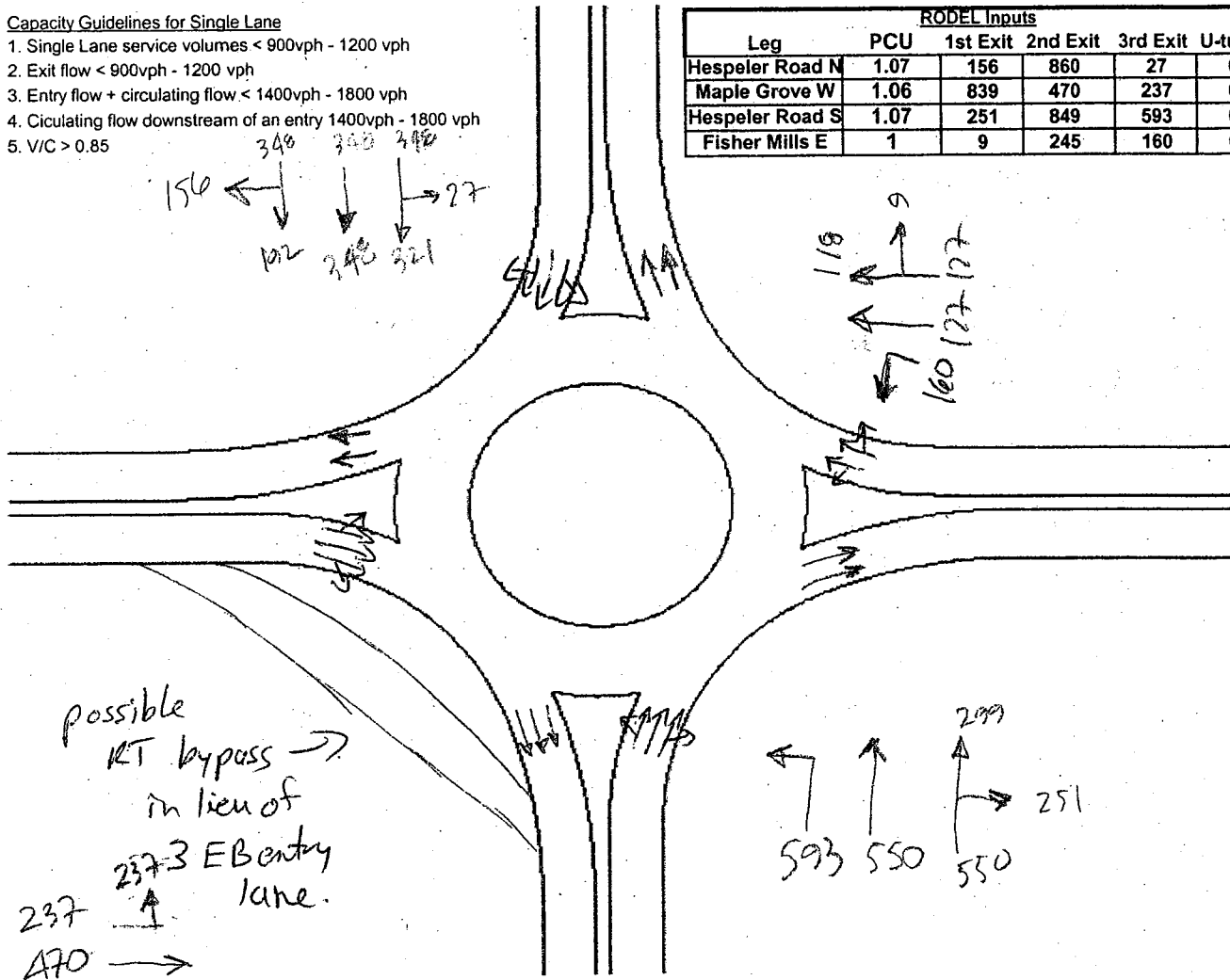
unbalanced lane flows



Capacity Guidelines for Single Lane

1. Single Lane service volumes < 900vph - 1200 vph
2. Exit flow < 900vph - 1200 vph
3. Entry flow + circulating flow < 1400vph - 1800 vph
4. Circulating flow downstream of an entry 1400vph - 1800 vph
5. V/C > 0.85

Leg	RODEL Inputs				
	PCU	1st Exit	2nd Exit	3rd Exit	U-turn
Hespeler Road N	1.07	156	860	27	0
Maple Grove W	1.06	839	470	237	0
Hespeler Road S	1.07	251	849	593	0
Fisher Mills E	1	9	245	160	0





Region of Waterloo

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**REGION OF WATERLOO
ROUNDBOUT FEASIBILITY
INITIAL SCREENING TOOL VERSION 1.0**

The intent of this screening tool is to provide a relatively quick assessment of the feasibility of a modern roundabout at a particular intersection in comparison to other appropriate forms of traffic control or road improvements including auxiliary lanes, traffic control signals, four-way stop, etc. The intended outcome of this tool is to provide enough information to assist staff in deciding whether or not to proceed to an Intersection Control Study to further investigate in more detail the feasibility of a roundabout.

