A Resource Guide for the Education, Promotion, Funding, and Design of Pedestrian and Bicycle Facilities

A Companion Document to the San Mateo County Comprehensive Bicycle and Pedestrian Plan

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1. Introduction

This Resource Guide provides cities and the County with information to assist with implementation of the projects contained within the San Mateo Countywide Comprehensive Bicycle and Pedestrian Plan. The Education, Safety and Promotion Guidebook outlines programs that engage the public around bicycle and pedestrian safety and education issues. The funding section describes potential sources to fund bicycle and pedestrian projects and programs. The pedestrian and bicycle design guidelines identify types of pedestrian and bicycle facilities and design-related best practices.

2. Education, Safety, and Promotion Guidebook

2.1 Introduction

This section provides C/CAG, the County and local cities with a menu of program options to support the San Mateo County Comprehensive Bicycle and Pedestrian Plan. These program ideas form a guidebook for actions that local agencies and community groups can take to promote walking and bicycling through education and encouragement.

Education, marketing and promotional events encourage residents to consider walking and bicycling viable transportation options.

Each program description includes information about the program purpose, a description of the basic approach, basic cost estimates, and links to model programs where possible. Because costs can vary significantly based on program details, costs have been estimated using the following categories:

- $ = $0 – $5,000
- $$ = $5,000 – $20,000
- $$$ = $20,000 - $50,000
- $$$$ = $50,000 - $100,000

2.2 Encouragement/Outreach

2.2.1 Bicycle/Pedestrian Safety Campaign

Purpose: Increase awareness of bicycling and walking; promote safety

Audience: General Public

Cost: $$$-$$$$ (Depending on advertising costs)

A marketing campaign that highlights bicyclist and pedestrian safety is an important part of creating awareness of bicycling and walking in San Mateo County. This type of high-profile campaign is an effective way to reach the public, highlight bicycling and walking as viable forms of transportation, and reinforce safety for all road users.

Safety campaigns that appeal to road users' sense of shared responsibility and respect are more effective than those that lecture the public.

A well-produced safety campaign will be memorable and effective. One good example is the Sonoma County Transit "You've got a friend who bikes!" campaign. It combines compelling ads with an easy-to-use website focused at motorists, pedestrians, and bicyclists. This type of campaign is particularly effective when kicked off in conjunction with other bicycling/walking events or back to school in the fall. The safety and awareness messages should be displayed near high-traffic corridors (e.g., on billboards), printed in local publications, and broadcast as radio and/or television ads.

Sample program: Sonoma County (CA) Transit: http://www.sctransit.com/bikesafe/bikes.htm

2.2.2 Safe Routes to School Program

Purpose: Encourage and educate students and their parents about walking and biking to school; improve safety through physical improvements and programs

Audience: School-aged children and their parents; School administrators, faculty, and staff

Cost: $ - $$$$ (Depending on program elements)

Helping children walk and bicycle to school is good for children's health and can reduce congestion, traffic dangers and air pollution caused by parents driving children to school. Safe Routes to School programs use a "5 Es" approach using Engineering, Education, Enforcement, Encouragement, and Evaluation strategies to improve safety and encourage children walking and biking to school. The programs are usually run by a coalition of city government, school and school district officials, and teachers, parents, students, and neighbors. C/CAG is developing a countywide Safe Routes to School Funding Program. Several communities in San Mateo County promote Safe Routes to Schools, including Redwood City and San Carlos.

Resource Guide: National Center for Safe Routes to School: http://www.saferoutesinfo.org/

2.2.3 Walking/Bicycling Maps

Purpose: Encourage walking and biking by providing route and facility information and highlighting walking and bicycling destinations

Audience: General public

Cost: $

One of the most effective ways of encouraging people to walk or bike for transportation and for recreation is through the use of maps and guides showing that the infrastructure exists, to demonstrate how easy it is to access different parts of the city by foot or by bike, and to highlight unique areas, shopping districts, or recreational areas. Walking and bicycling maps can be used to promote tourism, encourage residents to walk and bike, or promote local business districts. Maps can be citywide, district-specific, or neighborhood/family-friendly maps.

Safe Routes to School programs increase the number of children walking and biking to school and improve traffic safety near schools.

Once maps are produced, they can be made available online and distributed to residents by mail, at local

libraries and bike shops, and/or at community events. The maps can also be promoted through flyers in utility bills, city newsletters, and other community media outlets. Maps should be updated every few years to incorporate new facilities or other changes.

Sample maps:

- San Mateo County bike map: http://www.ccag.ca.gov/bpac.html
- Des Moines Regional Trails Map (online): http://www.dsmbikecollective.org/node/74/zoomify
- Long Beach, CA bike map: http://admin.longbeach.gov/civica/filebank/blobdload.asp?BlobID=27418

2.2.4 Launch Party for New Bikeways and Pedestrian Facilities

Purpose: Inform residents about new bicycle and pedestrian facilities to encourage use

Audience: Residents living near a newly completed facility

Cost: $

When a new bicycle or pedestrian facility is built, some residents will become aware of it and use it, but others may not realize that they have improved options available to them. A launch party/campaign is a good way to inform residents about a new bikeway or walking facility, and can also be an opportunity to share other bicycling and walking information (such as maps and brochures) and answer resident questions about bicycling and walking. A launch party should also be a media-friendly event, with elected official appearances, ribbon cuttings, and a press release that includes information about the new facility, other existing and future facilities, and any timely information about bicycling and walking.

Sample Program: When a new bikeway is built, the City of Vancouver throws a neighborhood party to celebrate. Cake, t-shirts, media and festivities are provided and all neighbors are invited as well as city workers (engineers, construction staff, and planners) who worked on it.

Launch parties for new bicycle and pedestrian facilities are a good way to inform residents about new places to walk and bike.

2.2.5 Bike Parking at Events

Purpose: Ease and encourage bicycle travel

Audience: General public, event goers

Cost: $

Providing convenient, secure bike parking at large events can make bicycling to an event a more attractive option. Arenas, parks, and other venues and gathering places often do not have the bike parking capacity to accommodate very large crowds. Temporary facilities, such as corrals or temporary racks, can be brought on site to meet the demand. This type of service can also prevent damage to trees and hand rails that bicyclists use when there is not enough bike parking. Temporary bike parking can be staffed or used with standard locks to ensure security.

Sample program: Silicon Valley Bicycle Coalition provides bicycle valet parking at major events and civic festivals for a small fee.

More information: http://bikesiliconvalley.org/valet

2.2.6 Personal Travel Encouragement Program

Purpose: Decrease car use and increase bicycling, walking, and transit use

Audience: General public within a defined target area

Cost: $$ - $$$$ (Depending on target area reached)

Personal Travel Encouragement programs are proven to reduce drive-alone trips and increase bicycling, walking, and transit use within a given target area. The program invites residents or employees of the target area to order a customized information packet containing travel information (e.g. an event calendar, walking and bicycling maps, a bicycling guide, transit maps and schedules). Customized packets are assembled and delivered by bicycle to residents at their home or employees at their workplace, along with an incentive gift of their choice. In addition to the customized information packet, the program hosts numerous encouraging activities such as group walks, guided bicycle rides, and classes and workshops. Trained staff appear at community or employer events to answer questions about walking, bicycling, and transit use. This approach is based on the annual award-winning City of Portland SmartTrips program, which has consistently shown a 9 to 13 percent reduction in drive-alone trips in the selected target area since 2004.

Residents often do not know where to find walking and cycling resources; a Personal Travel Encouragement program delivers brochures, maps and incentives directly to their homes.

Sample Program:

Portland SmartTrips: http://www.portlandonline.com/transportation/index.cfm?c=43801

2.2.7 Car-Free Street Events

Purpose: Encourage walking and biking by providing a car-free street event

Audience: General public, generally within a particular community but can be promoted city wide

Cost: $$-$$$ (Mostly for staff time and street closures)

These programs have many names: Sunday Parkways, Ciclovias, Summer Streets, and Sunday Streets. These events are periodic street closures (usually on weekends) that create a temporary park that is open to the public for walking, bicycling, dancing, hula hooping, roller-skating, etc. They have been very successful internationally and are rapidly becoming popular in the United States. They promote health by creating a safe and attractive space for physical activity and social contact, and are cost-effective compared to the cost of building new parks for the same purpose. These events can be weekly events or one-time events, and are generally very popular and well attended.

Cañada Road is closed to motorists every Sunday for most of the year.

Sample Programs:

- Cañada Road Bicycle Sunday:
- On Sundays, Cañada Road is closed to motorists between the Filoli entrance and Highway 92, allowing for biking, hiking, roller-skating, and walking. http://www.co.sanmateo.ca.us/
- New York City Summer Streets:
  http://www.nyc.gov/html/dot/summerstreets/html/home/home.shtml
  http://www.streetsblog.org/2008/08/11/streetfilms-summer-streets-2008/ (video)
- San Mateo County Streets Alive:
- The County sponsors an annual event in May with routes in several cities. The event highlights community centers and encourages healthy outdoor activites.
- http://www.streetsalivesmc.org/home

2.3 Education

2.3.1 Adult Cycling Skills Courses

Purpose: Educate older children and adults on safe bicycling skills; encourage bicycling

Audience: General public

Cost: $

Most bicyclists do not receive any training on safe cycling practices, the rules of the road and bicycle handling skills. Cycling skills courses can address this education gap. The most common program is the League of American Bicyclists courses (including Road I, Road II, and Commuting), taught by League Certified Instructors. Courses cover bicycle safety

Adult bicycle skills courses can ensure that bicyclists have the information and skills they need to avoid hazards and follow the law.

checks, fixing a flat, on-bike skills, crash avoidance techniques, and traffic negotiation. Courses are already available in San Mateo County. Cities could include them in their local recreation programs.

Sample programs:

- League of American Bicyclists http://bikeleague.org/programs/education/courses.php

2.3.2 Youth Bicycle Safety Education

Purpose: Educate school-aged children on safe bicycling skills and rules of the road; encourage bicycling among children

Audience: Youth

Cost: $$-$$$

Typical school-based bicycle education programs educate students about the rules of the road, proper use of bicycle equipment, biking skills, street crossing skills, and the benefits of biking. Education programs can be part of a Safe Routes to School program. These types of education programs are usually sponsored by a joint City/school district committee that includes appointed parents, teachers, student representatives, administrators, police, active bicyclists and engineering department staff.

Youth bicycle safety education provides children with knowledge and training about safe and proper bicycle use.

Sample programs:

- League of American Bicyclists: http://www.bikeleague.org/programs/education/courses.php#kids1
- Bicycle Transportation Alliance – Portland, OR: http://www.bta4bikes.org/resources/educational.php
- Redwood City Police Department teams with local schools to provide biking/walking education for students.
- Colma provides bicycle safety education for children through summer day camps offered by the Colma Recreation Department.

2.4 Enforcement, Policy, and Evaluation

2.4.1 Enforcement Actions

Purpose: Deter unsafe behaviors by motorists and bicyclists by enforcing traffic laws

Audience: Motorists and bicyclists

Cost: $$ (Staff time)

Enforcement actions can include motor vehicle speed enforcement, speed-reader board deployment, bicycle light enforcement, crosswalk enforcement, and other actions.

Speeding vehicles endanger bicyclists and pedestrians and discourage non-motorized transportation modes. Targeted speed enforcement activities can address these issues. Law enforcement agencies can enforce speed limits on designated bikeways, near schools, and in response to resident complaints. These campaigns are ideal for a Safe Routes to School Program. A speed-reader board request program will deploy speed-reader boards at the request of neighborhood associations and schools. The boards should be mounted temporarily (e.g. for two weeks) and then be moved to another location to keep motorists from becoming inured to the speed-reader board effect.

Radar speed trailers are one tool available to reduce dangerous speeding.

Sample programs:

- City of San Mateo conducts pedestrian stings operations on El Camino Real, where motorists are ticketed if they fail to stop for a plainclothes police officer crossing the street. The City also supports a volunteer policing effort, in which community members conduct speed surveys, turning movement counts, decoy cars, speed trailers, and monitor stop controlled intersections.

2.4.2 Bicycle and Pedestrian Advisory Committee

Purpose: Advise local agencies on bicycle and pedestrian issues

Audience: Citizen advocates

Cost: N/A

Many cities, counties, and Metropolitan Planning Organizations have Bicycle and Pedestrian Advisory Committees (BPACs). The C/CAG BPAC reviews projects from all areas of the County. Locally, many communities in San Mateo County have a BPAC or other advisory body dedicated to bicycle and pedestrian issues. Less common, a city may have separate bicycle and pedestrian advisory committees. Separate committees facilitate adequate review of pedestrian issues, as combined BPAC's typically focus on bicycle issues more than pedestrian issues.


Bicycle and Pedestrian Advisory Committee volunteers are an important part of public engagement on biking and walking issues.

These committees are usually comprised of local volunteers, appointed by the jurisdiction, who advise on local pedestrian and bicycling issues. An advisory committee establishes an area's commitment to making bicycling and walking safer and more desirable, and has the potential to assist in getting funding for bicycle and pedestrian projects. Establishing a committee is also desirable for receiving the Bicycle Friendly community designation.

The charges of the BPAC should include some or all of the following:

- Review and provide citizen input on capital project planning and design as it affects bicycling (e.g., corridor plans, street improvement projects, signing or signal projects, and parking facilities)
- Review and comment on changes to zoning, development code, comprehensive plans, and other long-term planning and policy documents
- Participate in the development, implementation and evaluation of Bicycle and Pedestrian Plans and bikeway and pedestrian facility standards
- Provide a formal liaison between local government, staff, and the public
- Develop and monitor goals and indices related to bicycling in the jurisdiction
- Promote bicycling, including bicycle safety and education

Because BPAC members are volunteers, it is essential to have strong staffing supporting the committee in order for it to be successful. An agency staff person should be formally assigned to the BPAC and should take charge of managing the application process, managing agendas and minutes, scheduling meetings, bringing agency issues to the BPAC, and reporting back to the agency and governing body about the BPAC's recommendations and findings.

2.4.3 Bicycle and Pedestrian Counts Program

Purpose: Gather important benchmarking information about cycling and walking activity

Audience: For use by agency staff

Cost: $ (Staff time, and optional equipment)

Collecting comprehensive bicycle and pedestrian counts allows a community to determine crash rates and risk, understand where people are biking and walking, and get a closer picture of how many people are biking and walking. At a minimum, a community should collect bicycle and pedestrian counts with every traffic count and compile these counts in one database. Ideally, a community would establish a separate count program for bicyclists and pedestrians that collects data at the same locations on a regular basis. In addition to a simple tally, it is common to collect additional information at the same time, such as gender, helmet use for bicyclists, or number of children. To supplement counts, intercept surveys can provide insight into demographics, trip origin/destination, and attitudes towards bicycle and pedestrian facilities. The National Bicycle and Pedestrian Documentation Project (NBPD) provides recommended count and survey methodologies. (http://bikepeddocumentation.org/)

Conducting robust bicycle and trail counts will provides a mechanism for tracking trends and progress over time.

2.4.4 Bicycle Friendly Community Designation

Purpose: Highlight bicycling initiatives and get national recognition for implementing the Bicycle and Pedestrian Master Plan

Audience: General public

Cost: $ (Staff time for application process)

The League of American Bicyclists has a well-respected Bicycle Friendly Communities award program. Communities fill out a detailed application that covers bike-related facilities, plans, education efforts, promotion initiatives, and evaluation work that has been completed by the jurisdiction. The award is designed to recognize progress that has been made, as well as assist communities in identifying priority projects to improve bicycling conditions. Receiving the award is a media-worthy event, and may give elected officials the opportunity to receive media coverage for the positive work they are doing. Awards are granted for Bronze, Silver, Gold and Platinum bicycle-friendly communities. Though many Bay Area communities have been recognized, the City of Menlo Park is the only bicycle-friendly community designated in San Mateo County.

Program Information: http://www.bikeleague.org/programs/bicyclefriendlyamerica/

2.4.5 Complete Streets Policy

Purpose: Ensure that County roadways are accessible and safe for all users

Audience: Implementing agency engineers and planners

Cost: N/A

Local governments adopt Complete Streets policies in order to direct transportation planners and engineers to design roadways with all users in mind (e.g., motorists, transit riders, pedestrians, bicyclists, older people, children, and people with disabilities). There are many ways to implement Complete Streets policies.

Once a policy is in place, professionals whose work will be affected by the policy (e.g., planners and engineers) should be trained on ways to implement the policy.

Complete streets are welcoming and safe for residents of all ages and abilities, no matter how they are traveling.

Guidance from the Complete Streets Coalition:

The Principle:

- Complete streets are designed and operated to enable safe access for all users. Pedestrians, bicyclists, motorists and transit riders of all ages and abilities must be able to move safely along and across a complete street
- Creating complete streets means changing the policies and practices of transportation agencies
- A Complete Streets policy ensures that the entire right-of-way is routinely designed and operated to enable safe access for all users
- Transportation agencies must ensure that all road projects result in a complete street appropriate to local context and needs

Elements of a Good Complete Streets Policy:

- Specifies that 'all users' includes pedestrians, bicyclists, transit vehicles and users, and motorists, of all ages and abilities
- Aims to create a comprehensive, integrated, connected network
- Recognizes the need for flexibility: that all streets are different and user needs will be balanced.

- Is adoptable by all agencies to cover all roads
- Applies to both new and retrofit projects, including design, planning, maintenance, and operations, for the entire right-of-way
- Makes any exceptions specific and sets a clear procedure that requires high-level approval of exceptions
- Directs the use of the latest and best design standards
- Directs that complete streets solutions fit in with context of the community
- Establishes performance standards with measurable outcomes

More information: http://www.completestreets.org/ .

3. Funding

City/County Association of Governments of San Mateo County (C/CAG) administers two funding sources for bicycle and pedestrian projects in San Mateo County: Transportation Development Act (TDA) funds and Regional Bicycle Program (RBP) funds. TDA and RBP funds are just one of many funding sources available for bicycle and pedestrian projects. To implement the projects recommended in this CBPP, local cities and the County will need to draw from many different funding sources. This section provides implementing agencies with a list of potential sources to fund bicycle and pedestrian projects and programs.

Bicycle and pedestrian funding is administered at all levels of government. This chapter begins with explaining the current state of federally-administered funding and the anticipated new transportation bill, which influences State, regional and local funding. **Table 2** lists the funding sources described in this chapter and summarizes important funding source components, such as funding amount available, application deadlines and eligible applicants.

3.1 Federally-Administered Funding

SAFETEA-LU, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, is the primary federal funding source for bicycle and pedestrian projects. SAFETEA-LU is the fourth iteration of the transportation vision established by the Intermodal Surface Transportation Efficiency Act (1991). Also known as the federal transportation bill, Congress passed the $286.5 billion SAFETEA-LU bill in 2005. SAFETEA-LU expired in 2009, at which time Congress approved extending funds through 2010. When the next multi-year federal transportation bill is reauthorized, funding available for bicycle and pedestrian projects is likely to change. Historically, these modes have received larger allocations with each new multi-year transportation bill.

Caltrans, the State Resources Agency and regional planning agencies administer SAFETEA-LU funding. Most, but not all of these funding programs emphasize transportation modes and purposes that reduce auto trips and provide inter-modal connections. SAFETEA-LU programs require a local match of between zero percent and 20 percent. SAFETEA-LU funds primarily capital improvements and safety and education programs that relate to the surface transportation system.

To be eligible for Federal transportation funds, States are required to develop a State Transportation Improvement Program (STIP) and update it at least every four years. A STIP is a multi-year capital improvement program of transportation projects that coordinates transportation-related capital improvements planned by metropolitan planning organizations and the state.

To be included in the STIP, projects must be identified either in the Interregional Transportation Improvement Plan (ITIP), which is prepared by Caltrans, or in the Regional Transportation Improvement Plan (RTIP), which in the Bay Area is prepared by the Metropolitan Transportation Commission. Bicycle and pedestrian projects are eligible for inclusion. Caltrans updates the STIP every two years.

The following programs are administered by the Federal government.

Transportation, Community and System Preservation (TCSP) Program

The Transportation, Community and System Preservation (TCSP) Program provides federal funding for transit oriented development, traffic calming and other projects that improve the efficiency of the

transportation system, reduce the impact on the environment, and provide efficient access to jobs, services and trade centers. The program provides communities with the resources to explore the integration of their transportation system with community preservation and environmental activities. TCSP Program funds require a 20 percent match. Congress appropriated $204 million to this program in Fiscal Year 2009. Funding has been extended under a continuing resolution for FY 2010.

Online resource: http://www.fhwa.dot.gov/tcsp/

Rivers, Trails and Conservation Assistance Program

The Rivers, Trails and Conservation Assistance Program (RTCA) is a National Parks Service program that provides technical assistance via direct staff involvement, to establish and restore greenways, rivers, trails, watersheds and open space. The RTCA program provides only for planning assistance—there are no implementation monies available. Projects are prioritized for assistance based upon criteria that include conserving significant community resources, fostering cooperation between agencies, serving a large number of users, encouraging public involvement in planning and implementation and focusing on lasting accomplishments.

Online resource: http://www.nps.gov/ncrc/programs/rtca/contactus/cu_apply.html

National Scenic Byways Program

The National Scenic Byways Program identifies roads with outstanding scenic, historic, and cultural, natural, recreational, and archaeological qualities as National Scenic Byways. The program provides funding for scenic byway projects and for planning, designing, and developing scenic byway programs. There is a 20 percent match requirement. National Scenic Byways Program can be used to fund on-street and off-street bicycle facilities, pedestrian facilities, intersection improvements, user maps and other publications. Within San Mateo County, Highway 1 is a National Scenic Byway, and Highways 280 and 35 are State Scenic Byways.

Nationally, $3 million were available each fiscal year between 2006 and 2009.

Grant applications for National Scenic Byways Programs are forwarded to the FHWA division office by the state or tribal scenic byways coordinator.

Federal Fact Sheet: http://www.fhwa.dot.gov/safetealu/factsheets/scenic.htm

National Scenic Byways Program: http://www.bywaysonline.org/grants/

Paul S. Sarbanes Transit in Parks Program

Paul S. Sarbanes Transit in Parks and Public Lands Program, formerly the Alternative Transportation in Parks and Public Lands (ATPPL) Program, funds transportation modes that reduce congestion in parks and public lands. The program funds planning and capital expenses for alternative modes in state and national lands, including bicycle and pedestrian paths. Any local, state, federal agency or tribal group that manages federal lands may apply for funds. Project awards range from $40,000 to $3 million.

Online resource: http://www.fta.dot.gov/funding/grants/grants_financing_6106.html

3.2 State-Administered Funding

The State of California uses both federal sources and its own budget to fund the following bicycle and pedestrian projects and programs.

Bicycle Transportation Account

The Bicycle Transportation Account (BTA) provides state funding for local projects that improve the safety and convenience of bicycling for transportation. Because of its focus on transportation, BTA projects must serve a transportation purpose. Funds are available for both planning and construction. Caltrans administers BTA funds, and requires eligible cities and counties to have adopted a Bicycle Transportation Plan. City Bicycle Transportation Plans must be approved by the local Metropolitan Transportation Commission (MPO) prior to Caltrans approval. Out of $7.2 million available statewide, the maximum amount available for individual projects is $1.2 million.

Online resource: www.dot.ca.gov/hq/LocalPrograms/bta/btawebPage.htm

Federal Safe Routes to School (SRTS) and California Safe Routes to School (SR2S)

Caltrans administers funding for Safe Routes to School projects through two separate and distinct programs: the state-legislated Program (SR2S) and the federally-legislated Program (SRTS). Both programs competitively award reimbursement grants with the goal of increasing the number of children who walk or bicycle to school.

California Safe Routes to School Program expires December 21, 2012, requires a 10 percent local match, is eligible to cities and counties, and targets children in grades K-12. The fund is primarily for construction, but applicants may use up to 10 percent of the program funds for education, encouragement, enforcement and evaluation activities. Cycle 9 provided $24.25 million for FY 10/11.

The Federal Safe Routes to School Program has been extended through December 31, 2010, and may be included in the future federal transportation bill. Cities, counties, school districts, non-profits, and tribal organizations are eligible for the 100 percent reimbursable funds that target children in grades K-8. Applicants may use funds for construction or for education, encouragement, enforcement, and evaluation activities. Construction must be within two miles of a grade school or middle school. Cycle 2 provided $46 million for FY 08/09 and 09/10.

