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March 14, 2000

Hand Delivery

Richard Aguglia, Esquire
Hunton & Williams
1900 K Street, N.W.
Washington, D.C. 20006-1109

Re: The Field School, BZA Application No. 16559

Dear Richard:

Pursuant to your request yesterday, I am enclosing the Technical Appendix for the Gorove Slade Traffic Report which was filed on behalf of The Field School. If you have any questions, please feel free to contact me.

Sincerely,

Phil T. Feola

Enclosure
184990

BZA
Case No. 16559
Exhibit No. 429

Board of Zoning Adjustment
District of Columbia
CASE NO.16559
EXHIBIT NO.429A1

Technical Appendix
The Field School

Prepared For



The Field School

Washington, D.C.

Prepared by
Gorove/Slade Associates, Inc.

1140 Connecticut Avenue NW
Suite 700
Washington, D.C. 20036
202-296-8625

February 29, 2000

Do Advance School Flashers Reduce Speed?

BY GIAN C. AGGARWAL AND STACEY L. MORTENSEN

In 1990, more than 6,400 pedestrians died in traffic accidents on American roads and highways. Nearly one in six people killed in motor vehicle accidents was a pedestrian. The annual cost of these accidents to society exceeds one billion dollars.

Historically, pedestrians older than 65 and younger than 14 are more likely to be involved in traffic fatalities. In major urban areas, they account for one-half of the motor vehicle-related deaths. Traffic accidents involving pedestrians become a major emotional public issue if the pedestrian happens to be a child walking to or from school. Although the safety record for school crossings is excellent, traffic engineers, in general, show extreme caution when planning safe school crossings. These safety measures are highly critical if the roadway in question is a high-speed roadway. In these situations, the Institute of Transportation Engineers and other professional organizations recommend alternatives that might include installation of flashing yellow beacons, traffic signals and pedestrian bridges. Although these are costly alternatives, cost becomes a secondary issue when considering the safety of the school children.

Background

The city of Vacaville, Calif., is on Interstate 80 midway between San Francisco and Sacramento. Both cities are within easy commute from Vacaville. Vacaville has been experiencing tremendous growth and was cited as the second fastest-growing city in Northern California in 1991. Between 1980 and 1990, the population grew by about 50 percent, bringing the total to about 75,000 people. In the past few years, more than 2,000 homes have been constructed in the vicinity of Browns Valley Road, which created the need for a new elementary school to accommodate the added enrollment. The new Browns Valley Elementary School is on Wrentham Drive off of Browns Valley Road, as shown in Figure 1.

Browns Valley Road is a major, high-speed arterial connecting the northern part of the city and the county to downtown Vacaville through E. Monte Avenue. It also intersects another major east-west arterial, Vaca Valley Parkway, which provides connections to Interstate 80 and Interstate 505.

Before the scheduled opening of this school, the school superintendent made a specific request to install traffic signals or flashing yellow beacons on Browns Valley Road. This was to reduce the speed of traffic passing through the school zone so that the school children could cross Browns Valley Road safely at the designated school crossings. The posted speed limit on this section of Browns Valley Road was 40 miles per hour (mph).

Selection of Traffic Control Measures

Traffic control devices aid pedestrians and drivers in making safe and efficient use of the road by regulating the assignment of the right-of-way, including giving information on crosswalks and their use. In studying the effectiveness of a traffic control device, it is necessary to take the existing traffic conditions into account.

Various locations were evaluated for potential school crossings from the east side of Browns Valley Road to the west side. Each location was reviewed with regard to the available sight distance, and the safest, most direct route to the school site.

Prior speed zone surveys conducted in 1988 on this segment of Browns Valley Road indicated that the average speed is 45 mph. Because of the prevailing high speeds, the following traffic control measures were considered in addition to the standard traffic signs and pavement markings:

- Flashing yellow beacons
- Fully actuated traffic signals
- Pedestrian bridge

Economic restrictions and the low side-street traffic volumes made it impractical to install a pedestrian bridge or traffic signals at any of the potential locations. However, the traffic manual of the California Department of Transportation (Caltran) suggests the supplemental installation of advance flashing yellow beacons if the "critical approach speed exceeds 35 mph." Flashing beacons, when activated, draw a driver's attention to unusual traffic conditions, which in this case, would be the presence of school children in the

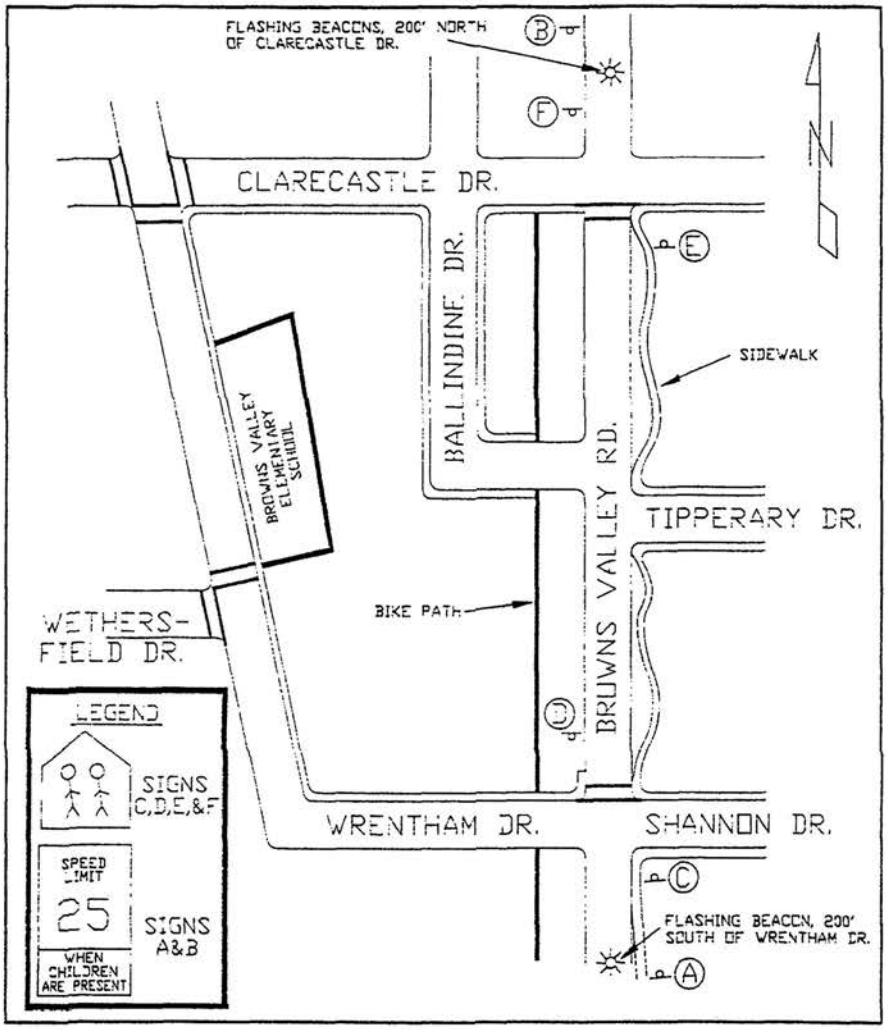


Figure 1. School site and various traffic controls.

crosswalk. Therefore, the installation of flashing beacons was recommended in addition to the standard signing and pavement markings for crosswalks.

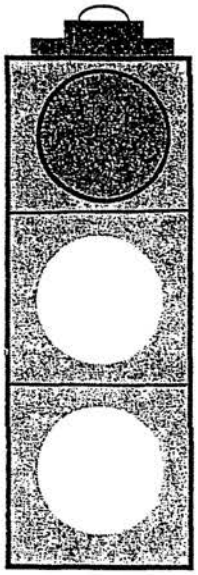
Installation and Operation of Flashers

Based on the above criteria, it was decided to provide the following traffic controls:

- Install yellow crosswalks on Browns Valley Road at Clarescastle Way and at Wrentham Drive, as shown in Figure 1, and assign an adult crossing guard to each location. School crossing signs also were installed for each direction of vehicular traffic to alert motorists to the existence of the crosswalks. These intersections provide the best available sight distance and service to school children from all areas of the east side of Browns Valley Road.
- Install "SLOW SCHOOL XING" pavement legends for each direction of vehicular traffic in advance of each crosswalk.
- Install advance flashing yellow beacons or flashers (as these are commonly called) and advance school crossing signs on Browns Valley Road at each of the school crossing zones to alert motorists to the upcoming crosswalk.
- Install 25 mph speed limit signs with "SCHOOL" and "WHEN CHILDREN ARE PRESENT" signs in advance of flashing beacons.

