	Lane 1			Lane 2			Lane 3	
L	T	R	L	T	R	L	T	R
Y	Y	Y	N	N	N	N	N	N

Channelized: N
Grade: 0.00

Data for Computing Effect of Delay to Major Street Vehicles:

	Northbound	Southbound
Shared ln volume, major th vehicles:	420	470
Shared ln volume, major rt vehicles:	1	35
Sat flow rate, major th vehicles:	1700	1700
Sat flow rate, major rt vehicles:	1700	1700
Number of major street through lanes:	1	1

Length of study period, hrs: 0.25

Worksheet 4 Critical Gap and Follow-up time calculation.

Critical Gap Calculations:

Movement	1	4	7	8	9	10	11	12
t c,base	4.1	4.1	7.1	6.5	6.2	7.1	6.5	6.2
t c,hv	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
P hv	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t c,g			0.2	0.2	0.1	0.2	0.2	0.1
G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t 3,lt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
t c,T:								
1 stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t c								
1 stage	4.1	4.1	7.1	6.5	6.2	7.1	6.5	6.2

Follow Up Time Calculations:

Movement	1	4	7	8	9	10	11	12
t f,base	2.2	2.2	3.5	4.0	3.3	3.5	4.0	3.3
t f,HV	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
P hv	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t f	2.2	2.2	3.5	4.0	3.3	3.5	4.0	3.3

Worksheet 6 Impedance and capacity equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	421	488
Potential Capacity	637	584
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	637	584
Probability of Queue free St.	1.00	0.92

Step 2: LT from Major St.	4	1
Conflicting Flows	421	505
Potential Capacity	1149	1070
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1149	1070
Probability of Queue free St.	1.00	0.96
Maj. L Shared In. Prob. Queue Free St.	1.00	0.95

Step 3: TH from Minor St.	8	11

Board of Zoning Adjustment
District of Columbia
CASE NO.16559
EXHIBIT NO.437A2

Conflicting Flows	1004					987					
Potential Capacity	244					250					
Pedestrian Impedance Factor							1.00				
Cap. Adj. factor due to Impeding mvmnt				0.95					0.95		
Movement Capacity				232			237				
Probability of Queue free St.				1.00			1.00				

Step 4: LT from Minor St.				7			10				
Conflicting Flows	1009					987					
Potential Capacity	221					228					
Pedestrian Impedance Factor				1.00			1.00				
Maj. L, Min T Impedance factor				0.95			0.95				
Maj. L, Min T Adj. Imp Factor.				0.96			0.96				
Cap. Adj. factor due to Impeding mvmnt				0.89					0.96		
Movement Capacity				196			219				

Worksheet 8 Shared Lane Calculations

Shared Lane Calculations

Movement	7	8	9	10	11	12
v(vph)	2	1	1	26	0	46
Movement Capacity	196	232	637	219	237	584
Shared Lane Capacity	249			365		

Worksheet 10 delay,queue length, and LOS

Movement	1	4	7	8	9	10	11	12
v(vph)	38	1	4			72		
C m(vph)	1070	1149	249			365		
v/c	0.04	0.00	0.02			0.20		
95% queue length								
Control Delay	8.5	8.1	19.7			17.3		
LOS	A	A	C			C		
Approach Delay				19.7			17.3	
Approach LOS				C			C	

Worksheet 11 Shared Major LT Impedance and Delay

Rank 1 Delay Calculations

Movement	2	5
P oj	0.96	1.00
V i1	420	470
V i2	1	35
S i1	1700	1700
S i2	1700	1700
P* 0j	0.95	1.00
D maj left	8.5	8.1
N number major st lanes	1	1
Delay, rank 1 mvmts	0.4	0.0

HCS: Unsignalized Intersections Release 3.1c

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Chad A Baird
Intersection: Whitehaven Pkwy and Foxhall Road
Count Date: Kerri Nolan
Time Period: AM - Existing

Intersection Orientation: North-South Major St.

Vehicle Volume Data:

Movements:	1	2	5	6	10	12
Volume:	42	656	753	179	54	79
HFR:	42	656	753	179	54	79
PHF:	1.00	1.00	1.00	1.00	1.00	1.00
PHV:	0.00	0.00	0.00	0.00	0.00	0.00

Pedestrian Volume Data:

Movements:

Flow:
Lane width:
Walk speed:
% Blockage:

Median Type: None
# of vehicles: 0

Flared approach Movements:

# of vehicles: Eastbound 0
# of vehicles: Westbound 0

Lane usage for movements 1,2&3 approach:

	Lane 1			Lane 2			Lane 3	
L	T	R	L	T	R	L	T	R
Y	N	N	N	Y	N	N	N	N

Channelized: N
Grade: 0.00

Lane usage for movements 4,5&6 approach:

	Lane 1			Lane 2			Lane 3	
L	T	R	L	T	R	L	T	R
N	Y	Y	N	N	N	N	N	N

Channelized: N
Grade: 0.00

Lane usage for movements 7,8&9 approach:

	Lane 1			Lane 2			Lane 3	
L	T	R	L	T	R	L	T	R
N	N	N	N	N	N	N	N	N

Channelized: N
Grade: 0.00

Lane usage for movements 10,11&12 approach:

	Lane 1			Lane 2			Lane 3		
	L	T	R	L	T	R	L	T	R
	Y	N	Y	N	N	N	N	N	N

Channelized: N
Grade: 0.00

Data for Computing Effect of Delay to Major Street Vehicles:

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

Length of study period, hrs: 0.25

Worksheet 4 Critical Gap and Follow-up time calculation.