1) Project Name/File No.:

2) Intersection Location
(Street/Road Names, distance from major intersection, etc.):

Bleams Road/Trussler Road at Ottawa Street

3) Brief Description of Intersection
(Number of Legs, Lanes on each leg, total AADT, AADT on each road, etc. Attach or sketch diagram showing existing and horizon-year turning movements.):

The intersection is a cross intersection with one lane approaching from all directions. The AADT entering the intersection is 10,945 with 3,886 entering from the north, 1,473 entering from the west, 2,861 entering from the south and 2,725 entering from the east. The most current count is May, 2008.

4) What operational problems are being experienced at this location?

Delay



REGION OF WATERLOO
ROUNDBOUT FEASIBILITY
INITIAL SCREENING TOOL VERSION 1.0

- 5) Is it a new intersection or is it a retrofit of an existing intersection? If existing, what is the existing traffic control?

This is an existing intersection with stop control on all approaches.

- 6) Is the intersection in the vicinity of a railroad crossing *or another intersection*? If so, how close and what type of traffic control exists at the adjacent intersection(s)? Will queues be a problem?

The closest intersection to the south is approximately 200m and approximately 250m to the north.

- 7) Would the intersection be located within a coordinated signal system?

No – it would operate as an isolated signalized intersection

- 8) Would the intersection be located on a Preferred Roundabout Corridor?

Trussler Road is a preferred corridor.

- 9) Is the intersection located within a corridor that is scheduled for improvements in the 10 Year Transportation Capital Program? What is the ultimate cross-section of the approach roads?

The intersection is within a corridor that is scheduled for improvements.

Improvements include left-turn lanes.

The signalized scenario would require the following auxiliary lanes based on 2018 volumes at 95th %ile queuing:

NBL – 7m storage

NBR – 7m storage(NB turn lanes required due to heavy NB through volumes)

SBL – 69m

EBL – 25m

WBL – 12m

WBR – 50m

Synchro analysis is available to be attached if necessary.



**REGION OF WATERLOO
ROUNDAABOUT FEASIBILITY
INITIAL SCREENING TOOL VERSION 1.0**

Region of Waterloo

- 10) What is the collision history of the intersection over the past five years? Is there a collision problem that needs to be addressed?

The collision history shows that there were 8 angle collision and 4 turning collisions within a five year period. However, since the installation of the all-way stop in December 2007 there has only been 1 angle collision.

- 11) Are persons with disabilities or horse and buggies frequent users of this intersection?

Horse and buggy - No

Disabilities - Unknown

- 12) What traditional road improvements are proposed for this intersection? (eg. traffic signals, all-way stop, auxiliary lanes, etc.)

Traffic volume entering the intersection meet the OTM warrants for traffic control signals. Left-turn lanes are being considered as per the reconstruction which is scheduled in the Regions 10-year Capital Program (deferred).

- 13) If traffic control signals are being considered, are the traffic signal warrants met for the horizon year?

Traffic control signal warrants are met under existing conditions.



**REGION OF WATERLOO
ROUNDBOUT FEASIBILITY
INITIAL SCREENING TOOL VERSION 1.0**

14) What size of roundabout is being considered for this intersection? (eg. Single-lane, two-lane entry or three-lane entry?) Please attach a Traffic Flow Worksheet and lane configuration diagram. Please attach a sketch showing how a roundabout would “fit” into the right-of-way.

The proposed roundabout will require single lane entries on the North and West approaches and two lane entries on the South and East approaches. ICD = 50m
Traffic Flow Worksheet and Rodel Analysis is available to be attached.

15) 20-Year Life Cycle Cost Estimate

Injury Collision Cost (ICC): \$30,000

Discount Rate: (i): 6%

20 YEAR LIFE-CYCLE COST COMPARISON		
Cost Item	Other Traffic Control	Roundabout
Implementation Cost	\$1,850,000	\$2,000,000
Injury Collision Cost (Present Value)	\$165,200	\$41,300
Total Life Cycle Cost	\$2,015,200	\$2,041,300

Notes:

- Implementation Cost
= sum of costs for construction, property utility relocations, illumination, engineering (20%), contingency (20%) and maintenance (5%);
- Present Value of 20 Year Injury Collision Cost
= expected annual collision frequency x ICC $((1 + i)^{20} - 1) / i(1+i)^{20}$
- Monte Carlo Analysis may be required. If so, a range for the implementation cost (i.e. 10%, 50%, 90% probability) is required