Online resource: http://www.dot.ca.gov/hq/LocalPrograms/saferoutes/saferoutes.htm

Recreational Trails Program

The Recreational Trails Program (RTP) of SAFETEA-LU allocates funds to states to develop and maintain recreational trails and trail-related facilities for both non-motorized and motorized recreational trail uses. Examples of trail uses include hiking, bicycling, in-line skating, equestrian use, and other non-motorized and motorized uses. The State Department of Parks and Recreation administers RTP funds in California. A minimum 12 percent of local match is required. California received a $1.3 million apportionment for FY 2010 and continuation of the program is dependent on Federal authorization of a new transportation bill. RTP projects must be ADA-compliant and may be used for:

- Maintenance and restoration of existing trails
- Purchase and lease of trail construction and maintenance equipment

- Construction of new trails, including unpaved trails
- Acquisition of easements or property for trails
- State-administrative costs related to this program (limited to seven percent of a State's funds)
- Operation of educational programs to promote safety and environmental protection related to trails (limited to five percent of a State's funds).

Online resource: http://www.fhwa.dot.gov/environmnet/rectrails/index.htm.

California Conservation Corps

The California Conservation Corps (CCC) is a public service program that occasionally provides assistance on construction projects. The CCC may be written into grant applications as a project partner. In order to utilize CCC labor, project sites must be public land or publicly-accessible. CCC labor will not perform regular maintenance, but will perform annual maintenance, such as the opening of trails in the spring.

Online resource: http://www.ccc.ca.gov/

Transportation Planning Grant Program

The Transportation Planning Grant Program, administered by Caltrans, provides two grants for bicycle and pedestrian project planning and construction.

The **Community-Based Transportation Planning Grant** funds projects that exemplify livable community concepts, including bicycle and pedestrian improvement projects. Eligible applicants include local governments, MPOs, and RPTAs. A 20 percent local match is required and projects must demonstrate a transportation component or objective. There is $3 million available annually statewide. The maximum grant award is $300,000.

The **Environmental Justice: Context Sensitive Planning Grants** promote context sensitive planning in diverse communities and funds planning activities that assist low-income, minority, and Native American communities to become active participants in transportation planning and project development. Grants are available to transit districts, cities, counties, and tribal governments. This grant is funded by the State Highway Account at $1.5 million annually statewide. The maximum grant award is $300,000.

Online resource: www.dot.ca.gov/hq/tpp/grants.html

Highway Safety Improvement Program

The Highway Safety Improvement Program funds are allocated to States as part of SAFETEA-LU. The goal of HSIP funds is to achieve a significant reduction in traffic fatalities and serious injuries on all public roads. As required under the Highway Safety Improvement Program (HSIP) California Department of Transportation has developed and is in the process of implementing a Strategic Highway Safety Plan (SHSP). A portion of the HSIP funds allocated to each state is set aside for construction and operational improvements on high-risk rural roads. If the state has a Strategic Highway Safety Plan, the remainder of the funds may be allocated to other programs, including projects on bicycle and pedestrian pathways or trails and education and enforcement. The local match varies between 0 and 10 percent. The maximum grant award is $900,000.

Caltrans issues an annual call for projects for HSIP funding. Projects must meet the goals of the Strategic Highway Safety Plan.

Federal HSIP online resource: http://www.fhwa.dot.gov/safetealu/factsheets/hsip.htm

Caltrans HSIP online resource: http://www.dot.ca.gov/hq/LocalPrograms/hsip.htm

Land and Water Conservation Fund

Land and Water Conservation Fund (LWCF) is a federally funded program, run through the National Park Service that provides grants for planning and acquiring outdoor recreation areas and facilities, including trails. The fund is administered by the California Department of Parks and Recreation. The fund has been reauthorized until 2015.

Cities, counties, and districts authorized to acquire, develop, operate, and maintain park and recreation facilities are eligible to apply. Applicants must fund the entire project, and will be reimbursed for 50 percent of costs. Property acquired or developed under the program must be retained in perpetuity for public recreational use.

On June 3, 2009, Secretary of the Interior Ken Salazar signed the LWCF 2009 Certificate of Apportionment, which distributes over $27 million to the States, Territories, and the District of Columbia. Approximately $2.3 million is available for projects in California.

National Park Service website: http://www.nps.gov/lwcf/

California LWCF website: http://www.parks.ca.gov/default.asp?page_id=21360

Wildlife Conservation Board Public Access Program

The Wildlife Conservation Board (WCB) is a California State board that provides grants to public agencies and non-profit groups and organizations. The focus of the Board's grant funding program is the acquisition of lands or improvements that preserve wildlife habitat or provide recreational access for hunting, fishing, or other wildlife-oriented activities. Up to $250,000 dollars are available per project. Applications are accepted quarterly. Projects eligible for funding include interpretive trails, river access, and trailhead parking areas. The State of California must have a proprietary interest in the project. Local agencies are generally responsible for the planning and engineering phases of each project.

Wildlife Conservation Board online resource: http://www.wcb.ca.gov/

Environmental Enhancement and Mitigation Funds

The Environmental Enhancement Mitigation Program (EEMP) provides grant opportunities for projects that indirectly mitigate environmental impacts of new transportation facilities. Projects should fall into one of the following three categories: highway landscaping and urban forestry, resource lands projects, or roadside recreation facilities. Funds are available for land acquisition and construction. The local Caltrans District must support the project. The average award amount is $250,000.

Online resource: http://resources.ca.gov/eem/

State Highway Operations & Protection Program

The State Highway Operations and Protection Program (SHOPP) is a Caltrans funding source with the purpose of purpose of maintaining and preserving the investment in the State Highway System and supporting infrastructure. Projects typically fall into the following categories: collision reduction, major damage restoration, bridge preservation, roadway preservation, roadside preservation, mobility enhancement,

and preservation of other transportation facilities related to the state highway system. In the past, SHOPP funds have been used to construct bicycle and pedestrian projects, including curb ramps, overcrossings, bike paths, sidewalks, and signal upgrades to meet ADA requirements. Jurisdictions work with Caltrans' districts to have projects placed on the SHOPP list.

The total amount available for the four-year SHOPP period between 2010/11 and 2013/14 fiscal years is $6.75 billion, which is a reduction in funding from prior SHOPP programs. Past project awards have ranged from approximately $140,000 to $4.68 million.

The American Recovery and Reinvestment Act (ARRA) granted funding to this program in California.

Online resource: http://www.dot.ca.gov/hq/transprog/shopp.htm

Petroleum Violation Escrow Account (PVEA)

In the late 1970s, a series of Federal court decisions against selected United States oil companies ordered refunds to the States for price overcharges on crude oil and refined petroleum products during a period of price control regulations. To qualify for PVEA funding, a project must save or reduce energy and provide a direct public benefit within a reasonable time frame. In the past, the PVEA has been used to fund programs based on public transportation, computerized bus routing and ride sharing, home weatherization, energy assistance and building energy audits, highway and bridge maintenance, and reducing airport user fees. In California, Caltrans administers funds for transportation-related PVEA projects. PVEA funds do not require a match and can be used as match for additional Federal funds.

Online resource: http://www.dot.ca.gov/hq/LocalPrograms/lam/prog_g/g22state.pdf

Office of Traffic Safety (OTS) Grants

Office of Traffic Safety Grants are supported by Federal funding under the National Highway Safety Act and SAFETEA-LU. In California, the grants are administered by the Office of Traffic Safety.

Grants are used to establish new traffic safety programs, expand ongoing programs or address deficiencies in current programs. Pedestrian safety is included in the list of traffic safety priority areas. Eligible grantees are governmental agencies, state colleges, state universities, local city and county government agencies, school districts, fire departments, and public emergency services providers. Grant funding cannot replace existing program expenditures, nor can traffic safety funds be used for program maintenance, research, rehabilitation, or construction. Grants are awarded on a competitive basis, and priority is given to agencies with the greatest need. Evaluation criteria to assess need include potential traffic safety impact, collision statistics and rankings, seriousness of problems, and performance on previous OTS grants. The California application deadline is January of each year.

There is no maximum cap to the amount requested, but all items in the proposal must be justified to meet the objectives of the proposal.

California OTS online resource: http://www.ots.ca.gov/Grants/default.asp

Community Development Block Grants

The CDBG program funds projects and programs that develop viable urban communities by providing decent housing and a suitable living environment and by expanding economic opportunities, principally for persons

of low and moderate income. Federal Community Development Block Grant Grantees may use CDBG funds for activities that include (but are not limited to) acquiring real property; building public facilities and improvements, such as streets, sidewalks, and recreational facilities; and planning and administrative expenses, such as costs related to developing a consolidated plan and managing CDBG funds. The state makes funds available to eligible agencies (cities and counties) through a variety of different grant types. Grantees enter into a contract with the state. Eligible agencies are determined based on a formula, and are listed on the HUD website.

California received a $42.8 million allocation for all CDBG programs in FY 2010. The maximum grant amount is $800,000 for up to two eligible projects or $400,000 for a public service program.

Online resource: http://www.hud.gov/offices/cpd/communitydevelopment/programs/index.cfm

Eligible CDBG Agencies in California: http://www.hud.gov/local/ca/community/cdbg/#state

3.3 Locally-Administered Funding

Local funding sources are generally administered by Metropolitan Planning Organizations, Congestion Management Agencies, Transportation Improvement Authorities, or other regional agencies. Counties or cities may administer some funding sources. These funding sources are supported by federal, state, or local revenue streams.

Regional Surface Transportation Program

The Regional Surface Transportation Program (RSTP) is a block grant program that provides funding for bicycle and pedestrian projects, among many other transportation projects. Under the RSTP, Metropolitan planning organizations, such as the Metropolitan Transportation Commission's (MTC), prioritize and approve projects that will receive RSTP funds. Metropolitan planning organizations can transfer funding from other federal transportation sources to the RSTP program in order to gain more flexibility in the way the monies are allocated. In California, 76 percent of RSTP funds are allocated to urban areas with populations of at least 200,000. The remaining funds are available statewide.

Online resource: http://www.mtc.ca.gov/funding/STPCMAQ/

Transportation for Livable Communities Program

The Transportation for Livable Communities Program (TLC) provides grant monies to public agencies to encourage land use decisions that support compact, pedestrian and bicycle-friendly development near transit hubs. MTC's Transportation Plan 2035 stipulates all eligible TLC projects to be within Priority Development Areas (PDAs), which focus growth around transit. MTC selects projects based on their status (planned or proposed) and their development intensity. MTC administers the TLC program with funds from the Regional Surface Transportation Project and caps grants at $400,000. Funds may be used for capital projects or planning.

Online resource: www.mtc.ca.gov/planning/smart_growth/tlc_grants.htm

Transportation Fund for Clean Air

Administered by the Bay Area Air Quality Management District (BAAQMD), the Transportation Fund for Clean Air (TFCA) is a grant program funded by a $4 surcharge on motor vehicles registered in the Bay Area. This surcharge generates approximately $22 million per year in revenue. TFCA's goal is to implement the

most cost-effective projects in the Bay Area that will decrease motor vehicle emissions, and therefore improve air quality. Projects must be consistent with the 1988 California Clean Air Act and the Bay Area Ozone Strategy. TFCA funds covers a wide range of project types, including bicycle facility improvements such as bike lanes, bicycle racks, and lockers; arterial management improvements to speed traffic flow on major arterials; and smart growth.

Online resource: http://www.baaqmd.gov/Divisions/Strategic-Incentives/Funding-Sources/TFCA.aspx

Bicycle Facilities Program

The BAAQMD Bicycle Facility Program (BFP) provides grant funding to reduce motor vehicle emissions through the implementation of new bikeways and bicycle parking facilities in the Bay Area. The TFCA program funds the BFP. Projects must cost between $10,000 and $120,000 and the applicant must have secured 50 percent in matching funds. The BAAQMD typically releases a call for projects in June or July, requiring an application submittal in September and announcing project awards in November.

Online resource: http://www.baaqmd.gov/Divisions/Strategic-Incentives/Bicycle-Facility-Program.aspx

Safe Routes to Transit (SR2T)

Regional Measure 2 (RM2), approved in March 2004, raised the toll on seven state-owned Bay Area bridges by one dollar for 20 years. This fee increase funds various operational improvements and capital projects that reduce congestion or improve travel in the toll bridge corridors.

MTC allocates the $20 million of RM2 funding to the Safe Routes to Transit Program, which provides competitive grant funding for capital and planning projects that improve bicycle and pedestrian access to transit facilities. Eligible projects must reduce congestion on one or more of the Bay Area's toll bridges. Transform and the East Bay Bicycle Coalition administer SR2T funding. Awarded in five $4 million grant cycles, the first round of funding was awarded in December 2005. Future funding cycles will be in 2011 and 2013.

Online resource: http://www.transcoalition.org/c/bikeped/bikeped_saferoutes.html

TDA Article 3

Transportation Development Act (TDA) Article 3 funds are state block grants awarded annually to local jurisdictions for transit, bicycle, and pedestrian projects in California. Funds originate from the Local Transportation Fund (LTF), which is derived from a quarter-cent of the general state sales tax. LTF funds are returned to each county based on sales tax revenues. MTC estimates allocating $22 million in revenues to San Mateo County. C/CAG develops a list of TDA Article 3 projects for San Mateo County through a competitive process, and then receives funding from MTC to distribute to local agencies.

Eligible pedestrian and bicycle projects include: construction and engineering for capital projects; maintenance of bikeways; bicycle safety education programs (up to five percent of funds); and development of comprehensive bicycle or pedestrian facilities plans. A city or county may apply for funding to develop or update bicycle plans not more than once every five years. TDA funds may be used to meet local match requirements for federal funding sources. Two percent of the total TDA apportionment is available for bicycle and pedestrian funding.

Online resource: http://www.mtc.ca.gov/funding/STA-TDA/

Regional Bicycle Program

The Regional Bicycle Program funds construction of bikeways on the Regional Bikeway Network for the Bay Area. While this program does not specifically include pedestrian projects, it does include multi-use paths, which benefit pedestrians. MTC administers RBP funds to county CMA's based on population, bikeway network capital cost, and unbuilt network miles. In San Mateo County, C/CAG administers and distributes this funding.

Online resource: www.mtc.ca.gov/planning/bicyclespedestrians/regional.htm

Measure A

San Mateo County Voters approved Measure A in 1988, increasing local sales tax by one-half of one percent for transportation improvements designated in the Transportation Expenditure Plan. The measure's 2004 reauthorization extended it through 2033. The San Mateo County Transportation Authority (TA) administers Measure A revenues to fund a wide variety of transportation-related projects and programs. In 2011, the TA will issue its first call for bicycle and pedestrian projects funded through Measure A.

Online resource: http://www.smcta.com/

Peninsula Traffic Congestion and Relief Alliance

The Peninsula Traffic Congestion and Relief Alliance (The Alliance) is San Mateo County's Transportation Demand Management Agency. The Alliance's mission is to reduce the number of single occupancy vehicles traveling in, to, and through San Mateo County, reducing vehicle emissions resulting in improved air quality. The Alliance is funded by the C/CAG, the San Mateo County TA, the BAAQMD and the MTC.

The Alliance provides small grants and cash incentives that allow communities and employers to provide bicycle parking and provide commuter benefits that encourage transit, walking and biking. Programs include the Commute Benefit Employer Incentive Program, which allows employers to provide employees with up to $230 pre-tax for most commute expenses, and the Bicycle Parking Incentive Program, which reimburses employers for 50 percent of the cost of bicycle parking, up to $500 per unit.

Online resource: www.commute.org

New Construction

Future construction projects are a means of providing sidewalks and other pedestrian facilities. To ensure that roadway construction projects provide facilities where needed and feasible, it is important that an effective review process be in place so that new roads meet the counties' and cities' standards and guidelines for the development of sidewalks and pedestrian facilities. A developer may also attempt to reduce the number of trips (and hence impacts and cost) by paying for on- and off-site bicycle and pedestrian improvements designed to encourage residents, employees and visitors to the new development to walk rather than drive.

General Funds

One of the local revenue sources of cities, towns, and counties available for use on bicycle and pedestrian improvements are general funds resulting from sales taxes, property taxes, and other miscellaneous taxes and fees. There are generally few restrictions on the use of these funds, which are utilized for a large variety of local budget needs. As such, there is typically high demand for these funds for numerous government services.

Design and construction of sidewalks and pathways through use of this funding source usually receives limited support from local governments unless their constituents lobby effectively for such use.

In some cases, a component of local general funds can be dedicated to transportation improvements including the construction and repair of sidewalks.

Special Improvement Districts

Counties and cities may establish special improvement districts to provide funding for specified public improvement projects within the designated district. Property owners in the district are assessed for the improvements and can pay the amount immediately or over a span of 10 to 20 years. Street pavement, curb and gutter, sidewalks, and streetlights are some of the common improvements funded by Special Improvement Districts. Business Improvement Districts and Special Assessment Districts are example of special improvement districts.

Mello-Roos Community Facilities Act

In 1982, California Legislature passed the Mello-Roos Community Facilities Act in response to reduced funding opportunities resulting from Proposition 13.[1] The Mello-Roos Act allows any county, city, special district, school district, or joint powers of authority to establish a Community Facility Districts (CFD) for the purpose of selling tax-exempt bonds to fund public improvements within that district. CFDs must be approved by a two-thirds margin of qualified voters in the district. Property owners within the district are responsible for paying back the bonds. Construction and maintenance of pedestrian and bicycle facilities are eligible for funding under CFD bonds.

Online resource: http://mello-roos.com/pdf/mrpdf.pdf

Parks and Recreation Funds

Local parks and recreation funds are generally derived from property and sales taxes and some fee revenues, and they are sometimes used directly for pathway or pathway-related facilities, including bathrooms, pocket parks, lighting, parking, and landscaping. Parks and recreation funds are also utilized to cover pathway maintenance costs incurred by these departments.

Integration into Larger Projects

"Routine accommodation" policies at Caltrans and MTC require agencies to design, construct, operate, and maintain transportation facilities using best practices for pedestrians and bicyclists. Local jurisdictions can begin to expect that some portion of pedestrian and bicyclist project costs, when they are built as part of larger transportation projects, will be covered in project construction budgets.

3.4 Other Sources

Community Action for a Renewed Environment (CARE)

(Administrator: U.S. EPA)

CARE is a competitive grant program that offers an innovative way for a community to organize and take action to reduce toxic pollution in its local environment. Through CARE, a community creates a partnership

[1] Approved by California voters in 1978, Proposition 13 limited property tax to one percent of full cash value of said property.

that implements solutions to reduce releases of toxic pollutants and minimize people's exposure to them. By providing financial and technical assistance, EPA helps CARE communities get on the path to a renewed environment. Transportation and "smart-growth" types of projects are eligible. Grants range between $75,000 and $300,000.

Online resource: http://www.epa.gov/care/

Bikes Belong Grant

Bikes Belong is an organization sponsored by bicycle manufacturers with the intent to increase bicycle riding in the United States. Bikes Belong provides grant opportunities up to $10,000 with a minimum 50 percent match to organizations and agencies seeking to support facility and advocacy efforts. Eligible projects include bike paths, trails, and bridges, mountain bike facilities, bike parks, and BMX facilities.

Online resource: http://www.bikesbelong.org/grants

Volunteer and Public-Private Partnerships

Local schools or community groups may use the bikeway projects as a project for the year, possibly working with a local designer or engineer. Work parties may be formed to help clear the right-of-way where needed. A local construction company may donate or discount services. A challenge grant program with local businesses may be a good source of local funding, where corporations 'adopt' a bikeway and help construct and maintain the facility.

Table 1: Funding Acronyms, Online Resources and Government Jurisdictions

Acronyms
BAAQMD – Bay Area Air Quality Management District
Caltrans - California Department of Transportation
C/CAG – City/County Association of Governments of San Mateo County
CMAQ - Congestion Mitigation and Air Quality
CTC - California Transportation Commission
FHWA - Federal Highway Administration
RTPA - Regional Transportation Planning Agency
State DPR - California Department of Parks and Recreation (under the State Resources Agency)
SAFETEA-LU – Safe Accountable Flexible, Efficient Transportation Equity Act: A Legacy for Users
TA – San Mateo County Transportation Authority
Jurisdictions for San Mateo County, California:
Caltrans - Caltrans District 4
Congressional District 12 and 14

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Table 2: Funding Sources

Grant Source	Due Date	Administering Agency	Annual Total	Matching Requirement	Eligible Applicants	Planning	Construction	Other	Comments
Federally-Administered Funding									
Transportation, Community and System Preservation Program	Varies, generally January or February.	Federal Transit Administration	$204 m nationally in 2009	20%	States, MPOs, local governments and tribal agencies	X	X	X	May be used for research. Funds projects that increase the efficiency of the transportation system.
Rivers, Trails and Conservation Assistance Program	Aug 1 for the following fiscal year	NPS	Program staff time is awarded.	Not applicable	Governments, communities			X	RTCA staff provides technical assistance to communities so they can conserve rivers, preserve open space, and develop trails and greenways. Contact NPS at (202) 354-6900.
National Scenic Byways Program	Varies by agency	FHWA	$3 m annually nationwide	20%	State and Tribal agencies	X	X	X	Can be used to fund on-street or off-street facilities, intersection improvements, user maps and other publications. Projects must be located along a National Scenic Byway. Since 1992, individual project awards ranged between $11,000 and $807,000.
Paul S. SarbanesTransit in Parks and Public Lands Program	Varies, Generally October.	Federal Transit Administration, Department of the Interior, Forest Service	$27 m in 2009	Not available	Federal, State, local and tribal agencies that manage federal lands	X	X		Funds transportation modes that reduce congestion in parks and public lands.
State-Administered Funding									
Bicycle Transportation Account	December	Caltrans	$7.2 m	min. 10% local match on construction	city, county	X	X		State-funded. Projects that improve safety and convenience of bicycle commuters. Contact Ken McGuire, Caltrans, (916) 653-2750. Maximum project award is $500,000.
Federal Safe Routes to School	Mid-July	Caltrans	$46 m	none	state, city, county, MPOs, RTPAs and other organizations that partner with one of the above.		X	X	Construction, education, encouragement and enforcement program to encourage walking and bicycling to school.
California Safe Routes to School	Late May/ Early June	Caltrans	$24.5 m	10%	city, county		X	X	Primarily construction program to enhance safety of pedestrian and bicycle facilities.
Recreational Trails Program	Oct. 1	CA Dept. of Parks and Recreation	$1.3 m in2010	12%	Agencies and organizations that manage public lands	X	X	X	Funds can be used for acquisition of easements for trails from a willing seller.
California Conservation Corps	On-going	California Conservation Corps	CCC donates labor hours	None	Federal and state agencies, city, county, school district, NPO, private industry		X	X	CCC provides labor assistance on construction projects and annual maintenance. Contact the Corps at (916) 341-3100.

