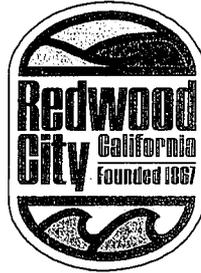


Police Department
Louis A. Cobarruviaz
Chief of Police



1301 Maple Street
Redwood City, CA 94063
Telephone (650) 780-7122
FAX Line (650) 780-7149

October 23, 2008

Department of Transportation
111 Grand Avenue
Oakland, CA 94623
Attention: Robin Pon and R.B. Dantes

Regarding: SR 84 (Woodside and Broadway-Encroachment Permit) Redwood City

Dear Sirs,

In April of 2007, Council members from the City of Redwood City, after public hearings, approved the use of photo red light enforcement. The intersection of Woodside Road (SR84) and Broadway was one of the recommended intersections for photo enforcement by the Council.

The City of Redwood City is requesting an encroachment permit to allow the installation of a red light camera system on Woodside Road at Broadway to enforce red light violations as authorized. The enforcement of red light violations using camera systems is authorized by Section 21455.5 of the California Vehicle Code.

The Redwood City Police Department along with other Police Departments within the County of San Mateo met with Caltrans officials in Oakland on August 27, 2007. Later we were given a list of criteria for the allowance of red light cameras at intersections under Caltrans' jurisdiction. We fully intend to comply with those guidelines (see attached copy). The intersection of Woodside Road and Broadway warrants the installation of a photo enforcement system for several reasons as outlined below.

The Redwood City Police Department is unable to safely enforce red light violations at the intersection of Woodside Road and Broadway. It is based on the configuration of the roadway and the due regard for the safety of other motorists. An officer would have to traverse numerous lanes of traffic against a solid red light to affect a traffic stop on a vehicle already traveling at a high rate of speed. Motorists, traveling in the opposite direction of the violator and officer, would be forced to take evasive actions to avoid a collision.

Collisions at the intersection of Woodside Road and Broadway typically require a minimum of 2-3 officers to conduct the investigation and traffic control needed for this intersection. A traffic accident at this intersection also backs up traffic S/B US 101 when the traffic in the exit lane (south bound US 101 to Woodside Road) can not get through the intersection because of a collision. Time and money is wasted when motorist can not move freely through the intersection due to a careless red light violator, not to mention the important fact of serious danger to other motorist, should they involved in the collision as well.

Photo enforcement provides 24 hour, seven days a-week enforcement. The Redwood City Police Department cannot provide this level of enforcement.

The Redwood City Police Department and Redflex researched the intersection and conducted video surveys. During a 15 hour run time, there were a total of 26 violations detected. Four (4) were left turn violation, thirteen (13) were straight through violations and nine (9) were right turn violations

Collision data provided by our traffic engineering office, confirm a higher rate of accidents than Caltrans' records illustrate (Dec 2004-Nov 2007). In the letter from Caltrans dated August 22, 2008, the records indicate there were 28 collisions in the intersection of Woodside Road and Broadway. Our traffic engineering office collected data indicating the intersection actually had 41 collisions during the above time frame. The accident rate demonstrated 0.66 vs. the statewide average of 0.43. In addition to our traffic engineer's data, the Redwood City Police Department actually shows there were 87 collisions at the intersections. These were the number of collisions we responded to during the same period. The discrepancy in traffic collision could indicate we had some collisions where the parties exchanged names and no report was taken.

I would like to add a quote from a Gary Richards (San Jose Mercury News) story on October 21, 2008 where a Communications Director, with the Governors Highway Safety Association (GHSA) stated; "Their use compliments traditional enforcement and is not a replacement for police officers. We can't have a cop at every intersection." He was speaking about the effectiveness of Red Light Photo Enforcement.

According to the Federal Highway Administration (FHWA), red light running is a national safety problem, resulting in as many as 17,600 injuries and 1,000 fatalities annually and an economic loss estimated at \$14 billion per year. One of the solutions to the problem is enforcement.

In summary, the intersection warrants the installation of a red light camera enforcement system for the following reason:

- Collision data shows there was at least 41 collisions during the 2004-2007 timeframe and possibly as high as 87 collisions.
- Input from community through the City Council indicated Red Light Photo Enforcement was needed.
- The video survey revealed that Woodside and Broadway experiences a significant number of red light violations.
- The intersection of Woodside and Broadway is a major arterial roadway from US 101 to US 280 and the City of Redwood City. The risk of major injury and delays to the County of San Mateo and City of Redwood City is impacted by the risk of collisions at this intersection.
- Enforcement by officers is difficult and is labor intensive at an intersection of this magnitude.
- Traffic backed up at Woodside and Broadway caused by a collision will impact the flow of traffic on S/B US 101, ultimately causing collisions on the freeway by inattentive drivers.

Sincerely,



Eric Stasiak, Sergeant
Field Services – Traffic



Civil and Transportation Engineering

**INTERSECTION STUDY
PROPOSED AUTOMATIC RED LIGHT ENFORCEMENT SYSTEM
WOODSIDE ROAD (STATE ROUTE 84) & BROADWAY
REDWOOD CITY, CALIFORNIA**

May 28, 2009

Prepared for -

Engineering Division
City of Redwood City
1017 Middlefield Road
Redwood City, CA 94063

List of Figures

Figure		Page
1.	Intersection Diagram	2
2.	Traffic Signal Indications	6
3.	Intersection Clearance	8

List of Tables

Table	Page
A. Reported Traffic Collision Data	3
B. Red Light Violation Collisions	4
C. Yellow and Red Clearance Times	7
D. Yellow and Red Clearance Times - Suggested Changes	10
E. Traffic Signal Timing Analysis	11

INTRODUCTION

SECTION 1.

