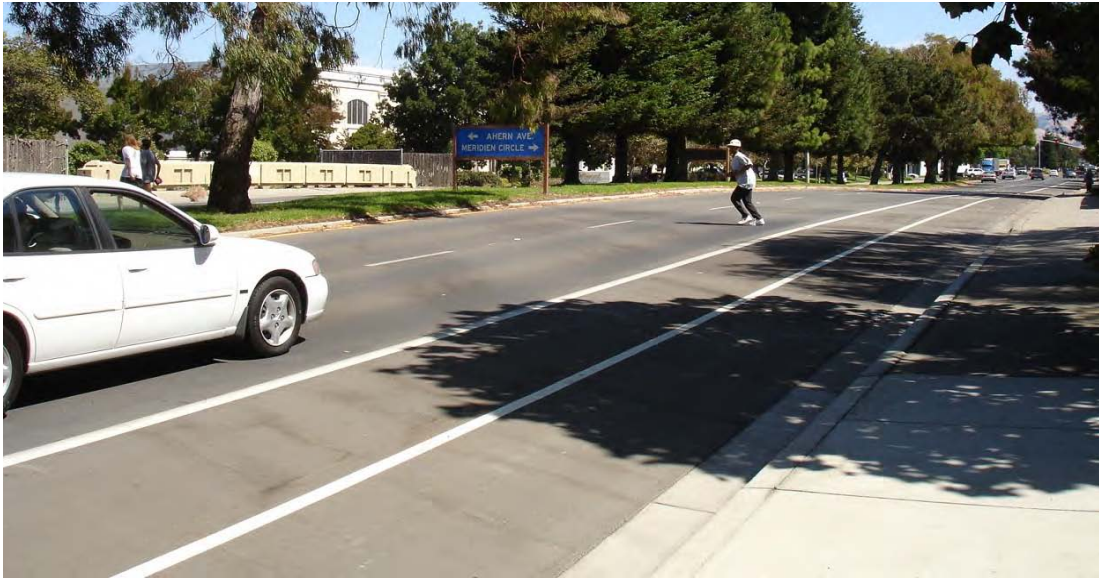


# Across the Arterial

## Mid-block Shared-Use Path Crossings of Multilane Roadways in California



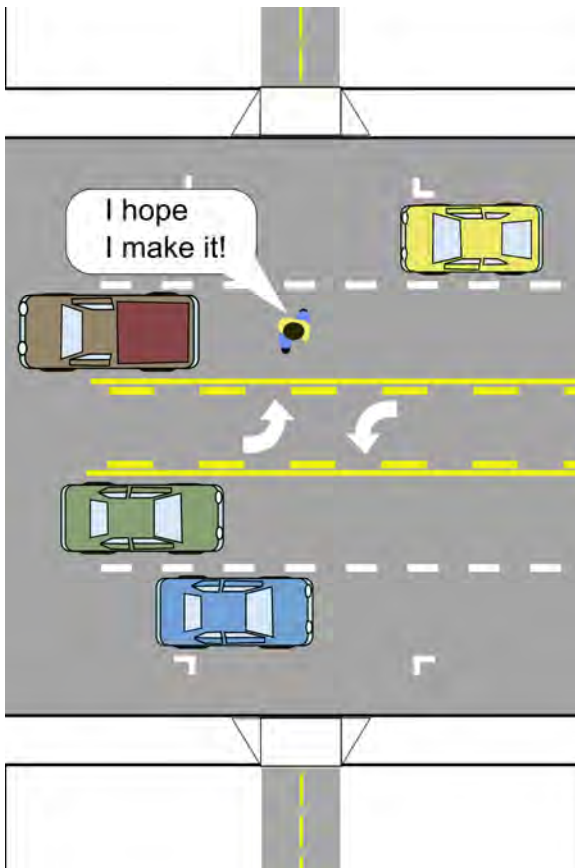
Produced by:  
Rails-to-Trails Conservancy  
Western Regional Office

Steve Schweigerdt  
Trail Development Manager

January 2011

This study is a product of the Healthy Transportation Network (HTN), a project of the California Active Communities (CAC) within the California Department of Public Health (CDPH).

## CONTENTS



Overview	3
<b>Methods to Improve Crossing Safety</b>	
Reduce Exposure and Crossing Distance	4
Increase Mutual Awareness and Visibility	5-7
Manage Traffic Speed and Flow	8
<b>Putting It All Together</b>	
Sample 5-Lane Enhanced Crossing	9
Sample 4-Lane with Bike Lanes	10
Sample Signalized Crossing	11
<b>Examples</b>	
Delta De Anza—Bailey Rd.	12
Bellflower Bikeway—Clark Avenue	13
Manteca Tidewater Bikeway—Louise Avenue	14
Richmond/Ohlone Greenway—San Pablo Avenue	15
Compton Creek Trails—Alondra Blvd.	16
<b>Appendix A</b> —Resources for planning crossings	17
<b>Appendix B</b> —Listing of crossings and treatments	18-19

This study was funded by the Healthy Transportation Network (HTN), a project of the California Active Communities (CAC) within the California Department of Public Health (CDPH). The HTN is a statewide project funded by the Caltrans Statewide Transportation Enhancements Activities Program, and is a collaboration of the following five organizations: California Bicycle Coalition; California Department of Public Health, California Active Communities; California WALKS; Local Government Commission; and Rails-to-Trails Conservancy, Western Regional Office.

We would like to thank everyone who assisted in developing the project: the cities of Manteca, Compton, and Bellflower, Contra Costa County Public Works, and Fehr & Peers for providing information on each of the example crossings; Paul Zykofsky of the Local Government Commission, Yves Zsutty of the City of San Jose Trails Program, Tim Bustos of Ecology Action, and Christine Carey of Fehr & Peers for reviewing the document and suggesting best practices; and our dedicated volunteer Kelly Haberer for editing assistance.

This report was produced by staff at Rails-to-Trails Conservancy's Western Regional Office:

Laura R. Cohen, J.D., Director  
 Steve Schweigerdt, Project Manager  
 Darrow Vanderburgh-Wertz, Program Assistant

## OVERVIEW



NOTE: An engineering study by a Traffic Engineer is required before improvements to crossings are made. Signal design, signage and markings should conform to state approved devices found in the California Manual on Uniform Traffic Control Devices (MUTCD). Roadway improvements should conform to the California Highway Design Manual.

Successful shared-use paths offer a continuous and extended recreation and transportation experience. Avoiding vehicular interaction is a major challenge in urban environments where shared-use paths intersect the roadway network on a regular basis. In the best cases, the paths are grade-separated from roadway traffic with pedestrian bridges or under-crossings. However, geometric constraints, financial resources and incompatible adjacent land uses can require trail planners to contemplate and implement at-grade crossings.

The focus of this report are these challenging at-grade crossings of multilane roadways at mid-block locations (but the report does not suggest that at-grade crossings are a suitable substitute for bridges and under-crossings where they are feasible and required to meet the trail system goals). The approximately 50 such at-grade crossings located in California exhibit a range of measures to reduce the potential of collisions and provide a good user experience. This brief overview of treatments is intended as an introduction for both planners and community members. For engineering design and construction of the crossings, in-depth resources listed in Appendix A can be consulted.

When required, the crossing of a busy multilane roadway should be as safe and convenient as possible. Where shared-use paths bisect major roadways, trail users want to continue on the path immediately across the roadway and desire to follow the most direct route to get there. Trail users have built-up momentum perpendicular to the roadway and perceive it as a barrier to rapid travel and the continuity of the trail experience.

Many urban shared-use paths follow former rail lines or channelized watercourses that intersect multilane roads well away from signalized intersections, and that often intersect at skewed angles that impact visibility.

