WELLS & ASSOCIATES, LLC
TRAFFIC, TRANSPORTATION, and PARKING CONSULTANTS

MEMORANDUM

TO: District of Columbia
Board of Zoning Adjustment

CC: David Shapiro
Walter Ailes
Edmund Burke School

FROM: Martin J. Wells, P.E.

DATE: October 14, 2003

SUBJECT: BZA Application No. 17022
Edmund Burke School
Response to Testimony of Joe Mehra in Opposition
To Edmund Burke School Application

Introduction

This memorandum responds to written testimony of Joe Mehra in opposition to the Edmund Burke School (EBS) application. This written testimony, which is undated, was delivered to the parties on September 30, 2003.

Mr. Mehra comments on the following topics:

- Traffic Counts.
- Connecticut Avenue Lane Use.
- EBS Trip Generation Estimates
- Future Traffic Forecasts
- Transportation Management Plan (TMP).

Responses to each of these comments are provided below.

Summary

BZA
Case No. 17022
Exhibit No. 167

In summary, we disagree with Mr. Mehra's findings. We reaffirm that:

Board of Zoning Adjustment
District of Columbia
CASE NO. 17022
EXHIBIT NO. 167

1. The Wells & Associates' traffic counts are valid.
2. The TMP is realistic and enforceable.
3. The proposed driveway on Connecticut Avenue will not impede or slow traffic on northbound Connecticut Avenue.
4. The proposed plan will not add to traffic on Upton Street.
5. Two-hundred-seventy (270) students and 35 faculty, without a TMP, will generate more traffic than 320 students and 70 faculty with the proposed TMP.

In numerous instances Mr. Mehra carefully selects data from the recently completed Connecticut Avenue Transportation Study (CATS) to support his positions but assiduously avoids the fundamental conclusion of that study, that the combined traffic impacts of The Sheridan School expansion, the EBS expansion, the nine-story, 166-unit residential development at 3883 Connecticut Avenue, and two embassy expansions will be "negligible". These development projects will have "very little effect on the LOS [level of service] of the studied intersections." No amount of parsing of the data can change the CATS conclusions.

Mr. Mehra offers no data of his own. To our knowledge, Mr. Mehra has conducted no counts or other traffic data, and has conducted no original research or analysis. He has not contacted the school to determine how the mandatory TMP, which was implemented this year, is actually operating.

Finally, Mr. Mehra's testimony is at odds with not only the Wells & Associates' traffic study but also the opinions of the District Department of Transportation (DDOT) and the CATS study commissioned by DDOT.

Traffic Counts

Traffic counts vary from day to day. It is not surprising, therefore, that the Wells & Associates counts and the CATS counts, which were taken on different days, are not the same.

In some cases the CATS counts are higher than the Wells & Associates counts; in other cases the reverse is true. The Wells & Associates' counts of all traffic entering the Connecticut Avenue/Tilden Street intersection are four (4) percent higher in the AM peak hour, and four (4) percent lower in the PM peak hour, than the CATS counts. The Wells & Associates counts are five (5) percent higher in the AM peak hour and nine (9) percent lower in the PM peak hour than the CATS counts at the Connecticut Avenue/Upton Street intersection. Finally, the Wells & Associates counts are three (3) percent lower in the AM peak hour and 28 percent lower in the PM peak hour at the Connecticut Avenue/Van Ness Street intersection.

These differences notwithstanding, the Wells & Associates and CATS studies reach the same conclusions: Connecticut Avenue is congested during commuter peak hours and the proposed EBS expansion will have a "negligible" traffic impact.

Connecticut Avenue Lane Use

Connecticut Avenue operates with four (4) southbound lanes and two (2) northbound lanes during the morning peak period (from 7:00 to 9:30 AM). It operates with four (4) northbound lanes and two (2) southbound lanes during the evening peak period (from 4:00 to 6:30 PM). Three (3) northbound and three (3) southbound lanes are operated at all other times of day.

These configurations were used in the capacity analyses included in the Wells & Associates traffic study, with the exception of the Connecticut Avenue/Upton Street intersection, where three (3) northbound and three (3) southbound lanes were erroneously assumed at all times of day.