All the recommended traffic control measures, including the advance flashers, were installed before the school opened for the new school year on July 1, 1991.

Since the secondary power source was quite a distance away from the flashers and installing conduit, wire and pullboxes were not cost effective, it was



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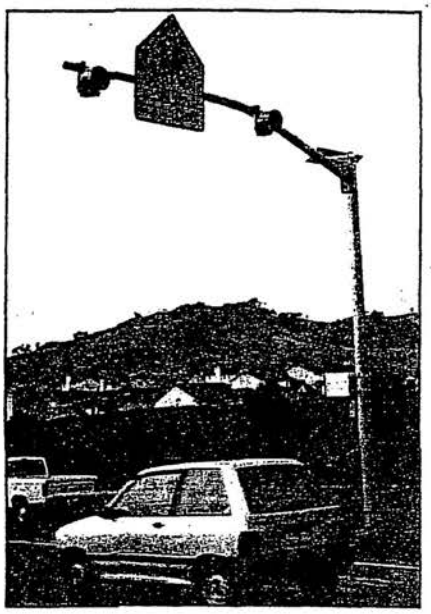


Figure 2. Advance school flashers with "School Xing" sign. Note solar panel on top of the pole.

decided to power these flashers by solar energy, as is shown in Figure 2.

The flashers were programmed to operate only for one hour during the school starting and quitting time, that is from 8 to 9 a.m. and from 2 to 3 p.m., Monday through Friday. All other hours the flashers would be off to avoid becoming a nuisance to the motoring public and to preserve their effectiveness. By operating only when school children are present, the flashers command more obedience and respect from drivers.

Field Data Collection and Analysis

Since the basic request for the flashers was based on the assumption that their installation would result in lower speeds during the period when the flashers are on, it was decided to conduct speed studies after the traffic conditions stabilized on this section of the roadway.

Speed study data was collected during the months of March and April 1992 at the school starting and quitting times. Tuesdays and Wednesdays were chosen for conducting these studies to nullify the effect of weekend and holiday traffic speeds.

Eight sets of speed studies (16 studies in all) were conducted—eight for the northbound direction and the other eight for southbound direction. Out of these eight studies, four were for the period when the flashers were off and the other four were when the flashers were in operation. Speed samples of 100 vehicles each were studied during a one-hour period when the flashers were off and during one hour when the flashers were on. Speeds for both northbound and southbound directions also were studied. Another precaution taken to assure consistency was to have all the observations taken by the same person.

The field data collected for these 16 speed studies was analyzed. In order to test the significance of the percentage change, a statistical analysis was conducted, as shown in the Appendix (see page 29). Tables 1 and 2 represent the analyzed data for northbound and southbound directions, respectively.

Out of the four sets of studies for northbound direction, the absolute reduction in average speeds for three sets of studies varies from 6.6 mph to 12.5 mph. The statistical analysis indicates a significant decrease in average speeds. These values translate into 16 percent to 32 percent reduction in average speeds when the flashers are on.

For the fourth study set, there is a slight increase of 0.3 mph in average speed. This increase is shown to be insignificant on the basis of the statistical analysis and can be ignored. These results are summarized in Table 3 and are shown in Figure 3.

For the southbound direction, the absolute reduction in average speeds for all four sets of studies varies from 2.8 mph to 7.6 mph and is shown to be significant based on this analysis. After calculating the percentages, these represent an 8 percent to 22 percent reduction in average speeds. These results are summarized in Table 4 and are shown in Figure 4.

An analysis of the 85th percentile speeds indicates that these speeds decreased for all eight sets of studies as shown in Tables 3 and 4. The reduction varied from 5 percent to 28 percent for the seven sets of studies while the results for studies III and IV were ignored. These 85th percentile speeds are represented in Figures 5 and 6.

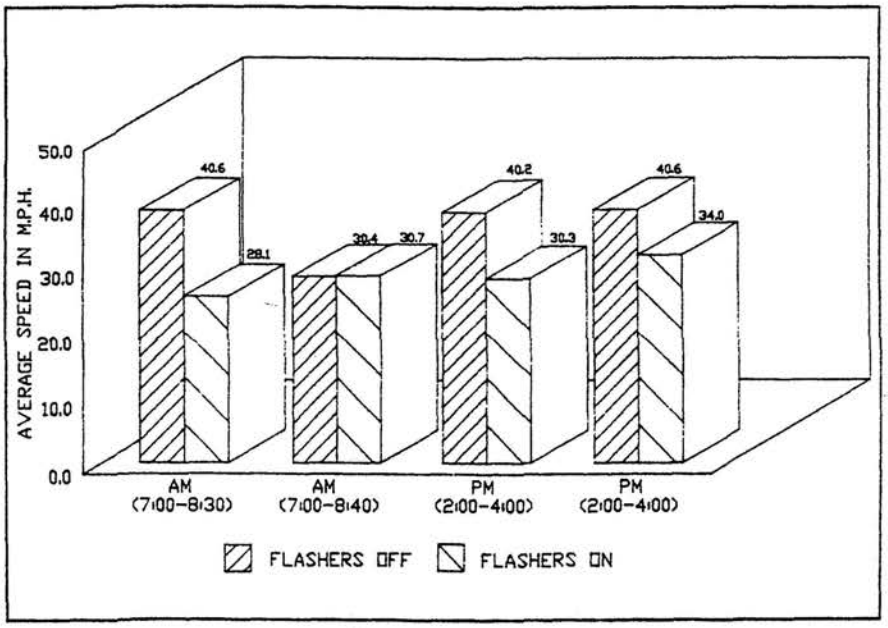


Figure 3. Average speed for northbound traffic.

Conclusions

Literature search indicates that the flashing beacons do not offer any benefits for pedestrian crossings in urban environments. Some studies even suggest that a significant increase in operating speeds occurred after flashers were added to the standard school crossing traffic controls.[1] The results of the present study are quite contrary to these findings and identify a considerable reduction in average speeds during the periods when these advance school flashers were operating. These decreases might be attributed to the local drivers' awareness and their respect for the traffic control devices.

Although the average speeds and the 85th percentile speeds seem to have

Table 3. Average Speeds (Northbound Traffic)

Study #	Flashers Off		Study #	Flashers On		Percentage Reduction (Increase) In	
	85th Percentile Speed	Average Speed		85th Percentile Speed	Average Speeds	85th Percentile Speed	Average Speed
I	45 mph	40.6 mph	II	33 mph	28.1 mph	26.7%	31.8%
III*	35 mph	30.4 mph	IV	34 mph	30.7 mph	2.9%	(1.0%)
V	45 mph	40.2 mph	VI	35 mph	30.3 mph	28.6%	24.7%
VII	43 mph	40.6 mph	VIII	39 mph	34.0 mph	9.3%	16.3%

*This observation for Study III may be ignored because of bad weather conditions.

Table 4. Average Speeds (Southbound Traffic)

Study #	Flashers Off		Study #	Flashers On		Percentage Readuction (Increase) In	
	85th Percentile Speed	Average Speed		85th Percentile Speed	Average Speed	85th Percentile Speed	Average Speed
IX	43 mph	40.1 mph	X	39 mph	32.5 mph	9.3%	19.0%
XI	39 mph	35.9 mph	XII	36 mph	31.7 mph	7.7%	11.7%
XIII	43 mph	39.7 mph	XIV	36 mph	31.1 mph	16.3%	21.7%
XV	39 mph	35.6 mph	XVI	37 mph	32.8 mph	5.1%	7.9%

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EXISTING TRAFFIC VOLUMES

Intersection Traffic Volume Counts and Peak Hour Volume

AM
PEAK HOUR

JOB NAME:	The Field School	**COUNTED BY:**	Kerri Nolan
PROJECT NO.	1634-006	**DAY & DATE:**	March 11, 1999
LOCATION:	Foxhall Road and Whitehaven Pkwy		**INTERVAL:** 15 min
CITY/COUNTY:	Palisades, NW Washington	**STATE:** DC	**WEATHER:** cold

NB. APPROACH: Foxhall Road
SB. APPROACH: Foxhall Road
EB. APPROACH: Whitehaven Pkwy
WB. APPROACH: Whitehaven Pkwy

