SUPPLEMENTAL PERMITTED LT WORKSHEET
for shared lefts

APPROACH	EB	WB	NB	SB
Cycle Length, C 70.0 sec				
Actual Green Time for Lane Group, G				
Effective Green Time for Lane Group, g				
Opposing Effective Green Time, go				
Number of Lanes in Lane Group, N				
Number of Opposing Lanes, No				
Adjusted Left-Turn Flow Rate, Vlt				
Proportion of Left Turns in Lane Group, Plt				
Proportion of Left Turns in Opposing Flow, Plto				
Adjusted Opposing Flow Rate, Vo				
Lost Time for Lane Group, tl				
Left Turns per Cycle: LTC=VltC/3600				
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600fluo				
Opposing Platoon Ratio, Rpo (Table 9-2 or Eqn 9-7)				
gf=[Gexp(- a * (LTC ** b))]-tl, gf<=g				
Opposing Queue Ratio: qro=1-Rpo(go/C)				
gq=(4.943Volc**0.762)(qro**1.061)-tl, gq<=g				
gu =g-gq if gq>=gf, =g-gf if gq<gf				
n=(gq-gf)/2, n>=0				
Ptho=1-Plto				
Pl*=Plt[1+{(N-1)g/(gf+gu/El1+4.24))}				
El1 (Figure 9-7)				
El2=(1-Ptho**n)/Plto, El2>=1.0				
fmin=2(1+Plt)/g or fmin=2(1+Pl)/g				
gdiff=max(gq-gf,0)				
fm=[gf/g]+[gu/g][1/{1+Pl(El1-1)}], (min=fmin;max=1.00)				
flt=fm=[gf/g]+gdiff[1/{1+Plt(El2-1)}] +[gu/g][1/(1+Plt(El1-1)],(min=fmin;max=1.0) or flt=[fm+0.91(N-1)]/N**				
flt Primary				

For special case of single-lane approach opposed by multilane approach, see text.

* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.

For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

Board of Zoning Adjustment
District of Columbia
CASE NO.16559
EXHIBIT NO.429A2

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

	EBLT	WBLT	NBLT	SBLT
Adj. LT Vol from Vol Adjustment Worksheet, v				
v/c ratio from Capacity Worksheet, X				
Primary phase effective green, g				
Secondary phase effective green, gq				
(From Supplemental Permitted LT Worksheet), gu				
Cycle length, C 70.0 Red =(C-g-gq-gu), r				
Arrivals: v/(3600(max(X,1.0))), qa				
Primary ph. departures: s/3600, sp				
Secondary ph. departures: s(gq+gu)/(gu*3600), ss				
XPerm				
XProt				
XCase				
Queue at beginning of green arrow, Qa				
Queue at beginning of unsaturated green, Qu				
Residual queue, Qr				
Uniform Delay, d1				

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 6.6 sec/veh Intersection LOS A

ERROR MESSAGES

No errors to report.

HCS: Signalized Intersections Release 3.1c

Inter: W Street and Foxhall Road
Analyst: Chad A Baird
Date: 02/29/00
E/W St: W Street

City/St: Washington, D.C.
Proj #: 1634-006
Period: AM - Total Future - Mitigation
N/S St: Foxhall Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	0	0	1	0	0	1	0	0	1	0
LGConfig		LTR			LTR			LTR			LTR	
Volume	19	0	61	5	0	2	31	804	1	1	840	36
Lane Width		12.0			12.0			12.0			12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	P				NB Left P			
Thru	P				Thru P			
Right	P				Right P			
Peds					Peds			
WB Left	P				SB Left P			
Thru	P				Thru P			
Right	P				Right P			
Peds					Peds			
NB Right					EB Right			
SB Right					WB Right			
Green	15.0				45.0			
Yellow	4.0				4.0			
All Red	1.0				1.0			

Cycle Length: 70.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LTR	305	1423	0.29	0.214	25.5	C	25.5	C
Westbound								
LTR	300	1402	0.03	0.214	21.9	C	21.9	C
Northbound								
LTR	1041	1620	0.89	0.643	22.0	C	22.0	C
Southbound								
LTR	1092	1699	0.89	0.643	21.5	C	21.5	C

Intersection Delay = 21.9 (sec/veh) Intersection LOS = C

HCS: Signalized Intersections Release 3.1c

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OPERATIONAL ANALYSIS

Intersection:	W Street and Foxhall Road
City/State:	Washington, D.C.
Analyst:	Chad A Baird
Project No:	1634-006
Time Period Analyzed:	AM - Total Future - Mitigation
Date:	02/29/00
East/West Street Name:	W Street
North/South Street Name:	Foxhall Road

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	19	0	61	5	0	2	31	804	1	1	840	36
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
PK 15 Vol	5	0	17	2	0	1	9	223	1	1	233	10
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat		1900			1900			1900			1900	
ParkExist												
NumPark												
% Heavy Veh	0	0	0	0	0	0	0	0	0	0	0	0
No. Lanes	0	1	0	0	1	0	0	1	0	0	1	0
LGConfig		LTR			LTR			LTR			LTR	
Lane Width		12.0			12.0			12.0			12.0	
RTOR Vol			0			0			0			0
Adj Flow		89			8			928			974	
%InSharedLn												
Prop Turns	0.24		0.76	0.75		0.25	0.04		0.00	0.00		0.04
NumPeds			0			0			0			0
NumBus		0			0			0			0	

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet		0.0			0.0			0.0			0.0	
Arriv. Type		3			3			3			3	
Unit Ext.		3.0			3.0			3.0			3.0	
I Factor		1.000			1.000			1.000			1.000	
Lost Time		2.0			2.0			2.0			2.0	
Ext of g		2.0			2.0			2.0			2.0	
Ped Min g		3.0			3.0			3.0			3.0	

PHASE DATA

Phase Combination	1	2	3	4	5	6	7	8
EB Left	P				NB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds					Peds			
WB Left	P				SB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds					Peds			
NB Right					EB Right			
SB Right					WB Right			
Green	15.0					45.0		
Yellow	4.0					4.0		
All Red	1.0					1.0		

Cycle Length: 70.0 secs

VOLUME ADJUSTMENT WORKSHEET

Appr./ Movement	Mvt Volume	PHF	Flow Rate	No. Lanes	Lane Group	RTOR	Adjusted Flow Rate In Lane Grp	Prop. Left Turns	Prop. Right Turns
Eastbound									
Left	19	0.90	21	0					
Thru	0	0.90	0	1	LTR		89	0.24	0.76
Right	61	0.90	68	0		0			
Westbound									
Left	5	0.90	6	0					
Thru	0	0.90	0	1	LTR		8	0.75	0.25
Right	2	0.90	2	0		0			
Northbound									
Left	31	0.90	34	0					
Thru	804	0.90	893	1	LTR		928	0.04	0.00
Right	1	0.90	1	0		0			
Southbound									
Left	1	0.90	1	0					
Thru	840	0.90	933	1	LTR		974	0.00	0.04
Right	36	0.90	40	0		0			

* Value entered by user.

