

METROPOLITAN TRANSPORTATION COMMISSION

Program for Arterial System Synchronization (PASS)

FY 14/15 Cycle - Fact Sheets

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PASS FY 14/15 CYCLE

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

Eleven projects from the PASS 14/15 cycle are listed in the table below, consisting of 306 traffic signals from three counties in the Bay Area. MTC, in partnership with Caltrans and the local agencies, has successfully completed these projects. In this cycle, 58 Caltrans signals were coordinated with local agency signals along major arterials in the Bay Area.

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

BENEFIT-COST SUMMARY

The PASS project benefits are assumed to be 100 percent on the first day after implementation of the new timing plans, declining steadily to zero by the end of the fourth year. The results from the 11 projects are summarized below:

- Total Auto Travel Time Savings: 16% or over 1.5 million hours
- Average Auto Speed Increase: 28%
- Total Auto Fuel Consumption Savings: 12% or over 5.2 million gallons
- Total Auto Emissions Reduction: 192.4 tons (ROG: 17.3 tons; NOx: 11.9 tons; PM2.5: 0.7 tons; CO: 162.5 tons)

Total Project Costs: \$1,262,000

Total Lifetime Benefits: \$51,669,000

Overall Benefit-Cost Ratio: 41:1

OTHER BENEFITS

The optimized signal timing plans were developed and implemented based on the 2014 California MUTCD guidelines. The Walk time and Flashing Don't Walk clearance timing parameters were updated to provide adequate crossing time for children and seniors to safely cross the study intersections. The minimum green times were reviewed and increased at many intersections to enhance safety for bicyclists crossing the intersections. The yellow time and all-red timing parameters were reviewed and updated to provide additional clearance time for vehicles to clear or stop safely at the intersections. Timing plans were optimized to reduce unnecessary delays along the side streets and achieve progression along the corridors.

#	County	Project Sponsors	# of Signals	Timing Plans/Services	Consultant
1	Alameda	Alameda County, Caltrans	12	Weekday Peaks	DKS Associates
2	Contra Costa	City of Antioch, City of Pittsburg, Caltrans	10	Weekday Peaks	Kimley-Horn
3	Contra Costa	City of Concord	53	Weekday Peaks; School PM Peak; Weekend Peaks	TJKM Consultants
4	Alameda	City of Fremont, Caltrans	8	Weekday Peaks	Kimley-Horn
5	Alameda	City of Oakland, Caltrans	41	Weekday Peaks; Weekend Peaks	Advantec
6	San Mateo	City of San Bruno, Caltrans	15	Weekday Peaks	DKS Associates
7	Contra Costa	City of San Ramon, Caltrans	21	Weekday Peaks; School PM Peak; Weekend Peaks	TJKM Consultants
8	San Mateo	City of South San Francisco, Caltrans	38	Weekday Peaks; Weekend Peaks	Advantec
9	Alameda	City of Union City, City of Hayward, Caltrans	19	Weekday Peaks	Kimley-Horn
10	Contra Costa	City of Walnut Creek, Caltrans	27	Traffic Responsive	Kimley-Horn
11	Contra Costa	City of Walnut Creek, Caltrans	62	Weekday Peaks; Weekend Peaks	DKS Associates
Total Signals			306		

Castro Valley Boulevard - Coordination Timing Plan

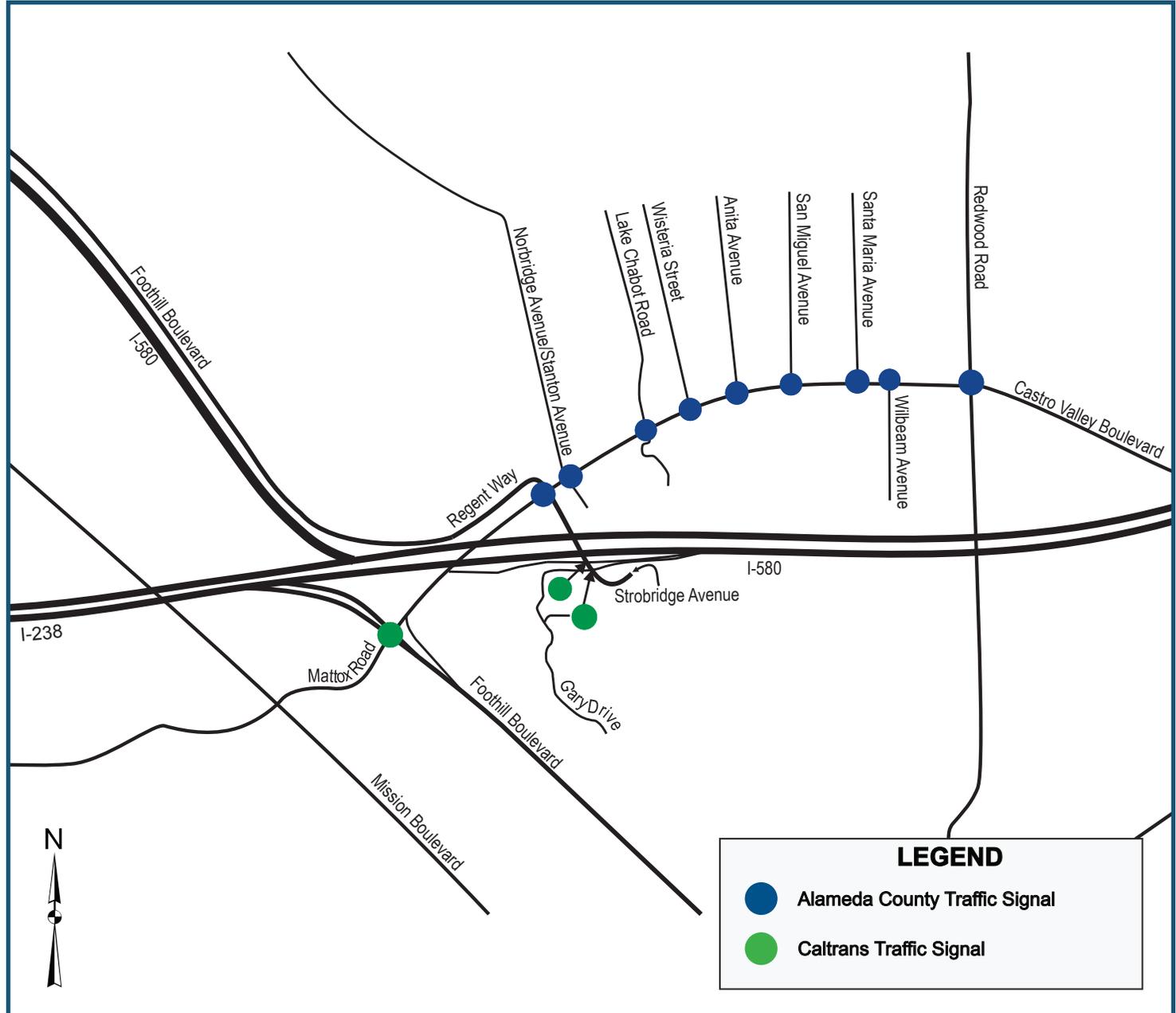
Alameda County | Caltrans | Metropolitan Transportation Commission

PROJECT OVERVIEW

The County of Alameda, 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 a total of 12 traffic signals along Castro Valley Boulevard and Strobridge Avenue corridors.

The goal of the project was to develop traffic signal timing plans for the weekday AM, midday, and PM peak periods to reduce traffic congestion, reduce delays, and reduce the emission of harmful greenhouse gases associated with frequent stop and go traffic. Nine traffic signals are owned, operated, and maintained by the County of Alameda and the remaining three signals are owned, operated, and maintained by Caltrans.

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



BENEFITS TO VARIOUS MODES



BENEFITS TO BICYCLISTS: The minimum green time was increased for the through movements at each study intersection to enhance traffic safety for bicyclists traveling along the Castro Valley Boulevard corridor.



BENEFITS TO PEDESTRIANS: The Walk time and Flashing Don't Walk clearance timing parameters were updated at 11 intersections to provide adequate time for children and seniors to safely cross the study intersections.

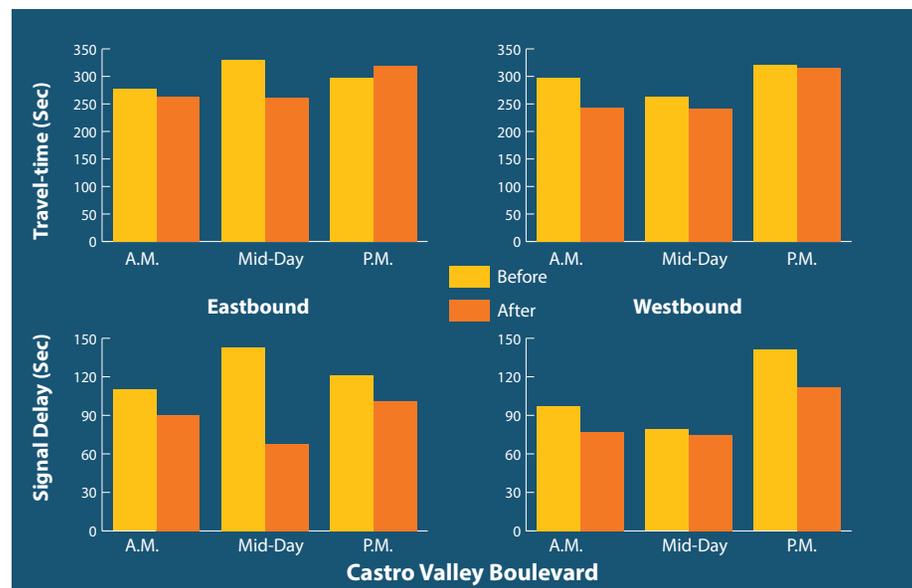


BENEFITS TO TRAFFIC SAFETY: To enhance traffic safety, the yellow clearance timing parameters were updated based on the posted speed limits along the study corridors, and the all red clearance timing parameters were updated based on the results of the collision analysis presented in the existing conditions analysis. These parameters were changed at two of the study intersections.