COUNTS

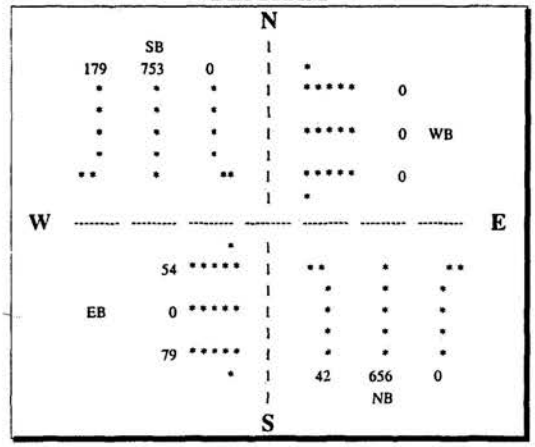
PEAK HOUR	AM	Southbound			Westbound			Northbound			Eastbound			TOTAL VEH.	HOURLY TOTAL	PHF	AM
	MOVEMENT #:	R 1	T 2	L 3	R 4	T 5	L 6	R 7	T 8	L 9	R 10	T 11	L 12				
0	06:00 AM - 06:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	06:00 AM - 06:15 AM
0	06:15 AM - 06:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	245	0.25	06:15 AM - 06:30 AM
0	06:30 AM - 06:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	527	0.47	06:30 AM - 06:45 AM
0	06:45 AM - 07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	819	0.70	06:45 AM - 07:00 AM
0	07:00 AM - 07:15 AM	6	85	0	0	0	0	0	149	2	1	0	2	245	1293	0.68	07:00 AM - 07:15 AM
0	07:15 AM - 07:30 AM	16	113	0	0	0	0	0	141	5	1	0	6	282	1572	0.75	07:15 AM - 07:30 AM
0	07:30 AM - 07:45 AM	25	133	0	0	0	0	0	118	6	3	0	7	292	1668	0.80	07:30 AM - 07:45 AM
1	07:45 AM - 08:00 AM	57	199	0	0	0	0	0	181	10	19	0	8	474	1763	0.84	07:45 AM - 08:00 AM
2	08:00 AM - 08:15 AM	95	218	0	0	0	0	0	143	24	28	0	16	524	1630	0.78	08:00 AM - 08:15 AM
2	08:15 AM - 08:30 AM	18	149	0	0	0	0	0	163	7	20	0	21	378	1106	0.71	08:15 AM - 08:30 AM
2	08:30 AM - 08:45 AM	9	187	0	0	0	0	0	169	1	12	0	9	387	728	0.47	08:30 AM - 08:45 AM
2	08:45 AM - 09:00 AM	11	146	0	0	0	0	0	167	5	7	0	5	341	341	0.25	08:45 AM - 09:00 AM
2	09:00 AM - 09:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	09:00 AM - 09:15 AM
2	09:15 AM - 09:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0			09:15 AM - 09:30 AM
2	09:30 AM - 09:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0			09:30 AM - 09:45 AM
2	09:45 AM - 10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0			09:45 AM - 10:00 AM
	AM TOTAL	237	1230	0	0	0	0	0	1231	60	91	0	74	2923	1763		AM TOTAL

PEAK HOUR VOLUMES

	AM	Southbound			Westbound			Northbound			Eastbound			TOTAL VEH.	HOURLY TOTAL	PHF	AM
	MOVEMENT #:	R 1	T 2	L 3	R 4	T 5	L 6	R 7	T 8	L 9	R 10	T 11	L 12				
8	07:45 AM - 08:00 AM	57	199	0	0	0	0	0	181	10	19	0	8	474	---	---	07:45 AM - 08:00 AM
9	08:00 AM - 08:15 AM	95	218	0	0	0	0	0	143	24	28	0	16	524	---	---	08:00 AM - 08:15 AM
10	08:15 AM - 08:30 AM	18	149	0	0	0	0	0	163	7	20	0	21	378	---	---	08:15 AM - 08:30 AM
11	08:30 AM - 08:45 AM	9	187	0	0	0	0	0	169	1	12	0	9	387	---	---	08:30 AM - 08:45 AM
	TOTAL	179	753	0	0	0	0	0	656	42	79	0	54	1763	0		AM TOTAL

AM Peak Volumes

DIAGRAM



APPROACH/DEPARTURE VOLUMES

SB	APPROACH:	932
	DEPART:	832
WB	APPROACH:	0
	DEPART:	221
NB	APPROACH:	698
	DEPART:	710
EB	APPROACH:	133
	DEPART:	0

1 3 4 5 6 7 8 9 10 11 12 13 14 15

Intersection Traffic Volume Counts and Peak Hour Volume

PM
PEAK HOUR

JOB NAME:	The Field School	**COUNTED BY:**	Raynette Savoy
PROJECT NO.	1636-002	**DAY & DATE:**	Wednesday, 05/19/99
LOCATION:	Whitehaven Pkwy & Foxhall Rd		**INTERVAL:** 15 Min.
CITY/COUNTY:	Washington	**STATE:** DC	**WEATHER:** Fair

NB. APPROACH: Foxhall Rd.
SB. APPROACH: Foxhall Rd.
EB. APPROACH: Whitehaven Pkwy.
WB. APPROACH:

COUNTS

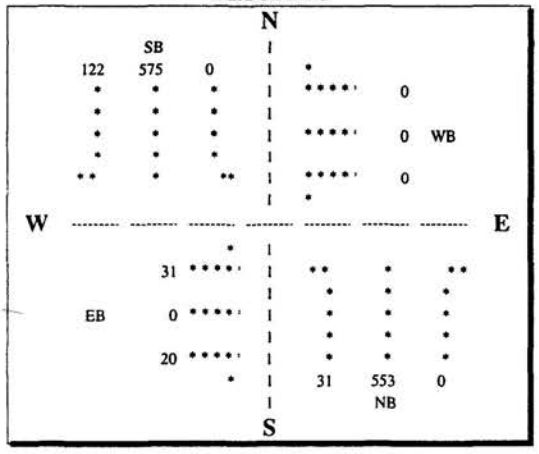
PEAK HOUR	PM	Southbound R	Southbound T	Southbound L	Westbound R	Westbound T	Westbound L	Northbound R	Northbound T	Northbound L	Eastbound R	Eastbound T	Eastbound L	TOTAL VEH.	HOURLY TOTAL	PHF	PM
	MOVEMENT #:	1	2	3	4	5	6	7	8	9	10	11	12				
0	02:00 PM - 02:15 PM	2	88	0	0	0	0	0	112	2	3	0	3	210	1144	0.89	02:00 PM - 02:15 PM
0	02:15 PM - 02:30 PM	12	116	0	0	0	0	0	149	5	4	0	6	292	1290	0.91	02:15 PM - 02:30 PM
1	02:30 PM - 02:45 PM	30	138	0	0	0	0	0	142	7	4	0	2	323	1332	0.94	02:30 PM - 02:45 PM
2	02:45 PM - 03:00 PM	47	127	0	0	0	0	0	125	6	5	0	9	319	1316	0.92	02:45 PM - 03:00 PM
2	03:00 PM - 03:15 PM	32	158	0	0	0	0	0	139	14	5	0	8	356	1077	0.76	03:00 PM - 03:15 PM
2	03:15 PM - 03:30 PM	13	152	0	0	0	0	0	147	4	6	0	12	334	721	0.54	03:15 PM - 03:30 PM
2	03:30 PM - 03:45 PM	4	144	0	0	0	0	0	127	5	11	0	16	307	387	0.32	03:30 PM - 03:45 PM
2	03:45 PM - 04:00 PM	3	30	0	0	0	0	0	41	4	0	0	2	80	80	0.25	03:45 PM - 04:00 PM
2																	
2																	
2																	
2																	
2																	
2																	
2																	
	PM TOTAL	143	953	0	0	0	0	0	982	47	38	0	58	2221	1332		PM TOTAL