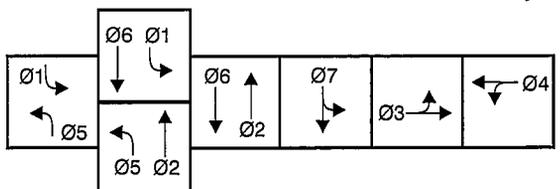
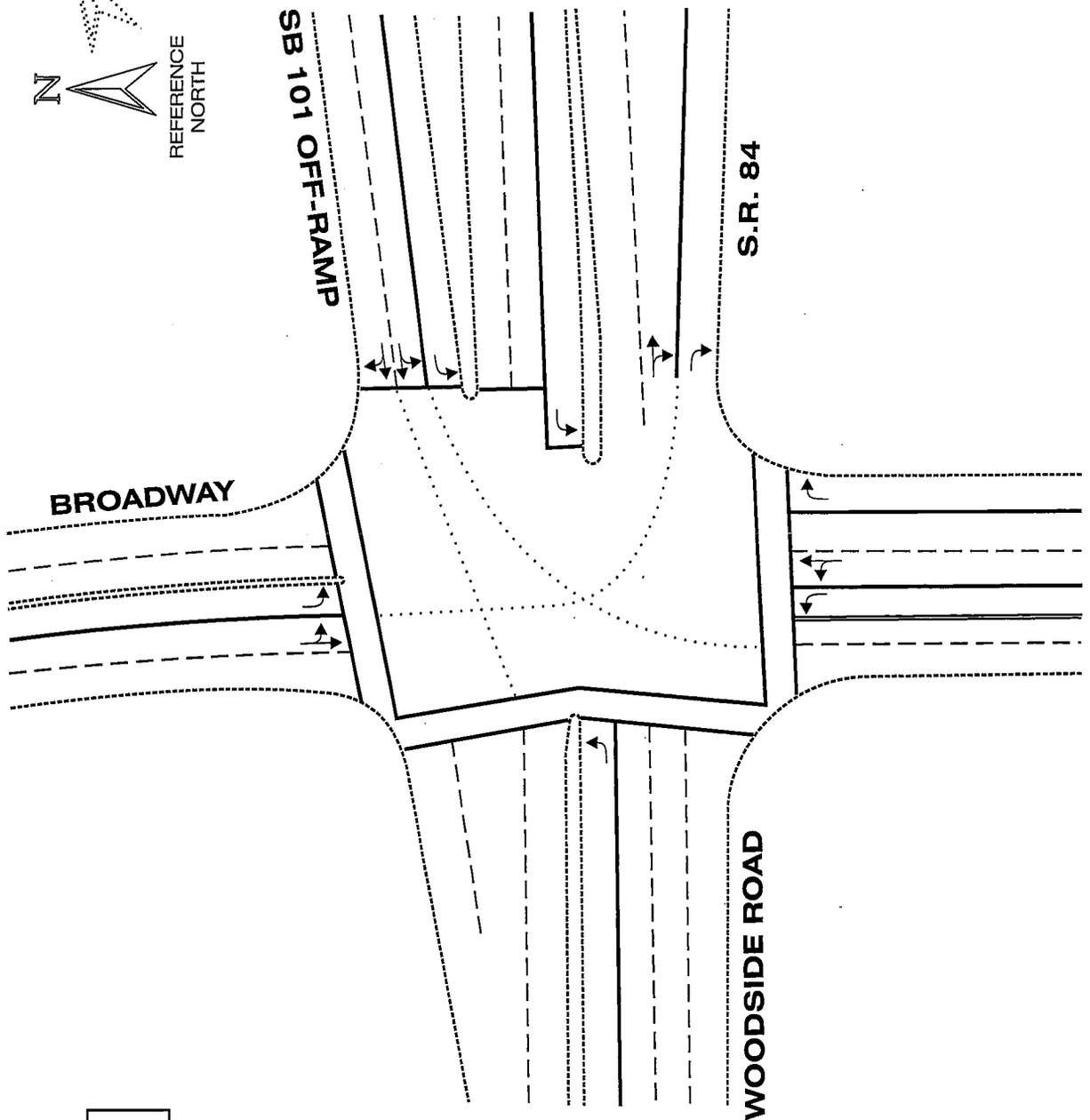
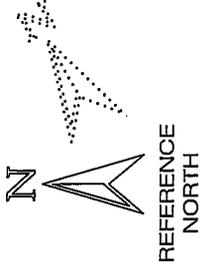
The intersection of Woodside Road & Broadway is located in the southeasterly portion of the City of Redwood City near the Bayshore Freeway (U.S. 101). Woodside Road from U.S. 101 westerly is State Route 84. It is a 5-leg intersection with the southbound off-ramp from U.S. 101 to westbound Woodside Road forming the fifth leg of what would otherwise be a conventional 4-way intersection. The Intersection Diagram, Figure 1, page 2, shows how the intersection is configured.

The intersection is controlled by a vehicle/pedestrian actuated, 6-phase traffic signal. The off-ramp and the two approaches of Broadway have their own exclusive traffic signal phases. There are pedestrian crosswalks on three legs of the intersection controlled by pedestrian actuated signals.

Traffic through the intersection averages 60,500 vehicles per day with 44,000 vehicles per day on Woodside Road and 16,500 vehicles per day on Broadway.¹

The purpose of this study is to evaluate the effectiveness of the installation of an automatic red light enforcement system (ARLES) on the southbound to westbound off-ramp approach to the intersection due to a high collision rate at the intersection.

¹ City of Redwood City traffic volume data.



TRAFFIC SIGNAL PHASE DIAGRAM

INTERSECTION DIAGRAM
FIGURE 1

COLLISION DATA

SECTION 2.

Reported traffic collisions for a five year period from January, 2004, to approximately the end of January, 2009, have been evaluated for the study intersection as well as two adjacent intersections on Woodside Road, those being at Bay Road and at Middlefield Road. The Bay Road intersection is approximately 0.12 mile west of the Broadway intersection and is a 4-way, traffic signal controlled intersection. The Middlefield Road intersection is approximately 0.5 mile west of the Broadway and it, too, is a 4-way, traffic signal controlled intersection.

The reported traffic collision data is summarized in Table A below for the three intersections. Collision data is summarized in tables in Appendix A.

Table A: Reported Traffic Collision Data January 1, 2001 - February, 2009			
	Woodside Rd. & Broadway	Woodside Rd. & Bay Rd.	Woodside Rd. & Middlefield Rd.
Intersection Approach Volume, vpd	60,500	51,000	60,000
Evaluation period, days	1834	1809	1818
Million Entering Vehicles, mev	105.4	87.6	103.6
Reported Collisions	76	38	52
Reported Collisions per mev	0.72	0.43	0.50
Red Light Violations	25	11	8
Red Light Violations per mev	0.24	0.13	0.08
Red Light Violations per year	4.98	2.22	1.61

The Woodside Road & Broadway intersection experiences collision rates 2-3 times that of the other two intersections and the red light violation accident rate is also 2-3 times that of the other two intersections

A breakdown of the red light violation collisions at the Woodside Road & Broadway intersection is provided in Table B on the following page.

Table B: Red Light Violation (RLV) Collisions Woodside Road & Broadway					
Time of Collision	Night		Dawn	Day	Dusk
	11		2	10	2
Approach	WB Off-Ramp	WB Woodside Rd.	EB Woodside Rd.	NB Broadway	SB Broadway
RLV Collisions	10	5	8	1	1
Time of Collision		Night	Dawn	Day	Dusk
WB Off-Ramp		7	0	3	0
WB Woodside Road		3	0	2	0
EB Woodside Road		2	1	4	1

Forty-four percent of the RLV accidents occurred at night. The westbound off-ramp approach accounted for 40% of the RLV accidents. Of those accidents, 70% occurred at night. In a few of the westbound approach nighttime accidents the drivers indicated confusion with the signal indications. The far side signal heads for the westbound Woodside Road and the westbound off-ramp approach are the programmed visibility type. This type of signal head is designed to convey the indication only to the lanes that are programmed into it. However, at night these signal heads do display a faintly visible indication to approach lanes other than those for which they are programmed.