Table 2: Funding Sources (continued)

Grant Source	Due Date	Administering Agency	Annual Total	Matching Requirement	Eligible Applicants	Planning	Construction	Other	Comments
Community Based Transportation Planning Demonstration Grant Program	November	Caltrans	$3 m	20% local	MPO, RPTA, city, county		X		Projects that exemplify livable community concepts. Contact Leigh Levine, Caltrans, (916) 651-6012.
Highway Safety Improvement Program	Oct in CA	Caltrans, NDOT	$50m in 2009	Varies between 0% and 10%	Local or regional governments	X	X	X	Projects must address safety issue. Education and enforcement programs are eligible.
Land and Water Conservation Fund	March	NPS, CA Dept. of Parks and Recreation	$2.3 m in CA in 2009	50%	Cities, counties and districts authorized to operate, acquire, develop and maintain park and recreation facilities	X		X	Lands acquired through program must be retained in perpetuity for public recreational use. Individual project awards are not available.
Wildlife Conservation Board Public Access Program	Quarterly	Wildlife Conservation Board	Grants can be up to $250,000	Up to 50%	Public agencies and nonprofits		X		State of California must have a proprietary interest in the project. Project awards are not available.
Environmental Enhancement and Mitigation Program	November	California Natural Resources Agency	$10 m	None	Federal, State, local agencies and NPO		X	X	EEMP funds projects in California, at an annual project average of $250,000. Funds may be used for land acquisition.
State Highway Operations and Protection Program (SHOPP)	Not Available	Caltrans	$1.69 m statewide annually through FY 2013/14	Not Available	Local and regional agencies		X	X	Capital improvements and maintenance projects that relate to maintenance, safety and rehabilitation of state highways and bridges.
Petroleum Violation Escrow Account	Not Applicable	Caltrans	Varies annually	None	Local and regional agencies		X	X	Funds programs based on public transportation, computerized bus routing and ride sharing, home weatherization, energy assistance and building energy audits, highway and bridge maintenance, and reducing airport user fees.
Office of Traffic Safety (OTS) Grants	January	Caltrans	Varies annually	None	Government agencies, state colleges, state universities, city, county, school district, fire department, public emergency service provider			X	Contact OTS at (916) 509-3030.
Community Development Block Grants	Varies between grants	U.S. Dept. of Housing and Urban Development (HUD)	$42.8 m	Varies between grants	City, county	X	X	X	Funds local community development activities such as affordable housing, anti-poverty programs, and infrastructure development. Can be used to build sidewalks, recreational facilities.
Locally-Administered Funding									
Regional Surface Transportation Program	Varies	Caltrans, RTPAs	Varies annually	Not applicable	Regional, local agencies	X	X		

Table 2: Funding Sources (continued)

Grant Source	Due Date	Administering Agency	Annual Total	Matching Requirement	Eligible Applicants	Planning	Construction	Other	Comments
Transportation for Livable Communities	Varies	MTC	$400,000 per project	Not applicable	Local and regional agencies	X	X	X	
Transportation Fund for Clean Air	Varies	Bay Area Air Quality Management District	$22 m	Not applicable	Local and regional agencies		X	X	
Bicycle Facilities Program	June/July	Bay Area Air Quality Management District	$10 - $120 k per project	50%	Local and regional agencies		X	X	Transportation Fund for Clean Air (TFCA) program funds the BFP.
Safe Routes to Transit	Varies	Transform/EBBC	$4 m annually	None	Local and regional agencies	X	X	X	
Transportation Development Act (TDA) Article 3 (2% of total TDA)	Jan.	C/CAG	varies	None	City, county, joint powers agency	X	X		Projects must be included in either a detailed circulation element or plan included in a general plan or an adopted comprehensive bikeway plan and must be ready to implement within the next fiscal year.
Regional Bicycle Program	Not applicable	MTC and C/CAG	varies	None	Not Applicable		X		MTC administers RBP funds to county CMA's based on population, bikeway network capital cost and unbuilt network miles.
Measure A	Not applicable	SMCTA	Varies	Not Applicable	Not Applicable		X		In 2011, the TA will issue its first call for bicycle and pedestrian projects funded through Measure A.
Peninsula Traffic Congestion Relief Alliance	None	Peninsula Traffic Congestion Relief Alliance	Varies	50%	Public agencies and private enterprises			X	"The Alliance" reimburses applicants 50% the cost of bicycle parking.
New Construction	Not applicable	City, county, joint powers authority	Varies	Not Applicable	City, county, joint powers authority		X		Fees related to new construction to provide bicycle and pedestrian amenities that mitigate transportation effects of new development.
General Funds	Not Applicable	City, county	Varies	Not Applicable	City, county	X	X	X	
Special Improvement Districts	Not Applicable	City, county, joint powers authority	Varies	Not Applicable	Neighborhoods, communities		X		Only those who benefit from the improvement may be taxed. Taxes should be tied to the amount of benefit received.
Mello-Roos Community Facilities Act	Not Applicable	City, county, special district, school district, joint powers authority	Varies	Not Applicable	city, county, special district, school district, joint powers of authority		X	X	Property owners within the district are responsible for paying back the bonds. May include maintenance.

Table 2: Funding Sources (continued)

Grant Source	Due Date	Administering Agency	Annual Total	Matching Requirement	Eligible Applicants	Planning	Construction	Other	Comments
Parks and Recreation Funds	Not applicable	City, county	Varies	Not Applicable	City, county	X	X	X	
Integration into Larger Projects	Not applicable	City, county, state, tribal agencies, non-profits	Varies	Not Applicable	City, county, state, tribal agencies, non-profits	X	X	X	Bicycle and pedestrian projects can be integrated into larger construction projects.
Other Sources									
Community Action for a Renewed Environment	March	US EPA	Varies	Not Available	applicant must fall within the statutory terms of EPA's research and demonstration grant authorities	X		X	Grant program to help community organize and take action to reduce toxic pollution in its local environment
Bikes Belong Grant	Multiple dates throughout year.	Bikes Belong	Not Available	50% minimum	organizations and agencies		X	X	
Volunteer and Public-Private Partnerships	Not Applicable	City, county, joint powers authority	Varies	Not Applicable	Public agency, private industry, schools, community groups		X	X	Requires community-based initiative to implement improvements.

4. San Mateo County Pedestrian Design Guidelines

A well-connected pedestrian network is a vital component to livable communities, which thrive on multimodal travel for all roadway users, regardless of age or ability. Multimodal travel incorporates the needs of not just motor vehicles in roadway design, but the needs of pedestrians, bicyclists, and transit users as well. The primary goal of the Design Guidelines is to assist San Mateo County in creating streets that accommodate pedestrians through a set of recommended practices that enhance the walkability of all streets within the County. These guidelines will help cities within the County to make decisions about the preferred application of pedestrian treatments in the following areas:

- Special Pedestrian Needs
- Streets and Sidewalks
- Uncontrolled Intersections / Mid-block Crossing Treatments
- Controlled Intersections
- Design Review for Development Projects

The pedestrian enhancements described throughout these guidelines provide street design best practice guidance, which can enhance the safety, convenience, and mobility for pedestrians. In particular, they provide guidance on appropriate treatments for the various "areas of focus" throughout San Mateo County, including downtown districts, access to transit stations, coastal areas, school zones, barrier crossings, and the El Camino Real corridor. Potential treatment types for each of these areas include different design options for streets/sidewalks, pedestrian crossings, multimodal connections and community vitality. Additional discussion of design considerations relevant to different areas of focus is provided in **Chapter 8: Priority Countywide Pedestrian Projects**.

4.1 Special Pedestrian Needs

"Complete streets" practices improve the pedestrian realm because they encourage the design of streets with well-connected and comfortable sidewalks, traffic calming measures to manage vehicle speeds and enhanced pedestrian crossings. Incomplete streets—those designed primarily for automobile access—can be a barrier in any community, particularly for people with disabilities, older adults, and children.

To improve transportation conditions in San Mateo County, development of "complete streets" is essential to move the County towards an integrated pedestrian street network. "Complete streets" offer a significant opportunity to give children and seniors better mobility; with a growing population of seniors and children in San Mateo County, providing appropriate pedestrian accommodations is even more critical. Streets that prioritize the automobile (including those with wide lanes, multi-lane approaches, long crossing distances and narrow or poorly-maintained sidewalks) are difficult for pedestrians to navigate. The needs of pedestrians should be addressed with every transportation investment, with a primary goal to have all roads work for children, seniors, and those with disabilities, especially within each of the eight pedestrian "areas of focus" defined in Chapter 8.

Special Needs for Children

Discussion

Children have special needs in the pedestrian realm and thus have unique considerations to accommodate their sensitive demands. This becomes apparent in school zones where a safe pedestrian environment is vital. Young children are often too small to be in the line of sight of drivers, so without proper designs, streets surrounding schools may not be safe for these young pedestrians. In addition, children walk slower than adults and may not be able to gauge the amount of time needed to cross an intersection. When streets surrounding schools have inadequate pedestrian facilities, parents may be reluctant to allow their children to walk to school, therefore driving children to school for even short distances.

Design Summary

Accommodating children and other vulnerable populations requires special provisions to remove barriers to pedestrian travel. These special provisions include measures such as reducing vehicle speeds and enhancing street crossings around schools. Reduced speed zones near schools, using striping patterns and colors to communicate to drivers that they are within a school zone, and traffic calming measures (described further in "Streets & Sidewalks" on page 31) can facilitate slower vehicle speeds. Reducing crossing lengths through bulb-outs, special crosswalk striping, and median refuges (described further in "Uncontrolled Crossing Treatments" on page 46) provide shorter crossings for children. Technical assistance and funding to implement these enhancements can be done through Safe Routes to School programs. Adequate sidewalk facilities and crosswalks are particularly important to separate children from vehicle traffic around school neighborhoods where children walk and ride their bicycles..

Design Example

Image Sources: Sacramento County Pedestrian Plan; Dan Burden

Special Needs for Seniors

Discussion

San Mateo County has a growing senior population, which increases the need to address their accommodation as pedestrians within the Countywide transportation network. While the County's population is projected to grow by 14% by 2030, adults 65 years of age and older are projected to grow by 72%.[2] Poor sidewalk and crossing conditions may foster isolation with limited opportunities for seniors' mobility; they need travel options other than driving, whether it be walking or taking transit. Seniors have slower walking speeds and reaction times, and may have other impairments that restrict their mobility, vision, and hearing. Sidewalks and street crossings should be sensitive to these barriers and how they affect the aging population.

Design Summary

Opportunities to orient streets to provide senior mobility include:

- Shortening street crossings with median refuges, sidewalk bulb-outs and adequate curb ramps.
- Installing sidewalk furniture to make walking more comfortable by providing places to rest.
- Adjusting signal timing to account for slower walking speeds.
- Treatments like pedestrian refuge islands are particularly important to help seniors cross a street since they tend to walk at slower speeds; if they are unable to make the crossing during the available signal time, a refuge provides a separated place to wait.

Each of these treatments is described in detail on later pages.

Design Example

Image Sources: Dan Burden

[2] *San Mateo County Aging Model*

Americans With Disabilities Act

Discussion

The Americans with Disabilities Act (ADA) protects the rights of people with disabilities, requiring public entities to develop transition plans to bring existing public facilities up to ADA standards. A key component to adequate ADA provision includes plans to improve curb ramps. It sets guidelines for people with disabilities to access public accommodations and commercial facilities. Disconnected sidewalks and unpaved surfaces can prove frustrating to disabled pedestrians. Additionally, pedestrian may not address the needs of those with poor vision without audible or vibro-tactile enhancements. Creating a comfortable and well-connected pedestrian network is important for "complete streets", as well as focusing on the needs of users with disabilities.

Design Summary

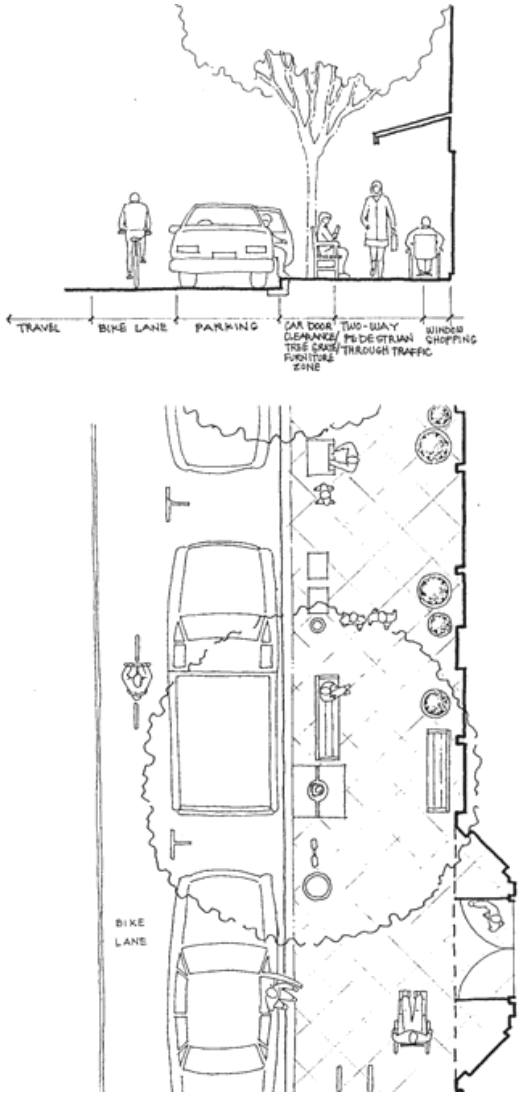
"Complete Streets" strategies will focus intersection designs to expand access for all users. Best practices include improving curb ramps, providing adequate pedestrian clearance intervals, and addressing pedestrian network gaps and sidewalk conditions, which cover many aspects of ADA requirements. Obstacles on sidewalks, such as cracks or misplaced sidewalk amenities, are a primary barrier to pedestrians with visual impairments. Accessible pedestrian signals communicate information about crossings to pedestrians with visual impairments with audible tones or vibrating systems. These accessible pedestrian signals should be placed with guidance from the Accessibility Disability Commission. Truncated domes provide a tactile signal to the visually impaired as they transition between walking paths or sidewalks and conflict areas such as intersections. Direct curb ramps (i.e., two ramps per corner) are preferred whenever possible, to direct pedestrians into a crosswalk instead of the intersection. Bus stops should be located at the far sides of intersections to encourage pedestrians to cross behind vehicles where they are more visible.

Design Example

Image Sources: Dan Burden

4.2 Streets and Sidewalks

Streets and sidewalks should support the activities and pedestrian levels along the street. Streets should be well-connected to ensure that destinations are within walking distance. Sidewalks should be wide enough to support the expected pedestrian volumes. The minimum width for sidewalks is five feet, wide enough for two people to walk side by side. However, sidewalks of this width assume minimal pedestrian traffic. The guidelines in this section specify the approach to determine sidewalk widths that meet walking demand and provide buffer space between motor vehicle lanes and sidewalks and space for walking, sitting, and lingering.



Typical Sidewalk Cross Section and Layout that Provides Space for Different Walking Oriented Activities
Source: Creating Livable Streets, Portland Metro

Street Connectivity

Discussion

A well-connected street network has seamless connections for pedestrians through continuous sidewalks and pedestrian crossings. A grid-like street network is easy for pedestrians to navigate and distributes traffic evenly. In such a network, frequent crossings and short block lengths result in high connectivity. Travel times and distances for pedestrians decrease with connected streets because there are more opportunities for direct paths of travel.

Design Summary

Internal street connectivity provides connections between streets within a particular area, while external connectivity provides connections to other neighborhoods. New road and pedestrian paths can increase pedestrian activity by creating better connections. If possible, cul-de-sacs should be avoided. However, if dead ends are unavoidable, there are alternatives to provide pedestrian connections.

- Pedestrian Pathways- Connects a pedestrian routes to a building entrance when a direct connection is lacking.
- Cul-de-sac connectors- Pathways where streets dead-end to connect people on foot or bicycle to other streets or land uses.
- Avoid large blocks- Buildings on "superblocks" are less connected to the street. Connectivity is important along the street as well as between buildings. An intersection density of at least 150-400 intersections per square mile is recommended for pedestrian-friendly blocks and street networks.

Design Example

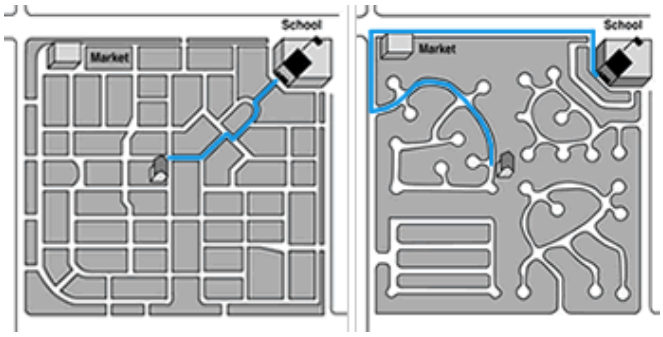


Image Source: http://www.saferoutesinfo.org

Traffic Calming

Discussion

High vehicle speeds reduce pedestrian comfort and increase injury severity in collisions. Controlling speeds is a critical element to ensure the pedestrian feels comfortable walking in a sidewalk or within a crosswalk. Traffic calming treatments are physical elements that alter the streetscape to manage vehicle speeds. As a result, driver awareness of pedestrians increases, and the improvements may have an effect on slowing speeds.

Design Summary

Speed tables/ raised crosswalk - An elevated surface above the travel lane attracts the attention of the driver and encourages lower speeds. It is useful in areas with high pedestrian activity by essentially raising the road surface over a short crossing distance.

Traffic Circles - Traffic circles are located in the middle of an intersection to slow traffic. Generally 10-20 feet in diameter, they typically have landscaping in the middle that reduces sight length down the street to slow vehicles. Traffic circles also manage speeds by forcing vehicles to drive around them.

Pedestrian Bulb-outs - Extend sidewalks into the street to create shorter crossing distances for pedestrians and smaller vehicle turning radii at intersections. More detail may be found in the *Intersections Section.*

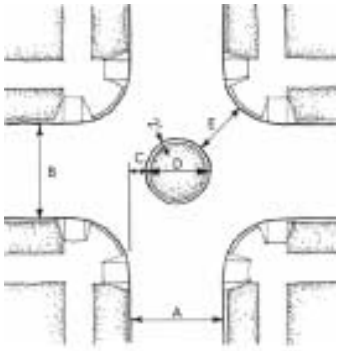
Refuge Islands - Provide a space in the middle of an intersection for pedestrian to comfortably wait until traffic clears and they can finish crossing the intersection. More detail may be found in *Intersections Section.*

Chokers/ Chicanes - These horizontal diversion treatments create "slow points" at mid-block locations by placing physical elements along the street to make vehicles slow down in order to maneuver around them. Chokers raise the curb on either side of a street to narrow the right of way, providing less space for vehicles to travel over a short distance and facilitate a shorter pedestrian crossing. Chicanes are the same concept but the raised curb is offset to force vehicles to slightly turn, thus providing an additional speed reduction measure. It is important that they do not impede with bicycle facilities.

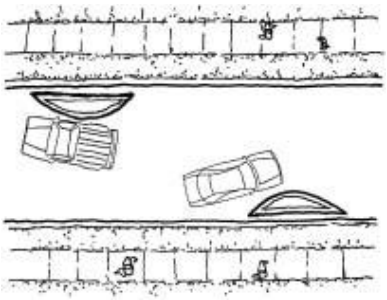
Design Example

Speed Table

Traffic Circle

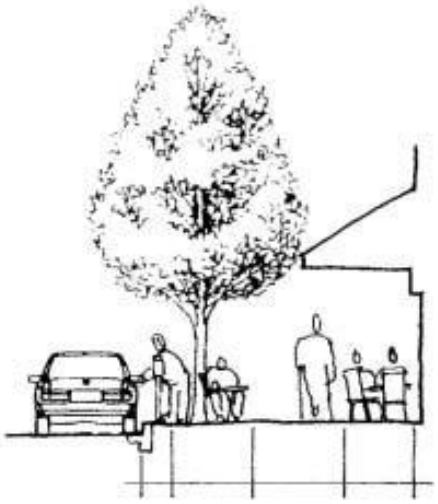


Chicane



Source (Top and Bottom): Valley Transportation Authority Pedestrian Technical Guidelines; (middle) San Diego Street Design Manual

Sidewalk Zones

Discussion	Design Example
The sidewalk zone is the portion of the street right-of-way between the curb and building front. Within this zone, there are four distinct areas that serve different organizational purposes.	
	Edge Furnishings Throughway Frontage
• Edge/ Curb Zone - At a minimum, such as in areas with lower pedestrian activity, there should be a 6-inch wide curb. Other areas, such as downtowns, should have at least an extra foot to accommodate car doors to not conflict with the sidewalk. • Furnishing Zone - This area acts as a buffer between the curb and throughway zone. This is the areas where trees should be planted and benches should be located. Any sidewalk amenities should be located within this area and should not interfere with the throughway zone. Streets with higher speeds should have larger furnishing zones. • Throughway zone - The minimum width of this zone should be 4 feet if there are low pedestrian volumes. However, in order to accommodate people walking side by side in higher volume areas, widths of at least 6 feet are appropriate. • Frontage Zone - This area borders the building façade or fence. The primary purpose of this zone is to create a buffer between pedestrians walking in the throughway zone from people entering and exiting buildings. It provides opportunities for shops to place signs, planters, or chairs that do not encroach into the throughway zone.	 *Sources: Valley Transportation Authority Pedestrian Technical Guidelines; Chula Vista Pedestrian Master Plan*

Pedestrian Amenities

Discussion

Providing amenities for pedestrians along their route makes for a more enjoyable and comfortable walking experience, thus encouraging more walking. They are an essential aspect of street infrastructure which makes pedestrians a priority within the streetscape. These elements enhance the pedestrian realm by serving as functional aspects that serve the needs of walkers while enhancing the character of the street.

Design Summary

A. Wayfinding & Signage - Wayfinding signage should cater to both vehicles and pedestrians, particularly in districts where there are high levels of walking activity. Signs and routes that direct pedestrians to specific destinations are key to providing adequate way finding for pedestrians.

B. Street Furniture - Street furniture is normally placed on a sidewalk in the Frontage Zone to provide additional comfort for pedestrians and enhance place making within the pedestrian realm. Street furniture makes pedestrians feel welcome, but it is important that they do not conflict with the pedestrian travel path. Street furniture can include benches, speacially designed newspaper racks, fountains, special garbage/recycling containers, etc.

C. Street Trees - *The San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook*, created in January 2009, establishes a practical framework to create low impact roadways and parking lots by managing stormwater. It addresses the impacts of stormwater from transportation infrastructure through the treatment of runoff within different design scenarios. Some examples include applying vegetated swales, planters, rain gardens, pervious paving, stormwater curb extensions, and green gutters. Street trees are an important aspect to the pedestrian realm as they increase the comfort for pedestrians, providing shade and a buffer from vehicles, ultimately enhancing the streetscape. The *Guidebook* also provides the following guidance on street tree selection and placement:

- Trees should be placed no greater than 60 feet apart, depending on the species. Trees planted 15-25 feet apart provide a continuous street canopy.
- Should be placed as close as possible to an intersection while not obstructing sight distances.

Design Example

Wayfinding and Signage

High Quality Street Furniture

Lighting - Pedestrian scale lighting provides a better-lit environment for pedestrians while improving visibility for motorists. Sidewalks with frequent nighttime pedestrian activity should have pedestrian lighting. Pedestrians tend to observe more details of the street environment since they travel at a slower pace than vehicles, and thus pedestrian scale lighting should have shorter light poles and shorter spacing between posts. A height of 12- 20 feet is common for pedestrian lighting. The level of lighting should reflect the location and level of pedestrian activity.

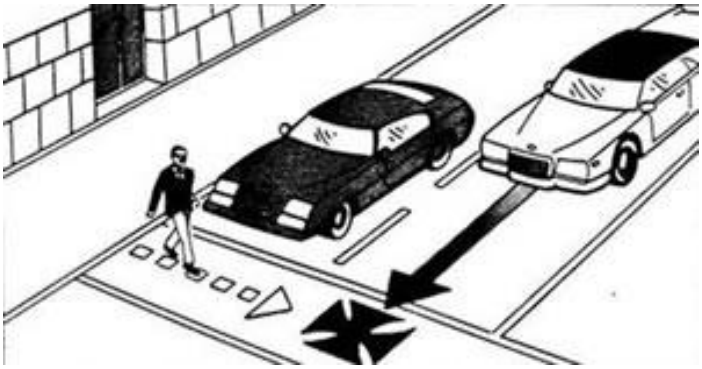
4.3 Uncontrolled Intersections and Mid-block Crossing Treatments

Uncontrolled intersections are locations without a stop sign or signal. Mid-block crossings are locations where there is marked crosswalk in between intersections. Without a formal signal to control traffic, uncontrolled locations and mid-block crossings require unique treatments to ensure that pedestrians are visible within the roadway.

