METROPOLITAN
TRANSPORTATION
COMMISSION

Joseph P. Bort MetroCenter
101 Eighth Street
Oakland, CA 94607-4700
TEL 510.817.5700
TDD/TTY 510.817.5769
FAX 510.817.5848
E-MAIL info@mtc.ca.gov
WEB www.mtc.ca.gov

Arterial Operations Committee (AOC)

10:15 A.M. – 12 P.M., Tuesday, March 10, 2015
Conference Room 171
Metropolitan Transportation Commission
101 Eighth Street, Oakland, CA 94607

Chair: Donald Shupp, WP Signal
Vice-Chair: Obaid Khan, City of Dublin
Staff Liaison: Linda Lee, MTC
Ganesh Karkee, MTC

For more information, please visit the Arterial Operations website at http://www.mtc.ca.gov/services/arterial_operations/

Meeting Agenda

1. **Introductions (Shupp)**
   - *Meeting Notes from January 13, 2015**
   - *Updates from Members*
2. **Arterial Operations Program Funding Update (Lee)**
3. **Program for Arterial System Synchronization (PASS)**
   - *FY 13/14 Cycle Update* (Karkee)*
   - *FY 14/15 Cycle Update* (Karkee)*
   - *FY 15/16 Cycle Update (Lee)*
4. **Next Gen Arterial Operations Program (Zhang)**
5. **Featured Presentation (Sandra Lennie, Iteris)**
   - *"Big Data for Congestion Management on Arterials"*
6. **Other Business (Shupp)**
   - *Local Transportation events scheduled this month:*
     i. *March 19th – 42nd Annual ITE Vendors Night, Hutchins Street Community Center, Lodi. Exhibition Hall Open 2:00 PM – 8:00 PM, Dinner 6:00 PM www.NorcalITE.org*
     ii. *March 31st - Connected Vehicle & Autonomous Vehicle (CV/AV) Technology Summit, Contra Costa Transportation Authority (CCTA), Concord Hilton, 7:30 AM – 3:00 PM. www.GomentumStation.org*
7. **Adjournment (Shupp)**
   - *Next Meeting: Tuesday, May 12, 2015 @ 10:15 A.M.*

*Attachment included

- This page left blank intentionally -

Arterial Operations Committee

Notes from meeting on January 13, 2015

1. **Introductions**
   - Meeting called to order at 10:15 AM in Conference Room 171 of the Joseph P. Bort MetroCenter. All members introduced themselves. Meeting notes from November 4, 2014 were reviewed and approved without any changes.
   - David Mahama (DKS) announced that DKS has some positions open and asked interested members to visit DKS' website for details. Donald Shupp (WP Signal) briefly discussed the Consumer Electronic Show (CES) 2015 and how this year's show included a lot of technology related to Connected Vehicle and Smart Cars, etc.
2. **Arterial Operations Program Funding Update**
   - Linda Lee (MTC) provided an update on the Arterial Operations Program (AOP) funding. The new funding cycle (Cycle 3) is a 5-year cycle from FY 2017/18 through FY 2021/22. MTC may be able to implement another cycle of PASS, if the NextGen AOP contingency of $1.25 million is not used as part of that program. In addition, there could potentially be another $0.5 million available for PASS.
   - Beside benefit-cost ratio results from past PASS projects, the AOC members discussed other possible data that can be used to demonstrate the benefits of PASS. Consistent with goals and objectives of Complete Streets, the group discussed the availability of bicycle/pedestrian data to demonstrate safety benefits. Ananth Prasad (Santa Clara County) suggested that since cycle lengths in coordination mode will be shorter than cycle lengths in free mode operation, this reduces the tendency for jaywalking and will enhance pedestrian and bicycle safety. Ananth offered to provide countywide accident data. Nayan Amin (TJKM) mentioned that many jurisdictions have pedestrian/bicycle advisory committees, and these agencies should be able to provide some type of data. Brian Sowers (Kimley-Horn) said that travel time savings to transit of at least 5-10% resulted from FY11/12 PASS projects. David Mahama (DKS) said that transit benefits from PASS projects might have mixed results. Amanuel Haile (Marin County) offered to provide some data from their bicycle/pedestrian committee.
   - Linda said that current consultant contracts expire on September 30, 2015. MTC may begin working on the next procurement for consultant services in February/March 2015.
   - Linda mentioned that MTC staff are looking into other possible funding sources for MTC's arterial programs, including Cap-and-Trade and Affordable Housing and Sustainable Community Program.
3. **Program for Arterial System Synchronization (PASS)**
   - Ganesh Karkee (MTC) provided a status update on the PASS FY 13/14 projects. Ganesh said that 15 out of 21 projects are completed. Two projects will be finalized in a couple of weeks. The other four projects are delayed due to construction and traffic controller issues. He reported that factsheets for 9 of the 15 completed projects have been completed. He will share the completed factsheets at the next AOC meeting.
   - Ganesh said there are 12 projects in the PASS FY 14/15 cycle. He reported that data collection has been completed for all projects, except the Fremont Project. Data collection is delayed due to construction but is scheduled for the end of January 2015.
   - A question was posed to the members about whether or not the factsheets were useful. Several members mentioned their usefulness to the Marin County Board of Supervisors and Directors, the City Council of South San Francisco, and at public meetings in Santa Clara County.

4. **Next Generation Arterial Operations Program (NextGen AOP)**
   - Linda provided the update on NextGen AOP. As a reminder, the four projects are: AC Transit, LAVTA/Dublin, Fremont, and Santa Clara County. Kick-off meetings were conducted in November/December 2014. The Systems Engineering analyses (Phase 1) are on-going. User Needs Assessments have been completed for all projects, except AC Transit, which is scheduled for January 28, 2015. Anticipated Phase 1 completion is as follows: Santa Clara County in February, Fremont in June, AC Transit in July, and LAVTA/Dublin in September, 2015. Phase 2 (procurement of systems) will begin upon completion of Phase 1.
   - Vamsi Tabjulu (TJKM) asked if consultants have been selected for the Phase 2 work. Linda said the Phase 2 evaluation plans will likely be done through MTC's current on-call bench consultants, since the current PASS contracts will have expired by the time this work is needed. As for procurement of systems and/or design work related to these systems, most project sponsors will be taking on those responsibilities.
   - William Leo Leon (Pacifica) asked about the next cycle of NextGen AOP. Linda said that at this time, there is no next cycle yet, since some of the current NexGen AOP projects won't be completed for another two years or so.
5. **Featured Presentation**
   - Therese Trivedi (MTC) was a feature presenter. Her topic for presentation was "Update on One Bay Area Grants – Complete Streets." The presentation is attached.
6. **Other Business**
   - No other business was discussed.
7. **Adjournment**
   - The meeting adjourned at 12 P.M. The next meeting will be held on Tuesday, March 10, 2015.

Arterial Operations Committee

Attendees from meeting on Tuesday, January 13, 2015

#	Name	Agency	Phone No.	E-Mail
1	Abhishek Parikh	Hayward	510.363.7375	abhishek.parikh@hayward.ca.gov
2	Amanuel Haile	Marin Co	415.499.7137	ahaile@marincounty.org
3	Ananth Prasad	SCL County	408.494.1342	ananth.prasad@rda.sccgov.org
4	Andrew Davidson	City of Sausalito	415.289.4180	adavidson@ci.sausalito.ca.gov
5	Barry Dee	Advantec	619.997.8361	leolee@advantec-usa.com
6	Brian Sowers	Kimley-Horn	925.398.4862	brian.sowers@kimley-horn.com
7	Chirag Safi	Kittelson	510.839.1742	csafi@kittelson.com
8	Christopher Flores	Sensys	510.548.4620	chrisf@sensysnetworks.com
9	David Huynh	Iteris	510.423.0742	dxh@iteris.com
10	David Mahama	DKS	510.267.6613	dcm@dksassociates.com
11	Denis Wu	W&S Solutions	925.895.6380	Denis.wu@wu-song.com
12	Donald Shupp	WP Signal	510.276.6400	shupp@wpsignal.com
13	Francisco Martin	Fehr & Peers	510.587.9422	f.martin@fehrandpeers.com
14	Frans van der Meer	City of Fremont	510.494.4796	fvandermeer@fremont.gov
15	Ganesh Karkee	MTC	510.817.5625	gkarkee@mtc.ca.gov
16	Greg Groves	Safetran	719.339.2243	ggroves@econolite.com
17	John Keener	Pacifica	650.557.9738	jwkeener296@gmail.com
18	Linda Lee	MTC	510.817.5825	llee@mtc.ca.gov
19	Majid Hafezieh	Hayward	510.583.4784	majid.hafezieh@hayward_ca.gov
20	Mark Spencer	W-Trans	510.444.2600	mspencer@w-trans.com
21	Michael Renk	Union City	510.675.5303	mrenk@ci.union-city.ca.us
22	Nayan Amin	TJKM	925.463.0611	namin@tjkm.com
23	Patrick Armijo	Western P Signal	562.441.1776	armijo@wpsignal.com
24	Rene Baile	Menlo Park	650.330.6770	rcbaile@menlopark.org
25	Ron Hernandez	Econolite	510.207.2281	rhernandez@econolite.com
26	Ruta Jariwala	TJKM	925.463.0611	rjariwala@tjkm.com
27	Shirley Chan	Daly City	650.991.8231	schan@dalycity.org
28	Simin Timuri	Walnut Creek	925.256.3529	timuri@walnut-creek.ca.us
29	Stan Zevin	Pacifica	650.355.9654	margstan@sbcglobal.net
30	Tam Nguyen	Alameda County	510.670.5758	tam@acpwa.org
31	Vamsi Tabjulu	TJKM	510.325.3462	vtabjulu@tjkm.com
32	William "Leo" Leon	Pacifica	650.355.5890	leo-Rollene@hotmail.com

Metropolitan Transportation Commission

Program for Arterial System Synchronization (PASS)

FY 13/14 Cycle Draft Factsheets

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

(CONTINUED ON NEXT PAGE)

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 to enable bicyclists to safely cross the intersections.

Benefits to Pedestrians: To improve safety, the pedestrian crossing timings were increased at all of the project intersections based on the 2012 California MUTCD. 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.

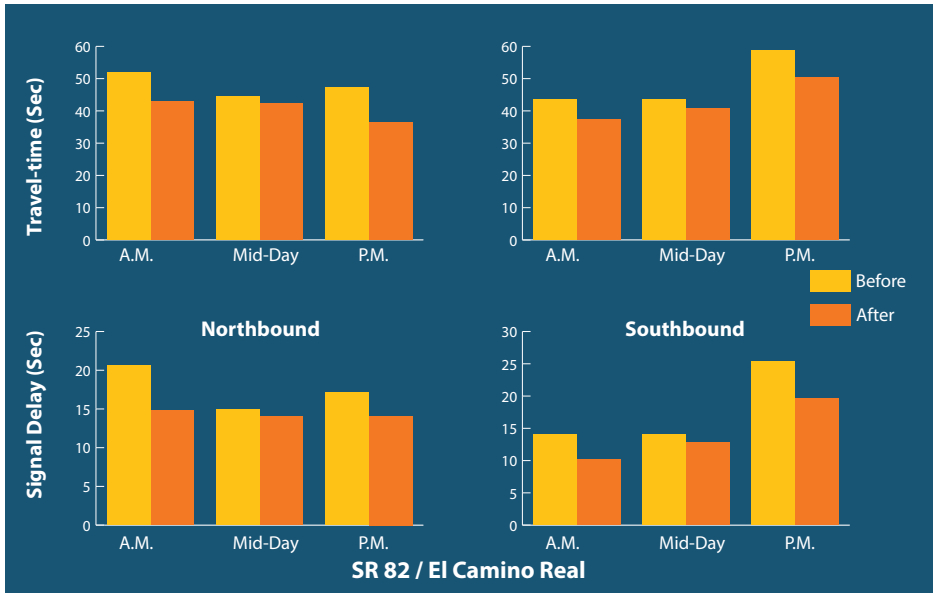
Benefits to Traffic Safety: To enhance traffic safety, the yellow clearance timing parameters were updated based on posted speed limits.

