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PASS FY 14/15 CYCLE SUMMARY

PROJECT FACT SHEETS FOR:

ALAMEDA COUNTY | CALTRANS

CITY OF ANTIOCH | CITY OF PITTSBURG | CALTRANS

CITY OF CONCORD

CITY OF FREMONT | CALTRANS

CITY OF OAKLAND | CALTRANS

CITY OF SAN BRUNO | CALTRANS

CITY OF SAN RAMON | CALTRANS

CITY OF SOUTH SAN FRANCISCO | CALTRANS

CITY OF UNION CITY | CITY OF HAYWARD | CALTRANS

CITY OF WALNUT CREEK | CALTRANS

CITY OF WALNUT CREEK | CALTRANS
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.

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

Total Signals: 306
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.

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### 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**

---

### Project Costs

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
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<tr>
<td>Consultant Costs (Basic Services/Plans)</td>
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<tr>
<td>Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)</td>
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<tr>
<td>Other Project Costs (GPS Clocks, Communications equipment, etc.)</td>
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<tr>
<td>Agency Staff Costs (Estimate)</td>
<td>$8,100</td>
</tr>
</tbody>
</table>

**Total Costs:** $40,500

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### Project Benefits

**Measures**

<table>
<thead>
<tr>
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<th>First Year</th>
<th>Lifetime (5 Years)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Savings</td>
<td>Monetized Savings</td>
</tr>
<tr>
<td>Travel Time Savings</td>
<td>8,600 hrs.</td>
<td>$172,795</td>
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<tr>
<td>Fuel Consumption Savings</td>
<td>32,270 gal.</td>
<td>$120,498</td>
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<tr>
<td>ROG Emissions Reduction</td>
<td>0.093 tons</td>
<td>$119</td>
</tr>
<tr>
<td>NOx Emissions Reduction</td>
<td>0.093 tons</td>
<td>$1,707</td>
</tr>
<tr>
<td>PM2.5 Emissions Reduction</td>
<td>0.002 tons</td>
<td>$781</td>
</tr>
<tr>
<td>CO Emissions Reduction</td>
<td>0.955 tons</td>
<td>$76</td>
</tr>
</tbody>
</table>

**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

---

### Agency Staff Costs

- **Estimate:** $8,100

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### Other Project Costs

- **GPS Clocks, Communications equipment, etc.:** $0

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### Consultant Costs

- **Basic Services/Plans:** $32,400
- **Additional Plans, TSP, IM Flush Plans, etc.:** $0

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### For more info, please contact:

**Jay Stagi (MTC)**
Arterial Operations Program Coordinator
Phone: 510.817.5808 • Email: JStagi@mtc.ca.gov

**Tam Nguyen (Alameda County)**
Associate Engineer • Phone: 510.670.5758
Email: tam@acpwa.org

**Project Consultant:**
DKS Associates

---

### Castro Valley Boulevard

**Travel-time (Sec)**

<table>
<thead>
<tr>
<th></th>
<th>A.M.</th>
<th>Mid-Day</th>
<th>P.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastbound</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Westbound</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Signal Delay (Sec)**

<table>
<thead>
<tr>
<th></th>
<th>A.M.</th>
<th>Mid-Day</th>
<th>P.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastbound</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Westbound</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.

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**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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**Project Costs**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tr>
<td>Consultant Costs (Basic Services/Plans)</td>
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<tr>
<td>Other Project Costs (GPS Clocks, Communications equipment, etc.)</td>
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<td>Agency Staff Costs (Estimate)</td>
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**Project Benefits**

**Measures**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Travel Time Savings</td>
<td></td>
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<tr>
<td></td>
<td>11,754 hrs.</td>
<td>$236,157</td>
</tr>
<tr>
<td></td>
<td>31,530 hrs.</td>
<td>$633,505</td>
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<tr>
<td>Fuel Consumption Savings</td>
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<tr>
<td></td>
<td>43,461 gal.</td>
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<td></td>
<td>116,585 gal.</td>
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<td>ROG Emissions Reduction</td>
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<tr>
<td></td>
<td>0.17 tons</td>
<td>$216</td>
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<tr>
<td></td>
<td>0.45 tons</td>
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<td>NOx Emissions Reduction</td>
<td></td>
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<tr>
<td></td>
<td>0.11 tons</td>
<td>$2,015</td>
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<tr>
<td></td>
<td>0.29 tons</td>
<td>$5,407</td>
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<tr>
<td>PM2.5 Emissions Reduction</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>0.01 tons</td>
<td>$2,052</td>
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<tr>
<td></td>
<td>0.02 tons</td>
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<tr>
<td>CO Emissions Reduction</td>
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</tr>
<tr>
<td></td>
<td>1.21 tons</td>
<td>$96</td>
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<tr>
<td></td>
<td>3.24 tons</td>
<td>$258</td>
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</table>

