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

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				

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		

1.1.3.2 Interseção A – 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: A
Jurisdiction: DER/DF
Units: U. S. Metric
Analysis Year: 2023
Project ID: AMPLIAÇÃO CNPQ - FUTURA
East/West Street: MOV01-MOV04
North/South Street: MOV04
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			731	8			
Peak-Hour Factor, PHF			0.91	0.91			
Hourly Flow Rate, HFR			803	8			
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
		L	T	R	L	T	R
Volume							

Peak Hour Factor, PHF 0.91
 Hourly Flow Rate, HFR 13
 Percent Heavy Vehicles 0
 Percent Grade (%) 0
 Flared Approach: Exists?/Storage 0 / 0 /
 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)										13		
C(m) (vph)										649		
v/c										0.02		
95% queue length										0.06		
Control Delay										10.7		
LOS										B		
Approach Delay										10.7		
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: A
 Jurisdiction: DER/DF
 Units: U. S. Metric
 Analysis Year: 2023
 Project ID: AMPLIAÇÃO CNPQ - 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	731		8			
Peak-Hour Factor, PHF	0.91		0.91			
Peak-15 Minute Volume	201		2			
Hourly Flow Rate, HFR	803		8			
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						
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			No			
Lanes			1			

Configuration R

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:		
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)	(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)

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 406
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)
s
P(x)
V(c,u,x)

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

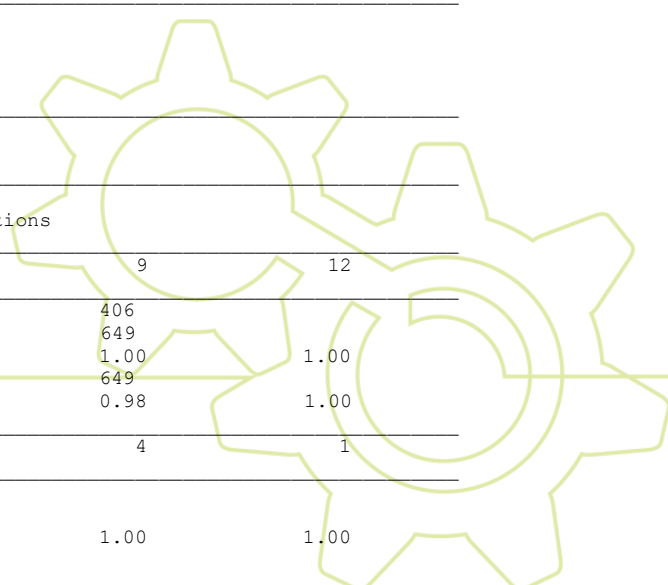
Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St. 9 12

Conflicting Flows	406	
Potential Capacity	649	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	649	
Probability of Queue free St.	0.98	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
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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
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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	0.98
Movement Capacity		

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		

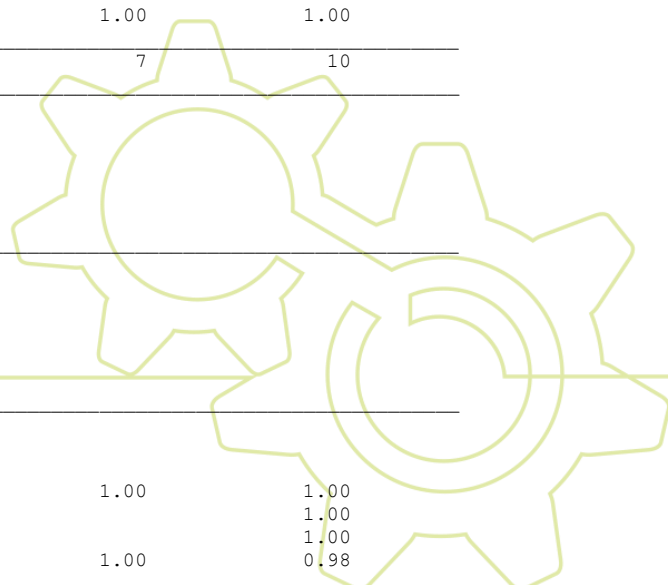
Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00

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		
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	0.98



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)			13			
Movement Capacity (vph)			649			
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			649			
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					R			
v (vph)					13			
C(m) (vph)					649			
v/c					0.02			
95% queue length					0.06			
Control Delay					10.7			
LOS					B			
Approach Delay				10.7				
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		

1.1.3.3 Interseção B – 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: B
 Jurisdiction: DER/DF
 Units: U. S. Metric
 Analysis Year: 2023
 Project ID: FUTURA
 East/West Street: M2
 North/South Street: M7
 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						9	763
Peak-Hour Factor, PHF						0.91	0.91
Hourly Flow Rate, HFR						9	838
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	8	9	10	11	12
		L	T	R	L	T	R
Volume		42					
Peak Hour Factor, PHF		0.91					
Hourly Flow Rate, HFR		46					
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	46							
C(m) (vph)	1560	578							
v/c	0.01	0.08							
95% queue length	0.02	0.26							
Control Delay	7.3	11.8							
LOS	A	B							
Approach Delay					11.8				
Approach LOS					B				

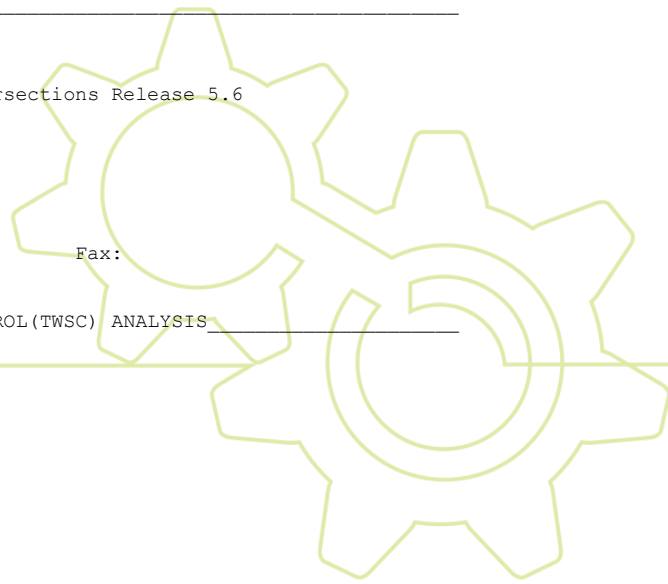
HCS+: Unsignalized Intersections Release 5.6

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: FUTURA



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 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
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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 movements, p(x)

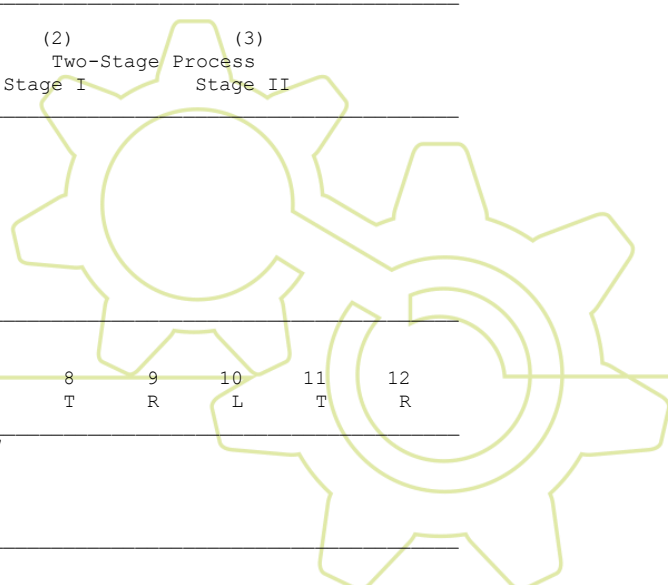
	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Two-Stage Process Stage II
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p(1)
p(4)
p(7)
p(8)
p(9)
p(10)
p(11)
p(12)

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 0 437
s
Px
V c, u, x
C r, x



C plat,x

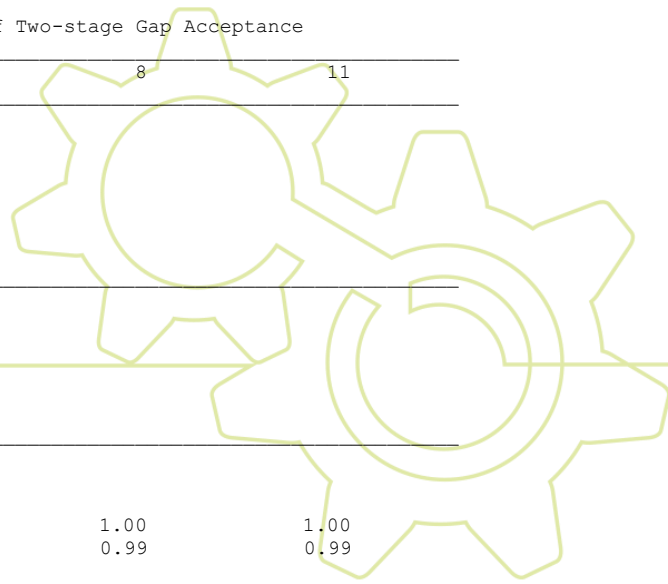
Two-Stage Process									
	7		8		10		11		
	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	
V(c,x)									
s		3000							
P(x)									
V(c,u,x)									
C(r,x)									
C(plat,x)									

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					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					437				
Potential Capacity					581				
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					578				

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 437

Potential Capacity 581

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 578

Results for Two-stage process:

a

y

C t

578

Worksheet 8-Shared Lane Calculations

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

Volume (vph) 46

Movement Capacity (vph) 578

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 578

Volume 46

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					

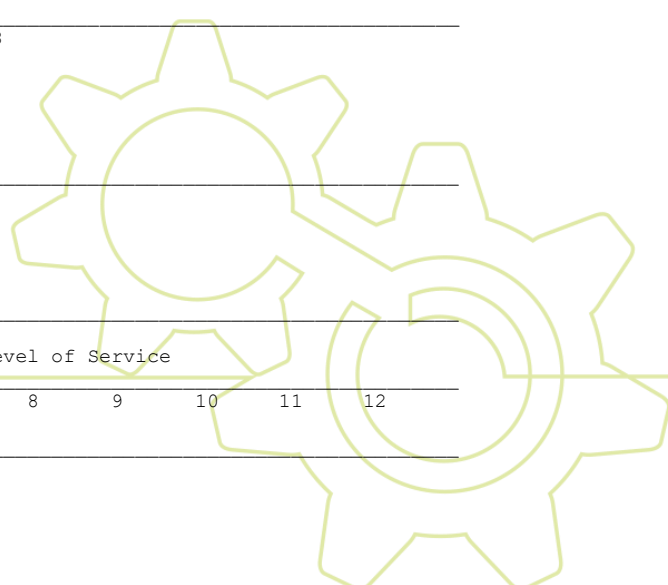
v (vph) 9 46

C (m) (vph) 1560 578

v/c 0.01 0.08

95% queue length 0.02 0.26

Control Delay 7.3 11.8



LOS	A	B	
Approach Delay			11.8
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		