Crossing multiple lanes requires anticipation of gaps in traffic that can afford safe passage. On roadways with four or more lanes it becomes very difficult to predict if a vehicle will be coming in the far lane, especially for visually impaired or inexperienced trail users.

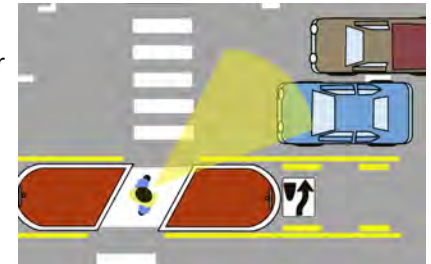
Despite the challenges, the studied crossings offer numerous measures that can increase the safety of these at-grade crossings and make crossing major roadways easier for trail users. The improvements fall into the following functional categories, which will be expanded on and are best used together for a comprehensive solution:

1. Reduce rail users' exposure to traffic and crossing distance.
2. Increase mutual awareness and visibility.
3. Manage traffic speed and flow.

## Reduce Exposure and Crossing Distance



**Raised medians or refuge islands**– Raised medians and refuge islands break up the crossings for pedestrians and cyclists into smaller sections, enabling trail users to focus on crossing one direction of traffic at a time. Raised medians and refuge islands also give trail users a safe place to wait for traffic to clear before crossing the second leg. Providing medians and refuge areas has been shown to dramatically reduce crashes by 46 percent when installed at marked crosswalks and by 39 percent at unmarked crossing locations<sup>1</sup>. They are among the “Top Nine” life-saving strategies recommended by the FHWA<sup>2</sup>. Medians and refuge areas can be installed in a two-way left-turn lane; if no two-way left-turn lane exists, they may be created by narrowing traffic lanes or replacing on-street parking spaces. Medians and refuge areas should be wide enough to accommodate wheelchairs and bicycles, typically six feet minimum.

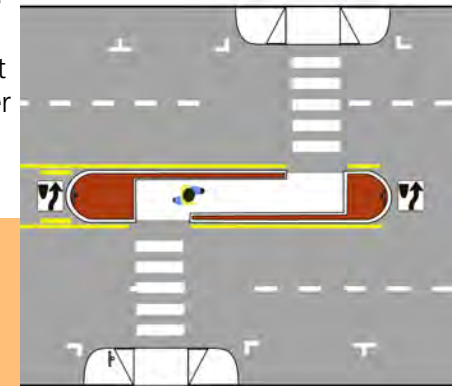


The refuge median area can be slanted to improve trail users view of oncoming traffic and increase their awareness.



**Bulb-outs or curb extensions** – Bulb-outs shorten the distance trail users need to cross and improve visibility of trail users for approaching vehicles. They can be used in areas where street parking is allowed or in a shoulder if they will not impede bike flow. Bulb-outs can also help reduce traffic speeds as they narrow the roadway and field of vision for drivers. The design should avoid encroachment into the travel lane that would create a pinch point for cyclists if the street is a cycling route.

**Perpendicular crossing** – Crossing the street perpendicular to the roadway decreases the crossing distance and time for trail users compared to a skewed crossing. For shared-use paths that intersect at a skewed angle with the road and have offset crossings, consider using an extended median to align the crossings across each direction of traffic.



An extended median breaks the crossing into shorter segments and the staggered crossing connects the offset path segments. Take measures to mitigate sharp curves if cyclists will be riding through the median. If the crossing is signalized in two stages, the impact on roadway capacity is lessened since vehicles are only required to stop in one direction at a time.

## Increase Mutual Awareness and Visibility

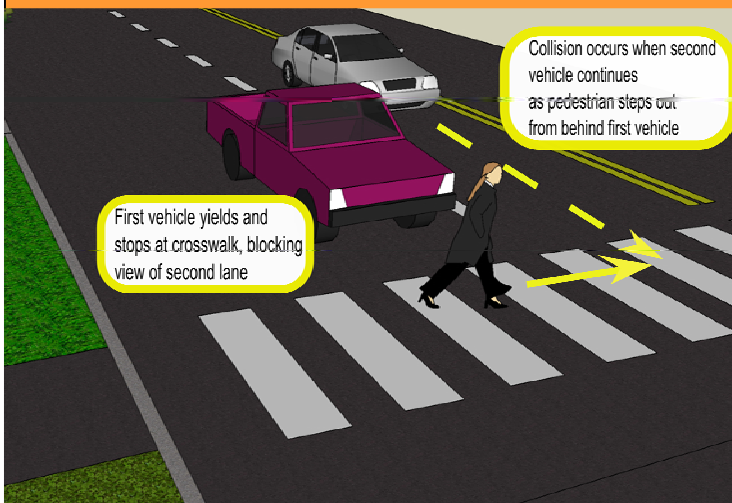


**Intersection Lighting** – Street lighting to illuminate crossings is recommended where paths remain open at night. Lighting improves safety by allowing drivers and trail users to see each other. Lighting also helps trail users see the surroundings and surface conditions, increasing personal safety and sense of security. Lighting should meet roadway standards of illumination to maximize visibility at the intersection. Seventy percent of pedestrian deaths in 2008 occurred at night<sup>3</sup>.

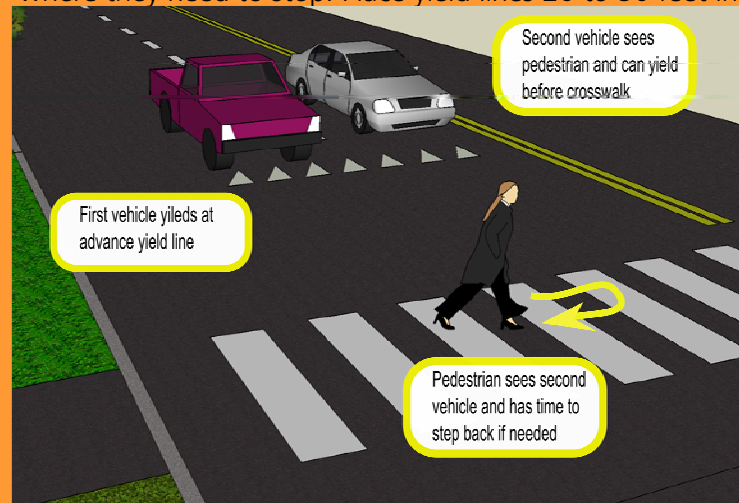
**Crosswalks and markings** – Crosswalks with zebra stripes or other high-visibility markings are preferred to increase the visibility of the crossing. Marked crosswalks alert drivers as to where trail users will cross, and they help drivers predict pedestrian movements. Advance yield and stop lines are critical on multilane streets to prevent multiple-threat crashes, as shown below. Crosswalks should never be installed in isolation, but should instead be augmented with additional signs, markings and beacons.

**Signage** – Signage raises awareness of the crossing. Signs should be placed in advance of the crossing and at the crossing location. In-street pedestrian yield signs (as shown on [page 10](#)) have shown increases in yield rates and are particularly effective if space does not allow for a refuge median or island. Signage should be placed along the path to warn trail users of the crossing.

Multiple-threat crashes are some of the most dangerous collisions for pedestrians.



Advance yield and stop lines (for signals) help prevent the multiple-threat crash by opening the field of vision between the pedestrian and the driver in the second lane. Advance yield lines are made of painted triangles in a “sharks’ teeth” pattern that indicates to drivers where they need to stop. Place yield lines 20 to 50 feet in advance of the crosswalk with the sign below to show drivers where to yield to trail users.