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

For more info, please contact:

Ganesh Karkee (MTC)

Arterial Operations Program Coordinator

Phone: 510.817.5625 • Email: GKarkee@mtc.ca.gov

Einar Acuna (Caltrans)

Senior Traffic Engineer • Phone: 510.622.5741

Email: einar_a_acuna@dot.ca.gov

Project Consultant:

ADVANTEC Consulting Engineers

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

Veterans Boulevard Signal Timing Project

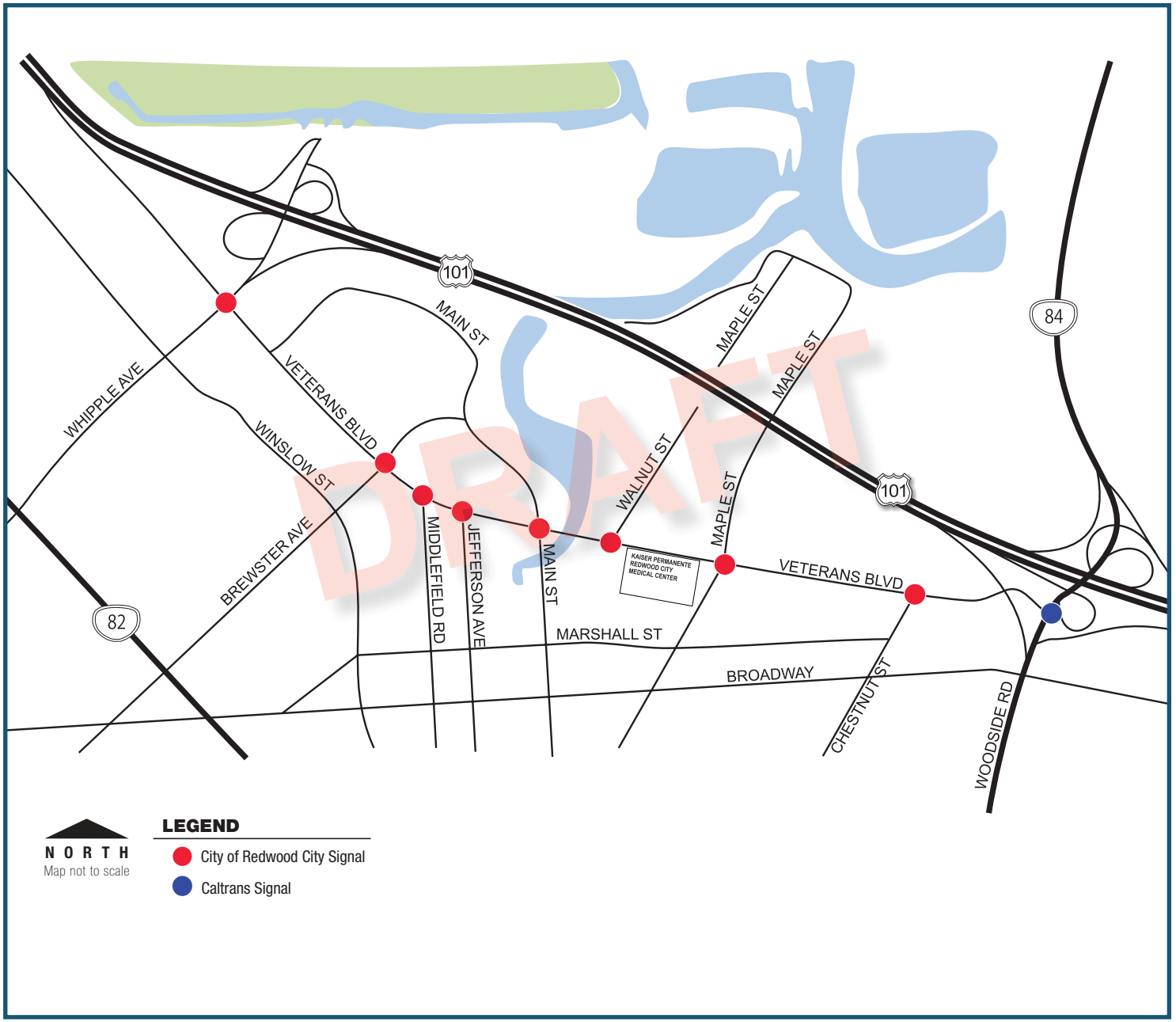
City of Redwood City | Caltrans | Metropolitan Transportation Commission

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.

(CONTINUED ON NEXT PAGE)



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.

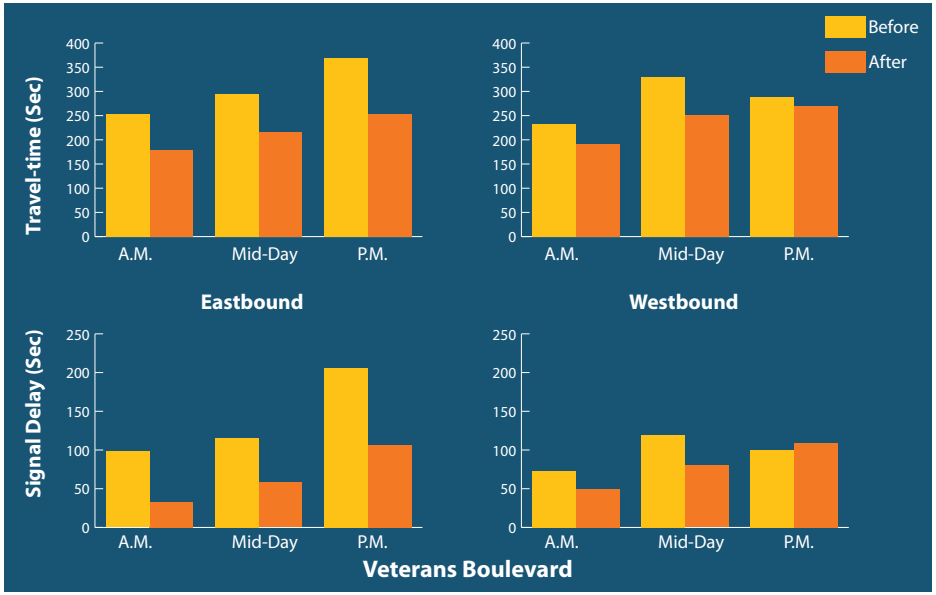
Benefits to Traffic Safety: To enhance traffic safety, the yellow clearance timing parameters were reviewed. The all red clearance timing parameters were updated based on the results of a collision analysis.

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

For more info, please contact:

Ganesh Karkee (MTC)
Arterial Operations Program Coordinator
Phone: 510.817.5625 • Email: GKarkee@mtc.ca.gov

Peter Delgado (Redwood City)
Phone: 650.780.7373
Email: pdelgado@redwoodcity.org

Project Consultant:
DKS Associates

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

Decoto Road Signal Timing Project

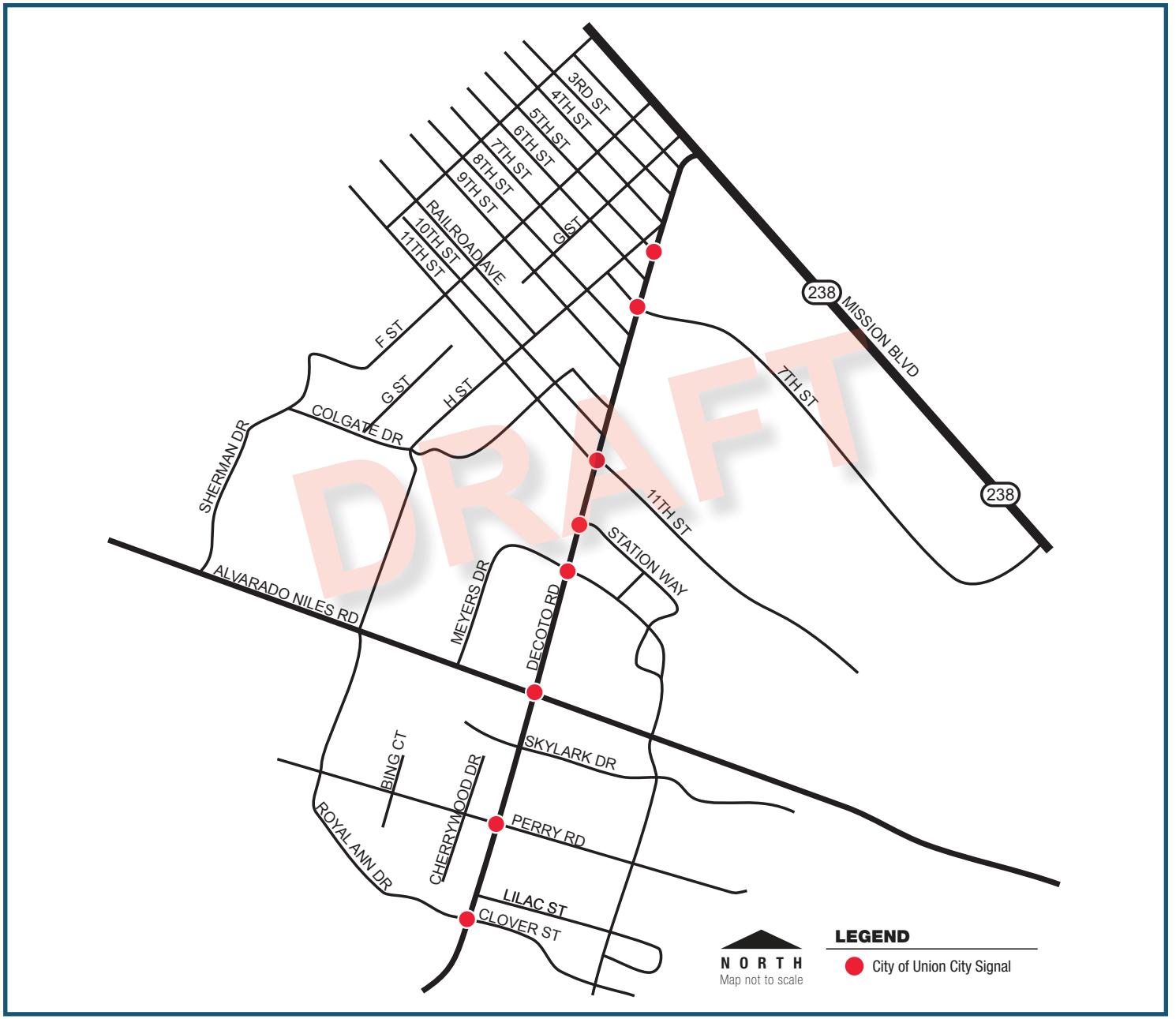
City of Union City | Metropolitan Transportation Commission

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.

(CONTINUED ON NEXT PAGE)



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 Pedestrians: The Walk timing and Flashing Don't Walk timing parameters were updated to provide adequate time for children and seniors to safely cross the study intersections.

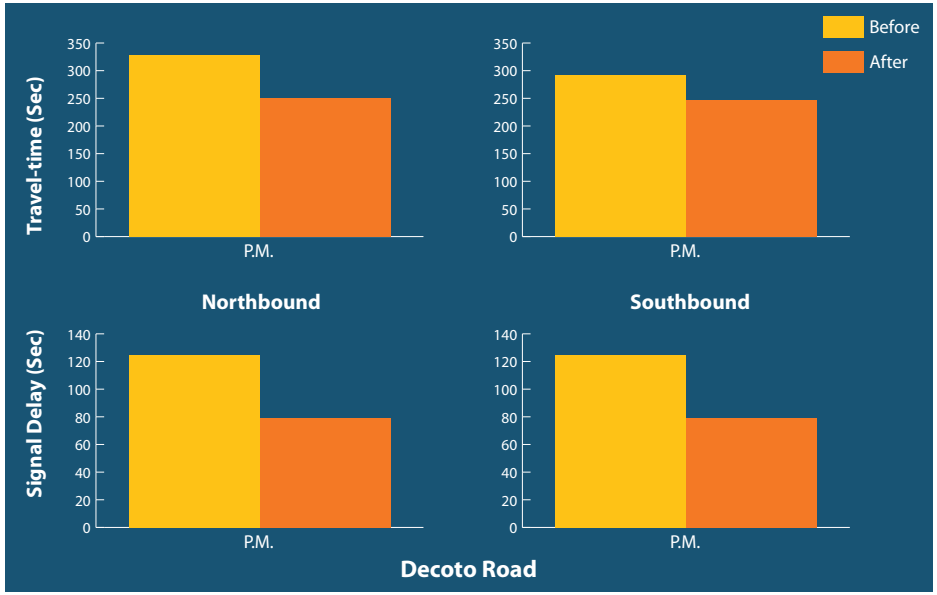
Benefits to Traffic Safety: To enhance traffic safety, the yellow clearance timing parameters were updated based on posted speed limits along the study corridor. The all-red clearance timing parameters were updated based on the results of a collision analysis.