1.1.3.4 Interseção B – 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: B
 Jurisdiction: DER/DF
 Units: U. S. Metric
 Analysis Year: 2023
 Project ID: FUTURA
 East/West Street: M2
 North/South Street: M7
 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				12	2008		
Peak-Hour Factor, PHF				0.91	0.91		
Hourly Flow Rate, HFR				13	2206		
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	32						
Peak Hour Factor, PHF	1.00						
Hourly Flow Rate, HFR	32						
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	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT	L					
v (vph)		13	32					

C(m) (vph)	1636	206	
v/c	0.01	0.16	
95% queue length	0.02	0.55	
Control Delay	7.2	25.7	
LOS	A	D	
Approach Delay			25.7
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: FUTURA
East/West Street: M2
North/South Street: M7
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				12	2008	
Peak-Hour Factor, PHF				0.91	0.91	
Peak-15 Minute Volume				3	552	
Hourly Flow Rate, HFR				13	2206	
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	32					
Peak Hour Factor, PHF	1.00					
Peak-15 Minute Volume	8					
Hourly Flow Rate, HFR	32					
Percent Heavy Vehicles	20					
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

Prog. Flow	Upstream Signal Data				Prog. Speed	Distance to Signal
	Sat Flow	Arrival Type	Green Time	Cycle Length		

	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	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		4.1	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)		0	20						
t(f)		2.2	3.7						

Worksheet 5-Effect of Upstream Signals

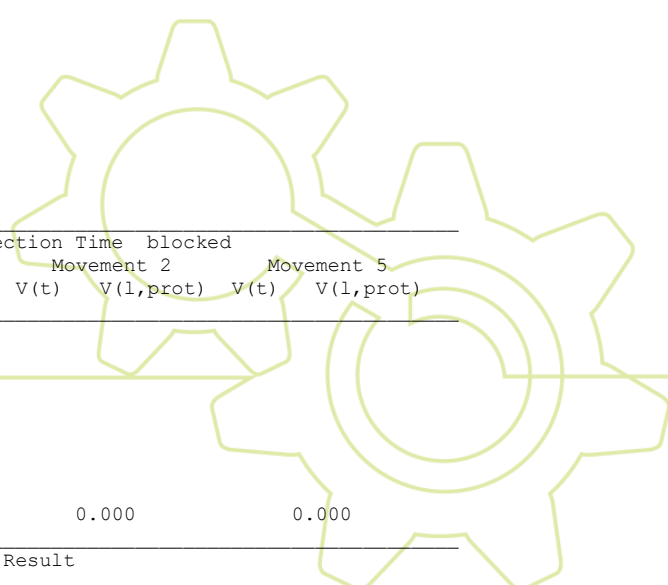
Computation 1-Queue Clearance Time at Upstream Signal				
	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)

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

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?											
<hr/>											
Proportion unblocked for minor movements, p(x)		(1) Single-stage Process		(2) Two-Stage Process Stage I		(3) Two-Stage Process Stage II					
<hr/>											
p(1)											
p(4)											
p(7)											
p(8)											
p(9)											
p(10)											
p(11)											
p(12)											
<hr/>											
Computation 4 and 5 Single-Stage Process											
Movement		1	4	7	8	9	10	11	12		
		L	L	L	T	R	L	T	R		
<hr/>											
V c,x			0	1129							
s											
Px											
V c,u,x											
<hr/>											
C r,x											
C plat,x											
<hr/>											
Two-Stage Process											
		7		8		10		11			
		Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2		
<hr/>											
V(c,x)											
s		3000									
P(x)											
V(c,u,x)											
<hr/>											
C(r,x)											
C(plat,x)											
<hr/>											
Worksheet 6-Impedance and Capacity Equations											
<hr/>											
Step 1: RT from Minor St.						9		12			
<hr/>											
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						1636					
Movement Capacity						1.00		1.00			
Probability of Queue free St.						1636					
Maj L-Shared Prob Q free St.						0.99		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						0.99		0.99			
Movement Capacity											
Probability of Queue free St.						1.00		1.00			
<hr/>											
Step 4: LT from Minor St.						7		10			
<hr/>											
Conflicting Flows						1129					

Potential Capacity	208	
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	206	

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

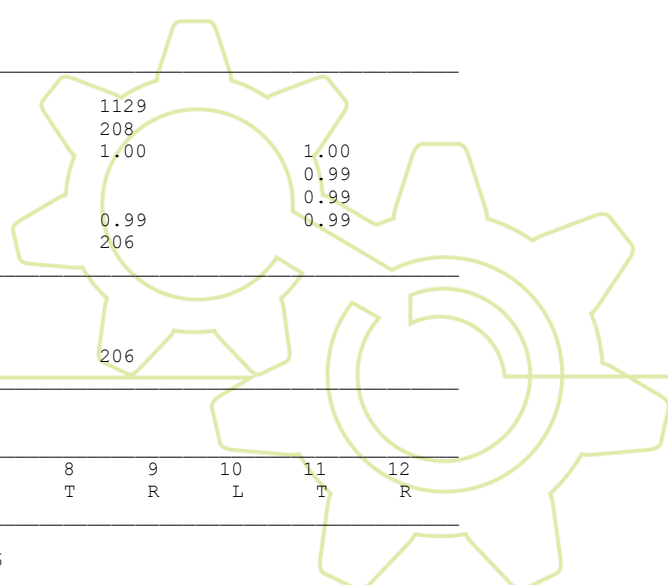
Conflicting Flows	1129	
Potential Capacity	208	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	206	

Results for Two-stage process:

a		
Y		
C t	206	

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	32					
Movement Capacity (vph)	206					



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	206					
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	4	7	8	9	10	11	12
Lane Config		LT	L					
v (vph)		13	32					
C(m) (vph)		1636	206					
v/c		0.01	0.16					
95% queue length		0.02	0.55					
Control Delay		7.2	25.7					
LOS		A	D					
Approach Delay				25.7				
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		7.2
N, Number of major street through lanes		2
d(rank,1) Delay for stream 2 or 5		

1.1.3.5 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 Manha
 Intersection: C
 Jurisdiction: DER/DF
 Units: U. S. Metric
 Analysis Year: 2023
 Project ID: FUTURO
 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 L	2 T	3 R	4 L	5 T	6 R
Volume	42	1790				
Peak-Hour Factor, PHF	0.91	0.91				

Hourly Flow Rate, HFR 46 1967
 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 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

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) 46 9
 C(m) (vph) 1636 226
 v/c 0.03 0.04
 95% queue length 0.09 0.12
 Control Delay 7.3 21.6
 LOS A C
 Approach Delay 21.6
 Approach LOS C

HCS+: Unsignalized Intersections Release 5.6

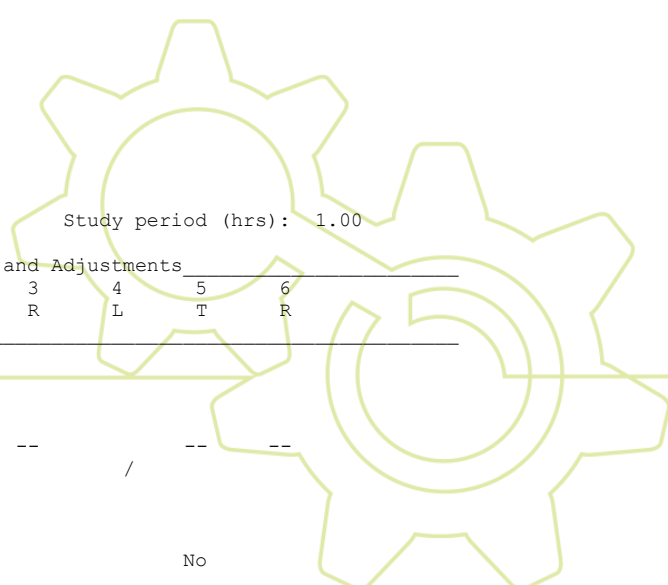
Phone: Fax:
 E-Mail:

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: FUTURO
 East/West Street: MOV01-MOV05-MOV07
 North/South Street: MOV08
 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	42	1790				
Peak-Hour Factor, PHF	0.91	0.91				
Peak-15 Minute Volume	12	492				
Hourly Flow Rate, HFR	46	1967				
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				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 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					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	4.1					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					12		
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) 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 s 0 1075
Px
V c,u,x

C r,x
C plat,x

Two-Stage Process

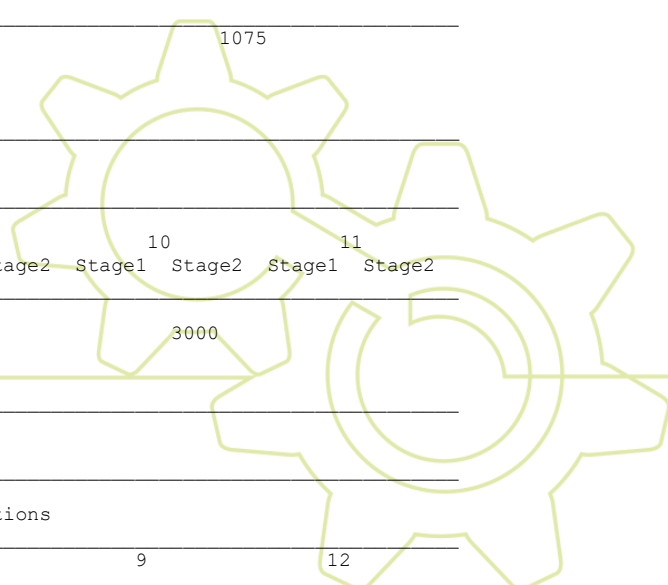
	7 Stage1	7 Stage2	8 Stage1	8 Stage2	10 Stage1	10 Stage2	11 Stage1	11 Stage2
--	-------------	-------------	-------------	-------------	--------------	--------------	--------------	--------------

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

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

Worksheet 6-Impedance and Capacity Equations

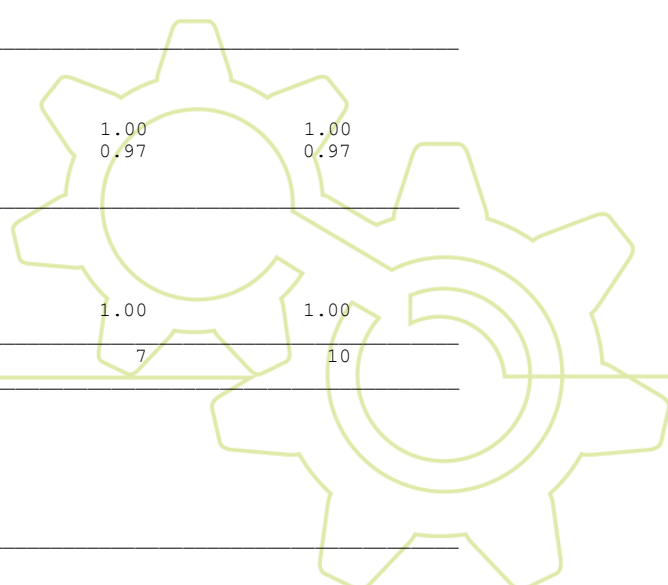
Step 1: RT from Minor St. 9 12



Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00
<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	0.97
Maj L-Shared Prob Q free St.		0.97
<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	0.97	0.97
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		1075
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		226

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

Step 3: TH from Minor St.		
<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	0.97	0.97
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		1075
Potential Capacity		233
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		226