COUNTERMEASURES

SECTION 3.

There are a number of countermeasures that could be applied to the intersection and its approaches that may provide effective in reducing the number of RLV collisions in lieu of the installation of an ARLES. Some of these countermeasures have already been installed at the intersection.

A. IMPROVED SIGNAL HEAD VISIBILITY

The southbound to westbound Route 101 off-ramp approach to the intersection has five signal heads controlling the approach, three at near side and two at far side locations. The adjacent westbound Woodside Road approach is controlled by only three signal heads, one at near side and two at far side locations. The far side signal indications for these two westbound approaches are the programmed visibility type in order to separate the conflicting signal indications. Figure 2, page 6, Traffic Signal Indications, shows the location and type of traffic signal heads for the entire intersection.

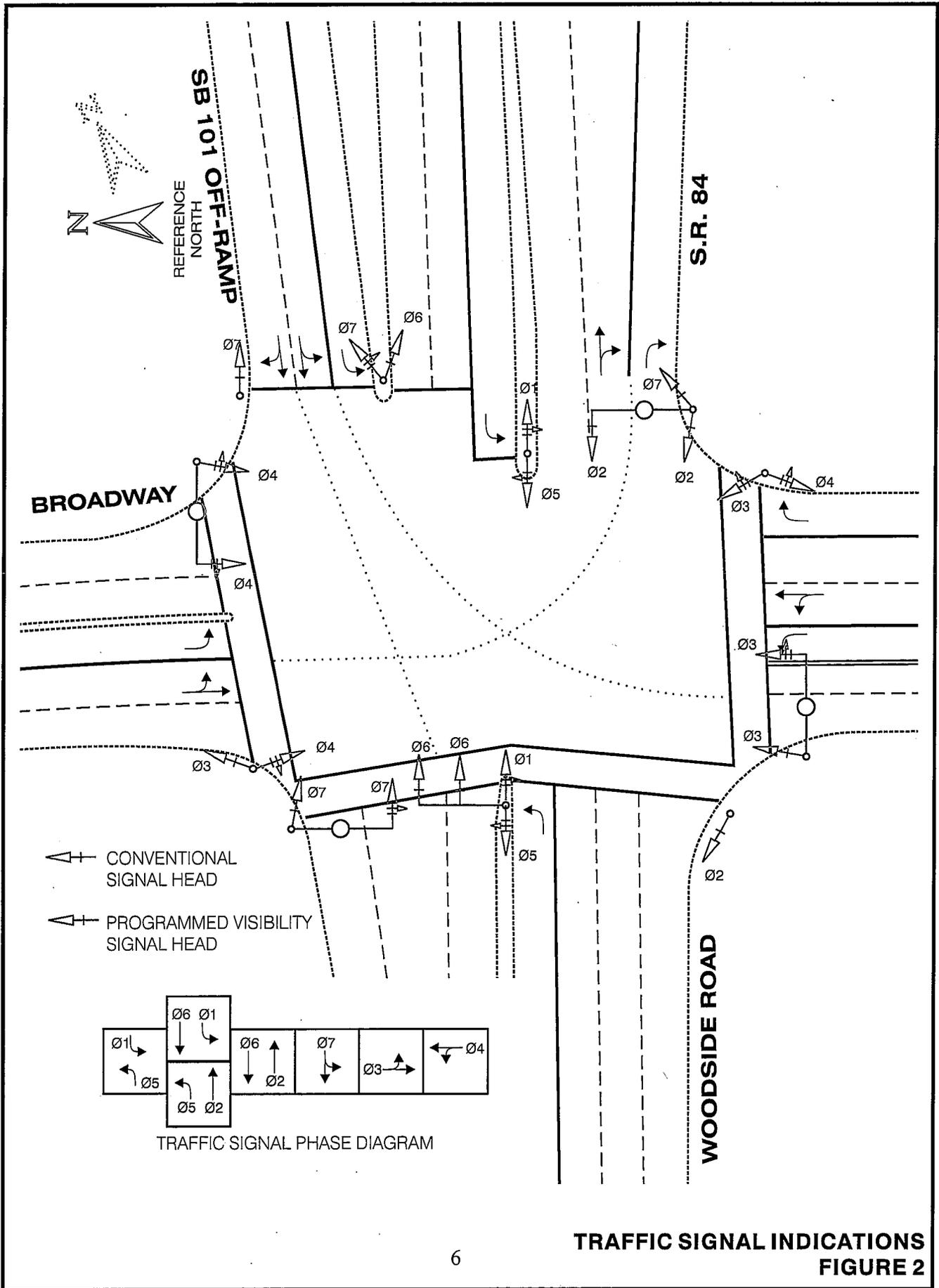
All of the signal heads and indications for all of the traffic movements appear to be in conformance with Caltrans and the California Manual on Uniform Traffic Control Devices (CAMUTCD). There are almost as many RLV's for the eastbound Woodside approach as there are for the southbound to westbound off-ramp approach. Visibility of signal indications does not appear to be the problem but rather driver inattention.

B. ADDITIONAL SIGNAL HEADS

As discussed in the previous sub-section the number and visibility of signal heads does not appear to be a significant contributor to the RLV collisions on any approach.

C. YELLOW CHANGE INTERVALS

The timing plan for the intersection as provided by Caltrans has the settings shown in Table C on page 7.



TRAFFIC SIGNAL INDICATIONS
FIGURE 2

**Table C: Yellow and Red Clearance Times
Woodside Road & Broadway
Timing Plan revised 06/09/2005**

Signal Phase		ø1	ø2	ø3	ø4	ø5	ø6	ø7
Movement		WBL	EBT	SBTL	NBTL	EBL	WBT	WBTL
Before	Yellow, sec.	3.0	4.0	3.6	3.2	3.0	4.0	3.6
	All-Red, sec.	0	0	0	0	0	0	2.0
After	Yellow, sec.	3.5	4.5	4.0	4.0	3.5	4.5	4.0
	All-Red, sec.	0	0	0	0	0	0	2.0

The minimum yellow change interval is set by Table 4D-102 in the California MUTCD using the formula $T = V/2d + t_r$ where T is the yellow time, V is the posted speed or prima facie speed in ft/sec, d is the deceleration rate of 10 ft/sec², and t_r is the reaction time taken at 1.0 sec.

The Institute of Transportation Engineers formula² is similar to the California MUTCD formula as is the formula contained in a U.S. Department of Transportation publication.³

$$CP = t + V/(2a + 64.4g) + (W+L)/V$$

CP = change period, sec.

t = perception-reaction time, typically 1.0 sec.

V = speed of approach, ft/sec

a = comfortable deceleration rate, typically 10 ft/sec²

W = width of intersection, curb to curb, ft.

L = length of vehicle, typically 20 ft.