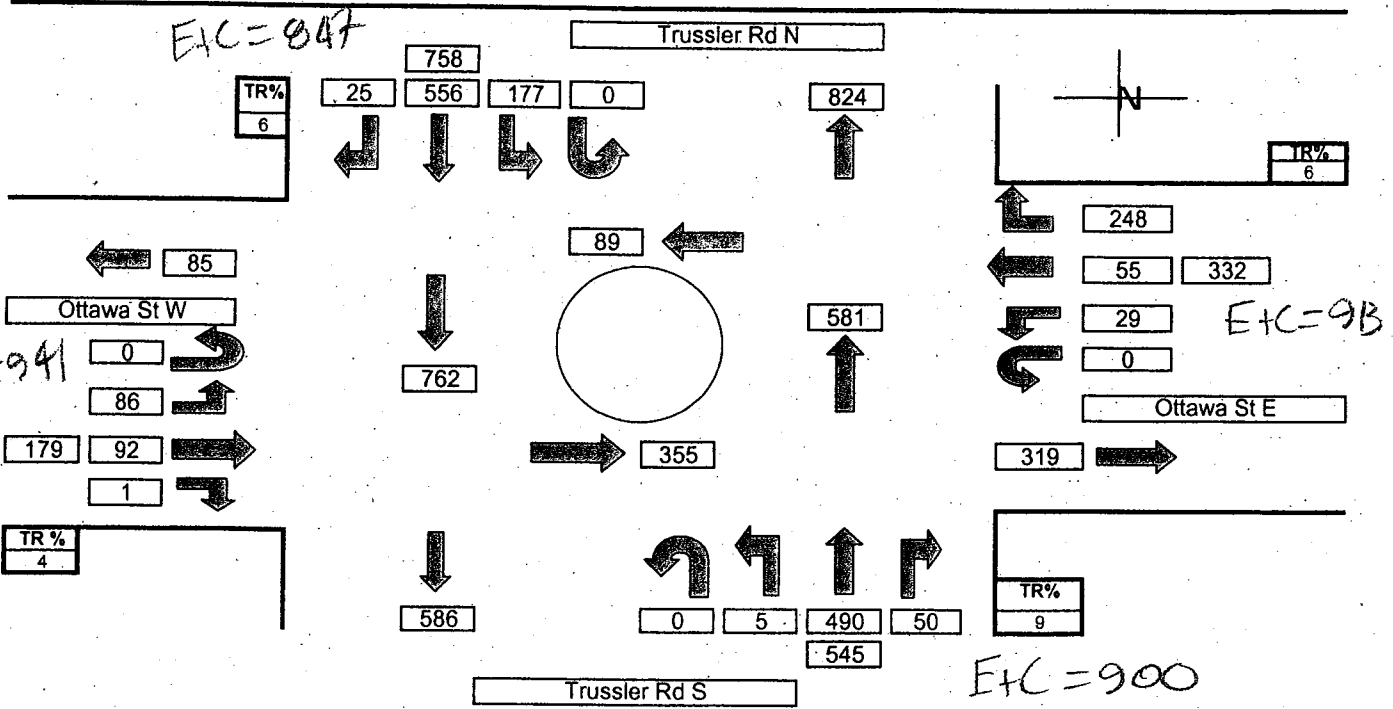


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**REGION OF WATERLOO
ROUNDAABOUT FEASIBILITY
INITIAL SCREENING TOOL VERSION 1.0**

Conclusions and Recommendation

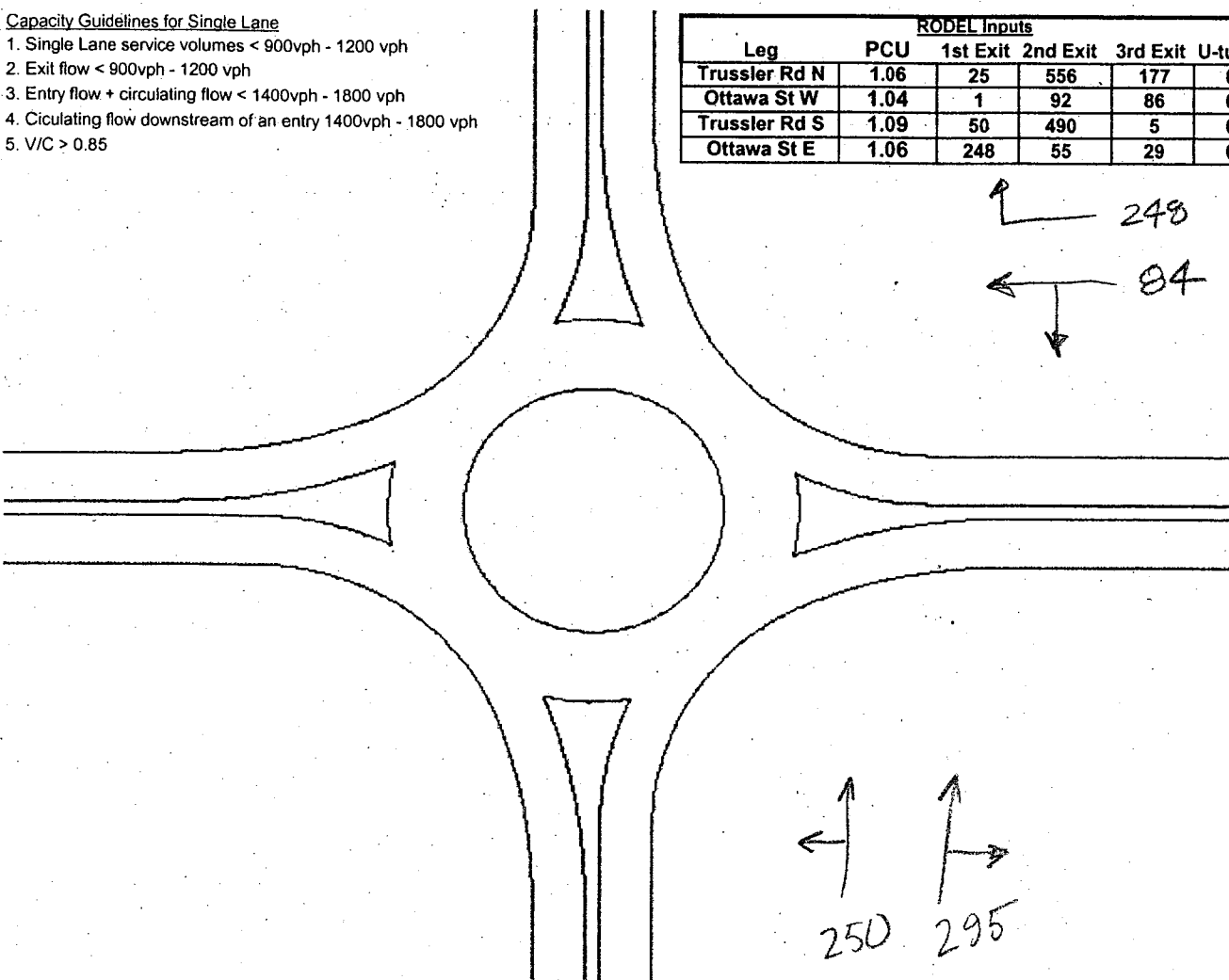
Proceed to an Intersection Control Study