Pedestrians tend to walk in the path that provides the shortest distance. If intersection crossings are too far apart, mid-block crossings may be necessary to accommodate these paths. Streets with lower speeds and volumes and narrower cross-sections are better suited for marked crosswalks than multi-lane, high volume streets. Marking a crosswalk helps to identify the most appropriate place to direct the pedestrian to find their way across the street. However, crosswalks need to be marked properly and placed in a location with proper sight lines. In order to identify the need to mark a crosswalk at an uncontrolled location, the following conditions should occur:

- Sufficient demand exists to justify the installation of a crosswalk
- The location has sufficient sight distance (as measured by stopping sight distance calculations) and/or sight distance will be improved prior to crosswalk marking
- Safety considerations do not preclude a crosswalk

Mid-block crossings must provide adequate sight distance so pedestrians can be clearly viewed by motorists, and vice versa. Additionally, it is important to consider challenges of "multiple threat" collisions in designating crosswalk locations and treatments. Multiple threat collisions occur on multi-lane roadways where a vehicle in the adjacent lane blocks the view of a crossing pedestrian from an approaching driver. San Mateo County has areas that are likely to have multiple-threat conflicts, including freeway interchanges, such as along Highway 101, and multi-lane arterials, like segments of El Camino Real.



Multiple Threat Risk on a Multi-lane Street
Source: FHWA

Street design should minimize conflict points with pedestrians. A highly visible marked crosswalk can reduce these conflicts by warning drivers that they are within a pedestrian realm. Advance yield lines (described within the *Intersections* Section) can create a buffer between the areas where the vehicle has to wait to the pedestrian crossing area. Other design strategies at uncontrolled locations include pedestrian bulb outs and restricting parking at corners, such as a 30 feet minimum, to improve visibility between motorists and pedestrians. The Federal Highway Administration has conducted research on the safety effects of marking crosswalks at uncontrolled locations (summarized in the following table). This research provides a framework for local jurisdictions seeking to establish guidelines for installing new crosswalks to facilitate pedestrian connectivity.

Generalized Crosswalk Installation Guidelines

Discussion: FHWA Guidance on Crosswalk Installation

Table 1. Recommendations for installing marked crosswalks and other needed pedestrian improvements at uncontrolled locations.*

Roadway Type (Number of Travel Lanes and Median Type)	Vehicle ADT < 9,000			Vehicle ADT >9000 to 12,000			Vehicle ADT >12,000 - 15,000			Vehicle ADT > 15,000		
	Speed Limit**											
	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h
2 Lanes	C	C	P	C	C	P	C	C	N	C	P	N
3 Lanes	C	C	P	C	P	P	P	P	N	P	N	N
Multi-Lane (4 or More Lanes) With Raised Median***	C	C	P	C	P	N	P	P	N	N	N	N
Multi-Lane (4 or More Lanes) Without Raised Median	C	P	N	P	P	N	N	N	N	N	N	N

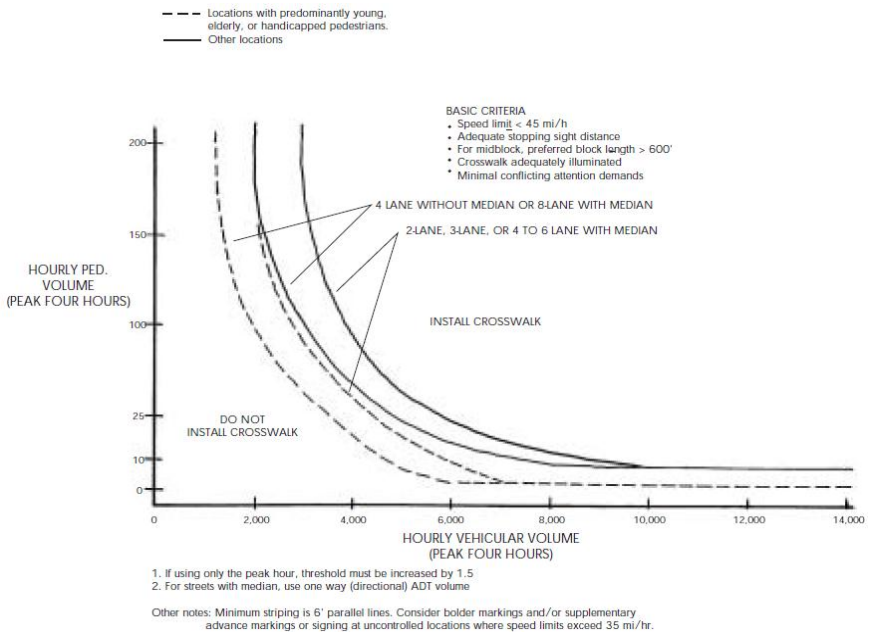
* These guidelines include intersection and midblock locations with no traffic signals or stop signs on the approach to the crossing. They do not apply to

These guidelines include intersection and mid-block locations with no traffic signals or stop signs on the approach to the crossing. They do not apply to school crossings. A two-way center turn lane is not considered a median. Crosswalks should not be installed at locations that could prevent an increased safety risk to pedestrians, such as where there is poor sight distance, complex or confusing designs, a substantial volume of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices. Adding crosswalks alone will not make crossing safer, nor will they necessarily result in more vehicles stopping for pedestrians. Whether or not marked crosswalks are installed, it is important to consider other pedestrian facility enhancements (e.g., raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic-calming measures, curb extensions), as needed to improve the safety of the crossing. These are general recommendations; good engineering judgment should be used in individual cases for deciding where to install crosswalks. ** Where the speed limit exceeds 40 m/h (64.4 km/h) marked crosswalks alone should not be used at unsignalized locations.

C= Candidate sites for marked crosswalks. Marked crosswalks must be installed carefully and selectively. Before installing new marked crosswalks, an engineering study is needed to determine whether the location is suitable for a marked crosswalk. For an engineering study, a site review may be sufficient at some locations, while a more in-depth study of pedestrian volume, vehicle speed, sight distance, vehicle mix, etc, may be needed at other sites. It is recommended that a minimum of 20 pedestrian crossings per peak hour (or 15 or more elderly and/or child pedestrians) exist at a location before placing a high priority on the installation of a marked crosswalk alone.

P= Possible increase in pedestrian crash risk may occur if crosswalks are added without other pedestrian facility enhancements. These locations should be closely monitored and enhanced with other pedestrian crossing improvements, if necessary, before adding a marked crosswalk.

N= Marked crosswalks alone are insufficient, since pedestrian crash risk may be increased due to providing marked crosswalks alone. Consider using other treatments, such as traffic-calming treatments, traffic signals with pedestrian signals where warranted, or other substantial crossing improvement to improve crossing safety for pedestrians.



Source: FHWA

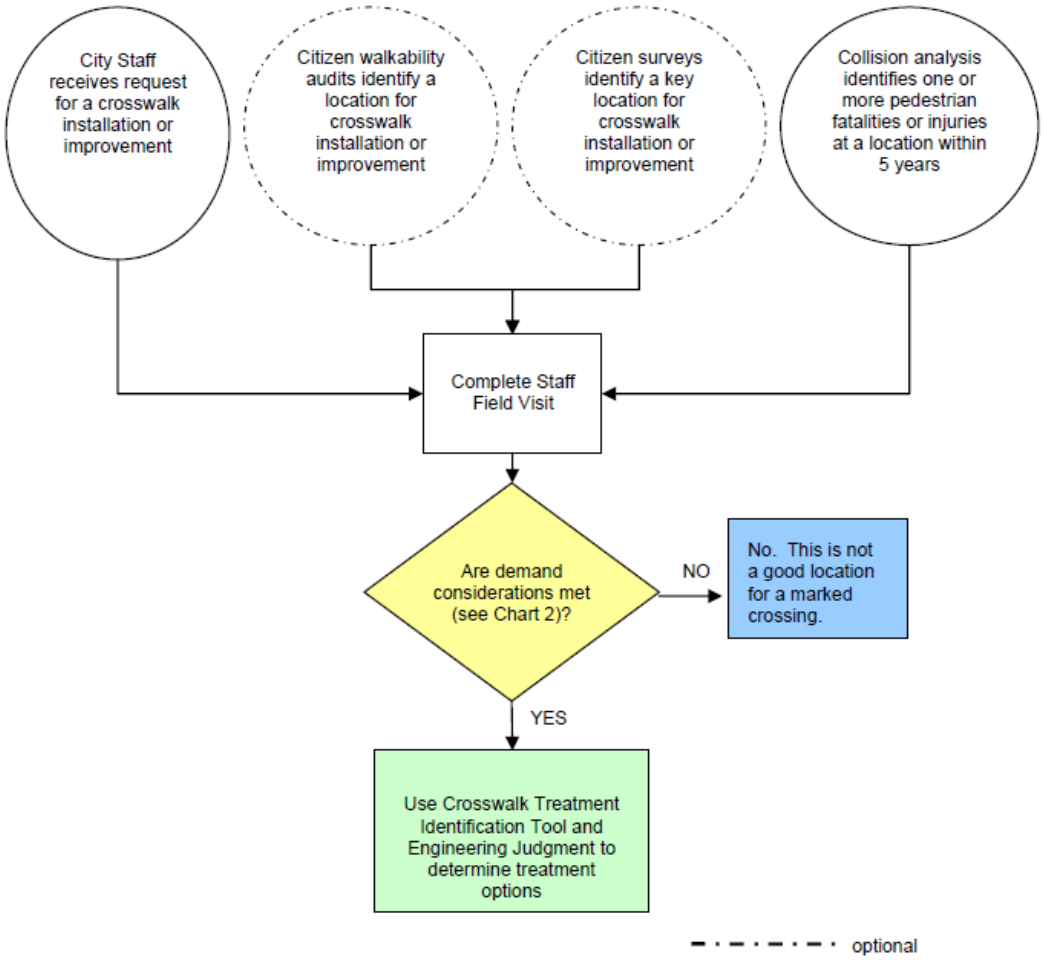
Identifying Uncontrolled Crosswalk Placement

Discussion

Recommendations for ideal crosswalk spacing are different depending on the area of focus (e.g. 300 – 600 ft in high/medium demand areas and rural town centers; at key crossing locations elsewhere). Providing a more direct path of travel may improve pedestrian accommodation and decrease jaywalking. Areas with low street network connectivity may benefit from the use of a mid-block crossing to help pedestrians take the most direct path. Sight distance and vehicle speed are two important factors to consider when installing a mid-block crossing. If speeds are more than 40 mph or volumes higher than 20,000 vehicles per day, mid-block crossings may not be the most suitable treatment. The two charts below provide guidance for the feasibility of crosswalks at uncontrolled and mid-block locations.

Design Summary

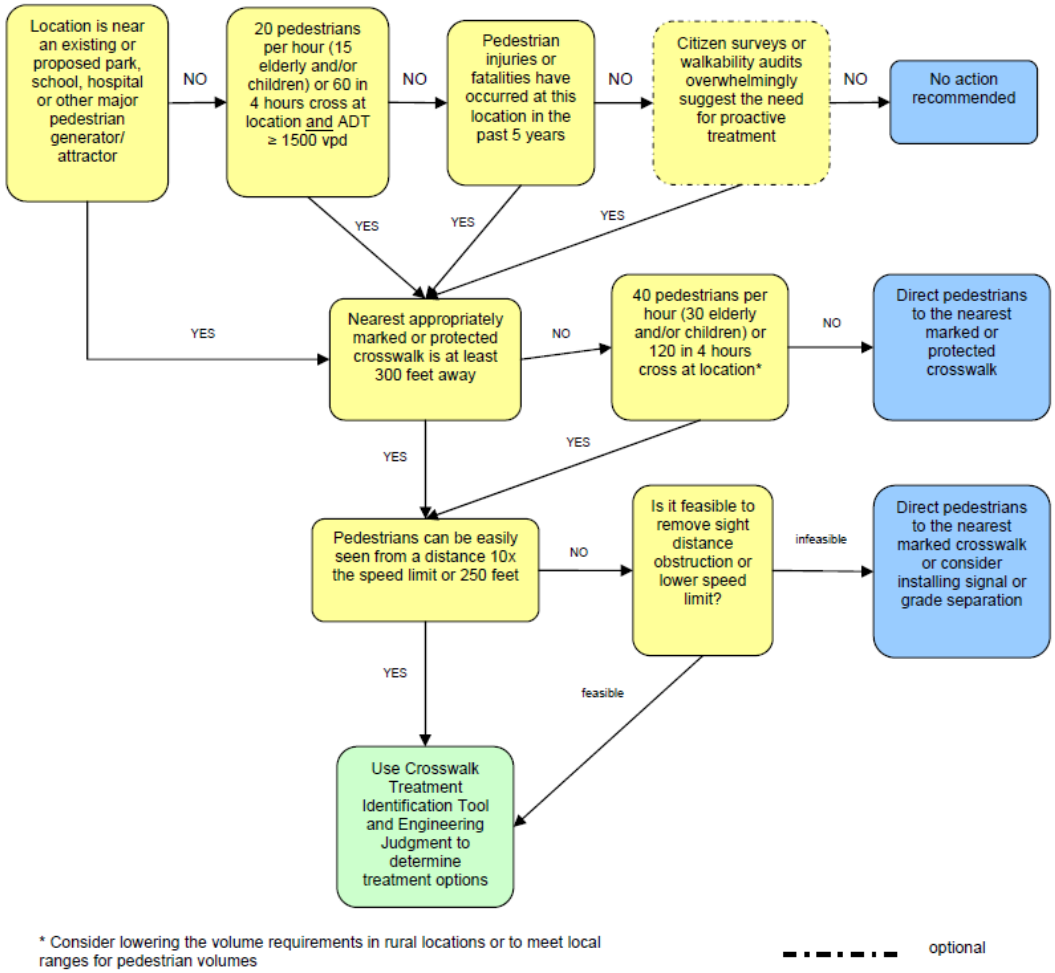
Potential Selection Process for Uncontrolled and Mid-Block Crosswalk Locations



Source: Fehr & Peers

Identifying Uncontrolled Crosswalk Placement

Feasibility Analysis for Treatments at Uncontrolled Locations



Source: Fehr & Peers

Design Example

The City of Sacramento currently has adopted Pedestrian Safety Guidelines document that incorporates the framework described in the flow charts. It can be accessed at:

http://www.cityofsacramento.org/transportation/dot_media/engineer_media/pdf/PedSafety.pdf

The City of San Mateo is currently in the process of developing its own Pedestrian Master Plan, part of which will include Crosswalk Installation Guidelines.

Median Island / Pedestrian Refuge

Discussion

Refuge islands provide a designated space in the middle of a crosswalk to allow pedestrians to wait halfway between crossings. Refuge islands are raised islands in the center of a roadway that separate opposing lanes of traffic with a cutout or ramp for an accessible pedestrian path. They reduce pedestrian exposure to motor vehicles, and allow a pedestrian to cross a roadway in two stages. Their application is most pertinent in higher traffic volume areas that have four-lane or wider streets or when crossing distances exceed 60 feet.

Design Summary

The minimum recommended width for a median island is 5-6 feet in order to accommodate bicyclists. In different contexts, the refuge island can be extended if there are higher amounts of pedestrian activity or additional travel lanes.

A special application of the median island is the two-stage crossing where the crosswalk is staggered such that a pedestrian crosses the street halfway and then is directed to walk towards the direction of traffic to reach the second half of the crosswalk. This channelization effect, typically described as a split-pedestrian cross-over, allows for the pedestrian to easily view traffic while completing the second part of the crossing.

Design Example

Pedestrian Refuge Island

Split Pedestrian Cross-Over

Image Sources: www.tfhrc.gov, www.flickr.com/photos/luton

High Visibility Crosswalk Striping

Discussion

In areas with high pedestrian volumes and where land uses may generate significant pedestrian activity, high visibility striping is a tool that brings attention to pedestrians crossing typically at an uncontrolled or mid-block location. It should be used in combination with other design treatments, like refuge islands, bulb-outs, and other active device enhancements for roadways with more than 4 lanes or speeds over 40 mph. They help to direct pedestrian traffic to specific locations.

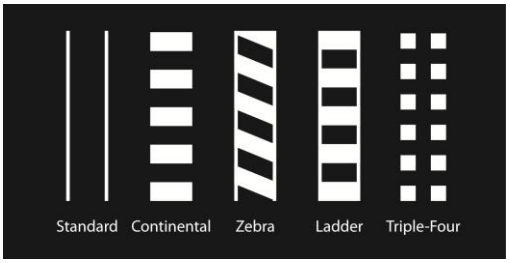
Design Summary

The use of high visibility striping is recommended at uncontrolled crossing locations, and other locations as traffic volumes, speeds, and vehicle-pedestrian conflicts require. There are several treatments for high visibility markings, including the ladder, continental, and zebra designs. Communities should choose a preferred style to use in these circumstances so it is consistently applied. Continental striping is often chosen to communicate sensitive pedestrian crossing areas as the designated high visibility tool.

The City of Sacramento, for example, developed its own standard high visibility striping treatment for uncontrolled locations called the triple-four (shown at right). The City has implemented this treatment citywide, involving three four-foot segments, two dashed lines on the outside with a clear space in the center to direct pedestrian traffic.

Design Example

Example Crosswalk Types



Triple Four Crosswalk

In-Street Pedestrian Crossing Signs

Discussion

This tool involves placing regulatory pedestrian signage in the middle of the roadway centerline, either in front or behind the crosswalk. It is MUTCD-approved and assists to remind road users of laws regarding to the right of way at unsignalized pedestrian crossings.

Design Summary

Signs may be placed on the roadway centerline directly, as in the picture below. Careful placement is necessary to avoid maintenance issues with vehicles knocking down the sign. One option is to temporarily place the sign during specific time periods, such as when school is in session. Another option is to put the sign within a raised median or place in-pavement raised markers around the sign. They can be placed either at mid-block locations or intersections with significant pedestrian activity, such as near transit stations or schools.

Design Example

Enhanced Uncontrolled Crossing Treatments

Discussion

At uncontrolled locations, enhanced treatments beyond striping and signing may be needed for candidate marked crosswalk locations under the following conditions:

- Multi-lane streets (three or more lanes); or
- Two-lane streets with daily traffic volumes (ADT) greater than 12,000; or
- Posted speed limit exceeding 30 miles per hour

Design Summary

The following treatments are methods to enhance crossings:

In-Pavement flashers

This enhanced treatment helps to improve the visibility of pedestrians at uncontrolled crosswalks. In-pavement markers are lined on both sides of a crosswalk, often containing an amber LED strobe light. They can either be actuated by a push-button or using remote pedestrian detection.

Flashing Beacons

This treatment enhances driver visibility of pedestrians by installing flashing amber lights either overhead or on a post-mounted sign before a vehicle approaches the crosswalk or at the crossing.

Rectangular Rapid Flashing Beacon (RRFB)

The RRFB, also known as a stutter flash, enhances the flashing beacon by replacing the slow flashing incandescent lamps with rapid flashing LED lamps. The lights can be activated either by a push-button or with remote pedestrian detection. This treatment is included in the 2009 Federal MUTCD, but has not yet been approved for use in California. There are also versions with LED lights placed within the pedestrian crossing sign.

High- Intensity Activated Crosswalk (HAWK)

This enhanced signal treatment is used in circumstances where there are high vehicle speeds as well as a high demand for pedestrian crossings. It combines the beacon flasher with a traffic control signal to generate a higher driver yield rate. They are pedestrian activated and will display a yellow indication to warn vehicles, then a solid red light. While pedestrians are crossing, the driver sees a flashing red light in a "wig wag" pattern until the pedestrian clearance phase has ended, then returns to a dark signal. The HAWK is included in the 2009 Federal MUTCD, but not yet approved for use in California.

Design Example

In-Pavement Flashers

Overhead Flashing Beacon

Rectangular Rapid Flashing Beacon

HAWK Signal

Enhanced Uncontrolled Crossing Treatments

Mid-Block Pedestrian Signal

A pedestrian signal may be use to provide the strictest right-of-way control at a pedestrian crossing. Warrants for placement are defined within the MUTCD (a new warrant is provided in the 2009 Federal MUTCD).

Mid-Block Pedestrian Signal

Image Sources: Chula Vista Pedestrian Master Plan,tti.tamu.edu, www.dc.go,

Grade Separated Crossing

Discussion

A grade-separated pedestrian crossing provides a complete separation of pedestrians from vehicles through a pedestrian-only overpass or underpass (generally bicycles are permitted as well). Grade separations are a tool to help overcome barriers and help pedestrians connect to sidewalks, off-road trails and paths. It should be used where topography is supportive and no other pedestrian facility is available.

Design Summary

Grade separated crossings should be constructed within the most direct path of a pedestrian. They should have visual appeal and entrances that are visible so pedestrians feel safe and not isolated from others.

Because they can be costly (typically from $2M to $8M), it is recommended that grade separated crossings be used in instances where there are unsafe vehicle speeds and volumes or no convenient substitute for the pedestrian.

Design Example

Image Sources: omahamidcenturymodern.blogsome.com
http://www.walkinginfo.org/library/details.cfm?id=2882
http://www.opacengineers.com/features/BerkeleyPOC

Bicycle and Pedestrian Trail Crossing
See the Bicycle Design Guidelines for a detailed description of this treatment.

4.4 Controlled Crossing Treatments / Intersection Design

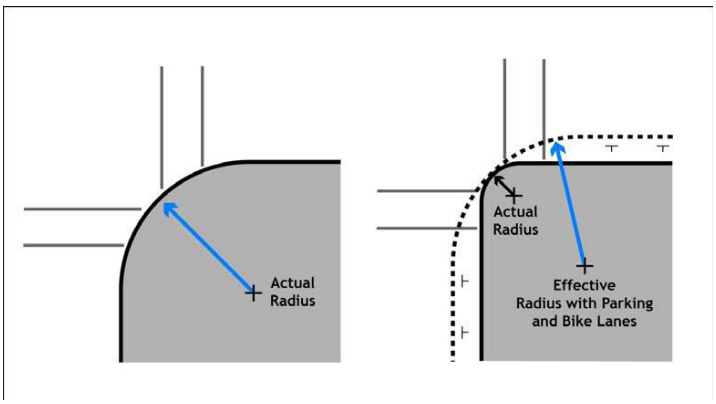
Pedestrian treatments at signalized locations throughout San Mateo County may be used to:

- Improve the visibility of pedestrians to motorists and vice-versa
- Communicate to motorists and pedestrians who has the right-of-way
- Accommodate vulnerable populations such as people with disabilities, children, and seniors
- Reduce conflicts between pedestrians and vehicles
- Reduce vehicular speeds at locations with potential pedestrian conflicts

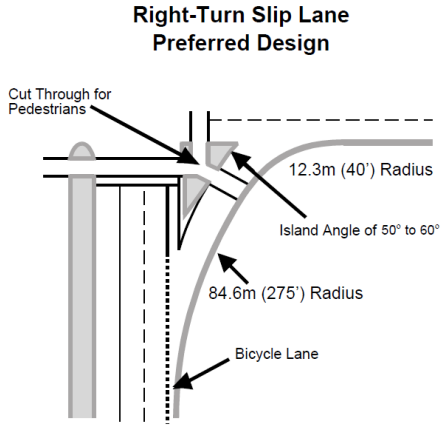
Improving Pedestrian Visibility – Shorten Crossing Distance

Intersections should be as compact as possible to minimize pedestrian crossing distances. Shorter crossing distances ultimately reduce the exposure time of pedestrians within the roadway and are easier to navigate. Consequently, compact intersections are more comfortable for pedestrians and improve visibility between motorists and pedestrians.

Reducing turning radii is one tool to foster compact intersection design and improve sight distance, in which dimensions of the curb at the intersection directly affects the speed of the approaching vehicle. A large turning radius (generally 30 feet or greater) allows vehicles to turn at high speeds. Reducing the radius forces approaching vehicles to slow down while still accommodating larger vehicles, thus reducing the frequency and severity of pedestrian collisions at intersections. As shown below, on-street parking and bicycle lanes can allow for smaller curb radii while maintaining the same effective curb radius. Note that on-street parking should be restricted in advance of crosswalks, to improve visibility for pedestrians.