Project Costs	
Consultant Costs (Basic Services/Plans)	\$32,400
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	\$0
Other Project Costs (GPS Clocks, Communications equipment, etc.)	\$0
Agency Staff Costs (Estimate)	\$8,100
Total Costs	\$40,500

Measures	First Year		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	8,600 hrs.	\$172,795	23,071 hrs.	\$463,533
Fuel Consumption Savings	32,270 gal.	\$120,498	86,567 gals.	\$323,242
ROG Emissions Reduction	0.093 tons	\$119	0.249 tons	\$319
NOx Emissions Reduction	0.093 tons	\$1,707	0.249 tons	\$4,580
PM2.5 Emissions Reduction	0.002 tons	\$781	0.007 tons	\$2,095
CO Emissions Reduction	0.955 tons	\$76	2.563 tons	\$204
Total Lifetime Benefits				\$793,973

Overall Project Benefits	Auto
Average Decrease in Travel Time	8%
Average Speed Increase	10%
Average Fuel Savings	7%
Average Reduction in Signal Delay	24%
Average Reduction in Number of Stops	15%
Overall Benefit-Cost Ratio	20:1



PROJECT BENEFITS SUMMARY



Average Reduction in Auto Signal Delay: 24%

Average Reduction in Number of Stops: 15%

Auto Fuel Consumption Savings: 7% or 85,567 gallons



Total Emissions Reduced (ROG, NOx, PM2.5, CO): 3.1 tons

Auto Travel Time Savings: 8% or 23,071 hours



Overall Project Benefit-cost Ratio = 20:1



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DKS Associates



Somersville Road and Auto Center Drive - Coordination Timing Plan

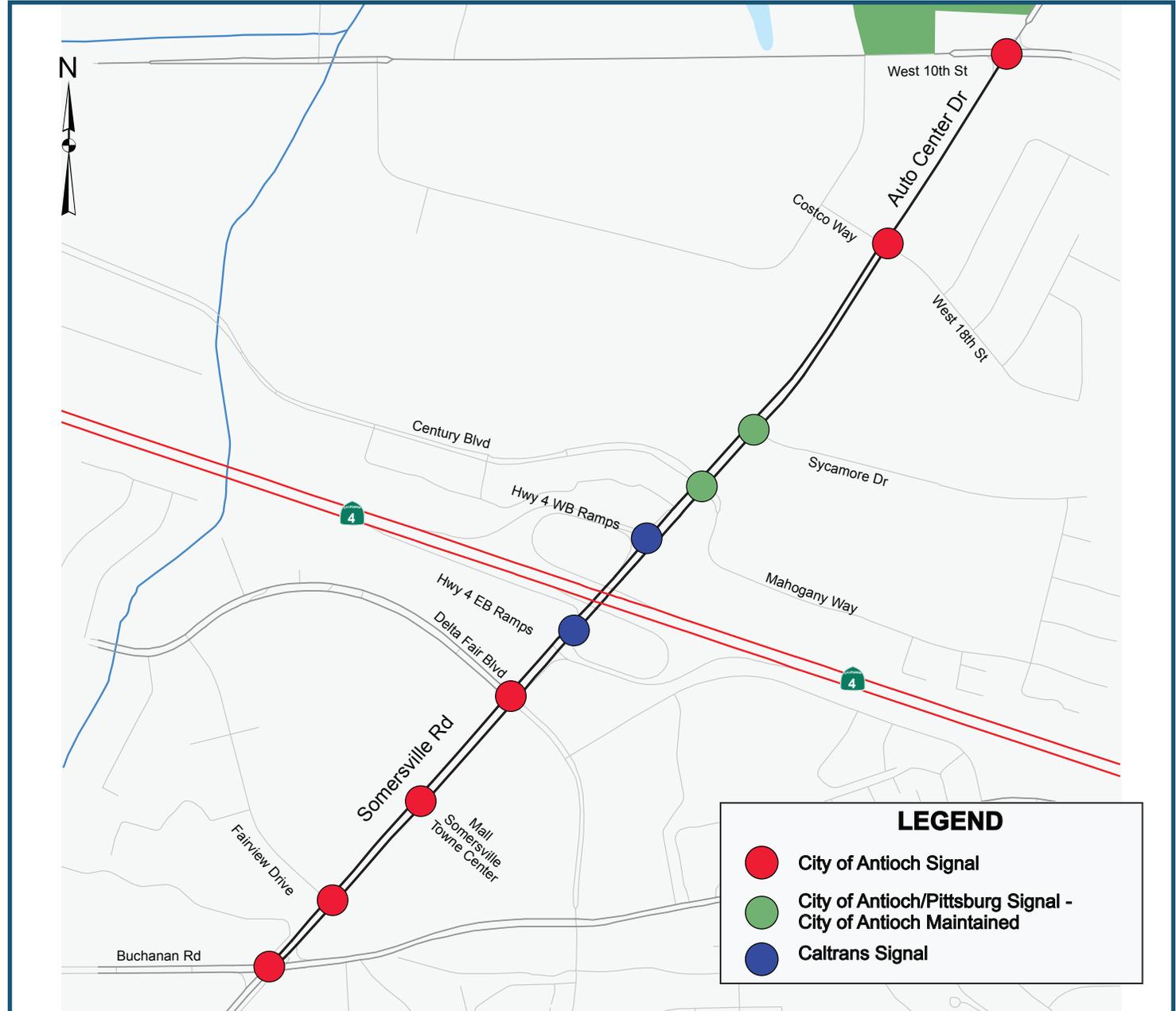
City of Antioch | City of Pittsburg | Caltrans | Metropolitan Transportation Commission

PROJECT OVERVIEW

The City of Antioch, in conjunction with Caltrans and the City of Pittsburg, received a Program for Arterial System Synchronization (PASS) grant from the Metropolitan Transportation Commission to conduct a signal timing study for 10 traffic signals on Somersville Road and Auto Center Drive.

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. Six of the project intersections are owned, operated, and maintained by the City of Antioch, two of the traffic signals are within both the Cities of Antioch and Pittsburg right-of-way but operated by the City of Antioch, and two of the project intersections are owned, operated, and maintained by Caltrans.

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; develop coordination plans for the analysis periods; implement and fine-tune the recommended timings; and conduct “before” and “after” travel time surveys to assess the performance of the new plans.



BENEFITS TO VARIOUS MODES



BENEFITS TO BICYCLISTS: The minimum green time intervals were reviewed for bicyclists. Changes to minimum green intervals were made at one project intersection.



BENEFITS TO PEDESTRIANS: The pedestrian timings were reviewed based on the 2014 California MUTCD to enhance safety. The pedestrian clearance intervals were increased at seven 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. The yellow intervals were updated at eight of the project intersections.

Project Costs

Consultant Costs (Basic Services/Plans)	\$25,700
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	\$0
Other Project Costs (GPS Clocks, Communications equipment, etc.)	\$0
Agency Staff Costs (Estimate)	\$6,425
Total Costs	\$32,125

Project Benefits

Measures	First Year		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	11,754 hrs.	\$236,157	31,530 hrs.	\$633,505
Fuel Consumption Savings	43,461 gal.	\$162,282	116,585 gal.	\$435,330
ROG Emissions Reduction	0.17 tons	\$216	0.45 tons	\$580
NOx Emissions Reduction	0.11 tons	\$2,015	0.29 tons	\$5,407
PM2.5 Emissions Reduction	0.01 tons	\$2,052	0.02 tons	\$5,504
CO Emissions Reduction	1.21 tons	\$96	3.24 tons	\$258
Total Lifetime Benefits				\$1,080,584

Overall Project Benefits

	Auto
Average Decrease in Travel Time	12%
Average Speed Increase	17%
Average Fuel Savings	9%
Average Reduction in Signal Delay	30%
Average Reduction in Number of Stops	32%

Overall Benefit-Cost Ratio

34:1

PROJECT BENEFITS SUMMARY



Average Reduction in Auto Signal Delay: 30%

Average Reduction in Number of Stops: 32%

Auto Fuel Consumption Savings: 9% or 116,585 gallons

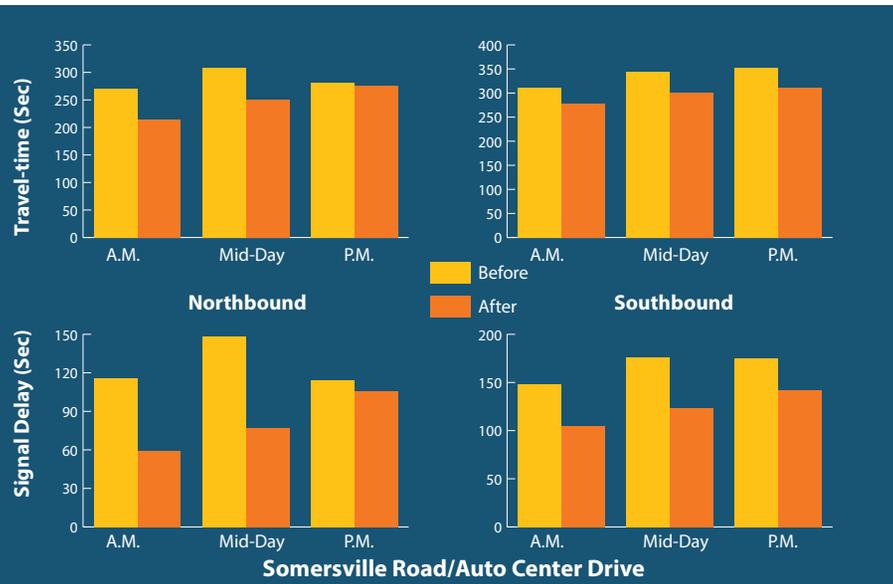


Total Emissions Reduced (ROG, NOx, PM2.5, CO): 4.0 tons

Auto Travel Time Savings: 12% or 31,530 hours



Overall Project Benefit-cost Ratio = 34:1



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City of Concord Signal Timing Project