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	0.09 tons	$109	0.23 tons	$293
NOx Emissions Reduction	0.07 tons	$1,328	0.20 tons	$3,561
PM2.5 Emissions Reduction	0.00 tons	$768	0.01 tons	$2,060
CO Emissions Reduction	0.74 tons	$57	1.99 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

For more info, please contact:

Ganesh Karkee (MTC)

Arterial Operations Program Coordinator

Phone: 510.817.5625 • Email: GKarkee@mtc.ca.gov

Michael Renk (Union City)

Civil Engineer • Phone: 510.675.5303

Email: MikeRenk@ci.union-city.ca.us

Project Consultant:

DKS Associates

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

Mission Boulevard Signal Timing Project

City of Fremont | Metropolitan Transportation Commission

Project Overview

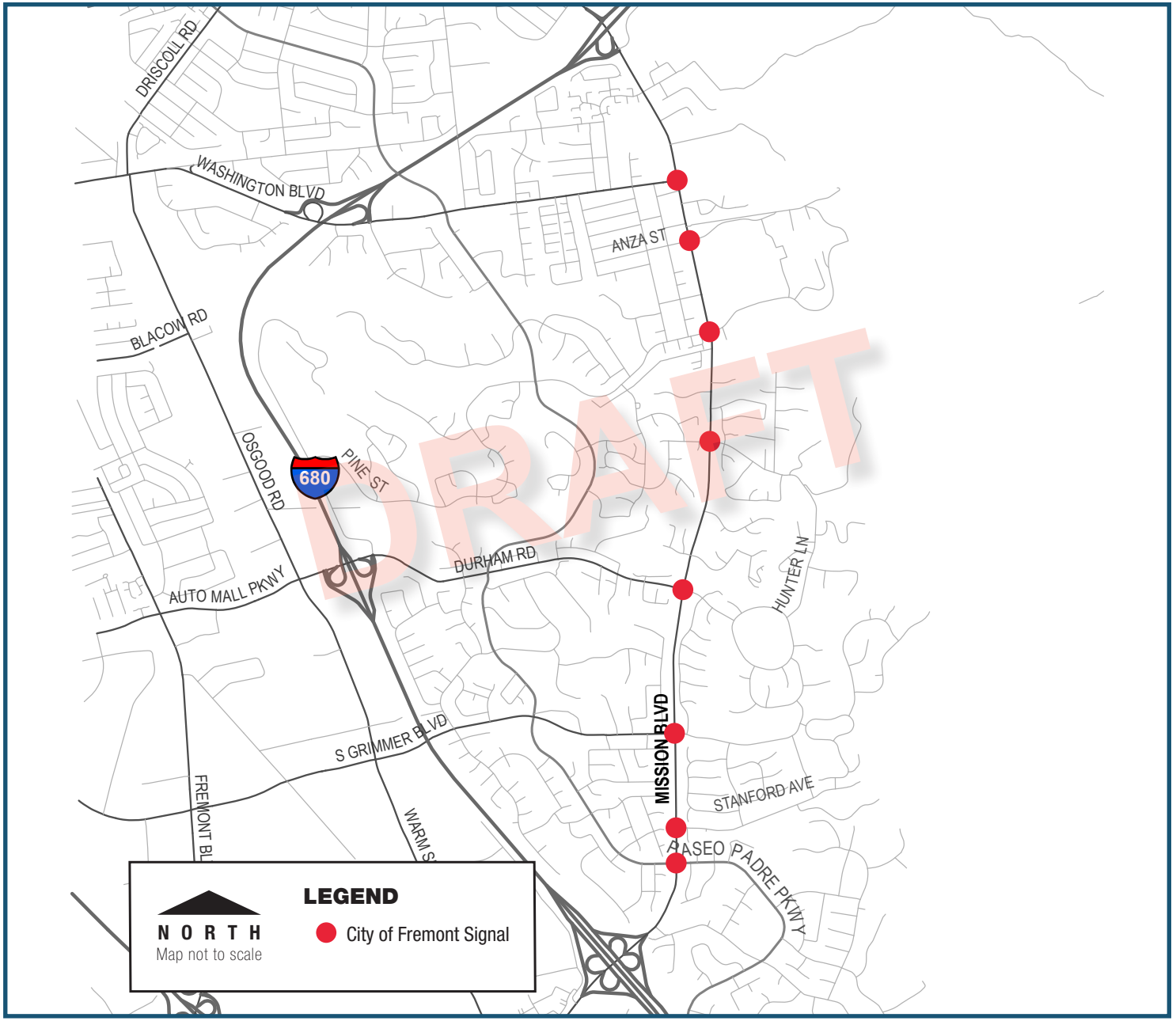
The City of Fremont received a grant from Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to deploy optimized signal timing plans along Mission Boulevard between Washington Boulevard and Paseo Padre Parkway. As part of the project, eight intersections were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

(CONTINUED ON NEXT PAGE)



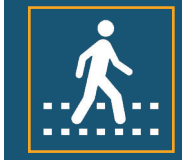
Project Overview (continued)

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	0.05 tons	$59	0.13 tons	$158
NOx Emissions Reduction	0.02 tons	$428	0.06 tons	$1,147
PM2.5 Emissions Reduction	0.00 tons	$446	0.00 tons	$1,197
CO Emissions Reduction	0.56 tons	$43	1.50 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

For more info, please contact:

Ganesh Karkee (MTC)
Arterial Operations Program Coordinator
Phone: 510.817.5625 • Email: GKarkee@mtc.ca.gov

Mirza Sabanovic (Fremont)
Transportation Engineer • Phone: 510-494-4788
Email: MSabanovic@fremont.gov

Project Consultant:

Iteris, Inc.

City of Fremont

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

East Blithedale Avenue and Camino Alto

City of Mill Valley | Caltrans | Metropolitan Transportation Commission

PROJECT OVERVIEW

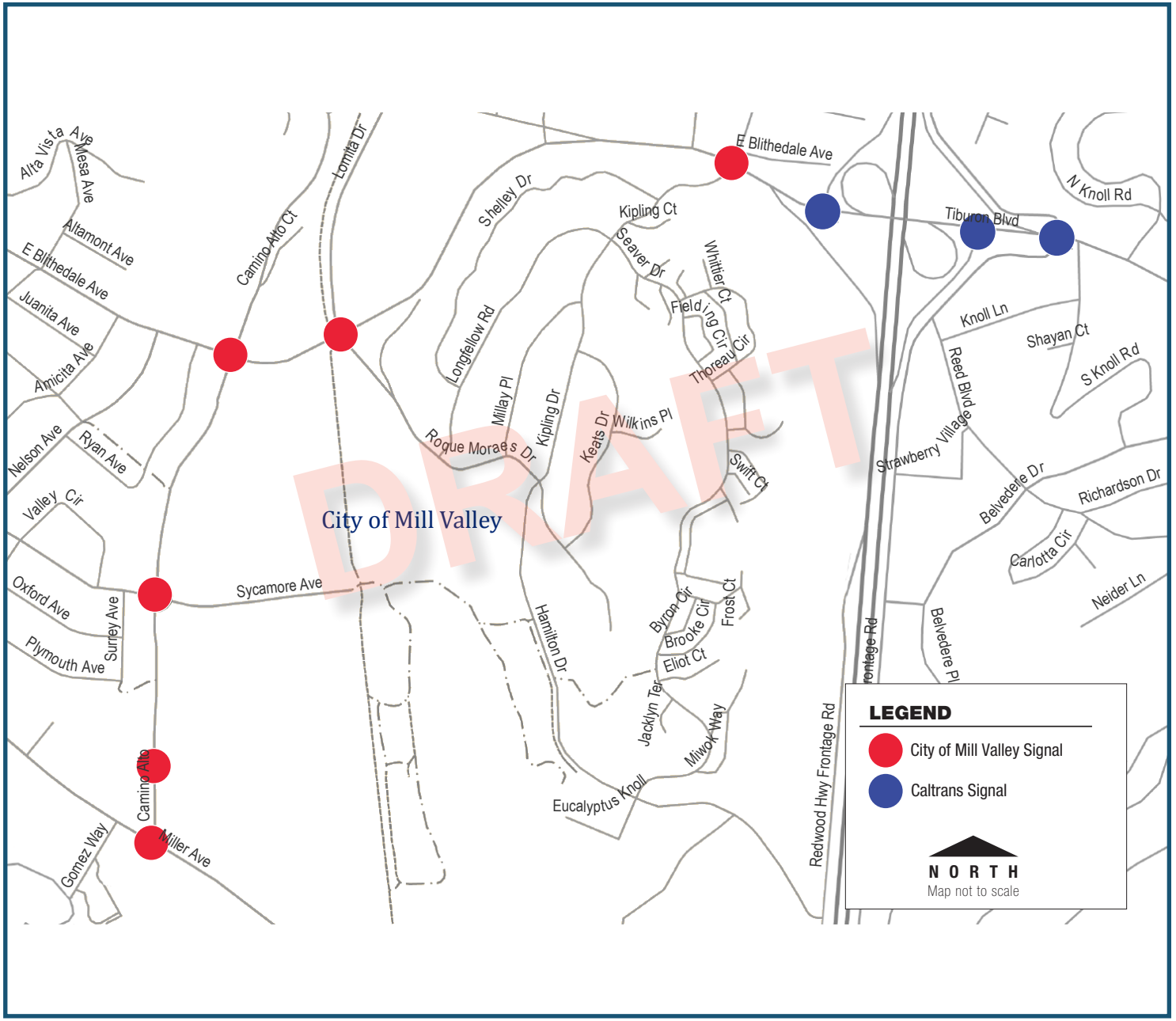
The City of Mill Valley received a grant from Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to deploy optimized signal timing plans along East Blithedale Avenue between Redwood Highway Frontage Road and Camino Alto, and along Camino Alto between East Blithedale 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

(CONTINUED ON NEXT PAGE)



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.

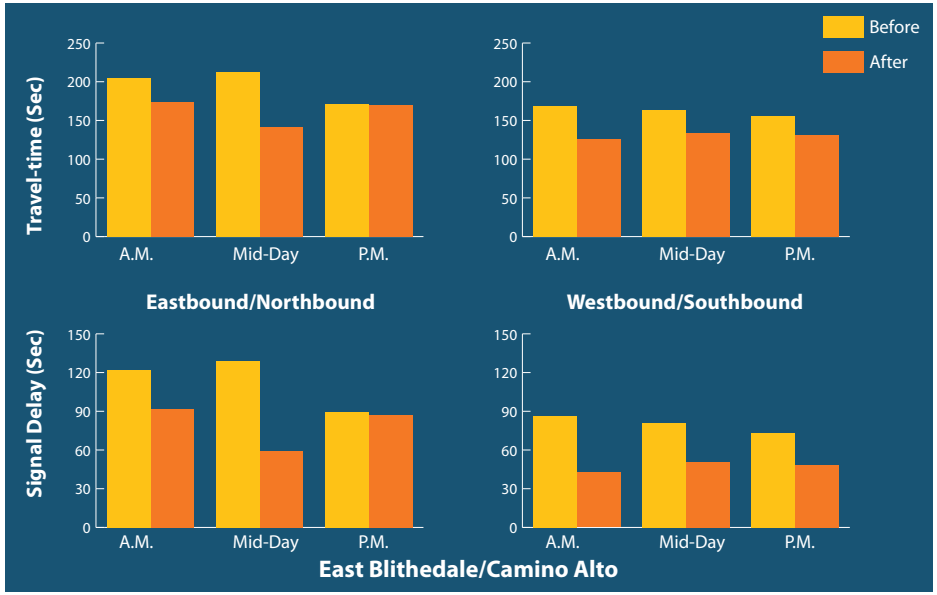
Benefits to Traffic Safety: To enhance traffic safety, all timing parameters at each project intersection were reviewed. These parameters include: minimum green time, yellow time, all-red clearance time, Walk time, Flashing Don't Walk time, and bicycle minimum green time.

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	0.12 tons	$157	0.33 tons	$421
NOx Emissions Reduction	0.11 tons	$1,982	0.30 tons	$5,316
PM2.5 Emissions Reduction	0.01 tons	$1,733	0.01 tons	$4,649
CO Emissions Reduction	1.28 tons	$99	3.44 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

For more info, please contact:

Ganesh Karkee (MTC)
Arterial Operations Program Coordinator
Phone: 510.817.5625 • Email: GKarkee@mtc.ca.gov

Jill Barnes (Mill Valley)
Public Works Director/City Engineer • 415.384.4801
jbarnes@cityofmillvalley.org

Project Consultant:

Iteris, Inc.