PEAK HOUR VOLUMES

	PM	Southbound R	Southbound T	Southbound L	Westbound R	Westbound T	Westbound L	Northbound R	Northbound T	Northbound L	Eastbound R	Eastbound T	Eastbound L	TOTAL VEH.	HOURLY TOTAL	PHF	PM
	MOVEMENT #:	1	2	3	4	5	6	7	8	9	10	11	12				
3	02:30 PM - 02:45 PM	30	138	0	0	0	0	0	142	7	4	0	2	323	---	---	02:30 PM - 02:45 PM
4	02:45 PM - 03:00 PM	47	127	0	0	0	0	0	125	6	5	0	9	319	---	---	02:45 PM - 03:00 PM
5	03:00 PM - 03:15 PM	32	158	0	0	0	0	0	139	14	5	0	8	356	---	---	03:00 PM - 03:15 PM
6	03:15 PM - 03:30 PM	13	152	0	0	0	0	0	147	4	6	0	12	334	---	---	03:15 PM - 03:30 PM
	TOTAL	122	575	0	0	0	0	0	553	31	20	0	31	1332	0		PM TOTAL

PM Peak Volumes

DIAGRAM



APPROACH/DEPARTURE VOLUMES

SB	
APPROACH:	697
DEPART:	595
WB	
APPROACH:	0
DEPART:	153
NB	
APPROACH:	584
DEPART:	584
EB	
APPROACH:	51
DEPART:	0

Intersection Traffic Volume Counts and Peak Hour Volume

AM
PEAK HOUR

JOB NAME:	The Field School	**COUNTED BY:**	Chad Baird and David Beardsley
PROJECT NO.	1634-006	**DAY & DATE:**	March 9, 11, 1999
LOCATION:	Foxhall Road and "W" Street		**INTERVAL:** 15 min
CITY/COUNTY:	Palisades, NW Washington	**STATE:** DC	**WEATHER:** cold

NB. APPROACH: Foxhall Road
SB. APPROACH: Foxhall Road
EB. APPROACH: W" Street
WB. APPROACH: W" Street

COUNTS

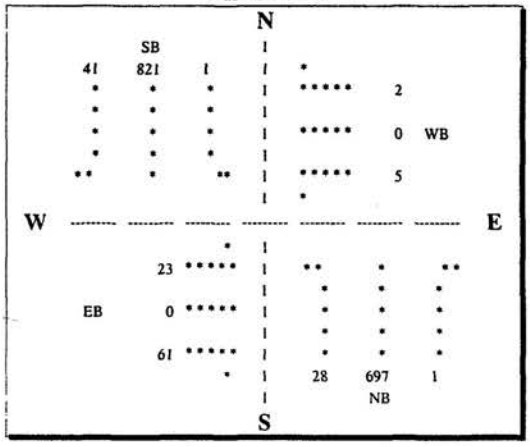
PEAK HOUR	AM	Southbound			Westbound			Northbound			Eastbound			TOTAL VEH.	HOURLY TOTAL	PHF	AM
		R	T	L	R	T	L	R	T	L	R	T	L				
	MOVEMENT #:	1	2	3	4	5	6	7	8	9	10	11	12				
0	06:00 AM - 06:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	06:00 AM - 06:15 AM
0	06:15 AM - 06:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	208	0.25	06:15 AM - 06:30 AM
0	06:30 AM - 06:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	466	0.45	06:30 AM - 06:45 AM
0	06:45 AM - 07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	786	0.61	06:45 AM - 07:00 AM
0	07:00 AM - 07:15 AM	3	74	0	0	0	1	0	119	5	5	0	1	208	1250	0.67	07:00 AM - 07:15 AM
0	07:15 AM - 07:30 AM	8	111	2	1	0	0	1	123	3	4	0	5	258	1459	0.79	07:15 AM - 07:30 AM
0	07:30 AM - 07:45 AM	4	145	1	0	0	1	1	147	5	12	0	4	320	1612	0.87	07:30 AM - 07:45 AM
1	07:45 AM - 08:00 AM	10	244	0	0	0	3	1	182	5	16	0	3	464	1680	0.91	07:45 AM - 08:00 AM
2	08:00 AM - 08:15 AM	11	229	0	0	0	0	0	142	9	22	0	4	417	1524	0.91	08:00 AM - 08:15 AM
2	08:15 AM - 08:30 AM	11	179	1	0	0	0	0	193	9	9	0	9	411	1107	0.67	08:15 AM - 08:30 AM
2	08:30 AM - 08:45 AM	9	169	0	2	0	2	0	180	5	14	0	7	388	696	0.45	08:30 AM - 08:45 AM
2	08:45 AM - 09:00 AM	8	136	0	0	0	0	1	141	5	10	0	7	308	308	0.25	08:45 AM - 09:00 AM
2	09:00 AM - 09:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	09:00 AM - 09:15 AM
2	09:15 AM - 09:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0			09:15 AM - 09:30 AM
2	09:30 AM - 09:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0			09:30 AM - 09:45 AM
2	09:45 AM - 10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0			09:45 AM - 10:00 AM
	AM TOTAL	64	1287	4	3	0	7	4	1227	46	92	0	40	2774	1680		AM TOTAL

PEAK HOUR VOLUMES

	AM	Southbound			Westbound			Northbound			Eastbound			TOTAL VEH.	HOURLY TOTAL	PHF	AM
		R	T	L	R	T	L	R	T	L	R	T	L				
	MOVEMENT #:	1	2	3	4	5	6	7	8	9	10	11	12				
8	07:45 AM - 08:00 AM	10	244	0	0	0	3	1	182	5	16	0	3	464	---	---	07:45 AM - 08:00 AM
9	08:00 AM - 08:15 AM	11	229	0	0	0	0	0	142	9	22	0	4	417	---	---	08:00 AM - 08:15 AM
10	08:15 AM - 08:30 AM	11	179	1	0	0	0	0	193	9	9	0	9	411	---	---	08:15 AM - 08:30 AM
11	08:30 AM - 08:45 AM	9	169	0	2	0	2	0	180	5	14	0	7	388	---	---	08:30 AM - 08:45 AM
	TOTAL	41	821	1	2	0	5	1	697	28	61	0	23	1680	0		AM TOTAL

AM Peak Volumes

DIAGRAM



APPROACH/DEPARTURE VOLUMES

SB		
	APPROACH:	863
	DEPART:	887
WB		
	APPROACH:	7
	DEPART:	69
NB		
	APPROACH:	726
	DEPART:	722
EB		
	APPROACH:	84
	DEPART:	2

Intersection Traffic Volume Counts and Peak Hour Volume

PM
PEAK HOUR

JOB NAME:	The Field School	**COUNTED BY:**	Raynette Savoy
PROJECT NO.	1636-002	**DAY & DATE:**	Wednesday, 05/19/99
LOCATION:	W Street & Foxhall Rd		**INTERVAL:** 15 Min.
CITY/COUNTY:	Washington	**STATE:** DC	**WEATHER:** Fair

NB. APPROACH: Foxhall Rd.
SB. APPROACH: Foxhall Rd.
EB. APPROACH: W Street
WB. APPROACH: W Street

COUNTS

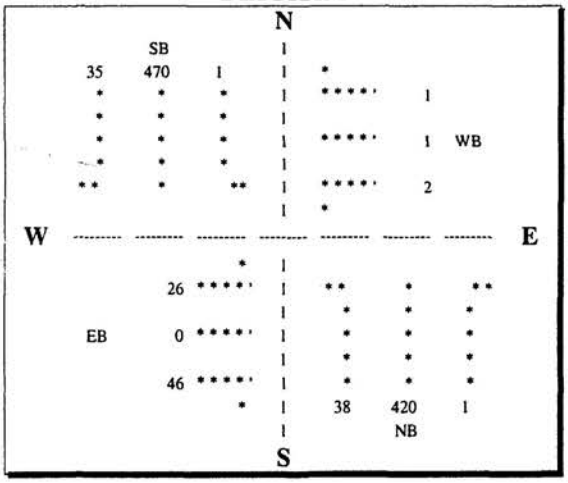
PM	Southbound			Westbound			Northbound			Eastbound			TOTAL VEH.	HOURLY TOTAL	PHF	PM
	R	T	L	R	T	L	R	T	L	R	T	L				
MOVEMENT #:	1	2	3	4	5	6	7	8	9	10	11	12				
01:30 PM - 01:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	468	0.46	01:30 PM - 01:45 PM
01:45 PM - 02:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	700	0.68	01:45 PM - 02:00 PM
02:00 PM - 02:15 PM	8	105	0	0	0	0	0	121	9	7	0	6	256	1041	0.76	02:00 PM - 02:15 PM
02:15 PM - 02:30 PM	11	94	1	1	0	0	0	85	7	6	0	7	212	1132	0.82	02:15 PM - 02:30 PM
02:30 PM - 02:45 PM	5	102	0	0	0	0	1	98	10	11	0	5	232	1214	0.87	02:30 PM - 02:45 PM
02:45 PM - 03:00 PM	11	169	0	0	1	2	0	116	12	22	0	8	341	1434	0.79	02:45 PM - 03:00 PM
03:00 PM - 03:15 PM	15	173	0	1	0	1	0	114	10	18	0	15	347	1396	0.77	03:00 PM - 03:15 PM
03:15 PM - 03:30 PM	14	110	0	0	0	0	0	130	8	16	0	16	294	1049	0.58	03:15 PM - 03:30 PM
03:30 PM - 03:45 PM	24	167	2	0	0	0	0	178	15	31	0	35	452	755	0.42	03:30 PM - 03:45 PM
03:45 PM - 04:00 PM	7	134	1	0	0	0	0	123	15	10	0	13	303	303	0.25	03:45 PM - 04:00 PM
04:00 PM - 04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	04:00 PM - 04:15 PM
04:15 PM - 04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	04:15 PM - 04:30 PM
04:30 PM - 04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	04:30 PM - 04:45 PM
04:45 PM - 05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	04:45 PM - 05:00 PM
05:00 PM - 05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	05:00 PM - 05:15 PM
05:15 PM - 05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	05:15 PM - 05:30 PM
05:30 PM - 05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	05:30 PM - 05:45 PM
05:45 PM - 06:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		0.25	05:45 PM - 06:00 PM
06:00 PM - 06:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		0.25	06:00 PM - 06:15 PM
06:15 PM - 06:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		0.25	06:15 PM - 06:30 PM
PM TOTAL	**95**	**1054**	**4**	**2**	**1**	**3**	**1**	**965**	**86**	**121**	**0**	**105**	**2437**	**1434**		**PM TOTAL**

