

APPENDIX C

Capacity Analysis outputs – Existing Conditions

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TWO-WAY STOP CONTROL SUMMARY

Analyst: M. Raso
 Agency/Co.: Durham/York Waste Study
 Date Performed: 01/05/2009
 Analysis Time Period: AM
 Intersection: Courtice Rd. & Hwy 401 N Ramps
 Jurisdiction:
 Units: U. S. Customary
 Analysis Year:
 Project ID:
 East/West Street: Hwy 401 on-off ramps
 North/South Street: Courtice Rd.
 Intersection Orientation: NS Study period (hrs): 0.25

Major Street: Approach Movement	Vehicle Volumes and Adjustments				Southbound			
	1 L	2 T	3 R	4 L	5 T	6 R		
Volume	22	123			210	305		
Peak-Hour Factor, PHF	0.95	0.95			0.95	0.95		
Hourly Flow Rate, HFR	23	129			221	321		
Percent Heavy Vehicles	20	--	--		--	--		
Median Type/Storage	Undivided				/			
RT Channelized?								
Lanes	0	1			1	0		
Configuration	LT				TR			
Upstream Signal?	No				No			

Minor Street: Approach Movement	Westbound			Eastbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume	23		204			
Peak Hour Factor, PHF	0.95		0.95			
Hourly Flow Rate, HFR	24		214			
Percent Heavy Vehicles	14		7			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			Yes	/2		/
Lanes	0		0			
Configuration	LR					

Approach Movement	Delay, Queue Length, and Level of Service					
	1 L	2 SB	3 Westbound	4	5	6 Eastbound
Lane Config	LT	4	7	LR	9	10 11 12
v (vph)	23		238			
C(m) (vph)	942		1010			
V/c	0.02		0.24			
95% queue length	0.08		0.92			
Control Delay	8.9		10.5			
LOS	A		B			
Approach Delay			10.5			
Approach LOS			B			

Phone: Fax:
 E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: M. Raso
 Agency/Co.: Durham/York Waste Study
 Date Performed: 01/05/2009
 Analysis Time Period: AM
 Intersection: Courtice Rd. & Hwy 401 N Ramps
 Jurisdiction:
 Units: U. S. Customary
 Analysis Year:
 Project ID:
 East/West Street: Hwy 401 on-off ramps
 North/South Street: Courtice Rd.
 Intersection Orientation: NS Study period (hrs): 0.25

Major Street Movements	Vehicle Volumes and Adjustments					
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	22	123		210	305	
Peak-Hour Factor, PHF	0.95	0.95		0.95	0.95	
Peak-15 Minute Volume	6	32		55	80	
Hourly Flow Rate, HFR	23	129		221	321	
Percent Heavy Vehicles	20	--	--	--	--	
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1		1	0	
Configuration	LT				TR	
Upstream Signal?	No			No		

Minor Street Movements	Westbound			Eastbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume	23		204			
Peak Hour Factor, PHF	0.95		0.95			
Peak-15 Minute Volume	6		54			
Hourly Flow Rate, HFR	24		214			
Percent Heavy Vehicles	14		7			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			Yes	/2		/
RT Channelized?						
Lanes	0		0			
Configuration	LR					

Movements	Pedestrian Volumes and Adjustments			
	13	14	15	16
Flow (ped/hr)	0	0	0	0
Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Prog. Flow vph	Upstream Signal Data				Prog. Speed to Signal mph	Distance feet
	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec		
S2 Left-Turn Through						
S5 Left-Turn Through						

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

Shared ln volume, major th vehicles: 129
 Shared ln volume, major rt vehicles: 0
 Sat flow rate, major th vehicles: 1700
 Sat flow rate, major rt vehicles: 1700
 Number of major street through lanes: 1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Movement	Critical Gap Calculation							
	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)	4.1		7.1		6.2			
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)	20		14		7			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Grade/100			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)	0.00		0.70		0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage	4.3		6.5		6.3		
2-stage								

Movement	Follow-Up Time Calculations							
	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20		3.50		3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	20		14		7			
t(f)	2.4		3.6		3.4			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal
 Movement 2 Movement 5
 V(t) V(l,prot) V(t) V(l,prot)

V prog
 Total Saturation Flow Rate, s (vph)
 Arrival Type
 Effective Green, g (sec)
 Cycle Length, C (sec)
 Rp (from Exhibit 16-11)
 Proportion vehicles arriving on green P
 g(q1)
 g(q2)
 g(q)

Computation 2-Proportion of TWSC Intersection Time blocked
 Movement 2 Movement 5
 V(t) V(l,prot) V(t) V(l,prot)

alpha
 beta
 Travel time, t(a) (sec)
 Smoothing Factor, F
 Proportion of conflicting flow, f
 Max platooned flow, V(c,max)
 Min platooned flow, V(c,min)
 Duration of blocked period, t(p)
 Proportion time blocked, p 0.000 0.000

Computation 3-Platoon Event Periods Result

p(2) 0.000
 p(5) 0.000
 p(dom)
 p(subo)
 Constrained or unconstrained?