MT · MILL VALLEY · Caltrans

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

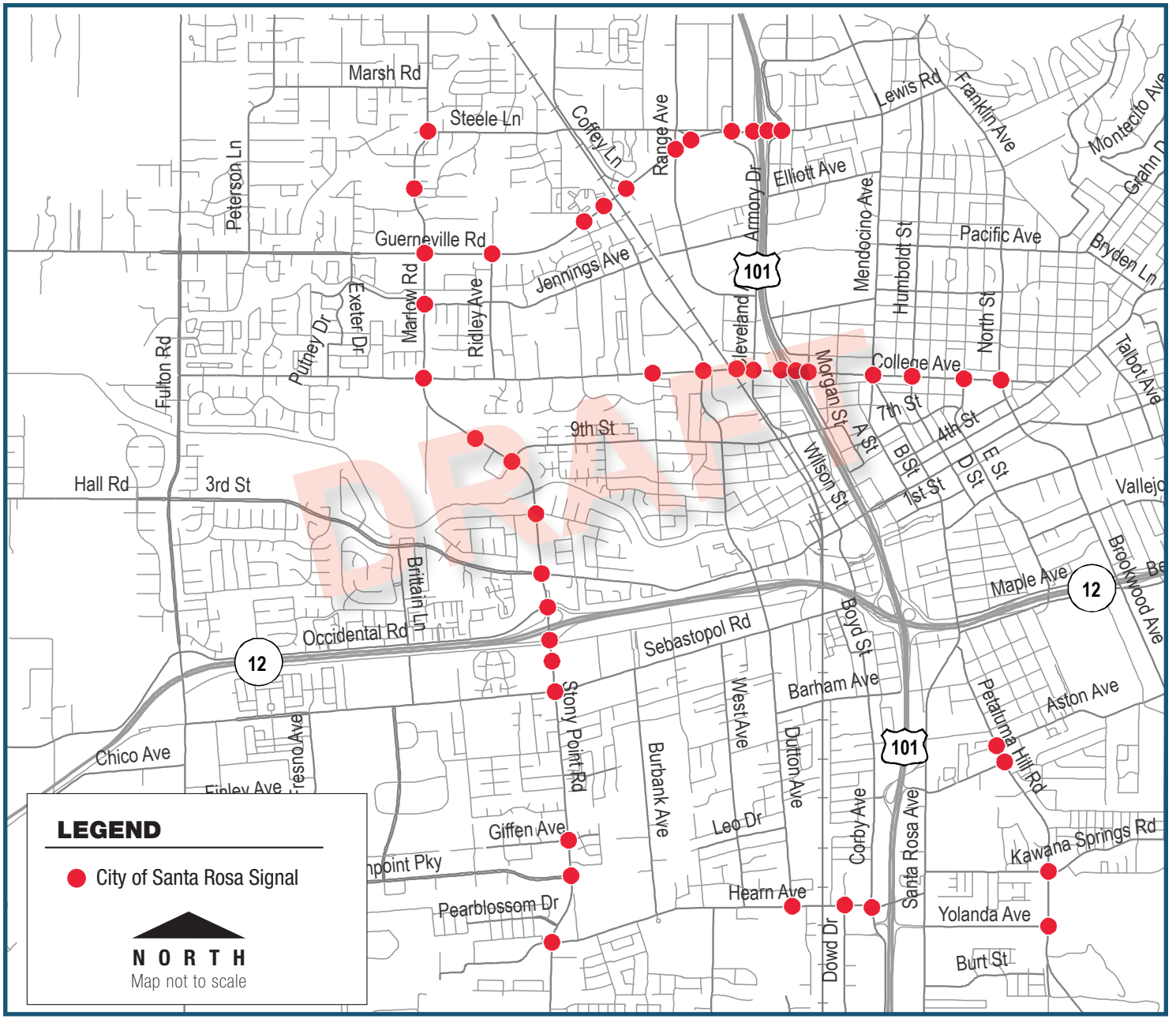
The City of Santa Rosa received a grant from the Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to deploy optimized signal timing plans for the 44 signals along Marlow Road/ Stony Point, Guerneville Road, College Avenue, Hearn Avenue, and Petaluma Road. All 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-

(CONTINUED ON NEXT PAGE)



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.

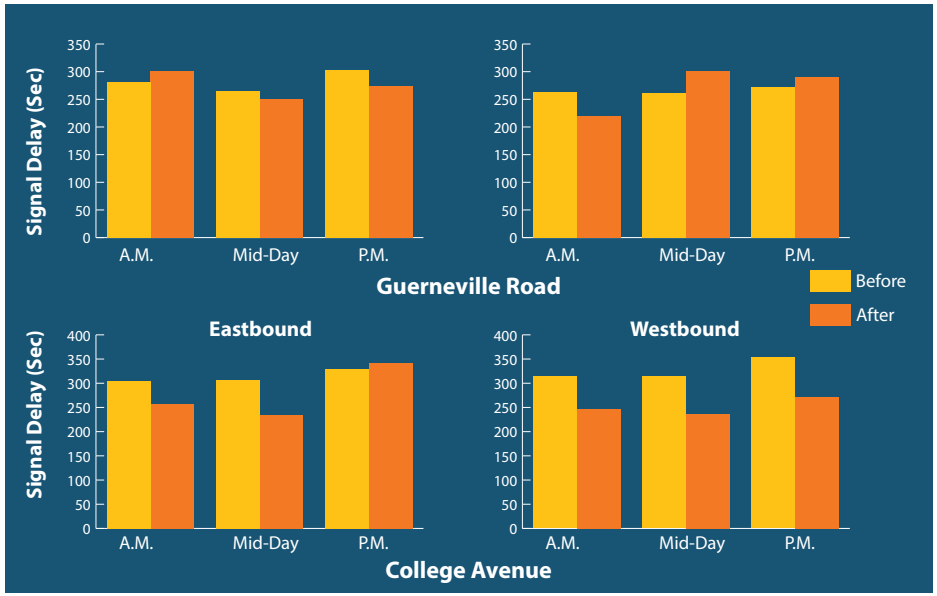
Benefits to Traffic Safety: To enhance traffic safety, all timing parameters at each project intersection were reviewed as per the latest California MUTCD. These parameters include: minimum green time, maximum green time, minimum gap, yellow time, all-red clearance time, Walk time, and Flashing Don't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

For more info, please contact:

Ganesh Karkee (MTC)

Arterial Operations Program Coordinator

Phone: 510.817.5625 • Email: GKarkee@mtc.ca.gov

Rob Sprinkle (Santa Rosa)

Supervising Engineer • Phone: 707-543-3817

Email: RSprinkle@srcity.org

Project Consultant:

Iteris, Inc.

City of Santa Rosa California

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

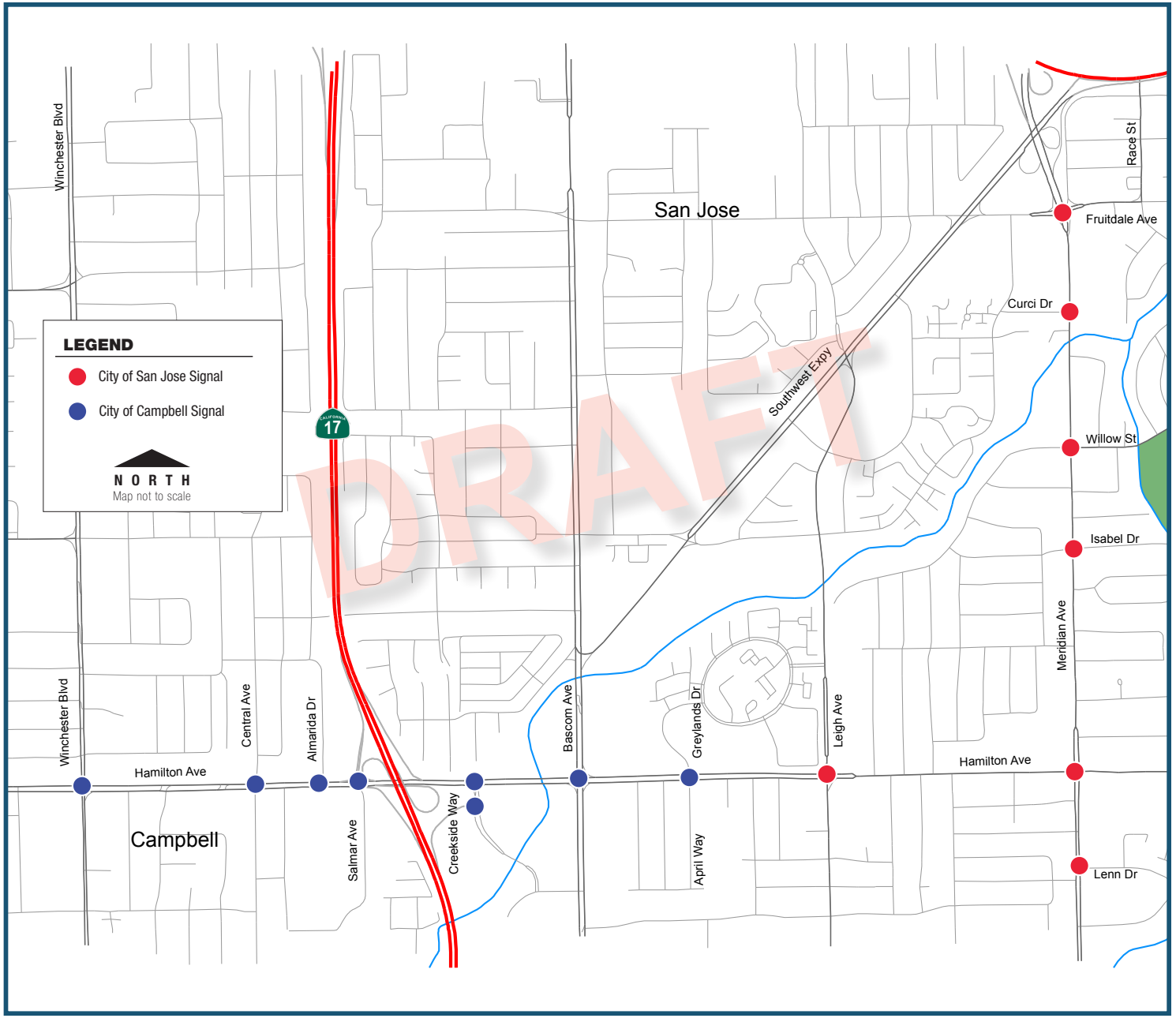
The City of Campbell, in conjunction with the City of San Jose, received a grant from the Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to deploy optimized signal timing plans for the 15 traffic signals on East Hamilton Avenue and Meridian Avenue. Eight of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

(CONTINUED ON NEXT PAGE)



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.

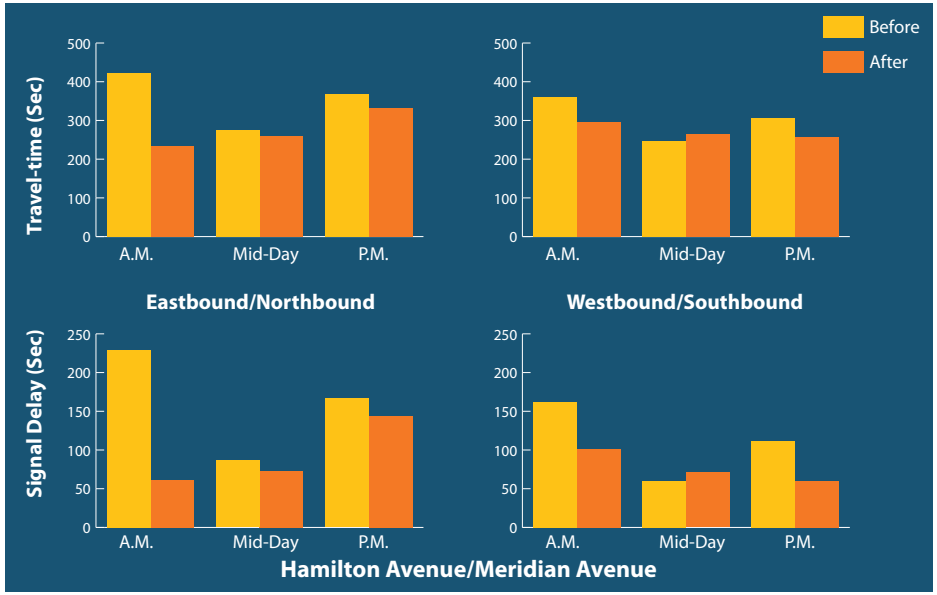
Benefits to Traffic Safety: To enhance traffic safety, all timing parameters at each project intersection were reviewed. A review of intersection level collisions along the corridors was conducted to identify any collision patterns that may be corrected through signal timing adjustments.

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

For more info, please contact:

Ganesh Karkee (MTC)
Arterial Operations Program Coordinator
Phone: 510.817.5625 • Email: GKarkee@mtc.ca.gov

Matthew Jue (Campbell)
Traffic Engineer | Phone: 408.866.2154
Email: matthewj@cityofcampbell.com

Project Consultant:

Kimley-Horn and Associates, Inc.