## Increase Mutual Awareness and Visibility



**Warning beacons** – At locations where sight distance or lighting enhancements are needed to alert drivers to trail users, flashing lights and beacons can be used. Beacons put drivers on alert but do not present a red light, so trail users will need to initiate crossing and monitor drivers to ensure that they yield. The beacon should be activated by trail users and accompanied by signage requiring drivers to yield to trail users at the crossing. Continuously flashing beacons are not advised, as drivers grow accustomed to them and yield rates decrease. In-pavement flashers are also common in California and have been found to increase yield rates by 35 percent in the daytime and up to 75 percent at night<sup>4</sup>. Even more effective is the Rectangular Rapid Flash Beacon (see below), which we anticipate increasing in use if approved by the California Traffic Control Devices Committee and incorporated in the California MUTCD.

**Notification of crossing for trail users** - Trail users also need to be notified that they are approaching a potentially dangerous crossing and need to slow or come to a stop.

- Appropriate signage, pavement markings and clear sight distance warn trail users they are approaching a roadway. Bollards should be avoided unless unauthorized use by motor vehicles is a documented problem. In special cases, curves can be designed to slow cyclists who may be traveling at high speeds.
- Detectable warning strips with truncated domes should be installed at the transition from the path to the roadway surface and in the median.
- Audible warnings with a message such as “Cross with caution, vehicles may not stop” alert trail users if drivers are not presented with a red light at the crossing location.
- Education campaigns can train trail users on best practices to communicate intentions to drivers.



### Rectangular Rapid Flash Beacon

This style of warning beacon has been shown to increase vehicle yield rates by 60 percent or more<sup>5</sup>. These yield rates are unheard of for any device other than a full traffic signal or “HAWK” beacon, both of which require vehicles to stop. The beacon operates with bright amber LED flashers in a wig-wag “flickering” pattern similar to the new flashers on construction and public safety vehicles.

The beacon should be mounted at the crosswalk on both the right and left side of the roadway facing traffic, and in the median refuge if available (as shown on page 9). The beacon must be activated by push button or passive sensors<sup>6</sup>. While it is not yet approved in the California MUTCD, it can be used with conditional or experimental approval.



## Increase Mutual Awareness and Visibility



**Pedestrian-activated traffic signal**—Typically, the community will seek to have a traffic signal or similar device installed at shared-use path intersections. If the volume of both trail users and vehicle traffic is high enough, a pedestrian-activated traffic signal may be warranted to stop traffic for trail users. The advantage of this type of signal is that it removes any ambiguity as to when drivers must yield and requires them to stop on the red light. The crossing must meet minimum standards or “warrants” that take into account the volume and speed of vehicles on the roadway, volume of pedestrians and cyclists on the path, and collision history of the crossing.

While traffic signals for shared-use paths crossings may be the preferred option for roadways with heavy and continuous traffic or high speeds, they can also frustrate trail users who need to wait for the signal to change when traffic is light or infrequent, as well as drivers when the traffic flow is disrupted. In many cases, trail users will cross against the light when there is a break in traffic rather than activate the signal and wait for it to change<sup>7</sup>.

Twenty of the 46 multilane shared-use path crossings investigated for this report had installed pedestrian-activated traffic signals to stop vehicles on the roadway and allow trail users to cross. This number was higher than we anticipated, given the high cost and disruption to traffic flow signals cause, but it is likely due to the fact that the positive control red lights afford gives the clearest direction to drivers and trail users.

The majority of midblock multilane roadway shared-use path crossings are in urbanized areas where the roadways being crossed have full traffic signals at nearby intersections. The nearby signals often provide gaps in traffic and allow safe pedestrian crossings with a refuge island or median and appropriate markings.



### High intensity Activated crossWalk (HAWK) pedestrian beacon

The HAWK beacon is a user-activated control that requires traffic to stop and creates gaps for crossing. Thus, it would be used on roadways with traffic too heavy or fast moving for median refuges and warning flashers to be adequate. It reduces delay for drivers as they can proceed on the flashing red light phase after stopping, especially when fast moving cyclists quickly clear the intersection. The HAWK is not yet approved in the CA MUTCD, but may be used with conditional or experimental approval.



## Manage Traffic Speed and Flow



Multilane roads are often traveled at higher speeds and volumes. On such roadways, some traffic-calming measures may be taken to reduce speeding behavior and improve traffic management.

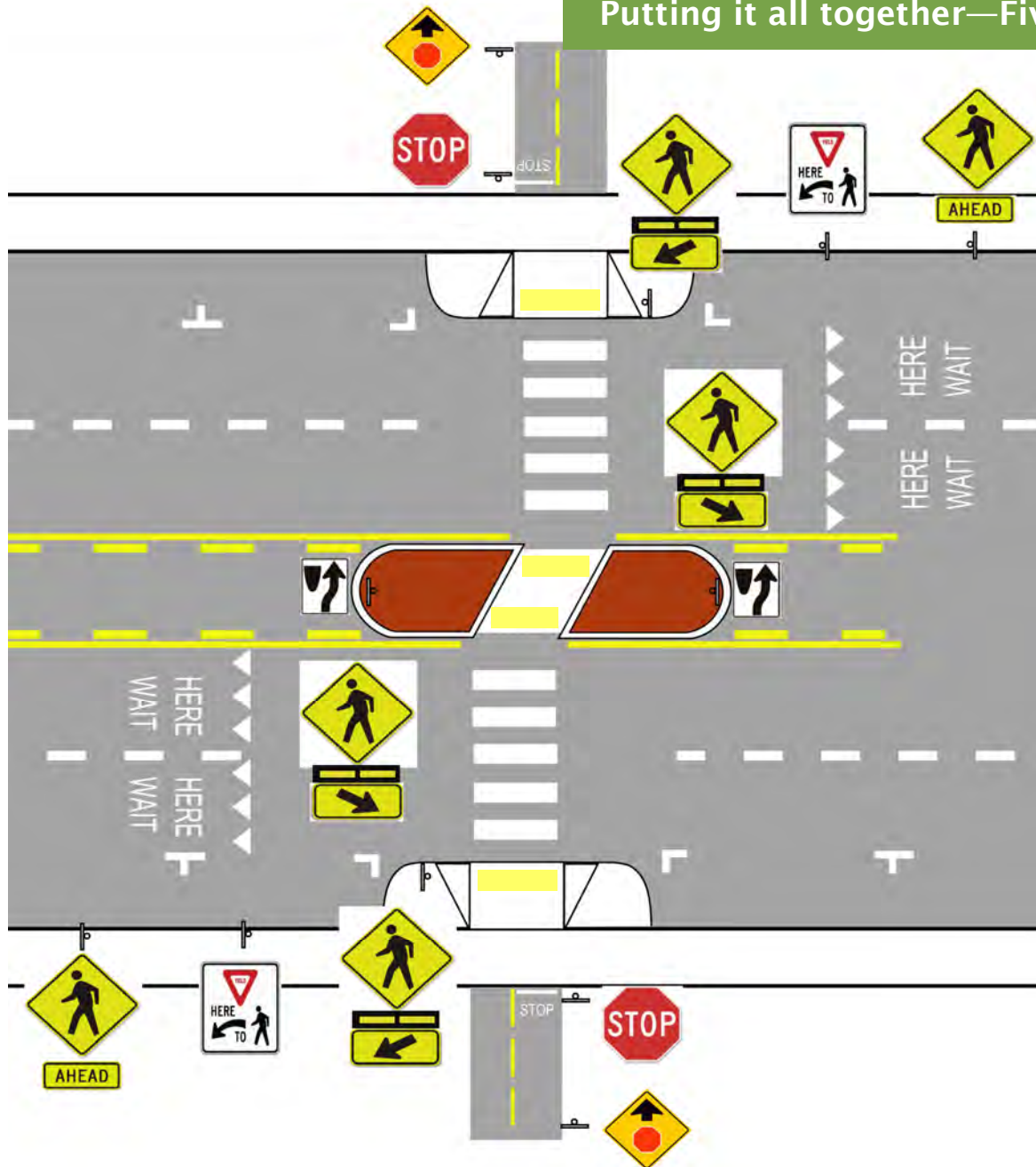
- Timing signals to the desired speed encourages compliance with speed limits.
- Reducing striped lane widths and installing landscaping and street trees can influence driver perception of space and reduce speeds.
- Four-lane streets with multiple access points or driveways should be considered for a road diet that reduces the roadway to three lanes including either a center turn lane or median.
- Where a shared-use path crosses smaller collector or residential streets, traffic-calming measures such as a road diet, speed tables (speed humps with a flat top suitable for a raised crosswalk), and curb extensions such as chokers or chicanes should be considered. Road diets reduce the roadway to three lanes with a center turn lane or median. The space gained by dropping a lane can be used to add Class II bicycle lanes on both sides or add parking on one side of the street. Road diets should be considered after thorough traffic analysis to determine feasibility.
- Enforcement actions such as pedestrian decoys, progressive ticketing, and crosswalk stings to ensure yielding can impact behavior on roadways and encourage compliance with traffic laws.