Critical Gap Calculations:

Movement	1	10	12
t c,base	4.1	7.1	6.2
t c,hv	1.0	1.0	1.0
P hv	0.00	0.00	0.00
t c,g		0.2	0.1
G	0.00	0.00	0.00
t 3,lt	0.0	0.7	0.0
t c,T:			
1 stage	0.00	0.00	0.00
t c			
1 stage	4.1	6.4	6.2

Follow Up Time Calculations:

Movement	1	10	12
t f,base	2.2	3.5	3.3
t f,HV	0.9	0.9	0.9
P hv	0.00	0.00	0.00
t f	2.2	3.5	3.3

Worksheet 6 Impedance and capacity equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	843	
Potential Capacity	367	
Pedestrian Impedance Factor	1.00	
Movement Capacity	367	
Probability of Queue free St.	0.78	

Step 2: LT from Major St.	4	1
Conflicting Flows	932	
Potential Capacity	743	
Pedestrian Impedance Factor	1.00	
Movement Capacity	743	
Probability of Queue free St.	0.94	

Step 4: LT from Minor St.	7	10
Conflicting Flows	1583	

Potential Capacity	121
Pedestrian Impedance Factor	1.00
Maj. L, Min T Impedance factor	0.94
Maj. L, Min T Adj. Imp Factor.	0.96
Cap. Adj. factor due to Impeding mvmnt	0.96
Movement Capacity	116

Worksheet 8 Shared Lane Calculations

Shared Lane Calculations

Movement	7	8	9	10	11	12
v(vph)			54		79	
Movement Capacity				116		367
Shared Lane Capacity				195		

Worksheet 10 delay,queue length, and LOS

Movement	1	4	7	8	9	10	11	12
v(vph)	42				133			
C m(vph)	743				195			
v/c	0.06				0.68			
95% queue length								
Control Delay	10.1				55.8			
LOS	B				F			
Approach Delay						55.8		
Approach LOS						F		

HCS: Unsignalized Intersections Release 3.1c

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Chad A Baird
Intersection: Whitehaven Pkwy and Foxhall Road
Count Date: Kerri Nolan
Time Period: PM - Existing

Intersection Orientation: North-South Major St.

Vehicle Volume Data:

Movements:	1	2	5	6	10	12
Volume:	20	528	469	91	20	16
HFR:	20	528	469	91	20	16
PHF:	1.00	1.00	1.00	1.00	1.00	1.00
PHV:	0.00	0.00	0.00	0.00	0.00	0.00

Pedestrian Volume Data:

Movements:

Flow:
Lane width:
Walk speed:
% Blockage:

Median Type: None
# of vehicles: 0

Flared approach Movements:

# of vehicles: Eastbound 0
# of vehicles: Westbound 0

Lane usage for movements 1,2&3 approach:

Lane 1			Lane 2			Lane 3		
L	T	R	L	T	R	L	T	R
Y	N	N	N	Y	N	N	N	N

Channelized: N
Grade: 0.00

Lane usage for movements 4,5&6 approach:

Lane 1			Lane 2			Lane 3		
L	T	R	L	T	R	L	T	R
N	Y	Y	N	N	N	N	N	N

Channelized: N
Grade: 0.00

Lane usage for movements 7,8&9 approach:

Lane 1			Lane 2			Lane 3		
L	T	R	L	T	R	L	T	R
N	N	N	N	N	N	N	N	N

Channelized: N
Grade: 0.00

Lane usage for movements 10,11&12 approach:

	Lane 1			Lane 2			Lane 3		
L	T	R	L	T	R	L	T	R
Y	N	Y	N	N	N	N	N	N

Channelized: N
Grade: 0.00

Data for Computing Effect of Delay to Major Street Vehicles:

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

Length of study period, hrs: 0.25

Worksheet 4 Critical Gap and Follow-up time calculation.

Critical Gap Calculations:

Movement	1	10	12
t c,base	4.1	7.1	6.2
t c,hv	1.0	1.0	1.0
P hv	0.00	0.00	0.00
t c,g		0.2	0.1
G	0.00	0.00	0.00
t 3,lt	0.0	0.7	0.0
t c,T:			
1 stage	0.00	0.00	0.00
t c			
1 stage	4.1	6.4	6.2

Follow Up Time Calculations:

Movement	1	10	12
t f,base	2.2	3.5	3.3
t f,HV	0.9	0.9	0.9
P hv	0.00	0.00	0.00
t f	2.2	3.5	3.3

Worksheet 6 Impedance and capacity equations

Step 1: RT from Minor St.	9	12
Conflicting Flows		515
Potential Capacity		564
Pedestrian Impedance Factor		1.00
Movement Capacity		564
Probability of Queue free St.		0.97

Step 2: LT from Major St.	4	1
Conflicting Flows		560
Potential Capacity		1021
Pedestrian Impedance Factor		1.00
Movement Capacity		1021
Probability of Queue free St.		0.98

Step 4: LT from Minor St.	7	10
Conflicting Flows		1083

Potential Capacity	243
Pedestrian Impedance Factor	1.00
Maj. L, Min T Impedance factor	0.98
Maj. L, Min T Adj. Imp Factor.	0.99
Cap. Adj. factor due to Impeding mvmnt	0.99
Movement Capacity	239

Worksheet 8 Shared Lane Calculations

Shared Lane Calculations

Movement	7	8	9	10	11	12
v(vph)			20		16	
Movement Capacity				239		564
Shared Lane Capacity				321		

Worksheet 10 delay,queue length, and LOS

Movement	1	4	7	8	9	10	11	12
v(vph)	20				36			
C m(vph)	1021					321		
v/c	0.02				0.11			
95% queue length								
Control Delay	8.6					17.6		
LOS	A				C			
Approach Delay							17.6	
Approach LOS							C	

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: 05/17/00 Period: AM (7:45 - 8:45) - Existing
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	749	53	31	836	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	17.0					45.0		
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	351	1445	0.29	0.243	23.6	C	23.6	C
Westbound								
LTR	306	1260	0.49	0.243	28.4	C	28.4	C
Northbound								
LTR	1088	1693	0.82	0.643	16.3	B	16.3	B
Southbound								
LTR	1049	1632	0.93	0.643	26.6	C	26.6	C

Intersection Delay = 22.3 (sec/veh) Intersection LOS = C

HCS: Signalized Intersections Release 3.1c

Chad A. Baird
Gorove/Slade Associates, Inc.
1140 Connecticut Avenue NW
Suite 700
Washington, DC 20036
Phone: (202)296-8625 Fax: (202)785-8825
E-Mail: CBaird@GSATrans.com

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) - Existing
Date:	05/17/00
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	749	53	31	836	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	208	15	9	232	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			891			977	
%InSharedLn												
Prop Turns	0.42		0.03	0.75		0.13	0.00		0.07	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	17.0					45.0		
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	749	0.90	832	1	LTR		891	0.00	0.07
Right	53	0.90	59	0		0			
Southbound									
Left	31	0.90	34	0					
Thru	836	0.90	929	1	LTR		977	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	0.849	1445

Westbound							Sec LT	Adj/LT	Sat:		

LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.883	0.751	1260

Northbound							Sec LT	Adj/LT	Sat:		

LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.891	1.000	1693

Southbound							Sec LT	Adj/LT	Sat:		

LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.898	0.956	1632

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	1445	0.07	0.243	351	0.29
Right							
Westbound							
Pri.							
Sec.							
Left							
Thru	LTR	151	1260	# 0.12	0.243	306	0.49
Right							
Northbound							
Pri.							
Sec.							
Left							
Thru	LTR	891	1693	0.53	0.643	1088	0.82
Right							
Southbound							
Pri.							
Sec.							
Left							
Thru	LTR	977	1632	# 0.60	0.643	1049	0.93
Right							

Sum (v/s) critical = 0.72

Lost Time/Cycle, L = 8.00 sec Critical v/c(X) = 0.81

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	0.243	21.6	1.000	351	0.50	2.1	0.0	23.6	C	23.6	C
Westbound												
LTR	0.49	0.243	22.8	1.000	306	0.50	5.6	0.0	28.4	C	28.4	C
Northbound												
LTR	0.82	0.643	9.4	1.000	1088	0.50	6.9	0.0	16.3	B	16.3	B
Southbound												
LTR	0.93	0.643	11.1	1.000	1049	0.50	15.5	0.0	26.6	C	26.6	C

Intersection Delay = 22.3 (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	17.0	17.0	45.0	45.0
Effective Green Time for Lane Group, g	17.0	17.0	45.0	45.0
Opposing Effective Green Time, go	17.0	17.0	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	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	977	891
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	19.00	17.33
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	4.0	0.1	0.0	19.2
Opposing Queue Ratio: qro=1-Rpo(go/C)	0.76	0.76	0.36	0.36
gq=(4.943Volc**0.762)(qro**1.061)-tl, gq<=g	4.36	2.15	11.63	10.57
gu =g-gq if gq>=gf, =g-gf if gq<gf	12.64	14.85	33.37	25.81
n=(gq-gf)/2, n>=0	0.19	1.00	5.81	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	3.65	3.36
El2=(1-Ptho**n)/Plto, El2>=1.0	1.00	1.00	5.35	1.00
fmin=2(1+Plt)/g or fmin=2(1+Pl)/g	0.17	0.21	0.04	0.05
gdiff=max(gq-gf,0)	0.39	2.01	11.63	0.00
fm=[gf/g]+[gu/g][1/{1+Pl(El1-1)}], (min=fmin;max=1.00)	0.85	0.75	1.00	0.96
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	0.849	0.751	1.000	0.956

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 22.3 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: 05/17/00 Period: PM (2:00 - 3:00) - Existing
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	433	38	15	426	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	17.0					45.0		
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	350	1442	0.19	0.243	22.2	C	22.2	C
Westbound								
LTR	333	1370	0.35	0.243	24.8	C	24.8	C
Northbound								
LTR	1084	1687	0.49	0.643	8.0	A	8.0	A
Southbound								
LTR	1072	1668	0.47	0.643	7.9	A	7.9	A

Intersection Delay = 10.4 (sec/veh) Intersection LOS = B

HCS: Signalized Intersections Release 3.1c

Chad A. Baird
Gorove/Slade Associates, Inc.
1140 Connecticut Avenue NW
Suite 700
Washington, DC 20036
Phone: (202)296-8625 Fax: (202)785-8825
E-Mail: CBaird@GSATrans.com

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 (2:00 - 3:00) - Existing
Date:	05/17/00
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	433	38	15	426	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	120	11	4	118	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			526			509	
%InSharedLn												
Prop Turns	0.47		0.09	0.53		0.21	0.01		0.08	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			
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	17.0					45.0		
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	433	0.90	481	1	LTR		526	0.01	0.08
Right	38	0.90	42	0		0			
Southbound									
Left	15	0.90	17	0					
Thru	426	0.90	473	1	LTR		509	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	0.855	1442

Westbound							Sec LT Adj/LT Sat:		----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.872	0.827	1370

Northbound							Sec LT Adj/LT Sat:		----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.889	0.998	1687

Southbound							Sec LT Adj/LT Sat:		----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.895	0.981	1668

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	1442		0.05	0.243	350	0.19
Right								
Westbound								
Pri.								
Sec.								
Left								
Thru	LTR	116	1370	#	0.08	0.243	333	0.35
Right								
Northbound								
Pri.								
Sec.								
Left								
Thru	LTR	526	1687	#	0.31	0.643	1084	0.49
Right								
Southbound								
Pri.								
Sec.								
Left								
Thru	LTR	509	1668		0.31	0.643	1072	0.47
Right								

Sum (v/s) critical = 0.40

Lost Time/Cycle, L = 8.00 sec Critical v/c(X) = 0.45

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	0.19	0.243	21.0	1.000	350	0.50	1.2	0.0	22.2	C	22.2	C
Westbound												
LTR	0.35	0.243	21.9	1.000	333	0.50	2.9	0.0	24.8	C	24.8	C
Northbound												
LTR	0.49	0.643	6.5	1.000	1084	0.50	1.6	0.0	8.0	A	8.0	A
Southbound												
LTR	0.47	0.643	6.4	1.000	1072	0.50	1.5	0.0	7.9	A	7.9	A

Intersection Delay = 10.4 (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	17.0	17.0	45.0	45.0
Effective Green Time for Lane Group, g	17.0	17.0	45.0	45.0
Opposing Effective Green Time, go	17.0	17.0	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	31	62	3	17
Proportion of Left Turns in Lane Group, Plt	0.47	0.53	0.01	0.03
Proportion of Left Turns in Opposing Flow, Plto	0.53	0.47	0.03	0.01
Adjusted Opposing Flow Rate, Vo	116	66	509	526
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	9.90	10.23
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	5.1	2.5	35.0	25.3
Opposing Queue Ratio: qro=1-Rpo(go/C)	0.76	0.76	0.36	0.36
gq=(4.943Volc**0.762)(qro**1.061)-tl, gq<=g	2.84	0.45	5.51	5.75
gu =g-gq if gq>=gf, =g-gf if gq<gf	11.90	14.54	10.03	19.69
n=(gq-gf)/2, n>=0	0.00	0.00	0.00	0.00
Ptho=1-Plto	0.47	0.53	0.97	0.99
Pl*=Plt[1+{(N-1)g/(gf+gu/El1+4.24)))	0.47	0.53	0.01	0.03
El1 (Figure 9-7)	1.56	1.48	2.32	2.36
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	0.17	0.18	0.04	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)	0.86	0.83	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	0.855	0.827	0.998	0.981

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 10.4 sec/veh Intersection LOS B

ERROR MESSAGES

No errors to report.