PEAK HOUR VOLUMES

PM	Southbound			Westbound			Northbound			Eastbound			TOTAL VEH.	HOURLY TOTAL	PHF	PM
	R	T	L	R	T	L	R	T	L	R	T	L				
MOVEMENT #:	1	2	3	4	5	6	7	8	9	10	11	12				
02:00 PM - 02:15 PM	8	105	0	0	0	0	0	121	9	7	0	6	256	---	---	02:00 PM - 02:15 PM
02:15 PM - 02:30 PM	11	94	1	1	0	0	0	85	7	6	0	7	212	---	---	02:15 PM - 02:30 PM
02:30 PM - 02:45 PM	5	102	0	0	0	0	1	98	10	11	0	5	232	---	---	02:30 PM - 02:45 PM
02:45 PM - 03:00 PM	11	169	0	0	1	2	0	116	12	22	0	8	341	---	---	02:45 PM - 03:00 PM
TOTAL	**35**	**470**	**1**	**1**	**1**	**2**	**1**	**420**	**38**	**46**	**0**	**26**	**1041**	**0**		**PM TOTAL**

PM Peak Volumes

DIAGRAM



APPROACH/DEPARTURE VOLUMES

SB	
APPROACH:	506
DEPART:	518
WB	
APPROACH:	4
DEPART:	74
NB	
APPROACH:	459
DEPART:	447
EB	
APPROACH:	72
DEPART:	2

Intersection Traffic Volume Counts and Peak Hour Volume

AM
PEAK HOUR

JOB NAME:	The Field School	**COUNTED BY:**	Chad Baird and Erwin Andres
PROJECT NO.	1634-006	**DAY & DATE:**	April 6, 1999
LOCATION:	Garfield Avenue and Foxhall Road		**INTERVAL:** 15 min
CITY/COUNTY:	Palisades, NW Washington	**STATE:** DC	**WEATHER:** cold

NB. APPROACH: Foxhall Road
SB. APPROACH: Foxhall Road
EB. APPROACH: Garfield Avenue
WB. APPROACH: Garfield Avenue

COUNTS

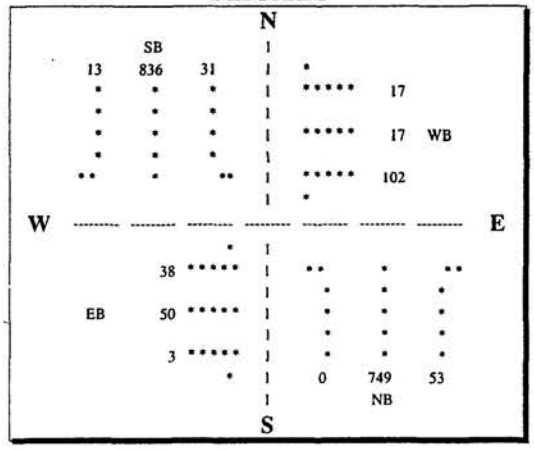
PEAK HOUR	AM	Southbound R	Southbound T	Southbound L	Westbound R	Westbound T	Westbound L	Northbound R	Northbound T	Northbound L	Eastbound R	Eastbound T	Eastbound L	TOTAL VEH.	HOURLY TOTAL	PHF	AM
	MOVEMENT #:	1	2	3	4	5	6	7	8	9	10	11	12				
0	06:00 AM - 06:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	06:00 AM - 06:15 AM
0	06:15 AM - 06:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	243	0.25	06:15 AM - 06:30 AM
0	06:30 AM - 06:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	528	0.46	06:30 AM - 06:45 AM
0	06:45 AM - 07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	851	0.66	06:45 AM - 07:00 AM
0	07:00 AM - 07:15 AM	1	98	3	0	4	16	5	110	0	0	4	2	243	1357	0.67	07:00 AM - 07:15 AM
0	07:15 AM - 07:30 AM	2	111	5	1	5	13	13	130	1	1	2	1	285	1613	0.80	07:15 AM - 07:30 AM
0	07:30 AM - 07:45 AM	1	112	10	6	3	18	15	142	0	1	10	5	323	1791	0.88	07:30 AM - 07:45 AM
1	07:45 AM - 08:00 AM	3	249	9	4	6	31	5	187	0	0	6	6	506	1909	0.94	07:45 AM - 08:00 AM
2	08:00 AM - 08:15 AM	4	221	6	6	5	31	16	185	0	1	12	12	499	1780	0.89	08:00 AM - 08:15 AM
2	08:15 AM - 08:30 AM	3	193	7	5	4	23	11	182	0	0	24	11	463	1281	0.69	08:15 AM - 08:30 AM
2	08:30 AM - 08:45 AM	3	173	9	2	2	17	21	195	0	2	8	9	441	818	0.46	08:30 AM - 08:45 AM
2	08:45 AM - 09:00 AM	2	157	10	3	7	12	9	164	0	1	6	6	377	377	0.25	08:45 AM - 09:00 AM
2	09:00 AM - 09:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	09:00 AM - 09:15 AM
2	09:15 AM - 09:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0			09:15 AM - 09:30 AM
2	09:30 AM - 09:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0			09:30 AM - 09:45 AM
2	09:45 AM - 10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0			09:45 AM - 10:00 AM
	AM TOTAL	19	1314	59	27	36	161	95	1295	1	6	72	52	3137	1909		AM TOTAL

PEAK HOUR VOLUMES

	AM	Southbound R	Southbound T	Southbound L	Westbound R	Westbound T	Westbound L	Northbound R	Northbound T	Northbound L	Eastbound R	Eastbound T	Eastbound L	TOTAL VEH.	HOURLY TOTAL	PHF	AM
	MOVEMENT #:	1	2	3	4	5	6	7	8	9	10	11	12				
8	07:45 AM - 08:00 AM	3	249	9	4	6	31	5	187	0	0	6	6	506	---	---	07:45 AM - 08:00 AM
9	08:00 AM - 08:15 AM	4	221	6	6	5	31	16	185	0	1	12	12	499	---	---	08:00 AM - 08:15 AM
10	08:15 AM - 08:30 AM	3	193	7	5	4	23	11	182	0	0	24	11	463	---	---	08:15 AM - 08:30 AM
11	08:30 AM - 08:45 AM	3	173	9	2	2	17	21	195	0	2	8	9	441	---	---	08:30 AM - 08:45 AM
	TOTAL	13	836	31	17	17	102	53	749	0	3	50	38	1909	0		AM TOTAL

AM Peak Volumes

DIAGRAM



APPROACH/DEPARTURE VOLUMES

SB		
	APPROACH:	880
	DEPART:	941
WB		
	APPROACH:	136
	DEPART:	30
NB		
	APPROACH:	802
	DEPART:	804
EB		
	APPROACH:	91
	DEPART:	134

