

Date Performed: 05/06/2023  
 Analysis Time Period: Pico Manha  
 Intersection: B  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: M2  
 North/South Street: M7  
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments							
Major Street:	Approach Movement	Eastbound				Westbound	
		1 L	2 T	3 R	4   L	5 T	6 R
Volume					9	757	
Peak-Hour Factor, PHF					0.91	0.91	
Hourly Flow Rate, HFR					9	831	
Percent Heavy Vehicles		--	--		12	--	--
Median Type/Storage		Undivided		/			
RT Channelized?							
Lanes					0	2	
Configuration					LT	T	
Upstream Signal?		No				No	

Minor Street:	Approach Movement	Northbound			Southbound		
		7 L	8 T	9 R	10   L	11 T	12 R
Volume		39					
Peak Hour Factor, PHF		1.00					
Hourly Flow Rate, HFR		39					
Percent Heavy Vehicles							
Percent Grade (%)		0			/	0	/
Flared Approach: Exists?/Storage					/		/
Lanes		1					
Configuration		L					

Approach Movement	Delay, Queue Length, and Level of Service							
	EB	WB	Northbound			Southbound		
Lane Config	1	4	7	8	9	10	11	12
		LT	L					
v (vph)	9	39						
C(m) (vph)	1560	581						
v/c	0.01	0.07						
95% queue length	0.02	0.22						
Control Delay	7.3	11.6						
LOS	A	B						
Approach Delay				11.6				
Approach LOS				B				

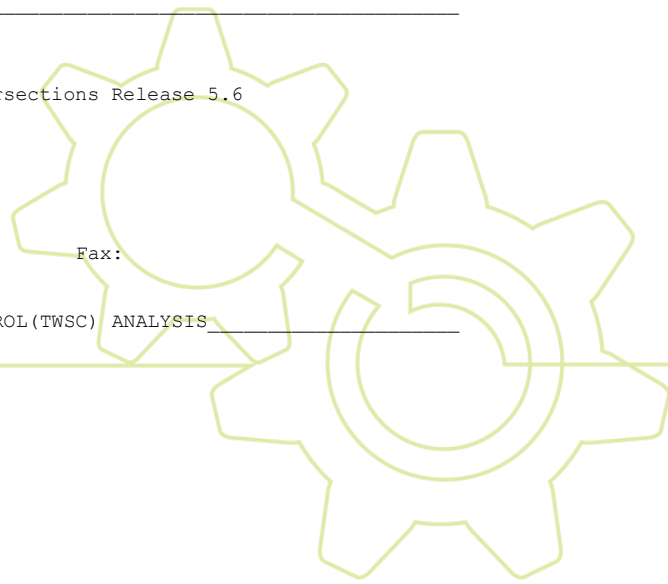
HCS+: Unsignalized Intersections Release 5.6

Phone:  
E-Mail:

Fax:

TWO-WAY STOP CONTROL (TWSC) ANALYSIS

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Manha  
 Intersection: B  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:





t (c)	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
	1-stage		4.2	6.4					
	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					
t (f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P (HV)		12						
t (f)		2.3	3.5					

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 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)

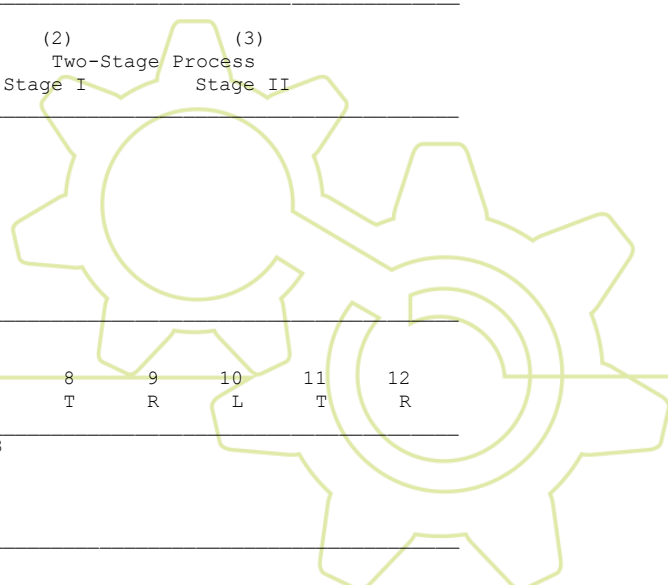
Computation 4 and 5

Single-Stage Process

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R

V c, x  
s  
Px  
V c, u, x  
C r, x

	0	433
--	---	-----



C plat,x

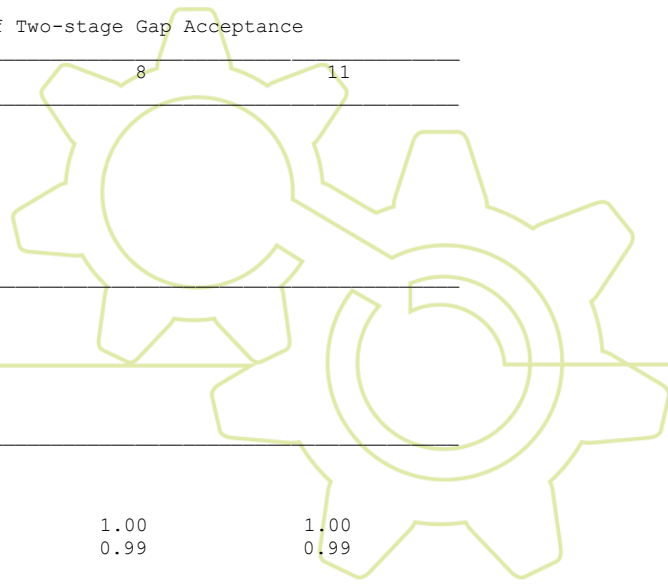
Two-Stage Process		7		8		10		11	
	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	
V(c,x)									
s		3000							
P(x)									
V(c,u,x)									
C(r,x)									
C(plat,x)									

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.					9			12
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor					1.00			1.00
Movement Capacity								
Probability of Queue free St.					1.00			1.00
Step 2: LT from Major St.					4			1
Conflicting Flows					0			
Potential Capacity					1560			
Pedestrian Impedance Factor					1.00			1.00
Movement Capacity					1560			
Probability of Queue free St.					0.99			1.00
Maj L-Shared Prob Q free St.					0.99			
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					0.99			0.99
Movement Capacity								
Probability of Queue free St.					1.00			1.00
Step 4: LT from Minor St.					7			10
Conflicting Flows					433			
Potential Capacity					584			
Pedestrian Impedance Factor					1.00			1.00
Maj. L, Min T Impedance factor								0.99
Maj. L, Min T Adj. Imp Factor.								1.00
Cap. Adj. factor due to Impeding mvmnt					0.99			1.00
Movement Capacity					581			

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 mvmnt								
Movement Capacity								
Probability of Queue free St.								
Part 2 - Second Stage								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor								
Cap. Adj. factor due to Impeding mvmnt								
Movement Capacity								
Part 3 - Single Stage								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor					1.00			1.00
Cap. Adj. factor due to Impeding mvmnt					0.99			0.99



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 mvmnt

Movement Capacity

Part 2 - Second Stage

Conflicting Flows

Potential Capacity

Pedestrian Impedance Factor

Cap. Adj. factor due to Impeding mvmnt

Movement Capacity

Part 3 - Single Stage

Conflicting Flows 433

Potential Capacity 584

Pedestrian Impedance Factor 1.00 1.00

Maj. L, Min T Impedance factor 0.99

Maj. L, Min T Adj. Imp Factor. 1.00

Cap. Adj. factor due to Impeding mvmnt 0.99 1.00

Movement Capacity 581

Results for Two-stage process:

a

Y

C t

581

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R

Volume (vph)	39
Movement Capacity (vph)	581
Shared Lane Capacity (vph)	

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R

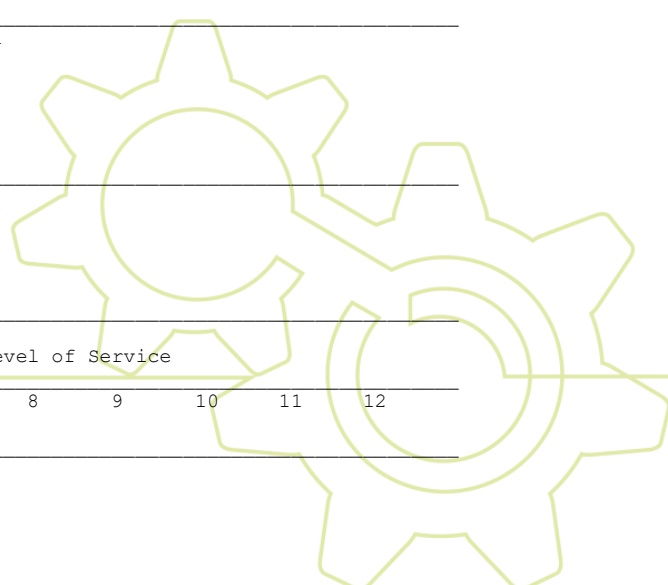
C sep	581
Volume	39
Delay	
Q sep	
Q sep +1	
round (Qsep +1)	

n max	
C sh	
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		LT	L					

v (vph)	9	39
C (m) (vph)	1560	581
v/c	0.01	0.07
95% queue length	0.02	0.22
Control Delay	7.3	11.6



LOS	A	B	
Approach Delay			11.6
Approach LOS			B

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	0.99
v(i1), Volume for stream 2 or 5		0
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)		0.99
d(M,LT), Delay for stream 1 or 4		7.3
N, Number of major street through lanes		2
d(rank,1) Delay for stream 2 or 5		

### 1.1.2.4 Interseção B – Pico Tarde

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TWO-WAY STOP CONTROL SUMMARY

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Tarde  
 Intersection: B  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: M2  
 North/South Street: M7  
 Intersection Orientation: EW

Study period (hrs): 0.25

Vehicle Volumes and Adjustments										
Major Street:	Approach Movement	Eastbound				Westbound				
		1	2	3	4	5	6			
		L	T	R	L	T	R			
Volume					12	2003				
Peak-Hour Factor, PHF					0.91	0.91				
Hourly Flow Rate, HFR					13	2201				
Percent Heavy Vehicles		--	--	--		--	--			
Median Type/Storage		Undivided				/				
RT Channelized?										
Lanes					0	2				
Configuration					LT	T				
Upstream Signal?		No				No				
Minor Street:	Approach Movement	Northbound				Southbound				
		7	8	9	10	11	12			
		L	T	R	L	T	R			
Volume		29								
Peak Hour Factor, PHF		1.00								
Hourly Flow Rate, HFR		29								
Percent Heavy Vehicles		20								
Percent Grade (%)		0				0				
Flared Approach: Exists?/Storage		/				/				
Lanes		1								
Configuration		L								
	Delay, Queue Length, and Level of Service									
Approach	EB	Northbound				Southbound				
Movement	1	4	7	8	9	10	11	12		
Lane Config	LT	L	L	L	L	L	L	L		
v (vph)	13	29								
C(m) (vph)	1560	207								

v/c	0.01	0.14	
95% queue length	0.03	0.48	
Control Delay	7.3	25.2	
LOS	A	D	
Approach Delay			25.2
Approach LOS			D

HCS+: Unsignalized Intersections Release 5.6

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
E-Mail: \_\_\_\_\_

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Tarde  
 Intersection: B  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: M2  
 North/South Street: M7  
 Intersection Orientation: EW  
 Study period (hrs): 0.25

Vehicle Volumes and Adjustments						
Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume				12	2003	
Peak-Hour Factor, PHF				0.91	0.91	
Peak-15 Minute Volume				3	550	
Hourly Flow Rate, HFR				13	2201	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes				0	2	
Configuration				LT	T	
Upstream Signal?		No			No	
Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R

Volume	29					
Peak Hour Factor, PHF	1.00					
Peak-15 Minute Volume	7					
Hourly Flow Rate, HFR	29					
Percent Heavy Vehicles	20					
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized						
Lanes	1					
Configuration	L					

Pedestrian Volumes and Adjustments				
Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0
Lane Width (m)	3.6	3.6	3.6	3.6
Walking Speed (m/sec)	1.2	1.2	1.2	1.2
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 kph	Distance to Signal 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:		0
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:		2

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					
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)			20					
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70					
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		4.2	6.6					
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					
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)			20					
t(f)		2.3	3.7					

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)

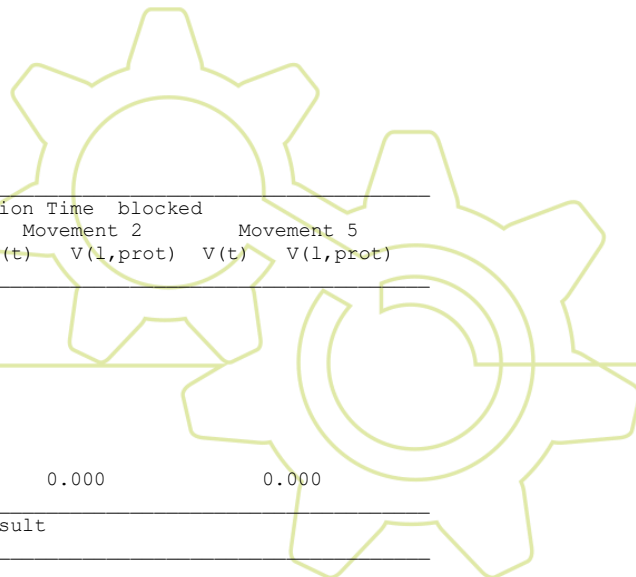
Computation 2-Proportion of TWSC Intersection Time blocked

	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

Computation 3-Platoon Event Periods

Result
0.000
0.000





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) 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 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
--	--------	--------	--------	--------	--------	---------	---------	---------

V c,x		0	1126					
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	3000							
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
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Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 2: LT from Major St.	4	1
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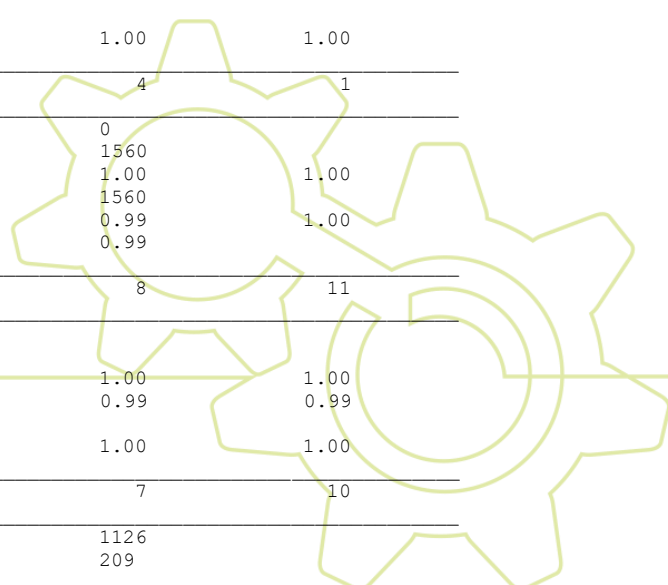
Conflicting Flows	0	
Potential Capacity	1560	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1560	
Probability of Queue free St.	0.99	1.00
Maj L-Shared Prob Q free St.	0.99	

Step 3: TH from Minor St.	8	11
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Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
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Conflicting Flows	1126
Potential Capacity	209



Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	207	

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

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

Part 2 - Second Stage  
 Conflicting Flows  
 Potential Capacity  
 Pedestrian Impedance Factor  
 Cap. Adj. factor due to Impeding mvmnt  
 Movement Capacity

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
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 mvmnt  
 Movement Capacity

Part 2 - Second Stage  
 Conflicting Flows  
 Potential Capacity  
 Pedestrian Impedance Factor  
 Cap. Adj. factor due to Impeding mvmnt  
 Movement Capacity

Part 3 - Single Stage		
Conflicting Flows	1126	
Potential Capacity	209	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	207	

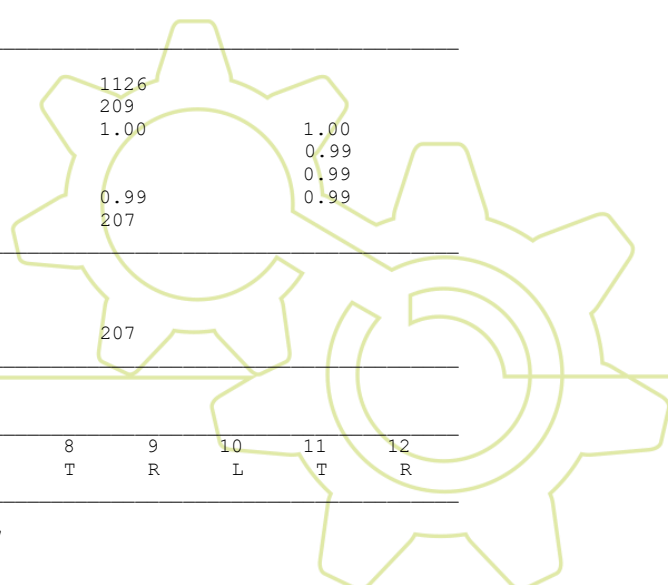
Results for Two-stage process:

a		
Y		
C t	207	

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R

Volume (vph)	29
Movement Capacity (vph)	207
Shared Lane Capacity (vph)	



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	207					
Volume	29					
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
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		LT	L					
v (vph)		13	29					
C(m) (vph)		1560	207					
v/c		0.01	0.14					
95% queue length		0.03	0.48					
Control Delay		7.3	25.2					
LOS		A	D					
Approach Delay				25.2				
Approach LOS				D				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	0.99
v(i1), Volume for stream 2 or 5		0
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)		0.99
d(M,LT), Delay for stream 1 or 4		7.3
N, Number of major street through lanes		2
d(rank,1) Delay for stream 2 or 5		

### 1.1.2.5 Interseção C – Pico Manhã

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Manhã  
 Intersection: C  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: MOV01-MOV05-MOV07  
 North/South Street: MOV08  
 Intersection Orientation: EW

Study period (hrs): 1.00

Major Street:	Approach Movement	Vehicle Volumes and Adjustments					
		Eastbound			Westbound		
		1	2	3	4	5	6
		L	T	R	L	T	R

Volume	39	1790					
Peak-Hour Factor, PHF	0.91	0.91					
Hourly Flow Rate, HFR	42	1967					
Percent Heavy Vehicles	--	--	--	--	--	--	--
Median Type/Storage	Undivided		/				
RT Channelized?							
Lanes	0	2					
Configuration	LT T						
Upstream Signal?	No				No		

Minor Street:	Approach	Northbound				Southbound		
	Movement	7	8	9		10	11	12
		L	T	R		L	T	R

Volume						9		
Peak Hour Factor, PHF						0.91		
Hourly Flow Rate, HFR						9		
Percent Heavy Vehicles						12		
Percent Grade (%)		0					0	
Flared Approach: Exists?/Storage					/			/
Lanes						1		
Configuration						L		

Delay, Queue Length, and Level of Service										
Approach	EB	WB	Northbound			Southbound				
Movement	1	4		7	8	9		10	11	12
Lane Config	LT							L		
v (vph)	42							9		
C(m) (vph)	1566							229		
v/c	0.03							0.04		
95% queue length	0.08							0.12		
Control Delay	7.4							21.4		
LOS	A							C		
Approach Delay									21.4	
Approach LOS									C	

HCS+: Unsignalized Intersections Release 5.6

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
E-Mail: \_\_\_\_\_

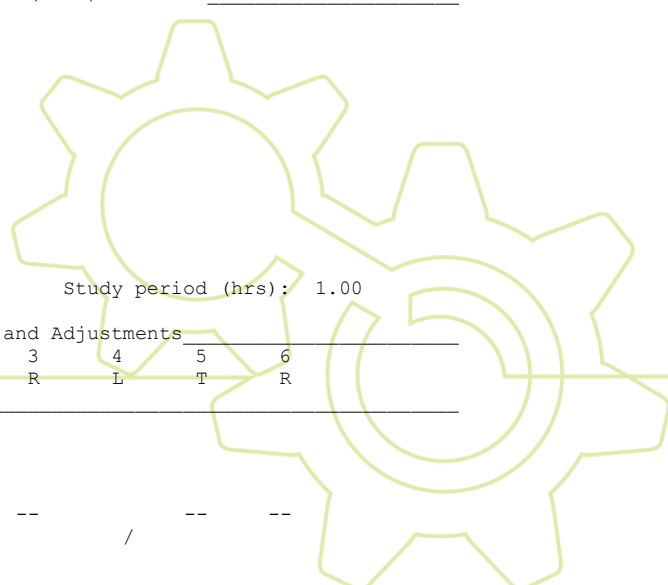
TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Progeplan  
Agency/Co.: \_\_\_\_\_  
Date Performed: 05/06/2023  
Analysis Time Period: Pico Manha  
Intersection: C  
Jurisdiction: DER/DF  
Units: U. S. Metric  
Analysis Year: 2023  
Project ID: \_\_\_\_\_  
East/West Street: MOV01-MOV05-MOV07  
North/South Street: MOV08  
Intersection Orientation: EW

Study period (hrs): 1.00

Vehicle Volumes and Adjustments						
Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R

Volume	39	1790					
Peak-Hour Factor, PHF	0.91	0.91					
Peak-15 Minute Volume	11	492					
Hourly Flow Rate, HFR	42	1967					
Percent Heavy Vehicles	--	--	--	--	--	--	--
Median Type/Storage	Undivided		/				
RT Channelized?							