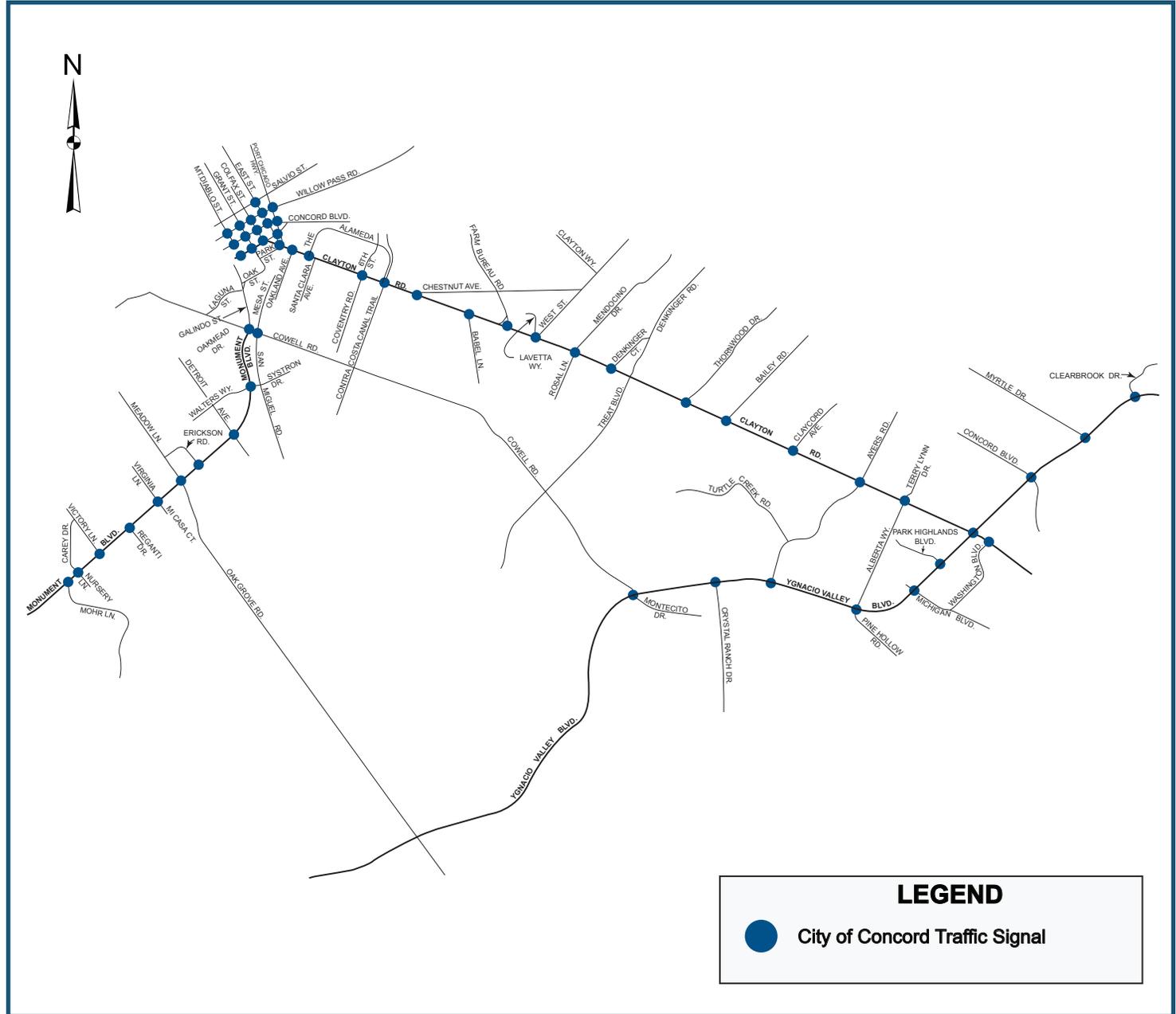
City of Concord | Metropolitan Transportation Commission

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 53 traffic signals along Kirker Pass Road, Ygnacio Valley Road, Clayton Road, and Monument Boulevard corridors. All of the project intersections are owned, operated, and maintained by the City of Concord.

The goal of the project was to conduct a timing analysis, develop, and implement signal coordination plans during weekdays for the 29 project signals and during weekends for the 24 project signals. Timing plans developed and implemented consisted of typical weekday AM, midday, PM, and weekend 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 "before" and "after" travel time surveys; review actuated settings; review collision history; develop the existing conditions model; develop coordination plans for the typical weekday AM, midday, PM, and weekend peak periods; implement and fine-tune the recommended timings; and document the analyses/findings for the project. The field fine-tuning was conducted during typical weekday and weekend peak periods and minor adjustments were made to the offsets and splits based on observed traffic conditions.



BENEFITS TO VARIOUS MODES



BENEFITS TO PEDESTRIANS:

The Walk timing and Flash Don't Walk clearance-timing parameters were updated at the 15 intersections to provide

adequate time for children and seniors to safely cross the study intersections to accommodate the new walking speed of 3.5 feet/second, as specified in the 2014 California MUTCD standards



BENEFITS TO TRAFFIC SAFETY:

The yellow clearance timing parameters were updated based on the posted speed limits along the study corridors at the 41 project intersections

and no changes were made to the all red clearance timing parameters.

Project Costs

Consultant Costs (Basic Services/Plans)	\$122,600
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	\$800
Other Project Costs (GPS Clocks, Communications equipment, etc.)	\$0
Agency Staff Costs (Estimate)	\$30,650
Total Costs	\$154,050

Project Benefits

Measures	First Year		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	77,964 hrs.	\$1,566,456	209,144 hrs.	\$4,202,107
Fuel Consumption Savings	277,156 gal.	\$1,034,900	743,487 gal.	\$2,776,179
ROG Emissions Reduction	0.79 tons	\$1,019	2.13 tons	\$2,733
NOx Emissions Reduction	0.62 tons	\$11,309	1.65 tons	\$30,336
PM2.5 Emissions Reduction	0.03 tons	\$10,041	0.08 tons	\$26,934
CO Emissions Reduction	8.89 tons	\$707	23.84 tons	\$1,898
Total Lifetime Benefits				\$7,040,187

Overall Project Benefits	Auto
Average Decrease in Travel Time	25%
Average Speed Increase	38%
Average Fuel Savings	19%
Average Reduction in Signal Delay	47%
Average Reduction in Number of Stops	54%
Overall Benefit-Cost Ratio	46:1

PROJECT BENEFITS SUMMARY



Average Reduction in Auto Signal Delay: 47%

Average Reduction in Number of Stops: 54%

Auto Fuel Consumption Savings: 19% or 743,487 gallons

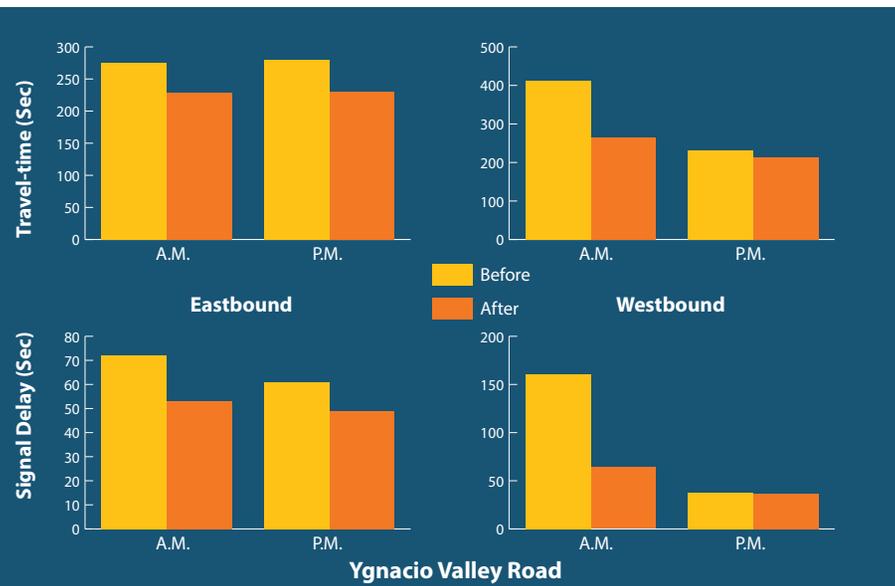


Total Emissions Reduced (ROG, NOx, PM2.5, CO): 27.7 tons

Auto Travel Time Savings: 25% or 209,144 hours



Overall Project Benefit-cost Ratio = 46:1



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Auto Mall Parkway - Coordination Timing Plan

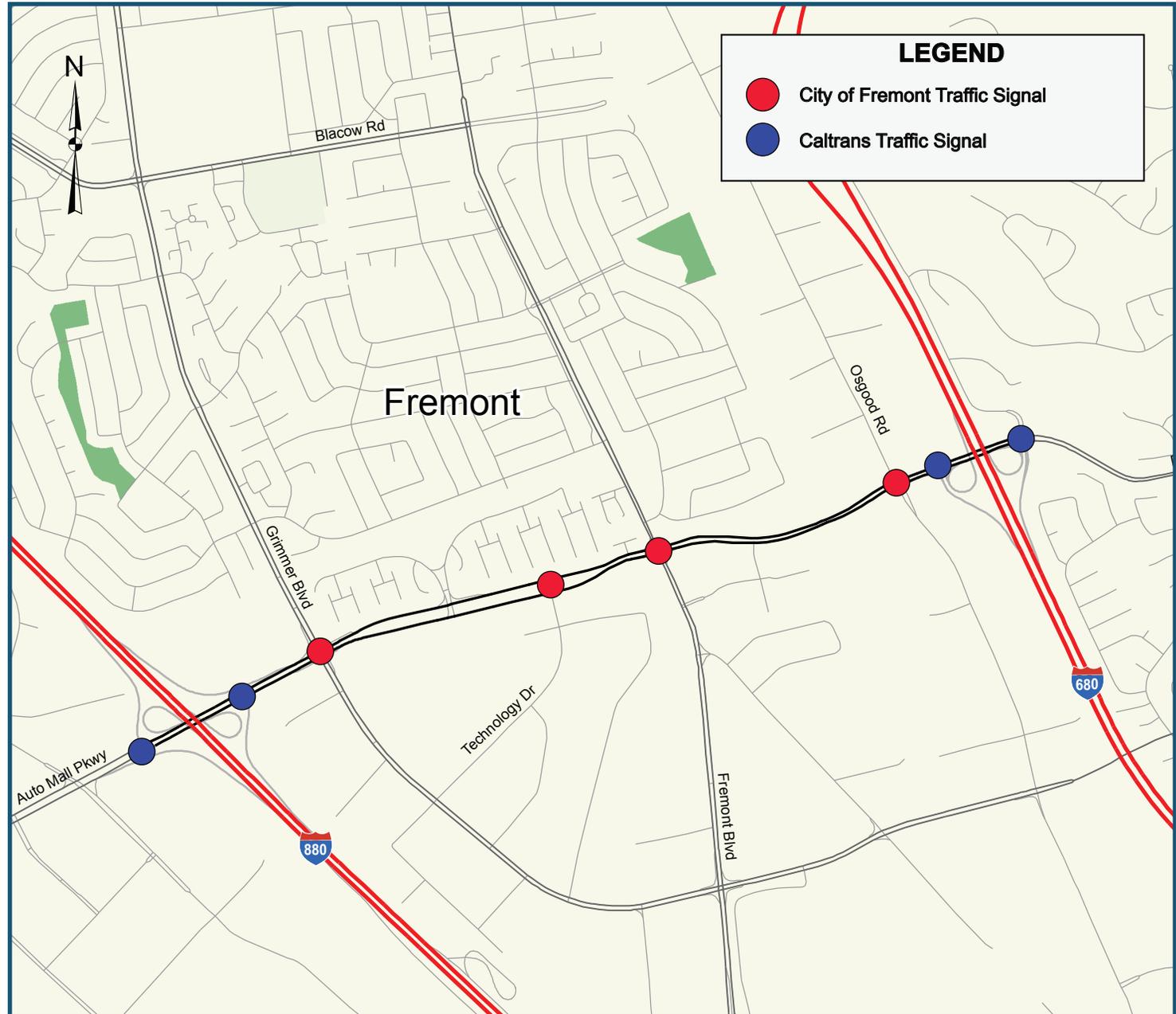
City of Fremont | Caltrans | Metropolitan Transportation Commission

PROJECT OVERVIEW

The City of Fremont, 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 eight traffic signals on Auto Mall Parkway.

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. Four traffic signals are owned, operated, maintained by each the City of Fremont and Caltrans.

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; develop coordination plans for the analysis periods; implement and fine-tune the recommended timings; and conduct "before" and "after" travel time surveys to assess the performance of the new plans.