Proportion unblocked (1) (2) (3)
 for minor Single-stage Two-Stage Process
 movements, p(x) Process Stage I Stage II

p(1)
 p(4)
 p(7)
 p(8)
 p(9)
 p(10)
 p(11)
 p(12)

Computation 4 and 5 Single-Stage Process
 Movement 1 4 7 8 9 10 11 12
 L L L T R L T R

V c,x 542 557 129
 s
 Px
 V c,u,x

C r,x
 C plat,x

Two-Stage Process 7 8 10 11
 Stage1 Stage2 Stage1 Stage2 Stage1 Stage2 Stage1 Stage2

V(c,x)
 s 1500
 P(x)
 V(c,u,x)

C(r,x)
 C(plat,x)

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St. 9 12
 Conflicting Flows 129
 Potential Capacity 908
 Pedestrian Impedance Factor 1.00 1.00
 Movement Capacity 908
 Probability of Queue free St. 0.76 1.00

Step 2: LT from Major St. 4 1
 Conflicting Flows
 Potential Capacity 542
 Pedestrian Impedance Factor 1.00 1.00
 Movement Capacity 942
 Probability of Queue free St. 1.00 0.97
 Maj L-Shared Prob Q free St. 0.97

Step 3: TH from Minor St. 8 11
 Conflicting Flows
 Potential Capacity
 Pedestrian Impedance Factor 1.00 1.00
 Cap. Adj. factor due to Impeding mvmnt 0.97 0.97

Movement Capacity		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Conflicting Flows	557	
Potential Capacity	472	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmt		
Movement Capacity	0.98	0.75
	460	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmt		
Movement Capacity		
Probability of Queue free St.		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmt	0.97	0.97
Movement Capacity		

Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	557	
Potential Capacity	472	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmt		
Movement Capacity	0.98	0.75
	460	

Results for Two-stage process:		
a		
y		
C t	460	

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	24		214			
Movement Capacity (vph)	460		908			
Shared Lane Capacity (vph)		827				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	460		908			
Volume	24		214			
Delay	13.3		10.2			
Q sep	0.09		0.61			
Q sep +1	1.09		1.61			
round (Qsep +1)	1		2			
n max		2				
C sh		827				
SUM C sep		1010				
n		2				
C act		1010				

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	10	11	12
Lane Config	LT			LR			
v (vph)	23		238				
C(m) (vph)	942		1010				
v/c	0.02		0.24				
95% queue length	0.08		0.92				
Control Delay	8.9		10.5				
LOS	A		B				
Approach Delay			10.5				
Approach LOS			B				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
P(oj)	0.98	1.00
v(i1), Volume for stream 2 or 5	129	
v(i2), Volume for stream 3 or 6	0	
s(i1), Saturation flow rate for stream 2 or 5	1700	
s(i2), Saturation flow rate for stream 3 or 6	1700	
P*(oj)	0.97	
d(M,LT), Delay for stream 1 or 4	8.9	
N, Number of major street through lanes	1	
d(rank,1) Delay for stream 2 or 5	0.2	

HCS+: Unsignalized Intersections Release 5.2

TWO-WAY STOP CONTROL SUMMARY											
Analyst: M. Raso											
Agency/Co.: Durham/York Waste Study											
Date Performed: 01/05/2009											
Analysis Time Period: PM											
Intersection: Courtice Rd. & Hwy 401 N Ramps											
Jurisdiction:											
Units: U. S. Customary											
Analysis Year: Existing Conditions											
Project ID:											
East/West Street: Hwy 401 E-N/S											
North/South Street: Courtice Rd.											
Intersection Orientation: NS Study period (hrs): 0.25											
Vehicle Volumes and Adjustments											
Major Street:	Approach	Northbound			Southbound						
Movement		1	2	3	4	5	6				
		L	T	R	L	T	R				
Volume		41	615			196	133				
Peak-Hour Factor, PHF		0.95	0.95			0.95	0.95				
Hourly Flow Rate, HFR		43	647			206	140				
Percent Heavy Vehicles		0	--	--		--	--				
Median Type/Storage		Undivided			/						
RT Channelized?											
Lanes		0	1			1	0				
Configuration		LT			TR						
Upstream Signal?		No			No						
Minor Street:	Approach	Westbound			Eastbound						
Movement		7	8	9	10	11	12				
		L	T	R	L	T	R				
Volume		15		207							
Peak Hour Factor, PHF		0.95		0.95							
Hourly Flow Rate, HFR		15		217							
Percent Heavy Vehicles		42		4							
Percent Grade (%)		0				0					
Flared Approach: Exists?/Storage		0		Yes	/2	0					/
Lanes		0		0							
Configuration		LR									
Delay, Queue Length, and Level of Service											
Approach	SB	Westbound			Eastbound						
Movement		1	2	3	4	5	6				
Lane Config		LT		LR		LR					
v (vph)		43		232							
C(m) (vph)		1224		499							
V/c		0.04		0.46							
95% queue length		0.11		2.43							
Control Delay		8.0		19.5							
LOS		A		C							
Approach Delay				19.5							
Approach LOS				C							

