METROPOLITAN TRANSPORTATION COMMISSION

Program for Arterial System Synchronization (PASS)

FY 13/14 Cycle - Fact Sheets

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PASS FY 13/14 Cycle

The purpose of the Program for Arterial System Synchronization (PASS) is to provide technical and financial assistance to Bay Area agencies to help improve the safe and efficient operation of certain traffic signal systems and corridors. The PASS provides traffic engineering assistance to local jurisdictions to retime their traffic signals.

The PASS 13/14 cycle had a total of 19 projects, listed in the table below, consisting of 555 traffic signals from six counties in the Bay Area. MTC, in partnership with Caltrans and the local agencies, has successfully completed these projects. In this cycle, 100 Caltrans signals were coordinated with local agency signals along major arterials in the Bay Area.

As a part of each project, new traffic counts were collected in the field to understand the traffic patterns and volumes along the corridors. The 7-day 24-hour volume counts (Average Daily Traffic, ADT), peak periods turning movement counts, including vehicular, pedestrian, bicycle counts, and historical collision data were analyzed in developing and implementing new coordination plans. Field implementation and fine-tuning are the last, but the most important, tasks to successfully achieve traffic progression. To provide a common time for some traffic signals, GPS clocks were procured and installed for several projects.

Benefit-Cost Summary

The PASS project benefits are assumed to be 100 percent on the first day after implementation of the new timing plans, declining steadily to zero by the end of the fourth year. The results from the 19 projects are summarized below:

- Total Auto Travel Time Savings: 15% or over 3.9 million hours
- Average Auto Speed Increase: 26%
- Total Auto Fuel Consumption Savings: 11% or over 11.5 million gallons
- Total Auto Emissions Reduction: 422.4 tons (ROG: 37.5 tons; NOx: 27.2 tons; PM2.5: 1.4 tons; CO: 356.3 tons)

Total Project Costs: $1,844,000
Total Lifetime Benefits: $122,758,000
Overall Benefit-Cost Ratio: 67:1

Other Benefits

The optimized signal timing plans were developed and implemented based on the 2012 California MUTCD guidelines. The pedestrian walking speed of 3.5 feet per second was used to provide adequate crossing time for children and seniors to safely cross the study intersections. The minimum green times were reviewed and increased at many intersections to enhance safety for bicyclists crossing the intersections. The yellow time and all-red timing parameters were reviewed and updated to provide additional clearance time for vehicles to clear or stop safely at the intersections. Timing plans were optimized to reduce unnecessary delays along the side streets and achieve progression along the corridors.

#	County	Project Sponsors	# of Signals	Timing Plans/Services	Consultant
1	SC	Caltrans	59	Weekday Peaks	Advantec
2	SC	County of Santa Clara	49	Weekday Peaks; Traffic Responsive; IM* Plans	Kimley-Horn
3	SC	City of Campbell, City of San Jose	15	Weekday Peaks; Weekend Peaks	Kimley-Horn
4	CC	City of Concord, Caltrans	78	Weekday Peaks	TJKM Consultants
5	AL	City of Dublin, City of Pleasanton	34	Weekday Peaks; IM* Plans	Kimley-Horn
6	AL	City of Fremont	8	Weekday Peaks	Iteris
7	AL	City of Hayward, Caltrans	14	Weekday Peaks	TJKM Consultants
8	CC	City of Lafayette	12	Weekday Peaks; School PM Peak; Weekend Peaks	TJKM Consultants
9	MA	City of Mill Valley, Caltrans	9	Weekday Peaks; School PM Peak; Weekend Peaks	Iteris
10	SC	City of Mountain View, Caltrans	14	Weekday Peaks	TJKM Consultants
11	AL	City of Oakland, Caltrans	20	Weekday Peaks	TJKM Consultants
12	SC	City of Palo Alto, City of East Palo Alto, City of Menlo Park, City of Mountain View, City of Los Altos, County of Santa Clara, Caltrans	65	Weekday Peaks; Weekend Peaks; Pedestrian Evaluation	Iteris
13	SM	City of Redwood City, Caltrans	9	Weekday Peaks; Post Lane-reduction Analysis	DKS Associates
14	SM	City of San Carlos, City of Belmont, County of San Mateo, Caltrans	46	Weekday PM Peak; School PM Peak	DKS Associates
15	SON	City of Santa Rosa	44	Weekday Peaks; Adaptive Signal Timing	Iteris
16	SM	City of South San Francisco, Caltrans	11	Weekday Peaks	DKS Associates
17	AL	City of Union City	8	Weekday PM Peak; School PM Peak	DKS Associates
18	CC	City of Walnut Creek, Caltrans	44	Weekend Peaks; Adaptive Signal Timing	Kimley-Horn
19	MA	Town of San Anselmo, City of San Rafael, Town of Fairfax, Town of Ross	16	Weekday Peaks; Weekend Peaks	Kimley-Horn
		Total Signals	**555**		

*IM Plan = Incident Management Plan
Note: AL = Alameda, CC = Contra Costa, MA = Marin, SC = Santa Clara, SON = Sonoma, and SM = San Mateo

PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY13/14 CYCLE

State Route 82 – El Camino Real (Santa Clara County) Signal Timing Project

Caltrans | Metropolitan Transportation Commission

PROJECT OVERVIEW

Caltrans received a grant from the Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to conduct a signal timing study for 59 traffic signals along State Route 82 (El Camino Real) in Santa Clara County. The project covered the segment from The Alameda to Medical Foundation, but it did not include six signals under jurisdiction of the City of Santa Clara. Fifty eight traffic signals are owned and operated by Caltrans, and one signal is operated by the City of Sunnyvale.

The goal of this project was to facilitate traffic progression along El Camino Real, and to optimize signal timing plans to achieve operational efficiency of the traffic signals. The project conducted timing analysis and developed and implemented signal coordination for the weekday AM, midday, and PM peak periods.

This PASS project involved the completion of the following major tasks: collecting traffic volumes and turning movement counts, including bike and pedestrian counts, at all project intersections; analyzing this traffic data including collision data to develop optimized signal timing plans; implementing and fine-tuning the plans in the field; and conducting travel time surveys to analyze

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Project Overview (continued)

the performance of the new timing plans. This project also provided GPS-based time-sources for 50 intersections.

Benefits to Various Modes

Benefits to Bicyclists: The minimum green time was increased at all project intersections according to the 2012 California MUTCD. This change will result in enhanced safety for bicyclists upon crossing intersections.

Benefits to Pedestrians: To improve safety, the pedestrian crossing timings were updated at all of the project intersections based on the 2012 California MUTCD. This resulted in additional crossing times at all intersections. Despite the increase in pedestrian timings, travel time savings for autos were achieved by efficiently allocating and maximizing the use of available time.

Benefits to Transit: As part of the installation of GPS clocks, Caltrans also upgraded hardware to enable the use of Transit System Priority (TSP) and the GPS clocks in the same controller cabinet. This allowed VTA buses to continue using TSP, when necessary, to maintain schedule.

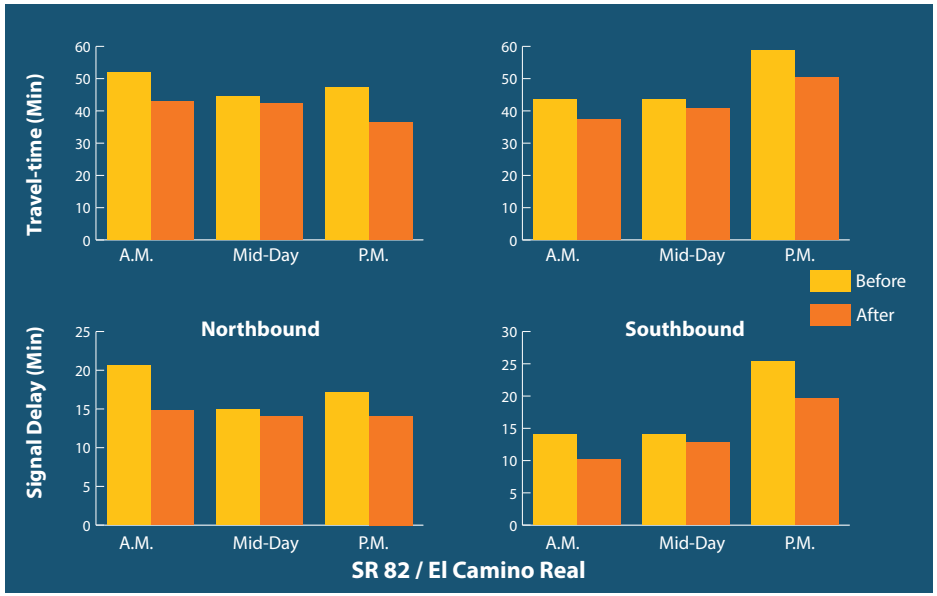
Benefits to Traffic Safety: To enhance traffic safety, the yellow clearance timing parameters were updated based on posted speed limits.

Project Costs	
Consultant Costs (Basic Services/ Plans)	$159,300
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	$4,400
Other Project Costs (GPS Clocks, Communications equipment, etc.)	$15,000
Agency Staff Costs (Estimate)	$39,825
Total Costs	**$218,525**

Project Benefits

Measures	*First Year*		*Lifetime (5 Years)*	
	Savings	*Monetized Savings*	*Savings*	*Monetized Savings*
Travel Time Savings	240,547 hrs.	$4,694,369	645,282 hrs.	$12,592,910
Fuel Consumption Savings	1,038,106 gal.	$4,006,223	2,784,777 gal.	$10,746,919
ROG Emissions Reduction	3.40 tons	$4,284	9.13 tons	$11,491
NOx Emissions Reduction	2.34 tons	$42,156	6.28 tons	$113,086
PM2.5 Emissions Reduction	0.13 tons	$39,465	0.34 tons	$105,867
CO Emissions Reduction	32.28 tons	$2,495	86.59 tons	$6,692
			Total Lifetime Benefits	**$23,576,966**

Overall Project Benefits	**Auto**
Average Decrease in Travel Time	**15%**
Average Speed Increase	**25%**
Average Fuel Savings	**12%**
Average Reduction in Signal Delay	**23%**
Average Reduction in Number of Stops	**33%**
Overall Benefit-Cost Ratio	**110:1**



SR 82 / El Camino Real

Project Benefits Summary

Average Reduction in Auto Signal Delay: 23%

Average Reduction in Number of Stops: 33%

Auto Fuel Consumption Savings: 12% or 2,784,777 gallons

Total Emissions Reduced (ROG, NOx, PM2.5, CO): 102.34 tons

Auto Travel Time Savings: 15% or 645,282 hours

Overall Project Benefit-cost Ratio = 110:1

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PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY13/14 CYCLE

County Expressways – Traffic Responsive Timing Plans

County of Santa Clara | Metropolitan Transportation Commission

Project Overview

The County of Santa Clara received a Program for Arterial System Synchronization (PASS) grant from the Metropolitan Transportation Commission (MTC) to develop traffic timing plans for 49 traffic signals, including 7 traffic signals on Oregon Expressway, 20 signals on Capitol Expressway, and 22 signals on Lawrence Expressway.

The goal of the project was to conduct a timing analysis, and to develop and implement new weekday signal coordination plans and traffic responsive timing at the traffic signals on Oregon Expressway, and update the traffic responsive timing for the weekend and weekday peak periods on Capitol Expressway and Lawrence Expressway.

Traffic responsive timing is a method of providing signal coordination by automatically deploying pre-set signal timing plans based on actual traffic volumes along the corridor, as opposed to plans being deployed at specific times during the day. Traffic volumes and loop detector data are continuously measured along the corridor and then a specific coordination plan is selected from a "bank" of plans based on the volumes.

Traffic responsive operation allows the system to select the most appropriate plan based on the actual traffic conditions and respond to

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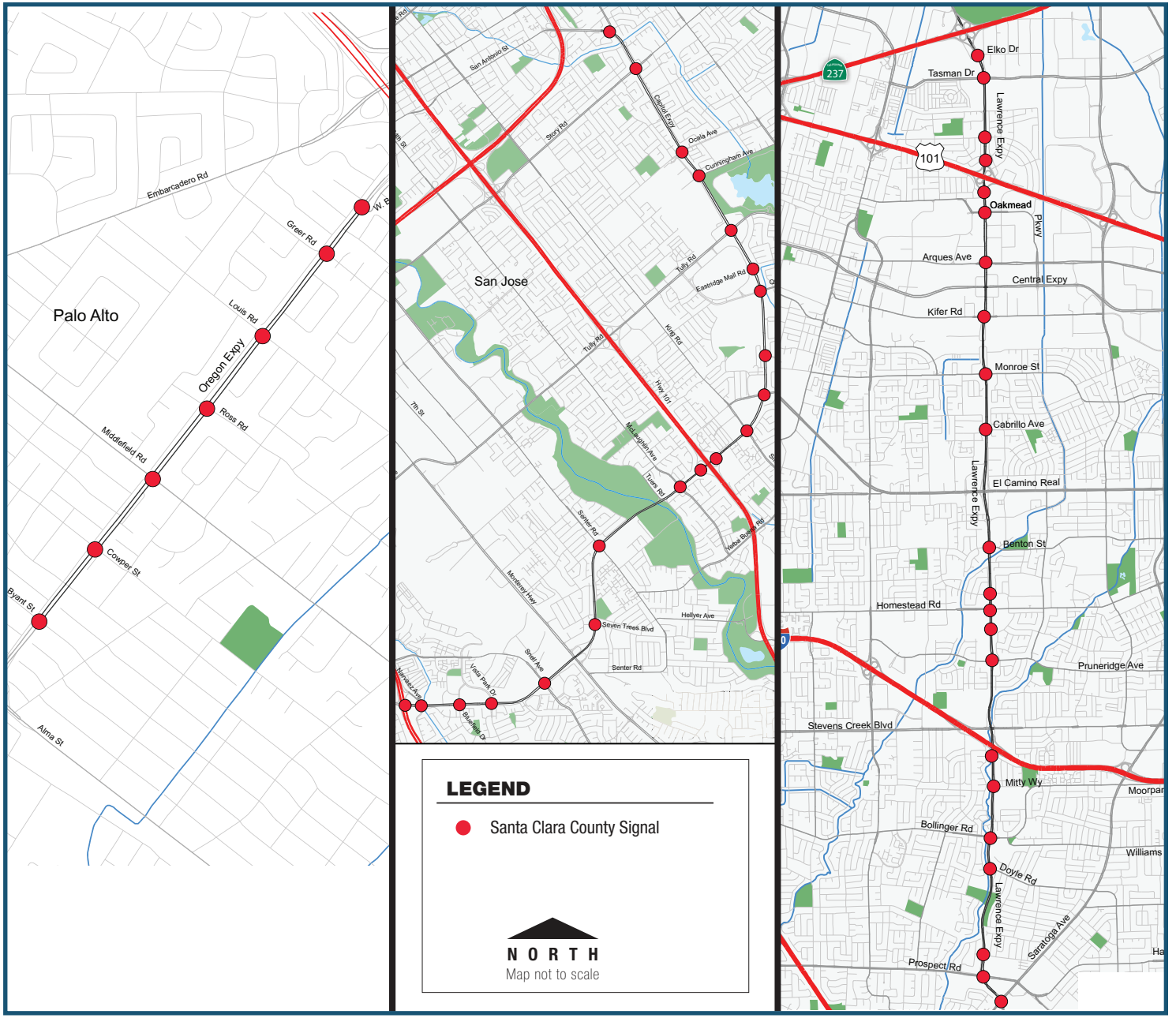


Project Overview (continued)

daily, weekly, and monthly traffic fluctuations.

The PASS project involved the completion of the following major tasks: collect detector data and existing timing plan information; collect turning movement counts; conduct travel time surveys and delay studies along the project corridors; collect collision history; and document the analyses and findings of the project.

Project Benefits

The traffic responsive operation will be in place during periods with varying volumes, such as during different times of the year when traffic is lighter (holidays or summer) or periods when traffic is heavier (during incidents on the freeway, when traffic diverts to the corridor). The use of more appropriate timing plans will result in reduced delay, vehicle emissions, and improved safety.

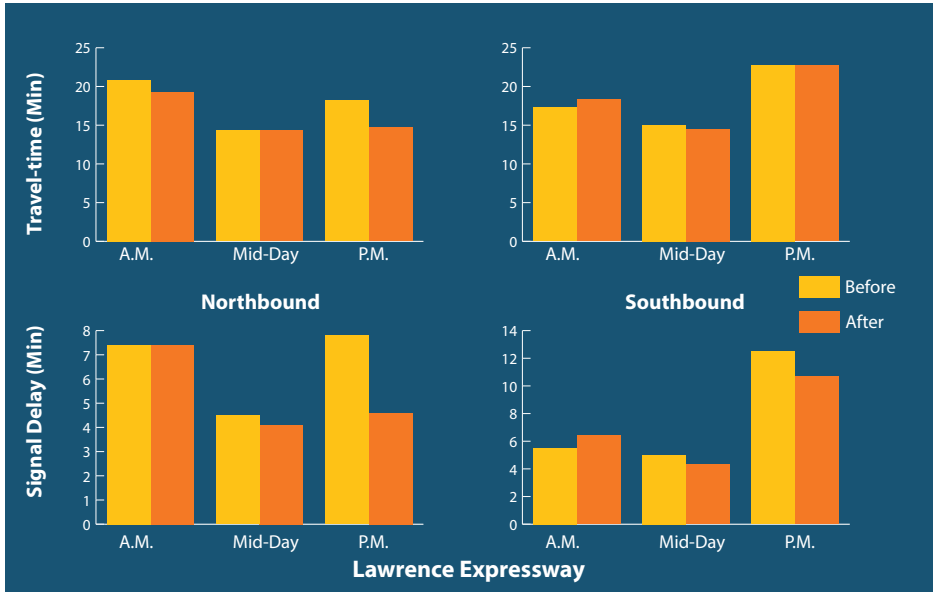
Existing bicycle and pedestrian timings were maintained with the traffic responsive timing. The implementation of traffic responsive timing did not have a negative impact on pedestrian and bicycle timings, and, in some cases, will even reduce the pedestrian and bicycle delay when lower cycle lengths are selected during lighter traffic periods.

Project Costs	
Consultant Costs (Basic Services/ Plans)	$22,500
Consultant Costs (Additional Plans Responsive Timing for Expressways)	$91,135
Other Project Costs (GPS Clocks, Communications equipment, etc.)	$0
Agency Staff Costs (Estimate)	$25,390
Total Costs	**$139,025**

Project Benefits

Measures	*First Year*		*Lifetime (5 Years)*	
	Savings	*Monetized Savings*	*Savings*	*Monetized Savings*
Travel Time Savings	178,710 hrs.	$3,487,593	479,400 hrs.	$9,355,666
Fuel Consumption Savings	522,123 gal.	$2,014,961	1,400,626 gal.	$5,405,248
ROG Emissions Reduction	1.63 tons	$2,046	4.36 tons	$5,487
NOx Emissions Reduction	1.09 tons	$19,596	2.92 tons	$52,567
PM2.5 Emissions Reduction	0.07 tons	$20,741	0.18 tons	$55,638
CO Emissions Reduction	17.32 tons	$1,339	46.47 tons	$3,592
			Total Lifetime Benefits	**$14,878,199**

Overall Project Benefits	**Auto**
Average Decrease in Travel Time	**8%**
Average Speed Increase	**15%**
Average Fuel Savings	**6%**
Average Reduction in Signal Delay	**21%**
Average Reduction in Number of Stops	**21%**
Overall Benefit-Cost Ratio	**107:1**



Project Benefits Summary

Average Reduction in Auto Signal Delay: 21%

Average Reduction in Number of Stops: 21%

Auto Fuel Consumption Savings: 6% or 1,400,626 gallons

Total Emissions Reduced (ROG, NOx, PM2.5, CO): 53.93 tons

Auto Travel Time Savings: 8% or 479,400 hours

Overall Project Benefit-cost Ratio = 107:1

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PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY13/14 CYCLE

City of Campbell Signal Timing Project

City of Campbell I City of San Jose I Metropolitan Transportation Commission

PROJECT OVERVIEW

The City of Campbell, in conjunction with the City of San Jose, received a grant from the Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to deploy optimized signal timing plans for the 15 traffic signals on East Hamilton Avenue and Meridian Avenue. Eight of the project intersections are owned and operated by the City of Campbell, and seven of the project intersections are owned and operated by the City of San Jose.

All of the project intersections are connected to a central signal system and can have implementation of the timings completely remotely.

The goal of the project was to conduct a timing analysis and develop and implement signal coordination plans during the weekday AM, midday, and PM peak periods, as well as the weekend peak and off-peak periods.