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

City of Dublin Signal Timing Project

City of Dublin | City of Pleasanton | Metropolitan Transportation Commission

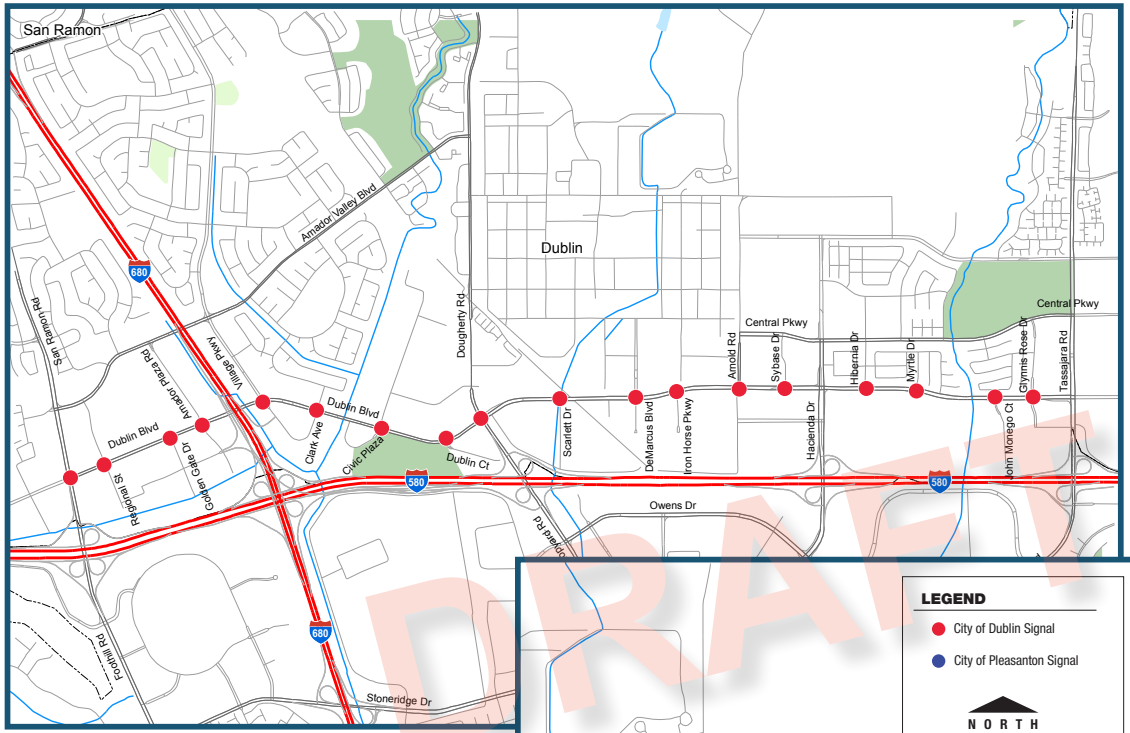
PROJECT OVERVIEW

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.

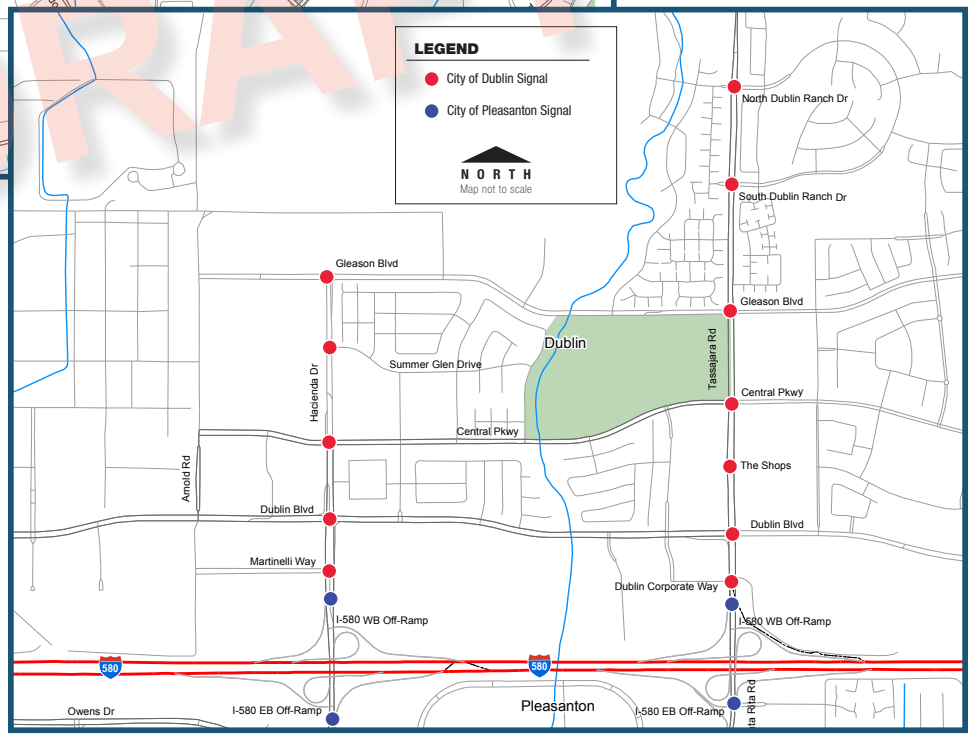
The PASS project involved the completion of the following tasks: collect turning movement counts, including vehicular, pedestrian, and bicycle counts; conduct field review of the project area; conduct travel time surveys; review actuated settings; review collision history; develop the existing conditions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

(CONTINUED ON NEXT PAGE)



◀ **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.

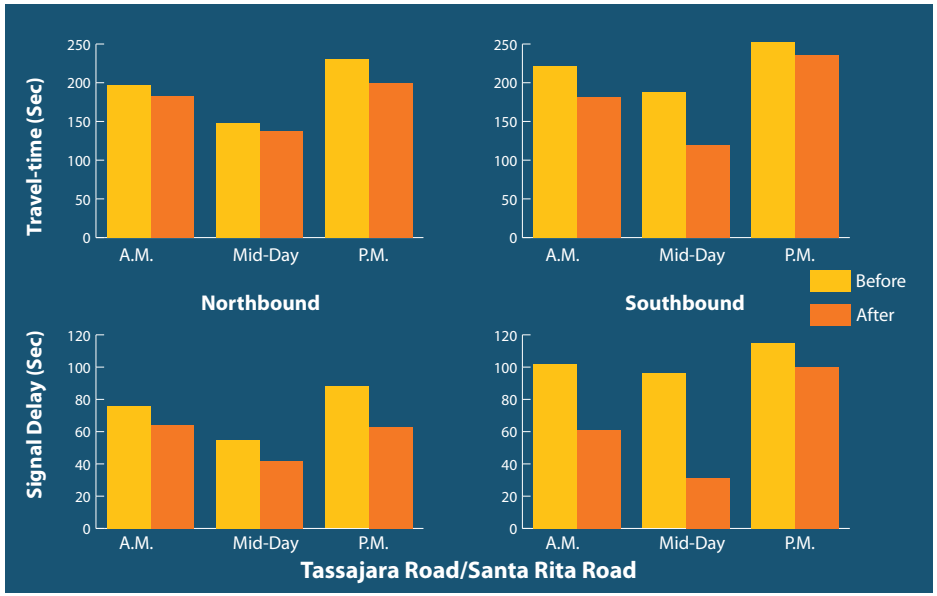
Benefits to Traffic Safety: To enhance traffic safety, all timing parameters at each project intersection were reviewed. Based on the review, changes to yellow intervals to meet the California MUTCD standards were implemented at seven project intersections.

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	0.11 tons	$135	0.29 tons	$361
NOx Emissions Reduction	0.10 tons	$1,744	0.26 tons	$4,679
PM2.5 Emissions Reduction	0.01 tons	$1,574	0.01 tons	$4,222
CO Emissions Reduction	1.18 tons	$92	3.18 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

For more info, please contact:

Ganesh Karkee (MTC)

Arterial Operations Program Coordinator

Phone: 510.817.5625 • Email: GKarkee@mtc.ca.gov

Obaid Khan (Dublin)

Transportation & Operations Manager

Phone: 925.833.6634 • Email: obaid.khan@dublin.ca.gov

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

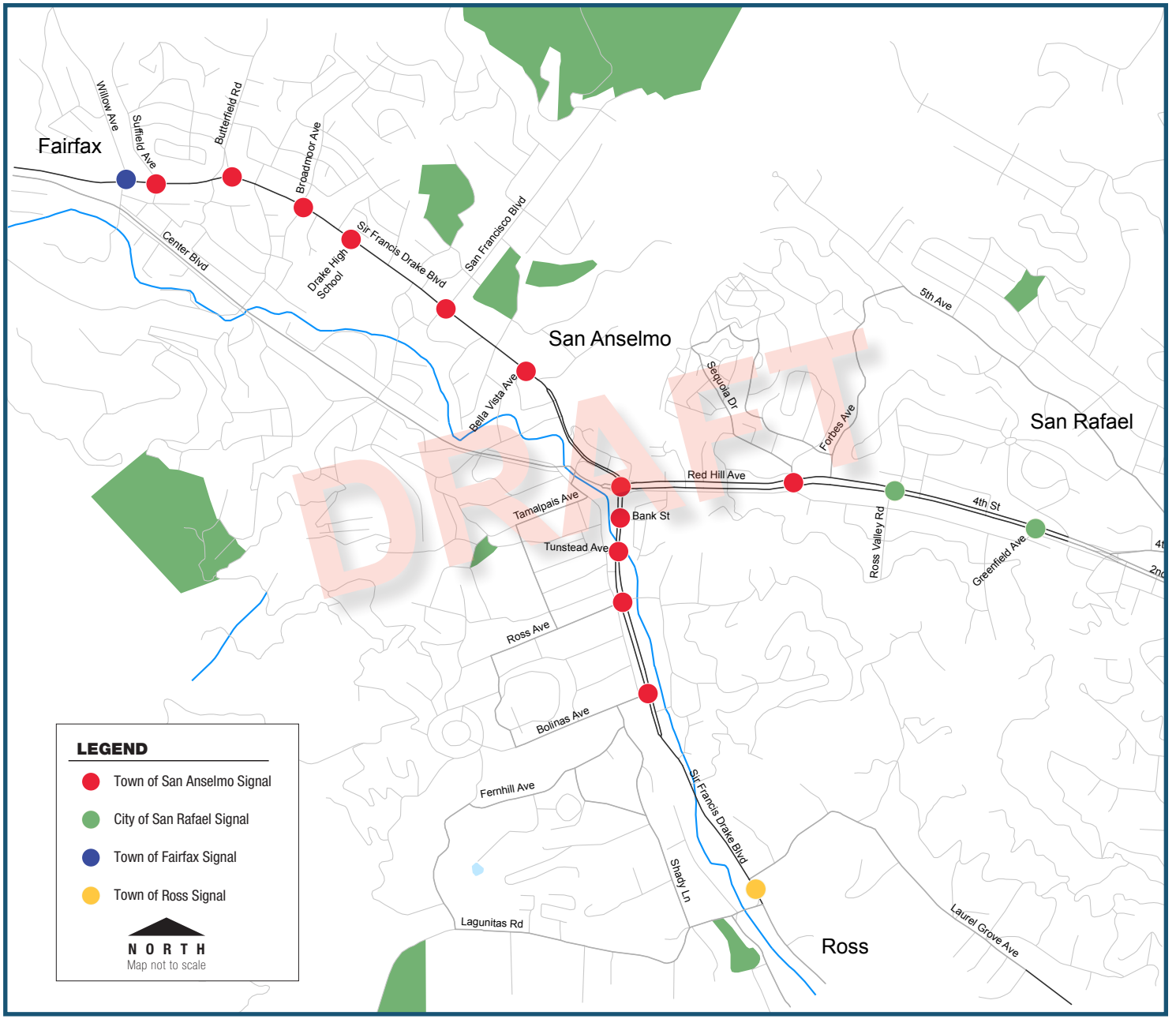
PROJECT OVERVIEW

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;

(CONTINUED ON NEXT PAGE)



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.

