FEHR PEERS

MEMORANDUM

Date: July 11, 2019

To: Lisa T. Lu, Stanford

From: Ellen Poling, Fehr & Peers

Subject: Intersection Operations Evaluation for the Proposed Office Building at 3215 Porter Drive

WC18-3546.00

Project Description and Analysis Overview

This memorandum describes the analysis of a proposed 21,933 square foot office building at 3215 Porter Drive in the Stanford Research Park. The project site is located northwest of Porter Drive/Hanover Street, at the intersection with Hillview Avenue. The project would take access from the driveway opposite Hillview Avenue. The Project would provide 70 vehicle parking spaces in a surface lot and underground structure, as well as storage for 50 bicycles (40 short-term spaces and 10 spaces in lockers in the garage). The site plan includes a proposed pedestrian path (or future two-way cycle track) along the north edge of the property, to facilitate movements to and from sites to the west and to form an eventual high-quality bicycle connection between Porter Drive and Page Mill Road. The intersection of Porter Drive/Hanover Street/Hillview Avenue will be modified to accommodate the new pedestrian path, to have crosswalks across all four legs of the intersection, and to accommodate bus movements to and from the site, including larger curb radii and associated signal modifications.

This memorandum provides an assessment of the intersection operations with the addition of the project and associated intersection improvements. The analysis does not extend to off-site intersections. Based on City of Palo Alto practice, which follows VTA guidelines, external intersections to which the project would add more than 10 trips per lane may require a traffic analysis; none of the nearby intersections on routes to and from the site would meet this threshold.

The remainder of this memorandum includes the following sections:

- Existing Conditions
- Intersection Evaluation
- Summary of Findings

Existing Conditions

Local Roadways

The following roadways adjoin the Project site:

- *Hillview Avenue* is a two-lane east-west commercial collector connecting Porter Drive/Hanover Street to Foothill Expressway and Arastradero Road
- *Hanover Street* is a two-lane north-south commercial collector connecting Porter Drive to Page Mill Road
- *Porter Drive* is a two-lane north-south commercial collector connecting Page Mill Road to Hanover Street

Fehr & Peers collected turning movement counts at the intersection of Porter Drive/Hanover Street/Hillview Avenue during the morning (7:00 – 9:00 AM) and afternoon (4:00 – 6:00 PM) peak periods on May 5, 2018. The count sheets and peak hour volume summaries are included in **Attachment A**.

Pedestrian Facilities

In the vicinity of the site, sidewalks are currently provided along the east side of Porter Drive and Hanover Street and on both sides of Hillview Avenue. New sidewalks on the west side of Porter Drive are being added as part of the 3181 Porter Drive construction adjacent to the project site. At the intersection of Hillview Avenue and Hanover Street/Porter Drive, crosswalks are provided on the eastern (Hillview Avenue) and southern (Porter Drive) approaches. There is no crosswalk provided on the northern approach to the intersection.

The Hillview Avenue and Hanover Street/Porter Drive intersection is a signalized intersection with split phases on Hanover Street and Porter Drive and permissive phasing on Hillview Avenue and the driveway. Current crosswalks at the intersection are activated with pedestrian push buttons.

Bicycle Facilities

Bikeway planning and design in California relies on guidelines and design standards established by California Department of Transportation (Caltrans) in the Highway Design Manual Chapter 1000:

Bikeway Planning and Design. Caltrans provides for four distinct types of bikeway facilities, as described below and shown in the accompanying figures.

- *Class I Bikeways (Shared-Use Paths)* provide a completely separate right-of-way and are designated for the exclusive use of bicycles and pedestrians, with vehicle and pedestrian cross-flow minimized. In general, bike paths serve corridors where on-street facilities are not feasible or where sufficient right-of-way exists to allow them to be constructed.
- *Class II Bikeways (Bicycle Lanes)* are dedicated lanes for bicyclists generally adjacent to the outer vehicle travel lanes. These lanes have special lane markings, pavement legends, and signage. Bicycle lanes are typically five (5) feet wide. Adjacent vehicle parking and vehicle/pedestrian cross-flow are permitted.
- *Class III Bikeways (Bicycle Routes)* are designated by signs or pavement markings for shared use with pedestrians or motor vehicles but have no separated bike right-of-way or lane striping. Bike routes serve either to: a) provide a connection to other bicycle facilities where dedicated facilities are infeasible, or b) designate preferred routes through high-demand corridors.
- *Class IV Bikeways (cycle tracks or "separated" bikeways)* provide a right-of-way designated exclusively for bicycle travel within a roadway and are protected from other vehicle traffic by physical barriers, including, but not limited to, grade separation, flexible posts, inflexible vertical barriers such as raised curbs, or parked cars.

The existing bicycle facilities along Hillview Avenue, Hanover Street, and Porter Drive in the vicinity of the project are all Class II bikeways (bicycle lanes).

Intersection operations for the existing condition are presented in the Intersection Evaluation section below.

Intersection Evaluation

Intersection Improvements

Fehr & Peers analyzed intersection operations with the proposed intersection improvements shown in **Figure 1** (attached at the end of this memo). The improvements consist of the following:

- New crosswalks across Hanover Street and the Project driveway.
- A revised crosswalk across Porter Drive connecting to the project site south of the new driveway
- A pedestrian path along the north side of the Project driveway.
- Signal timing changes to serve the new driveway.

Project Trip Generation, Distribution and Assignment

The peak hour trip generation was estimated using the trip generation rates in ITE's *Trip Generation, 10th Edition*. The rates for Use #710, General Office Building, were used. As shown in **Table 1**, the estimated trip generation is 48 trips in the AM peak hour and in 27 trips in the PM peak hour. Project trips were evenly distributed between the three approaches - Hillview Avenue, Hanover Street, and Porter Drive. With the addition of the project, it was assumed that bicycle trips to and from the site may increase; therefore, bicycle trips were estimated at 30 trips entering and 30 trips exiting the Project site during each peak hour, evenly distributed between Hillview Avenue, Hanover Street and Porter Drive. Increased pedestrian activity was also incorporated into the intersection analysis, by assuming pedestrian calls would be made on all crosswalks on each signal cycle.

Table 1: Project Trip Generation

Use (Amount)	AM Peak Hour			PM Peak Hour			Daily
	In	Out	Total	In	Out	Total	
Office Building (22 KSF)	42	6	48	5	22	27	239

Trip rate formulas:
AM Peak Hour Trips = 0.94*(KSF)+26.49; 86% inbound/14% outbound
PM peak hour trips = $e^{(0.95*Ln(KSF)+0.36)}$; 16% inbound/84% outbound
Daily trips = $e^{(0.97*Ln(KSF)+2.5)}$; 50% inbound/50% outbound

Figure 2 presents the vehicle and bicycle turning movements and pedestrian crossings for the Existing and Existing With Project cases.