Lanes	0		2			
Configuration	LT		T			
Upstream Signal?	No		No			
Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				9		
Peak Hour Factor, PHF				0.91		
Peak-15 Minute Volume				2		
Hourly Flow Rate, HFR				9		
Percent Heavy Vehicles				12		
Percent Grade (%)	0				0	
Flared Approach: Exists?/Storage			/		/	
RT Channelized						
Lanes				1		
Configuration				L		

Pedestrian Volumes and Adjustments				
Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0
Lane Width (m)	3.6	3.6	3.6	3.6
Walking Speed (m/sec)	1.2	1.2	1.2	1.2
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 kph	Distance to Signal 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:	0	
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:	2	

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		
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)						12		
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)	0.00					0.70		
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	4.2					6.5		
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		
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)						12		
t(f)	2.3					3.6		

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 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

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
----------	--------	--------	--------	--------	--------	---------	---------	---------

V c, x	0					1067			
s									
Px									
V c, u, x									

C r, x  
 C plat, x

---

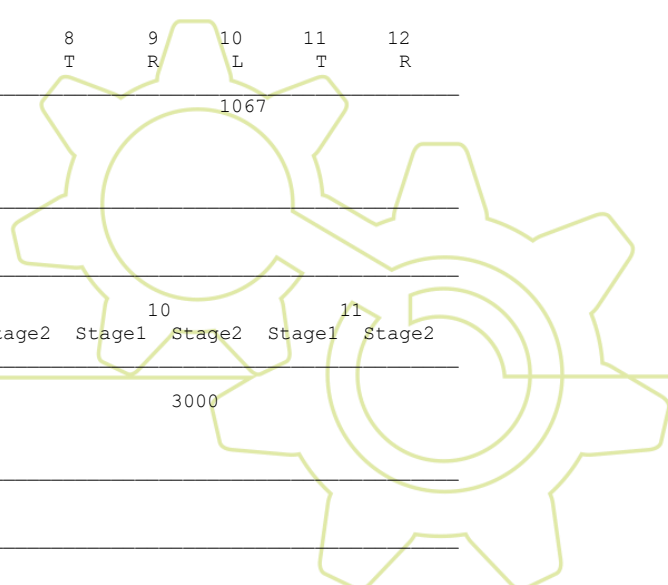
Two-Stage Process

	7 Stage1	8 Stage2	10 Stage1	11 Stage2
--	-------------	-------------	--------------	--------------

V(c, x)					3000				
s									
P(x)									
V(c, u, x)									

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

---

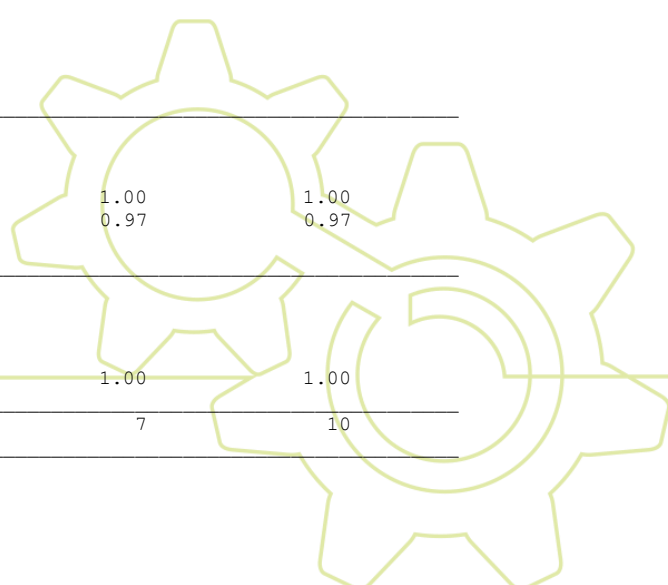


Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00
Step 2: LT from Major St.	4	1
Conflicting Flows		0
Potential Capacity		1566
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		1566
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		1067
Potential Capacity		235
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.97	
Maj. L, Min T Adj. Imp Factor.	0.98	
Cap. Adj. factor due to Impeding mvmnt	0.98	0.97
Movement Capacity		229

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 mvmnt		
Movement Capacity		
Probability of Queue free St.		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	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 mvmnt		



Movement Capacity

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		1067
Potential Capacity		235
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.97	
Maj. L, Min T Adj. Imp Factor.	0.98	
Cap. Adj. factor due to Impeding mvmnt	0.98	0.97
Movement Capacity		229
Results for Two-stage process:		
a		
Y		
C t		229

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)				9		
Movement Capacity (vph)				229		
Shared Lane Capacity (vph)						

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				229		
Volume				9		
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
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	LT					L		
v (vph)	42					9		
C (m) (vph)	1566					229		
v/c	0.03					0.04		
95% queue length	0.08					0.12		
Control Delay	7.4					21.4		
LOS	A					C		
Approach Delay							21.4	
Approach LOS							C	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	0.97	1.00
v(i1), Volume for stream 2 or 5	0	
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 7.4  
 N, Number of major street through lanes 2  
 d(rank,1) Delay for stream 2 or 5

### 1.1.2.6 Interseção C – Pico Tarde

HCS+: Unsignalized Intersections Release 5.6

#### TWO-WAY STOP CONTROL SUMMARY

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Tarde  
 Intersection: C  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: MOV01-MOV05-MOV07  
 North/South Street: MOV08  
 Intersection Orientation: EW Study period (hrs): 1.00

		Vehicle Volumes and Adjustments					
Major Street:	Approach Movement	Eastbound			Westbound		
		1	2	3	4	5	6
		L	T	R	L	T	R
Volume		29	703				
Peak-Hour Factor, PHF		0.91	0.91				
Hourly Flow Rate, HFR		31	772				
Percent Heavy Vehicles		21	--	--		--	--
Median Type/Storage		Undivided			/		
RT Channelized?							
Lanes		0	2				
Configuration		LT T					
Upstream Signal?		No				No	

Minor Street:	Approach Movement	Northbound			Southbound		
		7	8	9	10	11	12
		L	T	R	L	T	R
Volume					12		
Peak Hour Factor, PHF					0.91		
Hourly Flow Rate, HFR					13		
Percent Heavy Vehicles					0		
Percent Grade (%)		0				0	
Flared Approach: Exists?/Storage					/		/
Lanes					1		
Configuration					L		

		Delay, Queue Length, and Level of Service							
Approach Movement	EB	WB	Northbound			Southbound			
	1	4	7	8	9	10	11	12	
Lane Config	LT						L		
v (vph)	31						13		
C (m) (vph)	1507						560		
v/c	0.02						0.02		
95% queue length	0.06						0.07		
Control Delay	7.4						11.6		
LOS	A						B		
Approach Delay							11.6		
Approach LOS							B		

HCS+: Unsignalized Intersections Release 5.6

Phone:  
E-Mail:

Fax:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Tarde  
 Intersection: C  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: MOV01-MOV05-MOV07  
 North/South Street: MOV08  
 Intersection Orientation: EW  
 Study period (hrs): 1.00

Vehicle Volumes and Adjustments						
Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	29	703				
Peak-Hour Factor, PHF	0.91	0.91				
Peak-15 Minute Volume	8	193				
Hourly Flow Rate, HFR	31	772				
Percent Heavy Vehicles	21	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	2				
Configuration	LT T					
Upstream Signal?		No			No	
Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				12		
Peak Hour Factor, PHF				0.91		
Peak-15 Minute Volume				3		
Hourly Flow Rate, HFR				13		
Percent Heavy Vehicles				0		
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized						
Lanes				1		
Configuration				L		

Pedestrian Volumes and Adjustments				
Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0
Lane Width (m)	3.6	3.6	3.6	3.6
Walking Speed (m/sec)	1.2	1.2	1.2	1.2
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 kph	Distance to Signal 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:	0	0
Shared ln volume, major rt vehicles:	0	0
Sat flow rate, major th vehicles:	1700	1700
Sat flow rate, major rt vehicles:	1700	1700

Number of major street through lanes: 2

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		
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)	21					0		
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)	0.00					0.70		
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					6.4		
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		
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	21					0		
t(f)	2.4					3.5		

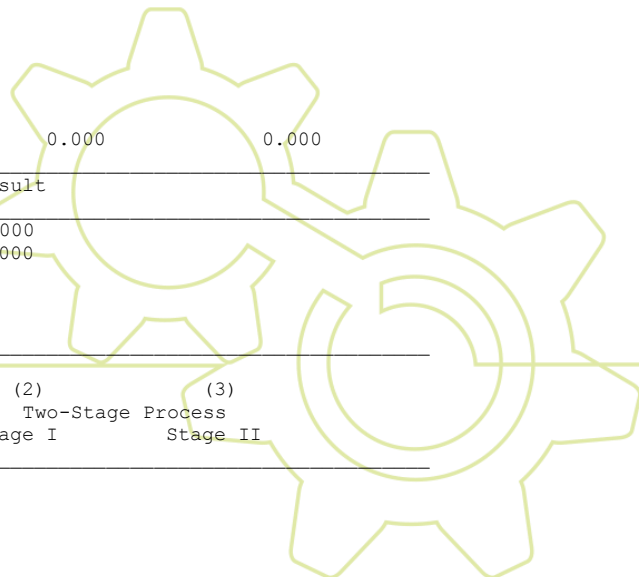
Worksheet 5-Effect of Upstream Signals

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 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

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R

---

V c,x	0					448		
-------	---	--	--	--	--	-----	--	--

s  
P<sub>x</sub>  
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)						3000		
--------	--	--	--	--	--	------	--	--

s  
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

Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00

---

Step 2: LT from Major St.	4	1
---------------------------	---	---

---

Conflicting Flows

Potential Capacity		0
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		1507
Probability of Queue free St.	1.00	0.98
Maj L-Shared Prob Q free St.		0.98

---

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	0.98	0.98
Movement Capacity		
Probability of Queue free St.	1.00	1.00

---

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

---

Conflicting Flows

Potential Capacity		448
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.98	
Maj. L, Min T Adj. Imp Factor.	0.98	
Cap. Adj. factor due to Impeding mvmnt	0.98	0.98
Movement Capacity		560

---

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

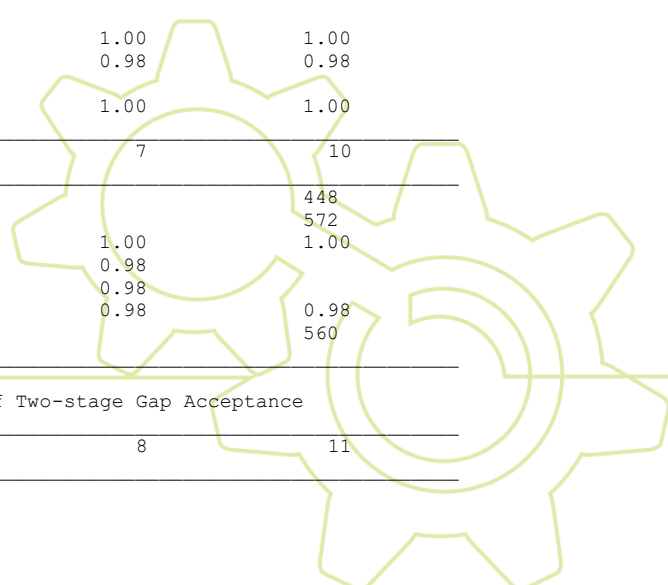
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Step 3: TH from Minor St.	8	11
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Part 1 - First Stage

Conflicting Flows  
Potential Capacity  
Pedestrian Impedance Factor



Cap. Adj. factor due to Impeding mvmnt  
Movement Capacity  
Probability of Queue free St.

---

Part 2 - Second Stage  
Conflicting Flows  
Potential Capacity  
Pedestrian Impedance Factor  
Cap. Adj. factor due to Impeding mvmnt  
Movement Capacity

---

Part 3 - Single Stage  
Conflicting Flows  
Potential Capacity  
Pedestrian Impedance Factor 1.00 1.00  
Cap. Adj. factor due to Impeding mvmnt 0.98 0.98  
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 mvmnt  
Movement Capacity

---

Part 2 - Second Stage  
Conflicting Flows  
Potential Capacity  
Pedestrian Impedance Factor  
Cap. Adj. factor due to Impeding mvmnt  
Movement Capacity

---

Part 3 - Single Stage  
Conflicting Flows 448  
Potential Capacity 572  
Pedestrian Impedance Factor 1.00 1.00  
Maj. L, Min T Impedance factor 0.98  
Maj. L, Min T Adj. Imp Factor. 0.98  
Cap. Adj. factor due to Impeding mvmnt 0.98 0.98  
Movement Capacity 560

---

Results for Two-stage process:  
a  
Y  
C t 560

---

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)				13		
Movement Capacity (vph)				560		
Shared Lane Capacity (vph)						

---

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				560		
Volume				13		
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						

C sh  
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	LT					L		
v (vph)	31					13		
C(m) (vph)	1507					560		
v/c	0.02					0.02		
95% queue length	0.06					0.07		
Control Delay	7.4					11.6		
LOS	A					B		
Approach Delay						11.6		
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	0	
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)	0.98	
d(M,LT), Delay for stream 1 or 4	7.4	
N, Number of major street through lanes	2	
d(rank,1) Delay for stream 2 or 5		

### 1.1.2.7 Interseção D – Pico Manhã

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Progeplan  
Agency/Co.:  
Date Performed: 05/06/2023  
Analysis Time Period: Pico Manha  
Intersection: D  
Jurisdiction: DER/DF  
Units: U. S. Metric  
Analysis Year: 2023  
Project ID:  
East/West Street: MOV01-MOV05-MOV07  
North/South Street: MOV06  
Intersection Orientation: EW

Study period (hrs): 1.00

Major Street: Approach Movement	Vehicle Volumes and Adjustments					
	Eastbound			Westbound		
	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		1790	10			
Peak-Hour Factor, PHF		0.91	0.91			
Hourly Flow Rate, HFR		1967	10			
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage RT Channelized?		Undivided		/		
Lanes		2	0			
Configuration		T	TR			
Upstream Signal?		No			No	
Minor Street: Approach Movement	Northbound			Southbound		
	7	8	9	10	11	12
	L	T	R	L	T	R
Volume			3			
Peak Hour Factor, PHF			0.91			
Hourly Flow Rate, HFR			3			

Percent Heavy Vehicles 34  
 Percent Grade (%) 0 / 0 /  
 Flared Approach: Exists?/Storage / /  
 Lanes 1  
 Configuration R

Delay, Queue Length, and Level of Service										
Approach	EB		WB		Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12		
Lane Config					R					
v (vph)						3				
C(m) (vph)						261				
v/c						0.01				
95% queue length						0.03				
Control Delay						19.0				
LOS						C				
Approach Delay						19.0				
Approach LOS						C				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:  
 E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Manha  
 Intersection: D  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: MOV01-MOV05-MOV07  
 North/South Street: MOV06  
 Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments						
Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		1790	10			
Peak-Hour Factor, PHF		0.91	0.91			
Peak-15 Minute Volume		492	3			
Hourly Flow Rate, HFR		1967	10			
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage		Undivided		/		
RT Channelized?						
Lanes		2	0			
Configuration		T	TR			
Upstream Signal?		No		No		
Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume			3			
Peak Hour Factor, PHF			0.91			
Peak-15 Minute Volume			1			
Hourly Flow Rate, HFR			3			
Percent Heavy Vehicles			34			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/		/	
RT Channelized			No			
Lanes			1			
Configuration			R			

Pedestrian Volumes and Adjustments				
Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0
Lane Width (m)	3.6	3.6	3.6	3.6
Walking Speed (m/sec)	1.2	1.2	1.2	1.2
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 kph	Distance to Signal 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:		
Shared ln volume, major rt vehicles:		
Sat flow rate, major th vehicles:		
Sat flow rate, major rt vehicles:		
Number of major street through lanes:		

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)					6.2			
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)					34			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)					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					6.5			
2-stage								

Follow-Up Time Calculations								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)					3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)					34			
t(f)					3.6			

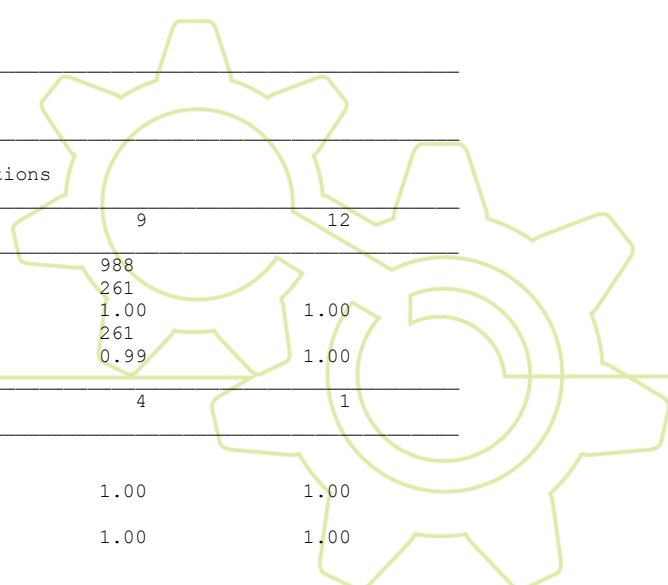
Worksheet 5-Effect of Upstream Signals

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 5



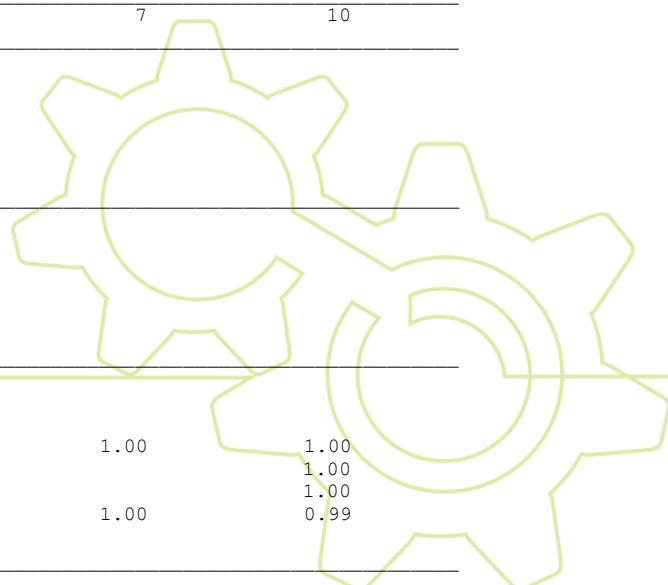
	V(t)	V(l,prot)	V(t)	V(l,prot)				
alpha								
beta								
Travel time, t(a) (sec)								
Smoothing Factor, F								
Proportion of conflicting flow, f								
Max platooned flow, V(c,max)								
Min platooned flow, V(c,min)								
Duration of blocked period, t(p)								
Proportion time blocked, p		0.000		0.000				
<b>Computation 3-Platoon Event Periods</b>								
		<b>Result</b>						
p(2)		0.000						
p(5)		0.000						
p(dom)								
p(subo)								
Constrained or unconstrained?								
<b>Proportion unblocked for minor movements, p(x)</b>								
	(1)	(2)	(3)					
	Single-stage Process	Two-Stage Process Stage I	Process Stage II					
p(1)								
p(4)								
p(7)								
p(8)								
p(9)								
p(10)								
p(11)								
p(12)								
<b>Computation 4 and 5 Single-Stage Process</b>								
Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x					988			
s								
Px								
V c,u,x								
C r,x								
C plat,x								
<b>Two-Stage Process</b>								
	7	8	10	11				
	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s								
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								
<b>Worksheet 6-Impedance and Capacity Equations</b>								
<b>Step 1: RT from Minor St.</b>					9	12		
Conflicting Flows					988			
Potential Capacity					261			
Pedestrian Impedance Factor					1.00		1.00	
Movement Capacity					261			
Probability of Queue free St.					0.99		1.00	
<b>Step 2: LT from Major St.</b>					4	1		
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor					1.00		1.00	
Movement Capacity								
Probability of Queue free St.					1.00		1.00	
Maj L-Shared Prob Q free St.								