### References

1. Zegeer, Charles V., Stewart, J. Richard, and Huang, Herman, *Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations: Executive Summary and Recommended Guidelines*, University of North Carolina Highway Safety Research Center for Federal Highway Administration, February 2002. p. 55  
[www.walkinginfo.org/library/details.cfm?id=543](http://www.walkinginfo.org/library/details.cfm?id=543)
2. FHWA Urges Road Agencies to Consider “Top Nine” Life-Saving Strategies Memo, FHWA Safety Program  
[http://safety.fhwa.dot.gov/policy/memo071008/docs/nine\\_measures.pdf](http://safety.fhwa.dot.gov/policy/memo071008/docs/nine_measures.pdf)
3. *Traffic Safety Facts, 2008 Data*, NHTSA Pedestrian Fact Sheet DOT HS 811163  
[www-nrd.nhtsa.dot.gov/Pubs/811163.pdf](http://www-nrd.nhtsa.dot.gov/Pubs/811163.pdf)
4. Malek, Mansour, *Crosswalk Enhancement Comparison Study*, City of San Jose Department of Transportation  
[www.lightguardsystems.com/PDFs/studies/SanJoseOverheadVSIRWLStudy.pdf](http://www.lightguardsystems.com/PDFs/studies/SanJoseOverheadVSIRWLStudy.pdf)
5. Dr. Ron Van Houten & Dr. J.E. Louis Malenfant, *Efficacy of Rectangular-shaped Rapid Flash LED Beacons.*, Center for Education and Research in Safety  
[www.spotdevices.com/docs/studies/Efficacy%20of%20Rectangular-shaped%20Rapid%20Flash%20LED%20Beacons%20-%20St.%20Petersburg.%20FL.pdf](http://www.spotdevices.com/docs/studies/Efficacy%20of%20Rectangular-shaped%20Rapid%20Flash%20LED%20Beacons%20-%20St.%20Petersburg.%20FL.pdf)
6. *Interim Approval for Optional Use of Rectangular Rapid Flashing Beacons (LA-11)*, FHWA Policy Memorandum  
[http://mutcd.fhwa.dot.gov/resources/interim\\_approval/ia11/fhwamemo.htm](http://mutcd.fhwa.dot.gov/resources/interim_approval/ia11/fhwamemo.htm)
7. *Improving Pedestrian Safety at Unsignalized Crossings*, TCRP Report 112/NCHRP Report 562 Improving Pedestrian Safety at Unsignalized Crossings – p. 57-58.  
[http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp\\_rpt\\_562.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_562.pdf)



## Putting it all together—Five-lane enhanced crossing



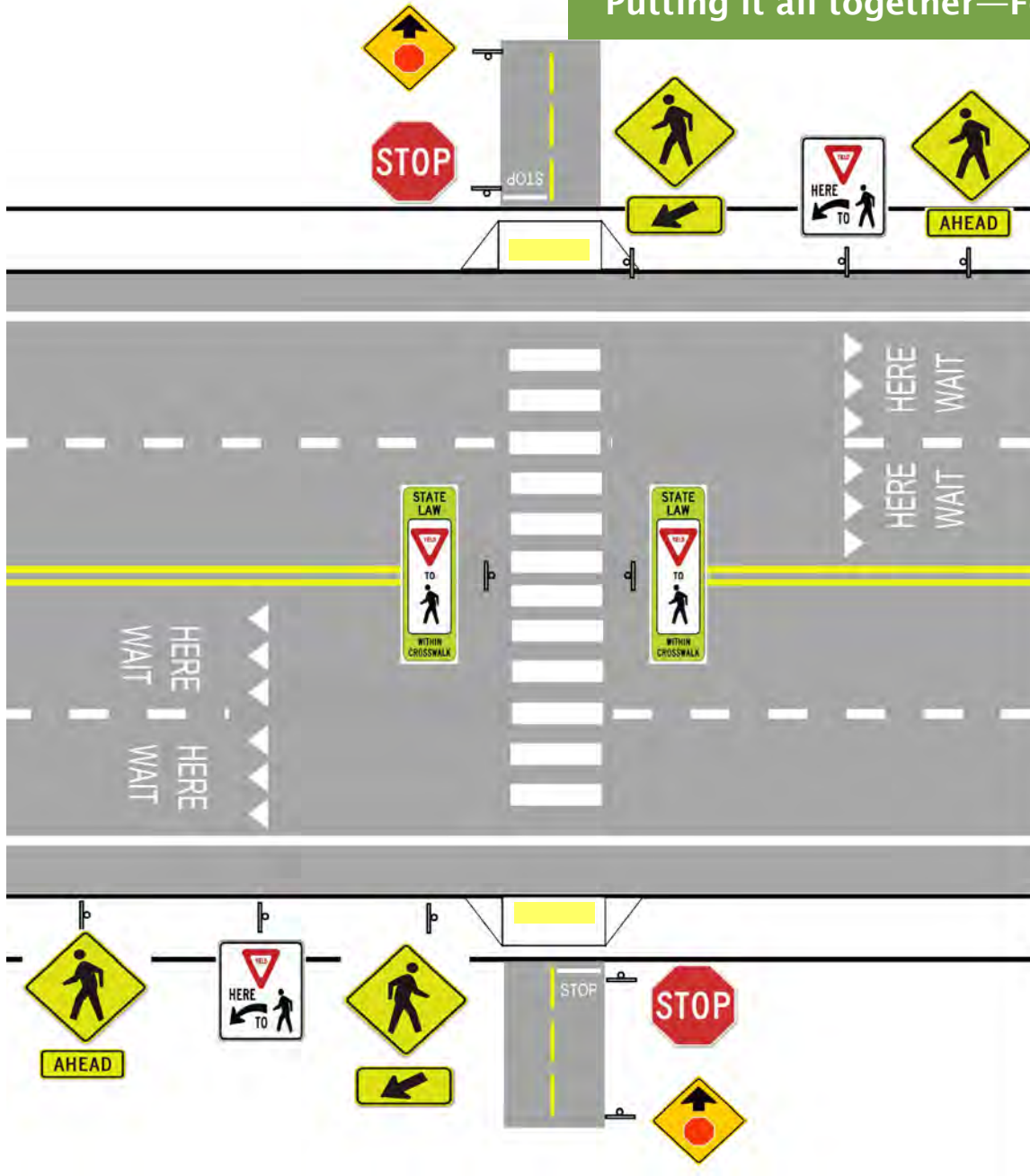
The crossing at left shows an effective treatment for a five-lane roadway with center turn lane or existing median. This example includes on-street parking. If traffic patterns on the roadway present regular gaps for trail users to utilize, this treatment can be an effective alternative to a pedestrian-activated signal.