The PASS project involved the completion of the following tasks: collect turning movement counts, including vehicular, pedestrian, and bicycle counts; conduct field review of the project area; conduct travel time surveys; review actuated settings; review collision history; develop the existing conditions model; develop coordination plans for the weekday AM, midday, and PM peak periods, as well

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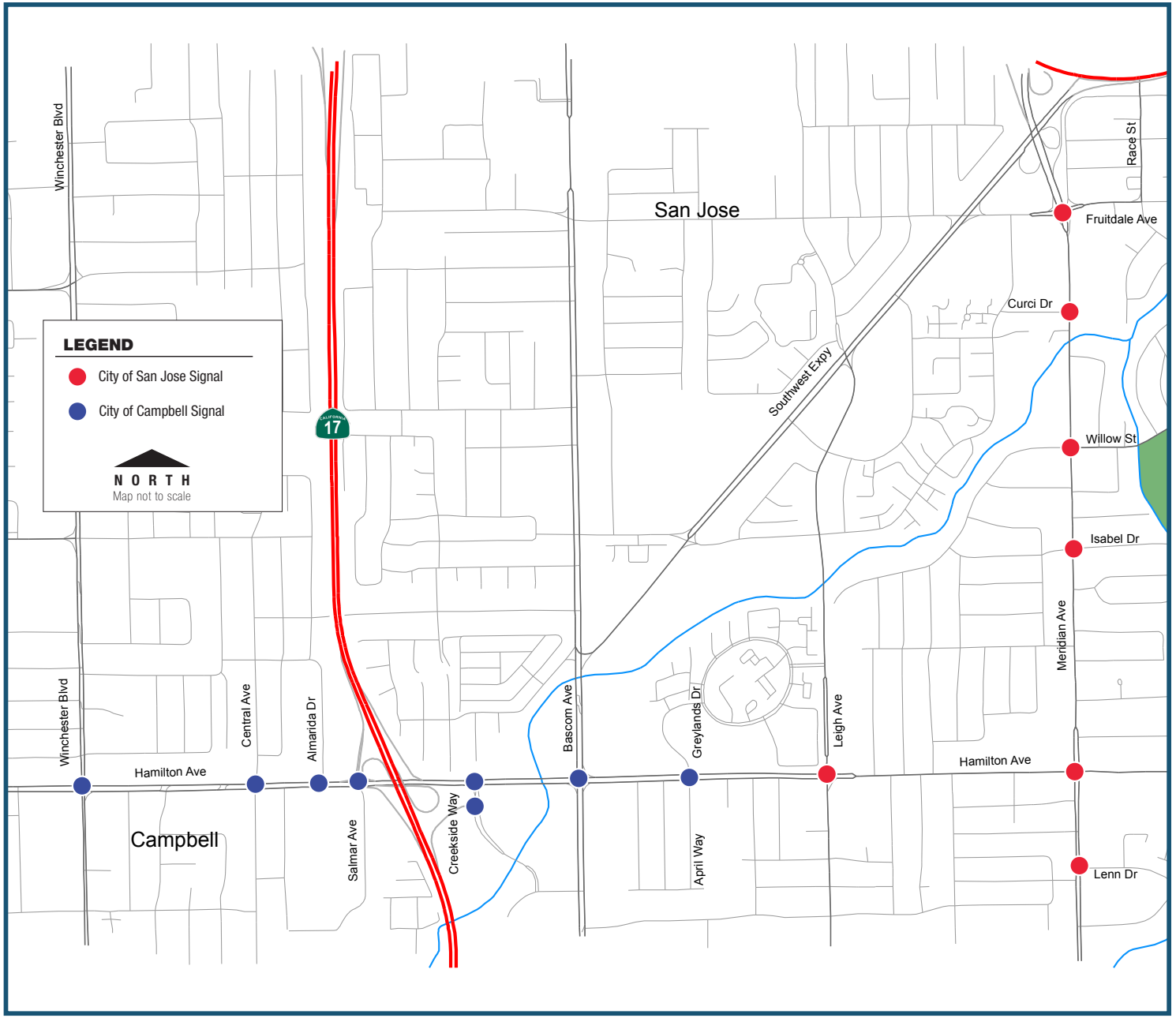


Project Overview (continued)

as the weekend peak and off-peak periods; implement and fine-tune the recommended timings; conduct the "before" and "after" travel time surveys; and document the analyses/ findings for the project.

After implementation of the timing plans, signal fine-tuning was conducted for all plans. Minor adjustments to the offsets and splits were made for each plan to achieve better performance of the signal timing based on observed conditions.

Benefits to Various Modes

Benefits to Bicyclists: The minimum green times were reviewed and increased at seven intersections to allow stopped bicyclists enough time to clear an intersection when the light turns green.

Benefits to Pedestrians: The pedestrian intervals were reviewed and increased at two intersections based on the 2012 California MUTCD to enhance safety.

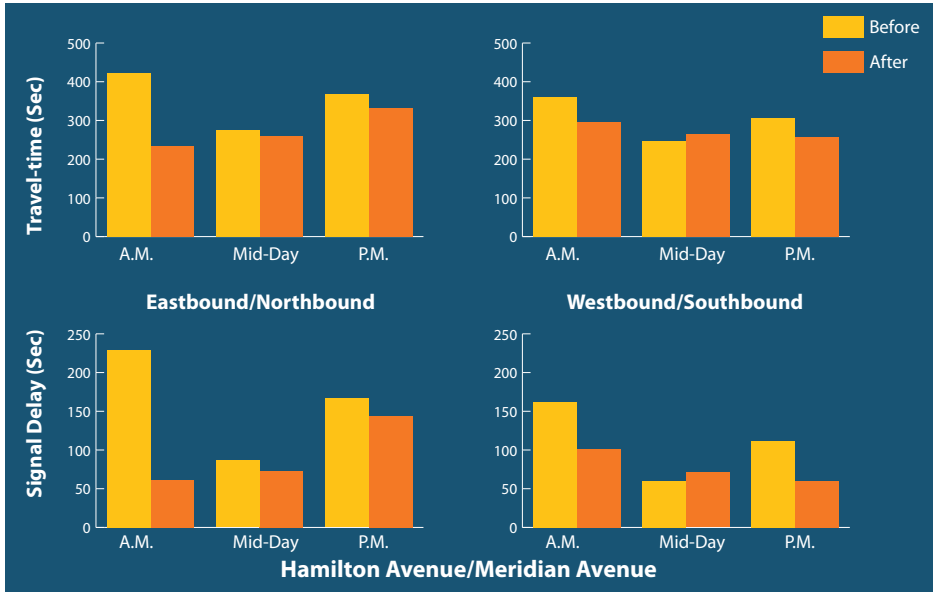
Benefits to Traffic Safety: To enhance traffic safety, all timing parameters at each project intersection were reviewed. A review of intersection level collisions along the corridors was conducted to identify any collision patterns that may be corrected through signal timing adjustments.

Project Costs	
Consultant Costs (Basic Services/ Plans)	$37,500
Consultant Costs (Weekend Coordination)	$33,000
Other Project Costs (GPS Clocks, Communications equipment, etc.)	$0
Agency Staff Costs (Estimate)	$9,375
Total Costs	**$79,875**

Project Benefits

Measures	*First Year*		*Lifetime (5 Years)*	
	Savings	*Monetized Savings*	*Savings*	*Monetized Savings*
Travel Time Savings	89,773 hrs.	$1,751,953	240,821 hrs.	$4,699,714
Fuel Consumption Savings	239,189 gal.	$923,069	641,637 gal.	$2,476,185
ROG Emissions Reduction	0.76 tons	$958	2.04 tons	$2,569
NOx Emissions Reduction	0.52 tons	$9,349	1.39 tons	$25,079
PM2.5 Emissions Reduction	0.03 tons	$8,418	0.07 tons	$22,581
CO Emissions Reduction	6.99 tons	$540	18.74 tons	$1,449
		Total Lifetime Benefits		**$7,227,576**

Overall Project Benefits	**Auto**
Average Decrease in Travel Time	**18%**
Average Speed Increase	**19%**
Average Fuel Savings	**11%**
Average Reduction in Signal Delay	**29%**
Average Reduction in Number of Stops	**27%**
Overall Benefit-Cost Ratio	**90:1**



Project Benefits Summary

Average Reduction in Auto Signal Delay: 29%

Average Reduction in Number of Stops: 27%

Auto Fuel Consumption Savings: 11% or 641,637 gallons

Total Emissions Reduced (ROG, NOx, PM2.5, CO): 22.24 tons

Auto Travel Time Savings: 18% or 240,821 hours

Overall Project Benefit-cost Ratio = 90:1

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PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY13/14 CYCLE

City of Concord Signal Timing Project

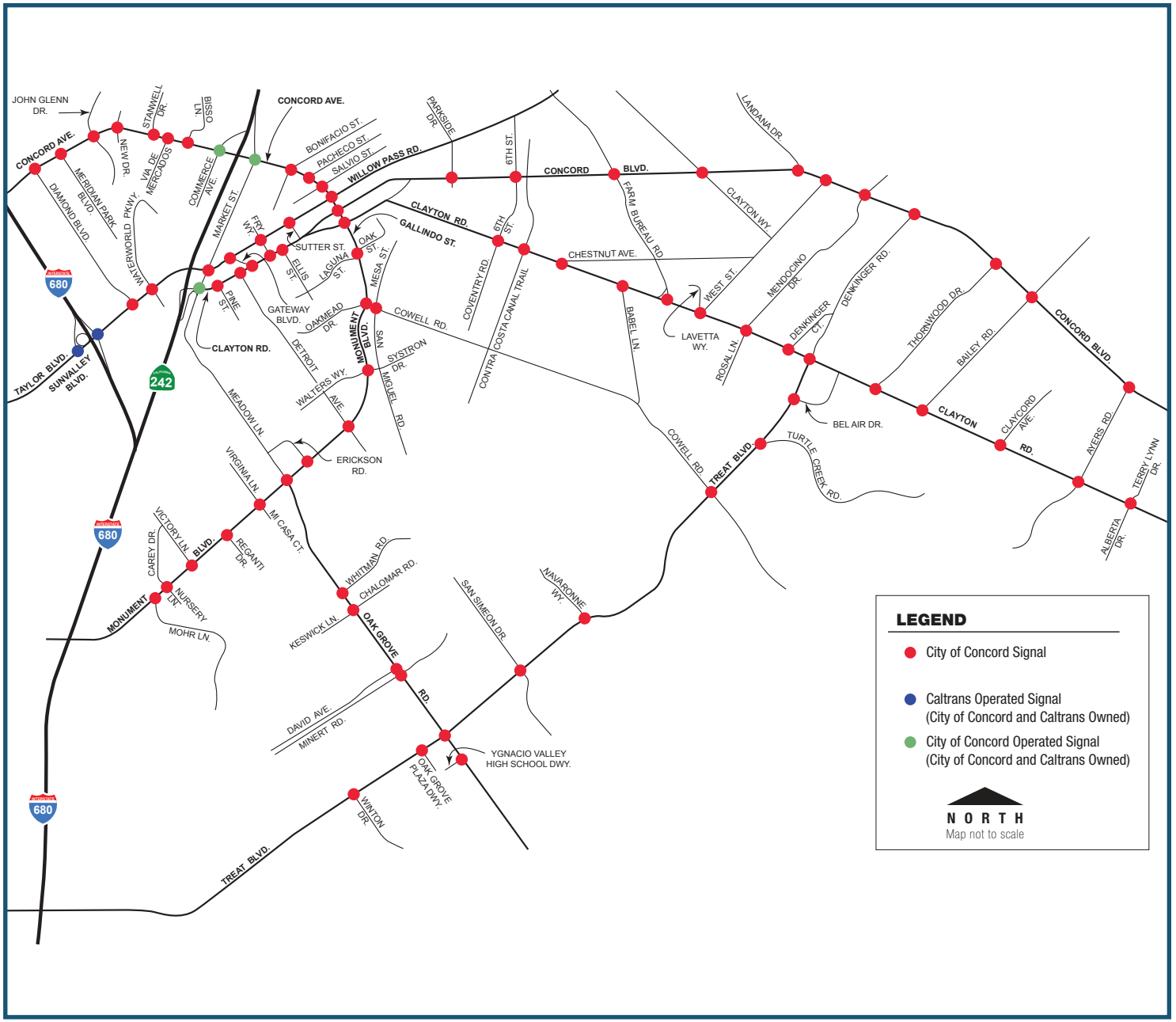
City of Concord | Caltrans | Metropolitan Transportation Commission

Project Overview

The City of Concord received a grant from the Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to conduct a signal timing study for 78 traffic signals along various corridors in the City. Seventy-three of the project intersections are owned and operated by the City of Concord, three signals are owned by the City and Caltrans but operated and maintained by the City, and two signals are owned by the City and Caltrans but operated and maintained by Caltrans.

The goal of the project was to conduct a timing analysis and develop and implement signal coordination plans during the weekdays for the 78 project signals. Timing plans developed and implemented consisted of AM, midday, and PM peak periods on typical weekdays.

The PASS project involved the completion of the following tasks: collect turning movement counts, including vehicular, pedestrian, and bicycle counts; conduct travel time surveys; review collision history; develop and implement coordination plans for the study periods; and conduct the "before" and "after" travel time surveys to assess the performance of the new plans. The field fine-tuning was conducted and minor adjustments were made to the offsets and splits based on observed traffic conditions.



Benefits to Various Modes

Benefits to Pedestrians: The Walk timing and Flashing Don't Walk clearance timing parameters were also updated to provide adequate time for children and seniors to safely cross the study intersections to accommodate the new walking speed of 3.5 feet/second, as specified in 2012 California MUTCD standards. The Walk times and Flashing Don't Walk clearance times were adjusted for all intersections.

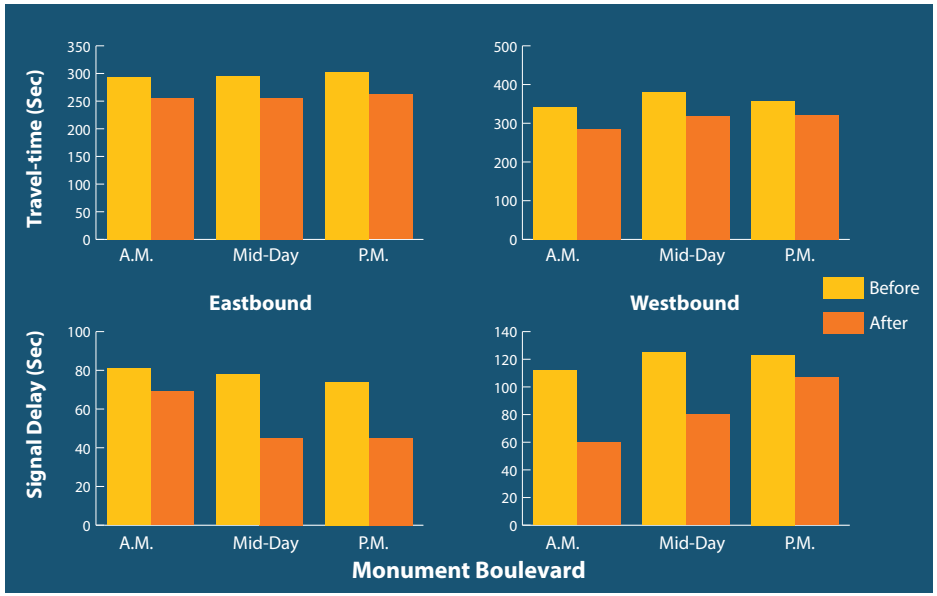
Benefits to Traffic Safety: The yellow clearance timing parameters were updated based on posted speed limits along the study corridors at seven project intersections and no changes were made to all red clearance timing parameters.

Project Costs	
Consultant Costs (Basic Services/ Plans)	$202,000
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	$1,680
Other Project Costs (GPS Clocks, Communications equipment, etc.)	$6,000
Agency Staff Costs (Estimate)	$50,500
Total Costs	**$260,180**

Project Benefits

Measures	*First Year*		*Lifetime (5 Years)*	
	Savings	*Monetized Savings*	*Savings*	*Monetized Savings*
Travel Time Savings	301,450 hrs.	$5,882,910	808,657 hrs.	$15,781,239
Fuel Consumption Savings	1,013,130 gal.	$3,909,839	2,717,779 gal.	$10,488,364
ROG Emissions Reduction	3.20 tons	$4,032	8.59 tons	$10,816
NOx Emissions Reduction	2.52 tons	$45,303	6.75 tons	$121,529
PM2.5 Emissions Reduction	0.11 tons	$35,421	0.30 tons	$95,020
CO Emissions Reduction	31.98 tons	$2,472	85.79 tons	$6,630
		Total Lifetime Benefits		**$26,503,598**

Overall Project Benefits	**Auto**
Average Decrease in Travel Time	**22%**
Average Speed Increase	**39%**
Average Fuel Savings	**18%**
Average Reduction in Signal Delay	**45%**
Average Reduction in Number of Stops	**38%**
Overall Benefit-Cost Ratio	**103:1**



Project Benefits Summary

Average Reduction in Auto Signal Delay: 45%

Average Reduction in Number of Stops: 38%

Auto Fuel Consumption Savings: 18% or 2,717,779 gallons

Total Emissions Reduced (ROG, NOx, PM2.5, CO): 101.43 tons

Auto Travel Time Savings: 22% or 808,657 hours

Overall Project Benefit-cost Ratio = 103:1

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PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY13/14 CYCLE

City of Dublin Signal Timing Project

City of Dublin I City of Pleasanton I Metropolitan Transportation Commission

PROJECT OVERVIEW

The City of Dublin, in conjunction with the City of Pleasanton, received a grant from the Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to deploy optimized signal timing plans for 16 traffic signals on Hacienda Drive and Tassajara Road-Santa Rita Road and 18 signals on Dublin Boulevard. The four project intersections located at the I-580 ramps are within Caltrans right-of-way but are operated and maintained by the City of Pleasanton. The remaining signals are owned and operated by the City of Dublin.

The goal of the project was to conduct timing analysis and develop and implement signal coordination plans during the weekday AM, midday, and PM peak periods on Hacienda Drive and Tassajara Road-Santa Rita Road, as well as to develop signal coordination flush plans for incident management for the signals on Dublin Boulevard.

The PASS project involved the completion of the following tasks: collect turning movement counts, including vehicular, pedestrian, and bicycle counts; conduct field review of the project area; conduct travel time surveys; review actuated settings; review collision history; develop the existing conditions model; develop coordination plans for the weekday AM, midday, and PM peak periods; implement and fine-tune the recommended

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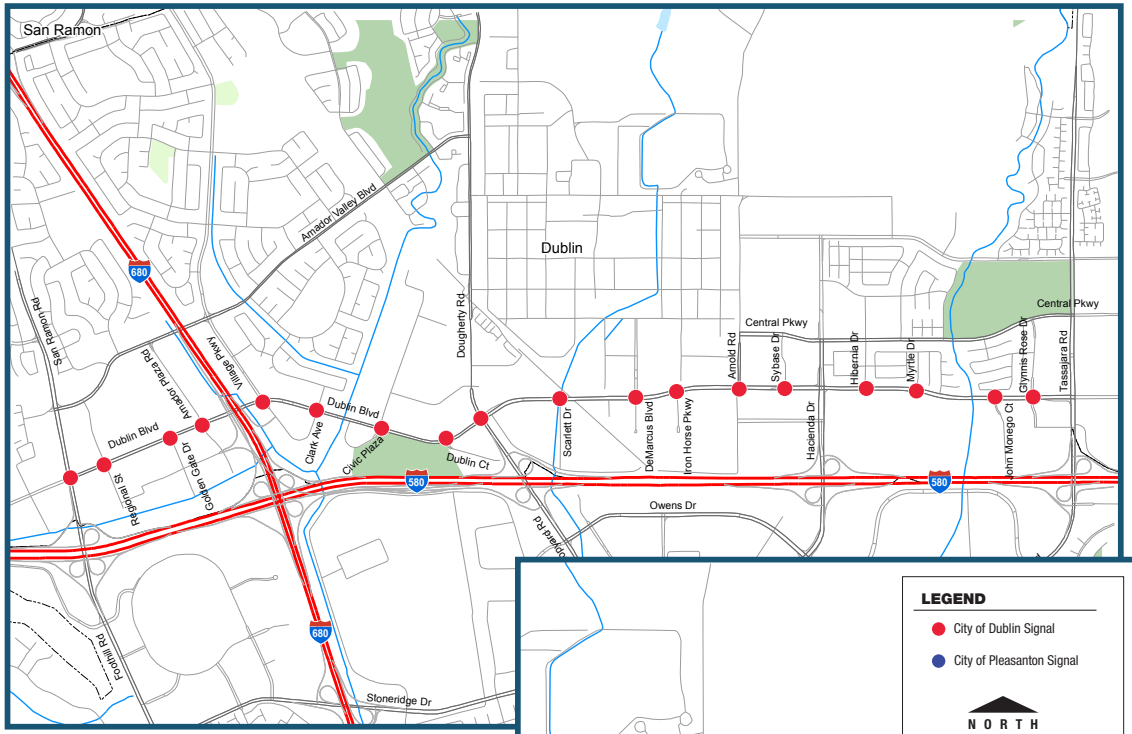
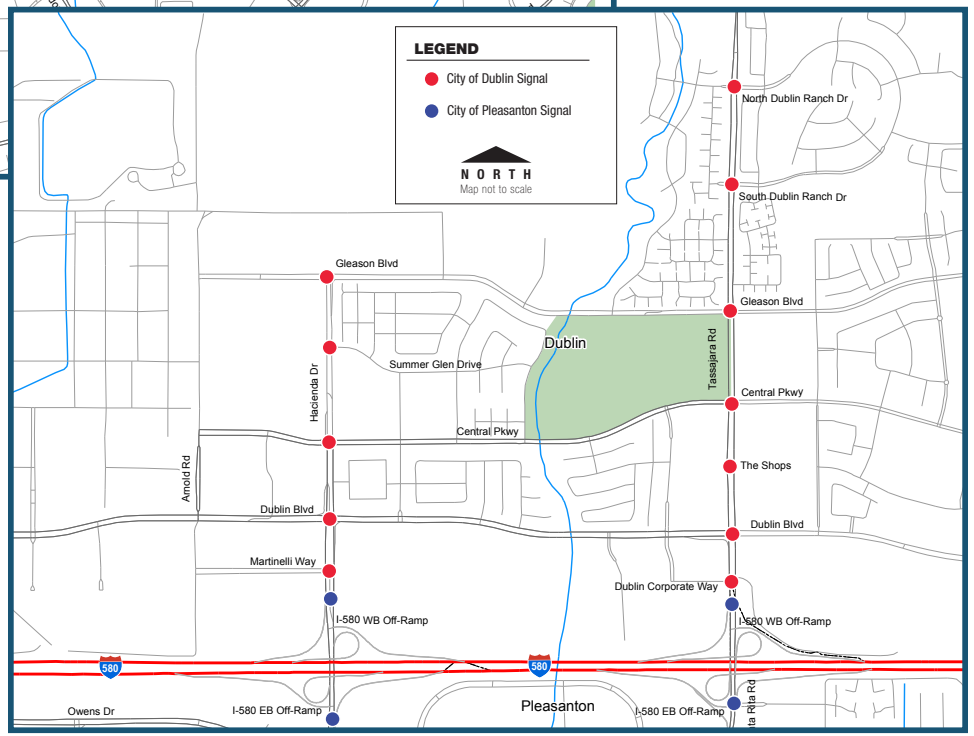


◀ **Dublin Boulevard Corridor**

Hacienda Drive and Tassajara Road Corridors ▶



Project Overview (continued)

timings; conduct the "before" and "after" travel time surveys; and document the analyses/ findings for the project.