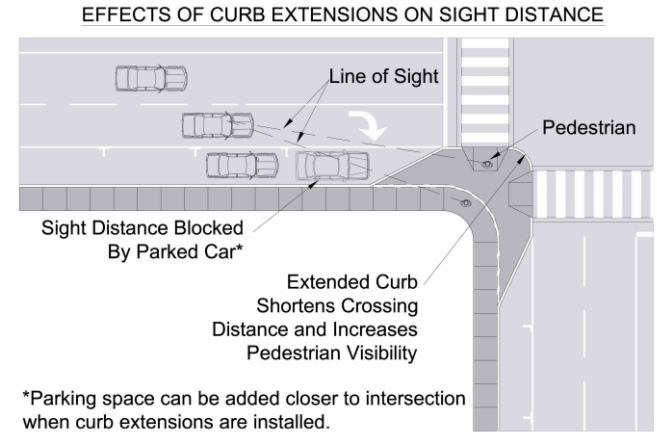
Free right turns should be restricted whenever possible as they encourage fast turning movements and present a challenging uncontrolled crossing for pedestrians. When they are necessary, design strategies can enhance the pedestrian crossing and improve visibility of bicyclists on intersecting streets (illustrated below).



Source: Fehr & Peers

Improving Pedestrian Visibility – Reducing Sight Distance Barriers

Compact intersection design can also improve pedestrian visibility by removing barriers to sight distance, including parked cars, roadway geometry, terrain, vegetation, sun glare, insufficient building setbacks, inadequate roadway lighting, poor signal visibility, signal controller cabinets/poles, and cluttered signage. Improving sight distances gives motorists a clear view of pedestrians, while allowing the pedestrian to observe and react to any hazards. Free vehicle right turns and permitted lefts are two situations that often create conflicts with pedestrians. Ensuring proper sight distances between pedestrians and vehicles can decrease the rate and severity of turning related pedestrian-vehicle collisions.



Source: Sacramento County Pedestrian Master Plan

Removing barriers to sight distance requires careful design when vehicles approach other vehicles and pedestrians. Design elements should be considered at intersections as well as mid-block crossings. Designers must particularly consider the needs of those pedestrians with special needs, including older adults, children, and people with disabilities. For example, children and people using wheelchairs have a lower eye height than standing adults.

Pedestrian Bulb-Outs

Discussion

Also known as curb extensions, bulb-outs increase driver awareness of pedestrians and help slow traffic. They provide a larger space for pedestrians to wait before crossing an intersection and prevent cars from parking near the crosswalk. Bulb-outs are highly beneficial in downtown or transit station areas, which generate significant pedestrian activity. They may also be beneficial in school zones or neighborhood districts, which have vulnerable pedestrians, such as children or older adults that would benefit from an enhanced treatment that reduces crossing distances.

Design Summary

Bulb-outs involve extending the curb space into the street to create a shorter pedestrian crossing. They should not extend into the bicyclist line of travel to avoid impeding bocyclists and motorists. They may require removal of on street parking.

Landscaping within bulb-outs, as depicted at right, can further enhance the character and comfort of the pedestrian realm. Bulb-outs may also create space for pedestrian amenities or bicycle parking. Bulbouts typically range in cost from between $10,000-50,000 per corner.

Design Example

Image Sources: Dan Burden (above)

Standard Crosswalk Striping

Discussion

Crosswalks should be marked on *all approaches* where feasible to delineate space for pedestrians to cross. While heavy vehicle volumes may present an exception, they are discouraged and should only be considered when all other options to accommodate motor vehicle demand have been considered.

At intersections, crosswalks are essentially an extension of the sidewalk; if the sidewalk extends to the intersection, proper striping should continue to direct the pedestrian to the other side of the intersection.

Advanced stop bars are another standard crosswalk treatment to discourage vehicles from encroaching into the crosswalk. They may be useful at signalized intersections and stop controlled intersections with multiple lanes. A yield line should be used as a replacement at uncontrolled intersections.

Design Summary

Standard dual while lane stripes are recommended for pedestrian crossings at signalized intersections. These bars should be one foot wide and extend from curb ramp to curb ramp.

Advanced stop or yield limit lines solid white lines extending through the traffic lane to communicate to drivers where they should stop. MUTCD requires they be placed at least 4 feet before the crosswalk, although placement at greater distances can enhance pedestrian visibility and vehicle reaction times.

Design Example

Sources: Sacramento County Pedestrian Plan

Special Paving Treatments

Discussion

Special paving treatments include adding texture to surfaces or coloring pavement to distinguish the sidewalk or crosswalk. This treatment enhances the character of the overall pedestrian environment. The rougher roadway surface may also slow vehicles and draw more attention to the pedestrian realm.

Design Summary

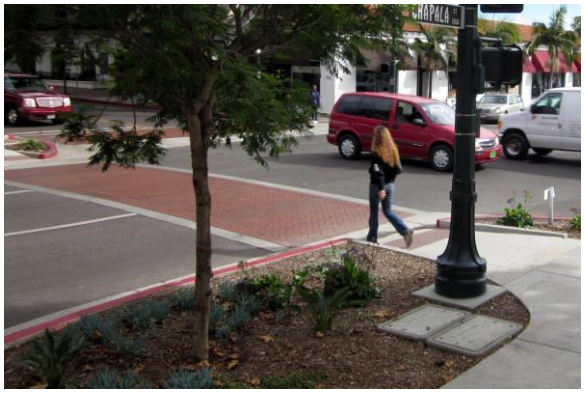
Types of special paving treatments typically include:

- Bricks, pavers, or colored concrete
- Stamped asphalt or concrete that is then painted to resemble bricks.
- Pavement stencils

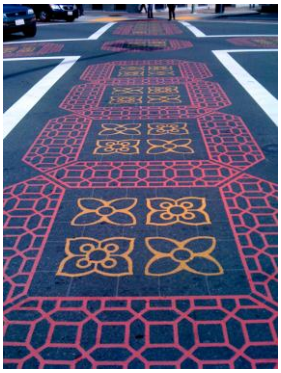
Designers must be careful to not confuse the visually impaired and cause problems for people with disabilities. Surfaces should be adapted to accommodate people using wheelchairs. A standard white stripe is recommended on either side of the crosswalk even when special paving treatments are used to enhance the contrast between the crossing and the roadway.

Design Example

Brick Pavers



Pavement Stencils



Sources: http://www.visualtexture.net/page/2/

Curb Ramps

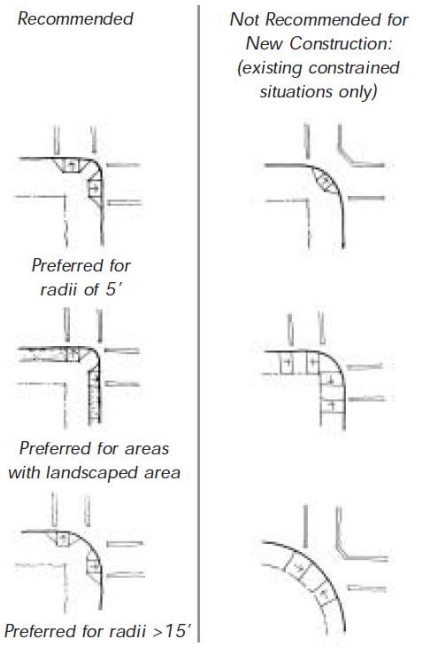
Discussion

Pedestrians with mobility impairments, such as people using wheelchairs or those with canes, need curb ramps to safely access a sidewalk.

Design Summary

The appropriate curb ramp design depends on the geometry of the intersection. Recommended practices for various sidewalk conditions are shown below. As depicted in the illustration, directional ramps are preferred over diagonal ramps as they provide direct access to each crosswalk. Curb ramps should be ADA compliant to accommodate mobility and visually impaired pedestrians. Detectable warnings are required by the ADA Accessibility Guidelines with any new curb ramp or reconstruction. These guidelines call for raised truncated domes of 23 mm diameter and 5mm height. Curb ramps should align in the direction of the crosswalk and have enough clear space beyond the curb line so the pedestrian is not drawn right into the line of traffic.

Design Example



Sources: Valley Transportation Authority Technical Pedestrian Guidelines, Fehr & Peers

Pedestrian Friendly Signal Treatments

Discussion

There are several innovative treatments that enhance the visibility and convenience of pedestrian crossings at traffic signals. These treatments can be applied in a variety of contexts depending on the pedestrian demand and vehicle movement within the streetscape

Design Summary

Leading Pedestrian Intervals

- An enhanced pedestrian treatment that gives pedestrians a walk indication while other approaches are red to prevent advancing. Crossing with this "head start" allows pedestrians to be more visible to motorists approaching an intersection.
- Should be used at locations with heavy right turn vehicle volumes as well as frequent pedestrian crossings.
- Vehicles are stopped for 2-4 seconds while pedestrians are allowed to begin crossing.
- May require restricting right-turn on red at some locations.

Countdown signals

- Displays a "countdown" of the number of seconds remaining for the pedestrian crossing interval.
- Information about the amount of time left to cross is Particularly helpful when crossing multi-lane arterials.
- Can improve pedestrian compliance while reducing the amount of pedestrians "dashing" across an intersection.

Scramble Phasing

- This enhanced crossing treatment allows pedestrians to walk in all directions while all vehicle approaches have a red phase. Pedestrians may cross the street orthogonally or diagonally, providing a direct and efficient walking route.

Audible Signal

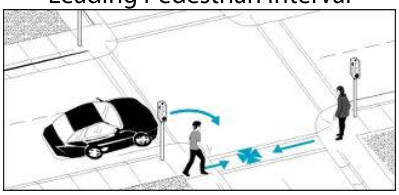
- Pedestrian phases are typically difficult for those with visual impairments to recognize.
- MUTCD 2003, Section 4A.01 specifies that signals that communicate to pedestrians in a non-visual way can include verbal messages or vibrating surfaces.
- Should be implemented on a separate pole close to the crosswalk line. If two are placed on the same corner, they should be 10 feet apart to distinguish between directions.
- Speaker on top of the signal can give bell, buzzer, speech message during walk interval or vibrate when walk signal is on. Or a personal individual receiver can communicate by infrared or LED to the signal.

Pedestrian Friendly Signal Timing

- See "Pedestrian Friendly Signal Timing" below.

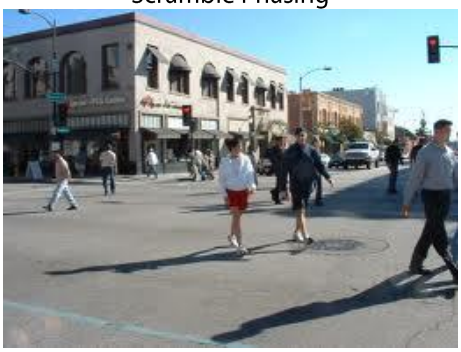
Design Example

Leading Pedestrian Interval



Countdown Signal

Scramble Phasing



Sources: http://www.walkinginfo.org,

www.saferoutesinfo.org,

www.streetswiki.wikispaces.com

Pedestrian Friendly Signal Phasing

Discussion

Left- and right-turning vehicles are required to yield to pedestrians in the crosswalk. Different signal phasing sequences accommodate pedestrian crossing intervals differently:

- Protected left turns allow vehicles turning left an exclusive phase, ultimately eliminating conflicts between pedestrians in the crosswalk; left-turning vehicles will never cross at the same time as the pedestrian signal.
- Split phasing, allows each intersection approach to receive a dedicated phase Pedestrian phases for parallel crosswalks will be activated at different times. This phasing can reduce intersection capacity.
- Permitted left turn phasing, where vehicles turning must yield to through traffic and pedestrians, can reduce pedestrian delay and improve traffic operational efficiency by minimizing the impact of pedestrian timing through allowing two pedestrian crossings at once.

Other types of pedestrian signal phasing, including "scramble" phasing and leading pedestrian intervals, are described in the "Pedestrian Friendly Signal Treatments" guideline above.

Design Summary

In urban or downtown settings where pedestrian volumes are high, using permitted signal phasing is generally preferred because it reduces pedestrian delay. In less urban settings, providing protected left-turn phasing to eliminate pedestrian-vehicle conflicts is recommended where feasible.

At intersections with heavy vehicle traffic volumes, providing convenient and comfortable pedestrian crossings must be balanced with the need to maintain intersection capacity and operations for automobiles. In these instances, it is important to incorporate additional treatments to enhance pedestrian visibility, such as special striping or signage. If a permitted left turn phase is used, the traffic and pedestrian signal should be located next to each other on the corner pole (as depicted in the picture) to attract driver's attention.

Design Example

Example of a Pedestrian Signal Head Mounted on a Signal Pole

Pedestrian Friendly Signal Timing

Discussion

Signal timing typically favors vehicle travel. However, in areas with high pedestrian activity, there are methods to alter signals to better meet the needs of pedestrians. The walk interval of a pedestrian phase is, at a minimum, four to seven seconds, followed by a pedestrian clearance interval, called the "flash don't walk" (FDW) phase. The FDW phase uses a standard rate to determine the amount of time provided for the pedestrian to clear an intersection. It is determined by dividing the width of an intersection by the pedestrian walking speed. The solid "Don't Walk" sign typically coincides with the yellow vehicle signal. The pedestrian timing is an important element to traffic signals since the green time for cars might not be sufficient for pedestrians to cross an intersection.

Design Summary

The standard for walking speeds at signalized intersections has changed from 4 feet per second to 3.5 feet per second to more accurately reflect the average pedestrian walking speed and aging population. The 2009 Federal MUTCD requires this reduction, although the change has not yet been adopted in California.

A slower walking rate of 2.8 feet per second (MUTCD 4E.10(CA)) is recommended in areas with a high number of children, older adults, or disabled pedestrians crossing. Pre-timed signals may warrant a longer walk phase in order to accommodate pedestrians. This should ultimately be at the discretion of the local agency's traffic engineer.

Design Example

Source: Dan Burden

Roundabouts

See the Bicycle Design Guidelines for a detailed description of this treatment.

4.5 Design Review and Implementation Checklists

The purpose of a Design Review and Implementation Checklist is to ensure that pedestrian needs are being considered in the planning, design, and construction of all transportation projects and new land use development. Also known as "Routine Accommodation" guidelines, these checklists can be used to ensure projects foster pedestrian safety and provide access in all roadways. Routine accommodation policies are included as part of the federal surface transportation act (SAFETEA-LU). Additionally, Caltrans Deputy Directive 64 (DD64-R1) requires the accommodation of pedestrians in all projects. In June 2006, the Metropolitan Transportation Commission (MTC) adopted regional policies to accommodate pedestrians through the Resolution No. 3765, which promotes the routine accommodation of all non-motorized travelers.

Documenting how well a project meets the County's goals to accommodate pedestrians within the transportation network is a valuable process, particularly in applying to future funding applications. The following section includes two resources to adequately consider pedestrian and bicycles as part of the project and land use planning process:

- **Design Summary for Pedestrian Accommodations:** This summary lists pedestrian-supportive treatments identified throughout this document to ensure a broad range of applications are considered within streets, sidewalks, controlled intersections/ crossings, and uncontrolled intersections/ crossings.
- **San Mateo County Project Development Review Checklist for Bicycles and Pedestrians:** This checklist for bicycles and pedestrians is a sample set of questions for cities within San Mateo to use with future transportation infrastructure and land use development projects.

Design Summary for Pedestrian Accommodations

Streets and Sidewalks

- Design "complete streets" which accommodate all pedestrians, paying special attention to vulnerable populations like children, older adults, and the disabled.
- Ensure a continuous network of sidewalks with appropriate widths depending on the pedestrian demand and surrounding land uses.
- Provide pedestrian amenities, including street trees, furniture, and pedestrian-scale lighting within the sidewalk where appropriate.
- Develop a connected and fine-grained street network, providing pedestrian paths where possible.
- Install traffic calming treatments where pedestrian activity is high but vehicle volumes and/or travel speeds are also high.
- Install curb ramps with truncated domes to facilitate a transition from street to sidewalk.
- Place buildings adjacent to the street when possible, avoiding placing large parking lots in front of buildings.

Uncontrolled Intersections

- Incorporate high visibility striping to enhance pedestrian crossings
- Install median islands where feasible, especially where there are long pedestrian crossings
- Consider installing innovative crossing treatments and special paving techniques in areas with high pedestrian demand
- Install in-street pedestrian crossing signs nears schools or senior centers
- Foster safe trail crossings
- Build grade separated crossings where there are no feasible alternatives to directly cross pedestrians on the street
- Install enhanced mid-block crossings at locations where pedestrian demands are supportive

Controlled Intersections

- Design compact intersections with tight curb radii
- Reduce sight distance barriers
- Install advanced stop bars at intersections
- Install pedestrian friendly signal treatments to accommodate pedestrians at the appropriate level of demand (example: pedestrian scramble at high demand areas)
- Mark crosswalks with standard dual white lines at all approaches
- Install countdown signals at signalized intersections and consider slower walking speeds where applicable
- Establish clear right-of-way control for pedestrian crossings to avoid conflicts with vehicle left or free right turns
- Install bulb-outs where there is a need to decrease traffic speeds and create more sidewalk space
- Incorporate ADA-compliant practices at intersections routinely
- Consider installing roundabouts at strategic locations, ensuring safe pedestrian designs

San Mateo County Project Development Review Checklist for Bicycles and Pedestrians

Discussion:

Recent federal, state and regional policies call for the routine consideration of bicyclists and pedestrians in the planning, design and construction of all transportation projects. These policies—known as "Routine Accommodation" guidelines—are included in the federal surface transportation act (SAFETEA-LU), Caltrans Deputy Directive 64, and MTC Resolution 3765.

This checklist was developed for project sponsors to document how the needs of bicyclists and pedestrians are being considered in the process of planning and/or designing of their project(s). For projects that do not accommodate bicyclists and pedestrians, project sponsors must document why not. Besides documenting how a project would meet a local jurisdiction's adopted goals for encouraging active, non-motorized transportation (e.g., walking and biking), the checklist can also be used to help develop funding applications for bicycle and pedestrian projects that would benefit a project.

This checklist is intended for use on projects at their earliest conception or design phase; however, some of the responses to questions in this checklist may be included in any transportation impact study prepared for a project. For projects that require substantial design work, this checklist should be completed and submitted to city or county staff before projects reach later design phases. Local City transportation engineers and planning staff, local Bicycle/Pedestrian Advisory Committees (BPAC) and other relevant commissions should be responsible for reviewing the answers submitted by project sponsors.

Design Summary:

Project sponsors should provide detailed answers to the following questions. Where appropriate, answers should include or reference project plans or design documents that illustrate how a project accommodates bicycles and pedestrians.

1. *What existing accommodations for bicycles and pedestrians are provided at the project site and on the adjacent streets? Please include a description of pedestrian and bicycle facilities located within 1,000 feet of the project site.*

- *The response to this question should identify any crosswalks, sidewalks, bike lanes, bike routes or shared-use paths.*
- *Describe any pedestrian generating areas near the project site, including schools, recreational centers, public facilities, parks, job centers, or commercial areas.*
- *Please describe any particular pedestrian or bicycle uses or needs along the project corridor that you have observed or of which you have been informed. Please include any deficiencies, including missing sidewalks or proposed bicycle or pedestrian facilities that have not been constructed.*
- *If there are no existing pedestrian or bicycle facilities, how far from the proposed project are the closest parallel bikeways and walkways?*

2. *Describe to what extend the proposed project would generate trips by non-auto modes (e.g., attract walking or bicycling customers, employees, students, visitors or others). If the project is required to prepare a transportation impact study, has the study attempted to estimate the number of new walkers or bikers to the site?*

3. *Is the project located in an area with reported collisions involving bicyclists or pedestrians? If so, describe where these collisions have occurred in respect to the project site, and describe whether or not the project would address these locations?*

4. *Do any adopted City or regional plans call for the development of bicycle or pedestrian facilities on, crossing or adjacent to the proposed project? If yes, list the applicable plan(s). Is the proposed project consistent with these plans? To respond to this question, the project sponsor should reference any city transportation plan, county plan, and any applicable special area plans.*

5. *Please describe the public outreach that has been conducted to date for the proposed project, and what comments have been made regarding bicycle and pedestrian accommodations.*

6a. *What bicycle or pedestrian accommodations are included in the proposed project design?*

- *This response should clearly document how pedestrians and bicyclists would access and maneuver on the project site, even if the project site does not propose new bicycle or pedestrian facilities.*
- *Please include a proposed project site plan that identifies on-site bicycle and pedestrian circulation. The plan should identify pedestrian entrances to any structure, bicycle parking areas, pedestrian walkways in parking areas and service loading docks. If the project includes additional elements that serve bicycle commuters, such as employee locker rooms, those areas should also be shown on the site plan.*
- *If the proposed project does not incorporate both bicycle and pedestrian facilities list reasons why the project is being proposed as designed.*

6b. *What would be the cost of the bicycle and/or pedestrian facilities included in the project description, and what is the cost of these facilities in proportion of the total project cost? If right-of-way acquisition is required, please describe land acquisition separately. If the project does not include bicycle and pedestrian accommodations, identify if cost was a primary factor when they were removed from the project description.*

7. *If the project includes bicycle or pedestrian facilities, what applicable design standards or guidelines been followed? If the project designed facilities using standards not identified in the design standards included in the city's plan (where applicable), please describe what design standards where used for these facilities.*

8. *Will the proposed project remove an existing bicycle or pedestrian facility or block or hinder bicycle or pedestrian movement? If yes, please describe situation in detail. Include a list reasons why the project is being proposed as designed.*

- *If the project is proposing any new driveways (i.e., curb cut), please describe how pedestrians and bicyclists will be accommodated. Discuss whether or not the driveway would result in additional conflicts between drivers and bicyclists in an existing or proposed on-street bicycle facility. If the driveway will cross an existing or proposed sidewalk or pedestrian path, describe whether or not vehicles would need to block the sidewalk in order to exit the site.*

9. *How will access around the project site for bicyclists and pedestrians be maintained during project construction? Describe if the project construction will require any temporary sidewalk or lane closures.*

10. *What agency will be responsible for ongoing maintenance of existing and proposed bicycle and pedestrian facilities at the project site and how will this be budgeted?*

4.6 Resource Documents

Federal Standards and Resource Documents:

Guide to the Development of Pedestrian Facilities, American Association of State Highway and Transportation Officials, 2000

Manual on Uniform Traffic Control Devices, Federal Highways Administration, December 2009.

Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials, 2004.

Americans with Disabilities Act Accessibility Guidelines (ADAAG). United States Access Board.

California Standards and Resource Documents:

California Manual on Uniform Traffic Control Devices, Caltrans, January 2010.

Highway Design Manual, California Department of Transportation.

Other Guidelines and Resource Documents:

TCRP Report 112/NCHRP Report 562: Improving Pedestrian Safety at Unsignalized Crossings. Washington D.C.: TCRP and NCHRP, 2006.

Pedestrian Technical Guideilnes: A Guide to Planning and Design for Local Agencies in Santa Clara County, Santa Clara Valley Transportation Authority, October 2003.

Routine Accommodations of Pedestrians and Bicyclists in the Bay Area, Metropolitan Transportation Commission, Available: http://www.mtc.ca.gov/planning/bicyclespedestrians/routine_accommodations.htm, 2006.

Pedestrian Safety Resource Guide, Metropolitan Transportation Commission Regional Pedestrian Committee, Available: http://www.mtc.ca.gov/planning/bicyclespedestrians/PEDSAFETYRESOURCEGUIDE.doc, 2004.

San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook, San Mateo Countywide Water Pollution Prevention Program, First Edition: January 2009, Available: http://www.flowstobay.org/ms_sustainable_guidebook.php

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5. Bicycle Design Guidelines

5.1 Introduction

This appendix presents an overview of bicycle facility designs, based on appropriate MUTCD and Highway Design Manuals, and as supplemented by AASHTO best practices and San Mateo County-specific design guidelines. The purpose is to provide readers and project designers with an understanding of the facility types that are proposed in the Plan, and with specific treatments that are recommended or required basin-wide.

5.2 Bicycle and Pedestrian Design Standards

The C/CAG San Mateo County Bicycle Design Guidelines present standards and recommendations that specifically provide for consistency in San Mateo County, or where details are needed beyond what is provided by state and federal design standards. All projects must also meet state and federal design standards. Therefore, in addition to these C/CAG San Mateo County Design Guidelines, planners and designers should also refer to the following documents and their subsequent updates when planning and designing bicycle and pedestrian facilities.