BENEFITS TO VARIOUS MODES



BENEFITS TO BICYCLISTS: The minimum green intervals were reviewed for bicyclists on the corridors. Changes to the minimum green intervals were made at one intersection.



BENEFITS TO PEDESTRIANS: The pedestrian timings were reviewed based on the 2014 California MUTCD to enhance safety and changes were recommended at five project intersections.

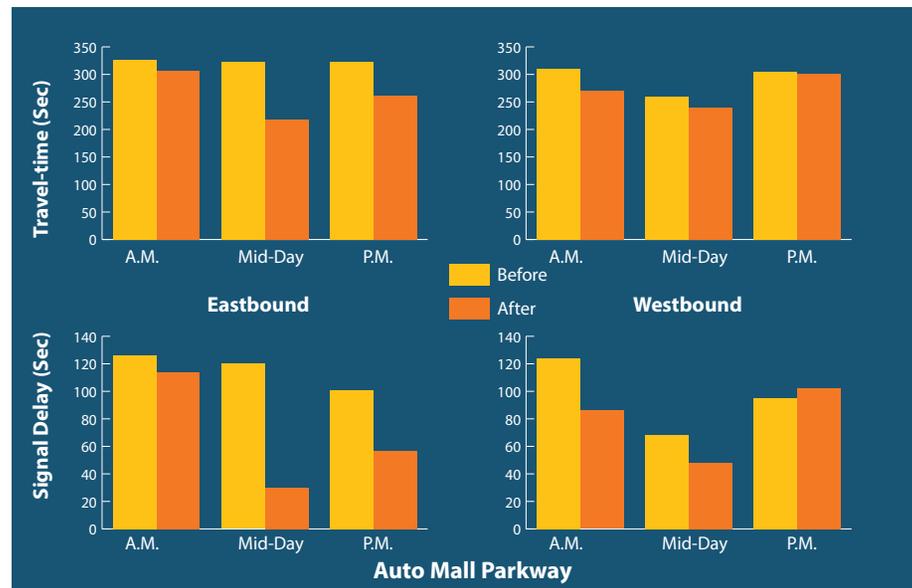


BENEFITS TO TRAFFIC SAFETY: A review of intersection-level collisions along the corridors was conducted to identify any collision patterns that may be corrected through signal timing adjustments. No specific timing changes were recommended as a result of the collision review. The yellow clearance timing parameters were updated at three project intersections to meet the 2014 California MUTCD standards.

Project Costs	
Consultant Costs (Basic Services/Plans)	\$20,800
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	\$0
Other Project Costs (GPS Clocks, Communications equipment, etc.)	\$0
Agency Staff Costs (Estimate)	\$5,200
Total Costs	\$26,000

Project Benefits				
Measures	First Year		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	26,410 hrs.	\$530,625	70,846 hrs.	\$1,423,433
Fuel Consumption Savings	105,963 gal.	\$395,665	284,251 gal.	\$1,061,395
ROG Emissions Reduction	0.32 tons	\$414	0.86 tons	\$1,110
NOx Emissions Reduction	0.27 tons	\$4,896	0.72 tons	\$13,133
PM2.5 Emissions Reduction	0.02 tons	\$5,263	0.04 tons	\$14,119
CO Emissions Reduction	3.38 tons	\$269	9.06 tons	\$721
Total Lifetime Benefits				\$2,513,911

Overall Project Benefits	Auto
Average Decrease in Travel Time	14%
Average Speed Increase	18%
Average Fuel Savings	12%
Average Reduction in Signal Delay	31%
Average Reduction in Number of Stops	29%
Overall Benefit-Cost Ratio	97:1



PROJECT BENEFITS SUMMARY



Average Reduction in Auto Signal Delay: 31%

Average Reduction in Number of Stops: 29%

Auto Fuel Consumption Savings: 12% or 284,251 gallons



Total Emissions Reduced (ROG, NOx, PM2.5, CO): 10.68 tons

Auto Travel Time Savings: 14% or 70,846 hours



Overall Project Benefit-cost Ratio = 97:1



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14th Street, Oak Street and 98th Avenue - 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 the 41 traffic signals along various corridors in the city. Thirty-seven of the project intersections are operated by the City of Oakland and the remaining 4 signals are operated by Caltrans.

The goal of the project was to conduct a timing analysis and develop and implement signal coordination plans during the weekday and weekend peak periods for the 41 project signals in Oakland. Timing plans developed and implemented consisted of weekday AM, midday, PM, and weekend 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 typical weekday AM, midday, PM, and weekend peaks; implement and fine-tune the recommended timings; conduct the "before" and "after" travel time surveys; and document the analyses/findings for the project.



GPS SIGNAL COMMUNICATIONS

To provide a common time-source and enable communication between the signals, 32 GPS clocks were installed as a part of the project. These GPS clocks 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: To improve safety, the minimum green intervals were reviewed for bicyclists on the corridors. Changes to minimum green intervals were made at three intersections.



BENEFITS TO PEDESTRIANS: The pedestrian timings were reviewed based on the 2014 California MUTCD to enhance safety and changes were implemented at all project intersections.

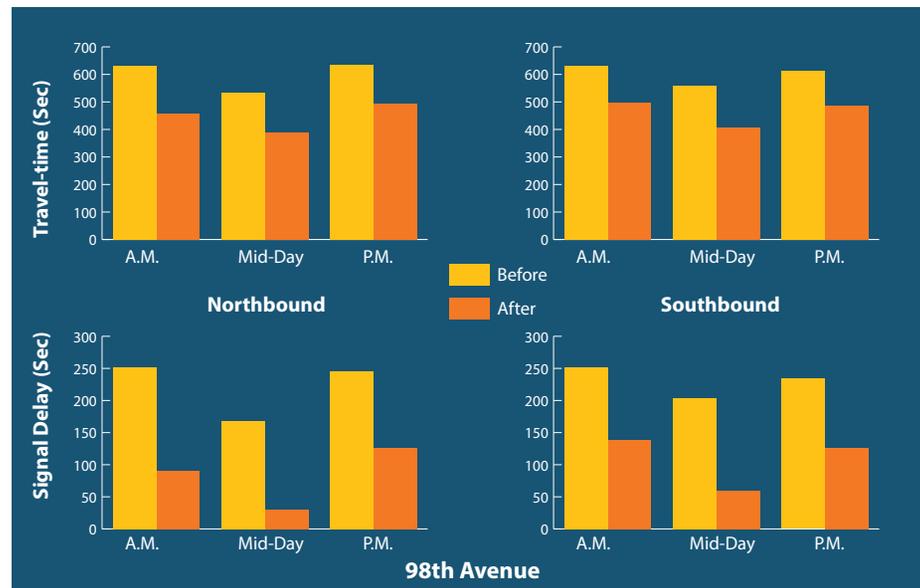


BENEFITS TO TRAFFIC SAFETY: To enhance traffic safety, the yellow clearance timing parameters were updated at all the study intersections based on 85th percentile speeds and the posted speed limits.

Project Costs	
Consultant Costs (Basic Services/Plans)	\$143,987
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	\$24,000
Other Project Costs (GPS Clocks, Communications equipment, etc.)	\$16,000
Agency Staff Costs (Estimate)	\$35,997
Total Costs	\$219,984

Measures	First Year		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	58,762 hrs.	\$1,180,652	157,633 hrs.	\$3,167,165
Fuel Consumption Savings	241,201 gal.	\$900,644	647,035 gal.	\$2,416,027
ROG Emissions Reduction	0.78 tons	\$1,006	2.10 tons	\$2,698
NOx Emissions Reduction	0.62 tons	\$11,420	1.67 tons	\$30,635
PM2.5 Emissions Reduction	0.03 tons	\$8,009	0.07 tons	\$21,485
CO Emissions Reduction	7.02 tons	\$559	18.84 tons	\$1,500
Total Lifetime Benefits				\$5,639,510

Overall Project Benefits	Auto
Average Decrease in Travel Time	25%
Average Speed Increase	37%
Average Fuel Savings	20%
Average Reduction in Signal Delay	51%
Average Reduction in Number of Stops	55%
Overall Benefit-Cost Ratio	29:1



PROJECT BENEFITS SUMMARY



Average Reduction in Auto Signal Delay: 51%

Average Reduction in Number of Stops: 55%

Auto Fuel Consumption Savings: 20% or 647,035 gallons



Total Emissions Reduced (ROG, NOx, PM2.5, CO): 22.7 tons

Auto Travel Time Savings: 25% or 157,633 hours



Overall Project Benefit-cost Ratio = 29:1



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San Bruno Avenue - Coordination Timing Plan

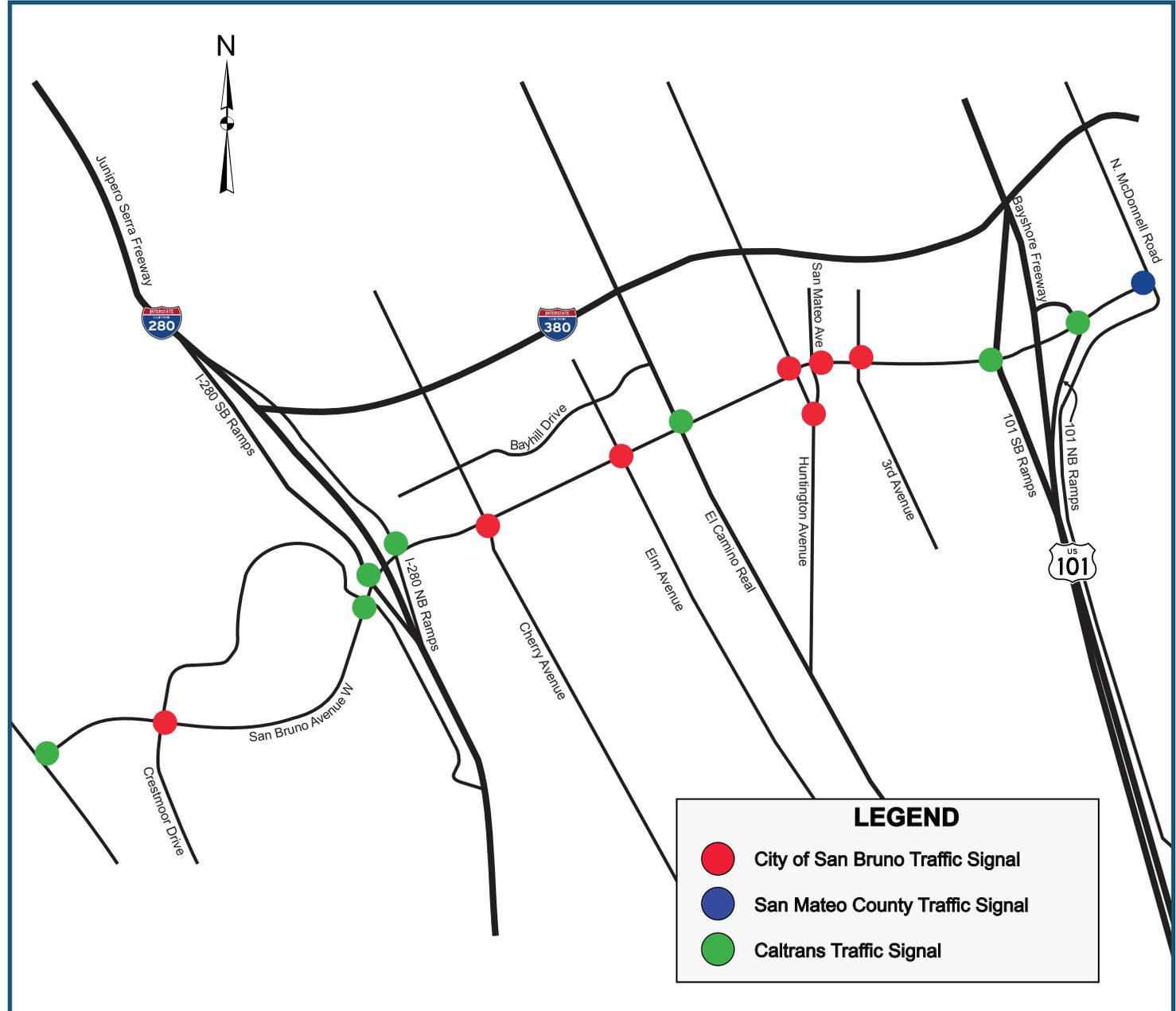
City of San Bruno | Caltrans | Metropolitan Transportation Commission