During fine-tuning, minor adjustments to the offsets and splits were made for each plan and the time-of-operation was adjusted during peak periods.

Flush plans were developed for Dublin Boulevard at project intersections to help manage the traffic when an incident occurs on adjacent I-580.

Benefits to Various Modes

Benefits to Bicyclists: The minimum green times were reviewed and increased at three intersections. The green times were increased to allow stopped bicyclists enough time to clear an intersection when the light turns green.

Benefits to Pedestrians: The pedestrian intervals were reviewed and increased at 13 intersections based on the 2012 California MUTCD to enhance safety.

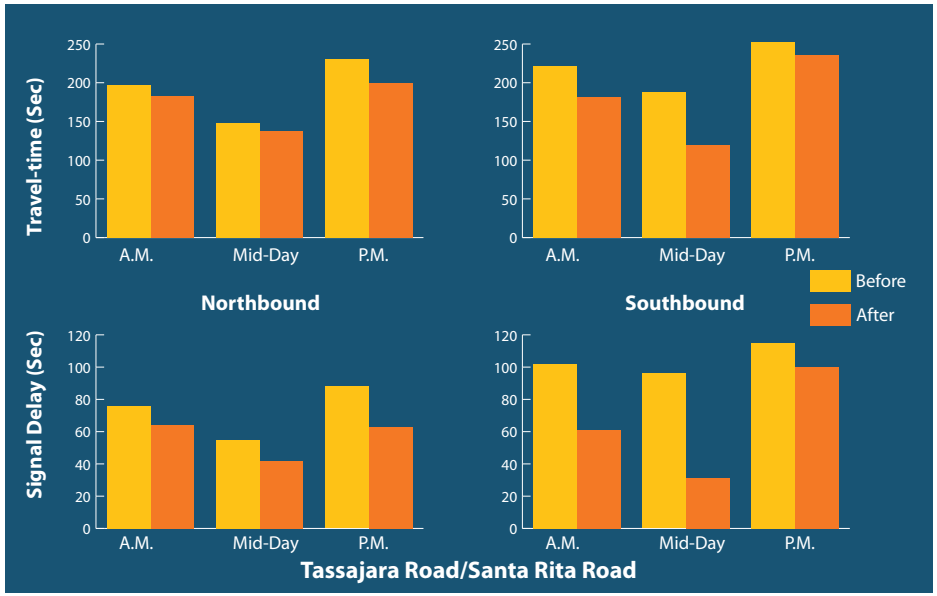
Benefits to Traffic Safety: To enhance traffic safety, all timing parameters at each project intersection were reviewed. Based on the review, changes to yellow intervals to meet the California MUTCD standards were implemented at seven project intersections.

Project Costs	
Consultant Costs (Basic Services/ Plans)	$40,000
Consultant Costs (Incident Management Flush Plans)	$16,210
Other Project Costs (GPS Clocks, Communications equipment, etc.)	$0
Agency Staff Costs (Estimate)	$10,000
Total Costs	**$66,210**

Project Benefits

Measures	*First Year*		*Lifetime (5 Years)*	
	Savings	*Monetized Savings*	*Savings*	*Monetized Savings*
Travel Time Savings	12,629 hrs.	$246,455	33,877 hrs.	$661,131
Fuel Consumption Savings	38,511 gal.	$148,620	103,307 gal.	$398,681
ROG Emissions Reduction	0.107 tons	$135	0.287 tons	$361
NOx Emissions Reduction	0.097 tons	$1,744	0.260 tons	$4,679
PM2.5 Emissions Reduction	0.005 tons	$1,574	0.014 tons	$4,222
CO Emissions Reduction	1.184 tons	$92	3.177 tons	$246
		Total Lifetime Benefits		**$1,069,319**

Overall Project Benefits	Auto
Average Decrease in Travel Time	**12%**
Average Speed Increase	**10%**
Average Fuel Savings	**11%**
Average Reduction in Signal Delay	**24%**
Average Reduction in Number of Stops	**38%**
Overall Benefit-Cost Ratio	**21:1**



Project Benefits Summary

Average Reduction in Auto Signal Delay: 24%

Average Reduction in Number of Stops: 38%

Auto Fuel Consumption Savings: 11% or 103,307 gallons

Total Emissions Reduced (ROG, NOx, PM2.5, CO): 3.74 tons

Auto Travel Time Savings: 12% or 33,877 hours

Overall Project Benefit-cost Ratio = 21:1

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Project Consultant:

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PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY13/14 CYCLE

Mission Boulevard Signal Timing Project

City of Fremont | Metropolitan Transportation Commission

PROJECT OVERVIEW

The City of Fremont received a grant from Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to deploy optimized signal timing plans along Mission Boulevard between Washington Boulevard and Paseo Padre Parkway. As part of the project, eight intersections were identified for retiming during the weekday AM, midday, and PM peak periods.

All signals are currently fully-actuated and owned and maintained by the City of Fremont. The project intersections operate using Eagle EPAC300 series controller (NEMA TS2) and communicate to the City's central signal system (Siemens ACTRA) in their Traffic Management Center (TMC) via copper twisted-pair cable.

The goal of this project is to improve traffic operation along the study corridor by developing and implementing optimized signal timing coordination plans that would improve air quality by decreasing traffic congestion.

The PASS project involved the completion of the following tasks: data collection, review of traffic data (including collision data), development of recommendations for actuated timings, development of coordination plans for the weekday AM, midday, and PM peak periods, implementation and fine-

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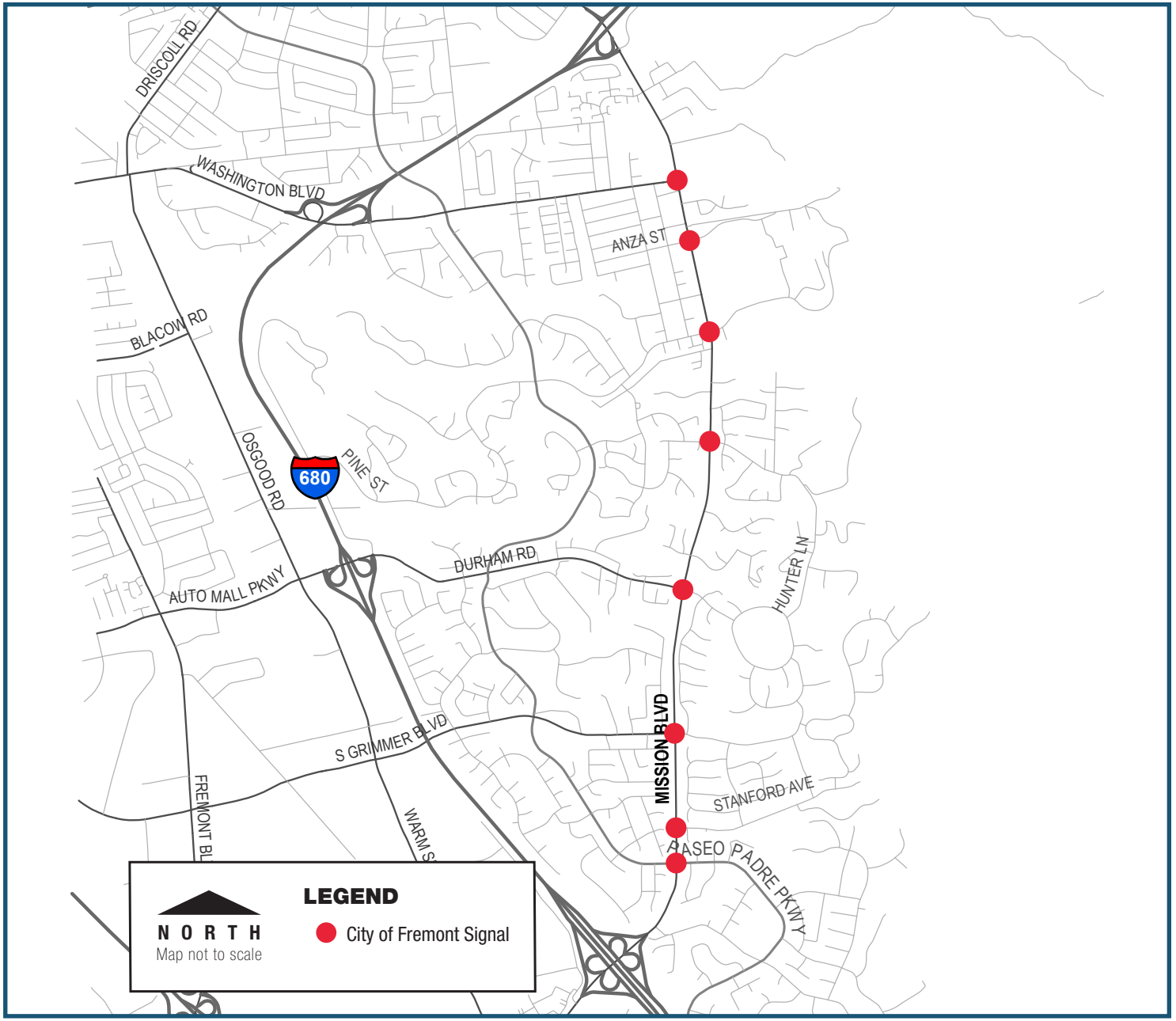


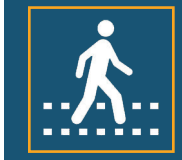
Project Overview (continued)

tuning of the recommended timings, "before" and "after" travel time surveys, and project documentation.

After fine-tuning, overall progression for the coordinated movements was good, with minimal delay for non-coordinated movements (i.e., side streets). Offset revisions were made to enable enhanced progression.

Benefits to Various Modes

Benefits to Bicyclists: Mission Boulevard has Class II bicycle lanes and the minimum green time for the major street was reviewed and compared with the City of Fremont's Typical Timing Parameters (TTP).



Benefits to Pedestrians: Pedestrian timing parameters were reviewed and all walk times were increased to seven seconds to meet the City's TTP.

Benefits to Traffic Safety: To enhance traffic safety, all timing parameters at each project intersection were reviewed. These parameters include: minimum green time, yellow time, red clearance time, Walk time, Flashing Don't Walk time, and extension time. The existing yellow time was updated to meet the 2012 California MUTCD and the City's TTP.

Project Costs	
Consultant Costs (Basic Services/ Plans)	$20,000
Other Project Costs (cabinet and controller equipment)	$0
Agency Staff Costs (Estimate)	$5,000
Total Costs	**$25,000**

Project Benefits

Measures	*First Year Average*		*Lifetime (5 Years)*	
	Savings	*Monetized Savings*	*Savings*	*Monetized Savings*
Travel Time Savings	6,291 hrs.	$122,770	16,876 hrs.	$329,337
Fuel Consumption Savings	14,120 gal.	$54,490	37,877 gal.	$146,173
ROG Emissions Reduction	0.047 tons	$59	0.126 tons	$158
NOx Emissions Reduction	0.024 tons	$428	0.064 tons	$1,147
PM2.5 Emissions Reduction	0.001 tons	$446	0.004 tons	$1,197
CO Emissions Reduction	0.560 tons	$43	1.502 tons	$116
			Total Lifetime Benefits	**$478,129**

Overall Project Benefits	**Auto**
Average Decrease in Travel Time	**9%**
Average Speed Increase	**15%**
Average Fuel Savings	**6%**
Average Reduction in Signal Delay	**57%**
Average Reduction in Number of Stops	**57%**
Overall Benefit-Cost Ratio	**19:1**

Project Benefits Summary

Average Reduction in Auto Signal Delay: 57%

Average Reduction in Number of Stops: 57%

Auto Fuel Consumption Savings: 6% or 37,877 gallons

Total Emissions Reduced (ROG, NOx, PM2.5, CO): 1.69 tons

Auto Travel Time Savings: 9% or 16,876 hours

Overall Project Benefit-cost Ratio = 19:1

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PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY13/14 CYCLE

City of Hayward Signal Timing Project

City of Hayward | Caltrans | Metropolitan Transportation Commission

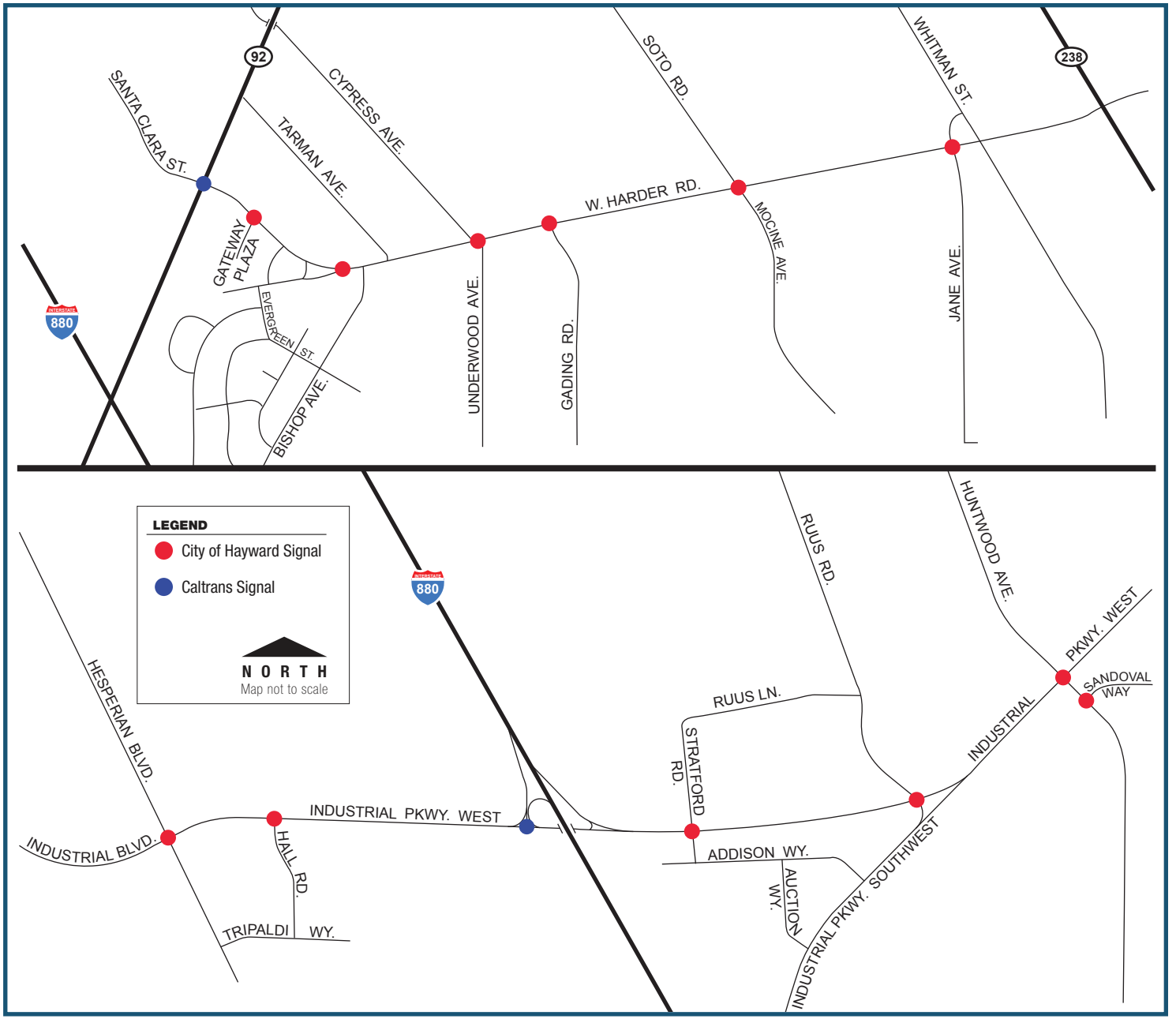
PROJECT OVERVIEW

The City of Hayward received a grant from the Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to conduct a signal timing study for 14 traffic signals along Harder Road and Industrial Parkway. Twelve of the project intersections are owned, operated and maintained by the City of Hayward, and two signals are owned, operated and maintained by Caltrans.

The goal of the project was to conduct a timing analysis and develop and implement signal coordination plans during the weekdays for the 14 project signals. Timing plans developed and implemented consisted of AM, midday, and PM peak periods on typical weekdays.

The PASS project involved the completion of the following tasks: collect turning movement counts, including vehicular, pedestrian, and bicycle counts; conduct travel time surveys; review collision history; develop coordination plans for the study periods; and conduct the "before" and "after" travel time surveys to assess the performance of the new plans.

The field fine-tuning was conducted during the typical weekday periods and minor adjustments were made to the offsets and splits based on observed traffic conditions.



Benefits to Various Modes

Benefits to Pedestrians: The pedestrian timings were reviewed based on the 2012 California MUTCD to ensure safety by providing adequate time for children and seniors to safely cross the study intersections. The Walk time and the Flashing Don't Walk clearance times were adjusted at all 14 project intersections.

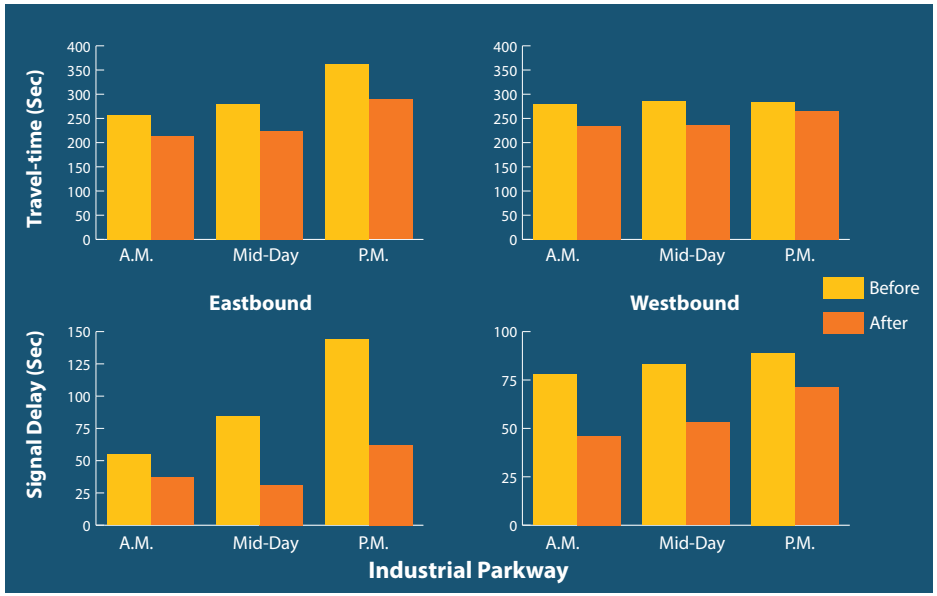
Benefits to Traffic Safety: The yellow clearance timing parameters were updated based on posted speed limits along the study corridors at seven project intersections and no changes were made to all red clearance timing parameters.