**Total Lifetime Benefits** $1,080,584

**Project Benefits Measures**

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>First Year</td>
<td>Lifetime (5 Years)</td>
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<tr>
<td>Savings</td>
<td>Monetized Savings</td>
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<tr>
<td>Travel Time Savings</td>
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<tr>
<td></td>
<td>11,754 hrs.</td>
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<td>31,530 hrs.</td>
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<tr>
<td>Fuel Consumption Savings</td>
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<tr>
<td></td>
<td>43,461 gal.</td>
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<td>116,585 gal.</td>
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<tr>
<td>ROG Emissions Reduction</td>
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<tr>
<td></td>
<td>0.17 tons</td>
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<tr>
<td></td>
<td>0.45 tons</td>
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<tr>
<td>NOx Emissions Reduction</td>
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<td></td>
<td>0.11 tons</td>
</tr>
<tr>
<td></td>
<td>0.29 tons</td>
</tr>
<tr>
<td>PM2.5 Emissions Reduction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.01 tons</td>
</tr>
<tr>
<td></td>
<td>0.02 tons</td>
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<tr>
<td>CO Emissions Reduction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.21 tons</td>
</tr>
<tr>
<td></td>
<td>3.24 tons</td>
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**Total Lifetime Benefits** $1,080,584

**Overall Project Benefits**

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Auto</strong></td>
<td></td>
</tr>
<tr>
<td>Average Decrease in Travel Time</td>
<td>12%</td>
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<tr>
<td>Average Speed Increase</td>
<td>17%</td>
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<tr>
<td>Average Fuel Savings</td>
<td>9%</td>
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<tr>
<td>Average Reduction in Signal Delay</td>
<td>30%</td>
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<tr>
<td>Average Reduction in Number of Stops</td>
<td>32%</td>
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**Overall Benefit-Cost Ratio** 34:1

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**Somersville Road/Auto Center Drive**

<table>
<thead>
<tr>
<th></th>
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<th>Mid-Day</th>
<th>P.M.</th>
</tr>
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<tbody>
<tr>
<td><strong>Travel Time (Sec)</strong>*</td>
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<td></td>
</tr>
<tr>
<td>Northbound</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Southbound</td>
<td></td>
<td></td>
<td></td>
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<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Signal Delay (Sec)</strong>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northbound</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Southbound</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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For more info, please contact:

**Jay Stagi (MTC)**
Arterial Operations Program Coordinator
Phone: 510.817.5808 • Email: JStagi@mtc.ca.gov

**Lynne Filson (City of Antioch)**
Assistant City Engineer • Phone: 925.779.7025
Email: lfilson@ci.antioch.ca.us

**Project Consultant:**
Kimley-Horn and Associates
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

<table>
<thead>
<tr>
<th>Category</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultant Costs (Basic Services/Plans)</td>
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<td>Other Project Costs (GPS Clocks, Communications equipment, etc.)</td>
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<tr>
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<td><strong>Total Costs</strong></td>
<td><strong>$154,050</strong></td>
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### Project Benefits

<table>
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<th>Measures</th>
<th>First Year Savings</th>
<th>Lifetime (5 Years) Savings</th>
<th>Monetized Savings</th>
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</thead>
<tbody>
<tr>
<td>Travel Time Savings</td>
<td>77,964 hrs.</td>
<td>209,144 hrs.</td>
<td>$1,566,456</td>
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<tr>
<td>Fuel Consumption Savings</td>
<td>277,156 gal.</td>
<td>743,487 gal.</td>
<td>$1,034,900</td>
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<tr>
<td>ROG Emissions Reduction</td>
<td>0.79 tons</td>
<td>2.13 tons</td>
<td>$1,019</td>
</tr>
<tr>
<td>NOx Emissions Reduction</td>
<td>0.62 tons</td>
<td>1.65 tons</td>
<td>$11,309</td>
</tr>
<tr>
<td>PM2.5 Emissions Reduction</td>
<td>0.03 tons</td>
<td>0.08 tons</td>
<td>$10,041</td>
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<tr>
<td>CO Emissions Reduction</td>
<td>8.89 tons</td>
<td>23.84 tons</td>
<td>$707</td>
</tr>
<tr>
<td><strong>Total Lifetime Benefits</strong></td>
<td><strong>$7,040,187</strong></td>
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### Overall Project Benefits