PROJECT OVERVIEW

The City of San Bruno, 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 a total of 15 traffic signals along the San Bruno Avenue corridor.

The overall goal of the project was to facilitate traffic progression along San Bruno Avenue, and update the timing parameters to comply with recent changes as per the California MUTCD traffic signal guidelines. Timing plans for the weekday AM, midday, and PM peak periods were prepared and implemented. Seven traffic signals are owned, operated, and maintained by each of the City of San Bruno and Caltrans. The remaining one traffic signal is owned, operated, and maintained by the County of San Mateo.

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



GPS SIGNAL COMMUNICATIONS

To provide a common time-source and enable communication between the signals, 5 GPS clocks were installed as a part of the project. These GPS clocks enable the signal controllers to regularly synchronize their clocks

BENEFITS TO VARIOUS MODES



BENEFITS TO BICYCLISTS: The minimum green time was increased for the through movements at each study intersection to enhance traffic safety for bicyclists traveling along the San Bruno Avenue corridor.



BENEFITS TO PEDESTRIANS: The Walk time and Flashing Don't Walk clearance timing parameters were updated at 10 intersections to provide adequate time for children and seniors to safely cross the study intersections.

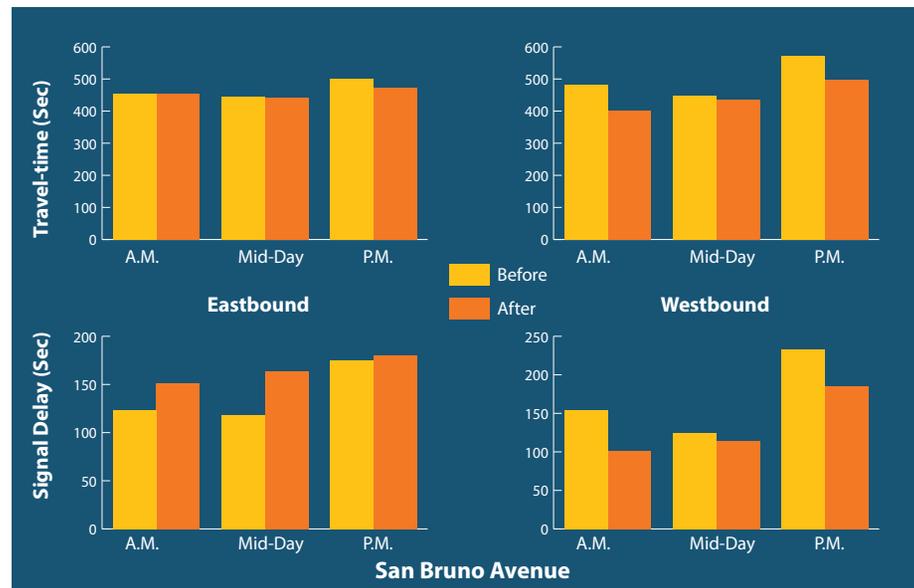


BENEFITS TO TRAFFIC SAFETY: To enhance traffic safety, the yellow clearance timing parameters were updated based on the posted speed limits along the study corridors, and the all red clearance timing parameters were updated based on the results of the collision analysis presented in the existing conditions analysis. These parameters were changed at seven of the study intersections.

Project Costs	
Consultant Costs (Basic Services/Plans)	\$40,500
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	\$0
Other Project Costs (GPS Clocks, Communications equipment, etc.)	\$2,500
Agency Staff Costs (Estimate)	\$10,125
Total Costs	\$53,125

Measures	First Year		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	7,830 hrs.	\$157,330	21,006 hrs.	\$422,046
Fuel Consumption Savings	22,774 gal.	\$85,038	61,092 gal.	\$228,118
ROG Emissions Reduction	0.057 tons	\$74	0.154 tons	\$198
NOx Emissions Reduction	0.049 tons	\$891	0.130 tons	\$2,390
PM2.5 Emissions Reduction	0.002 tons	\$566	0.005 tons	\$1,517
CO Emissions Reduction	0.695 tons	\$55	1.865 tons	\$148
Total Lifetime Benefits		\$654,418		

Overall Project Benefits	Auto
Average Decrease in Travel Time	7%
Average Speed Increase	7%
Average Fuel Savings	4%
Average Reduction in Signal Delay	4%
Average Reduction in Number of Stops	8%
Overall Benefit-Cost Ratio	12:1



PROJECT BENEFITS SUMMARY



Average Reduction in Auto Signal Delay: 4%

Average Reduction in Number of Stops: 8%

Auto Fuel Consumption Savings: 4% or 61,092 gallons



Total Emissions Reduced (ROG, NOx, PM2.5, CO): 2.2 tons

Auto Travel Time Savings: 7% or 21,006 hours



Overall Project Benefit-cost Ratio = 12:1



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City of San Ramon Signal Timing Project

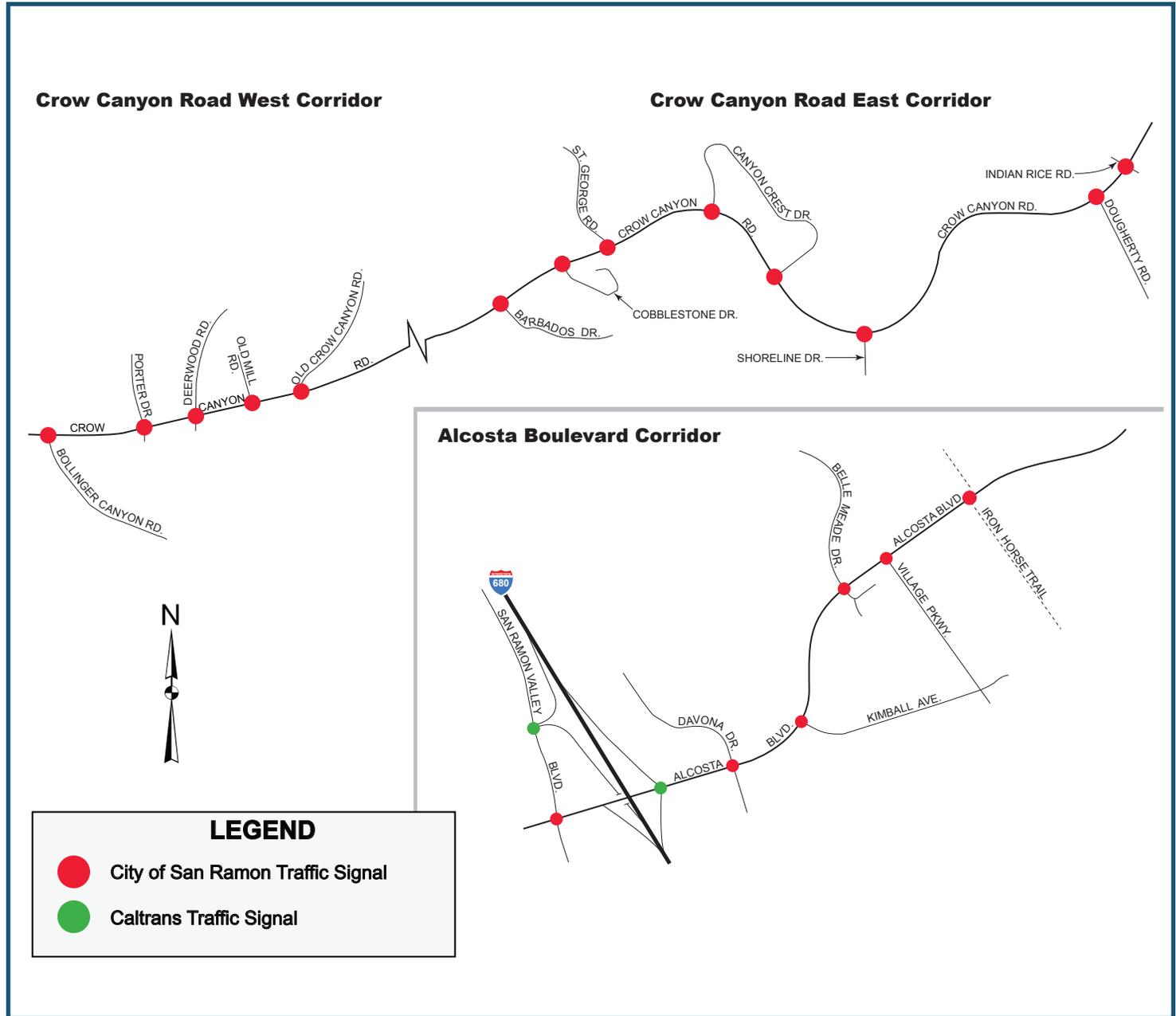
City of San Ramon | Caltrans | Metropolitan Transportation Commission

PROJECT OVERVIEW

The City of San Ramon received a grant from the Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to conduct a signal timing study for 21 traffic signals along Alcosta Boulevard, Crow Canyon Road (West), and Crow Canyon Road (East) corridors. Nineteen of the project intersections are owned, operated, and maintained by the City of San Ramon and the two project intersections are owned, operated, and maintained by Caltrans.

The goal of the project was to conduct a timing analysis, develop, and implement signal coordination plans during the weekdays for 21 traffic signals and during the weekends for 18 project signals. Timing plans developed and implemented consisted of a typical weekday AM, midday, PM, and weekend peak periods.

