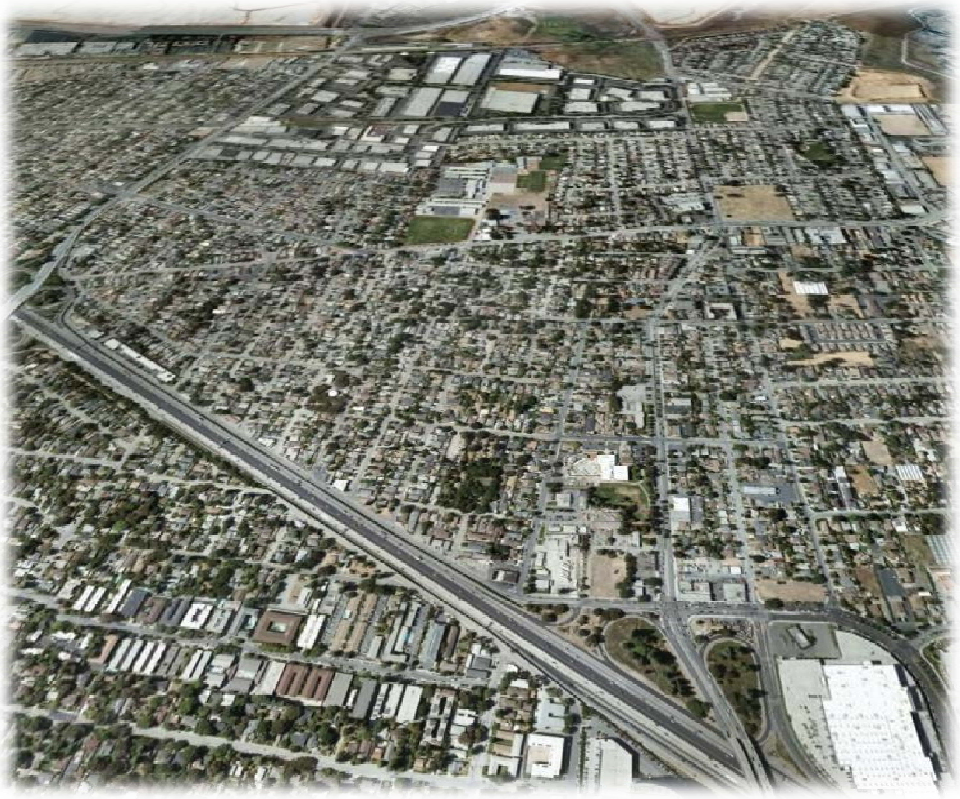
Final Report

Willow Road and University Avenue – Traffic Operations Study and Recommended Near-Term Improvements



Willow Road/University Avenue Study Area

For the
City/County Association of Governments of
San Mateo County
(C/CAG)

July 22, 2011

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Funding for this document was provided by the Metropolitan Transportation Commission.

July 22, 2011

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Prepared by:
TJKM Transportation Consultants
3875 Hopyard Road
Suite 200
Pleasanton, CA 94588-8526
Tel: 925.463.0611
Fax: 925.463.3690

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Introduction and Summary

Introduction

The objective of this project is to identify conceptual plans for traffic improvements on Willow Road and University Avenue to improve traffic operations for vehicles, including transit, and improve safety for pedestrians and bicyclists, while mitigating potential impacts on parallel streets and neighborhoods. Additional project objectives include ability to implement improvements in the short term (less than five years), at relatively reasonable cost, with minimal right-of-way acquisition and construction impacts on the community, as well as acceptance by neighboring residents, businesses, and the City Councils of East Palo Alto and Menlo Park.

This report includes the results of intersection traffic operations analysis and evaluation of accident records for Existing Conditions and Near Term Conditions. Based on the analysis findings, TJKM developed various alternatives for potential improvements on Willow Road and University Avenue between US 101 and Bayfront Expressway that could meet the project objectives. This report presents the conceptual plans, appropriate performance measures, and preliminary cost estimates for the potential improvements.

Summary

Currently, all study intersections, except the following six intersections, operate within acceptable level of service (LOS) standards, with service levels at LOS D or better during the a.m. and p.m. peak hours.

- The intersection of Willow Road / Newbridge Street operates at LOS E during both a.m. and p.m. peak hours.
- At the intersection of University Avenue / Michigan Avenue, the stop-controlled Michigan Avenue approach operates at LOS F with delay greater than 120 seconds per vehicle during the p.m. peak hour.
- At the intersection of University Avenue / Adams Drive, the stop-controlled Adams Drive approach operates at LOS F during both a.m. and p.m. peak hours.
- At the intersection of University Avenue / Purdue Avenue, the stop-controlled Purdue Avenue approach operates at LOS E during the a.m. peak hour and LOS F during the p.m. peak hour.
- The intersection of Bayfront Expressway / Willow Road operates at LOS F during the p.m. peak hour.
- The intersection of Bayfront Expressway / University Avenue operates at LOS E during the a.m. peak hour and LOS F during the p.m. peak hour.

Additionally, the intersection of University Avenue / Donohoe Street operates at LOS D with a delay of 53.7 seconds per vehicle (which is close to LOS E standard of 55.0 seconds per vehicle) during the p.m. peak hour.

Based on the accident analysis, the following two study intersections have collision rates that are significantly higher than the mean collision rate for comparable intersections:

- University Avenue / Donohoe Street
- University Avenue / Bell Street

In addition, the accident rates for the following two intersections are very close to the mean collision rate for comparable intersections:

- Willow Road / Newbridge Street
- University Avenue / Runnymede Street

Analysis of Near-Term Conditions assumes the addition of one percent annual growth in traffic volume over the next five years. All intersections with acceptable service levels for Existing Conditions are expected to continue operating at acceptable service levels in Near-Term Conditions, except the University Avenue / Donohoe Street intersection, which would deteriorate to LOS E in the p.m. peak hour. Under Near-Term Conditions, the following study intersections are expected to operate at LOS E or worse.

- The intersection of Willow Road / Newbridge Street would operate at LOS F during both a.m. and p.m. peak hours.
- The intersection of University Avenue / Donohoe Street would operate at LOS D with a delay of 51.3 seconds per vehicle (which is close to LOS E standard of 55.0 seconds per vehicle) during the a.m. peak hour and would operate at LOS E during the p.m. peak hour.
- At the intersection of University Avenue / Michigan Avenue, the stop-controlled Michigan Avenue approach would operate at LOS F with delay greater than 120 seconds per vehicle during the p.m. peak hour.
- At the intersection of University Avenue / Adams Drive, the stop-controlled Adams Drive approach would operate at LOS F during both a.m. and p.m. peak hours.
- At the intersection of University Avenue / Purdue Avenue, the stop-controlled Purdue Avenue approach would operate at LOS E during the a.m. peak hour and LOS F during the p.m. peak hour.
- The intersection of Bayfront Expressway / Willow Road operates at LOS F during the p.m. peak hour.
- The intersection of Bayfront Expressway / University Avenue operates at LOS E during the a.m. peak hour and LOS F during the p.m. peak hour.

Based on the comprehensive evaluation of existing and near-term traffic conditions, the needs for potential improvements on the Willow Road and University Avenue corridors were identified. TJKM developed various alternatives for potential improvements on Willow Road and University Avenue between US 101 and Bayfront Expressway that meet the project objectives, including reduced delays and queues for vehicle traffic and transit and enhanced safety for pedestrians and bicyclists. The background, need, opportunities, and a conceptual design approach for each of the recommended improvements is presented in detail in the report.

The needs and potential improvements can be broadly categorized and summarized as follows:

1. System-wide operational improvement
    a) Signal Coordination: Coordinate all signals along the University Avenue and Willow Road corridors; signal timings for all study intersections were optimized using a common cycle length on each corridor for the a.m. and the p.m. peaks. Reduces delay at intersections and travel time through the corridors.

2. Intersection-specific improvements (Safety and Operational)
    a) Willow Road and Newbridge Street: Roadway modifications and traffic control devices to improve conditions where traffic from northbound US 101 off-ramp merges onto eastbound Willow Road just west of the Newbridge Street intersection.
    b) Willow Road and Bayfront Expressway: Roadway modifications to increase capacity for the eastbound Willow Road right turn where long queues and delay conflict with the through lane and bicycle lane.
    c) University Avenue and Cooley Avenue: Restrict traffic access from Cooley Avenue to University Avenue to reduce neighborhood cut-through traffic and improve pedestrian safety crossing Cooley at the existing congested right-turn to University.
    d) University Avenue and Runnymede Street: Install a traffic signal system to add protected left-turn signal phase for University Avenue traffic and an emergency signal for the adjacent Fire Station access.
    e) University Avenue / Donohoe Street and Donohoe Street / Capitol Avenue: Roadway configuration, signal phasing, and traffic control modifications to address severe traffic congestion on northbound Donohoe Street that results in gridlock at the Capitol Avenue intersection.
3. Pedestrian/Bicycle/Other improvements
    a) Uncontrolled pedestrian crossings: Install in-roadway warning lights at two existing marked crosswalks on University Avenue, at Michigan Avenue and at Sacramento Street.
    b) Pedestrian safety across US 101 NB off ramp at University Avenue: Install devices to warn drivers about the pedestrian crossing, including warning signs, pedestrian-activated flashing beacons, and pavement markings.
    c) Pedestrian countdown signals: Install pedestrian signals that display the remaining time to cross at all existing traffic signals in the corridor, to enhance safety.
    d) Bicycle detection: Install bicycle detectors at all traffic signals, in the appropriate lanes on cross streets and left-turn lanes where a bicyclist would not otherwise trigger a green signal in the absence of motor vehicle traffic, to improve bicyclist convenience and safety.
    e) Emergency vehicle signal preemption: Install emergency vehicle preemption systems on all approaches at all traffic signals where they do not exist, including University Avenue signals and some cross street approaches to Willow Avenue, to improve emergency vehicle safety and response times.

TJKM evaluated the potential impacts of each alternative on vehicle traffic, pedestrians, bicyclists, transit, and on neighboring local streets. Synchro was used to analyze the benefits of signal coordination and each intersection-specific alternative to vehicle traffic LOS, delay, and queuing. TJKM met with City of Menlo Park, City of East Palo Alto, Caltrans, MTC and C/CAG staff to coordinate development of appropriate performance measures for the potential improvement alternatives, and to review the alternatives being considered.

Public outreach meetings were held on two occasions each in both Menlo Park and East Palo Alto. At the first meeting in each city, the findings of the existing and near-term traffic analyses were presented, a few general concepts for potential improvement alternatives were identified, and public comments were received. Based on public comments, potential improvement alternatives were further developed and analyzed, and those alternatives were presented at the second meeting in each city, where additional comments were received from transportation committee members and the public.

Subsequently, TJKM met with City of Menlo Park, City of East Palo Alto, Caltrans, MTC and C/CAG staff to finalize the recommended alternatives based on input from the public meetings. In addition to refinement of the potential alternatives listed above, two of those alternatives were significantly modified in the final recommendation:

- University Avenue and Cooley Avenue (2c above): The potential restriction of traffic access from Cooley Avenue to University Avenue was eliminated from consideration, based on concerns expressed at the East Palo Alto public meetings regarding potential traffic diversion impacts.
- University Avenue/ Donohoe Street and University Avenue / Capitol Avenue (2e): The project study team determined that the potential lane configuration modification under consideration, to add a northbound lane on Donohoe Street, would result in unacceptably narrow lanes for large trucks, unless the roadway is physically widened. As a result, the final recommendation is that the City of East Palo Alto work toward acquisition of additional public right-of-way on the south side of Donohoe Street to allow for the roadway widening needed to add a traffic lane. However, the cost and complexity of this alternative suggest a significantly longer time frame and less definite feasibility in comparison to the other recommended improvements. The final recommendation also includes additional signage and pavement markings at this location to provide clearer direction to drivers regarding the correct lane to use for various traffic movements, as well as enhanced "Do Not Block Intersection" signs at the Capitol Avenue intersection.

TJKM presented the final recommendations to the City Councils of Menlo Park and East Palo Alto at a regular meeting of each council. Council members had minor questions and comments, and generally accepted the recommended improvement concepts. Implementation will be the responsibility of each city to include in their capital improvement programs (CIP), in coordination as appropriate with MTC and C/CAG for potential funding opportunities, such as the Program for Arterial System Synchronization (PASS) and Measure M funds, respectively.

Intersection Analysis Methodology

Study Methodology

TJKM evaluated traffic conditions at twenty study intersections during both a.m. and p.m. peak hours for a typical weekday. The peak periods observed were between 7:00 a.m. – 9:00 a.m. and 4:00 p.m. – 6:00 p.m. The study intersections and their associated traffic controls are as follows:

- Willow Road / Newbridge Street (Signal)
- Willow Road/ O'Brien Drive (Signal)
- Willow Road / Ivy Drive (Signal)
- Willow Road / Hamilton Avenue (Signal)
- University Avenue / Donohoe Street (Signal)
- University Avenue / Bell Street (Signal)
- University Avenue / Runnymede Street (Signal)
- University Avenue / Cooley Avenue (Stop Sign on Cooley)
- University Avenue / Bay Road (Signal)
- University Avenue / Michigan Avenue (Stop Sign on Michigan)
- University Avenue / Kavanaugh Drive (Signal)
- University Avenue / Notre Dame Avenue (Signal)
- University Avenue / O'Brien Drive (Signal)
- University Avenue / Adams Drive (Stop Sign on Adams)
- University Avenue / Purdue Avenue (Stop Sign on Purdue)
- Capitol Avenue / Donohoe Street (Signal)
- University Avenue / US 101 SB Ramps (Signal)
- University Avenue / Woodland Avenue (Signal)
- Willow Road / Bayfront Expressway (Signal)
- University Avenue / Bayfront Expressway (Signal)

Figure 1 illustrates the study area intersections and the project vicinity. Figure 2 illustrates the existing lane geometry and traffic controls for the study intersections.

This study addresses the following two (2) traffic scenarios:

1. *Existing Conditions* – This scenario evaluates current intersection conditions based on field surveys and existing vehicle, bicycle, and pedestrian counts.
2. *Near Term Conditions* – This scenario is identical to Existing Conditions, but with the addition of one percent annual growth in traffic volume over the next five years.

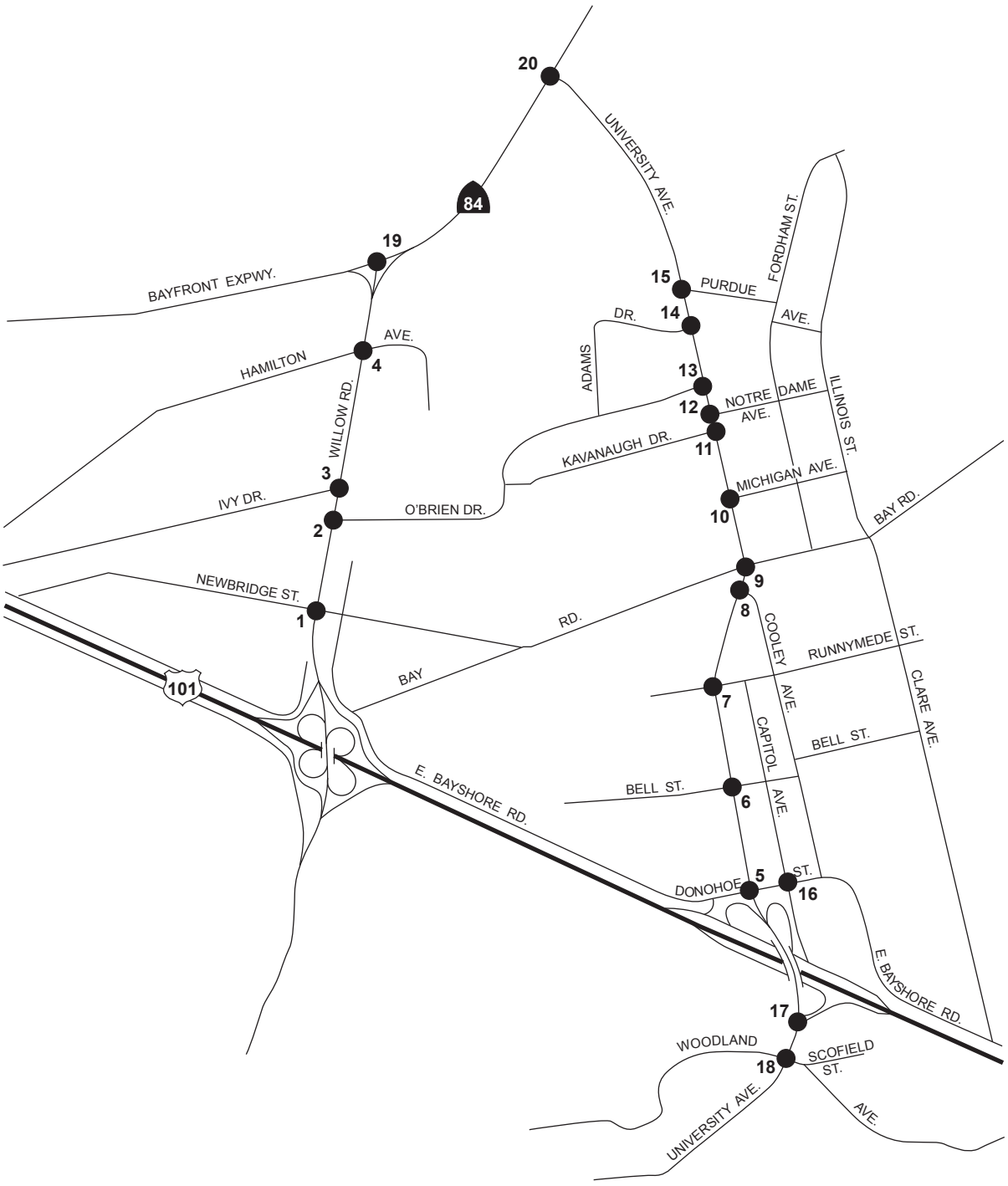
Level of Service Analysis Methodology

Traffic impacts on the study intersections were quantified through the determination of level of service (LOS), a qualitative measure describing operational conditions within a traffic stream. There are six levels of service defined for each type of facility (i.e., roadway or intersection) that is analyzed. LOS has letter designations ranging from A to F, with LOS A representing free-flow traffic with little or no delay and LOS F representing jammed conditions with excessive delay and long back-ups. Procedures for analyzing each type of facility are based on the *Highway Capacity Manual 2000 (HCM 2000)*. The LOS methodology is described in detail in Appendix A.

San Mateo County - Willow Road and University Avenue

Vicinity Map

Figure 1



NORTH
Not to Scale

TJKM

LEGEND

● Study Intersection

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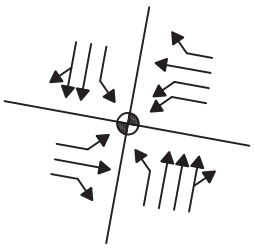
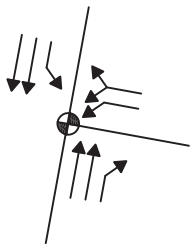
San Mateo County - Willow Road and University Avenue
Existing Lane Geometry and Controls

Figure 2

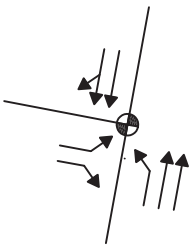
Intersection #1
Willow Rd./Newbridge St.



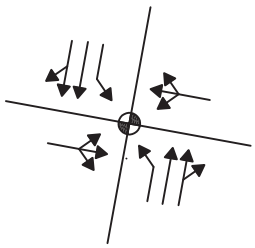
Intersection #2
Willow Rd./O'Brien Dr.



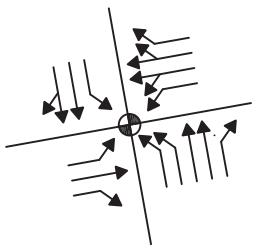
Intersection #3
Willow Rd./Ivy Dr.



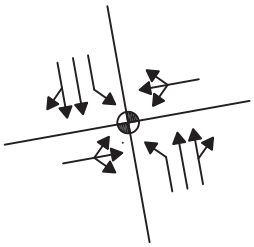
Intersection #4
Willow Rd./Hamilton Ave.



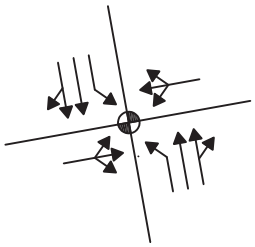
Intersection #5
University Ave./Donohoe St.



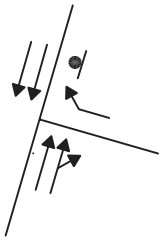
Intersection #6
University Ave./Bell St.



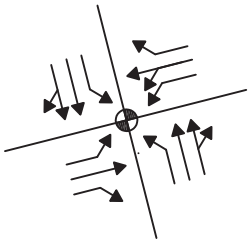
Intersection #7
University Ave./Runnymede St.



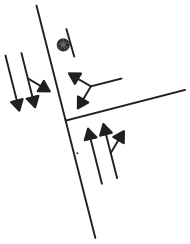
Intersection #8
University Ave./Cooley Ave.



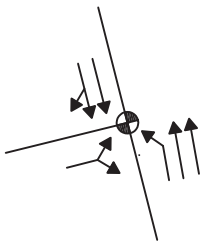
Intersection #9
University Ave./Bay Rd.



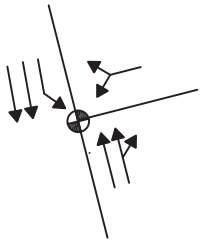
Intersection #10
University Ave./Michigan Ave.



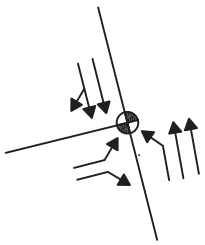
Intersection #11
University Ave./Kavanaugh Dr.



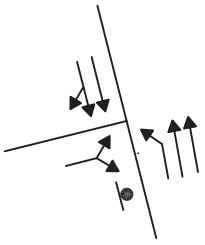
Intersection #12
University Ave./Notre Dame Ave.



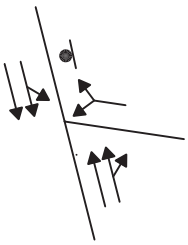
Intersection #13
University Ave./O'Brien Dr.



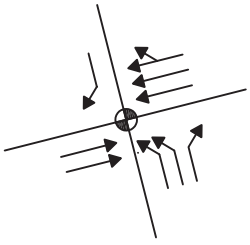
Intersection #14
University Ave./Adams Dr.



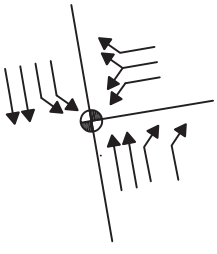
Intersection #15
University Ave./Purdue Ave.



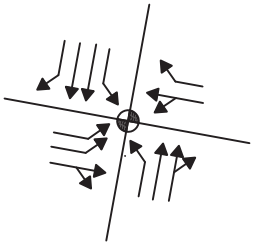
Intersection #16
Capitol Ave./Donohoe St.



Intersection #17
University Ave./US 101 SB Ramps



Intersection #18
University Ave./Woodland Ave.



Existing Conditions

Existing Roadway Network

University Avenue is a four-lane urban arterial roadway that runs approximately east-west connecting the Bayfront Expressway (State Route 84) and west side of US 101 in the study area. University Avenue west of Michigan Avenue has a posted speed limit of 25 mph for both directions. The posted speed limit east of Michigan Avenue is 35 mph for both directions.

Willow Road is a four-lane urban arterial roadway that runs approximately east-west connecting the Bayfront Expressway to the east and the west side of US 101 in the study area. The posted speed limit in the eastbound direction is 40 mph and in the westbound direction is 35 mph.

O'Brien Drive is a two-lane local roadway that runs north-south between Willow Road and University Avenue.

Bay Road is a two-lane local roadway that runs north-south between Newbridge Street and University Avenue. It becomes a four-lane roadway between University Avenue and Pulgas Avenue.

Newbridge Street is a two-lane local roadway that runs north-south between Pierce Road and Bay Road.

Donohoe Street is a portion of the East Bayshore Road. In the study area it is a local roadway with varying lane configuration from two lanes to five lanes that runs north-south between Euclid Avenue and Clarke Avenue.

Existing Transit Service

The following transit services exist within the study area:

- *Willow Road Caltrain Shuttle Service* – The Caltrain shuttle provides service between the Menlo Park Caltrain Station and the Willow Road area office buildings during commute hours. The shuttles serve the business parks to the west and east of US 101 for about three hours during the morning commute and four hours during the evening commute.
- *Midday Shuttle Service* is a free community service route that is open to the general public. The shuttle is a popular service, particularly for seniors. It runs along Willow Road and connects several destinations in the City of Menlo Park. This line operates on an hourly schedule on Monday to Friday between 9:30 a.m. and 3:30 p.m.
- *Samtrans Routes 281, 297, and 397* provide seven-day operation serving the cities of Menlo Park, East Palo Alto and Palo Alto. These buses travel through a portion of University Avenue within the study area.
- *Dumbarton Express* provides express service between Palo Alto and Union City. The Dumbarton Express serves both Willow Road and University Avenue with stops at the Intersection of Willow Road / Middlefield Road and University Avenue / Bay Road within the study area.

Existing Bicycle Facilities

There is an existing Class II bike lane on Willow Road between US 101 and Hamilton Avenue. The bike lanes are provided for both the westbound and eastbound directions. There is a Class II bike lane on University Avenue as well serving both directions within the study area.

Existing Traffic Volumes
Quality Counts collected existing weekday a.m. and p.m. peak hour vehicle, pedestrian, and bicycle counts at all the study intersections on University Avenue in November 2009. Vehicle counts for the study intersections on Willow Road were obtained from the City of Menlo Park, which collected the peak hour turning movement volumes in October 2009. Peak hour pedestrian and bicycle counts were collected at the Willow Road study intersections in March 2010. Figure 3 shows existing turning movement volumes at the study intersections.

Existing Pedestrian Facilities/Activity
TJKM reviewed existing pedestrian conditions in the project study area. The pedestrian activity is high near the densely developed areas. Pedestrian sidewalks and crosswalks are provided on all signalized intersections within the study area.

Table I and Table II summarize the pedestrian counts by direction for each of the study intersections during the a.m. and p.m. peak hours.

The following three intersections on University Avenue have high pedestrian activity:

- University Avenue / Bay Road
- University Avenue / Woodland Road
- University Avenue / Donohoe Street

There are three uncontrolled pedestrian crossings on University Avenue at the following locations:

- University Avenue / Weeks Street
- University Avenue / Sacramento Street
- University Avenue / Michigan Avenue

San Mateo County - Willow Road and University Avenue

Existing Turning Movement Volumes

Figure 3

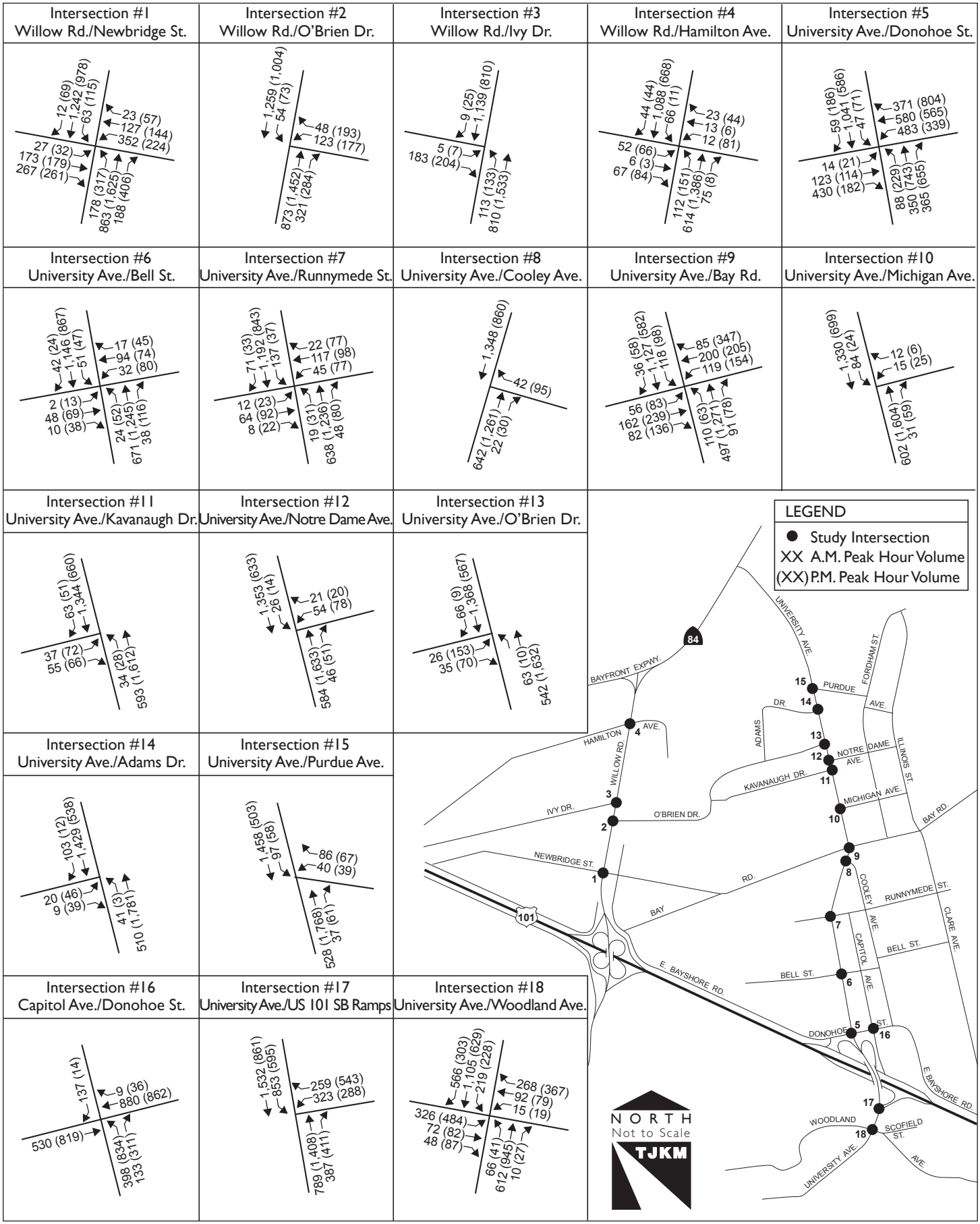


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Table I: Existing Pedestrian Counts during the A.M. Peak Hour

ID	*Intersection*	*Control*	*Westside*	*Eastside*	*Southside*	*Northside*
1	Willow Road / Newbridge Street	Signal	7	16	0	7
2	Willow Road/ O'Brien Drive	Signal	0	0	5	0
3	Willow Road / Ivy Drive	Signal	0	1	5	3
4	Willow Road / Hamilton Avenue	Signal	1	2	0	2
5	University Avenue / Donohoe Street	Signal	1	34	1	20
6	University Avenue / Bell Street	Signal	6	7	9	14
7	University Avenue / Runnymede Street	Signal	1	11	8	5
8	University Avenue / Cooley Avenue	Signal	11	1	1	0
9	University Avenue / Bay Road	Signal	14	18	70	15
10	University Avenue / Michigan Avenue	Stop	1	0	11	0
11	University Avenue / Kavanaugh Drive	Signal	0	0	10	1
12	University Avenue / Notre Dame Avenue	Signal	6	0	0	2
13	University Avenue / O'Brien Drive	Signal	0	0	0	0
14	University Avenue / Adams Drive	Stop	0	0	0	0
15	University Avenue / Purdue Avenue	Stop	0	0	0	0
16	Capitol Avenue / Donohoe Street	Signal	0	0	1	25
17	University Avenue / US 101 SB Ramps	Signal	1	0	0	0
18	University Avenue / Woodland Avenue	Signal	9	34	45	4
19	Bayfront Expressway / Willow Road	Signal	0	0	0	1
20	Bayfront Expressway / University Avenue	Signal	3	0	0	0

Table II: Existing Pedestrian Counts during the P.M. Peak Hour

ID	*Intersection*	*Control*	*Westside*	*Eastside*	*Southside*	*Northside*
1	Willow Road / Newbridge Street	Signal	18	43	6	17
2	Willow Road/ O'Brien Drive	Signal	0	0	12	0
3	Willow Road / Ivy Drive	Signal	15	10	26	12
4	Willow Road / Hamilton Avenue	Signal	1	0	1	0
5	University Avenue / Donohoe Street	Signal	1	33	0	24
6	University Avenue / Bell Street	Signal	1	10	9	36
7	University Avenue / Runnymede Street	Signal	10	16	12	13
8	University Avenue / Cooley Avenue	Signal	24	0	0	0
9	University Avenue / Bay Road	Signal	13	46	56	31
10	University Avenue / Michigan Avenue	Stop	2	0	14	0
11	University Avenue / Kavanaugh Drive	Signal	0	0	0	0
12	University Avenue / Notre Dame Avenue	Signal	3	4	2	4
13	University Avenue / O'Brien Drive	Signal	0	1	0	0
14	University Avenue / Adams Drive	Stop	0	0	0	0
15	University Avenue / Purdue Avenue	Stop	0	0	0	0
16	Capitol Avenue / Donohoe Street	Signal	1	0	4	22
17	University Avenue / US 101 SB Ramps	Signal	0	0	0	0
18	University Avenue / Woodland Avenue	Signal	0	28	37	1
19	Bayfront Expressway / Willow Road	Signal	1	0	0	20
20	Bayfront Expressway / University Avenue	Signal	0	0	0	1

Existing Average Daily Traffic Counts

In addition to intersection turning movement counts, 72-hour tube counts were performed at the following 16 locations within the study area. Table III lists the street segments and the corresponding Average Daily Traffic (ADT) Volume. Figure 4 shows the average daily traffic counts in each direction on Willow Road, University Avenue, East Bayshore Road, Newbridge Street, and O'Brien Drive.

Table III: Average Daily Traffic Count Locations

#	*Street*	*Segment*	*ADT*
1	Bayshore Road	North of Euclid	8,423
2	Euclid Road	Between Donohoe and Runnymede	3,019
3	Cooley Avenue	Between Donohoe and Weeks Street	4,402
4	Clarke Avenue	Between East Bayshore and Runnymede	2,688
5	Clarke Avenue	Between Runnymede and Notre Dame	2,176
6	Pulgas Avenue	Between East Bayshore and Runnymede	5,880
7	Notre Dame	South of University Avenue	1,465
8	Purdue Avenue	South of University Avenue	1,948
9	Hamilton Avenue	North of Willow Rd.	3,560
10	Ivy Drive	North of Willow Rd.	2,987
11	Newbridge Street	North of Willow Rd.	6,538
12	O'Brien Drive	South of Willow Rd.	6,053
13	Willow Road	East of US 101	32,766
14	Willow Road	West of Bayfront Expressway	19,840
15	University Avenue	East of US 101	29,210
16	University Avenue	West of Bayfront Expressway	22,540

Intersection Level of Service Analysis – Existing Conditions

Table IV below summarizes peak hour levels of service at the eighteen study intersections under Existing Conditions. LOS worksheets are provided in Appendix B.

Currently, all study intersections, except the following six intersections, operate within acceptable level of service (LOS) standards, with service levels at LOS D or better during the a.m. and p.m. peak hours.

- The intersection of Willow Road / Newbridge Street operates at LOS E during both a.m. and p.m. peak hours.
- At the intersection of University Avenue / Michigan Avenue, the stop-controlled Michigan Avenue approach operates at LOS F with delay greater than 120 seconds per vehicle during the p.m. peak hour.
- At the intersection of University Avenue / Adams Drive, the stop-controlled Adams Drive approach operates at LOS F during both a.m. and p.m. peak hours.

- At the intersection of University Avenue / Purdue Avenue, the stop-controlled Purdue Avenue approach operates at LOS E during the a.m. peak hour and LOS F during the p.m. peak hour.
- The intersection of Bayfront Expressway / Willow Road operates at LOS F during the p.m. peak hour.
- The intersection of Bayfront Expressway / University Avenue operates at LOS E during the a.m. peak hour and LOS F during the p.m. peak hour.

Additionally, the intersection of University Avenue / Donohoe Street operates at LOS D with a delay of 53.7 seconds per vehicle (which is close to LOS E standard of 55.0 seconds per vehicle) during the p.m. peak hour.

Table IV: Peak Hour Intersection Levels of Service – Existing Conditions

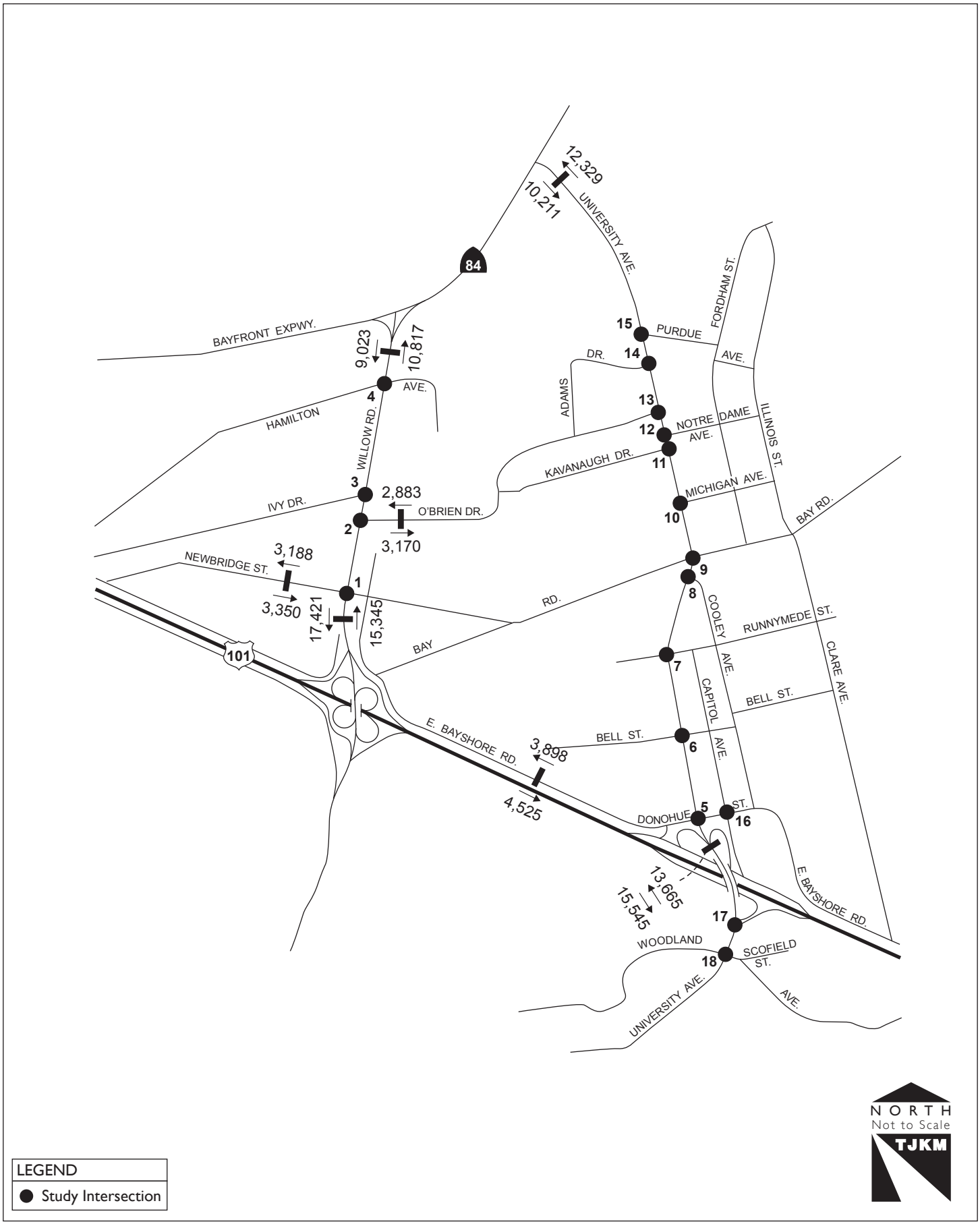
ID	*Intersection*	*Control*	*Existing Conditions*			
			A.M. Peak Hour		*P.M. Peak Hour*	
			Delay	*LOS*	*Delay*	*LOS*
1	Willow Road / Newbridge Street	Signal	**69.6**	**E**	**65.4**	**E**
2	Willow Road/ O'Brien Drive	Signal	6.9	A	12.5	B
3	Willow Road / Ivy Drive	Signal	22.6	C	21.4	C
4	Willow Road / Hamilton Avenue	Signal	16.4	B	20.9	C
5	University Avenue / Donohoe Street	Signal	44.4	D	**54.8**	**D**
6	University Avenue / Bell Street	Signal	6.7	A	10.7	B
7	University Avenue / Runnymede Street	Signal	8.7	A	11.0	B
8	University Avenue / Cooley Avenue	Signal	11.7	B	15.4	C
9	University Avenue / Bay Road	Signal	27.8	C	40.8	D
10	University Avenue / Michigan Avenue	Stop	**21.8**	**C**	**>120**	**F**
11	University Avenue / Kavanaugh Drive	Signal	19.3	B	8.1	A
12	University Avenue / Notre Dame Avenue	Signal	24.3	C	5.0	A
13	University Avenue / O'Brien Drive	Signal	8.7	A	6.7	A
14	University Avenue / Adams Drive	Stop	**> 80**	**F**	**55.8**	**F**
15	University Avenue / Purdue Avenue	Stop	**45.4**	**E**	**>120**	**F**
16	Capitol Avenue / Donohoe Street	Signal	18.7	B	30.0	C
17	University Avenue / US 101 SB Ramps	Signal	19.3	B	22.8	C
18	University Avenue / Woodland Avenue	Signal	26.5	C	30.1	C
19	Bayfront Expressway / Willow Road	Signal	**19.3**	**B**	**>120**	**F**
20	Bayfront Expressway / University Avenue	Signal	**61.5**	**E**	**>120**	**F**

Notes: Delay = Average control delay in seconds per vehicle. LOS = Level of Service. Values are for the critical minor approach of unsignalized intersections, and overall for signalized intersections.

San Mateo County - Willow Road and University Avenue

Average Daily Traffic (ADT)

Figure 4



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Accident Analysis – Existing Conditions

Accident data at study intersections along University Avenue and Willow Road was obtained from the City of Menlo Park and City of East Palo Alto. Table V summarizes the accident history by type of collision (rear-end, side-swipe, broadside) and the intersection locations. TJKM evaluated the accident history in order to determine any obvious accident patterns in the past collisions.

There were a total of 491 accidents reported during the five-year period in the study area with 192 rear-end collisions and 129 broadside collisions. The intersection of University Avenue / Donohoe has the highest number of collisions on University Avenue with 111 collisions. The intersection of Willow Road / Newbridge Street has the highest number of collisions on Willow Road with 51 collisions within the past five years.

There were a total of 351 accidents reported at University Avenue intersections and 114 accidents reported at Willow Road intersections. The most common type of collision was rear-end collisions followed by broadside collisions.

Table V: Accidents by Type of Collision

ID	*Intersection*	*Total*	*Head-on*	*Rear-end*	*Broadside*	*Sideswipe*	*Bike/ Pedestrian*	*Other*
1	Willow Rd. / Newbridge St.	51	1	26	9	11	0	4
2	Willow Rd./ O'Brien Drive	10	0	7	2	0	0	1
3	Willow Rd. / Ivy Drive	15	2	6	3	3	0	1
4	Willow Rd. / Hamilton Ave.	13	1	7	2	3	0	0
5	University Ave. / Donohoe St.	111	6	43	21	33	1	7
6	University Ave. / Bell St.	55	3	12	28	4	4	4
7	University Ave. / Runnymede St.	35	3	3	18	6	1	4
8	University Ave. / Cooley Ave.	5	1	1	2	0	1	0
9	University Ave. / Bay Rd.	37	1	15	5	8	2	6
10	University Ave. / Michigan Ave.	8	0	3	2	1	1	1
11	University Ave. / Kavanaugh Drive	12	1	6	1	4	0	0
12	University Ave. / Notre Dame Ave.	7	0	5	1	1	0	0
13	University Ave. / O'Brien Drive	3	0	3	0	0	0	0
14	University Ave. / Adams Drive	3	0	1	1	0	0	1
15	University Ave. / Purdue Ave.	7	0	1	4	2	0	0
16	Capitol Ave. / Donohoe St.	26	3	9	3	8	1	2
17	University Ave. / US 101 SB Ramps	19	1	14	3	1	0	0
18	University Ave. / Woodland Ave.	24	1	16	3	1	1	2
19	Bayfront Expressway / Willow Road	25	0	6	11	6	0	2
20	Bayfront Expressway / University Avenue	25	0	8	10	4	0	3
Totals		**491**	**24**	**192**	**129**	**96**	**12**	**38**

The collision data for study intersections were compared with the statewide mean collision rate for roadways with similar characteristics. This comparative analysis was undertaken using the Rate Quality Control Method.

The Rate Quality Control Method flags a location as hazardous if it satisfies the following threshold:

Accident Rate > *βeta*

The analysis method assists in identifying "accident-prone" locations where collision rates are significantly higher than the mean collision rate for a comparable traffic volume. βeta was set at the 95th-percentile confidence level, meaning that the observed accident rate would only occur by chance five times out of one hundred due to chance alone. Based on the 2007 accident data on California State Highways, the average statewide accident rates per million vehicles for a signalized four-legged intersection and a signalized three-legged intersection are 0.58 and 0.43 respectively, and the accident rate for a three-legged unsignalized intersection is 0.19. "Hazardous" intersections are identified as those having significantly higher accident rates than the statewide average.

Table VI summarizes the accident rate analysis. Additionally, Appendix C contains collision diagrams for the study intersections. Based on the collision data analysis, two study intersections fall under the "Hazardous" location category:

- University Avenue / Donohoe Street
- University Avenue / Bell Street

It is noted that signal upgrade to include protected left-turn arrow signal displays are already planned and designed for the intersection of University Avenue/Bell Street. That improvement is expected to reduce collisions considerably.

In addition, the following intersections are very close to being considered a Hazardous location:

- Willow Road / Newbridge Street
- University Avenue / Runnymede Street

Table VI: Accident Rate Analysis

ID	*Intersection*	*Total*	*Accident Rate[1]*	*βeta[2]*	*Remark*
1	Willow Road / Newbridge Street	51	0.71	0.73	Non Hazardous location
2	Willow Road / O'Brien Drive	10	0.19	0.30	Non Hazardous location
3	Willow Road / Ivy Drive	15	0.33	0.60	Non Hazardous location
4	Willow Road / Hamilton Avenue	13	0.30	0.60	Non Hazardous location
5	University Avenue / Donohoe Street	111	1.44	0.73	Hazardous location
6	University Avenue / Bell Street	55	1.24	0.78	Hazardous location
7	University Avenue / Runnymede Street	35	0.76	0.78	Non Hazardous location
8	University Avenue / Cooley Avenue	5	0.13	0.32	Non Hazardous location
9	University Avenue / Bay Road	37	0.68	0.76	Non Hazardous location
10	University Avenue / Michigan Avenue	8	0.20	0.31	Non Hazardous location
11	University Avenue / Kavanaugh Drive	12	0.28	0.61	Non Hazardous location
12	University Avenue / Notre Dame Avenue	7	0.17	0.61	Non Hazardous location
13	University Avenue / O'Brien Drive	3	0.07	0.61	Non Hazardous location
14	University Avenue / Adams Drive	3	0.07	0.31	Non Hazardous location
15	University Avenue / Purdue Avenue	7	0.16	0.31	Non Hazardous location
16	Capitol Avenue / Donohoe Street	26	0.57	0.78	Non Hazardous location
17	University Avenue / US 101 SB Ramps	19	0.25	0.56	Non Hazardous location
18	University Avenue / Woodland Avenue	24	0.39	0.75	Non Hazardous location
19	Bayfront Expressway / Willow Road	25	0.27	0.72	Non Hazardous location
20	Bayfront Expressway / University Avenue	25	0.20	0.70	Non Hazardous location
Totals		**491**			

Notes: 1) Accident Rate is defined as the number of accidents per million vehicles entering the intersection.
2) βeta is right hand expression of the inequality, given as; βeta = XS + K (XS/Vi)0.5 + 1/2 Vi. Where
XS = mean accident rate for locations with characteristics similar to those of location i.
Vi = volume of traffic at location i, in the same units as the accident rates are given.
K = 1.64 (constant)

Near-Term Conditions

Intersection Level of Service Analysis – Near-Term Conditions

This scenario is identical to Existing Conditions, but with the addition of one percent annual growth in traffic volume assumed over the next five years. Figure 5 shows near-term turning movement volumes at the study intersections.

Table VII below summarizes peak hour levels of service at the study intersections under Near-Term Conditions. LOS worksheets are provided in Appendix D. All intersections with acceptable service levels for Existing Conditions are expected to continue operating at acceptable service levels in Near-Term Conditions, except the University Avenue / Donohoe Street intersection, which would deteriorate to LOS E in the p.m. peak hour. Under Near-Term Conditions, the following study intersections are expected to operate at LOS E or worse.

- The intersection of Willow Road / Newbridge Street would operate at LOS F during both a.m. and p.m. peak hours.
- The intersection of University Avenue / Donohoe Street would operate at LOS D with a delay of 51.3 seconds per vehicle (which is close to LOS E standard of 55.0 seconds per vehicle) during the a.m. peak hour and operates at LOS E during the p.m. peak hour.
- At the intersection of University Avenue / Michigan Avenue, the stop-controlled Michigan Avenue approach would operate at LOS F with delay greater than 120 seconds per vehicle during the p.m. peak hour.
- At the intersection of University Avenue / Adams Drive, the stop-controlled Adams Drive approach would operate at LOS F during both a.m. and p.m. peak hours.
- At the intersection of University Avenue / Purdue Avenue, the stop-controlled Purdue Avenue approach would operate at LOS E during the a.m. peak hour and LOS F during the p.m. peak hour.
- The intersection of Bayfront Expressway / Willow Road would operate at LOS F during the p.m. peak hour.

The intersection of Bayfront Expressway / University Avenue would operate at LOS E during the a.m. peak hour and LOS F during the p.m. peak hour.