HCS+: Unsignalized Intersections Release 5.2

Phone:		Fax:									
E-Mail:											
TWO-WAY STOP CONTROL(TWSC) ANALYSIS											
Analyst: M. Raso											
Agency/Co.: Durham/York Waste Study											
Date Performed: 01/05/2009											
Analysis Time Period: PM											
Intersection: Courtice Rd. & Hwy 401 N Ramps											
Jurisdiction:											
Units: U. S. Customary											
Analysis Year: Existing Conditions											
Project ID:											
East/West Street: Hwy 401 E-N/S											
North/South Street: Courtice Rd.											
Intersection Orientation: NS Study period (hrs): 0.25											
Vehicle Volumes and Adjustments											
Major Street Movements	Approach	Northbound			Southbound						
Movement		1	2	3	4	5	6				
		L	T	R	L	T	R				
Volume		41	615			196	133				
Peak-Hour Factor, PHF		0.95	0.95			0.95	0.95				
Peak-15 Minute Volume		11	162			52	35				
Hourly Flow Rate, HFR		43	647			206	140				
Percent Heavy Vehicles		0	--	--		--	--				
Median Type/Storage		Undivided			/						
RT Channelized?											
Lanes		0	1			1	0				
Configuration		LT			TR						
Upstream Signal?		No			No						
Minor Street Movements	Approach	Westbound			Eastbound						
Movement		7	8	9	10	11	12				
		L	T	R	L	T	R				
Volume		15		207							
Peak Hour Factor, PHF		0.95		0.95							
Peak-15 Minute Volume		4		54							
Hourly Flow Rate, HFR		15		217							
Percent Heavy Vehicles		42		4							
Percent Grade (%)		0				0					
Flared Approach: Exists?/Storage		0		Yes	/2	0					/
RT Channelized?											
Lanes		0		0							
Configuration		LR									
Pedestrian Volumes and Adjustments											
Movements		13	14	15	16						
Flow (ped/hr)		0	0	0	0						
Lane Width (ft)		12.0	12.0	12.0	12.0						
Walking Speed (ft/sec)		4.0	4.0	4.0	4.0						
Percent Blockage		0	0	0	0						
Upstream Signal Data											
	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance feet				
S2 Left-Turn Through											
S5 Left-Turn Through											
Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles											

		Movement 2		Movement 5					
Shared ln volume, major th vehicles:		647							
Shared ln volume, major rt vehicles:		0							
Sat flow rate, major th vehicles:		1700							
Sat flow rate, major rt vehicles:		1700							
Number of major street through lanes:		1							
Worksheet 4-Critical Gap and Follow-up Time Calculation									
Critical Gap Calculation									
Movement	1	4	7	8	9	10	11	12	
	L	L	L	T	R	L	T	R	
t(c,base)	4.1		7.1		6.2				
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
P(HV)	0		42		4				
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10	
Grade/100			0.00	0.00	0.00	0.00	0.00	0.00	
t(3,lt)	0.00		0.70		0.00				
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	
t(c)	1-stage	4.1	6.8		6.2				
	2-stage								
Follow-Up Time Calculations									
Movement	1	4	7	8	9	10	11	12	
	L	L	L	T	R	L	T	R	
t(f,base)	2.20		3.50		3.30				
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	
P(HV)	0		42		4				
t(f)	2.2		3.9		3.3				
Worksheet 5-Effect of Upstream Signals									
Computation 1-Queue Clearance Time at Upstream Signal									
	Movement 2		Movement 5						
	V(t)	V(l,prot)	V(t)	V(l,prot)					
V prog									
Total Saturation Flow Rate, s (vph)									
Arrival Type									
Effective Green, g (sec)									
Cycle Length, C (sec)									
Rp (from Exhibit 16-11)									
Proportion vehicles arriving on green P									
g(q1)									
g(q2)									
g(q)									
Computation 2-Proportion of TWSC Intersection Time blocked									
	Movement 2		Movement 5						
	V(t)	V(l,prot)	V(t)	V(l,prot)					
alpha									
beta									
Travel time, t(a) (sec)									
Smoothering Factor, F									
Proportion of conflicting flow, f									
Max platooned flow, V(c,max)									
Min platooned flow, V(c,min)									
Duration of blocked period, t(p)	0.000		0.000						
Proportion time blocked, p									
Computation 3-Platoon Event Periods									
	Result								
p(2)	0.000								
p(5)	0.000								
p(dom)									
p(subo)									
Constrained or unconstrained?									
Proportion unblocked									
	(1)	(2)	(3)						
for minor movements, p(x)	Single-Stage Process	Two-Stage Process Stage I	Two-Stage Process Stage II						
p(1)									
p(4)									
p(7)									
p(8)									
p(9)									
p(10)									
p(11)									
p(12)									
Computation 4 and 5 Single-Stage Process									
Movement	1	4	7	8	9	10	11	12	
	L	L	L	T	R	L	T	R	
V c,x	346		1009		647				
s									
Px									
V c,u,x									
Two-Stage Process									
	7		8		10		11		
	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	
V(c,x)									
s									
P(x)	1500								
V(c,u,x)									
C(r,x)									
C(plat,x)									
Worksheet 6-Impedance and Capacity Equations									
Step 1: RT from Minor St.									
						9	12		
Conflicting Flows						647			
Potential Capacity						467			
Pedestrian Impedance Factor						1.00	1.00		
Movement Capacity						467			
Probability of Queue free St.						0.54	1.00		
Step 2: LT from Major St.									
						4	1		
Conflicting Flows						346			
Potential Capacity						1224			
Pedestrian Impedance Factor						1.00	1.00		
Movement Capacity						1224			
Probability of Queue free St.						1.00	0.96		
Maj L-Shared Prob Q free St.						0.94			
Step 3: TH from Minor St.									
						8	11		
Conflicting Flows						1.00	1.00		
Potential Capacity						0.94	0.94		
Pedestrian Impedance Factor						1.00	1.00		
Cap. Adj. factor due to Impeding mvmt						0.94	0.94		