Project Costs	
Consultant Costs (Basic Services/ Plans)	$40,500
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	$3,000
Other Project Costs (GPS Clocks, Communications equipment, etc.)	$3,500
Agency Staff Costs (Estimate)	$10,125
Total Costs	**$57,125**

Project Benefits

Measures	*First Year*		*Lifetime (5 Years)*	
	Savings	*Monetized Savings*	*Savings*	*Monetized Savings*
Travel Time Savings	59,772 hrs.	$1,166,476	160,342 hrs.	$3,129,138
Fuel Consumption Savings	110,224 gal.	$425,374	295,683 gal.	$1,141,090
ROG Emissions Reduction	0.35 tons	$446	0.95 tons	$1,198
NOx Emissions Reduction	0.26 tons	$4,717	0.70 tons	$12,654
PM2.5 Emissions Reduction	0.01 tons	$3,919	0.03 tons	$10,514
CO Emissions Reduction	3.39 tons	$262	9.09 tons	$702
		Total Lifetime Benefits		**$4,295,295**

Overall Project Benefits	Auto
Average Decrease in Travel Time	**21%**
Average Speed Increase	**30%**
Average Fuel Savings	**17%**
Average Reduction in Signal Delay	**50%**
Average Reduction in Number of Stops	**39%**
Overall Benefit-Cost Ratio	**79:1**



Project Benefits Summary

Average Reduction in Auto Signal Delay: 50%

Average Reduction in Number of Stops: 39%

Auto Fuel Consumption Savings: 17% or 295,683 gallons

Total Emissions Reduced (ROG, NOx, PM2.5, CO): 10.77 tons

Auto Travel Time Savings: 21% or 160,342 hours

Overall Project Benefit-cost Ratio = 79:1

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TJKM Transportation Consultants

PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY13/14 CYCLE

City of Lafayette Signal Timing Project

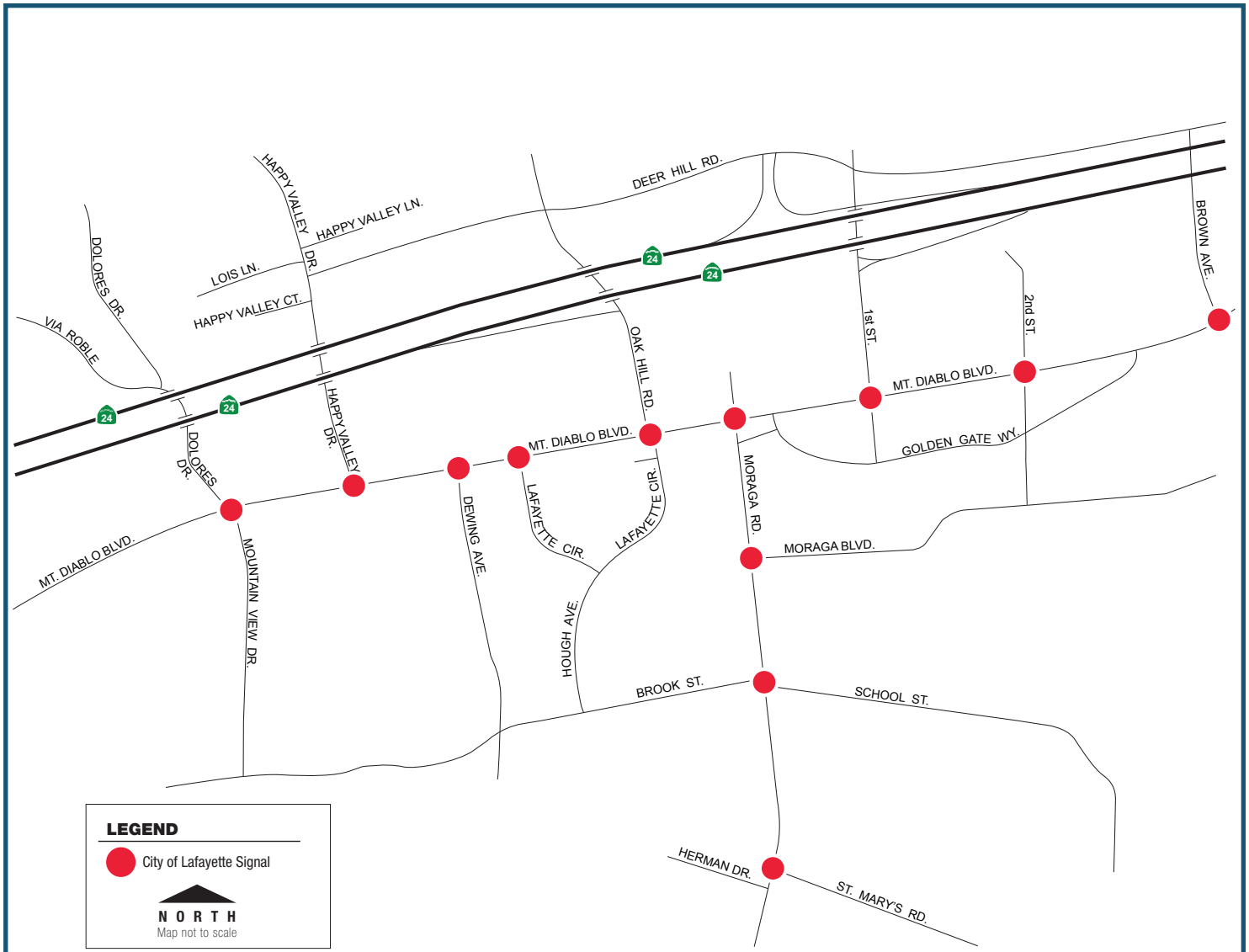
City of Lafayette | Metropolitan Transportation Commission

Project Overview

The City of Lafayette received a grant from the Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to conduct a signal timing study for 12 traffic signals along Mt. Diablo Boulevard and Moraga Road. All project intersections are owned, operated and maintained by the City of Lafayette.

The goal of the project was to conduct a timing analysis and develop and implement signal coordination plans during the weekdays and weekends for the 12 project signals. Timing plans developed and implemented consisted of AM, midday, school PM, PM peak periods on typical weekdays and midday and PM peak periods on typical weekends.

The PASS project involved the completion of the following tasks: collect turning movement counts, including vehicular, pedestrian, and bicycle counts; review actuated settings; review collision history; develop coordination plans for the study periods; implement and fine-tune the recommended timings; conduct "before" and "after" travel time surveys to assess the performance of the new plans; and document the analyses/findings for the project. The field fine-tuning was conducted during the typical weekday and weekend peak periods and minor adjustments were made to the offsets and splits based on observed traffic conditions.



Benefits to Various Modes

Benefits to Pedestrians: The Walk timing and Flash Don't Walk clearance-timing parameters were reviewed and updated at eight study intersections to provide adequate time for children and seniors to safely cross the study intersections to accommodate the new walking speed of 3.5 feet/second, as specified in 2012 California MUTCD standards.

Benefits to Bicyclists: To improve safety for bicyclists along the corridor, the minimum green intervals were reviewed; and changes were made at 11 study intersections.

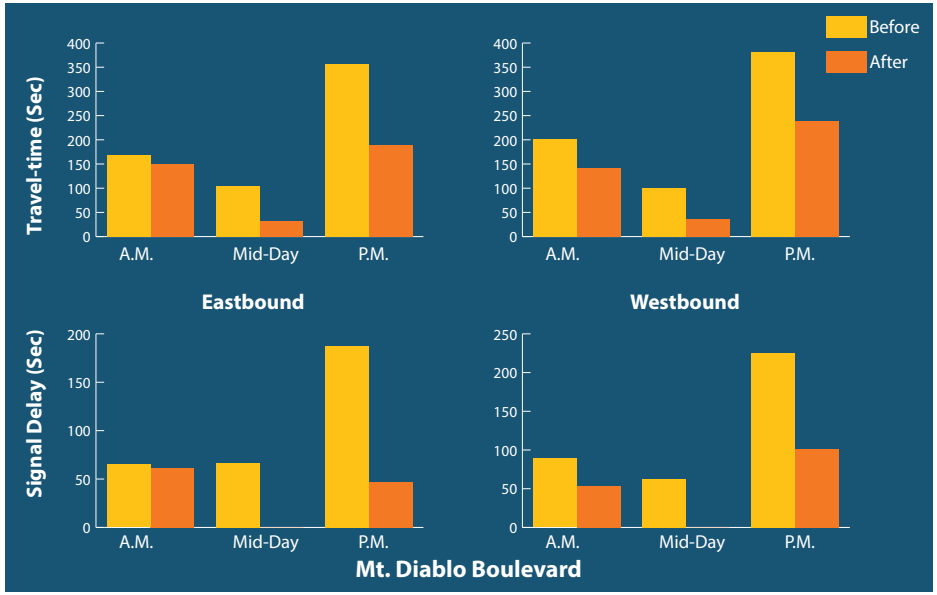
Benefits to Traffic Safety: The yellow clearance timing parameters were updated at one project intersection based on the posted speed limits along the study corridors. No changes were made to the All Red clearance timing parameters.

Project Costs	
Consultant Costs (Basic Services/Plans)	$70,800
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	$6,500
Other Project Costs (GPS Clocks, Communications equipment, etc.)	$3,960
Agency Staff Costs (Estimate)	$17,700
Total Costs	**$98,960**

Project Benefits

Measures	*First Year*		*Lifetime (5 Years)*	
	Savings	*Monetized Savings*	*Savings*	*Monetized Savings*
Travel Time Savings	84,074 hrs.	$1,640,735	225,533 hrs.	$4,401,363
Fuel Consumption Savings	5,681 gal.	$21,923	15,239 gal.	$58,810
ROG Emissions Reduction	0.023 tons	$28	0.061 tons	$76
NOx Emissions Reduction	0.014 tons	$244	0.036 tons	$656
PM2.5 Emissions Reduction	0.001 tons	$235	0.002 tons	$630
CO Emissions Reduction	0.154 tons	$12	0.412 tons	$32
			Total Lifetime Benefits	**$4,461,567**

Overall Project Benefits	**Auto**
Average Decrease in Travel Time	**35%**
Average Speed Increase	**62%**
Average Fuel Savings	**24%**
Average Reduction in Signal Delay	**57%**
Average Reduction in Number of Stops	**45%**
Overall Benefit-Cost Ratio	**48:1**



Project Benefits Summary

Average Reduction in Auto Signal Delay: 57%

Average Reduction in Number of Stops: 45%

Auto Fuel Consumption Savings: 24% or 15,239 gallons

Total Emissions Reduced (ROG, NOx, PM2.5, CO): 0.51 tons

Auto Travel Time Savings: 35% or 225,533 hours

Overall Project Benefit-cost Ratio = 48:1

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PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY13/14 CYCLE

East Blithedale Avenue and Camino Alto Signal Timing Project

City of Mill Valley | Caltrans I Metropolitan Transportation Commission

PROJECT OVERVIEW

The City of Mill Valley received a grant from Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to deploy optimized signal timing plans along East Blithedale Avenue between Redwood Highway Frontage Road and Camino Alto, and along Camino Alto between East Blithedale Avenue and Miller Avenue. As part of the project, nine intersections were identified for retiming during the weekday AM, midday, school peak, and PM periods, as well as the weekend peak period.

All signals are currently fully-actuated, of which six intersections are operated and maintained by the City of Mill Valley, and three intersections are operated and maintained by Caltrans. The City of Mill Valley last studied and retimed these signals in 2001. All City-maintained signals operate using BiTran 170 controllers. The signalized intersections that Caltrans maintains were recently upgraded to 2070 controllers with TSCP firmware.

The goal of this project is to improve coordination between these signals and help to address operational deficiencies.

The PASS project involved the completion of the following tasks: data collection, review of traffic data (including collision data), development of recommended adjustments to

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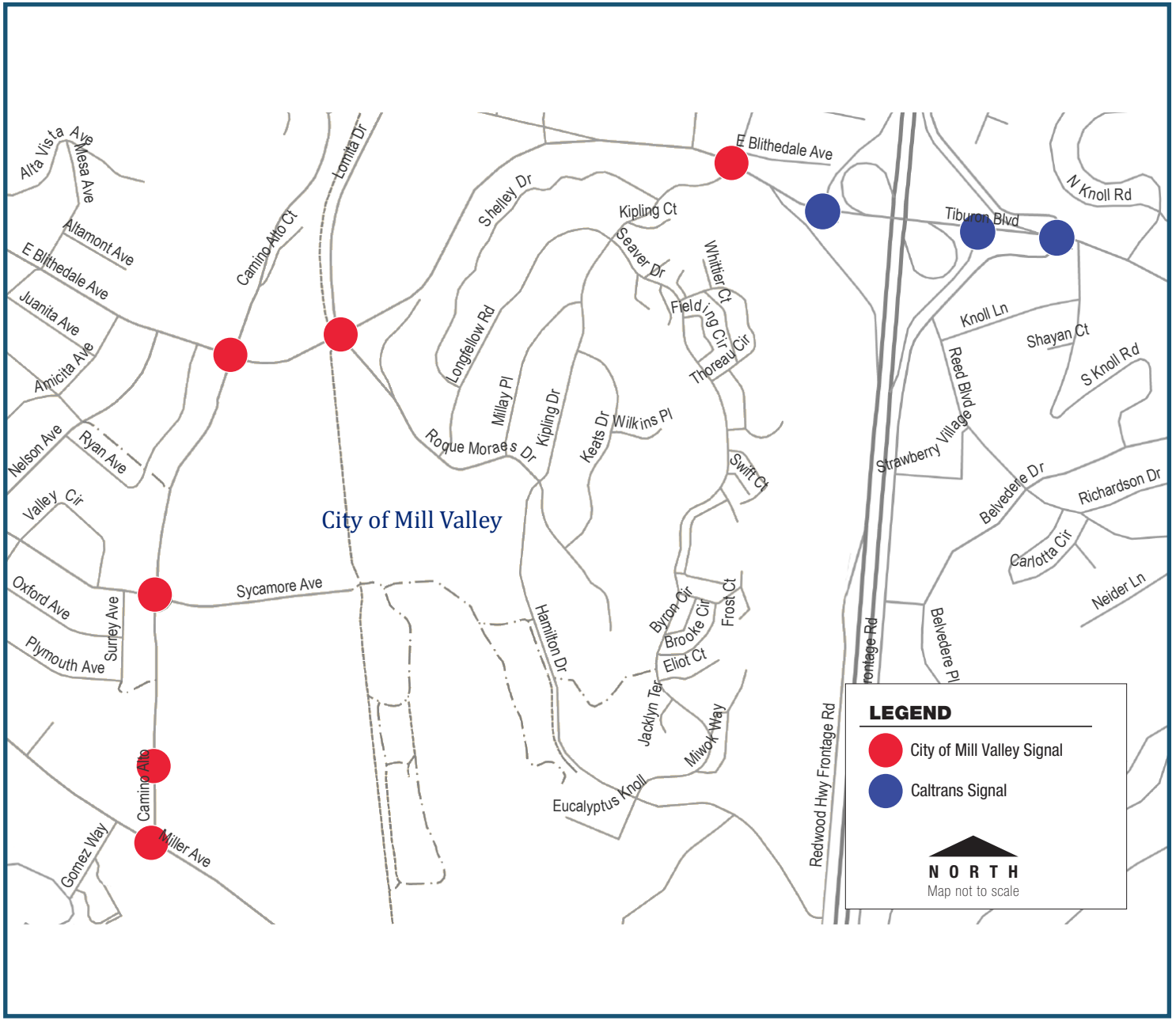


Project Overview (continued)

actuated timings, development of coordination plans for the weekday, weekend, and school peak periods, implementation and fine-tuning of the recommended timings, "before" and "after" travel time surveys, and project documentation.

Fine-tuning was conducted immediately following the implementation of the new timings to ensure the most effective timings were deployed into the system. Offset revisions were made to enable enhanced progression.

Benefits to Various Modes

Benefits to Bicyclists: Bicycle minimum green time was reviewed to meet the California MUTCD guidelines for minimum bicycle clearance.

Benefits to Pedestrians: Pedestrian timing parameters were reviewed for each project intersection to ensure adequate crossing time for pedestrians.

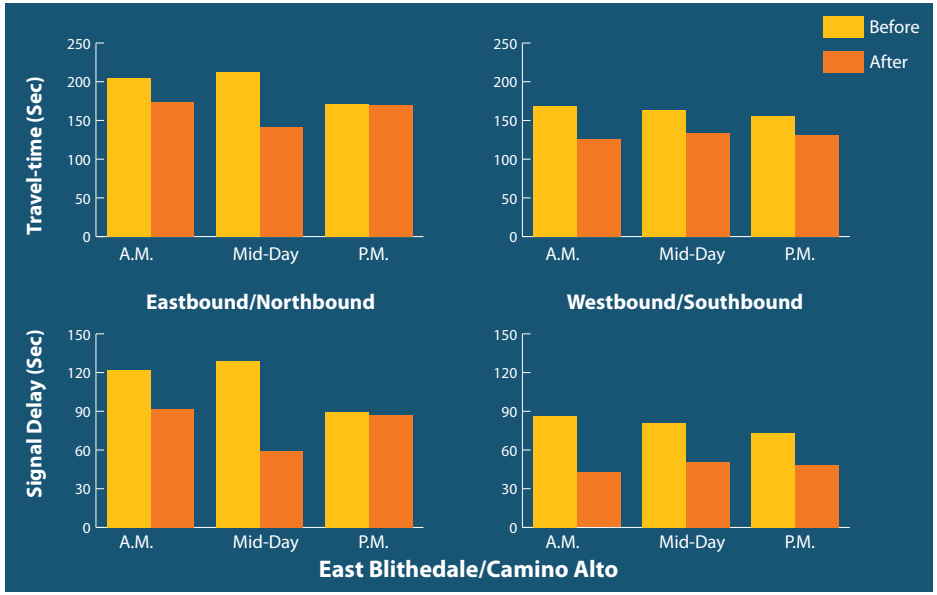
Benefits to Traffic Safety: To enhance traffic safety, all timing parameters at each project intersection were reviewed. These parameters include: minimum green time, yellow time, all-red clearance time, Walk time, Flashing Don't Walk time, and bicycle minimum green time.

Project Costs	
Consultant Costs (Basic Services/ Plans)	$40,500
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	$11,000
Other Project Costs (GPS Clocks, Communications equipment, etc.)	$2,500
Agency Staff Costs (Estimate)	$10,125
Total Costs	**$64,125**

Project Benefits

Measures	*First Year*		*Lifetime (5 Years)*	
	Savings	*Monetized Savings*	*Savings*	*Monetized Savings*
Travel Time Savings	23,395 hrs.	$456,568	62,759 hrs.	$1,224,771
Fuel Consumption Savings	42,859 gal.	$165,399	114,971 gal.	$443,692
ROG Emissions Reduction	0.125 tons	$157	0.334 tons	$421
NOx Emissions Reduction	0.110 tons	$1,982	0.295 tons	$5,316
PM2.5 Emissions Reduction	0.006 tons	$1,733	0.015 tons	$4,649
CO Emissions Reduction	1.283 tons	$99	3.443 tons	$266
		Total Lifetime Benefits		**$1,679,115**

Overall Project Benefits	Auto
Average Decrease in Travel Time	9%
Average Speed Increase	21%
Average Fuel Savings	6%
Average Reduction in Signal Delay	28%
Average Reduction in Number of Stops	37%
Overall Benefit-Cost Ratio	**32:1**



Project Benefits Summary

Average Reduction in Auto Signal Delay: 28%

Average Reduction in Number of Stops: 37%

Auto Fuel Consumption Savings: 6% or 114,971 gallons

Total Emissions Reduced (ROG, NOx, PM2.5, CO): 4.08 tons

Auto Travel Time Savings: 9% or 62,759 hours

Overall Project Benefit-cost Ratio = 32:1

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Project Consultant:

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PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY13/14 CYCLE

City of Mountain View Signal Timing Project

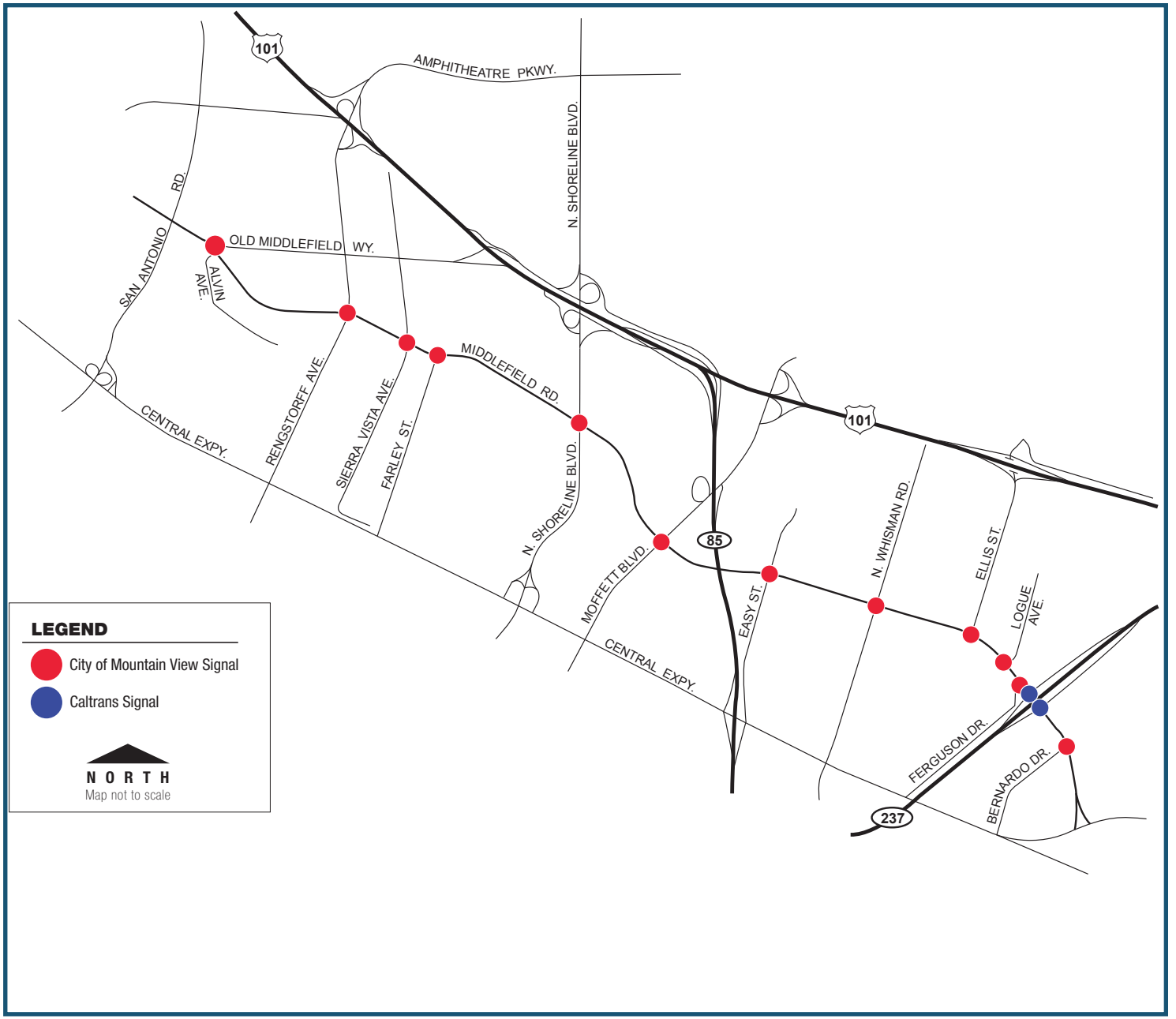
City of Mountain View I Caltrans I Metropolitan Transportation Commission

Project Overview

The City of Mountain View received a grant from the Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to conduct a signal timing study for 14 traffic signals along Middlefield Road. Twelve of the project intersections are owned, operated and maintained by the City of Mountain View, and two signals are owned, operated and maintained by Caltrans.

