



**METROPOLITAN TRANSPORTATION COMMISSION**

**Program for Arterial System Synchronization (PASS)**

**FY 12/13 Cycle - Fact Sheets**

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## PASS FY 12/13 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 in retiming their traffic signals.

This cycle of the PASS had a total of 18 projects, listed in the table below, consisting of 352 traffic signals from seven counties in the Bay Area. MTC, in partnership with Caltrans and the local agencies, has successfully completed these projects. In this cycle, 74 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 (ADT), peak period turning movement counts, bicycle and pedestrian counts, and historical collision data were analyzed in developing and implementing new signal 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-source for Caltrans and local signals, 77 GPS clocks were procured and installed for several projects. This time synchronizing enabled the coordination of state and local signals along some major arterials for the first time. When requested, the PASS also provides project sponsors with the technical help needed to address any issues or citizen complaints received for up to one year after the completion of the PASS project.

The Project Fact Sheets in the following pages provide an overview, project map, comparison charts, benefits to various modes, and the benefit-cost analysis information at a glance.

## BENEFIT-COST SUMMARY

The PASS project benefits are assumed to be 100 percent on the first day after implementation of the new signal timing plans, declining steadily to zero by end of the fourth year. The results from the 18 projects are summarized below:

- Total Auto Fuel Consumption Savings: 16% or over 5.33 million gallons
- Total Auto Travel Time Savings: 21% or over 2 million hours
- Average Auto Speed Increase: 28%
- Total Auto Emissions Reduction: 330 tons (ROG: 38 tons; NOx: 48 tons; PM10: 7 tons; CO: 237 tons)
- Total Transit Travel Time Savings: 6% or 48,000 hours
- Average Transit Speed Increase: 7%

**Total Project Costs: \$1,246,000**

**Total Lifetime Benefits: \$67,215,000**

**Overall Benefit-Cost ratio is 54:1**

## OTHER BENEFITS

The optimized signal timing plans were developed and implemented based on the recently adopted CA MUTCD guidelines. The pedestrian walking speed was reduced to 3.5 feet per sec. (previously 4.0 feet per sec.), providing adequate crossing time for pedestrians. To enhance pedestrian safety, lower walking speeds were used for intersections with children and senior citizens. The minimum green time was reviewed and increased at many intersections to enhance safety for bicyclists while crossing the intersection. The yellow time and all-red timing parameters were reviewed and updated to provide additional clearance time for the vehicular traffic to clear or stop safely at the intersections. The 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	MR	City of Novato, Caltrans	35	7-day Peaks; Incident Management Plans	URS Corporation
2	SN	City of Petaluma, Caltrans	14	Weekday Peaks; Post-construction Plans	TJKM Consultants
3	CC	City of Pinole, Caltrans	22	Weekday; School Peak Peaks	Kimley-Horn
4	AL	ACPWA, Caltrans	18	Weekday Peaks	TJKM Consultants
5	AL	City of Dublin	21	Weekday Peaks; TSP; SIC	TJKM Consultants
6	AL	City of Emeryville, City of Oakland, Caltrans	32	7-day Peaks; Transit Signal Priority	Kimley-Horn
7	AL	City of Fremont, Caltrans	9	Weekday; School Peaks	Kimley-Horn
8	AL	City of Livermore; Caltrans	39	Weekday; Incident Management Plans	Kimley-Horn
9	AL	City of Oakland	20	Weekday Peaks	TJKM Consultants
10	AL	City of Union City, Caltrans	12	Weekday; School Peaks; SIC	Kimley-Horn
11	SC	City of Cupertino	14	Weekday; School Peaks; TSP	Kimley-Horn
12	SC	Town of Los Gatos	9	Weekday; School Peaks	TJKM Consultants
13	SC	City of Mountain View, Caltrans	15	Weekday Peaks; Traffic Studies	TJKM Consultants
14	SC	City of San Jose	14	Weekend Peaks	Kimley-Horn
15	SC	County of Santa Clara	26	7-day Peaks; Traffic Responsive Plans	Kimley-Horn
16	SM	City of Daly City, Caltrans	11	7-day Peaks	Kimley-Horn
17	SM	City of Foster City, Caltrans	24	Weekday Peaks; Post-construction Plans	TJKM Consultants
18	SM	City of Menlo Park, Town of Atherton, Caltrans	16	Weekday Peaks	TJKM Consultants

\*TSP = Transit Signal Priority; SIC = Signal Interconnect

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# PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY12/13 CYCLE

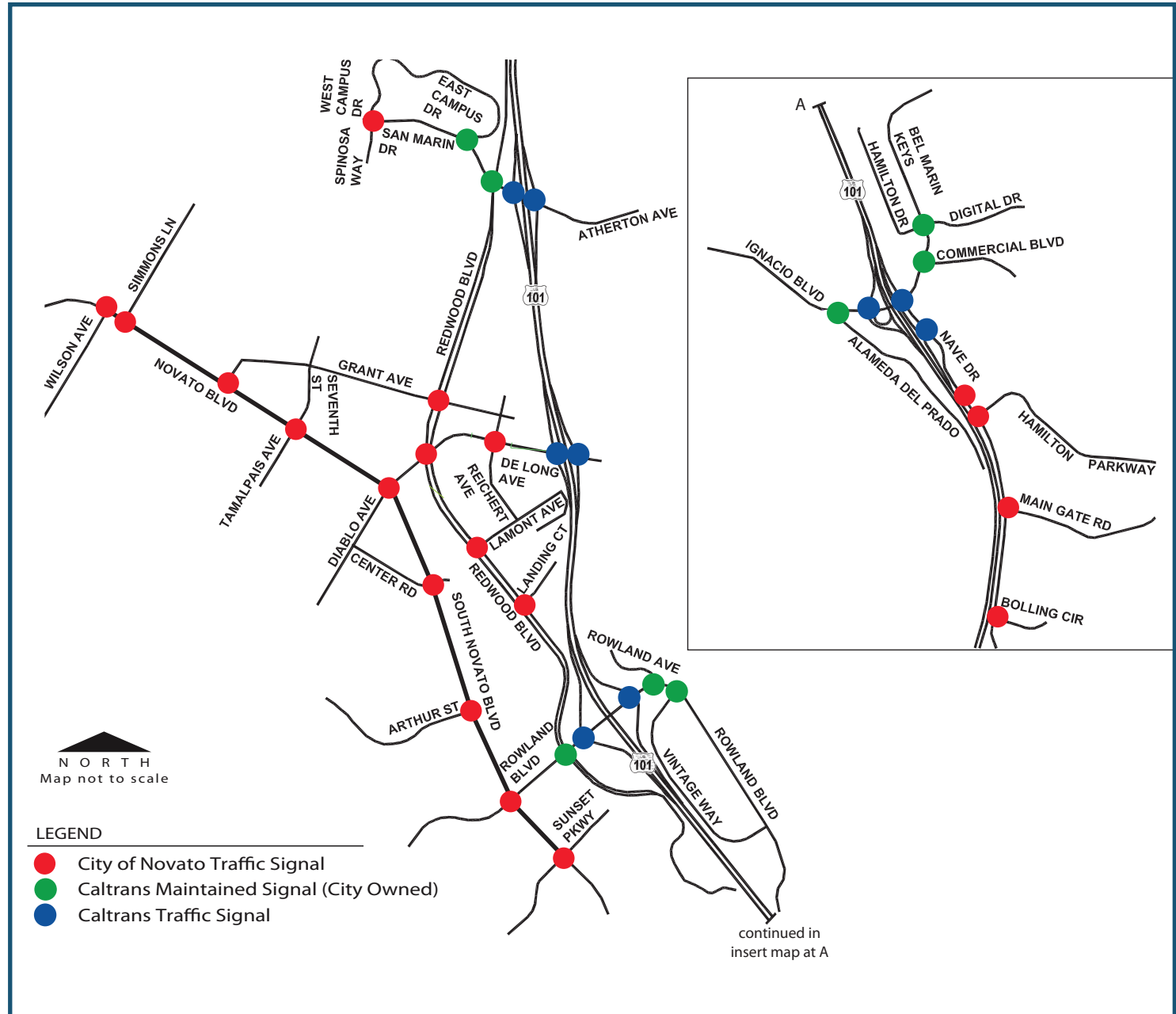
# Novato Citywide Traffic Signal Timing Project

City of Novato | Caltrans | Metropolitan Transportation Commission

## PROJECT OVERVIEW

The City of Novato 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 36 signals citywide, and weekend AM and PM periods for five signals along Rowland Blvd. The corridors encompass all major arterials -- as shown in the adjacent map -- within the City of Novato: San Marin Dr, Diablo/De Long Ave, Rowland Blvd, Ignacio/Bel Marin Key Blvd, Redwood Blvd, Novato Blvd and Nave Dr.

These corridors serve as a vital link for regional transit services from Golden Gate Transit and Marin County Transit. 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) conducting travel time surveys to analyze the performance of the new timing plans, including any effects on transit travel time and speed.



## 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 all 35 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:** For improved safety of bicyclists -- based on the new CA policy directives -- the minimum green time was increased at all project intersections to enable them to safely cross the intersection.



**BENEFITS TO PEDESTRIANS:** For improved safety, the pedestrian crossing timings were increased at all of the project intersections based on

the current standards. 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:** To assess the impacts on transit, travel time runs on transit vehicles were conducted both before and after the new timings were implemented. These evaluation results, as shown in the table to the right, demonstrate that the project provides significant benefits to transit without any negative impacts on autos.

### Project Costs

Consultant Costs (Basic Services/Plans, Additional Plans, IM Flush Plans, etc.)	\$124,800
Other Project Costs (Communications Equipment, etc.)	\$18,000
Agency Staff Costs (Estimate)	\$25,825
<b>Total Costs</b>	<b>\$168,625</b>

### Project Benefits

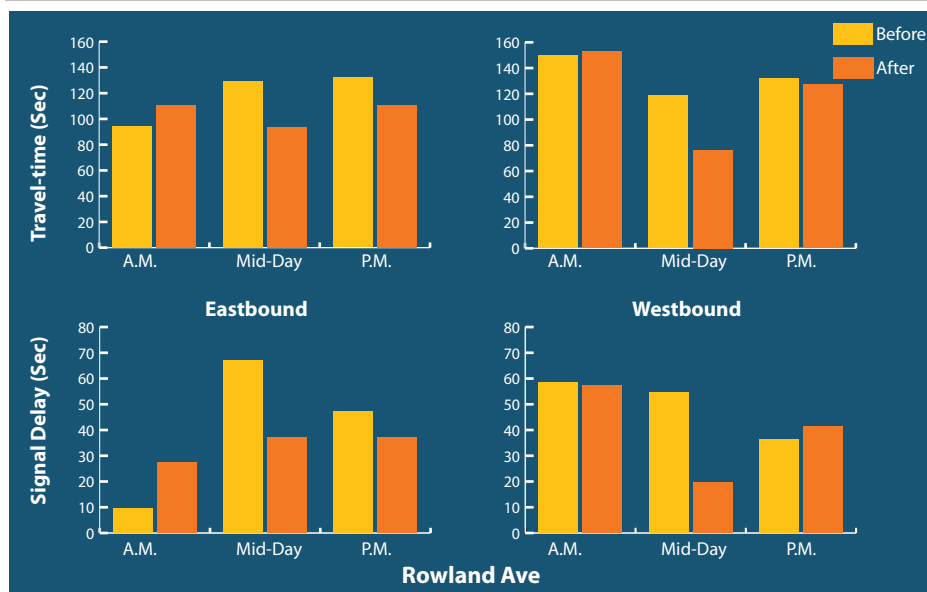
Measures	Annual Average		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	36,786 hrs.	\$702,166	183,932 hrs.	\$3,510,832
Fuel Consumption Savings	116,257 gal.	\$467,206	581,283 gal.	\$2,336,030
ROG Emissions Reduction	0.70 tons	\$876	3.48 tons	\$4,382
NOx Emissions Reduction	0.78 tons	\$13,989	3.89 tons	\$69,943
PM10 Emissions Reduction	0.14 tons	\$20,151	0.69 tons	\$100,757
CO Emissions Reduction	5.56 tons	\$430	27.79 tons	\$2,148
<b>Total Lifetime Benefits</b>				<b>\$6,024,091</b>
Transit Travel Time Savings	1,104 hrs.	\$21,077	5,521 hrs.	\$105,387
<b>Total Lifetime Benefits with Transit</b>				<b>\$6,129,478</b>

### Overall Project Benefits

	Auto	Transit
Average Decrease in Travel Time	16%	9%
Average Speed Increase	18%	12%
Average Fuel Savings	15%	N/A
Average Reduction in Signal Delay	31%	N/A
Average Reduction in Number of Stops	36%	N/A

### Overall Benefit-Cost Ratio

**42:1**



## PROJECT BENEFITS SUMMARY



**Average Reduction in Auto Signal Delay: 31%**

**Average Reduction in Number of Stops: 36%**

### Auto Fuel Consumption

**Savings: 15% or 581,283 gallons**



**Total Emissions Reduced (ROG, Nox, PM10, CO): 35.85 tons**

**Auto Travel Time Savings: 16% or 183,932 hours**



**Overall Project Benefit-cost Ratio = 42:1**

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### Project Consultant:

URS Corporation





# PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY12/13 CYCLE

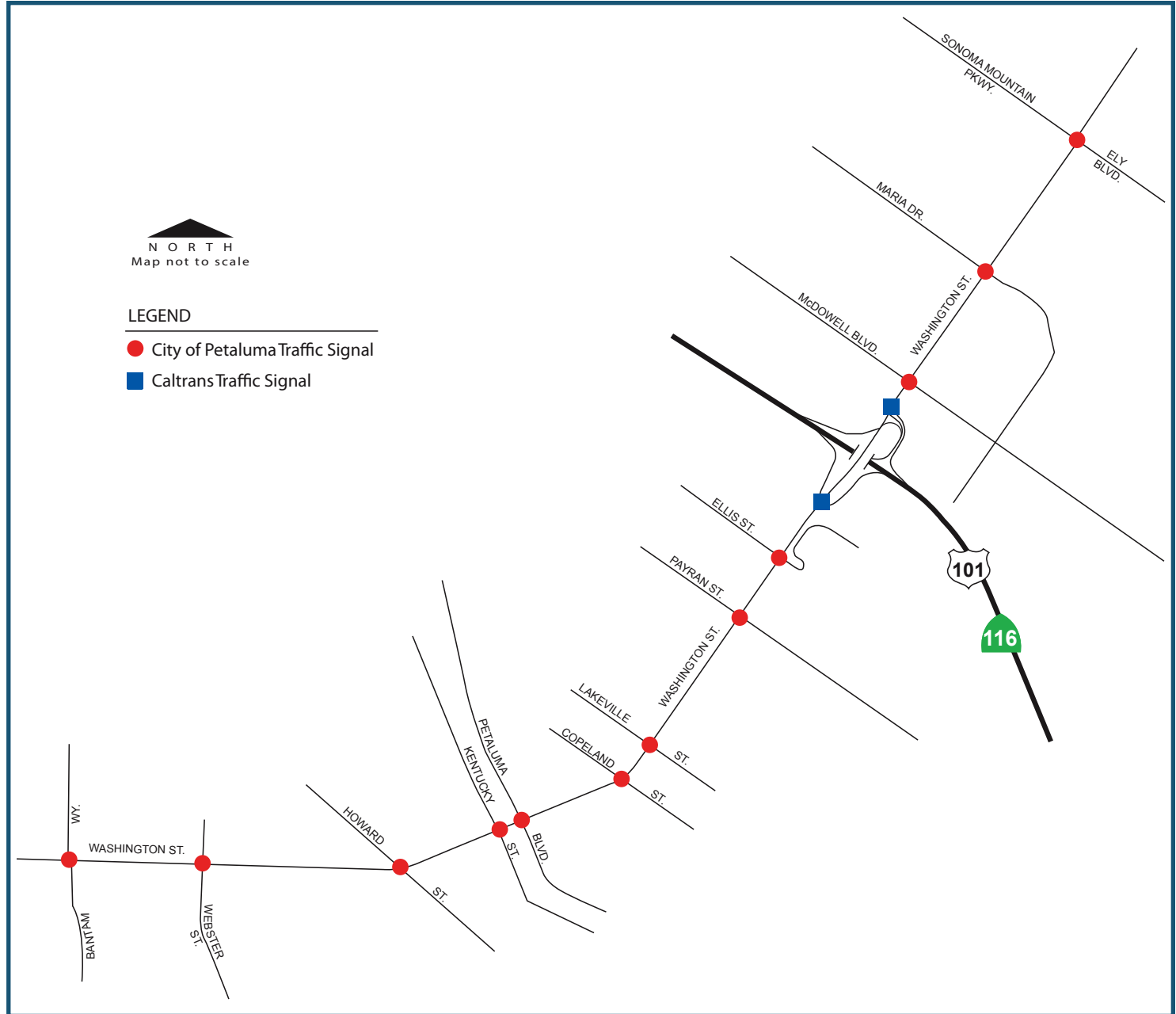
# Washington St ■ Traffic Signal Timing Project

City of Petaluma | Caltrans | Metropolitan Transportation Commission

## PROJECT OVERVIEW

The City of Petaluma received a Program for Arterial Synchronization (PASS) grant from the Metropolitan Transportation Commission to develop and implement new signal timings plans for 14 signals along Washington St and Bodega Ave. The goal of this project was to develop traffic signal timing plans for weekday AM, midday, and PM peak periods to achieve operational efficiency with the existing capacity constraints. Additional plans were developed to accommodate the anticipated lane configuration changes at the Caltrans intersections. These will be implemented after the completion of the construction activity.