### Treatments:

- The refuge island allows trail users to cross one direction of traffic at a time.
- Advance yield lines are critical to prevent multiple-threat crashes. As drivers slow for the advance yield lines, trail users can see both lanes and ascertain whether drivers are yielding.
- Bulb-outs are appropriate to increase visibility of trail users and drivers to each other and to decrease the distance of the crossing.
- High-visibility crosswalk and “WAIT HERE” markings in conjunction with signage raise awareness of crossing for drivers.

Rectangular rapid flash beacons are shown in this diagram and can be added for additional enhancement of the crossing. The rectangular rapid flash beacons are not yet approved in the CA MUTCD; in the interim in-pavement flashers or round yellow beacon lights may be used. The beacons or flashers should be push-button or passively activated so the flashing lights are only activated when pedestrians are present and need to cross.

## Putting it all together—Four-lane with Bike lanes



At left is an example of an effective treatment for a shared-use path crossing of a four-lane roadway with bike lanes and no median refuge available. This type of crossing would be appropriate for multilane roadways with speed limits less than 35 mph and gaps in traffic available for trail users to utilize.

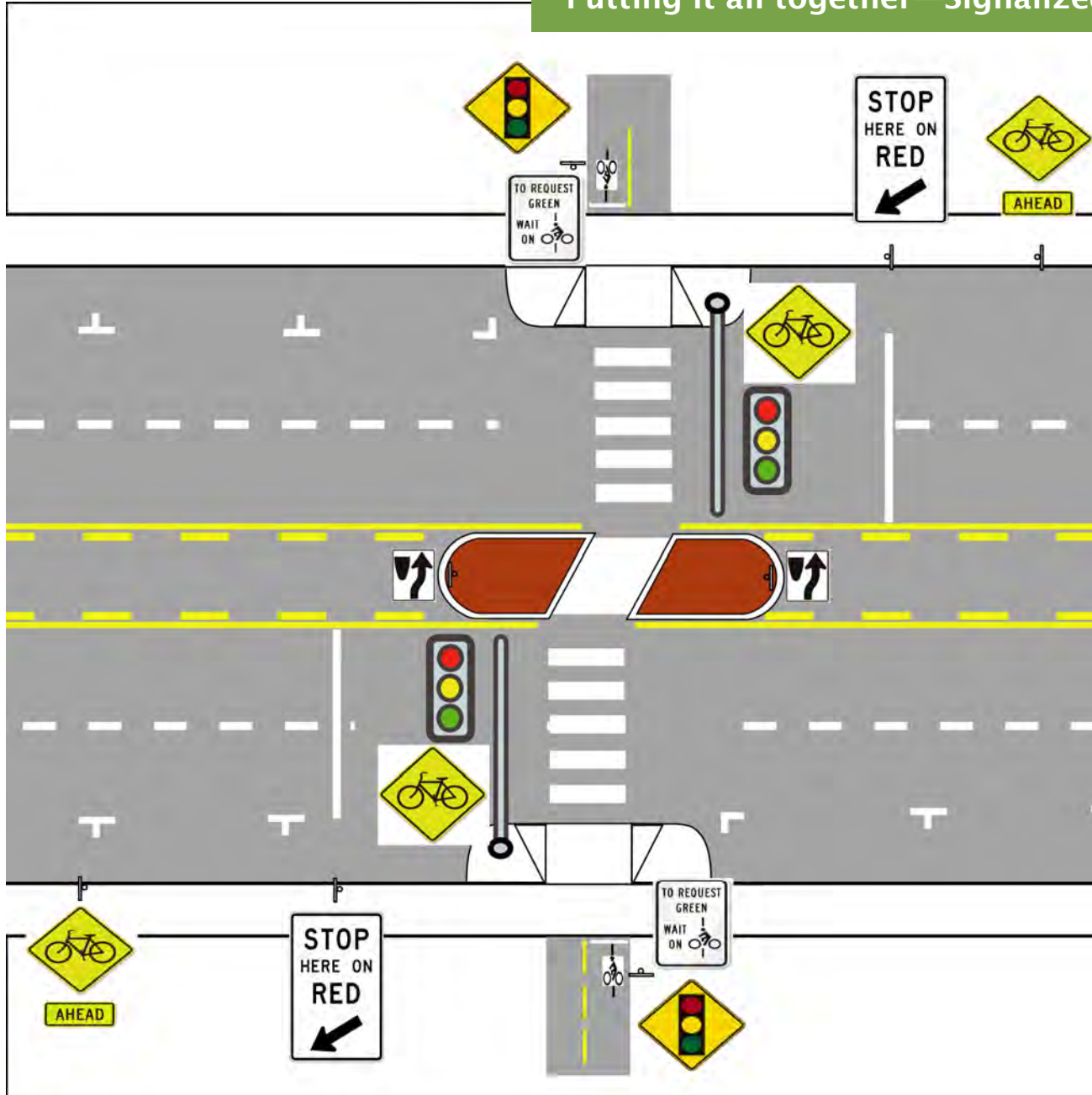
### Treatments:

- High-visibility crosswalk markings along with signage make the crossing easy to see for drivers. In-street signs are very effective in this case where no refuge island is available.
- Advance yield lines are critical to prevent multiple-threat crashes. Additional markings such as “PED XING” or “WAIT HERE” messages are optional to supplement the yield lines.
- Bulb-outs would interfere with the bike lanes and are not appropriate in this example.

### Is this street a candidate for a road diet?

If there are driveways along the roadway and frequent turning motions from vehicles, reducing the roadway to three lanes with a center turn lane or median can improve the safety of the roadway without reducing vehicular capacity. Refuge islands can be installed in the center turn lane. The space gained on the sides of the street can be used to add Class II bicycle lanes on both sides or parking on one side of the street .

## Putting it all together—Signalized crossing



For high-volume and high-speed roadways that do not provide gaps for trail users to cross, the best option may be a pedestrian-activated signal. The signal should meet warrants and provide cues for trail users on proper activation and use of the signalized crossing. Where possible the signal should be coordinated with nearby traffic signals to improve traffic flow. Alternatively, a two-stage crossing that only stops traffic in one direction at a time can reduce the impact on vehicular capacity.

### Treatments:

- Pedestrian-activated signal with audible features for hearing impaired trail users. Automatic detection of cyclists through loop detectors or video monitors decreases cyclist wait time and discourages crossing during red light phase.
- Refuge island provides additional protection.
- High-visibility crosswalk, markings and signage help drivers anticipate the crossing location. Advance stop lines add additional protection and visibility for trail users and drivers.
- Bulb-outs reduce the crossing distance and improve visibility for drivers and trail users.

## Examples: Delta de Anza Trail—Bailey Road



**The Path:** The Delta de Anza Regional Trail runs for approximately 15 miles in the eastern Bay Area, providing a transportation and recreation corridor that connects communities to parks, schools and a community college. In the community of Bay Point, the path coming from the west meets Bailey Road. Directly across the street, on the east side of Bailey Road, is the Bel Air Trail. The paths follow alongside an East Bay Municipal Utility District aqueduct which crosses Bailey Road on a diagonal alignment. The new street crossing for trail users follows this same diagonal alignment to provide a continuous alignment from path to path across Bailey Road.