The goal of the project was to conduct a timing analysis and develop and implement signal coordination plans during the weekdays for the 14 project signals. Timing plans developed and implemented consisted of AM, midday, and PM peak periods on typical weekdays.

The PASS project involved the completion of the following tasks: collect turning movement counts, including vehicular, pedestrian, and bicycle counts; conduct "before" and "after" travel time surveys; review actuated settings; review collision history; develop coordination plans for the study periods; implement and fine-tune the recommended timings; and document the analyses/findings for the project. The field fine-tuning was conducted during the typical weekday periods and minor adjustments were made to the offsets and splits based on observed traffic conditions.



Benefits to Various Modes

Benefits to Bicyclists: To improve safety for bicyclists traveling along the corridor, the minimum green intervals were reviewed; and changes were made at 10 study intersections from Bernardo Avenue to Rengstorff Avenue.

Benefits to Pedestrians: The Walk timing and Flash Don't Walk clearance timing parameters were updated at all of the study intersections to provide adequate time for children and seniors to safely cross the study intersections. The parameters were adjusted to accommodate the new walking speed of 3.5 feet/second, as specified in the 2012 California MUTCD standards.

Benefits to Traffic Safety: The yellow clearance timing parameters were updated at two project intersections, based on the posted speed limits along the study corridors. No changes were made to the All Red clearance timing parameters.

Project Costs	
Consultant Costs (Weekday Coordination Timing Plans)	$55,860
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	$8,020
Other Project Costs (GPS Clocks, Communications equipment, etc.)	$5,000
Agency Staff Costs (Estimate)	$13,965
Total Costs	**$82,845**

Project Benefits

Measures	*First Year*		*Lifetime (5 Years)*	
	Savings	*Monetized Savings*	*Savings*	*Monetized Savings*
Travel Time Savings	49,632 hrs.	$968,592	133,141 hrs.	$2,598,303
Fuel Consumption Savings	114,931 gal.	$443,536	308,308 gal.	$1,189,812
ROG Emissions Reduction	0.33 tons	$411	0.88 tons	$1,103
NOx Emissions Reduction	0.26 tons	$4,676	0.70 tons	$12,544
PM2.5 Emissions Reduction	0.01 tons	$3,525	0.03 tons	$9,456
CO Emissions Reduction	3.60 tons	$278	9.66 tons	$746
		Total Lifetime Benefits		**$3,811,964**

Overall Project Benefits	**Auto**
Average Decrease in Travel Time	**25%**
Average Speed Increase	**31%**
Average Fuel Savings	**19%**
Average Reduction in Signal Delay	**41%**
Average Reduction in Number of Stops	**19%**
Overall Benefit-Cost Ratio	**51:1**

Project Benefits Summary

Average Reduction in Auto Signal Delay: 41%

Average Reduction in Number of Stops: 19%

Auto Fuel Consumption Savings: 19% or 308,308 gallons

Total Emissions Reduced (ROG, NOx, PM2.5, CO): 11.27 tons

Auto Travel Time Savings: 25% or 133,141 hours

Overall Project Benefit-cost Ratio = 51:1

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Project Consultant:
TJKM Transportation Consultants

PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY13/14 CYCLE

City of Oakland Signal Timing Project

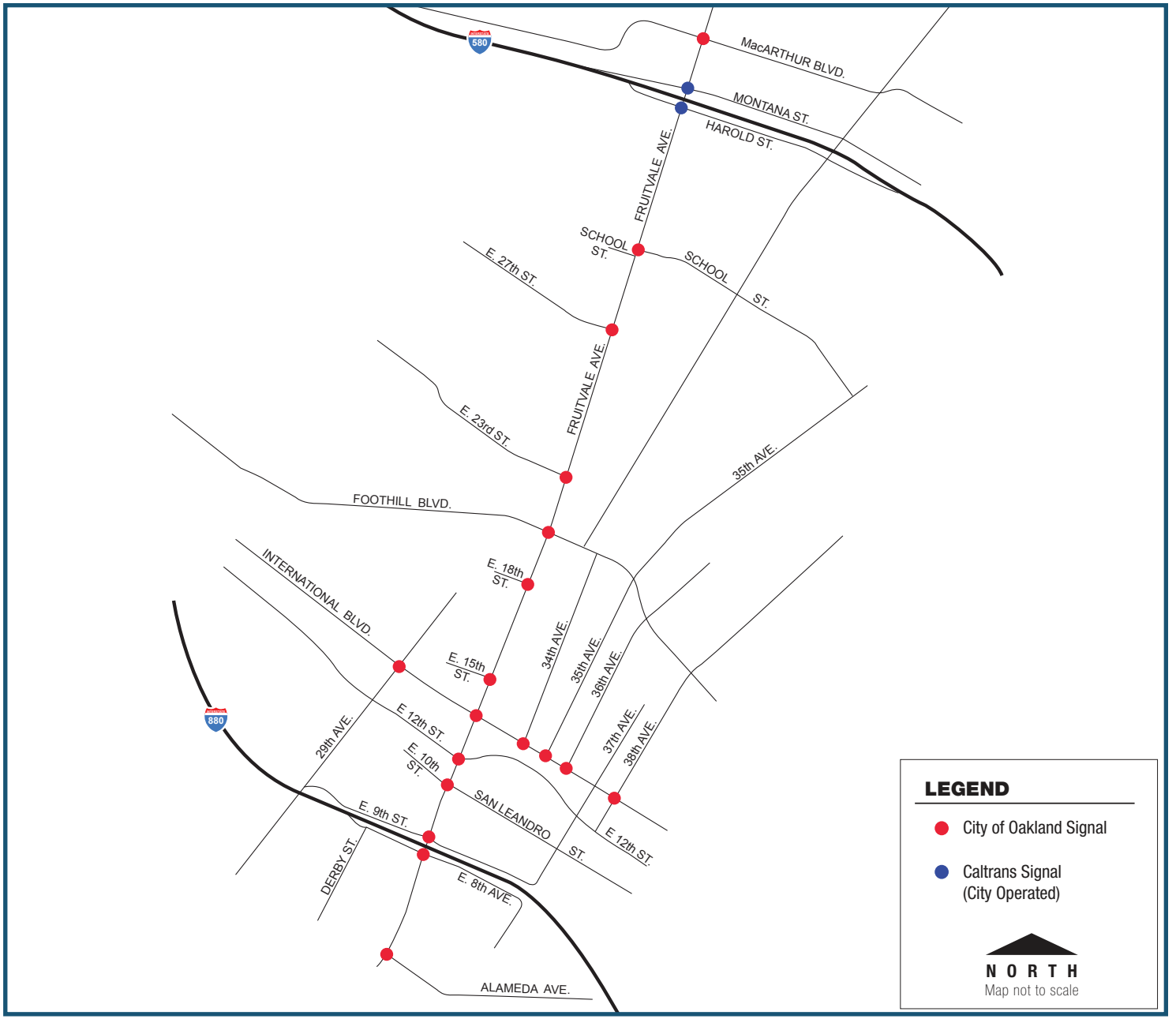
City of Oakland | Caltrans | Metropolitan Transportation Commission

PROJECT OVERVIEW

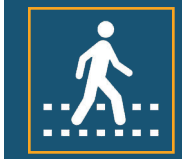
The City of Oakland received a grant from the Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to conduct a signal timing study for 20 traffic signals along various corridors in the City. All project intersections are operated and maintained by the City of Oakland. Two signals are owned by Caltrans, and 18 signals are owned by the City of Oakland.

The goal of the project was to conduct a timing analysis and develop and implement signal coordination plans during the weekdays for the 20 project signals. Timing plans developed and implemented consisted of AM, midday, and PM peak periods on typical weekdays.

The PASS project involved the completion of the following tasks: collect turning movement counts, including vehicular, pedestrian, and bicycle counts; conduct travel time surveys; review collision history; develop and implement coordination plans for the study periods; and conduct the "before" and "after" travel time surveys to assess the performance of the new plans. The field fine-tuning was conducted and minor adjustments were made to the offsets and splits based on observed traffic conditions.



Benefits to Various Modes



Benefits to Pedestrians: The Walk timing and Flash Don't Walk clearance timing parameters were also updated to provide adequate time for children and seniors to safely cross the study intersections to accommodate the new walking speed of 3.5 feet/second, as specified in 2012 California MUTCD standards. The Walk times and the Flashing Don't Walk clearance times were adjusted for 11 project intersections.

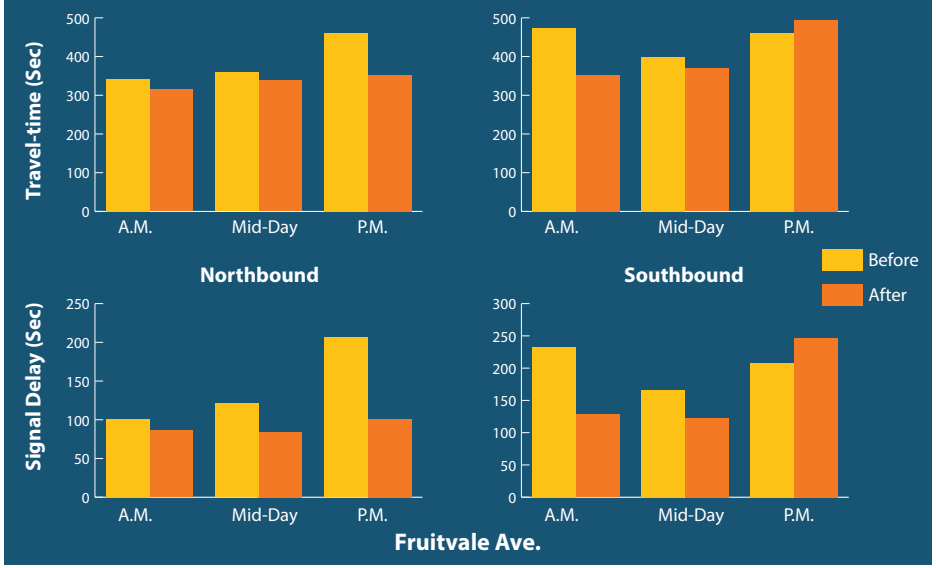
Benefits to Traffic Safety: The yellow clearance timing parameters were updated based on posted speed limits along the study corridors at three project intersections and no changes were made to all red clearance timing parameters.

Project Costs	
Consultant Costs (Basic Services/ Plans)	$54,000
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	$13,070
Other Project Costs (GPS Clocks, Communications equipment, etc.)	$7,500
Agency Staff Costs (Estimate)	$13,500
Total Costs	**$88,070**

Project Benefits

Measures	*First Year*		*Lifetime (5 Years)*	
	Savings	*Monetized Savings*	*Savings*	*Monetized Savings*
Travel Time Savings	21,584 hrs.	$421,218	57,900 hrs.	$1,129,940
Fuel Consumption Savings	46,604 gal.	$175,993	122,335 gal.	$472,112
ROG Emissions Reduction	0.17 tons	$216	0.46 tons	$579
NOx Emissions Reduction	0.11 tons	$1,898	0.28 tons	$5,090
PM2.5 Emissions Reduction	0.01 tons	$1,774	0.02 tons	$4,758
CO Emissions Reduction	1.25 tons	$96	3.34 tons	$258
		Total Lifetime Benefits		**$1,612,738**

Overall Project Benefits	Auto
Average Decrease in Travel Time	**11%**
Average Speed Increase	**17%**
Average Fuel Savings	**8%**
Average Reduction in Signal Delay	**6%**
Average Reduction in Number of Stops	**18%**
Overall Benefit-Cost Ratio	**22:1**



Project Benefits Summary

Average Reduction in Auto Signal Delay: 6%

Average Reduction in Number of Stops: 18%

Auto Fuel Consumption Savings: 8% or 122,335 gallons

Total Emissions Reduced (ROG, NOx, PM2.5, CO): 4.1 tons

Auto Travel Time Savings: 11% or 57,900 hours

Overall Project Benefit-cost Ratio = 22:1

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Project Consultant:

TJKM Transportation Consultants

PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY13/14 CYCLE

Palo Alto Signal Timing Project

City of Palo Alto I City of Menlo Park I City of East Palo Alto I City of Mountain View I City of Los Altos I County of Santa Clara I Caltrans I Metropolitan Transportation Commission

PROJECT OVERVIEW

The City of Palo Alto received a grant from Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to deploy optimized signal timing plans for a total of 65 traffic signals along the Hamilton Avenue, University Avenue, Lytton Avenue, Alma Street, Middlefield Road, Embarcadero Road, San Antonio Road, and Charleston Road corridors. Fifty-three of the project traffic signals are owned, operated, and maintained by the City of Palo Alto. The City of Los Altos, Caltrans, and the City of Mountain View own, operate, and maintain four, three, and two traffic signals, respectively; one traffic signal is owned, operated, and maintained by each of the Cities of East Palo Alto, Menlo Park and the County of Santa Clara. As part of the project, all intersections were identified for retiming during the weekday AM, midday, and PM periods. The weekend AM and PM peak periods timing plans were developed for the 34 project intersections.

The goal of this project was to improve traffic progression along the study corridor between signals and help to address operational deficiencies.

The PASS project involved the completion of the following tasks: data collection, review of traffic data (including collision data), development of recommended adjustments to actuated timings, development of coordination plans for the weekday and weekend peak periods, implementation and fine-tuning of the recommended timings, "before" and "after" travel time surveys, and project documentation.

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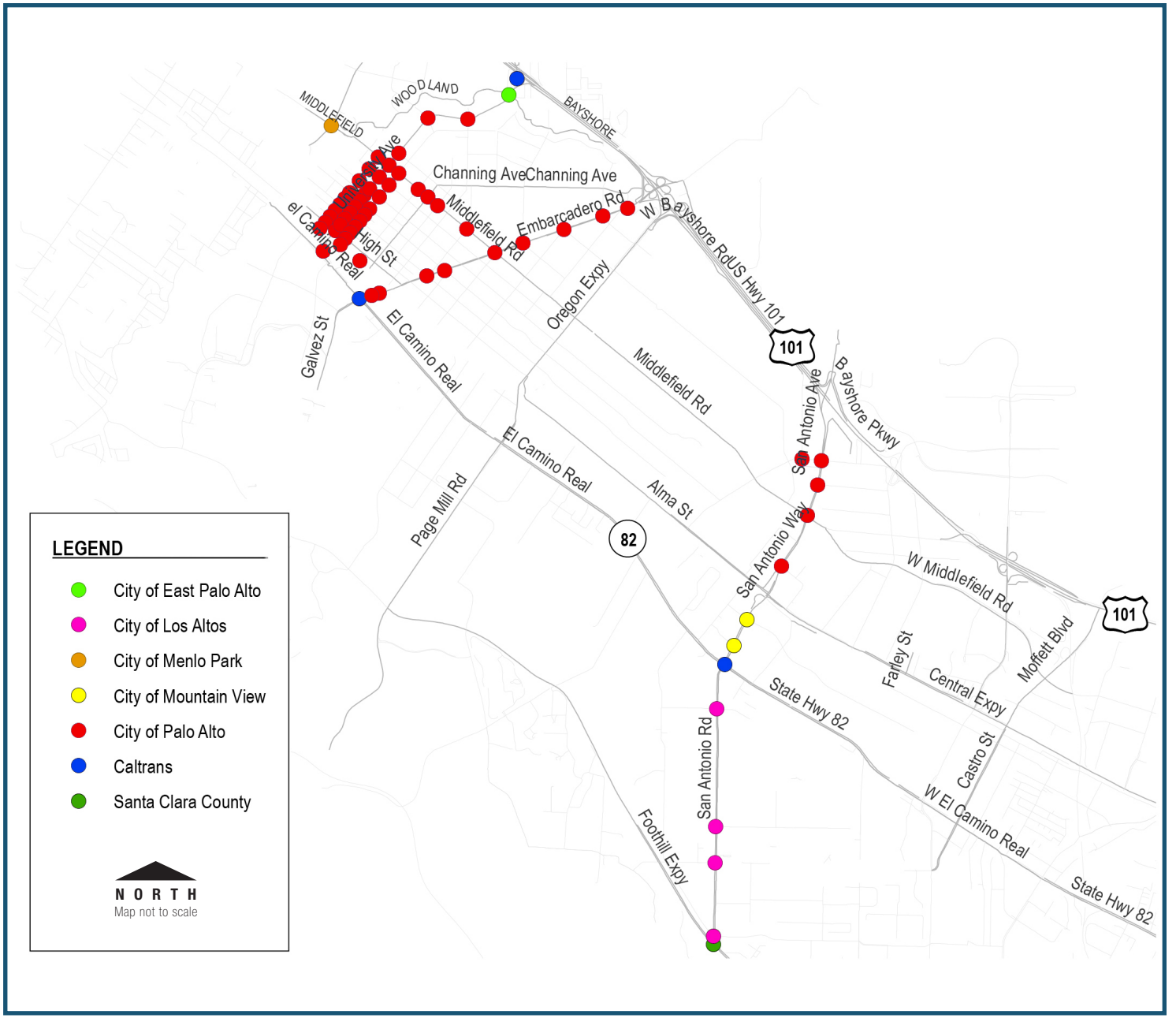


Project Overview (continued)

The new timing plans were implemented except the Palo Alto downtown area signals. Due to ongoing construction in the downtown area and the uncertainty in the construction completion date, new timing plans were not implemented. The new timing plans for the downtown area were developed and submitted to the City of Palo Alto for later implementation by city staff, upon completion of the construction work. Fine-tuning was conducted immediately following the implementation of the new timings to ensure the most effective timings were deployed into the system. Offset revisions were made to enable enhanced progression.

Benefits to Various Modes

Benefits to Bicyclists: Bicycle minimum green time was reviewed to meet the California MUTCD 2012 guidelines for minimum bicycle clearance. The minimum green time was adjusted at 10 project intersections.

Benefits to Pedestrians: The new pedestrian timing parameters were adjusted to accommodate the new walking speed of 3.5 feet/second as per the 2012 California MUTCD. Pedestrian timing parameters were reviewed for each project intersection to ensure adequate crossing time for pedestrians. These timing parameters were adjusted and implemented at 36 intersections.

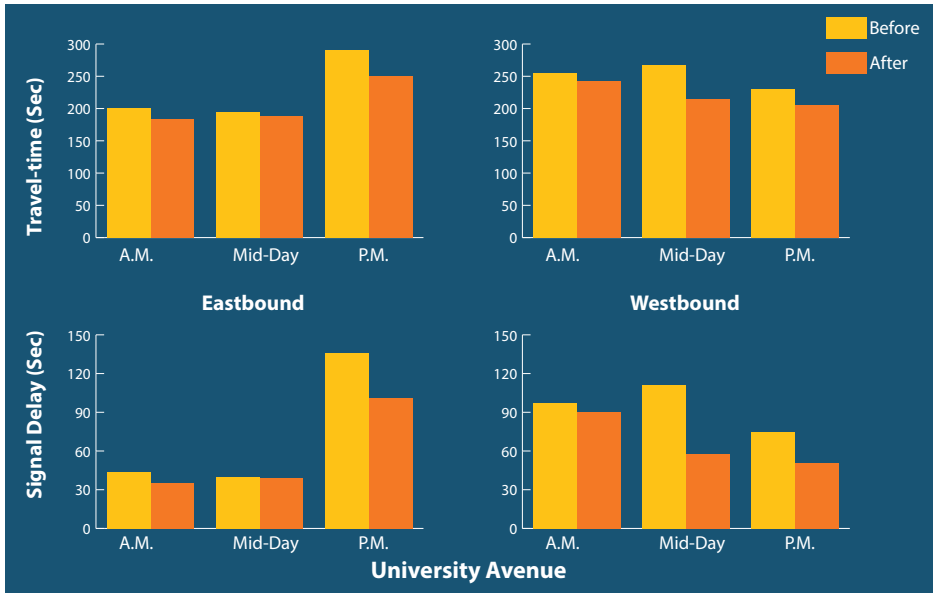
Benefits to Traffic Safety: The yellow and all red clearance times were reviewed using current speed surveys and/or the posted speed limits to ensure sufficient times are implemented for vehicular clearance through an intersection. These timing parameters were implemented at 36 project intersections.