Table VII: Peak Hour Intersection Levels of Service – Near-Term Conditions

ID	Intersection	Control	Near Term Conditions			
			A.M. Peak Hour		P.M. Peak Hour	
			Delay	LOS	Delay	LOS
1	Willow Road / Newbridge Street	Signal	**86.5**	**F**	**>120**	**F**
2	Willow Road/ O'Brien Drive	Signal	7.1	A	13.3	B
3	Willow Road / Ivy Drive	Signal	25.3	C	23.3	C
4	Willow Road / Hamilton Avenue	Signal	16.9	B	31.3	C
5	University Avenue / Donohoe Street	Signal	51.3	D	**62.1**	**E**
6	University Avenue / Bell Street	Signal	6.8	A	11.4	B
7	University Avenue / Runnymede Street	Signal	9.2	A	11.3	B
8	University Avenue / Cooley Avenue	Stop	11.8	B	15.6	C
9	University Avenue / Bay Road	Signal	28.3	C	44.0	D
10	University Avenue / Michigan Avenue	Stop	23.8	C	**>120**	**F**
11	University Avenue / Kavanaugh Drive	Signal	24.9	C	9.1	A
12	University Avenue / Notre Dame Avenue	Signal	27.1	C	5.3	A
13	University Avenue / O'Brien Drive	Signal	9.1	A	6.5	A
14	University Avenue / Adams Drive	Stop	**> 80**	**F**	**> 80**	**F**
15	University Avenue / Purdue Avenue	Stop	61.5	F	**>120**	**F**
16	Capitol Avenue / Donohoe Street	Signal	18.9	B	29.8	C
17	University Avenue / US 101 SB Ramps	Signal	20.3	C	26.5	C
18	University Avenue / Woodland Avenue	Signal	27.1	C	32.2	C
19	Bayfront Expressway / Willow Road	Signal	21.3	C	**>120**	**F**
20	Bayfront Expressway / University Avenue	Signal	**70.5**	**E**	**>120**	**F**

Notes: Delay = Average control delay in seconds per vehicle. LOS = Level of Service.
Values are for the critical minor approach of unsignalized intersections, and overall for signalized intersections

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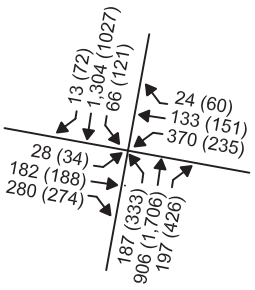
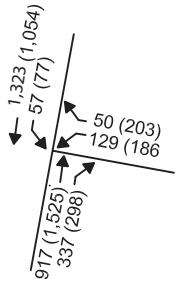
San Mateo County - Willow Road and University Avenue
Near Term Turning Movement Volumes

Figure 5

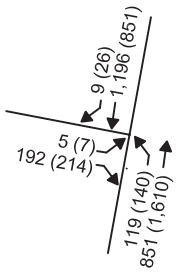
Intersection #1 Willow Rd./Newbridge St.



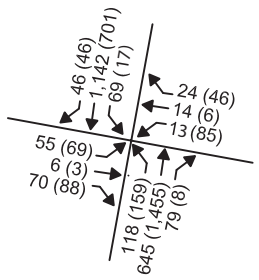
Intersection #2 Willow Rd./O'Brien Dr.



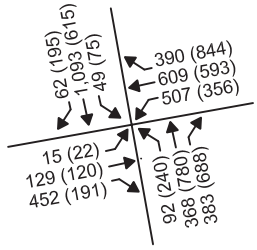
Intersection #3 Willow Rd./Ivy Dr.



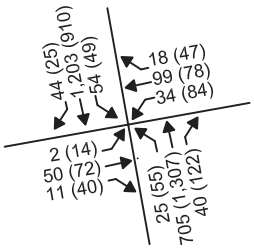
Intersection #4 Willow Rd./Hamilton Ave.



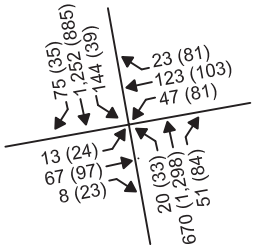
Intersection #5 University Ave./Donohoe St.



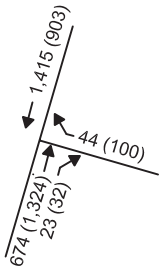
Intersection #6 University Ave./Bell St.



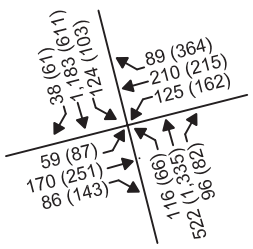
Intersection #7 University Ave./Runnymede St.



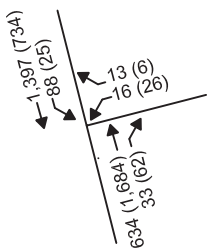
Intersection #8 University Ave./Cooley Ave.



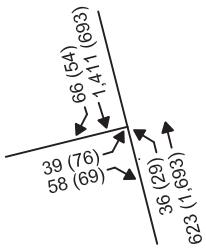
Intersection #9 University Ave./Bay Rd.



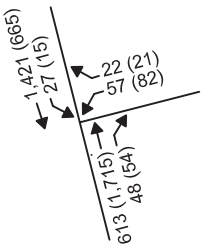
Intersection #10 University Ave./Michigan Ave.



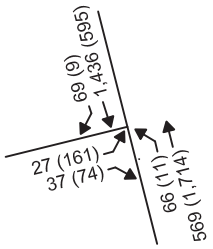
Intersection #11 University Ave./Kavanaugh Dr.



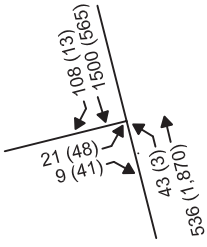
Intersection #12 University Ave./Notre Dame Ave.



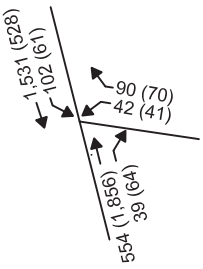
Intersection #13 University Ave./O'Brien Dr.



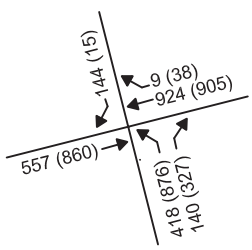
Intersection #14 University Ave./Adams Dr.



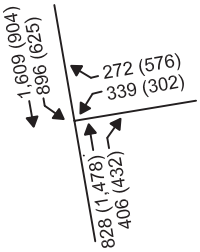
Intersection #15 University Ave./Purdue Ave.



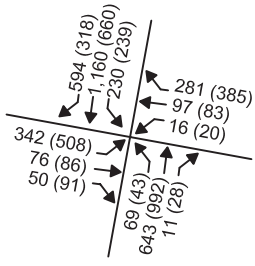
Intersection #16 Capitol Ave./Donohoe St.



Intersection #17 University Ave./US 101 SB Ramps



Intersection #18 University Ave./Woodland Ave.



Potential Improvements

Based on the comprehensive evaluation of existing and near-term traffic conditions, the needs for potential improvements on the Willow Road and University Avenue corridors were identified. TJKM developed various alternatives for potential improvements on Willow Road and University Avenue between US 101 and Bayfront Expressway that meet the project objectives, including reduced delays and queues for vehicle traffic and transit and enhanced safety for pedestrians and bicyclists. This section of the report presents background, need, opportunities, and a conceptual design approach for each of the recommended improvements.

The needs and potential improvements can be broadly categorized into the following groups:

1. System-wide operational improvement
    a) Signal Coordination (all signals along University Avenue and Willow Road)
2. Intersection-specific improvements (Safety and Operational)
    a) Willow Road / Newbridge Street and northbound US 101 Off-ramp to Willow
    b) Willow Road and Bayfront Expressway
    c) University Avenue and Cooley Avenue
    d) University Avenue and Runnymede Street
    e) University Avenue / Donohoe Street and Donohoe Street / Capitol Avenue
3. Pedestrian/Bicycle/Other improvements
    a) Uncontrolled pedestrian crossings
    b) Pedestrian safety across US 101 NB off-ramp at University Avenue
    c) Pedestrian countdown signals
    d) Bicycle detection
    e) Emergency vehicle signal preemption

TJKM evaluated the potential impacts of each alternative on vehicle traffic, pedestrians, bicyclists, transit, and on neighboring local streets. Synchro was used to analyze the benefits of signal coordination and each intersection-specific alternative to vehicle traffic LOS, delay, and queuing. TJKM met with City of Menlo Park, City of East Palo Alto, Caltrans, MTC and C/CAG staff to coordinate development of appropriate performance measures for the potential improvement alternatives, and to review the alternatives being considered. The need, conceptual design approach, evaluation of potential impacts, and performance measures for each of the potential improvement alternatives are presented in detail in the subsequent sections of this report.

Although the stop-controlled side streets intersecting University Avenue at Michigan Avenue, Adam Drive, and Purdue Avenue are expected to continue operating at unacceptable levels of service, this study did not identify any improvements for those intersections. In many communities similar to East Palo Alto, where arterial roadways have unsignalized intersections with low-volume side streets it is not unusual for the side street to operate at below-standard LOS. In most cases, it is often physically and operationally infeasible to provide improvements that would achieve acceptable LOS on the side street without impeding traffic flow on the major street, i.e. University Avenue. TJKM experience has found that the most typical mitigation measure used for improving

below-standard side street operations is to install a traffic signal. However, in this case it is operationally undesirable to install traffic signals at these locations, because the intersections do not meet signal warrants and signals would increase the delays on University Avenue at these intersections. Additionally, the reduced side street delay resulting with a signal would likely attract higher cut-through traffic volumes to the local neighborhood streets connecting to the intersection. Because these results would be contrary to the objectives of this study, no such improvements are recommended for the three subject stop-controlled side street intersections on University Avenue.

System-Wide Operational Improvement

Signal Coordination

Need

Based on the near-term LOS conditions described in a previous section of this report, four signalized intersections operate below the acceptable LOS. Traffic signal coordination is typically needed to process traffic efficiently through a group of intersections. Signal coordination utilizes the existing roadway infrastructure by insuring optimum travel speeds while reducing delay. Currently, the signals on University Avenue and Willow Road are not coordinated. The signals are operating with variable cycle lengths, which differ between intersections. This results in excessive delay, long queues, and an increased number of vehicle stops, which in turn increases vehicle emissions and poor air quality.

Improvement

To maximize the efficiency of the roadway system, TJKM recommends coordinating all the signals along the University Avenue and Willow Road corridor. Traffic signal coordination requires the cycle lengths at each of the intersection to be the same. Signal timings for all study intersections on University Avenue and Willow Road were optimized using a common cycle length for the a.m. and the p.m. peak periods.

The revised delays and LOS are presented in Tables VIII and IX.

Table VIII: A.M. Peak Near-Term Conditions Before and After Improvement

ID	*Intersection*	*Control*	*A.M. Near Term Conditions*			
			Before Improvement		*After Improvement*	
			Delay	*LOS*	*Delay*	*LOS*
1	Willow Road / Newbridge Street	Signal	**86.5**	**F**	**58.2**	**E**
2	Willow Road/ O'Brien Drive	Signal	7.1	A	7.1	A
3	Willow Road / Ivy Drive	Signal	25.3	C	9.0	A
4	Willow Road / Hamilton Avenue	Signal	16.9	B	17.9	B
5	University Avenue / Donohoe Street	Signal	51.3	D	37.3	D
6	University Avenue / Bell Street	Signal	6.8	A	7.1	A
7	University Avenue / Runnymede Street	Signal	9.2	A	6.7	A
9	University Avenue / Bay Road	Signal	28.3	C	25.9	C
11	University Avenue / Kavanaugh Drive	Signal	24.9	C	5.6	A
12	University Avenue / Notre Dame Avenue	Signal	27.1	C	8.9	A
13	University Avenue / O'Brien Drive	Signal	9.1	A	8.3	A
16	Capitol Avenue / Donohoe Street	Signal	18.9	B	22.5	C
17	University Avenue / US 101 SB Ramps	Signal	20.3	C	16.0	B
18	University Avenue / Woodland Avenue	Signal	27.1	C	29.8	C
19	Bayfront Expressway / Willow Road	Signal	21.3	C	25.8	C
20	Bayfront Expressway / University Avenue	Signal	**70.5**	**E**	28.0	C

Table IX: P.M. Peak Near-Term Conditions Before and After Improvement

ID	Intersection	Control	P.M. Near Term Conditions			
			Before Improvement		After Improvement	
			Delay	LOS	Delay	LOS
1	Willow Road / Newbridge Street	Signal	**>120**	**F**	45.0	D
2	Willow Road/ O'Brien Drive	Signal	13.3	B	14.0	B
3	Willow Road / Ivy Drive	Signal	23.3	C	7.1	A
4	Willow Road / Hamilton Avenue	Signal	31.3	C	14.6	B
5	University Avenue / Donohoe Street	Signal	**62.1**	**E**	39.9	D
6	University Avenue / Bell Street	Signal	11.4	B	9.7	A
7	University Avenue / Runnymede Street	Signal	11.3	B	14.1	B
9	University Avenue / Bay Road	Signal	44.0	D	36.9	D
11	University Avenue / Kavanaugh Drive	Signal	9.1	A	5.3	A
12	University Avenue / Notre Dame Avenue	Signal	5.3	A	4.6	A
13	University Avenue / O'Brien Drive	Signal	6.5	A	5.9	A
16	Capitol Avenue / Donohoe Street	Signal	29.8	C	22.5	C
17	University Avenue / US 101 SB Ramps	Signal	26.5	C	18.4	B
18	University Avenue / Woodland Avenue	Signal	32.2	C	31.0	C
19	Bayfront Expressway / Willow Road	Signal	**>120**	**F**	**>120**	**F**
20	Bayfront Expressway / University Avenue	Signal	**>120**	**F**	**>120**	**F**

In addition to the level of service analysis, travel time estimates were conducted based on the Synchro model. Travel time estimates were conducted for "with improvement" and "without improvement" conditions. Table X below summarizes the findings. As shown in Table X, signal coordination on University Avenue and Willow Road significantly reduces travel times on both the corridors. Drastic improvement is expected on Willow Road in the eastbound direction during the p.m. peak periods due to proper coordination and increased cycle length at the intersection of Willow Road and Newbridge Street. Even with signal retiming, the intersection of University Avenue and Bayfront Expressway continues to operate at LOS F with excessive delay. Therefore, the travel time benefits on University Avenue in the eastbound direction are expected to be moderate.

Table X: Travel Times With and Without Improvement (in seconds)

Corridor	A.M. Peak (Minutes:Seconds)			P.M. Peak (Minutes:Seconds)		
	Before Improvement	After Improvement	Diff	Before Improvement	After Improvement	Diff
Willow Road EB	3:03	3:10	+0:07	**5:57**	**3:22**	**-2:35**
Willow Road WB	**5:41**	**4:01**	**-1:40**	4:33	3:51	-0:42
University Ave EB	7:11	6:37	-0:34	**9:20**	**8:47**	**-0:33**
University Ave WB	**6:30**	**5:16**	**-1:14**	6:43	6:13	-0:30

Note: **0:00 (Bold)** shows the travel times for the peak traffic flow direction

Pros and Cons

Some of the advantages of traffic signal coordination are:

- Improves vehicle mobility and access through the area
- Reduces energy and fuel consumption
- Reduces vehicle stops and increases travel speeds
- Provides environmental benefits from reduced vehicle emissions

Some of the disadvantages of traffic signal coordination are:

- Increase in travel speeds may have a negative impact on the adjacent community
- May attract additional traffic through the corridor

Intersection-Specific Improvements

Based on analysis of the existing and near-term conditions, several intersections on Willow Road and University Avenue were identified for potential improvements. This section addresses the recommended improvements at each intersection in detail.

Willow Road / Newbridge Street and Northbound US 101 Off-ramp to Willow Road

Need

The intersection of Willow Road and Newbridge Street is expected to operate at LOS F under near-term conditions and the collision rates are high. This is partly due to the close proximity of the intersection to the US 101 northbound off-ramp. The existing lane configuration forces traffic exiting from the US 101 northbound off-ramp to merge into high-volume eastbound traffic lanes on Willow Road, which causes delays and queues for the off-ramp traffic. Additionally, traffic from the off-ramp subsequently making a left turn at the intersection of Willow Road and Newbridge Street needs to weave through the high-volume eastbound traffic on Willow Road within a short distance to access the left-turn lane. Counts conducted in September 2010 indicate that approximately 900 vehicles exit from the US 101 off-ramp and merge onto eastbound Willow Road during the p.m. peak hour, of which 35 vehicles weave through eastbound traffic to access the left-turn lane for Newbridge Street. The peak 15-minute volume was 12 vehicles weaving from the off-ramp to the eastbound left-turn lane during the p.m. peak. These conditions are potentially the cause for several rear-end and sideswipe accidents on Willow Road between the US 101 northbound off-ramp and Newbridge Street. The objective of the proposed improvement is to reduce traffic merging and weaving issues on this segment of Willow Road.

Three improvement options were considered to address the existing weaving issue. Figures 6, 7, and 8 show the concept plans.

Improvement Option 1

Option 1 would add a third eastbound lane on Willow Road extending from the US 101 northbound off-ramp to Newbridge Street. The third lane would be added by widening the north side of Willow Road and realigning the raised median as shown in Figure 6. Adding the third lane extending from the US 101 off-ramp would eliminate the need for ramp traffic to yield and merge into the eastbound traffic on Willow Road. The widening of the roadway and realignment of the median on Willow Road would also allow extending the exclusive eastbound left turn lane on Willow Road by approximately 75 feet.

As an extension of this alternative, TJKM considered the option of prohibiting traffic from the US 101 northbound off-ramp from making a left turn at the intersection of Willow Road and Newbridge Street. This would completely eliminate the need for weaving on this segment of Willow Road. The prohibition can be achieved by placing a left-turn restriction sign (Option 1b) visible to traffic exiting US 101 only and not visible to eastbound traffic on Willow Road. This would divert traffic and slightly increase the number of left turns and U-turns at the intersection of Willow Road/Ivy Drive, and thereby also increase volumes at the intervening Willow Road/O'Brien Drive intersection. TJKM conducted LOS analysis to check the impact at those two intersections with the increased volumes. Table XI shows the LOS and delay (in seconds) with and without the proposed Option 1b improvements. As shown in Table XI, the increase in delay at the intersections due to the shift in traffic would be insignificant.

It should be noted that eastbound traffic on Willow Road would still be able to make right turns at the Newbridge Street intersection. Figure 6 shows the concept sketch for the proposed Option 1 and Option 1b improvements.

Table XI: LOS and Delay (in seconds) With and Without Option 1b or Option 2

Near-Term Conditions	*LOS (Delay) Before Improvement*		*LOS (Delay) After Improvement*	
	A.M. Peak Hour	*P.M. Peak Hour*	*A.M. Peak Hour*	*P.M. Peak Hour*
Willow Road and Newbridge Street	E (58.2)	D (45.0)	D (49.7)	D (44.4)
Willow Road and O'Brien Drive	A (7.1)	B (14.0)	A (6.8)	B (15.0)
Willow Road and Ivy Drive	A (9.2)	A (7.1)	B (11.1)	B (10.4)

Improvement Option 2

This improvement is similar to Option 1b, but with the addition of delineator posts to physically restrict US 101 off-ramp traffic from making the left turns at the intersection of Newbridge Street. The level of service impact for this alternative would be similar to Option 1b. It should be noted that eastbound traffic on Willow Road would still be able to make right turns at the Newbridge Street intersection, but the delineator posts would make that movement more difficult by shortening the distance available to merge into the far right lane before turning right. Figure 7 shows the concept sketch for Option 2.

Improvement Option 3

Option 3 would install a signal at the intersection of Willow Road and the US 101 northbound off-ramp. The recommended signal would be a two-phase signal assigning right of way with green signals alternating between the US 101 off ramp and eastbound Willow Road. This would completely eliminate the weaving on this roadway segment. This option would not restrict the left-turn movement at the intersection of Willow Road and Newbridge Street. Figure 8 shows the concept plan for the proposed improvement.

TJKM conducted queuing analysis at the proposed signal to check whether queues could potentially block through traffic on the US 101 mainline. Table XII shows the expected queues at the proposed signal. As shown in Table XII, the off-ramp would need to be widened to two lanes to avoid queues from the proposed signal extending too close to the freeway mainline.

Table XII: Queues (in feet) on US 101 Northbound Off-Ramp at Willow with Option 3

Option 3 (Signalized off-ramp)	*50th Percentile Queue (ft)*	*95th Percentile Queue (ft)*
US 101 NB off ramp with single lane	491	705
US 101 NB off ramp with two lanes	200	329

Pros & Cons

Table XIII summarizes the advantages and disadvantages of the alternative options at Willow Road / Newbridge Street and the Northbound US 101 Off-ramp to Willow Road.

Table XIII: Pros and Cons of Alternative Options – Willow/Newbridge/US 101 Ramp

	Option 1	*Option 1b*	*Option 2*	*Option 3*
Benefits				
Resolve weaving issues and enhance safety			√	√
Reduce collisions due to weaving traffic			√	√
Improve capacity and lane utilization by eliminating forced merge	√	√	√	√
Provide left-turn access at Newbridge Street to traffic from US 101ramp	√			√
Issues				
Diverts desired left turn at Newbridge to a left or U-turn at Ivy Drive - increasing travel distance		√	√	
Right-of-way issues	√	√	√	
Signal timing coordination with other corridor intersections				√
Requires coordination with Caltrans due to modifications at US 101 freeway exit ramp	√	√	√	√√
Must ensure that traffic on the off-ramp will not back up and impact US 101 northbound freeway				√√

LEFT TURN POCKET STORAGE LENGTH:

EXISTING: 385'
PROPOSED: 460'

N

(NORTH ARROW PER STUDY CONVENTION)

0 40' 80'

SCALE: 1"=40'

LEFT TURN POCKET STORAGE LENGTH:

EXISTING: 385'
PROPOSED: 460'

N

(NORTH ARROW PER STUDY CONVENTION)

0 40' 80'

SCALE: 1"=40'

TJKM

N

(NORTH ARROW PER STUDY CONVENTION)

0 40' 80'

SCALE: 1"=40'

Willow Road and Bayfront Expressway

Need

The intersection of Willow Road and Bayfront Expressway operates at LOS F with heavy delays during the p.m. peak hour under existing conditions. It is expected that the delays will further increase at this intersection under near-term conditions. The eastbound right turn queue extends beyond the exclusive right turn lanes and thereby conflicts with the eastbound through traffic and the bicycle lane on Willow Road.

Two improvement options were considered to address the existing traffic conditions. Figures 9 and 10 show the concept plans.

Improvement Option 1

Option 1 would add a third right-turn lane for the eastbound right-turn movement by widening Willow Road, and convert the existing eastbound shared left-through lane to a through only lane. The proposed change in lane configuration would eliminate the need for the split-phase signal operation at this intersection. Figure 9 shows the concept plan for this improvement. Table XIV illustrates the expected improvements in traffic operations with the proposed improvements. With the proposed improvement the intersection is expected to continue operating at LOS F, but the delay is expected to reduce by approximately 49 seconds during the p.m. peak hour.

Table XIV: LOS and Delay (in seconds) With and Without Option 1 Improvements

Near-Term Conditions	*LOS (Delay) Before Improvement*		*LOS (Delay) After Improvement*	
	A.M. Peak Hour	*P.M. Peak Hour*	*A.M. Peak Hour*	*P.M. Peak Hour*
	C (25.8)	F (154.7)	C (25.1)	F (106.1)

Improvement Option 2

Option 2 would convert the eastbound right-turn lanes on Willow Road to a single free (not controlled by a traffic signal) right-turn lane. This modification would require widening Bayfront Expressway for approximately 1,200 feet to provide an acceleration lane for the free right-turn movement. Figure 10 shows the concept plan for the proposed improvement. Table XV shows the LOS and delay (in seconds) expected before and after the implementation of the improvement. With the proposed improvement, the intersection is expected to operate at LOS E with significant reduction in delay during the p.m. peak hour under near-term conditions.

It should be noted that this alternative would not provide a signalized pedestrian and bicycle crossing across the free right turn lane.

Table XV: LOS and Delay (in seconds) With and Without Option 2 Improvements

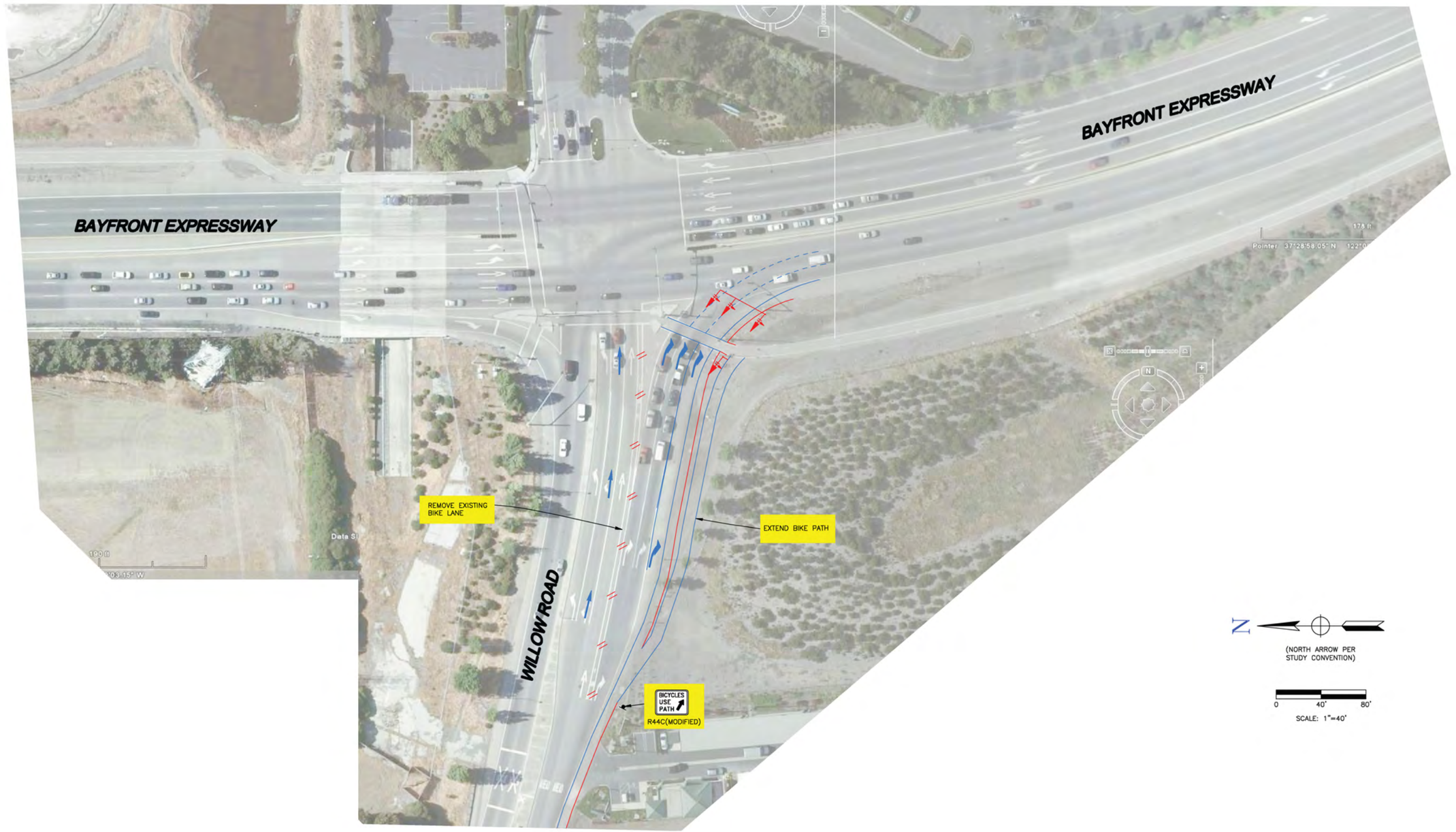
Near-Term Conditions	*LOS (Delay) Before Improvement*		*LOS (Delay) After Improvement*	
	A.M. Peak Hour	*P.M. Peak Hour*	*A.M. Peak Hour*	*P.M. Peak Hour*
	C (25.8)	F (154.7)	C (20.6)	E (61.3)

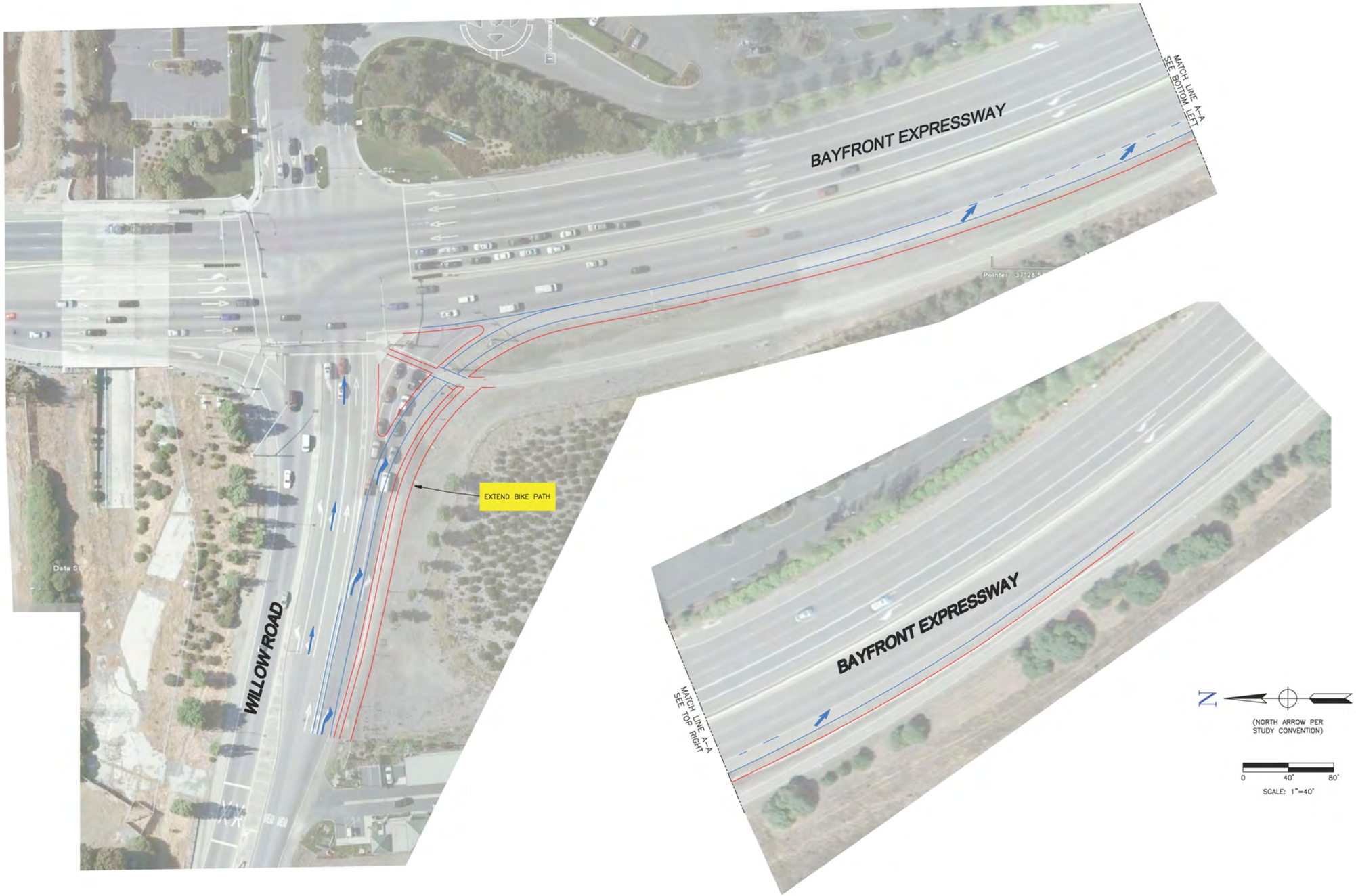
Pros & Cons

Table XVI summarizes the advantages and disadvantages of the alternative options at Willow Road and Bayfront Expressway.

Table XVI: Pros and Cons of Alternative Options – Willow Road/Bayfront Expressway

	Option 1	*Option 2*
Benefits		
Provides additional capacity for right-turn from eastbound Willow Road	√	√
Provides free flow movement for right-turn from eastbound Willow Road		√
Improves operation efficiency and reduces delay at the intersection	√	√
Emissions are also reduced	√	√
Better bicycle connection to Bay Trail and Dumbarton Bridge	√	
Issues		
Requires coordination with Caltrans for modifications at Bayfront Expressway	√	√
Wetlands Coordination and possible right-of-way acquisition	√	√
Pedestrians and bicyclists must cross free right-turn traffic flow to continue along Bay Trail to/from Dumbarton Bridge		√√


BAYFRONT EXPRESSWAY
BAYFRONT EXPRESSWAY
REMOVE EXISTING BIKE LANE
EXTEND BIKE PATH
WILLOW ROAD
BICYCLES USE PATH
R44C(MODIFIED)
(NORTH ARROW PER STUDY CONVENTION)
0 40' 80'
SCALE: 1"=40'


BAYFRONT EXPRESSWAY
MATCH LINE A-A
SEE BOTTOM LEFT
EXTEND BIKE PATH
WILLOW ROAD
BAYFRONT EXPRESSWAY
MATCH LINE A-A
SEE TOP RIGHT
(NORTH ARROW PER
STUDY CONVENTION)
0
40'
80'
SCALE: 1"=40'

University Avenue and Cooley Avenue

Need

The intersection of University Avenue and Cooley Avenue is located in close proximity to the intersection of University Avenue and Bay Road, which is congested during the p.m. peak period. Traffic turning right from Cooley Avenue results in increased traffic conflicts on University Avenue, because it is difficult to make the right turn onto University Avenue when traffic is backed up from the intersection of University Avenue and Bay Road. During the peak periods, Cooley Avenue serves as a cut-through route for traffic avoiding the congestion on University Avenue. The intersection of University Avenue and Cooley Avenue also has pedestrian safety concerns due to the conflicts between pedestrians crossing Cooley Avenue and the congested right turn to University Avenue.

Two improvement options that would restrict traffic access from Cooley Avenue to University Avenue were considered to address the existing traffic conditions at this intersection. Figures 11 and 12 show the concept plans.

Improvement Option 1

Option 1 would physically restrict traffic access from Cooley Avenue to University Avenue by constructing a raised curb bulb-out or barrier. This option would divert traffic currently exiting Cooley Avenue to instead use Runnymede Street to connect to University Avenue. However, traffic from eastbound University Avenue would still have right-turn access to enter Cooley Avenue. This configuration would potentially reduce neighborhood cut-through traffic and would also improve pedestrian safety crossing Cooley Avenue at the intersection. Figure 11 shows the conceptual sketch of this potential configuration for the intersection of University Avenue and Cooley Avenue.

TJKM conducted LOS analysis to check the impact at the intersection of University Avenue and Runnymede Street with this alternative, because it would divert some traffic to that intersection. Table XVII shows the LOS and delay (in seconds) at the intersection of University Avenue and Runnymede Street with and without the potential Option 1 improvements at the University Avenue / Cooley Avenue intersection. As shown in Table XVII, the intersection of University Avenue and Runnymede Street is expected to continue operating at LOS B or better with slight increases in delay. The expected increase in delay at the intersection of University Avenue and Runnymede Street due to the diversion of traffic is insignificant.

Table XVII: LOS and Delay (in seconds) With and Without Option 1 Improvements

Near Term Conditions	***LOS (Delay) Before Improvement***		***LOS (Delay) After Improvement***	
University Ave. and Runnymede St.	A.M. Peak Hour	P.M. Peak Hour	A.M. Peak Hour	P.M. Peak Hour
	A (6.7)	B (14.1)	A (7.3)	B (15.2)

Improvement Option 2

Option 2 would physically restrict all vehicular traffic movements between University Avenue and Cooley Avenue by constructing a cul-de-sac bulb at the north end of Cooley Avenue. This option would divert all traffic currently exiting and entering Cooley Avenue directly to/from University Avenue to instead use Runnymede Street to connect with University Avenue. This cul-de-sac configuration would eliminate neighborhood cut-through traffic using this portion of Cooley Avenue, and improve pedestrian safety by eliminating vehicle-pedestrian conflicts at this location on University Avenue. Figure 12 shows the concept sketch for this configuration on Cooley Avenue.

Because all traffic currently using Cooley Avenue to connect with University Avenue would be diverted to Runnymede Street, TJKM conducted LOS analysis to check the impact at the intersection of University Avenue and Runnymede Street with this alternative. Table XVIII shows the LOS and delay (in seconds) at the intersection of University Avenue and Runnymede Street with and without the potential Option 2 improvements at the University Avenue/Cooley Avenue intersection. As shown in Table XVIII, the intersection of University Avenue and Runnymede Street is expected to continue operating at LOS B or better with slight increases in delay. The expected increase in delay at the intersection of University Avenue and Runnymede Street due to the diversion of traffic is insignificant.

Table XVIII: LOS and Delay (in seconds) With and Without Option 2 Improvements

Near Term Conditions	***LOS (Delay) Before Improvement***		***LOS (Delay) After Improvement***	
University Ave. and Runnymede St.	A.M. Peak Hour	P.M. Peak Hour	A.M. Peak Hour	P.M. Peak Hour
	A (6.7)	B (14.1)	A (7.2)	B (15.3)

Pros & Cons

Table XIX summarizes the advantages and disadvantages of the alternative options at University Avenue and Cooley Avenue.

Table XIX: Pros and Cons of Alternative Options – University Ave./Cooley Ave.

	Option 1	***Option 2***
Benefits		
Eliminates cut-through traffic	√	√
Reduces pedestrian conflicts	√	√
Eliminates traffic interruptions on University Avenue	√	√
Will improve the overall flow of traffic and safety around the area	√	√
Issues		
Will divert traffic onto adjacent streets	√	√
Causes inconvenience to local residents	√	√
Traffic may use market private driveway to access University Avenue	√	√
Will need additional right-of-way to accommodate the changes		√√

San Mateo County - Willow Road and University Avenue

University Avenue/Cooley Avenue - Option 1

Figure 11

258-010 - 12/3/10 - RH

San Mateo County - Willow Road and University Avenue

University Avenue/Cooley Avenue - Option 2

Figure 12

258-010 - 12/3/10 - RH

University Avenue and Runnymede Street

Need

Based on the accident analysis, the intersection of University Avenue and Runnymede Street has collision rates that are significantly higher than the mean collision rate for comparable intersections. There were a total of 35 accidents reported during the last five-year period, including 18 broadside collisions. The second highest collision types at this location are rear-end accidents. Both types of accidents can be attributable to the lack of protected left-turn signal phases at the intersection and improper timing for intersection clearance intervals.

The access driveway for emergency vehicles exiting from a Fire Station is located just west of the intersection of University Avenue and Runnymede Street. It was observed that during peak periods, eastbound queues from the intersection block the access driveway to the Fire Station.

Two improvements are recommended that would potentially address the existing traffic conditions at this intersection.

Improvements

1. Upgrade the traffic signal hardware to include protected left-turn arrow signal displays and update signal timing plans to include protected left-turn signal phases for the eastbound and westbound left-turn movements. The protected left-turn phases are expected to reduce both broadside and rear-end collisions. However, this improvement is expected to increase the overall intersection average delays by three to four seconds. The intersection is expected to continue operating at an acceptable level of service of LOS B.
2. It is also recommended that an emergency signal be provided at the Fire Station access driveway just to the west of the intersection at University Avenue and Runnymede Street. The signal at the fire station access would have a preemption phasing sequence that would be coordinated with the signal at University Avenue and Runnymede Street when vehicles are exiting the station to respond to an emergency.

The proposed protected left-turn signals on University Avenue at Runnymede Street and the emergency signal at the Fire Station access driveway are recommended for design, installation, and operation as a single coordinated system.

Pros & Cons

Pros:

- A protected left-turn signal provides the motorists a period of time where left-turns can be made without encountering conflicting vehicular and pedestrian movements
- An emergency signal coordinated with the immediately adjacent intersection signal will facilitate vehicles exiting the Fire Station driveway to respond to an emergency, by clearing vehicle queues from the adjacent signal that might otherwise block the driveway, and allowing emergency vehicles to proceed without encountering conflicting vehicle movements at the driveway or the adjacent intersection.
- A protected left-turn signal at the intersection and emergency signal at the Fire Station driveway will enhance safety and reduce accidents.

Cons:

- Green time for the left turns will reduce the green time on through movements or side streets, which can be a disadvantage during peak hours with heavy main street traffic on University Avenue.
- A cost will be incurred in installing signal display hardware for left-turn arrows and the emergency signal, and connecting the additional signal conductor and detector wiring to the signal controller cabinet.

University Avenue / Donohoe Street and University Avenue / Capitol Avenue

Need

Severe traffic congestion occurs in the northbound direction on Donohoe Street extending from University Avenue to Capitol Avenue, resulting in a gridlock condition. Various improvement measures are proposed that would potentially alleviate the existing traffic conditions at this intersection.

Improvements

1. Add a northbound lane on Donohoe Street extending between University Avenue and Capitol Avenue. This could be achieved by narrowing the existing lanes in both directions on Donohoe Street to 10-foot lanes, which would not require any roadway widening and acquisition of right-of-way. The potential lane configuration for Donohoe Street is shown in Figure 13. The proposed lane configuration would replace the existing shared left-through lane with separate lanes for left-turn and through movements on the northbound approach of Donohoe Street.
2. Eliminating the shared left-through lane would allow the implementation of a standard signal phasing sequence with protected left-turn phases, replacing the existing split-phase sequence. As compared to a split-phase signal operation, a standard 8-phase signal sequence improves the overall efficiency of the intersection operation.
3. Remove the "No Right Turn on Red" restriction for the eastbound right turn movement from University Avenue to Donohoe Street.
4. Install additional signage and pavement markings to provide clearer direction to drivers regarding the correct lane to use for various traffic movements. Repaint the "Do Not Block Intersection" pavement marking and enhance signage for the intersection of Capitol Avenue and Donohoe Street.
5. Install red light camera enforcement systems at both intersections, which would help in increasing intersection safety.

Figure 13 presents the concept plan showing all the proposed improvements at the two intersections. It should be noted that improvements 1 and 2 are interdependent. Otherwise, proposed improvements can be implemented independently and in phases, if needed.

Table XX shows the improvement in LOS and delay with the proposed lane configuration, standard 8-phase signal operation, and removal of the "No Right Turn on Red" restriction. Other improvements are expected to provide better guidance and improve the overall intersection safety.

Table XX: LOS and Delay (in seconds) With and Without Improvements

Near-Term Conditions	*LOS (Delay) Before Improvement*		*LOS (Delay) After Improvement*	
	A.M. Peak Hour	*P.M. Peak Hour*	*A.M. Peak Hour*	*P.M. Peak Hour*
University Ave / Donohoe Street	D (37.3)	D (39.9)	D (36.2)	C(27.8)
Donohoe Street / Capitol Avenue	C (22.5)	C (22.5)	C(26.5)	C(28.9)

As shown in Table XX, the proposed improvements would improve traffic operations at the intersection of University Avenue and Donohoe Street by reducing intersection delay, especially p.m. peak hour operations, which would improve from LOS D to LOS C. The p.m. peak hour

intersection delay for Donohoe Street/Capitol Avenue is expected to slightly increase from 22.5 seconds/vehicle to up to 28.9 seconds/vehicle, but remain at an acceptable LOS C.

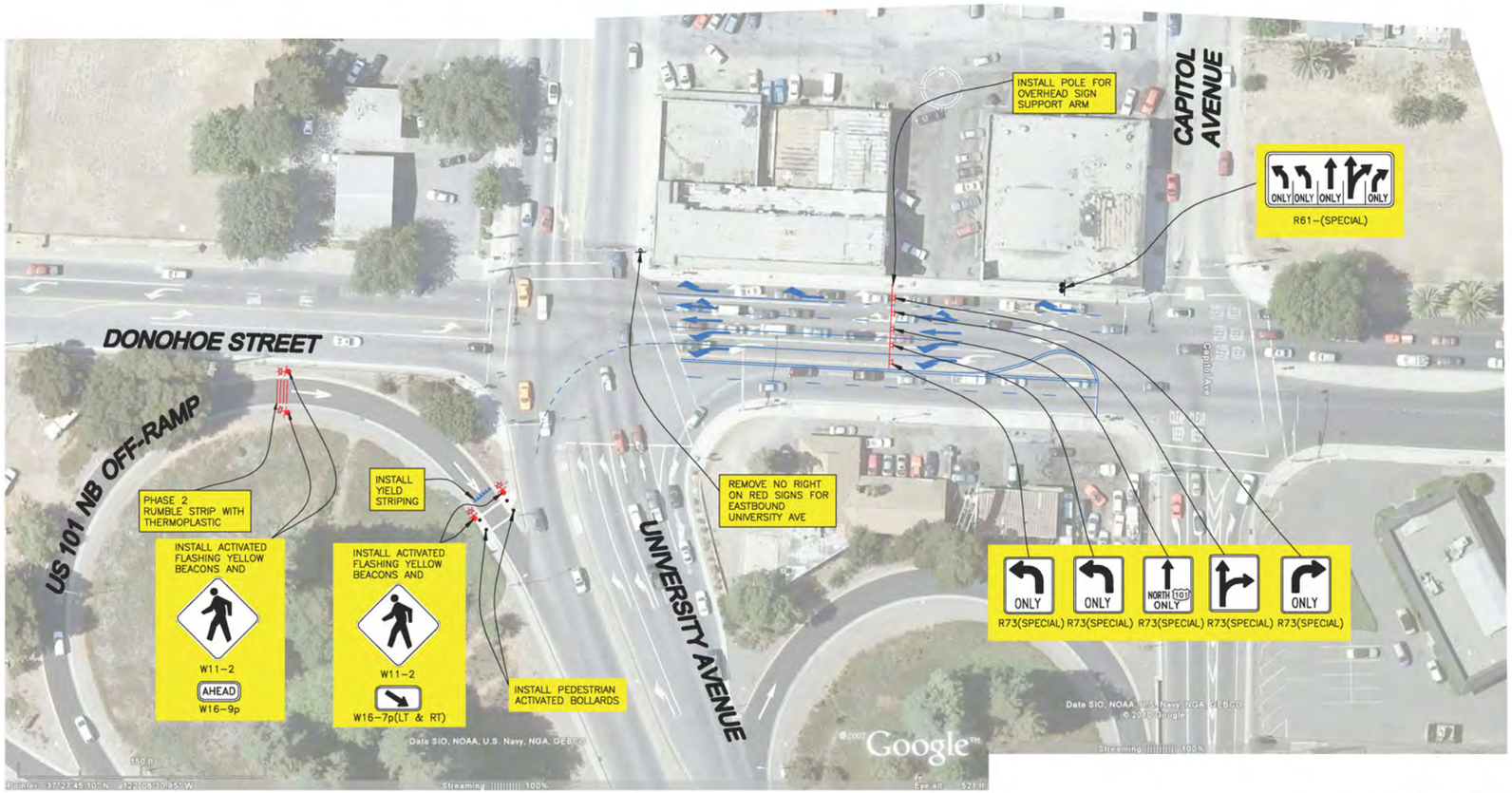
Pros and Cons

Some of the advantages of the proposed improvements are:

- Replacing the existing one left-turn-only lane and one shared left-through lane with two left-turn-only lanes and one through-only lane on northbound Donohoe Street at University Avenue would reduce the gridlock between the two intersections.
- The standard 8-phase signal sequence would provide additional green time for traffic movements at the intersection of University Avenue and Donohoe Street.
- These improvements would improve capacity and lane utilization at the two intersections.
- These improvements would improve overall operations at both intersections by reducing delay and queues on the northbound Donohoe Street approach to University Avenue and thereby relieving the gridlock conditions at Donohoe Street/Capitol Avenue.

Some of the disadvantages of the proposed improvements are:

- Adding one northbound lane would result in narrow lanes unless the roadway is widened. Narrow lanes would impact truck movements at the intersection.
- Widening the roadway to add a northbound lane would require right-of-way acquisition, which is expected to be expensive and time consuming.
- Additional signage may require long overhead signs with large support poles, which could be visually unpleasant.



(NORTH ARROW PER STUDY CONVENTION)

0 40' 80'

SCALE: 1"=40'

Bicycle, Pedestrian, and Other Improvements

Uncontrolled Pedestrian Crossings

Need

The need to improve safety for pedestrians crossing at uncontrolled intersections with high traffic volume was identified. There are three uncontrolled pedestrian crossings on University Avenue, which pose difficulties for pedestrians crossing due to heavy through traffic on University Avenue:

1. University Avenue/Michigan Avenue
2. University Avenue / Weeks Street
3. University Avenue / Sacramento Street

Improvements

In order to facilitate pedestrian crossings at the three uncontrolled intersections on University Avenue, In-Roadway Warning Lights at crosswalks were considered. In order to gauge the need for the In-Roadway Warning lights, the criteria shown in Table XXI were evaluated, with the findings on whether each location meets the criteria also summarized in the table as follows:

Table XXI: Criteria evaluation for In-Roadway Warning Lights

Criteria	*Location 1*	*Location 2*	*Location 3*
At least 40 pedestrians regularly use crosswalk during each of any two hours (not necessarily consecutive) during any 24-hour period.	No	No	No
The vehicular volumes through the crossing exceed 200 vehicles per hour in urban areas or 140 vehicles per hour in rural areas during peak-hour pedestrian usage	Yes	Yes	Yes
The critical approach speed (85th percentile) is 45 mph or less.	Yes	Yes	Yes

Vehicular traffic on University Avenue exceeds 200 vehicles during peak hours at all three locations. The posted speed limit is 25 mph. Currently less than 40 pedestrians are regularly using any of the three marked uncontrolled crosswalks during any two hour period. This may be due to the unsafe conditions at the intersections, which divert pedestrians to cross at a nearby signalized intersection. The intersection of University Avenue and Weeks Street is located within 300 feet of a signalized intersection, which provides a safe pedestrian crossing location. However, the remaining two locations are further away from a protected crossing location. Therefore, In-Roadway Warning Lights are recommended at the following two locations:

1. University Avenue/Michigan Avenue
2. University Avenue / Sacramento Street

Various studies have indicated that advance yield limit line ("shark-tooth") pavement markings enhance pedestrian safety on multi-lane roadways, where a vehicle may stop in one lane for a crossing pedestrian but inadvertently obscure the pedestrian from the view of vehicles in other lanes. Advance yield limit lines allow pedestrians and drivers to have a clearer view of each other and more time to assess intentions. TJKM recommends that advance yield lines be placed at both locations with appropriate signage.