SATURATION FLOW ADJUSTMENT WORKSHEET

Appr/ Lane Group	Ideal Sat Flow	f W	f HV	f G	f P	f BB	f A	f LU	f RT	f LT	Adj Sat Flow
Eastbound									Sec LT Adj/LT Sat: ----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.797	0.940 ----	1423
Westbound									Sec LT Adj/LT Sat: ----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.866	0.852 ----	1402
Northbound									Sec LT Adj/LT Sat: ----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.900	0.947 ----	1620
Southbound									Sec LT Adj/LT Sat: ----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.894	1.000 ----	1699

CAPACITY ANALYSIS WORKSHEET

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Pri.							
Sec.							
Left							
Thru	LTR	89	1423	# 0.06	0.214	305	0.29
Right							
Westbound							
Pri.							
Sec.							
Left							
Thru	LTR	8	1402	0.01	0.214	300	0.03
Right							
Northbound							
Pri.							
Sec.							
Left							
Thru	LTR	928	1620	0.57	0.643	1041	0.89
Right							
Southbound							
Pri.							
Sec.							
Left							
Thru	LTR	974	1699	# 0.57	0.643	1092	0.89
Right							

Sum (v/s) critical = 0.64

Lost Time/Cycle, L = 10.00 sec Critical v/c(X) = 0.74

LEVEL OF SERVICE WORKSHEET

Appr/ Lane Grp	Ratios v/c	Ratios g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Incremental Del d2	Res Del d3	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound												
LTR	0.29	0.214	23.0	1.000	305	0.50	2.4	0.0	25.5	C	25.5	C
Westbound												
LTR	0.03	0.214	21.7	1.000	300	0.50	0.2	0.0	21.9	C	21.9	C
Northbound												
LTR	0.89	0.643	10.5	1.000	1041	0.50	11.5	0.0	22.0	C	22.0	C
Southbound												
LTR	0.89	0.643	10.5	1.000	1092	0.50	11.1	0.0	21.5	C	21.5	C

Intersection Delay = 21.9 (sec/veh) Intersection LOS = C

SUPPLEMENTAL PERMITTED LT WORKSHEET
for exclusive lefts

APPROACH	EB	WB	NB	SB
Cycle Length, C 70.0 sec				
Actual Green Time for Lane Group, G				
Effective Green Time for Lane Group, g				
Opposing Effective Green Time, go				
Number of Lanes in Lane Group, N				
Number of Opposing Lanes, No				
Adjusted Left-Turn Flow Rate, Vlt				
Proportion of Left Turns in Opposing Flow, Plto				
Adjusted Opposing Flow Rate, Vo				
Lost Time for Lane Group, tl				
Left Turns per Cycle: LTC=VltC/3600				
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600fluo				
Opposing Platoon Ratio, Rpo (Table 9-2 or Eqn 9-7)				
gf=[Gexp(- a * (LTC ** b))]-tl, gf<=g				
Opposing Queue Ratio: qro=1-Rpo(go/C)				
gq=(4.943Volc**0.762)(qro**1.061)-tl, gq<=g				
gu =g-gq if gq>=gf, =g-gf if gq<gf				
n=(gq-gf)/2, n>=0				
Ptho=1-Plto				
Pl*=Plt[1+{(N-1)g/(gf+gu/El1+4.24)}]				
El1 (Figure 9-7)				
El2=(1-Ptho**n)/Plto, El2>=1.0				
fmin=2(1+Plt)/g or fmin=2(1+Pl)/g				
gdiff=max(gq-gf,0)				
fm=[gf/g]+[gu/g][1/{1+Pl(El1-1)}], (min=fmin;max=1.00)				
flt=fm=[gf/g]+gdiff[1/{1+Plt(El2-1)}] +[gu/g][1/(1+Plt(El1-1)],(min=fmin;max=1.0) or flt=[fm+0.91(N-1)]/N** flt				

For special case of single-lane approach opposed by multilane approach, see text.

* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.

For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PERMITTED LT WORKSHEET
for shared lefts