Intersection Traffic Volume Counts and Peak Hour Volume

PM
PEAK HOUR

JOB NAME:	The Field School	**COUNTED BY:**	Raynette Savoy
PROJECT NO.	1636-002	**DAY & DATE:**	Wednesday, 05/19/99
LOCATION:	Garfield Street & Foxhall Rd		**INTERVAL:** 15 Min.
CITY/COUNTY:	Washington	**STATE:** DC	**WEATHER:** Fair

NB. APPROACH: Foxhall Rd.
SB. APPROACH: Foxhall Rd.
EB. APPROACH: Garfield Street
WB. APPROACH: Garfield Street

COUNTS

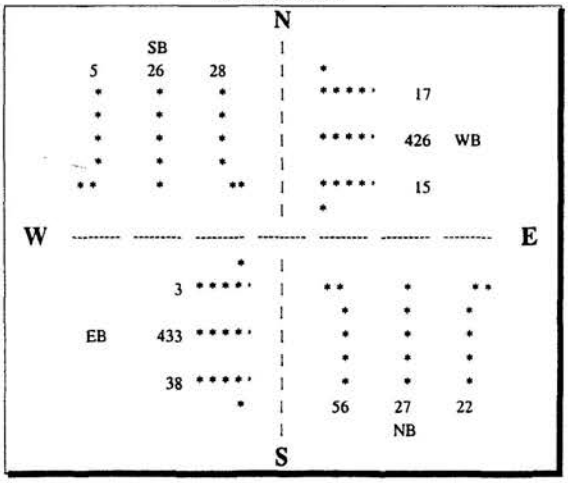
PM	Southbound			Westbound			Northbound			Eastbound			TOTAL	HOURLY		PM
	R	T	L	R	T	L	R	T	L	R	T	L	VEH.	TOTAL	PHF	
MOVEMENT #	1	2	3	4	5	6	7	8	9	10	11	12				
01:30 PM - 01:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	527	0.49	01:30 PM - 01:45 PM
01:45 PM - 02:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	786	0.73	01:45 PM - 02:00 PM
02:00 PM - 02:15 PM	1	5	7	6	102	3	5	8	15	7	109	1	269	1096	0.88	02:00 PM - 02:15 PM
02:15 PM - 02:30 PM	2	8	6	4	99	2	3	6	12	12	104	0	258	1168	0.86	02:15 PM - 02:30 PM
02:30 PM - 02:45 PM	2	6	9	5	96	6	10	6	9	8	101	1	259	1228	0.90	02:30 PM - 02:45 PM
02:45 PM - 03:00 PM	0	7	6	2	129	4	4	7	20	11	119	1	310	1351	0.88	02:45 PM - 03:00 PM
03:00 PM - 03:15 PM	0	16	7	2	139	3	6	6	19	14	129	0	341	1422	0.93	03:00 PM - 03:15 PM
03:15 PM - 03:30 PM	1	8	9	6	102	4	2	10	16	20	139	1	318	1081	0.71	03:15 PM - 03:30 PM
03:30 PM - 03:45 PM	0	5	6	6	142	2	5	9	16	21	170	0	382	763	0.50	03:30 PM - 03:45 PM
03:45 PM - 04:00 PM	9	15	19	21	149	0	0	12	9	7	137	3	381	381	0.25	03:45 PM - 04:00 PM
04:00 PM - 04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	04:00 PM - 04:15 PM
04:15 PM - 04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	04:15 PM - 04:30 PM
04:30 PM - 04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	04:30 PM - 04:45 PM
04:45 PM - 05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	04:45 PM - 05:00 PM
05:00 PM - 05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	05:00 PM - 05:15 PM
05:15 PM - 05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	05:15 PM - 05:30 PM
05:30 PM - 05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	05:30 PM - 05:45 PM
05:45 PM - 06:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		0.25	05:45 PM - 06:00 PM
06:00 PM - 06:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		0.25	06:00 PM - 06:15 PM
06:15 PM - 06:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0		0.25	06:15 PM - 06:30 PM
PM TOTAL	**15**	**70**	**69**	**52**	**958**	**24**	**35**	**64**	**116**	**100**	**1008**	**7**	**2518**	**1422**		**PM TOTAL**

PEAK HOUR VOLUMES

PM	Southbound			Westbound			Northbound			Eastbound			TOTAL	HOURLY		PM
	R	T	L	R	T	L	R	T	L	R	T	L	VEH.	TOTAL	PHF	
MOVEMENT #	1	2	3	4	5	6	7	8	9	10	11	12				
02:00 PM - 02:15 PM	1	5	7	6	102	3	5	8	15	7	109	1	269	---	---	02:00 PM - 02:15 PM
02:15 PM - 02:30 PM	2	8	6	4	99	2	3	6	12	12	104	0	258	---	---	02:15 PM - 02:30 PM
02:30 PM - 02:45 PM	2	6	9	5	96	6	10	6	9	8	101	1	259	---	---	02:30 PM - 02:45 PM
02:45 PM - 03:00 PM	0	7	6	2	129	4	4	7	20	11	119	1	310	---	---	02:45 PM - 03:00 PM
TOTAL	**5**	**26**	**28**	**17**	**426**	**15**	**22**	**27**	**56**	**38**	**433**	**3**	**1096**	**0**		**PM TOTAL**

PM Peak Volumes

DIAGRAM



APPROACH/DEPARTURE VOLUMES

SB		
	APPROACH:	59
	DEPART:	79
WB		
	APPROACH:	458
	DEPART:	487
NB		
	APPROACH:	105
	DEPART:	47
EB		
	APPROACH:	474
	DEPART:	483

EXISTING HIGHWAY CAPACITY ANALYSIS

HCS: Unsignalized Intersections Release 3.1b

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:	47	905	699	195	52	70
HFR:	47	905	699	195	52	70
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:	1	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		797
Potential Capacity		390
Pedestrian Impedance Factor		1.00
Movement Capacity		390
Probability of Queue free St.		0.82

Step 2: LT from Major St.	4	1
Conflicting Flows		894
Potential Capacity		767
Pedestrian Impedance Factor		1.00
Movement Capacity		767
Probability of Queue free St.		0.94

Step 4: LT from Minor St.	7	10
Conflicting Flows		1796
Potential Capacity		89
Pedestrian Impedance Factor		1.00
Maj. L, Min T Impedance factor		0.94
Maj. L, Min T Adj. Imp Factor.		0.95
Cap. Adj. factor due to Impeding mvmnt		0.95
Movement Capacity		85

Worksheet 8 Shared Lane Calculations

Shared Lane Calculations

Movement	7	8	9	10	11	12
	|			||------	------|
	|			||	|
	|			||	|
v(vph)				52		70
Movement Capacity				85		390
Shared Lane Capacity				154		

Worksheet 10 delay,queue length, and LOS

Movement	1	4	7	8	9	10	11	12
v(vph)	47					122		
C m(vph)	767					154		
v/c	0.06					0.79		
95% queue length								
Control Delay	10.0					83.6		
LOS	A					F		
Approach Delay							83.6	
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:	30	613	566	122	31	14
HFR:	30	613	566	122	31	14
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		627
Potential Capacity		487
Pedestrian Impedance Factor		1.00
Movement Capacity		487
Probability of Queue free St.		0.97

Step 2: LT from Major St.	4	1
Conflicting Flows		688
Potential Capacity		916
Pedestrian Impedance Factor		1.00
Movement Capacity		916
Probability of Queue free St.		0.97

Step 4: LT from Minor St.	7	10
Conflicting Flows		1300
Potential Capacity		180
Pedestrian Impedance Factor		1.00
Maj. L, Min T Impedance factor		0.97
Maj. L, Min T Adj. Imp Factor.		0.97
Cap. Adj. factor due to Impeding mvmnt		0.97
Movement Capacity		175

Worksheet 8 Shared Lane Calculations

Shared Lane Calculations

Movement	7	8	9	10	11	12
	|			||------	------|
	|			||	|
v(vph)				31		14
Movement Capacity				175		487
Shared Lane Capacity				219		

Worksheet 10 delay,queue length, and LOS

Movement	1	4	7	8	9	10	11	12
v(vph)	30					45		
C m(vph)	916					219		
v/c	0.03					0.21		
95% queue length								
Control Delay	9.1					25.7		
LOS	A					D		
Approach Delay							25.7	
Approach LOS							D	

HCS: Unsignalized Intersections Release 3.1b

TWO-WAY STOP CONTROL TWSC ANALYSIS

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

Intersection Orientation: North-South Major St.