Movement Capacity		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Conflicting Flows	1009	
Potential Capacity	225	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmt		0.94
Movement Capacity	0.96	0.96
Probability of Queue free St.	217	0.51

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmt		
Movement Capacity		
Probability of Queue free St.		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmt	0.94	0.94
Movement Capacity		

Result for 2 stage process:

a		
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
---------------------------	---	----

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	1009	
Potential Capacity	225	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmt		0.94
Movement Capacity	0.96	0.96
Probability of Queue free St.	217	0.51

Results for Two-stage process:

a		
y		
C t	217	

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	15		217			
Movement Capacity (vph)	217		467			
Shared Lane Capacity (vph)		435				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	217		467			
Volume	15		217			
Delay	22.8		19.2			
Q sep	0.10		1.16			
Q sep +1	1.10		2.16			
round (Qsep +1)	1		2			
n max		2				
C sh		435				
SUM C sep		499				
n		2				
C act		499				

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LT			LR				
v (vph)	43			232				
C(m) (vph)	1224			499				
v/c	0.04			0.46				
95% queue length	0.11			2.43				
Control Delay	8.0			19.5				
LOS	A			C				
Approach Delay				19.5				
Approach LOS				C				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
P(oj)	0.96	1.00
v(i1), Volume for stream 2 or 5	647	
v(i2), Volume for stream 3 or 6	0	
s(i1), Saturation flow rate for stream 2 or 5	1700	
s(i2), Saturation flow rate for stream 3 or 6	1700	
P*(oj)	0.94	
d(M,LT), Delay for stream 1 or 4	8.0	
N, Number of major street through lanes	1	
d(rank,1) Delay for stream 2 or 5	0.5	

HCS+: Unsignalized Intersections Release 5.2

TWO-WAY STOP CONTROL SUMMARY												
Analyst:		M. Raso										
Agency/Co.:		Durham/York Waste Study										
Date Performed:		01/05/2009										
Analysis Time Period:		AM										
Intersection:		Courtice Rd. & Hwy 401 S Ramps										
Jurisdiction:												
Units:		U. S. Metric										
Analysis Year:		Existing Volumes										
Project ID:												
East/West Street:		Hwy 401 W-N/S										
North/South Street:		Courtice Rd.										
Intersection Orientation:		NS										
		Study period (hrs): 0.25										
Vehicle Volumes and Adjustments												
Major Street:	Approach	Northbound			Southbound							
	Movement	1	2	3	4	5	6					
		L	T	R	L	T	R					
Volume		3	10	3	67	13	154					
Peak-Hour Factor, PHF		0.95	0.95	0.95	0.95	0.95	0.95					
Hourly Flow Rate, HFR		3	10	3	70	13	162					
Percent Heavy Vehicles		0	--	--	8	--	--					
Median Type/Storage		Undivided										
RT Channelized?												
Lanes		0	1	0	0	1	1					
Configuration		LTR			LT			R				
Upstream Signal?		No										
Minor Street:	Approach	Westbound			Eastbound							
	Movement	7	8	9	10	11	12					
		L	T	R	L	T	R					
Volume		4	2	17	119	72	11					
Peak Hour Factor, PHF		0.95	0.95	0.95	0.95	0.95	0.95					
Hourly Flow Rate, HFR		4	2	17	125	75	11					
Percent Heavy Vehicles		17	0	0	8	0	0					
Percent Grade (%)		0										
Flared Approach: Exists?/Storage		/										
Lanes		0	1	1	0	2	0					
Configuration		LTR			LT			TR				
Delay, Queue Length, and Level of Service												
Approach	SB	Westbound			Eastbound							
Movement	1	4	7	8	9	10	11	12				
Lane Config	LTR	LT	LT	R	R	LT	LT	TR				
v (vph)	3	70	55	17	162	48						
C(m) (vph)	1414	1567	865	1074	726	752						
V/c	0.00	0.04	0.01	0.02	0.22	0.06						
95% queue length	0.01	0.14	0.03	0.05	0.85	0.20						
Control Delay	7.6	7.4	11.6	8.4	11.4	10.1						
LOS	A	A	B	A	B	B						
Approach Delay				9.2			11.1					
Approach LOS				A			B					