Intersection Operations Analysis

The operational performance of a roadway network is commonly described with the term "level of service" (LOS). LOS is a qualitative description of operating conditions, ranging from LOS A (free-flow traffic conditions with little or no delay) to LOS F (oversaturated conditions where traffic flows exceed design capacity, resulting in long queues and delays). The LOS is related to control delay, which incorporates delay associated with deceleration, stopping, acceleration, and moving up in the queue. The LOS analysis methods outlined in Chapter 17 of the 2000/2010Highway Capacity Manual (HCM) were used in this study. This methodology incorporates characteristics such as the signal timing plan, the effects of pedestrians on signal phase duration, traffic volume peaking characteristics, motorist behavioral characteristics, and others. The HCM is considered the state-of-the-art methodology for assessing intersection operations and defining impacts, and allows for the accurate definition of mitigation measures, such as lengthening or adding turning lanes, modifying

the signal phasing or timing, and other options. The Synchro Version 10 analysis program was used to perform the HCM analysis. HCM 2000 settings were used because Synchro's application of the 2010 settings is incompatible with the NEMA phasing plan with which the Hillview/Hanover/Porter signal operates.

LOS D or better is considered acceptable in the City of Palo Alto.

For the Existing Conditions analysis, the peak hour vehicle, bicycle and pedestrian volumes based on the counts were included in the analysis, along with the current signal timing plan.

For the Existing With Project analysis, in addition to the vehicle and bicycle trip assumptions described above, pedestrian calls were assumed to occur on each cycle, to ensure a conservative analysis. Intersection LOS results for the study intersection are presented in **Table 2**. Detailed Synchro results are included in **Attachment B**.

Table 2: Intersection Operations

Intersection	Control	Peak Hour	Existing		Existing With Project	
			Delay (seconds)	LOS	Delay (seconds)	LOS
Porter Drive/Hanover Street/Hillview Avenue	Signal	AM PM	8.9 10.5	A B	22.9 23.5	C C

Source: Fehr & Peers, July 2019

The study intersection currently operates at LOS A in the AM peak hour and B in the PM peak hour. Under Existing With Project conditions, the intersection is projected to operate at LOS C in both peak hours. These results flow from the additional turning movements to and from the project driveway and the additional time allocated to the higher number of pedestrian and bicycle crossings assumed with the project.

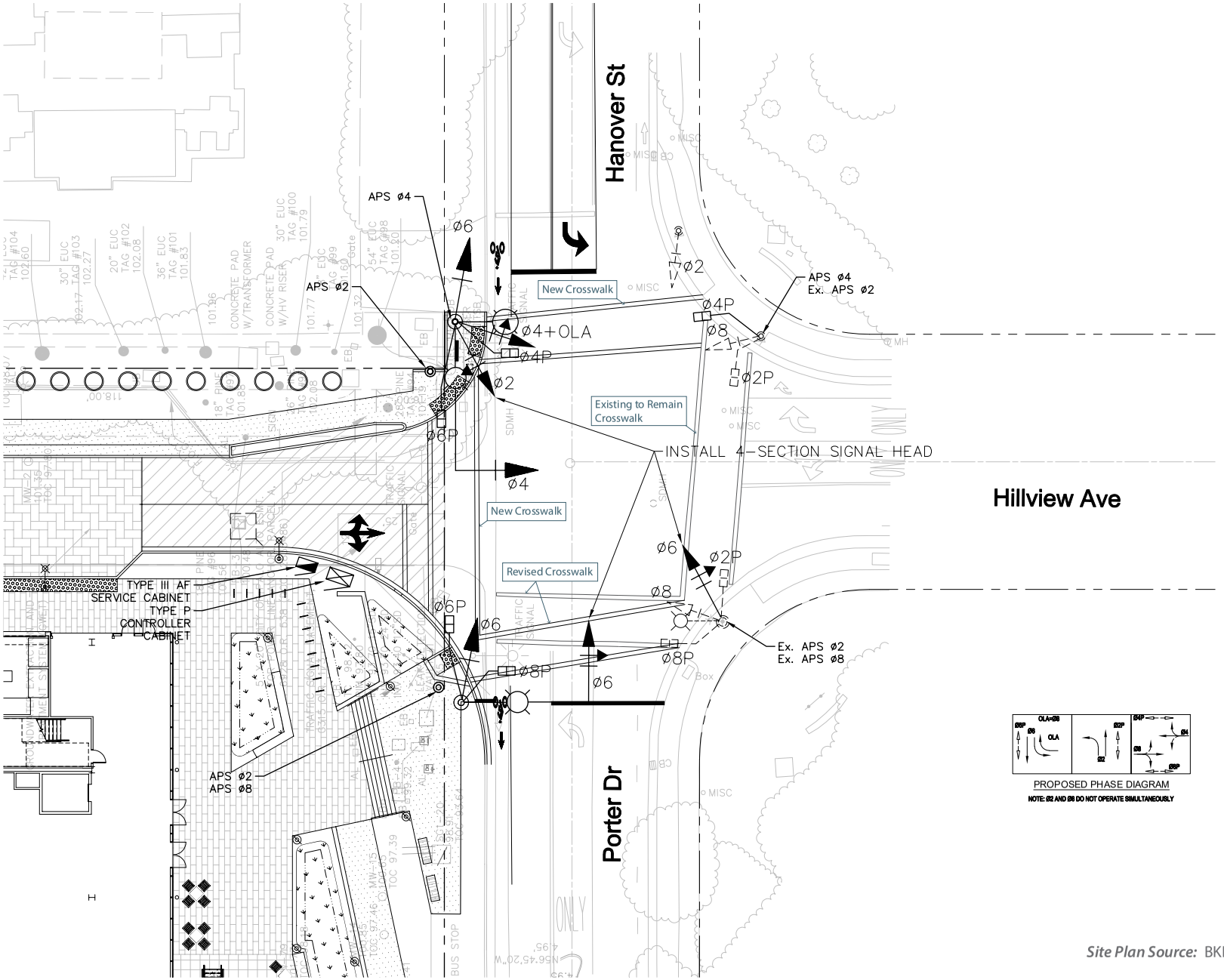
Summary of Findings

The Project will improve the Porter Drive/Hanover Street/Hillview Avenue intersection, providing a pedestrian path along the north property edge, crosswalks across all four intersection legs, and modifications to accommodate bus movements to and from the site. The intersection is projected to operate at LOS C in the AM and PM peak hours.

Please call Ellen Poling at (925) 930-7100 if you have any questions.