**The Road:** Bailey Road is a four-lane road with a center median. There were approximately 14,500 vehicles per day in 2007, and the speed limit is 35 mph. Bailey Road has bike lanes and parking is prohibited. It is about 140 feet from the trail crossing to the closest signalized intersection at Mims/ Canal Road. The light at Mims/Canal Road is coordinated with the path crossing signal and stops southbound drivers on Bailey Road at the path. No accidents were reported at the crossing before the project was started.

**Improvement Description:** Contra Costa County installed pedestrian-activated signals and constructed a crosswalk across Bailey Road in the summer of 2009. New curb ramps were added on both sides of Bailey Road to allow pedestrians and bicyclists to cross Bailey Road mid-block, and improvements included signing and striping. The existing median island was modified to allow a level passageway through it, in compliance with ADA.

Bulbouts were not included as they would be incompatible with the bike lanes on Bailey Road and were not needed to accomplish the goals of the project.



Contract Cost (Est.):  
\$192,000  
Funding Source: STIP  
Transportation Enhancements  
and local gas tax funds  
Construction Date: Summer  
2009

## Examples: Manteca Tidewater Bikeway—Louise Ave.



**The Path:** The Manteca Tidewater Bikeway follows the path of the old Tidewater Railway for 3.4 miles running north to south through the city of Manteca, Calif. The right-of-way, which varies in width from 18 feet to 130 feet, is landscaped using a low-maintenance natural approach. The bikeway is popular with bikers, inline skaters and walkers and consists of a 12-foot-wide asphalt path with a parallel 3-foot-wide decomposed granite jogging path. This pleasant urban trail connects neighborhoods and parks on the city's southern and northern boundaries to the central business section. The trail averages 200 or more users on weekdays, and more on the weekends. The distance to the nearest signalized crossing of Louise Avenue at Yvonne Avenue is approximately 750 feet.

**The Road:** Louise Avenue is an east to west thoroughfare with five lanes, including a center turn lane. The speed limit is 35 mph and there are approximately 20,300 vehicles per day. There were no accidents reported at the intersection before the intersection was improved, but the trail was not previously improved either. Louise Avenue does not have bike lanes, and parking is prohibited.

**Improvement Description:** The shared-use path construction included the installation of a pedestrian-activated signal, median refuge island, markings and signage. The pedestrian signal was warranted due to the speed and traffic volume on Louise Avenue. The median island raises awareness of drivers to the crossing since it includes signage and is the only median feature in the area. Advance stop lines are included along with a separate signal at the advance stop line location. The crossing could be further improved with high-visibility signage identifying the crossing and a ladder or zebra-style crosswalk that is more visible to drivers. Bulb-outs were not considered appropriate at this location since they could impede traffic.



## Examples: Bellflower Bikeway—Clark Ave.



**The Path:** The Bellflower Bikeway is a new rail-trail through urban Southeast Los Angeles County that follows the old West Santa Ana Branch rail line that carried the Red Cars for the Pacific Electric railway. Bellflower is the first city on the corridor to develop their portion into a trail, and study of the corridor for future mass transit is ongoing. The shared-use path connects to the San Gabriel River Bikeway at its eastern end through Caruthers Park and cuts through the city of Bellflower on a southeast diagonal. Because the rail corridor cuts through the arterial grid on a diagonal, crossings are often mid-block, away from major intersections and intersect with the streets at awkward angles.

**The Road:** Clark Avenue is a busy street with four lanes of traffic used by approximately 14,900 vehicles per day with a speed limit of 40 mph. The signalized intersection with Alondra Boulevard is approximately 225 feet south of the bikeway crossing.

**Improvement Description:** As a part of the shared-use path development, the city of Bellflower installed a pedestrian-activated signal at the bikeway crossing. Signage includes pedestrian crossing signs in advance of the crossing and at the signal and a Bike Trail street sign on the signal post. Street lighting is included on the signal for safety at night. Markings include a colored concrete crosswalk, advance stop lines with “WAIT HERE” markings indicating where vehicles should stop. Curb ramps were installed on both sides of the streets and curbs were painted red to prevent parked cars from limiting visibility. A small barricade directs trail users to the curb ramps for crossing, and a sign mounted on it indicates they should activate the signal for crossing. The path is aligned so that the

crossing is perpendicular to the street.

When first installed, there were complaints of confusion for northbound motorists. The city changed the signal head on the mast arm to a programmable visibility signal head that is not visible (appears black) from the distance where it could create motorist confusion.

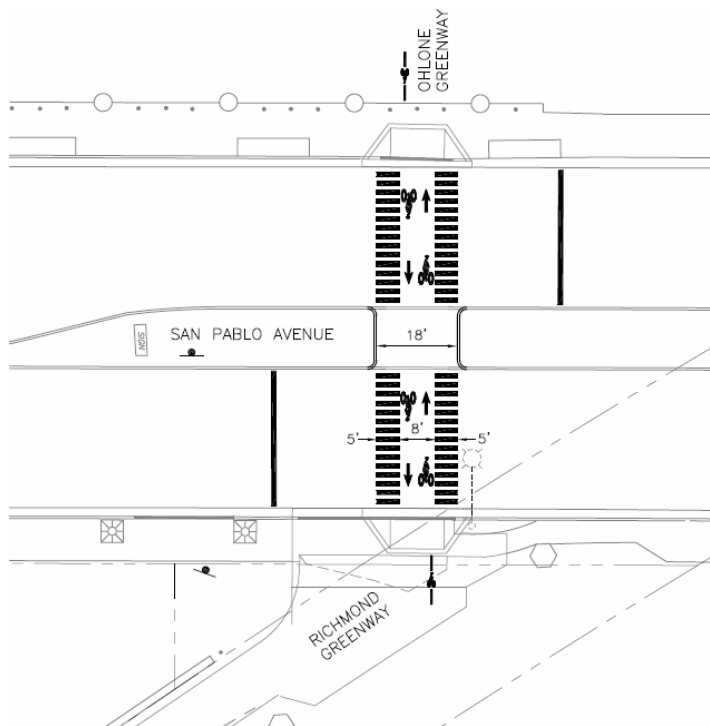


## Examples: Richmond/Ohlone Greenway—San Pablo Ave.



**The Path:** The Richmond and Ohlone greenways follow the BART and old Santa Fe Railroad right-of-way that arcs through the San Francisco Bay Area cities of Richmond, El Cerrito, Albany and Berkeley. The two greenways are currently disconnected by a small gap from the Interstate 80 under-crossing to San Pablo Avenue. The Ohlone Greenway in particular is an important commuter route and provides access to multiple BART stations. The recent Baxter Creek project extended the Ohlone Greenway to San Pablo Avenue and the eastern portion of the Richmond Greenway that brings it under Interstate 80 was completed in late 2009. The cities of El Cerrito and Richmond are currently designing the connection and crossing of San Pablo.

**The Road:** San Pablo Avenue is a major arterial in the East Bay paralleling I-80 from downtown Oakland to Crockett. The speed limit in the vicinity of the crossing is 30 mph. San Pablo has four lanes of traffic with a median in the crossing location. A left turn lane begins just north of the crossing location which the trail crossing will avoid. The shared-use path crossing is approximately 500 feet north of the nearest signalized intersection at Conlon Avenue, and 550 feet south of the signalized intersection at MacDonald Avenue. There is no history of accidents at the path crossing location, but there was one collision involving a bicycle at the intersection of MacDonald and San Pablo between 2004 and 2009.



**Cost** - The projected costs are approximately \$200,000 for the signalized crossing and \$1.2 million for the entire project, which includes extending the trail to connect to the Richmond Greenway and creek restoration.