Wells & Associates has revised the existing and future capacity analyses to reflect the correct lane use at this intersection. The capacity analysis worksheets are attached to this memorandum.

The revised lane usage has no significant impact on the original findings included in the Wells & Associates traffic study. Through traffic on Connecticut Avenue operates at level of service (LOS) "A" during all times of day. Upton Street, which is controlled by a stop sign at Connecticut Avenue, operates at an acceptable LOS "C" or better during the street and EBS AM peak hour and the EBS PM peak hour. Upton Street operates at capacity during the street PM peak hour. The proposed EBS expansion will have no significant impact on delays, levels of service, or queues on Connecticut Avenue.

Signal Timings

DDOT staff noted several differences between the CATS and Wells & Associates' studies regarding the Connecticut Avenue/Tilden Street and Connecticut Avenue/Van Ness Street intersections in terms of cycle length, clearance interval, and phasing. The Wells & Associates' capacity analyses were revised in accordance with the CATS timings. The revised analyses have no affect on the conclusions or recommendations of the Wells & Associates' study.

EBS Trip Generation Estimates

Mr. Mehra claims that the number of vehicle-trips that are currently generated by EBS are underestimated in Table 4-2 by 13 vehicle-trips (or almost 11 percent). Table 4-2 shows only 86 vehicle-trips instead of 99 vehicle-trips, according to Mr. Mehra. A more careful reading of Table 4-2 shows 86 vehicle-trips generated by parent drivers and another 12 vehicle-trips generated by student drivers, for a total of 98 vehicle-trips. The difference of one (1) vehicle trip (i.e., 99 vs. 98) is attributable to rounding.

The Wells & Associates' trip generation estimates are accurate.

Future Traffic Forecasts

The CATS study includes an exhaustive study of short- and long-term traffic conditions on Connecticut Avenue, including existing traffic, background traffic growth (estimated at one percent per year), and traffic that would be generated by five development projects: (1) The Sheridan School expansion, (2) the EBS expansion, (3) the nine-story, 166-unit residential project at 3883 Connecticut Avenue, (4) the Chinese Embassy in the International Chancery Center (ICC), and (5) the Moroccan Embassy in the ICC.

The Wells & Associates study did not attempt to replicate the CATS study. Rather, it focuses on the traffic impacts of the EBS expansion, physical plan, and TMP.

Transportation Management Plan

Spreading of Traffic. Spreading traffic over a connected street network is a fundamental principle of good traffic planning. The current voluntary TMP permits drop-offs at approved locations on Connecticut Avenue, Tilden Street, and Van Ness Street, west of Connecticut Avenue. This TMP has significantly reduced the traffic volume and congestion on Upton Street and the public alley adjacent to the school.

These off-site drop-off locations do not impede traffic flow or endanger students. For example, the District of Columbia Metropolitan Police conducted a study in mid-September of EBS drop-off activity on Van Ness Street, west of Connecticut Avenue, and determined that "the current drop off location and procedures utilized by the Edmund Burke School, has no negative effect on the flow of traffic, or student safety".

Risks of Walking. The approved drop-off locations are within acceptable walking distances of the school. Students can cross Connecticut Avenue below grade at the Van Ness Metro station. Students can safely cross Connecticut Avenue at grade at intersecting streets at signalized intersections that are equipped with pedestrian signals and marked crosswalks.

Traffic on Upton Street. The proposed physical plan and TMP would reduce traffic in the westbound direction, and increase traffic in the eastbound direction, resulting in no net change in traffic on Upton Street, east of the school. The TMP, however, removes drop-off and pick-up activity from Upton Street. The TMP, for the first time, provides an on-site, off-street pick-up/drop-off area. The proposed TMP will, therefore, significantly improve traffic conditions on Upton Street.

Use of Upton-Tilden Alley. EBS traffic will not be permitted to use the Upton Street-Tilden Street alley.