Attachments:

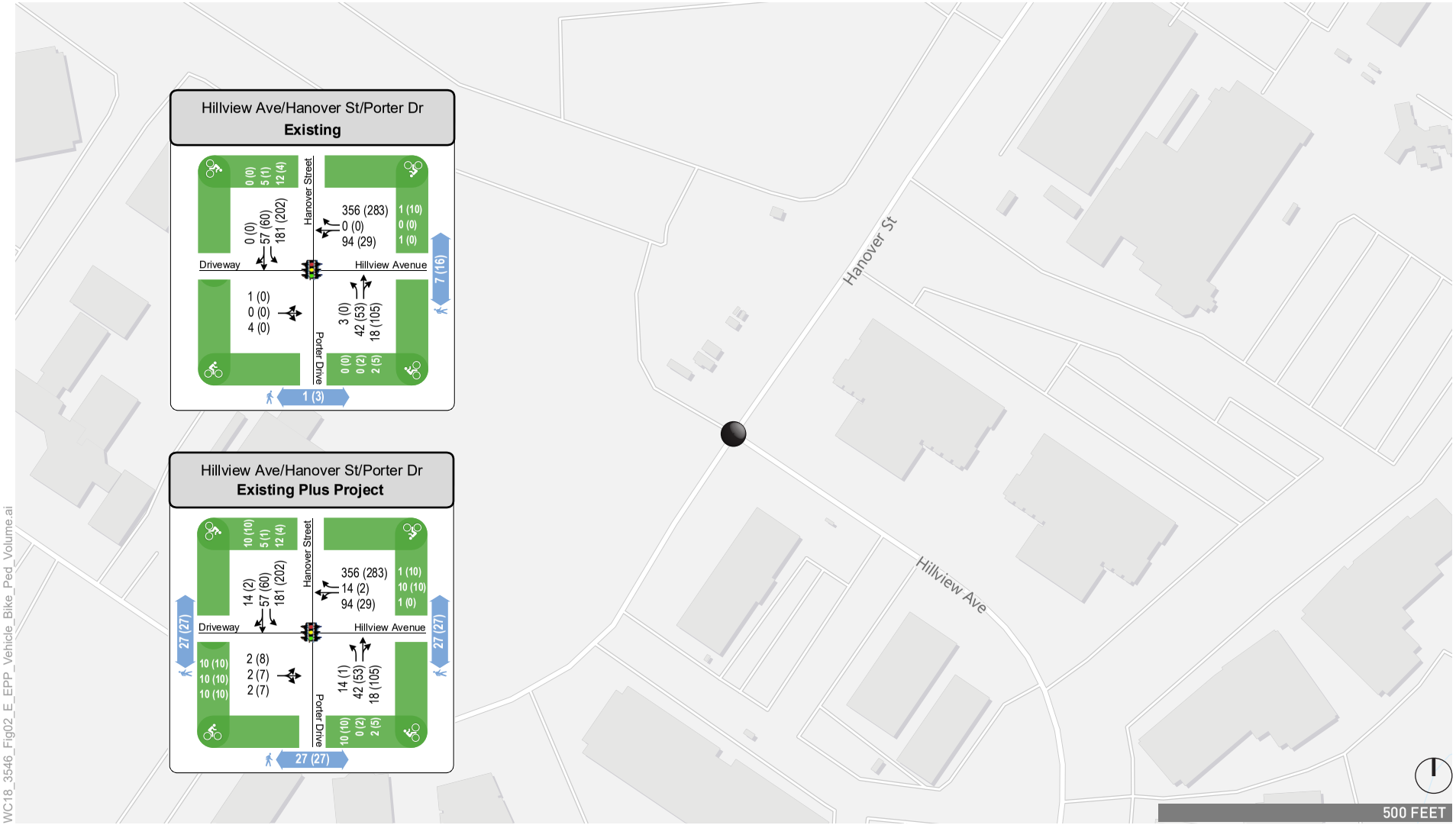
A - Peak Period Tuning Movement Counts
B - Intersection LOS Calculations



Site Plan Source: BKF, July 8, 2019.

Figure 1

Traffic Signal Improvement Plan



Study Intersection

X (Y) AM (PM) Peak Hour Vehicle Volumes

X (Y) AM (PM) Peak Hour Pedestrian Volumes

X (Y) AM (PM) Peak Hour Bicycle Volumes

Figure 2

Existing and Existing Plus Project Peak Hour Vehicle, Bicycle, and Pedestrian Volumes

Hillview - Hanover - Porter Intersection

Attachment A

Peak Period Turning Movement Counts

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Groups Printed- Lights - Buses - Trucks

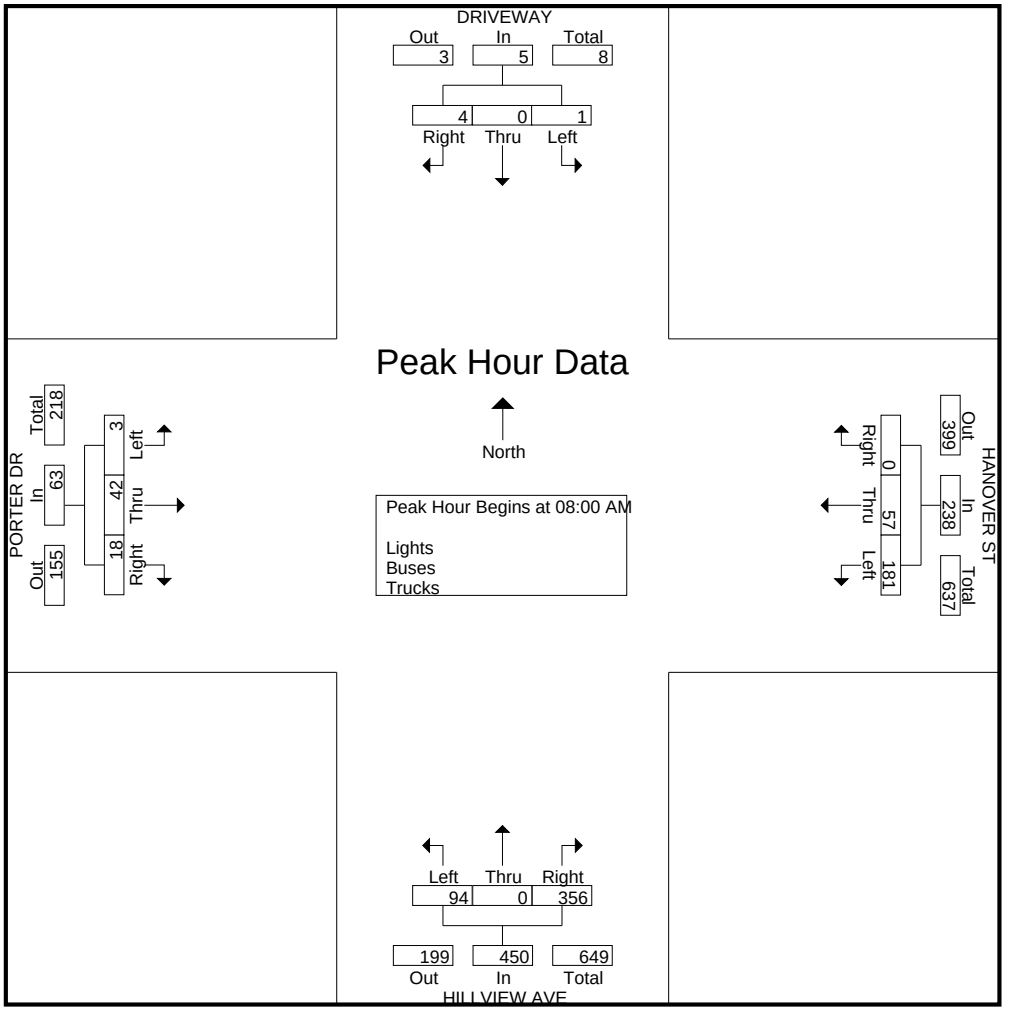
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Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	1	1	28	0	30	20	0	4	4	28	3	10	5	0	18	76
07:15 AM	2	1	0	0	3	0	5	49	0	54	30	0	7	4	41	2	12	0	0	14	112
07:30 AM	0	0	0	0	0	1	9	44	0	54	48	0	18	0	66	4	9	1	0	14	134
07:45 AM	1	0	0	0	1	0	10	51	0	61	78	0	26	6	110	3	12	1	0	16	188
Total	3	1	0	0	4	2	25	172	0	199	176	0	55	14	245	12	43	7	0	62	510
08:00 AM	1	0	0	0	1	0	17	39	0	56	83	0	16	1	100	3	12	0	0	15	172
08:15 AM	0	0	0	0	0	0	11	52	0	63	88	0	17	3	108	1	15	1	0	17	188
08:30 AM	1	0	0	0	1	0	12	49	0	61	94	0	32	0	126	4	9	1	0	14	202
08:45 AM	2	0	1	0	3	0	17	41	1	59	91	0	29	3	123	10	6	1	0	17	202
Total	4	0	1	0	5	0	57	181	1	239	356	0	94	7	457	18	42	3	0	63	764
09:00 AM	0	0	0	1	1	0	12	32	0	44	51	0	29	2	82	7	11	0	0	18	145
09:15 AM	0	0	0	0	0	0	6	28	0	34	39	0	24	1	64	6	10	1	0	17	115
09:30 AM	2	0	1	0	3	0	11	25	0	36	61	0	14	0	75	17	13	1	0	31	145
09:45 AM	1	0	0	0	1	0	10	31	0	41	53	0	15	1	69	6	16	0	0	22	133
Total	3	0	1	1	5	0	39	116	0	155	204	0	82	4	290	36	50	2	0	88	538
Grand Total	10	1	2	1	14	2	121	469	1	593	736	0	231	25	992	66	135	12	0	213	1812
Apprch %	71.4	7.1	14.3	7.1		0.3	20.4	79.1	0.2		74.2	0	23.3	2.5		31	63.4	5.6	0		
Total %	0.6	0.1	0.1	0.1	0.8	0.1	6.7	25.9	0.1	32.7	40.6	0	12.7	1.4	54.7	3.6	7.5	0.7	0	11.8	
Lights	7	0	2	1	10	1	118	442	1	562	702	0	223	25	950	48	132	10	0	190	1712
% Lights	70	0	100	100	71.4	50	97.5	94.2	100	94.8	95.4	0	96.5	100	95.8	72.7	97.8	83.3	0	89.2	94.5
Buses	1	0	0	0	1	0	1	21	0	22	27	0	4	0	31	18	1	1	0	20	74
% Buses	10	0	0	0	7.1	0	0.8	4.5	0	3.7	3.7	0	1.7	0	3.1	27.3	0.7	8.3	0	9.4	4.1
Trucks	2	1	0	0	3	1	2	6	0	9	7	0	4	0	11	0	2	1	0	3	26
% Trucks	20	100	0	0	21.4	50	1.7	1.3	0	1.5	1	0	1.7	0	1.1	0	1.5	8.3	0	1.4	1.4