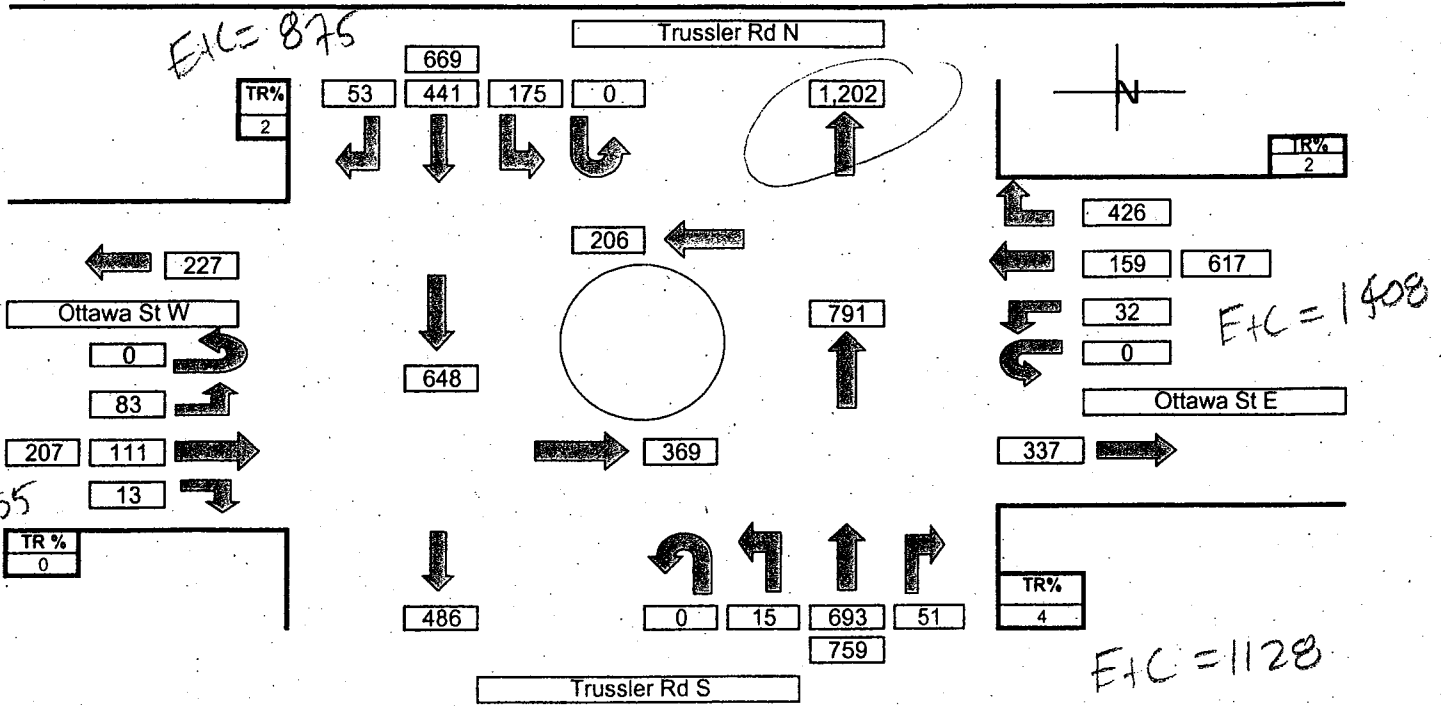


Capacity Guidelines for Single Lane

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2. Exit flow < 900vph - 1200 vph
3. Entry flow + circulating flow < 1400vph - 1800 vph
4. Circulating flow downstream of an entry 1400vph - 1800 vph
5. V/C > 0.85