Van Ness-Upton Alley/EBS Driveway/Upton Street Intersection. This intersection will function safely and efficiently. DDOT concurs in this opinion. According to the DDOT report on this BZA application, "DDOT engineers have reviewed the plans for the drop-off lane exit on Upton Street and its proximity to the alley exit, and feel that the queue line was properly designed and will be a safe situation, especially with uniformed police present to help direct traffic.

Connecticut Avenue Driveway. Several driveways on Connecticut Avenue operate safely and efficiently, without adversely affecting northbound Connecticut Avenue traffic. These include the driveways to two (2) commercial parking garages in the 4200 block of Connecticut Avenue, The Park Connecticut residential driveway, and the Van Ness Square retail driveway.

EBS parents/guardians approaching EBS from the north can easily and safely drop students off at the Van Ness Metro kiss-and-ride/UDC drop-off point or on the north side of Van Ness Street west of Connecticut Avenue. They need not make the turns described by Mr. Mehra.

EBS Shuttle Bus. The EBS shuttle bus stop on Shoemaker Street is a remote drop-off location that effectively intercepts traffic, particularly for students who reside east of Rock Creek Park. It reduces traffic on Tilden Street, Upton Street, and Connecticut Avenue. Shuttle bus ridership has increased from 17 passengers according to the January 14, 2003 student survey, to an average of 31 passengers between September 12 and October 3 as measured by school staff, to 40 passengers on October 8 as measured by Wells & Associates.

EBS Trip Generation

Mr. Mehra claims that 270 students and 35 faculty, without a TMP, will generate less traffic than 320 students and 70 faculty with the proposed TMP. Mr. Mehra offers no analysis to support this claim.

His logic appears to rest on the contention that a TMP cannot reduce the number of trips that would be generated by 390 persons (i.e., 320 + 70 = 390) to a number at or below the trips that would be generated by 305 persons (i.e., 270 + 35 = 305). Or, in other terms, 390 (or 85 more) students will always generate more trips than 305 students.

Without the TMP, however, EBS would not be obligated to offer a Metro benefit or shuttle bus service. A total of 157 students received the Metro benefit in the first trimester of 2003-2004. Current shuttle bus ridership is around 40 students. Clearly, with 197 students participating in these programs, Mr. Mehra's claim is groundless.

Summary

Again, we reaffirm that:

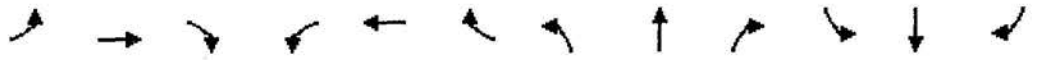
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5. Two-hundred-seventy (270) students and 35 faculty, without a TMP, will generate more traffic than 320 students and 70 faculty with the proposed TMP.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00	1.00		1.00			0.95			0.86	
Frpb, ped/bikes	1.00	1.00	0.92		0.99			0.97			0.98	
Flpb, ped/bikes	0.96	1.00	1.00		0.96			1.00			1.00	
Frt	1.00	1.00	0.85		0.98			0.99			0.99	
Flt Protected	0.95	1.00	1.00		0.97			0.99			1.00	
Satd. Flow (prot)	1692	1863	1449		1682			3387			6184	
Flt Permitted	0.67	1.00	1.00		0.82			0.49			0.90	
Satd. Flow (perm)	1187	1863	1449		1422			1678			5561	
Volume (vph)	116	29	85	73	35	20	128	814	52	36	2567	211
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	122	31	89	77	37	21	135	857	55	38	2702	222
Lane Group Flow (vph)	122	31	89	0	135	0	0	1047	0	0	2962	0
Confl. Peds. (#/hr)	37		44	44		37	98		264	264		98
Turn Type	Perm		Perm	Perm			Perm			Perm		
Protected Phases		2			6			4 7			8	
Permitted Phases	2		2	6			4 7			8		
Actuated Green, G (s)	22.0	22.0	22.0		22.0			56.0			42.0	
Effective Green, g (s)	24.0	24.0	24.0		24.0			58.0			44.0	
Actuated g/C Ratio	0.27	0.27	0.27		0.27			0.64			0.49	
Clearance Time (s)	6.0	6.0	6.0		6.0						6.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0						3.0	
Lane Grp Cap (vph)	317	497	386		379			1081			2719	
v/s Ratio Prot		0.02										
v/s Ratio Perm	c0.10		0.06		0.09			c0.62			c0.53	
v/c Ratio	0.38	0.06	0.23		0.36			1.55dl			1.09	
Uniform Delay, d1	27.0	24.6	25.8		26.7			15.1			23.0	
Progression Factor	1.00	1.00	1.00		1.00			2.02			1.00	
Incremental Delay, d2	3.5	0.2	1.4		2.6			13.9			47.1	
Delay (s)	30.5	24.9	27.2		29.3			44.5			70.1	
Level of Service	C	C	C		C			D			E	
Approach Delay (s)		28.5			29.3			44.5			70.1	
Approach LOS		C			C			D			E	