Pedestrian Crossing on US 101 northbound ramp to University Avenue

Need

A pedestrian crossing is located where the US 101 northbound off-ramp merges onto westbound University Avenue. Vehicles exiting the freeway have limited visibility of the crosswalk and are traveling at relatively high speed. This creates a potentially unsafe condition for pedestrians crossing at this uncontrolled crosswalk. The pedestrian volume is high at this location, because this crosswalk provides the only connection for pedestrians intending to cross the US 101 overcrossing.

The following improvement measures are proposed that would potentially enhance pedestrian safety at this crosswalk.

Improvements

1. Install pedestrian warning (W11-2) signs with pedestrian-activated flashing beacons at the following locations:
   a) At the uncontrolled marked crosswalk, and
   b) On the curved ramp n advance of the crosswalk.

   The recommended pedestrian activation for the flashing beacons would be "passive" detection devices (electronic bollards or ground pads) and not pedestrian push buttons.
2. Add yield limit line "shark-tooth" markings immediately ahead of the crosswalk

If needed, rumble strips could be considered at a later stage, based on the effectiveness of the above implementations. Caltrans has indicated that if rumble strips are installed they should be a thermoplastic design that is easier to install. The rumble strip would be installed in advance to the crosswalk location to alert drivers on the curved off-ramp approaching the crosswalk ahead at the merge onto University Avenue.

Figure 13 shows the location of the rumble strip and the associated signage warning about pedestrian crossing.

Pedestrian Countdown Signals

It is recommended that Pedestrian Countdown signals be added at all signalized intersections on both Willow Road and University Avenue. This will provide additional safety for pedestrian crossing, as pedestrians will be informed of the remaining signal time available and decide if it is too late to start crossing an intersection.

Bicycle Improvements:

Signals that do not detect bicycles discourage commute cycling by increasing travel times, and encourage cyclists to disregard the signals. Moreover, Caltrans policy directive recommends providing bicycle and motorcycle detection on all new and modified approaches to traffic-actuated signals. TJKM recommends adding bicycle detection with proper pavement markings for bicycles at all signalized intersection on both Willow Road and University Avenue. This will encourage bicycle travel within the community.

Emergency Vehicle Preemption

To accommodate emergency vehicles it is critical to include emergency vehicle preemption at all signals on University Avenue and Willow Road. This allows safe and faster passage of emergency vehicles through signalized intersections. The preemption system includes a real-time status monitor of an intersection. The system can also provide for audio warnings at an intersection to protect pedestrians who may not be in a position to see visual warnings or for various reasons cannot hear the approach of emergency vehicles.

Currently, Opticom brand preemption devices are installed for the east-west direction along Willow Road. TJKM recommends that Opticom devices be added for all four directions at the intersections on University Avenue, and the north-south direction for the three intersections on Willow Road where the devices are not currently in place (Ivy Drive, O'Brien Drive, and Hamilton Avenue).

Community Outreach

C/CAG, the Cities of East Palo Alto and Menlo Park, and the project team worked in close coordination on all outreach materials and activities. The project team conducted two sets of public meetings that encouraged community involvement in the traffic study and helped to develop and refine potential improvement options. Public outreach meetings were held twice each in both Menlo Park and East Palo Alto.

The first round of public meetings focused on existing conditions and problem identification. The goal was to describe existing conditions in the study area, present potential improvement concepts, and explain the traffic study process and next steps for refining the improvement options. Preliminary conceptual improvement alternatives were also presented to the public in a general manner at the first meetings. Members of the public were invited to provide input on existing traffic issues and priorities for improvement implementation. Based on public comments, potential improvement alternatives were further refined and analyzed, and those alternatives were presented at the second meeting in each city, where additional comments were received from transportation committee members and the public. The second round of public meetings presented the proposed alternatives and solicited targeted feedback for each proposed alternative. At these meetings, the public were asked to identify any impacts in surrounding neighborhoods, and to assist in the development of the preferred alternatives to be included in the draft and final report.

Details on the public outreach process and feedback received from public are included in Appendix E.

Subsequent to the public outreach meetings, TJKM met with City of Menlo Park, City of East Palo Alto, Caltrans, MTC and C/CAG staff to finalize the recommended alternatives based on input from the public meetings. The next section presents the final recommendations and preliminary cost estimates for the final recommendations.

Recommendations and Cost Estimates

Based on the input gathered from public outreach and the City of Menlo Park, City of East Palo Alto, Caltrans, MTC and C/CAG staff, the recommendation alternatives were refined as summarized below.

System-wide operational improvement

Coordinate all signals along the University Avenue and Willow Road corridors. Prior to signal coordination, both cities would verify that the signals are interconnected to each other and capable of synchronizing the controller clock. For locations where signals are not interconnected, TJKM recommends that GPS clocks be installed to provide the synchronized clock time as a common reference point for the signal controllers. This will ensure that proper signal coordination can be implemented along the corridors.

The estimated cost for the implementation of signal coordination, including the installation of one GPS clock along Willow Road, is approximately $24,000. Similarly, the estimated cost for signal coordination along University Avenue, including the installation of three GPS clocks, is approximately $54,000.

Intersection-specific improvements (Safety and Operational)

Willow Road and Newbridge Street

Add a third eastbound lane on Willow Road extending from the US 101 northbound off-ramp to Newbridge Street. The third lane would be added by widening the north side of Willow Road and realigning the raised median. Widening the roadway would also allow extending the eastbound left turn lane on Willow Road by approximately 75 feet. In addition to the widening, restrict left-turns onto Newbridge Street by placing a sign designed to be visible only to traffic exiting US 101 and not visible to the eastbound traffic on Willow Road. This is similar to Option 1b as illustrated in Figure 6. The left turn restriction on Newbridge Street will be in effect only on Monday to Friday between 4:00 p.m. and 7:00 p.m.

The estimated cost to implement these improvements is approximately $270,000.

Willow Road and Bayfront Expressway

Add a third right-turn lane for the eastbound right-turn movement by widening Willow Road, and convert the existing eastbound shared left-through lane to a through-only lane. Eliminate the split-phase signal operation. This is improvement Option 1 for this location as presented previously in this report and shown in Figure 9.

The proposed improvement will remove the short eastbound through bicycle lane segment approaching this intersection. Therefore, Caltrans recommended proper signage to notify bicyclists that the bicycle lane ends and all bicyclists should use the bicycle path.

The estimated cost to implement this improvement is approximately $475,000.

University Avenue and Cooley Avenue

The potential restriction of traffic access from Cooley Avenue to University Avenue was eliminated from consideration, based on concerns expressed at the East Palo Alto public meetings regarding potential traffic diversion impacts. No other near-term improvement was identified for this location.

University Avenue and Runnymede Street

Install a traffic signal system to add protected left-turn signal phase for University Avenue traffic and an emergency signal for the adjacent Fire Station access.

The estimated cost to implement these improvements is approximately $180,000.

University Avenue / Donohoe Street and Donohoe Street / Capitol Avenue

The project study team determined that the potential lane configuration modification under consideration would result in unacceptably narrow lanes for large trucks, unless the roadway is physically widened. As a result, the final recommendation is that the City of East Palo Alto work toward acquisition of additional public right-of-way on the south side of Donohoe Street to allow for the roadway widening needed to add a traffic lane. However, the cost and complexity of this alternative suggest a significantly longer time frame and less definite feasibility in comparison to the other recommended improvements.

The final recommendation includes the following:

1. Remove the "No Right Turn on Red" restriction for the eastbound right turn movement from University Avenue to Donohoe Street.
2. Install additional signage and pavement markings to provide clearer direction to drivers regarding the correct lane to use for various traffic movements. Repaint the "Do Not Block Intersection" pavement marking and enhance signage for the intersection of Capitol Avenue and Donohoe Street.
3. Recommend that City of East Palo Alto Police Department pursue installation of red light camera enforcement systems at both the intersections, which help in increasing intersection safety.

Figure 14 depicts recommended improvements 1 and 2 listed above assuming the existing lane configuration on Donohoe Street, which would be the likely near-term condition until such time that the recommended widening might occur to provide the additional northbound lane on Donohoe Street.

The estimated cost to implement improvements 1 and 2 listed above is approximately $50,000.

Pedestrian/Bicycle/Other improvements

Uncontrolled pedestrian crossings

Install in-roadway warning lights with advance yield limit lines at the existing marked crosswalks on University Avenue at the intersections with Michigan Avenue and with Sacramento Street.

The estimated cost to implement in-roadway warning lights at both locations is approximately $90,000.

Pedestrian crossing on US 101 northbound off-ramp at University Avenue

Install devices to warn drivers about the pedestrian crossing, including warning signs, pedestrian-activated flashing beacons, and pavement markings as shown in Figure 13.

The estimated cost to implement these improvements is approximately $100,000.

Pedestrian countdown signals

Install pedestrian countdown signals that display the remaining time to cross at all existing traffic signals in the study corridors, to enhance safety.

The estimated cost to install countdown pedestrian signals at all study intersections is approximately $174,000, including $56,550 for Willow Road and $117,450 for University Avenue.

Bicycle detection

Install bicycle detectors at all traffic signals, in the appropriate lanes on cross streets and left-turn lanes where a bicyclist would not otherwise trigger a green signal in the absence of motor vehicle traffic, to improve bicyclist convenience and safety.

The estimated cost to install bicycle detection at all study intersections is approximately $114,200 including $34,800 for Willow Road and $79,400 for University Avenue.

Emergency vehicle signal preemption

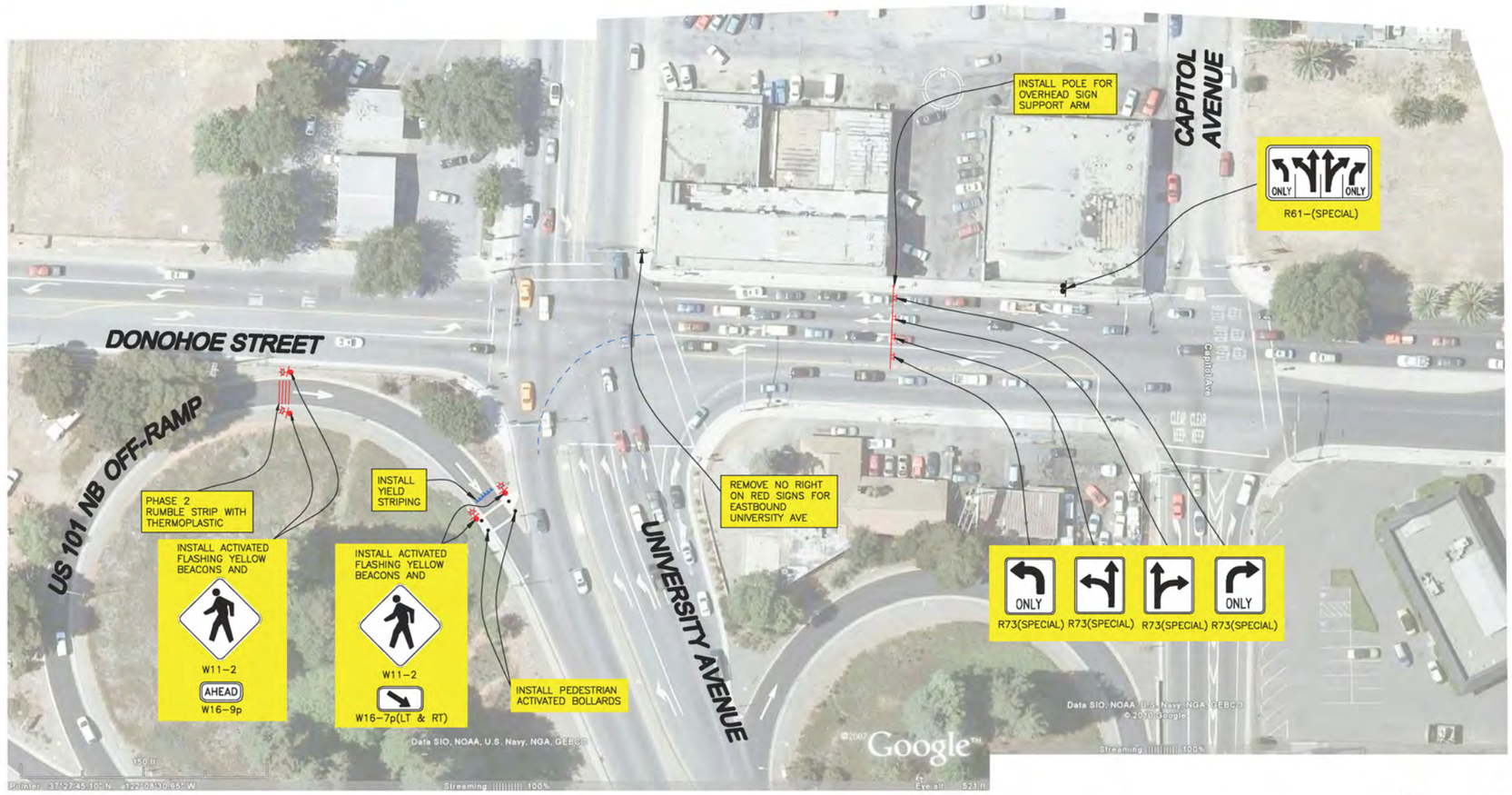
Install emergency vehicle preemption systems on all approaches at all traffic signals on University Avenue signals, and cross street approaches of Ivy Drive, O'Brien Drive, and Hamilton Avenue at Willow Road.

The estimated cost to install emergency vehicle signal preemption is approximately $95,000 including $15,250 for Willow Road and $79,750 for University Avenue.

Long Term Improvements

Various feedback was gathered from the public outreach and from City staffs regarding some potential improvements which would require a significantly longer time frame than that considered as part of this study. Therefore, these improvement alternatives were not analyzed, but are mentioned here for further consideration in the future:

- The pedestrian crossing on University Avenue over US 101 is very narrow and poses safety concerns for pedestrians walking extremely close to relatively high speed traffic. As part of future considerations, the pedestrian bridge should be widened or replaced to meet the standard width and configuration for a sidewalk, or a separate overcrossing constructed.
- Signal coordination along Willow Road and University Avenue will help relieve recurrent congestion on the corridor. However, both corridors experience severe non-recurring congestion, which cannot be handled by passive signal timing plans. As part of long-term improvements, a more sophisticated adaptive traffic signal system can be implemented, which would automatically coordinate the signal utilizing real-time traffic data. This would ensure optimized signal operation at all times, increasing traffic progression through the corridor.


DONOHOE STREET
US 101 NB OFF-RAMP
UNIVERSITY AVENUE
CAPITOL AVENUE
INSTALL POLE FOR OVERHEAD SIGN SUPPORT ARM
R61-(SPECIAL)
ONLY
ONLY
PHASE 2 RUMBLE STRIP WITH THERMOPLASTIC
INSTALL ACTIVATED FLASHING YELLOW BEACONS AND
W11-2
AHEAD
W16-9p
INSTALL YIELD STRIPING
INSTALL ACTIVATED FLASHING YELLOW BEACONS AND
W11-2
W16-7p(LT & RT)
INSTALL PEDESTRIAN ACTIVATED BOLLARDS
REMOVE NO RIGHT ON RED SIGNS FOR EASTBOUND UNIVERSITY AVE
ONLY
ONLY
R73(SPECIAL) R73(SPECIAL) R73(SPECIAL) R73(SPECIAL)
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
©2007 Google
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2010 Google
(NORTH ARROW PER STUDY CONVENTION)
0
40'
80'
SCALE: 1"=40'

Conclusions

Key Findings

Currently, all study intersections, except the following six intersections, operate within acceptable level of service (LOS) standards, with service levels at LOS D or better during the a.m. and p.m. peak hours.

- Willow Road / Newbridge Street
- University Avenue / Michigan Avenue
- University Avenue / Adams Drive
- University Avenue / Purdue Avenue
- Bayfront Expressway / Willow Road
- Bayfront Expressway / University Avenue

Additionally, the intersection of University Avenue / Donohoe Street operates at very close to unacceptable levels of service.

Based on the accident analysis, the following two study intersections have collision rates that are significantly higher than the mean collision rate for comparable intersections:

- University Avenue / Donohoe Street
- University Avenue / Bell Street

Additionally, the accident rates for the following two intersections are very close to the mean collision rate for comparable intersections:

- Willow Road / Newbridge Street
- University Avenue / Runnymede Street

Recommendations

Based on the comprehensive evaluation of existing and near-term traffic conditions, input from Caltrans, C/CAG, MTC, and Cities of Menlo Park and East Palo Alto staff, and issues raised at the public outreach meeting, several short-term potential improvements on the Willow Road and University Avenue corridors were identified.

The recommended potential near-term improvements are summarized as follows:

- Coordinate all signals along the University Avenue and Willow Road corridors.
- Widen Willow Road between the northbound US 101 ramps and the Newbridge Street intersection, and install traffic control devices.
- Add a third right-turn lane for the eastbound right turn movement and eliminate the split-phase signal operation at the intersection of Willow Road and Bayfront Expressway.
- Add protected left-turn signal phasing for University Avenue traffic and an emergency signal for the adjacent Fire Station access at the University Avenue / Runnymede Street intersection.
- Modify signing and pavement markings and install a red light camera enforcement system at the intersections of University Avenue / Donohoe Street and Donohoe Street / Capitol Avenue.

- Install in-roadway warning lights at two existing marked crosswalks at University Avenue/ Michigan Avenue and University Avenue/Sacramento Street.
- Install warning signs, pedestrian-activated flashing beacons, and pavement markings at the pedestrian crossing across the northbound US 101 off-ramp at University Avenue.
- Install pedestrian countdown signals at all existing traffic signals in the corridor.
- Install bicycle detectors at all traffic signals in the appropriate lanes on cross streets and left-turn lanes.
- Install emergency vehicle preemption systems on all approaches at all traffic signals where they do not exist, including University Avenue signals and three signals (Ivy Drive, O'Brien Drive and Hamilton Street) on Willow Road.

The project recommendations were presented to the City of East Palo Alto City Council on December 7, 2010, and to the City of Menlo Park City Council on May 24, 2011. Council members had minor questions and comments, and generally accepted the recommended improvement concepts. It was requested that the cities support the recommended improvements by including the projects in their respective capital improvement programs (CIP), and initiate implementation in the near-term (within 5 years).

Next Steps

Implementation of the recommended improvements will be the responsibility of each city to include in their capital improvement programs (CIP). Potential funding for the proposed projects includes local funds, in addition to other funding opportunities such as the MTC-administered Program for Arterial System Synchronization (PASS), which provides assistance to improve traffic signal systems and corridors, and the C/CAG-administered Measure M funds (vehicle registration fee) for San Mateo County, a portion of which is dedicated for intelligent transportation systems.

It should be noted that both the City of Menlo Park and the City of East Palo Alto applied for and received PASS funding grants (FY 2011/12) for their respective operational improvement projects.

Study Participants

Public Agency Project Team Members

John Hoang	C/CAG
Einar Acuna	Caltrans
Chip Taylor	City of Menlo Park
Rene Baile	City of Menlo Park
Kamal Fallaha	City of East Palo Alto
Brent Butler	City of East Palo Alto
Vamsi Tabjulu	MTC
Danielle Stanislaus	MTC

TJKM Transportation Consultants

Chris Kinzel, P.E.	President
Rich Haygood, P.E., T.E.	Senior Associate
Joy Bhattacharya, P.E., PTOE	Senior Associate
Pawan Mulukutla	Associate
Vishnu Gandluru	Transportation Engineer
Travis Richards, P.E.	Assistant Engineer
Dan Harrison	Graphics Production
Cindy DeRouchey	Word Processing

Public Outreach

Meghan Daniels	CirclePoint

Data Collection

Quality Counts

References

- *Highway Capacity Manual 2000,* Transportation Research Board, Washington D.C., 2000.

Appendix A – Level of Service Methodology

APPENDIX A

LEVEL OF SERVICE

The description and procedures for calculating capacity and level of service are found in Transportation Research Board, *Highway Capacity Manual 2000*. *Highway Capacity Manual 2000* represents the latest research on capacity and quality of service for transportation facilities.

Quality of service requires quantitative measures to characterize operational conditions within a traffic stream. Level of service is a quality measure describing operational conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience.

Six levels of service are defined for each type of facility that has analysis procedures available. Letters designate each level, from A to F, with level-of-service A representing the best operating conditions and level-of-service F the worst. Each level of service represents a range of operating conditions and the driver's perception of these conditions. Safety is not included in the measures that establish service levels.

A general description of service levels for various types of facilities is shown in Table A-I

Table A-I

LEVEL OF SERVICE DESCRIPTION

	Uninterrupted Flow	*Interrupted Flow*
Facility Type	Freeways Multi-lane Highways Two-lane Highways Urban Streets	Signalized Intersections Unsignalized Intersections Two-way Stop Control All-way Stop Control
LOS		
A	Free-flow	Very low delay.
B	Stable flow. Presence of other users noticeable.	Low delay.
C	Stable flow. Comfort and convenience starts to decline.	Acceptable delay.
D	High density stable flow.	Tolerable delay.
E	Unstable flow.	Limit of acceptable delay.
F	Forced or breakdown flow.	Unacceptable delay

Source: Highway Capacity Manual 2000

Urban Streets

The term "urban streets" refers to urban arterials and collectors, including those in downtown areas.

Arterial streets are roads that primarily serve longer through trips. However, providing access to abutting commercial and residential land uses is also an important function of arterials.

Collector streets provide both land access and traffic circulation within residential, commercial and industrial areas. Their access function is more important than that of arterials, and unlike arterials their operation is not always dominated by traffic signals.

Downtown streets are signalized facilities that often resemble arterials. They not only move through traffic but also provide access to local businesses for passenger cars, transit buses, and trucks. Pedestrian conflicts and lane obstructions created by stopping or standing buses, trucks and parking vehicles that cause turbulence in the traffic flow are typical of downtown streets.

The speed of vehicles on urban streets is influenced by three main factors, street environment, interaction among vehicles and traffic control. As a result, these factors also affect quality of service.

The street environment includes the geometric characteristics of the facility, the character of roadside activity and adjacent land uses. Thus, the environment reflects the number and width of lanes, type of median, driveway density, spacing between signalized intersections, existence of parking, level of pedestrian activity and speed limit.

The interaction among vehicles is determined by traffic density, the proportion of trucks and buses, and turning movements. This interaction affects the operation of vehicles at intersections and, to a lesser extent, between signals.

Traffic control (including signals and signs) forces a portion of all vehicles to slow or stop. The delays and speed changes caused by traffic control devices reduce vehicle speeds, however, such controls are needed to establish right-of-way.

The average travel speed for through vehicles along an urban street is the determinant of the operating level of service. The travel speed along a segment, section or entire length of an urban street is dependent on the running speed between signalized intersections and the amount of control delay incurred at signalized intersections.

Level-of-service A describes primarily free-flow operations. Vehicles are completely unimpeded in their ability to maneuver within the traffic stream. Control delay at signalized intersections is minimal.

Level-of-service B describes reasonably unimpeded operations. The ability to maneuver within the traffic stream is only slightly restricted, and control delays at signalized intersections are not significant.

Level-of-service C describes stable operations, however, ability to maneuver and change lanes in midblock location may be more restricted than at level-of-service B. Longer queues, adverse signal coordination, or both may contribute to lower travel speeds.

Level-of-service D borders on a range in which in which small increases in flow may cause substantial increases in delay and decreases in travel speed. Level-of-service D may be due to adverse signal progression, inappropriate signal timing, high volumes, or a combination of these factors.

Level-of-service E is characterized by significant delays and lower travel speeds. Such operations are caused by a combination of adverse progression, high signal density, high volumes, extensive delays at critical intersections, and inappropriate signal timing.

Level-of-service F is characterized by urban street flow at extremely low speeds. Intersection congestion is likely at critical signalized locations, with high delays, high volumes, and extensive queuing.

The methodology to determine level of service stratifies urban streets into four classifications. The classifications are complex, and are related to functional and design categories. Table A-II describes the functional and design categories, while Table A-III relates these to the urban street classification.

Once classified, the urban street is divided into segments for analysis. An urban street segment is a one-way section of street encompassing a series of blocks or links terminating at a signalized intersection. Adjacent segments of urban streets may be combined to form larger street sections, provided that the segments have similar demand flows and characteristics.

Levels of service are related to the average travel speed of vehicles along the urban street segment or section.

Travel times for existing conditions are obtained by field measurements. The maximum-car technique is used. The vehicle is driven at the posted speed limit unless impeded by actual traffic conditions. In the maximum-car technique, a safe level of vehicular operation is maintained by observing proper following distances and by changing speeds at reasonable rates of acceleration and deceleration. The maximum-car technique provides the best base for measuring traffic performance.

An observer records the travel time and locations and duration of delay. The beginning and ending points are the centers of intersections. Delays include times waiting in queues at signalized intersections. The travel speed is determined by dividing the length of the segment by the travel time. Once the travel speed on the arterial is determined, the level of service is found by comparing the speed to the criteria in Table A-IV. Level-of-service criteria vary for the different classifications of urban street, reflecting differences in driver expectations.

Table A-II

FUNCTIONAL AND DESIGN CATEGORIES FOR URBAN STREETS

Criterion	*Functional Category*			
	Principal Arterial		*Minor Arterial*	
Mobility function	Very important		Important	
Access function	Very minor		Substantial	
Points connected	Freeways, important activity centers, major traffic generators		Principal arterials	
Predominant trips served	Relatively long trips between major points and through trips entering, leaving, and passing through city		Trips of moderate length within relatively small geographical areas	
Criterion	*Design Category*			
	High-Speed	*Suburban*	*Intermediate*	*Urban*
Driveway access density	Very low density	Low density	Moderate density	High density
Arterial type	Multilane divided; undivided or two-lane with shoulders	Multilane divided: undivided or two-lane with shoulders	Multilane divided or undivided; one way, two lane	Undivided one way; two way, two or more lanes
Parking	No	No	Some	Usually
Separate left-turn lanes	Yes	Yes	Usually	Some
Signals per mile	0.5 to 2	1 to 5	4 to 10	6 to 12
Speed limits	45 to 55 mph	40 to 45 mph	30 to 40 mph	25 to 35 mph
Pedestrian activity	Very little	Little	Some	Usually
Roadside development	Low density	Low to medium density	Medium to moderate density	High density

Source: Highway Capacity Manual 2000

Table A-III

URBAN STREET CLASS BASED ON FUNCTION AND DESIGN CATEGORIES

Design Category	*Functional Category*	
	Principal Arterial	*Minor Arterial*
High-Speed	I	Not applicable
Suburban	II	II
Intermediate	II	III or IV
Urban	III or IV	IV

Source: Highway Capacity Manual 2000

Table A-IV

URBAN STREET LEVELS OF SERVICE BY CLASS

Urban Street Class	*I*	*II*	*III*	*IV*
Range of Free Flow Speeds (mph)	45 to 55	35 to 45	30 to 35	25 to 35
Typical Free Flow Speed (mph)	50	40	33	30
Level of Service	*Average Travel Speed (mph)*			
A	>42	>35	>30	>25
B	>34	>28	>24	>19
C	>27	>22	>18	>13
D	>21	>17	>14	>9
E	>16	>13	>10	>7
F	≤16	≤13	≤10	≤7

Source: Highway Capacity Manual 2000

Interrupted Flow

One of the more important elements limiting, and often interrupting the flow of traffic on a highway is the intersection. Flow on an interrupted facility is usually dominated by points of fixed operation such as traffic signals, stop and yield signs. These all operate quite differently and have differing impacts on overall flow.

Signalized Intersections

The capacity of a highway is related primarily to the geometric characteristics of the facility, as well as to the composition of the traffic stream on the facility. Geometrics are a fixed, or non-varying, characteristic of a facility.

At the signalized intersection, an additional element is introduced into the concept of capacity: time allocation. A traffic signal essentially allocates time among conflicting traffic movements seeking use of the same physical space. The way in which time is allocated has a significant impact on the operation of the intersection and on the capacity of the intersection and its approaches.

Level of service for signalized intersections is defined in terms of control delay, which is a measure of driver discomfort, frustration, fuel consumption, and increased travel time. The delay experienced by a motorist is made up of a number of factors that relate to control, traffic and incidents. Total delay is the difference between the travel time actually experienced and the reference travel time that would result during base conditions, *i. e.,* in the absence of traffic control, geometric delay, any incidents, and any other vehicles. Specifically, level of service criteria for traffic signals are stated in terms of average control delay per vehicle, typically for a 15-minute analysis period. Delay is a complex measure and depends on a number of variables, including the quality of progression, the cycle length, the ratio of green time to cycle length and the volume to capacity ratio for the lane group.

For each intersection analyzed the average control delay per vehicle per approach is determined for the peak hour. A weighted average of control delay per vehicle is then determined for the intersection. A level of service designation is given to the control delay to better describe the level of operation. A description of levels of service for signalized intersections can be found in Table A-V

Table A-V

DESCRIPTION OF LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS

Level of Service	*Description*
A	Very low control delay, up to 10 seconds per vehicle. Progression is extremely favorable, and most vehicles arrive during the green phase. Many vehicles do not stop at all. Short cycle lengths may tend to contribute to low delay values.
B	Control delay greater than 10 and up to 20 seconds per vehicle. There is good progression or short cycle lengths or both. More vehicles stop causing higher levels of delay.
C	Control delay greater than 20 and up to 35 seconds per vehicle. Higher delays are caused by fair progression or longer cycle lengths or both. Individual cycle failures may begin to appear. Cycle failure occurs when a given green phase doe not serve queued vehicles, and overflow occurs. The number of vehicles stopping is significant, though many still pass through the intersection without stopping.
D	Control delay greater than 35 and up to 55 seconds per vehicle. The influence of congestions becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high volumes. Many vehicles stop, the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.
E	Control delay greater than 55 and up to 80 seconds per vehicle. The limit of acceptable delay. High delays usually indicate poor progression, long cycle lengths, and high volumes. Individual cycle failures are frequent.
F	Control delay in excess of 80 seconds per vehicle. Unacceptable to most drivers. Oversaturation, arrival flow rates exceed the capacity of the intersection. Many individual cycle failures. Poor progression and long cycle lengths may also be contributing factors to higher delay.

Source: Highway Capacity Manual 2000

The use of control delay, which may also be referred to as signal delay, was introduced in the 1997 update to the *Highway Capacity Manual*, and represents a departure from previous updates. In the third edition, published in 1985 and the 1994 update to the third edition, delay only included stopped delay. Thus, the level of service criteria listed in Table A-V differs from earlier criteria.

Unsignalized Intersections

The current procedures on unsignalized intersections were first introduced in the 1997 update to the *Highway Capacity Manual* and represent a revision of the methodology published in the 1994 update to the 1985 *Highway Capacity Manual*. The revised procedures use control delay as a measure of effectiveness to determine level of service. Delay is a measure of driver discomfort, frustration, fuel

consumption, and increased travel time. The delay experienced by a motorist is made up of a number of factors that relate to control, traffic and incidents. Total delay is the difference between the travel time actually experienced and the reference travel time that would result during base conditions, *i. e.,* in the absence of traffic control, geometric delay, any incidents, and any other vehicles. Control delay is the increased time of travel for a vehicle approaching and passing through an unsignalized intersection, compared with a free-flow vehicle if it were not required to slow or stop at the intersection.

Two-Way Stop Controlled Intersections

Two-way stop controlled intersections in which stop signs are used to assign the right-of-way, are the most prevalent type of intersection in the United States. At two-way stop-controlled intersections the stop-controlled approaches are referred as the minor street approaches and can be either public streets or private driveways. The approaches that are not controlled by stop signs are referred to as the major street approaches.

The capacity of movements subject to delay are determined using the "critical gap" method of capacity analysis. Expected average control delay based on movement volume and movement capacity is calculated. A level of service designation is given to the expected control delay for each minor movement. Level of service is not defined for the intersection as a whole. Control delay is the increased time of travel for a vehicle approaching and passing through a stop-controlled intersection, compared with a free-flow vehicle if it were not required to slow or stop at the intersection. A description of levels of service for
two-way stop-controlled intersections is found in Table A-VI.

Table A-VI

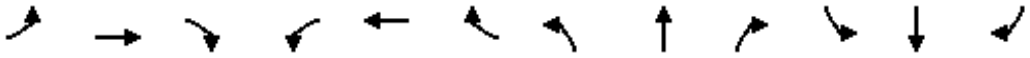
DESCRIPTION OF LEVEL OF SERVICE FOR TWO-WAY STOP CONTROLLED INTERSECTIONS

Level of Service	*Description*
A	Very low control delay less than 10 seconds per vehicle for each movement subject to delay.
B	Low control delay greater than 10 and up to 15 seconds per vehicle for each movement subject to delay.
C	Acceptable control delay greater than 15 and up to 25 seconds per vehicle for each movement subject to delay.
D	Tolerable control delay greater than 25 and up to 35 seconds per vehicle for each movement subject to delay.
E	Limit of tolerable control delay greater than 35 and up to 50 seconds per vehicle for each movement subject to delay.
F	Unacceptable control delay in excess of 50 seconds per vehicle for each movement subject to delay.

Source: Highway Capacity Manual 2000

Appendix B – Level of Service Worksheets: Existing Conditions

(Willow Road and University Avenue have been coded as north-south roadways in Synchro files)



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	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.96	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1548	3433	1863	1527	1770	4949		1770	3533	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1863	1548	3433	1863	1527	1770	4949		1770	3533	
Volume (vph)	27	173	267	352	127	23	178	863	188	63	1242	12
Peak-hour factor, PHF	0.85	0.50	0.85	0.92	0.92	0.92	0.89	0.89	0.89	0.86	0.86	0.86
Adj. Flow (vph)	32	346	314	383	138	25	200	970	211	73	1444	14
RTOR Reduction (vph)	0	0	159	0	0	21	0	19	0	0	1	0
Lane Group Flow (vph)	32	346	155	383	138	4	200	1162	0	73	1457	0
Confl. Peds. (#/hr)	16		7	7		16	7					7
Turn Type	Split		Perm	Split		Perm	Prot			Prot		
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4			3						
Actuated Green, G (s)	23.9	23.9	23.9	16.4	16.4	16.4	16.3	39.4		14.1	37.2	
Effective Green, g (s)	23.9	23.9	23.9	15.4	15.4	15.4	15.3	40.4		13.1	38.2	
Actuated g/C Ratio	0.22	0.22	0.22	0.14	0.14	0.14	0.14	0.37		0.12	0.35	
Clearance Time (s)	4.0	4.0	4.0	3.0	3.0	3.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	4.0		2.0	4.0	
Lane Grp Cap (vph)	389	409	340	486	264	216	249	1838		213	1240	
v/s Ratio Prot	0.02	c0.19		c0.11	0.07		c0.11	0.23		0.04	c0.41	
v/s Ratio Perm			0.10			0.00						
v/c Ratio	0.08	0.85	0.46	0.79	0.52	0.02	0.80	0.63		0.34	1.18	
Uniform Delay, d1	33.7	40.7	36.8	45.1	43.3	40.2	45.3	28.1		43.9	35.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.0	14.3	0.4	7.6	0.9	0.0	16.0	1.7		0.4	87.6	
Delay (s)	33.8	55.0	37.2	52.8	44.2	40.2	61.3	29.8		44.3	122.9	
Level of Service	C	D	D	D	D	D	E	C		D	F	
Approach Delay (s)		45.9			50.0			34.3			119.2	
Approach LOS		D			D			C			F	

Intersection Summary			
HCM Average Control Delay	69.6	HCM Level of Service	E
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	108.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	79.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.97		0.95	1.00	1.00	0.95
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	0.96		1.00	0.85	1.00	1.00
Flt Protected	0.97		1.00	1.00	0.95	1.00
Satd. Flow (prot)	3341		3539	1540	1770	3539
Flt Permitted	0.97		1.00	1.00	0.95	1.00
Satd. Flow (perm)	3341		3539	1540	1770	3539
Volume (vph)	123	48	873	321	54	1259
Peak-hour factor, PHF	0.87	0.87	0.92	0.92	0.92	0.92
Adj. Flow (vph)	141	55	949	349	59	1368
RTOR Reduction (vph)	49	0	0	116	0	0
Lane Group Flow (vph)	147	0	949	233	59	1368
Confl. Peds. (#/hr)				5	5	
Turn Type				Perm	Prot	
Protected Phases	4		2		1	6
Permitted Phases				2		
Actuated Green, G (s)	8.5		47.1	47.1	5.1	55.2
Effective Green, g (s)	7.5		47.1	47.1	4.1	55.2
Actuated g/C Ratio	0.11		0.67	0.67	0.06	0.78
Clearance Time (s)	3.0		4.0	4.0	3.0	4.0
Vehicle Extension (s)	2.0		4.0	4.0	2.0	4.0
Lane Grp Cap (vph)	354		2358	1026	103	2763
v/s Ratio Prot	c0.04		0.27		0.03	c0.39
v/s Ratio Perm				0.15		
v/c Ratio	0.41		0.40	0.23	0.57	0.50
Uniform Delay, d1	29.5		5.4	4.6	32.4	2.8
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3		0.5	0.5	4.7	0.6
Delay (s)	29.8		5.9	5.2	37.2	3.4
Level of Service	C		A	A	D	A
Approach Delay (s)	29.8		5.7			4.8
Approach LOS	C		A			A

Intersection Summary			
HCM Average Control Delay	6.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	70.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	3535	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	3535	
Volume (vph)	5	183	113	810	1139	9
Peak-hour factor, PHF	0.76	0.76	0.86	0.86	0.83	0.83
Adj. Flow (vph)	7	241	131	942	1372	11
RTOR Reduction (vph)	0	111	0	0	0	0
Lane Group Flow (vph)	7	130	131	942	1383	0
Confl. Peds. (#/hr)	1		3			3
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	11.5	11.5	5.0	60.1	52.1	
Effective Green, g (s)	10.5	10.5	4.0	60.1	52.1	
Actuated g/C Ratio	0.13	0.13	0.05	0.76	0.66	
Clearance Time (s)	3.0	3.0	3.0	4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	4.0	4.0	
Lane Grp Cap (vph)	236	211	90	2706	2343	
v/s Ratio Prot	0.00		c0.07	0.27	c0.39	
v/s Ratio Perm		c0.08				
v/c Ratio	0.03	0.62	1.46	0.35	0.59	
Uniform Delay, d1	29.6	32.1	37.3	3.0	7.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	3.7	256.1	0.4	0.5	
Delay (s)	29.6	35.9	293.4	3.3	7.8	
Level of Service	C	D	F	A	A	
Approach Delay (s)	35.7			38.7	7.8	
Approach LOS	D			D	A	

Intersection Summary				
HCM Average Control Delay	22.6	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.65			
Actuated Cycle Length (s)	78.6	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	54.7%	ICU Level of Service	A	
Analysis Period (min)	15			

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	0.95		1.00	0.95	
Frpb, ped/bikes		0.99			1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.93			0.98		1.00	0.98		1.00	0.99	
Flt Protected		0.98			0.96		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1680			1752		1770	3481		1770	3516	
Flt Permitted		0.85			0.68		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1462			1244		1770	3481		1770	3516	
Volume (vph)	52	6	67	112	13	23	112	614	75	66	1088	44
Peak-hour factor, PHF	0.95	0.95	0.95	0.80	0.80	0.80	0.95	0.95	0.95	0.89	0.89	0.89
Adj. Flow (vph)	55	6	71	140	16	29	118	646	79	74	1222	49
RTOR Reduction (vph)	0	46	0	0	7	0	0	6	0	0	2	0
Lane Group Flow (vph)	0	86	0	0	178	0	118	719	0	74	1269	0
Confl. Peds. (#/hr)	2		1	1		2	2					2
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)		14.3			14.3		7.9	43.2		5.1	40.4	
Effective Green, g (s)		13.3			13.3		6.9	43.2		4.1	40.4	
Actuated g/C Ratio		0.18			0.18		0.10	0.60		0.06	0.56	
Clearance Time (s)		3.0			3.0		3.0	4.0		3.0	4.0	
Vehicle Extension (s)		2.0			2.0		2.0	4.0		2.0	4.0	
Lane Grp Cap (vph)		268			228		168	2071		100	1957	
v/s Ratio Prot							c0.07	c0.21		0.04	c0.36	
v/s Ratio Perm		0.06			c0.14							
v/c Ratio		0.32			0.78		0.70	0.35		0.74	0.65	
Uniform Delay, d1		25.7			28.3		31.9	7.5		33.7	11.2	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.3			14.1		10.3	0.1		21.6	0.8	
Delay (s)		26.0			42.4		42.2	7.6		55.3	12.0	
Level of Service		C			D		D	A		E	B	
Approach Delay (s)		26.0			42.4			12.5			14.4	
Approach LOS		C			D			B			B	

Intersection Summary			
HCM Average Control Delay	16.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	72.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	62.5%	ICU Level of Service	B
Analysis Period (min)	15		

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	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.86	0.91	0.97	0.95	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.96	1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	0.99	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1805	1863	1578	1595	3144	1373	3335	3471	1568	1805	3451	
Flt Permitted	0.95	1.00	1.00	0.95	0.99	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1805	1863	1578	1595	3144	1373	3335	3471	1568	1805	3451	
Volume (vph)	14	123	430	483	580	371	88	350	365	47	1041	59
Peak-hour factor, PHF	0.83	0.83	0.83	0.90	0.90	0.90	0.88	0.88	0.88	0.95	0.95	0.95
Adj. Flow (vph)	17	148	518	537	644	412	100	398	415	49	1096	62
RTOR Reduction (vph)	0	0	398	0	0	317	0	0	0	0	4	0
Lane Group Flow (vph)	17	148	120	395	786	95	100	398	415	49	1154	0
Confl. Peds. (#/hr)	20		1	1		20	34		1	1		34
Heavy Vehicles (%)	0%	2%	1%	3%	3%	3%	5%	4%	3%	0%	3%	10%
Turn Type	Split		custom	Split		Perm	Prot		Prot	Prot		
Protected Phases	4	4		3	3		1	6	6	5	2	
Permitted Phases			3			3						
Actuated Green, G (s)	12.6	12.6	22.0	22.0	22.0	22.0	6.9	38.8	38.8	5.6	37.5	
Effective Green, g (s)	12.6	12.6	22.0	22.0	22.0	22.0	6.9	38.8	38.8	5.6	37.5	
Actuated g/C Ratio	0.13	0.13	0.23	0.23	0.23	0.23	0.07	0.41	0.41	0.06	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	239	247	365	369	728	318	242	1418	640	106	1362	
v/s Ratio Prot	0.01	c0.08		0.25	c0.25		c0.03	0.11	0.26	0.03	c0.33	
v/s Ratio Perm			0.08			0.07						
v/c Ratio	0.07	0.60	0.33	1.07	1.08	0.30	0.41	0.28	0.65	0.46	0.85	
Uniform Delay, d1	36.1	38.8	30.4	36.5	36.5	30.1	42.1	18.8	22.6	43.2	26.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.45	0.38	
Incremental Delay, d2	0.1	3.9	0.5	66.9	56.9	0.5	1.1	0.5	5.0	2.8	6.0	
Delay (s)	36.2	42.7	30.9	103.4	93.4	30.7	43.3	19.3	27.6	65.5	16.0	
Level of Service	D	D	C	F	F	C	D	B	C	E	B	
Approach Delay (s)		33.6			79.7			25.7			18.0	
Approach LOS		C			E			C			B	

Intersection Summary			
HCM Average Control Delay	44.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	90.4%	ICU Level of Service	E
Analysis Period (min)	15		
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	0.95		1.00	0.95	
Frpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		0.99	1.00	
Frt		0.98			0.98		1.00	0.99		1.00	0.99	
Flt Protected		1.00			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1734			1764		1731	3470		1760	3450	
Flt Permitted		0.99			0.93		0.19	1.00		0.35	1.00	
Satd. Flow (perm)		1727			1658		351	3470		644	3450	
Volume (vph)	2	48	10	32	94	17	24	671	38	51	1146	42
Peak-hour factor, PHF	0.82	0.82	0.82	0.83	0.83	0.83	0.92	0.92	0.92	0.94	0.94	0.94
Adj. Flow (vph)	2	59	12	39	113	20	26	729	41	54	1219	45
RTOR Reduction (vph)	0	9	0	0	6	0	0	3	0	0	2	0
Lane Group Flow (vph)	0	64	0	0	166	0	26	767	0	54	1262	0
Confl. Peds. (#/hr)	14		9	9		14	7		6	6		7
Heavy Vehicles (%)	0%	6%	10%	3%	2%	18%	4%	3%	3%	2%	4%	2%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			6			2	
Permitted Phases	4			4			6			2		
Actuated Green, G (s)		14.2			14.2		72.8	72.8		72.8	72.8	
Effective Green, g (s)		14.2			14.2		72.8	72.8		72.8	72.8	
Actuated g/C Ratio		0.15			0.15		0.77	0.77		0.77	0.77	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		258			248		269	2659		494	2644	
v/s Ratio Prot								0.22			c0.37	
v/s Ratio Perm		0.04			c0.10		0.07			0.08		
v/c Ratio		0.25			0.67		0.10	0.29		0.11	0.48	
Uniform Delay, d1		35.7			38.2		2.8	3.3		2.8	4.1	
Progression Factor		1.00			1.00		0.79	0.71		0.25	0.51	
Incremental Delay, d2		0.5			6.7		0.6	0.2		0.4	0.5	
Delay (s)		36.2			44.9		2.8	2.6		1.1	2.6	
Level of Service		D			D		A	A		A	A	
Approach Delay (s)		36.2			44.9			2.6			2.6	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM Average Control Delay	6.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.0%	ICU Level of Service	B
Analysis Period (min)	15		
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	0.95		1.00	0.95	
Frpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.99			0.98		1.00	0.99		1.00	0.99	
Flt Protected		0.99			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1787			1793		1799	3429		1734	3463	
Flt Permitted		0.93			0.89		0.16	1.00		0.35	1.00	
Satd. Flow (perm)		1675			1615		312	3429		630	3463	
Volume (vph)	12	64	8	45	117	22	19	638	48	137	1192	71
Peak-hour factor, PHF	0.76	0.76	0.76	0.96	0.96	0.96	0.89	0.89	0.89	0.92	0.92	0.92
Adj. Flow (vph)	16	84	11	47	122	23	21	717	54	149	1296	77
RTOR Reduction (vph)	0	5	0	0	6	0	0	4	0	0	3	0
Lane Group Flow (vph)	0	106	0	0	186	0	21	767	0	149	1370	0
Confl. Peds. (#/hr)	5		8	8		5	11		1	1		11
Heavy Vehicles (%)	0%	5%	0%	0%	3%	5%	0%	4%	4%	4%	3%	4%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			6			2	
Permitted Phases	4			4			6			2		
Actuated Green, G (s)		15.4			15.4		71.6	71.6		71.6	71.6	
Effective Green, g (s)		15.4			15.4		71.6	71.6		71.6	71.6	
Actuated g/C Ratio		0.16			0.16		0.75	0.75		0.75	0.75	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		272			262		235	2584		475	2610	
v/s Ratio Prot								0.22			c0.40	
v/s Ratio Perm		0.06			c0.12		0.07			0.24		
v/c Ratio		0.39			0.71		0.09	0.30		0.31	0.52	
Uniform Delay, d1		35.6			37.7		3.1	3.7		3.8	4.8	
Progression Factor		1.00			1.00		1.30	1.47		0.44	0.63	
Incremental Delay, d2		0.9			8.8		0.7	0.3		1.1	0.5	
Delay (s)		36.5			46.4		4.8	5.7		2.8	3.5	
Level of Service		D			D		A	A		A	A	
Approach Delay (s)		36.5			46.4			5.7			3.4	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM Average Control Delay	8.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

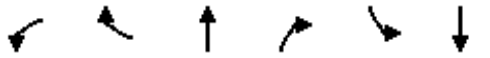
Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	642	22	0	1348	0	42
Peak Hour Factor	0.88	0.88	0.95	0.95	0.63	0.63
Hourly flow rate (vph)	730	25	0	1419	0	67
Pedestrians					11	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	972			302		
pX, platoon unblocked			1.00		0.67	1.00
vC, conflicting volume			766		1463	388
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			764		1194	386
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	89
cM capacity (veh/h)			849		121	606

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	NW 1
Volume Total	486	268	709	709	67
Volume Left	0	0	0	0	0
Volume Right	0	25	0	0	67
cSH	1700	1700	1700	1700	606
Volume to Capacity	0.29	0.16	0.42	0.42	0.11
Queue Length 95th (ft)	0	0	0	0	9
Control Delay (s)	0.0	0.0	0.0	0.0	11.7
Lane LOS					B
Approach Delay (s)	0.0		0.0		11.7
Approach LOS					B

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	40.6%	ICU Level of Service	A
Analysis Period (min)	15		

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	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.87	1.00	1.00	0.96	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	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1863	1319	1618	1687	1452	1703	3415		1752	3517	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1805	1863	1319	1618	1687	1452	1703	3415		1752	3517	
Volume (vph)	56	162	82	119	200	85	110	497	91	118	1127	36
Peak-hour factor, PHF	0.85	0.85	0.85	0.92	0.92	0.92	0.88	0.88	0.88	0.95	0.95	0.95
Adj. Flow (vph)	66	191	96	129	217	92	125	565	103	124	1186	38
RTOR Reduction (vph)	0	0	82	0	0	77	0	14	0	0	2	0
Lane Group Flow (vph)	66	191	14	129	217	15	125	654	0	124	1222	0
Confl. Peds. (#/hr)	15		70	70		15	18		14	14		18
Heavy Vehicles (%)	0%	2%	6%	6%	7%	7%	6%	2%	4%	3%	2%	0%
Turn Type	Split		Perm	Split		Perm	Prot			Prot		
Protected Phases	3	3		4	4		1	6		5	2	
Permitted Phases			3			4						
Actuated Green, G (s)	14.3	14.3	14.3	16.0	16.0	16.0	11.6	38.3		10.4	37.1	
Effective Green, g (s)	14.3	14.3	14.3	16.0	16.0	16.0	11.6	38.3		10.4	37.1	
Actuated g/C Ratio	0.15	0.15	0.15	0.17	0.17	0.17	0.12	0.40		0.11	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	272	280	199	273	284	245	208	1377		192	1373	
v/s Ratio Prot	0.04	c0.10		0.08	c0.13		c0.07	0.19		0.07	c0.35	
v/s Ratio Perm			0.01			0.01						
v/c Ratio	0.24	0.68	0.07	0.47	0.76	0.06	0.60	0.47		0.65	0.89	
Uniform Delay, d1	35.6	38.2	34.7	35.7	37.7	33.2	39.5	20.9		40.5	27.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.16		1.51	0.44	
Incremental Delay, d2	0.5	6.7	0.2	1.3	11.6	0.1	4.7	1.1		2.3	3.1	
Delay (s)	36.0	44.9	34.8	37.0	49.3	33.3	44.9	25.4		63.5	14.9	
Level of Service	D	D	C	D	D	C	D	C		E	B	
Approach Delay (s)		40.5			42.3			28.5			19.4	
Approach LOS		D			D			C			B	