Vehicle Volume Data:

Movements:	1	2	3	4	5	6	7	8	9	10	11	12
Volume:	28	697	1	1	821	41	5	0	2	23	0	61
HFR:	28	697	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	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:	697	[redacted]
Shared ln volume, major rt vehicles:	1	[redacted]
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	698	842
Potential Capacity	444	367
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	444	367
Probability of Queue free St.	1.00	0.83

Step 2: LT from Major St.	4	1
Conflicting Flows	698	862
Potential Capacity	908	789
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	908	789
Probability of Queue free St.	1.00	0.96
Maj. L Shared ln. Prob. Queue Free St.	1.00	0.94

Step 3: TH from Minor St.	8	11
Conflicting Flows	1618	1598
Potential Capacity	105	108
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.94	0.94
Movement Capacity	98	101
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	1628	1598
Potential Capacity	83	87
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	66	82

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	66	98	444	82	101	367
Shared Lane Capacity	87			188		

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	908	87			188		
v/c	0.04	0.00	0.08			0.45		
95% queue length								
Control Delay	9.7	9.0	50.1			38.6		
LOS	A	A	F			E		
Approach Delay				50.1			38.6	
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	697	821
V i2	1	41
S i1	1700	1700
S i2	1700	1700
P* oj	0.94	1.00
D maj left	9.7	9.0
N number major st lanes	1	1
Delay, rank 1 mvmts	0.6	0.0

HCS: Unsignalized Intersections Release 3.1b

TWO-WAY STOP CONTROL (TWSC) ANALYSIS

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

Intersection Orientation: North-South Major St.

Vehicle Volume Data:

Movements:	1	2	3	4	5	6	7	8	9	10	11	12
Volume:	47	654	2	1	557	27	1	0	3	39	0	24
HFR:	47	654	2	1	557	27	1	0	3	39	0	24
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	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:	654	[redacted]
Shared ln volume, major rt vehicles:	2	[redacted]
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	655	571
Potential Capacity	470	524
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	470	524
Probability of Queue free St.	0.99	0.95

Step 2: LT from Major St.	4	1
Conflicting Flows	656	584
Potential Capacity	941	1001
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	941	1001
Probability of Queue free St.	1.00	0.95
Maj. L Shared ln. Prob. Queue Free St.	1.00	0.92

Step 3: TH from Minor St.	8	11
Conflicting Flows	1335	1323
Potential Capacity	155	158
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.92	0.92
Movement Capacity	143	145
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	1334	1323
Potential Capacity	132	135
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.92	0.92
Maj. L, Min T Adj. Imp Factor.	0.94	0.94
Cap. Adj. factor due to Impeding mvmnt	0.90	0.93
Movement Capacity	119	126

Worksheet 8 Shared Lane Calculations

Shared Lane Calculations

Movement	7	8	9	10	11	12

v(vph)	1	0	3	39	0	24
Movement Capacity	119	143	470	126	145	824
Shared Lane Capacity	270			177		

Worksheet 10 delay, queue length, and LOS

Movement	1	4	7	8	9	10	11	12
v(vph)	47	1	4			63		
C m(vph)	1001	941	270			177		
v/c	0.05	0.00	0.01			0.36		
95% queue length								
Control Delay	8.8	8.8	18.5			36.2		
LOS	A	A	C			E		
Approach Delay				18.5			36.2	
Approach LOS				C			E	

Worksheet 11 Shared Major LT Impedance and Delay

Rank 1 Delay Calculations

Movement	2	5
P oj	0.95	1.00
V i1	654	557
V i2	2	27
S i1	1700	1700
S i2	1700	1700
P* oj	0.92	1.00
D maj left	8.8	8.8
N number major st lanes	1	1
Delay, rank 1 mvmts	0.7	0.0

HCS: Signals Release 3.1b

Inter: Foxhall Rd. and Garfield St. City/St: Washington, D.C.
Analyst: Chad A. Baird Proj #: 1636-002
Date: 5/6/99 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 1.00 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 Capcity	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	28.5	C	28.5	C
Northbound								
LTR	1088	1693	0.82	0.643	16.7	B	16.7	B
Southbound								
LTR	1049	1632	0.93	0.643	31.2	C	31.2	C

Intersection Delay = 24.6 (sec/veh) Intersection LOS = C

HCS: Signals Release 3.1b

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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) - Existing
Date:	5/6/99
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 1.00 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		0.0			0.0			0.0			0.0	

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	5.7	0.0	28.5	C	28.5	C
Northbound												
LTR	0.82	0.643	9.4	1.000	1088	0.50	7.3	0.0	16.7	B	16.7	B
Southbound												
LTR	0.93	0.643	11.1	1.000	1049	0.50	20.0	0.0	31.2	C	31.2	C

Intersection Delay = 24.6 (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	17.00	17.00	45.00	45.00
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 24.6 sec/veh Intersection LOS C

ERROR MESSAGES

No errors to report.

HCS: Signals Release 3.1b

Inter: Foxhall Rd. and Garfield St. City/St: Washington, D.C.
Analyst: Chad A. Baird Proj #: 1636-002
Date: 5/6/99 Period: PM (5:00 - 6:00) - 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	39	4	85	48	19	0	708	85	14	552	19
Lane Width		12.0			12.0			12.0			12.0	
RTOR Vol			0			0			0			0

Duration 1.00 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				
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	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 Capcity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LTR	353	1455	0.22	0.243	22.6	C	22.6	C
Westbound								
LTR	325	1337	0.52	0.243	28.8	C	28.8	C
Northbound								
LTR	1082	1683	0.81	0.643	16.5	B	16.5	B
Southbound								
LTR	1068	1662	0.61	0.643	9.9	A	9.9	A

Intersection Delay = 15.5 (sec/veh) Intersection LOS = B

HCS: Signals Release 3.1b

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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) - Existing
Date:	5/6/99
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	39	4	85	48	19	0	708	85	14	552	19
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	11	1	24	13	5	0	197	24	4	153	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		78			168			881			650	
%InSharedLn												
Prop Turns	0.40		0.05	0.56		0.13	0.00		0.11	0.02		0.03
NumPeds			0			0			0			0
NumBus		0			0			0			0	

Duration 1.00 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		0.0			0.0			0.0			0.0	

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	39	0.90	43	1	LTR		78	0.40	0.05
Right	4	0.90	4	0		0			
Westbound									
Left	85	0.90	94	0					
Thru	48	0.90	53	1	LTR		168	0.56	0.13
Right	19	0.90	21	0		0			
Northbound									
Left	0	0.90	0	0					
Thru	708	0.90	787	1	LTR		881	0.00	0.11
Right	85	0.90	94	0		0			
Southbound									
Left	14	0.90	16	0					
Thru	552	0.90	613	1	LTR		650	0.02	0.03
Right	19	0.90	21	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	0.893	0.858	1455

Westbound							Sec LT Adj/LT Sat:		----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.883	0.797	1337

Northbound							Sec LT Adj/LT Sat:		----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.886	1.000	1683

Southbound							Sec LT Adj/LT Sat:		----		
LTR	1900	1.000	1.000	1.000	1.000	1.000	1.00	1.00	0.896	0.977	1662

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	78	1455		0.05	0.243	353	0.22
Right								
Westbound								
Pri.								
Sec.								
Left								
Thru	LTR	168	1337	#	0.13	0.243	325	0.52
Right								
Northbound								
Pri.								
Sec.								
Left								
Thru	LTR	881	1683	#	0.52	0.643	1082	0.81
Right								
Southbound								
Pri.								
Sec.								
Left								
Thru	LTR	650	1662		0.39	0.643	1068	0.61
Right								

Sum (v/s) critical = 0.65

Lost Time/Cycle, L = 8.00 sec Critical v/c(X) = 0.73

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	0.22	0.243	21.2	1.000	353	0.50	1.4	0.0	22.6	C	22.6	C
Westbound												
LTR	0.52	0.243	22.9	1.000	325	0.50	5.9	0.0	28.8	C	28.8	C
Northbound												
LTR	0.81	0.643	9.4	1.000	1082	0.50	7.1	0.0	16.5	B	16.5	B
Southbound												
LTR	0.61	0.643	7.3	1.000	1068	0.50	2.6	0.0	9.9	A	9.9	A