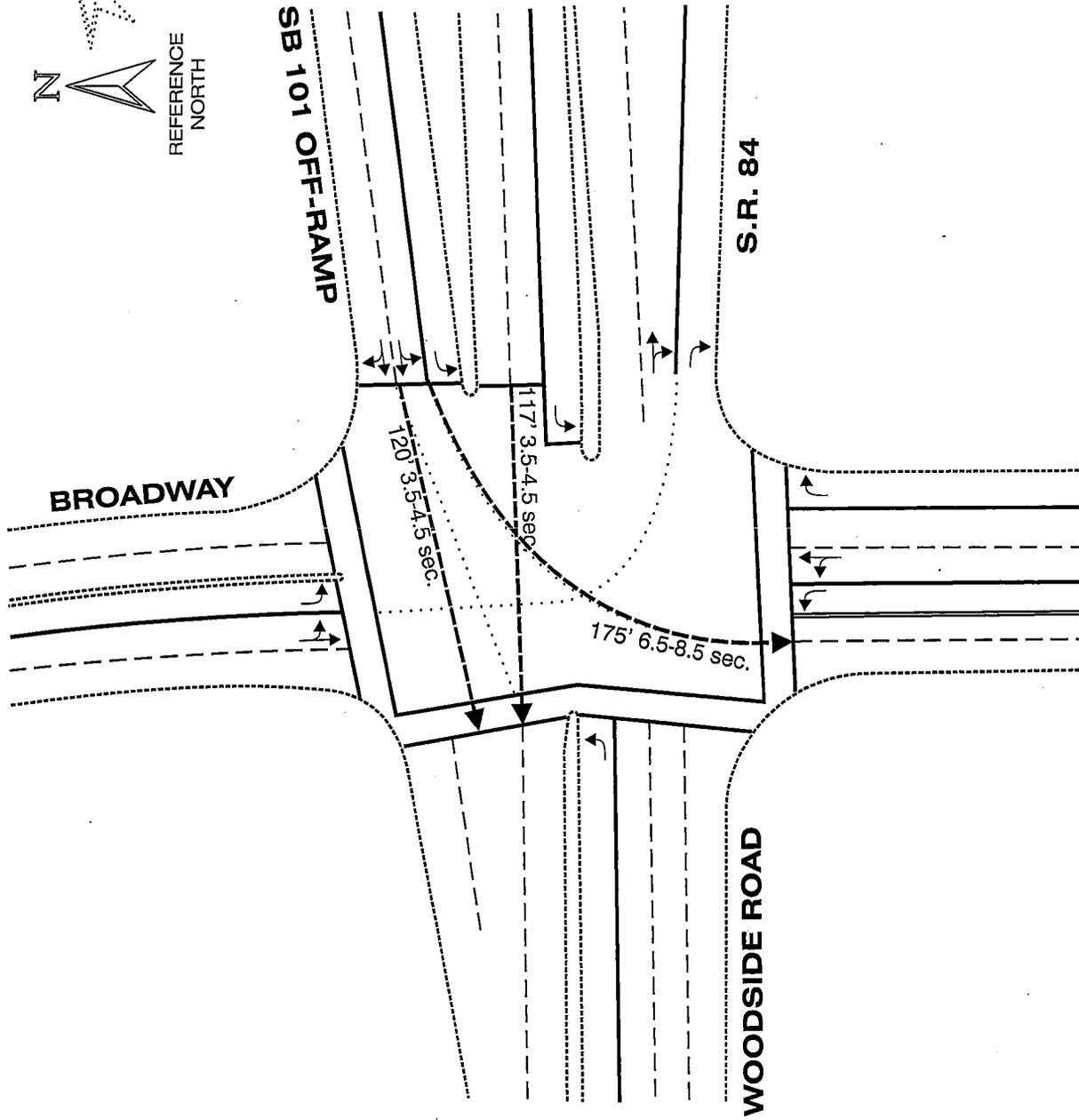
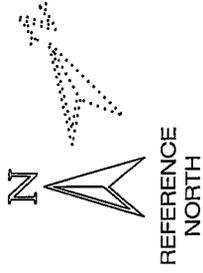
g = grade of the intersection in percent, positive or negative

However, the ITE formula contains consideration for the width of the intersection. The third term in the formula is typically used as the all red clearance interval.

Two field observations of the intersection were conducted during an off-peak, mid-week day period and one during the afternoon peak period of the same day. The observations focused on how traffic cleared the intersection at the end of each signal phase. Figure 3, Intersection Clearance, page 8, shows the clearance distances from the limit lines to the rear crosswalk line on the opposite side of the intersection for traffic on westbound Woodside Road and on the off-

² Institute of Transportation Engineers, *Manual of Traffic Signal Design*, 2nd Edition, © 1991

³ U.S. Department of Transportation, Federal Highway Administration publication, *Signalized Intersections: Informational Guide*, FHWA-HRT-04-091



INTERSECTION CLEARANCE
FIGURE 3

ramp. The clearance times were measured using a stop watch and the range of observed times are shown on Figure 3.

Assuming a 35 mph speed of approach and using the ITE formula, the CP for westbound Woodside Road should be 6.3 seconds (3.6 sec. yellow clearance and 2.7 sec. all-red). The present timing is 4.5 seconds of yellow clearance and no all-red timing. The maximum observed clearance time for this movement was measured at 4.5 seconds.

This same analysis applies to the off-ramp approach as well. For this movement the CP is calculated to be 6.3 seconds. The CP for this movement is 6.0 seconds including 2.0 seconds of all-red timing. For straight through movements the maximum observed clearance time was found to be 4.5 seconds. Left turn movements from the off-ramp must cover 175 feet to clear the intersection. Observation found this movement to take up to 8.5 seconds to clear the intersection. With the next phase in the signal sequence being southbound Broadway, lengthening the CP would not necessarily improve intersection safety. In the five year review period there was only one accident involving westbound off-ramp traffic with southbound Broadway traffic.

A review of the RLV collisions involving westbound Woodside Road and the off-ramp has found an increase in the rate of these type of collisions following the timing change. The rate of RLV collisions for westbound Woodside Road increased by 48.3% and the rate of RLV collisions for the off-ramp increased by 234%. For the total intersection the rate of RLV Collisions increased by 47.2%. However, there was an overall 14.6% reduction in the rate of total collisions at the intersection following the timing change.

During field observation the signal cycle length averaged 225 seconds during the afternoon peak traffic period. Additional increases in the CP will lengthen an already long cycle length leading to further delay. Frustration of drivers over lengthy delays contributes to red light violations and an increase in rear end accidents.⁴

D. ALL-RED INTERVALS

Presently only the southbound to westbound off-ramp approach signal phase 7 CP contains an all-red time. The CP for signal phase 2 (eastbound Woodside Road) and signal phase 6 (westbound Woodside Road) could have all red intervals according to the calculation in subsection 3.C. above. Table D on page 9 shows suggested CP timing for the intersection based on the ITE formula. The addition of all-red timing will increase the peak period cycle length by only about 1%. However, the increase in cycle length has the potential to increase RLV and rear end accidents.