Intersection Summary			
HCM Average Control Delay	27.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	76.3%	ICU Level of Service	D
Analysis Period (min)	15		
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)	15	12	602	31	84	1330
Peak Hour Factor	0.62	0.62	0.90	0.90	0.94	0.94
Hourly flow rate (vph)	24	19	669	34	89	1415
Pedestrians	1		11			
Lane Width (ft)	12.0		12.0			
Walking Speed (ft/s)	4.0		4.0			
Percent Blockage	0		1			
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)			626			758
pX, platoon unblocked	0.65	0.90			0.90	
vC, conflicting volume	1584	353			704	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	881	162			554	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	86	97			90	
cM capacity (veh/h)	168	771			913	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	44	446	257	561	943
Volume Left	24	0	0	89	0
Volume Right	19	0	34	0	0
cSH	258	1700	1700	913	1700
Volume to Capacity	0.17	0.26	0.15	0.10	0.55
Queue Length 95th (ft)	15	0	0	8	0
Control Delay (s)	21.8	0.0	0.0	2.6	0.0
Lane LOS	C			A	
Approach Delay (s)	21.8	0.0		1.0	
Approach LOS	C				

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	70.2%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	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	0.95	
Frpb, ped/bikes	0.98		1.00	1.00	1.00	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	0.92		1.00	1.00	0.99	
Flt Protected	0.98		0.95	1.00	1.00	
Satd. Flow (prot)	1557		1752	3505	3515	
Flt Permitted	0.98		0.95	1.00	1.00	
Satd. Flow (perm)	1557		1752	3505	3515	
Volume (vph)	37	55	34	593	1344	63
Peak-hour factor, PHF	0.77	0.77	0.93	0.93	0.93	0.93
Adj. Flow (vph)	48	71	37	638	1445	68
RTOR Reduction (vph)	65	0	0	0	3	0
Lane Group Flow (vph)	54	0	37	638	1510	0
Confl. Peds. (#/hr)	1	10				
Heavy Vehicles (%)	14%	4%	3%	3%	2%	2%
Turn Type			Prot			
Protected Phases	4		1	6	2	
Permitted Phases						
Actuated Green, G (s)	8.2		34.6	70.0	40.2	
Effective Green, g (s)	8.2		34.6	70.0	40.2	
Actuated g/C Ratio	0.09		0.36	0.74	0.42	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	134		638	2583	1487	
v/s Ratio Prot	c0.03		c0.02	c0.18	c0.43	
v/s Ratio Perm						
v/c Ratio	0.40		0.06	0.25	1.02	
Uniform Delay, d1	41.1		19.6	4.0	27.4	
Progression Factor	1.00		0.47	1.86	0.17	
Incremental Delay, d2	2.0		0.2	0.2	18.1	
Delay (s)	43.1		9.5	7.7	22.6	
Level of Service	D		A	A	C	
Approach Delay (s)	43.1			7.8	22.6	
Approach LOS	D			A	C	

Intersection Summary			
HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	53.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0		4.0	4.0
Lane Util. Factor	1.00		0.95		1.00	0.95
Frpb, ped/bikes	1.00		1.00		1.00	1.00
Flpb, ped/bikes	1.00		1.00		1.00	1.00
Frt	0.96		0.99		1.00	1.00
Flt Protected	0.97		1.00		0.95	1.00
Satd. Flow (prot)	1708		3447		1770	3610
Flt Permitted	0.97		1.00		0.95	1.00
Satd. Flow (perm)	1708		3447		1770	3610
Volume (vph)	54	21	584	46	26	1353
Peak-hour factor, PHF	0.78	0.78	0.92	0.92	0.92	0.92
Adj. Flow (vph)	69	27	635	50	28	1471
RTOR Reduction (vph)	18	0	3	0	0	0
Lane Group Flow (vph)	78	0	682	0	28	1471
Confl. Peds. (#/hr)		2		6	6	
Heavy Vehicles (%)	4%	0%	3%	7%	2%	0%
Turn Type					Prot	
Protected Phases	8		6		5	2
Permitted Phases						
Actuated Green, G (s)	8.2		70.0		4.8	40.2
Effective Green, g (s)	8.2		70.0		4.8	40.2
Actuated g/C Ratio	0.09		0.74		0.05	0.42
Clearance Time (s)	4.0		4.0		4.0	4.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	147		2540		89	1528
v/s Ratio Prot	c0.05		c0.20		c0.02	c0.41
v/s Ratio Perm						
v/c Ratio	0.53		0.27		0.31	0.96
Uniform Delay, d1	41.6		4.1		43.5	26.7
Progression Factor	1.00		0.18		1.20	0.72
Incremental Delay, d2	3.4		0.3		1.7	13.9
Delay (s)	45.0		1.0		53.8	33.2
Level of Service	D		A		D	C
Approach Delay (s)	45.0		1.0			33.6
Approach LOS	D		A			C

Intersection Summary			
HCM Average Control Delay	24.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	49.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

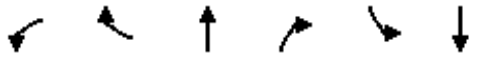
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1467	1293	1770	3505	3515	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1467	1293	1770	3505	3515	
Volume (vph)	26	35	63	542	1368	66
Peak-hour factor, PHF	0.79	0.79	0.90	0.90	0.95	0.95
Adj. Flow (vph)	33	44	70	602	1440	69
RTOR Reduction (vph)	0	41	0	0	2	0
Lane Group Flow (vph)	33	3	70	602	1507	0
Confl. Bikes (#/hr)		1				1
Heavy Vehicles (%)	23%	23%	2%	3%	2%	0%
Turn Type		Perm	Prot			
Protected Phases	8		1	6	2	
Permitted Phases		8				
Actuated Green, G (s)	6.5	6.5	7.9	80.5	68.6	
Effective Green, g (s)	6.5	6.5	7.9	80.5	68.6	
Actuated g/C Ratio	0.07	0.07	0.08	0.85	0.72	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	100	88	147	2970	2538	
v/s Ratio Prot	c0.02		c0.04	0.17	c0.43	
v/s Ratio Perm		0.00				
v/c Ratio	0.33	0.03	0.48	0.20	0.59	
Uniform Delay, d1	42.2	41.3	41.6	1.3	6.4	
Progression Factor	1.00	1.00	1.58	0.20	1.00	
Incremental Delay, d2	1.9	0.2	2.4	0.2	1.0	
Delay (s)	44.1	41.5	67.9	0.4	7.5	
Level of Service	D	D	E	A	A	
Approach Delay (s)	42.6			7.5	7.5	
Approach LOS	D			A	A	

Intersection Summary			
HCM Average Control Delay	8.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	20	9	41	510	1429	103
Peak Hour Factor	0.81	0.81	0.95	0.95	0.97	0.97
Hourly flow rate (vph)	25	11	43	537	1473	106
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)				640		
pX, platoon unblocked						
vC, conflicting volume	1881	790	1579			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1881	790	1579			
tC, single (s)	7.0	7.1	4.2			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.2			
p0 queue free %	52	96	89			
cM capacity (veh/h)	51	314	399			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	36	43	268	268	982	597
Volume Left	25	43	0	0	0	0
Volume Right	11	0	0	0	0	106
cSH	69	399	1700	1700	1700	1700
Volume to Capacity	0.52	0.11	0.16	0.16	0.58	0.35
Queue Length 95th (ft)	53	9	0	0	0	0
Control Delay (s)	103.6	15.1	0.0	0.0	0.0	0.0
Lane LOS	F	C				
Approach Delay (s)	103.6	1.1			0.0	
Approach LOS	F					

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	52.8%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	40	86	528	37	97	1458
Peak Hour Factor	0.88	0.88	0.92	0.92	0.96	0.96
Hourly flow rate (vph)	45	98	574	40	101	1519
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)			1038			
pX, platoon unblocked						
vC, conflicting volume	1555	307			614	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1555	307			614	
tC, single (s)	6.9	6.9			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	50	86			89	
cM capacity (veh/h)	92	692			955	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	143	383	232	607	1012
Volume Left	45	0	0	101	0
Volume Right	98	0	40	0	0
cSH	225	1700	1700	955	1700
Volume to Capacity	0.64	0.23	0.14	0.11	0.60
Queue Length 95th (ft)	96	0	0	9	0
Control Delay (s)	45.4	0.0	0.0	2.7	0.0
Lane LOS	E			A	
Approach Delay (s)	45.4	0.0		1.0	
Approach LOS	E				

Intersection Summary			
Average Delay	3.4		
Intersection Capacity Utilization	76.4%	ICU Level of Service	D
Analysis Period (min)	15		

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
Lane Util. Factor		0.95			0.91		0.97		1.00			1.00
Frpb, ped/bikes		1.00			1.00		1.00		1.00			1.00
Flpb, ped/bikes		1.00			1.00		1.00		1.00			1.00
Frt		1.00			1.00		1.00		0.85			0.86
Flt Protected		1.00			1.00		0.95		1.00			1.00
Satd. Flow (prot)		3505			4978		3400		1583			1611
Flt Permitted		1.00			1.00		0.95		1.00			1.00
Satd. Flow (perm)		3505			4978		3400		1583			1611
Volume (vph)	0	530	0	0	880	9	398	0	133	0	0	137
Peak-hour factor, PHF	0.90	0.90	0.90	0.84	0.84	0.84	0.95	0.95	0.95	0.73	0.73	0.73
Adj. Flow (vph)	0	589	0	0	1048	11	419	0	140	0	0	188
RTOR Reduction (vph)	0	0	0	0	2	0	0	0	98	0	0	48
Lane Group Flow (vph)	0	589	0	0	1057	0	419	0	42	0	0	140
Confl. Peds. (#/hr)	25		1	1		25						
Heavy Vehicles (%)	0%	3%	0%	0%	4%	0%	3%	0%	2%	0%	0%	2%
Turn Type							Prot		custom			custom
Protected Phases		4			4		5		5			6
Permitted Phases												
Actuated Green, G (s)		23.4			23.4		19.6		19.6			10.0
Effective Green, g (s)		23.4			23.4		19.6		19.6			10.0
Actuated g/C Ratio		0.36			0.36		0.30		0.30			0.15
Clearance Time (s)		4.0			4.0		4.0		4.0			4.0
Vehicle Extension (s)		3.0			3.0		3.0		3.0			3.0
Lane Grp Cap (vph)		1262			1792		1025		477			248
v/s Ratio Prot		0.17			c0.21		c0.12		0.03			c0.09
v/s Ratio Perm												
v/c Ratio		0.47			0.59		0.41		0.09			0.56
Uniform Delay, d1		16.0			16.9		18.1		16.3			25.5
Progression Factor		1.00			1.00		1.00		1.00			1.00
Incremental Delay, d2		0.3			0.5		1.2		0.4			9.0
Delay (s)		16.3			17.4		19.3		16.7			34.4
Level of Service		B			B		B		B			C
Approach Delay (s)		16.3			17.4			18.6			34.4	
Approach LOS		B			B			B			C	

Intersection Summary			
HCM Average Control Delay	18.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	47.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	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	0.97	0.91	0.95	0.88	0.97	0.95
Frpb, ped/bikes	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
Frt	0.99	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.96	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3354	1427	3505	2773	3400	3539
Flt Permitted	0.96	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3354	1427	3505	2773	3400	3539
Volume (vph)	323	259	789	387	853	1532
Peak-hour factor, PHF	0.87	0.87	0.88	0.88	0.92	0.92
Adj. Flow (vph)	371	298	897	440	927	1665
RTOR Reduction (vph)	7	220	0	49	0	0
Lane Group Flow (vph)	391	51	897	391	927	1665
Confl. Peds. (#/hr)				1	1	
Heavy Vehicles (%)	4%	3%	3%	1%	3%	2%
Turn Type		Perm		pm+ov	Prot	
Protected Phases	7		6	7	5	2
Permitted Phases		7		6		
Actuated Green, G (s)	15.9	15.9	28.7	44.6	28.4	61.1
Effective Green, g (s)	15.9	15.9	28.7	44.6	28.4	61.1
Actuated g/C Ratio	0.19	0.19	0.34	0.52	0.33	0.72
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	627	267	1183	1586	1136	2544
v/s Ratio Prot	c0.12		c0.26	0.05	c0.27	0.47
v/s Ratio Perm		0.04		0.09		
v/c Ratio	0.62	0.19	0.76	0.25	0.82	0.65
Uniform Delay, d1	31.8	29.1	25.1	11.0	25.9	6.3
Progression Factor	1.00	1.00	0.85	0.83	1.00	1.00
Incremental Delay, d2	1.9	0.3	3.7	0.1	4.6	1.3
Delay (s)	33.7	29.5	24.9	9.2	30.5	7.7
Level of Service	C	C	C	A	C	A
Approach Delay (s)	32.0		19.7			15.9
Approach LOS	C		B			B

Intersection Summary			
HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	68.1%	ICU Level of Service	C
Analysis Period (min)	15		
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		4.0	4.0	4.0
Lane Util. Factor	0.97	1.00			1.00	1.00	1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	0.96			1.00	0.98	1.00	1.00		1.00	1.00	0.89
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.94			1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3400	1557			1839	1554	1752	3523		1719	3505	1392
Flt Permitted	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3400	1557			1839	1554	1752	3523		1719	3505	1392
Volume (vph)	326	72	48	15	92	268	66	612	10	219	1105	566
Peak-hour factor, PHF	0.77	0.77	0.77	0.91	0.91	0.91	0.85	0.85	0.85	0.91	0.91	0.91
Adj. Flow (vph)	423	94	62	16	101	295	78	720	12	241	1214	622
RTOR Reduction (vph)	0	28	0	0	0	243	0	1	0	0	0	387
Lane Group Flow (vph)	423	128	0	0	117	52	78	731	0	241	1214	235
Confl. Peds. (#/hr)	4		45	45		4	34		9	9		34
Confl. Bikes (#/hr)			3									4
Heavy Vehicles (%)	3%	11%	10%	0%	3%	2%	3%	2%	10%	5%	3%	3%
Turn Type	Split			Split		custom	Prot			Prot		custom
Protected Phases	8	8		7	7		1	6		5	2	
Permitted Phases						8						6
Actuated Green, G (s)	14.9	14.9			8.3	14.9	7.6	30.3		15.5	38.2	30.3
Effective Green, g (s)	14.9	14.9			8.3	14.9	7.6	30.3		15.5	38.2	30.3
Actuated g/C Ratio	0.18	0.18			0.10	0.18	0.09	0.36		0.18	0.45	0.36
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	596	273			180	272	157	1256		313	1575	496
v/s Ratio Prot	c0.12	0.08			c0.06		0.04	0.21		c0.14	c0.35	
v/s Ratio Perm						0.03						0.17
v/c Ratio	0.71	0.47			0.65	0.19	0.50	0.58		0.77	0.77	0.47
Uniform Delay, d1	33.0	31.5			37.0	29.9	36.9	22.2		33.1	19.7	21.2
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.12	0.84	0.85
Incremental Delay, d2	3.9	1.3			8.1	0.3	2.5	2.0		8.5	2.9	2.5
Delay (s)	36.9	32.8			45.1	30.2	39.3	24.2		45.5	19.3	20.6
Level of Service	D	C			D	C	D	C		D	B	C
Approach Delay (s)		35.8			34.5			25.6			22.7	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM Average Control Delay	26.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	60.2%	ICU Level of Service	B
Analysis Period (min)	15		

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	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.91	0.91	0.88	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	1610	3379	2787	1770	3539	1563
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	1610	3379	2787	1770	3539	1563
Volume (vph)	41	767	169	1024	2100	13	87	150	340	3	13	6
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)	45	834	184	1113	2283	14	95	163	370	3	14	7
RTOR Reduction (vph)	0	0	130	0	0	5	0	0	201	0	0	7
Lane Group Flow (vph)	45	834	54	1113	2283	9	83	175	169	3	14	0
Confl. Peds. (#/hr)							1					1
Turn Type	Prot		Perm	Prot		Perm	Split		pm+ov	Split		Perm
Protected Phases	1	6		5	2		7	7	5	8	8	
Permitted Phases			6			2			7			8
Actuated Green, G (s)	3.7	19.5	19.5	26.6	43.4	43.4	7.6	7.6	34.2	2.0	2.0	2.0
Effective Green, g (s)	2.7	21.5	21.5	26.6	45.4	45.4	7.1	7.1	33.7	2.5	2.5	2.5
Actuated g/C Ratio	0.04	0.29	0.29	0.36	0.62	0.62	0.10	0.10	0.46	0.03	0.03	0.03
Clearance Time (s)	3.0	6.0	6.0	4.0	6.0	6.0	3.5	3.5	4.0	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	126	1483	462	1239	3132	975	155	326	1274	60	120	53
v/s Ratio Prot	0.01	0.16		c0.32	c0.45		0.05	c0.05	0.05	0.00	c0.00	
v/s Ratio Perm			0.03			0.01			0.01			0.00
v/c Ratio	0.36	0.56	0.12	0.90	0.73	0.01	0.54	0.54	0.13	0.05	0.12	0.00
Uniform Delay, d1	34.7	22.1	19.1	22.3	9.9	5.5	31.7	31.7	11.6	34.5	34.5	34.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.7	0.5	0.1	8.9	1.5	0.0	3.5	1.7	0.0	0.3	0.4	0.0
Delay (s)	36.4	22.6	19.2	31.1	11.4	5.5	35.3	33.4	11.6	34.8	35.0	34.4
Level of Service	D	C	B	C	B	A	D	C	B	C	C	C
Approach Delay (s)		22.6			17.8			20.8			34.8	
Approach LOS		C			B			C			C	

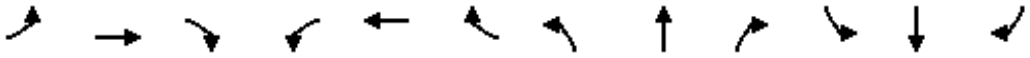
Intersection Summary			
HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	73.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	64.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	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	0.91	1.00	0.97	0.91	0.97	0.76
Frpb, ped/bikes	1.00	0.99	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	5085	1561	3433	5085	3433	3610
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	5085	1561	3433	5085	3433	3610
Volume (vph)	872	193	1659	3232	135	446
Peak-hour factor, PHF	0.91	0.91	0.93	0.93	0.88	0.88
Adj. Flow (vph)	958	212	1784	3475	153	507
RTOR Reduction (vph)	0	125	0	0	0	30
Lane Group Flow (vph)	958	87	1784	3475	153	477
Confl. Peds. (#/hr)		3	3			
Turn Type		Perm	Prot			pm+ov
Protected Phases	6		5	2	4	5
Permitted Phases		6				4
Actuated Green, G (s)	37.0	37.0	36.0	76.6	9.5	45.5
Effective Green, g (s)	39.0	39.0	35.5	78.5	8.5	44.0
Actuated g/C Ratio	0.41	0.41	0.37	0.83	0.09	0.46
Clearance Time (s)	6.0	6.0	3.5	5.9	3.0	3.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	2088	641	1283	4202	307	1824
v/s Ratio Prot	0.19		c0.52	c0.68	c0.04	0.10
v/s Ratio Perm		0.06				0.03
v/c Ratio	0.46	0.14	1.39	0.83	0.50	0.26
Uniform Delay, d1	20.3	17.5	29.8	4.5	41.2	15.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.1	180.6	2.0	1.3	0.1
Delay (s)	20.5	17.6	210.3	6.5	42.5	15.7
Level of Service	C	B	F	A	D	B
Approach Delay (s)	20.0			75.7	21.9	
Approach LOS	B			E	C	

Intersection Summary			
HCM Average Control Delay	61.5	HCM Level of Service	E
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	79.4%	ICU Level of Service	D
Analysis Period (min)	15		

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	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00	0.93	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	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1525	3433	1863	1469	1770	4899		1770	3491	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1863	1525	3433	1863	1469	1770	4899		1770	3491	
Volume (vph)	32	179	261	224	144	57	317	1625	406	115	978	69
Peak-hour factor, PHF	0.94	0.94	0.94	0.91	0.91	0.91	0.94	0.94	0.94	0.83	0.83	0.83
Adj. Flow (vph)	34	190	278	246	158	63	337	1729	432	139	1178	83
RTOR Reduction (vph)	0	0	239	0	0	52	0	23	0	0	3	0
Lane Group Flow (vph)	34	190	39	246	158	11	337	2138	0	139	1258	0
Confl. Peds. (#/hr)	43		18	18		43	17		6	6		17
Turn Type	Split		Perm	Split		Perm	Prot			Prot		
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4			3						
Actuated Green, G (s)	14.8	14.8	14.8	13.1	13.1	13.1	24.8	40.7		20.9	36.8	
Effective Green, g (s)	14.8	14.8	14.8	12.1	12.1	12.1	23.8	41.7		19.9	37.8	
Actuated g/C Ratio	0.14	0.14	0.14	0.12	0.12	0.12	0.23	0.40		0.19	0.36	
Clearance Time (s)	4.0	4.0	4.0	3.0	3.0	3.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	4.0		2.0	4.0	
Lane Grp Cap (vph)	251	264	216	398	216	170	403	1955		337	1263	
v/s Ratio Prot	0.02	c0.10		0.07	c0.08		0.19	c0.44		0.08	c0.36	
v/s Ratio Perm			0.03			0.01						
v/c Ratio	0.14	0.72	0.18	0.62	0.73	0.06	0.84	1.09		0.41	1.00	
Uniform Delay, d1	39.3	42.9	39.5	44.0	44.6	41.2	38.5	31.4		37.2	33.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	7.6	0.1	2.0	10.4	0.1	13.4	51.0		0.3	24.4	
Delay (s)	39.3	50.5	39.7	46.0	55.1	41.2	51.9	82.4		37.5	57.6	
Level of Service	D	D	D	D	E	D	D	F		D	E	
Approach Delay (s)		43.7			48.4			78.3			55.6	
Approach LOS		D			D			E			E	

Intersection Summary			
HCM Average Control Delay	65.4	HCM Level of Service	E
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	104.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.97		0.95	1.00	1.00	0.95
Frpb, ped/bikes	1.00		1.00	0.96	1.00	1.00
Flpb, ped/bikes	1.00		1.00	1.00	1.00	1.00
Frt	0.92		1.00	0.85	1.00	1.00
Flt Protected	0.98		1.00	1.00	0.95	1.00
Satd. Flow (prot)	3253		3539	1524	1770	3539
Flt Permitted	0.98		1.00	1.00	0.95	1.00
Satd. Flow (perm)	3253		3539	1524	1770	3539
Volume (vph)	177	193	1452	284	73	1004
Peak-hour factor, PHF	0.71	0.71	0.90	0.90	0.99	0.99
Adj. Flow (vph)	249	272	1613	316	74	1014
RTOR Reduction (vph)	235	0	0	91	0	0
Lane Group Flow (vph)	286	0	1613	225	74	1014
Confl. Peds. (#/hr)				12	12	
Turn Type				Perm	Prot	
Protected Phases	4		2		1	6
Permitted Phases				2		
Actuated Green, G (s)	10.8		44.7	44.7	7.0	54.7
Effective Green, g (s)	9.8		44.7	44.7	6.0	54.7
Actuated g/C Ratio	0.14		0.62	0.62	0.08	0.75
Clearance Time (s)	3.0		4.0	4.0	3.0	4.0
Vehicle Extension (s)	2.0		4.0	4.0	2.0	4.0
Lane Grp Cap (vph)	440		2182	940	146	2670
v/s Ratio Prot	c0.09		c0.46		c0.04	0.29
v/s Ratio Perm				0.15		
v/c Ratio	0.65		0.74	0.24	0.51	0.38
Uniform Delay, d1	29.7		9.8	6.3	31.8	3.1
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	2.5		2.3	0.6	1.0	0.4
Delay (s)	32.2		12.1	6.9	32.8	3.5
Level of Service	C		B	A	C	A
Approach Delay (s)	32.2		11.2			5.5
Approach LOS	C		B			A

Intersection Summary			
HCM Average Control Delay	12.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	72.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1545	1770	3539	3521	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1545	1770	3539	3521	
Volume (vph)	7	204	133	1533	810	25
Peak-hour factor, PHF	0.84	0.84	0.97	0.97	0.95	0.95
Adj. Flow (vph)	8	243	137	1580	853	26
RTOR Reduction (vph)	0	189	0	0	2	0
Lane Group Flow (vph)	8	54	137	1580	877	0
Confl. Peds. (#/hr)	10	15	12			12
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	9.5	9.5	5.0	60.1	52.1	
Effective Green, g (s)	8.5	8.5	4.0	60.1	52.1	
Actuated g/C Ratio	0.11	0.11	0.05	0.78	0.68	
Clearance Time (s)	3.0	3.0	3.0	4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	4.0	4.0	
Lane Grp Cap (vph)	196	171	92	2777	2395	
v/s Ratio Prot	0.00		c0.08	c0.45	0.25	
v/s Ratio Perm		c0.03				
v/c Ratio	0.04	0.31	1.49	0.57	0.37	
Uniform Delay, d1	30.4	31.4	36.3	3.2	5.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	0.4	268.9	0.9	0.1	
Delay (s)	30.4	31.7	305.2	4.1	5.3	
Level of Service	C	C	F	A	A	
Approach Delay (s)	31.7			28.1	5.3	
Approach LOS	C			C	A	

Intersection Summary			
HCM Average Control Delay	21.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	76.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.3%	ICU Level of Service	B
Analysis Period (min)	15		

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	0.95		1.00	0.95	
Frpb, ped/bikes		0.99			0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.93			0.95		1.00	1.00		1.00	0.99	
Flt Protected		0.98			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1672			1713		1770	3536		1769	3506	
Flt Permitted		0.82			0.66		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1407			1167		1770	3536		1769	3506	
Volume (vph)	66	3	84	81	6	44	151	1386	8	11	668	44
Peak-hour factor, PHF	0.87	0.87	0.87	0.94	0.94	0.94	0.96	0.96	0.96	0.92	0.92	0.92
Adj. Flow (vph)	76	3	97	86	6	47	157	1444	8	12	726	48
RTOR Reduction (vph)	0	51	0	0	22	0	0	0	0	0	3	0
Lane Group Flow (vph)	0	125	0	0	117	0	157	1452	0	12	771	0
Confl. Peds. (#/hr)	9		1	1		9			1	1		
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)		9.0			9.0		8.7	42.4		1.1	34.8	
Effective Green, g (s)		8.0			8.0		7.7	42.4		0.1	34.8	
Actuated g/C Ratio		0.13			0.13		0.12	0.68		0.00	0.56	
Clearance Time (s)		3.0			3.0		3.0	4.0		3.0	4.0	
Vehicle Extension (s)		2.0			2.0		2.0	4.0		2.0	4.0	
Lane Grp Cap (vph)		180			149		218	2399		3	1952	
v/s Ratio Prot							c0.09	c0.41		0.01	0.22	
v/s Ratio Perm		0.09			c0.10							
v/c Ratio		0.69			0.79		0.72	0.61		4.00	0.39	
Uniform Delay, d1		26.1			26.4		26.4	5.5		31.2	7.9	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		8.9			21.8		9.5	0.5		1914.2	0.2	
Delay (s)		35.0			48.2		35.8	6.0		1945.4	8.0	
Level of Service		C			D		D	A		F	A	
Approach Delay (s)		35.0			48.2			8.9			37.6	
Approach LOS		C			D			A			D	

Intersection Summary			
HCM Average Control Delay	20.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	62.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.1%	ICU Level of Service	C
Analysis Period (min)	15		

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	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.86	0.91	0.97	0.95	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	0.99	0.95	1.00	1.00	1.00	1.00	0.98	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.97	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1805	1900	1561	1626	3085	1366	3400	3539	1599	1736	3390	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1805	1900	1561	1626	3085	1366	3400	3539	1599	1736	3390	
Volume (vph)	21	114	182	339	565	804	229	743	655	71	586	186
Peak-hour factor, PHF	0.90	0.90	0.90	0.97	0.97	0.97	0.98	0.98	0.98	0.94	0.94	0.94
Adj. Flow (vph)	23	127	202	349	582	829	234	758	668	76	623	198
RTOR Reduction (vph)	0	0	179	0	25	387	0	0	0	0	32	0
Lane Group Flow (vph)	23	127	23	349	724	275	234	758	668	76	789	0
Confl. Peds. (#/hr)	24					24	33		1	1		33
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	0%	0%	2%	1%	1%	2%	3%	2%	1%	4%	1%	1%
Turn Type	Split		Perm	Split		Perm	Prot		Prot	Prot		
Protected Phases	4	4		3	3		1	6	6	5	2	
Permitted Phases			4			3						
Actuated Green, G (s)	10.4	10.4	10.4	22.0	22.0	22.0	11.4	33.4	33.4	8.2	30.2	
Effective Green, g (s)	10.4	10.4	10.4	22.0	22.0	22.0	11.4	33.4	33.4	8.2	30.2	
Actuated g/C Ratio	0.12	0.12	0.12	0.24	0.24	0.24	0.13	0.37	0.37	0.09	0.34	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	209	220	180	397	754	334	431	1313	593	158	1138	
v/s Ratio Prot	0.01	c0.07		0.21	c0.23		c0.07	0.21	c0.42	0.04	0.23	
v/s Ratio Perm			0.01			0.20						
v/c Ratio	0.11	0.58	0.13	0.88	0.96	0.82	0.54	0.58	1.13	0.48	0.69	
Uniform Delay, d1	35.7	37.7	35.7	32.7	33.6	32.2	36.9	22.7	28.3	38.9	25.9	
Progression Factor	1.00	1.00	1.00	0.96	0.98	2.55	1.10	1.28	1.18	0.86	0.92	
Incremental Delay, d2	0.2	3.6	0.3	15.3	19.5	11.8	0.7	0.9	68.1	2.1	3.2	
Delay (s)	35.9	41.4	36.1	46.6	52.3	93.8	41.1	29.9	101.4	35.7	27.1	
Level of Service	D	D	D	D	D	F	D	C	F	D	C	
Approach Delay (s)		38.0			66.7			60.2			27.8	
Approach LOS		D			E			E			C	

Intersection Summary			
HCM Average Control Delay	54.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.0%	ICU Level of Service	C
Analysis Period (min)	15		

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	0.95		1.00	0.95	
Frpb, ped/bikes		0.99			0.98		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		0.99	1.00		1.00	1.00	
Frt		0.96			0.97		1.00	0.99		1.00	1.00	
Flt Protected		0.99			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1771			1736		1794	3525		1769	3522	
Flt Permitted		0.96			0.73		0.27	1.00		0.15	1.00	
Satd. Flow (perm)		1705			1293		510	3525		277	3522	
Volume (vph)	13	69	38	80	74	45	52	1245	116	47	867	24
Peak-hour factor, PHF	0.83	0.83	0.83	0.86	0.86	0.86	0.97	0.97	0.97	0.93	0.93	0.93
Adj. Flow (vph)	16	83	46	93	86	52	54	1284	120	51	932	26
RTOR Reduction (vph)	0	21	0	0	13	0	0	6	0	0	2	0
Lane Group Flow (vph)	0	124	0	0	218	0	54	1398	0	51	956	0
Confl. Peds. (#/hr)	36		9	9		36	10		1	1		10
Heavy Vehicles (%)	0%	0%	3%	0%	4%	2%	0%	1%	0%	2%	2%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			6			2	
Permitted Phases	4			4			6			2		
Actuated Green, G (s)		18.0			18.0		64.0	64.0		64.0	64.0	
Effective Green, g (s)		18.0			18.0		64.0	64.0		64.0	64.0	
Actuated g/C Ratio		0.20			0.20		0.71	0.71		0.71	0.71	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		341			259		363	2507		197	2505	
v/s Ratio Prot								c0.40			0.27	
v/s Ratio Perm		0.07			c0.17		0.11			0.18		
v/c Ratio		0.36			0.84		0.15	0.56		0.26	0.38	
Uniform Delay, d1		31.1			34.6		4.2	6.2		4.6	5.2	
Progression Factor		1.00			1.00		0.45	0.76		1.16	0.92	
Incremental Delay, d2		0.7			21.3		0.6	0.6		2.9	0.4	
Delay (s)		31.7			55.9		2.5	5.3		8.3	5.2	
Level of Service		C			E		A	A		A	A	
Approach Delay (s)		31.7			55.9			5.2			5.3	
Approach LOS		C			E			A			A	

Intersection Summary			
HCM Average Control Delay	10.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.3%	ICU Level of Service	C
Analysis Period (min)	15		
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	0.95		1.00	0.95	
Frpb, ped/bikes		0.99			0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		0.99	1.00		1.00	1.00	
Frt		0.98			0.96		1.00	0.99		1.00	0.99	
Flt Protected		0.99			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1831			1765		1787	3531		1801	3513	
Flt Permitted		0.88			0.73		0.28	1.00		0.15	1.00	
Satd. Flow (perm)		1628			1315		521	3531		279	3513	
Volume (vph)	23	92	22	77	98	77	31	1236	80	37	843	33
Peak-hour factor, PHF	0.67	0.67	0.67	0.96	0.96	0.96	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	34	137	33	80	102	80	33	1315	85	39	897	35
RTOR Reduction (vph)	0	8	0	0	19	0	0	4	0	0	3	0
Lane Group Flow (vph)	0	196	0	0	243	0	33	1396	0	39	929	0
Confl. Peds. (#/hr)	13		12	12		13	16		10	10		16
Confl. Bikes (#/hr)												1
Heavy Vehicles (%)	0%	0%	0%	0%	0%	1%	0%	1%	1%	0%	2%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			6			2	
Permitted Phases	4			4			6			2		
Actuated Green, G (s)		18.9			18.9		63.1	63.1		63.1	63.1	
Effective Green, g (s)		18.9			18.9		63.1	63.1		63.1	63.1	
Actuated g/C Ratio		0.21			0.21		0.70	0.70		0.70	0.70	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		342			276		365	2476		196	2463	
v/s Ratio Prot								c0.40			0.26	
v/s Ratio Perm		0.12			c0.18		0.06			0.14		
v/c Ratio		0.57			0.88		0.09	0.56		0.20	0.38	
Uniform Delay, d1		31.9			34.5		4.3	6.6		4.7	5.5	
Progression Factor		1.00			1.00		0.30	0.19		1.00	1.00	
Incremental Delay, d2		2.3			26.1		0.4	0.8		2.3	0.4	
Delay (s)		34.2			60.6		1.7	2.1		6.9	5.9	
Level of Service		C			E		A	A		A	A	
Approach Delay (s)		34.2			60.6			2.1			5.9	
Approach LOS		C			E			A			A	

Intersection Summary			
HCM Average Control Delay	11.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	64.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1261	30	0	860	0	95
Peak Hour Factor	0.96	0.96	0.92	0.92	0.83	0.83
Hourly flow rate (vph)	1314	31	0	935	0	114
Pedestrians					24	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	972			302		
pX, platoon unblocked			0.85		0.91	0.85
vC, conflicting volume			1369		1821	696
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1254		1401	458
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	75
cM capacity (veh/h)			466		119	460

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	NW 1
Volume Total	876	469	467	467	114
Volume Left	0	0	0	0	0
Volume Right	0	31	0	0	114
cSH	1700	1700	1700	1700	460
Volume to Capacity	0.52	0.28	0.27	0.27	0.25
Queue Length 95th (ft)	0	0	0	0	24
Control Delay (s)	0.0	0.0	0.0	0.0	15.4
Lane LOS					C
Approach Delay (s)	0.0		0.0		15.4
Approach LOS					C

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	48.4%	ICU Level of Service	A
Analysis Period (min)	15		

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	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.86	1.00	1.00	0.92	1.00	1.00		1.00	0.98	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1369	1698	1770	1485	1719	3525		1805	3468	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1863	1369	1698	1770	1485	1719	3525		1805	3468	
Volume (vph)	83	239	136	154	205	347	63	1271	78	98	582	58
Peak-hour factor, PHF	0.93	0.93	0.93	0.92	0.92	0.92	0.99	0.99	0.99	0.91	0.91	0.91
Adj. Flow (vph)	89	257	146	167	223	377	64	1284	79	108	640	64
RTOR Reduction (vph)	0	0	122	0	0	310	0	3	0	0	5	0
Lane Group Flow (vph)	89	257	24	167	223	67	64	1360	0	108	699	0
Confl. Peds. (#/hr)	31		56	56		31	46		13	13		46
Heavy Vehicles (%)	2%	2%	2%	1%	2%	0%	5%	1%	3%	0%	1%	0%
Turn Type	Split		Perm	Split		Perm	Prot			Prot		
Protected Phases	3	3		4	4		1	6		5	2	
Permitted Phases			3			4						
Actuated Green, G (s)	19.9	19.9	19.9	18.5	18.5	18.5	8.5	53.5		12.1	57.1	
Effective Green, g (s)	19.9	19.9	19.9	18.5	18.5	18.5	8.5	53.5		12.1	57.1	
Actuated g/C Ratio	0.17	0.17	0.17	0.15	0.15	0.15	0.07	0.45		0.10	0.48	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	294	309	227	262	273	229	122	1572		182	1650	
v/s Ratio Prot	0.05	c0.14		0.10	c0.13		0.04	c0.39		c0.06	c0.20	
v/s Ratio Perm			0.02			0.04						
v/c Ratio	0.30	0.83	0.11	0.64	0.82	0.29	0.52	0.86		0.59	0.42	
Uniform Delay, d1	44.0	48.4	42.5	47.6	49.1	44.9	53.8	30.0		51.6	20.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.6	17.1	0.2	5.0	17.0	0.7	4.0	6.6		5.1	0.8	
Delay (s)	44.5	65.5	42.7	52.6	66.1	45.6	57.8	36.6		56.7	21.4	
Level of Service	D	E	D	D	E	D	E	D		E	C	
Approach Delay (s)		55.0			53.1			37.6			26.1	
Approach LOS		D			D			D			C	

Intersection Summary			
HCM Average Control Delay	40.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	85.2%	ICU Level of Service	E
Analysis Period (min)	15		
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)	25	6	1604	59	24	699
Peak Hour Factor	0.73	0.73	0.97	0.97	0.92	0.92
Hourly flow rate (vph)	34	8	1654	61	26	760
Pedestrians	2		14			
Lane Width (ft)	12.0		12.0			
Walking Speed (ft/s)	4.0		4.0			
Percent Blockage	0		1			
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)			626			748
pX, platoon unblocked	0.65	0.65			0.65	
vC, conflicting volume	2132	859			1716	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2177	242			1563	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	98			90	
cM capacity (veh/h)	23	492			271	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	42	1102	612	279	507
Volume Left	34	0	0	26	0
Volume Right	8	0	61	0	0
cSH	28	1700	1700	271	1700
Volume to Capacity	1.51	0.65	0.36	0.10	0.30
Queue Length 95th (ft)	125	0	0	8	0
Control Delay (s)	563.8	0.0	0.0	3.9	0.0
Lane LOS	F			A	
Approach Delay (s)	563.8	0.0		1.4	
Approach LOS	F				

Intersection Summary			
Average Delay	9.8		
Intersection Capacity Utilization	56.2%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	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	0.95	
Frt	0.94		1.00	1.00	0.99	
Flt Protected	0.97		0.95	1.00	1.00	
Satd. Flow (prot)	1705		1805	3574	3506	
Flt Permitted	0.97		0.95	1.00	1.00	
Satd. Flow (perm)	1705		1805	3574	3506	
Volume (vph)	72	66	28	1612	660	51
Peak-hour factor, PHF	0.93	0.93	0.97	0.97	0.87	0.87
Adj. Flow (vph)	77	71	29	1662	759	59
RTOR Reduction (vph)	41	0	0	0	3	0
Lane Group Flow (vph)	107	0	29	1662	815	0
Heavy Vehicles (%)	3%	0%	0%	1%	2%	0%
Turn Type			Prot			
Protected Phases	4		1	6	2	
Permitted Phases						
Actuated Green, G (s)	10.7		3.3	65.7	64.0	
Effective Green, g (s)	10.7		3.3	65.7	64.0	
Actuated g/C Ratio	0.12		0.04	0.73	0.71	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	203		66	2609	2493	
v/s Ratio Prot	c0.06		c0.02	c0.46	0.23	
v/s Ratio Perm						
v/c Ratio	0.53		0.44	0.64	0.33	
Uniform Delay, d1	37.3		42.4	6.1	4.9	
Progression Factor	1.00		1.00	1.00	0.46	
Incremental Delay, d2	2.4		4.6	1.2	0.3	
Delay (s)	39.7		47.1	7.3	2.6	
Level of Service	D		D	A	A	
Approach Delay (s)	39.7			8.0	2.6	
Approach LOS	D			A	A	

Intersection Summary			
HCM Average Control Delay	8.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0		4.0	4.0
Lane Util. Factor	1.00		0.95		1.00	0.95
Frpb, ped/bikes	1.00		1.00		1.00	1.00
Flpb, ped/bikes	1.00		1.00		1.00	1.00
Frt	0.97		1.00		1.00	1.00
Flt Protected	0.96		1.00		0.95	1.00
Satd. Flow (prot)	1763		3550		1805	3574
Flt Permitted	0.96		1.00		0.95	1.00
Satd. Flow (perm)	1763		3550		1805	3574
Volume (vph)	78	20	1633	51	14	633
Peak-hour factor, PHF	0.85	0.85	0.95	0.95	0.85	0.85
Adj. Flow (vph)	92	24	1719	54	16	745
RTOR Reduction (vph)	11	0	1	0	0	0
Lane Group Flow (vph)	105	0	1772	0	16	745
Confl. Bikes (#/hr)				3		
Heavy Vehicles (%)	1%	0%	1%	6%	0%	1%
Turn Type					Prot	
Protected Phases	8		6		5	2
Permitted Phases						
Actuated Green, G (s)	10.7		65.7		1.6	64.0
Effective Green, g (s)	10.7		65.7		1.6	64.0
Actuated g/C Ratio	0.12		0.73		0.02	0.71
Clearance Time (s)	4.0		4.0		4.0	4.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	210		2592		32	2542
v/s Ratio Prot	c0.06		c0.50		c0.01	0.21
v/s Ratio Perm						
v/c Ratio	0.50		0.68		0.50	0.29
Uniform Delay, d1	37.1		6.5		43.8	4.7
Progression Factor	1.00		0.25		1.07	0.74
Incremental Delay, d2	1.9		1.2		11.6	0.3
Delay (s)	39.0		2.8		58.5	3.8
Level of Service	D		A		E	A
Approach Delay (s)	39.0		2.8			5.0
Approach LOS	D		A			A

Intersection Summary			
HCM Average Control Delay	5.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1787	1578	1805	3574	3559	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1787	1578	1805	3574	3559	
Volume (vph)	153	70	10	1632	567	9
Peak-hour factor, PHF	0.91	0.91	0.95	0.95	0.90	0.90
Adj. Flow (vph)	168	77	11	1718	630	10
RTOR Reduction (vph)	0	65	0	0	1	0
Lane Group Flow (vph)	168	12	11	1718	639	0
Confl. Peds. (#/hr)			1			1
Confl. Bikes (#/hr)		7				1
Heavy Vehicles (%)	1%	0%	0%	1%	1%	11%
Turn Type		Perm	Prot			
Protected Phases	8		1	6	2	
Permitted Phases		8				
Actuated Green, G (s)	13.2	13.2	1.4	68.8	63.4	
Effective Green, g (s)	13.2	13.2	1.4	68.8	63.4	
Actuated g/C Ratio	0.15	0.15	0.02	0.76	0.70	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	262	231	28	2732	2507	
v/s Ratio Prot	c0.09		0.01	c0.48	0.18	
v/s Ratio Perm		0.01				
v/c Ratio	0.64	0.05	0.39	0.63	0.26	
Uniform Delay, d1	36.2	33.0	43.9	4.8	4.8	
Progression Factor	1.00	1.00	1.30	0.33	1.00	
Incremental Delay, d2	5.3	0.1	6.7	0.8	0.2	
Delay (s)	41.4	33.1	64.0	2.4	5.0	
Level of Service	D	C	E	A	A	
Approach Delay (s)	38.8			2.8	5.0	
Approach LOS	D			A	A	

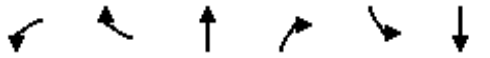
Intersection Summary			
HCM Average Control Delay	6.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	60.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	46	39	3	1781	538	12
Peak Hour Factor	0.89	0.89	0.95	0.95	0.88	0.88
Hourly flow rate (vph)	52	44	3	1875	611	14
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)				640		
pX, platoon unblocked	0.73					
vC, conflicting volume	1562	312	625			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1401	312	625			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	47	94	100			
cM capacity (veh/h)	97	689	966			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	96	3	937	937	408	217
Volume Left	52	3	0	0	0	0
Volume Right	44	0	0	0	0	14
cSH	161	966	1700	1700	1700	1700
Volume to Capacity	0.59	0.00	0.55	0.55	0.24	0.13
Queue Length 95th (ft)	79	0	0	0	0	0
Control Delay (s)	55.8	8.7	0.0	0.0	0.0	0.0
Lane LOS	F	A				
Approach Delay (s)	55.8	0.0			0.0	
Approach LOS	F					

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	39	67	1768	61	58	503
Peak Hour Factor	0.88	0.88	0.94	0.94	0.92	0.92
Hourly flow rate (vph)	44	76	1881	65	63	547
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)			1038			
pX, platoon unblocked	0.71	0.71			0.71	
vC, conflicting volume	2313	973			1946	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2440	556			1924	
tC, single (s)	6.8	6.9			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	78			70	
cM capacity (veh/h)	13	341			213	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	120	1254	692	245	364
Volume Left	44	0	0	63	0
Volume Right	76	0	65	0	0
cSH	34	1700	1700	213	1700
Volume to Capacity	3.53	0.74	0.41	0.30	0.21
Queue Length 95th (ft)	Err	0	0	30	0
Control Delay (s)	Err	0.0	0.0	14.5	0.0
Lane LOS	F			B	
Approach Delay (s)	Err	0.0		5.9	
Approach LOS	F				

Intersection Summary			
Average Delay	451.4		
Intersection Capacity Utilization	72.1%	ICU Level of Service	C
Analysis Period (min)	15		

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
Lane Util. Factor		0.95			0.91		0.97		1.00			1.00
Frpb, ped/bikes		1.00			1.00		1.00		1.00			1.00
Flpb, ped/bikes		1.00			1.00		1.00		1.00			1.00
Frt		1.00			0.99		1.00		0.85			0.86
Flt Protected		1.00			1.00		0.95		1.00			1.00
Satd. Flow (prot)		3539			5043		3467		1553			1536
Flt Permitted		1.00			1.00		0.95		1.00			1.00
Satd. Flow (perm)		3539			5043		3467		1553			1536
Volume (vph)	0	819	0	0	862	36	834	0	311	0	0	14
Peak-hour factor, PHF	0.97	0.97	0.97	0.94	0.94	0.94	0.96	0.96	0.96	0.63	0.63	0.63
Adj. Flow (vph)	0	844	0	0	917	38	869	0	324	0	0	22
RTOR Reduction (vph)	0	0	0	0	5	0	0	0	209	0	0	18
Lane Group Flow (vph)	0	844	0	0	950	0	869	0	115	0	0	4
Confl. Peds. (#/hr)	22		4	4		22			1	1		
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	1%	0%	4%	0%	0%	7%
Turn Type							Prot		custom			custom
Protected Phases		4			4		5		5			6
Permitted Phases												6
Actuated Green, G (s)		32.1			32.1		28.3		28.3			17.6
Effective Green, g (s)		32.1			32.1		28.3		28.3			17.6
Actuated g/C Ratio		0.36			0.36		0.31		0.31			0.20
Clearance Time (s)		4.0			4.0		4.0		4.0			4.0
Vehicle Extension (s)		3.0			3.0		3.0		3.0			3.0
Lane Grp Cap (vph)		1262			1799		1090		488			300
v/s Ratio Prot		c0.24			0.19		c0.25		0.07			c0.00
v/s Ratio Perm												
v/c Ratio		0.67			0.53		0.80		0.24			0.01
Uniform Delay, d1		24.5			22.9		28.2		22.8			29.2
Progression Factor		1.54			1.00		1.00		1.00			1.00
Incremental Delay, d2		0.4			0.3		4.1		0.2			0.1
Delay (s)		38.0			23.2		32.4		23.1			29.3
Level of Service		D			C		C		C			C
Approach Delay (s)		38.0			23.2			29.8			29.3	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM Average Control Delay	30.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	54.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	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	0.97	0.91	0.95	0.88	0.97	0.95
Frt	0.94	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.97	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3289	1441	3539	2814	3467	3539
Flt Permitted	0.97	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3289	1441	3539	2814	3467	3539
Volume (vph)	288	543	1408	411	595	861
Peak-hour factor, PHF	0.91	0.91	0.98	0.98	0.94	0.94
Adj. Flow (vph)	316	597	1437	419	633	916
RTOR Reduction (vph)	152	291	0	33	0	0
Lane Group Flow (vph)	397	73	1437	386	633	916
Heavy Vehicles (%)	2%	2%	2%	1%	1%	2%
Turn Type		Perm		pm+ov	Prot	
Protected Phases	7		6	7	5	2
Permitted Phases		7		6		
Actuated Green, G (s)	18.1	18.1	39.1	57.2	20.8	63.9
Effective Green, g (s)	18.1	18.1	39.1	57.2	20.8	63.9
Actuated g/C Ratio	0.20	0.20	0.43	0.64	0.23	0.71
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	661	290	1537	1914	801	2513
v/s Ratio Prot	c0.12		c0.41	0.04	c0.18	0.26
v/s Ratio Perm		0.05		0.10		
v/c Ratio	0.60	0.25	0.93	0.20	0.79	0.36
Uniform Delay, d1	32.7	30.3	24.2	6.9	32.5	5.1
Progression Factor	1.00	1.00	0.86	0.38	0.92	0.67
Incremental Delay, d2	1.5	0.5	8.4	0.0	4.5	0.3
Delay (s)	34.2	30.7	29.2	2.6	34.6	3.8
Level of Service	C	C	C	A	C	A
Approach Delay (s)	32.8		23.2			16.4
Approach LOS	C		C			B