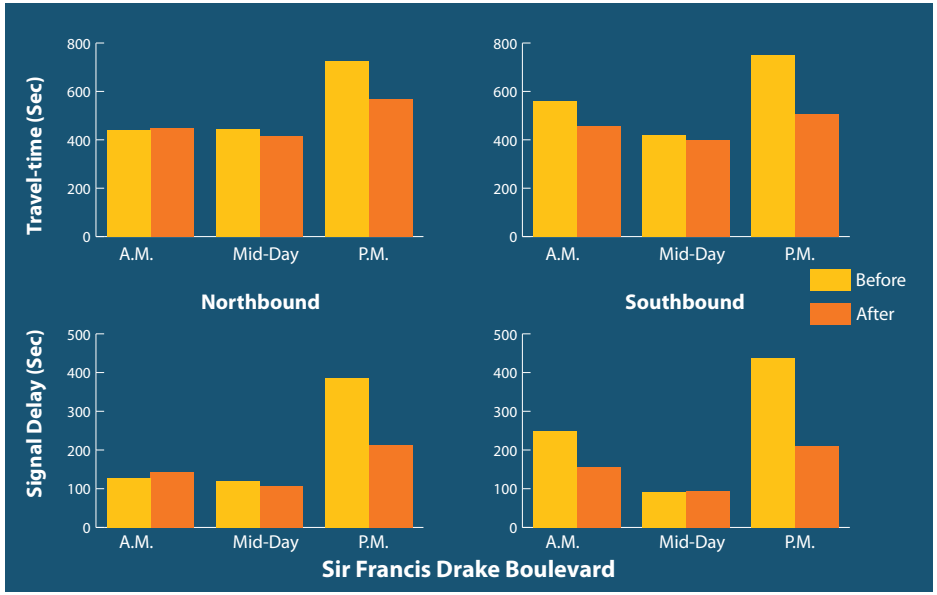
Benefits to Traffic Safety: A review of intersection level collisions along the corridors was conducted to identify any collision patterns that may be corrected through signal timing adjustments. No specific timing changes were needed as a result of the collision review.

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	**29%**
Overall Benefit-Cost Ratio	**57:1**



Project Benefits Summary

Average Reduction in Auto Signal Delay: 29%

Average Reduction in Number of Stops: 29%

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:

Ganesh Karkee (MTC)

Arterial Operations Program Coordinator

Phone: 510.817.5625 • Email: GKarkee@mtc.ca.gov

Sean Condry (San Anselmo)

Public Works & Building Director • Phone: 415.258.4676

Email: scondry@townofsananselmo.org

Project Consultant:

Kimley-Horn and Associates, Inc.

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

County Expressways – Traffic Responsive Timing Plans

County of Santa Clara | Metropolitan Transportation Commission

PROJECT OVERVIEW

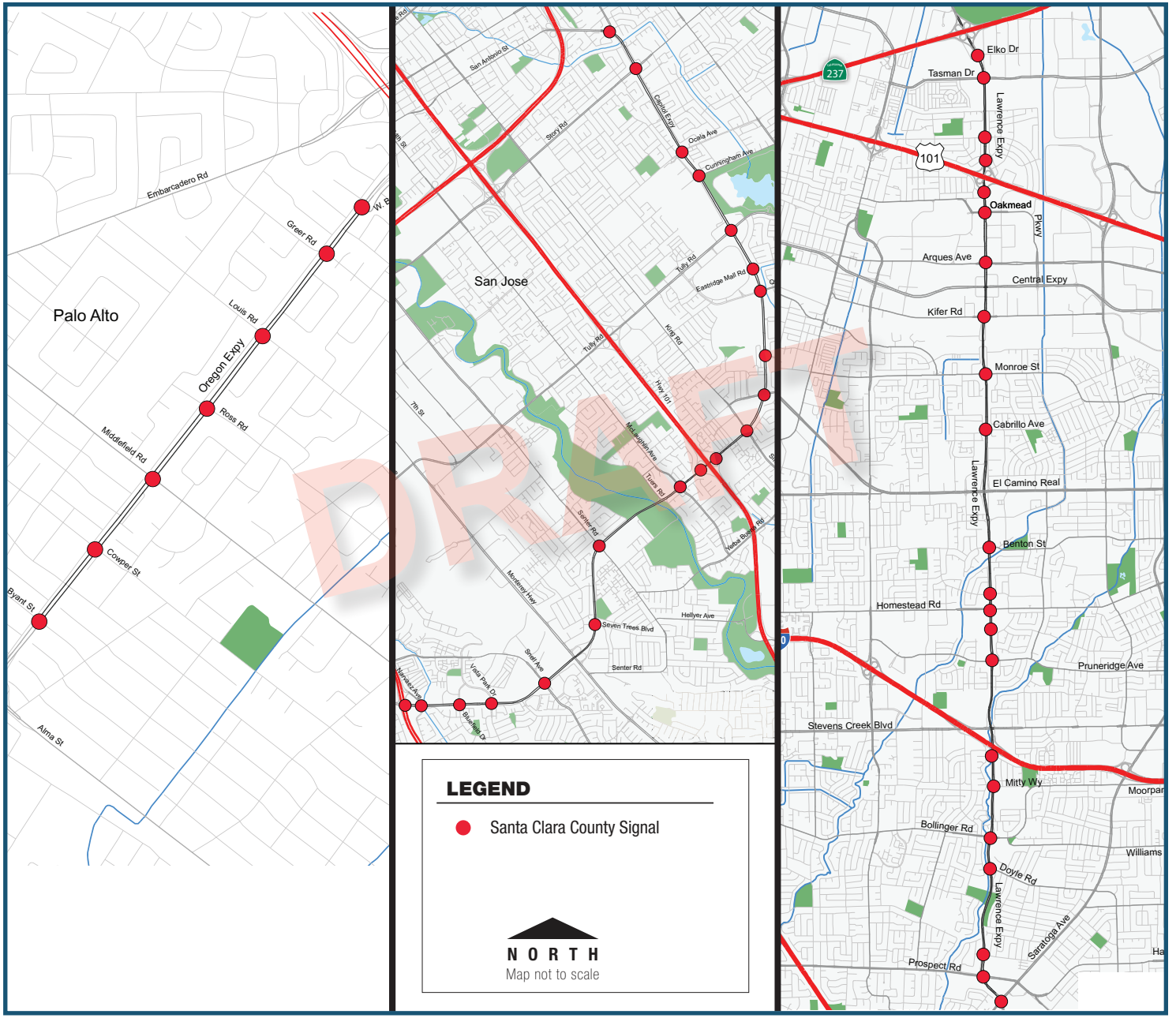
The County of Santa Clara received a Program for Arterial System Synchronization (PASS) grant from the Metropolitan Transportation Commission (MTC) to develop traffic timing plans for 49 traffic signals, including 7 traffic signals on Oregon Expressway, 20 signals on Capitol Expressway, and 22 signals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

(CONTINUED ON NEXT PAGE)



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.

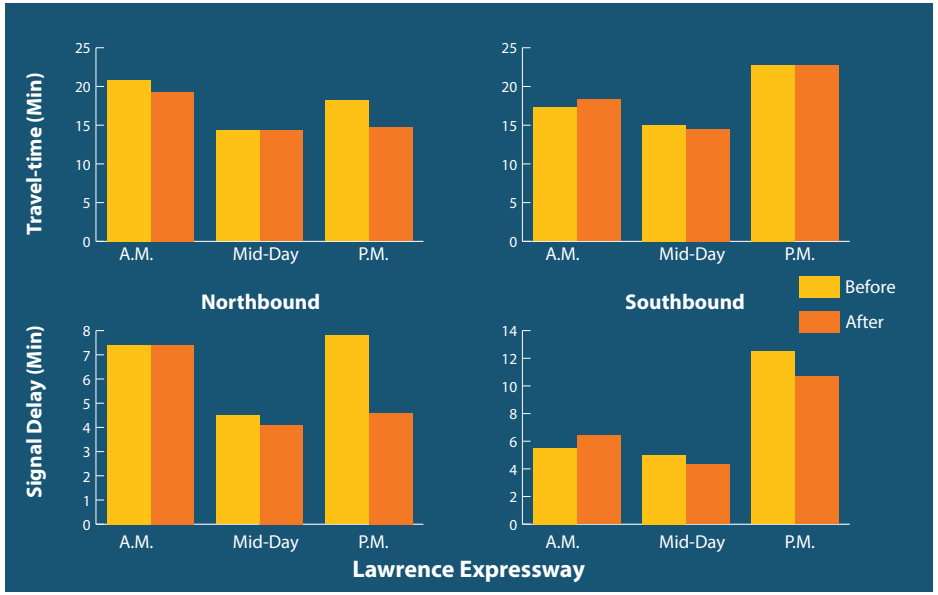
Existing bicycle and pedestrian timings were maintained with the traffic responsive timing. The implementation of traffic responsive timing did not have a negative impact on pedestrian and bicycle timings, and, in some cases, will even reduce the pedestrian and bicycle delay when lower cycle lengths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

For more info, please contact:

Ganesh Karkee (MTC)

Arterial Operations Program Coordinator

Phone: 510.817.5625 • Email: GKarkee@mtc.ca.gov

Ananth Prasad (County of Santa Clara)

Senior Civil Engineer • Phone: 408.494.1342

Email: Ananth.Prasad@rda.sccgov.org

Project Consultant:

Kimley-Horn and Associates, Inc.

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

City of Walnut Creek Signal Timing Project

City of Walnut Creek | Caltrans | Metropolitan Transportation Commission

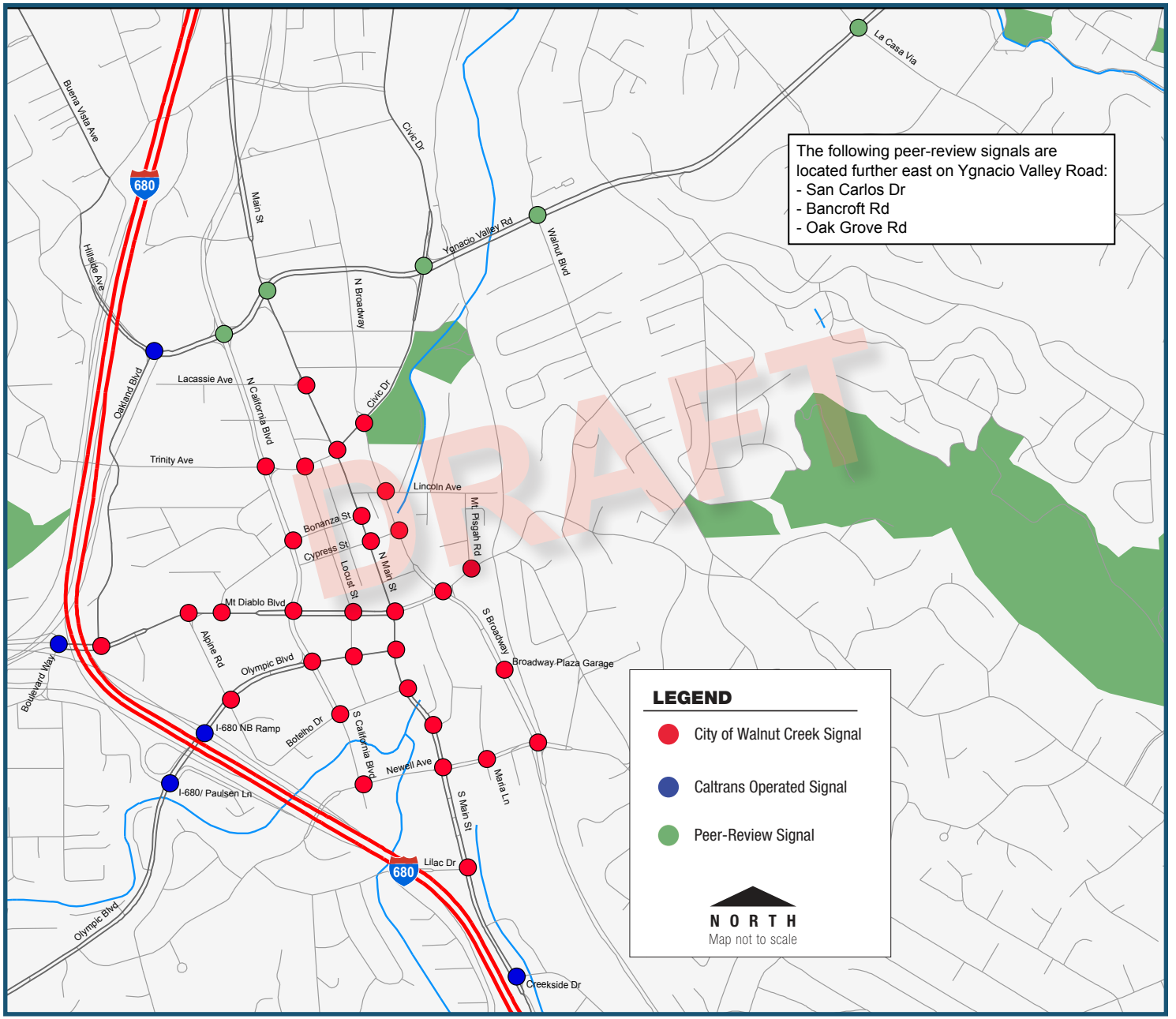
PROJECT OVERVIEW

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

(CONTINUED ON NEXT PAGE)



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.