Leg	PCU	RODEL Inputs			
		1st Exit	2nd Exit	3rd Exit	U-turn
Trussler Rd N	1.06	25	556	177	0
Ottawa St W	1.04	1	92	86	0
Trussler Rd S	1.09	50	490	5	0
Ottawa St E	1.06	248	55	29	0

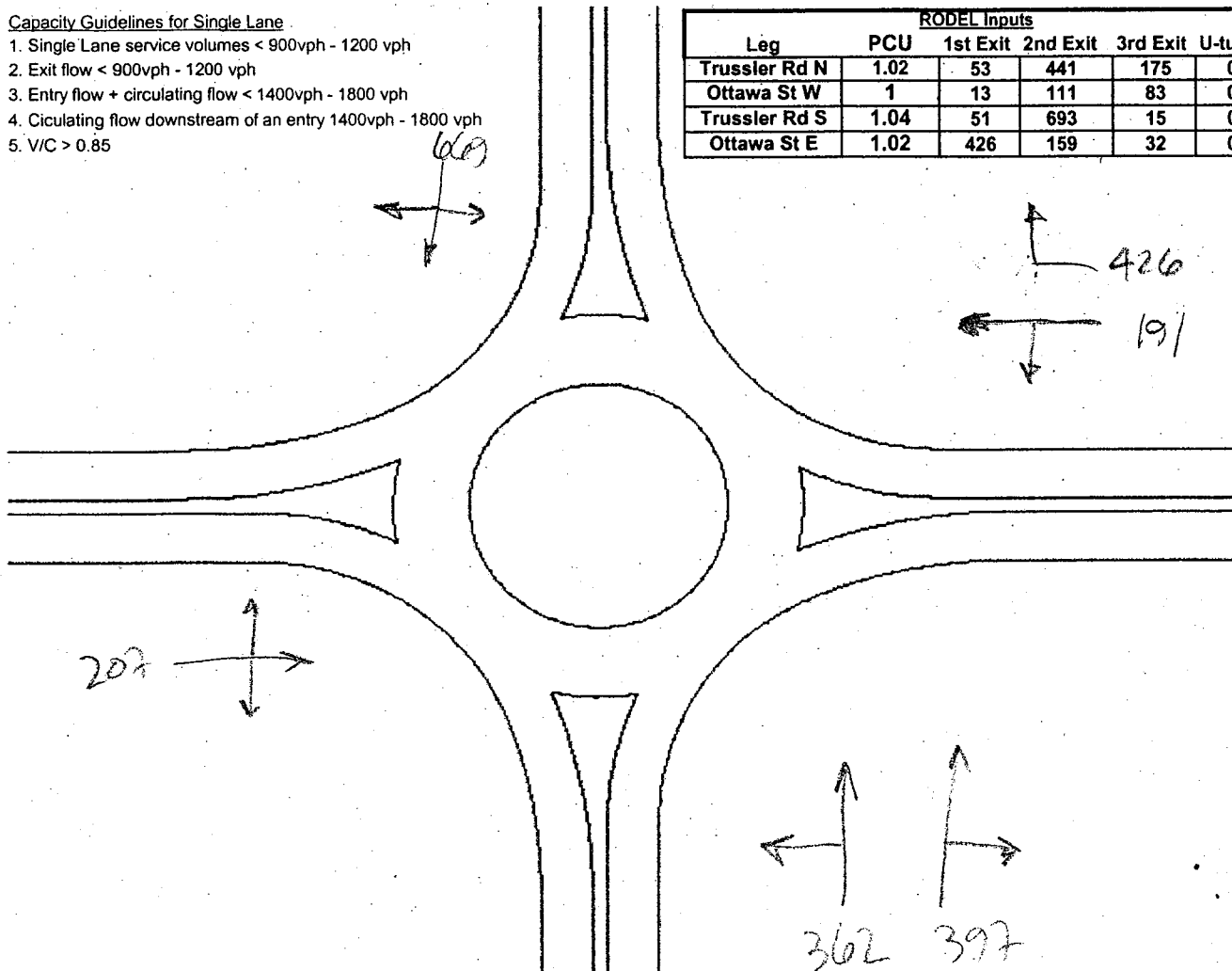




Capacity Guidelines for Single Lane

1. Single Lane service volumes < 900vph - 1200 vph
2. Exit flow < 900vph - 1200 vph
3. Entry flow + circulating flow < 1400vph - 1800 vph
4. Circulating flow downstream of an entry 1400vph - 1800 vph
5. VIC > 0.85

Leg	RODEL Inputs				
	PCU	1st Exit	2nd Exit	3rd Exit	U-turn
Trussler Rd N	1.02	53	441	175	0
Ottawa St W	1	13	111	83	0
Trussler Rd S	1.04	51	693	15	0
Ottawa St E	1.02	426	159	32	0