HCS+: Unsignalized Intersections Release 5.2

Phone:												
E-Mail:												
Fax:												
TWO-WAY STOP CONTROL(TWSC) ANALYSIS												
Analyst:		M. Raso										
Agency/Co.:		Durham/York Waste Study										
Date Performed:		01/05/2009										
Analysis Time Period:		AM										
Intersection:		Courtice Rd. & Hwy 401 S Ramps										
Jurisdiction:												
Units:		U. S. Metric										
Analysis Year:		Existing Volumes										
Project ID:												
East/West Street:		Hwy 401 W-N/S										
North/South Street:		Courtice Rd.										
Intersection Orientation:		NS										
		Study period (hrs): 0.25										
Vehicle Volumes and Adjustments												
Major Street Movements	Approach	Northbound			Southbound							
	Movement	1	2	3	4	5	6					
		L	T	R	L	T	R					
Volume		3	10	3	67	13	154					
Peak-Hour Factor, PHF		0.95	0.95	0.95	0.95	0.95	0.95					
Peak-15 Minute Volume		1	3	1	18	3	41					
Hourly Flow Rate, HFR		3	10	3	70	13	162					
Percent Heavy Vehicles		0	--	--	8	--	--					
Median Type/Storage		Undivided										
RT Channelized?												
Lanes		0	1	0	0	1	1					
Configuration		LTR			LT			R				
Upstream Signal?		No										
Minor Street Movements	Approach	Westbound			Eastbound							
	Movement	7	8	9	10	11	12					
		L	T	R	L	T	R					
Volume		4	2	17	119	72	11					
Peak Hour Factor, PHF		0.95	0.95	0.95	0.95	0.95	0.95					
Peak-15 Minute Volume		1	1	4	31	19	3					
Hourly Flow Rate, HFR		4	2	17	125	75	11					
Percent Heavy Vehicles		17	0	0	8	0	0					
Percent Grade (%)		0										
Flared Approach: Exists?/Storage		/										
RT Channelized?												
Lanes		0	1	1	0	2	0					
Configuration		LTR			LT			TR				
Pedestrian Volumes and Adjustments												
Movements	13		14		15		16					
Flow (ped/hr)	0	0	0	0	0	0	0					
Lane Width (m)	3.6	3.6	3.6	3.6	3.6	3.6						
Walking Speed (m/sec)	1.2	1.2	1.2	1.2	1.2	1.2						
Percent Blockage	0	0	0	0	0	0						
Upstream Signal Data												
Prog. Flow	Sat Flow	Arrival	Green	Cycle	Prog. Speed	Distance						
vph	vph	Type	Time	Length	to Signal	to meters						
S2 Left-Turn Through												
S5 Left-Turn Through												

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:	10	13
Shared ln volume, major rt vehicles:	3	0
Sat flow rate, major th vehicles:	1700	1700
Sat flow rate, major rt vehicles:	1700	1700
Number of major street through lanes:	1	1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation											
Movement	1	4	7	8	9	10	11	12			
	L	L	L	T	R	L	T	R			
t(c,base)	4.1	4.1	7.1	6.5	6.2	7.1	6.5	6.2			
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
P(HV)	0	8	17	0	0	8	0	0			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10			
Grade/100			0.00	0.00	0.00	0.00	0.00	0.00			
t(3,lt)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00			
t(c)	4.1	4.2	7.3	6.5	6.2	7.2	6.5	6.2			

Follow-Up Time Calculations											
Movement	1	4	7	8	9	10	11	12			
	L	L	L	T	R	L	T	R			
t(f,base)	2.20	2.20	3.50	4.00	3.30	3.50	4.00	3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90			
P(HV)	0	8	17	0	0	8	0	0			
t(f)	2.2	2.3	3.7	4.0	3.3	3.6	4.0	3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal											
	Movement 2			Movement 5							
	V(t)	V(l,prot)	V(t)	V(t)	V(l,prot)	V(t)	V(l,prot)				
V prog											
Total Saturation Flow Rate, s (vph)											
Arrival Type											
Effective Green, g (sec)											
Cycle Length, C (sec)											
Rp (from Exhibit 16-11)											
Proportion vehicles arriving on green P											
g(q1)											
g(q2)											
g(q)											