This PASS project involved the completion of the following major tasks: collecting traffic volumes (ADT) 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 the performance of the new timing plans, including the effects on transit. The performance evaluation results show reduced congestion and signal delay, and improved travel time and safety for all modes along this major arterial in the City of Petaluma.



## POST-CONSTRUCTION TIMING PLANS

Since there were two intersection improvement projects that would change the lane configuration and traffic patterns at the Washington St and US 101 Ramps, the PASS project developed timing plans for immediate deployment to alleviate congestion during construction, and post-construction timing plans to implement after the completion of the projects.

## BENEFITS TO VARIOUS MODES



### BENEFITS TO PEDESTRIANS:

The Walk timing and Flash Don't Walk clearance timing parameters were updated to provide adequate time for children and seniors to safely cross the intersections. The updated timing parameters are expected to enhance the central business district crossings at Washington St/Petaluma Blvd and Washington St/Kentucky St. The increased pedestrian timings had a slight impact on transit travel times but not a significant impact.



### BENEFITS TO TRAFFIC SAFETY:

To enhance traffic safety, the yellow clearance timing parameters were updated based on posted speed limits at nine intersections along Washington St.



**BENEFITS TO BICYCLISTS:** Per the new California policy directive, the minimum green time was increased for the through movements at all

fourteen-study intersections to enhance traffic safety for bicyclists traveling along the Washington St corridor from Ely Blvd to Bantam Way.

## Project Costs

Consultant Costs (Weekday, Transit Evaluation)	\$46,930
Other Project Costs (Communications Equipment)	\$1,000
Agency Staff Costs (Estimate)	\$2,808
<b>Total Costs</b>	<b>\$50,738</b>

## Project Benefits

Measures	Annual Average		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	10,648 hrs.	\$203,247	53,241 hrs.	\$1,016,237
Fuel Consumption Savings	20,733 gal.	\$83,320	103,664 gal.	\$416,601
ROG Emissions Reduction	0.16 tons	\$197	0.78 tons	\$984
NOx Emissions Reduction	0.19 tons	\$3,487	0.97 tons	\$17,437
PM10 Emissions Reduction	0.03 tons	\$4,317	0.15 tons	\$21,586
CO Emissions Reduction	0.9 tons	\$70	4.51 tons	\$348
<b>Total Lifetime Benefits</b>				<b>\$1,473,194</b>
Transit Travel Time Savings	(27) hrs.	(\$513)	(134) hrs.	(\$2,567)
<b>Total Lifetime Benefits with Transit</b>				<b>\$1,470,628</b>

## Overall Project Benefits

	Auto	Transit
Average Decrease in Travel Time	12%	(2%)
Average Speed Increase	14%	(2%)
Average Fuel Savings	9%	N/A
Average Reduction in Signal Delay	50%	N/A
Average Reduction in Number of Stops	25%	N/A

## Overall Benefit-Cost Ratio

37:1



## PROJECT BENEFITS SUMMARY



**Average Reduction in Auto Signal Delay: 50%**

**Average Reduction in Number of Stops: 25%**

**Auto Fuel Consumption Savings: 9% or 103,664 gallons**



**Total Emissions Reduced (ROG, Nox, PM10, CO): 6.41 tons**

**Auto Travel Time Savings: 12% or 53,241 hours**



**Average Transit Travel Time delay: 2%**

**Overall Project Benefit-cost Ratio = 37:1**



## MTC CONTACT:

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## Project Consultant:

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# PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY12/13 CYCLE

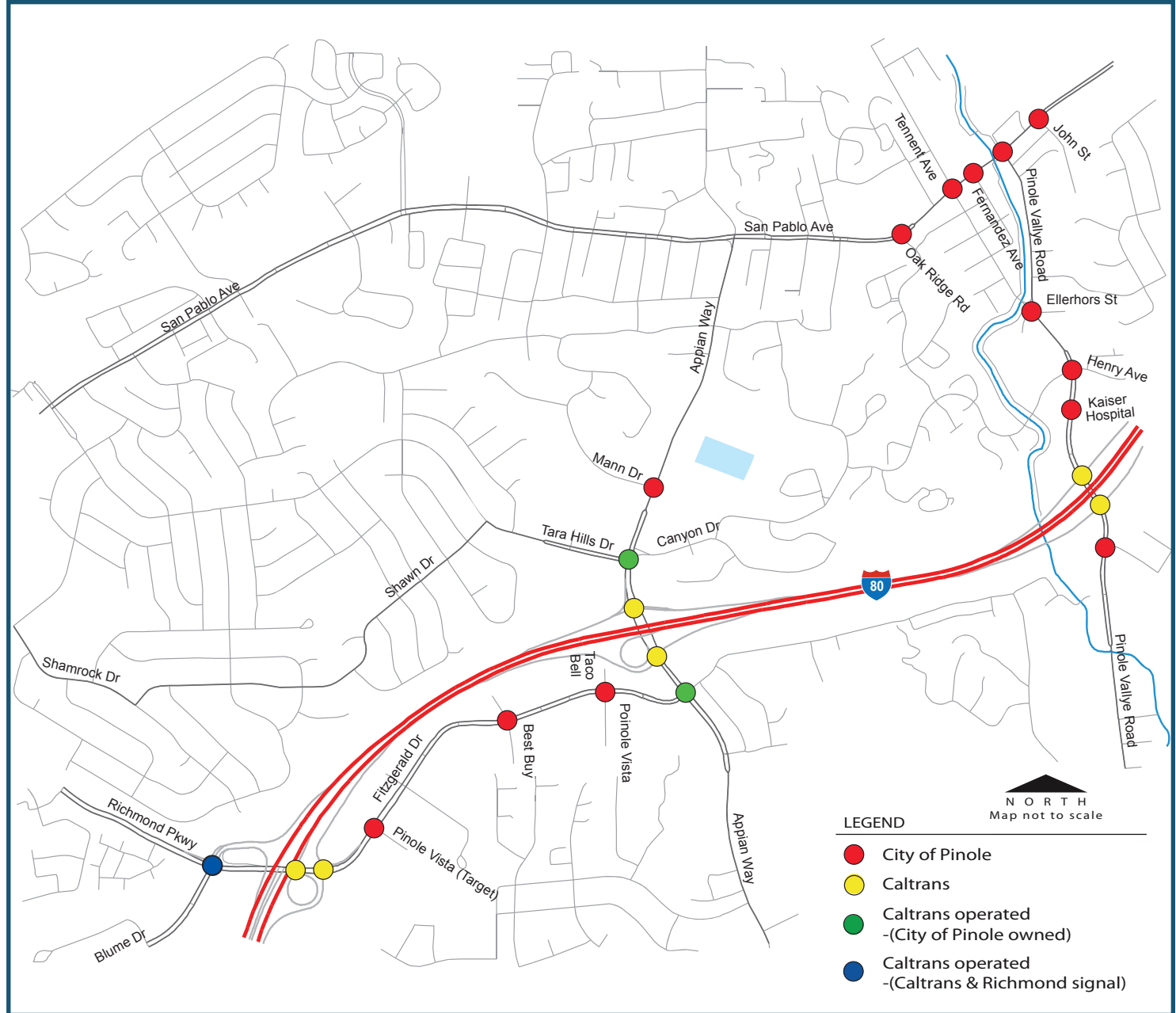
## Pinole Valley Rd/San Pablo Ave/Appian Way/Fitzgerald Dr

City of Pinole | Caltrans | Metropolitan Transportation Commission

### PROJECT OVERVIEW

The City of Pinole, in conjunction with Caltrans, received a Program for Arterial System Synchronization (PASS) grant from the Metropolitan Transportation Commission to develop and implement optimized signal timing plans for 22 signals along Pinole Valley Rd, San Pablo Ave, Appian Way, and Fitzgerald Dr/Richmond Pkwy.

The PASS project has optimized the signal coordination for the weekday AM and PM peak periods for all of the project intersections, as well as develop additional plans to address congestion during the school AM and PM peak periods for the six intersections along Pinole Valley Rd. The project also included an operational analysis to review lane configuration and phasing for the signals at Pinole Valley Rd/Tennent Ave, a 5-legged intersection with heavy school traffic, and San Pablo Ave/Tennent Ave, with heavy left turn movements. This project was coordinated with the schedule of the I-80 ICM project, which installed the signal interconnect between the traffic signals. The ICM project will also develop incident management flush plans for these corridors.



## ...IMMEDIATE RESULTS

After the new timing plans were implemented, the auto stops were reduced significantly by 48%. Additional benefits from reduction in stops include reduced vehicle maintenance, and reduced driver frustration. The additional school AM and PM peak signal timing plans resulted in the reduction in queuing and delay at the Pinole Valley Rd/Estates Ave, which was an important goal for the city in this PASS project.

## BENEFITS TO VARIOUS MODES



**BENEFITS TO BICYCLISTS:** For improved safety, the minimum green intervals were reviewed for bicyclists on the corridor. Changes to minimum green intervals were made at four project intersection.



**BENEFITS TO PEDESTRIANS:** For improved safety, the pedestrian intervals were reviewed and increased at 14 intersections based on the latest California MUTCD 2012 standards.



**BENEFITS TO TRANSIT:** To assess the impacts on transit, travel time runs on transit vehicles were conducted both before and after the new timings were implemented. These evaluation results, as shown in the table to the right, demonstrate that the program provides significant benefits to various modes.



**BENEFITS TO TRAFFIC SAFETY:** To enhance traffic safety, the yellow clearance timing parameters were updated based on current standards.

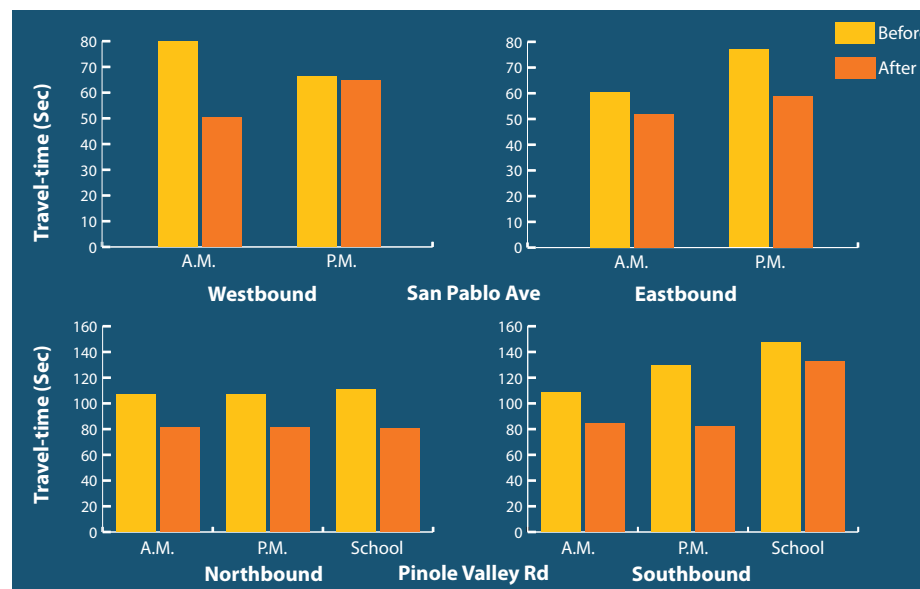
Changes to clearance intervals were made at four project intersections.

Project Costs	
Consultant Costs (Basic Services/Plans, School Peak, Transit Travel Time Runs)	\$65,445
Other Project Costs (Signal Operations Analysis)	\$3,300
Agency Staff Costs (Estimate)	\$16,361
<b>Total Costs</b>	<b>\$85,106</b>

Measures	Annual Average		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	13,638 hrs.	\$260,311	68,188 hrs.	\$1,301,557
Fuel Consumption Savings	31,726 gal.	\$127,500	158,632 gal.	\$637,501
ROG Emissions Reduction	0.22 tons	\$281	1.12 tons	\$1,405
NOx Emissions Reduction	0.27 tons	\$4,945	1.37 tons	\$24,725
PM10 Emissions Reduction	0.04 tons	\$6,236	0.21 tons	\$31,181
CO Emissions Reduction	1.42 tons	\$110	7.09 tons	\$548
<b>Total Lifetime Benefits</b>				<b>\$1,996,917</b>
Transit Travel Time Savings	63 hrs.	\$1,212	317 hrs.	\$6,058
<b>Total Lifetime Benefits with Transit</b>				<b>\$2,002,975</b>

Overall Project Benefits	Auto	Transit
Average Decrease in Travel Time	22%	4%
Average Speed Increase	26%	5%
Average Fuel Savings	19%	N/A
Average Reduction in Signal Delay	58%	N/A
Average Reduction in Number of Stops	48%	N/A

**Overall Benefit-Cost Ratio 25:1**



## PROJECT BENEFITS SUMMARY



**Average Reduction in Auto Signal Delay: 58%**

**Average Reduction in Number of Stops: 48%**

**Auto Fuel Consumption Savings: 19% or 158,632 gallons**



**Total Emissions Reduced (ROG, Nox, PM10, CO): 9.79 tons**

**Auto Travel Time Savings: 22% or 68,188 hours**



**Average Transit Travel Time Savings: 4% or 317 hours**

**Overall Project Benefit-cost Ratio = 25:1**



### MTC CONTACT:

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### Project Consultant:

Kimley-Horn and Associates, Inc.





# Emeryville Citywide Signal Timing Project

City of Emeryville | City of Oakland | Caltrans | Metropolitan Transportation Commission

## PROJECT OVERVIEW

The City of Emeryville, in conjunction with the City of Oakland and Caltrans, received a Program for Arterial System Synchronization (PASS) grant from the Metropolitan Transportation Commission (MTC) to develop and implement weekday and weekend (except Hollis St) signal coordination plans for 32 signals along San Pablo Ave, Hollis St, 40th St, and the Shellmound St/Christie Ave/Powell St route.

This project also developed transit signal priority (TSP) timing plans for 14 signals and a feasibility study to implement TSP at 10 signals. Based on the study results, TSP was implemented at six additional signals. The schedule of this PASS project was coordinated with the I-80 Integrated Corridor Mobility (ICM) project which installed the signal interconnect cable to Powell St at Hollis St intersection to support traffic signal coordination along Powell St. The performance evaluation shows reduced congestion, stops, signal delay and travel time; anticipated reduction in harmful greenhouse gas emissions; and improve traffic safety for all modes of users.



## TRANSIT SIGNAL PRIORITY (TSP)



The PASS procured and provided support for the installation of

16 Opticom Priority LED Emitters on all of the Emery Go-Round buses to enable signal priority for these buses. This shuttle service provides free transportation to Emeryville residents, shoppers, visitors and employees of local businesses by serving various routes throughout the city with a frequency of 10-15 minutes seven days a week.