Intersection Summary			
HCM Average Control Delay	22.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.8%	ICU Level of Service	D
Analysis Period (min)	15		

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		4.0	4.0	4.0
Lane Util. Factor	0.97	1.00			1.00	1.00	1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	0.97			1.00	0.99	1.00	1.00		1.00	1.00	0.90
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.92			1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3467	1636			1882	1547	1719	3518		1770	3574	1426
Flt Permitted	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3467	1636			1882	1547	1719	3518		1770	3574	1426
Volume (vph)	484	82	87	19	79	367	41	945	27	228	629	303
Peak-hour factor, PHF	0.94	0.94	0.94	0.92	0.92	0.92	0.95	0.95	0.95	0.92	0.92	0.92
Adj. Flow (vph)	515	87	93	21	86	399	43	995	28	248	684	329
RTOR Reduction (vph)	0	41	0	0	0	316	0	2	0	0	0	216
Lane Group Flow (vph)	515	139	0	0	107	83	43	1021	0	248	684	113
Confl. Peds. (#/hr)	1		37	37		1	28					28
Confl. Bikes (#/hr)			1						1			2
Heavy Vehicles (%)	1%	2%	5%	0%	0%	3%	5%	2%	7%	2%	1%	2%
Turn Type	Split			Split		custom	Prot			Prot		custom
Protected Phases	8	8		7	7		1	6		5	2	
Permitted Phases						8						6
Actuated Green, G (s)	18.8	18.8			9.0	18.8	5.3	31.0		15.2	40.9	31.0
Effective Green, g (s)	18.8	18.8			9.0	18.8	5.3	31.0		15.2	40.9	31.0
Actuated g/C Ratio	0.21	0.21			0.10	0.21	0.06	0.34		0.17	0.45	0.34
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	724	342			188	323	101	1212		299	1624	491
v/s Ratio Prot	c0.15	0.08			c0.06		0.03	c0.29		c0.14	0.19	
v/s Ratio Perm						0.05						0.08
v/c Ratio	0.71	0.41			0.57	0.26	0.43	0.84		0.83	0.42	0.23
Uniform Delay, d1	33.1	30.8			38.6	29.8	40.9	27.2		36.1	16.6	21.0
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.25	0.81	0.43
Incremental Delay, d2	3.3	0.8			3.9	0.4	2.9	7.2		15.8	0.7	1.0
Delay (s)	36.4	31.6			42.6	30.2	43.8	34.5		60.9	14.1	10.1
Level of Service	D	C			D	C	D	C		E	B	B
Approach Delay (s)		35.1			32.8			34.8			22.3	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM Average Control Delay	30.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	73.6%	ICU Level of Service	D
Analysis Period (min)	15		

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	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.91	0.91	0.88	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1562	3433	5085	1583	1610	3274	2787	1770	3539	1517
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1562	3433	5085	1583	1610	3274	2787	1770	3539	1517
Volume (vph)	5	2243	152	401	713	13	50	10	1479	114	168	48
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)	5	2438	165	436	775	14	54	11	1608	124	183	52
RTOR Reduction (vph)	0	0	42	0	0	5	0	0	193	0	0	46
Lane Group Flow (vph)	5	2438	123	436	775	9	27	38	1415	124	183	6
Confl. Peds. (#/hr)			1	1			20					20
Turn Type	Prot		Perm	Prot		Perm	Split		pm+ov	Split		Perm
Protected Phases	1	6		5	2		7	7	5	8	8	
Permitted Phases			6			2			7			8
Actuated Green, G (s)	1.2	32.5	32.5	47.0	79.3	79.3	15.0	15.0	62.0	13.9	13.9	13.9
Effective Green, g (s)	0.2	34.5	34.5	47.0	81.3	81.3	14.5	14.5	61.5	14.4	14.4	14.4
Actuated g/C Ratio	0.00	0.27	0.27	0.37	0.64	0.64	0.11	0.11	0.49	0.11	0.11	0.11
Clearance Time (s)	3.0	6.0	6.0	4.0	6.0	6.0	3.5	3.5	4.0	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	5	1388	426	1277	3271	1018	185	376	1356	202	403	173
v/s Ratio Prot	0.00	c0.48		0.13	0.15		0.02	0.01	c0.39	c0.07	0.05	
v/s Ratio Perm			0.08			0.01			0.12			0.00
v/c Ratio	1.00	1.76	0.29	0.34	0.24	0.01	0.15	0.10	1.04	0.61	0.45	0.03
Uniform Delay, d1	63.1	46.0	36.3	28.6	9.5	8.1	50.4	50.1	32.5	53.4	52.3	49.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	402.5	343.4	1.7	0.2	0.2	0.0	1.7	0.5	36.7	5.4	0.8	0.1
Delay (s)	465.6	389.4	38.0	28.7	9.7	8.1	52.0	50.7	69.2	58.8	53.1	49.9
Level of Service	F	F	D	C	A	A	D	D	E	E	D	D
Approach Delay (s)		367.3			16.4			68.5			54.6	
Approach LOS		F			B			E			D	

Intersection Summary			
HCM Average Control Delay	189.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.21		
Actuated Cycle Length (s)	126.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	118.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	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	0.91	1.00	0.97	0.91	0.97	0.76
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	5085	1583	3433	5085	3433	3610
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	5085	1583	3433	5085	3433	3610
Volume (vph)	3580	136	422	970	558	1751
Peak-hour factor, PHF	0.94	0.94	0.89	0.89	0.88	0.88
Adj. Flow (vph)	3809	145	474	1090	634	1990
RTOR Reduction (vph)	0	48	0	0	0	0
Lane Group Flow (vph)	3809	97	474	1090	634	1990
Confl. Peds. (#/hr)					1	
Turn Type		Perm	Prot			pm+ov
Protected Phases	6		5	2	4	5
Permitted Phases		6				4
Actuated Green, G (s)	48.6	48.6	24.5	76.7	24.6	49.1
Effective Green, g (s)	50.6	50.6	24.0	78.6	23.6	47.6
Actuated g/C Ratio	0.46	0.46	0.22	0.71	0.21	0.43
Clearance Time (s)	6.0	6.0	3.5	5.9	3.0	3.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	2335	727	748	3627	735	1690
v/s Ratio Prot	c0.75		0.14	0.21	0.18	c0.26
v/s Ratio Perm		0.06				0.29
v/c Ratio	1.63	0.13	0.63	0.30	0.86	1.18
Uniform Delay, d1	29.8	17.2	39.1	5.8	41.7	31.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	286.0	0.1	1.8	0.2	10.2	86.4
Delay (s)	315.8	17.3	40.9	6.0	52.0	117.7
Level of Service	F	B	D	A	D	F
Approach Delay (s)	304.9			16.6	101.8	
Approach LOS	F			B	F	

Intersection Summary			
HCM Average Control Delay	184.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.40		
Actuated Cycle Length (s)	110.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	116.7%	ICU Level of Service	H
Analysis Period (min)	15		

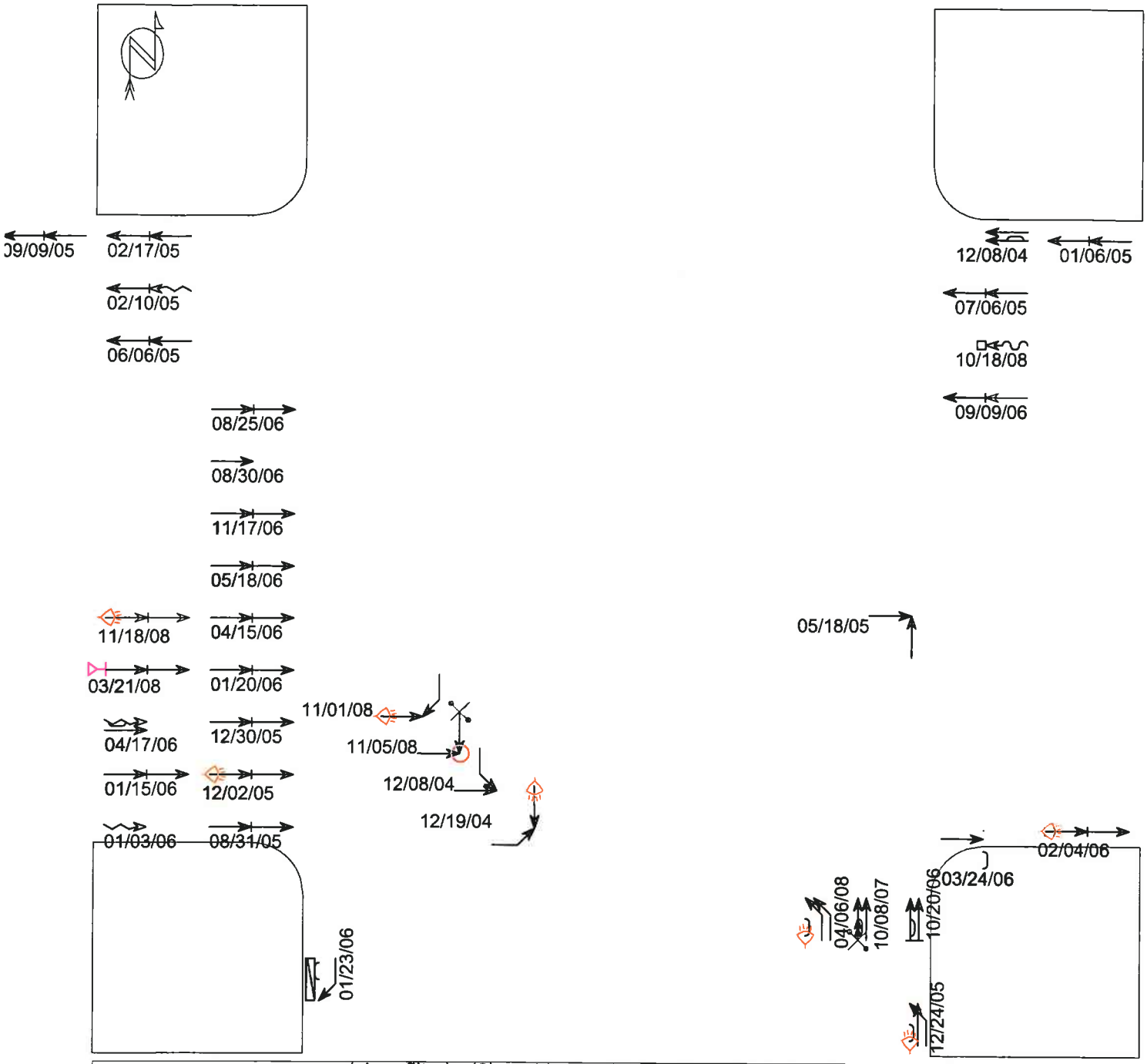
c Critical Lane Group

Appendix C – Accident Analysis

Willow Rd. & New Bridge St.

35 Accidents

Case ID List
01/01/04 - 10/06/09



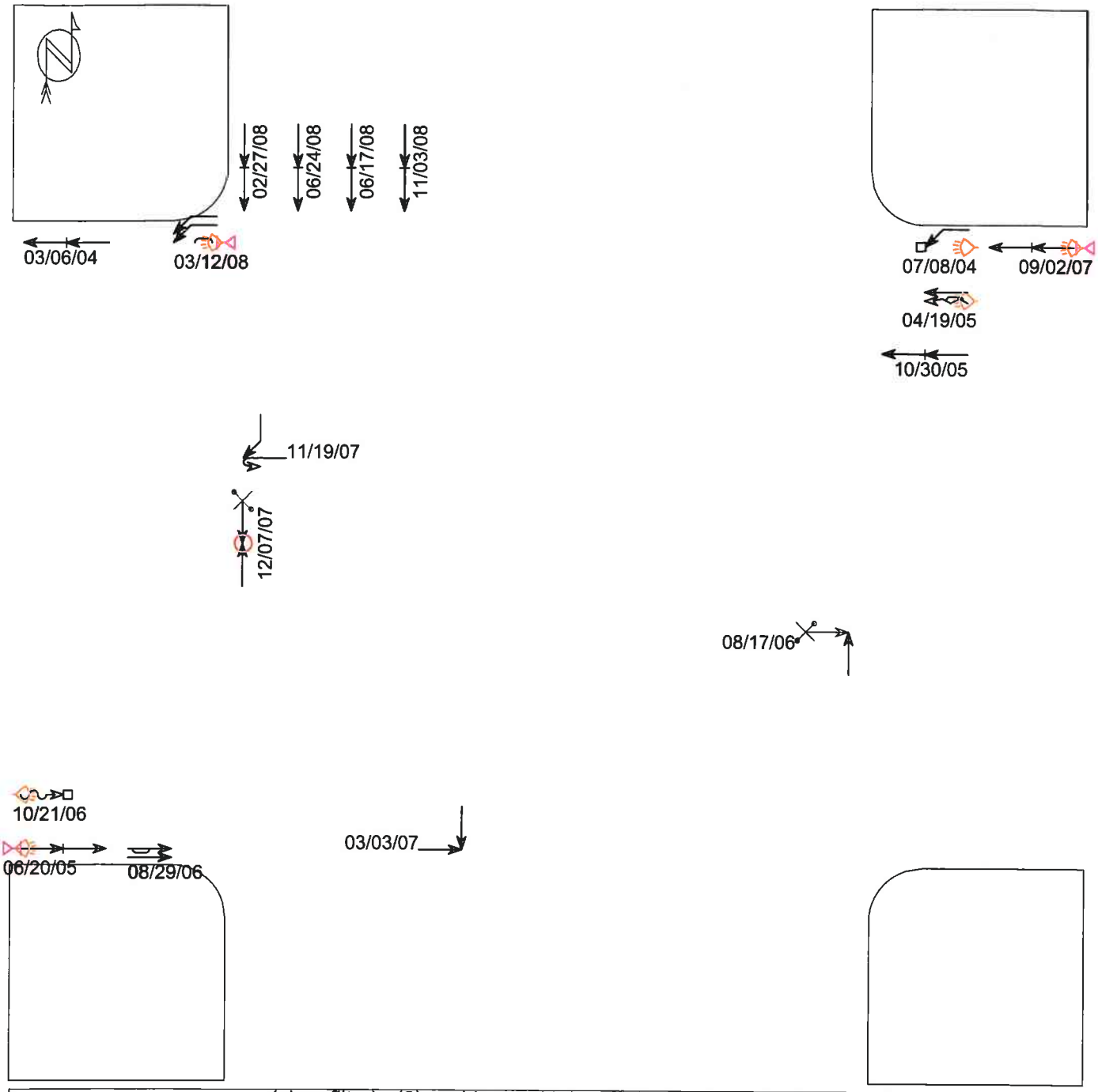
(clear filter), (0) accidents with insufficient data for display

Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole
Unknown	Out of control	Injury	Signal, Curb
Backing	Right turn	Fatality	Tree, Animal
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

Willow Rd. & New Bridge St.

17 Accidents

Case ID List
01/02/99 - 11/25/08



(clear filter), (0) accidents with insufficient data for display

Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole
Unknown	Out of control	Injury	Signal, Curb
Backing	Right turn	Fatality	Tree, Animal
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

10 Accidents

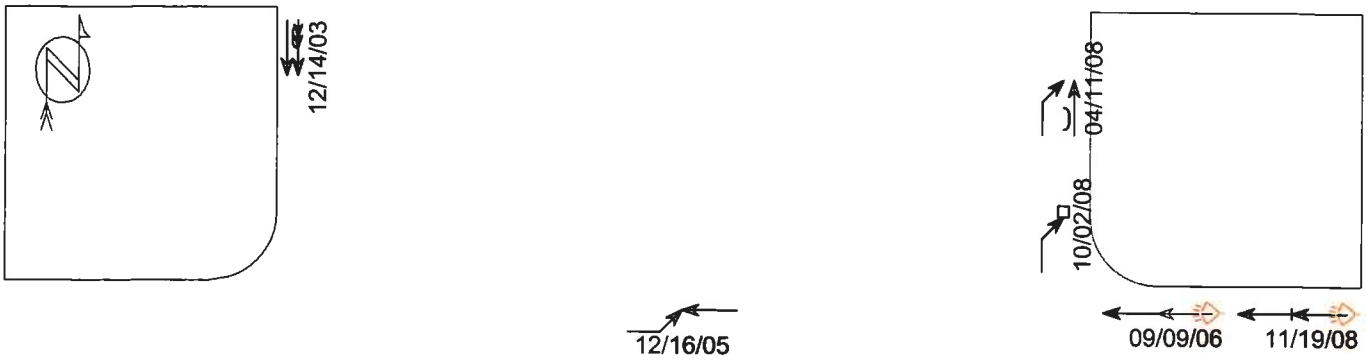
Obrien Dr & Willow Rd
11/25/03 - 11/25/08

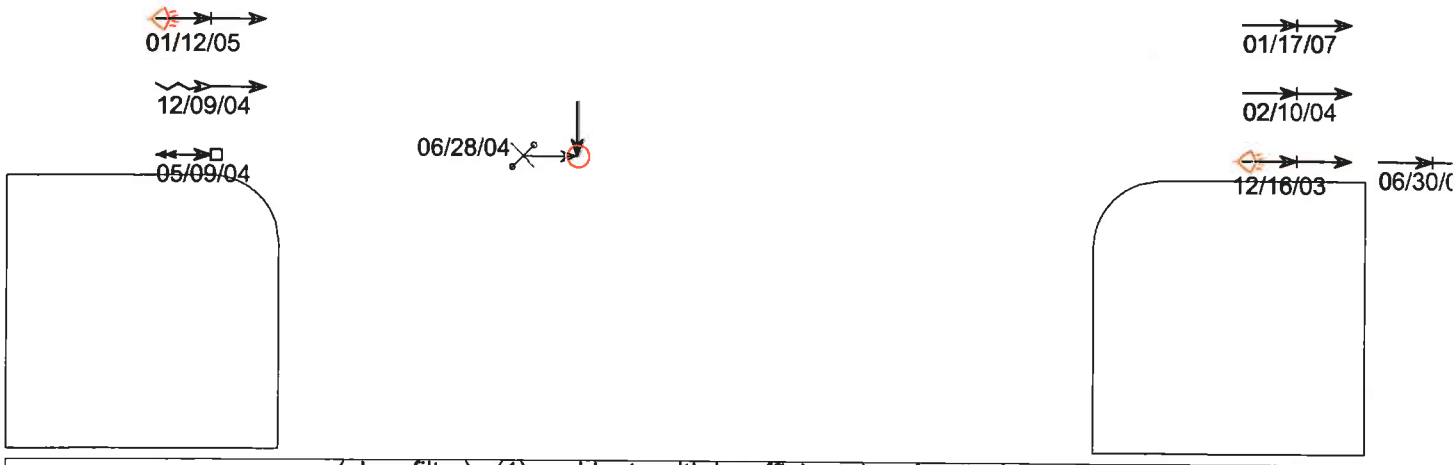
(clear filter), (0) accidents with insufficient data for display

Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole
Unknown	Out of control	Injury	Signal, Curb
Backing	Right turn	Fatality	Tree, Animal
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

15 Accidents

Ivy Dr & Willow Rd
11/25/03 - 11/25/08





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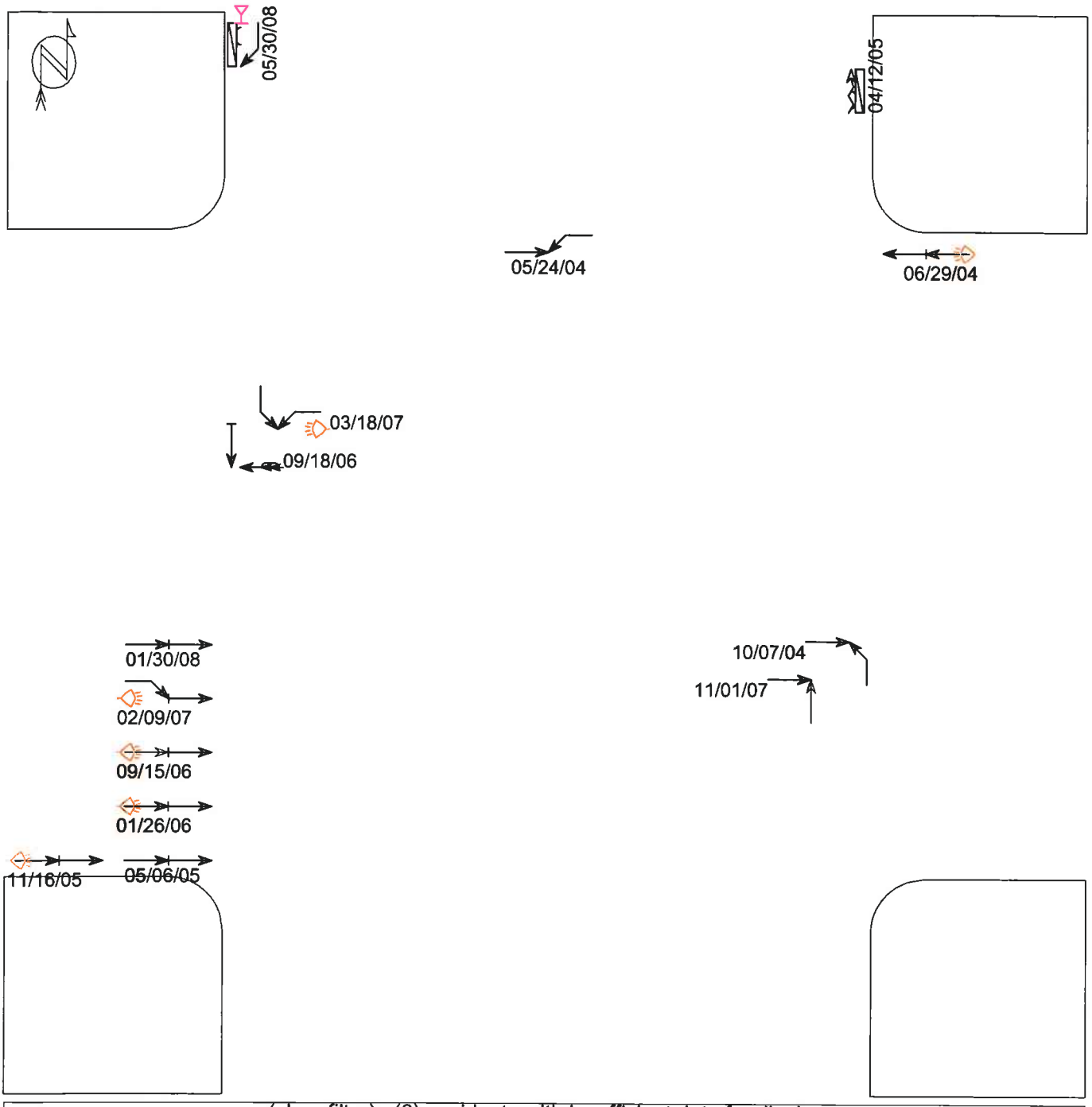
Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole
Unknown	Out of control	Injury	Signal, Curb
Backing	Right turn	Fatality	Tree, Animal
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

Hamilton Av & Willow Rd
14 Accidents 11/25/03 - 11/25/08



(clear filter), (0) accidents with insufficient data for display

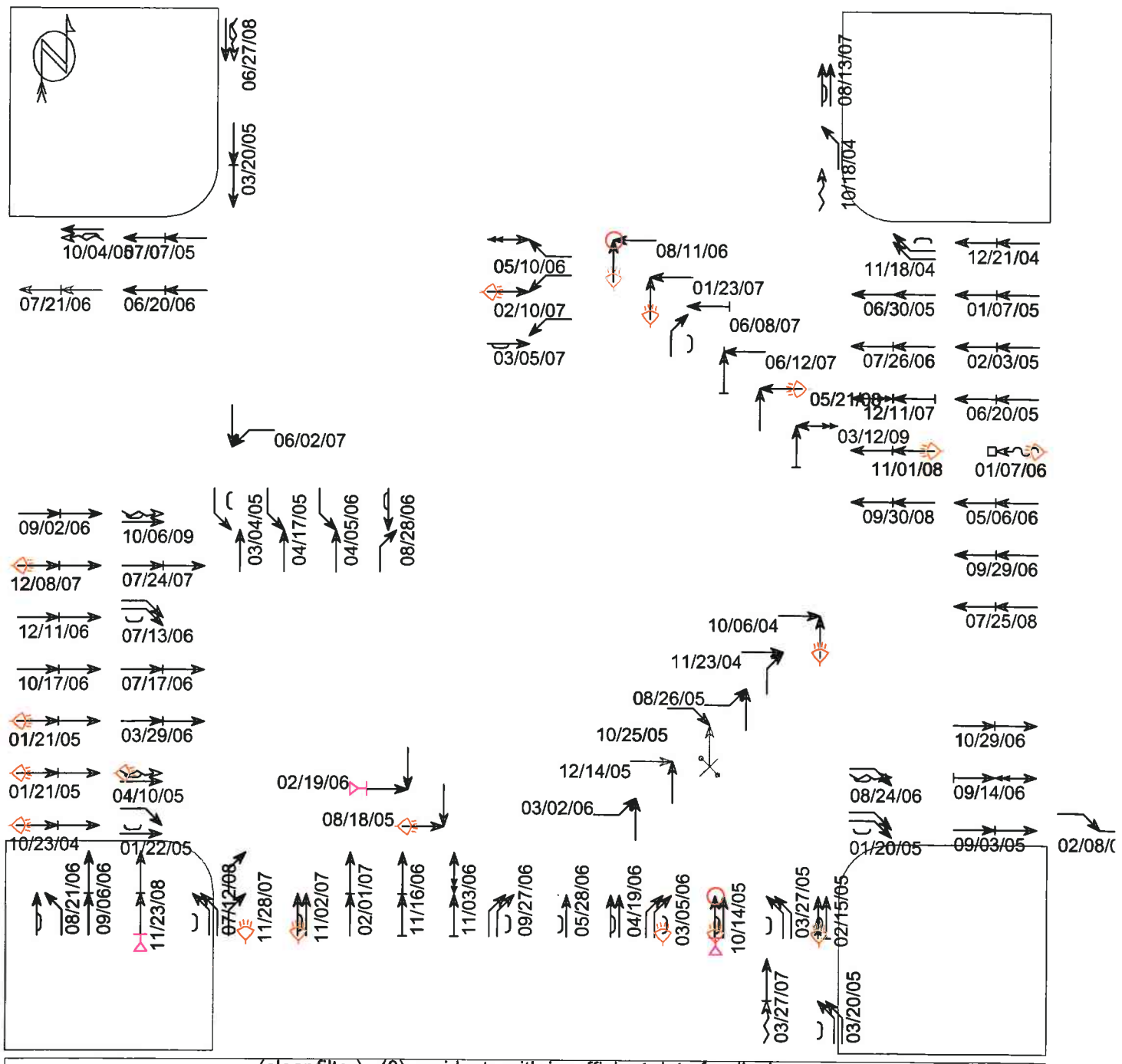
Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole
Unknown	Out of control	Injury	Signal, Curb
Backing	Right turn	Fatality	Tree, Animal
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

University Avenue & Donahue St.

82 Accidents

Case ID List

01/01/04 - 10/06/09



(clear filter), (0) accidents with insufficient data for display

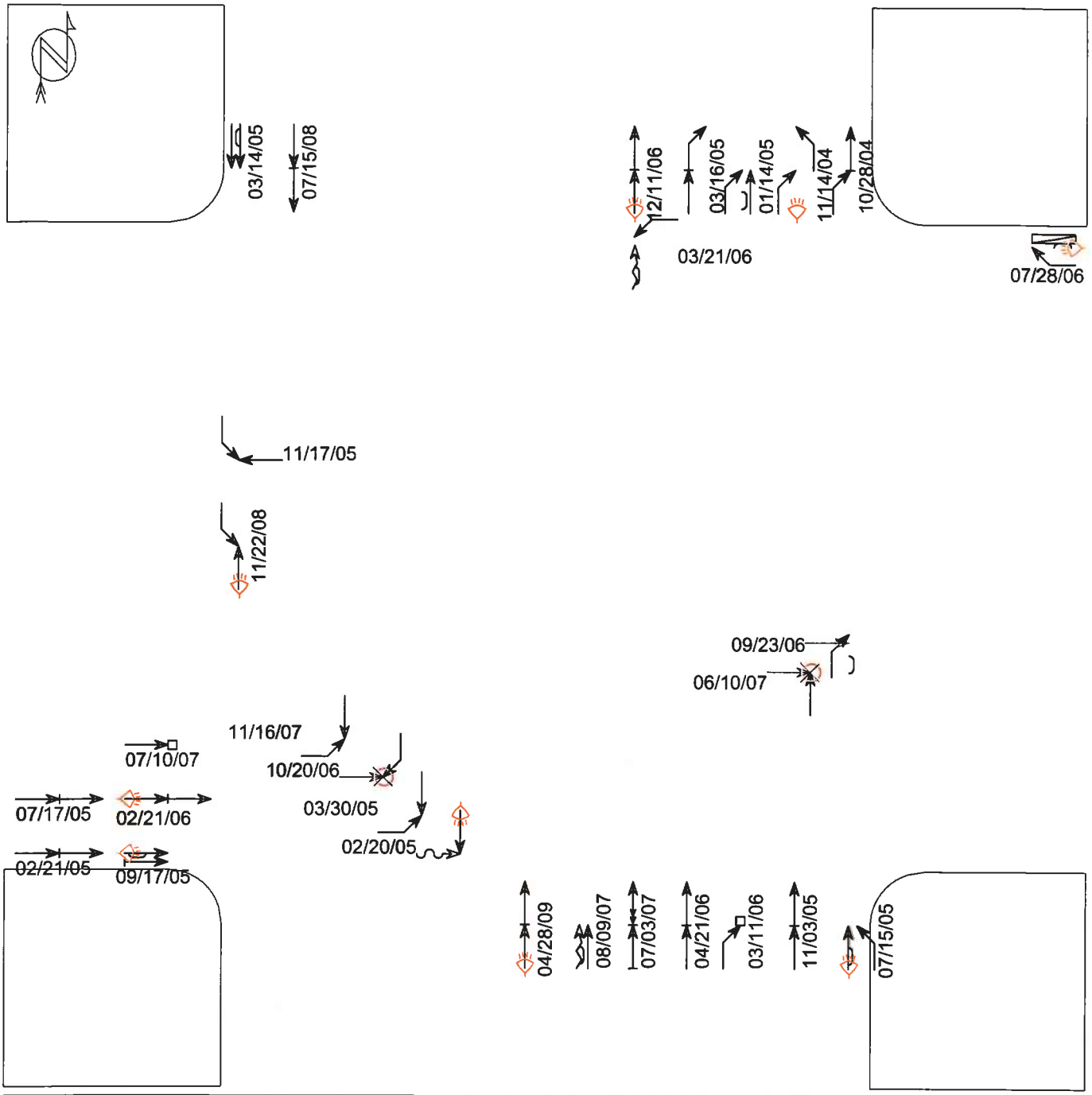
Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole
Unknown	Out of control	Injury	Signal, Curb
Backing	Right turn	Fatality	Tree, Animal
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

University Avenue & Donahue St.

Case ID List

29 Accidents

01/01/04 - 10/06/09

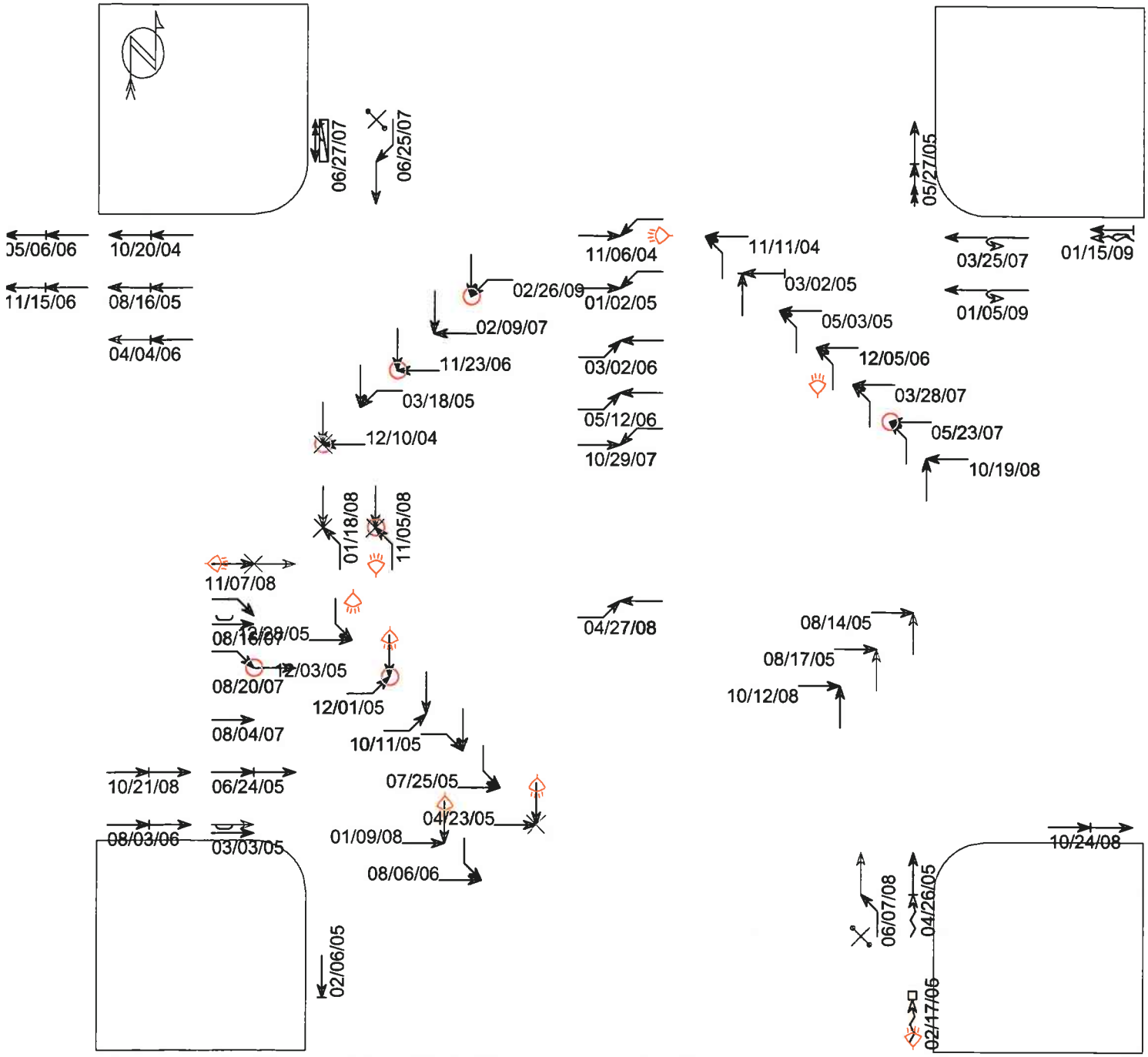


(clear filter), (0) accidents with insufficient data for display

Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole
Unknown	Out of control	Injury	Signal, Curb
Backing	Right turn	Fatality	Tree, Animal
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

55 Accidents

Bell St & University Av
10/06/04 - 10/06/09



(clear filter), (0) accidents with insufficient data for display

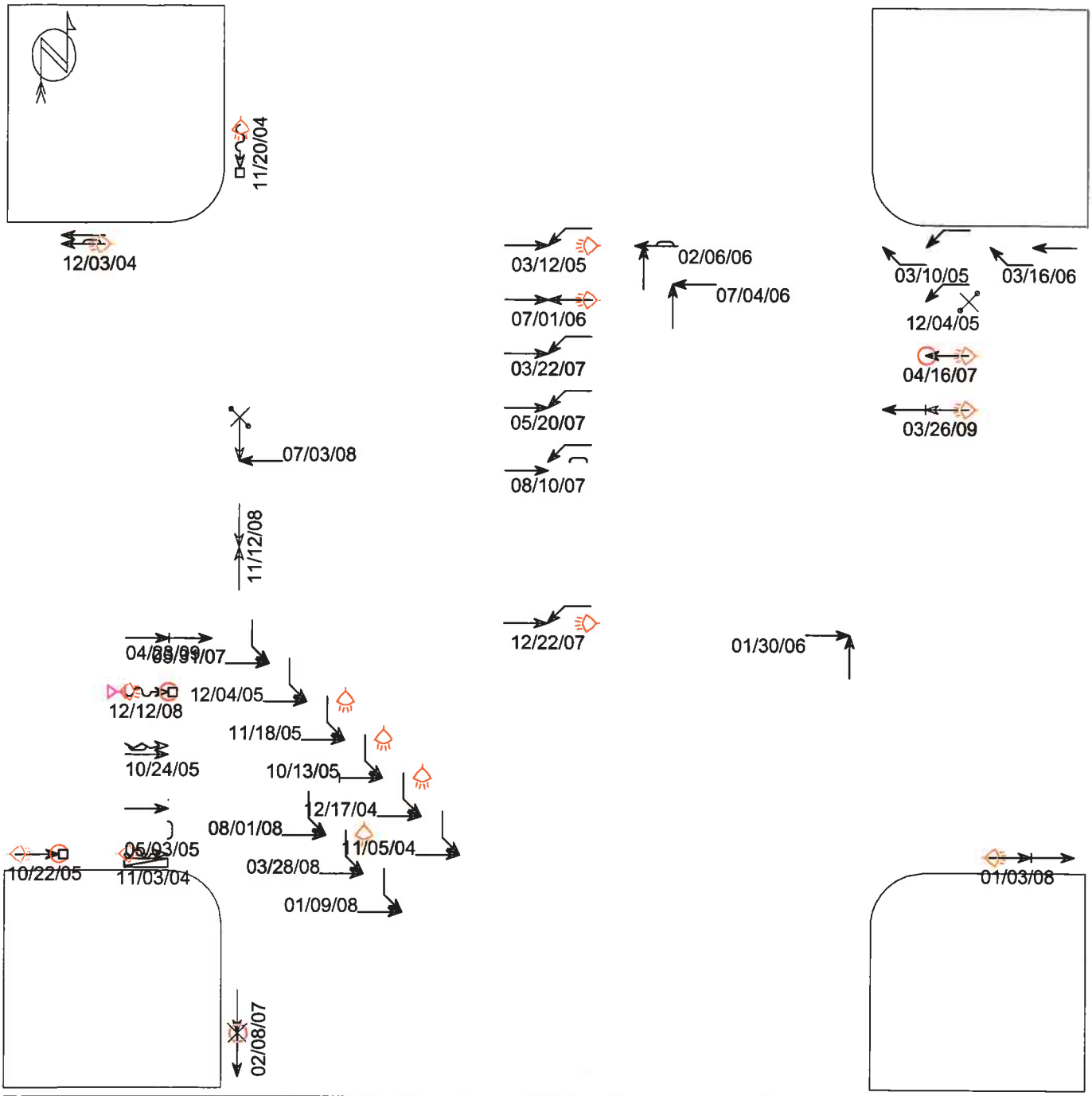
Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole
Unknown	Out of control	Injury	Signal, Curb
Backing	Right turn	Fatality	Tree, Animal
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

University Ave. & Runnymede St.

35 Accidents

Case ID List

01/01/04 - 10/06/09

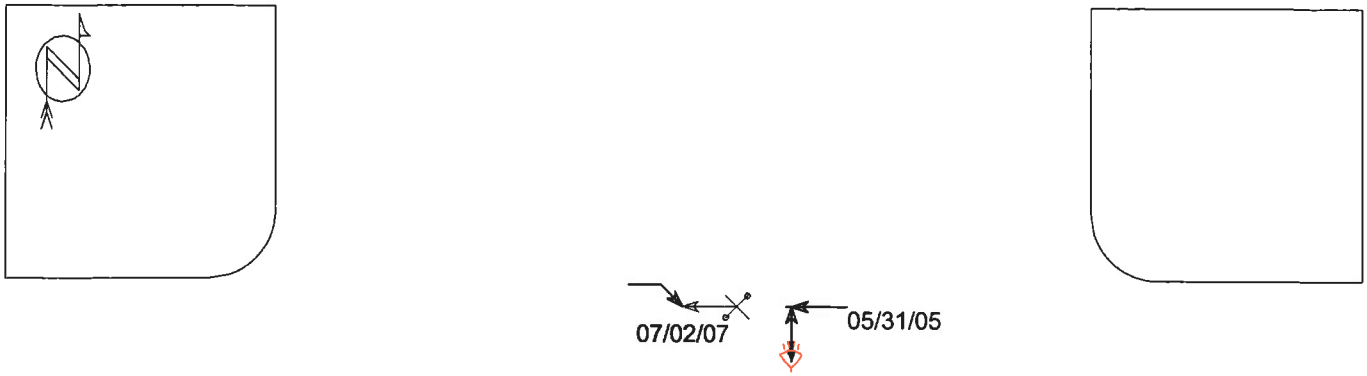


(clear filter), (0) accidents with insufficient data for display

Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole
Unknown	Out of control	Injury	Signal, Curb
Backing	Right turn	Fatality	Tree, Animal
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

5 Accidents

Cooley Av & University Av
10/06/04 - 10/06/09

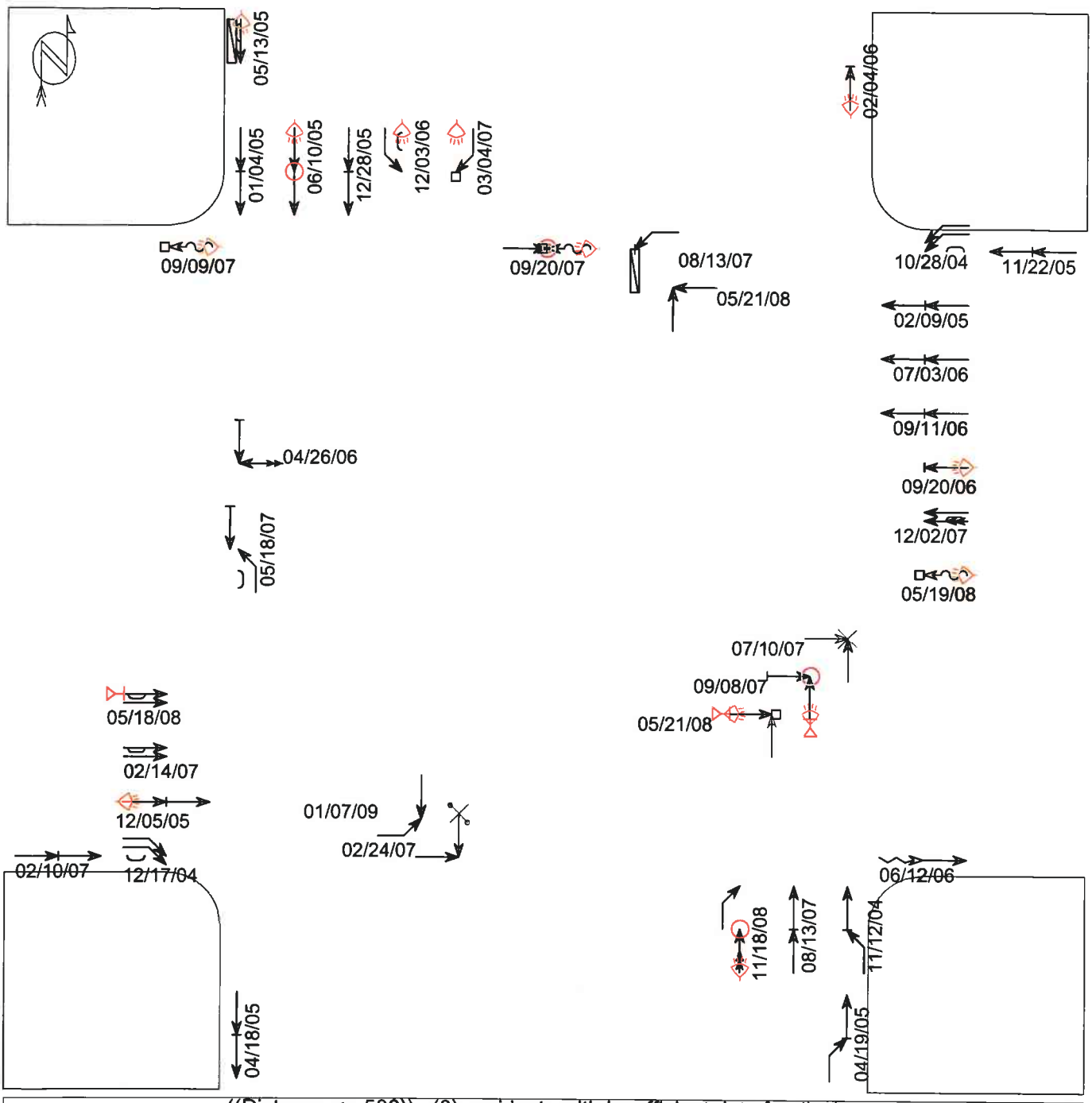


((Distance <= 500)), (0) accidents with insufficient data for display

Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole
Unknown	Out of control	Injury	Signal, Curb
Backing	Right turn	Fatality	Tree, Animal
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

37 Accidents

Bay Rd & University Av
10/06/04 - 10/06/09



((Distance <= 500)), (0) accidents with insufficient data for display

Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole
Unknown	Out of control	Injury	Signal, Curb
Backing	Right turn	Fatality	Tree, Animal
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

Michigan Av & University Av
8 Accidents 10/06/04 - 10/06/09

((Distance <= 500)), (0) accidents with insufficient data for display

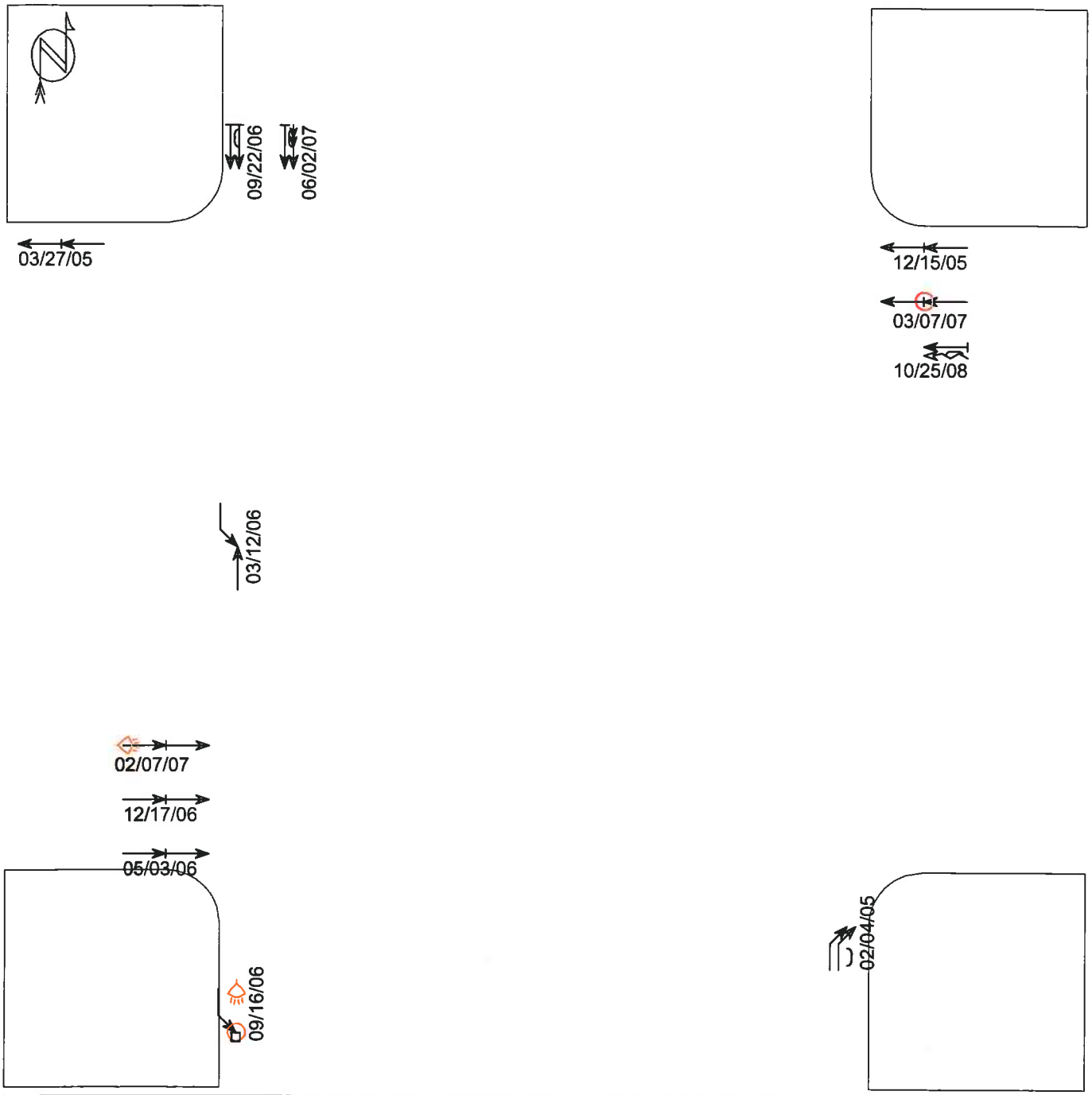
Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole, Signal, Curb, Tree, Animal
Unknown	Out of control	Injury	
Backing	Right turn	Fatality	
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

University Ave. & Kavanaugh Drive

12 Accidents

Case ID List

01/01/04 - 10/06/09



(clear filter), (0) accidents with insufficient data for display

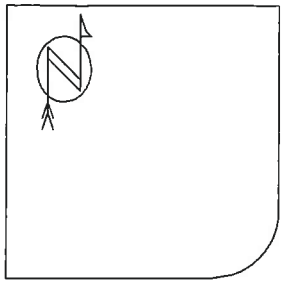
Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole
Unknown	Out of control	Injury	Signal, Curb
Backing	Right turn	Fatality	Tree, Animal
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

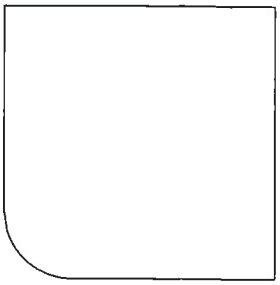
University Ave. & Notre Dame Ave.