Lanes, Volumes, Timings
3: Ottawa & Trussler

2018 Future
Timing Plan: AM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗	↗	↖	↗	↗	↖	↗	↖
Volume (vph)	86	92	1	29	55	248	5	490	50	177	556	25
Ideal Flow (vphpl)	1775	1650	1000	1775	1900	1750	1775	1900	1750	1775	1650	1000
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998				0.850			0.850		0.994	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1670	1540	0	1606	1667	1430	1686	1727	1417	1637	1573	0
Flt Permitted	0.721			0.697			0.446			0.337		
Satd. Flow (perm)	1267	1540	0	1178	1667	1430	792	1727	1417	581	1573	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1				248			50		5	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		219.0			226.5			308.2			226.5	
Travel Time (s)		15.8			16.3			22.2			16.3	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	1%	7%	0%	5%	14%	4%	0%	10%	5%	3%	1%	77%
Adj. Flow (vph)	86	92	1	29	55	248	5	490	50	177	556	25
Shared Lane Traffic (%)												
Lane Group Flow (vph)	86	93	0	29	55	248	5	490	50	177	581	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.20	2.17	1.09	1.00	1.11	1.09	1.00	1.11	1.09	1.20	2.17
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm			Perm		Perm	Perm		Perm	pm+pt		
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	4	4		8	8	8	2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0	4.0	10.0	
Minimum Split (s)	24.0	24.0		24.0	24.0	24.0	24.0	24.0	24.0	8.0	24.0	
Total Split (s)	24.0	24.0	0.0	24.0	24.0	24.0	36.0	36.0	36.0	10.0	46.0	0.0
Total Split (%)	34.3%	34.3%	0.0%	34.3%	34.3%	34.3%	51.4%	51.4%	51.4%	14.3%	65.7%	0.0%
Maximum Green (s)	18.0	18.0		18.0	18.0	18.0	30.0	30.0	30.0	6.0	40.0	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0	
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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	4.0	6.0	4.0
Lead/Lag							Lag	Lag	Lag	Lead		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None	None	Max	Max	Max	None	Max	
Walk Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0		7.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0	11.0	11.0	11.0		11.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0	0		0	
Act Effct Green (s)	11.0	11.0		11.0	11.0	11.0	30.0	30.0	30.0	42.0	40.0	

Lanes, Volumes, Timings
3: Ottawa & Trussler

2018 Future
Timing Plan: AM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Actuated g/C Ratio	0.17	0.17		0.17	0.17	0.17	0.48	0.48	0.48	0.67	0.63	
v/c Ratio	0.39	0.34		0.14	0.19	0.55	0.01	0.60	0.07	0.36	0.58	
Control Delay	28.6	26.5		23.6	23.7	8.6	9.6	16.2	3.7	6.4	9.8	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	28.6	26.5		23.6	23.7	8.6	9.6	16.2	3.7	6.4	9.8	
LOS	C	C		C	C	A	A	B	A	A	A	
Approach Delay		27.5			12.4			15.0			9.0	
Approach LOS		C			B			B			A	
Queue Length 50th (m)	9.4	10.0		3.1	5.8	0.0	0.3	39.6	0.0	6.2	32.4	
Queue Length 95th (m)	21.3	21.9		9.4	14.6	16.7	2.0	75.4	5.1	15.0	69.4	
Internal Link Dist (m)		195.0			202.5			284.2			202.5	
Turn Bay Length (m)												
Base Capacity (vph)	326	397		303	429	552	377	823	701	488	1001	
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.26	0.23		0.10	0.13	0.45	0.01	0.60	0.07	0.36	0.58	

Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 63

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.60

Intersection Signal Delay: 13.3

Intersection LOS: B

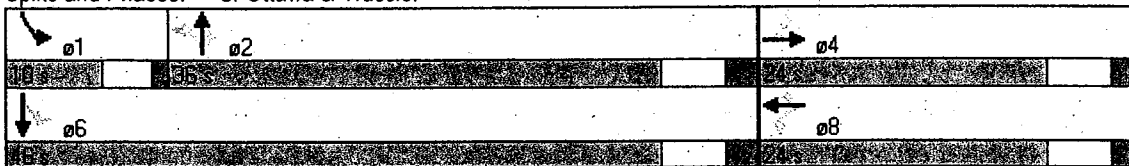
Intersection Capacity Utilization 70.5%

ICU Level of Service C

Analysis Period (min) 15

Description: 2018 PM Peak

Splits and Phases: 3: Ottawa & Trussler



Lanes, Volumes, Timings
3: Ottawa & Trussler

2018 Future
Timing Plan: PM

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗	↗	↖	↗	↗	↖	↗	↖
Volume (vph)	83	111	13	32	159	426	15	693	51	334	441	53
Ideal Flow (vphpl)	1775	1650	1000	1775	1900	1750	1775	1900	1750	1775	1650	1000
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.984				0.850			0.850		0.984	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1686	1624	0	1686	1863	1458	1441	1827	1417	1686	1563	0
Flt Permitted	0.638			0.677			0.483			0.196		
Satd. Flow (perm)	1132	1624	0	1202	1863	1458	733	1827	1417	348	1563	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6				317			51		12	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		219.0			226.5			308.2			226.5	
Travel Time (s)		15.8			16.3			22.2			16.3	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	2%	2%	17%	4%	5%	0%	4%	3%
Adj. Flow (vph)	83	111	13	32	159	426	15	693	51	334	441	53
Shared Lane Traffic (%)												
Lane Group Flow (vph)	83	124	0	32	159	426	15	693	51	334	494	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.20	2.17	1.09	1.00	1.11	1.09	1.00	1.11	1.09	1.20	2.17
Turning Speed (k/h)	25		15	25			25		15	25		15
Turn Type	Perm			Perm		Perm	Perm		Perm	pm+pt		
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	4	4		8	8	8	2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0	4.0	10.0	
Minimum Split (s)	24.0	24.0		24.0	24.0	24.0	24.0	24.0	24.0	8.0	24.0	
Total Split (s)	30.0	30.0	0.0	30.0	30.0	30.0	47.0	47.0	47.0	13.0	60.0	0.0
Total Split (%)	33.3%	33.3%	0.0%	33.3%	33.3%	33.3%	52.2%	52.2%	52.2%	14.4%	66.7%	0.0%
Maximum Green (s)	24.0	24.0		24.0	24.0	24.0	41.0	41.0	41.0	9.0	54.0	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0	
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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	4.0	6.0	4.0
Lead/Lag							Lag	Lag	Lag	Lead		
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None	None	Max	Max	Max	None	Max	
Walk Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0		7.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0	11.0	11.0	11.0		11.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0	0		0	
Act Effct Green (s)	15.1	15.1		15.1	15.1	15.1	41.2	41.2	41.2	56.3	54.3	



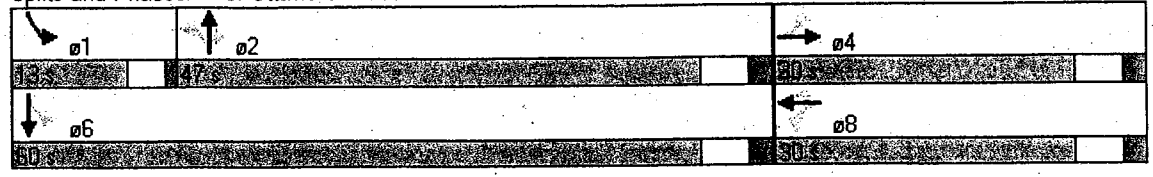
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Actuated g/C Ratio	0.19	0.19		0.19	0.19	0.19	0.51	0.51	0.51	0.69	0.67	
v/c Ratio	0.40	0.41		0.14	0.46	0.81	0.04	0.75	0.07	0.86	0.47	
Control Delay	34.2	31.2		28.1	33.4	21.2	12.9	23.9	4.4	32.0	9.3	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	34.2	31.2		28.1	33.4	21.2	12.9	23.9	4.4	32.0	9.3	
LOS	C	C		C	C	C	B	C	A	C	A	
Approach Delay		32.4			24.7			22.3			18.5	
Approach LOS		C			C			C			B	
Queue Length 50th (m)	12.0	17.0		4.4	23.2	15.7	1.1	81.3	0.0	16.4	30.7	
Queue Length 95th (m)	24.8	32.2		11.7	40.5	50.4	5.1	#173.6	6.2	#68.7	73.3	
Internal Link Dist (m)		195.0			202.5			284.2			202.5	
Turn Bay Length (m)												
Base Capacity (vph)	302	437		321	497	621	371	925	742	389	1046	
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.27	0.28		0.10	0.32	0.69	0.04	0.75	0.07	0.86	0.47	

Intersection Summary

Area Type: Other
 Cycle Length: 90
 Actuated Cycle Length: 81.4
 Natural Cycle: 80
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 0.86
 Intersection Signal Delay: 22.5
 Intersection Capacity Utilization 91.3%
 Analysis Period (min) 15
 Description: 2018 PM Peak
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Intersection LOS: C
 ICU Level of Service F

Splits and Phases: 3: Ottawa & Trussler



Ottawa at Trussler Roundabout Analysis
85th Percentile Confidence Level
Single Lane Entries