	DRIVEWAY Southbound				HANOVER ST Westbound				HILLVIEW AVE Northbound				PORTER DR Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	1	0	0	1	0	**17**	39	56	83	0	16	99	3	12	0	15	171
08:15 AM	0	0	0	0	0	11	**52**	**63**	88	0	17	105	1	**15**	**1**	**17**	185
08:30 AM	1	0	0	1	0	12	49	61	**94**	0	**32**	**126**	4	9	1	14	**202**
08:45 AM	**2**	0	**1**	**3**	0	17	41	58	91	0	29	120	**10**	6	1	17	198
Total Volume	4	0	1	5	0	57	181	238	356	0	94	450	18	42	3	63	756
% App. Total	80	0	20		0	23.9	76.1		79.1	0	20.9		28.6	66.7	4.8		
PHF	.500	.000	.250	.417	.000	.838	.870	.944	.947	.000	.734	.893	.450	.700	.750	.926	.936

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Groups Printed- Bikes

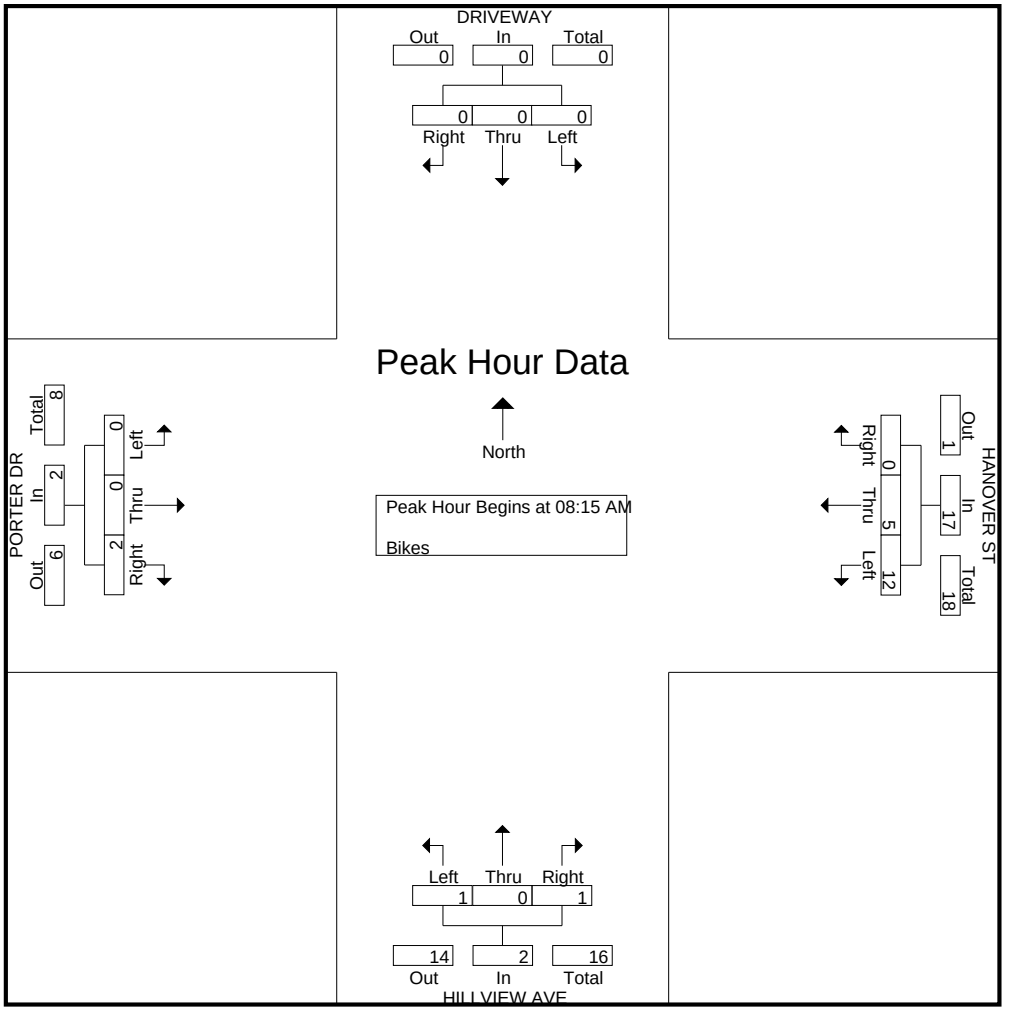
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Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1
07:15 AM	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1
07:30 AM	0	0	0	0	0	0	0	2	0	2	0	0	1	0	1	0	0	0	0	0	3
07:45 AM	0	0	0	0	0	0	1	1	0	2	0	0	0	0	0	0	0	0	0	0	2
Total	0	0	0	0	0	0	2	3	0	5	0	0	2	0	2	0	0	0	0	0	7
08:00 AM	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	0	0	0	0	2
08:15 AM	0	0	0	0	0	0	1	4	0	5	0	0	1	0	1	1	0	0	0	1	7
08:30 AM	0	0	0	0	0	0	1	6	0	7	1	0	0	0	1	0	0	0	0	0	8
08:45 AM	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	2
Total	0	0	0	0	0	0	4	10	0	14	1	0	2	0	3	2	0	0	0	2	19
09:00 AM	0	0	0	0	0	0	2	2	0	4	0	0	0	0	0	0	0	0	0	0	4
09:15 AM	0	0	0	0	0	0	0	1	0	1	1	0	0	0	1	1	0	0	0	1	3
09:30 AM	0	0	0	0	0	0	0	2	0	2	1	0	0	0	1	0	0	0	0	0	3
09:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1
Total	0	0	0	0	0	0	2	5	0	7	2	0	1	0	3	1	0	0	0	1	11
Grand Total	0	0	0	0	0	0	8	18	0	26	3	0	5	0	8	3	0	0	0	3	37
Apprch %	0	0	0	0		0	30.8	69.2	0		37.5	0	62.5	0		100	0	0	0		
Total %	0	0	0	0	0	0	21.6	48.6	0	70.3	8.1	0	13.5	0	21.6	8.1	0	0	0	8.1	