APPROACH	EB	WB	NB	SB
Cycle Length, C 70.0 sec				
Actual Green Time for Lane Group, G	15.0	15.0	45.0	45.0
Effective Green Time for Lane Group, g	15.0	15.0	45.0	45.0
Opposing Effective Green Time, go	15.0	15.0	45.0	45.0
Number of Lanes in Lane Group, N	1	1	1	1
Number of Opposing Lanes, No	1	1	1	1
Adjusted Left-Turn Flow Rate, Vlt	21	6	34	1
Proportion of Left Turns in Lane Group, Plt	0.24	0.75	0.04	0.00
Proportion of Left Turns in Opposing Flow, Plto	0.75	0.24	0.00	0.04
Adjusted Opposing Flow Rate, Vo	8	89	974	928
Lost Time for Lane Group, tl	5.00	5.00	5.00	5.00
Left Turns per Cycle: LTC=VltC/3600	0.41	0.12	0.66	0.02
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600fluo	0.16	1.73	18.94	18.04
Opposing Platoon Ratio, Rpo (Table 9-2 or Eqn 9-7)	1.00	1.00	1.00	1.00
gf=[Gexp(- a * (LTC ** b))]-tl, gf<=g	4.2	7.0	18.2	36.9
Opposing Queue Ratio: qro=1-Rpo(go/C)	0.79	0.79	0.36	0.36
gq=(4.943Volc**0.762)(qro**1.061)-tl, gq<=g	0.00	0.81	10.59	10.03
gu =g-gq if gq>=gf, =g-gf if gq<gf	10.81	7.99	26.81	8.13
n=(gq-gf)/2, n>=0	0.00	0.00	0.00	0.00
Ptho=1-Plto	0.25	0.76	1.00	0.96
Pl*=Plt[1+{(N-1)g/(gf+gu/El1+4.24)))	0.24	0.75	0.04	0.00
El1 (Figure 9-7)	1.39	1.51	3.64	3.48
El2=(1-Ptho**n)/Plto, El2>=1.0	1.00	1.00	1.00	1.00
fmin=2(1+Plt)/g or fmin=2(1+Pl)/g	0.16	0.23	0.05	0.04
gdiff=max(gq-gf,0)	0.00	0.00	0.00	0.00
fm=[gf/g]+[gu/g][1/{1+Pl(El1-1)}], (min=fmin;max=1.00)	0.94	0.85	0.95	1.00
flt=fm=[gf/g]+gdiff[1/{1+Plt(El2-1)}] +[gu/g][1/(1+Plt(El1-1)],(min=fmin;max=1.0) or flt=[fm+0.91(N-1)]/N**				
flt Primary	0.940	0.852	0.947	1.000

For special case of single-lane approach opposed by multilane approach, see text.

* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.

For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

	EBLT	WBLT	NBLT	SBLT
Adj. LT Vol from Vol Adjustment Worksheet, v				
v/c ratio from Capacity Worksheet, X				
Primary phase effective green, g				
Secondary phase effective green, gq				
(From Supplemental Permitted LT Worksheet), gu				
Cycle length, C 70.0 Red =(C-g-gq-gu), r				
Arrivals: v/(3600(max(X,1.0))), qa				
Primary ph. departures: s/3600, sp				
Secondary ph. departures: s(gq+gu)/(gu*3600), ss				
XPerm				
XProt				
XCase				
Queue at beginning of green arrow, Qa				
Queue at beginning of unsaturated green, Qu				
Residual queue, Qr				
Uniform Delay, d1				

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 21.9 sec/veh Intersection LOS C

ERROR MESSAGES

No errors to report.

HCS: Signalized Intersections Release 3.1c

Inter: W Street and Foxhall Road
Analyst: Chad A Baird
Date: 02/29/00
E/W St: W Street

City/St: Washington, D.C.
Proj #: 1634-006
Period: PM - Total Future - Mitigation
N/S St: Foxhall Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	0	0	1	0	0	1	0	0	1	0
LGConfig		LTR			LTR			LTR			LTR	
Volume	19	0	33	2	1	1	26	461	1	1	492	23
Lane Width		12.0			12.0			12.0			12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	P				NB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds					Peds			
WB Left	P				SB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds					Peds			
NB Right					EB Right			
SB Right					WB Right			
Green	20.0					40.0		
Yellow	4.0					4.0		
All Red	1.0					1.0		

Cycle Length: 70.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LTR	408	1427	0.14	0.286	19.3	B	19.3	B
Westbound								
LTR	439	1536	0.01	0.286	17.9	B	17.9	B
Northbound								
LTR	936	1638	0.58	0.571	12.2	B	12.2	B
Southbound								
LTR	970	1698	0.59	0.571	12.4	B	12.4	B

Intersection Delay = 12.7 (sec/veh) Intersection LOS = B

HCS: Signalized Intersections Release 3.1c

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OPERATIONAL ANALYSIS

Intersection:	W Street and Foxhall Road
City/State:	Washington, D.C.
Analyst:	Chad A Baird
Project No:	1634-006
Time Period Analyzed:	PM - Total Future - Mitigation
Date:	02/29/00
East/West Street Name:	W Street
North/South Street Name:	Foxhall Road

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	19	0	33	2	1	1	26	461	1	1	492	23
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
PK 15 Vol	5	0	9	1	1	1	7	128	1	1	137	6
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat		1900			1900			1900			1900	
ParkExist												
NumPark												
% Heavy Veh	0	0	0	0	0	0	0	0	0	0	0	0
No. Lanes	0	1	0	0	1	0	0	1	0	0	1	0
LGConfig		LTR			LTR			LTR			LTR	
Lane Width		12.0			12.0			12.0			12.0	
RTOR Vol			0			0			0			0
Adj Flow		58			4			542			574	
%InSharedLn												
Prop Turns	0.36		0.64	0.50		0.25	0.05		0.00	0.00		0.05
NumPeds			0			0			0			0
NumBus		0			0			0			0	

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet		0.0			0.0			0.0			0.0	
Arriv. Type		3			3			3			3	
Unit Ext.		3.0			3.0			3.0			3.0	
I Factor		1.000			1.000			1.000			1.000	
Lost Time		2.0			2.0			2.0			2.0	
Ext of g		2.0			2.0			2.0			2.0	
Ped Min g		3.0			3.0			3.0			3.0	

PHASE DATA

Phase Combination	1	2	3	4	5	6	7	8
EB Left	P				NB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds					Peds			
WB Left	P				SB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds					Peds			
NB Right					EB Right			
SB Right					WB Right			
Green	20.0					40.0		
Yellow	4.0					4.0		
All Red	1.0					1.0		

Cycle Length: 70.0 secs

VOLUME ADJUSTMENT WORKSHEET

Appr./ Movement	Mvt Volume	PHF	Flow Rate	No. Lanes	Lane Group	RTOR	Adjusted Flow Rate In Lane Grp	Prop. Left Turns	Prop. Right Turns
Eastbound									
Left	19	0.90	21	0					
Thru	0	0.90	0	1	LTR		58	0.36	0.64
Right	33	0.90	37	0		0			
Westbound									
Left	2	0.90	2	0					
Thru	1	0.90	1	1	LTR		4	0.50	0.25
Right	1	0.90	1	0		0			
Northbound									
Left	26	0.90	29	0					
Thru	461	0.90	512	1	LTR		542	0.05	0.00
Right	1	0.90	1	0		0			
Southbound									
Left	1	0.90	1	0					
Thru	492	0.90	547	1	LTR		574	0.00	0.05
Right	23	0.90	26	0		0			

* Value entered by user.