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	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.99
Movement Capacity		

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 mvmnt		
Movement Capacity		
Probability of Queue free St.		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
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 mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.99
Movement Capacity		



Results for Two-stage process:

a  
y  
C t

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)			3			
Movement Capacity (vph)			261			
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep			261			
Volume			3			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
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					R			
v (vph)					3			
C(m) (vph)					261			
v/c					0.01			
95% queue length					0.03			
Control Delay					19.0			
LOS					C			
Approach Delay				19.0				
Approach LOS				C				

Worksheet 11-Shared Major LT Impedance and Delay

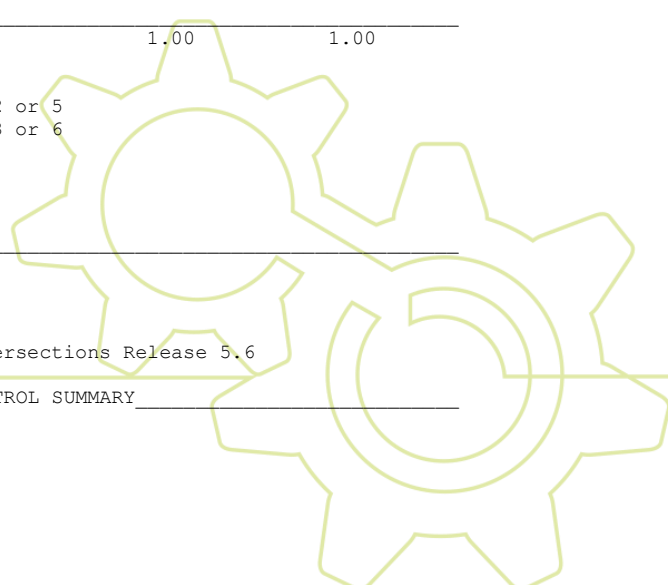
	Movement 2	Movement 5
p(oj)	1.00	1.00
v(i1), Volume for stream 2 or 5		
v(i2), Volume for stream 3 or 6		
s(i1), Saturation flow rate for stream 2 or 5		
s(i2), Saturation flow rate for stream 3 or 6		
P*(oj)		
d(M,LT), Delay for stream 1 or 4		
N, Number of major street through lanes		
d(rank,1) Delay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

### 1.1.2.8 Interseção D – Pico Tarde

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Progeplan  
Agency/Co.:  
Date Performed: 05/06/2023  
Analysis Time Period: Pico Tarde  
Intersection: D  
Jurisdiction: DER/DF  
Units: U. S. Metric



Analysis Year: 2023  
 Project ID: AMPLIAÇÃO CNPQ - FUTURO  
 East/West Street: MOV01-MOV05-MOV07  
 North/South Street: MOV06  
 Intersection Orientation: EW Study period (hrs): 1.00

		Vehicle Volumes and Adjustments					
Major Street:	Approach Movement	Eastbound			Westbound		
		1 L	2 T	3 R	4 L	5 T	6 R
Volume		703		6			
Peak-Hour Factor, PHF		0.91		0.91			
Hourly Flow Rate, HFR		772		6			
Percent Heavy Vehicles		--		--		--	--
Median Type/Storage		Undivided			/		
RT Channelized?							
Lanes		2		0			
Configuration		T		TR			
Upstream Signal?		No			No		

		Northbound			Southbound		
Minor Street:	Approach Movement	7	8	9	10	11	12
		L	T	R	L	T	R
Volume				8			
Peak Hour Factor, PHF				0.91			
Hourly Flow Rate, HFR				8			
Percent Heavy Vehicles				0			
Percent Grade (%)		0			0		
Flared Approach: Exists?/Storage				/			/
Lanes				1			
Configuration				R			

		Delay, Queue Length, and Level of Service								
Approach Movement	EB	WB	Northbound				Southbound			
			1	4	7	8	9	10	11	12
Lane Config								R		
v (vph)								8		
C (m) (vph)								664		
v/c								0.01		
95% queue length								0.04		
Control Delay								10.5		
LOS								B		
Approach Delay								10.5		
Approach LOS								B		

HCS+: Unsignalized Intersections Release 5.6

Phone:  
E-Mail:

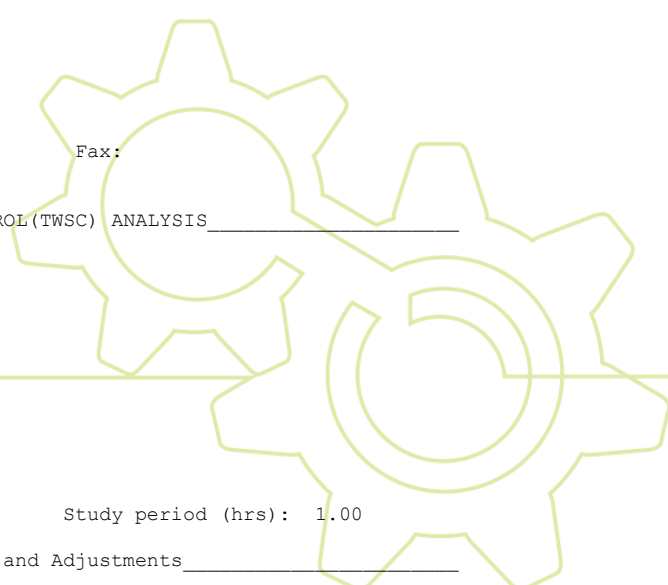
Fax:

\_\_\_\_\_ TWO-WAY STOP CONTROL (TWSC) ANALYSIS \_\_\_\_\_

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Tarde  
 Intersection: D  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID: AMPLIAÇÃO CNPQ - FUTURO  
 East/West Street: MOV01-MOV05-MOV07  
 North/South Street: MOV06  
 Intersection Orientation: EW

Study period (hrs): 1.00

\_\_\_\_\_ Vehicle Volumes and Adjustments \_\_\_\_\_



Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		703	6			
Peak-Hour Factor, PHF		0.91	0.91			
Peak-15 Minute Volume		193	2			
Hourly Flow Rate, HFR		772	6			
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage		Undivided		/		
RT Channelized?						
Lanes		2	0			
Configuration		T	TR			
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume			8			
Peak Hour Factor, PHF			0.91			
Peak-15 Minute Volume			2			
Hourly Flow Rate, HFR			8			
Percent Heavy Vehicles			0			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized			No			
Lanes			1			
Configuration			R			

Pedestrian Volumes and Adjustments				
Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0
Lane Width (m)	3.6	3.6	3.6	3.6
Walking Speed (m/sec)	1.2	1.2	1.2	1.2
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 kph	Distance to Signal 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:		
Shared ln volume, major rt vehicles:		
Sat flow rate, major th vehicles:		
Sat flow rate, major rt vehicles:		
Number of major street through lanes:		

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)					6.2			
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)					0			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)					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					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)					3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)					0			
t(f)					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)  
 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)

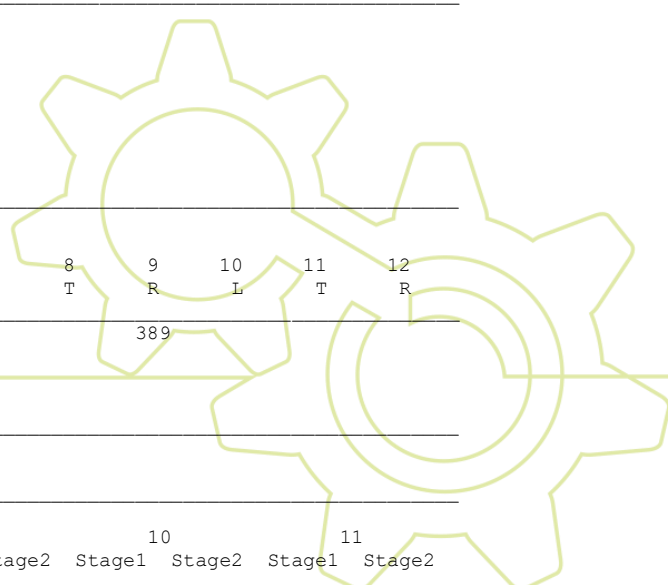
Computation 4 and 5  
 Single-Stage Process

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R

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

---

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

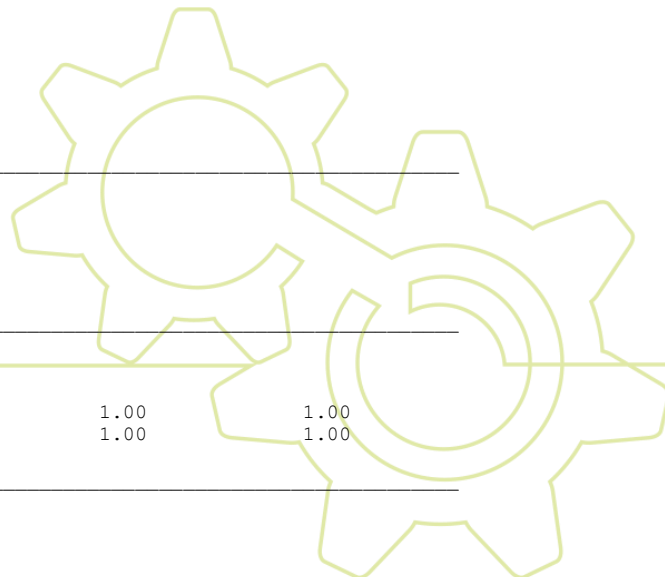
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Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	389	
Potential Capacity	664	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	664	
Probability of Queue free St.	0.99	1.00
Step 2: LT from Major St.	4	1
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.		
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	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.99
Movement Capacity		

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 mvmnt		
Movement Capacity		
Probability of Queue free St.		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
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 mvmnt  
Movement Capacity

---

Part 2 - Second Stage  
Conflicting Flows  
Potential Capacity  
Pedestrian Impedance Factor  
Cap. Adj. factor due to Impeding mvmnt  
Movement Capacity

---

Part 3 - Single Stage  
Conflicting Flows  
Potential Capacity  
Pedestrian Impedance Factor 1.00 1.00  
Maj. L, Min T Impedance factor 1.00  
Maj. L, Min T Adj. Imp Factor. 1.00  
Cap. Adj. factor due to Impeding mvmnt 1.00 0.99  
Movement Capacity

---

Results for Two-stage process:  
a  
Y  
C t

---

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)			8			
Movement Capacity (vph)			664			
Shared Lane Capacity (vph)						

---

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

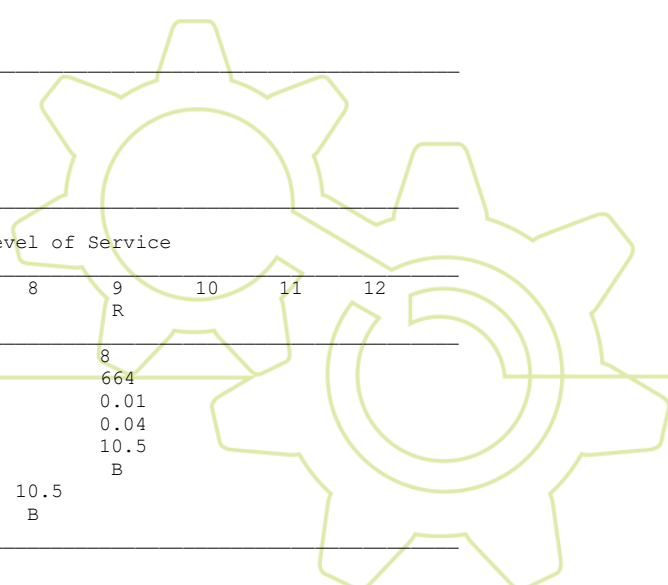
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep			664			
Volume			8			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

---

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

Movement	1	4	7	8	9	10	11	12
Lane Config					R			
v (vph)					8			
C (m) (vph)					664			
v/c					0.01			
95% queue length					0.04			
Control Delay					10.5			
LOS					B			
Approach Delay				10.5				
Approach LOS				B				

---





Worksheet 11-Shared Major LT Impedance and Delay

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

### 1.1.2.9 Interseção E – Pico Manhã

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

---

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Manha  
 Intersection: G  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: M2-M7+M8-M11+M12-M13  
 North/South Street: M13  
 Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Eastbound				Westbound		
		1 L	2 T	3 R	4 L	5 T	6 R	
Volume					5	718		
Peak-Hour Factor, PHF					0.91	0.91		
Hourly Flow Rate, HFR					5	789		
Percent Heavy Vehicles		--	--		0	--	--	
Median Type/Storage		Undivided		/				
RT Channelized?								
Lanes					0	2		
Configuration					LT	T		
Upstream Signal?		No				No		

Minor Street:	Approach Movement	Northbound				Southbound		
		7 L	8 T	9 R	10 L	11 T	12 R	
Volume		9						
Peak Hour Factor, PHF		1.00						
Hourly Flow Rate, HFR		9						
Percent Heavy Vehicles		11						
Percent Grade (%)			0		/	0	/	
Flared Approach: Exists?/Storage					/		/	
Lanes		1						
Configuration		L						

Delay, Queue Length, and Level of Service

Approach Movement	EB	WB	Northbound				Southbound	
			4	7	8	9	10	11
Lane Config	1		LT	L				
v (vph)		5	9					
C(m) (vph)		1636	584					
v/c		0.00	0.02					
95% queue length		0.01	0.05					
Control Delay		7.2	11.3					
LOS		A	B					
Approach Delay					11.3			

Approach LOS

B

HCS+: Unsignalized Intersections Release 5.6

Phone:  
E-Mail:

Fax:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Manha  
 Intersection: G  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: M2-M7+M8-M11+M12-M13  
 North/South Street: M13  
 Intersection Orientation: EW Study period (hrs): 1.00

Major Street Movements	Vehicle Volumes and Adjustments					
	1	2	3	4	5	6
	L	T	R	L	T	R

Volume				5	718	
Peak-Hour Factor, PHF				0.91	0.91	
Peak-15 Minute Volume				1	197	
Hourly Flow Rate, HFR				5	789	
Percent Heavy Vehicles		--	--	0	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes				0	2	
Configuration				LT	T	
Upstream Signal?	No			No		

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R

Volume	9					
Peak Hour Factor, PHF	1.00					
Peak-15 Minute Volume	2					
Hourly Flow Rate, HFR	9					
Percent Heavy Vehicles	11					
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized						
Lanes	1					
Configuration	L					

Movements	Pedestrian Volumes and Adjustments			
	13	14	15	16
Flow (ped/hr)	0	0	0	0
Lane Width (m)	3.6	3.6	3.6	3.6
Walking Speed (m/sec)	1.2	1.2	1.2	1.2
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 kph	Distance to Signal 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:		0
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:		2

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					
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		0	11					
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70					
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	6.5					
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					
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		0	11					
t(f)		2.2	3.6					

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

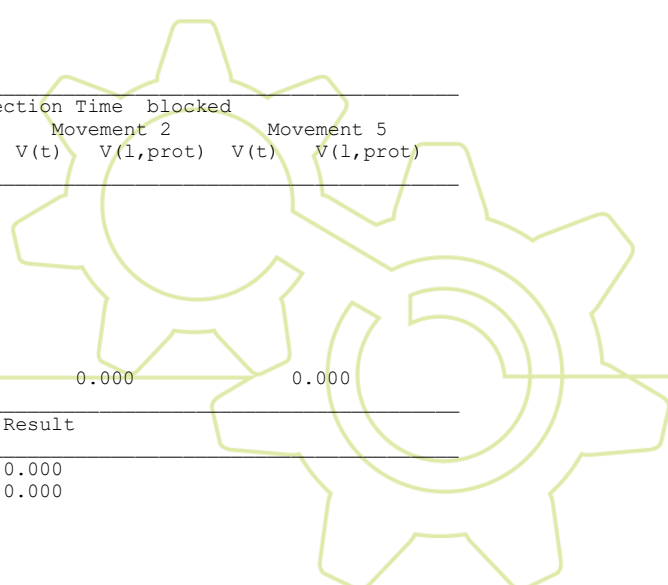
	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				
Total Saturation Flow Rate, s (vph)				
Arrival Type				
Effective Green, g (sec)				
Cycle Length, C (sec)				
Rp (from Exhibit 16-11)				
Proportion vehicles arriving on green P				
g(q1)				
g(q2)				
g(q)				

Computation 2-Proportion of TWSC Intersection Time blocked

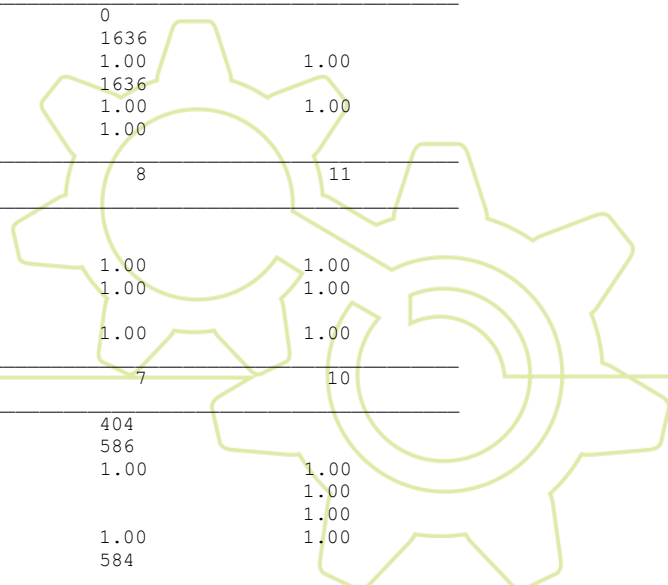
	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p		0.000		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 for minor movements, p(x)	(1) Single-stage Process		(2) Two-Stage Process Stage I		(3) 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 <sub>s</sub> (c,x)		0	404					
P <sub>s</sub> (x)								
V <sub>s</sub> (c,u,x)								
Two-Stage Process								
	7		8		10		11	
	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V <sub>s</sub> (c,x)		3000						
P <sub>s</sub> (x)								
V <sub>s</sub> (c,u,x)								
Worksheet 6-Impedance and Capacity Equations								
Step 1: RT from Minor St.								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor								
Movement Capacity								
Probability of Queue free St.								
Step 2: LT from Major St.								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor								
Movement Capacity								
Probability of Queue free St.								
Maj L-Shared Prob Q free St.								
Step 3: TH from Minor St.								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor								
Cap. Adj. factor due to Impeding mvmnt								
Movement Capacity								
Probability of Queue free St.								
Step 4: LT from Minor St.								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor								
Maj. L, Min T Impedance factor								
Maj. L, Min T Adj. Imp Factor.								
Cap. Adj. factor due to Impeding mvmnt								
Movement Capacity								



---

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 mvmnt  
 Movement Capacity  
 Probability of Queue free St.