The PASS project involved the completion of the following tasks: collect turning movement counts, including vehicles, pedestrians, and bicycles; conduct field review of the project area; conduct "before" and "after" travel time surveys; review actuated settings; review collision history; develop the existing conditions model; develop coordination plans for the typical weekday AM, midday, PM, and weekend peak periods; implement and fine-tune the recommended timings;



PROJECT OVERVIEW (CONTINUED)

and document the analyses/findings for the project. The field fine-tuning was conducted during typical weekday and weekend peak periods and minor adjustments were made to the offsets and splits based on observed traffic conditions.

BENEFITS TO VARIOUS MODES



BENEFITS TO BICYCLISTS: The minimum green intervals were reviewed for bicyclists on the corridor. Changes to the minimum green intervals were made at 18 study intersections.



BENEFITS TO PEDESTRIANS: The Walk timing and Flash Don't Walk clearance-timing parameters were updated at 14 intersections to provide adequate time for children and seniors to safely cross the study intersections to accommodate the new walking speed of 3.5 feet/second, as specified in the 2014 California MUTCD standards.

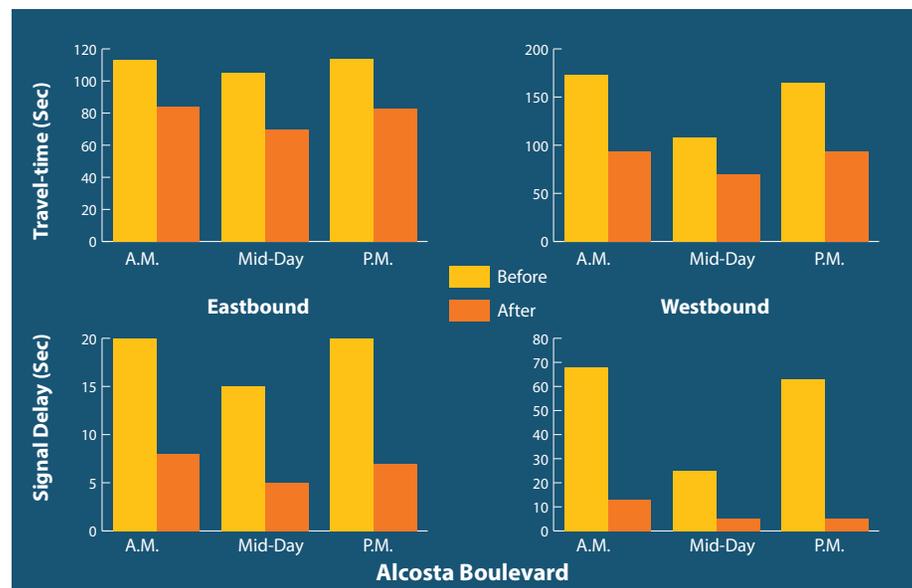


BENEFITS TO TRAFFIC SAFETY: The yellow clearance timing parameters were updated based on the posted speed limits along the study corridors at 11 project intersections and no changes were made to all red clearance timing parameters.

Project Costs	
Consultant Costs (Basic Services/Plans)	\$104,600
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	\$0
Other Project Costs (GPS Clocks, Communications equipment, etc.)	\$0
Agency Staff Costs (Estimate)	\$26,150
Total Costs	\$130,750

Measures	First Year		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	58,508 hrs.	\$1,175,537	156,950 hrs.	\$3,153,444
Fuel Consumption Savings	139,088 gal.	\$519,356	373,113 gal.	\$1,393,202
ROG Emissions Reduction	0.39 tons	\$501	1.05 tons	\$1,344
NOx Emissions Reduction	0.17 tons	\$3,054	0.45 tons	\$8,192
PM2.5 Emissions Reduction	0.02 tons	\$5,526	0.05 tons	\$14,823
CO Emissions Reduction	5.11 tons	\$406	13.70 tons	\$1,090
Total Lifetime Benefits				\$4,572,096

Overall Project Benefits	Auto
Average Decrease in Travel Time	31%
Average Speed Increase	46%
Average Fuel Savings	21%
Average Reduction in Signal Delay	56%
Average Reduction in Number of Stops	64%
Overall Benefit-Cost Ratio	35:1



PROJECT BENEFITS SUMMARY



Average Reduction in Auto Signal Delay: 56%

Average Reduction in Number of Stops: 64%

Auto Fuel Consumption Savings: 21% or 373,113 gallons



Total Emissions Reduced (ROG, NOx, PM2.5, CO): 15.3 tons

Auto Travel Time Savings: 31% or 156,950 hours



Overall Project Benefit-cost Ratio = 35:1



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PROGRAM FOR ARTERIAL SYSTEM SYNCHRONIZATION (PASS) FY14/15 CYCLE

East Grand Avenue, Airport Boulevard, South Airport Boulevard and El Camino Real - Signal Timing Project

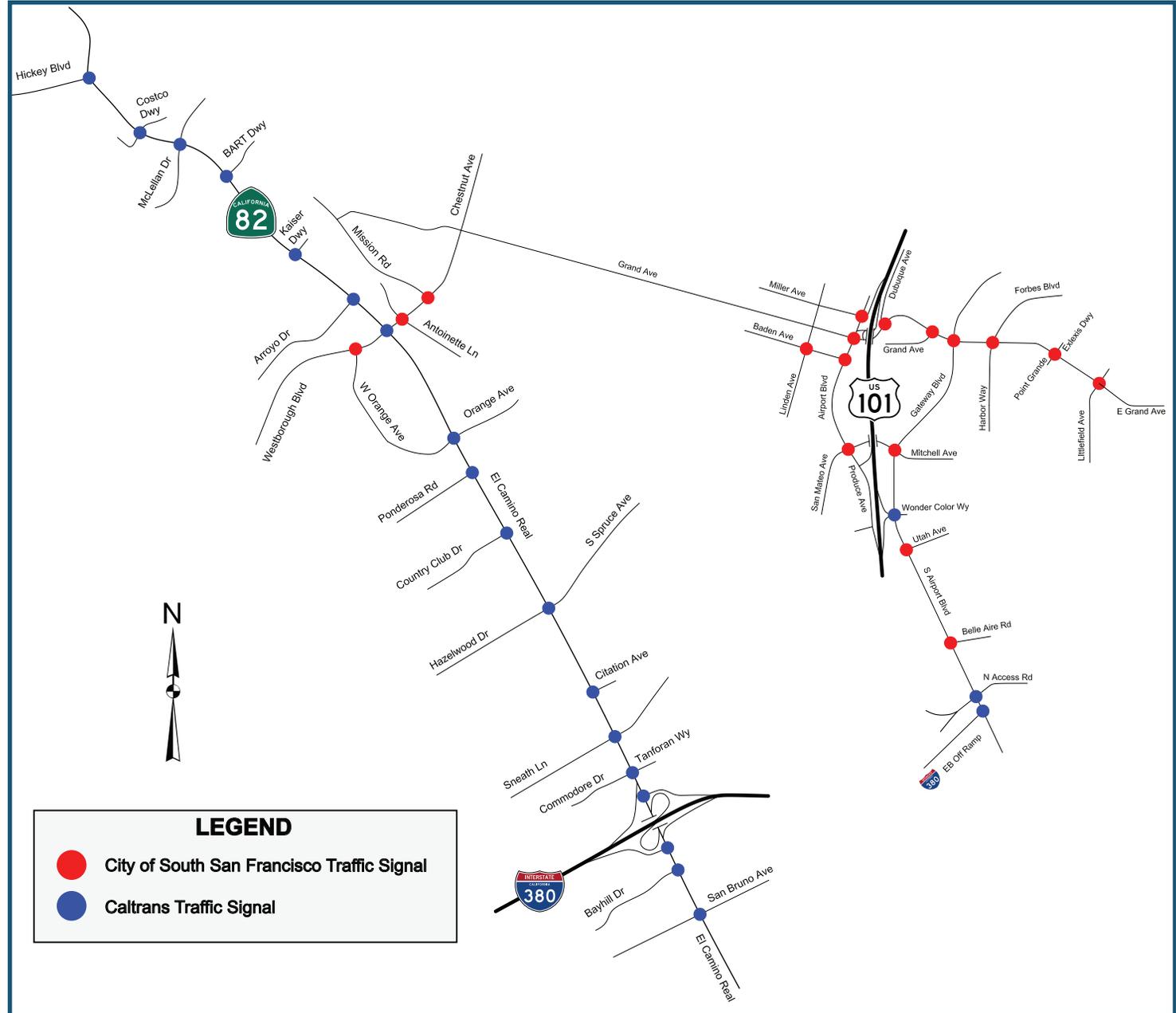
City of South San Francisco | Caltrans | Metropolitan Transportation Commission

PROJECT OVERVIEW

The City of South San Francisco received a grant from the Metropolitan Transportation Commission's Program for Arterial System Synchronization (PASS) to conduct a signal timing study for the 38 traffic signals along East Grand Avenue, Airport Boulevard, South Airport Boulevard, and El Camino Real corridors. Seventeen of the project intersections are operated by the City of South San Francisco and the remaining 21 signals are operated by Caltrans. All intersections were identified for retiming during the weekday AM, midday, PM, and weekend AM and PM peak periods.

The goal of the project was to facilitate traffic progression along the study corridors and to optimize signal timing plans to achieve operational efficiency of the traffic signals.

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 typical weekday AM, midday, PM, and weekend AM peak and PM peak periods; implement and fine-tuning the recommended timings;



PROJECT OVERVIEW (CONTINUED)

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

GPS SIGNAL COMMUNICATIONS

To provide a common GPS-based time source and enable communication between signals, GPS devices were installed at 10 intersections. These devices enable the signal controllers to regularly synchronize their clocks and help maintain the efficiency of signal coordination.

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 all intersections.



BENEFITS TO PEDESTRIANS: The pedestrian timings were reviewed based on the 2014 California MUTCD to enhance safety and changes were made at all project intersections.

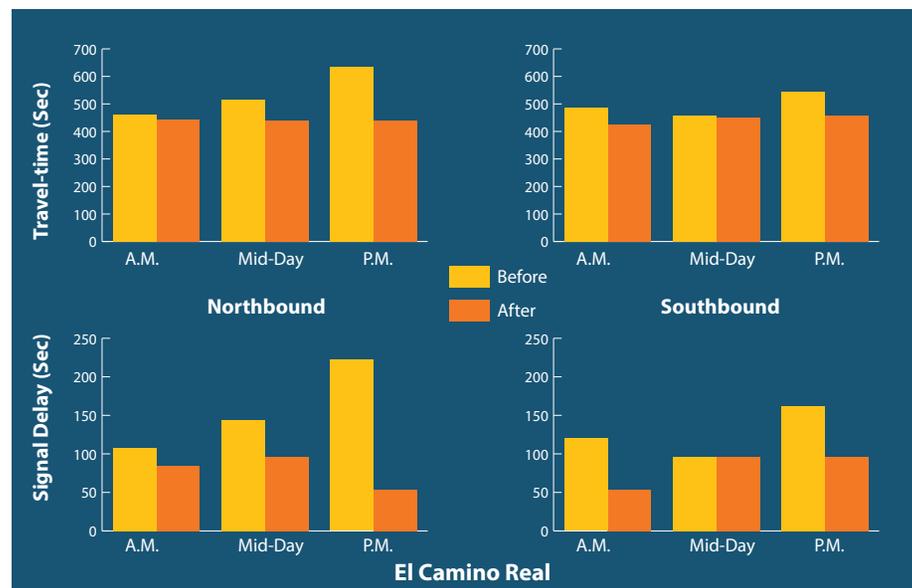


BENEFITS TO TRAFFIC SAFETY: To enhance traffic safety, the yellow clearance timing parameters were updated based on the 85th percentile speeds and the posted speed limits.