## BENEFITS TO VARIOUS MODES



**BENEFITS TO BICYCLISTS:** For improved safety for bicyclists, the minimum green intervals were reviewed and updated at 27 project intersections.



**BENEFITS TO PEDESTRIANS:** For improved safety, the pedestrian crossing intervals were reviewed and increased at 16 intersections based on the current 2012 California MUTCD standards.



**BENEFITS TO TRANSIT:** The project included updating and emabling TSP settings at 14 intersections, and deploying new TSP timings at six intersections. These updated settings are expected to reduce transit delays and stops.



**BENEFITS TO TRAFFIC SAFETY:** To enhance traffic safety, the yellow clearance timing parameters were updated based on current standards.

Changes to clearance intervals were made at 12 project intersections.

## Project Costs

Consultant Costs (Weekday/end Timing, Transit Travel Time Runs, TSP Timing, Timing Sheets)	\$164,285
Other Project Costs (TSP Feasibility Study)	\$5,280
Agency Staff Costs (Estimate)	\$41,071
<b>Total Costs</b>	<b>\$210,636</b>

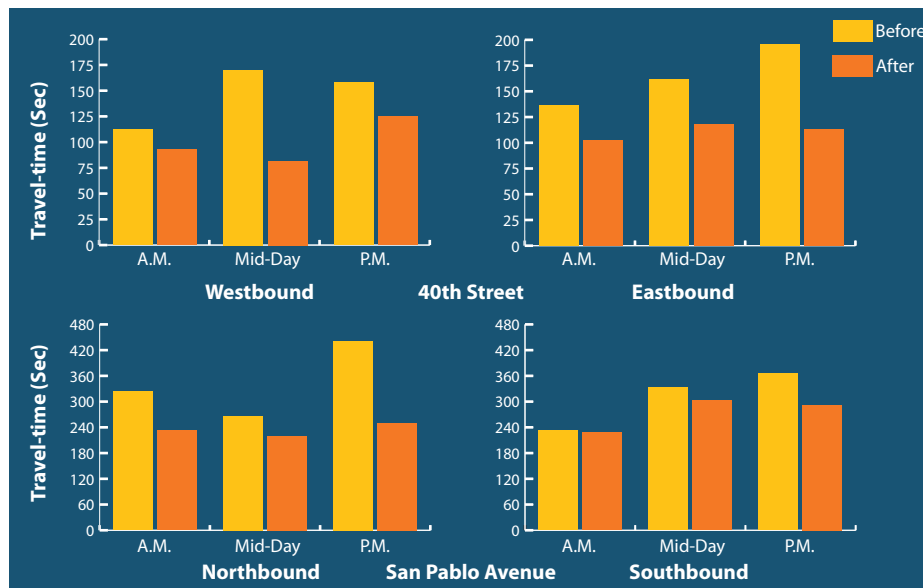
## Project Benefits

Measures	Annual Average		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	29,346 hrs.	\$560,154	146,732 hrs.	\$2,800,771
Fuel Consumption Savings	90,087 gal.	\$362,036	450,434 gal.	\$1,810,181
ROG Emissions Reduction	0.77 tons	\$975	3.87 tons	\$4,874
NOx Emissions Reduction	1.03 tons	\$18,620	5.17 tons	\$93,100
PM10 Emissions Reduction	0.14 tons	\$20,081	0.69 tons	\$100,407
CO Emissions Reduction	3.83 tons	\$296	19.14 tons	\$1,480
<b>Total Lifetime Benefits</b>				<b>\$4,810,814</b>
Transit Travel Time Savings	2,712 hrs.	\$51,771	13,561 hrs.	\$258,854
<b>Total Lifetime Benefits with Transit</b>				<b>\$5,069,668</b>

Overall Project Benefits	Auto	Transit
Average Decrease in Travel Time	19%	5%
Average Speed Increase	39%	4%
Average Fuel Savings	13%	N/A
Average Reduction in Signal Delay	42%	N/A
Average Reduction in Number of Stops	34%	N/A

## Overall Benefit-Cost Ratio

**25:1**



## PROJECT BENEFITS SUMMARY



**Average Reduction in Auto Signal Delay: 42%**

**Average Reduction in Number of Stops: 34%**

**Auto Fuel Consumption Savings: 13% or 450,434 gallons**



**Total Emissions Reduced (ROG, Nox, PM10, CO): 28.87 tons**

**Auto Travel Time Savings: 19% or 146,732 hours**



**Average Transit Travel Time Savings: 5% or 13,561 hours**

**Overall Project Benefit-cost Ratio = 25:1**



## MTC CONTACT:

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## Project Consultant:

Kimley-Horn and Associates, Inc.



# PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY12/13 CYCLE

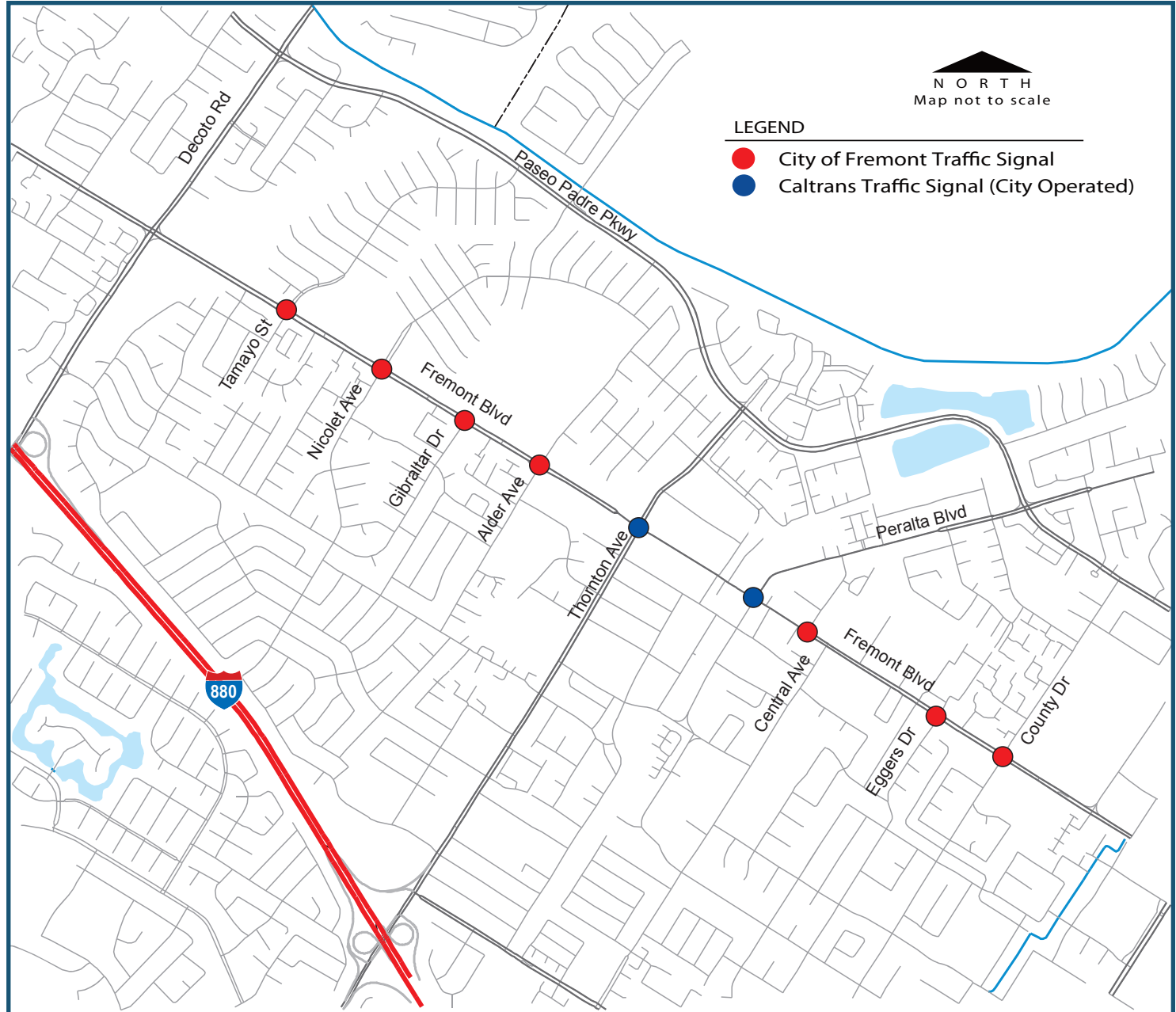
# Fremont Blvd ■ Traffic Signal Timing Project

City of Fremont | Caltrans | Metropolitan Transportation Commission

## PROJECT OVERVIEW

The City of Fremont received a Program for Arterial System Synchronization (PASS) grant from the Metropolitan Transportation Commission to optimize and coordinate traffic signals during weekday AM, midday and PM for nine intersections along Fremont Blvd between Tamayo St and Country Dr. In addition, the project included development and implementation of an AM school peak coordination plan to address congestion near schools along the corridor.

This PASS project involved the completion of the following major tasks: 1) collecting traffic volumes (ADT) 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) conducting travel time surveys to analyze the performance of the new timing plans, including the effects on transit.



## BENEFITS TO VARIOUS MODES



**BENEFITS TO BICYCLISTS:** For improved safety, the minimum green intervals were reviewed for bicyclists on the corridor.

Changes to minimum green intervals were made at one project intersection.



**BENEFITS TO PEDESTRIANS:** For improved safety, the pedestrian intervals were reviewed and increased at

most intersections based on current 2012 California MUTCD standards. Changes to pedestrian timing were made at all nine project intersections.



**BENEFITS TO TRANSIT:** To assess the impacts on transit, travel time runs on transit vehicles were conducted both

before and after the new timings were implemented. These evaluation results, as shown in the table to the right, demonstrate that the project provides 5% travel time savings for buses along this corridor.



**BENEFITS TO TRAFFIC SAFETY:** To enhance traffic safety, the yellow clearance timing parameters were updated

based on current standards. Changes to clearance intervals were required at two project intersections. The performance results show a reduction of 50% in the number of stops which is a major factor for secondary and rear end collisions.

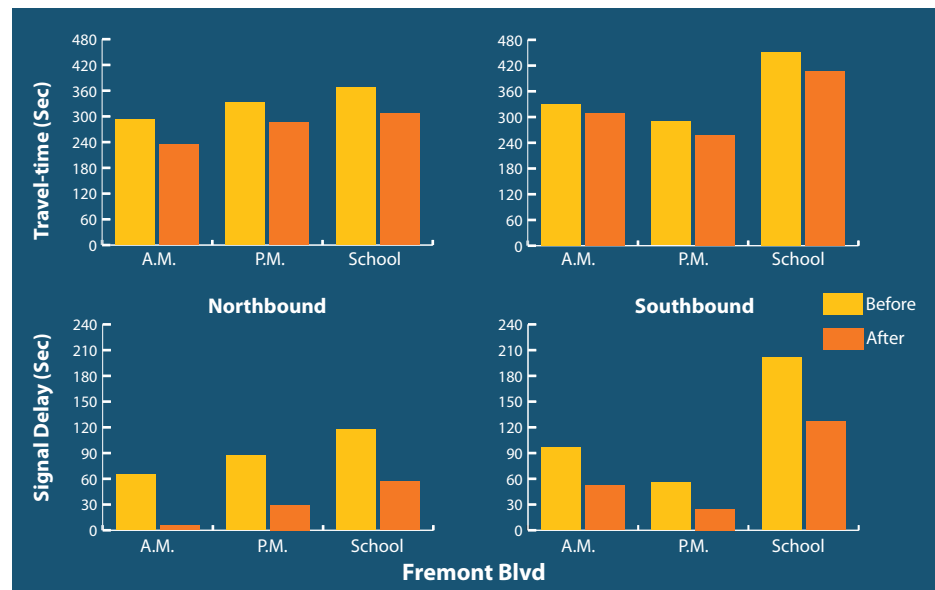
Project Costs	
Consultant Costs (Weekday Peak Coordination Plans, Transit Travel Time Runs)	\$28,290
Other Project Costs (Additional ADT count, and Visio Covers)	\$815
Agency Staff Costs (Estimate)	\$5,590
<b>Total Costs</b>	<b>\$35,055</b>

Project Benefits				
Measures	Annual Average		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	10,772 hrs.	\$205,614	53,860 hrs.	\$1,028,069
Fuel Consumption Savings	25,667 gal.	\$103,148	128,333 gal.	\$515,739
ROG Emissions Reduction	0.14 tons	\$177	0.70 tons	\$883
NOx Emissions Reduction	0.16 tons	\$2,877	0.80 tons	\$14,383
PM10 Emissions Reduction	0.03 tons	\$4,232	0.15 tons	\$21,159
CO Emissions Reduction	1.27 tons	\$98	6.34 tons	\$490

<b>Total Lifetime Benefits</b>				<b>\$1,580,722</b>
Transit Travel Time Savings	610 hrs.	\$11,641	3,049 hrs.	\$58,204
<b>Total Lifetime Benefits with Transit</b>				<b>\$1,638,926</b>

Overall Project Benefits	Auto	Transit
Average Decrease in Travel Time	11%	5%
Average Speed Increase	12%	7%
Average Fuel Savings	8%	N/A
Average Reduction in Signal Delay	45%	N/A
Average Reduction in Number of Stops	50%	N/A

**Overall Benefit-Cost Ratio 47:1**



## PROJECT BENEFITS SUMMARY



**Average Reduction in Auto Signal Delay: 45%**  
**Average Reduction in Number of Stops: 50%**

**Auto Fuel Consumption Savings: 8% or 128,333 gallons**



**Total Emissions Reduced (ROG, Nox, PM10, CO): 7.99 tons**

**Auto Travel Time Savings: 11% or 53,860 hours**



**Average Transit Travel Time Savings: 5% or 3,049 hours**

**Overall Project Benefit-cost Ratio = 47:1**



### MTC CONTACT:

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510.325.3462

**Project Consultant:**  
Kimley-Horn and Associates, Inc.





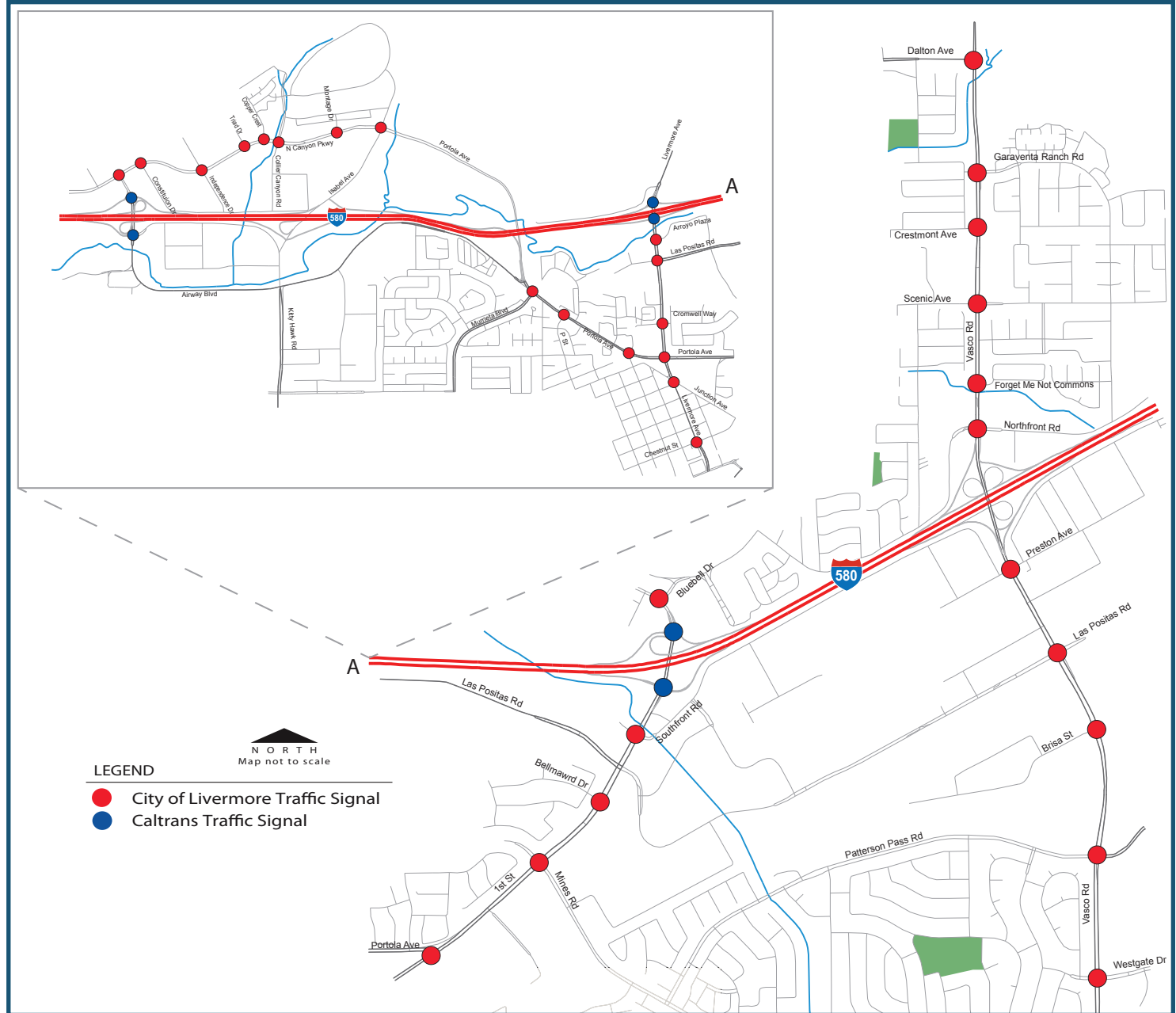
# Vasco Rd/First St/Portola Ave/Livermore Ave

City of Livermore | Caltrans | Metropolitan Transportation Commission

## PROJECT OVERVIEW

The City of Livermore, in conjunction with Caltrans, received a Program for Arterial System Synchronization (PASS) grant from the Metropolitan Transportation Commission to optimize signal coordination at 39 signals along N Canyons Pkwy, Portola Ave, Airway Blvd, Portola Ave, Livermore Ave, First St/Springtown Blvd, and N/S Vasco Rd. The project involved developing the weekday coordination plans for all project signals, and incident management flush plans for signals along N Canyons Pkwy, Portola Ave and Livermore Ave.