Project Costs	
Consultant Costs (Basic Services/ Plans)	$109,110
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	$4,000
Other Project Costs (GPS Clocks, Communications equipment, etc.)	$5,000
Agency Staff Costs (Estimate)	$27,278
Total Costs	**$145,388**

Project Benefits

Measures	*First Year*		*Lifetime (5 Years)*	
	Savings	*Monetized Savings*	*Savings*	*Monetized Savings*
Travel Time Savings	68,005 hrs.	$1,327,145	182,428 hrs.	$3,560,142
Fuel Consumption Savings	182,428 gal.	$704,019	489,372 gal.	$1,888,570
ROG Emissions Reduction	0.66 tons	$833	1.78 tons	$2,236
NOx Emissions Reduction	0.45 tons	$8,012	1.19 tons	$21,493
PM2.5 Emissions Reduction	0.02 tons	$7,373	0.06 tons	$19,778
CO Emissions Reduction	5.08 tons	$393	13.62 tons	$1,053
			Total Lifetime Benefits	**$5,493,271**

Overall Project Benefits	Auto
Average Decrease in Travel Time	**11%**
Average Speed Increase	**23%**
Average Fuel Savings	**8%**
Average Reduction in Signal Delay	**27%**
Average Reduction in Number of Stops	**22%**
Overall Benefit-Cost Ratio	**39:1**



Project Benefits Summary

Average Reduction in Auto Signal Delay: 27%

Average Reduction in Number of Stops: 22%

Auto Fuel Consumption Savings: 8% or 489,372 gallons

Total Emissions Reduced (ROG, NOx, PM2.5, CO): 16.66 tons

Auto Travel Time Savings: 11% or 182,428 hours

Overall Project Benefit-cost Ratio = 39:1

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Iteris, Inc.

PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY13/14 CYCLE

Veterans Boulevard Signal Timing Project

City of Redwood City | Caltrans | Metropolitan Transportation Commission

PROJECT OVERVIEW

The City of Redwood City in conjunction with Caltrans received a grant from Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to conduct a signal timing study for a total of nine traffic signals along Veterans Boulevard. Eight of the nine traffic signals along Veterans Boulevard are City-owned and operated. The traffic signal located at the Veterans Boulevard/Woodside Road intersection is operated and maintained by Caltrans. Veterans Boulevard provides connection to/from US 101 at Whipple Avenue to the north and at Woodside Road (SR 84) at the south end.

The goal of this project is to facilitate traffic progression along Veterans Boulevard, and update the timing parameters to comply with recent changes in the California MUTCD traffic signal timing guidelines. The pedestrian clearance timing for the Veterans Boulevard/Maple Avenue intersection was updated to accommodate slower walking speeds due to the location of a senior care facility in the vicinity of the intersection.

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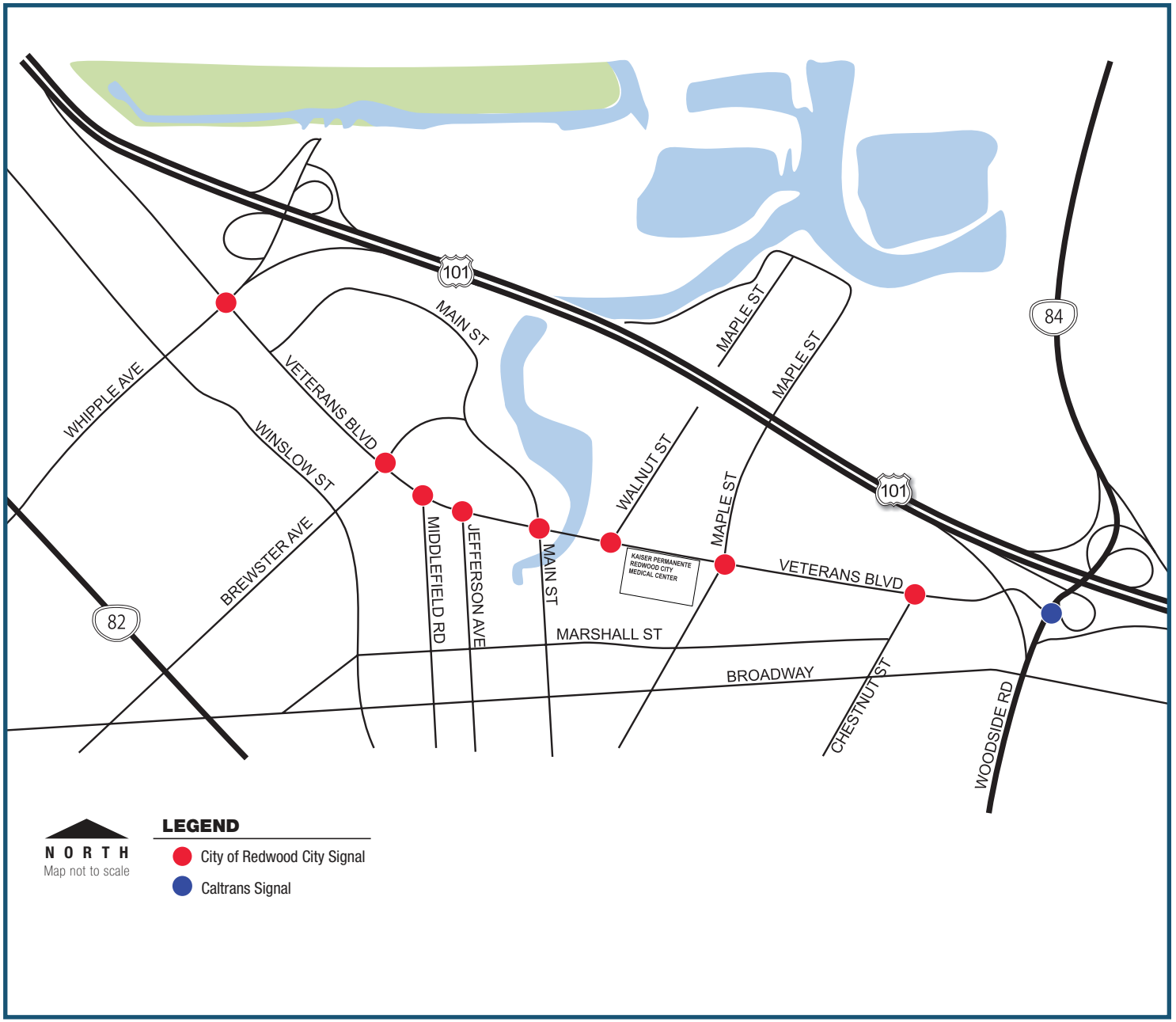


Project Overview (continued)

The PASS project involved the completion of the following tasks: collecting traffic volumes and turning movement counts including bike and pedestrian counts at project intersections; analyzing traffic data to develop optimized signal timing plans, implementing and fine-tuning the plans in the field; and conducting travel time surveys to analyze the performance measures of the new timing plans.

Benefits to Various Modes

Benefits to Bicyclists: Per the new California MUTCD, the minimum green time was increased for the through movements at each study intersection to enhance safety for bicyclists traveling along the Veterans Boulevard corridor.

Benefits to Pedestrians: Pedestrian timing parameters were adjusted to provide adequate time for children and seniors to safely cross the study intersections.

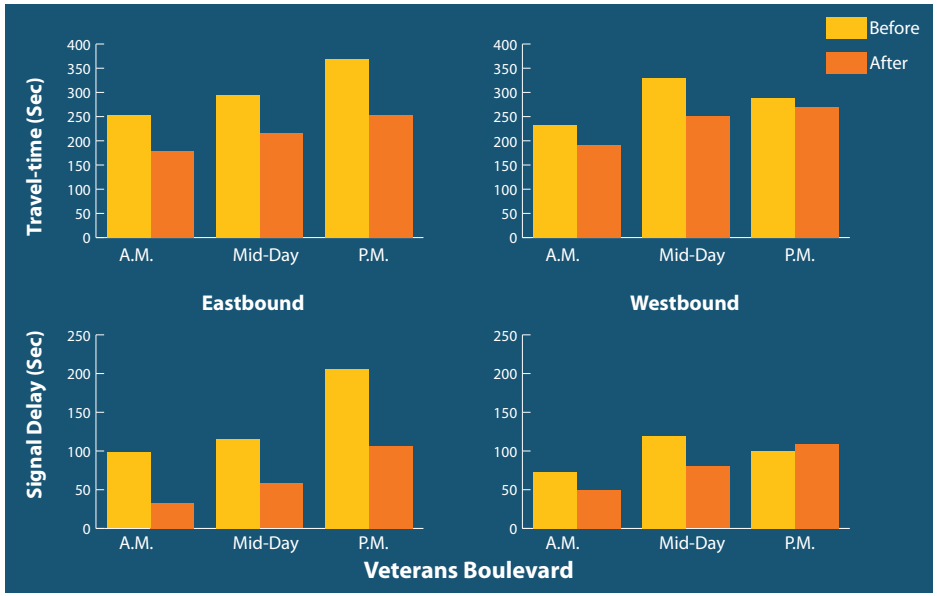
Benefits to Traffic Safety: To enhance traffic safety, the yellow clearance timing parameters were reviewed. The all red clearance timing parameters were updated based on the results of a collision analysis.

Project Costs	
Consultant Costs (Weekday Coordination Timing Plans)	$24,300
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	$5,570
Other Project Costs (cabinet and controller equipment)	$0
Agency Staff Costs (Estimate)	$6,075
Total Costs	**$35,945**

Project Benefits

Measures	*First Year Average*		*Lifetime (5 Years)*	
	Savings	*Monetized Savings*	*Savings*	*Monetized Savings*
Travel Time Savings	29,975 hrs.	$584,979	80,411 hrs.	$1,569,240
Fuel Consumption Savings	106,806 gal.	$412,184	286,514 gal.	$1,105,707
ROG Emissions Reduction	0.36 tons	$450	0.96 tons	$1,206
NOx Emissions Reduction	0.24 tons	$4,345	0.65 tons	$11,656
PM2.5 Emissions Reduction	0.01 tons	$3,687	0.03 tons	$9,891
CO Emissions Reduction	3.07 tons	$237	8.22 tons	$636
		Total Lifetime Benefits		**$2,698,335**

Overall Project Benefits	**Auto**
Average Decrease in Travel Time	**23%**
Average Speed Increase	**31%**
Average Fuel Savings	**18%**
Average Reduction in Signal Delay	**37%**
Average Reduction in Number of Stops	**21%**
Overall Benefit-Cost Ratio	**89:1**



Project Benefits Summary

Average Reduction in Auto Signal Delay: 37%

Average Reduction in Number of Stops: 21%

Auto Fuel Consumption Savings: 18% or 286,514 gallons

Total Emissions Reduced (ROG, NOx, PM2.5, CO): 9.86 tons

Auto Travel Time Savings: 23% or 80,411 hours

Overall Project Benefit-cost Ratio = 89:1

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Program for Arterial System Synchronization (PASS) FY13/14 Cycle

San Carlos Ave/ Holly St/ Industrial Rd/El Camino Real/ Ralston Ave/ Old County Rd/ Harbor Blvd

City of San Carlos I City of Belmont I County of San Mateo I Metropolitan Transportation Commission

Project Overview

The Cities of San Carlos and Belmont, the County of San Mateo, and Caltrans received a grant from Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to conduct a signal timing study for a total of 46 traffic signals along the San Carlos Avenue, Holly Street, Industrial Road, El Camino Real, Ralston Avenue, Old County Road and Harbor Boulevard corridors. Twenty-five of the 46 traffic signals are owned, maintained, operated by Caltrans. The traffic signal located at the Holly Street/Old County Road intersection is owned by the City of San Carlos but operated and maintained by Caltrans. Eleven traffic signals are owned, maintained, operated by the City of San Carlos. The City of Belmont and the County of San Mateo own, maintain, and operate six and three traffic signals, respectively.

The goal of this project was to facilitate traffic progression along the study corridors, and update the timing parameters to comply with recent changes in the California MUTCD traffic signal timing guidelines.

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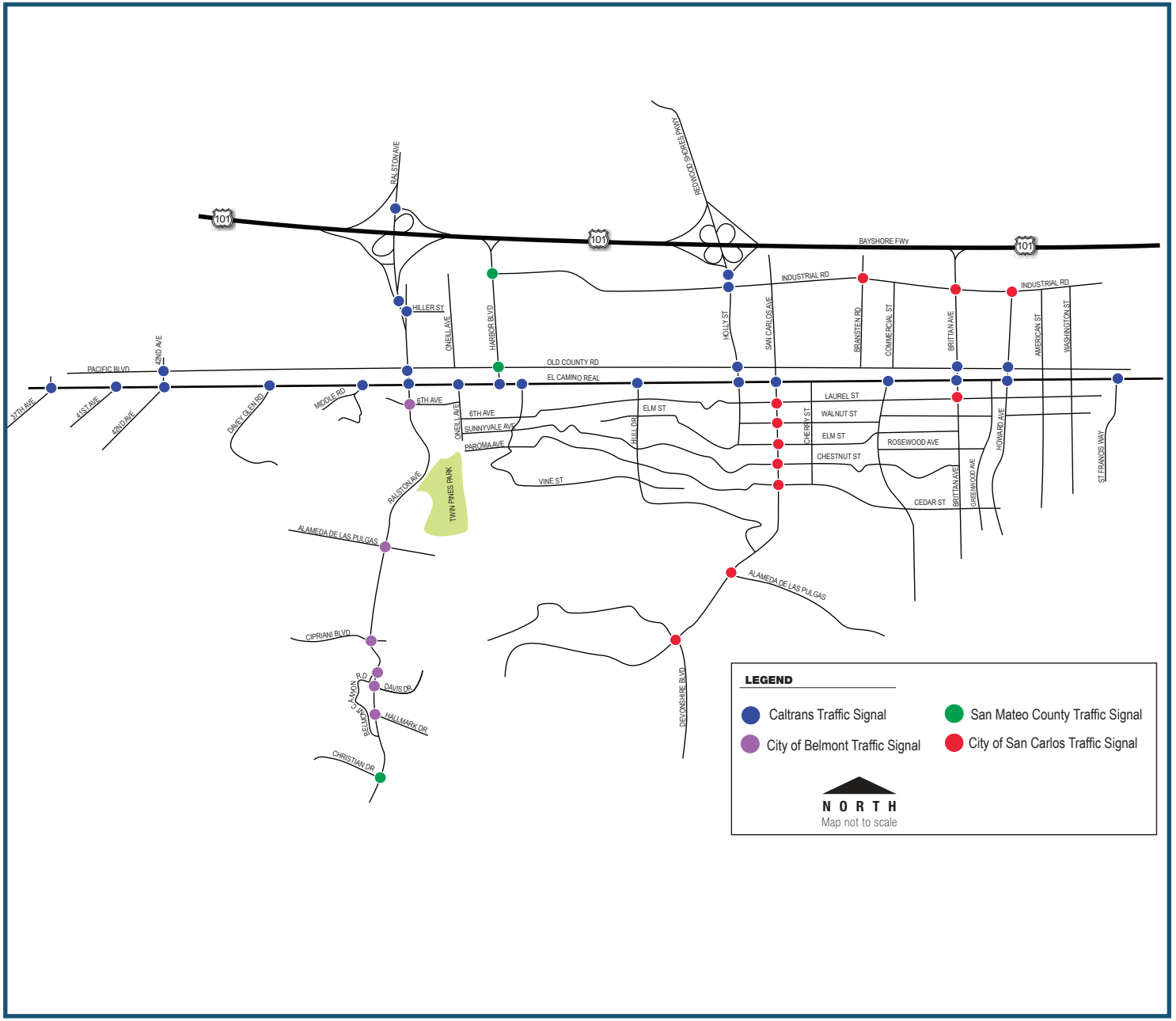

Project Overview (continued)

The PASS project involved the completion of the following tasks: collect traffic volumes and turning movement counts including bike and pedestrian counts at project intersections; analyze traffic data to develop optimized signal timing plans, implement and fine-tune the recommended timing plans in the field; conduct travel time surveys to analyze the performance measures of the new timing plans; and document the analyses/findings for the project.

Benefits to Various Modes

Benefits to Bicyclists: Per the 2012 California MUTCD, the minimum green time was increased for the through movements at each study intersection to enhance safety for bicyclists traveling along the San Carlos Avenue, Holly Street, Industrial Road, Ralston Avenue, El Camino Real, Old County Road and Harbor Boulevard corridors.

Benefits to Pedestrians: Pedestrian timing parameters were updated at several study intersections to provide adequate time for children and seniors to safely cross.

Benefits to Traffic Safety: To enhance traffic safety, the yellow clearance timing parameters were updated based on the posted speed limits along the study corridors. The All Red clearance timing parameters were updated based on the results of a collision analysis.based on the results of a collision analysis.

Project Costs	
Consultant Costs (Weekday Coordination Timing Plans)	$108,000
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	$46,350
Other Project Costs (GPS Clocks, Communications equipment, etc.)	$5,000
Agency Staff Costs (Estimate)	$38,588
Total Costs	**$197,938**

Project Benefits

Measures	*First Year*		*Lifetime (5 Years)*	
	Savings	*Monetized Savings*	*Savings*	*Monetized Savings*
Travel Time Savings	177,658 hrs.	$3,467,060	476,577 hrs.	$9,300,584
Fuel Consumption Savings	506,511 gal.	$1,954,709	1,358,743 gal.	$5,243,616
ROG Emissions Reduction	1.63 tons	$2,051	4.37 tons	$5,502
NOx Emissions Reduction	1.31 tons	$23,662	3.53 tons	$63,475
PM2.5 Emissions Reduction	0.07 tons	$20,324	0.17 tons	$54,520
CO Emissions Reduction	15.40 tons	$1,190	41.31 tons	$3,193
			Total Lifetime Benefits	**$14,670,890**

Overall Project Benefits	Auto
Average Decrease in Travel Time	**20%**
Average Speed Increase	**31%**
Average Fuel Savings	**15%**
Average Reduction in Signal Delay	**42%**
Average Reduction in Number of Stops	**36%**
Overall Benefit-Cost Ratio	**97:1**

Project Benefits Summary

Average Reduction in Auto Signal Delay: 42%

Average Reduction in Number of Stops: 36%

Auto Fuel Consumption Savings: 15% or 1,358,743 gallons

Total Emissions Reduced (ROG, NOx, PM2.5, CO): 49.38 tons

Auto Travel Time Savings: 20% or 476,577 hours

Overall Project Benefit-cost Ratio = 97:1

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Project Consultant:
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PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY13/14 CYCLE

City of Santa Rosa Signal Timing Project

City of Santa Rosa | Metropolitan Transportation Commission

Project Overview

The City of Santa Rosa received a grant from the Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to deploy optimized signal timing plans for the 44 signals along Marlow Road/ Stony Point, Guerneville Road, College Avenue, Hearn Avenue, and Petaluma Road. All intersections were identified for retiming during the weekday AM, midday, and PM peak periods. The corridors of Marlow Road/Stony Point Road, Guerneville Road, and College Avenue were identified for the retiming, as well as adaptive timing.

All signals are operated and maintained by the City of Santa Rosa. Seven of the 44 project intersections operate using BiTran 170 controllers, while the rest of the project intersections operate using 2070 controllers with SCATS firmware.

An analysis was performed from the collected data to develop the most optimal signal coordination plans for the City of Santa Rosa.

The PASS project involved the completion of the following tasks: data collection, review of traffic data (including collision data), development of recommendations for actuated timings, development of coordination plans for the weekday AM, midday, and PM peak periods, implementation and fine-

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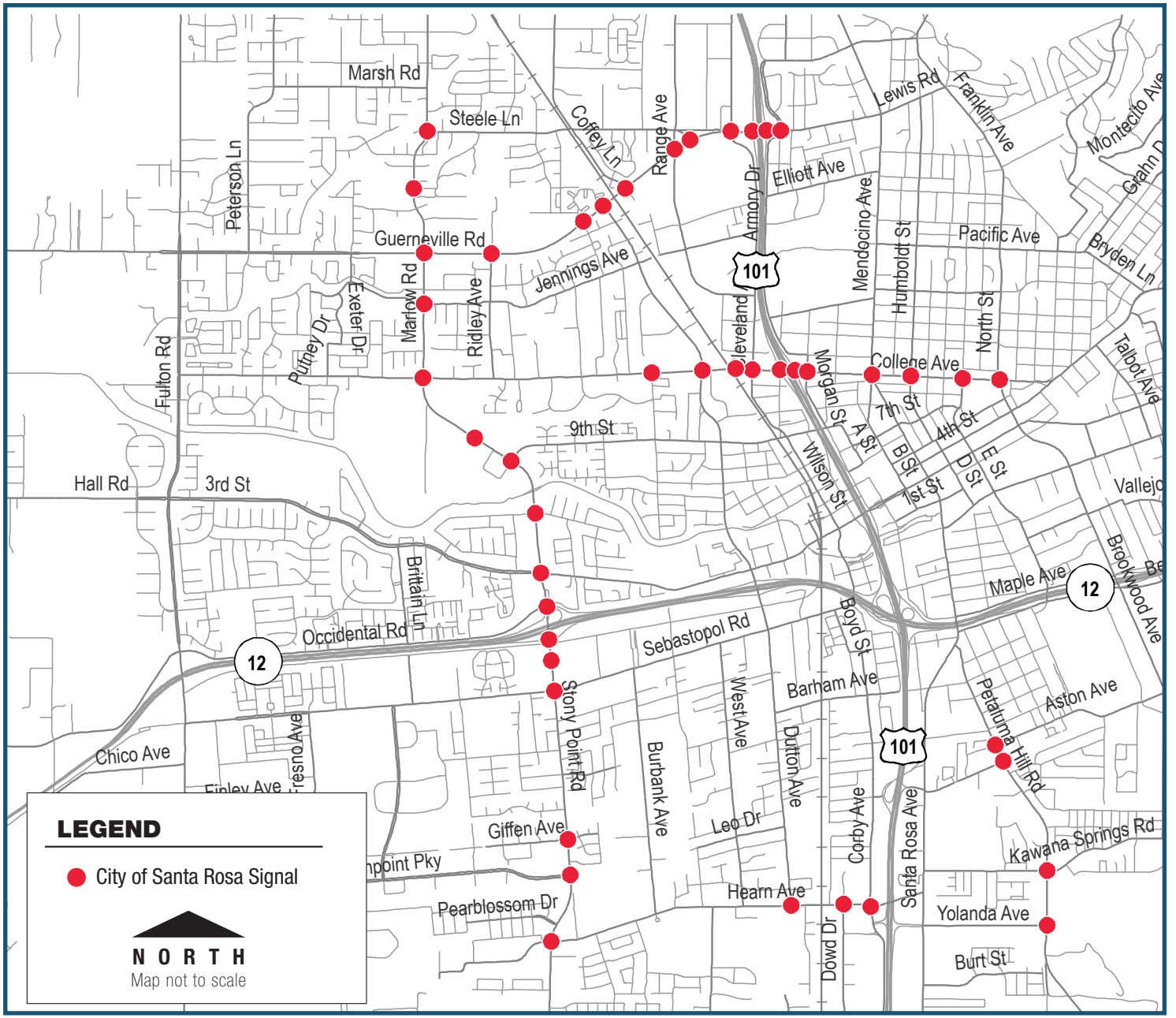


Project Overview (continued)

tuning of the recommended timings, "before" and "after" travel time surveys, and project documentation.