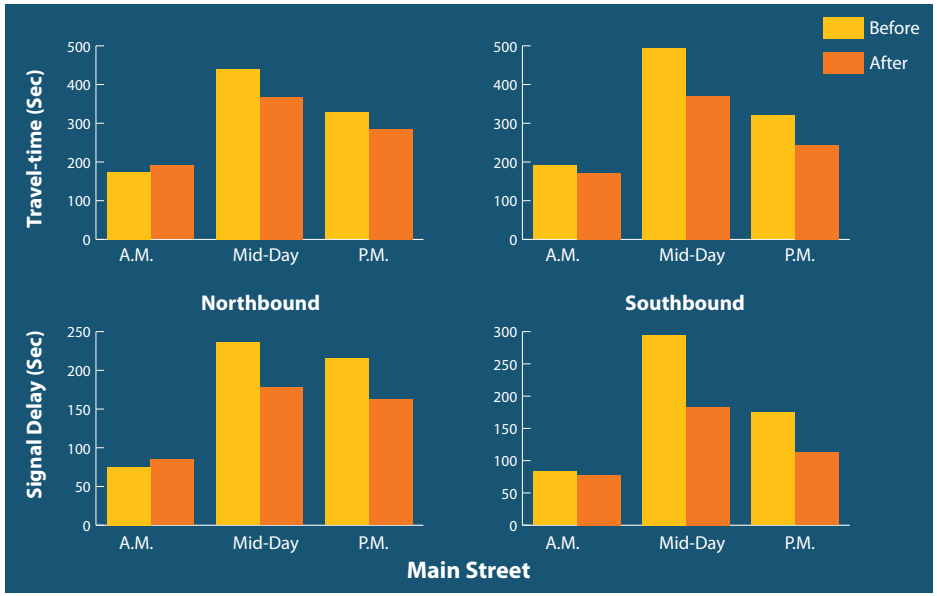
Benefits to Traffic Safety: A review of intersection-level collisions along the corridors was conducted to identify any collision patterns that may be corrected through signal timing adjustments. No specific timing changes were recommended as a result of the collision review.

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	0.10 tons	$127	0.27 tons	$341
NOx Emissions Reduction	0.06 tons	$1,084	0.16 tons	$2,909
PM2.5 Emissions Reduction	0.00 tons	$940	0.01 tons	$2,522
CO Emissions Reduction	0.69 tons	$53	1.84 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:

Ganesh Karkee (MTC)

Arterial Operations Program Coordinator

Phone: 510.817.5625 • Email: GKarkee@mtc.ca.gov

Simin Timuri (Walnut Creek)

Associate Traffic Engineer • Phone: 925.943.5899

Email: timuri@walnut-creek.org

Project Consultant:

Kimley-Horn and Associates, Inc.

MTC · City of Walnut Creek · Caltrans

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

City of Concord Signal Timing Project

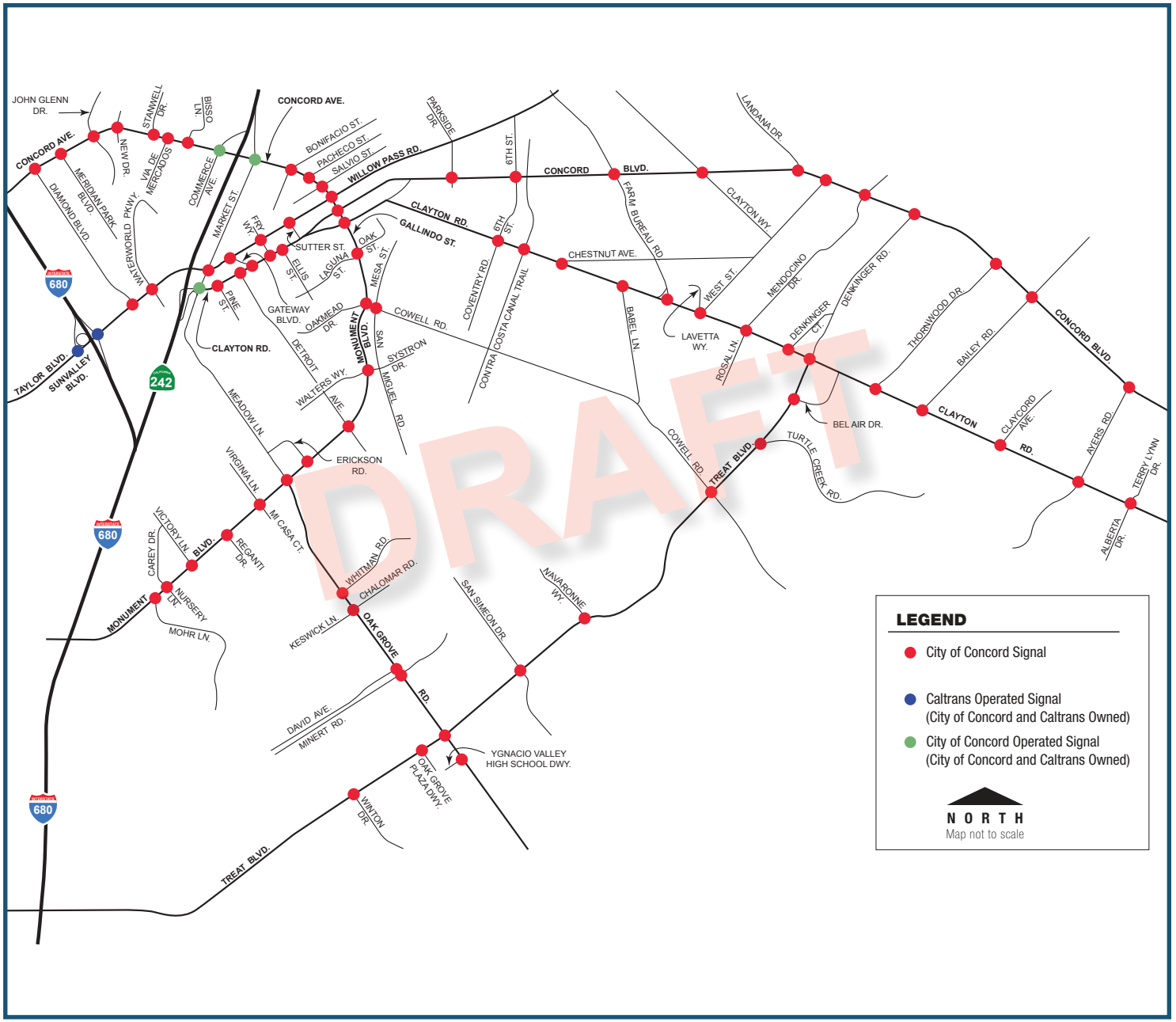
City of Concord | Caltrans | Metropolitan Transportation Commission

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.

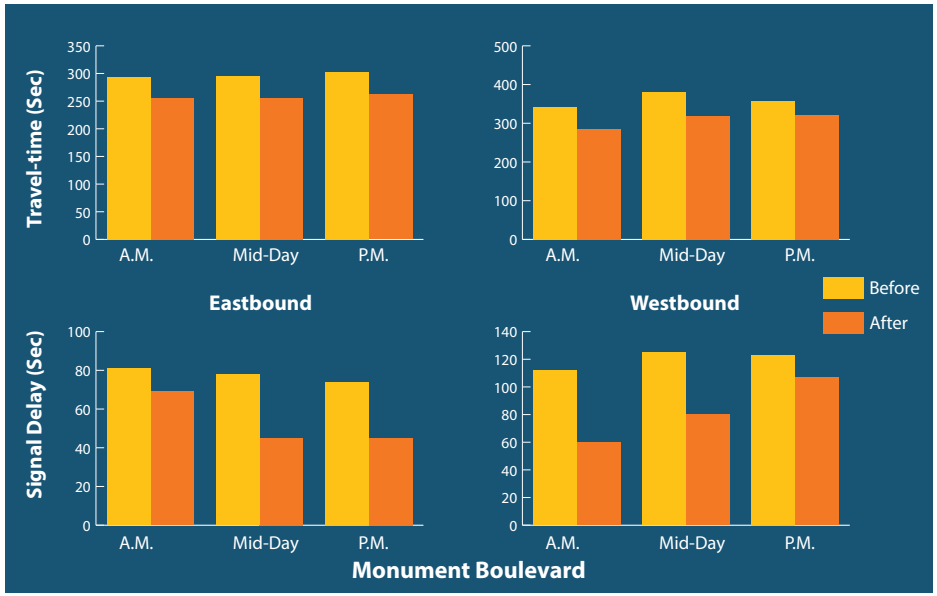
Benefits to Traffic Safety: The yellow clearance timing parameters were updated based on posted speed limits along the study corridors at seven project intersections and no changes were made to all red clearance timing parameters.

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

For more info, please contact:

Ganesh Karkee (MTC)

Arterial Operations Program Coordinator

Phone: 510.817.5625 • Email: GKarkee@mtc.ca.gov

Abul Hossain (Concord)

Transportation Program Manager

925.671.3181 • Email: abul.hossain@cityofconcord.org

Project Consultant:

TJKM Transportation Consultants

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

City of Hayward Signal Timing Project

City of Hayward | Caltrans | Metropolitan Transportation Commission

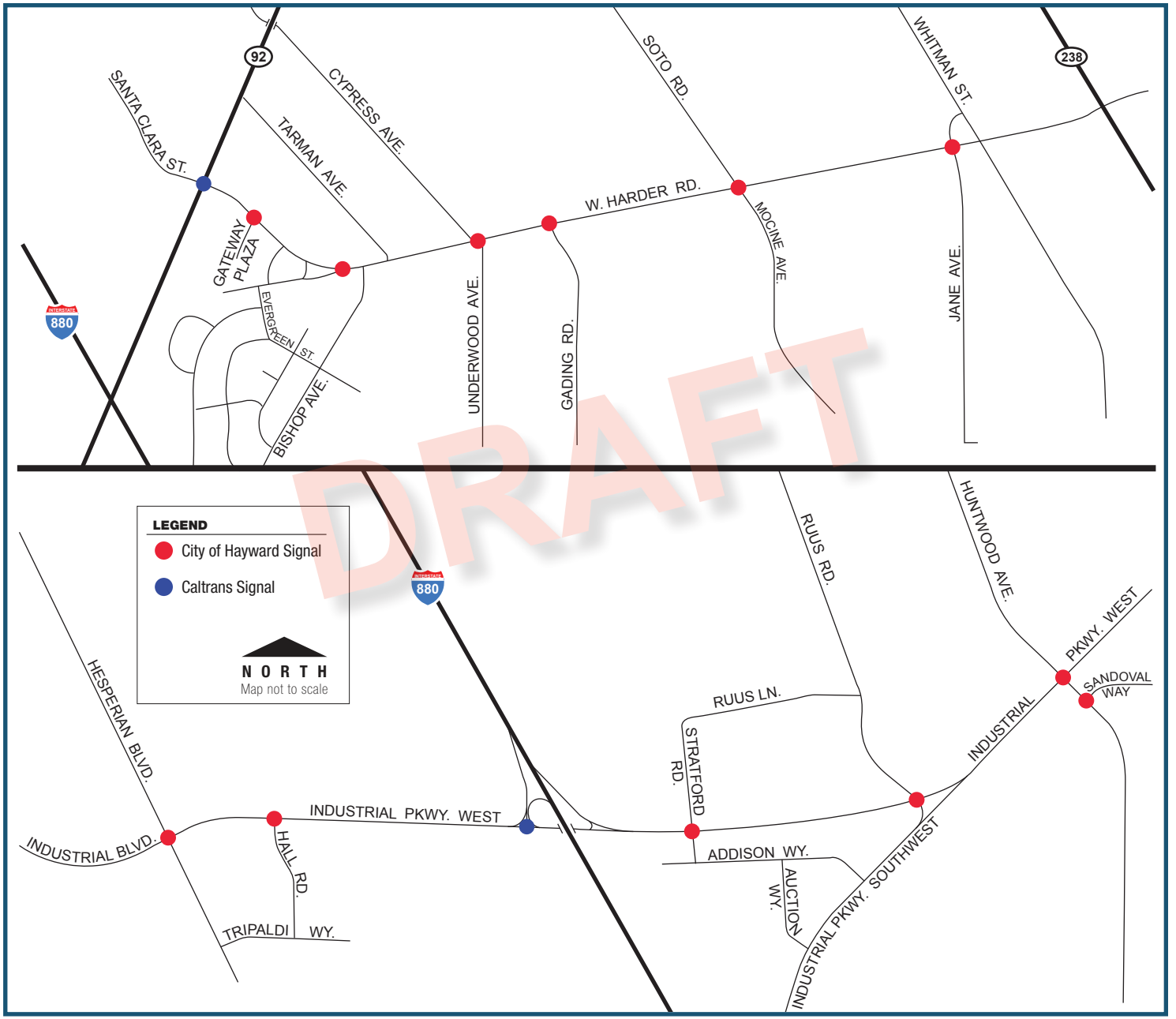
Project Overview

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.