Computation 2-Proportion of TWSC Intersection Time blocked											
	Movement 2			Movement 5							
	V(t)	V(l,prot)	V(t)	V(t)	V(l,prot)	V(t)	V(l,prot)				
alpha											
beta											
Travel time, t(a) (sec)											
Smoother Factor, F											
Proportion of conflicting flow, f											
Max platooned flow, V(c,max)											
Min platooned flow, V(c,min)											
Duration of blocked period, t(p)											
Proportion time blocked, p	0.000			0.000							

Computation 3-Platoon Event Periods												
	Result											
p(2)	0.000											
p(5)	0.000											
p(dom)												
p(subo)												
Constrained or unconstrained?												

Computation 4 and 5 Single-Stage Process											
Movement	1	4	7	8	9	10	11	12			
	L	L	L	T	R	L	T	R			
V c,x	175	13	295	333	12	171	172	13			
s											
Px											
V c,u,x											
C r,x											
C plat,x											

Two-Stage Process											
	7		8		10		11				
	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2			
V(c,x)	1500		1500		1500		1500				
P(x)											
V(c,u,x)											
C(r,x)											
C(plat,x)											

Worksheet 6-Impedance and Capacity Equations											
Step 1: RT from Minor St.						9		12			
Conflicting Flows						12		13			
Potential Capacity						1074		1073			
Pedestrian Impedance Factor						1.00		1.00			
Movement Capacity						1074		1073			
Probability of Queue free St.						0.98		0.99			
Step 2: LT from Major St.						4		1			
Conflicting Flows						13		175			
Potential Capacity						1567		1414			
Pedestrian Impedance Factor						1.00		1.00			
Movement Capacity						1567		1414			
Probability of Queue free St.						0.96		1.00			
Maj L-Shared Prob Q free St.						0.95		1.00			
Step 3: TH from Minor St.						8		11			
Conflicting Flows						333		172			
Potential Capacity						590		725			
Pedestrian Impedance Factor						1.00		1.00			
Cap. Adj. factor due to Impeding mvmt						0.95		0.95			

Movement Capacity	562	691
Probability of Queue free St.	1.00	0.89
Step 4: LT from Minor St.		
	7	10
Conflicting Flows	295	171
Potential Capacity	629	779
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.85	0.95
Maj. L, Min T Adj. Imp Factor.	0.88	0.96
Cap. Adj. factor due to Impeding mvmt	0.88	0.95
Movement Capacity	551	737

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.		
	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmt		
Movement Capacity		
Probability of Queue free St.		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	333	172
Potential Capacity	590	725
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmt	0.95	0.95
Movement Capacity	562	691

Result for 2 stage process:

a		
y		
C t	562	691
Probability of Queue free St.	1.00	0.89

Step 4: LT from Minor St.		
	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	295	171
Potential Capacity	629	779
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.85	0.95
Maj. L, Min T Adj. Imp Factor.	0.88	0.96
Cap. Adj. factor due to Impeding mvmt	0.88	0.95
Movement Capacity	551	737

Results for Two-stage process:

a		
y		
C t	551	737

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	4	2	17	125	75	11
Movement Capacity (vph)	551	562	1074	737	691	1073
Shared Lane Capacity (vph)	555			726		752

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	551	562	1074	737	691	1073
Volume	4	2	17	125	75	11
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh	555			726		752
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LTR	LT	LT		R	LT		TR
v (vph)	3	70	6		17	162		48
C(m) (vph)	1414	1567	555		1074	726		752
v/c	0.00	0.04	0.01		0.02	0.22		0.06
95% queue length	0.01	0.14	0.03		0.05	0.85		0.20
Control Delay	7.6	7.4	11.6		8.4	11.4		10.1
LOS	A	A	B		A	B		B
Approach Delay				9.2			11.1	
Approach LOS				A			B	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
P(oj)	1.00	0.96
v(i1), Volume for stream 2 or 5	10	13
v(i2), Volume for stream 3 or 6	3	0
s(i1), Saturation flow rate for stream 2 or 5	1700	1700
s(i2), Saturation flow rate for stream 3 or 6	1700	1700
P*(oj)	1.00	0.95
d(M,LT), Delay for stream 1 or 4	7.6	7.4
N, Number of major street through lanes	1	1
d(rank,1) Delay for stream 2 or 5	0.0	0.3

HCS+: Unsignalized Intersections Release 5.2

TWO-WAY STOP CONTROL SUMMARY

Analyst: M. Raso
 Agency/Co.: Durham/York Waste Study
 Date Performed: 06/25/2007
 Analysis Time Period: PM
 Intersection: Courtice Rd. & Hwy 401 S Ramps
 Jurisdiction:
 Units: U. S. Metric
 Analysis Year: Existing Volumes
 Project ID:
 East/West Street: Hwy 401 W-N/S
 North/South Street: Courtice Rd.
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments		Northbound		Southbound		
Major Street: Approach Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	4	11	4	29	13	169
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	4	11	4	30	13	177
Percent Heavy Vehicles	0	--	--	7	--	--
Median Type/Storage	Undivided /					
RT Channelized?	No					
Lanes	0	1	0	0	1	1
Configuration	LTR			LT		R
Upstream Signal?	No					