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Auto</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Decrease in Travel Time</td>
<td>25%</td>
</tr>
<tr>
<td>Average Speed Increase</td>
<td>38%</td>
</tr>
<tr>
<td>Average Fuel Savings</td>
<td>19%</td>
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<tr>
<td>Average Reduction in Signal Delay</td>
<td>47%</td>
</tr>
<tr>
<td>Average Reduction in Number of Stops</td>
<td>54%</td>
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<table>
<thead>
<tr>
<th>Benefit</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Overall Benefit-Cost Ratio</td>
<td>46:1</td>
</tr>
</tbody>
</table>

For more info, please contact:

**Jay Stagi** *(MTC)*
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Phone: 510.817.5808 • Email: JStagi@mtc.ca.gov

**Abul Hossain** *(Concord)*
Transportation Program Manager • Tel. 925.671.3181
Email: abul.hossain@cityofconcord.org

**Project Consultant:**
TJKM Transportation Consultants

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**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
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 Benefits Summary

<table>
<thead>
<tr>
<th>Measures</th>
<th>First Year</th>
<th>Lifetime (5 Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Savings</td>
<td>Monetized Savings</td>
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<tr>
<td>Travel Time Savings</td>
<td>26,410 hrs.</td>
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<tr>
<td>Fuel Consumption Savings</td>
<td>105,963 gal.</td>
<td>$395,665</td>
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<tr>
<td>ROG Emissions Reduction</td>
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<td>NOx Emissions Reduction</td>
<td>0.27 tons</td>
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<tr>
<td>PM2.5 Emissions Reduction</td>
<td>0.02 tons</td>
<td>$5,263</td>
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<tr>
<td>CO Emissions Reduction</td>
<td>3.38 tons</td>
<td>$269</td>
</tr>
</tbody>
</table>

**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

---

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**Project Consultant:**  
Kimley-Horn and Associates

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**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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**Project Consultant:**  
Kimley-Horn and Associates

---

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**Project Consultant:**  
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**Project Consultant:**  
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---

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**Project Consultant:**  
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---

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**Project Consultant:**  
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---

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**Project Consultant:**  
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---

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**Project Consultant:**  
Kimley-Horn and Associates

---

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**Project Consultant:**  
Kimley-Horn and Associates

---

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**Project Consultant:**  
Kimley-Horn and Associates

---

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Associate Transportation Engineer  Tel: 510.494.4757  Email: DAmiri@Fremont.gov

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

---

**PROJECT OVERVIEW (CONTINUED)**

**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.

**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.

**Project Benefits**

<table>
<thead>
<tr>
<th>Measures</th>
<th>First Year</th>
<th>Lifetime (5 Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Savings</td>
<td>Monetized Savings</td>
</tr>
<tr>
<td>Travel Time Savings</td>
<td>58,762 hrs.</td>
<td>$1,180,652</td>
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<tr>
<td>Fuel Consumption Savings</td>
<td>241,201 gal.</td>
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<tr>
<td>ROG Emissions Reduction</td>
<td>0.78 tons</td>
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<tr>
<td>NOx Emissions Reduction</td>
<td>0.62 tons</td>
<td>$11,420</td>
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<tr>
<td>PM2.5 Emissions Reduction</td>
<td>0.03 tons</td>
<td>$8,009</td>
</tr>
<tr>
<td>CO Emissions Reduction</td>
<td>7.02 tons</td>
<td>$559</td>
</tr>
</tbody>
</table>

**Total Lifetime Benefits** $5,639,510

---

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**Ade Oluwasogo (Oakland)**
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Email: aoluwasogo@oaklandnet.com

**Project Consultant:** ADVANTEC Consulting Engineers
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 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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**PROJECT COSTS**

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<th>Cost</th>
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</thead>
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<tr>
<td>Consultant Costs (Basic Services/Plans)</td>
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<tr>
<td>Consultant Costs (Additional Plans, TSP, IM Flush Plans, etc.)</td>
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</tr>
<tr>
<td>Other Project Costs (GPS Clocks, Communications equipment, etc.)</td>
<td>$2,500</td>
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<tr>
<td>Agency Staff Costs (Estimate)</td>
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<tr>
<td><strong>Total Costs</strong></td>
<td><strong>$53,125</strong></td>
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**PROJECT BENEFITS**