TOTAL FUTURE HIGHWAY CAPACITY ANALYSIS

HCS: Unsignalized Intersections Release 3.1c

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Chad A Baird
Intersection: Foxhall Road and "W" Street
Count Date: Kerri A. Nolan
Time Period: AM - Future

Intersection Orientation: North-South Major St.

Vehicle Volume Data:

Movements:	1	2	3	4	5	6	7	8	9	10	11	12
Volume:	28	729	1	1	821	41	5	0	2	23	0	61
HFR:	28	729	1	1	821	41	5	0	2	23	0	61
PHF:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PHV:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Pedestrian Volume Data:

Movements:

Flow:
Lane width:
Walk speed:
% Blockage:

Median Type: None
# of vehicles: 0

Flared approach Movements:

# of vehicles: Eastbound 0
# of vehicles: Westbound 0

Lane usage for movements 1,2&3 approach:

	Lane 1			Lane 2			Lane 3	
L	T	R	L	T	R	L	T	R
Y	Y	Y	N	N	N	N	N	N

Channelized: N
Grade: 0.00

Lane usage for movements 4,5&6 approach:

	Lane 1			Lane 2			Lane 3	
L	T	R	L	T	R	L	T	R
Y	Y	Y	N	N	N	N	N	N

Channelized: N
Grade: 0.00

Lane usage for movements 7,8&9 approach:

	Lane 1			Lane 2			Lane 3	
L	T	R	L	T	R	L	T	R
Y	Y	Y	N	N	N	N	N	N

Channelized: N
Grade: 0.00

Lane usage for movements 10,11&12 approach:

	Lane 1			Lane 2			Lane 3	
L	T	R	L	T	R	L	T	
Y	Y	Y	N	N	N	N	N	N

Channelized: N
Grade: 0.00

Data for Computing Effect of Delay to Major Street Vehicles:

	Northbound	Southbound
Shared ln volume, major th vehicles:	729	821
Shared ln volume, major rt vehicles:	1	41
Sat flow rate, major th vehicles:	1700	1700
Sat flow rate, major rt vehicles:	1700	1700
Number of major street through lanes:	1	1

Length of study period, hrs: 1.00

Worksheet 4 Critical Gap and Follow-up time calculation.

Critical Gap Calculations:

Movement	1	4	7	8	9	10	11	12
t c,base	4.1	4.1	7.1	6.5	6.2	7.1	6.5	6.2
t c,hv	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
P hv	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t c,g			0.2	0.2	0.1	0.2	0.2	0.1
G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t 3,lt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
t c,T:								
1 stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t c								
1 stage	4.1	4.1	7.1	6.5	6.2	7.1	6.5	6.2

Follow Up Time Calculations:

Movement	1	4	7	8	9	10	11	12
t f,base	2.2	2.2	3.5	4.0	3.3	3.5	4.0	3.3
t f,HV	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
P hv	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t f	2.2	2.2	3.5	4.0	3.3	3.5	4.0	3.3

Worksheet 6 Impedance and capacity equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	730	842
Potential Capacity	426	367
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	426	367
Probability of Queue free St.	1.00	0.83

Step 2: LT from Major St.	4	1
Conflicting Flows	730	862
Potential Capacity	883	789
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	883	789
Probability of Queue free St.	1.00	0.96
Maj. L Shared In. Prob. Queue Free St.	1.00	0.94

Step 3: TH from Minor St.	8	11

Conflicting Flows	1650		1630		
Potential Capacity	100		103		
Pedestrian Impedance Factor		1.00		1.00	
Cap. Adj. factor due to Impeding mvmnt		0.94		0.94	
Movement Capacity	93		96		
Probability of Queue free St.	1.00		1.00		

Step 4: LT from Minor St.	7		10		
Conflicting Flows	1660		1630		
Potential Capacity	79		82		
Pedestrian Impedance Factor		1.00		1.00	
Maj. L, Min T Impedance factor		0.94		0.94	
Maj. L, Min T Adj. Imp Factor.		0.95		0.95	
Cap. Adj. factor due to Impeding mvmnt		0.79		0.95	
Movement Capacity	62		78		

Worksheet 8 Shared Lane Calculations

Shared Lane Calculations

Movement	7	8	9	10	11	12
v(vph)	5	0	2	23	0	61
Movement Capacity	62	93	426	78	96	367
Shared Lane Capacity	82			182		

Worksheet 10 delay,queue length, and LOS

Movement	1	4	7	8	9	10	11	12
v(vph)	28	1	7			84		
C m(vph)	789	883	82			182		
v/c	0.04	0.00	0.08			0.46		
95% queue length								
Control Delay	9.7	9.1	52.8			41.4		
LOS	A	A	F			E		
Approach Delay				52.8			41.4	
Approach LOS				F			E	

Worksheet 11 Shared Major LT Impedance and Delay

Rank 1 Delay Calculations

Movement	2	5
P oj	0.96	1.00
V i1	729	821
V i2	1	41
S i1	1700	1700
S i2	1700	1700
P* 0j	0.94	1.00
D maj left	9.7	9.1
N number major st lanes	1	1
Delay, rank 1 mvmts	0.6	0.0

HCS: Unsignalized Intersections Release 3.1c

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Chad A Baird
Intersection: Foxhall Road and "W" Street
Count Date: Kerri A. Nolan
Time Period: PM - Future

Intersection Orientation: North-South Major St.

Vehicle Volume Data:

Movements:	1	2	3	4	5	6	7	8	9	10	11	12
Volume:	41	437	1	1	478	37	2	1	1	29	0	52
HFR:	41	437	1	1	478	37	2	1	1	29	0	52
PHF:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PHV:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Pedestrian Volume Data:

Movements:

Flow:
Lane width:
Walk speed:
% Blockage:

Median Type: None
# of vehicles: 0

Flared approach Movements:

# of vehicles: Eastbound 0
# of vehicles: Westbound 0

Lane usage for movements 1,2&3 approach:

	Lane 1			Lane 2			Lane 3	
L	T	R	L	T	R	L	T	R
Y	Y	Y	N	N	N	N	N	N

Channelized: N
Grade: 0.00

Lane usage for movements 4,5&6 approach:

	Lane 1			Lane 2			Lane 3	
L	T	R	L	T	R	L	T	R
Y	Y	Y	N	N	N	N	N	N

Channelized: N
Grade: 0.00

Lane usage for movements 7,8&9 approach:

	Lane 1			Lane 2			Lane 3	
L	T	R	L	T	R	L	T	R
Y	Y	Y	N	N	N	N	N	N

Channelized: N
Grade: 0.00

Lane usage for movements 10,11&12 approach:

	Lane 1			Lane 2			Lane 3	
L	T	R	L	T	R	L	T	
Y	Y	Y	N	N	N	N	N	N

Channelized: N
Grade: 0.00

Data for Computing Effect of Delay to Major Street Vehicles:

	Northbound	Southbound
Shared ln volume, major th vehicles:	437	478
Shared ln volume, major rt vehicles:	1	37
Sat flow rate, major th vehicles:	1700	1700
Sat flow rate, major rt vehicles:	1700	1700
Number of major street through lanes:	1	1

Length of study period, hrs: 1.00

Worksheet 4 Critical Gap and Follow-up time calculation.