San Mateo County is governed by the California MUTCD. As of January 21, 2010, the California Department of Transportation (Caltrans) has revised the California MUTCD 2010 to include FHWA's 2003 MUTCD Revision 2 dated December 21, 2007. FHWA has released the new 2009 MUTCD but it is not effective in California until Caltrans and the California Traffic Control Devices Committee (CTCDC) review it and incorporate the changes into California MUTCD through formal efforts. California has until January 15, 2012 to accomplish this task although it is anticipated that it would be done sooner. In the event that a specific treatment is not in the California MUTCD, it may be necessary to go through experimental testing procedures. Experimental testing is overseen by the California Traffic Control Devices Committee.

California Manual on Uniform Traffic Control Devices, 2010 Update
http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/ca_mutcd2010.htm

Manual on Uniform Traffic Control Devices (MUTCD), Federal Highway Administration
http://mutcd.fhwa.dot.gov/

Caltrans Policies and Directives
http://www.dot.ca.gov/hq/traffops/signtech/signdel/policy.htm

including:

Traffic Operations Policy Directive 09-06 "Provide Bicycle and Motorcycle Detection on all new and modified approaches to traffic-actuated signals in the state of California."

Caltrans Highway Design Manual
http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm

Caltrans Design Information Bulletins
http://www.dot.ca.gov/hq/oppd/dib/dibprg.htm

including:

DIB 80-01 Roundabouts

DIB 82-03 Design Information Bulletin 82-03 "Pedestrian Accessibility Guidelines for Highway Projects"

Caltrans Standard Plans
http://www.dot.ca.gov/hq/esc/oe/project_plans/HTM/06_plans_disclaim_US.htm

ADA Accessibility Guidelines for Buildings and Facilities (ADAAG)
http://www.access-board.gov/adaag/html/adaag.htm

Revised Draft Guidelines for Accessible Public Rights-of-Way, Access Board
http://www.access-board.gov/prowac/draft.htm

Guidelines for the Development of Bicycle Facilities, AASHTO

Guidelines for the Planning, Design, and Operations of Pedestrian Facilities, AASHTO
https://bookstore.transportation.org/home.aspx

A Policy on Geometric Designs of Highways, AASHTO
https://bookstore.transportation.org/Item_details.aspx?id=110

Disclaimer
This appendix is not intended to replace existing state or national mandatory or advisory standards, nor the exercise of engineering judgment by licensed professionals.

Cost estimates cited in the document reflect 2009 dollars and are included for reference only. All costs are for equipment and materials, and do not include labor. Actual costs to construct the facilities may vary depending on market fluctuations, design specifications, engineering requirements and availability of materials.

5.3 Bikeway Classifications

Bikeway Classification Overview

Discussion

Caltrans has defined three types of bikeways in Chapter 1000 of the Highway Design Manual: Class I/shared use path, Class II/Bike Lane, and Class III/Bike Route. This document uses the generic terms "shared use path", "bike lane" and "bike route".

Design Summary

Path Width:

8 feet is the minimum allowed for a two-way bicycle path and is only recommended for low traffic situations.

10 feet is recommended in most situations and will be adequate for moderate to heavy use.

12 feet is recommended for heavy use situations with high concentrations of multiple users such as joggers, bicyclists, rollerbladers and pedestrians. A separate track (5' minimum) can be provided for pedestrian use.

Bike Lane Width with Adjacent On-Street Parking:

5' minimum recommended when parking stalls are marked

Bike Lane Width without Adjacent Parking:

4' minimum when no gutter is present (rural road sections)

5' minimum when adjacent to curb and gutter (3' more than the gutter pan width if the gutter pan is greater than 2')

Recommended Width: 6' where right-of-way allows

Lane Width for Bicycle Route With Wide Outside Lane:

Fourteen feet (14') minimum is preferred. Fifteen feet (15') should be considered if heavy truck or bus traffic is present. Bike lanes should be considered on roadways with outside lanes wider than 15 feet. This treatment is found on all residential streets, collectors, and minor arterials.

Design Example

Class I Shared Use Bike Path

Class II Bike Lane

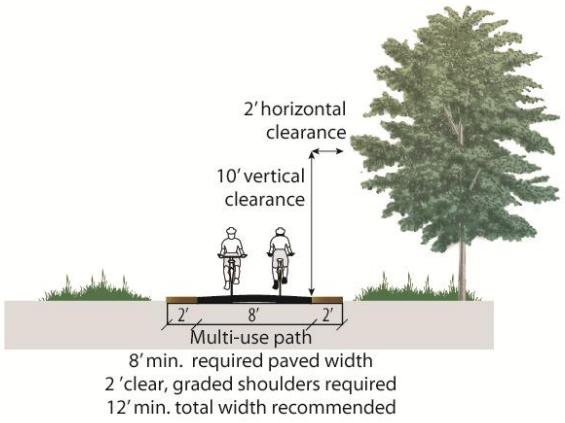
Class III Bike Route

Bikeway Classification Overview

Recommended Design

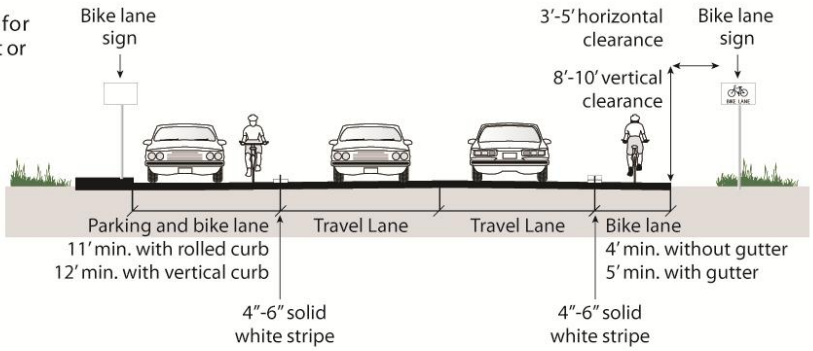
CLASS I
Multi-Use Path

Provides a completely separated right of way for the exclusive use of bicycles and pedestrians with crossflow minimized.



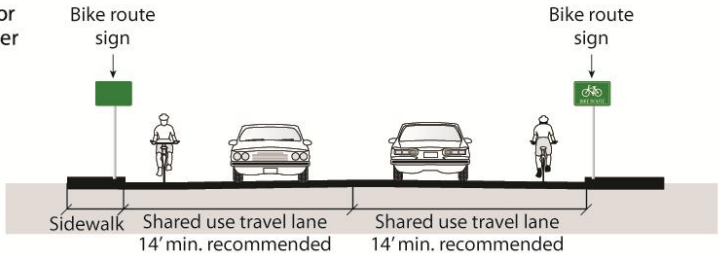
CLASS II
Bike Lane

Provides a striped lane for one-way bike travel on a street or highway.



CLASS III
Bike Route
Signed Shared Roadway

Provides for shared use with pedestrian or motor vehicle traffic, typically on lower volume roadways.



Guidance	Cost
Caltrans Highway Design Manual (Chapter 1000: Sections 1003.1(1) and (2), 1003.2(1), 1003.3(1), and 1003.5) California MUTCD Chapter 9 AASHTO Guide for the Development of Bicycle Facilities, Chapter 2	Class I Path: $1,000,000 - $4,000,000 per mile Class II Bike Lane: $5,000 - $500,000 per mile Class III Bike Route: $1,000 - $300,000 per mile

5.4 Shared Use Paths

Pathway Design

A shared use path (Class I) allows for two-way, off-street bicycle use and also may be used by pedestrians, skaters, wheelchair users, joggers and other non-motorized users. These facilities are frequently found in parks, along rivers, beaches, and in greenbelts or utility corridors where there are few conflicts with motorized vehicles. Class I facilities can also include amenities such as lighting, signage, and fencing (where appropriate).

General Design Practices

Both the California Highway Design Manual Chapter 1000 and the AASHTO Guide for the Development of Bicycle Facilities generally recommend against the development of shared use paths directly adjacent to roadways. Also known as "sidepaths", these facilities create a situation where a portion of the bicycle traffic rides against the normal flow of motor vehicle traffic and can result in wrong-way riding when either entering or exiting the path. This can also result in an unsafe situation where motorists entering or crossing the roadway at intersections and driveways do not notice bicyclists coming from their right, as they are not expecting traffic coming from that direction. Stopped cross-street motor vehicle traffic or vehicles exiting side streets or driveways may frequently block path crossings. Even bicyclists coming from the left may also go unnoticed, especially when sight distances are poor.

Shared use paths may be considered along roadways under the following conditions:

- The path will generally be separated from all motor vehicle traffic.
- Bicycle and pedestrian use is anticipated to be high.
- In order to provide continuity with an existing path through a roadway corridor.
- The path can be terminated at each end onto streets with good bicycle facilities, or onto another well-designed path.
- There is adequate access to local cross-streets and other facilities along the route.
- The total cost of providing the proposed path is proportionate to the need.

As bicyclists gain experience and realize some of the advantages of riding on the roadway, many stop riding on paths adjacent to roadways. Bicyclists may also tend to prefer the roadway as pedestrian traffic on the bicycle path increases due to its location next to an urban roadway. When designing a bikeway network, the presence of a nearby or parallel path should not be used as a reason to not provide adequate shoulder or bicycle lane width on the roadway, as the on-street bicycle facility will generally be superior to the "sidepath" for experienced bicyclists and those who are cycling for transportation purposes. Bicycle lanes should be provided as an alternate (more transportation-oriented) facility whenever possible.

Pathway Design

Discussion

Ten-foot wide paths are usually best for accommodating all uses, and better for long-term maintenance and emergency vehicle access. When motor vehicles are driven on shared use paths, their wheels often will be at or very near the edges of the path. Since this can cause edge damage that, in turn, will reduce the effective operating width of the path, adequate edge support should be provided. Edge support can be either in the form of stabilized shoulders, a concrete "ribbon curb" along one or more edges of the path, or constructing additional pavement width or thickness. Constructing a typical pavement width of 10 feet, where right-of-way and other conditions permit, lessens the edge raveling problem.

Surfacing and Path Construction

Thicker surfacing and a well-prepared sub-grade will reduce deformation over time and reduce long-term maintenance costs. At a minimum, off-street paths should be designed with sufficient surfacing structural depth for the sub-grade soil type to support maintenance and emergency vehicles.

Asphalt and concrete are the most common surface treatment for multi-use paths, however the material composition and construction methods used can have a significant determination on the longevity of the pathway. Surface selection should take place during the design process.

If trees are adjacent to the path, a root barrier should be installed along the path to avoid root uplift.

Design Summary

Width

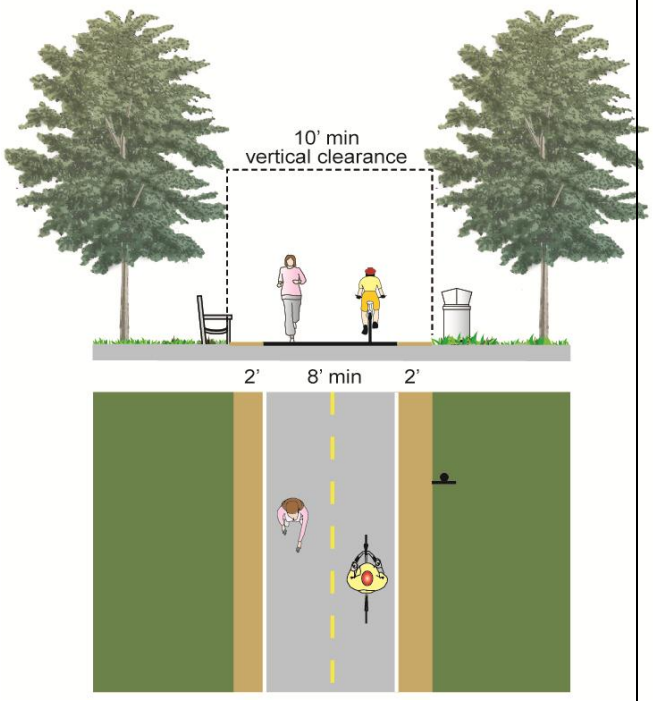
8 feet minimum paved path width (Caltrans). AASHTO recommends a paved width of 10 feet.

A 3 to 4-foot wide native surface path may be considered alongside shared-use paths for runners.

Paving

Hard, all-weather pavement surfaces are usually preferred over those of crushed aggregate, sand, clay or stabilized earth (AASHTO).

Recommended Design



Pathway Design

Design Summary (cont.)	Design Example
Separation From Highway When two-way shared use paths are located adjacent to a roadway, wide separation between a shared use path and the adjacent highway is desirable. Bike paths closer than 5 feet from the edge of the shoulder shall include a physical barrier to prevent bicyclists from encroaching onto the highway (Caltrans). Where used, the barrier should be a minimum of 42 inches high (AASHTO).	
Guidance	**Cost**
Caltrans Highway Design Manual (Chapter 1000 Section 1003.1(1) and (2), and 1003.5) AASHTO Guide for the Development of Bicycle Facilities, Chapter 2 California MUTCD Chapter 9B. Signs Guidelines for Accessible Public Rights-of-Way	Class I Path: $350,000 - $2,000,000 per mile (Note 1: This assumes an asphalt or concrete path. Note 2: The concrete option is likely to cost 50 percent more than a standard asphalt pathway.)

Lighting

Discussion

Lighting improves the safety of the trail or path user by increasing visibility during non-daylight hours. Lighting should consider the surrounding land use to minimize light pollution in sensitive areas. The fixtures should be installed near benches, drinking fountains, bicycle racks, trailheads, and roadway and trail crossings.

Design Summary

Depending on the location, average maintained horizontal illumination levels of 5 lux to 22 lux should be considered (AASHTO). Where special security problems exist, higher illumination levels may be considered.

Light standards (poles) should meet the recommended horizontal and vertical clearances.

Guidance

Caltrans Highway Design Manual (Chapter 1000 Section 1003.1(16))

AASHTO Guide for the Development of Bicycle Facilities, Chapter 2

Design Example

Bollards

Discussion

Minimize the use of bollards to avoid creating obstacles for bicyclists. Bollards, particularly solid bollards, have caused serious injury to bicyclists. The California MUTCD explains, "Such devices should be used only where extreme problems are encountered" (Section 9C.101). Instead, design the path entry and use signage to alert drivers that motor vehicles are prohibited.

Bollards are ether fixed or removable and may be flexible or rigid. Flexible bollards and posts are designed to give way on impact and can be used instead of steel or solid posts. Bollards are typically installed using one of two methods: 1) The bollard is set into concrete footing in the ground; and 2) the bollard is attached to the surface by mechanical means (mechanical anchoring or chemical anchor).

Design Summary

Where removable bollards are used, the top of the mount point should be flush with the path's surface so as not to create a hazard. Posts shall be permanently reflectorized for nighttime visibility and painted a bright color for improved daytime visibility.

Striping an envelope around the post is recommended.

When more than one post is used, an odd number of posts at 1.5m (5-foot) spacing is desirable. Wider spacing can allow entry by adult tricycles, wheelchair users and bicycles with trailers.

Guidance

MUTCD – California Supplement (Section 9C.101-CA)

AASHTO Guide for the Development of Bicycle Facilities Chapter 2

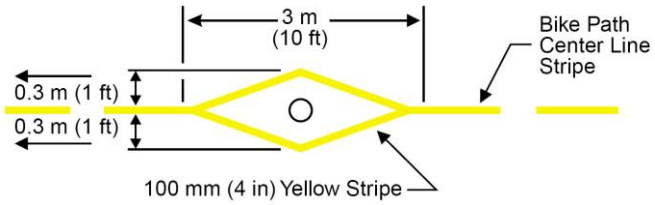
Cost

Bollard, fixed: $220 - $800 each

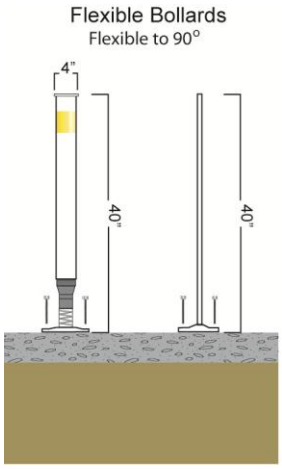
Bollard, removable: $680 - $940 each

Recommended Design

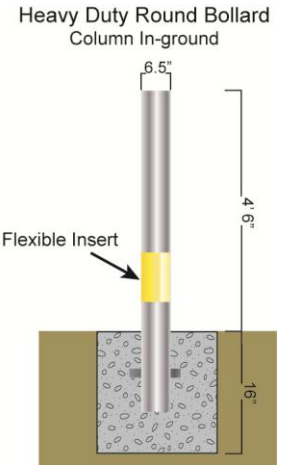
Barrier Post Striping



Flexible Bollards

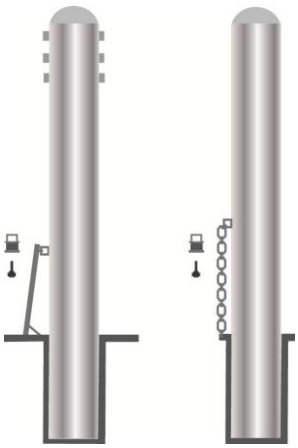


Source: Lighthouse Bollards



Source: Andian Sales

Removable Bollards



Source: Reliance Foundry Co. Ltd

Recommended Yield Policies

Discussion

Custom signage may be installed to guide trail users on proper trail etiquette (see graphic), especially in areas where conflicts are likely to occur. Because pedestrians typically travel at slower speeds than bicyclists, it is recommended that any signage direct pedestrians to walk on the right. Where signage is necessary, any of the three types of signage to the right are recommended as ways to encourage path users to yield to each other and to keep the paths clear.

A centerline marking is particularly beneficial in the following circumstances: A) Where there is heavy use; B) On curves with restricted sight distance; and C) Where the path is unlighted and nighttime riding is expected.

Design Summary

Signage

The Shared-Use Path Restriction (R9-7) sign may be installed on facilities that are to be shared by pedestrians and bicyclists.

Recommended Design

User Etiquette Signs along Multi-Use Paths

R9-7

Guidance

MUTCD, Sections 9B.12 and 9C.03

MUTCD – California Supplement, Section 9B.11 and 9C.03

AASHTO Guide for the Development of Bicycle Facilities, Chapter 2

Cost

Signs, trail regulation: $150 each

Signs, trail wayfinding / information: $500 - $2,000 each

5.5 Pathway Crossing

Shared use paths can intersect with roadways at midblock locations, or as part of a roadway-roadway intersection. Common issues at intersections of shared use paths and roadways include:

- Bicyclists entering or exiting the path may travel against motor vehicle traffic;
- Motorists crossing the shared use path at driveways and intersections may not notice path users, particularly path users coming from the right;
- Stopped motor vehicle traffic or vehicles exiting side streets or driveways may block the path; and
- Motorists may not expect or be able to yield to fast-moving bicyclists at the intersection.

Treatments

Bicycle and pedestrian pathway designers and traffic engineers generally have four options for designing multi-use pathway crossings. These include:

Option 1 – Reroute to the nearest at-grade controlled intersection crossing;

Option 2 – Create a new at-grade midblock crossing with traffic controls where the pathway intersects with the roadway;

Option 3 – Create a new unprotected midblock crossing where the pathway intersects with the roadway; and

Option 4 – Create a grade-separated undercrossing or overcrossing of the roadway where the pathway intersects the roadway.

Given the use characteristics specific to San Mateo County, it is likely that pathway users would use any of these four crossing options. This section addresses treatments at each of these crossing types.

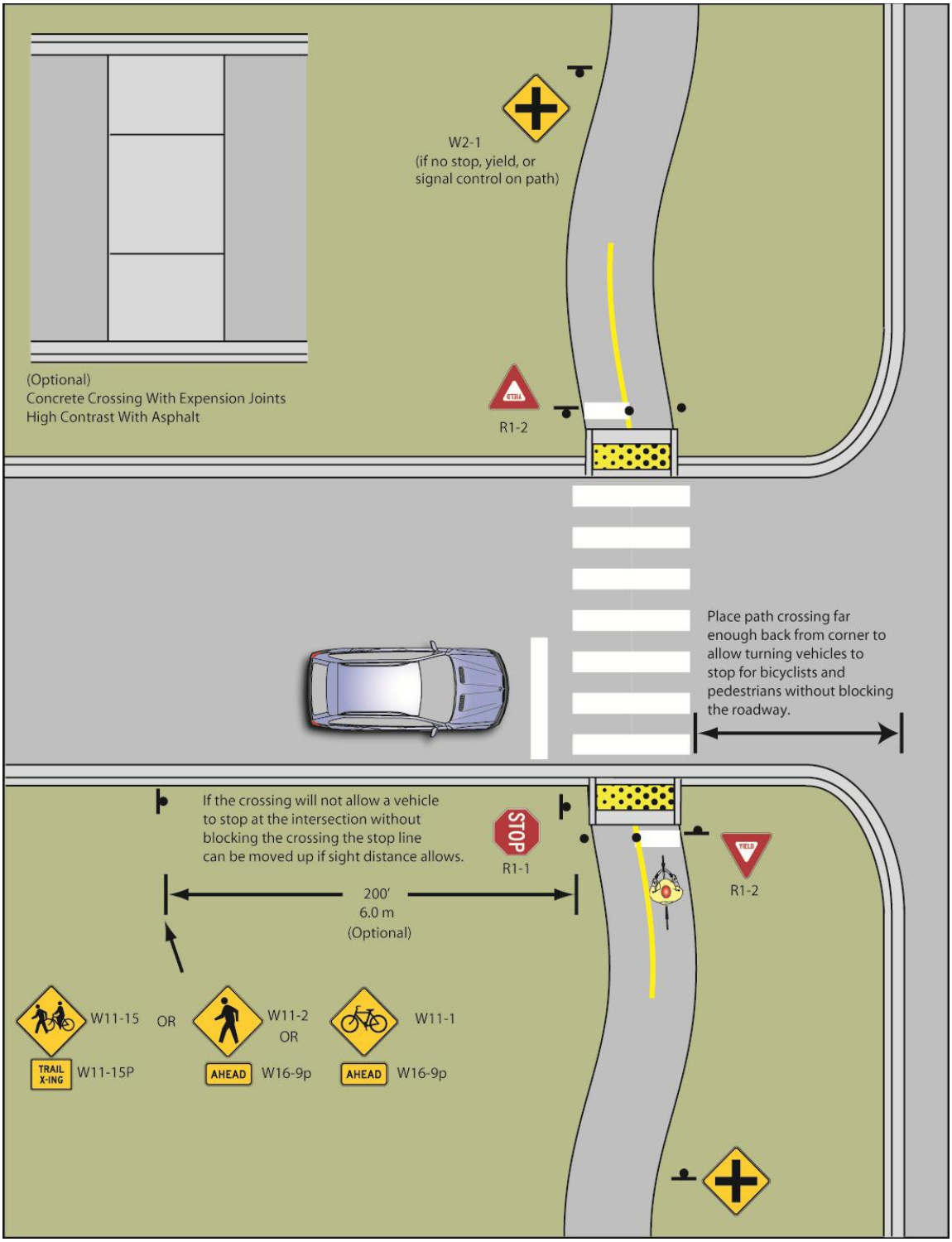
Path Crossing at Intersection

Discussion	Design Summary
The evaluation of a roadway crossing involves analysis of vehicular traffic and trail user travel patterns, including speeds, street width, traffic volumes (average daily traffic, peak hour traffic), line of sight, and trail user profile (age distribution and destinations). When engineering judgment determines that the visibility of the intersection is limited on the shared-use path approach, Intersection Warning signs should be used.	A path should be routed to a signalized intersection if the path would cross a major arterial with a high ADT within 350 feet of a signalized intersection. **Signage** Intersection Warning (W2-1 through W2-5) signs may be used on a roadway, street, or shared-use path in advance of an intersection to indicate the presence of an intersection and the possibility of turning or entering traffic. A trail-sized stop sign (R1-1) should be placed about 5 feet before the intersection. **Traffic Calming** Reducing the speed of the conflicting motor vehicle traffic should be considered. Options may include: transverse rumble strips approaching the trail crossing or sinusoidal speed humps[3]. **Crosswalk Markings** Colored and/or high visibility crosswalks should be considered. **Trail Speed Control** A chicane, or swerve in multi-use path approaching the crossing is recommended to slow bicyclist speed. Trail users traveling in different directions should be separated either with physical separation (bollard or raised median) or a centerline. If a centerline is used, it should be striped for the last 100 feet of the approach.