	DRIVEWAY Southbound				HANOVER ST Westbound				HILLVIEW AVE Northbound				PORTER DR Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:15 AM																	
08:15 AM	0	0	0	0	0	1	4	5	0	0	**1**	**1**	**1**	0	0	**1**	7
08:30 AM	0	0	0	0	0	1	**6**	**7**	**1**	0	0	1	0	0	0	0	**8**
08:45 AM	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	2
09:00 AM	0	0	0	0	0	**2**	2	4	0	0	0	0	0	0	0	0	4
Total Volume	0	0	0	0	0	5	12	17	1	0	1	2	2	0	0	2	21
% App. Total	0	0	0		0	29.4	70.6		50	0	50		100	0	0		
PHF	.000	.000	.000	.000	.000	.625	.500	.607	.250	.000	.250	.500	.500	.000	.000	.500	.656

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Groups Printed- Lights - Buses - Trucks

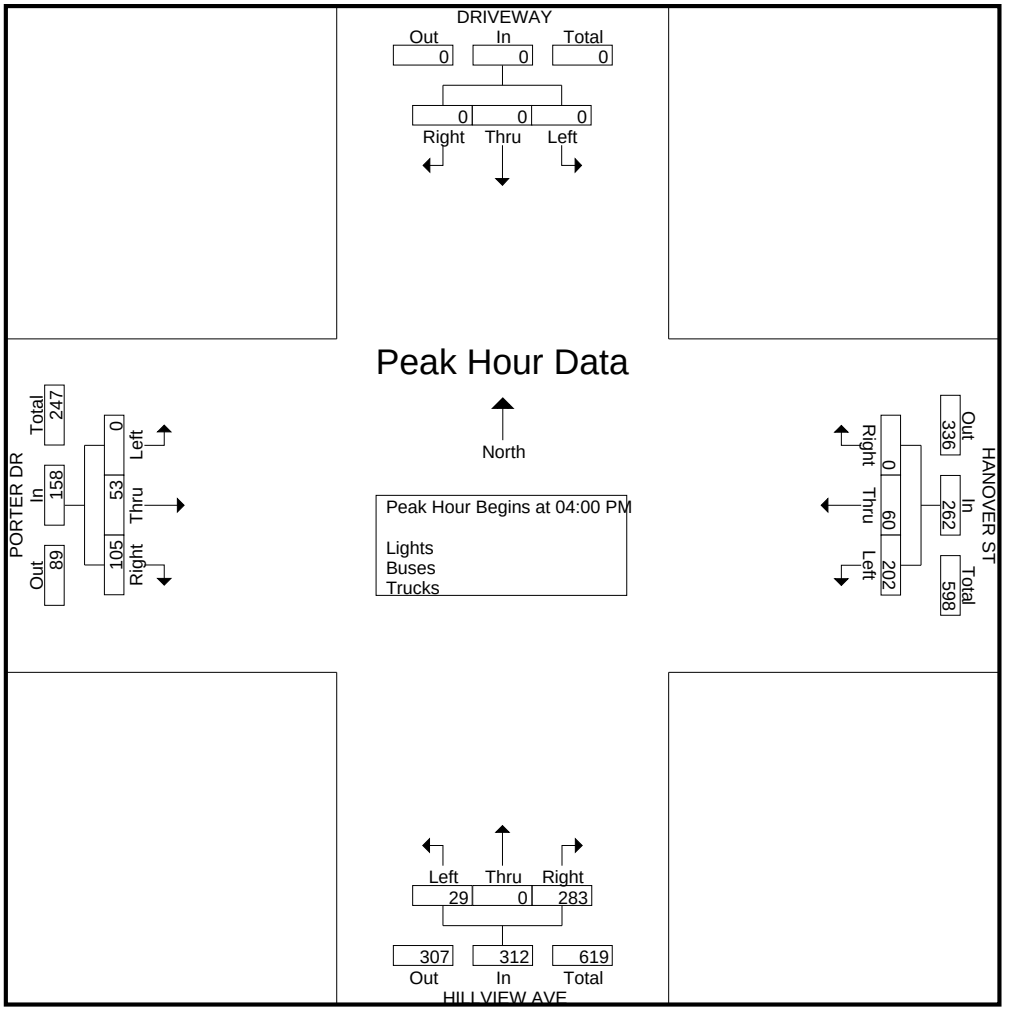
	DRIVEWAY Southbound					HANOVER ST Westbound					HILLVIEW AVE Northbound					PORTER DR Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0	0	14	69	0	83	73	0	7	7	87	27	10	0	0	37	207
04:15 PM	0	0	0	0	0	0	13	45	0	58	69	0	5	5	79	35	14	0	2	51	188
04:30 PM	0	0	0	0	0	0	13	50	0	63	79	0	10	1	90	22	19	0	1	42	195
04:45 PM	0	0	0	0	0	0	20	38	0	58	62	0	7	3	72	21	10	0	0	31	161
Total	0	0	0	0	0	0	60	202	0	262	283	0	29	16	328	105	53	0	3	161	751
05:00 PM	0	0	0	0	0	0	15	57	0	72	54	0	6	3	63	28	16	0	4	48	183
05:15 PM	0	0	0	1	1	0	10	45	0	55	61	0	4	3	68	31	15	0	0	46	170
05:30 PM	0	0	0	0	0	0	9	39	0	48	65	0	3	1	69	29	3	0	0	32	149
05:45 PM	0	0	0	0	0	0	7	45	0	52	35	0	3	5	43	16	3	0	1	20	115
Total	0	0	0	1	1	0	41	186	0	227	215	0	16	12	243	104	37	0	5	146	617
06:00 PM	0	0	0	0	0	0	4	39	0	43	39	0	2	1	42	14	4	0	1	19	104
06:15 PM	0	0	0	0	0	0	9	44	0	53	36	0	4	7	47	12	5	0	0	17	117
06:30 PM	0	0	0	0	0	0	9	24	0	33	33	0	3	1	37	6	3	0	0	9	79
06:45 PM	0	0	0	0	0	0	4	21	0	25	24	0	0	1	25	9	4	0	0	13	63
Total	0	0	0	0	0	0	26	128	0	154	132	0	9	10	151	41	16	0	1	58	363
Grand Total	0	0	0	1	1	0	127	516	0	643	630	0	54	38	722	250	106	0	9	365	1731
Apprch %	0	0	0	100		0	19.8	80.2	0		87.3	0	7.5	5.3		68.5	29	0	2.5		
Total %	0	0	0	0.1	0.1	0	7.3	29.8	0	37.1	36.4	0	3.1	2.2	41.7	14.4	6.1	0	0.5	21.1	
Lights	0	0	0	1	1	0	127	497	0	624	609	0	41	38	688	245	104	0	9	358	1671
% Lights	0	0	0	100	100	0	100	96.3	0	97	96.7	0	75.9	100	95.3	98	98.1	0	100	98.1	96.5
Buses	0	0	0	0	0	0	0	18	0	18	19	0	13	0	32	3	0	0	0	3	53
% Buses	0	0	0	0	0	0	0	3.5	0	2.8	3	0	24.1	0	4.4	1.2	0	0	0	0.8	3.1
Trucks	0	0	0	0	0	0	0	1	0	1	2	0	0	0	2	2	2	0	0	4	7
% Trucks	0	0	0	0	0	0	0	0.2	0	0.2	0.3	0	0	0	0.3	0.8	1.9	0	0	1.1	0.4