Project Costs	
Consultant Costs (Basic Services/Plans)	\$153,000
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	\$0
Other Project Costs (GPS Clocks, Communications equipment, etc.)	\$4,000
Agency Staff Costs (Estimate)	\$38,250
Total Costs	\$195,250

Project Benefits				
Measures	First Year		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	96,163 hrs.	\$1,932,114	257,964 hrs.	\$5,183,004
Fuel Consumption Savings	351,562 gal.	\$1,312,732	943,084 gal.	\$3,521,477
ROG Emissions Reduction	1.18 tons	\$1,511	3.16 tons	\$4,054
NOx Emissions Reduction	0.86 tons	\$15,859	2.32 tons	\$42,543
PM2.5 Emissions Reduction	0.04 tons	\$13,383	0.11 tons	\$35,900
CO Emissions Reduction	11.13 tons	\$886	29.86 tons	\$2,377
Total Lifetime Benefits				\$8,789,355

Overall Project Benefits	Auto
Average Decrease in Travel Time	21%
Average Speed Increase	40%
Average Fuel Savings	16%
Average Reduction in Signal Delay	44%
Average Reduction in Number of Stops	47%
Overall Benefit-Cost Ratio	45:1



PROJECT BENEFITS SUMMARY



Average Reduction in Auto Signal Delay: 44%

Average Reduction in Number of Stops: 47%

Auto Fuel Consumption Savings: 16% or 943,084 gallons



Total Emissions Reduced (ROG, NOx, PM2.5, CO): 35.5 tons

Auto Travel Time Savings: 21% or 257,964 hours



Overall Project Benefit-cost Ratio = 45:1



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ADVANTEC Consulting Engineers



Whipple Road and Dyer Street - Coordination Timing Plan

City of Union City | City of Hayward | Caltrans | Metropolitan Transportation Commission

PROJECT OVERVIEW

The City of Union City, in conjunction with the City of Hayward and Caltrans, received a Program for Arterial System Synchronization (PASS) grant from the Metropolitan Transportation Commission (MTC) to conduct a signal timing study for 19 traffic signals on Whipple Road and Dyer Street.

The goal of the project was to conduct timing analysis, develop, and implement signal coordination plans during the AM, midday, and PM peak periods. Twelve of the project intersections are owned, operated, and maintained by the City of Union City; two of the project intersections are owned, operated, and maintained by the City of Hayward; three of the project intersections are owned by the Cities of Union City and Hayward but operated and maintained by the City of Hayward; and the remaining two project intersections are owned, operated, and maintained by Caltrans.

The PASS project involved the completion of the following major tasks: collect turning movement counts, including vehicles, pedestrians, and bicycles; review collision history; prepare coordination plans for the analysis periods; implement and fine-tune the recommended timings; conduct "before" and "after" travel time surveys to assess the performance of the new plans; and document the analyses and findings of the project.



GPS SIGNAL COMMUNICATIONS

To provide a common time-source and enable communication between the signals, three GPS clocks were installed as a part of the project. These GPS clocks enable the signal controllers to regularly synchronize their clocks.

BENEFITS TO VARIOUS MODES



BENEFITS TO BICYCLISTS: To improve safety, the minimum green intervals were reviewed for bicyclists on the corridors. Changes to the minimum green intervals were made at 14 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 timings were reviewed based on the 2014 California MUTCD to enhance safety and changes were recommended at six project intersections.

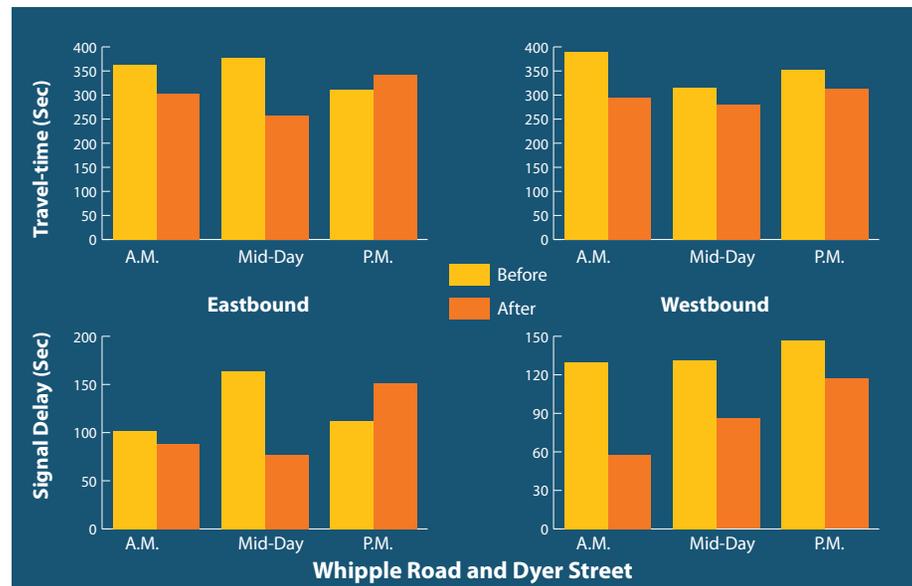


BENEFITS TO TRAFFIC SAFETY: A review of intersection-level collisions along the corridors was conducted to identify any collision patterns that may be corrected through signal timing adjustments. No specific timing changes were recommended as a result of the collision review. The yellow time intervals were updated at 16 project intersections to meet the current California MUTCD.

Project Costs	
Consultant Costs (Basic Services/Plans)	\$48,900
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	\$0
Other Project Costs (GPS Clocks, Communications equipment, etc.)	\$0
Agency Staff Costs (Estimate)	\$12,225
Total Costs	\$61,125

Measures	First Year		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	26,888 hrs.	\$540,235	72,129 hrs.	\$1,449,212
Fuel Consumption Savings	69,156 gal.	\$258,227	185,514 gal.	\$692,710
ROG Emissions Reduction	0.20 tons	\$258	0.54 tons	\$692
NOx Emissions Reduction	0.14 tons	\$2,483	0.36 tons	\$6,661
PM2.5 Emissions Reduction	0.01 tons	\$2,608	0.02 tons	\$6,995
CO Emissions Reduction	2.11 tons	\$168	5.67 tons	\$451
Total Lifetime Benefits				\$2,156,721

Overall Project Benefits	Auto
Average Decrease in Travel Time	13%
Average Speed Increase	18%
Average Fuel Savings	10%
Average Reduction in Signal Delay	24%
Average Reduction in Number of Stops	30%
Overall Benefit-Cost Ratio	35:1



PROJECT BENEFITS SUMMARY



Average Reduction in Auto Signal Delay: 25%

Average Reduction in Number of Stops: 30%

Auto Fuel Consumption Savings: 10% or 185,514 gallons



Total Emissions Reduced (ROG, NOx, PM2.5, CO): 6.6 tons

Auto Travel Time Savings: 13% or 72,129 hours



Overall Project Benefit-cost Ratio = 35:1



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City of Walnut Creek Signal Timing Project

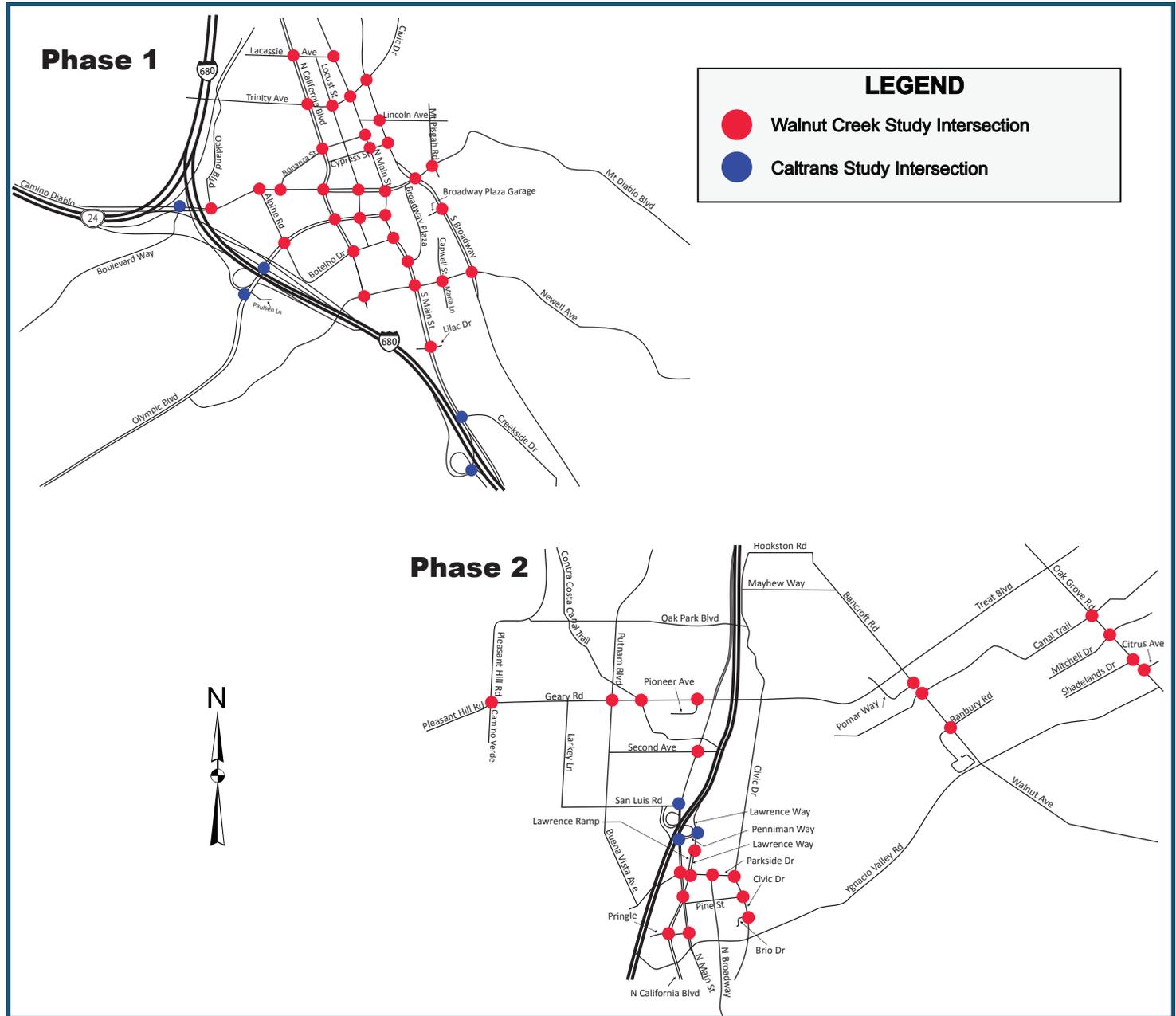
City of Walnut Creek | Caltrans | Metropolitan Transportation Commission

PROJECT OVERVIEW

The City of Walnut Creek, in conjunction with Caltrans, received a Program for Arterial System Synchronization (PASS) grant from the Metropolitan Transportation Commission (MTC) to conduct a signal timing study for 62 traffic signals along the 12 study corridors. Eight of the project traffic signals are owned by Caltrans and the remaining 54 project traffic signals are owned by the City of Walnut Creek. All of the project intersections are operated and maintained by the City of Walnut Creek. All the traffic signals are operated with Naztec 2070 controllers and are interconnected via copper hardware to the City of Walnut Creek's ATMS.now traffic management center. As part of the project, signal timing plans were developed for the AM, midday, and PM peak periods.