SATURATION FLOW ADJUSTMENT WORKSHEET

Appr/ Lane Group	Ideal Sat Flow	f W	f HV	f G	f P	f BB	f A	f LU	f RT	f LT	Adj Sat Flow
Eastbound							Sec LT Adj/LT Sat:		----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.814	0.923	1427

Westbound							Sec LT Adj/LT Sat:		----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.866	0.933	1536

Northbound							Sec LT Adj/LT Sat:		----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.900	0.958	1638

Southbound							Sec LT Adj/LT Sat:		----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.894	1.000	1698

CAPACITY ANALYSIS WORKSHEET

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)		Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound								
Pri.								
Sec.								
Left								
Thru	LTR	58	1427	#	0.04	0.286	408	0.14
Right								
Westbound								
Pri.								
Sec.								
Left								
Thru	LTR	4	1536		0.00	0.286	439	0.01
Right								
Northbound								
Pri.								
Sec.								
Left								
Thru	LTR	542	1638		0.33	0.571	936	0.58
Right								
Southbound								
Pri.								
Sec.								
Left								
Thru	LTR	574	1698	#	0.34	0.571	970	0.59
Right								

Sum (v/s) critical = 0.38

Lost Time/Cycle, L = 10.00 sec Critical v/c(X) = 0.44

LEVEL OF SERVICE WORKSHEET

Appr/ Lane Grp	Ratios v/c	Ratios g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Incremental Del d2	Res Del d3	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound												
LTR	0.14	0.286	18.6	1.000	408	0.50	0.7	0.0	19.3	B	19.3	B
Westbound												
LTR	0.01	0.286	17.9	1.000	439	0.50	0.0	0.0	17.9	B	17.9	B
Northbound												
LTR	0.58	0.571	9.6	1.000	936	0.50	2.6	0.0	12.2	B	12.2	B
Southbound												
LTR	0.59	0.571	9.7	1.000	970	0.50	2.7	0.0	12.4	B	12.4	B

Intersection Delay = 12.7 (sec/veh) Intersection LOS = B

SUPPLEMENTAL PERMITTED LT WORKSHEET
for exclusive lefts

APPROACH	EB	WB	NB	SB
Cycle Length, C 70.0 sec				
Actual Green Time for Lane Group, G				
Effective Green Time for Lane Group, g				
Opposing Effective Green Time, go				
Number of Lanes in Lane Group, N				
Number of Opposing Lanes, No				
Adjusted Left-Turn Flow Rate, Vlt				
Proportion of Left Turns in Opposing Flow, Plto				
Adjusted Opposing Flow Rate, Vo				
Lost Time for Lane Group, tl				
Left Turns per Cycle: LTC=VltC/3600				
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600fluo				
Opposing Platoon Ratio, Rpo (Table 9-2 or Eqn 9-7)				
gf=[Gexp(- a * (LTC ** b))]-tl, gf<=g				
Opposing Queue Ratio: qro=1-Rpo(go/C)				
gq=(4.943Volc**0.762)(qro**1.061)-tl, gq<=g				
gu =g-gq if gq>=gf, =g-gf if gq<gf				
n=(gq-gf)/2, n>=0				
Ptho=1-Plto				
Pl*=Plt[1+{(N-1)g/(gf+gu/El1+4.24)}]				
El1 (Figure 9-7)				
El2=(1-Ptho**n)/Plto, El2>=1.0				
fmin=2(1+Plt)/g or fmin=2(1+Pl)/g				
gdiff=max(gq-gf,0)				
fm=[gf/g]+[gu/g][1/{1+Pl(El1-1)}], (min=fmin;max=1.00)				
flt=fm=[gf/g]+gdiff[1/{1+Plt(El2-1)}] +[gu/g][1/(1+Plt(El1-1)],(min=fmin;max=1.0) or flt=[fm+0.91(N-1)]/N** flt				

For special case of single-lane approach opposed by multilane approach, see text.

* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.

For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PERMITTED LT WORKSHEET
for shared lefts

APPROACH	EB	WB	NB	SB
Cycle Length, C 70.0 sec				
Actual Green Time for Lane Group, G	20.0	20.0	40.0	40.0
Effective Green Time for Lane Group, g	20.0	20.0	40.0	40.0
Opposing Effective Green Time, go	20.0	20.0	40.0	40.0
Number of Lanes in Lane Group, N	1	1	1	1
Number of Opposing Lanes, No	1	1	1	1
Adjusted Left-Turn Flow Rate, Vlt	21	2	29	1
Proportion of Left Turns in Lane Group, Plt	0.36	0.50	0.05	0.00
Proportion of Left Turns in Opposing Flow, Plto	0.50	0.36	0.00	0.05
Adjusted Opposing Flow Rate, Vo	4	58	574	542
Lost Time for Lane Group, tl	5.00	5.00	5.00	5.00
Left Turns per Cycle: LTC=VltC/3600	0.41	0.04	0.56	0.02
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600fluo	0.08	1.13	11.16	10.54
Opposing Platoon Ratio, Rpo (Table 9-2 or Eqn 9-7)	1.00	1.00	1.00	1.00
gf=[Gexp(- a * (LTC ** b))]-tl, gf<=g	7.3	12.9	17.0	32.2
Opposing Queue Ratio: qro=1-Rpo(go/C)	0.71	0.71	0.43	0.43
gq=(4.943Volc**0.762)(qro**1.061)-tl, gq<=g	0.00	0.00	7.65	7.10
gu =g-gq if gq>=gf, =g-gf if gq<gf	12.74	7.11	23.04	7.78
n=(gq-gf)/2, n>=0	0.00	0.00	0.00	0.00
Ptho=1-Plto	0.50	0.64	1.00	0.95
Pl*=Plt[1+{(N-1)g/(gf+gu/El1+4.24))}	0.36	0.50	0.05	0.00
El1 (Figure 9-7)	1.38	1.46	2.47	2.40
El2=(1-Ptho**n)/Plto, El2>=1.0	1.00	1.00	1.00	1.00
fmin=2(1+Plt)/g or fmin=2(1+Pl)/g	0.14	0.15	0.05	0.05
gdiff=max(gq-gf,0)	0.00	0.00	0.00	0.00
fm=[gf/g]+[gu/g][1/{1+Pl(El1-1)}], (min=fmin;max=1.00)	0.92	0.93	0.96	1.00
flt=fm=[gf/g]+gdiff[1/{1+Plt(El2-1)}]				
+[gu/g][1/(1+Plt(El1-1)],(min=fmin;max=1.0) or flt=[fm+0.91(N-1)]/N**				
flt Primary	0.923	0.933	0.958	1.000

For special case of single-lane approach opposed by multilane approach, see text.

* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.

For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

	EBLT	WBLT	NBLT	SBLT
Adj. LT Vol from Vol Adjustment Worksheet, v				
v/c ratio from Capacity Worksheet, X				
Primary phase effective green, g				
Secondary phase effective green, gq				
(From Supplemental Permitted LT Worksheet), gu				
Cycle length, C 70.0 Red =(C-g-gq-gu), r				
Arrivals: v/(3600(max(X,1.0))), qa				
Primary ph. departures: s/3600, sp				
Secondary ph. departures: s(gq+gu)/(gu*3600), ss				
XPerm				
XProt				
XCase				
Queue at beginning of green arrow, Qa				
Queue at beginning of unsaturated green, Qu				
Residual queue, Qr				
Uniform Delay, d1				

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 12.7 sec/veh Intersection LOS B

ERROR MESSAGES

No errors to report.

HCS: Signalized Intersections Release 3.1c

Inter: Foxhall Rd. and Garfield St. City/St: Washington, D.C.
Analyst: Chad A. Baird Proj #: 1636-002
Date: 02/29/00 Period: AM (7:45 - 8:45) - Future
E/W St: Garfield Street N/S St: Foxhall Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	0	0	1	0	0	1	0	0	1	0
LGConfig		LTR			LTR			LTR			LTR	
Volume	38	50	3	102	17	17	0	790	80	31	839	13
Lane Width		12.0			12.0			12.0			12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	P				NB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds					Peds			
WB Left	P				SB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds					Peds			
NB Right					EB Right			
SB Right					WB Right			
Green	16.0					46.0		
Yellow	4.0					4.0		
All Red	0.0					0.0		

Cycle Length: 70.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LTR	332	1454	0.30	0.229	24.7	C	24.7	C
Westbound								
LTR	286	1252	0.53	0.229	30.5	C	30.5	C
Northbound								
LTR	1108	1686	0.87	0.657	19.2	B	19.2	B
Southbound								
LTR	1068	1625	0.92	0.657	24.1	C	24.1	C

Intersection Delay = 22.4 (sec/veh) Intersection LOS = C

HCS: Signalized Intersections Release 3.1c

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OPERATIONAL ANALYSIS

Intersection:	Foxhall Rd. and Garfield St.
City/State:	Washington, D.C.
Analyst:	Chad A. Baird
Project No:	1636-002
Time Period Analyzed:	AM (7:45 - 8:45) - Future
Date:	02/29/00
East/West Street Name:	Garfield Street
North/South Street Name:	Foxhall Road

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	38	50	3	102	17	17	0	790	80	31	839	13
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
PK 15 Vol	11	14	1	28	5	5	0	219	22	9	233	4
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat		1900			1900			1900			1900	
ParkExist												
NumPark												
% Heavy Veh	0	0	0	0	0	0	0	0	0	0	0	0
No. Lanes	0	1	0	0	1	0	0	1	0	0	1	0
LGConfig		LTR			LTR			LTR			LTR	
Lane Width		12.0			12.0			12.0			12.0	
RTOR Vol			0			0			0			0
Adj Flow		101			151			967			980	
%InSharedLn												
Prop Turns	0.42		0.03	0.75		0.13	0.00		0.09	0.03		0.01
NumPeds			0			0			0			0
NumBus		0			0			0			0	

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet		0.0			0.0			0.0			0.0	
Arriv. Type		3			3			3			3	
Unit Ext.		3.0			3.0			3.0			3.0	
I Factor		1.000			1.000			1.000			1.000	
Lost Time		2.0			2.0			2.0			2.0	
Ext of g		2.0			2.0			2.0			2.0	
Ped Min g		3.0			3.0			3.0			3.0	

PHASE DATA

Phase Combination	1	2	3	4	5	6	7	8
EB Left	P				NB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds					Peds			
WB Left	P				SB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds					Peds			
NB Right					EB Right			
SB Right					WB Right			
Green	16.0					46.0		
Yellow	4.0					4.0		
All Red	0.0					0.0		

Cycle Length: 70.0 secs

VOLUME ADJUSTMENT WORKSHEET

Appr./ Movement	Mvt Volume	PHF	Flow Rate	No. Lanes	Lane Group	RTOR	Adjusted Flow Rate In Lane Grp	Prop. Left Turns	Prop. Right Turns
Eastbound									
Left	38	0.90	42	0					
Thru	50	0.90	56	1	LTR		101	0.42	0.03
Right	3	0.90	3	0		0			
Westbound									
Left	102	0.90	113	0					
Thru	17	0.90	19	1	LTR		151	0.75	0.13
Right	17	0.90	19	0		0			
Northbound									
Left	0	0.90	0	0					
Thru	790	0.90	878	1	LTR		967	0.00	0.09
Right	80	0.90	89	0		0			
Southbound									
Left	31	0.90	34	0					
Thru	839	0.90	932	1	LTR		980	0.03	0.01
Right	13	0.90	14	0		0			

* Value entered by user.