Case ID List

7 Accidents

01/01/04 - 10/06/09





04/11/09

05/11/07

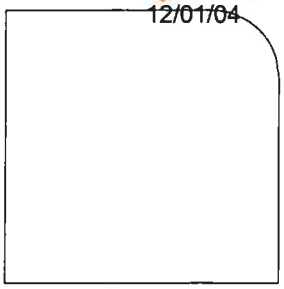
05/05/05

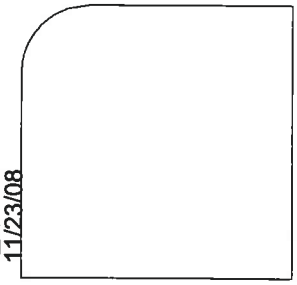
03/30/05

12/01/04

08/26/06

11/23/08





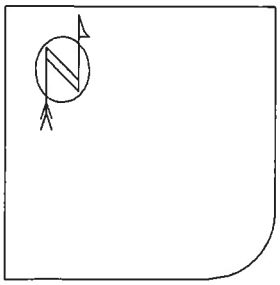
(clear filter), (0) accidents with insufficient data for display

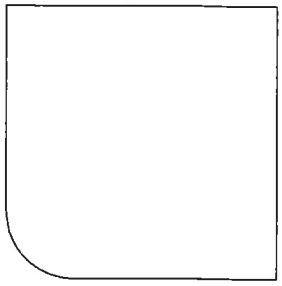
Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Signal, Tree, Pole, Curb, Animal
Unknown	Out of control	Injury	
Backing	Right turn	Fatality	
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

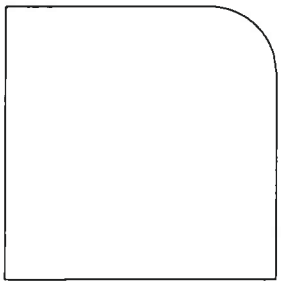
Obrien Dr & University Av

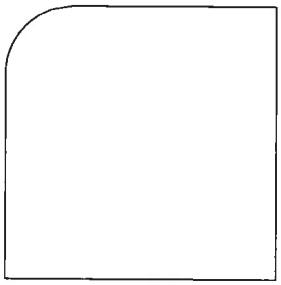
1 Accidents

11/25/03 - 11/25/08









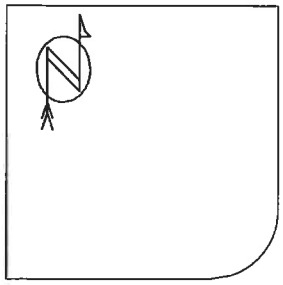
(clear filter), (0) accidents with insufficient data for display

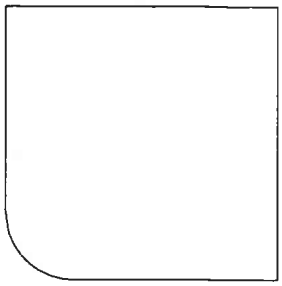
Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole
Unknown	Out of control	Injury	Signal, Curb
Backing	Right turn	Fatality	Tree, Animal
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

University Ave & O'Brien Drive

2 Accidents

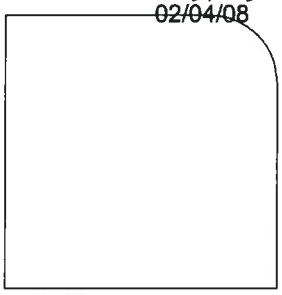
Case ID List
01/01/04 - 10/06/09

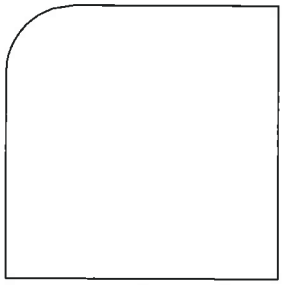




03/17/09

02/04/08





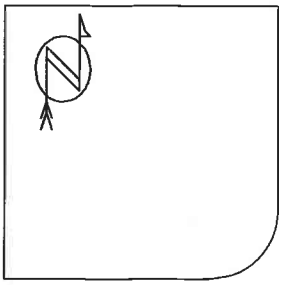
(clear filter), (0) accidents with insufficient data for display

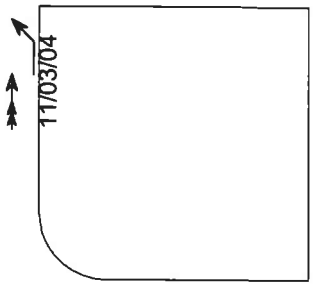
Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole
Unknown	Out of control	Injury	Signal, Curb
Backing	Right turn	Fatality	Tree, Animal
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

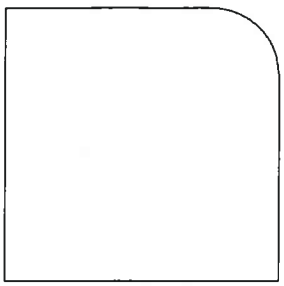
Adams Dr & University Av

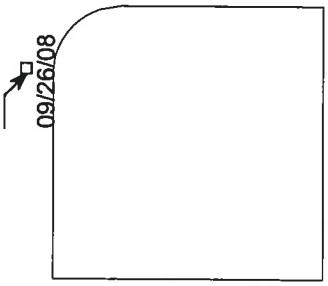
2 Accidents

11/25/03 - 11/25/08









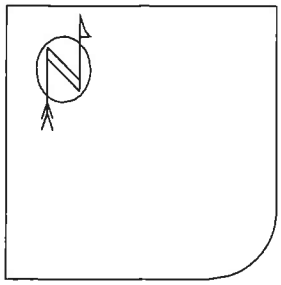
(clear filter), (0) accidents with insufficient data for display

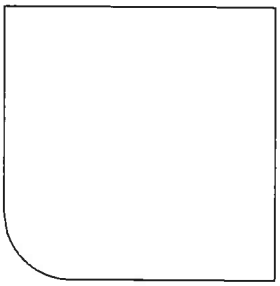
Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole, Signal, Curb, Tree, Animal
Unknown	Out of control	Injury	
Backing	Right turn	Fatality	
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

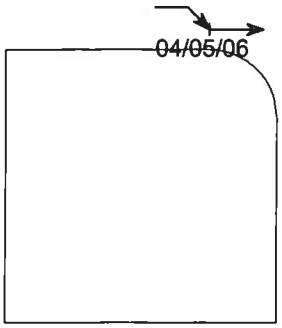
Adams Dr & University Av

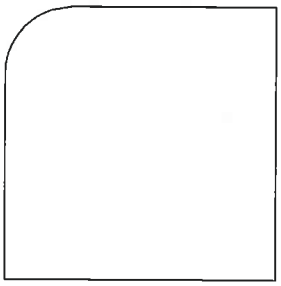
1 Accidents

10/06/04 - 10/06/09









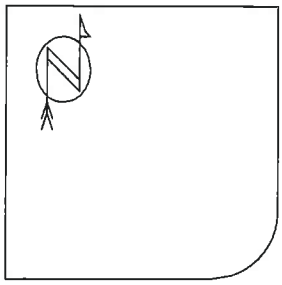
((Distance <= 500)), (0) accidents with insufficient data for display

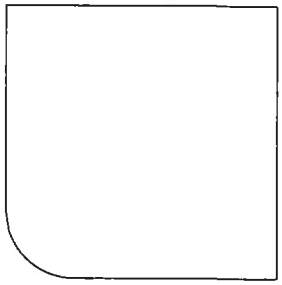
Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Signal, Tree, Pole, Curb, Animal
Unknown	Out of control	Injury	
Backing	Right turn	Fatality	
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

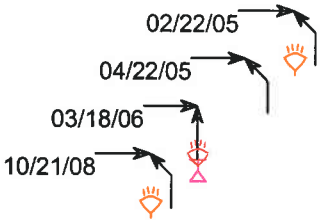
University Ave. & Purdue Ave.

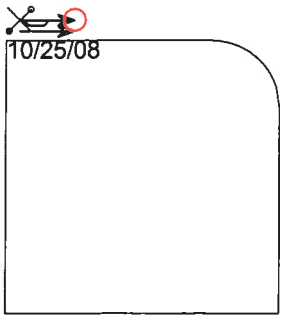
7 Accidents

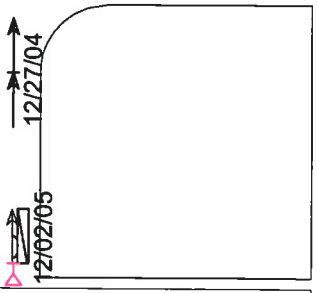
Case ID List
01/01/04 - 10/06/09









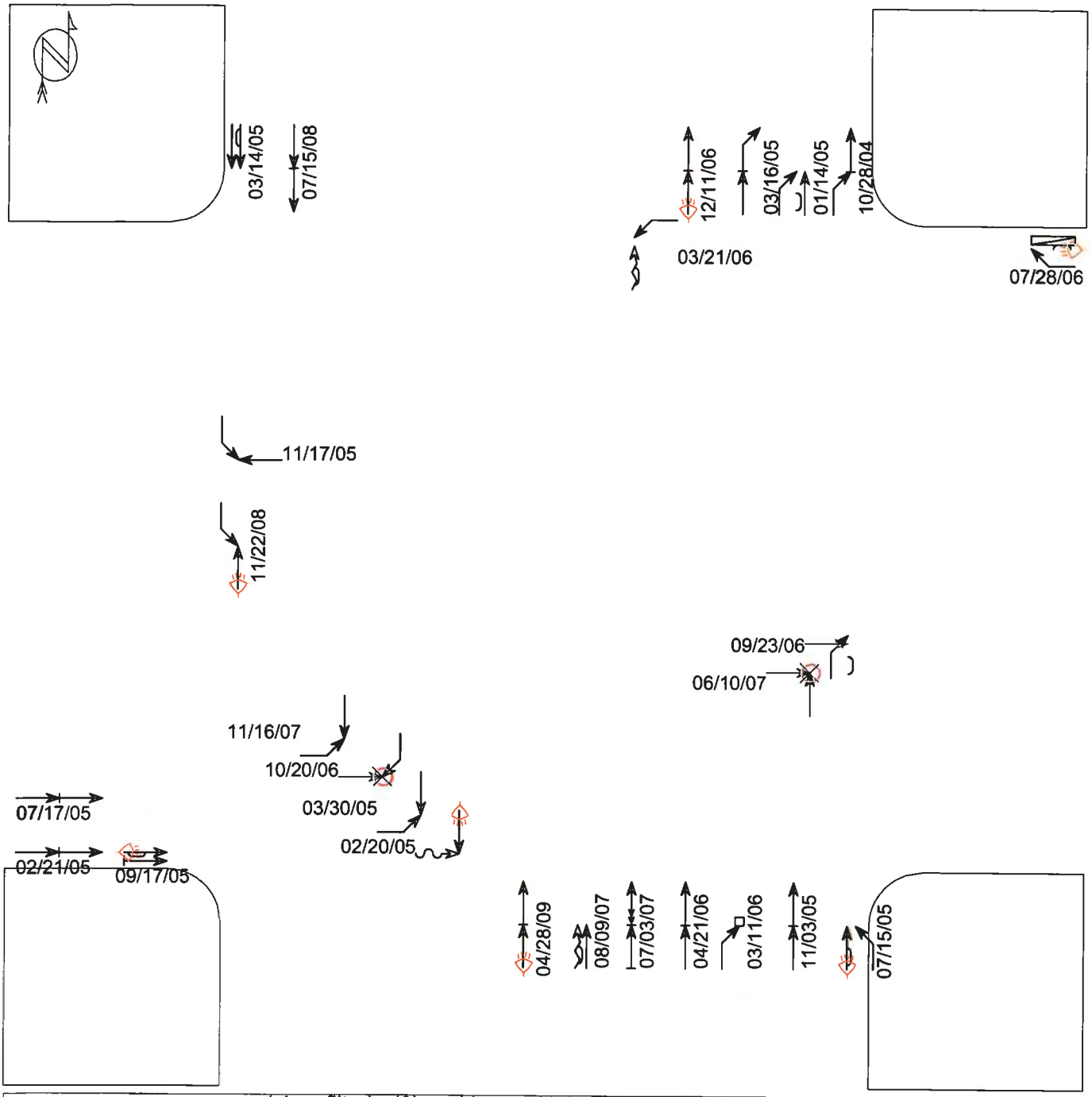


(clear filter), (0) accidents with insufficient data for display

Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole, Signal, Curb, Tree, Animal
Unknown	Out of control	Injury	
Backing	Right turn	Fatality	
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

Capitol Avenue & Donahue Street

26 Accidents 01/01/04 - 10/06/09

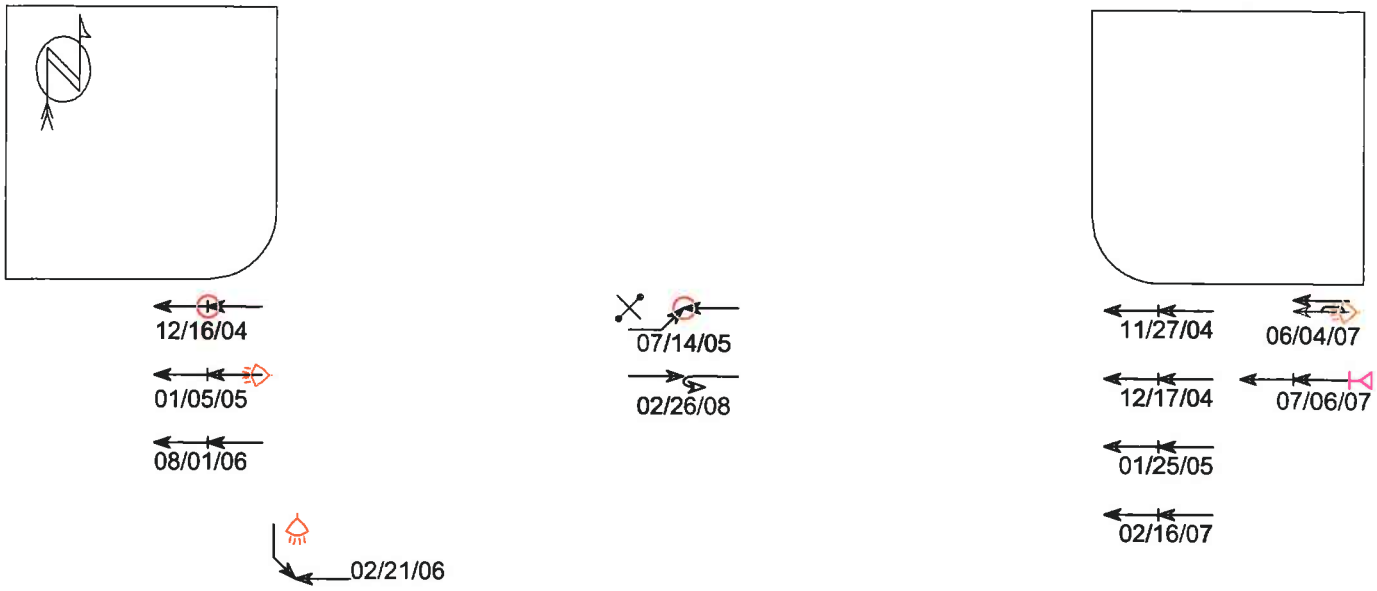


(clear filter), (0) accidents with insufficient data for display

Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole
Unknown	Out of control	Injury	Signal, Curb
Backing	Right turn	Fatality	Tree, Animal
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

19 Accidents

Rt 101 & University Av
10/06/04 - 10/06/09



((Distance <= 500)), (0) accidents with insufficient data for display

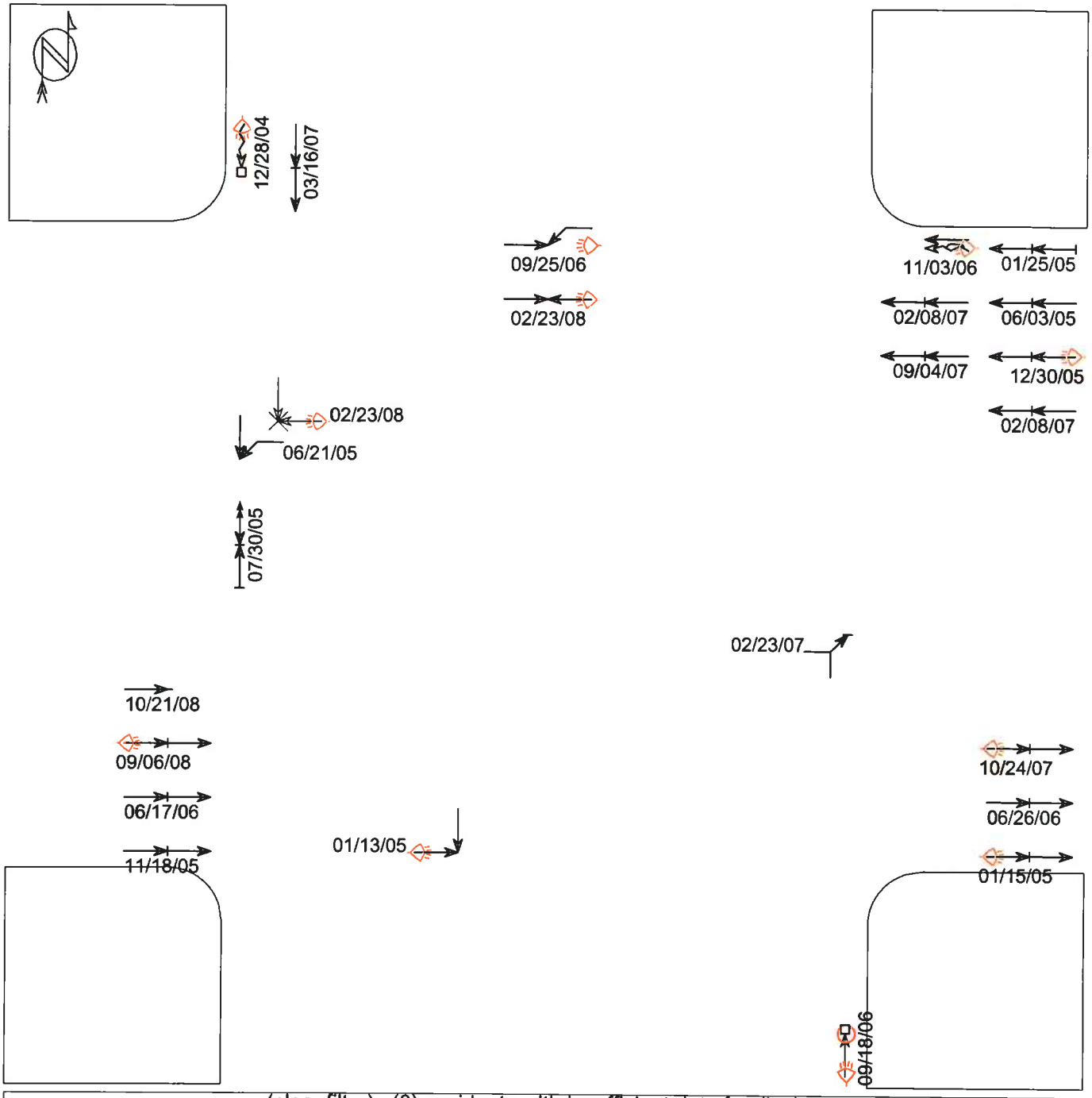
Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole
Unknown	Out of control	Injury	Signal, Curb
Backing	Right turn	Fatality	Tree, Animal
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

University Ave. & Woodland Ave.

Case ID List

24 Accidents

01/01/04 - 10/06/09

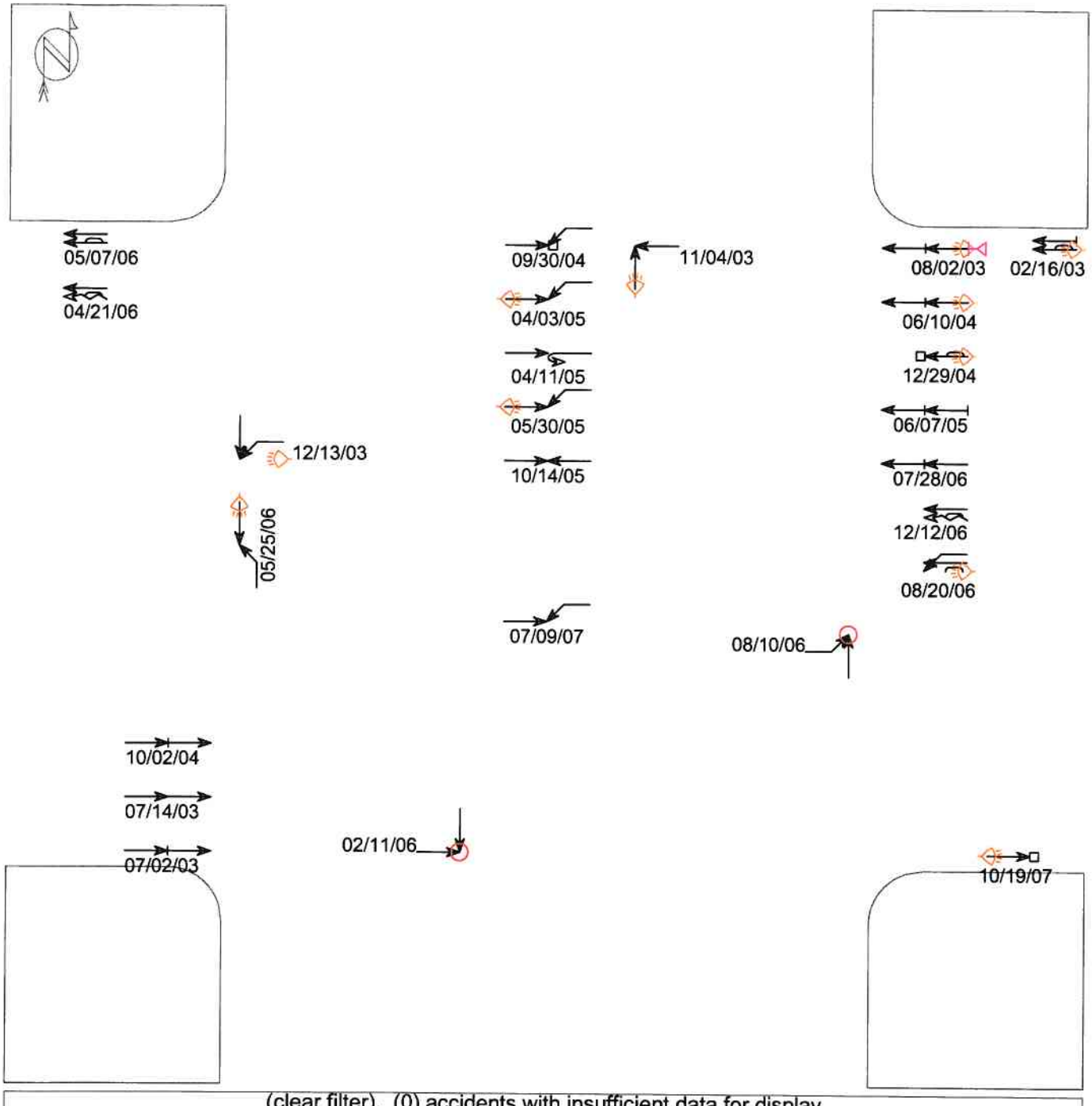


(clear filter), (0) accidents with insufficient data for display

Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole
Unknown	Out of control	Injury	Signal, Curb
Backing	Right turn	Fatality	Tree, Animal
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

Bayfront Expressway/ Willow Road

25 Accidents 01/02/99 - 01/30/10

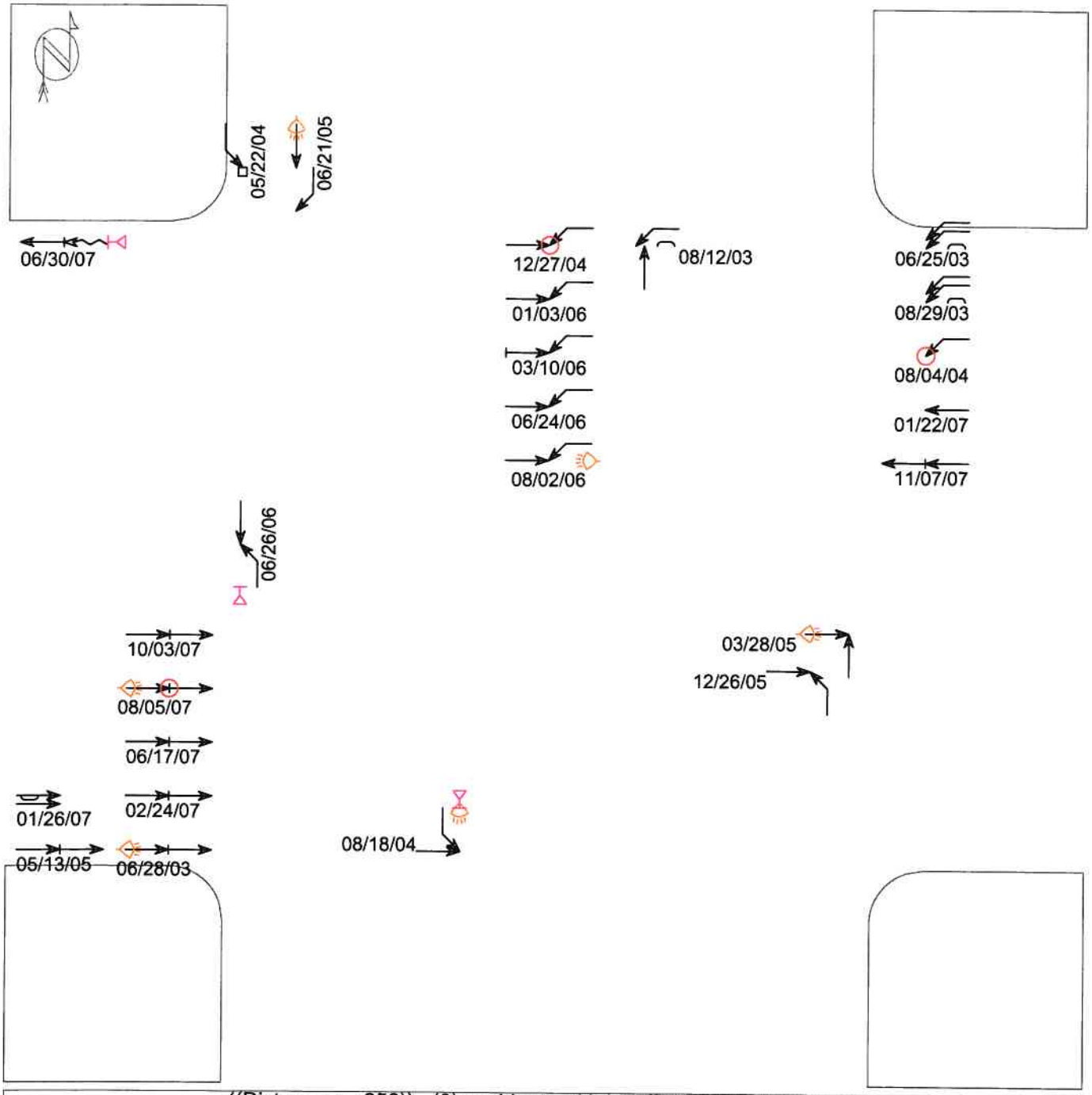


(clear filter), (0) accidents with insufficient data for display

Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole
Unknown	Out of control	Injury	Signal, Curb
Backing	Right turn	Fatality	Tree, Animal
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

25 Accidents

Rt 84 & University Av
01/01/03 - 01/01/08



((Distance <= 250)), (0) accidents with insufficient data for display

Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole, Signal, Curb, Tree, Animal
Unknown	Out of control	Injury	
Backing	Right turn	Fatality	
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

Appendix D – Level of Service Worksheets: Near Term Conditions

(Willow Road and University Avenue have been coded as north-south roadways in Synchro files)

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	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.96	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1548	3433	1863	1526	1770	4949		1770	3533	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1863	1548	3433	1863	1526	1770	4949		1770	3533	
Volume (vph)	27	173	267	352	127	23	178	863	188	63	1242	12
Peak-hour factor, PHF	0.85	0.50	0.85	0.92	0.92	0.92	0.89	0.89	0.89	0.86	0.86	0.86
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	33	363	330	402	145	26	210	1018	222	77	1516	15
RTOR Reduction (vph)	0	0	159	0	0	22	0	19	0	0	1	0
Lane Group Flow (vph)	33	363	171	402	145	4	210	1221	0	77	1530	0
Confl. Peds. (#/hr)	16		7	7		16	7					7
Turn Type	Split		Perm	Split		Perm	Prot			Prot		
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4			3						
Actuated Green, G (s)	25.4	25.4	25.4	17.4	17.4	17.4	17.3	39.5		15.0	37.2	
Effective Green, g (s)	25.4	25.4	25.4	16.4	16.4	16.4	16.3	40.5		14.0	38.2	
Actuated g/C Ratio	0.23	0.23	0.23	0.15	0.15	0.15	0.15	0.36		0.12	0.34	
Clearance Time (s)	4.0	4.0	4.0	3.0	3.0	3.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	4.0		2.0	4.0	
Lane Grp Cap (vph)	400	421	350	501	272	223	257	1785		221	1202	
v/s Ratio Prot	0.02	c0.19		c0.12	0.08		c0.12	0.25		0.04	c0.43	
v/s Ratio Perm			0.11			0.00						
v/c Ratio	0.08	0.86	0.49	0.80	0.53	0.02	0.82	0.68		0.35	1.27	
Uniform Delay, d1	34.3	41.8	37.8	46.4	44.4	41.0	46.6	30.5		45.0	37.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.0	15.9	0.4	8.5	1.0	0.0	17.1	2.1		0.3	129.5	
Delay (s)	34.3	57.7	38.2	54.9	45.4	41.1	63.6	32.6		45.3	166.6	
Level of Service	C	E	D	D	D	D	E	C		D	F	
Approach Delay (s)		47.8			51.9			37.1			160.8	
Approach LOS		D			D			D			F	

Intersection Summary			
HCM Average Control Delay	86.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	112.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.97		0.95	1.00	1.00	0.95
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	0.96		1.00	0.85	1.00	1.00
Flt Protected	0.97		1.00	1.00	0.95	1.00
Satd. Flow (prot)	3341		3539	1540	1770	3539
Flt Permitted	0.97		1.00	1.00	0.95	1.00
Satd. Flow (perm)	3341		3539	1540	1770	3539
Volume (vph)	123	48	873	321	54	1259
Peak-hour factor, PHF	0.87	0.87	0.92	0.92	0.92	0.92
Growth Factor (vph)	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	148	58	996	366	62	1437
RTOR Reduction (vph)	52	0	0	123	0	0
Lane Group Flow (vph)	154	0	996	243	62	1437
Confl. Peds. (#/hr)				5	5	
Turn Type				Perm	Prot	
Protected Phases	4		2		1	6
Permitted Phases				2		
Actuated Green, G (s)	8.6		47.1	47.1	5.1	55.2
Effective Green, g (s)	7.6		47.1	47.1	4.1	55.2
Actuated g/C Ratio	0.11		0.67	0.67	0.06	0.78
Clearance Time (s)	3.0		4.0	4.0	3.0	4.0
Vehicle Extension (s)	2.0		4.0	4.0	2.0	4.0
Lane Grp Cap (vph)	359		2354	1024	103	2759
v/s Ratio Prot	c0.05		0.28		0.04	c0.41
v/s Ratio Perm				0.16		
v/c Ratio	0.43		0.42	0.24	0.60	0.52
Uniform Delay, d1	29.6		5.5	4.7	32.6	2.9
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3		0.6	0.5	6.6	0.7
Delay (s)	29.9		6.1	5.3	39.2	3.6
Level of Service	C		A	A	D	A
Approach Delay (s)	29.9		5.9			5.1
Approach LOS	C		A			A

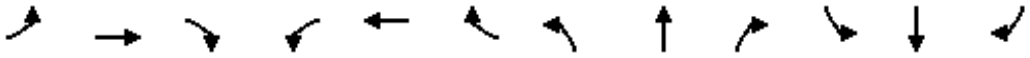
Intersection Summary			
HCM Average Control Delay	7.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	70.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	49.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	3535	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	3535	
Volume (vph)	5	183	113	810	1139	9
Peak-hour factor, PHF	0.76	0.76	0.86	0.86	0.83	0.83
Growth Factor (vph)	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	7	253	138	989	1441	11
RTOR Reduction (vph)	0	105	0	0	0	0
Lane Group Flow (vph)	7	148	138	989	1452	0
Confl. Peds. (#/hr)	1		3			3
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	12.2	12.2	5.0	60.2	52.2	
Effective Green, g (s)	11.2	11.2	4.0	60.2	52.2	
Actuated g/C Ratio	0.14	0.14	0.05	0.76	0.66	
Clearance Time (s)	3.0	3.0	3.0	4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	4.0	4.0	
Lane Grp Cap (vph)	250	223	89	2683	2324	
v/s Ratio Prot	0.00		c0.08	0.28	c0.41	
v/s Ratio Perm		c0.09				
v/c Ratio	0.03	0.66	1.55	0.37	0.62	
Uniform Delay, d1	29.4	32.3	37.7	3.2	7.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	5.7	295.5	0.4	0.6	
Delay (s)	29.4	38.0	333.2	3.6	8.5	
Level of Service	C	D	F	A	A	
Approach Delay (s)	37.8			44.0	8.5	
Approach LOS	D			D	A	

Intersection Summary			
HCM Average Control Delay	25.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	79.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.6%	ICU Level of Service	B
Analysis Period (min)	15		
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	0.95		1.00	0.95	
Frpb, ped/bikes		0.99			1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.93			0.98		1.00	0.98		1.00	0.99	
Flt Protected		0.98			0.96		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1681			1753		1770	3481		1770	3515	
Flt Permitted		0.85			0.68		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1460			1233		1770	3481		1770	3515	
Volume (vph)	52	6	67	112	13	23	112	614	75	66	1088	44
Peak-hour factor, PHF	0.95	0.95	0.95	0.80	0.80	0.80	0.95	0.95	0.95	0.89	0.89	0.89
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	57	7	74	147	17	30	124	679	83	78	1284	52
RTOR Reduction (vph)	0	45	0	0	7	0	0	6	0	0	2	0
Lane Group Flow (vph)	0	93	0	0	187	0	124	756	0	78	1334	0
Confl. Peds. (#/hr)	2		1	1		2	2					2
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)		15.0			15.0		8.1	40.9		6.5	39.3	
Effective Green, g (s)		14.0			14.0		7.1	40.9		5.5	39.3	
Actuated g/C Ratio		0.19			0.19		0.10	0.56		0.08	0.54	
Clearance Time (s)		3.0			3.0		3.0	4.0		3.0	4.0	
Vehicle Extension (s)		2.0			2.0		2.0	4.0		2.0	4.0	
Lane Grp Cap (vph)		282			238		174	1966		134	1908	
v/s Ratio Prot							c0.07	0.22		0.04	c0.38	
v/s Ratio Perm		0.06			c0.15							
v/c Ratio		0.33			0.78		0.71	0.38		0.58	0.70	
Uniform Delay, d1		25.2			27.8		31.7	8.8		32.3	12.2	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.3			14.4		10.9	0.2		4.1	1.2	
Delay (s)		25.4			42.2		42.5	8.9		36.4	13.4	
Level of Service		C			D		D	A		D	B	
Approach Delay (s)		25.4			42.2			13.6			14.7	
Approach LOS		C			D			B			B	

Intersection Summary			
HCM Average Control Delay	16.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	72.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.1%	ICU Level of Service	C
Analysis Period (min)	15		
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	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.86	0.91	0.97	0.95	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.96	1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	0.99	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1805	1863	1578	1595	3144	1373	3335	3471	1568	1805	3451	
Flt Permitted	0.95	1.00	1.00	0.95	0.99	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1805	1863	1578	1595	3144	1373	3335	3471	1568	1805	3451	
Volume (vph)	14	123	430	483	580	371	88	350	365	47	1041	59
Peak-hour factor, PHF	0.83	0.83	0.83	0.90	0.90	0.90	0.88	0.88	0.88	0.95	0.95	0.95
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	18	156	544	564	677	433	105	418	436	52	1151	65
RTOR Reduction (vph)	0	0	397	0	0	333	0	0	0	0	4	0
Lane Group Flow (vph)	18	156	147	415	826	100	105	418	436	52	1212	0
Confl. Peds. (#/hr)	20		1	1		20	34		1	1		34
Heavy Vehicles (%)	0%	2%	1%	3%	3%	3%	5%	4%	3%	0%	3%	10%
Turn Type	Split		custom	Split		Perm	Prot		Prot	Prot		
Protected Phases	4	4		3	3		1	6	6	5	2	
Permitted Phases			3			3						
Actuated Green, G (s)	12.9	12.9	22.0	22.0	22.0	22.0	7.0	37.0	37.0	7.1	37.1	
Effective Green, g (s)	12.9	12.9	22.0	22.0	22.0	22.0	7.0	37.0	37.0	7.1	37.1	
Actuated g/C Ratio	0.14	0.14	0.23	0.23	0.23	0.23	0.07	0.39	0.39	0.07	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	245	253	365	369	728	318	246	1352	611	135	1348	
v/s Ratio Prot	0.01	c0.08		0.26	c0.26		c0.03	0.12	0.28	0.03	c0.35	
v/s Ratio Perm			0.09			0.07						
v/c Ratio	0.07	0.62	0.40	1.12	1.13	0.32	0.43	0.31	0.71	0.39	0.90	
Uniform Delay, d1	35.8	38.7	30.9	36.5	36.5	30.3	42.1	20.1	24.5	41.9	27.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.44	0.42	
Incremental Delay, d2	0.1	4.4	0.7	85.1	77.0	0.6	1.2	0.6	7.0	1.6	8.7	
Delay (s)	36.0	43.1	31.7	121.6	113.5	30.8	43.3	20.7	31.5	62.0	20.3	
Level of Service	D	D	C	F	F	C	D	C	C	E	C	
Approach Delay (s)		34.3			94.1			28.1			22.0	
Approach LOS		C			F			C			C	

Intersection Summary			
HCM Average Control Delay	51.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	94.4%	ICU Level of Service	F
Analysis Period (min)	15		

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	0.95		1.00	0.95	
Frpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		0.99	1.00	
Frt		0.98			0.98		1.00	0.99		1.00	0.99	
Flt Protected		1.00			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1732			1762		1732	3470		1760	3450	
Flt Permitted		0.99			0.93		0.18	1.00		0.33	1.00	
Satd. Flow (perm)		1722			1658		322	3470		615	3450	
Volume (vph)	2	48	10	32	94	17	24	671	38	51	1146	42
Peak-hour factor, PHF	0.82	0.82	0.82	0.83	0.83	0.83	0.92	0.92	0.92	0.94	0.94	0.94
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	3	61	13	40	119	22	27	766	43	57	1280	47
RTOR Reduction (vph)	0	9	0	0	6	0	0	3	0	0	2	0
Lane Group Flow (vph)	0	68	0	0	175	0	27	806	0	57	1325	0
Confl. Peds. (#/hr)	14		9	9		14	7		6	6		7
Heavy Vehicles (%)	0%	6%	10%	3%	2%	18%	4%	3%	3%	2%	4%	2%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			6			2	
Permitted Phases	4			4			6			2		
Actuated Green, G (s)		14.7			14.7		72.3	72.3		72.3	72.3	
Effective Green, g (s)		14.7			14.7		72.3	72.3		72.3	72.3	
Actuated g/C Ratio		0.15			0.15		0.76	0.76		0.76	0.76	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		266			257		245	2641		468	2626	
v/s Ratio Prot								0.23			c0.38	
v/s Ratio Perm		0.04			c0.11		0.08			0.09		
v/c Ratio		0.25			0.68		0.11	0.31		0.12	0.50	
Uniform Delay, d1		35.3			37.9		3.0	3.5		3.0	4.4	
Progression Factor		1.00			1.00		0.76	0.70		0.23	0.48	
Incremental Delay, d2		0.5			7.2		0.8	0.3		0.4	0.6	
Delay (s)		35.8			45.2		3.1	2.7		1.1	2.7	
Level of Service		D			D		A	A		A	A	
Approach Delay (s)		35.8			45.2			2.7			2.6	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM Average Control Delay	6.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.0%	ICU Level of Service	B
Analysis Period (min)	15		

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	0.95		1.00	0.95	
Frpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.99			0.98		1.00	0.99		1.00	0.99	
Flt Protected		0.99			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1788			1793		1800	3429		1734	3463	
Flt Permitted		0.93			0.89		0.15	1.00		0.33	1.00	
Satd. Flow (perm)		1667			1607		283	3429		601	3463	
Volume (vph)	12	64	8	45	117	22	19	638	48	137	1192	71
Peak-hour factor, PHF	0.76	0.76	0.76	0.96	0.96	0.96	0.89	0.89	0.89	0.92	0.92	0.92
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	17	88	11	49	128	24	22	753	57	156	1360	81
RTOR Reduction (vph)	0	4	0	0	6	0	0	4	0	0	3	0
Lane Group Flow (vph)	0	112	0	0	195	0	22	806	0	156	1438	0
Confl. Peds. (#/hr)	5		8	8		5	11		1	1		11
Heavy Vehicles (%)	0%	5%	0%	0%	3%	5%	0%	4%	4%	4%	3%	4%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			6			2	
Permitted Phases	4			4			6			2		
Actuated Green, G (s)		15.9			15.9		71.1	71.1		71.1	71.1	
Effective Green, g (s)		15.9			15.9		71.1	71.1		71.1	71.1	
Actuated g/C Ratio		0.17			0.17		0.75	0.75		0.75	0.75	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		279			269		212	2566		450	2592	
v/s Ratio Prot								0.24			c0.42	
v/s Ratio Perm		0.07			c0.12		0.08			0.26		
v/c Ratio		0.40			0.73		0.10	0.31		0.35	0.55	
Uniform Delay, d1		35.3			37.5		3.3	3.9		4.1	5.1	
Progression Factor		1.00			1.00		1.30	1.53		0.52	0.71	
Incremental Delay, d2		0.9			9.3		1.0	0.3		1.2	0.5	
Delay (s)		36.2			46.8		5.2	6.3		3.3	4.1	
Level of Service		D			D		A	A		A	A	
Approach Delay (s)		36.2			46.8			6.3			4.0	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM Average Control Delay	9.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	642	22	0	1348	0	42
Peak Hour Factor	0.88	0.88	0.95	0.95	0.63	0.63
Hourly flow rate (vph)	766	26	0	1490	0	70
Pedestrians					11	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	972			302		
pX, platoon unblocked			0.99		0.65	0.99
vC, conflicting volume			803		1535	407
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			788		1221	386
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	88
cM capacity (veh/h)			822		112	599

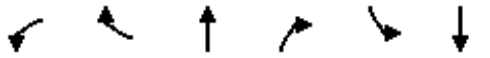
Direction, Lane #	NB 1	NB 2	SB 1	SB 2	NW 1
Volume Total	511	282	745	745	70
Volume Left	0	0	0	0	0
Volume Right	0	26	0	0	70
cSH	1700	1700	1700	1700	599
Volume to Capacity	0.30	0.17	0.44	0.44	0.12
Queue Length 95th (ft)	0	0	0	0	10
Control Delay (s)	0.0	0.0	0.0	0.0	11.8
Lane LOS					B
Approach Delay (s)	0.0		0.0		11.8
Approach LOS					B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	42.5%	ICU Level of Service	A
Analysis Period (min)	15		

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	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.87	1.00	1.00	0.96	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	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1863	1319	1618	1687	1452	1703	3414		1752	3517	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1805	1863	1319	1618	1687	1452	1703	3414		1752	3517	
Volume (vph)	56	162	82	119	200	85	110	497	91	118	1127	36
Peak-hour factor, PHF	0.85	0.85	0.85	0.92	0.92	0.92	0.88	0.88	0.88	0.95	0.95	0.95
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	69	200	101	136	228	97	131	593	109	130	1246	40
RTOR Reduction (vph)	0	0	85	0	0	80	0	15	0	0	2	0
Lane Group Flow (vph)	69	200	16	136	228	17	131	687	0	130	1284	0
Confl. Peds. (#/hr)	15		70	70		15	18		14	14		18
Heavy Vehicles (%)	0%	2%	6%	6%	7%	7%	6%	2%	4%	3%	2%	0%
Turn Type	Split		Perm	Split		Perm	Prot			Prot		
Protected Phases	3	3		4	4		1	6		5	2	
Permitted Phases			3			4						
Actuated Green, G (s)	14.6	14.6	14.6	16.3	16.3	16.3	11.8	37.4		10.7	36.3	
Effective Green, g (s)	14.6	14.6	14.6	16.3	16.3	16.3	11.8	37.4		10.7	36.3	
Actuated g/C Ratio	0.15	0.15	0.15	0.17	0.17	0.17	0.12	0.39		0.11	0.38	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	277	286	203	278	289	249	212	1344		197	1344	
v/s Ratio Prot	0.04	c0.11		0.08	c0.14		c0.08	0.20		0.07	c0.37	
v/s Ratio Perm			0.01			0.01						
v/c Ratio	0.25	0.70	0.08	0.49	0.79	0.07	0.62	0.51		0.66	0.96	
Uniform Delay, d1	35.4	38.1	34.4	35.6	37.7	33.0	39.5	21.9		40.4	28.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.15		1.51	0.46	
Incremental Delay, d2	0.5	7.3	0.2	1.4	13.3	0.1	5.1	1.4		0.7	2.3	
Delay (s)	35.8	45.4	34.6	36.9	51.0	33.1	45.0	26.4		61.9	15.3	
Level of Service	D	D	C	D	D	C	D	C		E	B	
Approach Delay (s)		40.7			43.1			29.3			19.6	
Approach LOS		D			D			C			B	

Intersection Summary			
HCM Average Control Delay	28.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.6%	ICU Level of Service	D
Analysis Period (min)	15		

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)	15	12	602	31	84	1330
Peak Hour Factor	0.62	0.62	0.90	0.90	0.94	0.94
Hourly flow rate (vph)	25	20	702	36	94	1486
Pedestrians	1		11			
Lane Width (ft)	12.0		12.0			
Walking Speed (ft/s)	4.0		4.0			
Percent Blockage	0		1			
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)			626			758
pX, platoon unblocked	0.64	0.88			0.88	
vC, conflicting volume	1663	370			740	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	934	156			574	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	83	97			89	
cM capacity (veh/h)	153	767			885	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	46	468	270	589	990
Volume Left	25	0	0	94	0
Volume Right	20	0	36	0	0
cSH	237	1700	1700	885	1700
Volume to Capacity	0.19	0.28	0.16	0.11	0.58
Queue Length 95th (ft)	17	0	0	9	0
Control Delay (s)	23.8	0.0	0.0	2.7	0.0
Lane LOS	C			A	
Approach Delay (s)	23.8	0.0		1.0	
Approach LOS	C				

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	73.0%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	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	0.95	
Frpb, ped/bikes	0.98		1.00	1.00	1.00	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	0.92		1.00	1.00	0.99	
Flt Protected	0.98		0.95	1.00	1.00	
Satd. Flow (prot)	1557		1752	3505	3515	
Flt Permitted	0.98		0.95	1.00	1.00	
Satd. Flow (perm)	1557		1752	3505	3515	
Volume (vph)	37	55	34	593	1344	63
Peak-hour factor, PHF	0.77	0.77	0.93	0.93	0.93	0.93
Growth Factor (vph)	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	50	75	38	670	1517	71
RTOR Reduction (vph)	67	0	0	0	3	0
Lane Group Flow (vph)	58	0	38	670	1585	0
Confl. Peds. (#/hr)	1	10				
Heavy Vehicles (%)	14%	4%	3%	3%	2%	2%
Turn Type			Prot			
Protected Phases	4		1	6	2	
Permitted Phases						
Actuated Green, G (s)	9.6		32.4	68.5	41.0	
Effective Green, g (s)	9.6		32.4	68.5	41.0	
Actuated g/C Ratio	0.10		0.34	0.72	0.43	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	157		598	2527	1517	
v/s Ratio Prot	c0.04		c0.02	c0.19	c0.45	
v/s Ratio Perm						
v/c Ratio	0.37		0.06	0.27	1.04	
Uniform Delay, d1	39.9		21.1	4.6	27.0	
Progression Factor	1.00		0.46	1.80	0.18	
Incremental Delay, d2	1.5		0.2	0.2	26.1	
Delay (s)	41.3		9.9	8.5	30.9	
Level of Service	D		A	A	C	
Approach Delay (s)	41.3			8.6	30.9	
Approach LOS	D			A	C	

Intersection Summary			
HCM Average Control Delay	24.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0		4.0	4.0
Lane Util. Factor	1.00		0.95		1.00	0.95
Frpb, ped/bikes	1.00		1.00		1.00	1.00
Flpb, ped/bikes	1.00		1.00		1.00	1.00
Frt	0.96		0.99		1.00	1.00
Flt Protected	0.97		1.00		0.95	1.00
Satd. Flow (prot)	1708		3448		1770	3610
Flt Permitted	0.97		1.00		0.95	1.00
Satd. Flow (perm)	1708		3448		1770	3610
Volume (vph)	54	21	584	46	26	1353
Peak-hour factor, PHF	0.78	0.78	0.92	0.92	0.92	0.92
Growth Factor (vph)	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	73	28	667	52	30	1544
RTOR Reduction (vph)	18	0	3	0	0	0
Lane Group Flow (vph)	83	0	716	0	30	1544
Confl. Peds. (#/hr)		2		6	6	
Heavy Vehicles (%)	4%	0%	3%	7%	2%	0%
Turn Type					Prot	
Protected Phases	8		6		5	2
Permitted Phases						
Actuated Green, G (s)	9.6		68.5		4.9	41.0
Effective Green, g (s)	9.6		68.5		4.9	41.0
Actuated g/C Ratio	0.10		0.72		0.05	0.43
Clearance Time (s)	4.0		4.0		4.0	4.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	173		2486		91	1558
v/s Ratio Prot	c0.05		c0.21		c0.02	c0.43
v/s Ratio Perm						
v/c Ratio	0.48		0.29		0.33	0.99
Uniform Delay, d1	40.3		4.7		43.5	26.8
Progression Factor	1.00		0.22		1.18	0.71
Incremental Delay, d2	2.1		0.3		1.7	18.5
Delay (s)	42.4		1.3		53.2	37.6
Level of Service	D		A		D	D
Approach Delay (s)	42.4		1.3			37.9
Approach LOS	D		A			D