Critical Gap Calculations:

Movement	1	4	7	8	9	10	11	12
t c,base	4.1	4.1	7.1	6.5	6.2	7.1	6.5	6.2
t c,hv	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
P hv	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t c,g			0.2	0.2	0.1	0.2	0.2	0.1
G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t 3,lt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
t c,T:								
1 stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t c								
1 stage	4.1	4.1	7.1	6.5	6.2	7.1	6.5	6.2

Follow Up Time Calculations:

Movement	1	4	7	8	9	10	11	12
t f,base	2.2	2.2	3.5	4.0	3.3	3.5	4.0	3.3
t f,HV	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
P hv	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t f	2.2	2.2	3.5	4.0	3.3	3.5	4.0	3.3

Worksheet 6 Impedance and capacity equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	438	497
Potential Capacity	623	577
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	623	577
Probability of Queue free St.	1.00	0.91

Step 2: LT from Major St.	4	1
Conflicting Flows	438	515
Potential Capacity	1133	1061
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1133	1061
Probability of Queue free St.	1.00	0.96
Maj. L Shared In. Prob. Queue Free St.	1.00	0.95

Step 3: TH from Minor St.	8	11

Conflicting Flows	1037		1019			
Potential Capacity	233		239			
Pedestrian Impedance Factor		1.00		1.00		
Cap. Adj. factor due to Impeding mvmnt		0.95		0.95		
Movement Capacity	221		226			
Probability of Queue free St.	1.00		1.00			

Step 4: LT from Minor St.	7	10

Conflicting Flows	1044		1019			
Potential Capacity	209		217			
Pedestrian Impedance Factor		1.00		1.00		
Maj. L, Min T Impedance factor		0.95		0.94		
Maj. L, Min T Adj. Imp Factor.	0.96		0.96			
Cap. Adj. factor due to Impeding mvmnt		0.87		0.95		
Movement Capacity	182		207			

Worksheet 8 Shared Lane Calculations

Shared Lane Calculations

Movement	7	8	9	10	11	12
v(vph)	2	1	1	29	0	52
Movement Capacity	182	221	623	207	226	577
Shared Lane Capacity	234			352		

Worksheet 10 delay,queue length, and LOS

Movement	1	4	7	8	9	10	11	12
v(vph)	41	1	4		81			
C m(vph)	1061	1133	234			352		
v/c	0.04	0.00	0.02		0.23			
95% queue length								
Control Delay	8.5	8.2	20.7			18.3		
LOS	A	A	C		C			
Approach Delay			20.7			18.3		
Approach LOS			C			C		

Worksheet 11 Shared Major LT Impedance and Delay

Rank 1 Delay Calculations

Movement	2	5
P oj	0.96	1.00
V i1	437	478
V i2	1	37
S i1	1700	1700
S i2	1700	1700
P* 0j	0.95	1.00
D maj left	8.5	8.2
N number major st lanes	1	1
Delay, rank 1 mvmts	0.4	0.0

HCS: Signalized Intersections Release 3.1c

Inter: Whithaven Pwy and Foxhall Road City/St: Washington, D.C.
Analyst: Chad A Baird Proj #: 1634-006
Date: 05/17/00 Period: AM - Total Future - Mitigation
E/W St: Whitehaven Parkway 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	1	0	1	0	0	0	1	1	0	0	1	1
LGConfig	L		R				L	T			T	R
Volume	54		79				42	688			753	179
Lane Width	12.0		12.0				12.0	12.0			12.0	12.0
RTOR Vol			0									0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left		A			NB	Left	A			
Thru						Thru	A			
Right		A				Right				
Peds						Peds				
WB Left					SB	Left				
Thru						Thru	A			
Right						Right	A			
Peds						Peds				
NB Right					EB	Right				
SB Right		A			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								
L	413	1805	0.15	0.229	21.7	C		
							22.1	C
R	369	1615	0.24	0.229	22.4	C		
Westbound								
Northbound								
L	350	532	0.13	0.657	4.7	A		
T	1249	1900	0.61	0.657	7.8	A	7.6	A
Southbound								
T	1249	1900	0.67	0.657	8.8	A	7.1	A
R	1615	1615	0.12	1.000	0.0+	A		

Intersection Delay = 8.4 (sec/veh) Intersection LOS = A

HCS: Signalized Intersections Release 3.1c

Chad A. Baird
Gorove/Slade Associates, Inc.
1140 Connecticut Avenue NW
Suite 700
Washington, DC 20036
Phone: (202)296-8625 Fax: (202)785-8825
E-Mail: CBaird@GSATrans.com

OPERATIONAL ANALYSIS

Intersection:	Whithaven Pwy and Foxhall Road
City/State:	Washington, D.C.
Analyst:	Chad A Baird
Project No:	1634-006
Time Period Analyzed:	AM - Total Future - Mitigation
Date:	05/17/00
East/West Street Name:	Whitehaven Parkway
North/South Street Name:	Foxhall Road

HCS: Signalized Intersections Release 3.1c

Inter: Whithaven Pwy and Foxhall Road City/St: Washington, D.C.
Analyst: Chad A Baird Proj #: 1634-006
Date: 05/17/00 Period: PM - Total Future - Mitigation
E/W St: Whitehaven Parkway 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	1	0	1	0	0	0	1	1	0	0	1	1
LGConfig	L		R				L	T			T	R
Volume	34		40				34	535			475	99
Lane Width	12.0		12.0				12.0	12.0			12.0	12.0
RTOR Vol			0									0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left		A			NB	Left	A			
Thru						Thru	A			
Right		A				Right				
Peds						Peds				
WB Left					SB	Left				
Thru						Thru	A			
Right						Right	A			
Peds						Peds				
NB Right					EB	Right				
SB Right		A			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								
L	413	1805	0.09	0.229	21.4	C		
							21.5	C
R	369	1615	0.12	0.229	21.6	C		
Westbound								
Northbound								
L	516	785	0.07	0.657	4.4	A		
T	1249	1900	0.48	0.657	6.3	A	6.2	A
Southbound								
T	1249	1900	0.42	0.657	5.9	A	4.9	A
R	1615	1615	0.07	1.000	0.0+	A		