SATURATION FLOW ADJUSTMENT WORKSHEET

Appr/ Lane Group	Ideal Sat Flow	f W	f HV	f G	f P	f BB	f A	f LU	f RT	f LT	Adj Sat Flow
Eastbound							Sec LT Adj/LT Sat:		----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.896	0.854	1454

Westbound							Sec LT Adj/LT Sat:		----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.883	0.746	1252

Northbound							Sec LT Adj/LT Sat:		----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.888	1.000	1686

Southbound							Sec LT Adj/LT Sat:		----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.898	0.952	1625

CAPACITY ANALYSIS WORKSHEET

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)		Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound								
Pri.								
Sec.								
Left								
Thru	LTR	101	1454		0.07	0.229	332	0.30
Right								
Westbound								
Pri.								
Sec.								
Left								
Thru	LTR	151	1252	#	0.12	0.229	286	0.53
Right								
Northbound								
Pri.								
Sec.								
Left								
Thru	LTR	967	1686		0.57	0.657	1108	0.87
Right								
Southbound								
Pri.								
Sec.								
Left								
Thru	LTR	980	1625	#	0.60	0.657	1068	0.92
Right								

Sum (v/s) critical = 0.72

Lost Time/Cycle, L = 8.00 sec Critical v/c(X) = 0.82

LEVEL OF SERVICE WORKSHEET

Appr/ Lane Grp	Ratios v/c	Ratios g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Del d2	Res Del d3	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound												
LTR	0.30	0.229	22.4	1.000	332	0.50	2.4	0.0	24.7	C	24.7	C
Westbound												
LTR	0.53	0.229	23.7	1.000	286	0.50	6.8	0.0	30.5	C	30.5	C
Northbound												
LTR	0.87	0.657	9.6	1.000	1108	0.50	9.5	0.0	19.2	B	19.2	B
Southbound												
LTR	0.92	0.657	10.4	1.000	1068	0.50	13.7	0.0	24.1	C	24.1	C

Intersection Delay = 22.4 (sec/veh) Intersection LOS = C

SUPPLEMENTAL PERMITTED LT WORKSHEET
for exclusive lefts

APPROACH	EB	WB	NB	SB
Cycle Length, C 70.0 sec				
Actual Green Time for Lane Group, G				
Effective Green Time for Lane Group, g				
Opposing Effective Green Time, go				
Number of Lanes in Lane Group, N				
Number of Opposing Lanes, No				
Adjusted Left-Turn Flow Rate, Vlt				
Proportion of Left Turns in Opposing Flow, Plto				
Adjusted Opposing Flow Rate, Vo				
Lost Time for Lane Group, tl				
Left Turns per Cycle: LTC=VltC/3600				
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600fluo				
Opposing Platoon Ratio, Rpo (Table 9-2 or Eqn 9-7)				
gf=[Gexp(- a * (LTC ** b))]-tl, gf<=g				
Opposing Queue Ratio: qro=1-Rpo(go/C)				
gq=(4.943Volc**0.762)(qro**1.061)-tl, gq<=g				
gu =g-gq if gq>=gf, =g-gf if gq<gf				
n=(gq-gf)/2, n>=0				
Ptho=1-Plto				
Pl*=Plt[1+{(N-1)g/(gf+gu/El1+4.24)}]				
El1 (Figure 9-7)				
El2=(1-Ptho**n)/Plto, El2>=1.0				
fmin=2(1+Plt)/g or fmin=2(1+Pl)/g				
gdiff=max(gq-gf,0)				
fm=[gf/g]+[gu/g][1/{1+Pl(El1-1)}], (min=fmin;max=1.00)				
flt=fm=[gf/g]+gdiff[1/{1+Plt(El2-1)}] +[gu/g][1/(1+Plt(El1-1)],(min=fmin;max=1.0) or flt=[fm+0.91(N-1)]/N** flt				

For special case of single-lane approach opposed by multilane approach, see text.

* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.

For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PERMITTED LT WORKSHEET
for shared lefts

APPROACH	EB	WB	NB	SB
Cycle Length, C 70.0 sec				
Actual Green Time for Lane Group, G	16.0	16.0	46.0	46.0
Effective Green Time for Lane Group, g	16.0	16.0	46.0	46.0
Opposing Effective Green Time, go	16.0	16.0	46.0	46.0
Number of Lanes in Lane Group, N	1	1	1	1
Number of Opposing Lanes, No	1	1	1	1
Adjusted Left-Turn Flow Rate, Vlt	42	113	0	34
Proportion of Left Turns in Lane Group, Plt	0.42	0.75	0.00	0.03
Proportion of Left Turns in Opposing Flow, Plto	0.75	0.42	0.03	0.00
Adjusted Opposing Flow Rate, Vo	151	101	980	967
Lost Time for Lane Group, tl	4.00	4.00	4.00	4.00
Left Turns per Cycle: LTC=VltC/3600	0.82	2.20	0.00	0.66
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600fluo	2.94	1.96	19.06	18.80
Opposing Platoon Ratio, Rpo (Table 9-2 or Eqn 9-7)	1.00	1.00	1.00	1.00
gf=[Gexp(- a * (LTC ** b))]-tl, gf<=g	3.5	0.0	0.0	19.7
Opposing Queue Ratio: qro=1-Rpo(go/C)	0.77	0.77	0.34	0.34
gq=(4.943Volc**0.762)(qro**1.061)-tl, gq<=g	4.53	2.28	11.00	10.85
gu =g-gq if gq>=gf, =g-gf if gq<gf	11.47	13.72	35.00	26.29
n=(gq-gf)/2, n>=0	0.51	1.14	5.50	0.00
Ptho=1-Plto	0.25	0.58	0.97	1.00
Pl*=Plt[1+{(N-1)g/(gf+gu/El1+4.24))}	0.42	0.75	0.00	0.03
El1 (Figure 9-7)	1.61	1.53	3.66	3.62
El2=(1-Ptho**n)/Plto, El2>=1.0	1.00	1.10	5.09	1.00
fmin=2(1+Plt)/g or fmin=2(1+Pl)/g	0.18	0.22	0.04	0.04
gdiff=max(gq-gf,0)	1.02	2.28	11.00	0.00
fm=[gf/g]+[gu/g][1/{1+Pl(El1-1)}], (min=fmin;max=1.00)	0.85	0.75	1.00	0.95
flt=fm=[gf/g]+gdiff[1/{1+Plt(El2-1)}] +[gu/g][1/(1+Plt(El1-1)],(min=fmin;max=1.0) or flt=[fm+0.91(N-1)]/N**				
flt Primary	0.854	0.746	1.000	0.952

For special case of single-lane approach opposed by multilane approach, see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

	EBLT	WBLT	NBLT	SBLT
Adj. LT Vol from Vol Adjustment Worksheet, v				
v/c ratio from Capacity Worksheet, X				
Primary phase effective green, g				
Secondary phase effective green, gq				
(From Supplemental Permitted LT Worksheet), gu				
Cycle length, C 70.0 Red =(C-g-gq-gu), r				
Arrivals: v/(3600(max(X,1.0))), qa				
Primary ph. departures: s/3600, sp				
Secondary ph. departures: s(gq+gu)/(gu*3600), ss				
XPerm				
XProt				
XCase				
Queue at beginning of green arrow, Qa				
Queue at beginning of unsaturated green, Qu				
Residual queue, Qr				
Uniform Delay, d1				

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 22.4 sec/veh Intersection LOS C

ERROR MESSAGES

No errors to report.