Intersection Summary			
HCM Average Control Delay	27.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	51.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1467	1293	1770	3505	3515	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1467	1293	1770	3505	3515	
Volume (vph)	26	35	63	542	1368	66
Peak-hour factor, PHF	0.79	0.79	0.90	0.90	0.95	0.95
Growth Factor (vph)	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	35	47	74	632	1512	73
RTOR Reduction (vph)	0	44	0	0	2	0
Lane Group Flow (vph)	35	3	74	632	1583	0
Confl. Bikes (#/hr)		1				1
Heavy Vehicles (%)	23%	23%	2%	3%	2%	0%
Turn Type		Perm	Prot			
Protected Phases	8		1	6	2	
Permitted Phases		8				
Actuated Green, G (s)	6.6	6.6	8.1	80.4	68.3	
Effective Green, g (s)	6.6	6.6	8.1	80.4	68.3	
Actuated g/C Ratio	0.07	0.07	0.09	0.85	0.72	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	102	90	151	2966	2527	
v/s Ratio Prot	c0.02		c0.04	0.18	c0.45	
v/s Ratio Perm		0.00				
v/c Ratio	0.34	0.04	0.49	0.21	0.63	
Uniform Delay, d1	42.1	41.2	41.5	1.4	6.8	
Progression Factor	1.00	1.00	1.58	0.20	1.00	
Incremental Delay, d2	2.0	0.2	2.4	0.2	1.2	
Delay (s)	44.1	41.4	68.0	0.4	8.0	
Level of Service	D	D	E	A	A	
Approach Delay (s)	42.6			7.5	8.0	
Approach LOS	D			A	A	

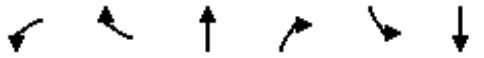
Intersection Summary			
HCM Average Control Delay	9.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	58.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	20	9	41	510	1429	103
Peak Hour Factor	0.81	0.81	0.95	0.95	0.97	0.97
Hourly flow rate (vph)	26	12	45	564	1547	111
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)				640		
pX, platoon unblocked						
vC, conflicting volume	1975	829	1658			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1975	829	1658			
tC, single (s)	7.0	7.1	4.2			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.2			
p0 queue free %	40	96	88			
cM capacity (veh/h)	43	296	371			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	38	45	282	282	1031	627
Volume Left	26	45	0	0	0	0
Volume Right	12	0	0	0	0	111
cSH	59	371	1700	1700	1700	1700
Volume to Capacity	0.64	0.12	0.17	0.17	0.61	0.37
Queue Length 95th (ft)	66	10	0	0	0	0
Control Delay (s)	140.4	16.0	0.0	0.0	0.0	0.0
Lane LOS	F	C				
Approach Delay (s)	140.4	1.2			0.0	
Approach LOS	F					

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	54.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	40	86	528	37	97	1458
Peak Hour Factor	0.88	0.88	0.92	0.92	0.96	0.96
Hourly flow rate (vph)	48	103	603	42	106	1595
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)			1038			
pX, platoon unblocked						
vC, conflicting volume	1633	322			645	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1633	322			645	
tC, single (s)	6.9	6.9			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	41	85			89	
cM capacity (veh/h)	81	676			929	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	150	402	243	638	1063
Volume Left	48	0	0	106	0
Volume Right	103	0	42	0	0
cSH	202	1700	1700	929	1700
Volume to Capacity	0.74	0.24	0.14	0.11	0.63
Queue Length 95th (ft)	123	0	0	10	0
Control Delay (s)	61.5	0.0	0.0	2.9	0.0
Lane LOS	F			A	
Approach Delay (s)	61.5	0.0		1.1	
Approach LOS	F				

Intersection Summary			
Average Delay	4.4		
Intersection Capacity Utilization	79.7%	ICU Level of Service	D
Analysis Period (min)	15		

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
Lane Util. Factor		0.95			0.91		0.97		1.00			1.00
Frpb, ped/bikes		1.00			1.00		1.00		1.00			1.00
Flpb, ped/bikes		1.00			1.00		1.00		1.00			1.00
Frt		1.00			1.00		1.00		0.85			0.86
Flt Protected		1.00			1.00		0.95		1.00			1.00
Satd. Flow (prot)		3505			4979		3400		1583			1611
Flt Permitted		1.00			1.00		0.95		1.00			1.00
Satd. Flow (perm)		3505			4979		3400		1583			1611
Volume (vph)	0	530	0	0	880	9	398	0	133	0	0	137
Peak-hour factor, PHF	0.90	0.90	0.90	0.84	0.84	0.84	0.95	0.95	0.95	0.73	0.73	0.73
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	0	618	0	0	1100	11	440	0	147	0	0	197
RTOR Reduction (vph)	0	0	0	0	2	0	0	0	104	0	0	41
Lane Group Flow (vph)	0	618	0	0	1109	0	440	0	43	0	0	156
Confl. Peds. (#/hr)	25		1	1		25						
Heavy Vehicles (%)	0%	3%	0%	0%	4%	0%	3%	0%	2%	0%	0%	2%
Turn Type							Prot		custom			custom
Protected Phases		4			4		5		5			6
Permitted Phases												
Actuated Green, G (s)		24.2			24.2		18.8		18.8			10.0
Effective Green, g (s)		24.2			24.2		18.8		18.8			10.0
Actuated g/C Ratio		0.37			0.37		0.29		0.29			0.15
Clearance Time (s)		4.0			4.0		4.0		4.0			4.0
Vehicle Extension (s)		3.0			3.0		3.0		3.0			3.0
Lane Grp Cap (vph)		1305			1854		983		458			248
v/s Ratio Prot		0.18			c0.22		c0.13		0.03			c0.10
v/s Ratio Perm												
v/c Ratio		0.47			0.60		0.45		0.09			0.63
Uniform Delay, d1		15.5			16.5		18.9		16.9			25.8
Progression Factor		1.00			1.00		1.00		1.00			1.00
Incremental Delay, d2		0.3			0.5		1.5		0.4			11.4
Delay (s)		15.8			17.0		20.3		17.3			37.2
Level of Service		B			B		C		B			D
Approach Delay (s)		15.8			17.0			19.6			37.2	
Approach LOS		B			B			B			D	

Intersection Summary			
HCM Average Control Delay	18.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	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	0.97	0.91	0.95	0.88	0.97	0.95
Frpb, ped/bikes	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
Frt	0.99	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.96	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3357	1427	3505	2775	3400	3539
Flt Permitted	0.96	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3357	1427	3505	2775	3400	3539
Volume (vph)	323	259	789	387	853	1532
Peak-hour factor, PHF	0.87	0.87	0.88	0.88	0.92	0.92
Growth Factor (vph)	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	390	313	941	462	974	1748
RTOR Reduction (vph)	6	233	0	43	0	0
Lane Group Flow (vph)	408	56	941	419	974	1748
Confl. Peds. (#/hr)				1	1	
Heavy Vehicles (%)	4%	3%	3%	1%	3%	2%
Turn Type		Perm		pm+ov	Prot	
Protected Phases	7		6	7	5	2
Permitted Phases		7		6		
Actuated Green, G (s)	16.4	16.4	27.1	43.5	29.5	60.6
Effective Green, g (s)	16.4	16.4	27.1	43.5	29.5	60.6
Actuated g/C Ratio	0.19	0.19	0.32	0.51	0.35	0.71
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	648	275	1117	1551	1180	2523
v/s Ratio Prot	c0.12		c0.27	0.05	c0.29	0.49
v/s Ratio Perm		0.04		0.10		
v/c Ratio	0.63	0.20	0.84	0.27	0.83	0.69
Uniform Delay, d1	31.5	28.8	27.0	11.8	25.4	6.9
Progression Factor	1.00	1.00	0.84	0.82	1.00	1.00
Incremental Delay, d2	2.0	0.4	6.1	0.1	4.8	1.6
Delay (s)	33.5	29.2	28.8	9.7	30.2	8.5
Level of Service	C	C	C	A	C	A
Approach Delay (s)	31.7		22.5			16.3
Approach LOS	C		C			B

Intersection Summary			
HCM Average Control Delay	20.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.0%	ICU Level of Service	C
Analysis Period (min)	15		

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		4.0	4.0	4.0
Lane Util. Factor	0.97	1.00			1.00	1.00	1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	0.96			1.00	0.98	1.00	1.00		1.00	1.00	0.89
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.94			1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3400	1557			1839	1554	1752	3524		1719	3505	1392
Flt Permitted	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3400	1557			1839	1554	1752	3524		1719	3505	1392
Volume (vph)	326	72	48	15	92	268	66	612	10	219	1105	566
Peak-hour factor, PHF	0.77	0.77	0.77	0.91	0.91	0.91	0.85	0.85	0.85	0.91	0.91	0.91
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	445	98	65	17	106	309	82	756	12	253	1275	653
RTOR Reduction (vph)	0	29	0	0	0	254	0	1	0	0	0	392
Lane Group Flow (vph)	445	134	0	0	123	55	82	767	0	253	1275	261
Confl. Peds. (#/hr)	4		45	45		4	34		9	9		34
Confl. Bikes (#/hr)			3									4
Heavy Vehicles (%)	3%	11%	10%	0%	3%	2%	3%	2%	10%	5%	3%	3%
Turn Type	Split			Split		custom	Prot			Prot		custom
Protected Phases	8	8		7	7		1	6		5	2	
Permitted Phases						8						6
Actuated Green, G (s)	15.0	15.0			8.4	15.0	7.7	29.6		16.0	37.9	29.6
Effective Green, g (s)	15.0	15.0			8.4	15.0	7.7	29.6		16.0	37.9	29.6
Actuated g/C Ratio	0.18	0.18			0.10	0.18	0.09	0.35		0.19	0.45	0.35
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	600	275			182	274	159	1227		324	1563	485
v/s Ratio Prot	c0.13	0.09			c0.07		0.05	0.22		c0.15	c0.36	
v/s Ratio Perm						0.04						0.19
v/c Ratio	0.74	0.49			0.68	0.20	0.52	0.62		0.78	0.82	0.54
Uniform Delay, d1	33.2	31.5			37.0	29.9	36.9	23.1		32.8	20.5	22.2
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.13	0.84	0.70
Incremental Delay, d2	4.9	1.4			9.5	0.4	2.8	2.4		8.7	3.6	3.1
Delay (s)	38.1	32.9			46.5	30.2	39.7	25.5		45.7	20.8	18.7
Level of Service	D	C			D	C	D	C		D	C	B
Approach Delay (s)		36.7			34.9			26.9			23.1	
Approach LOS		D			C			C			C	

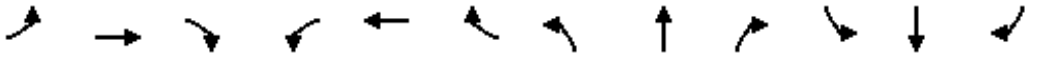
Intersection Summary			
HCM Average Control Delay	27.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	64.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

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	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.91	0.91	0.88	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	1610	3379	2787	1770	3539	1563
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	1610	3379	2787	1770	3539	1563
Volume (vph)	41	767	169	1024	2100	13	87	150	340	3	13	6
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
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	47	875	193	1169	2397	15	99	171	388	3	15	7
RTOR Reduction (vph)	0	0	136	0	0	6	0	0	211	0	0	7
Lane Group Flow (vph)	47	875	57	1169	2397	9	87	183	177	3	15	0
Confl. Peds. (#/hr)							1					1
Turn Type	Prot		Perm	Prot		Perm	Split		pm+ov	Split		Perm
Protected Phases	1	6		5	2		7	7	5	8	8	
Permitted Phases			6			2			7			8
Actuated Green, G (s)	3.7	19.9	19.9	26.6	43.8	43.8	7.8	7.8	34.4	2.0	2.0	2.0
Effective Green, g (s)	2.7	21.9	21.9	26.6	45.8	45.8	7.3	7.3	33.9	2.5	2.5	2.5
Actuated g/C Ratio	0.04	0.29	0.29	0.36	0.62	0.62	0.10	0.10	0.46	0.03	0.03	0.03
Clearance Time (s)	3.0	6.0	6.0	4.0	6.0	6.0	3.5	3.5	4.0	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	125	1499	467	1229	3134	976	158	332	1272	60	119	53
v/s Ratio Prot	0.01	0.17		c0.34	c0.47		0.05	c0.05	0.05	0.00	c0.00	
v/s Ratio Perm			0.04			0.01			0.01			0.00
v/c Ratio	0.38	0.58	0.12	0.95	0.76	0.01	0.55	0.55	0.14	0.05	0.13	0.00
Uniform Delay, d1	35.0	22.3	19.2	23.2	10.3	5.5	31.9	31.9	11.7	34.8	34.8	34.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	0.6	0.1	15.4	1.8	0.0	4.1	2.0	0.1	0.3	0.5	0.0
Delay (s)	36.9	22.9	19.3	38.6	12.2	5.5	36.0	33.9	11.8	35.1	35.3	34.7
Level of Service	D	C	B	D	B	A	D	C	B	D	D	C
Approach Delay (s)		22.9			20.8			21.1			35.1	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM Average Control Delay	21.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	74.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	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	0.91	1.00	0.97	0.91	0.97	0.76
Frpb, ped/bikes	1.00	0.99	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	5085	1561	3433	5085	3433	3610
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	5085	1561	3433	5085	3433	3610
Volume (vph)	872	193	1659	3232	135	446
Peak-hour factor, PHF	0.91	0.91	0.93	0.93	0.88	0.88
Growth Factor (vph)	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	1006	223	1873	3649	161	532
RTOR Reduction (vph)	0	132	0	0	0	24
Lane Group Flow (vph)	1006	91	1873	3649	161	508
Confl. Peds. (#/hr)		3	3			
Turn Type		Perm	Prot			pm+ov
Protected Phases	6		5	2	4	5
Permitted Phases		6				4
Actuated Green, G (s)	37.0	37.0	36.0	76.6	9.8	45.8
Effective Green, g (s)	39.0	39.0	35.5	78.5	8.8	44.3
Actuated g/C Ratio	0.41	0.41	0.37	0.82	0.09	0.46
Clearance Time (s)	6.0	6.0	3.5	5.9	3.0	3.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	2081	639	1279	4189	317	1830
v/s Ratio Prot	0.20		c0.55	c0.72	c0.05	0.10
v/s Ratio Perm		0.06				0.04
v/c Ratio	0.48	0.14	1.46	0.87	0.51	0.28
Uniform Delay, d1	20.7	17.7	29.9	5.2	41.2	15.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.1	213.3	2.8	1.3	0.1
Delay (s)	20.9	17.8	243.2	8.0	42.5	15.8
Level of Service	C	B	F	A	D	B
Approach Delay (s)	20.3			87.8	22.0	
Approach LOS	C			F	C	

Intersection Summary			
HCM Average Control Delay	70.5	HCM Level of Service	E
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	95.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	82.7%	ICU Level of Service	E
Analysis Period (min)	15		
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	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00	0.93	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	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1523	3433	1863	1466	1770	4899		1770	3490	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1863	1523	3433	1863	1466	1770	4899		1770	3490	
Volume (vph)	32	179	261	224	144	57	317	1625	406	115	978	69
Peak-hour factor, PHF	0.94	0.94	0.94	0.91	0.91	0.91	0.94	0.94	0.94	0.83	0.83	0.83
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	36	200	292	258	166	66	354	1815	454	145	1237	87
RTOR Reduction (vph)	0	0	249	0	0	52	0	25	0	0	3	0
Lane Group Flow (vph)	36	200	43	258	166	14	354	2244	0	145	1321	0
Confl. Peds. (#/hr)	43		18	18		43	17		6	6		17
Turn Type	Split		Perm	Split		Perm	Prot			Prot		
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4			3						
Actuated Green, G (s)	15.9	15.9	15.9	14.1	14.1	14.1	27.2	35.9		27.2	35.9	
Effective Green, g (s)	15.9	15.9	15.9	13.1	13.1	13.1	26.2	36.9		26.2	36.9	
Actuated g/C Ratio	0.15	0.15	0.15	0.12	0.12	0.12	0.24	0.34		0.24	0.34	
Clearance Time (s)	4.0	4.0	4.0	3.0	3.0	3.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	4.0		2.0	4.0	
Lane Grp Cap (vph)	260	274	224	416	226	178	429	1672		429	1191	
v/s Ratio Prot	0.02	c0.11		0.08	c0.09		0.20	c0.46		0.08	c0.38	
v/s Ratio Perm			0.03			0.01						
v/c Ratio	0.14	0.73	0.19	0.62	0.73	0.08	0.83	1.34		0.34	1.11	
Uniform Delay, d1	40.1	44.0	40.5	45.1	45.8	42.1	38.8	35.6		33.8	35.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	8.0	0.2	2.1	10.2	0.1	11.7	158.1		0.2	61.3	
Delay (s)	40.2	52.0	40.6	47.2	56.0	42.2	50.4	193.7		34.0	96.9	
Level of Service	D	D	D	D	E	D	D	F		C	F	
Approach Delay (s)		44.9			49.5			174.3			90.7	
Approach LOS		D			D			F			F	

Intersection Summary			
HCM Average Control Delay	124.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	108.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	83.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.97		0.95	1.00	1.00	0.95
Frpb, ped/bikes	1.00		1.00	0.96	1.00	1.00
Flpb, ped/bikes	1.00		1.00	1.00	1.00	1.00
Frt	0.92		1.00	0.85	1.00	1.00
Flt Protected	0.98		1.00	1.00	0.95	1.00
Satd. Flow (prot)	3253		3539	1523	1770	3539
Flt Permitted	0.98		1.00	1.00	0.95	1.00
Satd. Flow (perm)	3253		3539	1523	1770	3539
Volume (vph)	177	193	1452	284	73	1004
Peak-hour factor, PHF	0.71	0.71	0.90	0.90	0.99	0.99
Growth Factor (vph)	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	262	285	1694	331	77	1065
RTOR Reduction (vph)	245	0	0	92	0	0
Lane Group Flow (vph)	302	0	1694	239	77	1065
Confl. Peds. (#/hr)				12	12	
Turn Type				Perm	Prot	
Protected Phases	4		2		1	6
Permitted Phases				2		
Actuated Green, G (s)	11.1		44.6	44.6	7.1	54.7
Effective Green, g (s)	10.1		44.6	44.6	6.1	54.7
Actuated g/C Ratio	0.14		0.61	0.61	0.08	0.75
Clearance Time (s)	3.0		4.0	4.0	3.0	4.0
Vehicle Extension (s)	2.0		4.0	4.0	2.0	4.0
Lane Grp Cap (vph)	451		2168	933	148	2659
v/s Ratio Prot	c0.09		c0.48		c0.04	0.30
v/s Ratio Perm				0.16		
v/c Ratio	0.67		0.78	0.26	0.52	0.40
Uniform Delay, d1	29.8		10.5	6.5	31.9	3.2
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	2.9		2.9	0.7	1.5	0.5
Delay (s)	32.7		13.4	7.1	33.5	3.7
Level of Service	C		B	A	C	A
Approach Delay (s)	32.7		12.3			5.7
Approach LOS	C		B			A

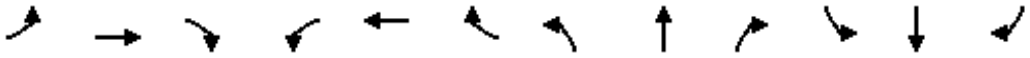
Intersection Summary			
HCM Average Control Delay	13.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	72.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	70.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1545	1770	3539	3521	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1545	1770	3539	3521	
Volume (vph)	7	204	133	1533	810	25
Peak-hour factor, PHF	0.84	0.84	0.97	0.97	0.95	0.95
Growth Factor (vph)	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	9	255	144	1659	895	28
RTOR Reduction (vph)	0	178	0	0	2	0
Lane Group Flow (vph)	9	77	144	1659	921	0
Confl. Peds. (#/hr)	10	15	12			12
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	10.0	10.0	5.0	60.1	52.1	
Effective Green, g (s)	9.0	9.0	4.0	60.1	52.1	
Actuated g/C Ratio	0.12	0.12	0.05	0.78	0.68	
Clearance Time (s)	3.0	3.0	3.0	4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	4.0	4.0	
Lane Grp Cap (vph)	207	180	92	2759	2379	
v/s Ratio Prot	0.01		c0.08	c0.47	0.26	
v/s Ratio Perm		c0.05				
v/c Ratio	0.04	0.43	1.57	0.60	0.39	
Uniform Delay, d1	30.2	31.7	36.5	3.5	5.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	0.6	300.2	1.0	0.1	
Delay (s)	30.3	32.3	336.8	4.5	5.6	
Level of Service	C	C	F	A	A	
Approach Delay (s)	32.2			31.0	5.6	
Approach LOS	C			C	A	

Intersection Summary			
HCM Average Control Delay	23.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	77.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	64.4%	ICU Level of Service	C
Analysis Period (min)	15		
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	0.95		1.00	0.95	
Frpb, ped/bikes		0.99			0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.93			0.95		1.00	1.00		1.00	0.99	
Flt Protected		0.98			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1674			1714		1770	3536		1769	3507	
Flt Permitted		0.82			0.65		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1400			1153		1770	3536		1769	3507	
Volume (vph)	66	3	84	81	6	44	151	1386	8	16	668	44
Peak-hour factor, PHF	0.87	0.87	0.87	0.94	0.94	0.94	0.96	0.96	0.96	0.92	0.92	0.92
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	80	4	101	90	7	49	165	1516	9	18	762	50
RTOR Reduction (vph)	0	50	0	0	21	0	0	0	0	0	3	0
Lane Group Flow (vph)	0	135	0	0	125	0	165	1525	0	18	809	0
Confl. Peds. (#/hr)	9		1	1		9			1	1		
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)		9.2			9.2		8.7	42.0		1.1	34.4	
Effective Green, g (s)		8.2			8.2		7.7	42.0		0.1	34.4	
Actuated g/C Ratio		0.13			0.13		0.12	0.67		0.00	0.55	
Clearance Time (s)		3.0			3.0		3.0	4.0		3.0	4.0	
Vehicle Extension (s)		2.0			2.0		2.0	4.0		2.0	4.0	
Lane Grp Cap (vph)		184			152		219	2384		3	1936	
v/s Ratio Prot							c0.09	c0.43		0.01	0.23	
v/s Ratio Perm		0.10			c0.11							
v/c Ratio		0.73			0.82		0.75	0.64		6.00	0.42	
Uniform Delay, d1		26.0			26.3		26.4	5.8		31.1	8.1	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		12.1			27.7		12.2	0.6		2823.7	0.2	
Delay (s)		38.1			54.0		38.6	6.5		2854.8	8.3	
Level of Service		D			D		D	A		F	A	
Approach Delay (s)		38.1			54.0			9.6			70.1	
Approach LOS		D			D			A			E	

Intersection Summary			
HCM Average Control Delay	31.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	62.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		
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	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.86	0.91	0.97	0.95	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	0.99	0.95	1.00	1.00	1.00	1.00	0.98	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.97	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1805	1900	1561	1626	3084	1366	3400	3539	1599	1736	3390	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1805	1900	1561	1626	3084	1366	3400	3539	1599	1736	3390	
Volume (vph)	21	114	182	339	565	804	229	743	655	71	586	186
Peak-hour factor, PHF	0.90	0.90	0.90	0.97	0.97	0.97	0.98	0.98	0.98	0.94	0.94	0.94
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	24	133	212	367	612	870	245	796	702	79	655	208
RTOR Reduction (vph)	0	0	187	0	25	383	0	0	0	0	32	0
Lane Group Flow (vph)	24	133	25	367	764	310	245	796	702	79	831	0
Confl. Peds. (#/hr)	24					24	33		1	1		33
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	0%	0%	2%	1%	1%	2%	3%	2%	1%	4%	1%	1%
Turn Type	Split		Perm	Split		Perm	Prot		Prot	Prot		
Protected Phases	4	4		3	3		1	6	6	5	2	
Permitted Phases			4			3						
Actuated Green, G (s)	10.5	10.5	10.5	22.0	22.0	22.0	11.6	33.3	33.3	8.2	29.9	
Effective Green, g (s)	10.5	10.5	10.5	22.0	22.0	22.0	11.6	33.3	33.3	8.2	29.9	
Actuated g/C Ratio	0.12	0.12	0.12	0.24	0.24	0.24	0.13	0.37	0.37	0.09	0.33	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	211	222	182	397	754	334	438	1309	592	158	1126	
v/s Ratio Prot	0.01	c0.07		0.23	c0.25		c0.07	0.22	c0.44	0.05	0.25	
v/s Ratio Perm			0.02			0.23						
v/c Ratio	0.11	0.60	0.14	0.92	1.01	0.93	0.56	0.61	1.19	0.50	0.74	
Uniform Delay, d1	35.6	37.8	35.7	33.2	34.0	33.2	36.8	23.0	28.4	38.9	26.6	
Progression Factor	1.00	1.00	1.00	0.93	0.95	2.32	1.09	1.29	1.19	0.84	0.94	
Incremental Delay, d2	0.2	4.3	0.3	21.8	31.6	25.2	0.6	0.9	90.9	2.3	4.0	
Delay (s)	35.8	42.1	36.0	52.7	63.8	102.4	40.8	30.6	124.7	35.0	28.9	
Level of Service	D	D	D	D	E	F	D	C	F	D	C	
Approach Delay (s)		38.2			76.1			69.9			29.4	
Approach LOS		D			E			E			C	

Intersection Summary			
HCM Average Control Delay	62.1	HCM Level of Service	E
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.0%	ICU Level of Service	D
Analysis Period (min)	15		
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	0.95		1.00	0.95	
Frpb, ped/bikes		0.99			0.98		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		0.99	1.00		1.00	1.00	
Frt		0.96			0.97		1.00	0.99		1.00	1.00	
Flt Protected		0.99			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1771			1736		1795	3525		1770	3522	
Flt Permitted		0.96			0.72		0.25	1.00		0.13	1.00	
Satd. Flow (perm)		1708			1279		478	3525		247	3522	
Volume (vph)	13	69	38	80	74	45	52	1245	116	47	867	24
Peak-hour factor, PHF	0.83	0.83	0.83	0.86	0.86	0.86	0.97	0.97	0.97	0.93	0.93	0.93
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	16	87	48	98	90	55	56	1348	126	53	979	27
RTOR Reduction (vph)	0	21	0	0	13	0	0	6	0	0	2	0
Lane Group Flow (vph)	0	130	0	0	230	0	56	1468	0	53	1004	0
Confl. Peds. (#/hr)	36		9	9		36	10		1	1		10
Heavy Vehicles (%)	0%	0%	3%	0%	4%	2%	0%	1%	0%	2%	2%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			6			2	
Permitted Phases	4			4			6			2		
Actuated Green, G (s)		18.7			18.7		63.3	63.3		63.3	63.3	
Effective Green, g (s)		18.7			18.7		63.3	63.3		63.3	63.3	
Actuated g/C Ratio		0.21			0.21		0.70	0.70		0.70	0.70	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		355			266		336	2479		174	2477	
v/s Ratio Prot								c0.42			0.29	
v/s Ratio Perm		0.08			c0.18		0.12			0.21		
v/c Ratio		0.37			0.87		0.17	0.59		0.30	0.41	
Uniform Delay, d1		30.6			34.4		4.5	6.8		5.0	5.5	
Progression Factor		1.00			1.00		0.47	0.77		1.28	0.95	
Incremental Delay, d2		0.6			24.2		0.6	0.6		4.1	0.5	
Delay (s)		31.2			58.6		2.7	5.8		10.5	5.7	
Level of Service		C			E		A	A		B	A	
Approach Delay (s)		31.2			58.6			5.7			5.9	
Approach LOS		C			E			A			A	

Intersection Summary			
HCM Average Control Delay	11.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	71.0%	ICU Level of Service	C
Analysis Period (min)	15		

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	0.95		1.00	0.95	
Frpb, ped/bikes		0.99			0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		0.99	1.00		1.00	1.00	
Frt		0.98			0.96		1.00	0.99		1.00	0.99	
Flt Protected		0.99			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1832			1765		1789	3532		1805	3513	
Flt Permitted		0.88			0.73		0.26	1.00		0.13	1.00	
Satd. Flow (perm)		1622			1308		488	3532		247	3513	
Volume (vph)	23	92	22	77	98	77	31	1236	80	37	843	33
Peak-hour factor, PHF	0.67	0.67	0.67	0.96	0.96	0.96	0.94	0.94	0.94	0.94	0.94	0.94
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	36	144	34	84	107	84	35	1381	89	41	942	37
RTOR Reduction (vph)	0	8	0	0	19	0	0	5	0	0	3	0
Lane Group Flow (vph)	0	206	0	0	256	0	35	1465	0	41	976	0
Confl. Peds. (#/hr)	13		12	12		13	16		10	10		16
Confl. Bikes (#/hr)												1
Heavy Vehicles (%)	0%	0%	0%	0%	0%	1%	0%	1%	1%	0%	2%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			6			2	
Permitted Phases	4			4			6			2		
Actuated Green, G (s)		19.8			19.8		62.2	62.2		62.2	62.2	
Effective Green, g (s)		19.8			19.8		62.2	62.2		62.2	62.2	
Actuated g/C Ratio		0.22			0.22		0.69	0.69		0.69	0.69	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		357			288		337	2441		171	2428	
v/s Ratio Prot								c0.41			0.28	
v/s Ratio Perm		0.13			c0.20		0.07			0.17		
v/c Ratio		0.58			0.89		0.10	0.60		0.24	0.40	
Uniform Delay, d1		31.4			34.0		4.6	7.3		5.1	5.9	
Progression Factor		1.00			1.00		0.30	0.19		1.00	1.00	
Incremental Delay, d2		2.3			26.6		0.5	0.9		3.3	0.5	
Delay (s)		33.6			60.6		1.9	2.3		8.4	6.4	
Level of Service		C			E		A	A		A	A	
Approach Delay (s)		33.6			60.6			2.3			6.5	
Approach LOS		C			E			A			A	

Intersection Summary			
HCM Average Control Delay	11.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1261	30	0	860	0	95
Peak Hour Factor	0.96	0.96	0.92	0.92	0.83	0.83
Hourly flow rate (vph)	1379	33	0	982	0	120
Pedestrians					24	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	972			302		
pX, platoon unblocked			0.81		0.88	0.81
vC, conflicting volume			1436		1910	730
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1304		1446	433
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	74
cM capacity (veh/h)			427		107	458

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	NW 1
Volume Total	919	493	491	491	120
Volume Left	0	0	0	0	0
Volume Right	0	33	0	0	120
cSH	1700	1700	1700	1700	458
Volume to Capacity	0.54	0.29	0.29	0.29	0.26
Queue Length 95th (ft)	0	0	0	0	26
Control Delay (s)	0.0	0.0	0.0	0.0	15.6
Lane LOS					C
Approach Delay (s)	0.0		0.0		15.6
Approach LOS					C

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	50.5%	ICU Level of Service	A
Analysis Period (min)	15		

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	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.86	1.00	1.00	0.92	1.00	1.00		1.00	0.98	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1369	1698	1770	1485	1719	3525		1805	3468	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1863	1369	1698	1770	1485	1719	3525		1805	3468	
Volume (vph)	83	239	136	154	205	347	63	1271	78	98	582	58
Peak-hour factor, PHF	0.93	0.93	0.93	0.92	0.92	0.92	0.99	0.99	0.99	0.91	0.91	0.91
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	94	270	154	176	234	396	67	1348	83	113	672	67
RTOR Reduction (vph)	0	0	122	0	0	304	0	3	0	0	5	0
Lane Group Flow (vph)	94	270	32	176	234	92	67	1428	0	113	734	0
Confl. Peds. (#/hr)	31		56	56		31	46		13	13		46
Heavy Vehicles (%)	2%	2%	2%	1%	2%	0%	5%	1%	3%	0%	1%	0%
Turn Type	Split		Perm	Split		Perm	Prot			Prot		
Protected Phases	3	3		4	4		1	6		5	2	
Permitted Phases			3			4						
Actuated Green, G (s)	20.3	20.3	20.3	18.8	18.8	18.8	8.7	52.5		12.4	56.2	
Effective Green, g (s)	20.3	20.3	20.3	18.8	18.8	18.8	8.7	52.5		12.4	56.2	
Actuated g/C Ratio	0.17	0.17	0.17	0.16	0.16	0.16	0.07	0.44		0.10	0.47	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	299	315	232	266	277	233	125	1542		187	1624	
v/s Ratio Prot	0.05	c0.14		0.10	c0.13		0.04	c0.40		c0.06	c0.21	
v/s Ratio Perm			0.02			0.06						
v/c Ratio	0.31	0.86	0.14	0.66	0.84	0.40	0.54	0.93		0.60	0.45	
Uniform Delay, d1	43.7	48.4	42.4	47.6	49.2	45.5	53.7	31.9		51.5	21.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.6	19.9	0.3	6.1	20.4	1.1	4.4	11.0		5.4	0.9	
Delay (s)	44.3	68.3	42.7	53.7	69.6	46.6	58.1	42.9		56.9	22.4	
Level of Service	D	E	D	D	E	D	E	D		E	C	
Approach Delay (s)		56.4			54.8			43.6			27.0	
Approach LOS		E			D			D			C	

Intersection Summary			
HCM Average Control Delay	44.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	88.2%	ICU Level of Service	E
Analysis Period (min)	15		

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)	25	6	1604	59	24	699
Peak Hour Factor	0.73	0.73	0.97	0.97	0.92	0.92
Hourly flow rate (vph)	36	9	1736	64	27	798
Pedestrians	2		14			
Lane Width (ft)	12.0		12.0			
Walking Speed (ft/s)	4.0		4.0			
Percent Blockage	0		1			
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)			626			748
pX, platoon unblocked	0.62	0.61			0.61	
vC, conflicting volume	2238	902			1802	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2299	204			1676	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	98			88	
cM capacity (veh/h)	18	490			231	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	45	1158	643	293	532
Volume Left	36	0	0	27	0
Volume Right	9	0	64	0	0
cSH	22	1700	1700	231	1700
Volume to Capacity	2.06	0.68	0.38	0.12	0.31
Queue Length 95th (ft)	144	0	0	10	0
Control Delay (s)	871.5	0.0	0.0	5.0	0.0
Lane LOS	F			A	
Approach Delay (s)	871.5	0.0		1.8	
Approach LOS	F				

Intersection Summary			
Average Delay	15.1		
Intersection Capacity Utilization	58.5%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	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	0.95	
Frt	0.94		1.00	1.00	0.99	
Flt Protected	0.97		0.95	1.00	1.00	
Satd. Flow (prot)	1705		1805	3574	3506	
Flt Permitted	0.97		0.95	1.00	1.00	
Satd. Flow (perm)	1705		1805	3574	3506	
Volume (vph)	72	66	28	1612	660	51
Peak-hour factor, PHF	0.93	0.93	0.97	0.97	0.87	0.87
Growth Factor (vph)	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	81	75	30	1745	797	62
RTOR Reduction (vph)	42	0	0	0	3	0
Lane Group Flow (vph)	114	0	30	1745	856	0
Heavy Vehicles (%)	3%	0%	0%	1%	2%	0%
Turn Type			Prot			
Protected Phases	4		1	6	2	
Permitted Phases						
Actuated Green, G (s)	11.0		3.3	64.0	63.7	
Effective Green, g (s)	11.0		3.3	64.0	63.7	
Actuated g/C Ratio	0.12		0.04	0.71	0.71	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	208		66	2542	2481	
v/s Ratio Prot	c0.07		c0.02	c0.49	0.24	
v/s Ratio Perm						
v/c Ratio	0.55		0.45	0.69	0.34	
Uniform Delay, d1	37.2		42.5	7.3	5.1	
Progression Factor	1.00		1.00	1.00	0.45	
Incremental Delay, d2	2.9		4.9	1.5	0.4	
Delay (s)	40.1		47.4	8.9	2.7	
Level of Service	D		D	A	A	
Approach Delay (s)	40.1			9.5	2.7	
Approach LOS	D			A	A	

Intersection Summary			
HCM Average Control Delay	9.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0		4.0	4.0
Lane Util. Factor	1.00		0.95		1.00	0.95
Frpb, ped/bikes	1.00		1.00		1.00	1.00
Flpb, ped/bikes	1.00		1.00		1.00	1.00
Frt	0.97		1.00		1.00	1.00
Flt Protected	0.96		1.00		0.95	1.00
Satd. Flow (prot)	1763		3551		1805	3574
Flt Permitted	0.96		1.00		0.95	1.00
Satd. Flow (perm)	1763		3551		1805	3574
Volume (vph)	78	20	1633	51	14	633
Peak-hour factor, PHF	0.85	0.85	0.95	0.95	0.85	0.85
Growth Factor (vph)	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	96	25	1805	56	17	782
RTOR Reduction (vph)	11	0	1	0	0	0
Lane Group Flow (vph)	110	0	1860	0	17	782
Confl. Bikes (#/hr)				3		
Heavy Vehicles (%)	1%	0%	1%	6%	0%	1%
Turn Type					Prot	
Protected Phases	8		6		5	2
Permitted Phases						
Actuated Green, G (s)	11.0		64.0		3.0	63.7
Effective Green, g (s)	11.0		64.0		3.0	63.7
Actuated g/C Ratio	0.12		0.71		0.03	0.71
Clearance Time (s)	4.0		4.0		4.0	4.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	215		2525		60	2530
v/s Ratio Prot	c0.06		c0.52		c0.01	0.22
v/s Ratio Perm						
v/c Ratio	0.51		0.74		0.28	0.31
Uniform Delay, d1	37.0		7.9		42.5	4.9
Progression Factor	1.00		0.22		1.07	0.74
Incremental Delay, d2	1.9		1.5		2.5	0.3
Delay (s)	38.9		3.2		47.8	3.9
Level of Service	D		A		D	A
Approach Delay (s)	38.9		3.2			4.9
Approach LOS	D		A			A

Intersection Summary			
HCM Average Control Delay	5.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

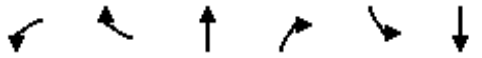
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1787	1579	1805	3574	3560	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1787	1579	1805	3574	3560	
Volume (vph)	153	70	10	1632	567	9
Peak-hour factor, PHF	0.91	0.91	0.95	0.95	0.90	0.90
Growth Factor (vph)	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	177	81	11	1804	662	10
RTOR Reduction (vph)	0	65	0	0	1	0
Lane Group Flow (vph)	177	16	11	1804	671	0
Confl. Peds. (#/hr)			1			1
Confl. Bikes (#/hr)		7				1
Heavy Vehicles (%)	1%	0%	0%	1%	1%	11%
Turn Type		Perm	Prot			
Protected Phases	8		1	6	2	
Permitted Phases		8				
Actuated Green, G (s)	13.6	13.6	1.4	68.4	63.0	
Effective Green, g (s)	13.6	13.6	1.4	68.4	63.0	
Actuated g/C Ratio	0.15	0.15	0.02	0.76	0.70	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	270	239	28	2716	2492	
v/s Ratio Prot	c0.10		0.01	c0.50	0.19	
v/s Ratio Perm		0.01				
v/c Ratio	0.66	0.07	0.39	0.66	0.27	
Uniform Delay, d1	36.0	32.8	43.9	5.2	5.0	
Progression Factor	1.00	1.00	1.40	0.21	1.00	
Incremental Delay, d2	5.6	0.1	6.2	0.9	0.3	
Delay (s)	41.6	32.9	67.6	2.0	5.3	
Level of Service	D	C	E	A	A	
Approach Delay (s)	38.9			2.4	5.3	
Approach LOS	D			A	A	

Intersection Summary			
HCM Average Control Delay	6.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	46	39	3	1781	538	12
Peak Hour Factor	0.89	0.89	0.95	0.95	0.88	0.88
Hourly flow rate (vph)	54	46	3	1968	642	14
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)				640		
pX, platoon unblocked	0.69					
vC, conflicting volume	1640	328	656			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1477	328	656			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	34	93	100			
cM capacity (veh/h)	82	673	941			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	100	3	984	984	428	228
Volume Left	54	3	0	0	0	0
Volume Right	46	0	0	0	0	14
cSH	137	941	1700	1700	1700	1700
Volume to Capacity	0.73	0.00	0.58	0.58	0.25	0.13
Queue Length 95th (ft)	106	0	0	0	0	0
Control Delay (s)	82.0	8.8	0.0	0.0	0.0	0.0
Lane LOS	F	A				
Approach Delay (s)	82.0	0.0			0.0	
Approach LOS	F					

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	63.5%	ICU Level of Service	B
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	39	67	1768	61	58	503
Peak Hour Factor	0.88	0.88	0.94	0.94	0.92	0.92
Hourly flow rate (vph)	47	80	1975	68	66	574
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)			1038			
pX, platoon unblocked	0.66	0.66			0.66	
vC, conflicting volume	2428	1022			2043	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2651	514			2065	
tC, single (s)	6.8	6.9			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	76			62	
cM capacity (veh/h)	8	336			173	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	126	1317	726	258	383
Volume Left	47	0	0	66	0
Volume Right	80	0	68	0	0
cSH	20	1700	1700	173	1700
Volume to Capacity	6.20	0.77	0.43	0.38	0.23
Queue Length 95th (ft)	Err	0	0	41	0
Control Delay (s)	Err	0.0	0.0	22.0	0.0
Lane LOS	F			C	
Approach Delay (s)	Err	0.0		8.8	
Approach LOS	F				

Intersection Summary			
Average Delay	452.1		
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		

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
Lane Util. Factor		0.95			0.91		0.97		1.00			1.00
Frpb, ped/bikes		1.00			1.00		1.00		1.00			1.00
Flpb, ped/bikes		1.00			1.00		1.00		1.00			1.00
Frt		1.00			0.99		1.00		0.85			0.86
Flt Protected		1.00			1.00		0.95		1.00			1.00
Satd. Flow (prot)		3539			5043		3467		1553			1536
Flt Permitted		1.00			1.00		0.95		1.00			1.00
Satd. Flow (perm)		3539			5043		3467		1553			1536
Volume (vph)	0	819	0	0	862	36	834	0	311	0	0	14
Peak-hour factor, PHF	0.97	0.97	0.97	0.94	0.94	0.94	0.96	0.96	0.96	0.63	0.63	0.63
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	0	887	0	0	963	40	912	0	340	0	0	23
RTOR Reduction (vph)	0	0	0	0	5	0	0	0	202	0	0	19
Lane Group Flow (vph)	0	887	0	0	998	0	912	0	138	0	0	4
Confl. Peds. (#/hr)	22		4	4		22			1	1		
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	1%	0%	4%	0%	0%	7%
Turn Type							Prot		custom			custom
Protected Phases		4			4		5		5			6
Permitted Phases												6
Actuated Green, G (s)		33.1			33.1		29.2		29.2			15.7
Effective Green, g (s)		33.1			33.1		29.2		29.2			15.7
Actuated g/C Ratio		0.37			0.37		0.32		0.32			0.17
Clearance Time (s)		4.0			4.0		4.0		4.0			4.0
Vehicle Extension (s)		3.0			3.0		3.0		3.0			3.0
Lane Grp Cap (vph)		1302			1855		1125		504			268
v/s Ratio Prot		c0.25			0.20		c0.26		0.09			c0.00
v/s Ratio Perm												
v/c Ratio		0.68			0.54		0.81		0.27			0.01
Uniform Delay, d1		24.0			22.4		27.9		22.5			30.7
Progression Factor		1.57			1.00		1.00		1.00			1.00
Incremental Delay, d2		0.1			0.3		4.5		0.3			0.1
Delay (s)		37.7			22.7		32.4		22.8			30.9
Level of Service		D			C		C		C			C
Approach Delay (s)		37.7			22.7			29.8			30.9	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM Average Control Delay	29.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	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	0.97	0.91	0.95	0.88	0.97	0.95
Frt	0.94	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.97	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3292	1441	3539	2814	3467	3539
Flt Permitted	0.97	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3292	1441	3539	2814	3467	3539
Volume (vph)	288	543	1408	411	595	861
Peak-hour factor, PHF	0.91	0.91	0.98	0.98	0.94	0.94
Growth Factor (vph)	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	332	627	1509	440	665	962
RTOR Reduction (vph)	148	311	0	29	0	0
Lane Group Flow (vph)	421	79	1509	411	665	962
Heavy Vehicles (%)	2%	2%	2%	1%	1%	2%
Turn Type		Perm		pm+ov	Prot	
Protected Phases	7		6	7	5	2
Permitted Phases		7		6		
Actuated Green, G (s)	18.2	18.2	38.3	56.5	21.5	63.8
Effective Green, g (s)	18.2	18.2	38.3	56.5	21.5	63.8
Actuated g/C Ratio	0.20	0.20	0.43	0.63	0.24	0.71
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	666	291	1506	1892	828	2509
v/s Ratio Prot	c0.13		c0.43	0.04	c0.19	0.27
v/s Ratio Perm		0.05		0.10		
v/c Ratio	0.63	0.27	1.00	0.22	0.80	0.38
Uniform Delay, d1	32.8	30.3	25.9	7.2	32.3	5.2
Progression Factor	1.00	1.00	0.85	0.42	0.92	0.66
Incremental Delay, d2	2.0	0.5	18.1	0.0	4.7	0.4
Delay (s)	34.8	30.8	40.0	3.1	34.3	3.8
Level of Service	C	C	D	A	C	A
Approach Delay (s)	33.2		31.7			16.3
Approach LOS	C		C			B

Intersection Summary			
HCM Average Control Delay	26.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	83.3%	ICU Level of Service	E
Analysis Period (min)	15		
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		4.0	4.0	4.0
Lane Util. Factor	0.97	1.00			1.00	1.00	1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	0.97			1.00	0.99	1.00	1.00		1.00	1.00	0.90
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.92			1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3467	1638			1882	1547	1719	3517		1770	3574	1426
Flt Permitted	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3467	1638			1882	1547	1719	3517		1770	3574	1426
Volume (vph)	484	82	87	19	79	367	41	945	27	228	629	303
Peak-hour factor, PHF	0.94	0.94	0.94	0.92	0.92	0.92	0.95	0.95	0.95	0.92	0.92	0.92
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	541	92	97	22	90	419	45	1044	30	260	718	346
RTOR Reduction (vph)	0	40	0	0	0	330	0	2	0	0	0	230
Lane Group Flow (vph)	541	149	0	0	112	89	45	1072	0	260	718	116
Confl. Peds. (#/hr)	1		37	37		1	28					28
Confl. Bikes (#/hr)			1						1			2
Heavy Vehicles (%)	1%	2%	5%	0%	0%	3%	5%	2%	7%	2%	1%	2%
Turn Type	Split			Split		custom	Prot			Prot		custom
Protected Phases	8	8		7	7		1	6		5	2	
Permitted Phases						8						6
Actuated Green, G (s)	19.1	19.1			9.2	19.1	5.3	30.1		15.6	40.4	30.1
Effective Green, g (s)	19.1	19.1			9.2	19.1	5.3	30.1		15.6	40.4	30.1
Actuated g/C Ratio	0.21	0.21			0.10	0.21	0.06	0.33		0.17	0.45	0.33
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	736	348			192	328	101	1176		307	1604	477
v/s Ratio Prot	c0.16	0.09			c0.06		0.03	c0.30		c0.15	0.20	
v/s Ratio Perm						0.06						0.08
v/c Ratio	0.74	0.43			0.58	0.27	0.45	0.91		0.85	0.45	0.24
Uniform Delay, d1	33.1	30.7			38.6	29.6	40.9	28.7		36.0	17.1	21.7
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.25	0.80	0.40
Incremental Delay, d2	3.8	0.8			4.5	0.4	3.1	12.1		17.5	0.8	1.1
Delay (s)	36.9	31.6			43.0	30.1	44.0	40.8		62.6	14.5	9.8
Level of Service	D	C			D	C	D	D		E	B	A
Approach Delay (s)		35.5			32.8			40.9			22.7	
Approach LOS		D			C			D			C	

Intersection Summary			
HCM Average Control Delay	32.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	76.8%	ICU Level of Service	D
Analysis Period (min)	15		
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	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.91	0.91	0.88	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1562	3433	5085	1583	1610	3273	2787	1770	3539	1517
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1562	3433	5085	1583	1610	3273	2787	1770	3539	1517
Volume (vph)	5	2243	152	401	713	13	50	10	1479	114	168	48
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
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	6	2560	173	458	814	15	57	11	1688	130	192	55
RTOR Reduction (vph)	0	0	42	0	0	5	0	0	185	0	0	48
Lane Group Flow (vph)	6	2560	131	458	814	10	29	39	1503	130	192	7
Confl. Peds. (#/hr)			1	1			20					20
Turn Type	Prot		Perm	Prot		Perm	Split		pm+ov	Split		Perm
Protected Phases	1	6		5	2		7	7	5	8	8	
Permitted Phases			6			2			7			8
Actuated Green, G (s)	1.2	32.5	32.5	47.0	79.3	79.3	15.0	15.0	62.0	14.3	14.3	14.3
Effective Green, g (s)	0.2	34.5	34.5	47.0	81.3	81.3	14.5	14.5	61.5	14.8	14.8	14.8
Actuated g/C Ratio	0.00	0.27	0.27	0.37	0.64	0.64	0.11	0.11	0.49	0.12	0.12	0.12
Clearance Time (s)	3.0	6.0	6.0	4.0	6.0	6.0	3.5	3.5	4.0	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	5	1384	425	1272	3260	1015	184	374	1352	207	413	177
v/s Ratio Prot	0.00	c0.50		0.13	0.16		0.02	0.01	c0.41	c0.07	0.05	
v/s Ratio Perm			0.08			0.01			0.13			0.00
v/c Ratio	1.20	1.85	0.31	0.36	0.25	0.01	0.16	0.10	1.11	0.63	0.46	0.04
Uniform Delay, d1	63.3	46.1	36.7	29.0	9.7	8.2	50.6	50.3	32.6	53.4	52.3	49.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	488.2	385.2	1.9	0.2	0.2	0.0	1.8	0.6	61.2	5.8	0.8	0.1
Delay (s)	551.5	431.3	38.5	29.2	9.9	8.2	52.5	50.9	93.8	59.2	53.1	49.8
Level of Service	F	F	D	C	A	A	D	D	F	E	D	D
Approach Delay (s)		406.8			16.7			92.2			54.7	
Approach LOS		F			B			F			D	

Intersection Summary			
HCM Average Control Delay	214.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.28		
Actuated Cycle Length (s)	126.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	123.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	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	0.91	1.00	0.97	0.91	0.97	0.76
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	5085	1583	3433	5085	3433	3610
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	5085	1583	3433	5085	3433	3610
Volume (vph)	3580	136	422	970	558	1751
Peak-hour factor, PHF	0.94	0.94	0.89	0.89	0.88	0.88
Growth Factor (vph)	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	3999	152	498	1144	666	2089
RTOR Reduction (vph)	0	48	0	0	0	0
Lane Group Flow (vph)	3999	104	498	1144	666	2089
Confl. Peds. (#/hr)					1	
Turn Type		Perm	Prot			pm+ov
Protected Phases	6		5	2	4	5
Permitted Phases		6				4
Actuated Green, G (s)	48.6	48.6	24.5	76.7	25.5	50.0
Effective Green, g (s)	50.6	50.6	24.0	78.6	24.5	48.5
Actuated g/C Ratio	0.46	0.46	0.22	0.71	0.22	0.44
Clearance Time (s)	6.0	6.0	3.5	5.9	3.0	3.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	2316	721	742	3597	757	1706
v/s Ratio Prot	c0.79		0.15	0.22	0.19	c0.26
v/s Ratio Perm		0.07				0.31
v/c Ratio	1.73	0.14	0.67	0.32	0.88	1.22
Uniform Delay, d1	30.2	17.6	39.9	6.1	41.9	31.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	328.8	0.1	2.4	0.2	11.4	106.5
Delay (s)	359.1	17.7	42.3	6.4	53.3	137.8
Level of Service	F	B	D	A	D	F
Approach Delay (s)	346.6			17.3	117.4	
Approach LOS	F			B	F	

Intersection Summary			
HCM Average Control Delay	209.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.47		
Actuated Cycle Length (s)	111.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	122.2%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Appendix E – Public Outreach Process

Willow Road/University Avenue
Traffic Study

City/County Association of Governments of San Mateo County
In coordination with the Cities of East Palo Alto and Menlo Park

April 21, 2010 and April 22, 2010
July 14, 2010 and July 21, 2010
Informational Open House Meetings
Summary Report

August 2010

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Appendices

Chapter 1 Introduction

1.0 Introduction

This report provides a summary of the informational open house meetings held in April 2010 and July 2010 as part of the Willow Road/University Avenue Traffic Study. This report also provides a brief project overview, meeting notification, meeting descriptions, and summary of public comments provided at the meetings.