---

Part 2 - Second Stage  
 Conflicting Flows  
 Potential Capacity  
 Pedestrian Impedance Factor  
 Cap. Adj. factor due to Impeding mvmnt  
 Movement Capacity

---

Part 3 - Single Stage  
 Conflicting Flows  
 Potential Capacity  
 Pedestrian Impedance Factor 1.00 1.00  
 Cap. Adj. factor due to Impeding mvmnt 1.00 1.00  
 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 mvmnt  
 Movement Capacity

---

Part 2 - Second Stage  
 Conflicting Flows  
 Potential Capacity  
 Pedestrian Impedance Factor  
 Cap. Adj. factor due to Impeding mvmnt  
 Movement Capacity

---

Part 3 - Single Stage  
 Conflicting Flows 404  
 Potential Capacity 586  
 Pedestrian Impedance Factor 1.00 1.00  
 Maj. L, Min T Impedance factor 1.00  
 Maj. L, Min T Adj. Imp Factor. 1.00  
 Cap. Adj. factor due to Impeding mvmnt 1.00 1.00  
 Movement Capacity 584

---

Results for Two-stage process:  
 a  
 Y  
 C t 584

---

Worksheet 8-Shared Lane Calculations

---

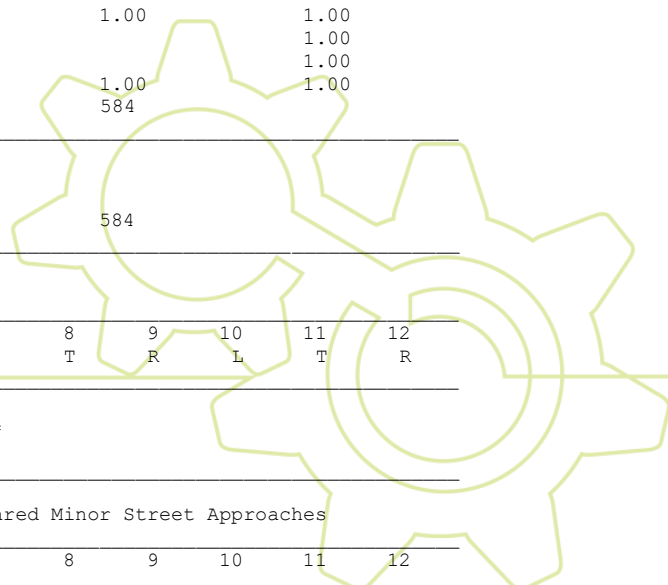
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	9					
Movement Capacity (vph)	584					
Shared Lane Capacity (vph)						

---

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	584					
Volume	9					
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
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		LT	L					
v (vph)		5	9					
C(m) (vph)		1636	584					
v/c		0.00	0.02					
95% queue length		0.01	0.05					
Control Delay		7.2	11.3					
LOS		A	B					
Approach Delay				11.3				
Approach LOS				B				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(i1), Volume for stream 2 or 5		0
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)		1.00
d(M,LT), Delay for stream 1 or 4		7.2
N, Number of major street through lanes		2
d(rank,1) Delay for stream 2 or 5		

### 1.1.2.10 Interseção E – Pico Tarde

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

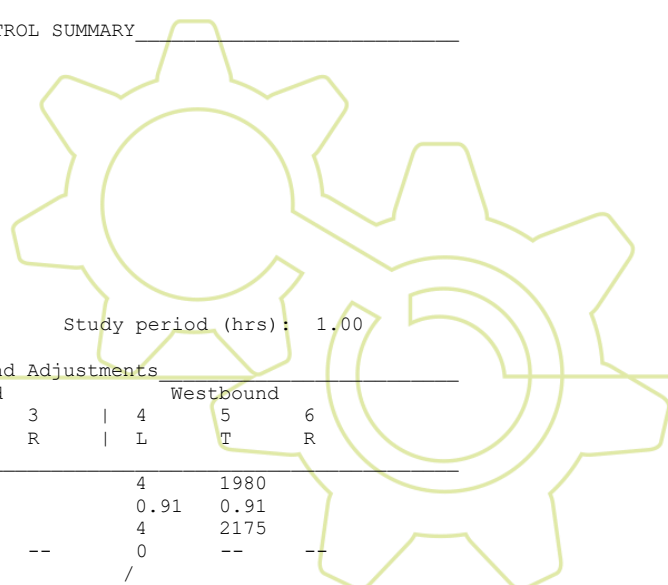
---

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Tarde  
 Intersection: E  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: M2-M7+M8-M11  
 North/South Street: M11  
 Intersection Orientation: EW

Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound			
	Movement	1	2	3	4	5	6
	L	T	R	L	T	R	
Volume				4		1980	
Peak-Hour Factor, PHF				0.91		0.91	
Hourly Flow Rate, HFR				4		2175	
Percent Heavy Vehicles				0		--	--
Median Type/Storage		Undivided		/			



RT Channelized?								
Lanes					0	2		
Configuration					LT	T		
Upstream Signal?		No				No		
Minor Street: Approach		Northbound				Southbound		
Movement	7	8	9		10	11	12	
	L	T	R		L	T	R	
Volume	6							
Peak Hour Factor, PHF	1.00							
Hourly Flow Rate, HFR	6							
Percent Heavy Vehicles	0							
Percent Grade (%)		0				0		
Flared Approach: Exists?/Storage				/			/	
Lanes	1							
Configuration	L							

Delay, Queue Length, and Level of Service										
Approach	EB	WB	Northbound			Southbound				
Movement	1	4		7	8	9		10	11	12
Lane Config		LT		L						
v (vph)	4	6								
C(m) (vph)	1636	238								
v/c	0.00	0.03								
95% queue length	0.01	0.08								
Control Delay	7.2	20.5								
LOS	A	C								
Approach Delay					20.5					
Approach LOS					C					

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:  
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Tarde  
 Intersection: E  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: M2-M7+M8-M11  
 North/South Street: M11  
 Intersection Orientation: EW  
 Study period (hrs): 1.00

Vehicle Volumes and Adjustments						
Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume				4	1980	
Peak-Hour Factor, PHF				0.91	0.91	
Peak-15 Minute Volume				1	544	
Hourly Flow Rate, HFR				4	2175	
Percent Heavy Vehicles				0		
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes				0	2	
Configuration				LT	T	
Upstream Signal?		No			No	
Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R

Volume	6
Peak Hour Factor, PHF	1.00
Peak-15 Minute Volume	2
Hourly Flow Rate, HFR	6
Percent Heavy Vehicles	0
Percent Grade (%)	0
Flared Approach: Exists?/Storage	/ /
RT Channelized	
Lanes	1
Configuration	L

Pedestrian Volumes and Adjustments				
Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0
Lane Width (m)	3.6	3.6	3.6	3.6
Walking Speed (m/sec)	1.2	1.2	1.2	1.2
Percent Blockage	0	0	0	0

Upstream Signal Data							
	Prog.	Sat	Arrival	Green	Cycle	Prog.	Distance
	Flow	Flow	Type	Time	Length	Speed	to Signal
	vph	vph		sec	sec	kph	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:		0
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:		2

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					
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		0	0					
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70					
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	6.4					
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					
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		0	0					
t(f)		2.2	3.5					

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)  
 $R_p$  (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 for minor movements, $p(x)$	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) 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

---

$V_{c,x}$	0	1095
-----------	---	------

$s$

$P_x$

$V_{c,u,x}$

---

$C_{r,x}$

$C_{plat,x}$

---

Two-Stage Process

	7		8		10		11	
	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2

---

$V(c,x)$

$s$

3000

$P(x)$

$V(c,u,x)$

---

$C(r,x)$

$C(plat,x)$

---

Worksheet 6-Impedance and Capacity Equations

---

Step 1: RT from Minor St.

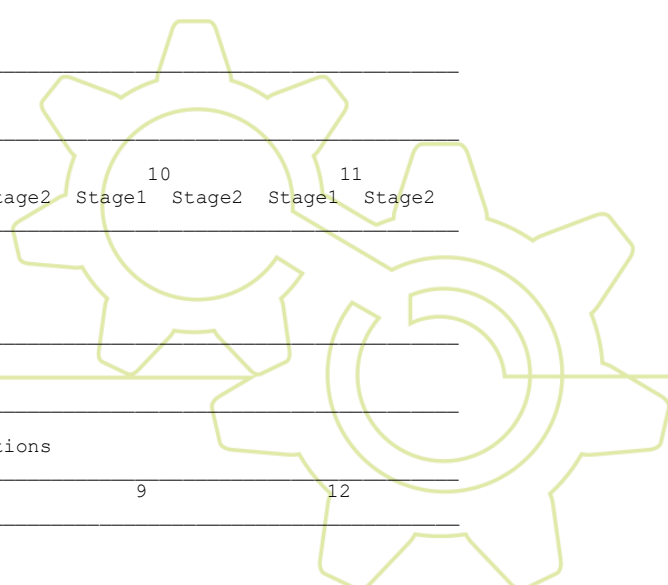
9

12

---

Conflicting Flows

Potential Capacity



Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00

---

Step 2: LT from Major St.	4	1
---------------------------	---	---

---

Conflicting Flows	0	
Potential Capacity	1636	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1636	
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.	1.00	

---

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	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00

---

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

---

Conflicting Flows	1095	
Potential Capacity	239	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity	238	

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 mvmnt		
Movement Capacity		
Probability of Queue free St.		

---

Part 2 - Second Stage

Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

---

Part 3 - Single Stage

Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
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
---------------------------	---	----

---

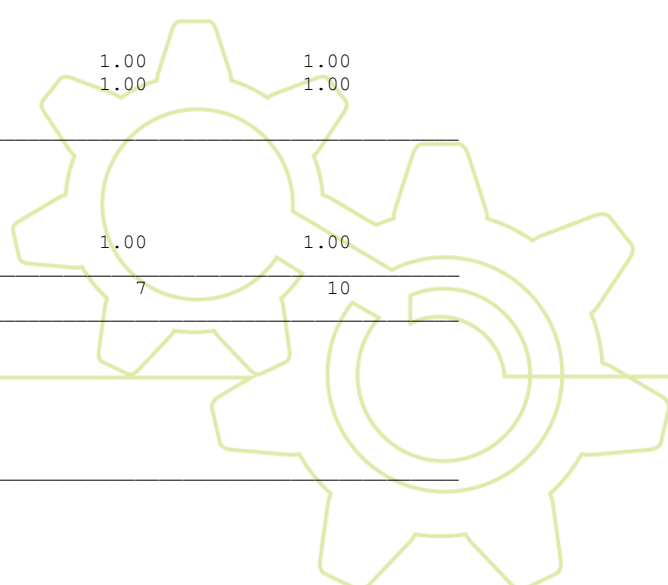
Part 1 - First Stage

Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

---

Part 2 - Second Stage

Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		



Cap. Adj. factor due to Impeding mvmnt  
Movement Capacity

Part 3 - Single Stage		
Conflicting Flows	1095	
Potential Capacity	239	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity	238	

Results for Two-stage process:

a	
y	
C t	238

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)	6					
Movement Capacity (vph)	238					
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

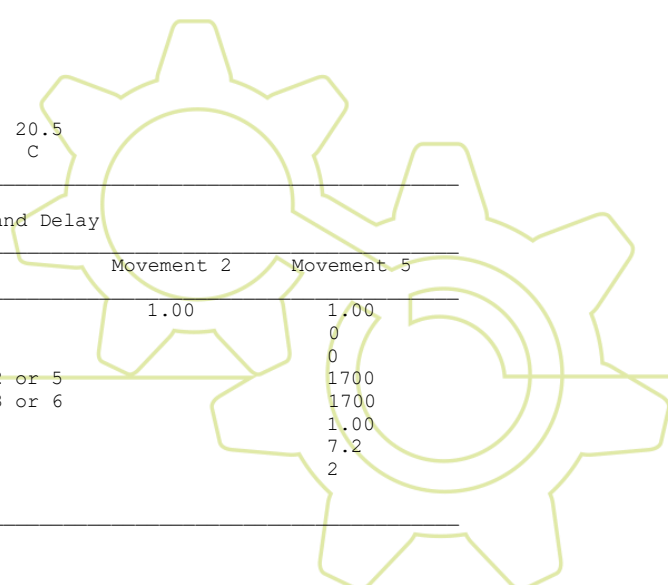
Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep	238					
Volume	6					
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

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

Movement	1	4	7	8	9	10	11	12
Lane Config		LT	L					
v (vph)		4	6					
C(m) (vph)		1636	238					
v/c		0.00	0.03					
95% queue length		0.01	0.08					
Control Delay		7.2	20.5					
LOS		A	C					
Approach Delay				20.5				
Approach LOS				C				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(i1), Volume for stream 2 or 3	0	0
v(i2), Volume for stream 3 or 6	0	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	1.00
d(M,LT), Delay for stream 1 or 4	7.2	7.2
N, Number of major street through lanes	2	2
d(rank,1) Delay for stream 2 or 3		



### 1.1.2.11 Interseção F – Pico Manhã

HCS+: Unsignalized Intersections Release 5.6

#### TWO-WAY STOP CONTROL SUMMARY

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Manha  
 Intersection: F  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: M01-M05-M07+M08+M06-M11  
 North/South Street: M12  
 Intersection Orientation: EW Study period (hrs): 0.25

#### Vehicle Volumes and Adjustments

Major Street: Approach Movement	Eastbound				Westbound		
	1 L	2 T	3 R	4   L	5 T	6 R	
Volume	9	1793					
Peak-Hour Factor, PHF	0.91	0.91					
Hourly Flow Rate, HFR	9	1970					
Percent Heavy Vehicles	12	--	--		--	--	
Median Type/Storage	Undivided			/			
RT Channelized?							
Lanes	0	2					
Configuration		LT T					
Upstream Signal?		No			No		

Minor Street: Approach Movement	Northbound				Southbound		
	7 L	8 T	9 R	10   L	11 T	12 R	
Volume				5			
Peak Hour Factor, PHF				0.91			
Hourly Flow Rate, HFR				5			
Percent Heavy Vehicles				0			
Percent Grade (%)	0				0		
Flared Approach: Exists?/Storage				/		/	
Lanes				1			
Configuration				L			

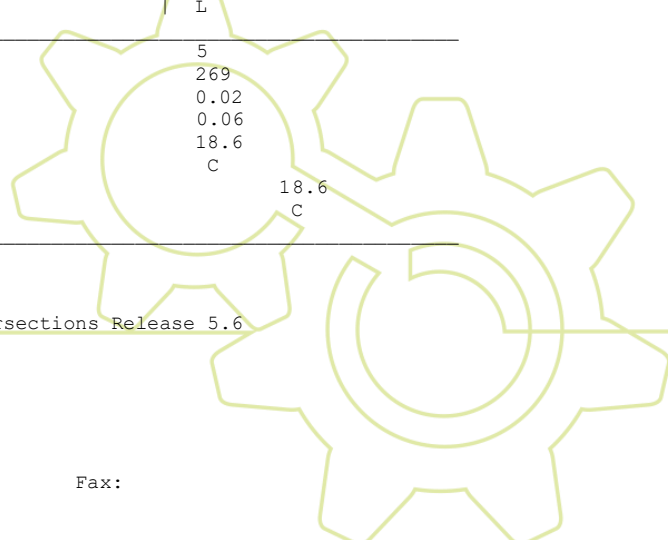
#### Delay, Queue Length, and Level of Service

Approach Movement	EB	WB	Northbound			Southbound		
	1	4	7	8	9	10	11	12
Lane Config	LT					L		
v (vph)	9					5		
C(m) (vph)	1560					269		
v/c	0.01					0.02		
95% queue length	0.02					0.06		
Control Delay	7.3					18.6		
LOS	A					C		
Approach Delay							18.6	
Approach LOS							C	

HCS+: Unsignalized Intersections Release 5.6

Phone:  
E-Mail:

Fax:



TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Manha  
 Intersection: F  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: M01-M05-M07+M08+M06-M11  
 North/South Street: M12  
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	9	1793				
Peak-Hour Factor, PHF	0.91	0.91				
Peak-15 Minute Volume	2	493				
Hourly Flow Rate, HFR	9	1970				
Percent Heavy Vehicles	12	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	2				
Configuration	LT T					
Upstream Signal?	No				No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				5		
Peak Hour Factor, PHF				0.91		
Peak-15 Minute Volume				1		
Hourly Flow Rate, HFR				5		
Percent Heavy Vehicles				0		
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized						
Lanes				1		
Configuration				L		

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0
Lane Width (m)	3.6	3.6	3.6	3.6
Walking Speed (m/sec)	1.2	1.2	1.2	1.2
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 kph	Distance to Signal 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:	0	
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:	2	

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)	4.1					7.1		
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)	12					0		
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)	0.00					0.70		
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	4.2					6.4		
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20					3.50		
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	12					0		
t(f)	2.3					3.5		

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

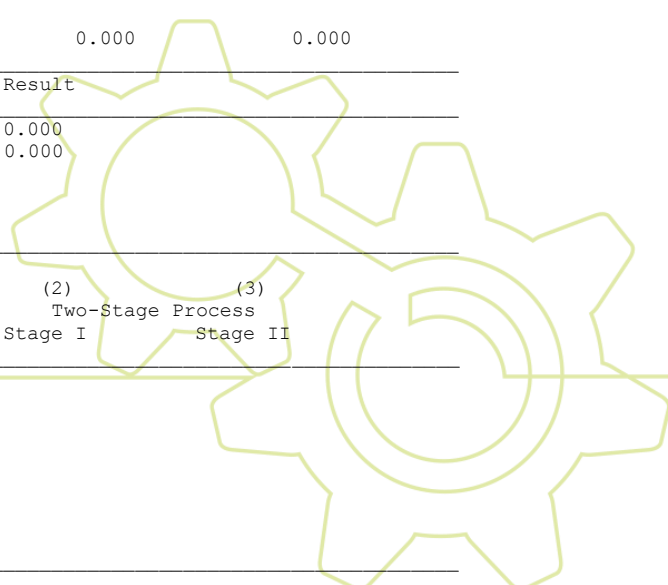
	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)

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 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

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R

V c,x	0					1003		
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)						3000		
s								
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
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Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 2: LT from Major St.	4	1
---------------------------	---	---

Conflicting Flows		0
Potential Capacity		1560
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		1560
Probability of Queue free St.	1.00	0.99
Maj L-Shared Prob Q free St.		0.99

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	0.99	0.99
Movement Capacity		
Probability of Queue free St.	1.00	1.00

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

Conflicting Flows		1003
Potential Capacity		271
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.99	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	1.00	0.99
Movement Capacity		269

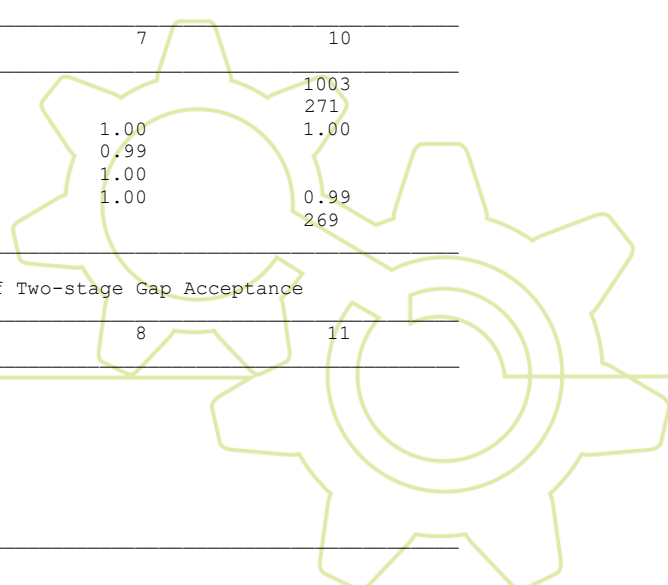
Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
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Part 1 - First Stage

Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage



Conflicting Flows  
Potential Capacity  
Pedestrian Impedance Factor  
Cap. Adj. factor due to Impeding mvmnt  
Movement Capacity

---

Part 3 - Single Stage

Conflicting Flows  
Potential Capacity  
Pedestrian Impedance Factor 1.00 1.00  
Cap. Adj. factor due to Impeding mvmnt 0.99 0.99  
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 mvmnt  
Movement Capacity

---

Part 2 - Second Stage

Conflicting Flows  
Potential Capacity  
Pedestrian Impedance Factor  
Cap. Adj. factor due to Impeding mvmnt  
Movement Capacity

---

Part 3 - Single Stage

Conflicting Flows 1003  
Potential Capacity 271  
Pedestrian Impedance Factor 1.00 1.00  
Maj. L, Min T Impedance factor 0.99  
Maj. L, Min T Adj. Imp Factor. 1.00  
Cap. Adj. factor due to Impeding mvmnt 1.00 0.99  
Movement Capacity 269

---

Results for Two-stage process:

a  
y  
C t 269

---

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				5		
Movement Capacity (vph)				269		
Shared Lane Capacity (vph)						

---

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep				269		
Volume				5		
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
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	LT					L		
v (vph)	9					5		
C(m) (vph)	1560					269		
v/c	0.01					0.02		
95% queue length	0.02					0.06		
Control Delay	7.3					18.6		
LOS	A					C		
Approach Delay						18.6		
Approach LOS						C		

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	0.99	1.00
v(i1), Volume for stream 2 or 5	0	
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)	0.99	
d(M,LT), Delay for stream 1 or 4	7.3	
N, Number of major street through lanes	2	
d(rank,1) Delay for stream 2 or 5		

### 1.1.2.12 Interseção F – Pico Tarde

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Tarde  
 Intersection: F  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: M01-M05-M07+M08+M06-M11  
 North/South Street: M12  
 Intersection Orientation: EW Study period (hrs): 1.00

		Vehicle Volumes and Adjustments					
Major Street: Approach Movement	Eastbound			Westbound			
	1 L	2 T	3 R	4 L	5 T	6 R	
Volume	6	717					
Peak-Hour Factor, PHF	0.91	0.91					
Hourly Flow Rate, HFR	6	787					
Percent Heavy Vehicles	0	--	--	--	--	--	
Median Type/Storage	Undivided /						
RT Channelized?							
Lanes	0 2						
Configuration	LT T						
Upstream Signal?	No		No				
		Northbound			Southbound		
Minor Street: Approach Movement	7 L	8 T	9 R	10 L	11 T	12 R	
Volume				4			
Peak Hour Factor, PHF				0.91			
Hourly Flow Rate, HFR				4			
Percent Heavy Vehicles				0			
Percent Grade (%)	0				0		

Flared Approach: Exists?/Storage / /  
 Lanes 1  
 Configuration L

Delay, Queue Length, and Level of Service								
Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						L	
v (vph)	6						4	
C(m) (vph)	1636						604	
v/c	0.00						0.01	
95% queue length	0.01						0.02	
Control Delay	7.2						11.0	
LOS	A						B	
Approach Delay							11.0	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:  
 E-Mail:

TWO-WAY STOP CONTROL (TWSC) ANALYSIS

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Tarde  
 Intersection: F  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: M01-M05-M07+M08+M06-M11  
 North/South Street: M12  
 Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments						
Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	6	717				
Peak-Hour Factor, PHF	0.91	0.91				
Peak-15 Minute Volume	2	197				
Hourly Flow Rate, HFR	6	787				
Percent Heavy Vehicles	0	--	--	--	--	--
Median Type/Storage	Undivided /					
RT Channelized?	No					
Lanes	0	2				
Configuration	LT	T				
Upstream Signal?	No					
Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				4		
Peak Hour Factor, PHF				0.91		
Peak-15 Minute Volume				1		
Hourly Flow Rate, HFR				4		
Percent Heavy Vehicles				0		
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized						
Lanes				1		
Configuration				L		

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0
Lane Width (m)	3.6	3.6	3.6	3.6
Walking Speed (m/sec)	1.2	1.2	1.2	1.2
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 kph	Distance to Signal 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:	0	
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:	2	

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		
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)	0					0		
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)	0.00					0.70		
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					6.4		
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		
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	0					0		
t(f)	2.2					3.5		

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 for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Stage I	(3) 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	0							405
-------	---	--	--	--	--	--	--	-----

s  
Px  
V c,u,x

C r,x  
C plat,x

---

Two-Stage Process

	7	8	10	11
	Stage1	Stage2	Stage1	Stage2

V(c,x)								3000
--------	--	--	--	--	--	--	--	------

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

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

---

Worksheet 6-Impedance and Capacity Equations

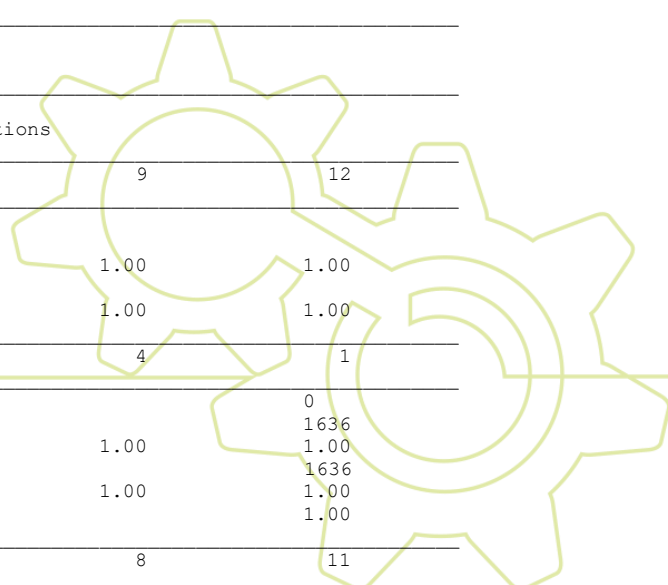
Step 1: RT from Minor St.	9				12
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Conflicting Flows					
Potential Capacity					
Pedestrian Impedance Factor	1.00				1.00
Movement Capacity					
Probability of Queue free St.	1.00				1.00

Step 2: LT from Major St.	4				1
---------------------------	---	--	--	--	---

Conflicting Flows					0
Potential Capacity					1636
Pedestrian Impedance Factor	1.00				1.00
Movement Capacity					1636
Probability of Queue free St.	1.00				1.00
Maj L-Shared Prob Q free St.					1.00

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	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00
<hr/>		
Step 4: LT from Minor St.	7	10

Conflicting Flows		
Potential Capacity		405
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	1.00	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		
		604

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

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

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		

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

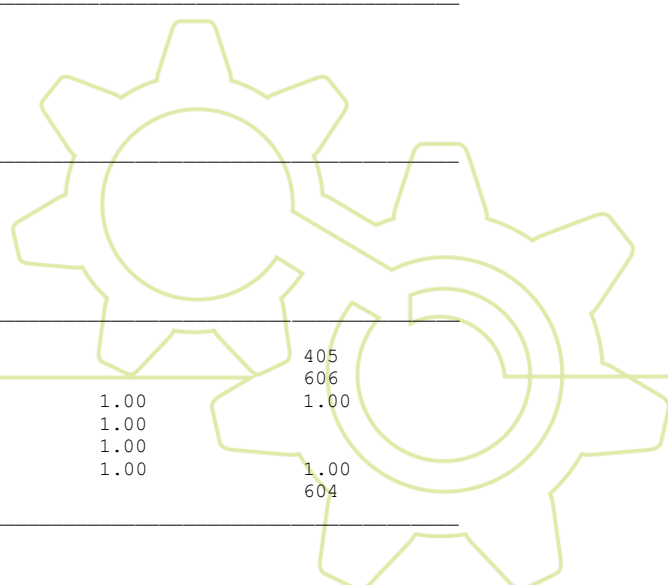
Step 4: LT from Minor St.	7	10
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Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		405
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	1.00	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		
		604

Results for Two-stage process:		
a		



Y  
C t 604

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				4		
Movement Capacity (vph)				604		
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep				604		
Volume				4		
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

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

Movement	1 LT	4	7	8	9	10 L	11	12
v (vph)	6					4		
C(m) (vph)	1636					604		
v/c	0.00					0.01		
95% queue length	0.01					0.02		
Control Delay	7.2					11.0		
LOS	A					B		
Approach Delay							11.0	
Approach LOS							B	

Worksheet 11-Shared Major LT Impedance and Delay

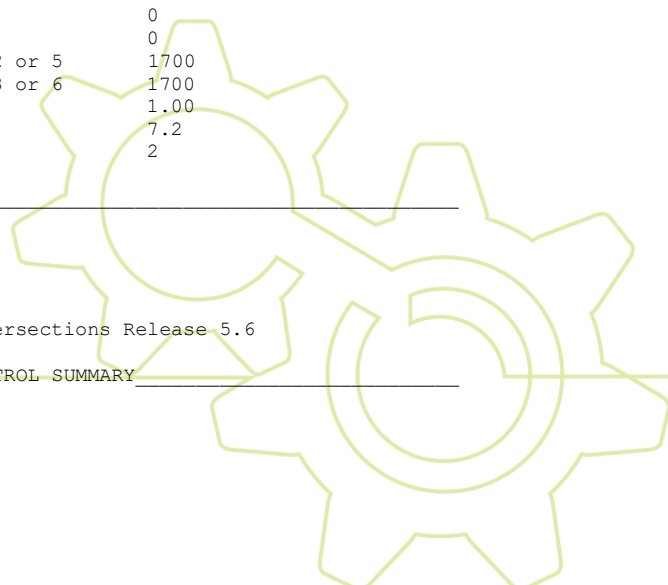
	Movement 2	Movement 5
p(oj)	1.00	1.00
v(i1), Volume for stream 2 or 5	0	
v(i2), Volume for stream 3 or 6	0	
s(i1), Saturation flow rate for stream 2 or 5	1700	
s(i2), Saturation flow rate for stream 3 or 6	1700	
P*(oj)	1.00	
d(M,LT), Delay for stream 1 or 4	7.2	
N, Number of major street through lanes	2	
d(rank,1) Delay for stream 2 or 5		

### 1.1.2.13 Interseção G – Pico Manhã

HCS+: Unsignalized Intersections Release 5.6

~~TWO-WAY STOP CONTROL SUMMARY~~

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Manha  
 Intersection: G  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023



Project ID:  
 East/West Street: M2-M7+M8-M11+M12-M13  
 North/South Street: M13  
 Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments							
Major Street:	Approach Movement	Eastbound			Westbound		
		1 L	2 T	3 R	4 L	5 T	6 R
Volume					30	721	
Peak-Hour Factor, PHF					0.91	0.91	
Hourly Flow Rate, HFR					32	792	
Percent Heavy Vehicles		--	--		4	--	--
Median Type/Storage		Undivided			/		
RT Channelized?							
Lanes					0	2	
Configuration					LT	T	
Upstream Signal?		No				No	

Minor Street:	Approach Movement	Northbound			Southbound		
		7 L	8 T	9 R	10 L	11 T	12 R
Volume		2					
Peak Hour Factor, PHF		1.00					
Hourly Flow Rate, HFR		2					
Percent Heavy Vehicles		0					
Percent Grade (%)			0			0	
Flared Approach: Exists?/Storage				/		/	
Lanes		1					
Configuration		L					

Delay, Queue Length, and Level of Service									
Approach Movement	EB	WB	Northbound			Southbound			
			4	7	8	9	10	11	12
Lane Config	1	LT	L						
v (vph)		32	2						
C (m) (vph)		1610	552						
v/c		0.02	0.00						
95% queue length		0.06	0.01						
Control Delay		7.3	11.5						
LOS		A	B						
Approach Delay				11.5					
Approach LOS				B					

HCS+: Unsignalized Intersections Release 5.6

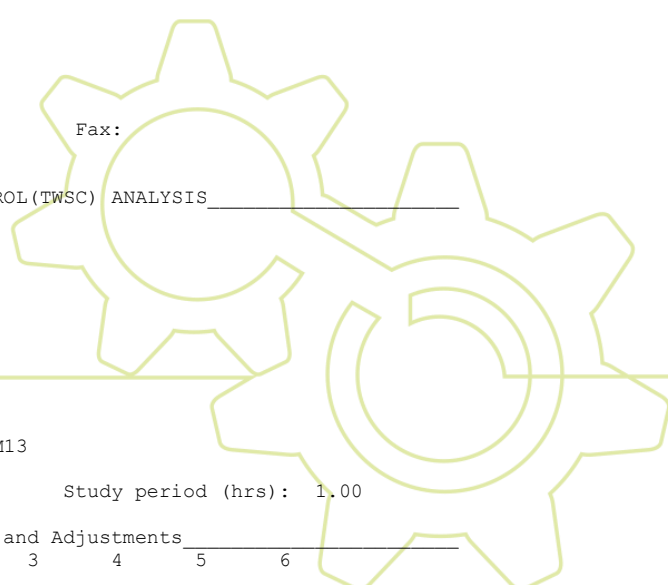
Phone:  
E-Mail:

Fax:

TWO-WAY STOP CONTROL (TWSC) ANALYSIS

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Manha  
 Intersection: G  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: M2-M7+M8-M11+M12-M13  
 North/South Street: M13  
 Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments						
Major Street Movements	1	2	3	4	5	6



	L	T	R	L	T	R
Volume				30	721	
Peak-Hour Factor, PHF				0.91	0.91	
Peak-15 Minute Volume				8	198	
Hourly Flow Rate, HFR				32	792	
Percent Heavy Vehicles		--	--	4	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes				0	2	
Configuration				LT	T	
Upstream Signal?	No			No		

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R

Volume	2					
Peak Hour Factor, PHF	1.00					
Peak-15 Minute Volume	0					
Hourly Flow Rate, HFR	2					
Percent Heavy Vehicles	0					
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized						
Lanes	1					
Configuration	L					

Pedestrian Volumes and Adjustments				
Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0
Lane Width (m)	3.6	3.6	3.6	3.6
Walking Speed (m/sec)	1.2	1.2	1.2	1.2
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 kph	Distance to Signal 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:		0
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:		2

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					
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		4	0					
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70					
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	6.4					
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					
t (f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P (HV)		4	0					
t (f)		2.2	3.5					

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

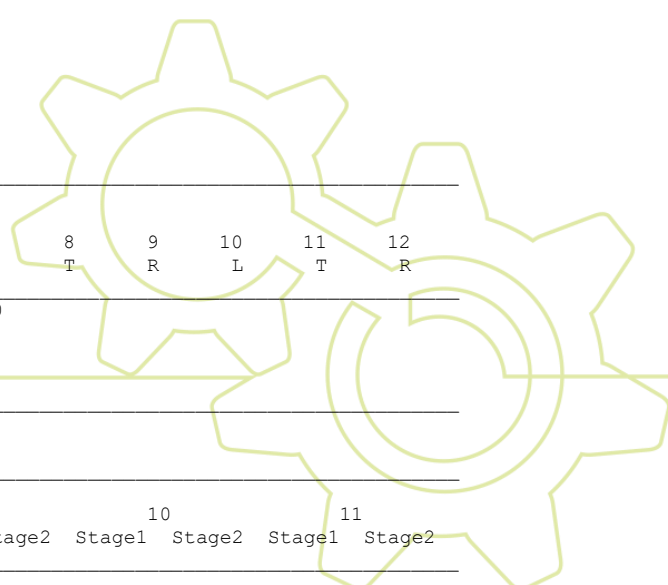
unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Two-Stage Process Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5  
Single-Stage Process

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x		0	460					
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

	7 Stage1	8 Stage2	10 Stage1	11 Stage2



V(c, x)  
s 3000  
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  
Potential Capacity  
Pedestrian Impedance Factor 1.00 1.00  
Movement Capacity  
Probability of Queue free St. 1.00 1.00

Step 2: LT from Major St. 4 1

Conflicting Flows 0  
Potential Capacity 1610  
Pedestrian Impedance Factor 1.00 1.00  
Movement Capacity 1610  
Probability of Queue free St. 0.98 1.00  
Maj L-Shared Prob Q free St. 0.98

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 0.98 0.98  
Movement Capacity  
Probability of Queue free St. 1.00 1.00

Step 4: LT from Minor St. 7 10

Conflicting Flows 460  
Potential Capacity 563  
Pedestrian Impedance Factor 1.00 1.00  
Maj. L, Min T Impedance factor 0.98  
Maj. L, Min T Adj. Imp Factor. 0.98  
Cap. Adj. factor due to Impeding mvmnt 0.98 0.98  
Movement Capacity 552

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

Step 3: TH from Minor St. 8 11

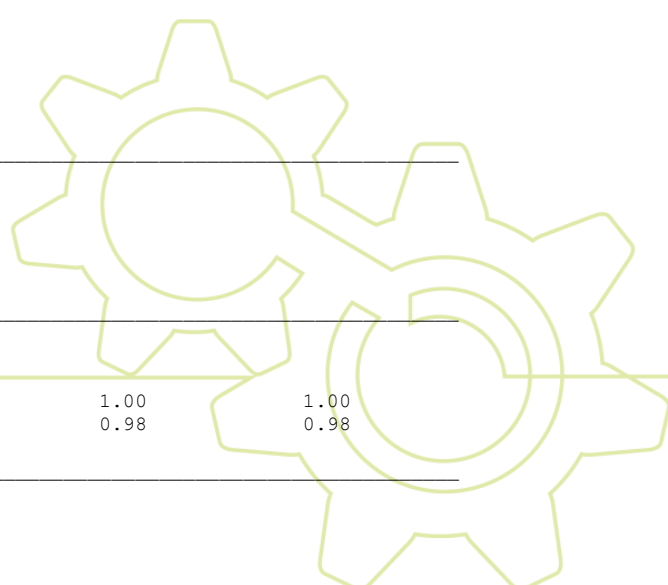
Part 1 - First Stage  
Conflicting Flows  
Potential Capacity  
Pedestrian Impedance Factor  
Cap. Adj. factor due to Impeding mvmnt  
Movement Capacity  
Probability of Queue free St.

Part 2 - Second Stage  
Conflicting Flows  
Potential Capacity  
Pedestrian Impedance Factor  
Cap. Adj. factor due to Impeding mvmnt  
Movement Capacity

Part 3 - Single Stage  
Conflicting Flows  
Potential Capacity  
Pedestrian Impedance Factor 1.00 1.00  
Cap. Adj. factor due to Impeding mvmnt 0.98 0.98  
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 mvmnt  
Movement Capacity

Part 2 - Second Stage

Conflicting Flows  
Potential Capacity  
Pedestrian Impedance Factor  
Cap. Adj. factor due to Impeding mvmnt  
Movement Capacity

Part 3 - Single Stage

Conflicting Flows 460  
Potential Capacity 563  
Pedestrian Impedance Factor 1.00  
Maj. L, Min T Impedance factor 0.98  
Maj. L, Min T Adj. Imp Factor. 0.98  
Cap. Adj. factor due to Impeding mvmnt 0.98  
Movement Capacity 552

Results for Two-stage process:

a  
y  
C t 552

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	2					
Movement Capacity (vph)	552					
Shared Lane Capacity (vph)						

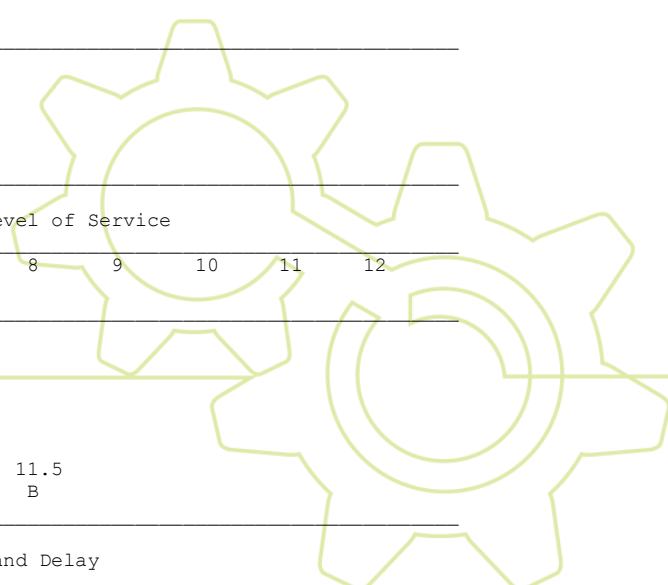
Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	552					
Volume	2					
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
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		LT	L					
v (vph)		32	2					
C(m) (vph)		1610	552					
v/c		0.02	0.00					
95% queue length		0.06	0.01					
Control Delay		7.3	11.5					
LOS		A	B					
Approach Delay				11.5				
Approach LOS				B				

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		0
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)		0.98
d(M,LT), Delay for stream 1 or 4		7.3
N, Number of major street through lanes		2
d(rank,1) Delay for stream 2 or 5		

### 1.1.2.14 Interseção G – Pico Tarde

HCS+: Unsignalized Intersections Release 5.6

#### TWO-WAY STOP CONTROL SUMMARY

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Tarde  
 Intersection: G  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: M2-M7+M8-M11+M12-M13  
 North/South Street: M13  
 Intersection Orientation: EW Study period (hrs): 1.00

#### Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Eastbound				Westbound		
		1 L	2 T	3 R	4 L	5 T	6 R	
Volume					35	1978		
Peak-Hour Factor, PHF					0.91	0.91		
Hourly Flow Rate, HFR					38	2173		
Percent Heavy Vehicles		--	--		0	--	--	
Median Type/Storage		Undivided		/				
RT Channelized?								
Lanes					0	2		
Configuration					LT	T		
Upstream Signal?		No				No		

Minor Street:	Approach Movement	Northbound				Southbound		
		7 L	8 T	9 R	10 L	11 T	12 R	
Volume		6						
Peak Hour Factor, PHF		1.00						
Hourly Flow Rate, HFR		6						
Percent Heavy Vehicles		0						
Percent Grade (%)			0			0		
Flared Approach: Exists?/Storage		/		/				
Lanes		1						
Configuration		L						

#### Delay, Queue Length, and Level of Service

Approach Movement	EB	WB	Northbound				Southbound	
			4	7	8	9	10	11
Lane Config	1	LT	L					
v (vph)		38	6					
C(m) (vph)		1636	213					
v/c		0.02	0.03					
95% queue length		0.07	0.09					
Control Delay		7.3	22.4					
LOS		A	C					
Approach Delay				22.4				

Approach LOS

C

HCS+: Unsignalized Intersections Release 5.6

Phone:  
E-Mail:

Fax:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Tarde  
 Intersection: G  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: M2-M7+M8-M11+M12-M13  
 North/South Street: M13  
 Intersection Orientation: EW Study period (hrs): 1.00

Major Street Movements	Vehicle Volumes and Adjustments					
	1 L	2 T	3 R	4 L	5 T	6 R

Volume				35	1978	
Peak-Hour Factor, PHF				0.91	0.91	
Peak-15 Minute Volume				10	543	
Hourly Flow Rate, HFR				38	2173	
Percent Heavy Vehicles		--	--	0	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes				0	2	
Configuration				LT	T	
Upstream Signal?		No			No	

Minor Street Movements	7 L	8 T	9 R	10 L	11 T	12 R
------------------------	--------	--------	--------	---------	---------	---------

Volume	6					
Peak Hour Factor, PHF	1.00					
Peak-15 Minute Volume	2					
Hourly Flow Rate, HFR	6					
Percent Heavy Vehicles	0					
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized						
Lanes	1					
Configuration	L					

Movements	Pedestrian Volumes and Adjustments			
	13	14	15	16

Flow (ped/hr)	0	0	0	0
Lane Width (m)	3.6	3.6	3.6	3.6
Walking Speed (m/sec)	1.2	1.2	1.2	1.2
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 kph	Distance to Signal 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:		0
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:		2

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					
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		0	0					
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70					
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	6.4					
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					
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		0	0					
t(f)		2.2	3.5					