HCS: Signalized Intersections Release 3.1c

Inter: Foxhall Rd. and Garfield St. City/St: Washington, D.C.
Analyst: Chad A. Baird Proj #: 1636-002
Date: 02/29/00 Period: PM (5:00 - 6:00) - Future
E/W St: Garfield Street N/S St: Foxhall Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	0	0	1	0	0	1	0	0	1	0
LGConfig		LTR			LTR			LTR			LTR	
Volume	28	26	5	56	27	22	3	493	67	15	439	17
Lane Width		12.0			12.0			12.0			12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	P				NB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds					Peds			
WB Left	P				SB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds					Peds			
NB Right					EB Right			
SB Right					WB Right			
Green	16.0					46.0		
Yellow	4.0					4.0		
All Red	0.0					0.0		

Cycle Length: 70.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LTR	328	1437	0.20	0.229	23.2	C	23.2	C
Westbound								
LTR	312	1365	0.37	0.229	26.1	C	26.1	C
Northbound								
LTR	1102	1677	0.57	0.657	8.7	A	8.7	A
Southbound								
LTR	1093	1664	0.48	0.657	7.5	A	7.5	A

Intersection Delay = 10.5 (sec/veh) Intersection LOS = B

HCS: Signalized Intersections Release 3.1c

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OPERATIONAL ANALYSIS

Intersection:	Foxhall Rd. and Garfield St.
City/State:	Washington, D.C.
Analyst:	Chad A. Baird
Project No:	1636-002
Time Period Analyzed:	PM (5:00 - 6:00) - Future
Date:	02/29/00
East/West Street Name:	Garfield Street
North/South Street Name:	Foxhall Road

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	28	26	5	56	27	22	3	493	67	15	439	17
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
PK 15 Vol	8	7	2	16	8	6	1	137	19	4	122	5
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat		1900			1900			1900			1900	
ParkExist												
NumPark												
% Heavy Veh	0	0	0	0	0	0	0	0	0	0	0	0
No. Lanes	0	1	0	0	1	0	0	1	0	0	1	0
LGConfig		LTR			LTR			LTR			LTR	
Lane Width		12.0			12.0			12.0			12.0	
RTOR Vol			0			0			0			0
Adj Flow		66			116			625			524	
%InSharedLn												
Prop Turns	0.47		0.09	0.53		0.21	0.00		0.12	0.03		0.04
NumPeds			0			0			0			0
NumBus		0			0			0			0	

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet		0.0			0.0			0.0			0.0	
Arriv. Type		3			3			3			3	
Unit Ext.		3.0			3.0			3.0			3.0	
I Factor		1.000			1.000			1.000			1.000	
Lost Time		2.0			2.0			2.0			2.0	
Ext of g		2.0			2.0			2.0			2.0	
Ped Min g		3.0			3.0			3.0			3.0	

PHASE DATA

Phase Combination	1	2	3	4	5	6	7	8
EB Left	P				NB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds					Peds			
NB Left	P				SB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds					Peds			
NB Right					EB Right			
SB Right					WB Right			
Green	16.0					46.0		
Yellow	4.0					4.0		
All Red	0.0					0.0		

Cycle Length: 70.0 secs

VOLUME ADJUSTMENT WORKSHEET

Appr./ Movement	Mvt Volume	PHF	Flow Rate	No. Lanes	Lane Group	RTOR	Adjusted Flow Rate In Lane Grp	Prop. Left Turns	Prop. Right Turns
Eastbound									
Left	28	0.90	31	0					
Thru	26	0.90	29	1	LTR		66	0.47	0.09
Right	5	0.90	6	0		0			
Westbound									
Left	56	0.90	62	0					
Thru	27	0.90	30	1	LTR		116	0.53	0.21
Right	22	0.90	24	0		0			
Northbound									
Left	3	0.90	3	0					
Thru	493	0.90	548	1	LTR		625	0.00	0.12
Right	67	0.90	74	0		0			
Southbound									
Left	15	0.90	17	0					
Thru	439	0.90	488	1	LTR		524	0.03	0.04
Right	17	0.90	19	0		0			

* Value entered by user.

SATURATION FLOW ADJUSTMENT WORKSHEET

Appr/ Lane Group	Ideal Sat Flow	f W	f HV	f G	f P	f BB	f A	f LU	f RT	f LT	Adj Sat Flow
Eastbound							Sec LT Adj/LT Sat:		----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.888	0.852	1437

Westbound							Sec LT Adj/LT Sat:		----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.872	0.824	1365

Northbound							Sec LT Adj/LT Sat:		----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.884	0.999	1677

Southbound							Sec LT Adj/LT Sat:		----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.895	0.979	1664

CAPACITY ANALYSIS WORKSHEET

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)		Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound								
Pri.								
Sec.								
Left								
Thru	LTR	66	1437		0.05	0.229	328	0.20
Right								
Westbound								
Pri.								
Sec.								
Left								
Thru	LTR	116	1365	#	0.08	0.229	312	0.37
Right								
Northbound								
Pri.								
Sec.								
Left								
Thru	LTR	625	1677	#	0.37	0.657	1102	0.57
Right								
Southbound								
Pri.								
Sec.								
Left								
Thru	LTR	524	1664		0.31	0.657	1093	0.48
Right								