The PASS project installed three GPS devices at Caltrans intersections to enable synchronization with the city signals. The following major tasks were completed in this project: collecting traffic volumes (ADT) 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 the performance of the new timing plans.



## INCIDENT MANAGEMENT FLUSH PLANS

The PASS project also developed signal coordination flush plans along North Canyon Pkwy, Portola Ave, and Livermore Ave to help manage the traffic when an incident occurs on the adjacent I-580. These signal timing plans called the Incident Management flush plans aim to effectively take the diverted traffic from the city streets back onto the freeways. The city staff are now able to remotely select and activate these flush plans based on the location and time of the incident on the freeway.

## BENEFITS TO VARIOUS MODES



**BENEFITS TO BICYCLISTS:** For improved safety, the minimum green intervals were reviewed for bicyclists on the corridors.

Changes to minimum green intervals were made at 21 project intersections.



**BENEFITS TO PEDESTRIANS:** For improved safety, the pedestrian intervals were reviewed and increased at most intersections based on current 2012 California MUTCD standards.

Changes to pedestrian timing were made at all 33 project intersections.



**BENEFITS TO TRAFFIC SAFETY:** To enhance traffic safety, the yellow clearance timing parameters were updated based on current standards.

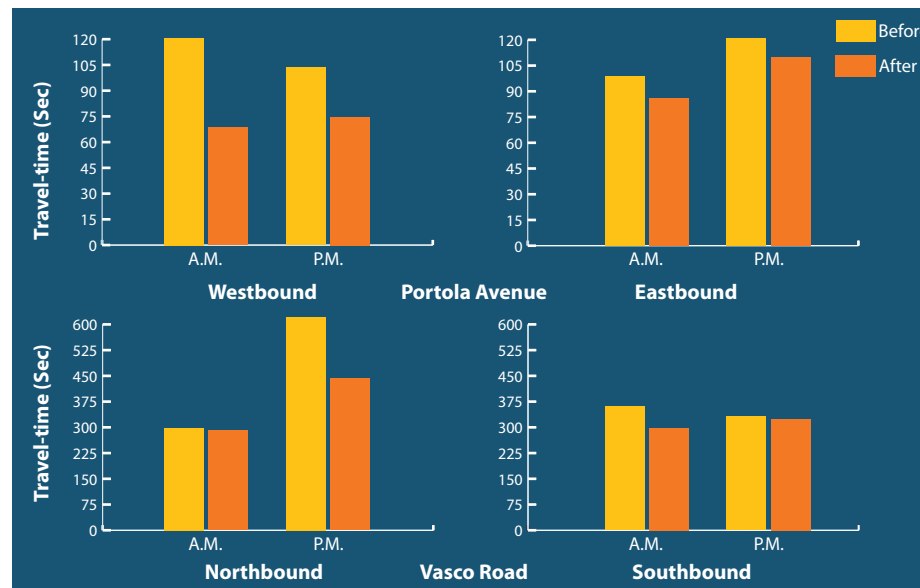
Changes to clearance intervals were made at 13 project intersections.

Project Costs	
Consultant Costs (Basic Services/Plans, Incident Management Flush Plans)	\$97,135
Other Project Costs (Reduced Services, GPS Clocks)	\$710
Agency Staff Costs (Estimate)	\$21,338
<b>Total Costs</b>	<b>\$119,183</b>

Measures	Annual Average		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	16,599 hrs.	\$316,834	82,994 hrs.	\$1,584,169
Fuel Consumption Savings	46,981 gal.	\$188,806	234,906 gal.	\$944,029
ROG Emissions Reduction	0.28 tons	\$356	1.41 tons	\$1,778
NOx Emissions Reduction	0.33 tons	\$5,906	1.64 tons	\$29,532
PM10 Emissions Reduction	0.06 tons	\$8,298	0.29 tons	\$41,491
CO Emissions Reduction	2.25 tons	\$174	11.24 tons	\$869
<b>Total Lifetime Benefits</b>				<b>\$2,601,868</b>

Overall Project Benefits	Auto
Average Decrease in Travel Time	11%
Average Speed Increase	15%
Average Fuel Savings	8%
Average Reduction in Signal Delay	36%
Average Reduction in Number of Stops	37%

**Overall Benefit-Cost Ratio 24:1**



## PROJECT BENEFITS SUMMARY



**Average Reduction in Auto Signal Delay: 36%**

**Average Reduction in Number of Stops: 37%**

**Auto Fuel Consumption Savings: 8% or 234,906 gallons**



**Total Emissions Reduced (ROG, Nox, PM10, CO): 14.58 tons**

**Auto Travel Time Savings: 11% or 82,994 hours**



**Overall Project Benefit-cost Ratio = 24:1**

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### Project Consultant:

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LIVERMORE CALIFORNIA



# PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY12/13 CYCLE

# Grand Ave ■ Traffic Signal Timing Project

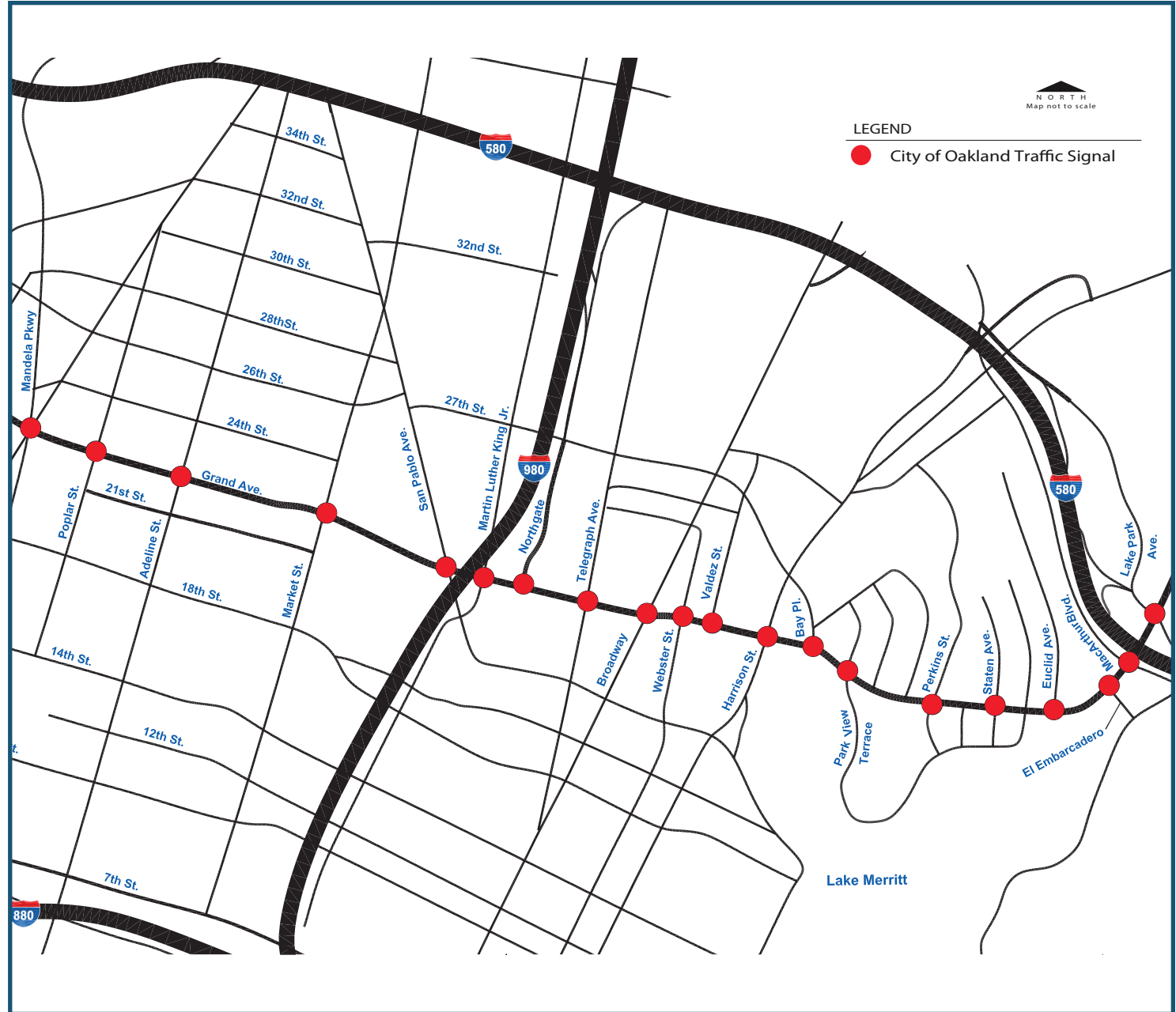
City of Oakland | Metropolitan Transportation Commission

## PROJECT OVERVIEW

The City of Oakland received a Program for Arterial System Synchronization (PASS) grant from the Metropolitan Transportation Commission to optimize signal timing for 20 signals along Grand Ave. The project conducted timing analysis and developed and implemented signal coordination for the AM, midday, and PM peak periods.

The goal of this project was to facilitate traffic progression along Grand Ave; and to optimize signal timing plans to achieve operational efficiency of the traffic signals.

This corridor serves as a vital link for regional transit services for AC Transit. 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 the performance of the new timing plans.



## BENEFITS TO VARIOUS MODES



**BENEFITS TO BICYCLISTS:** For improved safety, the minimum green intervals were reviewed for bicyclists on the corridor.



**BENEFITS TO PEDESTRIANS:** For improved safety, the Walk timing and Flash Don't Walk clearance timing parameters were updated to provide adequate time for children and seniors to safely cross the intersections and to accommodate the 2012 CA MUTCD requirement of walking speed of 3.5 feet/second.



**BENEFITS TO TRANSIT:** To assess the impacts on transit, travel time runs on transit vehicles were conducted both before and after the new timings were implemented. These evaluation results, as shown in the table to the right, demonstrate that the project provides significant benefits to transit.



**BENEFITS TO TRAFFIC SAFETY:** To enhance traffic safety, the yellow clearance timing parameters were updated based on current standards.

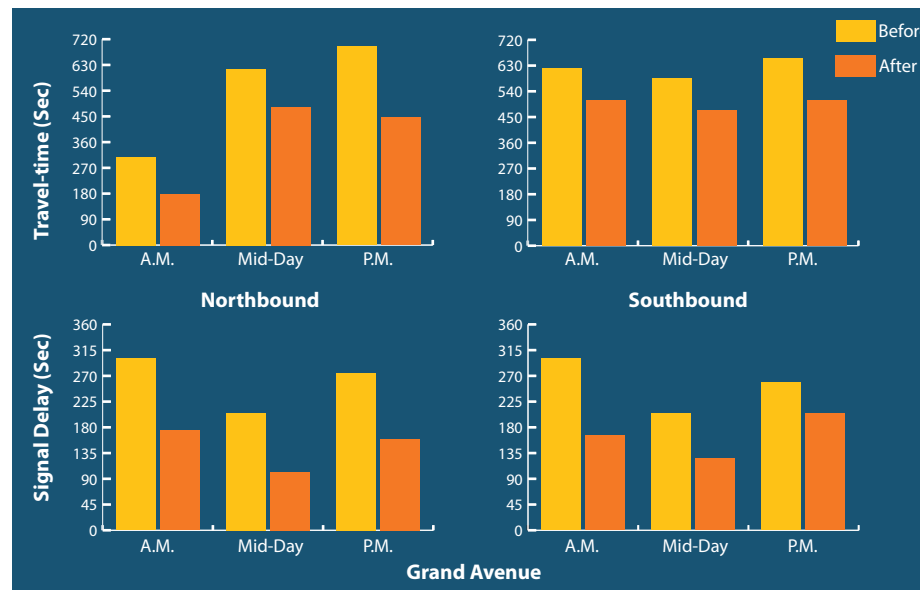
All-red clearance timing parameters were reviewed to be consistent with the city's practices. The performance results show that signal delay and number of stops have reduced significantly, which helps in lowering greenhouse gas emissions, and possibly some secondary and rear-end collisions.