[3] Humps with a sinusoidal profile are similar to round-top humps but have a shallower initial rise (similar to a sine wave). They were developed to provide a more comfortable ride for cyclists in traffic calmed areas.

Path Crossing at Intersection

Recommended Design



Recommended "Typical" At-Grade Crossing at an Intersection Where Trail is Adjacent to a Road

Path Crossing at Intersection

Design Example

Typical "at grade" roadway crossing

Source: PBIC Image Library
Photographer: Danny McCullough

Guidance

Caltrans Highway Design Manual (Chapter 1000 Section 1003.1(4))

MUTCD – California Supplement, Part 9

AASHTO Guide for the Development of Bicycle Facilities and "A Policy on the Geometric Design of Highways and Streets"

FHWA-RD-87-038 Investigation of Exposure-Based Pedestrian Accident Areas: Crosswalks, Sidewalks, Local Streets, and Major Arterials.

Cost

Crosswalk, Transverse (parallel) Lines: $320 - $550 each

Crosswalk, Thermoplastic: $6 per square foot

Stop bar: $210 each

Stop Limit Bars / Yield Teeth: $210 - $530 each

Stop Pavement Markings: $420 each

Curb Ramps, Retrofit (diagonal, per corner): $800 – 5,340 each

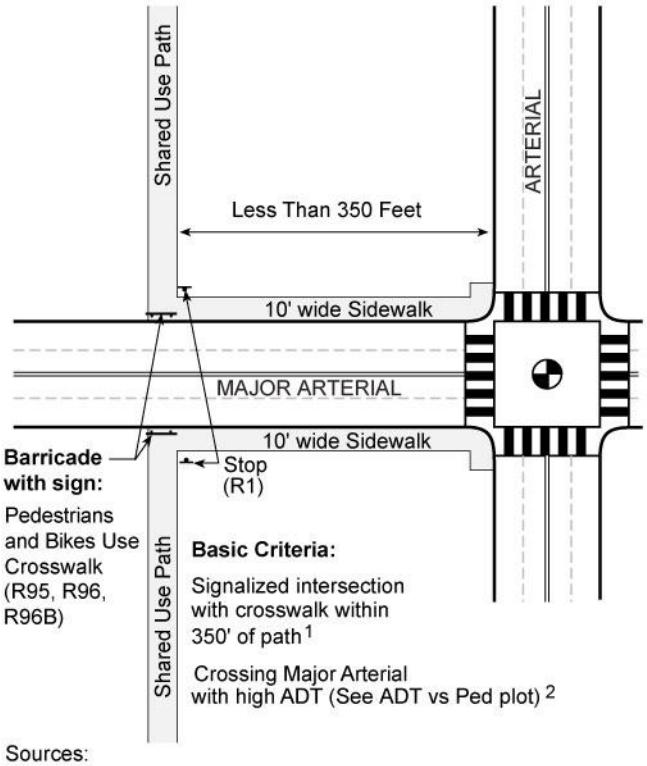
Curb Ramps, Retrofit (perpendicular, per corner): $5,340 - $10,000 each

Signs, High-Visibility: $430 each

Bollard, fixed: $220 - $800 each

Bollard, removable: $680 - $940 each

Recommended Design (Continued)



Recommended "Typical" At-Grade Crossing of a Major Arterial at an Intersection Where Trail is Within 350 Feet of a Roadway Intersection

Uncontrolled Mid-Block Crossing

Discussion

The table on the following page is a summary for implementing at-grade roadway crossings in San Mateo County. The number one (1) indicates a ladder style crosswalk with appropriate signage is warranted. (1/1+) indicates the crossing warrants enhanced treatments such as flashing beacons, or in-pavement flashers. (1+/3) indicates Pedestrian Light Control Activated (Pelican), Puffin, or Hawk signals should be considered.

Design Summary

Placement

Mid-block crosswalks should be installed where there is a significant demand for crossing and no nearby existing crosswalks.

Yield Lines

If yield lines are used for vehicles, they shall be placed 20 to 50 feet in advance of the nearest crosswalk line to indicate the point at which the yield is intended or required to be made and 'Yield Here to Pedestrians' signs shall be placed adjacent to the yield line. Where traffic is not heavy, stop or yield signs for pedestrians and bicyclists may suffice.

Warning Signs

The Bicycle Warning (W11-1) sign alerts the road user to unexpected entries into the roadway by bicyclists, and other crossing activities that might cause conflicts.

Pavement Markings

A ladder crosswalk should be used. Warning markings on the path and roadway should be installed.

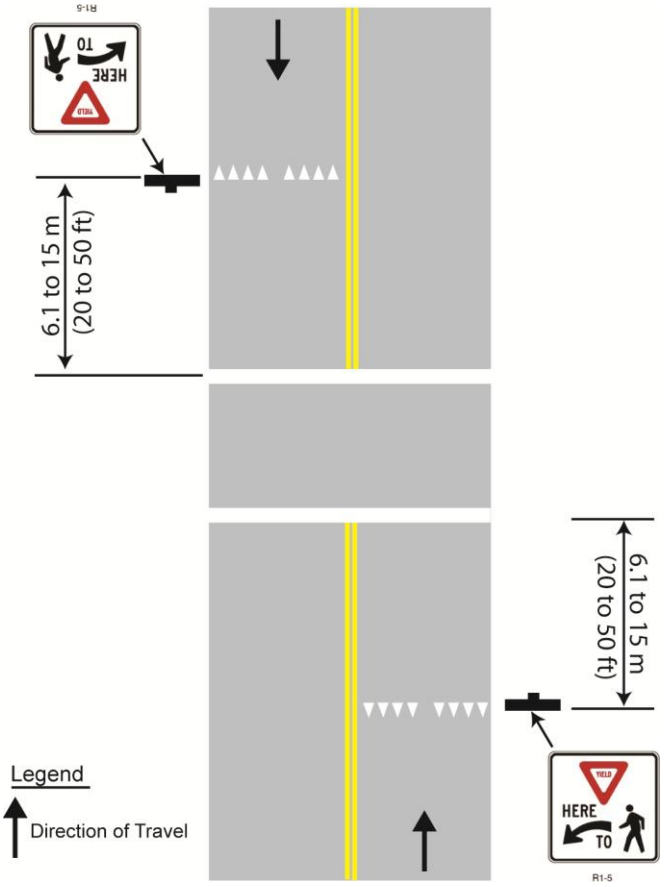
Other Treatments

See table on the following page to determine if treatments such as raised median refuges, flashing beacons should be used.

Beacons

See page H-16 of this appendix.

Recommended Design



Source: California MUTCD, Figure 3B-15

Uncontrolled Mid-Block Crossing

Guidance	Recommended Design (continued)
Caltrans Highway Design Manual (Chapter 1000) MUTCD – California Supplement, Parts 2 and 9 AASHTO Guide for the Development of Bicycle Facilities	 **CA MUTCD**

Cost

(See additional costing details on page H-11.

Roadway Type (Number of Travel Lanes and Median Type)	Vehicle ADT ≤ 9,000			Vehicle ADT > 9,000 to 12,000			Vehicle ADT > 12,000 to 15,000			Vehicle ADT > 15,000		
	Speed Limit**											
	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h
2 Lanes	1	1	1/1+	1	1	1/1+	1	1	1+/3	1	1/1+	1+/3
3 Lanes	1	1	1/1+	1	1/1+	1/1+	1/1+	1/1+	1+/3	1/1+	1+/3	1+/3
Multi-Lane (4 or more lanes) with raised median***	1	1	1/1+	1	1/1+	1+/3	1/1+	1/1+	1+/3	1+/3	1+/3	1+/3
Multi-Lane (4 or more lanes) without raised median	1	1/1+	1+/3	1/1+	1/1+	1+/3	1+/3	1+/3	1+/3	1+/3	1+/3	1+/3

*General Notes: Crosswalks should not be installed at locations that could present an increased risk to pedestrians, such as where there is poor sight distance, complex or confusing designs, a substantial volume of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices. Adding crosswalks alone will not make crossings safer, nor will they necessarily result in more vehicles stopping for pedestrians. Whether or not marked crosswalks are installed, it is important to consider other pedestrian facility enhancements (e.g., raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic-calming measures, curb extensions), as needed, to improve the safety of the crossing. These are general recomendations; good engineering judgment should be used in individual cases for deciding which treatment to use.
For each trail-roadway crossing, an engineering study is needed to determine the proper location. For each engineering study, a site review may be sufficient at some locations, while a more in-depth study of pedestrian volume, vehicle speed, sight distance, vehicle mix, etc. may be needed at other sites.
**Where the speed limit exceeds 40 mi/h (64.4 km/h), marked crosswalks alone should not be used at unsignalized locations.
***The raised median or crossing island must be at least 4 ft (1.2 m) wide and 6 ft (1.8 m) long to adequately serve as a refuge area for pedestrians in accordance with MUTCD and AASHTO guidelines. A two-way center turn lane is not considered a median.
1= Type 1 Crossings. Ladder-style crosswalks with appropriate signage should be used.
1/1+ = With the higher volumes and speeds, enhanced treatments should be used, including marked ladder style crosswalks, median refuge, flashing beacons, and/or in-pavement flashers. Ensure there are sufficient gaps through signal timing, as well as sight distance.
1+/3 = Carefully analyze signal warrants using a combination of Warrant 2 or 5 (depending on school presence) and EAU factoring. Make sure to project usage based on future potential demand. Consider Pelican, Puffin, or Hawk signals in lieu of full signals. For those intersections not meeting warrants or where engineering judgment or cost recommends against signalization, implement Type 1 enhanced crosswalk markings with marked ladder style crosswalks, median refuge, flashing beacons, and/or in-pavement flashers. Ensure there are sufficient gaps through signal timing, as well as sight distance.

Stop versus Yield Markings at Crossings

Discussion

Stop versus Yield for Path Users

Where conditions require path users, but not roadway users, to stop or yield, the STOP sign or YIELD sign should be placed on the path. When placement of STOP or YIELD signs is considered, priority at a shared-use path/roadway intersection should be assigned with consideration of the following:

- Relative speeds of shared-use path and roadway users;
- Relative volumes of shared-use path and roadway traffic; and
- Relative importance of shared-use path and roadway.

Speed should not be the sole factor used to determine priority, as it is sometimes appropriate to give priority to a high-volume shared-use path crossing a low-volume street, or to a regional shared-use path crossing a minor collector street. In some cases it may be appropriate to control the roadway only, while not controlling the path. The least restrictive appropriate controls should be used. STOP signs should not be used where YIELD signs would be acceptable.

Design Summary

Trail Crossing Signage

STOP (R1-1) signs shall be installed on shared-use paths at points where bicyclists are required to stop. YIELD (R1-2) signs shall be installed on shared-use paths at points where bicyclists have an adequate view of conflicting traffic as they approach the sign, and where bicyclists are required to yield the right-of-way to that conflicting traffic.

Recommended Design

Design Example

Intersection crossing

Guidance

MUTCD – California Supplement, Parts 2, 3 and 9

Caltrans Highway Design Manual (Chapter 1000)

AASHTO Guide for the Development of Bicycle Facilities

Cost

Stop limit bars/yield teeth: $200-$530 per set

Stop pavement markings: $420 each

Pavement Markings (Thermoplastic): $3.39 per square foot

Signs, Trail Crossing: $780 each

Signs, Trail Stop/Trail Yield: $520 each

Signs, Trail Regulation: $150 each

Crossing Beacons

Discussion

Beacons are typically used to supplement advance warning signals or at midblock crosswalks.

Types of Beacons

MUTCD identifies the following types of flashing beacons relevant to shared use trail - roadway intersections:

Intersection control beacon - a beacon used only at an intersection to control two or more directions of travel

Warning beacons - a beacon used only to supplement an appropriate warning or regulatory sign or marker

Stop beacons - a beacon used to supplement a STOP sign, a DO NOT ENTER sign, or a WRONG WAY sign

Experimental Treatments

There are other experimental pedestrian beacons that have been shown to have higher yielding rates than the standard flashing beacon. These include:

The Rectangular-Shaped Rapid Flash LED Beacons, which have been shown to have an 80 to 90 percent compliance rate in the field; and

The Pedestrian Hybrid Beacon, or High-Intensity Actuated Crosswalk (HAWK). The HAWK has a driver yielding rate of 97 percent and reduces pedestrian-motor vehicle crashes by 58 percent.

The application of experimental treatments within California should follow the California Traffic Control Devices Committee's (CTCDC) approval process (http://www.dot.ca.gov/hq/traffops/signtech/newtech/). Jurisdictions within California can apply to the CTCDC for permission to use experimental treatments. Note that the CTCDC has not approved the HAWK treatment to date. (See CTCDC's October 11, 2007 agenda and meeting minutes available on the Committee's website.)

Recommended Design

HAWK Crossing

(This beacon type has not been approved for use in California)

Design Summary

Traffic Control Signal Warrants

MUTCD Section 4C.01 identifies the minimum use and spacing parameters that must be met in order to warrant installation of a beacon.

Overhead flashing pedestrian beacons are governed under Section 4K.03 of the CA MUTCD.

CA MUTCD Section 4K.103 (CA) permits flashing beacons at school crosswalks. Section 4C.06 describes warrants (i.e., minimum requirements) for installation of a signal on a route to school.

Guidance

MUTCD – California Supplement, Sections 4C and 4K

ITE – Alternative Treatments for At-Grade Pedestrian Crossings

Cost

Signs, Overhead Beacon: $15,000-$55,120 each

Detection, Automated Beacon: $800 each

Crossing, Hawk: $50,000 each

Actuated Pedestrian Crossing: $40,000 each

Signalized Mid-Block Crossing

Discussion

Warrants from the MUTCD combined with sound engineering judgment should be considered when determining the type of traffic control device to be installed at path-roadway intersections. Traffic signals for path-roadway intersections are appropriate under certain circumstances. The MUTCD lists 11 warrants for traffic signals, and although path crossings are not addressed, bicycle traffic on the path may be functionally classified as vehicular traffic and the warrants applied accordingly.

Pedestrian volumes can also be used for warrants.

Experimental Treatment

A Toucan crossing (derived from: "two can cross") is used in higher traffic areas where pedestrians and bicyclists are crossing together.

Design Summary

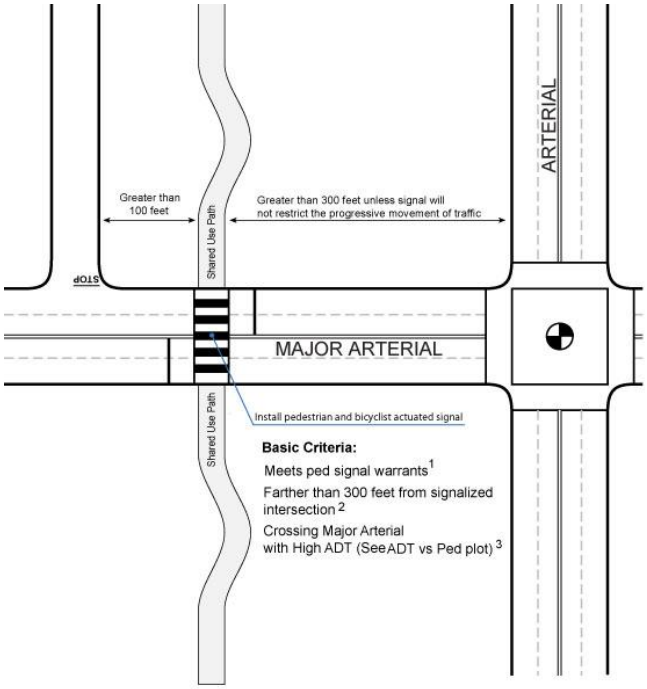
Warrants

Section 4C.05 in the CAMUTCD describes pedestrian volume minimum requirements (referred to as warrants) for a mid-block pedestrian-actuated signal.

Pavement Markings

Stop lines at midblock signalized locations should be placed at least 40 feet in advance of the nearest signal indication.

Recommended Design



Sources:
1. California MUTCD 4C.05
2. California MUTCD 4D.01
3. Investigation of Exposure Based Accident Areas: Crosswalks, Local Street, and Arterials, Knoblauch, 1987

Design Example

Toucan Crossing (This experimental treatment has not been approved for use in California)

Guidance

MUTCD – California Supplement, Chapters 3 and 9 and Section 4C.05 and 4D

AASHTO Guide for the Development of Bicycle Facilities, Chapter 2

Cost

Crossing, Toucan: $90,000 each

Path Crossings at Roundabouts

Discussion

The California MUTCD defines a roundabout as "a circular intersection with yield control of all entering traffic, channelized approaches, and appropriate geometric curvature, such that travel speeds on the circulatory roadway are typically less than 30 mph."

Roundabouts provide for higher motor vehicle capacity than a signalized intersection with the same number of approach lanes, and reduce the number of conflict points for motorists. Research has shown single-lane roundabouts to have safety benefits. However, multi-lane roundabouts may not provide the same benefits, and may even increase conflicts for bicyclists.

Bicycle lanes should not be provided on the outside of the circulating roadway; as this increases, conflicts between bicyclists and motorists. Instead, roundabouts should be designed to encourage bicyclists riding on the roadway to control the lane as they travel through the roundabout. Ways of doing this include limiting the number of lanes, narrowing travel and circulating lanes, and designing the roundabout to operate at speeds close to 20 to 15 miles per hour.

Design Summary

Path users should be directed around the roundabout to cross at the crosswalks on the circulating legs.

Bicycle ramps may be provided between the approach and exit legs and the path to allow bicyclists on the street to use the path and pedestrian crossings to navigate through the roundabout.

Crosswalks shall be marked at roundabouts, including rural locations, on all legs where pedestrians will be crossing.

The preferred type of crosswalk markings at roundabouts on the State Highway system is the "ladder" type.

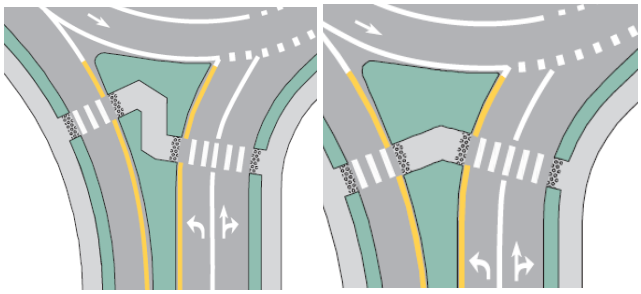
The pedestrian refuge should be a minimum width of 6 ft to adequately provide shelter for persons pushing a stroller or walking a bicycle.

At single-lane roundabouts, the pedestrian crossing should be located one vehicle-length (25 ft) away from the yield line. At double-lane roundabouts, the pedestrian crossing should

Recommended Design

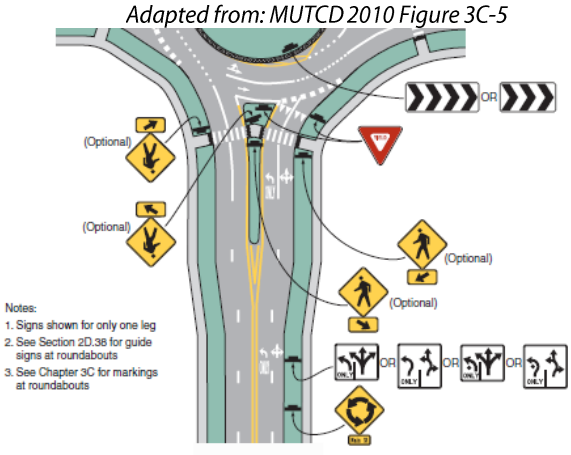
Example of Markings for Approach and Circulatory Roadways at a Roundabout

Source: MUTCD 2010 Figure 3C-1



Two Options for Crossing Splitter Islands

Adapted from: MUTCD 2010 Figure 3C-5



Example of Regulatory and Warning Signs for a Two-Lane Roundabout with Consecutive Double Lefts

Adapted from: MUTCD 2010 Figure 2B-23

Path Crossings at Roundabouts

Design Summary (cont.)

be located one, two, or three car lengths (approximately 25 ft, 50 ft, or 75 ft) away from the yield line.

The pedestrian refuge should be designed at street level, rather than elevated to the height of the splitter island. This eliminates the need for ramps within the refuge area, which can be cumbersome for people in wheelchairs.

Ramps should be provided on each end of the crosswalk to connect the crosswalk to other crosswalks around the roundabout and to the sidewalk network.

Apply detectable warning surfaces to splitter island and curb ramp as required by ADAAG.

Guidance

Caltrans Design Information Bulletin 80-01

CA MUTCD and MUTCD

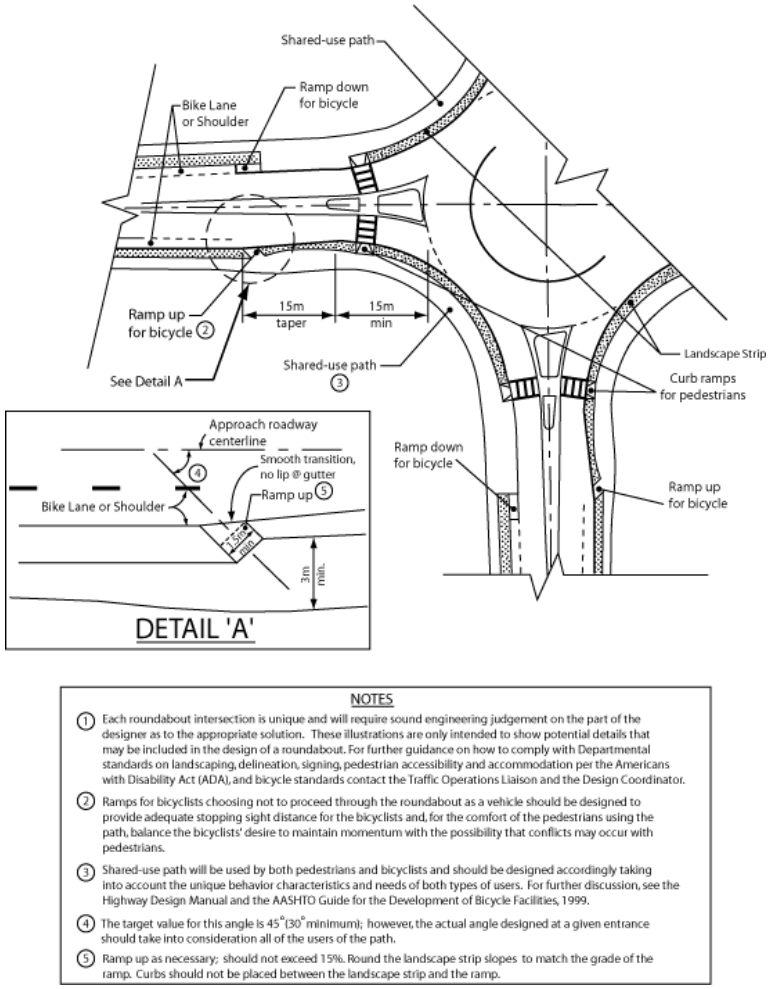
FHWA Roundabouts: An Informational Guide (2006) and forthcoming edition.

Cost

Not available.

Path and crossings should be constructed as part of the roundabout.

Recommended Design (Continued)



Bicycle Access Ramp to Shared Use Path

Source: Caltrans Design Information Bulletin 80-01 Figure 4

5.6 On-Street Bicycle Facility Design

Bike Lanes

Bike lanes or Class II bicycle facilities (Caltrans designation) are defined as a portion of the roadway that has been designated by striping, signage, and pavement markings for the preferential or exclusive use of bicyclists. Bike lanes are generally found on major arterial and collector roadways and are 4 to 7 feet wide. Bike lanes can be found in a large variety of configurations, and can even incorporate special characteristics including coloring and placement, if beneficial.

Bike lanes enable bicyclists to ride at their preferred speed without interference from prevailing traffic conditions and facilitate predictable behavior and movements between bicyclists and motorists. Bicyclists may leave the bike lane to pass other bicyclists, make left turns, avoid obstacles or debris, and to avoid other conflicts with other roadway users.

General Design Guidance:

Width:

Varies depending on roadway configuration, see following pages for design examples.