Fine-tuning was conducted to ensure the most effective timings were deployed into the system. Offset revisions were made to enable enhanced progression.

Benefits to Various Modes

Benefits to Bicyclists: The minimum green intervals were reviewed and calculated as per the latest California MUTCD for bicyclists on the study corridors.

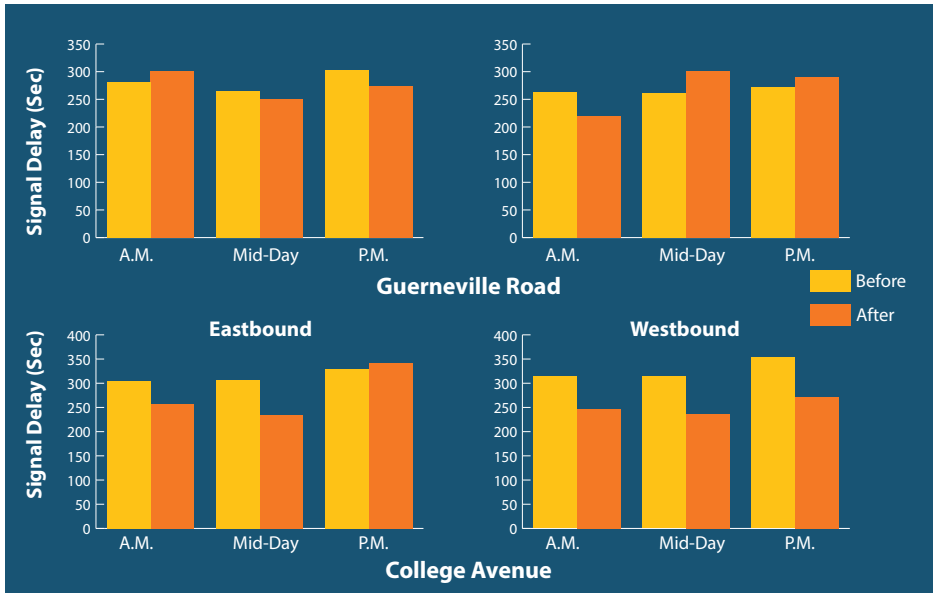
Benefits to Traffic Safety: To enhance traffic safety, all timing parameters at each project intersection were reviewed as per the latest California MUTCD. These parameters include: minimum green time, maximum green time, minimum gap, yellow time, all-red clearance time, Walk time, and Flashing Don't Walk time.

Project Costs	
Consultant Costs (Basic Services/ Plans)	$108,300
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	$27,580
Other Project Costs (GPS Clocks, Communications equipment, etc.)	$2,000
Agency Staff Costs (Estimate)	$27,075
Total Costs	**$164,955**

Project Benefits

Measures	*First Year*		*Lifetime (5 Years)*	
	Savings	*Monetized Savings*	*Savings*	*Monetized Savings*
Travel Time Savings	38,664 hrs.	$754,533	103,717 hrs.	$2,024,079
Fuel Consumption Savings	83,021 gal.	$320,391	222,708 gal.	$859,468
ROG Emissions Reduction	0.28 tons	$350	0.75 tons	$938
NOx Emissions Reduction	0.21 tons	$3,772	0.56 tons	$10,119
PM2.5 Emissions Reduction	0.01 tons	$2,681	0.02 tons	$7,191
CO Emissions Reduction	2.48 tons	$192	6.65 tons	$514
		Total Lifetime Benefits		**$2,902,309**

Overall Project Benefits	**Auto**
Average Decrease in Travel Time	**7%**
Average Speed Increase	**16%**
Average Fuel Savings	**6%**
Average Reduction in Signal Delay	**16%**
Average Reduction in Number of Stops	**17%**
Overall Benefit-Cost Ratio	**21:1**



Project Benefits Summary

Average Reduction in Auto Signal Delay: 16%

Average Reduction in Number of Stops: 17%

Auto Fuel Consumption Savings: 6% or 222,708 gallons

Total Emissions Reduced (ROG, NOx, PM2.5, CO): 7.98 tons

Auto Travel Time Savings: 7% or 103,717 hours

Overall Project Benefit-cost Ratio = 21:1

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MT

City of Santa Rosa California

PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY13/14 CYCLE

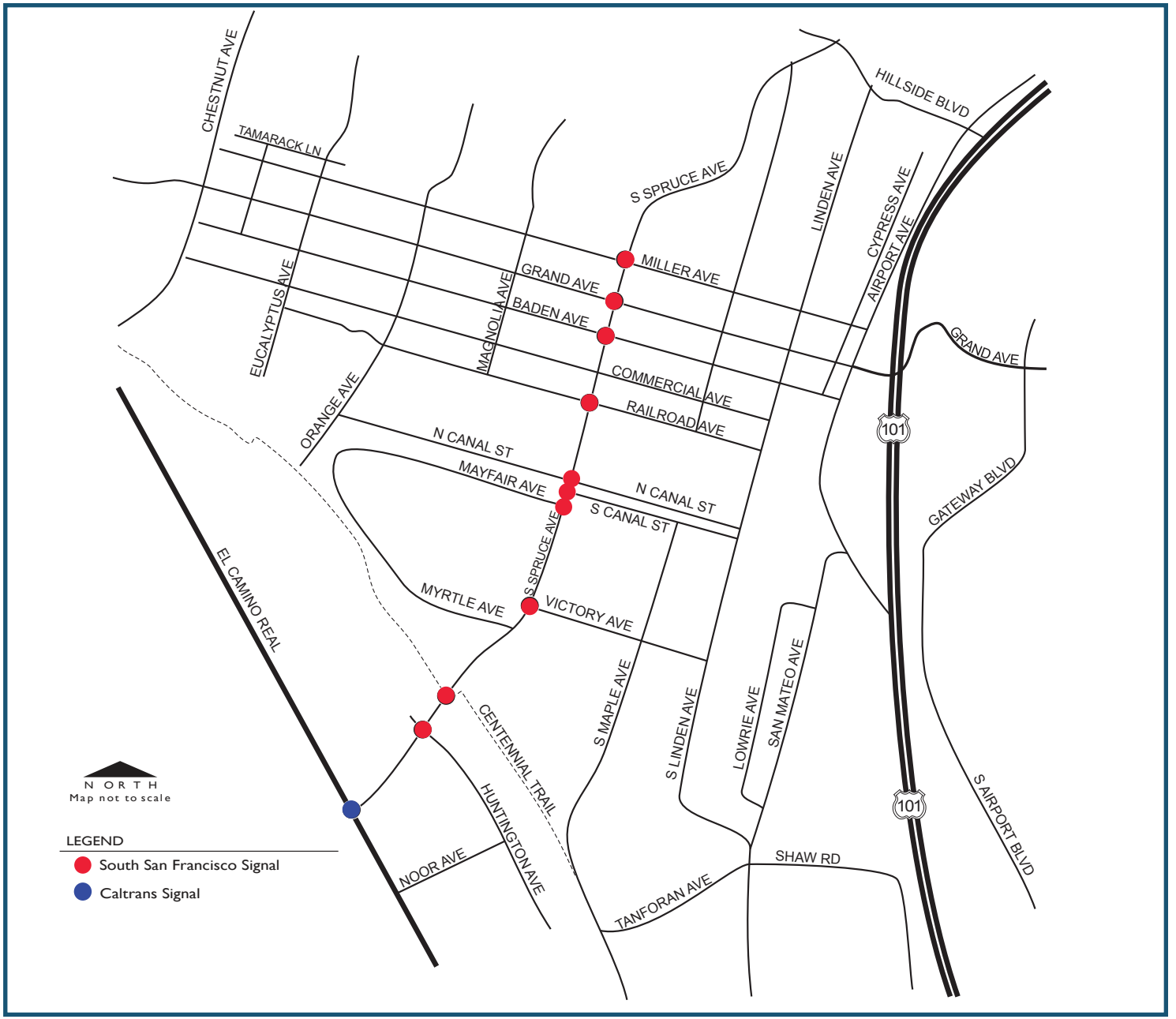
Spruce Ave. Traffic Signal Timing Project

City of South San Francisco | Caltrans | Metropolitan Transportation Commission

Project Overview

The City of South San Francisco and Caltrans received a grant from the Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to develop and implement optimized timing plans for weekday AM, midday, and PM peak periods for 11 signals along Spruce Avenue. Spruce Avenue is a north-south arterial in the City of South San Francisco and provides access to the San Bruno BART station and downtown of South San Francisco. Spruce Avenue is a designated truck route carrying significant volumes during peak periods.

The traffic signals along Spruce Avenue are closely spaced and have not been retimed since 1997. This results in motorists experiencing frequent stops while traveling along Spruce Avenue because of the outdated timing plans. This PASS project involved the completion of the following major tasks: 1) collecting traffic volumes and turning movement counts, including bike and pedestrian counts, at all project intersections; 2) analyzing this traffic data including collision data to develop optimized signal timing plans; 3) implementing and fine-tuning the plans in the field; and 4) conductinig travel time surveys to analyze the performance of the new timing plans, including a benefit-cost analysis.



GPS Signal Communications

To provide a common time-source and enable communication between the City and Caltrans signals cost-effectively, GPS devices were installed at two project intersections. These devices enable the signal controllers to regularly synchronize their clocks, efficiently deploy the timing plans at the same time, and thus help maintain the efficiency of signal coordination.

Benefits to Various Modes

Benefits to Bicyclists: Per the new California MUTCD, the minimum green time was increased for the through movements at each study intersection to enhance traffic safety for bicyclists traveling along the Spruce Avenue corridor.

Benefits to Pedestrians: The Walk timing and Flash Don't Walk clearance timing parameters were also updated to provide adequate time for children and seniors to safely cross the intersections. The updated timing parameters are expected to enhance safe school crossing at intersections on Spruce Avenue between Miller Avenue and Baden Avenue.

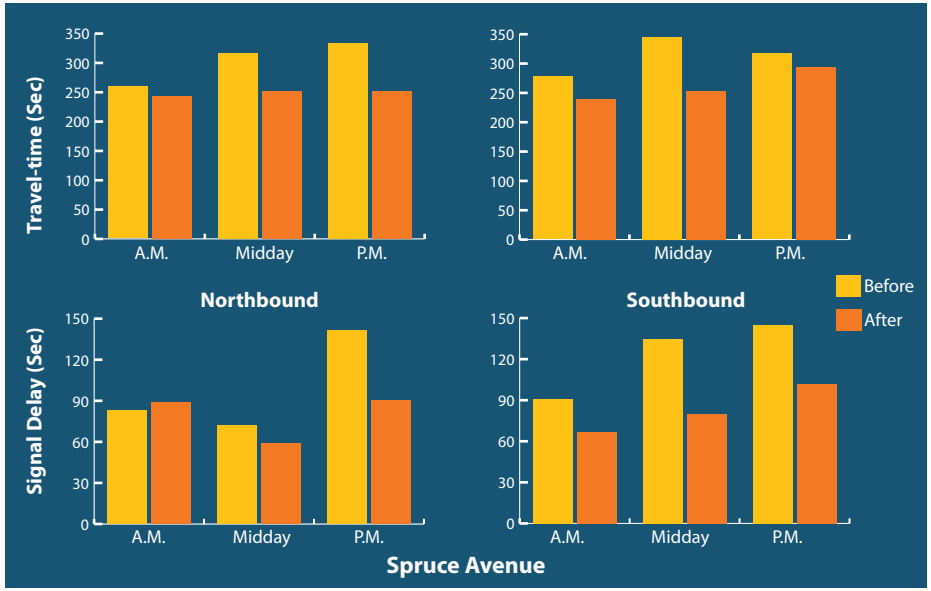
Benefits to Traffic Safety: To enhance traffic safety, the yellow clearance timing parameters were updated based on posted speed limits along the study corridors, and the all red clearance timing parameters were updated based on the results of the collision analysis presented in the existing conditions analysis.

Project Costs	
Consultant Costs (Signal Timing Plans - Weekday AM, Midday, PM)	$29,700
Other Project Costs (GPS, additional analysis, etc.)	$6,570
Agency Staff Costs (Estimate)	$7,425
Total Costs	**$43,695**

Project Benefits

Measures	*First Year*		*Lifetime (5 Years)*	
	Savings	*Monetized Savings*	*Savings*	*Monetized Savings*
Travel Time Savings	14,063 hrs.	$274,449	37,725 hrs.	$736,226
Fuel Consumption Savings	31,515 gal.	$121,620	84,540 gal.	$326,254
ROG Emissions Reduction	0.125 tons	$158	0.337 tons	$424
NOx Emissions Reduction	0.069 tons	$1,244	0.185 tons	$3,338
PM2.5 Emissions Reduction	0.004 tons	$1,256	0.011 tons	$3,370
CO Emissions Reduction	0.868 tons	$67	2.329 tons	$180
			Total Lifetime Benefits	**$1,069,791**

Overall Project Benefits	*Auto*
Average Decrease in Travel Time	**17%**
Average Speed Increase	**20%**
Average Fuel Savings	**12%**
Average Reduction in Signal Delay	**24%**
Average Reduction in Number of Stops	**18%**
Overall Benefit-Cost Ratio	**28:1**



Project Benefits Summary

Average Reduction in Auto Signal Delay: 24%

Average Reduction in Number of Stops: 18%

Auto Fuel Consumption Savings: 12% or 84,540 gallons

Total Emissions Reduced (ROG, Nox, PM10, CO): 2.87 tons

Auto Travel Time Savings: 17% or 37,725 hours

Overall Project Benefit-cost Ratio = 28:1

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PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY13/14 CYCLE

Decoto Road Signal Timing Project

City of Union City | Metropolitan Transportation Commission

PROJECT OVERVIEW

The City of Union City received a grant from Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to deploy optimized signal timing plans for a total of eight traffic signals along Decoto Road between 5th Street to Royal Ann Drive/Clover Street. All eight traffic signals are currently interconnected with hardware/twisted-pair cables to the City's Quicknet traffic management system located in the City Hall. Decoto Road is a major north/south regional arterial that connects with other regionally-significant arterials including Mission Boulevard, Alvarado Niles Road and the Dumbarton Bridge to the west in the City of Union City. Decoto Road serves AC Transit, the Dumbarton Express, and provides direct access to the Union City BART Station.

The goal of this project is to facilitate traffic progression along Decoto Road and update the timing parameters to comply with recent changes in traffic signal timing guidelines. The project objective is to develop traffic signal timing plans for the weekday PM peak and school PM peak periods to reduce traffic congestion, reduce traffic delays, reduce the emission of harmful greenhouse gases, reduce automobile travel time along the study corridor, and improve traffic safety.

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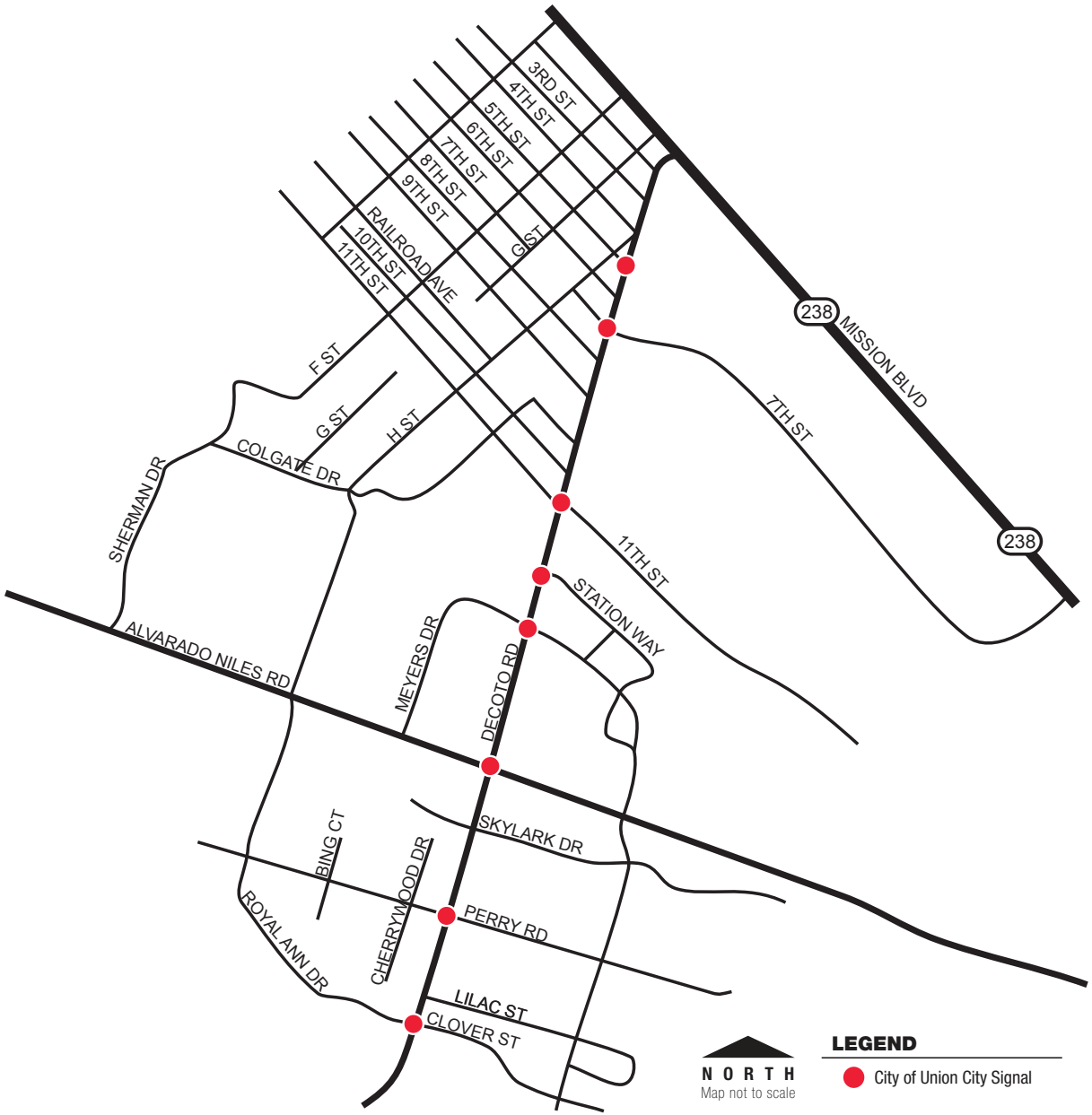


Project Overview (continued)

The PASS project involved the completion of the following tasks: collecting traffic volumes and turning movement counts, including bicycle and pedestrian counts at project intersections; analyzing traffic data to develop optimized signal timing plans; implementing and fine-tuning the plans in the field; review collision data; and conducting travel time surveys to analyze the performance measures of the new timing plans.

Benefits to Various Modes

Benefits to Bicyclists: Per the new California MUTCD, the minimum green time was increased for the through movements at each study intersection to enhance safety for bicyclists traveling along the Decoto Road corridor.

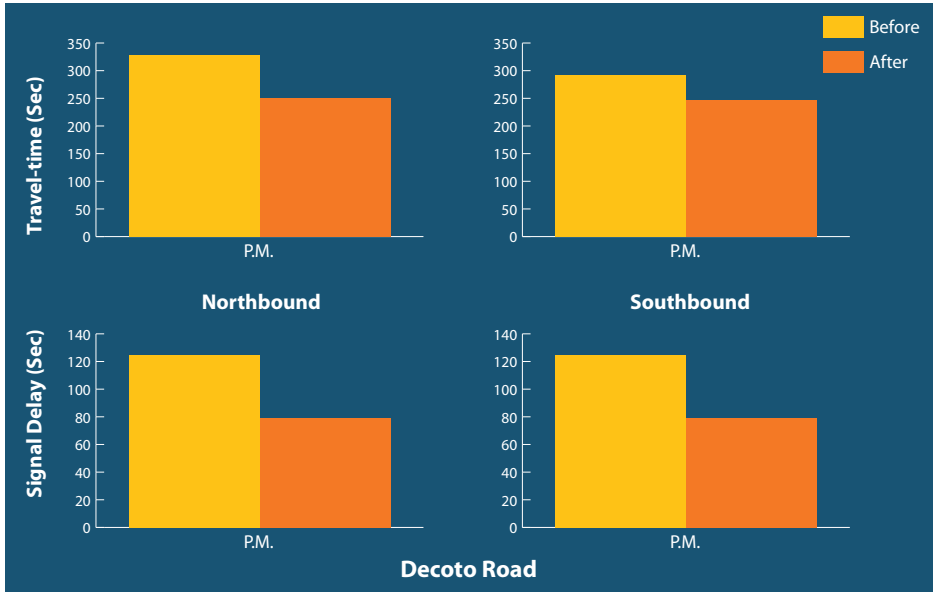
Benefits to Traffic Safety: To enhance traffic safety, the yellow clearance timing parameters were updated based on posted speed limits along the study corridor.