Intersection Summary			
HCM Average Control Delay	60.4	HCM Level of Service	E
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	98.3%	ICU Level of Service	E

dl Defacto Left Lane. Recode with 1 though lane as a left lane.
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00	1.00		1.00			0.95			0.86	
Frpb, ped/bikes	1.00	1.00	0.90		0.99			0.98			0.97	
Flpb, ped/bikes	0.97	1.00	1.00		0.96			1.00			1.00	
Frt	1.00	1.00	0.85		0.98			0.99			0.99	
Flt Protected	0.95	1.00	1.00		0.98			1.00			1.00	
Satd. Flow (prot)	1715	1863	1431		1687			3448			6147	
Flt Permitted	0.66	1.00	1.00		0.85			0.56			0.92	
Satd. Flow (perm)	1186	1863	1431		1467			1924			5635	
Volume (vph)	90	32	84	62	43	23	69	692	28	25	2253	196
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	95	34	88	65	45	24	73	728	29	26	2372	206
Lane Group Flow (vph)	95	34	88	0	134	0	0	830	0	0	2604	0
Confl. Peds. (#/hr)	26		51	51		26	118		161	161		118
Turn Type	Perm		Perm	Perm			Perm			Perm		
Protected Phases		2			6			4 7			8	
Permitted Phases	2		2	6			4 7			8		
Actuated Green, G (s)	22.0	22.0	22.0		22.0			56.0			42.0	
Effective Green, g (s)	24.0	24.0	24.0		24.0			58.0			44.0	
Actuated g/C Ratio	0.27	0.27	0.27		0.27			0.64			0.49	
Clearance Time (s)	6.0	6.0	6.0		6.0						6.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0						3.0	
Lane Grp Cap (vph)	316	497	382		391			1240			2755	
v/s Ratio Prot		0.02										
v/s Ratio Perm	0.08		0.06		c0.09			c0.43			c0.46	
v/c Ratio	0.30	0.07	0.23		0.34			0.67			0.95	
Uniform Delay, d1	26.3	24.6	25.8		26.6			10.0			21.9	
Progression Factor	1.00	1.00	1.00		1.00			1.91			1.00	
Incremental Delay, d2	2.4	0.3	1.4		2.4			0.9			7.8	
Delay (s)	28.7	24.9	27.2		29.0			20.0			29.6	
Level of Service	C	C	C		C			C			C	
Approach Delay (s)		27.5			29.0			20.0			29.6	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	27.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	86.7%	ICU Level of Service	D