Minor Street: Approach Movement		Westbound			Eastbound		
	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume	1	2	53	591	30	6	
Peak Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	
Hourly Flow Rate, HFR	1	2	55	622	31	6	
Percent Heavy Vehicles	25	0	0	3	0	0	
Percent Grade (%)	0 /						
Flared Approach: Exists?/Storage	0 /						
Lanes	0	1	1	1	1	0	
Configuration	LTR		R	L	TR		

Delay, Queue Length, and Level of Service		SB		Westbound		Eastbound	
Approach Movement	1	4	7	8	9	10	11
Lane Config	LTR	LT	LT	R	L	L	TR
v (vph)	4	30	3	55	622	37	
C(m) (vph)	1396	1571	640	1073	824	816	
V/c	0.00	0.02	0.00	0.05	0.75	0.05	
95% queue length	0.01	0.06	0.01	0.16	7.19	0.14	
Control Delay	7.6	7.3	10.7	8.5	21.5	9.6	
LOS	A	A	B	A	C	A	
Approach Delay				8.6	20.8		
Approach LOS				A	C		

HCS+: Unsignalized Intersections Release 5.2

Phone: Fax:
 E-Mail:

Analyst: M. Raso
 Agency/Co.: Durham/York Waste Study
 Date Performed: 06/25/2007
 Analysis Time Period: PM
 Intersection: Courtice Rd. & Hwy 401 S Ramps
 Jurisdiction:
 Units: U. S. Metric
 Analysis Year: Existing Volumes
 Project ID:
 East/West Street: Hwy 401 W-N/S
 North/South Street: Courtice Rd.
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments		Northbound		Southbound		
Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	4	11	4	29	13	169
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Peak-15 Minute Volume	1	3	1	8	3	44
Hourly Flow Rate, HFR	4	11	4	30	13	177
Percent Heavy Vehicles	0	--	--	7	--	--
Median Type/Storage	Undivided /					
RT Channelized?	No					
Lanes	0	1	0	0	1	1
Configuration	LTR			LT		R
Upstream Signal?	No					

Minor Street Movements		Westbound			Eastbound		
	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume	1	2	53	591	30	6	
Peak Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	
Peak-15 Minute Volume	0	1	14	156	8	2	
Hourly Flow Rate, HFR	1	2	55	622	31	6	
Percent Heavy Vehicles	25	0	0	3	0	0	
Percent Grade (%)	0 /						
Flared Approach: Exists?/Storage	0 /						
RT Channelized?	No						
Lanes	0	1	1	1	1	0	
Configuration	LTR		R	L	TR		

Pedestrian Volumes and Adjustments		Movements	
	13	14	15
Flow (ped/hr)	0	0	0
Lane Width (m)	3.6	3.6	3.6
Walking Speed (m/sec)	1.2	1.2	1.2
Percent Blockage	0	0	0

Upstream Signal Data		Prog. Flow		Sat Flow		Arrival Time		Green Cycle		Prog. Speed		Distance	
		vph	vph	sec	sec	sec	sec	sec	sec	kph	kph	meters	meters
S2	Left-Turn Through												
S5	Left-Turn Through												

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:	11	13
Shared ln volume, major rt vehicles:	4	0
Sat flow rate, major th vehicles:	1900	1900
Sat flow rate, major rt vehicles:	1700	1900
Number of major street through lanes:	1	1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation		1		4		7		8		9		10		11		12	
Movement		L	L	L	T	T	R	L	L	L	T	T	R	L	L	T	R
t(c,base)		4.1	4.1	7.1	6.5	6.2	7.1	6.5	6.2	7.1	6.5	6.2	7.1	6.5	6.2	7.1	6.5
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		0	7	25	0	0	3	0	0	3	0	0	3	0	0	3	0
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10	0.20	0.20	0.10	0.20	0.20	0.10	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	0.00
t(c)	1-stage	4.1	4.2	7.3	6.5	6.2	7.1	6.5	6.2	7.1	6.5	6.2	7.1	6.5	6.2	7.1	6.5
	2-stage																

Follow-Up Time Calculations		1		4		7		8		9		10		11		12	
Movement		L	L	L	T	T	R	L	L	L	T	T	R	L	L	T	R
t(f,base)		2.20	2.20	3.50	4.00	3.30	3.50	4.00	3.30	3.50	4.00	3.30	3.50	4.00	3.30	3.50	4.00
t(f,hv)		0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		0	7	25	0	0	3	0	0	3	0	0	3	0	0	3	0
t(f)		2.2	2.3	3.7	4.0	3.3	3.5	4.0	3.3	3.5	4.0	3.3	3.5	4.0	3.3	3.5	4.0