Results for Two-stage process:

a	
y	
C t	226

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				9		
Movement Capacity (vph)				226		
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				226		
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 LT	4	7	8	9	10 L	11	12
Lane Config								
v (vph)	46					9		
C(m) (vph)	1636					226		
v/c	0.03					0.04		
95% queue length	0.09					0.12		
Control Delay	7.3					21.6		
LOS	A					C		
Approach Delay							21.6	
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	7.3	
N, Number of major street through lanes	2	
d(rank,1) Delay for stream 2 or 5		

1.1.3.6 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: FUTURA
 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 L	2 T	3 R	4 L	5 T	6 R	
Volume		32	703					
Peak-Hour Factor, PHF		0.91	0.91					
Hourly Flow Rate, HFR		35	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 L	8 T	9 R	10 L	11 T	12 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		
			4	7	8	9	10 L	11
Lane Config	LT							
v (vph)	35						13	
C(m) (vph)	1507						553	
v/c	0.02						0.02	
95% queue length	0.07						0.07	
Control Delay	7.4						11.7	
LOS	A						B	
Approach Delay								11.7
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: FUTURA
 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	32	703				
Peak-Hour Factor, PHF	0.91	0.91				
Peak-15 Minute Volume	9	193				
Hourly Flow Rate, HFR	35	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	
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)	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 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)	21					0		
t(f)	2.4					3.5		

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

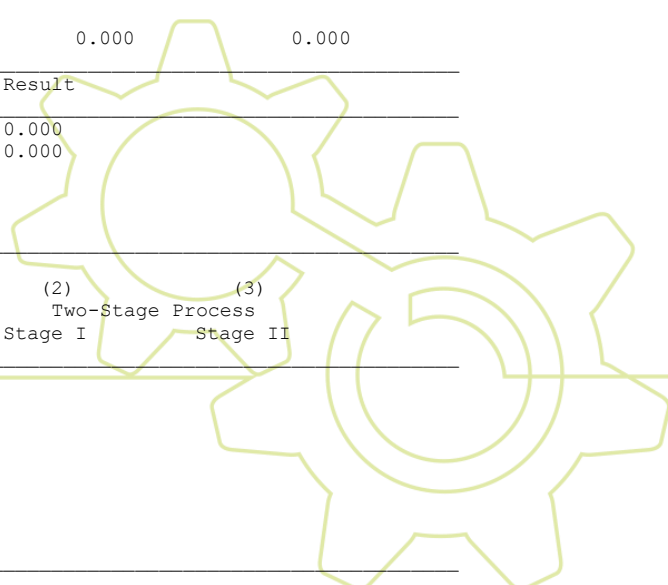
	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				
Total Saturation Flow Rate, s (vph)				
Arrival Type				
Effective Green, g (sec)				
Cycle Length, C (sec)				
Rp (from Exhibit 16-11)				
Proportion vehicles arriving on green P				
g(q1)				
g(q2)				
g(q)				

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					456		
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		1507
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		456
Potential Capacity		566
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		553

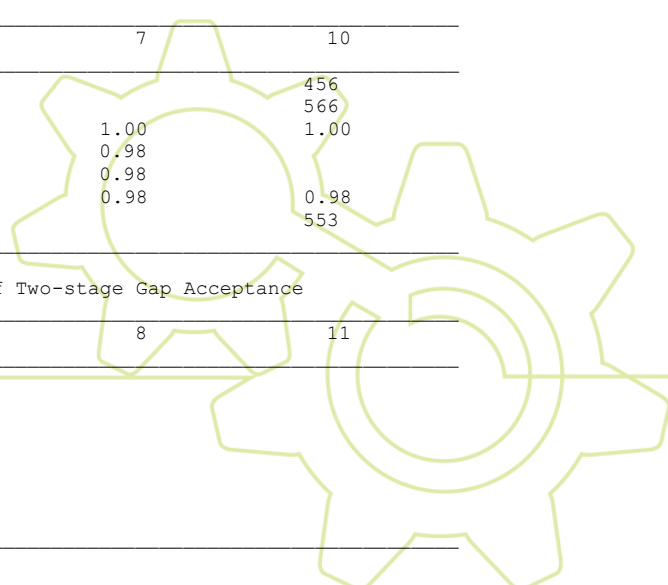
Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

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 0.98 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 456
Potential Capacity 566
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 553

Results for Two-stage process:

a
y
C t 553

Worksheet 8-Shared Lane Calculations

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

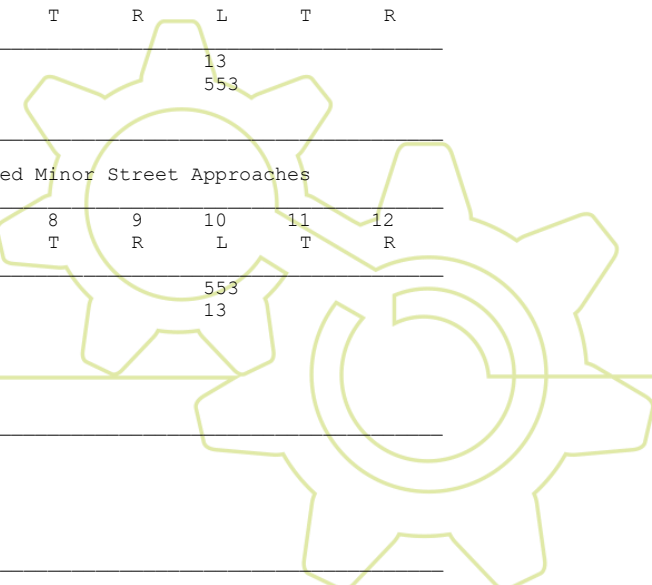
Volume (vph)				13		
Movement Capacity (vph)				553		
Shared Lane Capacity (vph)						

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				553		
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)	35					13		
C(m) (vph)	1507					553		
v/c	0.02					0.02		
95% queue length	0.07					0.07		
Control Delay	7.4					11.7		
LOS	A					B		
Approach Delay							11.7	
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		

1.1.3.7 Interseção D – Pico Manhã

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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: FUTURA
 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		1790	16				
Peak-Hour Factor, PHF		0.91	0.91				
Hourly Flow Rate, HFR		1967	17				
Percent Heavy Vehicles		--	--		--	--	
Median Type/Storage		Undivided		/			
RT Channelized?							
Lanes		2	0				
Configuration		T	TR				
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			0.91				
Hourly Flow Rate, HFR			6				
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)					6		
C(m) (vph)					260		
v/c					0.02		
95% queue length					0.07		
Control Delay					19.2		
LOS					C		
Approach Delay				19.2			
Approach LOS				C			

HCS+: Unsignalized Intersections Release 5.6

Phone:
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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: FUTURA
 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	16			
Peak-Hour Factor, PHF		0.91	0.91			
Peak-15 Minute Volume		492	4			
Hourly Flow Rate, HFR		1967	17			
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			6			
Peak Hour Factor, PHF			0.91			
Peak-15 Minute Volume			2			
Hourly Flow Rate, HFR			6			
Percent Heavy Vehicles			34			
Percent Grade (%)		0		/	0	/
Flared Approach: Exists?/Storage			No	/		/
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)					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	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)					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 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)			6			
Movement Capacity (vph)			260			
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			260			
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					R			
v (vph)					6			
C(m) (vph)					260			
v/c					0.02			
95% queue length					0.07			
Control Delay					19.2			
LOS					C			
Approach Delay				19.2				
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		
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		

1.1.3.8 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	11				
Peak-Hour Factor, PHF		0.91	0.91				
Hourly Flow Rate, HFR		772	12				
Percent Heavy Vehicles		--	--		--	--	
Median Type/Storage		Undivided		/			
RT Channelized?							
Lanes		2	0				
Configuration		T	TR				
Upstream Signal?		No			No		

Minor Street:	Approach Movement	Northbound			Southbound		
		7 L	8 T	9 R	10 L	11 T	12 R
Volume				11			
Peak Hour Factor, PHF				0.91			
Hourly Flow Rate, HFR				12			
Percent Heavy Vehicles				0		0	
Percent Grade (%)		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)					12			
C (m) (vph)					661			
v/c					0.02			
95% queue length					0.06			
Control Delay					10.5			
LOS					B			
Approach Delay				10.5				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.6

Phone:
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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	11				
Peak-Hour Factor, PHF	0.91	0.91				

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) 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

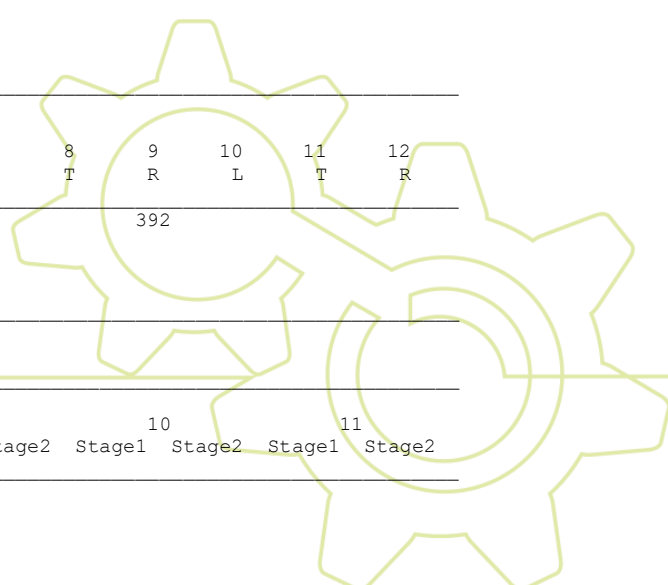
Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R

V c,x 392
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)



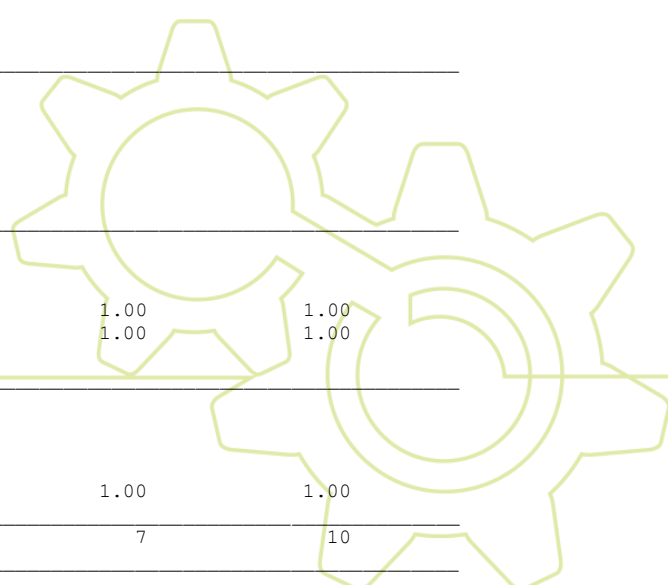
C(r,x)
C(plat,x)

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	392	
Potential Capacity	661	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	661	
Probability of Queue free St.	0.98	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	0.98
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 0.98
 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)			12			
Movement Capacity (vph)			661			
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