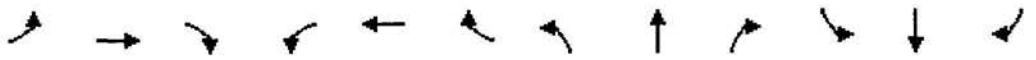
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00	1.00		1.00			0.86			0.95	
Frpb, ped/bikes	1.00	1.00	0.92		0.99			0.97			0.95	
Flpb, ped/bikes	0.99	1.00	1.00		0.98			1.00			1.00	
Frt	1.00	1.00	0.85		0.95			0.99			0.98	
Flt Protected	0.95	1.00	1.00		0.98			0.99			1.00	
Satd. Flow (prot)	1747	1863	1460		1681			6127			3273	
Flt Permitted	0.67	1.00	1.00		0.90			0.71			0.90	
Satd. Flow (perm)	1233	1863	1460		1534			4360			2946	
Volume (vph)	207	26	200	41	30	41	206	1628	137	10	812	143
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	218	27	211	43	32	43	217	1714	144	11	855	151
Lane Group Flow (vph)	218	27	211	0	118	0	0	2075	0	0	1017	0
Confl. Peds. (#/hr)	10		40	40		10	123		143	143		123
Turn Type	Perm		Perm	Perm			Perm			Perm		
Protected Phases		2			6			4 7			8	
Permitted Phases	2		2	6			4 7			8		
Actuated Green, G (s)	23.0	23.0	23.0		23.0			55.0			38.0	
Effective Green, g (s)	25.0	25.0	25.0		25.0			57.0			40.0	
Actuated g/C Ratio	0.28	0.28	0.28		0.28			0.63			0.44	
Clearance Time (s)	6.0	6.0	6.0		6.0						6.0	
Lane Grp Cap (vph)	343	518	406		426			2761			1309	
v/s Ratio Prot		0.01										
v/s Ratio Perm	c0.18		0.14		0.08			c0.48			0.35	
v/c Ratio	0.64	0.05	0.52		0.28			1.50dl			0.78	
Uniform Delay, d1	28.5	23.8	27.4		25.4			11.5			21.2	
Progression Factor	1.00	1.00	1.00		1.00			2.26			1.00	
Incremental Delay, d2	8.7	0.2	4.7		1.6			1.6			4.6	
Delay (s)	37.2	24.0	32.1		27.0			27.7			25.8	
Level of Service	D	C	C		C			C			C	
Approach Delay (s)		34.1			27.0			27.7			25.8	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	27.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	89.5%	ICU Level of Service	D

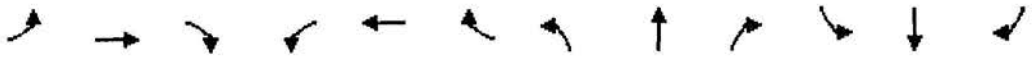
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c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00	1.00		1.00			0.86			0.95	
Frpb, ped/bikes	1.00	1.00	0.96		0.98			0.97			0.98	
Flpb, ped/bikes	0.96	1.00	1.00		0.99			1.00			1.00	
Frt	1.00	1.00	0.85		0.96			0.99			0.97	
Flt Protected	0.95	1.00	1.00		0.98			0.99			1.00	
Satd. Flow (prot)	1704	1863	1515		1697			6111			3366	
Flt Permitted	0.65	1.00	1.00		0.88			0.71			0.91	
Satd. Flow (perm)	1165	1863	1515		1525			4366			3080	
Volume (vph)	180	53	168	47	40	40	189	1046	85	12	628	143
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	189	56	177	49	42	42	199	1101	89	13	661	151
Lane Group Flow (vph)	189	56	177	0	133	0	0	1389	0	0	825	0
Confl. Peds. (#/hr)	31		19	19		31	33		164	164		33
Turn Type	Perm		Perm	Perm			Perm			Perm		
Protected Phases		2			6			4 7			8	
Permitted Phases	2		2	6			4 7			8		
Actuated Green, G (s)	23.0	23.0	23.0		23.0			55.0			38.0	
Effective Green, g (s)	25.0	25.0	25.0		25.0			57.0			40.0	
Actuated g/C Ratio	0.28	0.28	0.28		0.28			0.63			0.44	
Clearance Time (s)	6.0	6.0	6.0		6.0						6.0	
Lane Grp Cap (vph)	324	518	421		424			2765			1369	
v/s Ratio Prot		0.03										
v/s Ratio Perm	c0.16		0.12		0.09			c0.32			c0.27	
v/c Ratio	0.58	0.11	0.42		0.31			0.95dl			0.60	
Uniform Delay, d1	28.0	24.2	26.6		25.7			8.9			19.0	
Progression Factor	1.00	1.00	1.00		1.00			1.80			1.00	
Incremental Delay, d2	7.5	0.4	3.1		1.9			0.6			2.0	
Delay (s)	35.5	24.6	29.6		27.6			16.5			20.9	
Level of Service	D	C	C		C			B			C	
Approach Delay (s)		31.6			27.6			16.5			20.9	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM Average Control Delay	20.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.59		
Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	72.1%	ICU Level of Service	C