⁴ Iowa State University, *The Effectiveness of Iowa's Automated Red Light Running Enforcement Programs*, Dec. 2007

Table D: Yellow and Red Clearance Times Woodside Road & Broadway Suggested Changes							
Signal Phase	ø1	ø2	ø3	ø4	ø5	ø6	ø7
Movement	WBL	EBT	SBTL	NBTL	EBL	WBT	WBTL
Yellow, sec.	3.5	4.5	4.0	4.0	3.5	4.5	4.5
All-Red, sec.	0	2.0	0	0	0	2.0	2.0

E. ADVANCE WARNING SIGNING

Advance warning signs (Signal Ahead, W3-3) are in place on both sides of the southbound to westbound off-ramp approximately 200 feet in advance of the limit line. There are no other advance warning signal ahead signs on any other approach to the intersection. Because of the curve of the road and foliage along side it, visibility of the intersection is obstructed for traffic exiting the freeway. There are advisory, 45 mph speed limit signs on the off-ramp.

The minimum approach sight distance for a 35 mph posted speed limit is 325 feet for signalized intersections. All of the other approaches have intersection sight distance in excess of the minimum. No additional advance warning signs are needed.

F. ADVANCED YELLOW FLASHING BEACONS

The two advance warning signs on the off-ramp each have 12-inch yellow flashing beacons as part of the sign structure. No other advanced yellow flashing beacons are provided on any of the other approaches to the intersection.

G. TRAFFIC SIGNAL COORDINATION

The intersection traffic signal is coordinated with the two adjacent signalized intersections on Woodside Road at Bay Road and Veterans Boulevard. The master controller is located at the Bay Road intersection.

H. ADDITIONAL ADVANCE DETECTION

All of the through lane approaches have advance, in-pavement loop detection as well as limit line loop detectors. No additional advance detection is needed.

TRAFFIC SIGNAL TIMING PLAN

SECTION 4.

An evaluation of the intersection was made for the morning peak hour (7:30-8:30 a.m.) and the afternoon peak hour (4:30-5:30 p.m.) using count data provided by the City and the Synchro 6 program⁵ to optimize the cycle length and phase splits. The analysis evaluated the timing using the current plan and one with modified change periods, CP, as shown in Table D, page 9. The current timing plan is provided in Appendix B together with the peak period turning movement count data.

The analysis found the optimal cycle length did not change with the addition of all-red times in the CP for phases 2 and 6. Table E below shows the phase splits for both the morning and afternoon peak hours.

Phase	Movement	Phase Split, sec.*		Maximum Extension, sec.	
		AM Peak Hour	PM Peak Hour	Existing	Recommended
1	WB Left	22	20	30	21
2	EB Through	62.5	54.5	80	59
3	SB	38	38	28	38
4	NB	20.5	20.5	16	20
5	EB Left	13	12	21	13
6	WB Through	71.5	62.5	40	67
7	SB 101 Off-Ramp	42	52	32	47
Cycle Length		185	185	186	185

* Synchro 6 analysis.

The intersection operates at LOS (level of service) F during the peak hours of the day and will continue to operate at this level even with the recommended changes in the maximum phase extensions. However, a more equitable balance of phase splits should lessen frustration by drivers on the critical phases, particularly phase 7. Driver frustration is a contributor to RLV collisions.

⁵ Traffware Ltd., Version 6, Build 614, (c)2005

CONCLUSIONS AND RECOMMENDATIONS

SECTION 5.

CONCLUSIONS

The intersection of Woodside Road & Broadway experiences 2-3 times the rate of RLV collisions as do two nearby intersections on Woodside Road. The southbound to westbound 101 off ramp traffic accounts for 40% of the RLV collisions at the intersection. Eight countermeasures were evaluated to determine if any of them could reduce the potential for RLV collisions. Timing changes made in 2005 to lengthen the CP for all signal phases resulted in a 14.6% reduction in the rate of all collisions at the intersection, but the rate of RLV collisions actually increased, particularly on the off-ramp approach.

Most of the countermeasure actions have already been applied to the intersection or would have no effect on the rate of RLV collisions. The suggestions for modifying the timing plan may reduce driver frustration on some of the approaches which in turn may reduce RLV collisions, but with the intersection operating at LOS F during the peak traffic hours, the effect will be minimal.

RECOMMENDATIONS

1. Install an ARLES (automatic red light enforcement system) on the southbound to westbound off-ramp approach to the intersection to reduce the number of RLV collisions.
2. Consider for future installation an ARLES on the eastbound Woodside Road approach to the intersection.

Richard K Hopper

Richard K. Hopper, P.E.
Principal



APPENDICES

- A. Traffic Collision Data**
- B. Traffic Signal Timing Plan**

**APPENDIX A
TRAFFIC COLLISION DATA**

COLLISION DIAGRAM

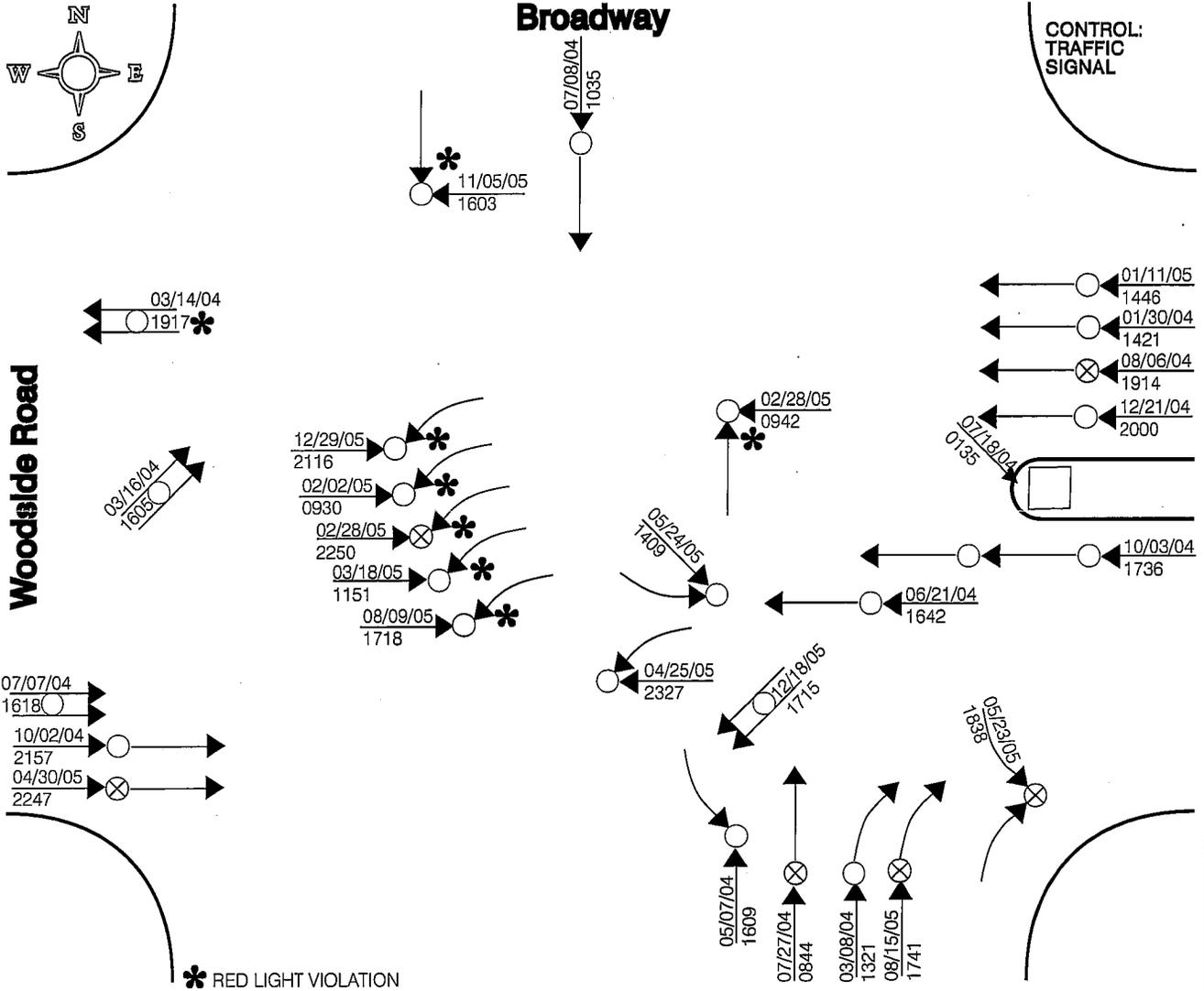
LOCATION: Woodside Road & Broadway, Redwood City