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal		Movement 2		Movement 5		
	V(t)	V(l,prot)	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog						
Total Saturation Flow Rate, s (vph)						
Arrival Type						
Effective Green, g (sec)						
Cycle Length, C (sec)						
Rp (from Exhibit 16-11)						
Proportion vehicles arriving on green P						
g(q1)						
g(q2)						
g(q)						

Computation 2-Proportion of TWSC Intersection Time blocked		Movement 2		Movement 5		
	V(t)	V(l,prot)	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha						
beta						
Travel time, t(a) (sec)						
Smoothing Factor, F						
Proportion of conflicting flow, f						
Max platooned flow, V(c,max)						
Min platooned flow, V(c,min)						
Duration of blocked period, t(p)						
Proportion time blocked, p		0.000		0.000		

Computation 3-Platoon Event Periods		Result	
p(2)		0.000	
p(5)		0.000	
p(dom)			
p(subo)			
Constrained or unconstrained?			

Proportion unblocked for minor movements, p(x)		(1) Single-Stage Process		(2) Two-Stage Process Stage I		(3) Two-Stage Process Stage II	
p(1)							
p(4)							
p(7)							
p(8)							
p(9)							
p(10)							
p(11)							
p(12)							

Computation 4 and 5 Single-Stage Process		1		4		7		8		9		10		11		12	
Movement		L	L	L	T	T	R	L	L	L	T	T	R	L	L	T	R
V c,x		190	15	201	271	13	95	96	13								
s																	
Px																	
V c,u,x																	
C r,x																	
C (plat,x)																	

Two-Stage Process		7		8		10		11	
		Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)		1500		1500		1500		1500	
P(x)									
V(c,u,x)									
C(r,x)									
C(plat,x)									

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.		9		12	
Conflicting Flows		13		13	
Potential Capacity		1073		1073	
Pedestrian Impedance Factor		1.00		1.00	
Movement Capacity		1073		1073	
Probability of Queue free St.		0.95		0.99	

Step 2: LT from Major St.		4		1	
Conflicting Flows		15		190	
Potential Capacity		1571		1396	
Pedestrian Impedance Factor		1.00		1.00	
Movement Capacity		1571		1396	
Probability of Queue free St.		0.98		1.00	
Maj L-Shared Prob Q free St.		0.98		1.00	

Step 3: TH from Minor St.		8		11	
Conflicting Flows		271		96	
Potential Capacity		639		798	
Pedestrian Impedance Factor		1.00		1.00	
Cap. Adj. factor due to Impeding mvmt		0.98		0.98	

Movement Capacity	625	780
Probability of Queue free St.	1.00	0.96
Step 4: LT from Minor St.		
	7	10
Conflicting Flows	201	95
Potential Capacity	710	886
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.94	0.97
Maj. L, Min T Adj. Imp Factor.	0.95	0.98
Cap. Adj. factor due to Impeding mvmt	0.95	0.93
Movement Capacity	673	824

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.		
	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmt		
Movement Capacity		
Probability of Queue free St.		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	271	96
Potential Capacity	639	798
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmt	0.98	0.98
Movement Capacity	625	780

Result for 2 stage process:

a		
y		
C t	625	780
Probability of Queue free St.	1.00	0.96

Step 4: LT from Minor St.		
	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	201	95
Potential Capacity	710	886
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.94	0.97
Maj. L, Min T Adj. Imp Factor.	0.95	0.98
Cap. Adj. factor due to Impeding mvmt	0.95	0.93
Movement Capacity	673	824

Results for Two-stage process:

a		
y		
C t	673	824

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	1	2	55	622	31	6
Movement Capacity (vph)	673	625	1073	824	780	1073
Shared Lane Capacity (vph)	640					816

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	673	625	1073	824	780	1073
Volume	1	2	55	622	31	6
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh	640					816
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LTR	LT	LT		R	L		TR
v (vph)	4	30	3		55	622		37
C(m) (vph)	1396	1571	640		1073	824		816
v/c	0.00	0.02	0.00		0.05	0.75		0.05
95% queue length	0.01	0.06	0.01		0.16	7.19		0.14
Control Delay	7.6	7.3	10.7		8.5	21.5		9.6
LOS	A	A	B		A	C		A
Approach Delay				8.6			20.8	
Approach LOS				A			C	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
P(oj)	1.00	0.98
v(i1), Volume for stream 2 or 5	11	13
v(i2), Volume for stream 3 or 6	4	0
s(i1), Saturation flow rate for stream 2 or 5	1900	1900
s(i2), Saturation flow rate for stream 3 or 6	1700	1900
P*(oj)	1.00	0.98
d(M,LT), Delay for stream 1 or 4	7.6	7.3
N, Number of major street through lanes	1	1
d(rank,1) Delay for stream 2 or 5	0.0	0.1