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c Critical Lane Group

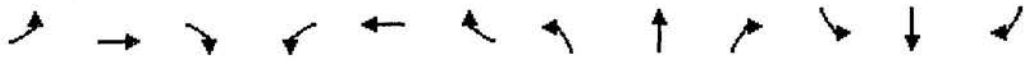


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.86	
Frpb, ped/bikes		1.00			0.98			1.00			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		1.00			0.96			0.99			1.00	
Flt Protected		0.99			0.99			1.00			1.00	
Satd. Flow (prot)		1852			1741			3495			6373	
Flt Permitted		0.78			0.86			1.00			0.73	
Satd. Flow (perm)		1461			1510			3495			4676	
Volume (vph)	24	181	0	96	360	204	0	707	39	112	2549	36
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	25	191	0	101	379	215	0	744	41	118	2683	38
Lane Group Flow (vph)	0	216	0	0	695	0	0	785	0	0	2839	0
Confl. Peds. (#/hr)	26		5	5		26	28		48	48		28
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			1 6	
Permitted Phases	4			8			2			1 6		
Actuated Green, G (s)		23.0			23.0			28.0			55.0	
Effective Green, g (s)		25.0			25.0			30.0			57.0	
Actuated g/C Ratio		0.28			0.28			0.33			0.63	
Clearance Time (s)		6.0			6.0			6.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		406			419			1165			2961	
v/s Ratio Prot								0.22				
v/s Ratio Perm		0.15			c0.46						c0.61	
v/c Ratio		0.53			1.66			0.67			0.98dl	
Uniform Delay, d1		27.5			32.5			25.8			15.4	
Progression Factor		1.00			1.00			1.00			2.00	
Incremental Delay, d2		1.3			306.9			3.1			1.1	
Delay (s)		28.9			339.4			28.9			31.9	
Level of Service		C			F			C			C	
Approach Delay (s)		28.9			339.4			28.9			31.9	
Approach LOS		C			F			C			C	

Intersection Summary			
HCM Average Control Delay	78.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	127.8%	ICU Level of Service	H

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

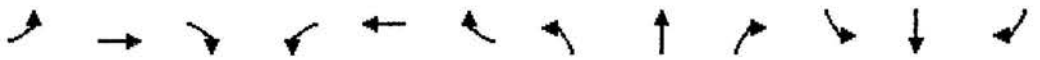
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.86	
Frpb, ped/bikes		1.00			0.98			1.00			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.98			0.96			0.99			1.00	
Flt Protected		0.99			0.99			1.00			1.00	
Satd. Flow (prot)		1813			1741			3493			6382	
Flt Permitted		0.84			0.94			0.82			0.79	
Satd. Flow (perm)		1536			1644			2880			5038	
Volume (vph)	18	108	19	65	282	157	12	584	30	67	2281	23
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	19	114	20	68	297	165	13	615	32	71	2401	24
Lane Group Flow (vph)	0	153	0	0	530	0	0	660	0	0	2496	0
Confl. Peds. (#/hr)	26		6	6		26	35		51	51		35
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			1 6	
Permitted Phases	4			8			2			1 6		
Actuated Green, G (s)		23.0			23.0			28.0			55.0	
Effective Green, g (s)		25.0			25.0			30.0			57.0	
Actuated g/C Ratio		0.28			0.28			0.33			0.63	
Clearance Time (s)		6.0			6.0			6.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		427			457			960			3191	
v/s Ratio Prot												
v/s Ratio Perm		0.10			c0.32			0.23			c0.50	
v/c Ratio		0.36			1.16			0.69			0.78	
Uniform Delay, d1		26.1			32.5			25.9			12.0	
Progression Factor		1.00			1.00			1.00			2.09	
Incremental Delay, d2		0.5			93.8			4.0			0.6	
Delay (s)		26.6			126.3			30.0			25.6	
Level of Service		C			F			C			C	
Approach Delay (s)		26.6			126.3			30.0			25.6	
Approach LOS		C			F			C			C	