Project Costs	
Consultant Costs (basic Services/Plans, Transit Evaluation)	\$55,615
Other Project Costs	\$0
Agency Staff Costs (Estimate)	\$1,154
<b>Total Costs</b>	<b>\$56,769</b>

Measures	Annual Average		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	16,568 hrs.	\$316,236	82,838 hrs.	\$1,581,181
Fuel Consumption Savings	60,408 gal.	\$242,766	302,042 gal.	\$1,213,829
ROG Emissions Reduction	0.53 tons	\$664	2.64 tons	\$3,318
NOx Emissions Reduction	0.7 tons	\$12,649	3.51 tons	\$63,247
PM10 Emissions Reduction	0.09 tons	\$13,692	0.47 tons	\$68,458
CO Emissions Reduction	2.57 tons	\$198	12.83 tons	\$992
<b>Total Lifetime Benefits</b>				<b>\$2,931,024</b>
Transit Travel Time Savings	1,322 hrs.	\$25,227	6,608 hrs.	\$126,137
<b>Total Lifetime Benefits with Transit</b>				<b>\$3,057,161</b>

Overall Project Benefits	Auto	Transit
Average Decrease in Travel Time	23%	12%
Average Speed Increase	30%	15%
Average Fuel Savings	18%	N/A
Average Reduction in Signal Delay	41%	N/A
Average Reduction in Number of Stops	25%	N/A

**Overall Benefit-Cost Ratio 59:1**



## PROJECT BENEFITS SUMMARY



**Average Reduction in Auto Signal Delay: 41%**

**Average Reduction in Number of Stops: 25%**

**Auto Fuel Consumption Savings: 18% or 302,042 gallons**



**Total Emissions Reduced (ROG, Nox, PM10, CO): 19.45 tons**

**Auto Travel Time Savings: 23% or 82,838 hours**



**Average Travel Time Savings: 12% or 6,608 hours**

**Overall Project Benefit-cost Ratio = 59:1**



### MTC CONTACT:

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### Project Consultant:

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# Alvarado-Niles Rd ■ Traffic Signal Timing Project

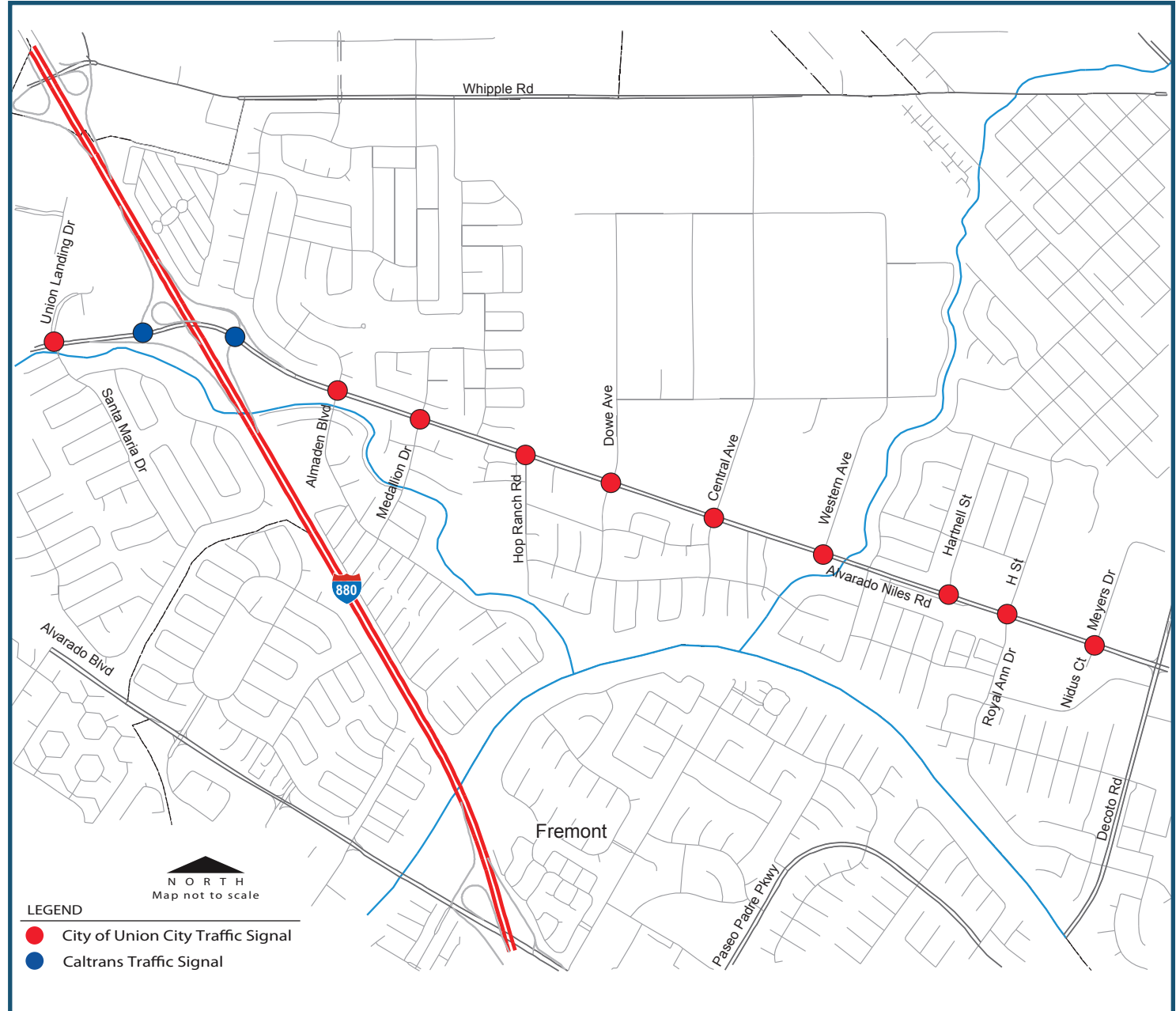
City of Union City | Caltrans | Metropolitan Transportation Commission

## PROJECT OVERVIEW

The City of Union City, in conjunction with Caltrans, received a Program for Arterial System Synchronization (PASS) grant from the Metropolitan Transportation Commission to conduct a signal timing study for 12 signals along Alvarado-Niles Rd. In addition, the project included development and implementation of school peak AM and PM coordination plans to mitigate congestion near schools along the corridor.

The goal of this project was to facilitate traffic progression along the corridor; and to update the signal timing plans to achieve operational efficiency of the traffic signals. Attaining this goal is expected to reduce traffic congestion, reduce traffic delays, reduce the emission of harmful greenhouse gases, reduce travel time along the study corridor, and improve traffic safety.

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 the performance of the new timing plans.



## SIGNAL INTERCONNECT ACROSS I-880

The PASS project also provided funding to install approx. 4,500 feet of signal Interconnect (SIC) to connect the intersections of Alvarado-Niles Rd/Almaden Blvd and Alvarado-Nile Rd/Union Landing Dr and provide direct communication to the City Hall TMC. The city used an existing 3" conduit across the I-880 interchange and installed the cable with the help of city's contractor. With the closure of this SIC gap, intersections to the west of I-880 are directly communicating to the TMC, and receiving continuous time updates from the new GPS device installed at the TMC.

## BENEFITS TO VARIOUS MODES



**BENEFITS TO BICYCLISTS:** For improved safety, the minimum green intervals were reviewed for bicyclists on the corridor. Changes to minimum green intervals were made at all project intersections.



**BENEFITS TO PEDESTRIANS:** For improved safety, the pedestrian intervals were reviewed and increased at most intersections based on current 2012 California MUTCD standards. Changes to pedestrian timing were made at 11 project intersections.



**BENEFITS TO TRANSIT:** To assess the impacts on transit, travel time runs on transit vehicles were conducted both before and after the new timings were implemented. The evaluation results, as shown in the table to the right, demonstrate that the project resulted in some speed and travel time savings.

### Project Costs

Consultant Costs (Basic Services/Plans, Transit Travel Time Runs)	\$33,740
Other Project Costs (GPS Clocks, School Peak Timing, etc.)	\$8,645
Agency Staff Costs (Estimate)	\$7,150
<b>Total Costs</b>	<b>\$49,535</b>

### Project Benefits

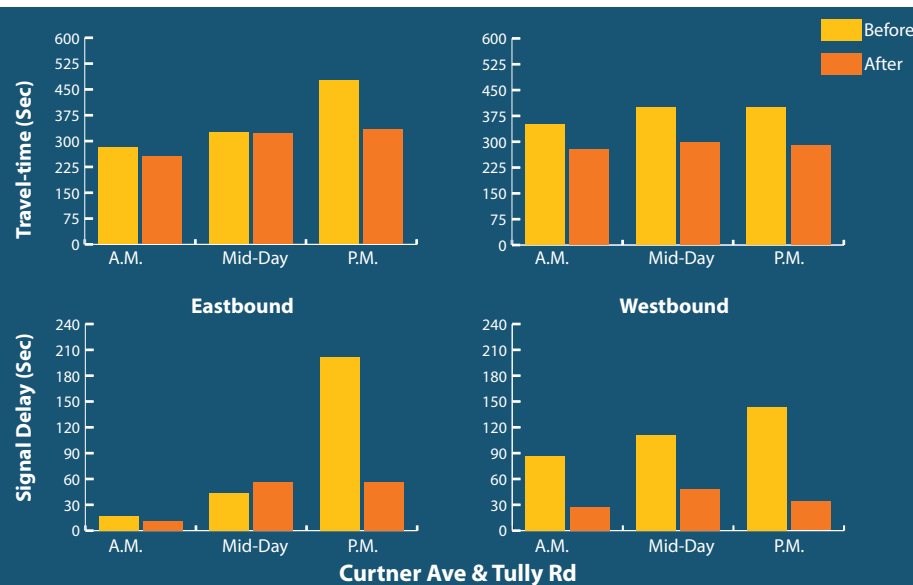
Measures	Annual Average		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	31,260 hrs.	\$596,679	156,300 hrs.	\$2,983,394
Fuel Consumption Savings	65,915 gal.	\$264,898	329,577 gal.	\$1,324,488
ROG Emissions Reduction	0.37 tons	\$465	1.85 tons	\$2,325
NOx Emissions Reduction	0.42 tons	\$7,555	2.10 tons	\$37,775
PM10 Emissions Reduction	0.08 tons	\$11,082	0.38 tons	\$55,409
CO Emissions Reduction	3.07 tons	\$238	15.37 tons	\$1,188
<b>Total Lifetime Benefits</b>				<b>\$4,404,580</b>
Transit Travel Time Savings	399 hrs.	\$7,616	1,995 hrs.	\$38,080
<b>Total Lifetime Benefits with Transit</b>				<b>\$4,442,660</b>

### Overall Project Benefits

	Auto	Transit
Average Decrease in Travel Time	20%	3%
Average Speed Increase	26%	5%
Average Fuel Savings	17%	N/A
Average Reduction in Signal Delay	48%	N/A
Average Reduction in Number of Stops	50%	N/A

### Overall Benefit-Cost Ratio

**90:1**



## PROJECT BENEFITS SUMMARY



**Average Reduction in Auto Signal Delay: 48%**

**Average Reduction in Number of Stops: 50%**

**Auto Fuel Consumption Savings: 17% or 329,577 gallons**



**Total Emissions Reduced (ROG, NOx, PM10, CO): 19.7 tons**

**Auto Travel Time Savings: 20% or 156,300 hours**



**Overall Project Benefit-cost Ratio = 90:1**

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### Project Consultant:

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# PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY12/13 CYCLE

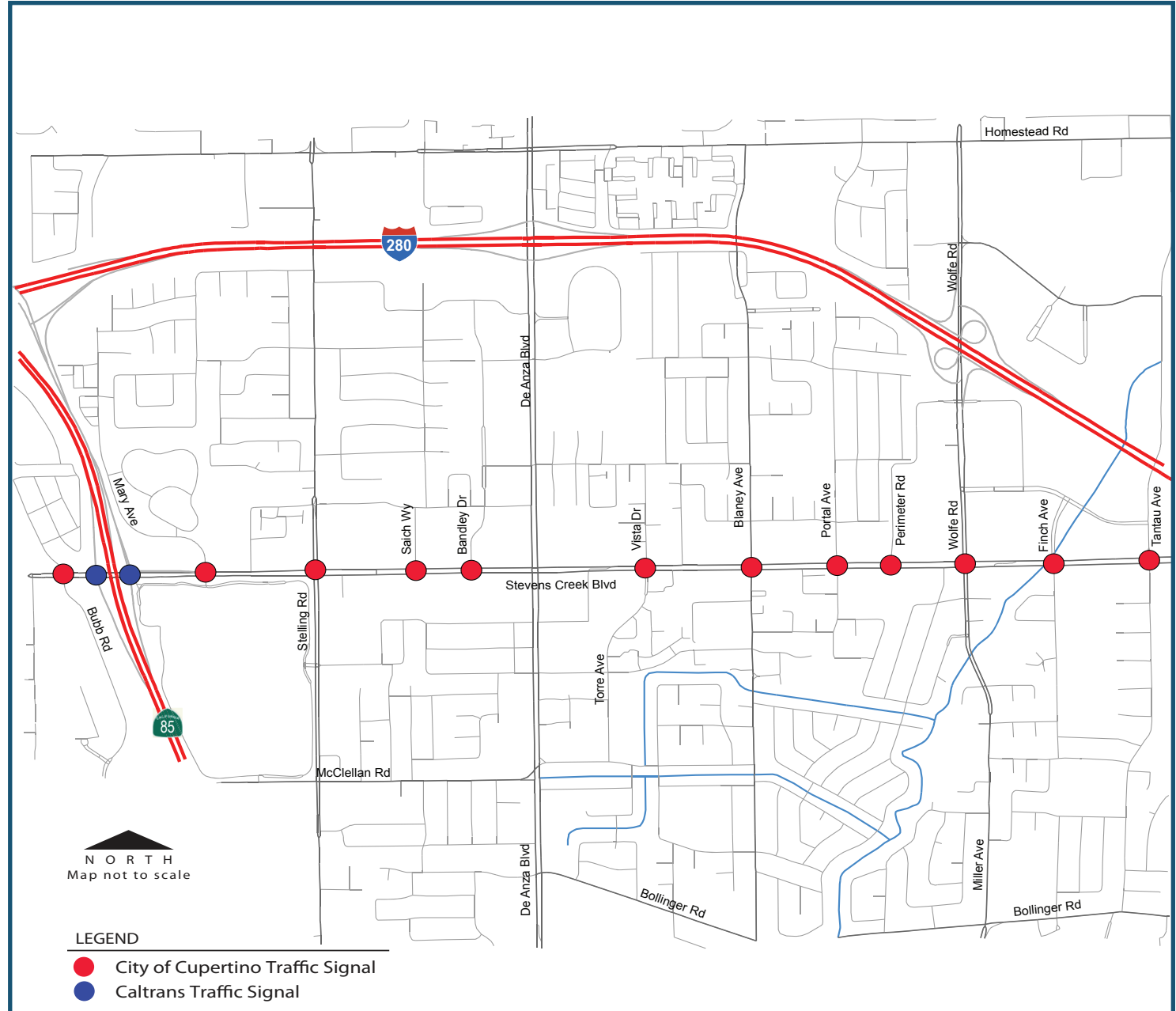
# Stevens Creek Blvd ■ Traffic Signal Timing Project

City of Cupertino | Metropolitan Transportation Commission

## PROJECT OVERVIEW

The City of Cupertino received a Program for Arterial Synchronization (PASS) grant from the Metropolitan Transportation Commission to conduct a signal timing study for 14 signals along Stevens Creek Blvd between Bubb Rd/ Peninsula Ave and Tantau Ave.

The project objective was to develop traffic signal coordination timing plans for the weekday AM, midday, and PM peak periods, for all project signals, and school peak periods, for three of signals on the east end of the corridor. There was a concurrent Transit Performance Initiative (TPI) project that was being completed for VTA Line 323 Limited Service to provide transit signal priority (TSP) along this route within the project limits, therefore the PASS project was coordinated with the TPI project in development of the timings.



## BENEFITS TO VARIOUS MODES



**BENEFITS TO BICYCLISTS:** For improved safety, the minimum green intervals were reviewed for bicyclists on the corridor.

Changes to minimum green intervals were made at five project intersections.



**BENEFITS TO PEDESTRIANS:** For improved safety, the pedestrian intervals were reviewed based on City standards.

Changes to pedestrian timing were made at two project intersections.



**BENEFITS TO TRANSIT:** Based on the transit travel time runs, the project resulted in an average of 7% increase in speed and an average of 11% savings in travel time for the buses serving the corridor.

These results show that optimizing signal timings on a regular basis provides significant benefits to the users and transit operators.



**BENEFITS TO TRAFFIC SAFETY:** To enhance safety, the yellow clearance intervals were reviewed and updated based

on current standards. Changes to clearance intervals were made at five project intersections. After the new timing plans were implemented, the auto stops were reduced by 45%. Additional benefits from reduction in stops include reduced vehicle maintenance, and reduced driver frustration.