<table>
<thead>
<tr>
<th>Measures</th>
<th>First Year</th>
<th>Lifetime (5 Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Savings</td>
<td>Monetized Savings</td>
</tr>
<tr>
<td>Travel Time Savings</td>
<td>7,830 hrs.</td>
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<tr>
<td>Fuel Consumption Savings</td>
<td>22,774 gal.</td>
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<tr>
<td>ROG Emissions Reduction</td>
<td>0.057 tons</td>
<td>$74</td>
</tr>
<tr>
<td>NOx Emissions Reduction</td>
<td>0.049 tons</td>
<td>$891</td>
</tr>
<tr>
<td>PM2.5 Emissions Reduction</td>
<td>0.002 tons</td>
<td>$566</td>
</tr>
<tr>
<td>CO Emissions Reduction</td>
<td>0.695 tons</td>
<td>$55</td>
</tr>
<tr>
<td><strong>Total Lifetime Benefits</strong></td>
<td><strong>$654,418</strong></td>
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</tr>
</tbody>
</table>

**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**

---

**San Bruno Avenue**

**Travel Time (Sec)**

- **A.M.**
  - Before: 0
  - After: 0

- **Mid-Day**
  - Before: 0
  - After: 0

- **P.M.**
  - Before: 0
  - After: 0

---

**Signal Delay (Sec)**

- **A.M.**
  - Before: 0
  - After: 0

- **Mid-Day**
  - Before: 0
  - After: 0

- **P.M.**
  - Before: 0
  - After: 0

---

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- **Joseph Cervantes (San Bruno)**  
  Associate Engineer • Phone: 650.616.7067  
  Email: jcervantes@sanbruno.ca.gov

**Project Consultant:**  
DKS Associates
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;
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.

<table>
<thead>
<tr>
<th>Measures</th>
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<th>Lifetime (5 Years)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Savings</td>
<td>Monetized Savings</td>
</tr>
<tr>
<td></td>
<td>Savings</td>
<td>Monetized Savings</td>
</tr>
<tr>
<td>Travel Time Savings</td>
<td>58,508 hrs.</td>
<td>$1,175,537</td>
</tr>
<tr>
<td>Fuel Consumption Savings</td>
<td>139,088 gal.</td>
<td>$519,356</td>
</tr>
<tr>
<td>ROG Emissions Reduction</td>
<td>0.39 tons</td>
<td>$501</td>
</tr>
<tr>
<td>NOx Emissions Reduction</td>
<td>0.17 tons</td>
<td>$3,054</td>
</tr>
<tr>
<td>PM2.5 Emissions Reduction</td>
<td>0.02 tons</td>
<td>$5,526</td>
</tr>
<tr>
<td>CO Emissions Reduction</td>
<td>5.11 tons</td>
<td>$406</td>
</tr>
</tbody>
</table>

**Total Lifetime Benefits** $4,572,096

**Overall Project Benefits**

- 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

<table>
<thead>
<tr>
<th>Travel Time (Sec)</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.M.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid-Day</td>
<td></td>
<td></td>
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<tr>
<td>P.M.</td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Signal Delay (Sec)</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.M.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid-Day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P.M.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

**Average Reduction in Number of Stops:** 64%

**Auto Travel Time Savings:** 31% or 156,850 hours

**Overall Project Benefit-cost Ratio** = 35:1

**Project Consultant:**

TJKM Transportation Consultants

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**Project Consultant:**

TJKM Transportation Consultants

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

**Total Emissions Reduced (ROG, NOx, PM2.5, CO):** 15.3 tons
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 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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Lawrence Henriquez (South San Francisco)
Associate Civil Engineer • Phone: 650.829.6663
Email: lawrence.henriquez@ssf.net

Project Consultant:
ADVANTEC Consulting Engineers

<table>
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<tr>
<th>Measures</th>
<th>First Year</th>
<th>Lifetime (5 Years)</th>
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</thead>
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<tr>
<td></td>
<td>Savings</td>
<td>Monetized Savings</td>
</tr>
<tr>
<td>Travel Time Savings</td>
<td>96,163 hrs.</td>
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<td>Fuel Consumption Savings</td>
<td>351,562 gal.</td>
<td>$1,312,732</td>
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<tr>
<td>ROG Emissions Reduction</td>
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<tr>
<td>NOx Emissions Reduction</td>
<td>0.86 tons</td>
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<td>PM2.5 Emissions Reduction</td>
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<td>CO Emissions Reduction</td>
<td>11.13 tons</td>
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<td><strong>Total Lifetime Benefits</strong></td>
<td><strong>$8,789,355</strong></td>
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Overall Project Benefits