Intersection Delay = 15.5 (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	17.0	17.0	45.0	45.0
Effective Green Time for Lane Group, g	17.00	17.00	45.00	45.00
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	94	0	16
Proportion of Left Turns in Lane Group, Plt	0.40	0.56	0.00	0.02
Proportion of Left Turns in Opposing Flow, Plto	0.56	0.40	0.02	0.00
Adjusted Opposing Flow Rate, Vo	168	78	650	881
Lost Time for Lane Group, tl	4.00	4.00	4.00	4.00
Left Turns per Cycle: LTC=VltC/3600	0.60	1.83	0.00	0.31
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600fluo	3.27	1.52	12.64	17.13
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	0.8	0.0	25.8
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	5.07	1.05	7.46	10.44
gu =g-gq if gq>=gf, =g-gf if gq<gf	11.90	15.95	37.54	19.21
n=(gq-gf)/2, n>=0	0.00	0.11	3.73	0.00
Ptho=1-Plto	0.44	0.60	0.98	1.00
Pl*=Plt[1+{(N-1)g/(gf+gu/El1+4.24)))	0.40	0.56	0.00	0.02
El1 (Figure 9-7)	1.64	1.49	2.66	3.33
El2=(1-Ptho**n)/Plto, El2>=1.0	1.00	1.00	3.60	1.00
fmin=2(1+Plt)/g or fmin=2(1+Pl)/g	0.16	0.18	0.04	0.05
gdiff=max(gq-gf,0)	0.00	0.22	7.46	0.00
fm=[gf/g]+[gu/g][1/{1+Pl(El1-1)}], (min=fmin;max=1.00)	0.86	0.80	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	0.858	0.797	1.000	0.977

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 15.5 sec/veh Intersection LOS B

ERROR MESSAGES

No errors to report.

TOTAL FUTURE HIGHWAY CAPACITY ANALYSIS

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: 02/29/00 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	120		86				75	728			722	198
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	0.32	0.229	22.9	C		
							22.8	C
R	369	1615	0.26	0.229	22.5	C		
Westbound								
Northbound								
L	365	556	0.23	0.657	5.2	A		
T	1249	1900	0.65	0.657	8.3	A	8.1	A
Southbound								
T	1249	1900	0.64	0.657	8.3	A	6.5	A
R	1615	1615	0.14	1.000	0.0+	A		

Intersection Delay = 8.9 (sec/veh) Intersection LOS = A

HCS: Signalized Intersections Release 3.1c

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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:	02/29/00
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	120		86				75	728			722	198
PHF	0.90		0.90				0.90	0.90			0.90	0.90
PK 15 Vol	33		24				21	202			201	55
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	133		96				83	809			802	220
%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	120	0.90	133	1	L		133		
Thru				0					
Right	86	0.90	96	1	R	0	96		
Westbound									
Left				0					
Thru				0					
Right				0					
Northbound									
Left	75	0.90	83	1	L		83		
Thru	728	0.90	809	1	T		809		
Right				0					
Southbound									
Left				0					
Thru	722	0.90	802	1	T		802		
Right	198	0.90	220	1	R	0	220		

* 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	----	0.293	556
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	133	1805	#	0.07	0.229	413	0.32
Thru								
Right	R	96	1615		0.06	0.229	369	0.26
Westbound								
Pri.								
Sec.								
Left								
Thru								
Right								
Northbound								
Pri.								
Sec.								
Left	L	83	556		0.15	0.657	365	0.23
Thru	T	809	1900	#	0.43	0.657	1249	0.65
Right								
Southbound								
Pri.								
Sec.								
Left								
Thru	T	802	1900		0.42	0.657	1249	0.64
Right	R	220	1615		0.14	1.000	1615	0.14

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	0.32	0.229	22.5	1.000	413	0.11	0.5	0.0	22.9	C		
											22.8	C
R	0.26	0.229	22.1	1.000	369	0.11	0.4	0.0	22.5	C		
Westbound												
Northbound												
L	0.23	0.657	4.8	1.000	365	0.11	0.3	0.0	5.2	A		
T	0.65	0.657	7.2	1.000	1249	0.23	1.2	0.0	8.3	A	8.1	A
Southbound												
T	0.64	0.657	7.1	1.000	1249	0.22	1.1	0.0	8.3	A	6.5	A
R	0.14	1.000	0.0	1.000	1615	0.11	0.0	0.0	0.0+	A		

Intersection Delay = 8.9 (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			83	
Proportion of Left Turns in Opposing Flow, Plto			0.00	
Adjusted Opposing Flow Rate, Vo			802	
Lost Time for Lane Group, tl			4.00	
Left Turns per Cycle: LTC=VltC/3600			1.61	
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600fluo			15.59	
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			8.88	
gu =g-gq if gq>=gf, =g-gf if gq<gf			37.12	
n=(gq-gf)/2, n>=0			4.44	
Ptho=1-Plto			1.00	
Pl*=Plt[1+{(N-1)g/(gf+gu/El1+4.24)}]			1.00	
El1 (Figure 9-7)			2.76	
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)			0.29	
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			0.293	

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 8.9 sec/veh Intersection LOS A

ERROR MESSAGES

No errors to report.

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: 02/29/00 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	53		58				44	437			484	130
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	0.14	0.229	21.7	C		
							21.8	C
R	369	1615	0.17	0.229	21.9	C		
Westbound								
Northbound								
L	510	776	0.10	0.657	4.5	A		
T	1249	1900	0.39	0.657	5.7	A	5.6	A
Southbound								
T	1249	1900	0.43	0.657	6.0	A	4.7	A
R	1615	1615	0.09	1.000	0.0+	A		

Intersection Delay = 6.6 (sec/veh) Intersection LOS = A

HCS: Signalized Intersections Release 3.1c

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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:	02/29/00
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	53		58				44	437			484	130
PHF	0.90		0.90				0.90	0.90			0.90	0.90
PK 15 Vol	15		16				12	121			134	36
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	59		64				49	486			538	144
%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	53	0.90	59	1	L		59		
Thru				0					
Right	58	0.90	64	1	R	0	64		
Westbound									
Left				0					
Thru				0					
Right				0					
Northbound									
Left	44	0.90	49	1	L		49		
Thru	437	0.90	486	1	T		486		
Right				0					
Southbound									
Left				0					
Thru	484	0.90	538	1	T		538		
Right	130	0.90	144	1	R	0	144		

* 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	----	0.408	776
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	59	1805		0.03	0.229	413	0.14
Thru								
Right	R	64	1615	#	0.04	0.229	369	0.17
Westbound								
Pri.								
Sec.								
Left								
Thru								
Right								
Northbound								
Pri.								
Sec.								
Left	L	49	776		0.06	0.657	510	0.10
Thru	T	486	1900		0.26	0.657	1249	0.39
Right								
Southbound								
Pri.								
Sec.								
Left								
Thru	T	538	1900	#	0.28	0.657	1249	0.43
Right	R	144	1615		0.09	1.000	1615	0.09

Sum (v/s) critical = 0.32

Lost Time/Cycle, L = 8.00 sec Critical v/c(X) = 0.36

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	0.14	0.229	21.5	1.000	413	0.11	0.2	0.0	21.7	C		
											21.8	C
R	0.17	0.229	21.7	1.000	369	0.11	0.2	0.0	21.9	C		
Westbound												
Northbound												
L	0.10	0.657	4.4	1.000	510	0.11	0.1	0.0	4.5	A		
T	0.39	0.657	5.5	1.000	1249	0.11	0.2	0.0	5.7	A	5.6	A
Southbound												
T	0.43	0.657	5.7	1.000	1249	0.11	0.2	0.0	6.0	A	4.7	A
R	0.09	1.000	0.0	1.000	1615	0.11	0.0	0.0	0.0+	A		

Intersection Delay = 6.6 (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			49	
Proportion of Left Turns in Opposing Flow, Plto			0.00	
Adjusted Opposing Flow Rate, Vo			538	
Lost Time for Lane Group, tl			4.00	
Left Turns per Cycle: LTC=VltC/3600			0.95	
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600fluo			10.46	
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			5.50	
gu =g-gq if gq>=gf, =g-gf if gq<gf			40.50	
n=(gq-gf)/2, n>=0			2.75	
Ptho=1-Plto			1.00	
Pl*=Plt[1+{(N-1)g/(gf+gu/El1+4.24)}]			1.00	
El1 (Figure 9-7)			2.16	
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			0.408	

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 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