### Planned crossing treatments include:

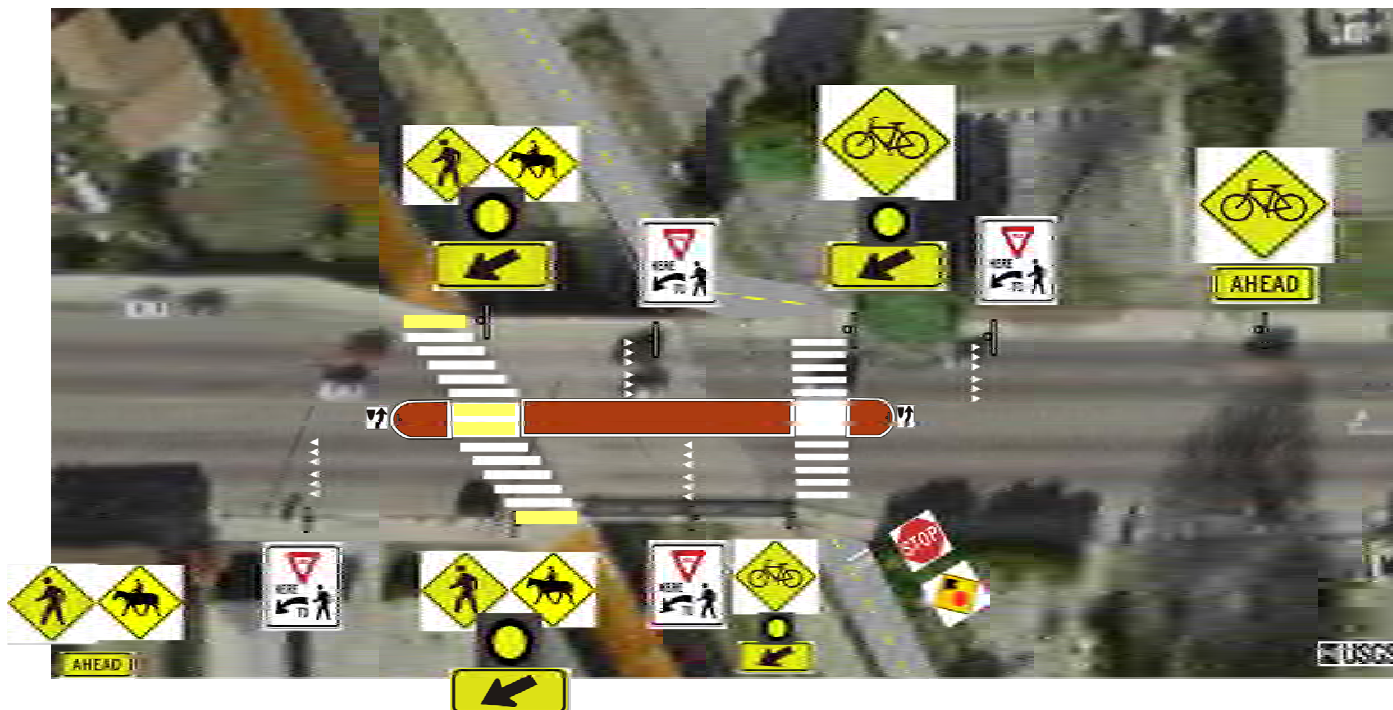
- Modify the median to provide a level crossing for pedestrians and bicyclists.
- Signalize the crossing with a pedestrian and bicyclist activated signal. Bicycle loop detectors will be installed at the approaches to the crossing as well as push buttons for pedestrians. The signal will be coordinated with both the Conlon Avenue and MacDonald Avenue signals to optimize flow through the intersection.
- Provide high-visibility crosswalk, associated signage and advance stop markings.
- Planners are considering bulb-outs since there are parking lanes on both sides of the street. The difficulty at this location is that the street is very flat, and bulb-outs could exacerbate existing drainage problems. Planners are looking at a compromise that would maintain drainage at the existing curb line and still provide bulb-outs into the street.

## Examples: Compton Creek Trails—Alondra Blvd.



**The Path:** The Compton Creek Bike Path and Multiuse Trail extends along channelized Compton Creek, connecting neighborhoods to schools and commercial areas in the city of Compton. The shared-use path crosses several major arterials at skewed angles, away from intersections with no improvements in place to assist trail users with crossing. The right-of-way is constrained with the creek channel on one side of the trail and houses and commercial facilities on the other. A bike path is on the east side of the channel, and an equestrian and running path is on the west side, which further complicates the intersection with trail users crossing at different locations. The trail crosses Alondra Boulevard, Compton Boulevard, Rosecrans Avenue, and Wilmington Avenue and the only current improvements are a crosswalk and signage at Compton Boulevard. The trail is used by equestrians, who commonly cross Alondra Boulevard to utilize the continuous stretch of trail north to Compton Boulevard. For this project we will focus on the crossing at Alondra Boulevard.

**The Road:** Alondra Boulevard is a five-lane arterial with bike lanes and a center turn lane. The speed limit is 35 mph and traffic volume is approximately 20,000 vehicles per day. With a predicted volume of fewer than 100 users per day, the crossing is unlikely to meet warrants for a full traffic signal. It is approximately 300 feet from the crossing to the nearest signalized intersection at Oleander Avenue.



### Recommendations:

- Install median refuge island with level crossing for both the bike path and multiuse trail.
- Redirect bike path on north side of Alondra to adjacent driveway and allow perpendicular crossing.
- Paint crosswalk and advance yield lines. Advance yield lines are critical to prevent multiple threat crashes.
- Install signage warning drivers of crossing location and trail users of street crossing.
- Consider trail user activated flashing beacons as shown, in-roadway flashers, or rectangular rapid flash beacons when they are approved for use in California. (Rectangular rapid flash beacons should also be installed in median to maximize effectiveness.)



## Appendix A

### **Technical resources for designing crossings:**

*California Manual on Uniform Traffic Control Devices* – Lists approved signage, markings and devices that can be used in California

[www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/](http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/)

*NCHRP Report 562 Improving Pedestrian Safety at Unsignalized Crossings* – Recommends crossing treatments and contains guidelines and decision-making flowchart in the Appendix.

[www.trb.org/Main/Blurbs/Improving Pedestrian Safety at Unsignalized Crossi 157723.aspx](http://www.trb.org/Main/Blurbs/Improving_Pedestrian_Safety_at_Unsignalized_Crossi_157723.aspx)

*Pedestrian and Bicycling Information Center*—Engineering solutions offered for various trail and pedestrian design problems.

[www.walkinginfo.org/engineering/](http://www.walkinginfo.org/engineering/)

*Pedestrian Safety and Crosswalk Installation Guidelines*, City of Stockton - California

These clear guidelines developed by Fehr & Peers help planners and engineers determine appropriate treatments for crossings.

[www.stocktongov.com/publicworks/publications/PedGuidelines.pdf](http://www.stocktongov.com/publicworks/publications/PedGuidelines.pdf)

*Contra Costa Trail Design Resource Handbook* –

Covers all aspects of trail design, including crossings.

<http://atfiles.org/files/pdf/ContraCostaTrailDesign.pdf>

*Pedestrian and Bicycle Facilities in California—A Technical Reference and Technology Transfer Synthesis for Caltrans Planners and Engineers*

An overview of treatments, with particular mention of pedestrian signals and traffic-calming techniques.

[www.dot.ca.gov/hq/traffops/survey/pedestrian/TR\\_MAY0405.pdf](http://www.dot.ca.gov/hq/traffops/survey/pedestrian/TR_MAY0405.pdf)

### **Lighting Design**

*Informational Report on Lighting Design for Midblock Crosswalks* Publication FHWA-HRT-08-053

This document summarizes the results of studies and gives guidance on lighting designs.