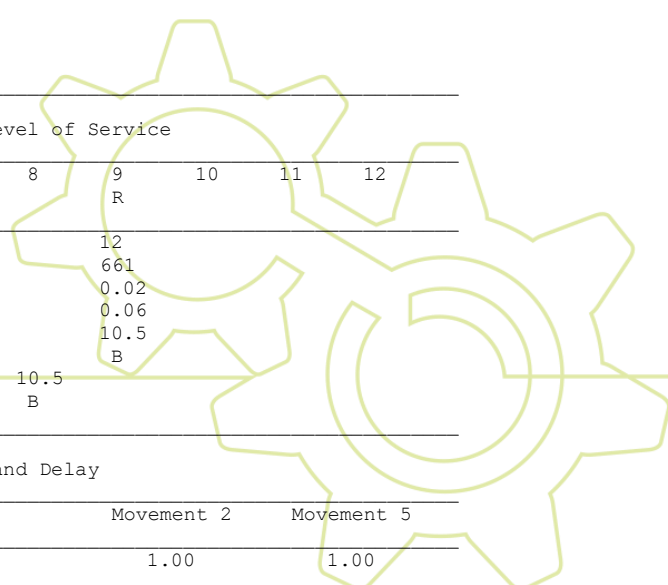
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep			661			
Volume			12			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

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

Movement	1	4	7	8	9	10	11	12
Lane Config					R			
v (vph)					12			
C (m) (vph)					661			
v/c					0.02			
95% queue length					0.06			
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

1.1.3.9 Interseção E – Pico Manhã

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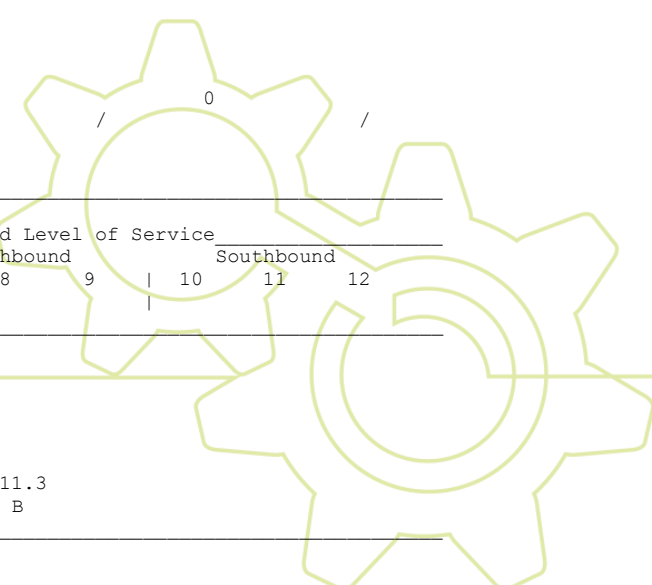
TWO-WAY STOP CONTROL SUMMARY

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: FUTURA
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	724	
Peak-Hour Factor, PHF					0.91	0.91	
Hourly Flow Rate, HFR					5	795	
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		12					
Peak Hour Factor, PHF		1.00					
Hourly Flow Rate, HFR		12					
Percent Heavy Vehicles		11					
Percent Grade (%)			0		/	0	/
Flared Approach: Exists?/Storage							
Lanes		1					
Configuration		L					

Approach Movement	Delay, Queue Length, and Level of Service							
	EB 1	WB 4	Northbound 7 8 9			Southbound 10 11 12		
Lane Config		LT	L					
v (vph)	5	12						
C(m) (vph)	1636	581						
v/c	0.00	0.02						
95% queue length	0.01	0.06						
Control Delay	7.2	11.3						
LOS	A	B						
Approach Delay				11.3				
Approach LOS				B				



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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: G
Jurisdiction: DER/DF
Units: U. S. Metric
Analysis Year: 2023
Project ID: FUTURA
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				5	724	
Peak-Hour Factor, PHF				0.91	0.91	
Peak-15 Minute Volume				1	199	
Hourly Flow Rate, HFR				5	795	
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	12					
Peak Hour Factor, PHF	1.00					
Peak-15 Minute Volume	3					
Hourly Flow Rate, HFR	12					
Percent Heavy Vehicles	11					
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/		0	/
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							

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

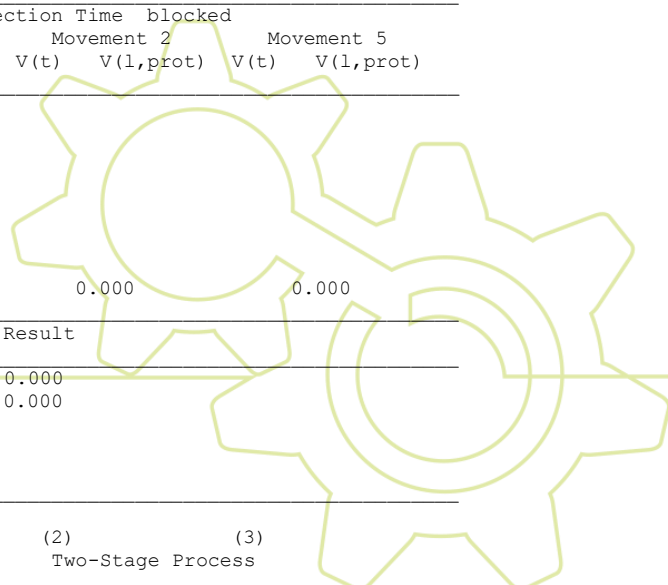
	0.000	0.000
--	-------	-------

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



movements, p(x)	Process		Stage I		Stage II			
p(1)								
p(4)								
p(7)								
p(8)								
p(9)								
p(10)								
p(11)								
p(12)								

Computation 4 and 5
Single-Stage Process

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

V c,x		0	407					
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

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

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

Conflicting Flows

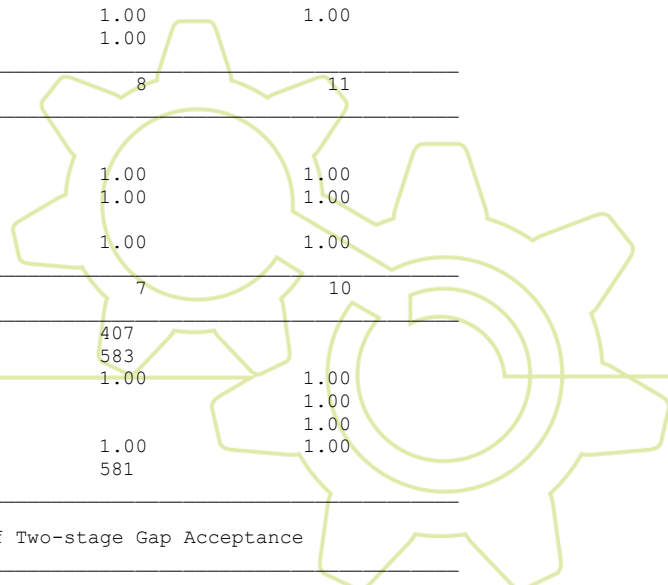
Potential Capacity								
Pedestrian Impedance Factor					1.00		1.00	
Cap. Adj. factor due to Impeding mvmnt					1.00		1.00	
Movement Capacity								
Probability of Queue free St.					1.00		1.00	

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

Conflicting Flows

Potential Capacity					407			
Pedestrian Impedance Factor					583			
Maj. L, Min T Impedance factor					1.00		1.00	
Maj. L, Min T Adj. Imp Factor.							1.00	
Cap. Adj. factor due to Impeding mvmnt					1.00		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 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 407
 Potential Capacity 583
 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 581

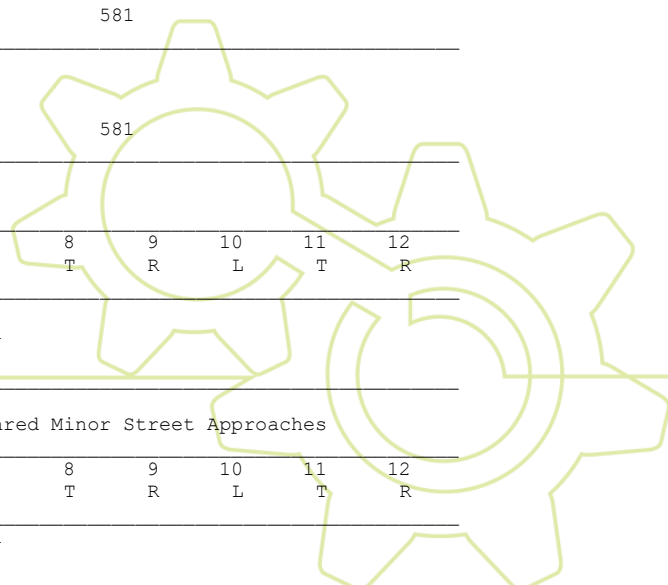
Results for Two-stage process:
 a
 Y
 C t 581

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	12					
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	12					



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	12					
C (m) (vph)		1636	581					
v/c		0.00	0.02					
95% queue length		0.01	0.06					
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		

1.1.3.10 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

Major Street: Approach	Vehicle Volumes and Adjustments					
	Eastbound			Westbound		
	1	2	3	4	5	6
Movement	L	T	R	L	T	R
Volume				4	1985	
Peak-Hour Factor, PHF				0.91	0.91	
Hourly Flow Rate, HFR				4	2181	
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	9						
Peak Hour Factor, PHF	1.00						
Hourly Flow Rate, HFR	9						
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)	4	9					
C(m) (vph)	1636	237					
v/c	0.00	0.04					
95% queue length	0.01	0.12					
Control Delay	7.2	20.8					
LOS	A	C					
Approach Delay				20.8			
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	1985	
Peak-Hour Factor, PHF				0.91	0.91	
Peak-15 Minute Volume				1	545	
Hourly Flow Rate, HFR				4	2181	
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 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 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 1098
 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

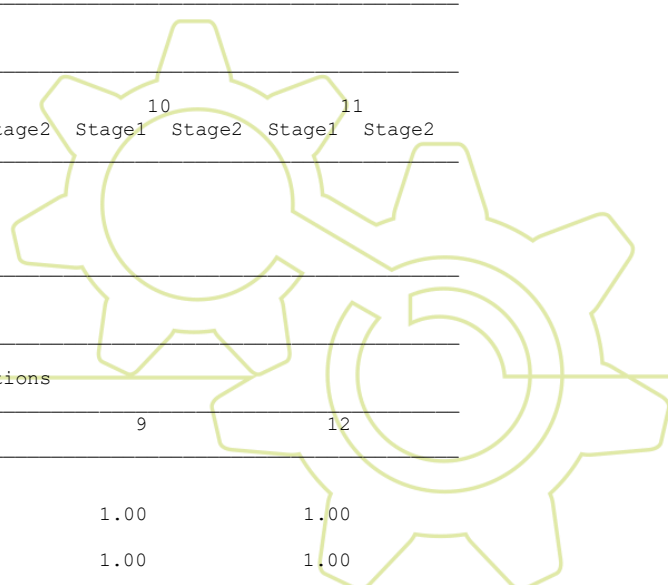
V(c,x)
 s 3000
 P(x)
 V(c,u,x)