	DRIVEWAY Southbound				HANOVER ST Westbound				HILLVIEW AVE Northbound				PORTER DR Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	0	0	0	0	0	14	**69**	**83**	73	0	7	80	27	10	0	37	**200**
04:15 PM	0	0	0	0	0	13	45	58	69	0	5	74	**35**	14	0	**49**	181
04:30 PM	0	0	0	0	0	13	50	63	**79**	0	**10**	**89**	22	**19**	0	41	193
04:45 PM	0	0	0	0	0	**20**	38	58	62	0	7	69	21	10	0	31	158
Total Volume	0	0	0	0	0	60	202	262	283	0	29	312	105	53	0	158	732
% App. Total	0	0	0		0	22.9	77.1		90.7	0	9.3		66.5	33.5	0		
PHF	.000	.000	.000	.000	.000	.750	.732	.789	.896	.000	.725	.876	.750	.697	.000	.806	.915

Traffic Data Service

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Groups Printed- Bikes

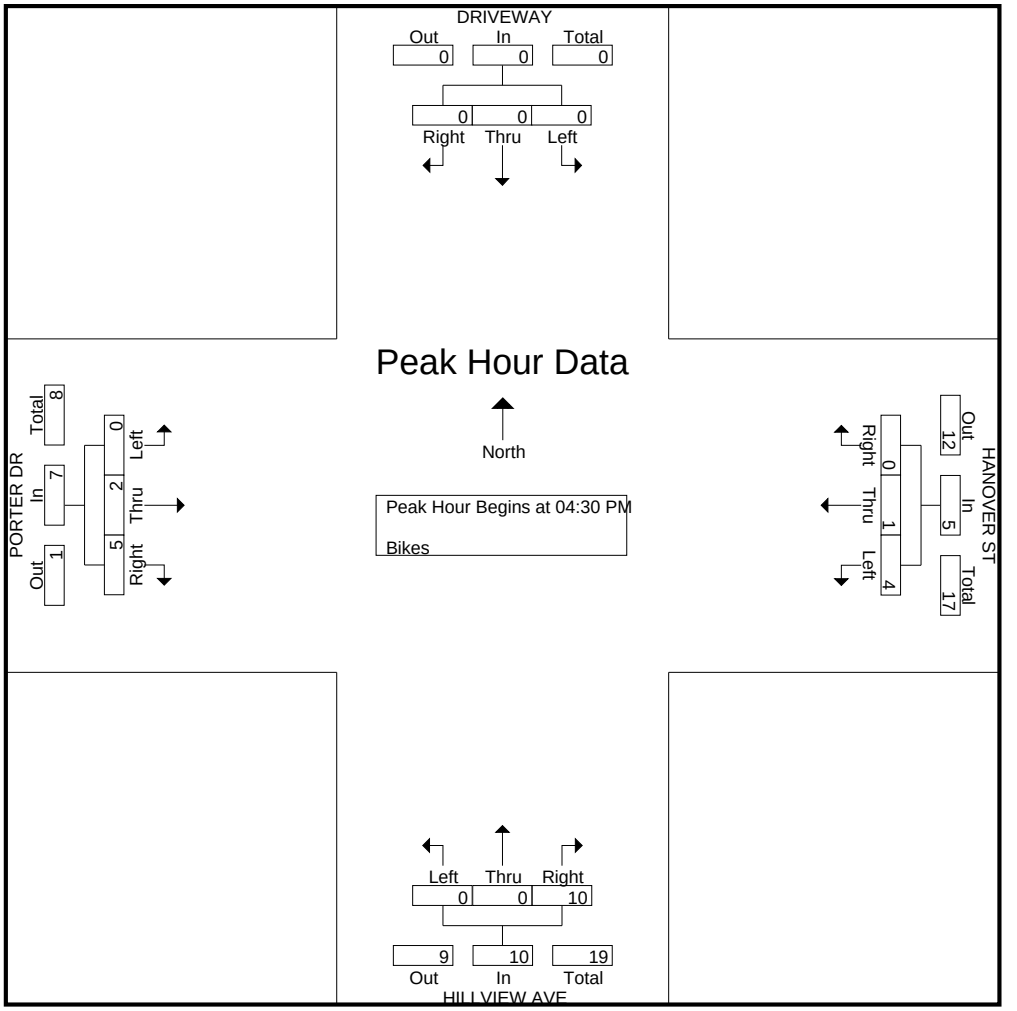
	DRIVEWAY Southbound					HANOVER ST Westbound					HILLVIEW AVE Northbound					PORTER DR Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	1	0	0	1	3
04:15 PM	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	0	0	0	0	0	3
04:30 PM	0	0	0	0	0	0	0	1	0	1	1	0	0	0	1	2	0	0	0	2	4
04:45 PM	0	0	0	0	0	0	1	0	0	1	2	0	0	0	2	2	1	0	0	3	6
Total	0	0	0	0	0	0	1	1	0	2	8	0	0	0	8	4	2	0	0	6	16
05:00 PM	0	0	0	0	0	0	0	1	0	1	3	0	0	0	3	0	0	0	0	0	4
05:15 PM	0	0	0	0	0	0	0	2	0	2	4	0	0	0	4	1	1	0	0	2	8
05:30 PM	0	0	0	0	0	0	1	0	0	1	1	0	0	0	1	0	1	0	0	1	3
05:45 PM	0	0	0	0	0	0	0	0	0	0	1	0	1	0	2	0	1	0	0	1	3
Total	0	0	0	0	0	0	1	3	0	4	9	0	1	0	10	1	3	0	0	4	18
06:00 PM	0	0	0	0	0	0	0	0	0	0	5	0	0	0	5	0	0	0	0	0	5
06:15 PM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	2
06:30 PM	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	2	1	0	0	3	6
06:45 PM	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1
Total	0	0	0	0	0	0	0	1	0	1	10	0	0	0	10	2	1	0	0	3	14
Grand Total	0	0	0	0	0	0	2	5	0	7	27	0	1	0	28	7	6	0	0	13	48
Apprch %	0	0	0	0		0	28.6	71.4	0		96.4	0	3.6	0		53.8	46.2	0	0		
Total %	0	0	0	0	0	0	4.2	10.4	0	14.6	56.2	0	2.1	0	58.3	14.6	12.5	0	0	27.1	