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

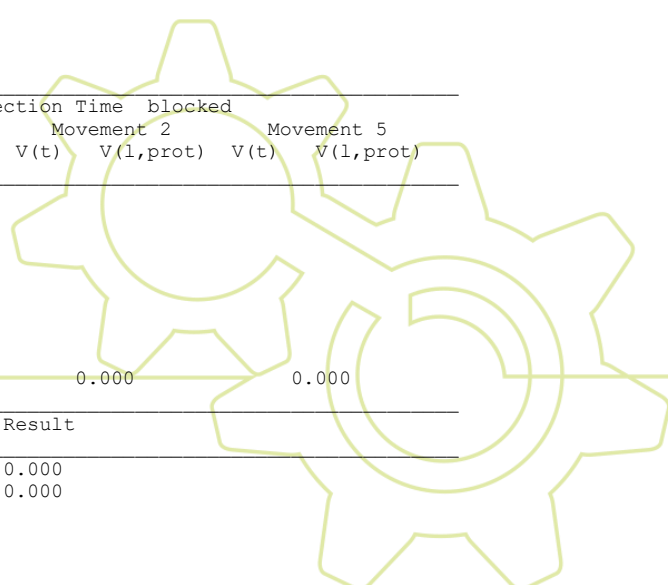
	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				
Total Saturation Flow Rate, s (vph)				
Arrival Type				
Effective Green, g (sec)				
Cycle Length, C (sec)				
Rp (from Exhibit 16-11)				
Proportion vehicles arriving on green P				
g(q1)				
g(q2)				
g(q)				

Computation 2-Proportion of TWSC Intersection Time blocked

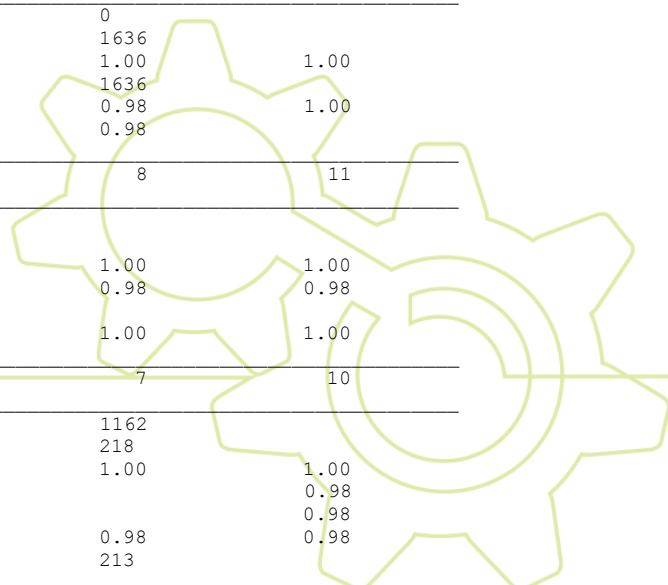
	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p		0.000		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 for minor movements, p(x)	(1) Single-stage Process		(2) Two-Stage Process Stage I		(3) 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								
s		0	1162					
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		3000						
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								
Worksheet 6-Impedance and Capacity Equations								
Step 1: RT from Minor St.								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor								
Movement Capacity								
Probability of Queue free St.								
Step 2: LT from Major St.								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor								
Movement Capacity								
Probability of Queue free St.								
Maj L-Shared Prob Q free St.								
Step 3: TH from Minor St.								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor								
Cap. Adj. factor due to Impeding mvmnt								
Movement Capacity								
Probability of Queue free St.								
Step 4: LT from Minor St.								
Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor								
Maj. L, Min T Impedance factor								
Maj. L, Min T Adj. Imp Factor.								
Cap. Adj. factor due to Impeding mvmnt								
Movement Capacity								



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

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Step 3: TH from Minor St. 8 11

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Part 1 - First Stage  
 Conflicting Flows  
 Potential Capacity  
 Pedestrian Impedance Factor  
 Cap. Adj. factor due to Impeding mvmnt  
 Movement Capacity  
 Probability of Queue free St.

---

Part 2 - Second Stage  
 Conflicting Flows  
 Potential Capacity  
 Pedestrian Impedance Factor  
 Cap. Adj. factor due to Impeding mvmnt  
 Movement Capacity

---

Part 3 - Single Stage  
 Conflicting Flows  
 Potential Capacity  
 Pedestrian Impedance Factor 1.00 1.00  
 Cap. Adj. factor due to Impeding mvmnt 0.98 0.98  
 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 mvmnt  
 Movement Capacity

---

Part 2 - Second Stage  
 Conflicting Flows  
 Potential Capacity  
 Pedestrian Impedance Factor  
 Cap. Adj. factor due to Impeding mvmnt  
 Movement Capacity

---

Part 3 - Single Stage  
 Conflicting Flows 1162  
 Potential Capacity 218  
 Pedestrian Impedance Factor 1.00 1.00  
 Maj. L, Min T Impedance factor 0.98  
 Maj. L, Min T Adj. Imp Factor. 0.98  
 Cap. Adj. factor due to Impeding mvmnt 0.98 0.98  
 Movement Capacity 213

---

Results for Two-stage process:  
 a  
 Y  
 C t 213

---

Worksheet 8-Shared Lane Calculations

---

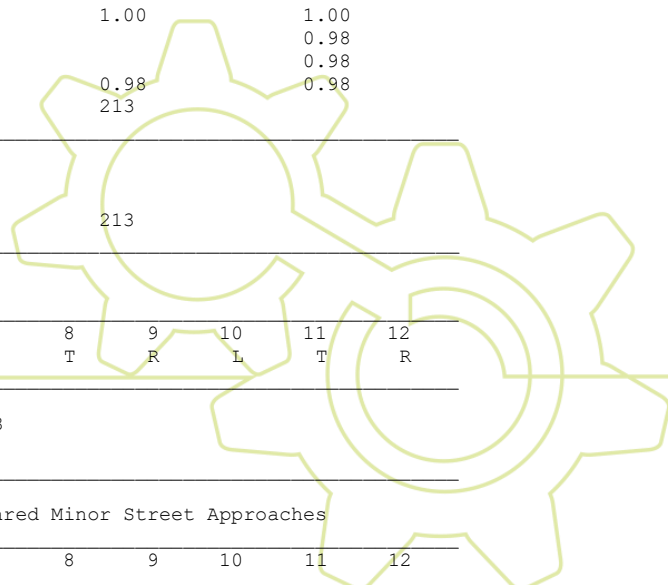
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	6					
Movement Capacity (vph)	213					
Shared Lane Capacity (vph)						

---

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	213					
Volume	6					
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
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		LT	L					
v (vph)		38	6					
C(m) (vph)		1636	213					
v/c		0.02	0.03					
95% queue length		0.07	0.09					
Control Delay		7.3	22.4					
LOS		A	C					
Approach Delay				22.4				
Approach LOS				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		0
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)		0.98
d(M,LT), Delay for stream 1 or 4		7.3
N, Number of major street through lanes		2
d(rank,1) Delay for stream 2 or 5		

### 1.1.2.15 Interseção H – Pico Manhã

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Manhã  
 Intersection: H  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: M01-M05-M07+M08+M06-M11+M12  
 North/South Street: M14  
 Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Eastbound			Westbound		
		1	2	3	4	5	6
		L	T	R	L	T	R
Volume		1	1798				
Peak-Hour Factor, PHF		0.91	0.91				

Hourly Flow Rate, HFR 1 1975  
 Percent Heavy Vehicles 0 -- -- -- --  
 Median Type/Storage Undivided / -- --  
 RT Channelized?  
 Lanes 0 2  
 Configuration LT T  
 Upstream Signal? No No

Minor Street: Approach Movement	Northbound				Southbound		
	7	8	9	10	11	12	
	L	T	R	L	T	R	

Volume 30  
 Peak Hour Factor, PHF 0.91  
 Hourly Flow Rate, HFR 32  
 Percent Heavy Vehicles 4  
 Percent Grade (%) 0 0  
 Flared Approach: Exists?/Storage / /  
 Lanes 1  
 Configuration L

Approach Movement	Delay, Queue Length, and Level of Service							
	EB	WB	Northbound			Southbound		
	1	4	7	8	9	10	11	12
Lane Config	LT					L		

v (vph) 1 32  
 C(m) (vph) 1636 271  
 v/c 0.00 0.12  
 95% queue length 0.00 0.40  
 Control Delay 7.2 20.1  
 LOS A C  
 Approach Delay 20.1  
 Approach LOS C

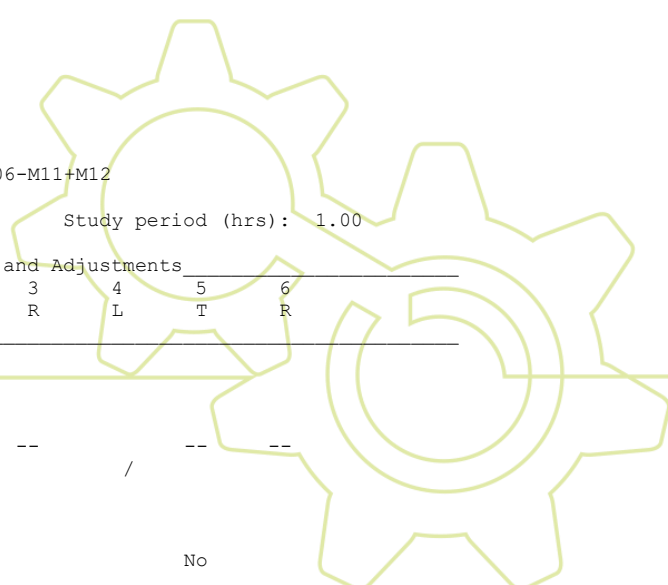
HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:  
 E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Manha  
 Intersection: H  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: M01-M05-M07+M08+M06-M11+M12  
 North/South Street: M14  
 Intersection Orientation: EW  
 Study period (hrs): 1.00

Major Street Movements	Vehicle Volumes and Adjustments					
	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	1	1798				
Peak-Hour Factor, PHF	0.91	0.91				
Peak-15 Minute Volume	0	494				
Hourly Flow Rate, HFR	1	1975				
Percent Heavy Vehicles	0	--	--	--	--	--
Median Type/Storage	Undivided /					
RT Channelized?						
Lanes	0 2					
Configuration	LT T					
Upstream Signal?	No No					



Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				30		
Peak Hour Factor, PHF				0.91		
Peak-15 Minute Volume				8		
Hourly Flow Rate, HFR				32		
Percent Heavy Vehicles				4		
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized						
Lanes				1		
Configuration				L		

Pedestrian Volumes and Adjustments				
Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0
Lane Width (m)	3.6	3.6	3.6	3.6
Walking Speed (m/sec)	1.2	1.2	1.2	1.2
Percent Blockage	0	0	0	0

Upstream Signal Data							
	Prog. Flow vph	Sat vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed kph	Distance to Signal 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:	0	
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:	2	

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		
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)	0					4		
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)	0.00					0.70		
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					6.4		
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		
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	0					4		
t(f)	2.2					3.5		

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 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

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R

---

V c,x	0		989
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)			3000
s			
P(x)			
V(c,u,x)			

---

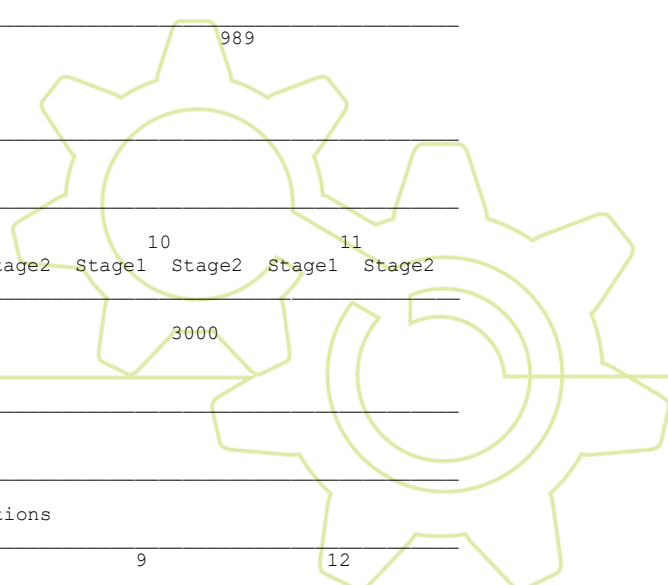
C(r,x)  
C(plat,x)

---

Worksheet 6-Impedance and Capacity Equations

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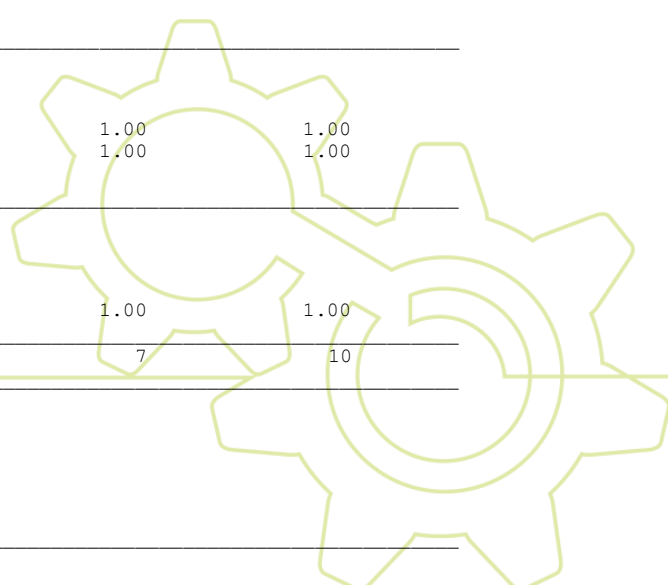
Step 1: RT from Minor St.	9	12
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Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00
<hr/>		
Step 2: LT from Major St.	4	1
<hr/>		
Conflicting Flows		
Potential Capacity		0
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		1636
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.		1.00
<hr/>		
Step 3: TH from Minor St.	8	11
<hr/>		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00
<hr/>		
Step 4: LT from Minor St.	7	10
<hr/>		
Conflicting Flows		
Potential Capacity		989
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	1.00	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		271

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

Step 3: TH from Minor St.		
8		11
<hr/>		
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		
<hr/>		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
<hr/>		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		
<hr/>		
Result for 2 stage process:		
a		
Y		
C t		
Probability of Queue free St.	1.00	1.00
<hr/>		
Step 4: LT from Minor St.	7	10
<hr/>		
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
<hr/>		
Part 2 - Second Stage		



Conflicting Flows  
Potential Capacity  
Pedestrian Impedance Factor  
Cap. Adj. factor due to Impeding mvmnt  
Movement Capacity

Part 3 - Single Stage		
Conflicting Flows		989
Potential Capacity		271
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	1.00	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		271

Results for Two-stage process:

a	
y	
C t	271

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				32		
Movement Capacity (vph)				271		
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep				271		
Volume				32		
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

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

Movement	1 LT	4	7	8	9	10 L	11	12
v (vph)	1					32		
C(m) (vph)	1636					271		
v/c	0.00					0.12		
95% queue length	0.00					0.40		
Control Delay	7.2					20.1		
LOS	A					C		
Approach Delay							20.1	
Approach LOS							C	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(i1), Volume for stream 2 or 5	0	
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)	1.00	
d(M,LT), Delay for stream 1 or 4	7.2	
N, Number of major street through lanes	2	
d(rank,1) Delay for stream 2 or 5		

### 1.1.2.16 Interseção H – Pico Tarde

HCS+: Unsignalized Intersections Release 5.6

#### TWO-WAY STOP CONTROL SUMMARY

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Tarde  
 Intersection: H  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: M01-M05-M07+M08+M06-M11+M12  
 North/South Street: M14  
 Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments								
Major Street:	Approach Movement	Eastbound			Westbound			
		1 L	2 T	3 R	4 L	5 T	6 R	
Volume		6	721					
Peak-Hour Factor, PHF		0.91	0.91					
Hourly Flow Rate, HFR		6	792					
Percent Heavy Vehicles		0	--	--		--	--	
Median Type/Storage		Undivided			/			
RT Channelized?								
Lanes		0	2					
Configuration			LT T					
Upstream Signal?			No			No		

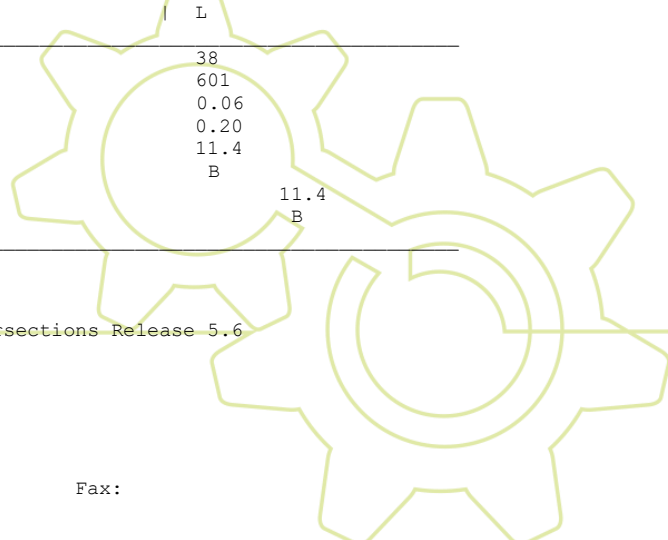
Minor Street:	Approach Movement	Northbound			Southbound		
		7 L	8 T	9 R	10 L	11 T	12 R
Volume					35		
Peak Hour Factor, PHF					0.91		
Hourly Flow Rate, HFR					38		
Percent Heavy Vehicles					0		
Percent Grade (%)		0				0	
Flared Approach: Exists?/Storage				/		/	
Lanes					1		
Configuration					L		

Delay, Queue Length, and Level of Service								
Approach Movement	EB	WB	Northbound			Southbound		
			4	7	8	9	10 L	11
Lane Config	LT							
v (vph)	6						38	
C(m) (vph)	1636						601	
v/c	0.00						0.06	
95% queue length	0.01						0.20	
Control Delay	7.2						11.4	
LOS	A						B	
Approach Delay							11.4	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.6

Phone:  
E-Mail:

Fax:



TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Tarde  
 Intersection: H  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: M01-M05-M07+M08+M06-M11+M12  
 North/South Street: M14  
 Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	6	721				
Peak-Hour Factor, PHF	0.91	0.91				
Peak-15 Minute Volume	2	198				
Hourly Flow Rate, HFR	6	792				
Percent Heavy Vehicles	0	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	2				
Configuration	LT T					
Upstream Signal?	No				No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				35		
Peak Hour Factor, PHF				0.91		
Peak-15 Minute Volume				10		
Hourly Flow Rate, HFR				38		
Percent Heavy Vehicles				0		
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized						
Lanes				1		
Configuration				L		

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
	Flow (ped/hr)	0	0	0
Lane Width (m)	3.6	3.6	3.6	3.6
Walking Speed (m/sec)	1.2	1.2	1.2	1.2
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 kph	Distance to Signal 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:	0	
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:	2	

Worksheet 4-Critical Gap and Follow-up Time Calculation



Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)	4.1					7.1		
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)	0					0		
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)	0.00					0.70		
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					6.4		
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20					3.50		
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	0					0		
t(f)	2.2					3.5		

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

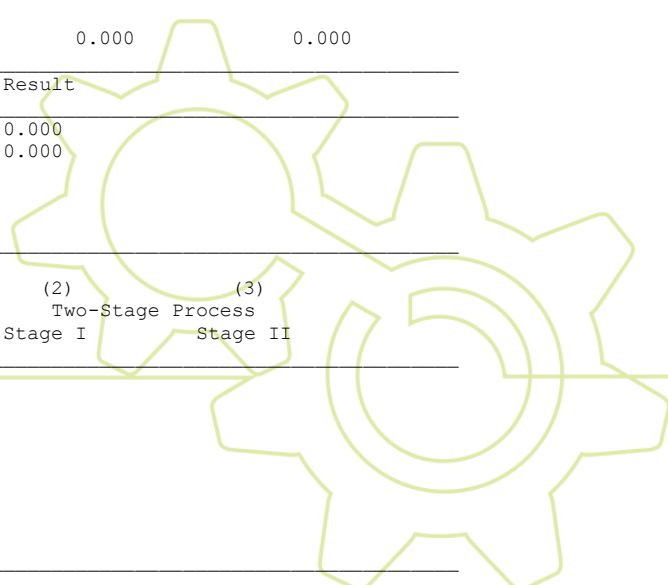
Computation 3-Platoon Event Periods

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

Proportion unblocked 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

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R

V c,x	0					408		
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						3000		
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		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 2: LT from Major St.	4	1
---------------------------	---	---

Conflicting Flows		0
Potential Capacity		1636
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		1636
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.		1.00

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	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00

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

Conflicting Flows		408
Potential Capacity		603
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	1.00	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		601