BY: RKH
DATE: 04/01/09

PERIOD: 2 years

FROM: 01/2004

TO: 12/2005



SYMBOLS

- MOVING VEHICLE
- ←←←← BACKING VEHICLE
- - - - PEDESTRIAN
- ▬ TRAIN
- ▬▬▬▬ PARKED VEHICLE
- FIXED OBJECT
- FATALITY
- ⊗ INJURY
- PROPERTY DAMAGE ONLY

COLLISION TYPES

- ← HEAD-ON
- ←○→ SIDESWIPE
- REAR END
- BROADSIDE
- ↘ APPROACH TURN
- ↗ OVERTAKING TURN

- ~→ OUT OF CONTROL
- ~→ VEHICLE OVERTURNED

SUMMARY

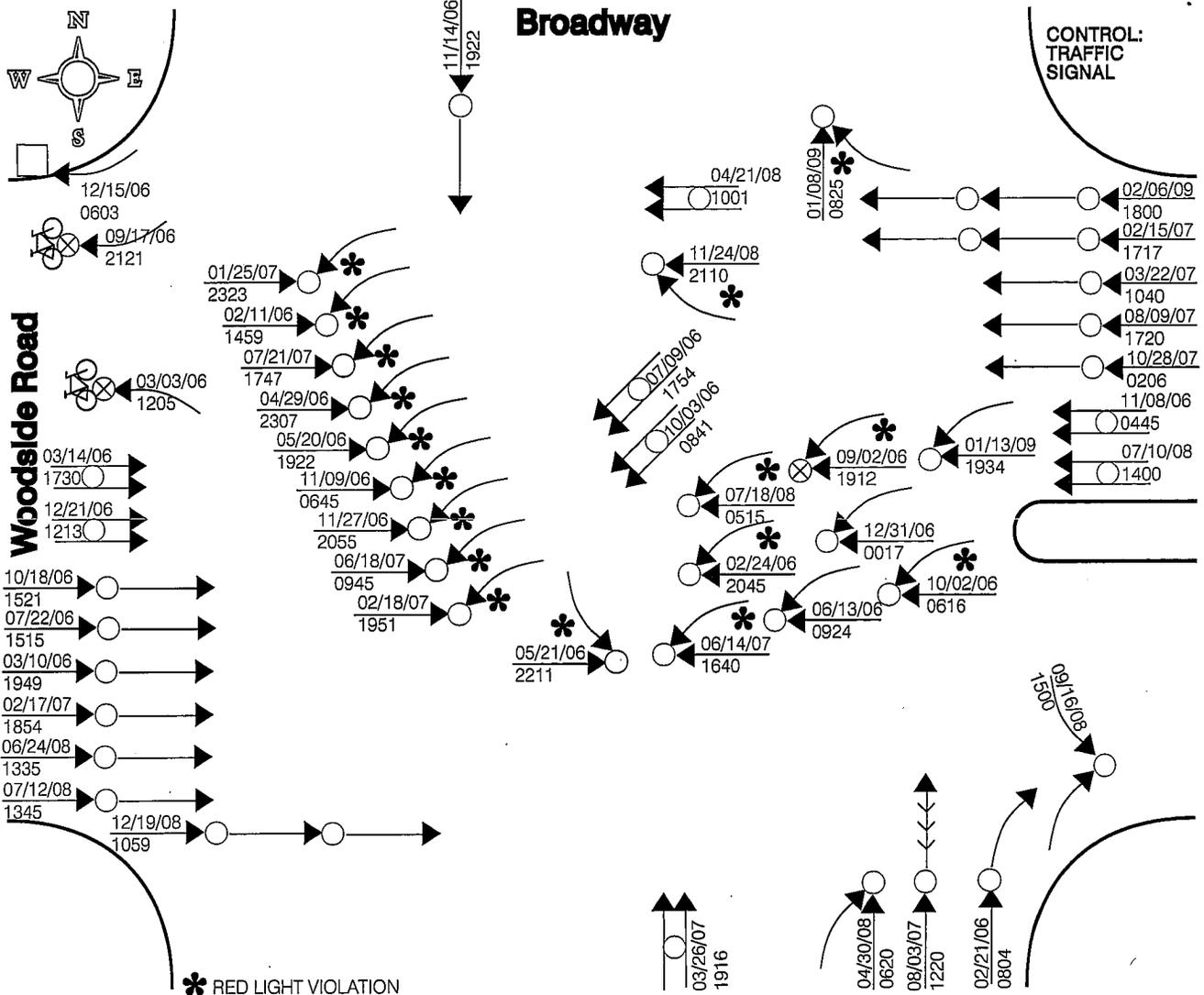
0	●	FATALITY
6	⊗	INJURY
22	○	PROPERTY DAMAGE ONLY
28		TOTAL

COLLISION DIAGRAM

LOCATION: Woodside Road & Broadway, Redwood City

BY: RKH
DATE: 04/01/09

PERIOD: 38 months FROM: 01/2006 TO: 02/2009



SYMBOLS

- MOVING VEHICLE
- BACKING VEHICLE
- PEDESTRIAN
- BICYCLE
- TRAIN
- PARKED VEHICLE
- FIXED OBJECT

COLLISION TYPES

- HEAD-ON
- SIDESWIPE
- REAR END
- BROADSIDE
- APPROACH TURN
- OVERTAKING TURN

- OUT OF CONTROL
- VEHICLE OVERTURNED

SUMMARY

0	●	FATALITY
3	⊗	INJURY
45	○	PROPERTY DAMAGE ONLY
<u>48</u>		TOTAL

RKH

REPORTED INTERSECTION TRAFFIC ACCIDENTS

CITY: Redwood City, California
 MAIN ST.: Woodside Road
 CROSS ST.: Broadway

DATE	TIME	MVMT. VEH. 1		MVMT. VEH. 2		HEAD-ON		SIDE REAR		BROADSIDE		APPROACH		FIXED		BIKE	PED/	VICTIMS	R.O.R.	VIOLATION	CVC	
		Left	W	Straight	E	Left	W	Straight	E	Left	W	Straight	E	Left	W							Straight
2/11/2006	2:59 PM																				21453(a)	X
2/21/2006	8:04 AM	Straight	N	Straight	N				X												22350	X
2/24/2006	8:45 PM	Left	W	Straight	W									X								
3/3/2006	12:05 PM	Left	N	Straight	N												X		1V		21650	
3/10/2006	7:49 PM	Straight	E	Straight	E				X												22350	
3/14/2006	5:30 PM	Straight	E	Straight	E			X													21658(a)	
3/26/2006	7:16 PM	Straight	N	Straight	N				X												22107	
4/29/2006	11:07 PM	Left	W	Straight	E																21453(c)	X
5/20/2006	7:22 PM	Straight	E	Left	W																21453(a)	X
5/21/2006	10:11 PM	Straight	E	Left	S																23152(a)	X
6/13/2006	9:24 AM	Straight	W	Left	W																	
7/19/2006	5:54 PM	Left	W	Left	W			X													21658(a)	
7/22/2006	3:15 PM	Straight	E	Straight	E				X												22350	
9/2/2006	7:12 PM	Left	W	Straight	W									X							21453(a)	X
9/17/2006	9:21 PM	Straight	N	Straight	N																21650	
10/2/2006	6:16 AM	Left	W	Straight	W									X							21453(a)	X
10/3/2006	8:41 AM	Left	W	Left	W			X														
10/18/2006	3:21 PM	Straight	E	Straight	E				X													
11/8/2006	4:45 AM	Straight	W	Left	W			X													22107	
11/9/2006	6:45 AM	Straight	E	Left	W																	
11/14/2006	7:22 PM	Straight	S	Straight	S				X												22350	X
11/27/2006	8:55 PM	Left	W	Straight	E																21453(a)	X
12/15/2006	6:03 AM	Right	S																		22107	
12/21/2006	12:13 PM	Straight	E	Straight	E			X													22350	
12/31/2006	12:17 AM	Left	W	Straight	W									X								
1/25/2007	11:23 PM	Left	W	Straight	E																21453(a)	X
2/15/2007	5:17 PM	Straight	W	Straight	W				X												22350	
2/17/2007	6:54 PM	Straight	E	Straight	E				X													
2/18/2007	7:51 PM	Straight	E	Left	W																21453(a)	X
3/22/2007	10:40 AM	Straight	W	Straight	W				X												22106	
6/14/2007	4:40 PM	Straight	W	Left	W																21453(a)	X
6/18/2007	9:45 AM	Straight	E	Left	W																21453(a)	X
7/21/2007	5:47 PM	Left	W	Straight	E																21453(a)	X
8/3/2007	12:20 PM	Backin	N	Straight	N				X												22106	
8/9/2007	5:20 PM	Straight	W	Straight	W				X												22350	
10/28/2007	2:06 AM	Straight	W	Straight	W				X												22350	
4/21/2008	10:01 AM	Straight	W	Straight	W																	
4/30/2008	6:20 AM	Right	N	Straight	N																21658(a)	

TOTAL: 38
 % TOTAL: 0% 7 11 11 0 10 7 1 2 0 0 0 14
 DATE: 4/24/2009
 BY: RKH

C - complaint of pain
 V - visible injury
 S - severe injury
 K - killed