Intersection Summary			
HCM Average Control Delay	40.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	107.7%	ICU Level of Service	F

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.86			0.95	
Frpb, ped/bikes		1.00			0.99			1.00			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		1.00			0.94			1.00			0.99	
Flt Protected		0.99			0.99			1.00			0.99	
Satd. Flow (prot)		1853			1724			6360			3484	
Flt Permitted		0.85			0.92			1.00			0.50	
Satd. Flow (perm)		1584			1595			6360			1739	
Volume (vph)	24	205	0	51	225	196	0	1693	55	141	852	50
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	25	216	0	54	237	206	0	1782	58	148	897	53
Lane Group Flow (vph)	0	241	0	0	497	0	0	1840	0	0	1098	0
Confl. Peds. (#/hr)	14					14	17		46	46		17
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			1 6	
Permitted Phases	4			8			2			1 6		
Actuated Green, G (s)		23.0			23.0			44.0			55.0	
Effective Green, g (s)		25.0			25.0			46.0			57.0	
Actuated g/C Ratio		0.28			0.28			0.51			0.63	
Clearance Time (s)		6.0			6.0			6.0				
Lane Grp Cap (vph)		440			443			3251			1101	
v/s Ratio Prot								0.29				
v/s Ratio Perm		0.15			c0.31						c0.63	
v/c Ratio		0.55			1.12			0.57			1.72dl	
Uniform Delay, d1		27.7			32.5			15.1			16.4	
Progression Factor		1.00			1.00			1.00			1.27	
Incremental Delay, d2		4.8			80.4			0.7			22.7	
Delay (s)		32.5			112.9			15.9			43.6	
Level of Service		C			F			B			D	
Approach Delay (s)		32.5			112.9			15.9			43.6	
Approach LOS		C			F			B			D	

Intersection Summary			
HCM Average Control Delay	38.3	HCM Level of Service	D
HCM Volume to Capacity ratio	1.03		
Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	112.5%	ICU Level of Service	G

dl Defacto Left Lane. Recode with 1 though lane as a left lane.
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.86			0.95	
Frpb, ped/bikes		1.00			0.98			1.00			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.94			1.00			1.00	
Flt Protected		1.00			0.99			1.00			1.00	
Satd. Flow (prot)		1843			1712			6358			3508	
Flt Permitted		0.93			0.88			0.92			0.66	
Satd. Flow (perm)		1724			1524			5833			2324	
Volume (vph)	16	218	11	57	191	191	14	1054	29	82	721	18
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	17	229	12	60	201	201	15	1109	31	86	759	19
Lane Group Flow (vph)	0	258	0	0	462	0	0	1155	0	0	864	0
Confl. Peds. (#/hr)	16		4	4		16	14		56	56		14
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			1 6	
Permitted Phases	4			8			2			1 6		
Actuated Green, G (s)		23.0			23.0			44.0			55.0	
Effective Green, g (s)		25.0			25.0			46.0			57.0	
Actuated g/C Ratio		0.28			0.28			0.51			0.63	
Clearance Time (s)		6.0			6.0			6.0				
Lane Grp Cap (vph)		479			423			2981			1472	
v/s Ratio Prot												
v/s Ratio Perm		0.15			c0.30			0.20			c0.37	
v/c Ratio		0.54			1.09			0.39			0.59	
Uniform Delay, d1		27.6			32.5			13.4			9.6	
Progression Factor		1.00			1.00			1.00			0.53	
Incremental Delay, d2		4.3			71.0			0.4			1.5	
Delay (s)		31.9			103.5			13.8			6.6	
Level of Service		C			F			B			A	
Approach Delay (s)		31.9			103.5			13.8			6.6	
Approach LOS		C			F			B			A	