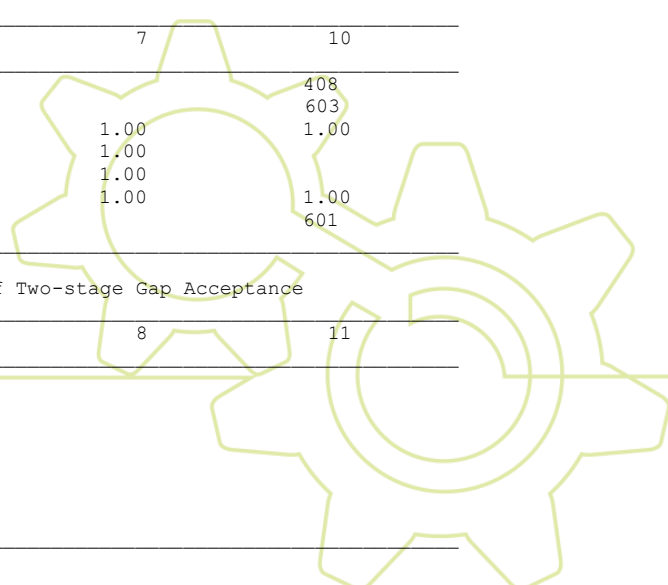
Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
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Part 1 - First Stage

Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage



Conflicting Flows  
Potential Capacity  
Pedestrian Impedance Factor  
Cap. Adj. factor due to Impeding mvmnt  
Movement Capacity

---

Part 3 - Single Stage

Conflicting Flows  
Potential Capacity  
Pedestrian Impedance Factor 1.00 1.00  
Cap. Adj. factor due to Impeding mvmnt 1.00 1.00  
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 mvmnt  
Movement Capacity

---

Part 2 - Second Stage

Conflicting Flows  
Potential Capacity  
Pedestrian Impedance Factor  
Cap. Adj. factor due to Impeding mvmnt  
Movement Capacity

---

Part 3 - Single Stage

Conflicting Flows 408  
Potential Capacity 603  
Pedestrian Impedance Factor 1.00 1.00  
Maj. L, Min T Impedance factor 1.00  
Maj. L, Min T Adj. Imp Factor. 1.00  
Cap. Adj. factor due to Impeding mvmnt 1.00 1.00  
Movement Capacity 601

---

Results for Two-stage process:

a  
y  
C t 601

---

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				38		
Movement Capacity (vph)				601		
Shared Lane Capacity (vph)						

---

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep				601		
Volume				38		
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
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	LT					L		
v (vph)	6					38		
C(m) (vph)	1636					601		
v/c	0.00					0.06		
95% queue length	0.01					0.20		
Control Delay	7.2					11.4		
LOS	A					B		
Approach Delay						11.4		
Approach LOS						B		

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(i1), Volume for stream 2 or 5	0	
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)	1.00	
d(M,LT), Delay for stream 1 or 4	7.2	
N, Number of major street through lanes	2	
d(rank,1) Delay for stream 2 or 5		

### 1.1.2.17 Interseção I – Pico Manhã

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Manha  
 Intersection: I  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: MOV01-MOV04-MOV10  
 North/South Street: MOV10  
 Intersection Orientation: EW Study period (hrs): 1.00

Major Street: Approach	Vehicle Volumes and Adjustments					
	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	14	1807				
Peak-Hour Factor, PHF	0.91	0.91				
Hourly Flow Rate, HFR	15	1985				
Percent Heavy Vehicles	0	--			--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	2				
Configuration		LT T				
Upstream Signal?		No			No	
Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				6		
Peak Hour Factor, PHF				0.91		
Hourly Flow Rate, HFR				6		
Percent Heavy Vehicles				17		
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		

Lanes 1  
Configuration L

Delay, Queue Length, and Level of Service									
Approach	EB	WB	Northbound				Southbound		
Movement	1	4	7	8	9	10	11	12	
Lane Config	LT					L			
v (vph)	15					6			
C(m) (vph)	1636					243			
v/c	0.01					0.02			
95% queue length	0.03					0.08			
Control Delay	7.2					20.2			
LOS	A					C			
Approach Delay							20.2		
Approach LOS							C		

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:  
E-Mail:

TWO-WAY STOP CONTROL (TWSC) ANALYSIS

Analyst: Progeplan  
Agency/Co.:  
Date Performed: 05/06/2023  
Analysis Time Period: Pico Manha  
Intersection: I  
Jurisdiction: DER/DF  
Units: U. S. Metric  
Analysis Year: 2023  
Project ID:  
East/West Street: MOV01-MOV04-MOV10  
North/South Street: MOV10  
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments						
Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	14	1807				
Peak-Hour Factor, PHF	0.91	0.91				
Peak-15 Minute Volume	4	496				
Hourly Flow Rate, HFR	15	1985				
Percent Heavy Vehicles	0	--	--	--	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	0	2				
Configuration	LT T					
Upstream Signal?	No		No			
Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				6		
Peak Hour Factor, PHF				0.91		
Peak-15 Minute Volume				2		
Hourly Flow Rate, HFR				6		
Percent Heavy Vehicles				17		
Percent Grade (%)	0			0		
Flared Approach: Exists?/Storage			/		/	
RT Channelized						
Lanes	1					
Configuration	L					

Pedestrian Volumes and Adjustments				
Movements	13	14	15	16

Flow (ped/hr)	0	0	0	0
Lane Width (m)	3.6	3.6	3.6	3.6
Walking Speed (m/sec)	1.2	1.2	1.2	1.2
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 kph	Distance to Signal 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:	0	
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:	2	

Worksheet 4-Critical Gap and Follow-up Time Calculation

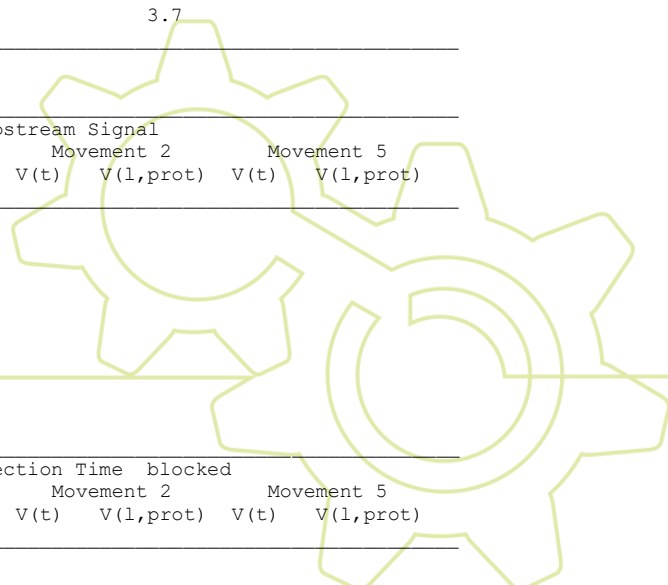
Critical Gap Calculation								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)	4.1					7.1		
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)	0					17		
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)	0.00					0.70		
t(c,T):	1-stage 0.00	0.00	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					6.6		
	2-stage							

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

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  
 for minor movements,  $p(x)$

	(1) Single-stage Process	(2) Two-Stage Stage I	(3) 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

$V_{c,x}$  0 1022  
 s  
 P<sub>x</sub>  
 $V_{c,u,x}$

$C_{r,x}$   
 $C_{plat,x}$

Two-Stage Process

	7	8	10	11
	Stage1	Stage2	Stage1	Stage2

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

3000

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

Worksheet 6-Impedance and Capacity Equations

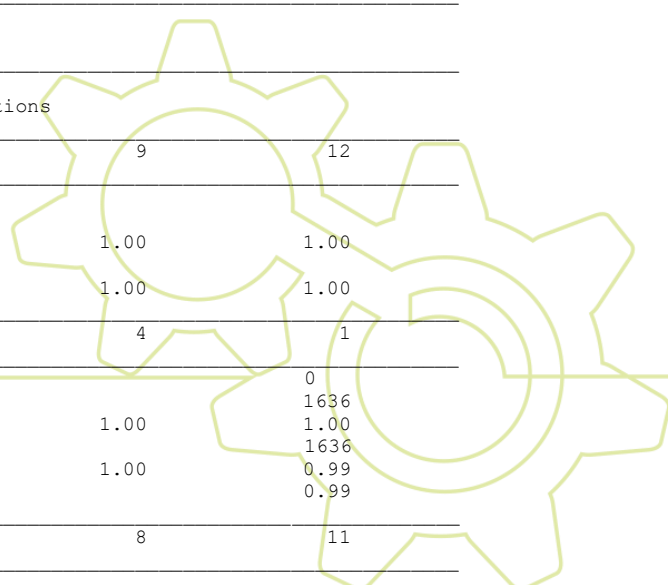
Step 1: RT from Minor St. 9 12

Conflicting Flows  
 Potential Capacity  
 Pedestrian Impedance Factor 1.00 1.00  
 Movement Capacity  
 Probability of Queue free St. 1.00 1.00

Step 2: LT from Major St. 4 1

Conflicting Flows  
 Potential Capacity 1636  
 Pedestrian Impedance Factor 1.00 1.00  
 Movement Capacity 1636  
 Probability of Queue free St. 1.00 0.99  
 Maj L-Shared Prob Q free St. 0.99

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	0.99	0.99
Movement Capacity		
Probability of Queue free St.	1.00	1.00

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Step 4: LT from Minor St.	7	10
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Conflicting Flows		1022
Potential Capacity		245
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.99	
Maj. L, Min T Adj. Imp Factor.	0.99	
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity		243

---

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

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Step 3: TH from Minor St.	8	11
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Part 1 - First Stage

Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

---

Part 2 - Second Stage

Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

---

Part 3 - Single Stage

Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
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
---------------------------	---	----

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Part 1 - First Stage

Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

---

Part 2 - Second Stage

Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

---

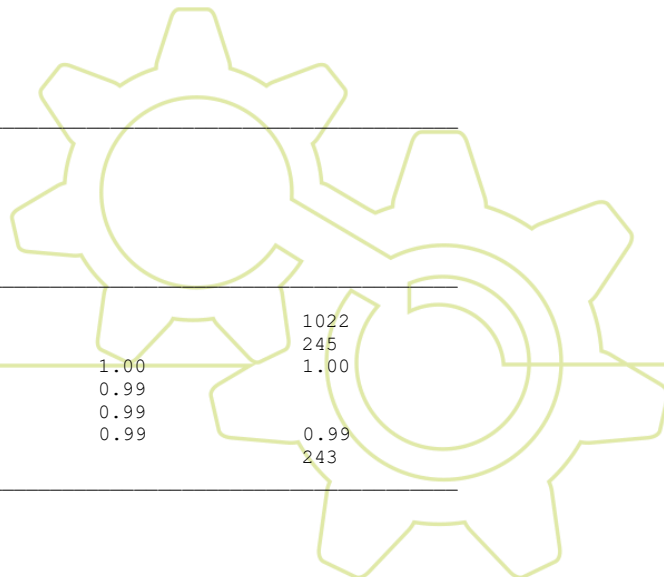
Part 3 - Single Stage

Conflicting Flows		1022
Potential Capacity		245
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.99	
Maj. L, Min T Adj. Imp Factor.	0.99	
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity		243

---

Results for Two-stage process:

a		
y		





Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				6		
Movement Capacity (vph)				243		
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep				243		
Volume				6		
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
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	LT					L		
v (vph)	15					6		
C(m) (vph)	1636					243		
v/c	0.01					0.02		
95% queue length	0.03					0.08		
Control Delay	7.2					20.2		
LOS	A					C		
Approach Delay							20.2	
Approach LOS							C	

Worksheet 11-Shared Major LT Impedance and Delay

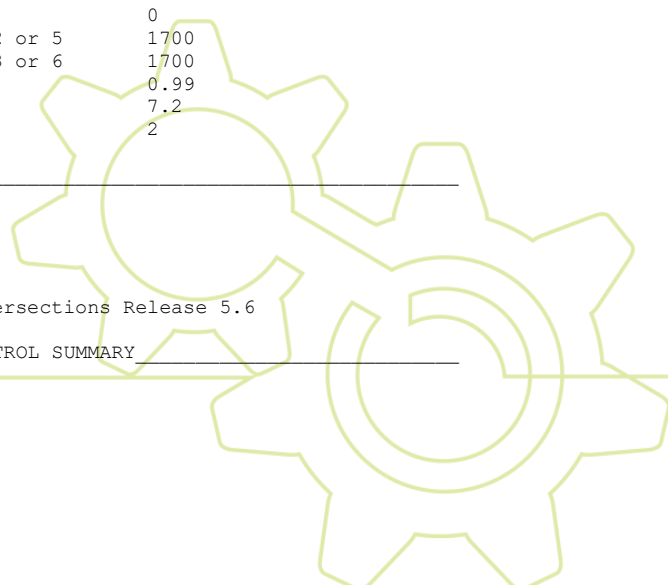
	Movement 2	Movement 5
p(oj)	0.99	1.00
v(i1), Volume for stream 2 or 5	0	
v(i2), Volume for stream 3 or 6	0	
s(i1), Saturation flow rate for stream 2 or 5	1700	
s(i2), Saturation flow rate for stream 3 or 6	1700	
P*(oj)	0.99	
d(M,LT), Delay for stream 1 or 4	7.2	
N, Number of major street through lanes	2	
d(rank,1) Delay for stream 2 or 5		

### 1.1.2.18 Interseção I – Pico Tarde

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Tarde  
 Intersection: I  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:



East/West Street: MOV01-MOV04-MOV10  
 North/South Street: MOV10  
 Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments							
Major Street: Approach Movement	Eastbound				Westbound		
	1 L	2 T	3 R	4 L	5 T	6 R	
Volume	6	707					
Peak-Hour Factor, PHF	0.91	0.91					
Hourly Flow Rate, HFR	6	776					
Percent Heavy Vehicles	0	--	--		--	--	
Median Type/Storage RT Channelized?	Undivided			/			
Lanes	0	2					
Configuration		LT T					
Upstream Signal?		No			No		

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume				19		
Peak Hour Factor, PHF				0.91		
Hourly Flow Rate, HFR				20		
Percent Heavy Vehicles				6		
Percent Grade (%)	0				0	
Flared Approach: Exists?/Storage				/		/
Lanes				1		
Configuration				L		

Approach Movement Lane Config	Delay, Queue Length, and Level of Service								
	EB 1 LT	WB 4	Northbound 7 8 9			Southbound 10 11 12			
v (vph)	6					20			
C(m) (vph)	1636					596			
v/c	0.00					0.03			
95% queue length	0.01					0.10			
Control Delay	7.2					11.2			
LOS	A					B			
Approach Delay							11.2		
Approach LOS							B		

HCS+: Unsignalized Intersections Release 5.6

Phone:  
E-Mail:

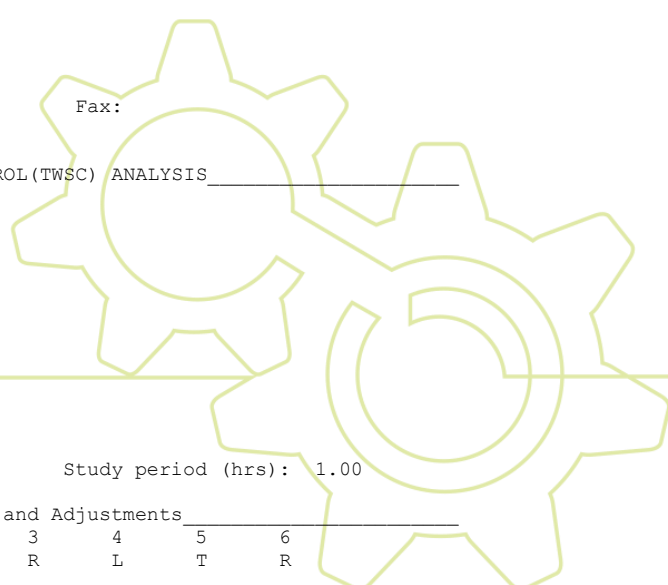
Fax:

\_\_\_\_\_ TWO-WAY STOP CONTROL (TWSC) ANALYSIS \_\_\_\_\_

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Tarde  
 Intersection: I  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: MOV01-MOV04-MOV10  
 North/South Street: MOV10  
 Intersection Orientation: EW

Study period (hrs): 1.00

Vehicle Volumes and Adjustments						
Major Street Movements	1 L	2 T	3 R	4 L	5 T	6 R





t(f,base)	2.20					3.50		
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	0					6		
t(f)	2.2					3.6		

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 for minor movements, p(x)

(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Process Stage II
-----------------------------	-------------------------------------	----------------------------

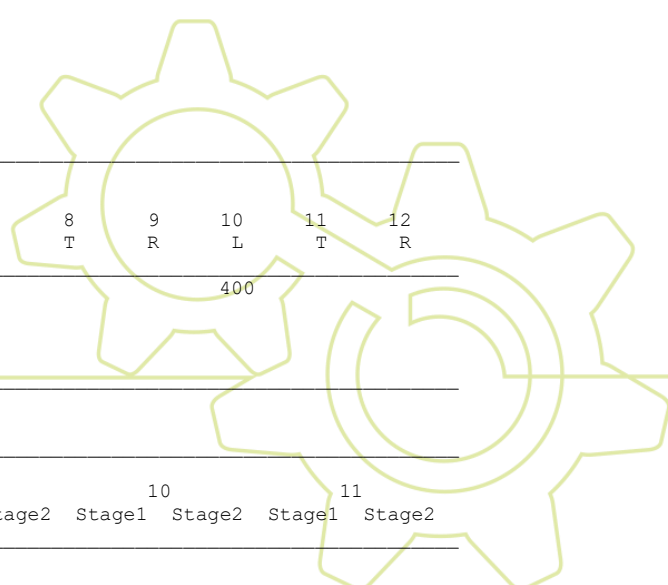
p(1)  
p(4)  
p(7)  
p(8)  
p(9)  
p(10)  
p(11)  
p(12)

Computation 4 and 5  
Single-Stage Process

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c, x	0					400		
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 3000  
P(x)  
V(C,u,x)

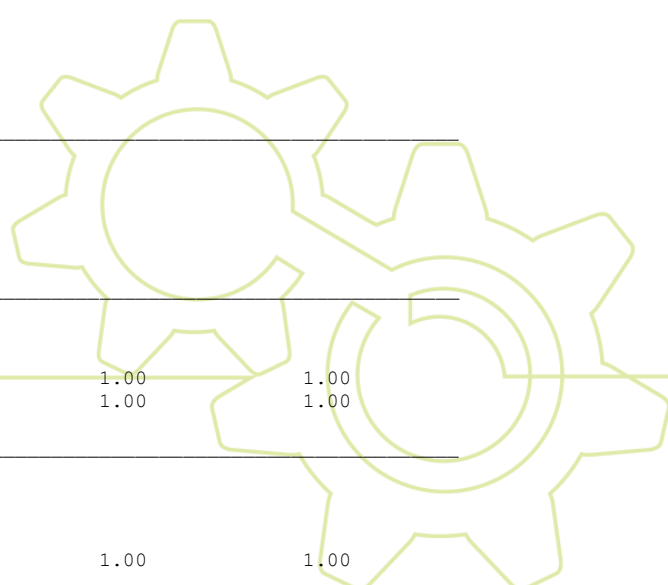
C(r,x)  
C(plat,x)

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00
Step 2: LT from Major St.	4	1
Conflicting Flows		0
Potential Capacity		1636
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		1636
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.		1.00
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	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Conflicting Flows		400
Potential Capacity		598
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	1.00	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		596

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 mvmnt		
Movement Capacity		
Probability of Queue free St.		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
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
<b>Part 1 - First Stage</b>		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
<b>Part 2 - Second Stage</b>		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
<b>Part 3 - Single Stage</b>		
Conflicting Flows		400
Potential Capacity		598
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	1.00	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		596
<b>Results for Two-stage process:</b>		
a		
y		
C t		596

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)				20		
Movement Capacity (vph)				596		
Shared Lane Capacity (vph)						

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				596		
Volume				20		
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
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	LT					L		
v (vph)	6					20		
C(m) (vph)	1636					596		
v/c	0.00					0.03		
95% queue length	0.01					0.10		
Control Delay	7.2					11.2		
LOS	A					B		
Approach Delay							11.2	
Approach LOS							B	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(i1), Volume for stream 2 or 5	0	
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)	1.00	
d(M,LT), Delay for stream 1 or 4	7.2	
N, Number of major street through lanes	2	
d(rank,1) Delay for stream 2 or 5		

### 1.1.2.19 Interseção J – Pico Manhã

HCS+: Unsignalized Intersections Release 5.6

#### TWO-WAY STOP CONTROL SUMMARY

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Manha  
 Intersection: J  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: M2-M10  
 North/South Street: M9  
 Intersection Orientation: EW  
 Study period (hrs): 1.00

		Vehicle Volumes and Adjustments							
Major Street:	Approach Movement	Eastbound				Westbound			
		1 L	2 T	3 R	4 L	5 T	6 R		
Volume					6	751			
Peak-Hour Factor, PHF					0.91	0.91			
Hourly Flow Rate, HFR					6	825			
Percent Heavy Vehicles			--	--	17	--	--		
Median Type/Storage		Undivided				/			
RT Channelized?									
Lanes					0	2			
Configuration					LT T				
Upstream Signal?			No			No			