The goal of the project was to facilitate traffic progression along the study corridors, and update the timing parameters to comply with recent changes in the 2014 CA MUTCD traffic signal timing guidelines. The new timing plans should reduce traffic congestion, reduce traffic delays, reduce the emission of harmful greenhouse gases, reduce automobile travel time along the study corridors, and improve traffic safety.

The PASS project involved the completion of the following tasks: collect turning movement counts, including vehicles, pedestrians, and bicycles;



PROJECT OVERVIEW (CONTINUED)

conduct field review of the project area; conduct travel time surveys; review collision history; and document the analyses and findings of the project.

BENEFITS TO VARIOUS MODES



BENEFITS TO PEDESTRIANS:

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



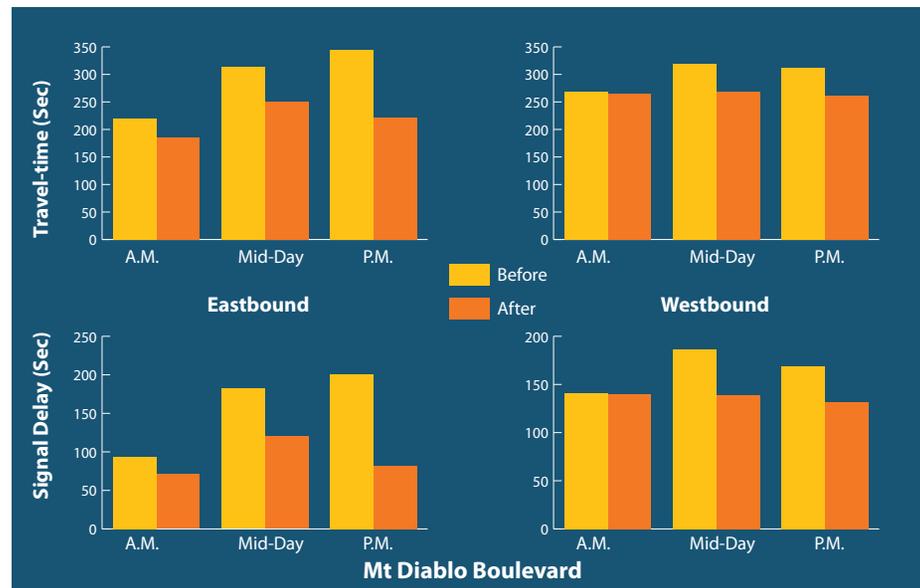
BENEFITS TO TRAFFIC SAFETY:

To enhance traffic safety, the yellow clearance timing parameters were updated based on the posted speed limits along the study corridors, and the all red clearance timing parameters were updated based on the results of the collision analysis presented in the existing conditions analysis. The yellow timing and the all red timing parameters were changed at 10 and six study intersections respectively.

Project Costs	
Consultant Costs (Basic Services/Plans)	\$222,500
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	\$0
Other Project Costs (GPS Clocks, Communications equipment, etc.)	\$0
Agency Staff Costs (Estimate)	\$55,625
Total Costs	\$278,125

Project Benefits				
Measures	First Year		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	103,604 hrs.	\$2,081,619	277,925 hrs.	\$5,584,060
Fuel Consumption Savings	270,001 gal.	\$1,008,183	724,293 gal.	\$2,704,509
ROG Emissions Reduction	1.05 tons	\$1,348	2.82 tons	\$3,615
NOx Emissions Reduction	0.66 tons	\$12,158	1.78 tons	\$32,615
PM2.5 Emissions Reduction	0.04 tons	\$11,867	0.10 tons	\$31,834
CO Emissions Reduction	7.41 tons	\$590	19.87 tons	\$1,581
Total Lifetime Benefits				\$8,358,214

Overall Project Benefits	Auto
Average Decrease in Travel Time	12%
Average Speed Increase	22%
Average Fuel Savings	9%
Average Reduction in Signal Delay	22%
Average Reduction in Number of Stops	17%
Overall Benefit-Cost Ratio	30:1



PROJECT BENEFITS SUMMARY



Average Reduction in Auto Signal Delay: 22%

Average Reduction in Number of Stops: 17%

Auto Fuel Consumption Savings: 9% or 724,293 gallons



Total Emissions Reduced (ROG, NOx, PM2.5, CO): 24.6 tons

Auto Travel Time Savings: 12% or 277,925 hours



Overall Project Benefit-cost Ratio = 30:1

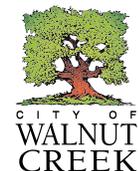


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Project Consultant:
DKS Associates



PROJECT OVERVIEW (CONTINUED)

daily, weekly, and monthly traffic fluctuations. Therefore, coordination will operate during only those times at which it is needed and with the most appropriate timing plan, resulting in reduced delay, vehicle emissions, and improved safety. The PASS project involved the completion of the following major tasks: collect detector data and existing timing plan information; collect turning movement counts, including vehicular, pedestrians, and bicycle counts; conduct field review of the project area; conduct travel time surveys; review actuated settings; review collision history; and document the analyses and findings of the project.

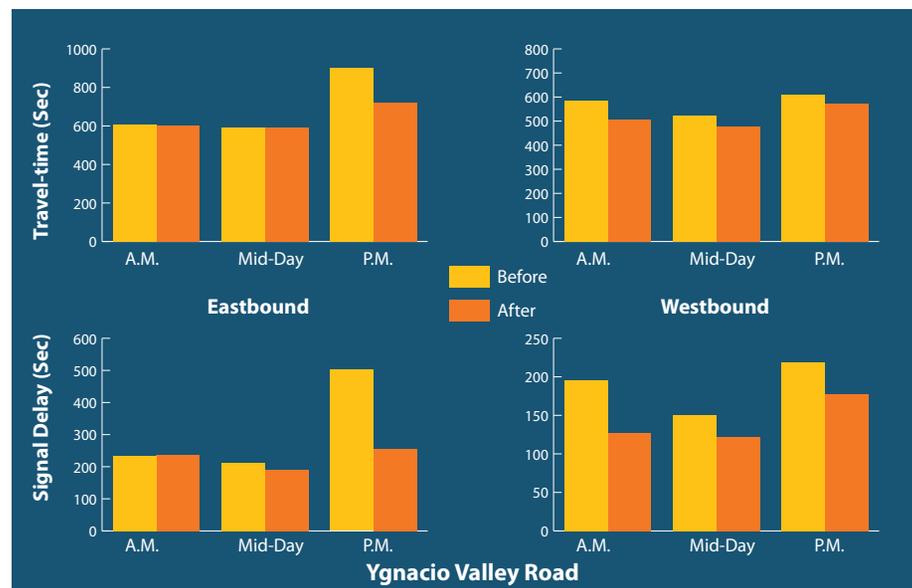
PROJECT BENEFITS

Since the traffic responsive operation will be in place during periods with varying volumes, such as during different times of the year where traffic is lighter (holidays or summer) or periods where traffic is heavier (during incidents on the freeway when traffic diverts to the corridor). Existing bicycle and pedestrian timings were maintained with the traffic responsive timing. Therefore, the implementation of traffic responsive timing did not have a negative impact on pedestrian and bicycle timings and in some cases even reduced the pedestrian and bicycle delay when lower cycle lengths are selected during lighter traffic periods.

Project Costs	
Consultant Costs (Basic Services/Plans)	\$76,785
Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)	\$0
Other Project Costs (GPS Clocks, Communications equipment, etc.)	\$0
Agency Staff Costs (Estimate)	\$19,196
Total Costs	\$95,981

Project Benefits				
Measures	First Year		Lifetime (5 Years)	
	Savings	Monetized Savings	Savings	Monetized Savings
Travel Time Savings	108,315 hrs.	\$2,176,256	290,560 hrs.	\$5,837,930
Fuel Consumption Savings	412,672 gal.	\$1,540,919	1,107,017 gal.	\$4,133,601
ROG Emissions Reduction	1.43 tons	\$1,835	3.83 tons	\$4,923
NOx Emissions Reduction	0.85 tons	\$15,687	2.29 tons	\$42,080
PM2.5 Emissions Reduction	0.06 tons	\$18,343	0.15 tons	\$49,206
CO Emissions Reduction	12.67 tons	\$1,008	33.99 tons	\$2,705
Total Lifetime Benefits	\$10,070,446			

Overall Project Benefits	Auto
Average Decrease in Travel Time	12%
Average Speed Increase	14%
Average Fuel Savings	8%
Average Reduction in Signal Delay	32%
Average Reduction in Number of Stops	35%
Overall Benefit-Cost Ratio	105:1



PROJECT BENEFITS SUMMARY



Average Reduction in Auto Signal Delay: 32%

Average Reduction in Number of Stops: 35%

Auto Fuel Consumption Savings: 8% or 1,107,017 gallons



Total Emissions Reduced (ROG, NOx, PM2.5, CO): 40.3 tons

Auto Travel Time Savings: 12% or 290,560 hours



Overall Project Benefit-cost Ratio = 105:1



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Program Partner:

CALTRANS

Project Sponsors:

ALAMEDA COUNTY

CITY OF ANTIOCH

CITY OF CONCORD

CITY OF FREMONT

CITY OF HAYWARD

CITY OF OAKLAND

CITY OF PITTSBURG

CITY OF SAN BRUNO

CITY OF SAN RAMON

CITY OF SOUTH SAN FRANCISCO

CITY OF UNION CITY

CITY OF WALNUT CREEK

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ADVANTEC CONSULTING ENGINEERS

DKS ASSOCIATES

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