Intersection Delay = 6.5 (sec/veh) Intersection LOS = A

HCS: Signalized Intersections Release 3.1c

Chad A. Baird
Gorove/Slade Associates, Inc.
1140 Connecticut Avenue NW
Suite 700
Washington, DC 20036
Phone: (202)296-8625 Fax: (202)785-8825
E-Mail: CBaird@GSATrans.com

OPERATIONAL ANALYSIS

Intersection:	Whithaven Pwy and Foxhall Road
City/State:	Washington, D.C.
Analyst:	Chad A Baird
Project No:	1634-006
Time Period Analyzed:	PM - Total Future - Mitigation
Date:	05/17/00
East/West Street Name:	Whitehaven Parkway
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	34		40				34	535			475	99
PHF	0.90		0.90				0.90	0.90			0.90	0.90
PK 15 Vol	9		11				9	149			132	28
Hi Ln Vol												
% Grade		0						0			0	
Ideal Sat	1900		1900				1900	1900			1900	1900
ParkExist												
NumPark												
% Heavy Veh	0		0				0	0			0	0
No. Lanes	1	0	1	0	0	0	1	1	0	0	1	1
LGConfig	L		R				L	T			T	R
Lane Width	12.0		12.0				12.0	12.0			12.0	12.0
RTOR Vol			0									0
Adj Flow	38		44				38	594			528	110
%InSharedLn												
Prop Turns												
NumPeds			0			0						0
NumBus	0		0				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			0.0	0.0
Arriv. Type	3		3				3	3			3	3
Unit Ext.	3.0		3.0				3.0	3.0			3.0	3.0
I Factor		1.000						1.000			1.000	
Lost Time	2.0		2.0				2.0	2.0			2.0	2.0
Ext of g	2.0		2.0				2.0	2.0			2.0	2.0
Ped Min g		3.0						3.0			3.0	

PHASE DATA

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A				NB Left	A		
Thru					Thru	A		
Right	A				Right			
Peds					Peds			
WB Left					SB Left			
Thru					Thru	A		
Right					Right	A		
Peds					Peds			
NB Right					EB Right			
SB Right	A				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	34	0.90	38	1	L		38		
Thru				0					
Right	40	0.90	44	1	R	0	44		
Westbound									
Left				0					
Thru				0					
Right				0					
Northbound									
Left	34	0.90	38	1	L		38		
Thru	535	0.90	594	1	T		594		
Right				0					
Southbound									
Left				0					
Thru	475	0.90	528	1	T		528		
Right	99	0.90	110	1	R	0	110		

* 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:				
L	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	----	0.950	1805

R	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.850	----	1615
Westbound							Sec LT Adj/LT Sat:				

Northbound							Sec LT Adj/LT Sat:				
L	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	----	0.413	785
T	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	1.000	1.000	1900

Southbound							Sec LT Adj/LT Sat:				

T	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	1.000	1.000	1900
R	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.850	----	1615

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	L	38	1805		0.02	0.229	413	0.09
Thru								
Right	R	44	1615	#	0.03	0.229	369	0.12
Westbound								
Pri.								
Sec.								
Left								
Thru								
Right								
Northbound								
Pri.								
Sec.								
Left	L	38	785		0.05	0.657	516	0.07
Thru	T	594	1900	#	0.31	0.657	1249	0.48
Right								
Southbound								
Pri.								
Sec.								
Left								
Thru	T	528	1900		0.28	0.657	1249	0.42
Right	R	110	1615		0.07	1.000	1615	0.07

Sum (v/s) critical = 0.34

Lost Time/Cycle, L = 8.00 sec Critical v/c(X) = 0.38

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												
L	0.09	0.229	21.3	1.000	413	0.11	0.1	0.0	21.4	C		
											21.5	C
R	0.12	0.229	21.4	1.000	369	0.11	0.1	0.0	21.6	C		
Westbound												
Northbound												
L	0.07	0.657	4.3	1.000	516	0.11	0.1	0.0	4.4	A		
T	0.48	0.657	6.0	1.000	1249	0.11	0.3	0.0	6.3	A	6.2	A
Southbound												
T	0.42	0.657	5.7	1.000	1249	0.11	0.2	0.0	5.9	A	4.9	A
R	0.07	1.000	0.0	1.000	1615	0.11	0.0	0.0	0.0+	A		

Intersection Delay = 6.5 (sec/veh) Intersection LOS = A

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			46.0	
Effective Green Time for Lane Group, g			46.0	
Opposing Effective Green Time, go			46.0	
Number of Lanes in Lane Group, N			1	
Number of Opposing Lanes, No			1	
Adjusted Left-Turn Flow Rate, Vlt			38	
Proportion of Left Turns in Opposing Flow, Plto			0.00	
Adjusted Opposing Flow Rate, Vo			528	
Lost Time for Lane Group, tl			4.00	
Left Turns per Cycle: LTC=VltC/3600			0.74	
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600fluo			10.27	
Opposing Platoon Ratio, Rpo (Table 9-2 or Eqn 9-7)			1.00	
gf=[Gexp(- a * (LTC ** b))]-tl, gf<=g			0.0	
Opposing Queue Ratio: qro=1-Rpo(go/C)			0.34	
gq=(4.943Volc**0.762)(qro**1.061)-tl, gq<=g			5.36	
gu =g-gq if gq>=gf, =g-gf if gq<gf			40.64	
n=(gq-gf)/2, n>=0			2.68	
Ptho=1-Plto			1.00	
Pl*=Plt[1+{(N-1)g/(gf+gu/El1+4.24)}]			1.00	
El1 (Figure 9-7)			2.14	
El2=(1-Ptho**n)/Plto, El2>=1.0			1.00	
fmin=2(1+Plt)/g or fmin=2(1+Pl)/g			0.09	
gdiff=max(gq-gf,0)			0.00	
fm=[gf/g]+[gu/g][1/{1+Pl(El1-1)}], (min=fmin;max=1.00)			0.41	
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			0.413	

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				
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.