Intersection Summary			
HCM Average Control Delay	28.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	95.0%	ICU Level of Service	E

c Critical Lane Group



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	7	78	916	19	36	2689
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (veh/h)	7	82	964	20	38	2831
Pedestrians	57		3			
Lane Width (ft)	12.0		12.0			
Walking Speed (ft/s)	4.0		4.0			
Percent Blockage	5		0			
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)			605			503
pX, platoon unblocked	0.56					
vC, conflicting volume	1818	549			1041	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	122	549			1041	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	82			94	
cM capacity (veh/h)	432	457			632	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3	SB 4
Volume Total	89	643	341	442	809	809	809
Volume Left	7	0	0	38	0	0	0
Volume Right	82	0	20	0	0	0	0
cSH	455	1700	1700	632	1700	1700	1700
Volume to Capacity	0.20	0.38	0.20	0.06	0.48	0.48	0.48
Queue Length (ft)	18	0	0	5	0	0	0
Control Delay (s)	14.8	0.0	0.0	1.7	0.0	0.0	0.0
Lane LOS	B			A			
Approach Delay (s)	14.8	0.0		0.3			
Approach LOS	B						

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	60.9%	ICU Level of Service	B



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	8	49	740	19	36	2363
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (veh/h)	8	52	779	20	38	2487
Pedestrians	46		1			
Lane Width (ft)	12.0		12.0			
Walking Speed (ft/s)	4.0		4.0			
Percent Blockage	4		0			
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)			605			503
pX, platoon unblocked	0.65					
vC, conflicting volume	1534	445			845	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	219	445			845	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	90			95	
cM capacity (veh/h)	446	539			757	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3	SB 4
Volume Total	60	519	280	393	711	711	711
Volume Left	8	0	0	38	0	0	0
Volume Right	52	0	20	0	0	0	0
cSH	524	1700	1700	757	1700	1700	1700
Volume to Capacity	0.11	0.31	0.16	0.05	0.42	0.42	0.42
Queue Length (ft)	10	0	0	4	0	0	0
Control Delay (s)	12.8	0.0	0.0	1.5	0.0	0.0	0.0
Lane LOS	B			A			
Approach Delay (s)	12.8	0.0		0.2			
Approach LOS	B						

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	53.1%	ICU Level of Service	A



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	6	83	1888	25	16	1037
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (veh/h)	6	87	1987	26	17	1092
Pedestrians	56					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	5					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)			605			503
pX, platoon unblocked	0.79					
vC, conflicting volume	2636	566			2070	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2807	566			2070	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	38	80			93	
cM capacity (veh/h)	10	446			253	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	94	568	568	568	310	381	728
Volume Left	6	0	0	0	0	17	0
Volume Right	87	0	0	0	26	0	0
cSH	114	1700	1700	1700	1700	253	1700
Volume to Capacity	0.82	0.33	0.33	0.33	0.18	0.07	0.43
Queue Length (ft)	119	0	0	0	0	5	0
Control Delay (s)	110.8	0.0	0.0	0.0	0.0	2.5	0.0
Lane LOS	F					A	
Approach Delay (s)	110.8	0.0				0.9	
Approach LOS	F						

Intersection Summary			
Average Delay	3.5		
Intersection Capacity Utilization	47.5%	ICU Level of Service	A



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	5	84	1236	25	27	816
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (veh/h)	5	88	1301	26	28	859
Pedestrians	49		4			2
Lane Width (ft)	12.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	4		0			0
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)			605			503
pX, platoon unblocked	0.87					
vC, conflicting volume	1854	389			1376	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1831	389			1376	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	90	85			94	
cM capacity (veh/h)	53	583			474	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	94	372	372	372	212	315	573
Volume Left	5	0	0	0	0	28	0
Volume Right	88	0	0	0	26	0	0
cSH	373	1700	1700	1700	1700	474	1700
Volume to Capacity	0.25	0.22	0.22	0.22	0.12	0.06	0.34
Queue Length (ft)	24	0	0	0	0	5	0
Control Delay (s)	17.9	0.0	0.0	0.0	0.0	2.0	0.0
Lane LOS	C					A	
Approach Delay (s)	17.9	0.0				0.7	
Approach LOS	C						

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	44.2%	ICU Level of Service	A