[www.fhwa.dot.gov/publications/research/safety/08053/](http://www.fhwa.dot.gov/publications/research/safety/08053/)

### **Traffic signals**

*Accessible Pedestrian Signals* – A guide to best practices

This site gives a brief overview of considerations traffic engineers use when determining whether a traffic signal is warranted at an intersection.

[www.apsguide.org/chapter3\\_mutcd.cfm](http://www.apsguide.org/chapter3_mutcd.cfm)

### **Bicycle Signal Warrant**

The California supplement to the MUTCD lists a signal warrant in section 4C.103 and can be used for multi-use paths if they meet the volume warrant.

[www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/pdf/CA-Chap4A-Chap4C.pdf](http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/pdf/CA-Chap4A-Chap4C.pdf)

## Appendix B—Listing of shared-use path crossings and treatments

Shared-use Path	Roadway	County	Treatments chosen
Iron Horse Regional Trail	Santa Rita Rd.	Alameda	In design process, median available, currently unmarked
Berkeley Santa Fe Trail	University Ave.	Alameda	Median refuge, pedestrian-activated signal, high-visibility crosswalk and markings, advance stop lines
Eden Greenway	West Harder Rd.	Alameda	Raised median, non accessible, unmarked crossing
Union City Canal trail	Whipple Rd.	Alameda	Raised median, non accessible, unmarked crossing
Chico Airport Path	East Ave.	Butte	Pedestrian-activated signal, lighting, crosswalk, advance stop lines
Richmond Greenway/Ohlone Greenway	San Pablo Ave.	Contra Costa	Currently in design - See example
Delta De Anza Trail	Bailey Rd.	Contra Costa	Median refuge, pedestrian-activated signal, crosswalk, signage
Contra Costa Trail	James Donlon Blvd.	Contra Costa	Median refuge, high-visibility crosswalk, signage
Contra Costa Trail	Lone Tree Way	Contra Costa	No pedestrian crossing signage - cross at Clayburn Rd.
Contra Costa Canal Trail	Oak Rd.	Contra Costa	Pedestrian-activated signal, crosswalk, signage, advance stop lines
Contra Costa Canal Trail	Gregory Lane	Contra Costa	Refuge island, school crossing, crosswalk, signage, advance stop lines and markings
Iron Horse Regional Trail	Mt Diablo Blvd.	Contra Costa	Lighting, high-visibility crosswalk, signage
Iron Horse Regional Trail	San Ramon Valley Blvd.	Contra Costa	Median refuge, pedestrian-activated signal, lighting, high-visibility crosswalk, advance stop lines, signage
Iron Horse Regional Trail	Crow Canyon Rd.	Contra Costa	Median refuge, pedestrian-activated signal, lighting, crosswalk, advance stop lines, signage
Iron Horse Regional Trail	Norris Canyon Rd.	Contra Costa	Redirected to adjacent signalized commercial driveways
Black Diamond Trail	Clayton Rd.	Contra Costa	Median with split pedestrian cross over, pedestrian-activated signal, lighting, crosswalk, advance stop lines, signage
Contra Costa Canal Trail	Treat Blvd.	Contra Costa	Redirected to signalized crossing at Navarone Way
Richmond Greenway	Harbor Way	Contra Costa	High-visibility school crosswalk and markings, signage
Bay Trail	Marina Bay Parkway	Contra Costa	Median refuge, crosswalk, signage
Fresno Sugar Pine Trail	East Shepherd Ave.	Fresno	Median refuge (angled median), high-visibility crosswalk, signage
Compton Creek Bike Path	Wilmington Ave.	Los Angeles	Raised median, non accessible, unmarked crossing
Compton Creek Bike Path	Rosencrans Ave.	Los Angeles	Raised median, non accessible, unmarked crossing
Compton Creek Bike Path	Alondra Blvd.	Los Angeles	Unmarked crossing
Compton Creek Bike Path	Compton Blvd.	Los Angeles	Crosswalk, signage
Bellflower Bikeway	Clark Ave.	Los Angeles	Pedestrian-activated signal, lighting, crosswalk, advance stop lines and markings, signage
Whittier Greenway Trail	Hadley St.	Los Angeles	Pedestrian-activated signal, lighting, crosswalk, signage
San Jose Creek Bike Path	Turnbull Canyon Rd.	Los Angeles	Lighting
San Jose Creek Bike Path	South 7th Street	Los Angeles	Lighting

Shared-use Path	Roadway	County	Treatments chosen
Laguna Dominguez Trail	Manhattan Beach Blvd.	Los Angeles	Unmarked crossing
Laguna Dominguez Trail	Marine Ave.	Los Angeles	Unmarked crossing
North Redondo Beach Bikeway	Artesia Blvd.	Los Angeles	Median refuge, pedestrian-activated signal, lighting, high-visibility crosswalk, signage, advance stop lines
Humbug-Willow Creek Parkway	Oak Ave. Parkway	Sacramento	Median refuge, pedestrian-activated signal, lighting, crosswalk, advance stop lines, signage
Laguna Creek Parkway	Elk Grove Florin Rd.	Sacramento	Pedestrian-activated signal, lighting, crosswalk, advance stop lines and markings, signal ahead warning beacon
Laguna Creek Parkway	Bond Rd.	Sacramento	Pedestrian-activated signal, lighting, crosswalk, advance stop lines and markings, signal ahead warning beacon
Elk Grove Creek Trail	Laguna Blvd.	Sacramento	Median refuge, pedestrian-activated signal, lighting, crosswalk, advance stop lines and markings, signal ahead warning beacon
Folsom South Canal	Sunrise Blvd.	Sacramento	Median refuge, pedestrian-activated signal, lighting, high-visibility crosswalk, advance stop lines, signage
Manteca Tidewater Bikeway	Northgate Dr.	San Joaquin	Refuge island, pedestrian-activated signal, crosswalk, advance stop lines, signage with yellow warning beacon
Manteca Tidewater Bikeway	West Louise Ave.	San Joaquin	Refuge island, pedestrian-activated signal, crosswalk, advance stop lines, signage with yellow warning beacon
South San Francisco Centennial Trail	South Spruce Ave.	San Mateo	Pedestrian-activated signal, lighting, crosswalk, curb ramps, advance stop lines
San Francisco Bay Trail	J Hart Clinton Dr.	San Mateo	Median refuge, pedestrian-activated signal, lighting, high-visibility crosswalk, signage, advance stop lines
San Thomas Aquino Creek Trail	Monroe St.	Santa Clara	Pedestrian-activated signal, lighting, high-visibility crosswalks, diagonal bike crossing, signage
Vacaville Branch Line Trail	Alamo Rd.	Solano	Pedestrian-activated signal, lighting, crosswalk, advance stop lines, signage
Modesto Hetch Hetchy Trail	Prescott Rd.	Stanislaus	Crosswalk, signage
Modesto Hetch Hetchy Trail	Tully Rd.	Stanislaus	Median refuge, crosswalk, signage
Modesto Virginia Corridor	Orangeburg Ave.	Stanislaus	Lighting, crosswalk, signage
Modesto Virginia Corridor	College Ave.	Stanislaus	Lighting, crosswalk, signage



**rails-to-trails**  
conservancy

**Western Regional Office** / 235 Montgomery St. Suite 769 / San Francisco, CA 94104  
tel 415.814.1100 / fax 415.989.1255 / [www.railstotrails.org](http://www.railstotrails.org)

**National Headquarters** / 2121 Ward Court, NW, 5th Floor / Washington, DC 20037  
tel 202.331.9696 / fax 202.223.9257 / [www.railstotrails.org](http://www.railstotrails.org)