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

Intersection Delay 6.5 sec/veh Intersection LOS A

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: 05/17/00 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	107	17	17	0	790	80	31	905	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	333	1457	0.30	0.229	24.7	C	24.7	C
Westbound								
LTR	285	1248	0.55	0.229	31.3	C	31.3	C
Northbound								
LTR	1108	1686	0.87	0.657	19.2	B	19.2	B
Southbound								
LTR	1072	1631	0.98	0.657	35.4	D	35.4	D

Intersection Delay = 27.8 (sec/veh) Intersection LOS = C

HCS: Signalized Intersections Release 3.1c

Chad A. Baird
Gorove/Slade Associates, Inc.
1140 Connecticut Avenue NW
Suite 700
Washington, DC 20036
Phone: (202)296-8625 Fax: (202)785-8825
E-Mail: CBaird@GSATrans.com

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:	05/17/00
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	107	17	17	0	790	80	31	905	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	30	5	5	0	219	22	9	251	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			157			967			1054	
%InSharedLn												
Prop Turns	0.42		0.03	0.76		0.12	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	107	0.90	119	0					
Thru	17	0.90	19	1	LTR		157	0.76	0.12
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	905	0.90	1006	1	LTR		1054	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	0.856	1457

Westbound							Sec LT	Adj/LT	Sat:		

LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.884	0.744	1248

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	0.956	1631

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	1457	0.07	0.229	333	0.30
Right							
Westbound							
Pri.							
Sec.							
Left							
Thru	LTR	157	1248	# 0.13	0.229	285	0.55
Right							
Northbound							
Pri.							
Sec.							
Left							
Thru	LTR	967	1686	0.57	0.657	1108	0.87
Right							
Southbound							
Pri.							
Sec.							
Left							
Thru	LTR	1054	1631	# 0.65	0.657	1072	0.98
Right							

Sum (v/s) critical = 0.77

Lost Time/Cycle, L = 8.00 sec Critical v/c(X) = 0.87

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	0.30	0.229	22.4	1.000	333	0.50	2.3	0.0	24.7	C	24.7	C
Westbound												
LTR	0.55	0.229	23.8	1.000	285	0.50	7.5	0.0	31.3	C	31.3	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	0.98	0.657	11.6	1.000	1072	0.50	23.7	0.0	35.4	D	35.4	D

Intersection Delay = 27.8 (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	119	0	34
Proportion of Left Turns in Lane Group, Plt	0.42	0.76	0.00	0.03
Proportion of Left Turns in Opposing Flow, Plto	0.76	0.42	0.03	0.00
Adjusted Opposing Flow Rate, Vo	157	101	1054	967
Lost Time for Lane Group, tl	4.00	4.00	4.00	4.00
Left Turns per Cycle: LTC=VltC/3600	0.82	2.31	0.00	0.66
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600fluo	3.05	1.96	20.49	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	4.79	2.28	11.86	10.85
gu =g-gq if gq>=gf, =g-gf if gq<gf	11.21	13.72	34.14	26.29
n=(gq-gf)/2, n>=0	0.64	1.14	5.93	0.00
Ptho=1-Plto	0.24	0.58	0.97	1.00
Pl*=Plt[1+{(N-1)g/(gf+gu/El1+4.24)))	0.42	0.76	0.00	0.03
El1 (Figure 9-7)	1.62	1.53	3.93	3.62
El2=(1-Ptho**n)/Plto, El2>=1.0	1.00	1.10	5.48	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)	1.28	2.28	11.86	0.00
fm=[gf/g]+[gu/g][1/{1+Pl(El1-1)}], (min=fmin;max=1.00)	0.86	0.74	1.00	0.96
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	0.856	0.744	1.000	0.956

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 27.8 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: 05/17/00 Period: PM (2:00 - 3:00) - 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	57	27	22	3	493	67	15	446	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	1436	0.20	0.229	23.2	C	23.2	C
Westbound								
LTR	311	1362	0.38	0.229	26.2	C	26.2	C
Northbound								
LTR	1102	1677	0.57	0.657	8.7	A	8.7	A
Southbound								
LTR	1094	1665	0.49	0.657	7.6	A	7.6	A

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

HCS: Signalized Intersections Release 3.1c

Chad A. Baird
Gorove/Slade Associates, Inc.
1140 Connecticut Avenue NW
Suite 700
Washington, DC 20036
Phone: (202)296-8625 Fax: (202)785-8825
E-Mail: CBaird@GSATrans.com

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 (2:00 - 3:00) - Future
Date:	05/17/00
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	57	27	22	3	493	67	15	446	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	124	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			117			625			532	
%InSharedLn												
Prop Turns	0.47		0.09	0.54		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			
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	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	57	0.90	63	0					
Thru	27	0.90	30	1	LTR		117	0.54	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	446	0.90	496	1	LTR		532	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	1436

Westbound							Sec LT Adj/LT Sat:		----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.872	0.822	1362

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	1665

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	1436	0.05	0.229	328	0.20
Right							
Westbound							
Pri.							
Sec.							
Left							
Thru	LTR	117	1362	# 0.09	0.229	311	0.38
Right							
Northbound							
Pri.							
Sec.							
Left							
Thru	LTR	625	1677	# 0.37	0.657	1102	0.57
Right							
Southbound							
Pri.							
Sec.							
Left							
Thru	LTR	532	1665	0.32	0.657	1094	0.49
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	0.38	0.229	22.8	1.000	311	0.50	3.4	0.0	26.2	C	26.2	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	0.49	0.657	6.0	1.000	1094	0.50	1.5	0.0	7.6	A	7.6	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	63	3	17
Proportion of Left Turns in Lane Group, Plt	0.47	0.54	0.00	0.03
Proportion of Left Turns in Opposing Flow, Plto	0.54	0.47	0.03	0.00
Adjusted Opposing Flow Rate, Vo	117	66	532	625
Lost Time for Lane Group, tl	4.00	4.00	4.00	4.00
Left Turns per Cycle: LTC=VltC/3600	0.60	1.23	0.06	0.33
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600fluo	2.28	1.28	10.34	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	2.0	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	3.02	0.54	5.42	6.65
gu =g-gq if gq>=gf, =g-gf if gq<gf	11.44	13.98	10.17	20.04
n=(gq-gf)/2, n>=0	0.00	0.00	0.00	0.00
Ptho=1-Plto	0.46	0.53	0.97	1.00
Pl*=Plt[1+{(N-1)g/(gf+gu/El1+4.24)))	0.47	0.54	0.00	0.03
El1 (Figure 9-7)	1.56	1.48	2.37	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	0.822	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		Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
			Unadj. ds	Adj. d1 sec				
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 10.5 sec/veh Intersection LOS B

ERROR MESSAGES

No errors to report.