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

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St. 9 12

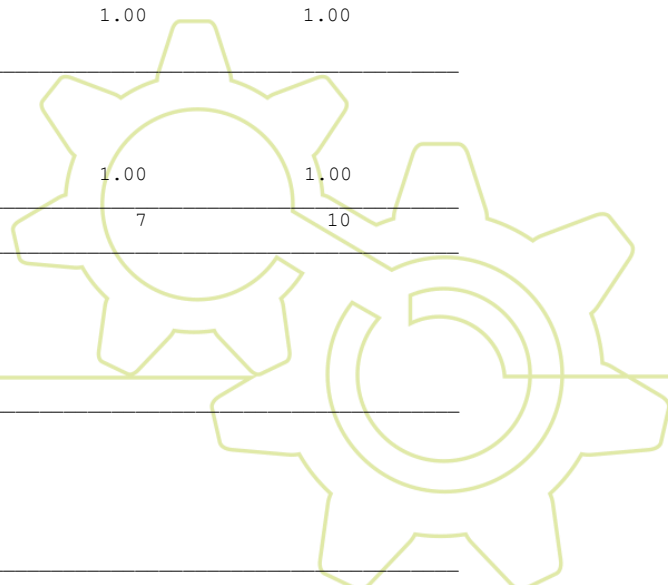
Conflicting Flows
 Potential Capacity
 Pedestrian Impedance Factor 1.00 1.00
 Movement Capacity
 Probability of Queue free St. 1.00 1.00



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	1098	
Potential Capacity	238	
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	237	

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	1098	
Potential Capacity	238	
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 mvmt	1.00	1.00
Movement Capacity	237	

Results for Two-stage process:

a	
y	
C t	237

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	9					
Movement Capacity (vph)	237					
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	237					
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)		4	9					
C(m) (vph)		1636	237					
v/c		0.00	0.04					
95% queue length		0.01	0.12					
Control Delay		7.2	20.8					
LOS		A	C					
Approach Delay				20.8				
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		

1.1.3.11 Interseção F – Pico Manhã

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: FUTURA
 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	2	3	4	5	6
		L	T	R	L	T	R
Volume		9	1796				
Peak-Hour Factor, PHF		0.91	0.91				
Hourly Flow Rate, HFR		9	1973				
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	8	9	10	11	12
		L	T	R	L	T	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
		LT						L	
v (vph)		9					5		
C (m) (vph)		1560					268		
v/c		0.01					0.02		
95% queue length		0.02					0.06		
Control Delay		7.3					18.7		
LOS		A					C		
Approach Delay								18.7	
Approach LOS								C	

HCS+: Unsignalized Intersections Release 5.6

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 E-Mail: _____

TWO-WAY STOP CONTROL (TWSC) ANALYSIS

Analyst: Progeplan
 Agency/Co.:
 Date Performed: 05/06/2023
 Analysis Time Period: Pico Manha

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
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00
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)	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

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) (3)
Two-Stage Process
Stage I Stage II

p (1)

p (4)

p (7)

p (8)

p (9)

p (10)

p (11)

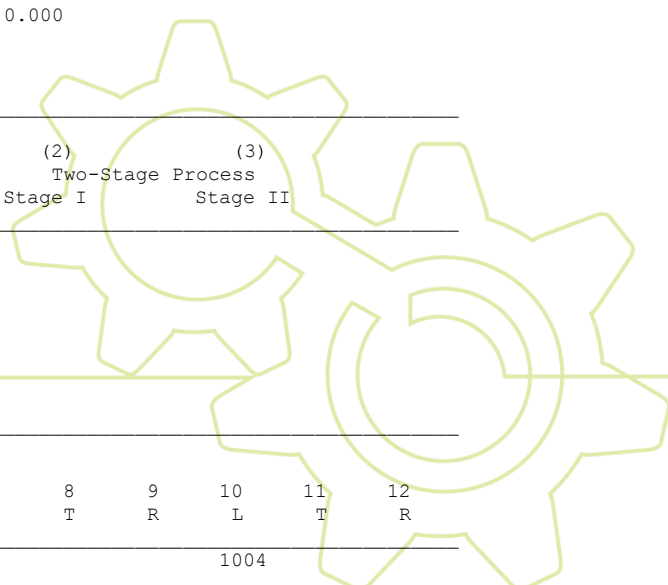
p (12)

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 1004



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
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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
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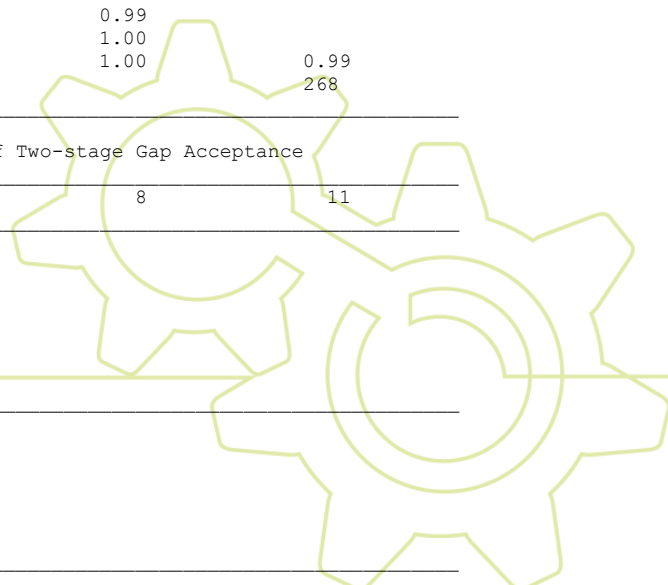
Conflicting Flows				1004
Potential Capacity				270
Pedestrian Impedance Factor		1.00		1.00
Maj. L, Min T Impedance factor		0.99		
Maj. L, Min T Adj. Imp Factor.		1.00		
Cap. Adj. factor due to Impeding mvmnt		1.00		0.99
Movement Capacity				268

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
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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		
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		

Results for Two-stage process:

a	
Y	
C t	268

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)				5		
Movement Capacity (vph)				268		
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				268		
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	268	
v/c	0.01	0.02	
95% queue length	0.02	0.06	
Control Delay	7.3	18.7	
LOS	A	C	
Approach Delay			18.7
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		

1.1.3.12 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: FUTURO
 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	Eastbound				Westbound			
	Movement	1	2	3	4	5	6	
		L	T	R	L	T	R	
Volume	6	720						
Peak-Hour Factor, PHF	0.91	0.91						
Hourly Flow Rate, HFR	6	791						
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				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
Lane Config	LT							L		

v (vph)	6	4
C(m) (vph)	1636	602
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:
E-Mail:

Fax:

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: FUTURO
 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	720				
Peak-Hour Factor, PHF	0.91	0.91				
Peak-15 Minute Volume	2	198				
Hourly Flow Rate, HFR	6	791				
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				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
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	

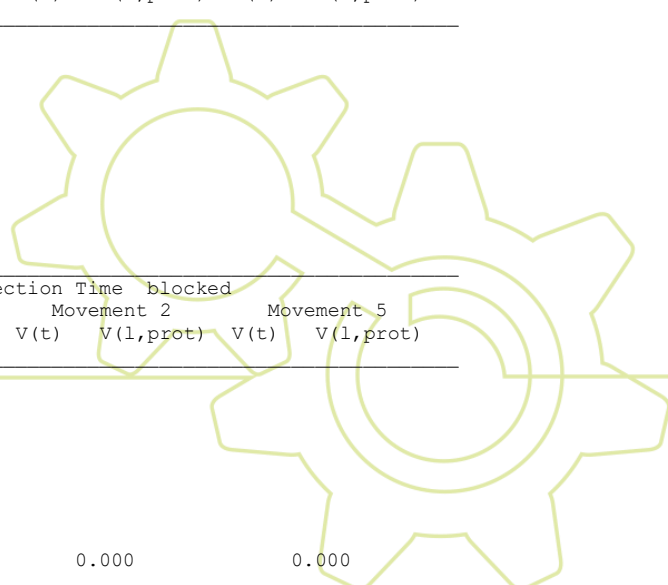
Worksheet 4-Critical Gap and Follow-up Time Calculation

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

V c,x s	0					407		
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

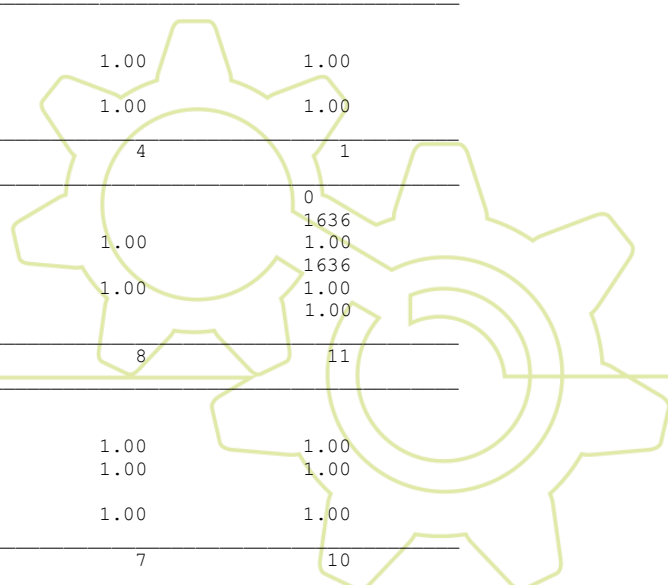
Step 2: LT from Major St.	4	1
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Conflicting Flows		0
Potential Capacity		1636
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		1636
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.		1.00

Step 3: TH from Minor St.	8	11
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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		407
Potential Capacity		604
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		602

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

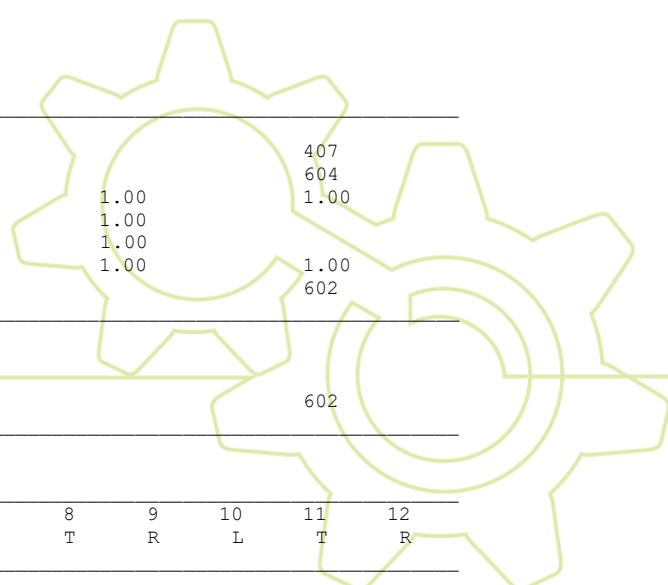
Conflicting Flows		407
Potential Capacity		604
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	1.00	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		602

Results for Two-stage process:

a		
Y		
C t		602

Worksheet 8-Shared Lane Calculations

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



Volume (vph) 4
 Movement Capacity (vph) 602
 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				602		
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	4	7	8	9	10	11	12
Lane Config	LT					L		
v (vph)	6					4		
C (m) (vph)	1636					602		
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		

1.1.3.13 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 Manhã
 Intersection: G
 Jurisdiction: DER/DF
 Units: U. S. Metric
 Analysis Year: 2023
 Project ID: FUTURO
 East/West Street: M2-M7+M8-M11+M12-M13
 North/South Street: M13
 Intersection Orientation: EW
 Study period (hrs): 1.00