	DRIVEWAY Southbound				HANOVER ST Westbound				HILLVIEW AVE Northbound				PORTER DR Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:30 PM																	
04:30 PM	0	0	0	0	0	0	1	1	1	0	0	1	**2**	0	0	2	4
04:45 PM	0	0	0	0	0	**1**	0	1	2	0	0	2	2	**1**	0	**3**	6
05:00 PM	0	0	0	0	0	0	1	1	3	0	0	3	0	0	0	0	4
05:15 PM	0	0	0	0	0	0	**2**	**2**	**4**	0	0	**4**	1	1	0	2	**8**
Total Volume	0	0	0	0	0	1	4	5	10	0	0	10	5	2	0	7	22
% App. Total	0	0	0		0	20	80		100	0	0		71.4	28.6	0		
PHF	.000	.000	.000	.000	.000	.250	.500	.625	.625	.000	.000	.625	.625	.500	.000	.583	.688

Traffic Data Service

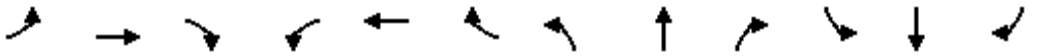
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Attachment B

Intersection LOS Calculations



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	4	94	0	356	3	42	18	181	57	0
Future Volume (vph)	1	0	4	94	0	356	3	42	18	181	57	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes		0.98			1.00	1.00	1.00	0.99		1.00	1.00	
Flpb, ped/bikes		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frt		0.89			1.00	0.85	1.00	0.95		1.00	1.00	
Flt Protected		0.99			0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1617			1768	1583	1770	1764		1770	1863	
Flt Permitted		0.95			0.75	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1558			1404	1583	1770	1764		1770	1863	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	0	4	102	0	387	3	46	20	197	62	0
RTOR Reduction (vph)	0	4	0	0	0	130	0	18	0	0	0	0
Lane Group Flow (vph)	0	1	0	0	102	257	3	48	0	197	62	0
Confl. Peds. (#/hr)			1	1					7			7
Confl. Bikes (#/hr)												5
Turn Type	Perm	NA		Perm	NA	pt+ov	Split	NA		Split	NA	
Protected Phases		3			3	3 1	2	2		1	1	
Permitted Phases	3			3								
Actuated Green, G (s)		11.8			11.8	30.0	5.2	5.2		13.2	13.2	
Effective Green, g (s)		11.8			11.8	30.0	5.2	5.2		13.2	13.2	
Actuated g/C Ratio		0.26			0.26	0.66	0.12	0.12		0.29	0.29	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		406			366	1050	203	202		516	544	
v/s Ratio Prot						c0.16	0.00	c0.03		c0.11	0.03	
v/s Ratio Perm		0.00			0.07							
v/c Ratio		0.00			0.28	0.24	0.01	0.24		0.38	0.11	
Uniform Delay, d1		12.4			13.3	3.1	17.7	18.2		12.7	11.7	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.0			0.4	0.1	0.0	0.6		0.5	0.1	
Delay (s)		12.4			13.7	3.2	17.8	18.8		13.2	11.8	
Level of Service		B			B	A	B	B		B	B	
Approach Delay (s)		12.4			5.4			18.8			12.9	
Approach LOS		B			A			B			B	

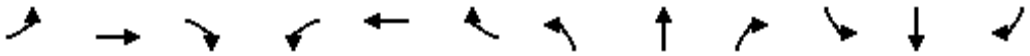
Intersection Summary			
HCM 2000 Control Delay	8.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	45.2	Sum of lost time (s)	15.0
Intersection Capacity Utilization	44.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	5	102	387	3	66	197	62
v/c Ratio	0.01	0.28	0.29	0.01	0.17	0.38	0.11
Control Delay	0.0	19.9	1.4	19.3	15.9	18.7	16.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	0.0	19.9	1.4	19.3	15.9	18.7	16.7
Queue Length 50th (ft)	0	21	0	1	11	41	12
Queue Length 95th (ft)	0	83	32	7	46	137	51
Internal Link Dist (ft)	293	858			626		649
Turn Bay Length (ft)				80		80	
Base Capacity (vph)	1156	1022	1525	1155	1155	1389	1462
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.00	0.10	0.25	0.00	0.06	0.14	0.04

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	29	0	283	0	53	105	202	60	0
Future Volume (vph)	0	0	0	29	0	283	0	53	105	202	60	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0	5.0		5.0		5.0	5.0	
Lane Util. Factor					1.00	1.00		1.00		1.00	1.00	
Frpb, ped/bikes					1.00	1.00		0.97		1.00	1.00	
Flpb, ped/bikes					1.00	1.00		1.00		1.00	1.00	
Frt					1.00	0.85		0.90		1.00	1.00	
Flt Protected					0.95	1.00		1.00		0.95	1.00	
Satd. Flow (prot)					1764	1583		1633		1770	1863	
Flt Permitted					0.76	1.00		1.00		0.95	1.00	
Satd. Flow (perm)					1406	1583		1633		1770	1863	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	32	0	308	0	58	114	220	65	0
RTOR Reduction (vph)	0	0	0	0	0	122	0	73	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	32	186	0	99	0	220	65	0
Confl. Peds. (#/hr)			3	3					16	16		16
Confl. Bikes (#/hr)									2			1
Turn Type				Perm	NA	pt+ov	Split	NA		Split	NA	
Protected Phases		3			3	3 1	2	2		1	1	
Permitted Phases	3			3								
Actuated Green, G (s)					8.8	26.9		7.7		13.1	13.1	
Effective Green, g (s)					8.8	26.9		7.7		13.1	13.1	
Actuated g/C Ratio					0.20	0.60		0.17		0.29	0.29	
Clearance Time (s)					5.0			5.0		5.0	5.0	
Vehicle Extension (s)					3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)					277	954		281		519	547	
v/s Ratio Prot						c0.12		c0.06		c0.12	0.03	
v/s Ratio Perm					0.02							
v/c Ratio					0.12	0.19		0.35		0.42	0.12	
Uniform Delay, d1					14.7	4.0		16.3		12.7	11.5	
Progression Factor					1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2					0.2	0.1		0.8		0.6	0.1	
Delay (s)					14.9	4.1		17.0		13.3	11.6	
Level of Service					B	A		B		B	B	
Approach Delay (s)		0.0			5.1			17.0			12.9	
Approach LOS		A			A			B			B	