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	54		79				42	688			753	179
PHF	0.90		0.90				0.90	0.90			0.90	0.90
PK 15 Vol	15		22				12	191			209	50
Hi Ln Vol												
% Grade		0						0			0	
Ideal Sat	1900		1900				1900	1900			1900	1900
ParkExist												
NumPark												
% Heavy Veh	0		0				0	0			0	0
No. Lanes	1	0	1	0	0	0	1	1	0	0	1	1
LGConfig	L		R				L	T			T	R
Lane Width	12.0		12.0				12.0	12.0			12.0	12.0
RTOR Vol			0									0
Adj Flow	60		88				47	764			837	199
%InSharedLn												
Prop Turns												
NumPeds			0			0						0
NumBus	0		0				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			0.0	0.0
Arriv. Type	3		3				3	3			3	3
Unit Ext.	3.0		3.0				3.0	3.0			3.0	3.0
I Factor		1.000						1.000			1.000	
Lost Time	2.0		2.0				2.0	2.0			2.0	2.0
Ext of g	2.0		2.0				2.0	2.0			2.0	2.0
Ped Min g		3.0						3.0			3.0	

PHASE DATA

Phase Combination	1	2	3	4		5	6	7	8
EB Left	A				NB Left	A			
Thru					Thru	A			
Right	A				Right				
Peds					Peds				
WB Left					SB Left				
Thru					Thru	A			
Right					Right	A			
Peds					Peds				
NB Right					EB Right				
SB Right	A				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	54	0.90	60	1	L		60		
Thru				0					
Right	79	0.90	88	1	R	0	88		
Westbound									
Left				0					
Thru				0					
Right				0					
Northbound									
Left	42	0.90	47	1	L		47		
Thru	688	0.90	764	1	T		764		
Right				0					
Southbound									
Left				0					
Thru	753	0.90	837	1	T		837		
Right	179	0.90	199	1	R	0	199		

* 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:				
L	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	----	0.950	1805

R	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.850	----	1615
Westbound							Sec LT Adj/LT Sat:				

Northbound							Sec LT Adj/LT Sat:				
L	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	----	0.280	532
T	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	1.000	1.000	1900

Southbound							Sec LT Adj/LT Sat:				

T	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	1.000	1.000	1900
R	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.850	----	1615

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	L	60	1805		0.03	0.229	413	0.15
Thru								
Right	R	88	1615	#	0.05	0.229	369	0.24
Westbound								
Pri.								
Sec.								
Left								
Thru								
Right								
Northbound								
Pri.								
Sec.								
Left	L	47	532		0.09	0.657	350	0.13
Thru	T	764	1900		0.40	0.657	1249	0.61
Right								
Southbound								
Pri.								
Sec.								
Left								
Thru	T	837	1900	#	0.44	0.657	1249	0.67
Right	R	199	1615		0.12	1.000	1615	0.12

Sum (v/s) critical = 0.50

Lost Time/Cycle, L = 8.00 sec Critical v/c(X) = 0.56

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												
L	0.15	0.229	21.5	1.000	413	0.11	0.2	0.0	21.7	C		
											22.1	C
R	0.24	0.229	22.0	1.000	369	0.11	0.3	0.0	22.4	C		
Westbound												
Northbound												
L	0.13	0.657	4.5	1.000	350	0.11	0.2	0.0	4.7	A		
T	0.61	0.657	6.9	1.000	1249	0.20	0.9	0.0	7.8	A	7.6	A
Southbound												
T	0.67	0.657	7.4	1.000	1249	0.24	1.4	0.0	8.8	A	7.1	A
R	0.12	1.000	0.0	1.000	1615	0.11	0.0	0.0	0.0+	A		

Intersection Delay = 8.4 (sec/veh) Intersection LOS = A

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			46.0	
Effective Green Time for Lane Group, g			46.0	
Opposing Effective Green Time, go			46.0	
Number of Lanes in Lane Group, N			1	
Number of Opposing Lanes, No			1	
Adjusted Left-Turn Flow Rate, Vlt			47	
Proportion of Left Turns in Opposing Flow, Plto			0.00	
Adjusted Opposing Flow Rate, Vo			837	
Lost Time for Lane Group, tl			4.00	
Left Turns per Cycle: LTC=VltC/3600			0.91	
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600fluo			16.27	
Opposing Platoon Ratio, Rpo (Table 9-2 or Eqn 9-7)			1.00	
gf=[Gexp(- a * (LTC ** b))]-tl, gf<=g			0.0	
Opposing Queue Ratio: qro=1-Rpo(go/C)			0.34	
gq=(4.943Volc**0.762)(qro**1.061)-tl, gq<=g			9.30	
gu =g-gq if gq>=gf, =g-gf if gq<gf			36.70	
n=(gq-gf)/2, n>=0			4.65	
Ptho=1-Plto			1.00	
Pl*=Plt[1+{(N-1)g/(gf+gu/El1+4.24)}]			1.00	
El1 (Figure 9-7)			2.85	
El2=(1-Ptho**n)/Plto, El2>=1.0			1.00	
fmin=2(1+Plt)/g or fmin=2(1+Pl)/g			0.09	
gdiff=max(gq-gf,0)			0.00	
fm=[gf/g]+[gu/g][1/{1+Pl(El1-1)}], (min=fmin;max=1.00)			0.28	
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			0.280	

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				
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.

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 8.4 sec/veh Intersection LOS A

ERROR MESSAGES

No errors to report.

From: Louis Slade
To: "BOYERA@gunet.georgetown.edu"@GSDomain.GWIA
Date: 5/15/00 4:01PM
Subject: Call from Lew Bolan

Alice,
Lew called me with a question, and I wanted to coordinate with you on the answer. He explained that he is looking at the implications of the SW Quad on the west Georgetown and Burliegh housing market. One of his thoughts was that as the demand by students for off campus housing becomes reduced, the number of students' cars using curb parking in the neighborhood would also reduce. Lew guessed that 780 students might have several hundred cars which they would no longer park on neighborhood streets.

I explained that students would need a residential parking permit to park on the street in those neighborhoods, and that to obtain a permit, they would have to register their car in the District. Registration would require that they pay an excise tax on the car. Lew agreed that this would be extremely costly and that the number of students likely to have cars would, for this reason, be a low number.

I am assuming that my response to Lew accurately reflects the University's viewpoint on this. I would appreciate your comment before I confirm this to Lew.

Thanks,
Lou Slade

CC: Chad Baird, Nicole White