REPORTED INTERSECTION TRAFFIC ACCIDENTS

CITY: Redwood City
 MAIN ST.: Woodside Road (SR 84)
 CROSS ST.: Bay Road

DATE	TIME	MVMT. VEH. 1	MVMT. VEH. 2	VEH. 1	VEH. 2	MVMT.	VEH. 1	VEH. 2	TYPE			APPROACH			FIXED	OBJECT	BIKE	PED/	R.O.R.	VICTIMS	VIOLATION	RLV	CVC																			
									HEAD-ON	REAR	BROADSIDE	TURN	OVERTAKE	TURN										BIKE	PED/																	
2/16/2004	1:07 PM	Straight	E	Straight	E	Straight	E	Straight	E																																	
4/14/2004	2:54 PM	Left	N	Straight	S						X										2C	21801(a)																				
6/11/2004	2:40 PM	Straight	E	Straight	E																1C	22350																				
8/3/2004	7:06 PM	Straight	N	Straight	E						X											21453(a)	X																			
9/22/2004	11:59 AM	Straight	N	Left	N																	22350																				
10/13/2004	3:05 PM	Straight	S	Straight	W						X											21453(a)	X																			
10/20/2004	1:16 PM	Straight	E	Straight	E																																					
12/27/2004	1:40 PM	Backin	E	Straight	E																	22106																				
1/21/2005	6:29 PM	Straight	W	Straight	N						X												X																			
2/4/2005	3:58 PM	Straight	W	Straight	N						X											21451(a)	X																			
3/15/2005	4:18 PM	Straight	E	Straight	E																1C	21703																				
4/19/2005	10:17 PM	Straight	E	Straight	E						X											22350																				
8/5/2005	5:47 PM	Left	E	Straight	W																																					
10/15/2005	5:45 PM	Straight	E	Straight	E						X											21453(a)	X																			
11/1/2005	6:02 AM	Straight	E	Left	S																	22107																				
11/28/2005	3:01 PM	Straight	E	Straight	E						X																															
1/9/2006	6:45 PM	Straight	W	Straight	W																																					
2/22/2006	10:52 PM	Straight	E	Left	W																																					
5/30/2006	3:56 PM	Straight	N	Left	W																	22350																				
6/3/2006	7:51 AM	Straight	E	Straight	S																	21453(a)	X																			
6/4/2006	5:43 PM	Left	N	Straight	S																	21453(a)	X																			
6/20/2006	7:30 AM	Straight	E	Straight	E																	21801(a)																				
6/26/2006	4:24 PM	Straight	E	Straight	E						X											22350																				
7/18/2006	1:00 PM	Straight	W	Straight	W																																					
12/17/2006	3:57 PM	Straight	E	Straight	E																	22106																				
1/21/2007	11:07 AM	Straight	E	Straight	E																	22350																				
3/31/2007	7:20 AM	Straight	W	Straight	W																	21703(c)																				
4/3/2007	5:18 PM	Left	S	Straight	N																	22350																				
8/17/2007	3:22 PM	Left	S	Straight	N																	21801(a)																				
8/12/2007	2:10 PM	Straight	E	Straight	E																	21801(a)																				
10/12/2007	5:37 PM	Straight	E	Straight	E						X											22350																				
10/17/2007	4:44 PM	Straight	E	Straight	E																	21658(a)																				
11/14/2007	10:24 AM	Left	E	Straight	W																	22350																				
12/17/2007	5:24 PM	Straight	W	Straight	W																	21453(c)	X																			
9/15/2008	12:59 PM	Straight	E	Straight	E																	22350																				
9/22/2008	6:24 PM	Straight	N	Straight	N																	22350																				
12/16/2008	11:12 PM	Straight	W	Straight	W																	22350																				
1/29/2009	6:21 PM	Straight	W	Straight	S																	22107																				
TOTAL:	38																																									
																						TOTAL BY TYPE	0	3	18	8	6	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
																						% TOTAL:	0%	8%	47%	21%	16%	0%	0%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