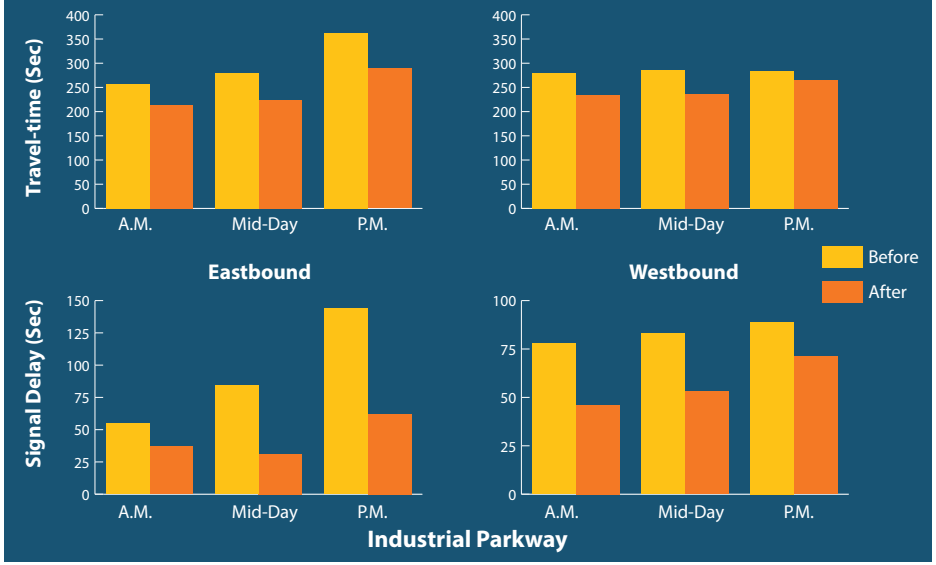
Benefits to Traffic Safety: The yellow clearance timing parameters were updated based on posted speed limits along the study corridors at seven project intersections and no changes were made to all red clearance timing parameters.

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

For more info, please contact:

Ganesh Karkee (MTC)

Arterial Operations Program Coordinator

Phone: 510.817.5625 • Email: GKarkee@mtc.ca.gov

Majid Hafezieh (Hayward)

Associate Transportation Engineer

510.583.4784 • Email: Majid.Hafezieh@hayward-ca.gov

Project Consultant:

TJKM Transportation Consultants

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

City of Oakland Signal Timing Project

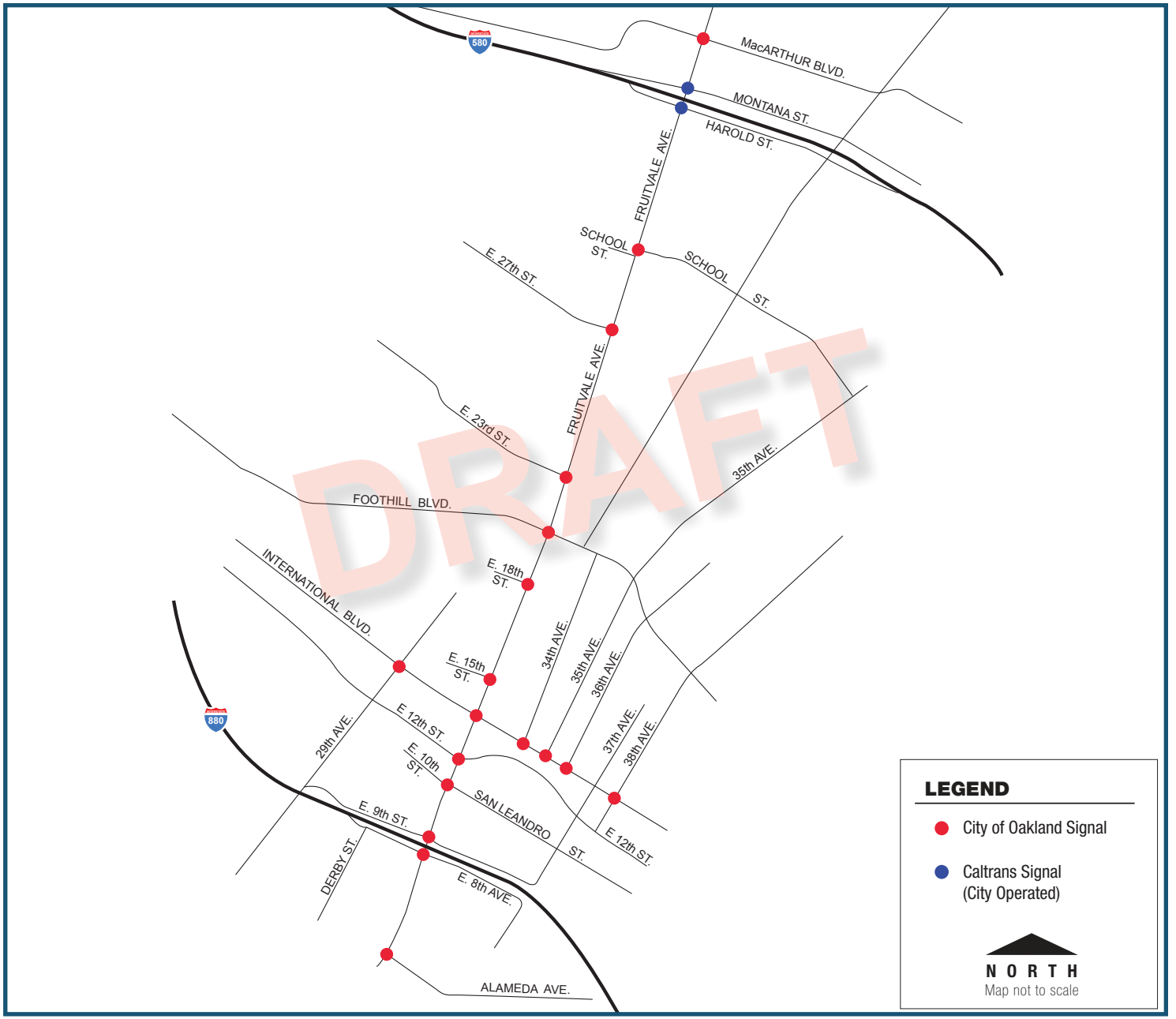
City of Oakland | Caltrans | Metropolitan Transportation Commission

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.

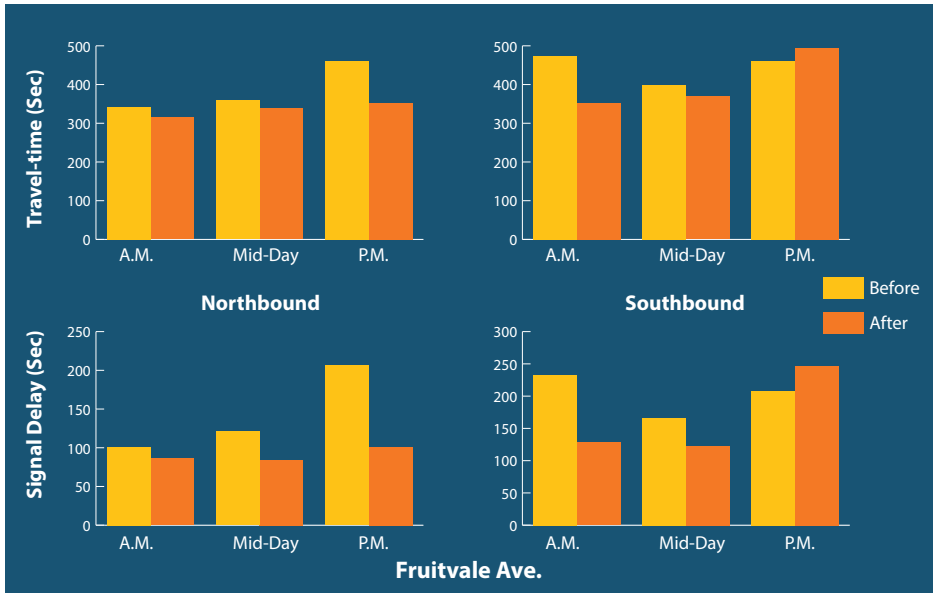
Benefits to Traffic Safety: The yellow clearance timing parameters were updated based on posted speed limits along the study corridors at three project intersections and no changes were made to all red clearance timing parameters.

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

For more info, please contact:

Ganesh Karkee (MTC)

Arterial Operations Program Coordinator

Phone: 510.817.5625 • Email: GKarkee@mtc.ca.gov

Ade Oluwasogo (Oakland)

Supervising Transportation Engineer

Phone: 510.238.6103 • Email: aosogo@oaklandnet.com

Project Consultant:

TJKM Transportation Consultants

CITY OF OAKLAND

Caltrans

Program for Arterial System Synchronization (PASS) FY 14/15 Cycle - Project Status Update (As of 3/2/2015)

#	County	Project Sponsors (# of signals)	# of Signals			Project Corridors (# of signals)	Project Services and Plans	GPS Clocks				Consultant	Project Status*
			Local	Caltrans	Total			Controller	Local	Caltrans	Total		
1	**Alameda**	**Oakland (36), Caltrans (5)**	36	5	41	14th St (14), Oak St (8), 98th Ave (19)	Weekday (AM/Midday/PM); Weekend (one period)	170E (26), 170 (5), 2070 (1)	28	4	32	**Advantec**	**2A**
2	**San Mateo**	**South San Francisco (17), Caltrans (21)**	17	21	38	E Grand Ave (6); Airport Blvd (5); S Airport Blvd (6); ECR/Chestnut/Westborough (21)	Weekday (AM/Midday/PM) (38); Weekend (Midday/PM) (21)		0	0	0	**Advantec**	**2A**
3	**Alameda**	**Alameda County (9), Caltrans (3)**	9	3	12	Castro Valley Blvd (10); Strobridge Ave (2)	Weekday (AM/Midday/PM)		0	0	0	**DKS**	**3A**
4	**San Mateo**	**San Bruno (7), San Mateo County (1), Caltrans (7)**	8	7	15	San Bruno Ave	Weekday (AM/Midday/PM)	170E (5), EPAC 300 (2); Naztec 2070 (1)	4	4	8	**DKS**	**3A**
5	**Solano**	**Suisun City (9), Caltrans (3)**	9	3	12	Sunset Ave (5), Walters Ave (4), SR 12 (3)	Weekday (AM/Midday/PM); Turning Movement Analysis (Sunset/Railroad Ave)		0	0	0	**DKS**	**2B**
6	**Contra Costa**	**Walnut Creek (54), Caltrans (8)****	54	8	62	Citywide	Weekday (AM/Midday/PM) (62); Weekend (AM/Midday/PM) (27)		0	0	0	**DKS**	**2A**
7	**Contra Costa**	**Antioch (8), Caltrans (2)**	8	2	10	Somersville Rd	Weekday (AM/Midday/PM)		0	0	0	**KHA**	**3B**
8	**Alameda**	**Fremont (4), Caltrans (4)**	4	4	8	Auto Mall Pkwy	Weekday (AM/Midday/PM)		0	0	0	**KHA**	**1B**
9	**Alameda**	**Union City (12), Hayward (5), Caltrans (2)**	17	2	19	Whipple Rd (14), Dyer St (5)	Weekday (AM/Midday/PM)	2070 (2), Econolite (1)	1	2	3	**KHA**	**3A**
10	**Contra Costa**	**Walnut Creek (21), Contra Costa County (3)**, Caltrans (3)****	23	4	27	Treat Blvd/Main St (9); Ygnacio Valley Rd (18)	Traffic Responsive (27) [Ygnacio-18, Treat-9]		0	0	0	**KHA**	**3A**
11	**Contra Costa**	**Concord (53)**	53	0	53	Ygnacio Valley Rd (11); Downtown (18); Clayton Rd (13); Monument Blvd (11)	Weekday (AM/Midday/PM) (20); Weekday (AM/PM) (9); Weekend (two peaks) (24); Actelis EADs Copper based (10)		0	0	0	**TJKM**	**2B**
12	**Contra Costa**	**San Ramon (19), Caltrans (2)**	19	2	21	E Crow Canyon Rd (8), W Crow Canyon Rd (5), Alcosta Blvd (8)	Weekday (AM/Midday/PM) (18); Weekday (AM/PM) (3); School (AM/PM) (3); Weekend (two peaks) (18)		0	0	0	**TJKM**	**3A**
Total			**257**	**61**	**318**				**33**	**10**	**43**		

*1B = Final Scope, Schedule and Budget; 2A = Draft Existing Conditions Report; 2B = Final Existing Conditions Report; 3A = Draft Recommendations Report; 3B = Revised Recommendations Report.

**Signals are operated and maintained by the City of Walnut Creek.

(#) Indicates the number of signals.