### Project Costs

Consultant Costs(Weekday Peak Coordination Plans, Transit Travel Time Runs)	\$37,550
Other Project Costs (Additional ADT count, School Peak Timing)	\$5,025
Agency Staff Costs (Estimate)	\$8,225
<b>Total Costs</b>	<b>\$50,800</b>

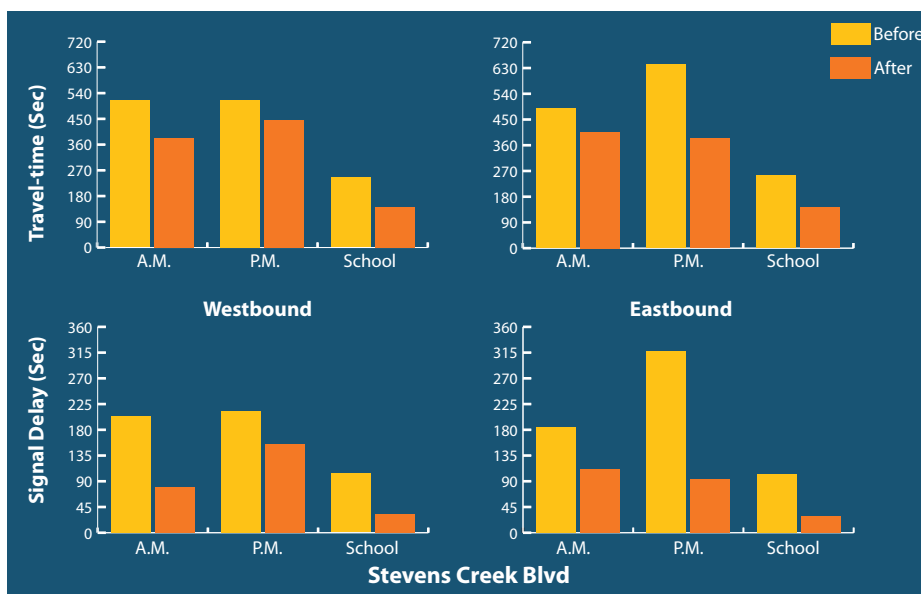
### Project Benefits

Measures	Annual Average		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	53,647 hrs.	\$1,024,002	268,237 hrs.	\$5,120,010
Fuel Consumption Savings	190,686 gal.	\$766,320	953,431 gal.	\$3,831,601
ROG Emissions Reduction	1.34 tons	\$1,690	6.71 tons	\$8,452
NOx Emissions Reduction	1.65 tons	\$29,665	8.24 tons	\$148,325
PM10 Emissions Reduction	0.26 tons	\$37,572	1.29 tons	\$187,861
CO Emissions Reduction	8.36 tons	\$646	41.79 tons	\$3,230
<b>Total Lifetime Benefits</b>				<b>\$9,299,479</b>
Transit Travel Time Savings	3,141 hrs.	\$59,953	15,705 hrs.	\$299,766
<b>Total Lifetime Benefits with Transit</b>				<b>\$9,599,245</b>

Overall Project Benefits	Auto	Transit
Average Decrease in Travel Time	28%	11%
Average Speed Increase	42%	7%
Average Fuel Savings	23%	N/A
Average Reduction in Signal Delay	56%	N/A
Average Reduction in Number of Stops	45%	N/A

### Overall Benefit-Cost Ratio

**189:1**



## PROJECT BENEFITS SUMMARY



**Average Reduction in Auto Signal Delay: 56%**

**Average Reduction in Number of Stops: 45%**

**Auto Fuel Consumption Savings: 23% or 953,461 gallons**



**Total Emissions Reduced (ROG, Nox, PM10, CO): 58.03 tons**

**Auto Travel Time Savings: 28% or 268,237 hours**



**Average Travel Time Savings: 11% or 15,705 hours**

**Overall Project Benefit-cost Ratio = 189:1**



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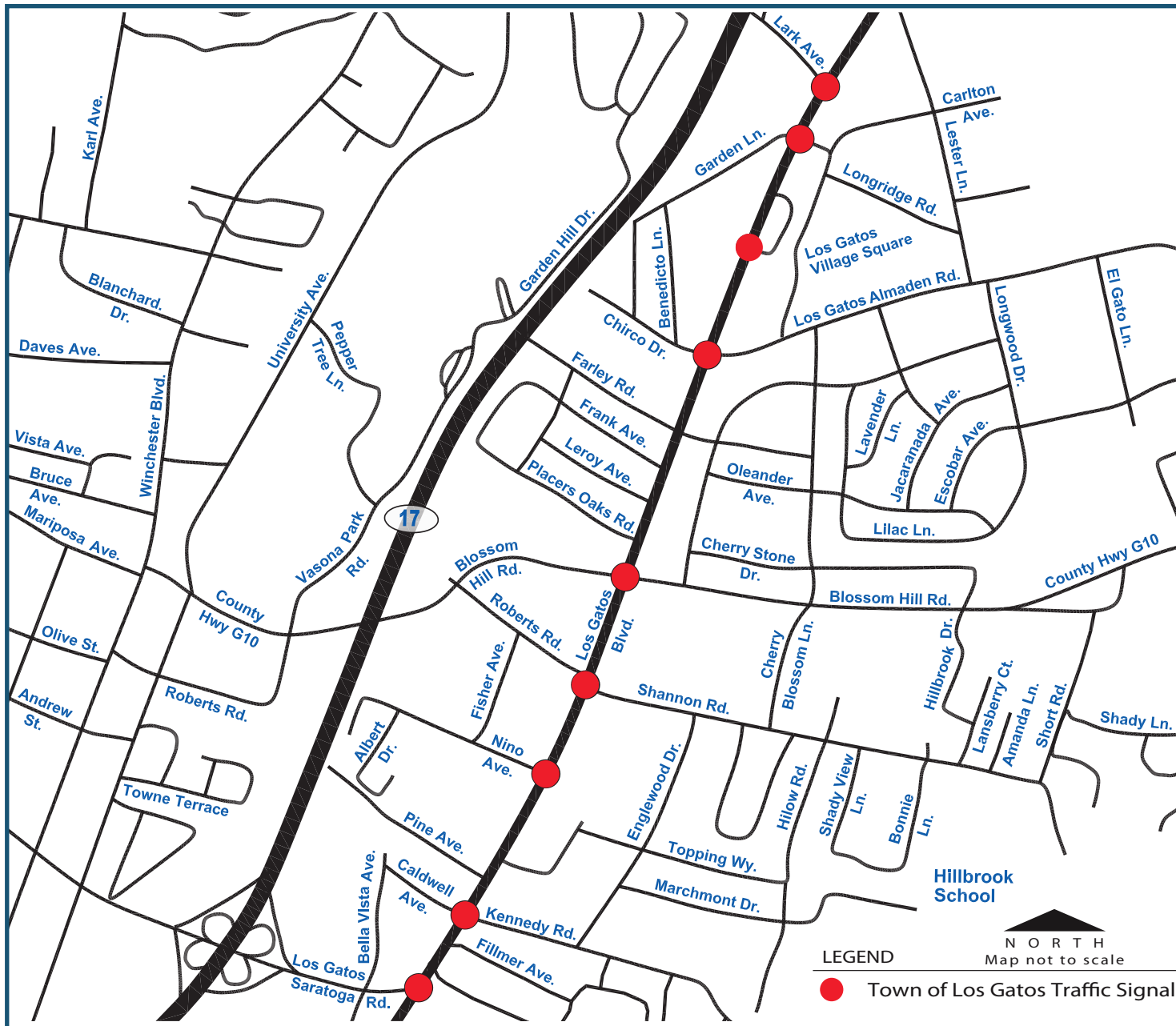
# Los Gatos Blvd ■ Traffic Signal Timing Project

Town of Los Gatos | Metropolitan Transportation Commission

## PROJECT OVERVIEW

The Town of Los Gatos received a Program for Arterial Synchronization (PASS) grant from the Metropolitan Transportation Commission to conduct a signal timing study for nine signals along Los Gatos Boulevard between Saratoga Road and Lark Avenue. The goal of this project was to facilitate traffic progression along Los Gatos Boulevard; and to update the signal timing plans to achieve operational efficiency of the traffic signals. The project objective was to develop traffic signal coordination timing plans for the AM, school PM, and PM peak periods.

These new timing plans effectively serve the heavy directional traffic of the corridor, which varies for the AM and the PM commute peak periods. Specifically, traffic congestion along Los Gatos Blvd between Saratoga Rd and Lark Ave has been reduced significantly. Other intrinsic benefits that were derived from investing in the project include minimizing motorists' frustration by reducing traffic congestion and delay.



## ...PROJECT OVERVIEW

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 the performance of the new timing plans.

## BENEFITS TO VARIOUS MODES



### BENEFITS TO PEDESTRIANS:

The Walk timing and Flash Don't Walk clearance timing parameters were updated to provide adequate time for children and seniors to safely cross the intersections, and to adhere to the 2012 CA MUTCD walking speed of 3.5 feet/second.



### BENEFITS TO TRANSIT:

Based on the transit travel time runs, the project resulted in an average of 9% increase in speed and an average of 4% savings in travel time for the buses serving the corridor. These results show that optimizing signal timings on a regular basis provides significant benefits to the users and transit operators.



### BENEFITS TO TRAFFIC SAFETY:

To enhance traffic safety, the yellow clearance timing parameters were updated based on posted speed limits along the study corridor, and all red clearance timing parameters were reviewed.

## Project Costs

Consultant Costs (Weekday Peak Coordination Plans)	\$27,900
Other Project Costs (Communication Equipment, etc.)	\$0
Agency Staff Costs (Estimate)	\$6,975
<b>Total Costs</b>	<b>\$34,875</b>

## Project Benefits

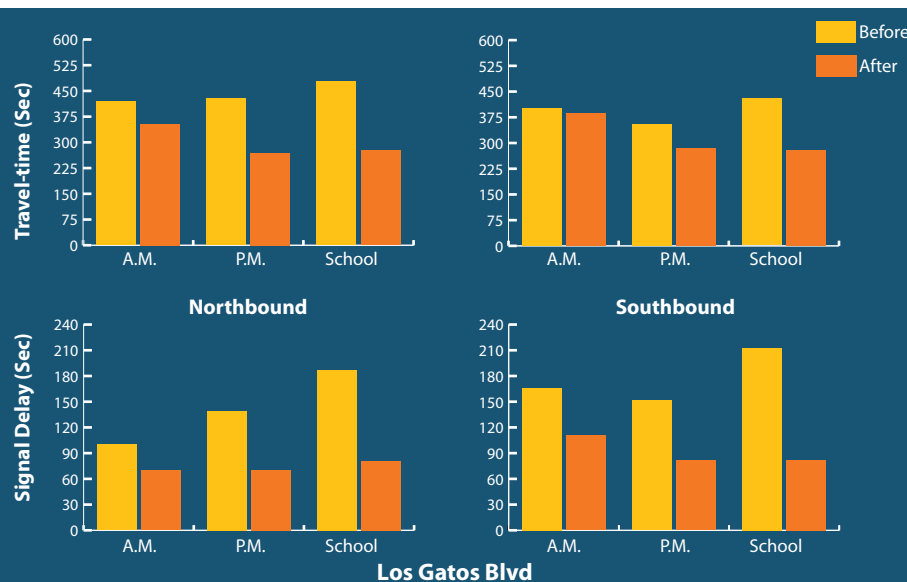
Measures	Annual Average		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	28,979 hrs.	\$553,147	144,896 hrs.	\$2,765,734
Fuel Consumption Savings	55,232 gal.	\$221,964	276,161 gal.	\$1,109,822
ROG Emissions Reduction	0.41 tons	\$520	2.06 tons	\$2,598
NOx Emissions Reduction	0.52 tons	\$9,313	2.59 tons	\$46,563
PM10 Emissions Reduction	0.08 tons	\$11,327	0.39 tons	\$56,635
CO Emissions Reduction	2.4 tons	\$186	12.01 tons	\$928
<b>Total Lifetime Benefits</b>				<b>\$3,982,280</b>
Transit Travel Time Savings	52 hrs.	\$988	259 hrs.	\$4,938
<b>Total Lifetime Benefits with Transit</b>				<b>\$3,987,219</b>

## Overall Project Benefits

	Auto	Transit
Average Decrease in Travel Time	28%	4%
Average Speed Increase	42%	9%
Average Fuel Savings	22%	N/A
Average Reduction in Signal Delay	47%	N/A
Average Reduction in Number of Stops	45%	N/A

## Overall Benefit-Cost Ratio

114:1



## PROJECT BENEFITS SUMMARY



Average Reduction in Auto Signal Delay: 47%

Average Reduction in Number of Stops: 45%

Auto Fuel Consumption Savings: 22% or 276,161 gallons



Total Emissions Reduced (ROG, Nox, PM10, CO): 17.05 tons

Auto Travel Time Savings: 28% or 144,896 hours



Average Transit Travel Time Savings: 4% or 259 hours

Overall Project Benefit-cost Ratio = 114:1



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# PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY12/13 CYCLE

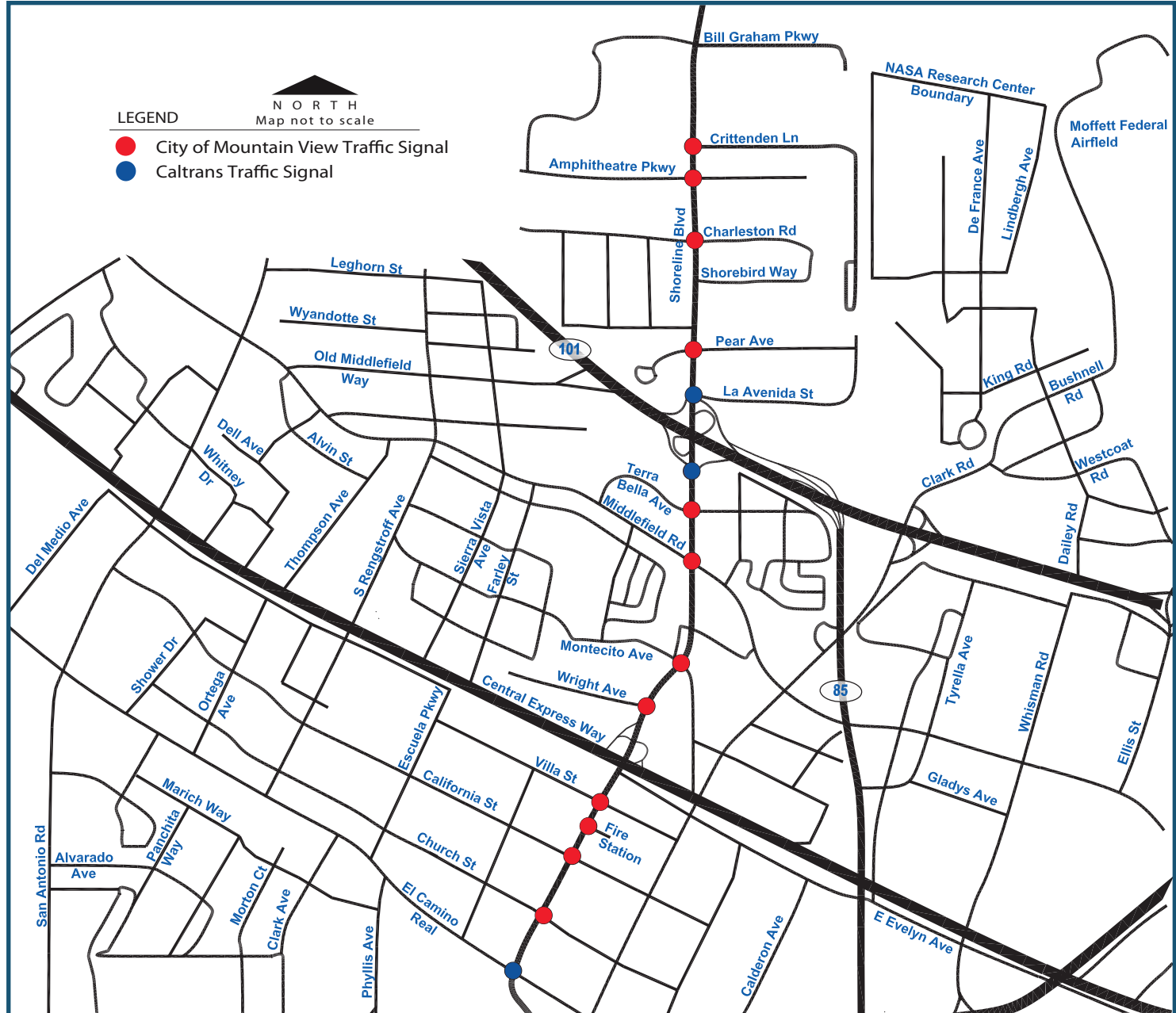
# Shoreline Blvd ■ Traffic Signal Timing Project

City of Mountain View | Caltrans | Metropolitan Transportation Commission

## PROJECT OVERVIEW

The City of Mountain View, in conjunction with Caltrans, received a Program for Arterial System Synchronization (PASS) grant from the Metropolitan Transportation Commission to conduct a signal timing study for 15 signals along Shoreline Blvd between Crittenden Lane and El Camino Real. The project services include developing and implementing traffic signal coordination timing plans for the AM, midday and PM peak periods to facilitate traffic progression along Shoreline Blvd, and to improve the operational efficiency of the traffic signals with the existing capacity constraints.