DATE: 4/24/2009
 BY: RKH

C - complaint of pain
 V - visible injury
 S - severe injury
 K - killed

REPORTED INTERSECTION TRAFFIC ACCIDENTS

CITY: Redwood City
 MAIN ST.: Woodside Road
 CROSS ST.: Middlefield Road

DATE	TIME	MVM.T.		VEH. 1		VEH. 2		HEAD-ON		SIDE		REAR		BROADSIDE	APPROACH			FIXED	OBJECT	BIKE	PED/	R.O.R.	VICTIMS	VIOLATION	CVC
		W	S	W	S	W	S	W	S	W	S	W	S		TURN	OVERTAKE	TURN								
11/12/2007	7:30 PM	Straigh	W	Straigh	W								X												
12/5/2007	11:38 AM	Straigh	W	Straigh	W							X												22350	
12/20/2007	9:03 AM	Straigh	W	Straigh	W							X												22350	
6/9/2008	12:15 PM	Straigh	W	Straigh	W							X											2C	22350	
8/15/2008	2:09 PM	Straigh	N	Straigh	W									X									1V	21453(a)	
8/30/2008	1:30 PM	Straigh	S	Straigh	S							X											1C	22350	
9/18/2008	12:15 PM	Straigh	E	Straigh	E							X												22350	
9/23/2008	8:29 PM	Straigh	E	Straigh	E							X												22350	
11/10/2008	3:30 PM	Right	S	Right	S							X												22106	
11/15/2009	1:24 PM	Straigh	E	Straigh	E							X												22350	
11/19/2009	12:58 PM	Straigh	E	Straigh	E							X												22350	
1/24/2009	9:49 AM	Straigh	W	Straigh	N																			21800(a)	
1/29/2009	3:54 PM	Right	S	Right	S							X												22350	
2/7/2009	8:38 AM	Left	S	Left	S							X												21658(a)	
TOTAL:		14	TOTAL BY TYPE		0	1	11	1	0	1	11	1	1	1	0	0	0	0	0	1	0	0	0	1	
			% TOTAL:		0%	7%	79%	7%	0%	7%	79%	7%	7%	0%	0%	0%	0%	0%	0%	7%	0%	0%	0%	1	

C - complaint of pain
 V - visible injury
 S - severe injury
 K - killed

DATE: 4/24/2009
 BY: RKH

**APPENDIX B
TRAFFIC SIGNAL TIMING PLAN**

RKH

MARKS TRAFFIC DATA

CITY OF REDWOOD CITY

File Name : broadway-woodside-p
 Site Code : 5
 Start Date : 6/3/2008
 Page No : 1

tek 916-806-0250

Groups Printed- Vehicles Only

Start Time	BROADWAY Southbound				US 101 SB OFF-RAMP Southwestbound				WOODSIDE RD Westbound				BROADWAY Northbound				WOODSIDE RD Eastbound				Int. Total
	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	
16:00	11	56	52	119	21	128	87	236	22	238	37	297	109	58	29	196	7	305	16	328	1176
16:15	18	79	60	157	29	146	91	266	26	194	33	253	123	47	22	192	5	345	16	366	1234
16:30	24	98	76	198	16	138	89	243	23	215	32	270	146	73	21	240	6	306	18	330	1281
16:45	19	87	78	184	22	156	105	283	17	224	22	263	145	58	25	228	5	265	19	289	1247
Total	72	320	266	658	88	568	372	1028	88	871	124	1083	523	236	97	856	23	1221	69	1313	4938
17:00	23	89	84	196	26	145	83	254	18	252	28	298	161	65	32	258	8	318	20	346	1352
17:15	16	80	68	164	23	170	85	278	20	247	36	303	116	55	48	219	6	298	16	320	1284
17:30	11	101	77	189	22	166	85	273	28	221	29	278	98	60	32	190	2	239	20	261	1191
17:45	15	94	52	161	24	154	58	236	23	236	28	287	60	63	15	138	10	240	12	262	1084
Total	65	364	281	710	95	635	311	1041	89	956	121	1166	435	243	127	805	26	1095	68	1189	4911
Grand Total	137	684	547	1368	183	1203	683	2069	177	1827	245	2249	958	479	224	1661	49	2316	137	2502	9849
Apprch %	10	50	40		8.8	58.1	33		7.9	81.2	10.9		57.7	28.8	13.5		2	92.6	5.5		
Total %	1.4	6.9	5.6	13.9	1.9	12.2	6.9	21	1.8	18.6	2.5	22.8	9.7	4.9	2.3	16.9	0.5	23.5	1.4	25.4	

Start Time	BROADWAY Southbound				US 101 SB OFF-RAMP Southwestbound				WOODSIDE RD Westbound				BROADWAY Northbound				WOODSIDE RD Eastbound				Int. Total
	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	
16:30	24	98	76	198	16	138	89	243	23	215	32	270	146	73	21	240	6	306	18	330	1281
16:45	19	87	78	184	22	156	105	283	17	224	22	263	145	58	25	228	5	265	19	289	1247
17:00	23	89	84	196	26	145	83	254	18	252	28	298	161	65	32	258	8	318	20	346	1352
17:15	16	80	68	164	23	170	85	278	20	247	36	303	116	55	48	219	6	298	16	320	1284
Total Volume	82	354	306	742	87	609	362	1058	78	938	118	1134	568	251	126	945	25	1187	73	1285	5164
% App. Total	11.1	47.7	41.2		8.2	57.6	34.2		6.9	82.7	10.4		60.1	26.6	13.3		1.9	92.4	5.7		
PHF	.854	.903	.911	.937	.837	.896	.862	.935	.848	.931	.819	.936	.882	.860	.656	.916	.781	.933	.913	.928	.955

Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
 Peak Hour for Entire Intersection Begins at 16:30