Project Costs	
Consultant Costs (Weekday Coordination Timing Plans)	$19,240
Other Project Costs (cabinet and controller equipment)	$0
Agency Staff Costs (Estimate)	$4,810
Total Costs	**$24,050**

Project Benefits

Measures	*First Year Average*		*Lifetime (5 Years)*	
	Savings	*Monetized Savings*	*Savings*	*Monetized Savings*
Travel Time Savings	10,807 hrs.	$210,911	28,992 hrs.	$565,780
Fuel Consumption Savings	25,553 gal.	$98,614	68,548 gal.	$264,537
ROG Emissions Reduction	0.087 tons	$109	0.233 tons	$293
NOx Emissions Reduction	0.074 tons	$1,328	0.198 tons	$3,561
PM2.5 Emissions Reduction	0.002 tons	$768	0.007 tons	$2,060
CO Emissions Reduction	0.743 tons	$57	1.994 tons	$154
			Total Lifetime Benefits	**$836,386**

Overall Project Benefits	**Auto**
Average Decrease in Travel Time	**20%**
Average Speed Increase	**22%**
Average Fuel Savings	**14%**
Average Reduction in Signal Delay	**45%**
Average Reduction in Number of Stops	**43%**
Overall Benefit-Cost Ratio	**35:1**



Project Benefits Summary

Average Reduction in Auto Signal Delay: 45%

Average Reduction in Number of Stops: 43%

Auto Fuel Consumption Savings: 14% or 68,548 gallons

Total Emissions Reduced (ROG, NOx, PM2.5, CO): 2.43 tons

Auto Travel Time Savings: 20% or 28,992 hours

Overall Project Benefit-cost Ratio = 35:1

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PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY13/14 CYCLE

City of Walnut Creek Signal Timing Project

City of Walnut Creek | Caltrans | Metropolitan Transportation Commission

PROJECT OVERVIEW

The City of Walnut Creek received a grant from the Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to conduct a signal timing study for the 44 traffic signals along various corridors in the City. Thirty-nine of the project intersections are owned and operated by the City of Walnut Creek and the remaining five signals are owned by Caltrans, but operated and maintained the City.

The goal of the project was to conduct a timing analysis, and to develop and implement signal coordination plans during typical weekends for the 35 project signals in and around the Downtown area. In addition to implementation of timing plans on typical weekends, the project included implementing special signal coordination plans to operate during the heavier holiday peak periods. Timing plans developed and implemented consisted of AM off-peak, midday peak, and PM off-peak periods on both typical and holiday weekends.

The PASS project involved the completion of the following major tasks: collect turning movement counts, including vehicular, pedestrian, and bicycle counts; conduct travel time surveys; review collision history; coordination plans for the analysis periods; implement and fine-tune the recommended timings; conduct the "before" and "after" travel

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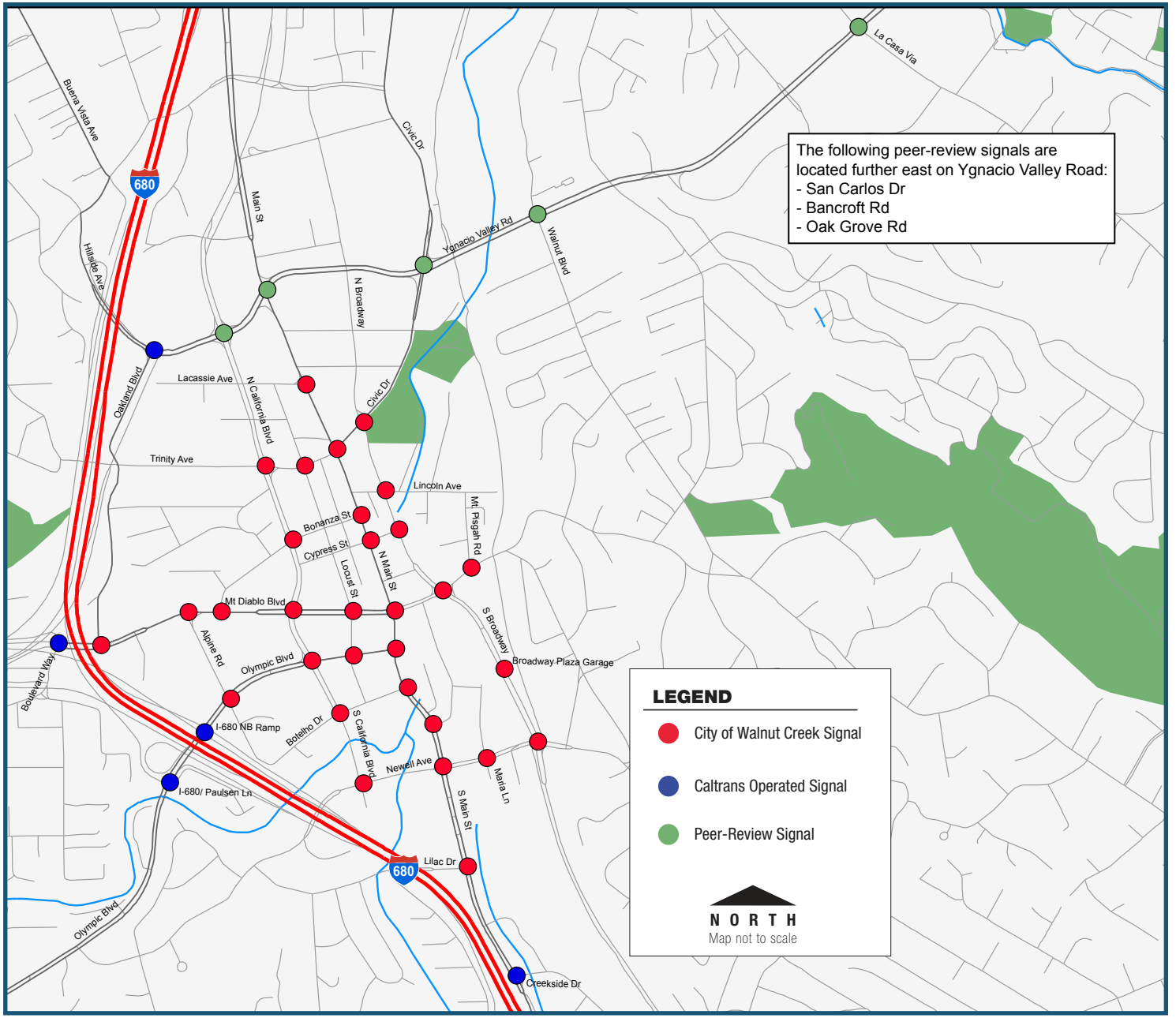


Project Overview (continued)

time surveys to assess the performance of the new plans; and peer-review of nine intersections on Ygnacio Valley Road.

The field fine-tuning was conducted during both the holiday weekend and typical weekend periods and minor adjustments were made to the offsets and splits based on the observed traffic conditions.

Benefits to Various Modes

Benefits to Bicyclists: To improve safety, the minimum green intervals were reviewed for bicyclists on the corridors. Changes to minimum green intervals were made at 11 intersections.

Benefits to Pedestrians: The pedestrian timings were reviewed based on the 2012 California MUTCD to enhance safety and changes were recommended at three project intersections.

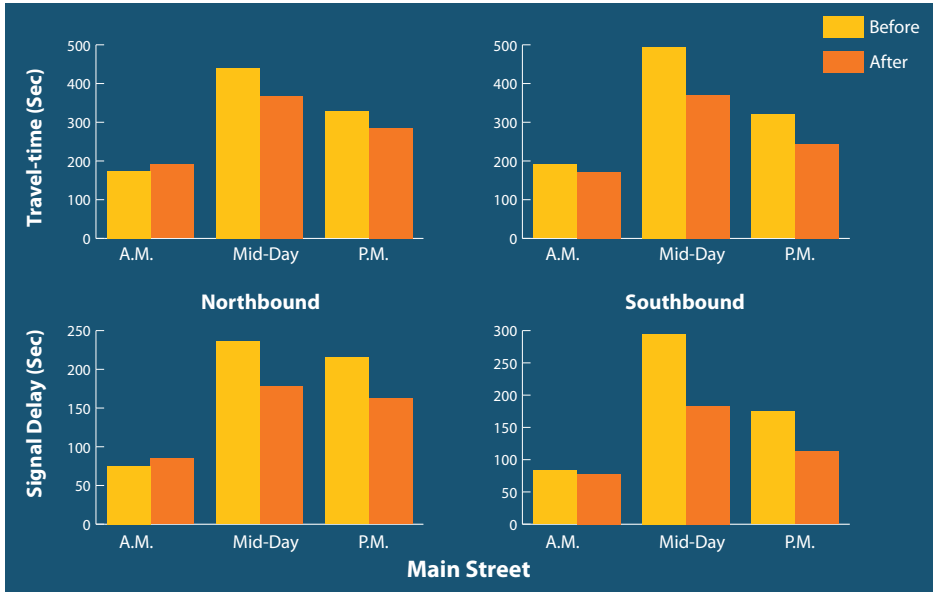
Benefits to Traffic Safety: A review of intersection-level collisions along the corridors was conducted to identify any collision patterns that may be corrected through signal timing adjustments. No specific timing changes were recommended as a result of the collision review.

Project Costs	
Consultant Costs (Basic Services/ Plans)	$87,500
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	$16,210
Other Project Costs (GPS Clocks, Communications equipment, etc.)	$0
Agency Staff Costs (Estimate)	$21,875
Total Costs	**$125,585**

Project Benefits

Measures	*First Year*		*Lifetime (5 Years)*	
	Savings	*Monetized Savings*	*Savings*	*Monetized Savings*
Travel Time Savings	12,888 hrs.	$251,508	34,572 hrs.	$674,683
Fuel Consumption Savings	25,606 gal.	$98,817	68,689 gal.	$265,081
ROG Emissions Reduction	0.101 tons	$127	0.271 tons	$341
NOx Emissions Reduction	0.060 tons	$1,084	0.162 tons	$2,909
PM2.5 Emissions Reduction	0.003 tons	$940	0.008 tons	$2,522
CO Emissions Reduction	0.685 tons	$53	1.839 tons	$142
		Total Lifetime Benefits		**$945,678**

Overall Project Benefits	**Auto**
Average Decrease in Travel Time	**14%**
Average Speed Increase	**23%**
Average Fuel Savings	**9%**
Average Reduction in Signal Delay	**15%**
Average Reduction in Number of Stops	**29%**
Overall Benefit-Cost Ratio	**8:1**



Project Benefits Summary

Average Reduction in Auto Signal Delay: 15%

Average Reduction in Number of Stops: 29%

Auto Fuel Consumption Savings: 9% or 68,689 gallons

Total Emissions Reduced (ROG, NOx, PM2.5, CO): 2.28 tons

Auto Travel Time Savings: 14% or 34,572 hours

Overall Project Benefit-cost Ratio = 8:1

For more info, please contact:

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Project Consultant:

Kimley-Horn and Associates, Inc.

PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY13/14 CYCLE

Sir Francis Drake Boulevard and Red Hill Avenue Signal Timing Project

Town of San Anselmo I City of San Rafael I Town of Fairfax I Town of Ross I Metropolitan Transportation Commission

PROJECT OVERVIEW

The Town of San Anselmo, in conjunction with the City of San Rafael, Town of Fairfax, and Town of Ross, received a grant from the Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to deploy optimized signal timing plans for the 16 traffic signals along Sir Francis Drake Boulevard and Red Hill Avenue/4th Street. Twelve of the project intersections are owned and operated by the Town of San Anselmo, two signals are owned and operated by the City of San Rafael, and one signal is owned and operated by each Towns of Fairfax and Ross.

The goal of the project was to conduct a timing analysis and develop and implement signal coordination plans during the weekday AM, midday, and PM peak periods, as well as the weekend peak and off-peak periods.

The PASS project involved the completion of the following tasks: collect turning movement counts, including vehicular, pedestrian, and bicycle counts; conduct field review of the project area; conduct travel time surveys; review actuated settings; review collision history; develop the existing conditions model; develop coordination plans for the weekday AM, midday, and PM peak periods, as well as the weekend peak and off-peak periods;

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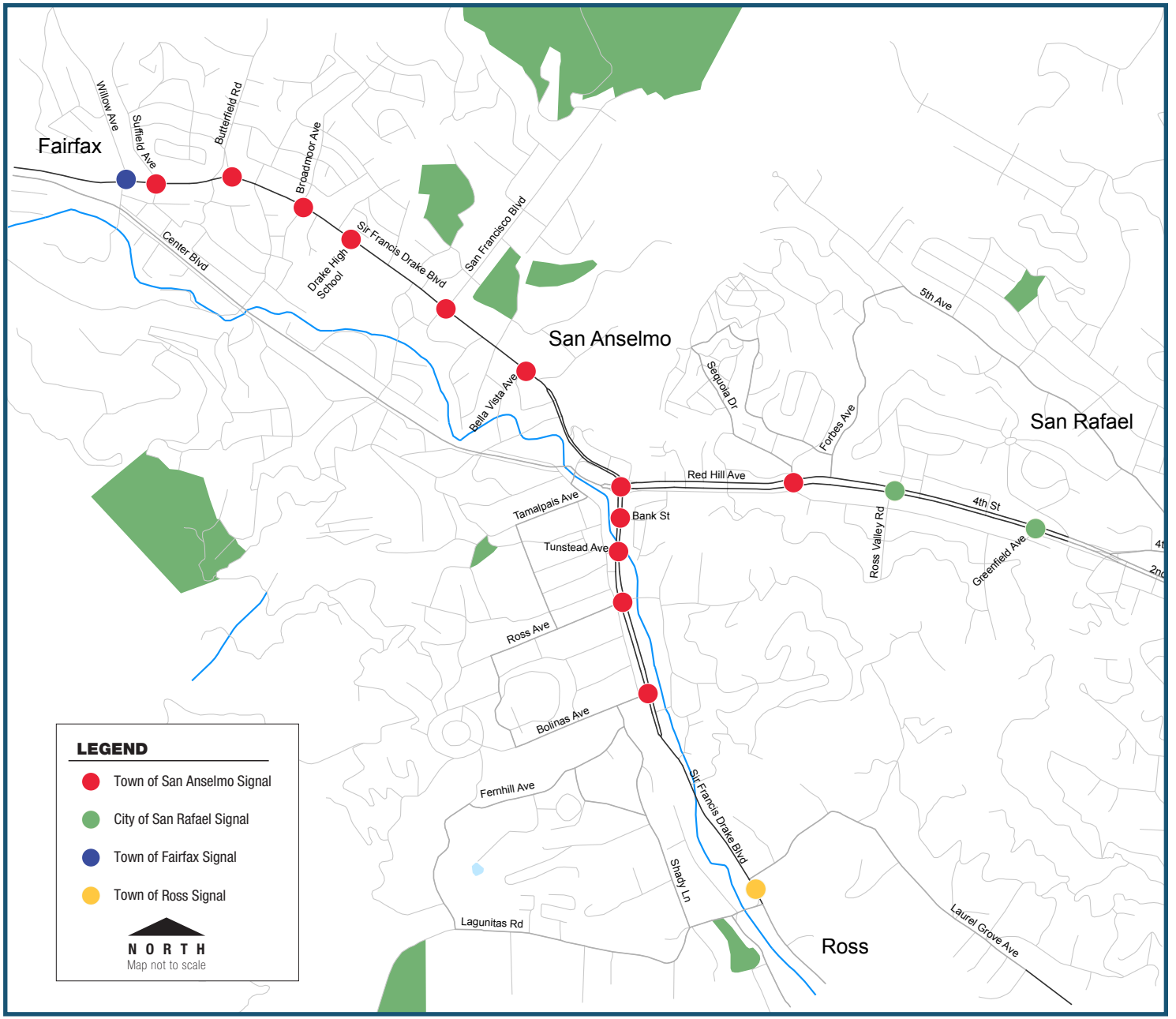


Project Overview (continued)

implement and fine-tune the recommended timings; conduct the "before" and "after" travel time surveys; and document the analyses/ findings for the project.

After the proposed signal timing plans were developed; marked-up timing sheets were prepared. Fine-tuning was conducted during the peak periods and minor adjustments were made to the timing based on the observed traffic conditions.

Benefits to Various Modes

Benefits to Bicyclists: The minimum green times were reviewed and increased at 14 intersections to allow stopped bicyclists enough time to clear an intersection when the light turns green.

Benefits to Pedestrians: The pedestrian intervals were reviewed and increased at two intersections based on the 2012 California MUTCD to enhance safety. The Walk intervals were increased at five project intersections.

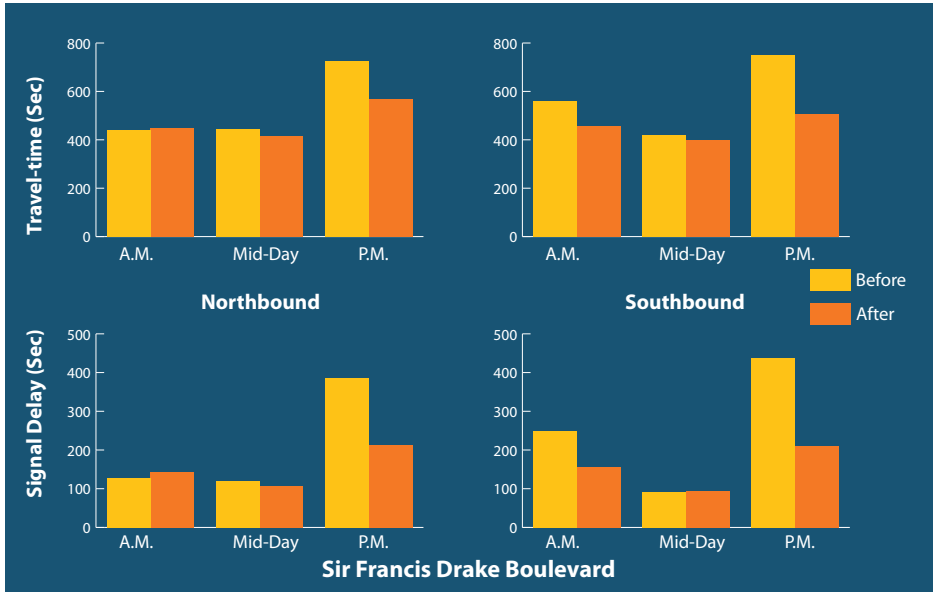
Benefits to Traffic Safety: A review of intersection level collisions along the corridors was conducted to identify any collision patterns that may be corrected through signal timing adjustments. No specific timing changes were needed as a result of the collision review.

Project Costs	
Consultant Costs (Basic Services/ Plans)	$37,500
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	$33,000
Other Project Costs (GPS Clocks, Communications equipment, etc.)	$0
Agency Staff Costs (Estimate)	$9,375
Total Costs	**$79,875**

Project Benefits

Measures	*First Year*		*Lifetime (5 Years)*	
	Savings	*Monetized Savings*	*Savings*	*Monetized Savings*
Travel Time Savings	54,209 hrs.	$1,057,902	145,418 hrs.	$2,837,882
Fuel Consumption Savings	161,344 gal.	$622,651	432,813 gal.	$1,670,298
ROG Emissions Reduction	0.58 tons	$729	1.55 tons	$1,956
NOx Emissions Reduction	0.4 tons	$7,158	1.07 tons	$19,203
PM2.5 Emissions Reduction	0.02 tons	$6,383	0.05 tons	$17,122
CO Emissions Reduction	4.51 tons	$349	12.1 tons	$935
		Total Lifetime Benefits		**$4,547,395**

Overall Project Benefits	Auto
Average Decrease in Travel Time	**19%**
Average Speed Increase	**24%**
Average Fuel Savings	**14%**
Average Reduction in Signal Delay	**29%**
Average Reduction in Number of Stops	**33%**
Overall Benefit-Cost Ratio	**57:1**



Project Benefits Summary

Average Reduction in Auto Signal Delay: 29%

Average Reduction in Number of Stops: 33%

Auto Fuel Consumption Savings: 14% or 432,813 gallons

Total Emissions Reduced (ROG, NOx, PM2.5, CO): 14.77 tons

Auto Travel Time Savings: 19% or 145,418 hours

Overall Project Benefit-cost Ratio = 57:1

For more info, please contact:

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Program Partner:

CALTRANS

Project Sponsors:

CALTRANS
COUNTY OF SANTA CLARA
CITY OF BELMONT
CITY OF CAMPBELL
CITY OF CONCORD
CITY OF DUBLIN
CITY OF EAST PALO ALTO
CITY OF FREMONT
CITY OF HAYWARD
CITY OF LAFAYETTE
CITY OF LOS ALTOS
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CITY OF SAN CARLOS
CITY OF SAN JOSE
CITY OF SAN RAFAEL
CITY OF SANTA ROSA
CITY OF SOUTH SAN FRANCISCO
CITY OF UNION CITY
CITY OF WALNUT CREEK
TOWN OF FAIRFAX
TOWN OF ROSS
TOWN OF SAN ANSELMO

Project Consultants:

ADVANTEC CONSULTING ENGINEERS
DKS ASSOCIATES
ITERIS, INC.
KIMLEY-HORN & ASSOCIATES, INC.
TJKM TRANSPORTATION CONSULTANTS

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