At the request of the city, the PASS also completed these additional services: 1) evaluating the options to provide communication between the project signals and the city traffic operations center; 2) evaluating the removal of an exclusive left-turn on the northbound approach at the intersection of Shoreline Blvd and Pear Ave; and 3) evaluating the need for a dedicated right-turn lane for the eastbound approach of Charleston Rd at Shoreline Blvd, including providing concept level signing and striping layout.





## OTHER RECOMMENDED IMPROVEMENTS

The following recommendations could be further studied to mitigate congestion along Shoreline Blvd: i) To provide a bus pull out area to serve as a passenger drop-off location north of Pear Ave along Shoreline Blvd; and ii) To relocate the current drop-off location north of Charleston Ave to a new location, to reduce backup past Charleston Rd and to reduce weaving within the intersection.

## BENEFITS TO VARIOUS MODES



**BENEFITS TO BICYCLISTS:** The minimum green intervals were reviewed for bicyclists to improve the safety at the intersections based on 2012

California MUTCD standards. Changes to minimum green were made at the intersections not meeting the standard requirements.



**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.



**BENEFITS TO TRANSIT:** Based on the transit travel time runs, the project resulted in an average of 35% increase in speed and an average of

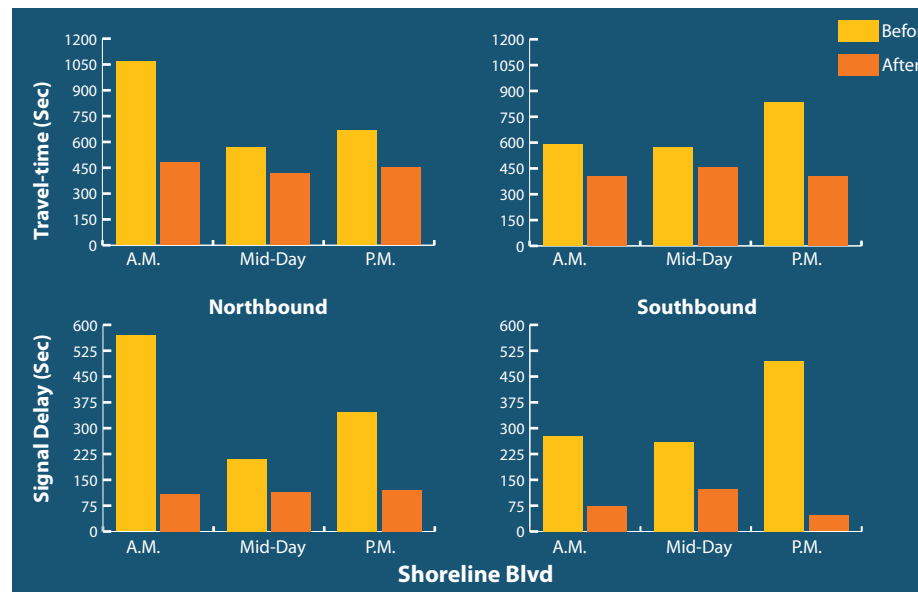
22% savings in transit travel time. These results show that optimizing signal timings on a regular basis provides significant benefits to the users and transit operators.

Project Costs	
Consultant Costs (Basic Services/Plans)	\$38,250
Other Project Costs (GPS Clocks, Communications Equipment, etc.)	\$14,550
Agency Staff Costs (Estimate)	\$9,563
<b>Total Costs</b>	<b>\$62,363</b>

Project Benefits				
Measures	Annual Average		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	55,725 hrs.	\$1,063,665	278,627 hrs.	\$5,318,327
Fuel Consumption Savings	106,331 gal.	\$427,318	531,655 gal.	\$2,136,588
ROG Emissions Reduction	0.89 tons	\$1,114	4.43 tons	\$5,570
NOx Emissions Reduction	1.17 tons	\$21,111	5.87 tons	\$105,554
PM10 Emissions Reduction	0.16 tons	\$23,071	0.79 tons	\$115,354
CO Emissions Reduction	4.53 tons	\$350	22.65 tons	\$1,750
<b>Total Lifetime Benefits</b>				<b>\$7,683,143</b>
Transit Travel Time Savings	286 hrs.	\$5,456	1,429 hrs.	\$27,279
<b>Total Lifetime Benefits with Transit</b>				<b>\$7,710,422</b>

Overall Project Benefits	Auto	Transit
Average Decrease in Travel Time	40%	22%
Average Speed Increase	62%	35%
Average Fuel Savings	32%	N/A
Average Reduction in Signal Delay	72%	N/A
Average Reduction in Number of Stops	69%	N/A

**Overall Benefit-Cost Ratio 124:1**



## PROJECT BENEFITS SUMMARY



**Average Reduction in Auto Signal Delay: 72%**

**Average Reduction in Number of Stops: 69%**

**Auto Fuel Consumption Savings: 32% or 531,655 gallons**



**Total Emissions Reduced (ROG, Nox, PM10, CO): 33.74 tons**

**Auto Travel Time Savings: 40% or 278,627 hours**



**Average Transit Travel Time Savings: 22% or 1,429 hours**

**Overall Project Benefit-cost Ratio = 124:1**



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TJKM Transportation Consultants



# PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY12/13 CYCLE

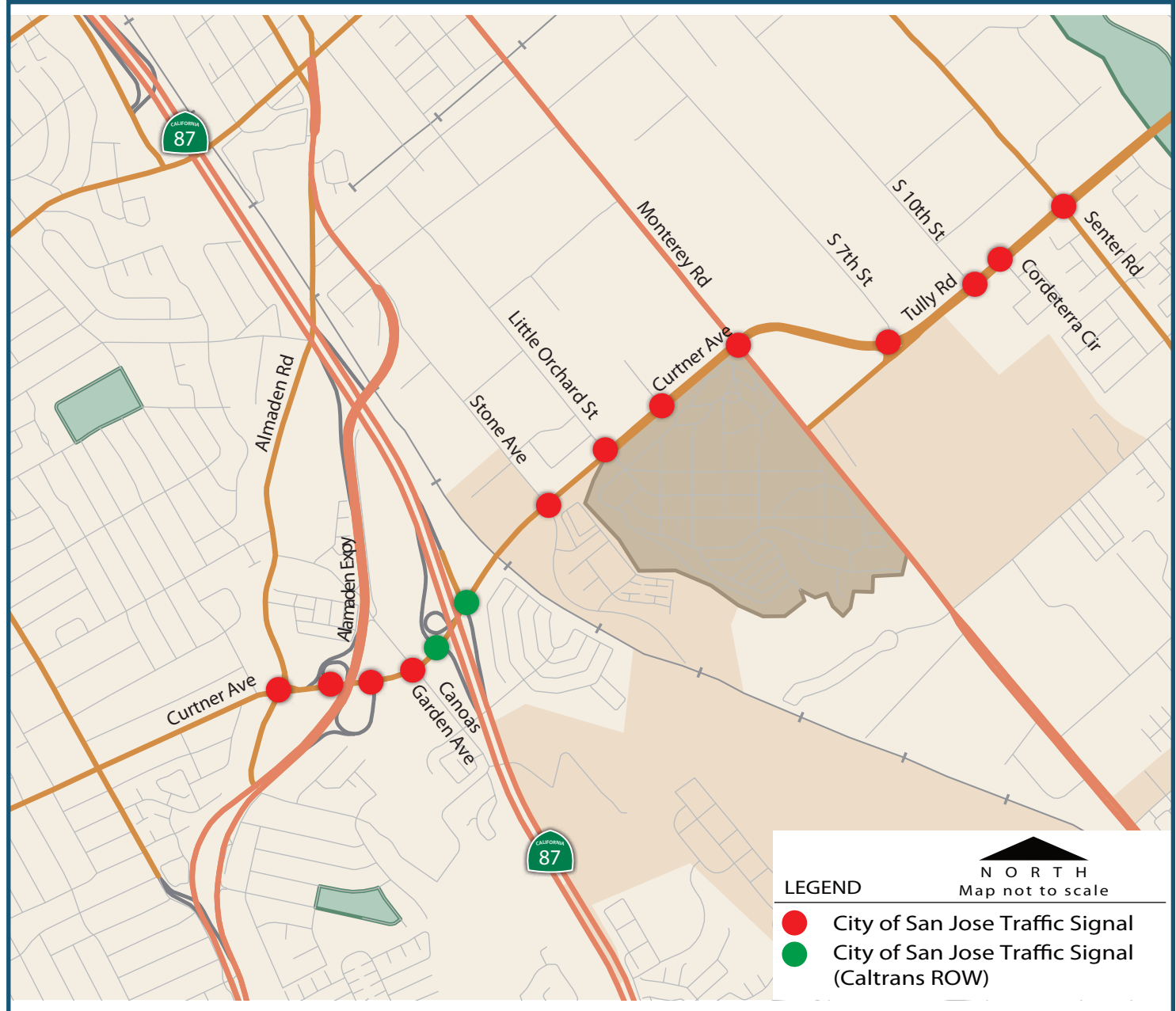
# Curtner Ave/Tully Rd ■ Traffic Signal Timing Project

City of San Jose | Metropolitan Transportation Commission

## PROJECT OVERVIEW

The City of San Jose received a Program for Arterial System Synchronization (PASS) grant from the Metropolitan Transportation Commission (MTC) to conduct a signal timing study for 14 signals along Curtner Ave/Tully Rd between Almaden Rd and Senter Rd. The goal of the project was to develop and implement signal coordination during the Weekend AM and PM peak periods. This east-west arterial provides access to the Almaden Expressway and SR 87 near the west end, the Fairgrounds on the east end, and commercial and shopping centers, including the 650,000 square-foot Plant Shopping Center.

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 the performance of the new timing plans.



### ...PROJECT OVERVIEW

During all Saturday peak periods, there was a decrease in average travel time, delay, and stops in both directions. Field fine-tuning consisted of driving the corridors and standing at critical intersections to review traffic progression and intersection operations. Minor adjustments to offsets and splits were made during fine-tuning to further improve traffic progression along the corridors and to optimize intersection operations.

### BENEFITS TO VARIOUS MODES



#### BENEFITS TO PEDESTRIANS:

The minimum pedestrian clearance time was reviewed and updated at all project intersections to provide enhanced safety for the pedestrians in accordance to the 2012 California MUTCD standards.



#### BENEFITS TO TRANSIT:

To assess the impacts on transit, travel time runs on transit vehicles were conducted both before and after the new timings were implemented. These evaluation results, as shown in the table to the right, demonstrate that the project provides significant benefits to transit.

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#### BENEFITS TO TRAFFIC SAFETY:

The project updated the yellow clearance intervals according to the current standards.

### Project Costs

Consultant Costs (Weekday Peak Coordination Plans, Transit Travel Time)	\$36,870
Other Project Costs (GPS Clocks, Communications Equipment, etc.)	\$0
Agency Staff Costs (Estimate)	\$8,225
<b>Total Costs</b>	<b>\$45,095</b>

### Project Benefits

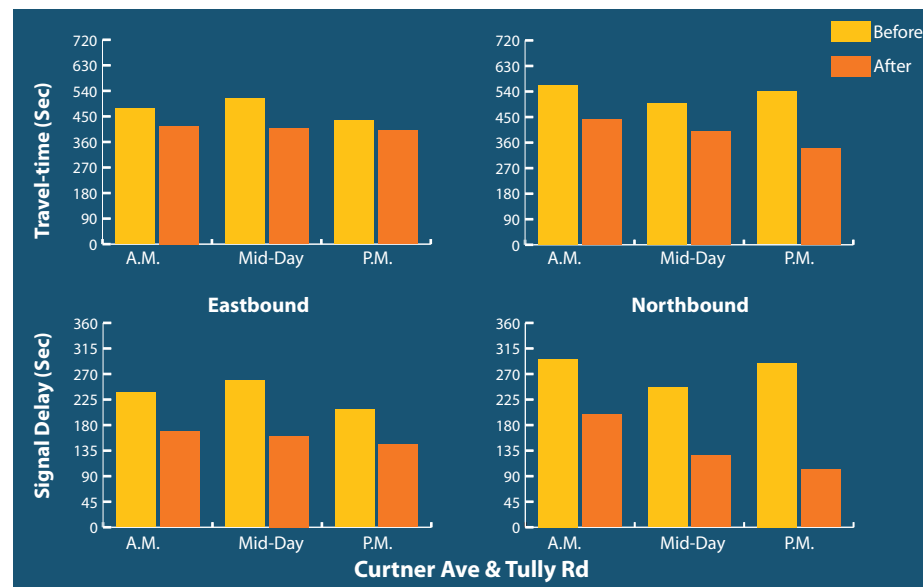
Measures	Annual Average		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	10,637 hrs.	\$203,030	53,184 hrs.	\$1,015,152
Fuel Consumption Savings	31,146 gal.	\$125,167	155,729 gal.	\$625,837
ROG Emissions Reduction	0.24 tons	\$307	1.22 tons	\$1,534
NOx Emissions Reduction	0.31 tons	\$5,524	1.53 tons	\$27,620
PM10 Emissions Reduction	0.05 tons	\$6,636	0.23 tons	\$33,179
CO Emissions Reduction	1.35 tons	\$104	6.75 tons	\$522
<b>Total Lifetime Benefits</b>				<b>\$1,703,844</b>
Transit Travel Time Savings	321 hrs.	\$6,135.45	1,607 hrs.	\$30,677
<b>Total Lifetime Benefits with Transit</b>				<b>\$1,734,521</b>

### Overall Project Benefits

	Auto	Transit
Average Decrease in Travel Time	20%	10%
Average Speed Increase	25%	6%
Average Fuel Savings	15%	N/A
Average Reduction in Signal Delay	41%	N/A
Average Reduction in Number of Stops	44%	N/A

### Overall Benefit-Cost Ratio

**38:1**



### PROJECT BENEFITS SUMMARY



**Average Reduction in Auto Signal Delay: 41%**

**Average Reduction in Number of Stops: 44%**

**Auto Fuel Consumption Savings: 15% or 155,729 gallons**



**Total Emissions Reduced (ROG, Nox, PM10, CO): 9.73 tons**

**Auto Travel Time Savings: 20% or 53,184 hours**



**Average Transit Travel Time Savings: 10% or 1,607 hours**

**Overall Project Benefit-cost Ratio = 38:1**



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### Project Consultant:

Kimley-Horn and Associates, Inc.



# PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY12/13 CYCLE

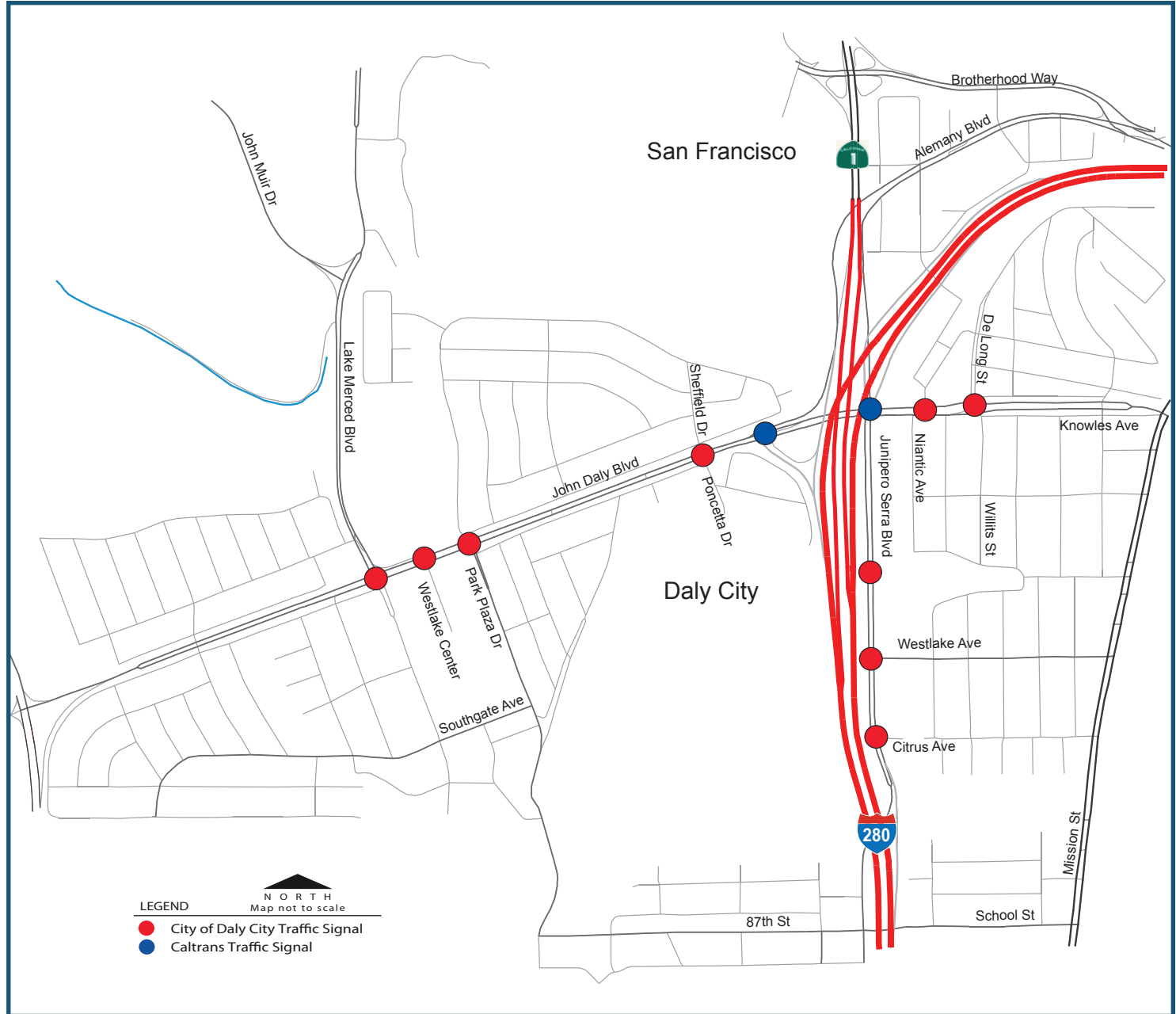
## John Daly/Junipero Serra Blvd ■ Traffic Signal Timing Project

City of Daly City | Caltrans | Metropolitan Transportation Commission

### PROJECT OVERVIEW

The City of Daly City, in conjunction with Caltrans, received a Program for Arterial System Synchronization (PASS) grant from the Metropolitan Transportation Commission to develop and implement optimized signal coordination timing plans for 11 signals along John Daly Blvd and Junipero Serra Blvd. The project objective was to develop traffic signal coordination timing plans for the weekday AM, midday, and PM peak periods for all project signals and weekend peak periods for six of the project signals.

The goal of this project was to facilitate traffic progression along the corridors, and achieve operational efficiency of the traffic signals with the existing capacity constraints. Attaining this goal is expected to mitigate congestion, reduce harmful greenhouse gas emissions, reduce travel time, and improve traffic safety.





### ...PROJECT OVERVIEW

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 the performance of the new timing plans.

### 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. They are installed at the city signal at John Daly Blvd & DeLong St, and the Caltrans signal at John Daly Blvd & Southbound I-280 Ramp intersections.



### BENEFITS TO PEDESTRIANS:

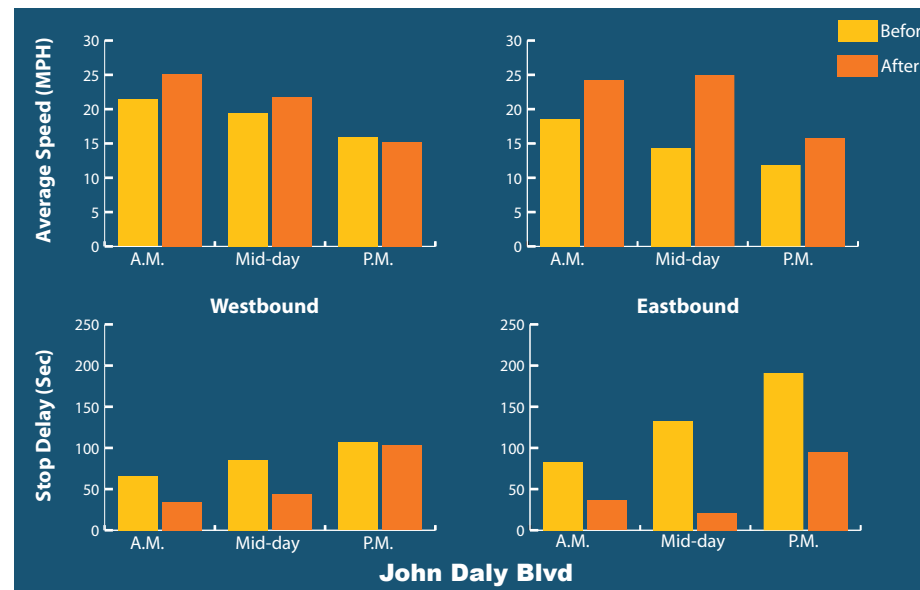
For improved safety, the pedestrian intervals were reviewed and increased at most intersections based on current 2012 California MUTCD standards. Changes to pedestrian timing were made at nine project intersections.

Project Costs	
Consultant Costs (Weekday Peak Coordination Plans)	\$26,650
Consultant Costs (Transit Travel Time Runs, Weekend Timing)	\$17,490
Agency Staff Costs (Estimate)	\$6,663
<b>Total Costs</b>	<b>\$50,803</b>

Measures	Annual Average		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	13,200 hrs.	\$251,963	66,002 hrs.	\$1,259,814
Fuel Consumption Savings	45,045 gal.	\$181,024	225,225 gal.	\$905,122
ROG Emissions Reduction	0.36 tons	\$447	1.78 tons	\$2,237
NOx Emissions Reduction	0.47 tons	\$8,393	2.33 tons	\$41,963
PM10 Emissions Reduction	0.06 tons	\$9,388	0.32 tons	\$46,941
CO Emissions Reduction	1.95 tons	\$151	9.77 tons	\$755
	<b>Total Lifetime Benefits</b>			<b>\$2,256,831</b>
Transit Travel Time Savings	69 hrs.	\$1,311	343 hrs.	\$6,554
	<b>Total Lifetime Benefits with Transit</b>			<b>\$2,263,385</b>

Overall Project Benefits	Auto	Transit
Average Decrease in Travel Time	16%	0%
Average Speed Increase	18%	1%
Average Fuel Savings	12%	N/A
Average Reduction in Signal Delay	42%	N/A
Average Reduction in Number of Stops	37%	N/A

**Overall Benefit-Cost Ratio 45:1**



### PROJECT BENEFITS SUMMARY



**Average Reduction in Auto Signal Delay: 42%**

**Average Reduction in Number of Stops: 37%**

**Auto Fuel Consumption Savings: 12% or 225,225 gallons**



**Total Emissions Reduced (ROG, NOx, PM10, CO): 14.2 tons**

**Auto Travel Time Savings: 16% or 66,000 hours**



**Overall Project Benefit-cost Ratio = 45:1**

### MTC CONTACT:

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# PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY12/13 CYCLE

# Marsh Rd/Middlefield Rd/Sand Hill Rd

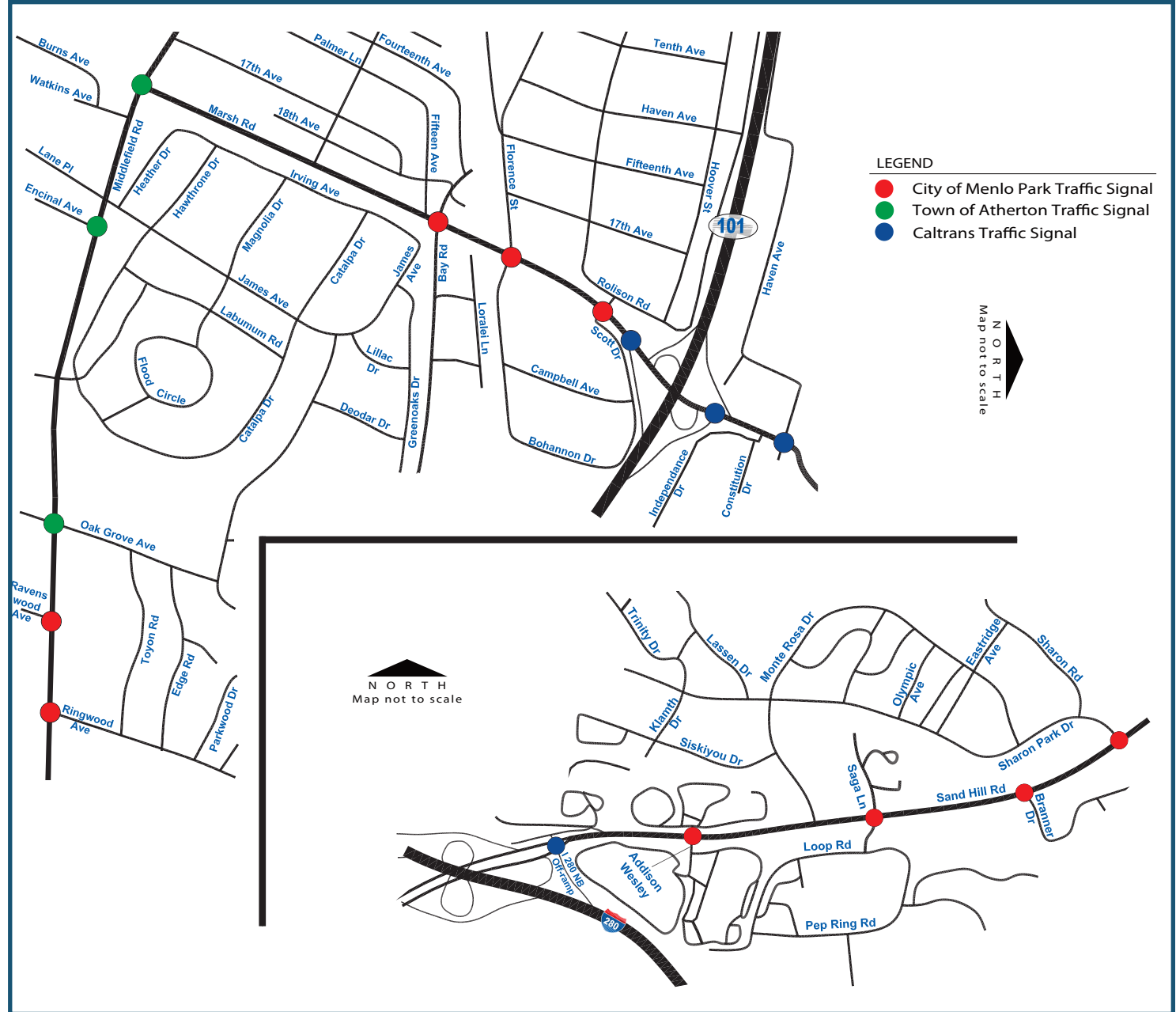
City of Menlo Park | Town of Atherton | Caltrans | Metropolitan Transportation Commission

## PROJECT OVERVIEW

The City of Menlo Park, in conjunction with Caltrans and Town of Atherton, received a Program for Arterial System Synchronization (PASS) grant from the Metropolitan Transportation Commission to conduct a signal timing study for 16 signals along Marsh Rd, Middlefield Rd and Sand Hill Rd.

The project services include developing and implementing traffic signal coordination timing plans for the AM and PM peak periods for all project intersections and an additional midday peak period plan for five intersections along Sand Hill Road.

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 the performance of the new timing plans.



### ...PROJECT OVERVIEW

The implementation of the new timing plans resulted in significant improvements in traffic operations at the intersection of US 101 Southbound Ramps/Marsh Rd. They also reduced queuing at the off-ramp during the PM peak period. To resolve implementation issues towards the end of the project, the PASS also helped in upgrading the existing firmware at Sand Hill Rd/Branner Dr and Sand Hill Rd/Sharon Park Dr intersections.

### 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.



**BENEFITS TO TRANSIT:** Based on the transit travel time runs, the project resulted in an average of 9% increase in speed and an average of 5% savings in transit travel time.



**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 (Basic Services, Additional Plans)	\$45,415
Other Project Costs (GPS Clocks, Communications Equipment, etc.)	\$4,044
Agency Staff Costs (Estimate)	\$1,154
<b>Total Costs</b>	<b>\$50,613</b>

### Project Benefits

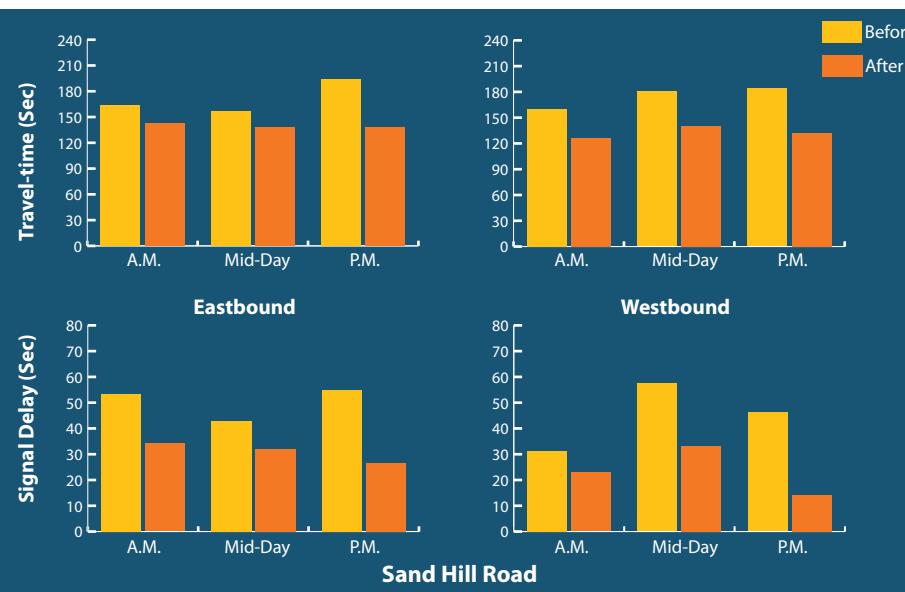
Measures	Annual Average		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	19,176 hrs.	\$366,023	95,879 hrs.	\$1,830,114
Fuel Consumption Savings	39,253 gal.	\$157,746	196,263 gal.	\$788,732
ROG Emissions Reduction	0.34 tons	\$423	1.68 tons	\$2,116
NOx Emissions Reduction	0.45 tons	\$8,101	2.25 tons	\$40,506
PM10 Emissions Reduction	0.06 tons	\$8,577	0.29 tons	\$42,884
CO Emissions Reduction	1.69 tons	\$131	8.47 tons	\$654
<b>Total Lifetime Benefits</b>				<b>\$2,705,006</b>
Transit Travel Time Savings	151 hrs.	\$2,880	754 hrs.	\$14,401
<b>Total Lifetime Benefits with Transit</b>				<b>\$2,719,407</b>

### Overall Project Benefits

	Auto	Transit
Average Decrease in Travel Time	22%	5%
Average Speed Increase	26%	9%
Average Fuel Savings	16%	N/A
Average Reduction in Signal Delay	51%	N/A
Average Reduction in Number of Stops	49%	N/A

### Overall Benefit-Cost Ratio

**59:1**



### PROJECT BENEFITS SUMMARY



**Average Reduction in Auto Signal Delay: 51%**

**Average Reduction in Number of Stops: 49%**

**Auto Fuel Consumption Savings: 16% or 196,263 gallons**



**Total Emissions Reduced (ROG, Nox, PM10, CO): 12.69 tons**

**Auto Travel Time Savings: 22% or 95,879 hours**



**Average Transit Travel Time Savings: 5% or 754 hours**

**Overall Project Benefit-cost Ratio = 59:1**



### MTC CONTACT:

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