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

Volume		30	727
Peak-Hour Factor, PHF		0.91	0.91
Hourly Flow Rate, HFR		32	798
Percent Heavy Vehicles	-- --	4	-- --
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	
Lane Config	L	T	R		L	T	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	EB	WB	Northbound				Southbound			
Movement	1	4		7	8	9		10	11	12
Lane Config		LT		L						
v (vph)		32		2						
C(m) (vph)		1610		550						
v/c		0.02		0.00						
95% queue length		0.06		0.01						
Control Delay		7.3		11.6						
LOS		A		B						
Approach Delay					11.6					
Approach LOS					B					

HCS+: Unsignalized Intersections Release 5.6

Phone: _____ Fax: _____
E-Mail: _____

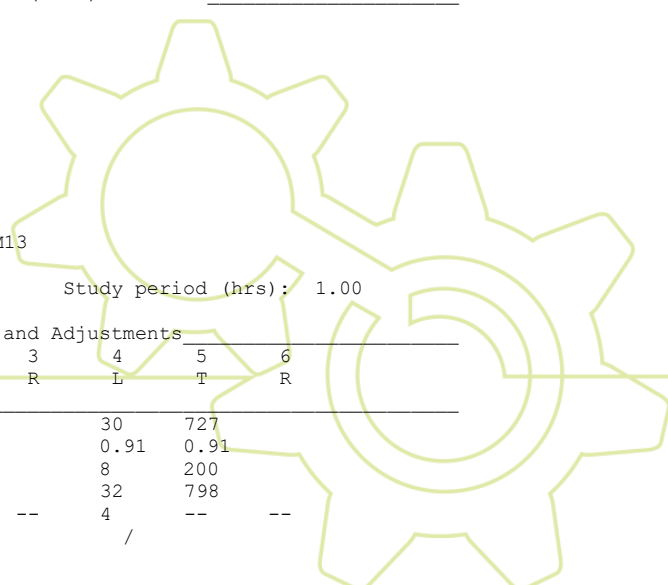
TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Progeplan
Agency/Co.:
Date Performed: 05/06/2023
Analysis Time Period: Pico Manha
Intersection: G
Jurisdiction: DER/DF
Units: U. S. Metric
Analysis Year: 2023
Project ID: FUTURO
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	727
Peak-Hour Factor, PHF		0.91	0.91
Peak-15 Minute Volume		8	200
Hourly Flow Rate, HFR		32	798
Percent Heavy Vehicles	-- --	4	-- --
Median Type/Storage	Undivided	/	
RT Channelized?			



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	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				/	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							

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	463					
s								
Px								
V c, u, x								

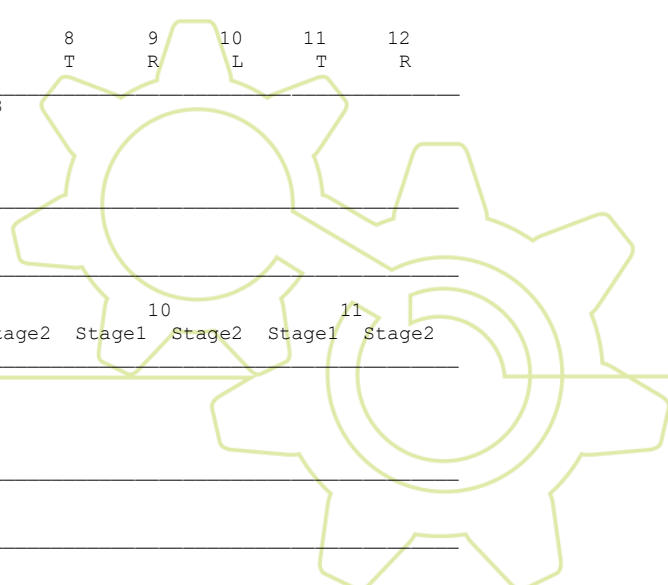
C r, x
 C plat, x

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)

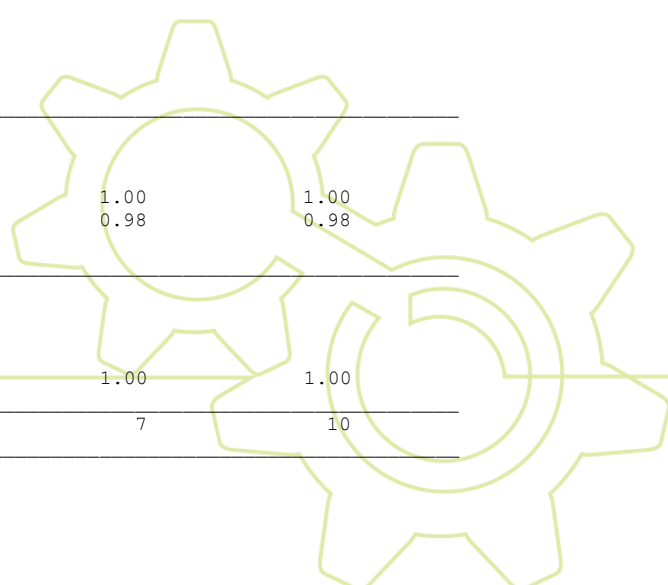


Worksheet 6-Impedance and Capacity Equations

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		
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		
Potential Capacity	463	
Pedestrian Impedance Factor	561	
Maj. L, Min T Impedance factor	1.00	1.00
Maj. L, Min T Adj. Imp Factor.		0.98
Cap. Adj. factor due to Impeding mvmnt	0.98	0.98
Movement Capacity	550	

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	463	
Potential Capacity	561	
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	550	

Results for Two-stage process:

a	
Y	
C t	550

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	2					
Movement Capacity (vph)	550					
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	550					
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	550					
v/c		0.02	0.00					
95% queue length		0.06	0.01					
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	0.98
v(i1), Volume for stream 2 or 3			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

1.1.3.14 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	2	3	4	5	6
		L	T	R	L	T	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?					0	2	
Lanes					LT	T	
Configuration					No		
Upstream Signal?	No				No		

		Northbound			Southbound		
Minor Street:	Approach 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)		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

Vehicle Volumes and Adjustments						
Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	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	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			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 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)	(2)	(3)
	Single-stage Process	Two-Stage Process Stage I	Two-Stage Process Stage II
p(1)			
p(4)			
p(7)			
p(8)			

p(9)
p(10)
p(11)
p(12)

Computation 4 and 5
Single-Stage Process

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

V _s (c,x)	0	1162
P _s (x)		
V _s (c,u,x)		

C_s(r,x)
C_s(plat,x)

Two-Stage Process

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

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

C_s(r,x)
C_s(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	1636	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1636	
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

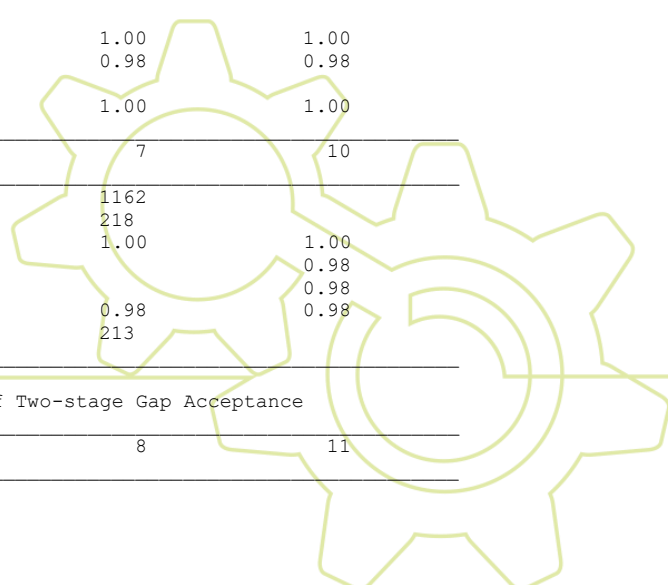
Potential Capacity	1162	
Potential Capacity	218	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.98
Maj. L, Min T Adj. Imp Factor.		0.98
Cap. Adj. factor due to Impeding mvmnt	0.98	0.98
Movement Capacity	213	

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 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

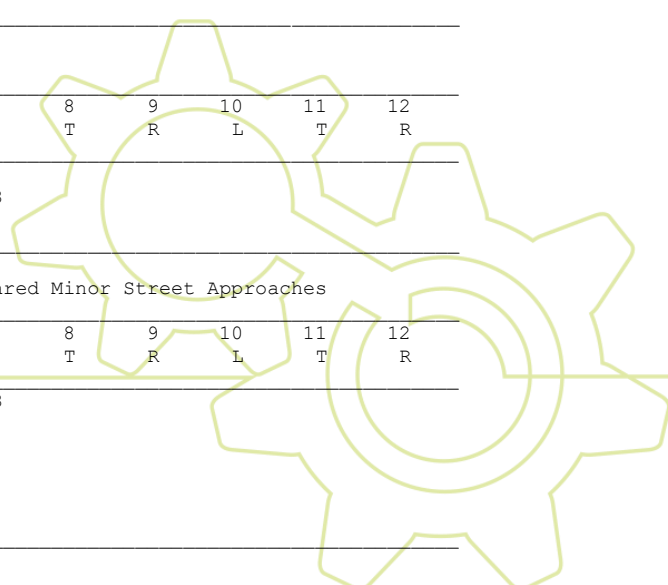
Results for Two-stage process:
a
Y
C t 213

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 3		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		

1.1.3.15 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 Manha
Intersection: H
Jurisdiction: DER/DF
Units: U. S. Metric
Analysis Year: 2023
Project ID: FUTURA
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		1	1801				
Peak-Hour Factor, PHF		0.91	0.91				
Hourly Flow Rate, HFR		1	1979				
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					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 Lane Config	Delay, Queue Length, and Level of Service							
	EB	WB	Northbound			Southbound		
	1	4	7	8	9	10	11	12
	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: FUTURA
 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	1801				
Peak-Hour Factor, PHF	0.91	0.91				
Peak-15 Minute Volume	0	495				
Hourly Flow Rate, HFR	1	1979				
Percent Heavy Vehicles	0	--	--	--	--	--
Median Type/Storage	Undivided /					
RT Channelized?						
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				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	Sat Flow	Arrival Type	Green Time	Cycle Length	Prog. Speed	Distance 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					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 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					991			
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)									

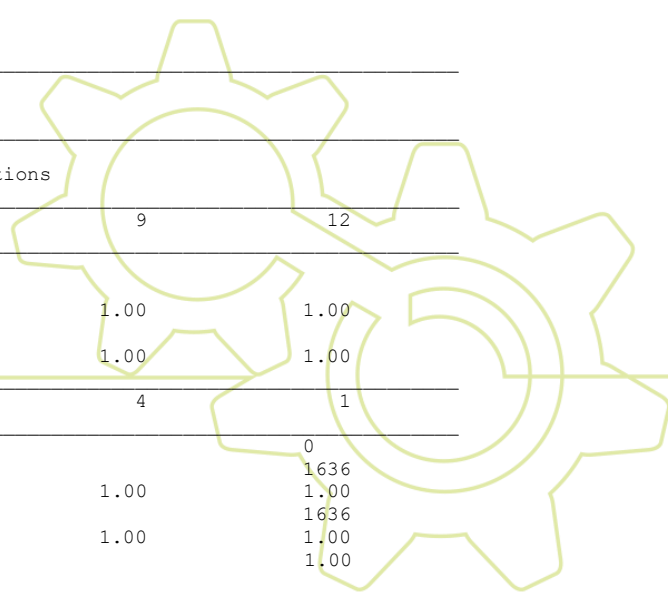
Worksheet 6-Impedance and Capacity Equations