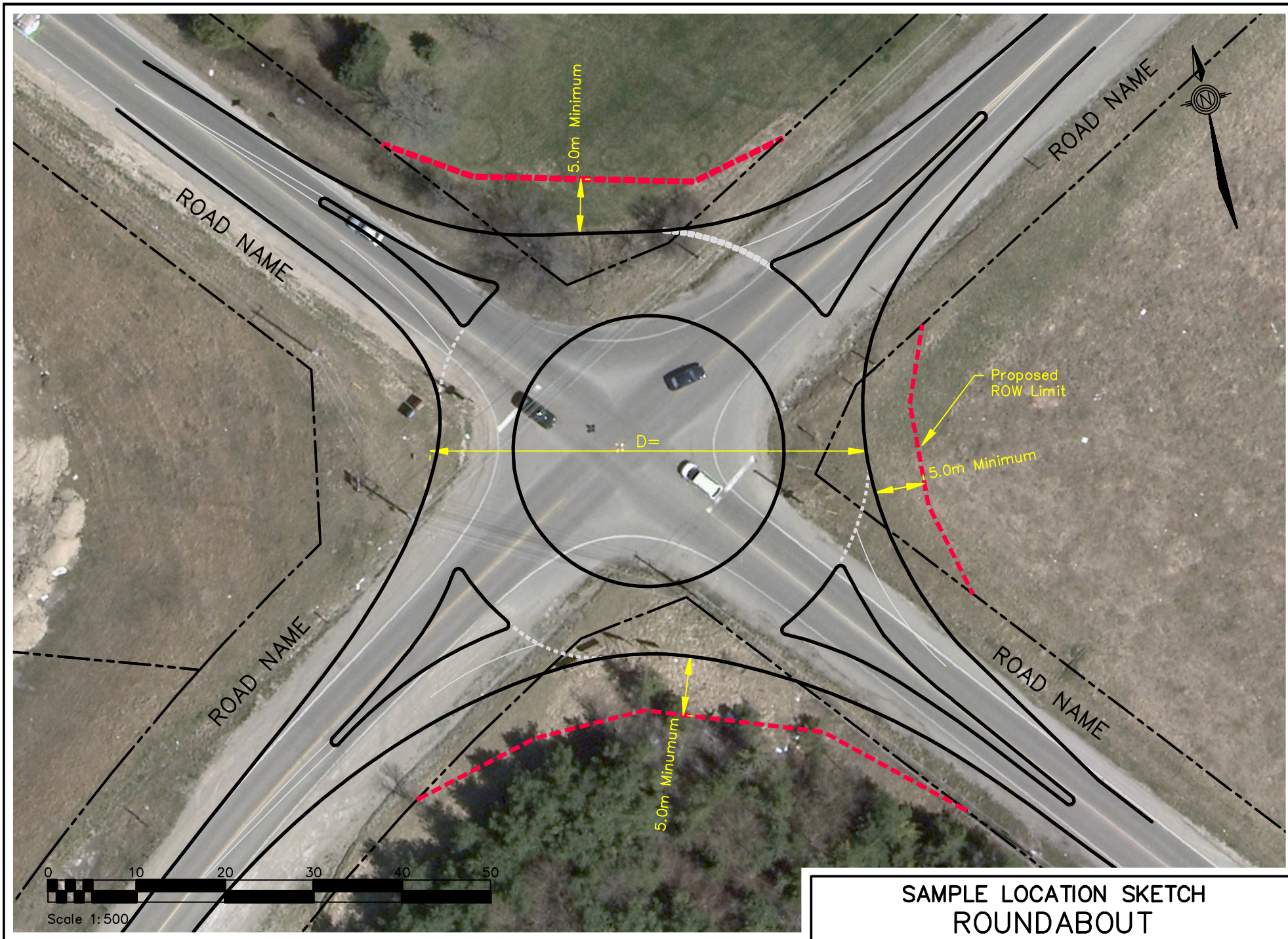
2018 Volumes

AM Peak

Shortcut to RODEL													
	4.00	4.00	4.30	4.30						90			
	20.00	10.00	30.00	30.00						15			
	3.50	3.50	3.50	3.50						15 75			
	20.00	20.00	20.00	20.00						15.00			
	30.00	30.00	30.00	30.00						15 75			
	45.00	45.00	45.00	45.00						0FH			
	0	0	0	0						0M			
TRUSS N	1.06	25	556	177	0	1.00	85	0.75	1.125	0.75	15	45	75
OTTAWA W	1.04	1	92	86	0	1.00	85	0.75	1.125	0.75	15	45	75
TRUSS S	1.09	50	490	5	0	1.00	85	0.75	1.125	0.75	15	45	75
OTTAWA E	1.06	248	55	29	0	1.00	85	0.75	1.125	0.75	15	45	75
			758	179	545	332							
			952	599	861	753							14.3
			0.34	0.14	0.19	0.14							B
			0.57	0.20	0.29	0.20							7.2
			4	0	2	1							100.0
			7	1	2	1							

PM Peak

Shortcut to RODEL													
	4.00	4.00	4.30	4.30						90			
	20.00	10.00	30.00	30.00						15			
	3.50	3.50	3.50	3.50						15 75			
	20.00	20.00	20.00	20.00						15.00			
	30.00	30.00	30.00	30.00						15 75			
	45.00	45.00	45.00	45.00						0FH			
	0	0	0	0						PM			
TRUSS N	1.02	53	441	334	0	1.00	85	0.75	1.125	0.75	15	45	75
OTTAWA W	1.00	13	141	83	0	1.00	85	0.75	1.125	0.75	15	45	75
TRUSS S	1.04	51	693	15	0	1.00	85	0.75	1.125	0.75	15	45	75
OTTAWA E	1.02	426	159	32	0	1.00	85	0.75	1.125	0.75	15	45	75
			828	207	759	612							
			929	616	818	683							53.9
			0.70	0.14	1.21	1.04							F
			1.38	0.20	2.52	2.13							36.1
			10	1	16	11							541.0
			18	1	33	22							



SAMPLE LOCATION SKETCH
ROUNABOUT