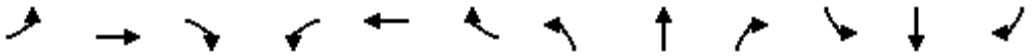
Intersection Summary			
HCM 2000 Control Delay	10.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	44.6	Sum of lost time (s)	15.0
Intersection Capacity Utilization	41.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



Lane Group	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	32	308	172	220	65
v/c Ratio	0.12	0.27	0.41	0.43	0.12
Control Delay	20.6	1.6	13.4	19.0	16.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	20.6	1.6	13.4	19.0	16.1
Queue Length 50th (ft)	6	0	17	41	11
Queue Length 95th (ft)	34	29	82	152	53
Internal Link Dist (ft)	858		626		649
Turn Bay Length (ft)				80	
Base Capacity (vph)	1003	1519	1048	1421	1496
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.03	0.20	0.16	0.15	0.04

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	2	2	2	94	14	356	14	42	18	181	57	14
Future Volume (vph)	2	2	2	94	14	356	14	42	18	181	57	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes		0.98			1.00	0.97	1.00	0.97		1.00	0.98	
Flpb, ped/bikes		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frt		0.95			1.00	0.85	1.00	0.95		1.00	0.97	
Flt Protected		0.98			0.96	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1706			1785	1533	1770	1733		1770	1778	
Flt Permitted		0.98			0.96	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1706			1785	1533	1770	1733		1770	1778	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	2	2	102	15	387	15	46	20	197	62	15
RTOR Reduction (vph)	0	2	0	0	0	236	0	12	0	0	6	0
Lane Group Flow (vph)	0	4	0	0	117	151	15	54	0	197	71	0
Confl. Peds. (#/hr)			27			27			27			27
Confl. Bikes (#/hr)						10			10			15
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	3	3		4	4	5	1	6		5	2	
Permitted Phases						4						
Actuated Green, G (s)		8.5			15.0	32.4	1.4	22.0		17.4	38.0	
Effective Green, g (s)		8.5			15.0	32.4	1.4	22.0		17.4	38.0	
Actuated g/C Ratio		0.10			0.18	0.39	0.02	0.27		0.21	0.46	
Clearance Time (s)		5.0			5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		174			322	599	29	459		371	815	
v/s Ratio Prot		c0.00			c0.07	0.05	0.01	c0.03		c0.11	0.04	
v/s Ratio Perm						0.05						
v/c Ratio		0.02			0.36	0.25	0.52	0.12		0.53	0.09	
Uniform Delay, d1		33.5			29.8	17.1	40.4	23.1		29.1	12.7	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.1			0.7	0.2	14.7	0.1		1.5	0.0	
Delay (s)		33.5			30.5	17.3	55.1	23.2		30.6	12.7	
Level of Service		C			C	B	E	C		C	B	
Approach Delay (s)		33.5			20.3			29.1			25.6	
Approach LOS		C			C			C			C	

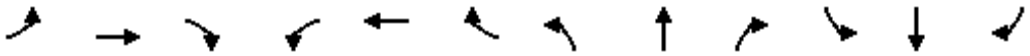
Intersection Summary			
HCM 2000 Control Delay	22.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.28		
Actuated Cycle Length (s)	82.9	Sum of lost time (s)	20.0
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	6	117	387	15	66	197	77
v/c Ratio	0.02	0.27	0.45	0.09	0.18	0.50	0.08
Control Delay	33.2	33.1	2.8	53.0	30.3	41.5	19.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.2	33.1	2.8	53.0	30.3	41.5	19.6
Queue Length 50th (ft)	2	64	0	10	28	129	27
Queue Length 95th (ft)	15	123	24	34	72	205	65
Internal Link Dist (ft)	301	753			651		649
Turn Bay Length (ft)				80		80	
Base Capacity (vph)	664	896	1166	173	816	869	1163
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.13	0.33	0.09	0.08	0.23	0.07

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	7	7	29	2	283	1	53	105	202	60	2
Future Volume (vph)	8	7	7	29	2	283	1	53	105	202	60	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes		0.98			1.00	0.97	1.00	0.94		1.00	1.00	
Flpb, ped/bikes		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frt		0.96			1.00	0.85	1.00	0.90		1.00	1.00	
Flt Protected		0.98			0.96	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1708			1779	1541	1770	1583		1770	1850	
Flt Permitted		0.98			0.96	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1708			1779	1541	1770	1583		1770	1850	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	9	8	8	32	2	308	1	58	114	220	65	2
RTOR Reduction (vph)	0	7	0	0	0	197	0	0	0	0	1	0
Lane Group Flow (vph)	0	18	0	0	34	111	1	172	0	220	66	0
Confl. Peds. (#/hr)			27			27			27			27
Confl. Bikes (#/hr)						10			12			11
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	3	3		4	4	5	1	6		5	2	
Permitted Phases						4						
Actuated Green, G (s)		8.3			11.7	30.9	0.7	26.5		19.2	45.0	
Effective Green, g (s)		8.3			11.7	30.9	0.7	26.5		19.2	45.0	
Actuated g/C Ratio		0.10			0.14	0.36	0.01	0.31		0.22	0.53	
Clearance Time (s)		5.0			5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		165			242	555	14	489		396	971	
v/s Ratio Prot		c0.01			0.02	c0.04	0.00	c0.11		c0.12	0.04	
v/s Ratio Perm						0.03						
v/c Ratio		0.11			0.14	0.20	0.07	0.35		0.56	0.07	
Uniform Delay, d1		35.3			32.6	18.9	42.2	22.9		29.5	10.0	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.3			0.3	0.2	2.2	0.4		1.7	0.0	
Delay (s)		35.6			32.8	19.1	44.3	23.4		31.2	10.1	
Level of Service		D			C	B	D	C		C	B	
Approach Delay (s)		35.6			20.4			23.5			26.2	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	23.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	85.7	Sum of lost time (s)	20.0
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	25	34	308	1	172	220	67
v/c Ratio	0.08	0.08	0.39	0.01	0.46	0.51	0.06
Control Delay	33.1	33.6	2.6	54.0	40.9	40.6	18.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.1	33.6	2.6	54.0	40.9	40.6	18.9
Queue Length 50th (ft)	10	18	0	1	108	147	27
Queue Length 95th (ft)	37	49	24	7	194	235	62
Internal Link Dist (ft)	301	753			651		649
Turn Bay Length (ft)				80		80	
Base Capacity (vph)	702	964	1153	182	785	938	1206
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.04	0.27	0.01	0.22	0.23	0.06

Intersection Summary