Minor Street:	Approach Movement	Northbound				Southbound			
		7 L	8 T	9 R	10 L	11 T	12 R		
Volume		14							
Peak Hour Factor, PHF		1.00							
Hourly Flow Rate, HFR		14							
Percent Heavy Vehicles		0							
Percent Grade (%)			0		/	0	/		
Flared Approach: Exists?/Storage					/		/		
Lanes		1							
Configuration		L							

		Delay, Queue Length, and Level of Service							
Approach Movement	EB 1	Northbound				Southbound			
		WB 4	7	8	9	10	11	12	
Lane Config		LT	L			L			
v (vph)		6	14						
C(m) (vph)		1530	589						
v/c		0.00	0.02						
95% queue length		0.01	0.07						
Control Delay		7.4	11.3						
LOS		A	B						
Approach Delay				11.3					
Approach LOS				B					

HCS+: Unsignalized Intersections Release 5.6

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
E-Mail: \_\_\_\_\_

\_\_\_\_\_TWO-WAY STOP CONTROL(TWSC) ANALYSIS\_\_\_\_\_

Analyst: Progeplan  
Agency/Co.: \_\_\_\_\_  
Date Performed: 05/06/2023  
Analysis Time Period: Pico Manha  
Intersection: J  
Jurisdiction: DER/DF  
Units: U. S. Metric  
Analysis Year: 2023  
Project ID: \_\_\_\_\_  
East/West Street: M2-M10  
North/South Street: M9  
Intersection Orientation: EW Study period (hrs): 1.00

\_\_\_\_\_Vehicle Volumes and Adjustments\_\_\_\_\_

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R

Volume				6	751	
Peak-Hour Factor, PHF				0.91	0.91	
Peak-15 Minute Volume				2	206	
Hourly Flow Rate, HFR				6	825	
Percent Heavy Vehicles		--	--	17	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes				0	2	
Configuration				LT	T	
Upstream Signal?	No			No		

\_\_\_\_\_Minor Street Movements\_\_\_\_\_

	7	8	9	10	11	12
	L	T	R	L	T	R

Volume	14					
Peak Hour Factor, PHF	1.00					
Peak-15 Minute Volume	4					
Hourly Flow Rate, HFR	14					
Percent Heavy Vehicles	0					
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/	0	/
RT Channelized						
Lanes	1					
Configuration	L					

\_\_\_\_\_Pedestrian Volumes and Adjustments\_\_\_\_\_

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0
Lane Width (m)	3.6	3.6	3.6	3.6
Walking Speed (m/sec)	1.2	1.2	1.2	1.2
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 kph	Distance to Signal meters
S2 Left-Turn Through							
S5 Left-Turn Through							



Movement 2      Movement 5

Shared ln volume, major th vehicles:	0
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:	2

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					
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		17	0					
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70					
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	6.4					
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					
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		17	0					
t(f)		2.4	3.5					

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

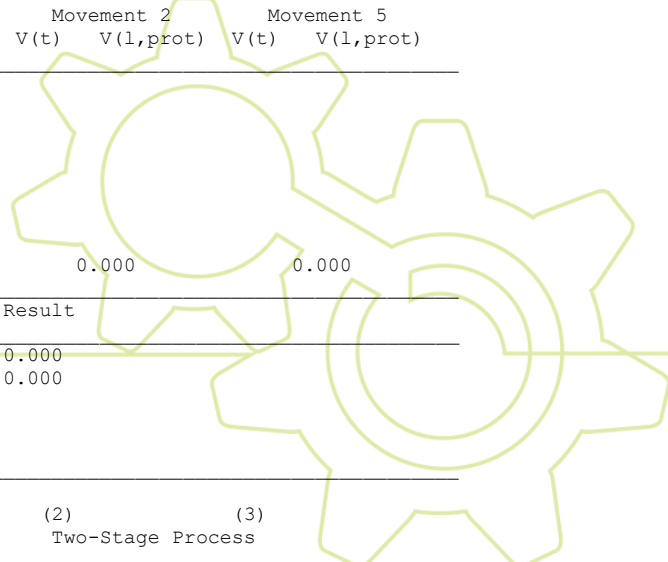
	0.000	0.000
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Computation 3-Platoon Event Periods

	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	

Constrained or unconstrained?

Proportion unblocked for minor	(1) Single-stage	(2) Two-Stage Process	(3)
--------------------------------	---------------------	--------------------------	-----



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		0	424					
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		3000						
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								
Potential Capacity								
Pedestrian Impedance Factor					1.00		1.00	
Movement Capacity								
Probability of Queue free St.					1.00		1.00	

Step 2: LT from Major St.					4		1	
---------------------------	--	--	--	--	---	--	---	--

Conflicting Flows					0			
Potential Capacity					1530			
Pedestrian Impedance Factor					1.00		1.00	
Movement Capacity					1530			
Probability of Queue free St.					1.00		1.00	
Maj L-Shared Prob Q free St.					1.00			

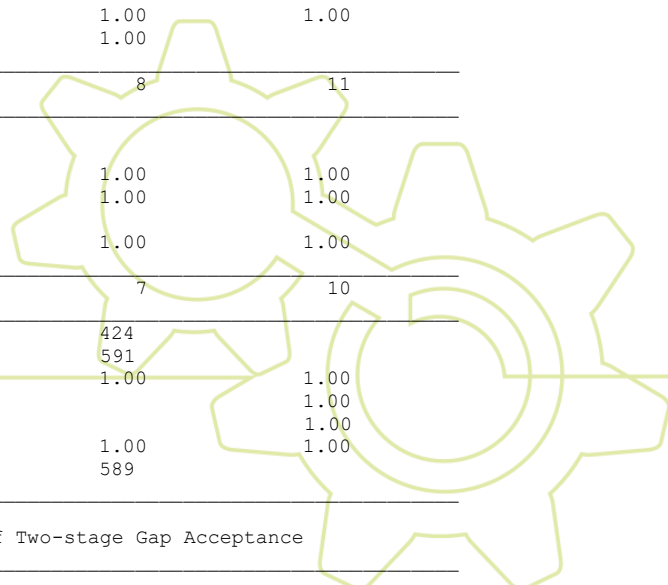
Step 3: TH from Minor St.					8		11	
---------------------------	--	--	--	--	---	--	----	--

Conflicting Flows								
Potential Capacity								
Pedestrian Impedance Factor					1.00		1.00	
Cap. Adj. factor due to Impeding mvmnt					1.00		1.00	
Movement Capacity								
Probability of Queue free St.					1.00		1.00	

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

Conflicting Flows					424			
Potential Capacity					591			
Pedestrian Impedance Factor					1.00		1.00	
Maj. L, Min T Impedance factor							1.00	
Maj. L, Min T Adj. Imp Factor.							1.00	
Cap. Adj. factor due to Impeding mvmnt					1.00		1.00	
Movement Capacity					589			

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 mvmnt  
 Movement Capacity  
 Probability of Queue free St.

---

Part 2 - Second Stage  
 Conflicting Flows  
 Potential Capacity  
 Pedestrian Impedance Factor  
 Cap. Adj. factor due to Impeding mvmnt  
 Movement Capacity

---

Part 3 - Single Stage  
 Conflicting Flows  
 Potential Capacity  
 Pedestrian Impedance Factor 1.00 1.00  
 Cap. Adj. factor due to Impeding mvmnt 1.00 1.00  
 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 mvmnt  
 Movement Capacity

---

Part 2 - Second Stage  
 Conflicting Flows  
 Potential Capacity  
 Pedestrian Impedance Factor  
 Cap. Adj. factor due to Impeding mvmnt  
 Movement Capacity

---

Part 3 - Single Stage  
 Conflicting Flows 424  
 Potential Capacity 591  
 Pedestrian Impedance Factor 1.00 1.00  
 Maj. L, Min T Impedance factor 1.00  
 Maj. L, Min T Adj. Imp Factor. 1.00  
 Cap. Adj. factor due to Impeding mvmnt 1.00 1.00  
 Movement Capacity 589

---

Results for Two-stage process:  
 a  
 Y  
 C t 589

---

Worksheet 8-Shared Lane Calculations

---

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	14					
Movement Capacity (vph)	589					
Shared Lane Capacity (vph)						

---

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	589					
Volume	14					

Delay  
Q sep  
Q sep +1  
round (Qsep +1)

n max  
C sh  
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		LT	L					
v (vph)		6	14					
C (m) (vph)		1530	589					
v/c		0.00	0.02					
95% queue length		0.01	0.07					
Control Delay		7.4	11.3					
LOS		A	B					
Approach Delay				11.3				
Approach LOS				B				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(i1), Volume for stream 2 or 5		0
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)		1.00
d(M,LT), Delay for stream 1 or 4		7.4
N, Number of major street through lanes		2
d(rank,1) Delay for stream 2 or 5		

### 1.1.2.20 Interseção J – Pico Tarde

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: Progeplan  
Agency/Co.:  
Date Performed: 05/06/2023  
Analysis Time Period: Pico Tarde  
Intersection: J  
Jurisdiction: DER/DF  
Units: U. S. Metric  
Analysis Year: 2023  
Project ID:  
East/West Street: M2-M10  
North/South Street: M9  
Intersection Orientation: EW

Study period (hrs): 1.00

Major Street: Approach	Vehicle Volumes and Adjustments					
	Eastbound			Westbound		
Movement	1 L	2 T	3 R	4 L	5 T	6 R
Volume				19	1984	
Peak-Hour Factor, PHF				0.91	0.91	
Hourly Flow Rate, HFR				20	2180	
Percent Heavy Vehicles		--	--	6	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes				0	2	
Configuration				LT	T	
Upstream Signal?		No			No	
Minor Street: Approach	Northbound			Southbound		

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	6					
Peak Hour Factor, PHF	0.91					
Hourly Flow Rate, HFR	6					
Percent Heavy Vehicles	0					
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
Lanes	1					
Configuration	L					

Delay, Queue Length, and Level of Service								
Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT	L					
v (vph)		20	6					
C (m) (vph)		1597	224					
v/c		0.01	0.03					
95% queue length		0.04	0.08					
Control Delay		7.3	21.5					
LOS		A	C					
Approach Delay				21.5				
Approach LOS				C				

HCS+: Unsignalized Intersections Release 5.6

Phone:  
E-Mail:

Fax:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Progeplan  
 Agency/Co.:  
 Date Performed: 05/06/2023  
 Analysis Time Period: Pico Tarde  
 Intersection: J  
 Jurisdiction: DER/DF  
 Units: U. S. Metric  
 Analysis Year: 2023  
 Project ID:  
 East/West Street: M2-M10  
 North/South Street: M9  
 Intersection Orientation: EW

Study period (hrs): 1.00

Vehicle Volumes and Adjustments						
Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume				19	1984	
Peak-Hour Factor, PHF				0.91	0.91	
Peak-15 Minute Volume				5	545	
Hourly Flow Rate, HFR				20	2180	
Percent Heavy Vehicles		--	--	6	--	--
Median Type/Storage		Undivided		/		
RT Channelized?						
Lanes				0	2	
Configuration				LT	T	
Upstream Signal?		No			No	
Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	6					
Peak Hour Factor, PHF	0.91					
Peak-15 Minute Volume	2					
Hourly Flow Rate, HFR	6					
Percent Heavy Vehicles	0					

Percent Grade (%) 0 0  
 Flared Approach: Exists?/Storage / /  
 RT Channelized  
 Lanes 1  
 Configuration L

Pedestrian Volumes and Adjustments				
Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0
Lane Width (m)	3.6	3.6	3.6	3.6
Walking Speed (m/sec)	1.2	1.2	1.2	1.2
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 kph	Distance to Signal 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:		0
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:		2

Worksheet 4-Critical Gap and Follow-up Time Calculation

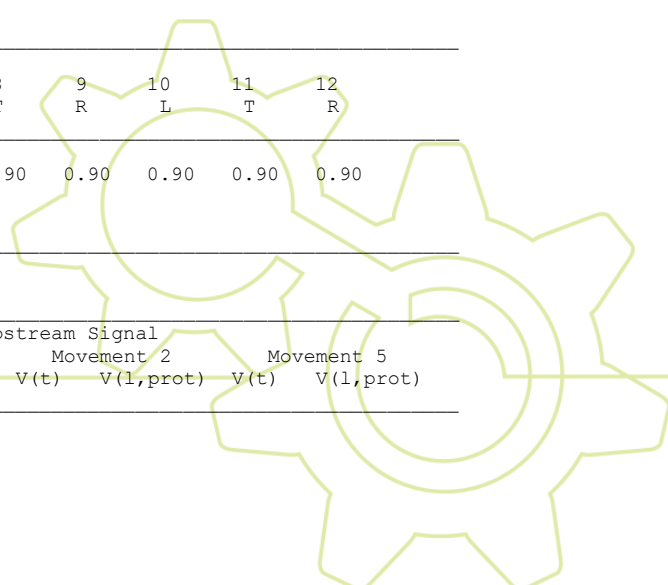
Critical Gap Calculation								
Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
t(c,base)		4.1	7.1					
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		6	0					
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70					
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00
t(c) 1-stage		4.2	6.4					
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					
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		6	0					
t(f)		2.3	3.5					

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 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

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R

V c, x	0	1130
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	3000							
P(x)								
V(c, u, x)								

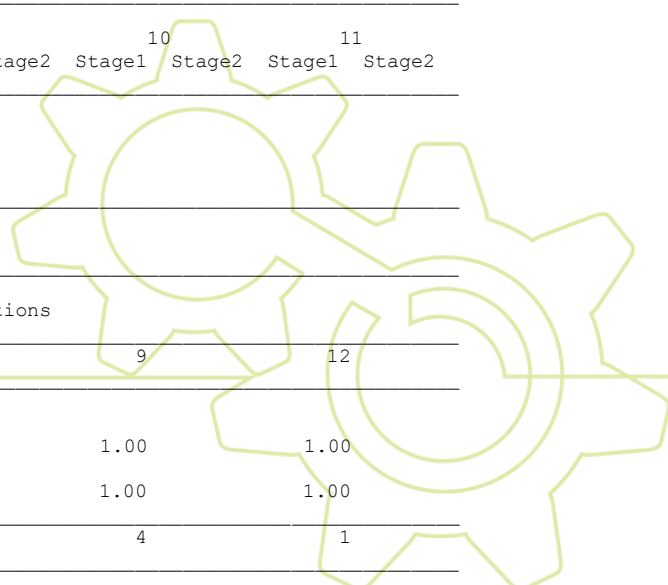
C(r, x)	
C(plat, x)	

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
---------------------------	---	----

Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 2: LT from Major St.	4	1
---------------------------	---	---



Conflicting Flows	0	
Potential Capacity	1597	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1597	
Probability of Queue free St.	0.99	1.00
Maj L-Shared Prob Q free St.	0.99	

---

Step 3: TH from Minor St. 8 11

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Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity		
Probability of Queue free St.	1.00	1.00

---

Step 4: LT from Minor St. 7 10

---

Conflicting Flows	1130	
Potential Capacity	227	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	224	

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

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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 mvmnt		
Movement Capacity		
Probability of Queue free St.		

---

Part 2 - Second Stage

Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

---

Part 3 - Single Stage

Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
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 mvmnt		
Movement Capacity		

---

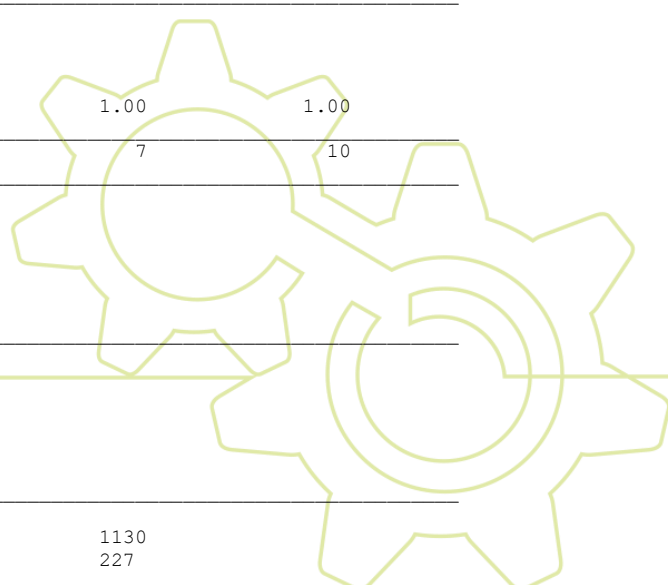
Part 2 - Second Stage

Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

---

Part 3 - Single Stage

Conflicting Flows	1130	
Potential Capacity	227	





Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	224	

Results for Two-stage process:

a	
Y	
C t	224

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	6					
Movement Capacity (vph)	224					
Shared Lane Capacity (vph)						

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	224					
Volume	6					
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
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		LT	L					
v (vph)	20	6						
C (m) (vph)	1597	224						
v/c	0.01	0.03						
95% queue length	0.04	0.08						
Control Delay	7.3	21.5						
LOS	A	C						
Approach Delay				21.5				
Approach LOS				C				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	0.99
v(i1), Volume for stream 2 or 5		0
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)		0.99
d(M,LT), Delay for stream 1 or 4		7.3
N, Number of major street through lanes		2
d(rank,1) Delay for stream 2 or 5		

### 1.1.3 Memória de cálculo da análise de capacidade e níveis de serviço – Cenário FUTURO Com empreendimento em funcionamento e com acréscimo de área – USO INSTITUCIONAL

#### 1.1.3.1 Interseção A – Pico Manhã

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY										
Analyst:		Progeplan								
Agency/Co.:										
Date Performed:		05/06/2023								
Analysis Time Period:		Pico Manha								
Intersection:		A								
Jurisdiction:		DER/DF								
Units: U. S. Metric										
Analysis Year:		2023								
Project ID:		FUTURA								
East/West Street:		MOV01-MOV04								
North/South Street:		MOV04								
Intersection Orientation:		EW				Study period (hrs): 1.00				
Vehicle Volumes and Adjustments										
Major Street:	Approach	Eastbound				Westbound				
	Movement	1	2	3	4	5	6			
		L	T	R	L	T	R			
Volume		1819	23							
Peak-Hour Factor, PHF		0.91	1.00							
Hourly Flow Rate, HFR		1998	23							
Percent Heavy Vehicles		--	--			--	--			
Median Type/Storage		Undivided				/				
RT Channelized?										
Lanes		2	0							
Configuration		T	TR							
Upstream Signal?		No				No				
Minor Street:	Approach	Northbound				Southbound				
	Movement	7	8	9	10	11	12			
		L	T	R	L	T	R			
Volume				30						
Peak Hour Factor, PHF				0.91						
Hourly Flow Rate, HFR				32						
Percent Heavy Vehicles				0						
Percent Grade (%)		0				0				
Flared Approach: Exists?/Storage						/				
Lanes		1								
Configuration		R								
Delay, Queue Length, and Level of Service										
Approach	EB	WB	Northbound				Southbound			
Movement	1	4	7	8	9	10	11	12		
Lane Config					R					
v (vph)					32					
C(m) (vph)					294					
v/c					0.11					
95% queue length					0.37					
Control Delay					18.7					
LOS					C					
Approach Delay				18.7						
Approach LOS				C						

HCS+: Unsignalized Intersections Release 5.6

Phone:  
E-Mail:

Fax:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Progeplan  
Agency/Co.:  
Date Performed: 05/06/2023  
Analysis Time Period: Pico Manha  
Intersection: A  
Jurisdiction: DER/DF  
Units: U. S. Metric  
Analysis Year: 2023  
Project ID: FUTURA  
East/West Street: MOV01-MOV04  
North/South Street: MOV04  
Intersection Orientation: EW

Study period (hrs): 1.00

Vehicle Volumes and Adjustments						
Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		1819	23			
Peak-Hour Factor, PHF		0.91	1.00			
Peak-15 Minute Volume		500	6			
Hourly Flow Rate, HFR		1998	23			
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		2	0			
Configuration		T	TR			
Upstream Signal?		No			No	
Minor Street Movements						
Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume			30			
Peak Hour Factor, PHF			0.91			
Peak-15 Minute Volume			8			
Hourly Flow Rate, HFR			32			
Percent Heavy Vehicles			0			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized			No			
Lanes			1			
Configuration			R			

Pedestrian Volumes and Adjustments				
Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0
Lane Width (m)	3.6	3.6	3.6	3.6
Walking Speed (m/sec)	1.2	1.2	1.2	1.2
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 kph	Distance to Signal 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:  
Shared ln volume, major rt vehicles:  
Sat flow rate, major th vehicles:  
Sat flow rate, major rt vehicles:  
Number of major street through lanes:

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)					6.2			
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)					0			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)					0.00			
t(c,T):	1-stage	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	0.00
t(c)	1-stage				6.2			
	2-stage							

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)					3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)					0			
t(f)					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)  
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)