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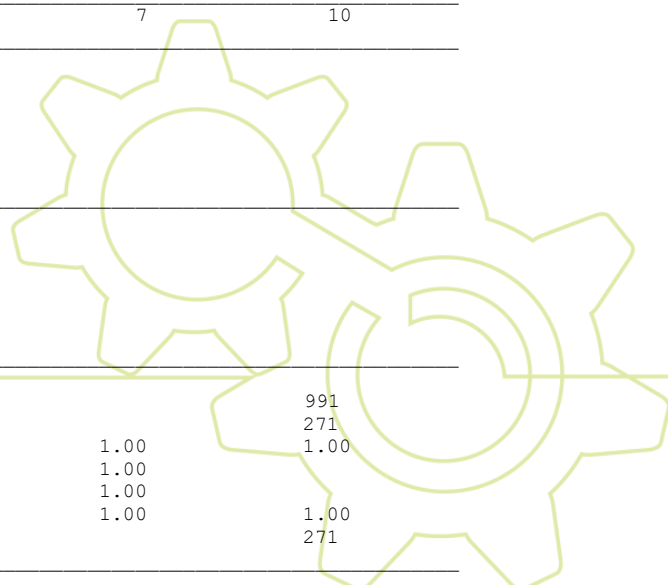
Conflicting Flows		0
Potential Capacity		1636
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		1636
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.		1.00



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		
Potential Capacity		991
Pedestrian Impedance Factor	1.00	271
Maj. L, Min T Impedance factor	1.00	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
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	991
Maj. L, Min T Impedance factor	1.00	271
Maj. L, Min T Adj. Imp Factor.	1.00	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		

1.1.3.16 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: FUTURA
 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	724					
Peak-Hour Factor, PHF	0.91	0.91					
Hourly Flow Rate, HFR	6	795					
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	
	1	4	7	8	9	10	11 12
Lane Config	LT					L	
v (vph)	6					38	
C(m) (vph)	1636					600	
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

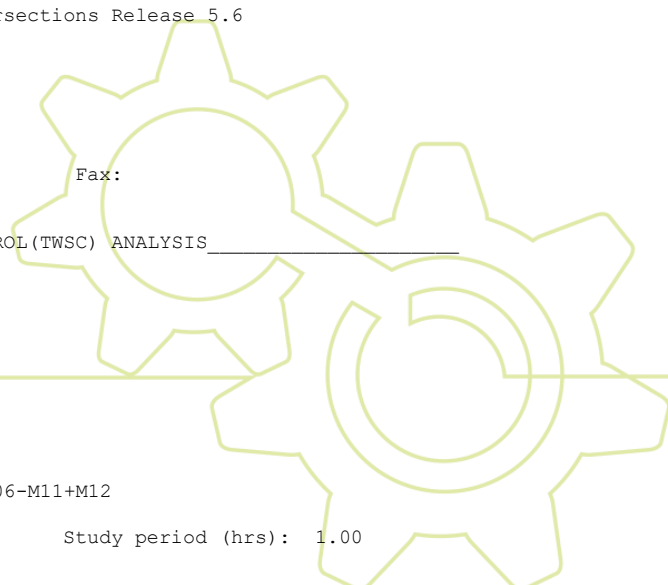
HCS+: Unsignalized Intersections Release 5.6

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: FUTURA
 East/West Street: M01-M05-M07+M08+M06-M11+M12
 North/South Street: M14
 Intersection Orientation: EW Study period (hrs): 1.00



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
--	--------------------------------	--	---

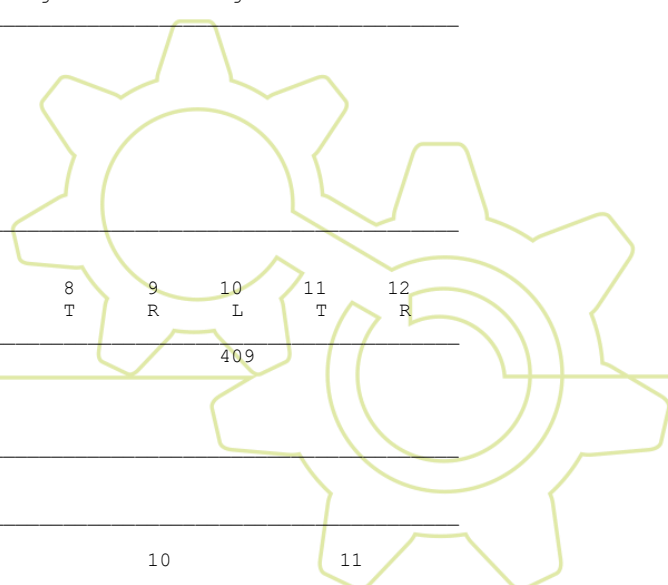
p(1)
p(4)
p(7)
p(8)
p(9)
p(10)
p(11)
p(12)

Computation 4 and 5
Single-Stage Process

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x	0					409		
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

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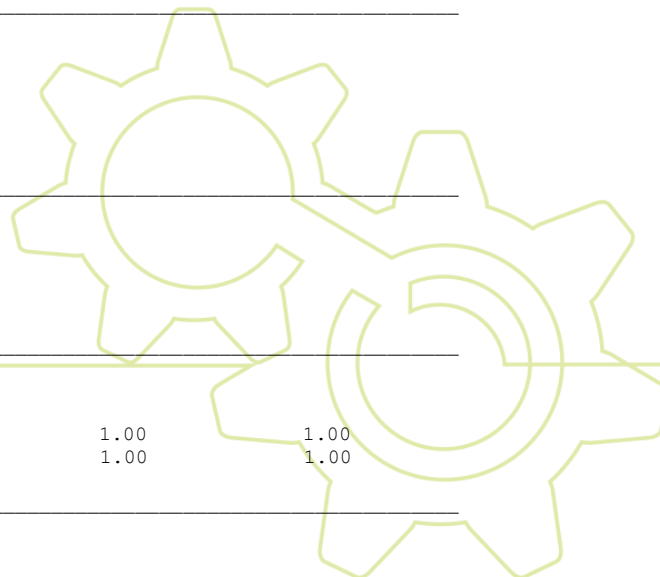
	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)						3000		
s								
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

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								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								409
Potential Capacity								602
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								600

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								



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		

1.1.3.17 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: FUTURA
 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		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 Movement	Northbound			Southbound		
		7 L	8 T	9 R	10 L	11 T	12 R
Volume					12		
Peak Hour Factor, PHF					0.91		
Hourly Flow Rate, HFR					13		
Percent Heavy Vehicles					17		
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)	15	13
C(m) (vph)	1636	243
v/c	0.01	0.05
95% queue length	0.03	0.17
Control Delay	7.2	20.7
LOS	A	C
Approach Delay		20.7
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: FUTURA
 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				12		
Peak Hour Factor, PHF				0.91		
Peak-15 Minute Volume				3		
Hourly Flow Rate, HFR				13		
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.	Sat	Arrival	Green	Cycle	Prog.	Distance

	Flow vph	Flow vph	Type	Time sec	Length sec	Speed kph	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					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	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					17		
t(f)	2.2					3.7		

Worksheet 5-Effect of Upstream Signals

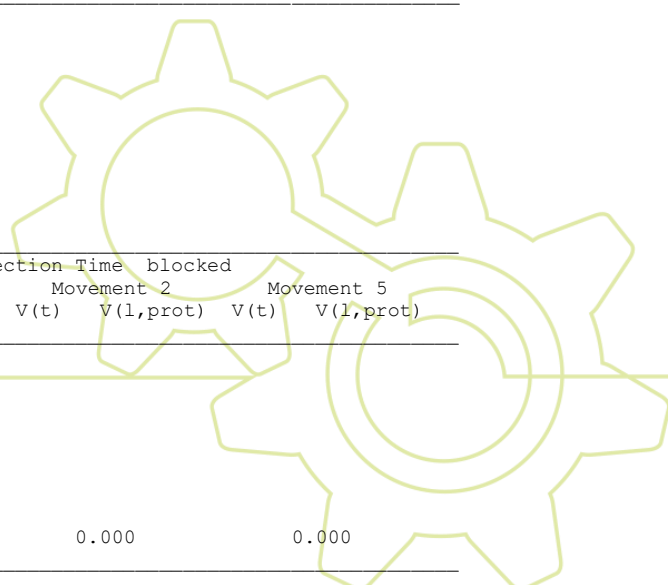
Computation 1-Queue Clearance Time at Upstream Signal				
	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)

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 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					1022		
s								
P _x								
V _{c,u,x}								

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

Two-Stage Process

	7 Stage1 Stage2		8 Stage1 Stage2		10 Stage1 Stage2		11 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

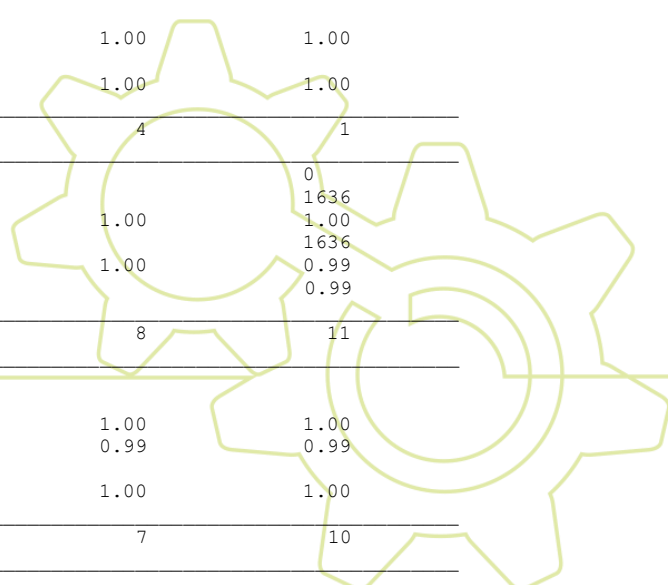
Step 2: LT from Major St.	4	1
---------------------------	---	---