1.1 Project Background

The City/County Association of Governments of San Mateo County (C/CAG) initiated the Willow Road/University Avenue Traffic Study to evaluate traffic operation improvement options on the segments of Willow Road and University Avenue located between US 101 and the Bayfront Expressway. These traffic segments are located in the City of Menlo Park and City of East Palo Alto. This evaluation of potential traffic system management strategies was identified as one of the priority projects in the 2020 Peninsula Gateway Corridor Study.

The purpose of the traffic study is to assess existing traffic conditions and operations, establish operational improvement strategies and make recommendations to address congestion and safety issues within the study area. Examples of potential solutions include signal synchronization and coordination with Caltrans signals, dedicated right-turn pockets (called "tapers") at key intersections, pedestrian countdown signals, or other methods to improve the safety of drivers, pedestrians and bicyclists.

1.2 The Outreach Process

The C/CAG, the Cities of East Palo Alto and Menlo Park, and the project team worked in close coordination on all outreach materials and activities. The outreach approach centers around two sets of public meetings that encourage community involvement in the traffic study to help develop and refine potential improvement options.

The first round of public meetings focused on existing conditions and problem identification. The goal was to describe existing conditions in the study area, present potential improvements options, and explain the traffic study process and next steps for refining the improvement options. Members of the public were invited to provide input on existing traffic issues and priorities for improvement implementation.

The second round of public meetings, held after the technical studies had been completed, presented the proposed alternatives and solicited feedback. These meetings presented updated information on the traffic study and technical reports, presented the refined project alternatives and any potential impacts and proposed mitigation measures, and explained the next steps for implementation. At these meetings, the public was asked to identify any impacts in surrounding neighborhoods, and to help inform the development of the preferred alternatives and mitigation measures to be included in the draft and final report.

Chapter 2 Public Meetings: Existing Conditions

2.0 Announcement of the Open House and Public Workshop

Local residents, elected officials and other interested parties were notified of the open house meeting through a variety of methods:

Press Release – On April 4, 2010, the C/CAG distributed a press release about the informational open houses to newspapers, radio stations and local TV stations.

Direct Mail Postcard – On April 6, 2010, a postcard announcing the informational open house meetings was mailed to all individuals on the project mailing list. In total, more than 1,400 notifications were sent. Postcards provided basic project information, a brief explanation of the purpose of the meetings and encouraged recipients to participate. All written elements of the postcard appeared in both English and Spanish.

Letters to Elected Officials – The cities of East Palo Alto and Menlo Park sent letters on April 7, 2010 to elected officials to formally announce the traffic study and provide notice about the informational open house meetings. Letters were sent to local, state and federal elected officials.

E-mail Notice – The cities of East Palo Alto and Menlo Park sent e-mails in early April to their respective stakeholder lists. The e-mail provided basic project information, a brief explanation of the purpose of the meetings, a list of potential near-term traffic improvements under consideration, and a call to email recipients to participate in the meetings. All written elements of the e-mail appeared in both English and Spanish.

2.1 Format of the Open House Meetings

The Cities of East Palo Alto and Menlo Park each hosted an informational open house during the week of April 19, 2010. The same informational materials and personnel were made available at each meeting. Legislators, supervisors, council members, and representatives of interested local, state and federal agencies, civic groups, and the general public were informed and invited to attend.

The first meeting was held on April 21, 2010 in East Palo Alto, from 6:45 p.m. to 9:30 p.m. at the East Palo Alto City Hall (2415 University Avenue in East Palo Alto). The meeting opened with a 45-minute open house and was followed by a regularly scheduled Public Works/Transportation Commission meeting, which included a presentation and public discussion of the traffic study.

The second meeting was held on April 22, 2010 in Menlo Park from 6:30 p.m. to 8:00 p.m. at the Menlo Park Senior Center (100 Terminal Avenue in Menlo Park). Beginning with an open house, the meeting featured a presentation from the project team at 7:00 p.m. followed by a public discussion of the traffic study.

A total of approximately 10 members of the community and other interested parties attended the two open house meetings. The East Palo Alto Transportation Commission also participated in the East Palo Alto Meeting. At the meetings, participants were provided an agenda and comment sheets. Large poster board exhibits were provided to offer information to the group of attendees

during the open house portion of the meeting. The project team also facilitated a PowerPoint presentation with in-depth information on the project, after which question and comments were taken (a copy of the PowerPoint presentation is included in *Appendix A*).

2.2 Open House Exhibits

The informational exhibit boards at the informational open house are described below. The same exhibit boards were shown at each meeting.

2.2.1 Station 1: Sign-in

Attendees were asked to sign in so that staff could maintain an attendance record and ensure that all interested parties were added to the project mailing list. Each attendee was given a program which listed the agenda. Staff explained the format of the meeting, and attendees were encouraged to ask questions of the project team in attendance. Comment sheets were available for attendees to submit comments in writing.

2.2.2 Station 2: Potential Near-Term Improvements Map (Line Drawing Map)

The project team developed a 24 x 36 inch poster board displaying a line-drawing map of the study area. The map highlighted five potential tactics to improve traffic operations in the area and marked which specific intersections were under consideration as part of the study.

2.2.3 Station 3: Willow Road Map (Satellite Map)

The project team used satellite mapping images of Willow Road to highlight specific intersections of concern and provide greater visual context on the area for study.

2.2.4 Station 4: University Avenue Map (Satellite Map)

The project team used satellite mapping images of University Avenue to highlight specific intersections of concern and provide greater visual context on the area for study.

2.3 Presentation

An brief informational presentation was given by the project team at each meeting to provide background information, define the study, gather feedback on existing conditions, discuss various improvement options and explain the project's next steps. The same informational presentation was given at each meeting (a copy of the presentation is included in *Appendix A).*

2.4 Personnel on Hand

The following personnel set up and conducted the meetings and were available to answer questions from the public.

- East Palo Alto: Brent Butler, Kamal Fallaha,
- Menlo Park: Rene Baile
- C/CAG of San Mateo: John Hoang
- Project Team: Joy Bhattacharya, Meghan Daniels, Rich Haygood

2.5 Results of the Input Process

At the two open house meetings, participants were encouraged to provide input on existing traffic conditions and on the options currently under consideration to address congestion and improve safety in the corridor and adjacent streets. Written comments were collected on comment cards submitted at the meeting. Between the two meetings, a total of 3 written comments were submitted. Verbal comments were also collected, both during conversation with open house participants and during the question/comment session held after the presentation portion of each meeting.

Comments were also accepted by mail or e-mail to C/CAG through April 29, 2010. One additional comment was submitted at a later date.

A summary of the written and verbal comments provided at the two meetings is provided below. Comments have been separated into general topic areas. This summary is not a transcript of the comments received; instead it summarizes the major issues and ideas provided by participants.

2.6 Summary of Input

At the East Palo Alto meeting, participants were primarily concerned that improvement to University Avenue should not negatively impact the residents in favor of providing improved traffic flow for commuters. Many participants commented that improvements to bicycle and pedestrian facilities are vital to improving safety and recreational opportunities to the community. In particular, longer pedestrian crossing time, flashing warning lights and prohibiting free right turns were key improvement suggestions. Specifically, the intersection at University Avenue and Donohoe Street, the off-ramp at Donohoe and the Highway 101 overcrossing are all critical to creating a safe interconnected bicycle/pedestrian corridor.

At the Menlo Park meeting, participants were primarily concerned about traffic congestion due to Highway 101 and Bayshore Freeway intersections on Willow Road. Red light violation traffic cameras as well as caution signs were proposed to help relieve congestion and reduce traffic accidents. In addition, a representative from the Menlo Business Park commented on the need to improve traffic circulation, especially during commuting hours, by coordinating traffic signals.

2.7 Summary of Comments, Organized by Topic

Pedestrian & Bicycle Concerns

- Question: What level of pedestrian traffic warrants midblock in-pavement pedestrian crosswalks? Will implementation of lights be bound by Caltrans standards, if proposed on Caltrans right-of-way?
- Consider restricting free flowing right turns off of Highway 101, as it is important to protect pedestrians crossing at that intersection
- Implement pedestrian crossing lights at Highway 101 northbound off-ramp to University Avenue.

- Improve bicycle and pedestrian access on roads to University to increase safety and reduce automobile dependency
- Need to provide traffic calming mechanisms on the adjacent school streets
- Need for a forced stop or pedestrian flashing warning lights at intersections where there are no traffic signals
- Consider implementing a "numbered seconds" countdown pedestrian signal heads at crosswalks
- Make sidewalks wheelchair and stroller accessible, especially on the Highway 101 overcrossing
- Consider installing a barrier between the road and pedestrian/bicycle lane on the Highway 101 overcrossing
- The existing condition is such that pedestrians do not have enough time to cross the intersection at Donohoe Street /University Avenue (near IKEA). Need to change timing on light to allow pedestrians more time to cross
- The existing pedestrian crossing at IKEA from University Avenue/Donohoe Street intersection is dangerous due to vehicles making a free-right onto University and not yielding to pedestrians in the crosswalk
- The existing off-ramp at Donohoe Street is dangerous for pedestrians to cross

Cut-Through and Commuter Traffic

- Question: What percentage of traffic is local traffic, versus commuter traffic?
- Need to discourage commuter traffic at Bay Shore and Embarcadero
- Consider diverting traffic from University Avenue to Willow Road
- Consider the impacts of improved traffic flow on encouraging commuter traffic
- The existing traffic conditions indicate a lack of respect by commuters for the local residents and impacts from cut-through traffic

Access Concerns

- Maintain left turns off University Avenue, as these left turns serve the residents. Prohibiting left turns would create a negative impact on the community
- Question: How can you fit right turn pockets in the existing footprint? Would you widen the street or narrow the lanes? ROW acquisition would not be supported
- Consider that improvements to the University/Runnymede intersection will be difficult due to access requirement at the fire station. This may change due to the fire station remodel

Other Existing Impacts

- Narrowing Willow Road for bike lanes, landscaping and traffic calming measures on the west side of US 101 has displaced traffic onto the freeway
- Traffic on University Avenue has adverse air quality impacts on the residents' health
- The light at Obrien turns green when there is not a vehicle at the intersection; consider an adaptive light during non-peak hours

- There are a number of accidents on University Avenue at Runnymede in front of the fire station
- Cars are often stopped at green lights due to upstream traffic; consider changing the signal coordination as the first improvement. This is particularly an issue along University Avenue adjacent to Highway 101
- The three stop lights at IKEA are too close together making it difficult to drive and dangerous; consider removing one
- Capitol/Donohoe Street and Highway 101 traffic compete with each other at the intersection, which leads to vehicles in the intersection when the light turns red
- The Capitol/Donohoe Street and Highway 101 area is confusing for motorists, as lane status changes without clear lane demarcation
- University Avenue and Willow Road appear to act as a bottleneck to bridge traffic
- The Chevron at University and 101 causes congestion for cars traveling north on Donohoe
- The existing cross-traffic lights at Newbridge and Willow, as well as at University and Bell, are held red for too long. Consider lowering the duration of the red light

Study-Related Questions or Concerns

- Question: Where is the project funding coming from for the proposed project?
- Gather input from Oracle and Sun Systems
- Place meeting exhibits on the City web site
- Clarify whether the purpose of the study is to improve residents' safety or facilitate commuter traffic getting to Highway 101
- Ensure that this project does not "undo" the traffic improvements that resulted from the previous traffic study (10 years prior) that lessened cut-through traffic
- Consider conducting a traffic study including Palo Alto, especially Embarcadero
- Provide exiting and near term conditions report to the transportation commission
- Provide information on which intersections are controlled by Caltrans
- Need to enact improvements at intersections that have congestion/operational deficiencies, not just those with high accident counts
- Ensure that Caltrans recognizes the local community on stop light issues and works with the City to coordinate stop lights, especially during commuting hours
- Ease concerns that Caltrans will not be responsive to suggested improvements
- Implement simple fixes first to build community confidence
- Consider the existing business driveways, minor road intersections and access management solutions along University Avenue
- The two sides of Highway 101 are inextricably linked; it is difficult to improve traffic on one side without considering the other side
- Traffic stifles growth and development in Menlo Park because of existing access issues

Specific Improvement Suggestions

- Need to reduce northbound traffic congestion on Highway 101 at the Willow Road exit
- Need caution signs to warn drivers exiting off the bridge at University and Highway 101 to slow down for the upcoming stop sign and traffic queue
- Implement red light violation traffic cameras are at University Avenue and Bayshore Freeway
- Need police enforcement of red light violators
- Need to train law enforcement to stop trucks over 6500 lbs from using University Avenue
- Need to lower traffic speeds on University Avenue
- Need to recognize improvement feasibility; prohibiting left turns appears to be a simple signal adjustment, which would be easy to implement
- Need to recognize source of traffic congestion; most congestion on the East Bay Shore Road crossing over Highway 101 to University Avenue/Donohoe Street could be alleviated by proper signal timing
- Consider a congestion management fee, specifically a part of the Dumbarton Bridge toll given the commuter impacts on the local community in East Palo Alto
- Need lighting upgrades on University Avenue
- Consider implementing green, solar powered signal equipment
- Consider implementing signal synchronization before the entire project report is approved by councils
- Consider installing an adaptive signal system to operate during non-peak hours and a synchronized system during peak hours
- Consider a high cost adaptive signal system as that will lower long term costs as future traffic studies and fixes will not be needed

Other Comments/Considerations

- Consider the development along Marsh Road, as the first phase of hotels and office space will be implemented within five years and impact traffic
- Send video footage of the traffic study corridor drive-through to the transportation commission
- Need to consider how University Avenue will function as a life line for disaster preparedness as it is a major route for East Palo Alto residents
- Need for regional transportation connections
- Need for improvements for increased traffic, as traffic will increase when the economy improves
- Consider whether the City of East Palo Alto should petition Caltrans for ownership of University Avenue
- Consider making Route 84 a historic road as a tourist attraction

♦

Chapter 3 Public Meetings: Proposed Alternatives

3.0 Announcement of the Open House and Community Meetings

As with the previous set of meetings, local residents, elected officials and other interested parties were notified of the open house meetings through the same variety of methods:

Press Release – On July 7, 2010, the C/CAG distributed a press release about the informational open houses to newspapers, radio stations and local TV stations.

Direct Mail Postcard – On June 25, 2010, a postcard announcing the informational open house meetings was mailed to all individuals on the project mailing list. In total, approximately 500 notifications were sent. Postcards provided basic project information, a brief explanation of the purpose of the meetings and encouraged recipients to participate. All written elements of the postcard appeared in both English and Spanish.

Letters to Elected Officials – The cities of East Palo Alto and Menlo Park sent letters on July 6, 2010 to elected officials to formally announce the traffic study and provide notice about the informational open house meetings. Letters were sent to local, state and federal elected officials.

E-mail Notice – The cities of East Palo Alto and Menlo Park sent e-mails in early July to their respective stakeholder lists. The e-mail provided basic project information, a brief explanation of the purpose of the meetings, a list of potential near-term traffic improvements under consideration, and a call to email recipients to participate in the meetings. All written elements of the e-mail appeared in both English and Spanish.

3.1 Format of the Open House and Community Meetings

As with the previous set of meetings, the Cities of East Palo Alto and Menlo Park each hosted an informational open house. However, during this round of meetings, the open house was presented at transportation commission meetings during mid-July 2010. The same informational materials and personnel were made available at each meeting.

The first meeting was held on July 14, 2010 in Menlo Park from 6:30 p.m. to 8:30 p.m. at the Menlo Park City Council Chambers (801 Laurel Street in Menlo Park). Beginning with a 30-minute open house, the meeting featured a presentation to the transportation commission from the project team at 7:00 p.m. followed by a public discussion of the traffic study.

The second meeting was held on July 21, 2010 in East Palo Alto, from 7:30 p.m. to 10:30 p.m. at the East Palo Alto City Hall (2415 University Avenue in East Palo Alto). The meeting took place during a regularly scheduled Public Works/Transportation Commission meeting and included a presentation and public discussion of the traffic study.

A total of approximately 12 members of the community and other interested parties attended the two community meetings, in addition to the members of each city's transportation commission. As

at the previous set of meetings, participants were provided with comment sheets. A large poster board exhibit was provided to offer information to the group of attendees during the open house portion of the meeting. The project team also facilitated a PowerPoint presentation with in-depth information on the project (a consolidated copy of the presentations is included in *Appendix B*), after which question and comments were taken.

3.2 Open House Exhibits

An informational exhibit board that described the project area was made available at each meeting. The same board was shown at each meeting.

3.3 Presentation

An informational presentation was given by the project team at each meeting to provide background information, define the study, discuss various improvement options and explain the project's next steps. The presentation was tailored to focus on the intersections in the city receiving the information (a consolidated copy of the presentations is included in *Appendix B).*

3.4 Personnel on Hand

The same personnel that were available at the previous set of meetings also led this set of meetings. As such, the following personnel set up and conducted the meetings and were available to answer questions from the public.

- East Palo Alto: Brent Butler, Kamal Fallaha
- Menlo Park: Rene Baile
- Project Team: Rich Haygood, Joy Bhattacharya, Meghan Daniels (MP) or Samantha Robinson (EPA)

3.5 Results of the Input Process

At the two open house meetings, participants were encouraged to identify any impacts in surrounding neighborhoods and to offer feedback on preferences in the development of the preferred alternatives and mitigation measures to be included in the draft and final report. Written comments were collected on comment cards submitted at the meeting. Between the two meetings, a total of 1 written comment was submitted. Verbal comments were also collected, both during conversation with open house participants and during the question/comment session held after the presentation portion of each meeting.

Comments were also accepted by mail or e-mail to C/CAG through July 31, 2010. No further comments were submitted at a later date.

A summary of the written and verbal comments provided at the two meetings is provided below. Comments have been separated into general topic areas. This summary is not a transcript of the comments received; instead it summarizes the major issues and ideas provided by participants.

3.6 Summary of Input

At the East Palo Alto meeting, much like at the previous meeting, participants were primarily concerned that improvements should not negatively impact the residents in favor of providing improved traffic flow for commuters. Most participants expressed some level of support for signal synchronization. There were concerns about the expense and value of bicycle detectors. Most participants expressed concerns regarding impacts of all options for University and Cooley, and for Willow and Newbridge. Regarding cut-through traffic on Donohoe at University and Capitol, participants expressed concerns at the cost, proposed lane narrowing, and the perceived source of the traffic. Participants also indicated that the metering light at the freeway entrance may have impacts on traffic that were not captured in the study.

At the Menlo Park meeting, participants were primarily concerned about pedestrian and bicycle conflicts with traffic. Participants largely expressed support for traffic signal coordination, pedestrian crossing signals and potentially a bike lane a Newbridge, and ensuring that cross-traffic from adjacent communities crossing Willow will not be impacted by any changes. Bayfront Options 1 and 2 both caused some concerns: Option 1 with lane change operations and Option 2 with pedestrian/bike conflicts. Participants expressed concerns with bicycle detectors causing delays and lane delineators blocking pedestrians at Willow. Participants expressed concerns regarding project timeframe and the impacts on construction on businesses.

3.7 Summary of Comments, Organized by Topic

Pedestrian & Bicycle Concerns

- Note that there are conflicts with bicycles and traffic from eastbound Highway 101 traffic; consider adding flashing lights at the University intersection
- Ensure improvement options will not cause an additional delay for bicycle traffic
- Consider camera detectors instead of pavement detectors for bicycles
- Note that there are concerns about the impact of delineators on pedestrian access, particularly with children crossing Willow to get to school
- Consider installing a delineator next to the bicycle lane
- Implementing bicycle detectors is expensive; in East Palo Alto, demand may not be high enough to merit the cost
- Place clear signage to explain any bicycle detectors

Traffic Signal Synchronization

- Coordinate traffic signalization on all of Willow Road, including Willow Road outside the study area, and consider coordination along University
- Clarify the cost and funding source for signal coordination
- Consider synchronization along the roads parallel to University
- Ensure that traffic signal synchronizations does not impact cross-traffic or pedestrians attempting to cross University

- Note that traffic synchronization should help at the Donohoe and University/Capitol intersections

Other Impacts

- Concern that the widening of Willow Road would require significant construction activities that will impact communities and businesses
- Need to ensure these options will not impact cross traffic from adjacent communities trying to cross Willow
- Consider the impacts of queuing at metered entrances to the freeway, as traffic will remain backed-up onto the access roads

Study-Related Questions or Concerns

- Question: Where is the project funding coming from for the proposed project?
- Question: The Willow Avenue / Highway 101 interchange has been listed as being redesigned as a potential full diamond interchange. Is this being considered as a near term improvement in this study?
- Question: What is meant by "near-term" improvement?

Specific Improvement Suggestions

Willow Rd. & Newbridge

- Consider a bicycle lane for Option 2
- Need to know how many vehicles make left turns from Highway 101 to Newbridge in order to make a decision about preventing the left turn
- Consider additional storage on Highway 101 ramp
- Consider providing a pedestrian crossing signal light at Newbridge
- Adding delineators would create significant impacts for residents as there are not many through-streets in this area
- Consider eliminating the left turn from Willow in favor of forcing a U-turn later on Willow, so that cars would return and have a longer queue

Bayfront

- Do not consider Bayfront Option 2 due to bicycle/pedestrian conflicts with traffic
- Concern that Bayfront Option 1 will force bicycles to activate a signal and will cause bicycle delays
- Concern that Bayfront Option 1 with three lanes will result in difficult lane change operations to get left to go north on Bayfront from Willow

University & Cooley

- Concern that Option 3 does not seem like it would have much impact
- Concern that other options do not seem to benefit the community

Donohoe & University; Donohoe & Capitol

- Concern that the additional left-turn pocket does not ease the source or site of congestion
- Concern that traffic is congested here because people exit the freeway at Bayshore, then take surface streets to reach their final destinations
- Consider adding a sign that clearly indicates lane status; much of the congestion is due to confusion regarding which lanes turn and which are through-lanes. Consider adding an overhead sign that indicates lane status
- Consider greater code enforcement at this intersection
- Removing the median might allow a longer dedicated left-turn lane
- If legal, post a sign indicating the price of a traffic ticket for blocking the intersection
- Note that truck drivers prefer the existing 12' lanes to the proposed 10' lanes

University & Runnymede

- Question: Why do so many people have accidents with the fence on the property across from the fire station?
- Support making the fire station safer, improving access and implementing four-way stop lights when emergency vehicles need to use the intersections

♦

Chapter 4: Next Steps

C/CAG, in cooperation with the Cities of East Palo Alto and Menlo Park, will incorporate all public comments to help refine and select the preferred improvement options. After the analysis has been completed, the project team will present the preferred improvement options at City Council meetings this fall and solicit feedback on the options.

The community and other interested parties can contact the appropriate city staff member at the phone number listed below with any questions about the traffic study and proposed improvements.

- East Palo Alto: Kamal Fallaha, (650) 853-3117 or kfallaha@cityofepa.org
- Menlo Park: Chip Taylor, (650) 330-6771 or CWTaylor@menlopark.org

APPENDICES

Appendix A – Public Meetings: Existing Conditions Presentation

WELCOME

Willow Road/University Avenue Traffic Study

Community Meeting
April 21, 2010
East Palo Alto

WELCOME

Willow Road/University Avenue Traffic Study

Community Meeting
April 22, 2010
Menlo Park

Public Meeting Agenda

- Welcome and Introductions
- Meeting Purpose
- Study Overview
- Study Process and Schedule
- Question and Answers
  - Hear comments related to the traffic study
  - Verbal and submitted written comments will be documented in a meeting summary report

Introductions

- Study Team and Partners
  - City/County Associate of Governments of San Mateo County (C/CAG)
  - Metropolitan Transportation Commission (MTC)
  - City of East Palo Alto
  - City of Menlo Park
  - Caltrans
  - Study Team

Purpose of the Meeting

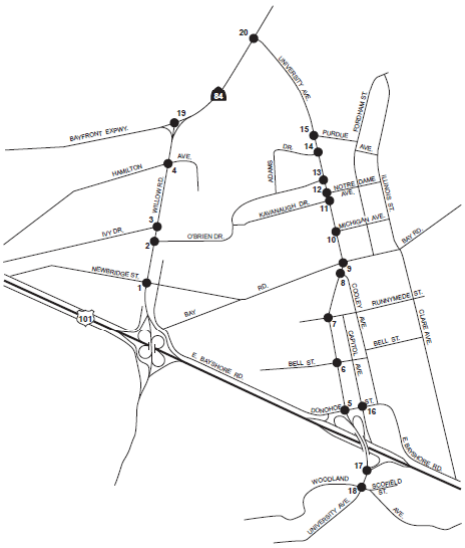
- Learn about the traffic study purpose
- Provide input on existing traffic concerns on Willow Road and University Avenue
- Discuss potential solutions with the study team
- Learn about the next steps in the study process

Study Overview

- The purpose of the study is to identify near-term improvements to:
  - Improve traffic operations and congestion for vehicles and transit along Willow Road and University Avenue between US 101 and the Bayfront Expressway
  - Improve safety for automobiles, pedestrians and bicyclists
  - Improve pedestrian and bicycle connectivity

Study Overview

- Study area
- Traffic analysis
- Bicycle and pedestrian analysis



Study Overview

- Potential improvements include:
  - Turn restrictions such as prohibiting left turns during peak traffic periods
  - Dedicated right-turn pockets (tapers) at intersections along Willow Road and University Avenue
  - Pedestrian crossing warning lights to improve safety for pedestrians and bicyclists
  - Improve coordination of traffic signal timing sequence between intersections

Study Process and Schedule

- Collect data, analyze and document existing conditions and needs
  - Existing and Near Term Analysis – 2/10
- Develop potential improvements and identify impacts
  - Solicit community input – 4/10
- Develop preferred alternatives
  - Technical Memorandum – 6/10
- Present Draft and Final Reports to City Councils
  - Council meetings – 7/10

Public Comments

- Open House
  - Input provided during the open house will be documented
- Questions and Answer Session
  - Attendees are invited to ask questions of the study team during the Q & A session
- Written Comments
  - Comments may be submitted today at the close of this meeting

Stay Involved

Please submit written comments today, or mail by **April 29, 2010** to:

Kamal Fallaha, City Engineer
East Palo Alto City Hall
2nd Floor - 2415 University Ave
East Palo Alto, CA 94303

Tel: 650-853-3100

E-mail: kfallaha@cityofepa.org

Stay Involved

Please submit written comments today, or mail by **April 29, 2010** to:

Chip Taylor, Transportation Manager
City of Menlo Park
701 Laurel Street
Menlo Park, CA 94025
Tel: 650-330-6771

E-mail: ctaylor@menlopark.org

Appendix B – Public Meetings: Proposed Alternatives Presentation

WELCOME

Willow Road/University Avenue Traffic Study

Transportation Commission Meeting
July 14, 2010
Menlo Park



WELCOME

Willow Road/University Avenue Traffic Study

Public Works/Transportation Commission Meeting
July 21, 2010
East Palo Alto



Study Overview

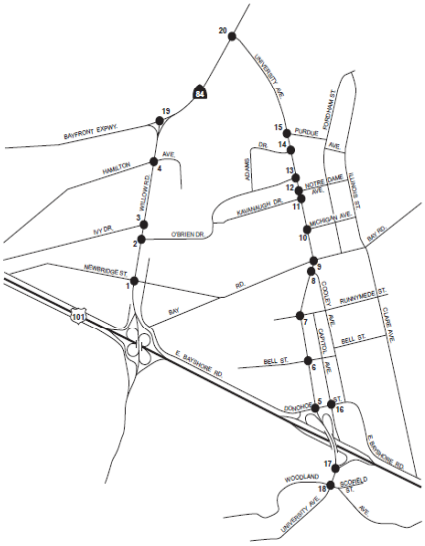
- Product of 2020 Peninsula Gateway Corridor Study
  - Traffic conditions and potential improvement alternatives for roadway connections between US 101 and Bayfront Expressway
  - Phase 1: Comprehensive preliminary study
  - **Phase 2: Identify near-term improvements along Willow Road and University Avenue**
  - Future Phases: Detailed studies of long-term major roadway projects identified in Phase 1

Study Overview

- Purpose - Identify near-term improvements to:
  - Improve traffic operations and congestion along Willow Road and University Avenue between US 101 and the Bayfront Expressway
  - Improve safety for automobiles, pedestrians and bicyclists
  - Improve pedestrian and bicycle connectivity

Study Overview

- Existing Conditions
- Near-Term Conditions
- Improvement Options



Study Overview

- Potential improvements considered include:
  - Improving traffic signal coordination between intersections
  - Adding or extending length of turn lanes/pockets at intersections
  - Modifying lane configurations and/or signal phasing

Study Overview

- Potential improvements considered (cont'd):
  - Adding pedestrian crossing warning lights to improve safety for pedestrians and bicyclists
  - Adding signal control devices to improve access for pedestrians, bicyclists, and emergency vehicles

Existing Conditions Analysis

- Data Collection – *Counts, Travel Time, Video, etc.*
- Level of Service Analysis – *AM & PM Peak Hour*
- Collision Analysis

Near-Term Conditions Analysis

- Level of Service Analysis – *AM & PM Peak Hour*
- System-wide Improvements
- Options for Individual Locations

Existing Level of Service (LOS)

Long-Delay Locations

Location	Control	AM Peak LOS	PM Peak LOS
Willow Road / Newbridge Street	Signal	E	E
Willow Road / Bayfront Exprswy	Signal	B	F
University Avenue / Donohoe Street	Signal	D	D (53.7 sec.)*
University Avenue /Michigan Avenue	Side Street Stop Sign	C	F
University Avenue / Adams Drive	Side Street Stop Sign	F	F
University Avenue / Purdue Avenue	Side Street Stop Sign	E	F

* Delay approaching 55 seconds = LOS E threshold

Existing Collision Rate Analysis

Locations with higher than average collision rates:

- Willow Road / Newbridge Street
- University Avenue / Donohoe Street
- University Avenue / Bell Street
- University Avenue / Runnymede Street

Near-Term LOS Conditions –

Long-Delay Locations

Location	Control	AM Peak LOS	PM Peak LOS
Willow Road / Newbridge Street	Signal	F	F
Willow Road / Bayfront Exprswy	Signal	C	F
University Avenue / Donohoe Street	Signal	D (51.3 sec.)*	E
University Avenue /Michigan Avenue	Side Street Stop Sign	C	F
University Avenue / Adams Drive	Side Street Stop Sign	F	F
University Avenue / Purdue Avenue	Side Street Stop Sign	E	F

* Delay approaching 55 seconds = LOS E threshold

Prior Public Outreach Meetings

- East Palo Alto – April 21
- Menlo Park – April 22
- Purpose of Meetings
  - Learn about study goals
  - Provide input on existing traffic concerns on Willow Road and University Avenue
  - Discuss potential solutions with study team
  - Learn about next steps in study process

Signal Timing Improvements

- **Issues:**
  - Not all signals are currently coordinated
  - Cycle lengths differ for some intersections
  - Interrupted flow, long queue lengths and increased delays
- **Improvements:** Signal timings and sequential coordination for all study intersections will be optimized using a uniform cycle length

Travel Time Results

- Travel times estimated from Synchro model with and without optimization of signal timings along Willow Road corridor:

Corridor	A.M. Peak (Minutes:Seconds)			P.M. Peak (Minutes:Seconds)		
	Before Improvement	After Improvement	Difference	Before Improvement	After Improvement	Difference
Eastbound Willow Road	3:03	3:10	+0:07	**5:57**	**3:22**	**-2:35**
Westbound Willow Road	**5:41**	**4:01**	**-1:40**	4:33	3:51	-0:42

0:00 (Bold) = Peak traffic flow direction travel times

Travel Time Results

- Travel times estimated from Synchro model with and without optimization of signal timings along University Avenue corridor:

Corridor	A.M. Peak (Minutes:Seconds)			P.M. Peak (Minutes:Seconds)		
	Before Improvement	After Improvement	Difference	Before Improvement	After Improvement	Difference
Eastbound University Avenue	7:11	6:37	-0:34	**9:20**	**8:47**	**-0:33**
Westbound University Avenue	**6:30**	**5:16**	**-1:14**	6:43	6:13	-0:30

0:00 (Bold) = Peak traffic flow direction travel times

System-Wide Improvements

- Pedestrian Countdown Signals
  - Pedestrian safety enhancement – *Display remaining crossing time*
- Bicycle Detectors and Markings
  - Reduce signal delay and improve convenience for bicyclists
  - Improve bicyclist safety
- Emergency Vehicle Pre-emption
  - Existing on Willow Road at all signals, and on Newbridge Street and Bayfront Expressway approaches
  - Recommended on O'Brien Drive, Ivy Drive, Hamilton Ave. approaches
  - Benefits
    - Provides safer passage for responding emergency vehicles
    - Improves emergency response times to surrounding community

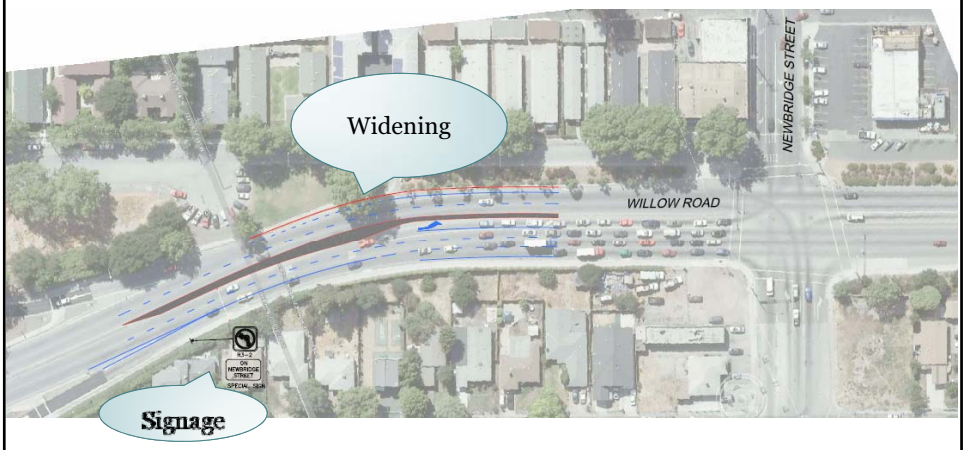
Intersection Operational Improvements

- Based on analysis of existing and near-term conditions
- Two Willow Road intersections identified for potential improvements
- Recommended improvements at each intersection:
  - Sketch plans presented as figures
  - Pros and Cons described

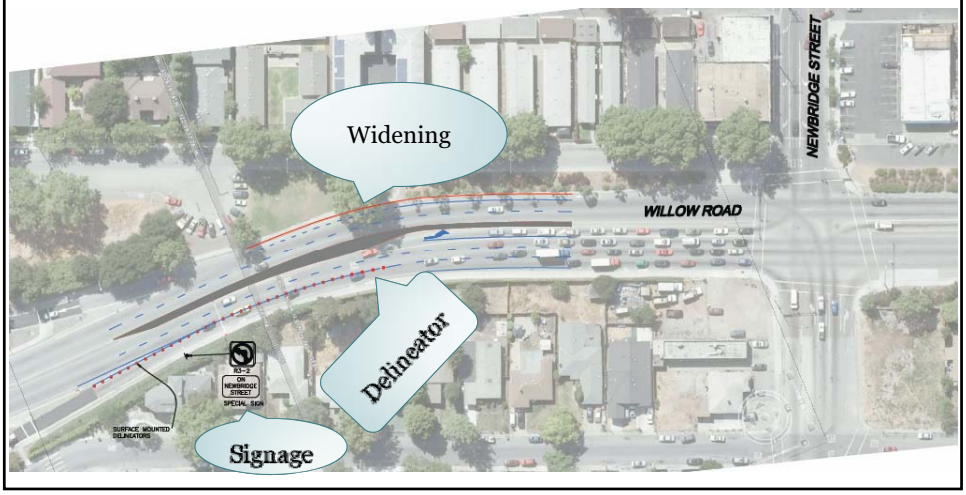
Intersection – *Willow Road & Newbridge Street*

- **Issue:** Traffic exiting from the US 101 Northbound off-ramp and attempting eastbound left turn movement at Newbridge Street
  - Merging and weaving movements with eastbound Willow Road through traffic
  - Queue backup onto freeway off-ramp
  - History of rear-end and sideswipe collisions

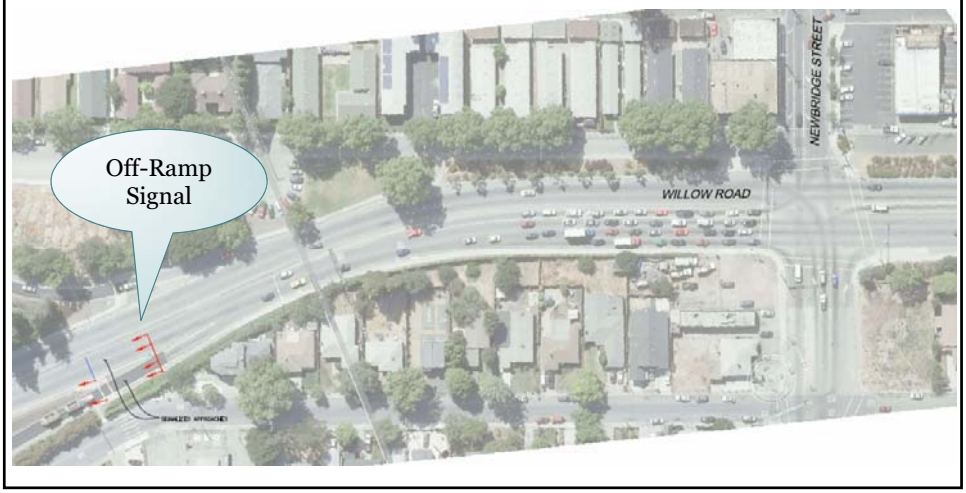
Option 1a: Add Lane from Off-Ramp
Option 1b: 1a plus No Left-Turn Sign



Option 2: Add Lane & Prohibit Left Turn with Delineator Posts



Option 3: Signalize Off-Ramp and Eastbound Willow Road Connection



Pros

Benefit	Option 1a	Option 1b	Option 2	Option 3
Resolve weaving issues and enhance safety			√	√
Reduce collisions due to weaving traffic			√	√
Improve capacity and lane utilization by eliminating forced merge	√	√	√	√
Provide left-turn access at Newbridge Street to traffic from US 101ramp	√			√

Cons

Issue	Option 1a	Option 1b	Option 2	Option 3
Diverts desired left turn at Newbridge to a left or U-turn at Ivy Drive - increasing travel distance		√	√	
Right-of-way issues	√	√	√	
Signal timing coordination with other corridor intersections				√
Requires coordination with Caltrans due to modifications at US 101 freeway exit ramp	√	√	√	√√
Must ensure that traffic on the off-ramp will not back up and impact US 101 northbound freeway				√√

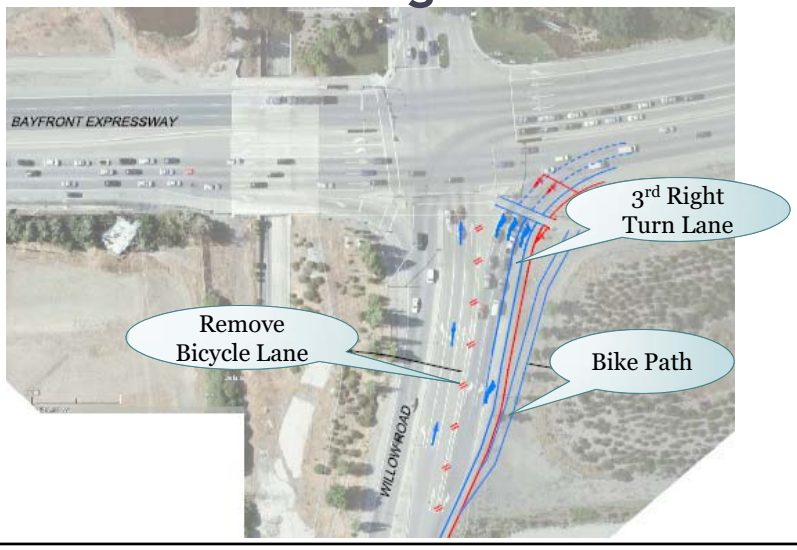
Cost Estimates

Option 1a/1b	Option 2	Option 3
$260,000	$265,000	$170,000

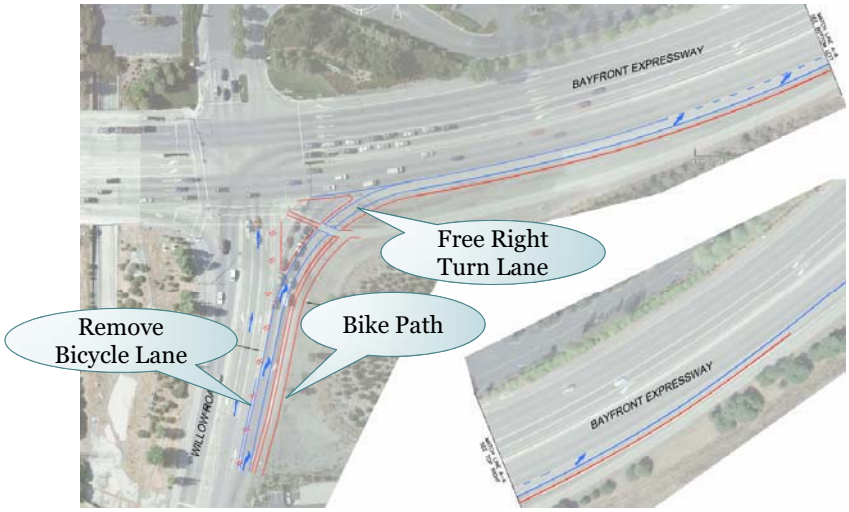
Intersection – *Willow Road & Bayfront Expressway*

- **Issues:**
  - Existing LOS F during the P.M. peak hour
  - Eastbound Willow Road – *long queues and delays for right turn conflicts with through lane and bicycle lane*
  - Delays will further increase in the near term

Option 1: Third Right Turn Lane



Option 2: Free Flow Right Turn



Pros

Benefit	Option 1	Option 2
Provides additional capacity for right-turn from eastbound Willow Road	√	√
Provides free flow movement for right-turn from eastbound Willow Road		√
Improves operation efficiency and reduces delay at the intersection	√	√
Emissions are also reduced	√	√
Better bicycle connection to Bay Trail and Dumbarton Bridge	√	

Cons

Issue	Option 1	Option 2
Requires coordination with Caltrans for modifications at Bayfront Expressway	√	√
Wetlands Coordination and possible right-of-way acquisition	√	√
Pedestrians and bicyclists must cross free right-turn traffic flow to continue along Bay Trail to/from Dumbarton Bridge		√√

Cost Estimates

Option 1	Option 2
$475,000	$950,000

Intersection Operational Improvements

- Based on analysis of the existing and near-term conditions
- Three University Avenue intersections identified for potential improvements
- Recommended improvements at each intersection:
  - Sketch plans presented as figures
  - Pros and Cons described

Intersection – *University Avenue & Cooley Avenue*

- **Issue:** Traffic exiting from Cooley Avenue in close proximity to Bay Road
  - Cooley Avenue serves as a cut-through route to avoid University Avenue congestion
  - Queue backup from Bay Road makes it difficult to make right turn out of Cooley Avenue
  - Safety concern due to heavy conflicting pedestrian activity

Option 1

Option 2

Option 3

Pros

Benefit	Option 1	Option 2	Option 3
Eliminates cut-through traffic	√	√	
Reduces pedestrian conflicts	√	√	
Eliminates traffic interruptions on University Avenue	√	√	
Will improve the overall flow of traffic and safety around the area	√	√	

Cons

Issues	Option 1	Option 2	Option 3
Will divert traffic onto adjacent streets	√	√	
Cause inconvenience to local residents	√	√	
Traffic may use Market driveway to access University Avenue	√	√	
Will need additional right-of-way to accommodate the changes		√√	

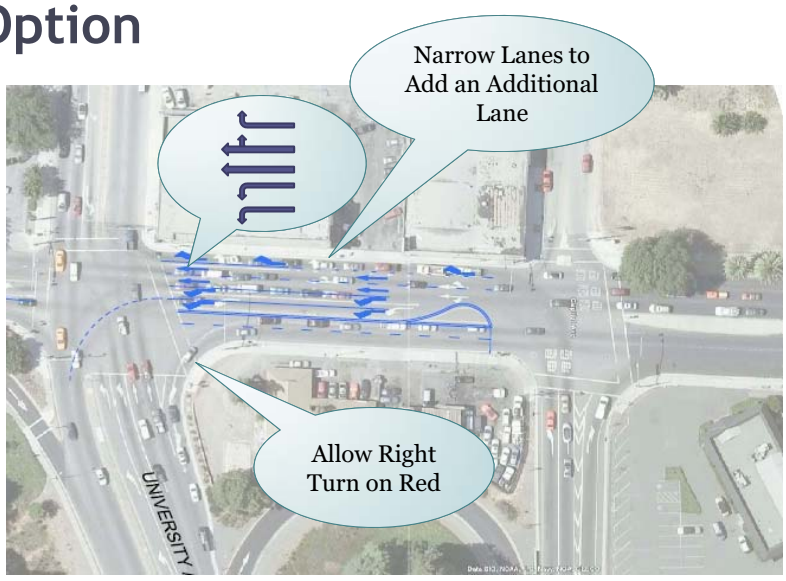
Cost Estimates

Option 1	Option 2	Option 3
$150,000	$1,000,000	$5,000

Intersections: University Avenue & Donohoe Street, Donohoe Street & Capitol Avenue

- **Issues:**
  - Closely spaced intersections
  - Northbound Donohoe St. – *long queues and delays*
  - High collision rates

Option



Pros

- Will allow standard signal phasing at University/Donohoe - Improves capacity and lane utilization on northbound Donohoe
- Reduces intersection delay and queues
- Reduces occurrences of gridlock at Donohoe/Capitol Avenue

Cons

- Lanes narrower than 12 foot standard width on Donohoe Street
- Slight increase in delay at Donohoe Street/Capitol Avenue, LOS C

Cost Estimate

- $40,000

Intersection: University Avenue & Runnymede Street

- **Issues:**
  - Several broadside, rear-end & sideswipe collisions
- **Options:**
  - Install protected left turn signal phase for traffic on University Ave.
  - Provide emergency signal for Fire Station access

Pros

- Protected left turn signal will reduce vehicular and pedestrian conflicts, improving safety
- Improves signal operation and reduces delay for left turners
- Improves Fire Station access safety, emergency response time

Cons

- May slightly increase delay for through traffic on University Avenue during peak periods.

Cost Estimate

- $180,000

Pedestrian Crossings

- In-roadway Warning Lights at
  - University Ave and Michigan Ave
  - University Ave and Sacramento St

- Rumble Strip & Flashing Beacon Sign - US 101 NB off-ramp near University Ave. exit

Rumble Strip & Signage

Pros

- Additional safety for pedestrians crossing University Avenue, US 101 Northbound Off-ramp
- Alerts drivers to look out for pedestrians – Reduce pedestrian-related collisions

Cons

- May create false sense of security for pedestrians crossing University Avenue

Cost Estimates

- In-Roadway Warning Lights (2 locations): $85,000
- Rumble Strip and Signage on US 101 NB Off-ramp: $100,000

Study Process and Next Steps

- Collect data; analyze and document existing conditions and needs
  - Existing and Near-term Analysis – *Completed February 2010*
- Develop potential improvements and identify impacts
  - Solicit community input at public meetings – *Completed April 2010*
- Develop preferred alternatives
  - Solicit input on Improvement Options – *July 2010*
- Present Draft and Final Reports to City Councils
  - Council meetings – *September 2010*
- Final Traffic Study Report
  - Implementation of improvement options – *Determined by available funding and project approval process*

Feedback Requested on Preferred Options

- Transportation Commission Meeting
  - Input provided during the meeting will be documented for incorporation in the Final Report
  - Comments will help refine and identify preferred improvement options

Feedback Requested on Preferred Options

- Questions & Answer Session
  - Attendees are invited to ask questions of the study team during the Q & A session

Your Involvement Is Requested

Please submit written comments today, or E-mail by **July 30, 2010** to:

Chip Taylor, Transportation Manager
City of Menlo Park
701 Laurel Street
Menlo Park, CA 94025
Tel: 650-330-6771

E-mail: ctaylor@menlopark.org

Your Involvement Is Requested

Please submit written comments today, or E-mail by **July 30, 2010** to:

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