Sum (v/s) critical = 0.46

Lost Time/Cycle, L = 8.00 sec Critical v/c(X) = 0.52

LEVEL OF SERVICE WORKSHEET

Appr/ Lane Grp	Ratios v/c	Ratios g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Incremental Del d2	Res Del d3	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound												
LTR	0.20	0.229	21.8	1.000	328	0.50	1.4	0.0	23.2	C	23.2	C
Westbound												
LTR	0.37	0.229	22.8	1.000	312	0.50	3.4	0.0	26.1	C	26.1	C
Northbound												
LTR	0.57	0.657	6.6	1.000	1102	0.50	2.1	0.0	8.7	A	8.7	A
Southbound												
LTR	0.48	0.657	6.0	1.000	1093	0.50	1.5	0.0	7.5	A	7.5	A

Intersection Delay = 10.5 (sec/veh) Intersection LOS = B

SUPPLEMENTAL PERMITTED LT WORKSHEET
for exclusive lefts

APPROACH	EB	WB	NB	SB
Cycle Length, C 70.0 sec				
Actual Green Time for Lane Group, G				
Effective Green Time for Lane Group, g				
Opposing Effective Green Time, go				
Number of Lanes in Lane Group, N				
Number of Opposing Lanes, No				
Adjusted Left-Turn Flow Rate, Vlt				
Proportion of Left Turns in Opposing Flow, Plto				
Adjusted Opposing Flow Rate, Vo				
Lost Time for Lane Group, tl				
Left Turns per Cycle: LTC=VltC/3600				
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600fluo				
Opposing Platoon Ratio, Rpo (Table 9-2 or Eqn 9-7)				
gf=[Gexp(- a * (LTC ** b))]-tl, gf<=g				
Opposing Queue Ratio: qro=1-Rpo(go/C)				
gq=(4.943Volc**0.762)(qro**1.061)-tl, gq<=g				
gu =g-gq if gq>=gf, =g-gf if gq<gf				
n=(gq-gf)/2, n>=0				
Ptho=1-Plto				
Pl*=Plt[1+{(N-1)g/(gf+gu/El1+4.24)}]				
El1 (Figure 9-7)				
El2=(1-Ptho**n)/Plto, El2>=1.0				
fmin=2(1+Plt)/g or fmin=2(1+Pl)/g				
gdiff=max(gq-gf,0)				
fm=[gf/g]+[gu/g][1/{1+Pl(El1-1)}], (min=fmin;max=1.00)				
flt=fm=[gf/g]+gdiff[1/{1+Plt(El2-1)}]				
+[gu/g][1/(1+Plt(El1-1)],(min=fmin;max=1.0) or flt=[fm+0.91(N-1)]/N**				
flt				

For special case of single-lane approach opposed by multilane approach, see text.

* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.

For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PERMITTED LT WORKSHEET
for shared lefts

APPROACH	EB	WB	NB	SB
Cycle Length, C 70.0 sec				
Actual Green Time for Lane Group, G	16.0	16.0	46.0	46.0
Effective Green Time for Lane Group, g	16.0	16.0	46.0	46.0
Opposing Effective Green Time, go	16.0	16.0	46.0	46.0
Number of Lanes in Lane Group, N	1	1	1	1
Number of Opposing Lanes, No	1	1	1	1
Adjusted Left-Turn Flow Rate, Vlt	31	62	3	17
Proportion of Left Turns in Lane Group, Plt	0.47	0.53	0.00	0.03
Proportion of Left Turns in Opposing Flow, Plto	0.53	0.47	0.03	0.00
Adjusted Opposing Flow Rate, Vo	116	66	524	625
Lost Time for Lane Group, tl	4.00	4.00	4.00	4.00
Left Turns per Cycle: LTC=VltC/3600	0.60	1.21	0.06	0.33
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600fluo	2.26	1.28	10.19	12.15
Opposing Platoon Ratio, Rpo (Table 9-2 or Eqn 9-7)	1.00	1.00	1.00	1.00
gf=[Gexp(- a * (LTC ** b))]-tl, gf<=g	4.6	2.1	35.8	26.0
Opposing Queue Ratio: qro=1-Rpo(go/C)	0.77	0.77	0.34	0.34
gq=(4.943Volc**0.762)(qro**1.061)-tl, gq<=g	2.98	0.54	5.31	6.65
gu =g-gq if gq>=gf, =g-gf if gq<gf	11.44	13.92	10.17	20.04
n=(gq-gf)/2, n>=0	0.00	0.00	0.00	0.00
Ptho=1-Plto	0.47	0.53	0.97	1.00
Pl*=Plt[1+{(N-1)g/(gf+gu/El1+4.24))}	0.47	0.53	0.00	0.03
El1 (Figure 9-7)	1.56	1.48	2.35	2.60
El2=(1-Ptho**n)/Plto, El2>=1.0	1.00	1.00	1.00	1.00
fmin=2(1+Plt)/g or fmin=2(1+Pl)/g	0.18	0.19	0.04	0.04
gdiff=max(gq-gf,0)	0.00	0.00	0.00	0.00
fm=[gf/g]+[gu/g][1/{1+Pl(El1-1)}], (min=fmin;max=1.00)	0.85	0.82	1.00	0.98
flt=fm=[gf/g]+gdiff[1/{1+Plt(El2-1)}]				
+[gu/g][1/(1+Plt(El1-1)],(min=fmin;max=1.0) or flt=[fm+0.91(N-1)]/N**				
flt Primary	0.852	0.824	0.999	0.979

For special case of single-lane approach opposed by multilane approach, see text.

* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.

For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

	EBLT	WBLT	NBLT	SBLT
Adj. LT Vol from Vol Adjustment Worksheet, v				
v/c ratio from Capacity Worksheet, X				
Primary phase effective green, g				
Secondary phase effective green, gq				
(From Supplemental Permitted LT Worksheet), gu				
Cycle length, C 70.0 Red =(C-g-gq-gu), r				
Arrivals: v/(3600(max(X,1.0))), qa				
Primary ph. departures: s/3600, sp				
Secondary ph. departures: s(gq+gu)/(gu*3600), ss				
XPerm				
XProt				
XCase				
Queue at beginning of green arrow, Qa				
Queue at beginning of unsaturated green, Qu				
Residual queue, Qr				
Uniform Delay, d1				

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 10.5 sec/veh Intersection LOS B

ERROR MESSAGES

No errors to report.