Conflicting Flows		0
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

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



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

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

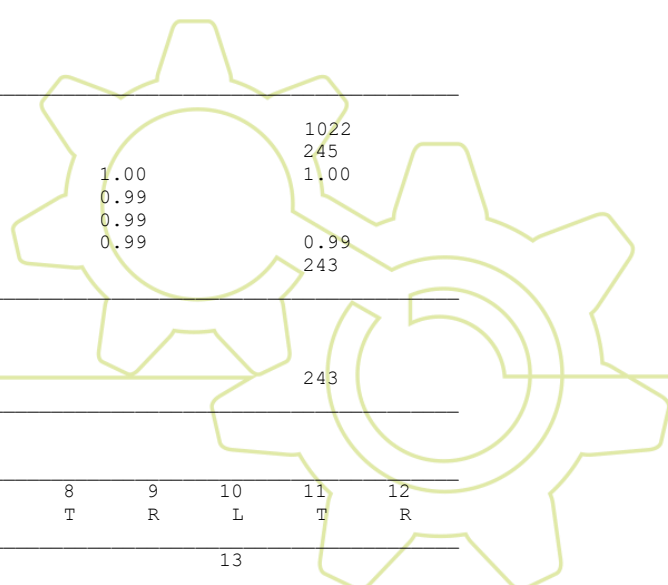
Part 3 - Single Stage		
Conflicting Flows		1022
Potential Capacity		245
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.99	
Maj. L, Min T Adj. Imp Factor.	0.99	
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity		243

Results for Two-stage process:

a		
y		
C t		243

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)				13		



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				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)	15					13		
C(m) (vph)	1636					243		
v/c	0.01					0.05		
95% queue length	0.03					0.17		
Control Delay	7.2					20.7		
LOS	A					C		
Approach Delay							20.7	
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		

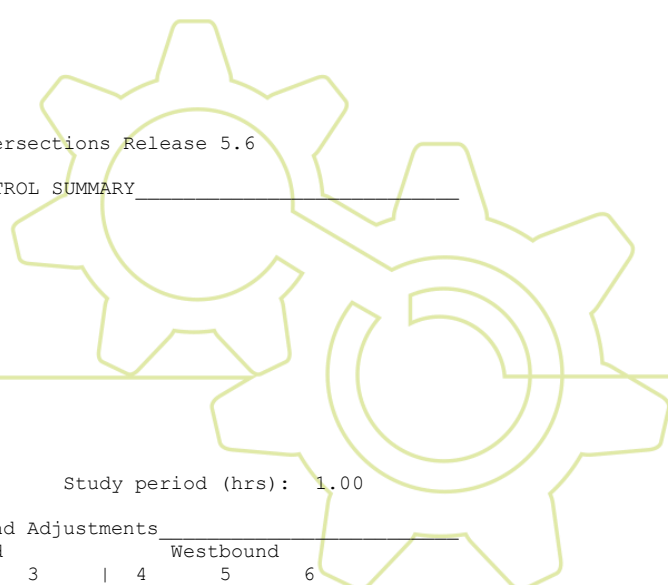
1.1.3.18 Interseção I – Pico Tarde

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: FUTURA
 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	6	707					
Peak-Hour Factor, PHF	0.91	0.91					
Hourly Flow Rate, HFR	6	776					
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					24		
Peak Hour Factor, PHF					0.91		
Hourly Flow Rate, HFR					26		
Percent Heavy Vehicles					6		
Percent Grade (%)	0					0	
Flared Approach: Exists?/Storage				/			/
Lanes					1		
Configuration					L		

Approach	Delay, Queue Length, and Level of Service									
	EB	WB	Northbound			Southbound				
Movement	1	4	7	8	9	10	11	12		
Lane Config	LT						L			
v (vph)	6						26			
C(m) (vph)	1636						596			
v/c	0.00						0.04			
95% queue length	0.01						0.14			
Control Delay	7.2						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 Tarde
 Intersection: I
 Jurisdiction: DER/DF
 Units: U. S. Metric
 Analysis Year: 2023
 Project ID: FUTURA
 East/West Street: MOV01-MOV04-MOV10
 North/South Street: MOV10
 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	6	707				
Peak-Hour Factor, PHF	0.91	0.91				
Peak-15 Minute Volume	2	194				
Hourly Flow Rate, HFR	6	776				
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				24		
Peak Hour Factor, PHF				0.91		
Peak-15 Minute Volume				7		
Hourly Flow Rate, HFR				26		
Percent Heavy Vehicles				6		
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					6		
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					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	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R

V c,x	0
s	400
Px	
V c,u,x	

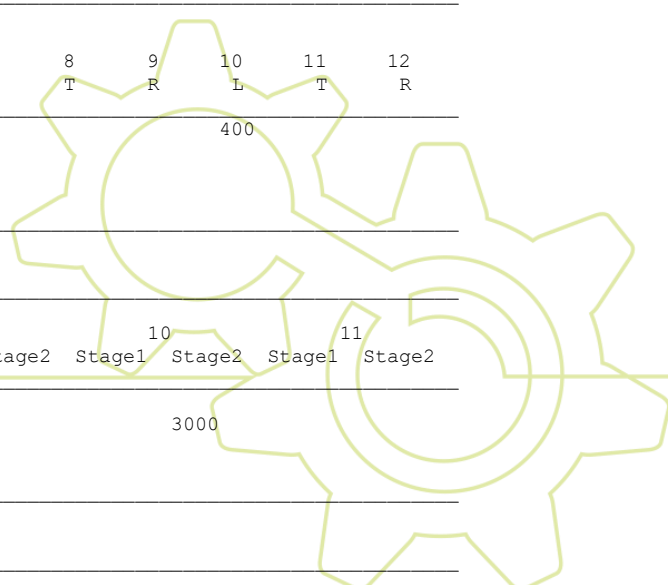
C r,x	
C plat,x	

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)	

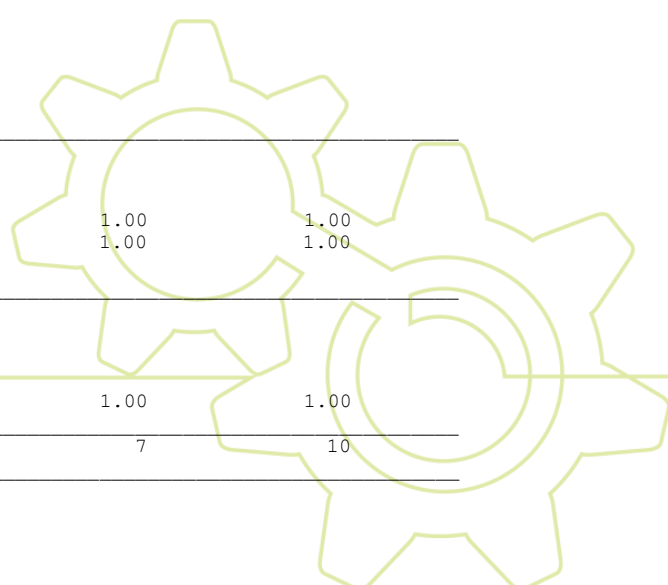


Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
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
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		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

Results for Two-stage process:

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)				26		
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				26		
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					26		
C(m) (vph)	1636					596		
v/c	0.00					0.04		
95% queue length	0.01					0.14		
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

1.1.3.19 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: FUTURA
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					12	751	
Peak-Hour Factor, PHF					0.91	0.91	
Hourly Flow Rate, HFR					13	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		17					
Peak Hour Factor, PHF		1.00					
Hourly Flow Rate, HFR		17					
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 LT	7 L	8 R	9 L	10 L	11 T
v (vph)		13	17					
C (m) (vph)		1530	575					
v/c		0.01	0.03					
95% queue length		0.03	0.09					
Control Delay		7.4	11.5					
LOS		A	B					
Approach Delay		11.5						
Approach LOS		B						

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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: J
 Jurisdiction: DER/DF
 Units: U. S. Metric
 Analysis Year: 2023
 Project ID: FUTURA
 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				12	751	
Peak-Hour Factor, PHF				0.91	0.91	
Peak-15 Minute Volume				3	206	
Hourly Flow Rate, HFR				13	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	17					
Peak Hour Factor, PHF	1.00					
Peak-15 Minute Volume	4					
Hourly Flow Rate, HFR	17					
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	Sat Flow	Arrival Type	Green Time	Cycle Length	Prog. Speed	Distance 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 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)		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	0.00	1.00	1.00	1.00	0.00
t(c) 1-stage		4.3	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)		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

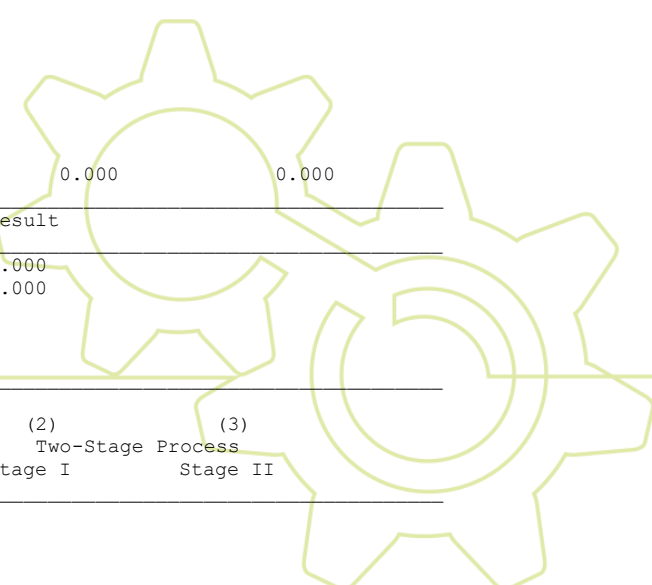
0.000 0.000

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	438					
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)				
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
---------------------------	---	---

Conflicting Flows

Potential Capacity	0	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1530	
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

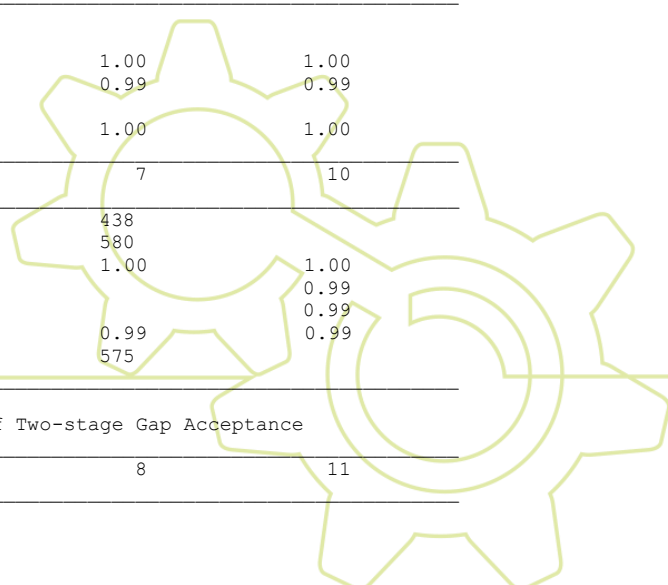
Potential Capacity	438	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	575	

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 438
Potential Capacity 580
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 575

Results for Two-stage process:
a
Y
C t 575

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	17					
Movement Capacity (vph)	575					
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	575					
Volume	17					
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	17					
C(m) (vph)		1530	575					
v/c		0.01	0.03					
95% queue length		0.03	0.09					
Control Delay		7.4	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	0.99
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		7.4
N, Number of major street through lanes		2
d(rank,1) Delay for stream 2 or 5		

1.1.3.20 Interseção J – 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: J
Jurisdiction: DER/DF
Units: U. S. Metric
Analysis Year: 2023
Project ID: FUTURA
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				19	1987	
	Peak-Hour Factor, PHF				0.91	0.91	
	Hourly Flow Rate, HFR				20	2183	
	Percent Heavy Vehicles		--	--	6	--	--
	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