- 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

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<th>Measure</th>
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<tr>
<td>El Camino Real Mid-Day</td>
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<tr>
<td>El Camino Real P.M.</td>
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</tbody>
</table>

<table>
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<tr>
<th>Measure</th>
<th>Before</th>
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<td>Northbound A.M.</td>
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<td>Northbound Mid-Day</td>
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<tr>
<td>Northbound P.M.</td>
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<tr>
<th>Measure</th>
<th>Before</th>
<th>After</th>
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<tbody>
<tr>
<td>Southbound A.M.</td>
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<tr>
<td>Southbound Mid-Day</td>
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<td>0</td>
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<tr>
<td>Southbound P.M.</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Average Reduction 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 Project Benefit-cost Ratio = 45:1

El Camino Real

Travel Time (Sec)

Signal Delay (Sec)

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
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 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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Civil Engineer III • Phone: 510.675.5303
Email: mikerenk@ci.union-city.ca.us

Project Consultant:
Kimley-Horn and Associates, Inc.

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

Overall Project Benefits

- 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

Whipple Road and Dyer Street
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 hardwire to the City of Walnut Creek’s ATMSnow 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)
correct 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.

<table>
<thead>
<tr>
<th>Measures</th>
<th>First Year</th>
<th>Lifetime (5 Years)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Savings</td>
<td>Monetized Savings</td>
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<tr>
<td>Travel Time Savings</td>
<td>103,604 hrs.</td>
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<td>Fuel Consumption Savings</td>
<td>270,001 gal.</td>
<td>$1,008,183</td>
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<td>ROG Emissions Reduction</td>
<td>1.05 tons</td>
<td>$1,348</td>
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<tr>
<td>NOx Emissions Reduction</td>
<td>0.66 tons</td>
<td>$12,158</td>
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<tr>
<td>PM2.5 Emissions Reduction</td>
<td>0.04 tons</td>
<td>$11,867</td>
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<tr>
<td>CO Emissions Reduction</td>
<td>7.41 tons</td>
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Total Costs $278,125

<table>
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<tr>
<th>Overall Project Benefits</th>
<th>Auto</th>
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<tbody>
<tr>
<td>Average Decrease in Travel Time</td>
<td>12%</td>
</tr>
<tr>
<td>Average Speed Increase</td>
<td>22%</td>
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<tr>
<td>Average Fuel Savings</td>
<td>9%</td>
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<tr>
<td>Average Reduction in Signal Delay</td>
<td>22%</td>
</tr>
<tr>
<td>Average Reduction in Number of Stops</td>
<td>17%</td>
</tr>
</tbody>
</table>

Overall Benefit-Cost Ratio 30:1

For more info, please contact:
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Simin Timuri (City of Walnut Creek)  
Associate Traffic Engineer • Phone: 925.943.5899  
Email: timuri@walnut-creek.org

Project Consultant:  
DKS Associates

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

Mt Diablo Boulevard
The City of Walnut Creek, in conjunction with Contra Costa County and Caltrans, received a Program for Arterial System Synchronization (PASS) grant from the Metropolitan Transportation Commission (MTC) to conduct a signal timing study for 27 traffic signals, including eight signals on Treat Boulevard, 18 signals on Ygnacio Valley Road, and one signal on North Main Street.

The goal of the project was to conduct timing analysis, to develop and implement new weekday and weekend signal coordination plans, and to implement traffic responsive timing during off-peak periods. Three of the signals are within Contra Costa County and four of the signals are within Caltrans right-of-way, but all of the signals are operated and maintained by the City of Walnut Creek.

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

**LEGEND**

- Red: City of Walnut Creek Signal
- Green: Contra Costa County Signal - City Operated & Maintained
- Blue: Caltrans Signal - City Operated & Maintained
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 BENEFITS SUMMARY

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

PROJECT BENEFITS

Average Reduction in Auto Signal Delay: 32%
Average Reduction in Number of Stops: 35%

Measures

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

Overall Project Benefits

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

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Email: timuri@walnut-creek.org

Project Consultant:
Kimley-Horn and Associates, Inc.
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

Project Consultants:
ADVANTEC CONSULTING ENGINEERS
DKS ASSOCIATES
KIMLEY-HORN & ASSOCIATES, INC.
TJKM TRANSPORTATION CONSULTANTS

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