Striping:

- Line separating vehicle lane from bike lane (typically left sideline): 6 inches
- Line separating bike lane from parking lane (if applicable): 4 inches
- Dashed white stripe when:
- Vehicle merging area — Varies
- Delineate conflict area in intersections (optional) — Length of conflict area

Signing:

Use R-81 Bike Lane Sign at:

- Beginning of bike lane;
- Far side of all intersection crossings;
- At approaches and at far side of all arterial crossings;
- At major changes in direction; and
- At intervals not to exceed ½ mile.

R-81 Sign

Pavement Markings:

There are three potential variations of pavement markings for bike lanes allowed by the California MUTCD. Most cities nationwide are moving to use the graphic representation of cyclist with directional arrow (pictured right), and as such this stencil is recommended here. This stencil should be used at:

- Beginning of bike lane;
- Far side of all bike path (Class I) crossings;
- At approaches and at far side of all arterial crossings;
- At major changes in direction;
- At intervals not to exceed ½ mile; and
- At beginning and end of bike lane pockets at approach to intersection.

Recommended Bike Lane Stencil

Bike Lane with No On-Street Parking

Discussion

Recommended bicycle lane width is 5 feet minimum when adjacent to curb and gutter. Wider bicycle lanes are desirable in certain circumstances such as on higher speed arterials (45 mph+) where a wider bicycle lane can increase separation between passing vehicles and bicyclists. Appropriate signing and stenciling is important with wide bicycle lanes to ensure motorists do not mistake the lane for a vehicle lane or parking lane. Bicycle lanes wider than seven feet are not recommended.

Design Summary

Bike Lane Width:

4′ minimum when no gutter is present (rural road sections)

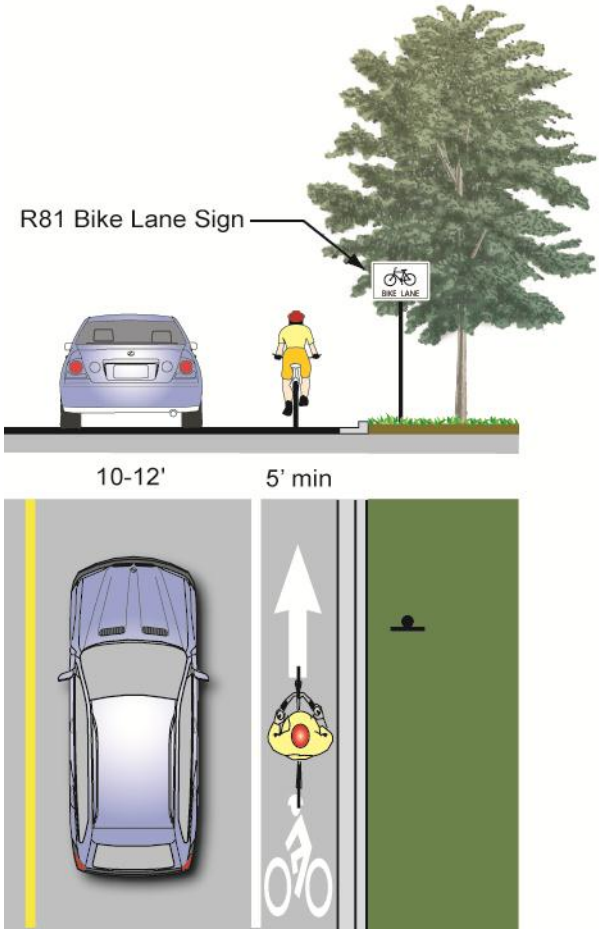
5′ minimum when adjacent to curb and gutter (3′ more than the gutter pan width if the gutter pan is greater than 2′)

Recommended Width:

6′ where right-of-way allows

Design Example

Recommended Design



Guidance

MUTCD

Caltrans Highway Design Manual (Chapter 1000)

MUTCD – California Supplement

AASHTO Guide for the Development of Bicycle Facilities

Cost

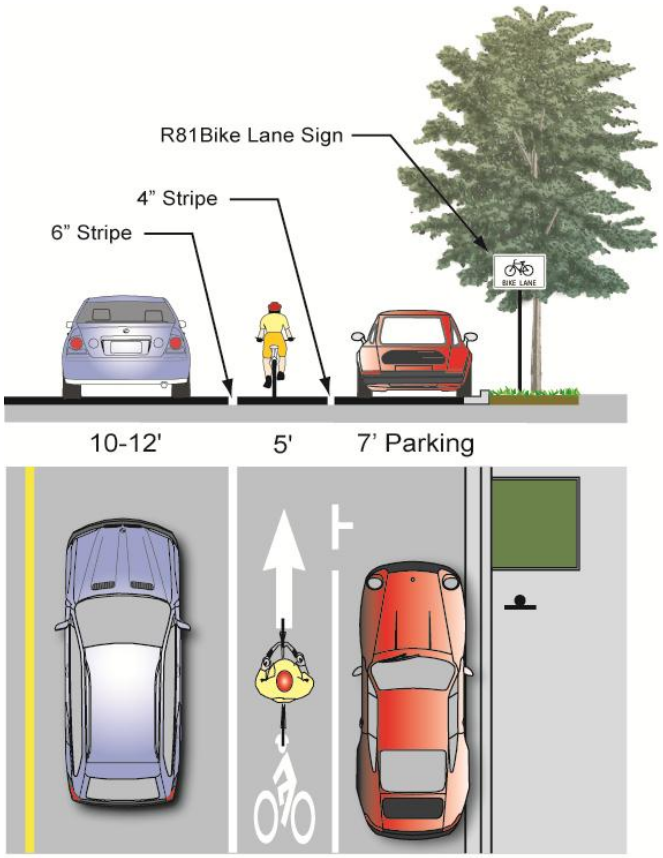
Class II Bike Lane: $5,000-$500,000 per mile

Bike Lane With On-Street Parallel Parking

Discussion

Bike lanes adjacent to parallel parking should be designed to be wide enough to allow bicyclists to ride outside of the "door zone" (i.e., five feet minimum).

Recommended Design



Design Summary

Bike Lane Width:

5 feet minimum recommended when parking stalls are marked

7 feet maximum (wider lanes may encourage vehicle loading in bike lane)

12 feet for a shared lane adjacent to a curb face (13 feet is preferred where parking is substantial or turnover is high), or 11' minimum for a shared bike/parking lane on streets without curbs where parking is permitted.

Guidance

Caltrans Highway Design Manual (Chapter 1000)

MUTCD – California Supplement

AASHTO Guide for the Development of Bicycle Facilities

Cost

Class II Bike Lane: $5,000-$500,000 per mile

Bike Routes

Bike routes, or Class III bicycle facilities (Caltrans designation), are defined as facilities shared with motor vehicles. They are typically used on roads with low speeds and traffic volumes, however can be used on higher volume roads with wide outside lanes or with shoulders. Bike routes can be established along through routes not served by shared use paths (Class I) or bike lanes (Class II), or to connect discontinuous segments of bikeway. A motor vehicle driver will usually have to cross over into the adjacent travel lane to pass a bicyclist, unless a wide outside lane or shoulder is provided.

Bicycle Routes can employ a large variety of treatments from simple signage to complex treatments including various types of traffic calming and/or pavement stenciling. The level of treatment to be provided for a specific location or corridor depends on several factors.

General Design Guidance:

Signing:

Use D11-1 Bicycle Route Sign at:

- Beginning or end of bicycle route (with applicable M4 series sign);
- Entrance to bicycle path (Class I) – optional;
- At major changes in direction or at intersections with other bicycle routes (with applicable M7 series sign); and
- At intervals along bicycle routes not to exceed ½ mile.

D11-1 Sign

Pavement Markings:

Shared Lane Markings may be applied to bicycle routes.

Bike Route on Low Volume Street

Discussion

Bicycle routes on local streets should have vehicle traffic volumes under 1,000 vehicles per day. Traffic calming may be appropriate on streets that exceed this limit.

Bicycle routes may be placed on streets with outside lane width of less than 15 feet if vehicle speeds and volumes are low.

Design Summary

Sign Placement:

Bicycle Route signage should be applied at intervals frequent enough to keep bicyclists informed of changes in route direction and to remind motorists of the presence of bicyclists.

Design Example

Guidance

Caltrans Highway Design Manual (Chapter 1000)

MUTCD – California Supplement

AASHTO Guide for the Development of Bicycle Facilities

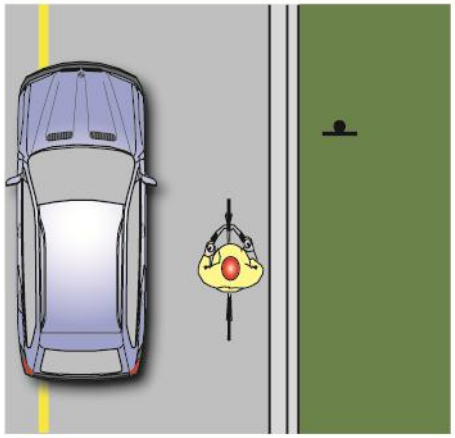
Cost

Class III Bike Route: $1,000-$40,000 per mile (assumes no major renovation is required)

$150,000 - $300,000 (assuming moderate to major roadway renovation)

Recommended Design

Local Street - Width Varies



Shoulder Bike Route

Discussion

Bicycle routes on rural arterials and state highways can offer a functional option to the installation of bicycle lanes when bicycle lanes are not possible. Major intersections should still have bicycle pockets (if applicable) and other treatments to make bicycle travel safer and more visible.

Design Summary

Shoulder Width:

Shoulder width should be 4 feet wide minimum to accommodate a shoulder bike route. If a rumble strip is present (such as on a state highway) it is recommended to include a skip (or gap) in the rumble strip to allow bicyclists to cross from the shoulder to the travel lane when encountering debris.

Sign Placement:

Bicycle Route signage should be applied at intervals frequent enough to keep bicyclists informed of changes in route direction and to remind motorists of the presence of bicyclists.

Guidance

Caltrans Highway Design Manual (Chapter 1000)

MUTCD – California Supplement

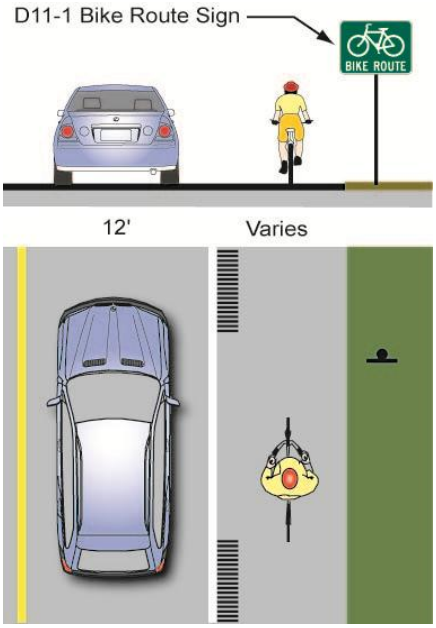
AASHTO Guide for the Development of Bicycle Facilities

Cost

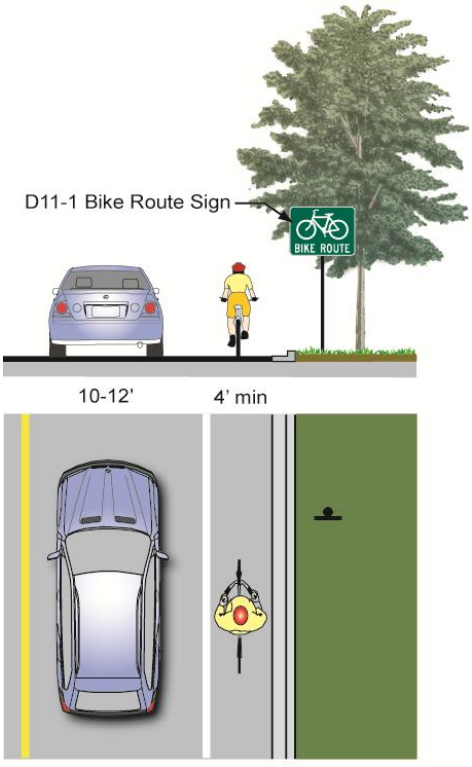
Class III Bike Route with Shoulder Stripe: $20,000-60,000 per mile (assumes no major renovation is required)

Rumble Strip: $0.10 to $0.50 per linear foot

Recommended Design



Bike Route with Wide Shoulder and Bicycle Friendly Rumble Strip



Bike Route with Shoulder Stripe

Shared Lane Markings (SLM)

Discussion

Recently, Shared Lane Marking (SLM) stencils (also called "Sharrows") have been introduced for use in California as an additional treatment for bike route (Class III) facilities and are currently approved in conjunction with on-street parking. The stencil can serve a number of purposes, such as making motorists aware of the need to share the road with bicyclists, showing bicyclists the direction of travel, and, with proper placement, reminding bicyclists to bike further from parked cars to prevent "dooring" collisions.

The CA MUTCD includes guidance for placement of the SLM

Though not always possible, placing the SLM markings outside of vehicle tire tracks will increase the life of the markings and the long-term cost of the treatment.

Design Summary

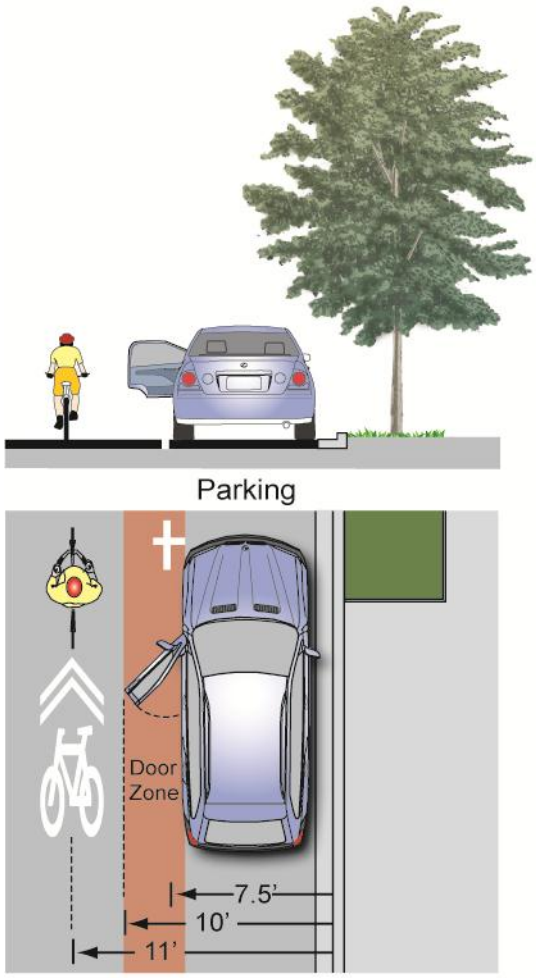
Door Zone Width:

The width of the door zone is generally assumed to be 2.5 feet from the edge of the parking lane.

Recommended SLM placement:

Minimum of 11.5 feet from edge of curb where on-street parking is present. If parking lane is wider than 7.5 feet the SLM should be moved further out accordingly.

Recommended Design



Shared Lane Marking Placement

Design Example

Guidance

MUTCD – California Supplement, Section 9C.103

Cost

Stencils only: $250 each

Additional Bike Route Signage

Discussion

'Share the Road' signs are intended to 'reduce motor vehicle/bicyclist conflict' and are appropriate to be placed on routes that lack paved shoulders or other bicycle facilities. They typically work best in rural situations, or when placed near activity centers such as schools, shopping centers and other destinations that attract bicycle traffic.

In urban areas, many cities around the country have been experimenting with a new type of signage that encourages bicyclists to take the lane when the lane is too narrow. This type of sign is becoming known as BAUFL (Bikes Allowed Use of Full Lane). This can be quantified to lanes being less than 14 feet wide with no parking and less than 22 feet wide with adjacent parallel parking. The 2009 update to the MUTCD recognizes the need for such signage and has designated the white and black sign at right (R4-11). The 2010 CA MUTCD states that Shared Lane Markings (which serve a similar function as Bikes May Use Full Lane signage) should not be placed on roadways that have a speed limit above 40 mph. Dedicated bicycle facilities are recommended for roadways with speed limits above 40 mph where the need for bicycle access exists.

Design Summary

Placement:

Signs should be placed at regular intervals along routes with no designated bicycle facilities.

Guidance

MUTCD – California Supplement Section 9C.103

Cost

Sign, regulation: $150 each

Recommended Design

Share The Road Signs (National MUTCD)

Bicycle Boulevards

Discussion

Bicycle boulevards have been implemented in a variety of locations including Palo Alto, San Luis Obispo, Berkeley and Davis, California and Portland, Oregon. Bicycle boulevards, also known as bicycle priority streets, are non-arterial streets that are designed to allow bicyclists to travel at a consistent, comfortable speed along low-traffic roadways and to cross arterials conveniently and safely. Bicycle boulevards typically include treatments that allow bicyclists to travel along the bicycle boulevard with minimal stopping while discouraging motor vehicle traffic. Traffic calming and traffic management treatments such as traffic circles, chicanes, and diverters are used to discourage motor vehicles from speeding and using the bicycle boulevard as a cutthrough. Quick-response traffic signals, median islands, or other crossing treatments are provided to facilitate bicycle crossings of arterial roadways.

Design Summary

Residential streets with low traffic volumes (typically between 3000 to 5000 average daily vehicles).

Can include secondary commercial streets.

Bicycle boulevard pavement markings should be installed in conjunction with wayfinding signs.

Can be designed to accommodate the particular needs of the residents and businesses along the routes, and may be as simple as pavement markings with wayfinding signs or as complex as a street with traffic diverters and bicycle signals.

Guidance

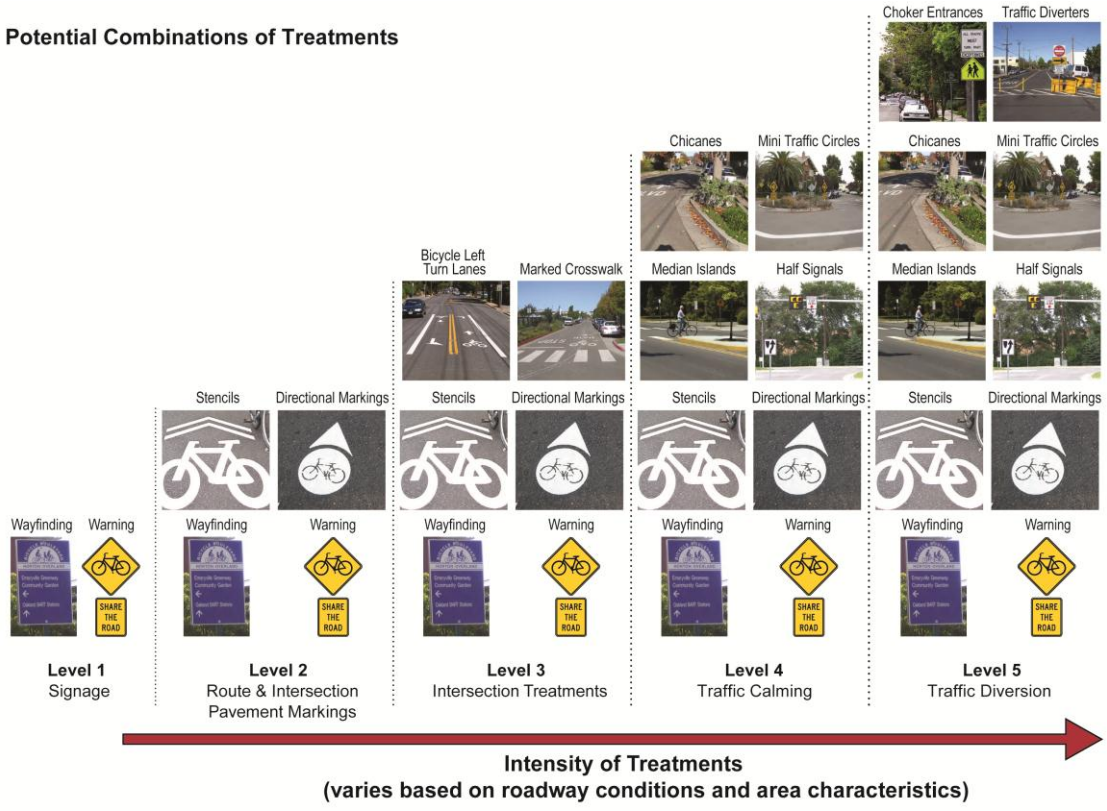
This treatment is not currently present in any State or Federal design standards

Berkeley Bicycle Boulevard Design Tools and Guidelines: http://www.ci.berkeley.ca.us/ContentDisplay.aspx?id=6652

Cost

$310,500 per mi (source: San Benito Bike Plan, 2008)

Recommended Design



Buffered Bike Lanes

Discussion

A buffered bike lane, also called an enhanced bike lane or protected bike lane, is a five-foot-wide bike lane that is buffered by a striped "shy zone" between the bike lane and the moving vehicle lane. With the shy zone, the buffered lane offers a more comfortable riding environment for bicyclists who prefer not to ride adjacent to traffic. This design makes movement safer for both bicyclists and vehicles. Motorists can drive at a normal speed and only need to watch for cyclists when turning right at cross-streets or driveways and when crossing the buffered lane to park. The advantages of the buffered bicycle lane design are that it provides a more protected and comfortable space for cyclists than a conventional bike lane and does not have the same turning movement constraints as cycletracks that accommodate two-way bicycle travel along one side of the roadway.

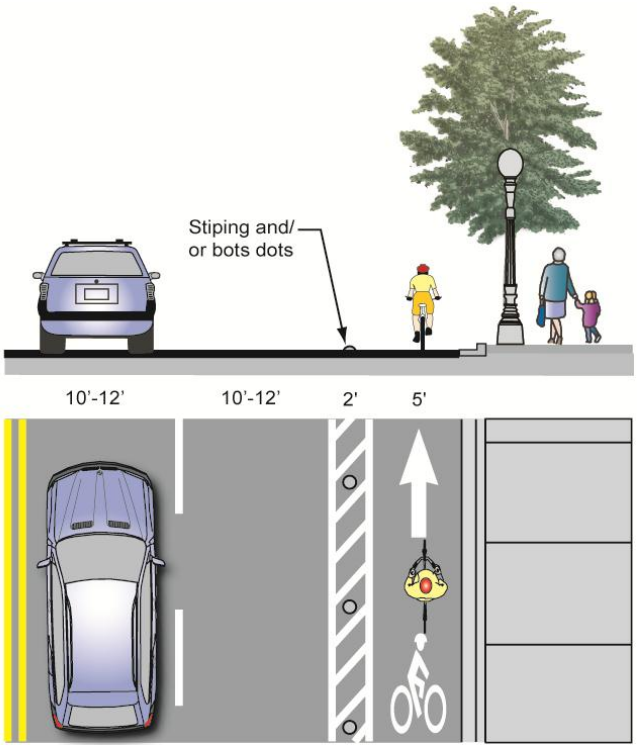
The buffer area may only be painted on the road or it may be physically separated by devices such as bots dots or bollards.

Design Summary

A spatial buffer increases the distance between the bike lane and the automobile travel lane or the parking zone.

Appropriate for roadways with high automobile traffic speeds and volumes, and/or high volume of truck/oversized vehicle traffic, and roadways with bike lanes adjacent to high turnover on-street parking.

Recommended Design



Design Example

Buffered bike lane in Fairfax, CA

Cost

Cycletracks

Discussion

Cycletracks combine the user experience of a separated path with the on-street infrastructure of a conventional bike lane. Cycletracks have different forms, but all share common elements. They are separated from vehicle traffic lanes, parking lanes and sidewalks and provide space exclusively for bicyclists. When on-street parking is available, cycletracks are located on the outside of the parking lane. Cycletracks can be either one-way or two-way, on one or both sides of a street, and are separated from vehicles and pedestrians by pavement markings or coloring, bollards, curbs/medians or a combination of these elements.

See following page for additional discussion.

Design Summary

Bikeways separated from adjacent motor vehicles by a physical barrier or line of parked cars.

Separation can be achieved in multiple ways, including grade separation, mountable curb, bollards, planters and markings.

Most appropriate on wide, high-volume, high-speed roadways that are on major bike routes; and roadways with infrequent cross streets, curb cuts and long blocks.

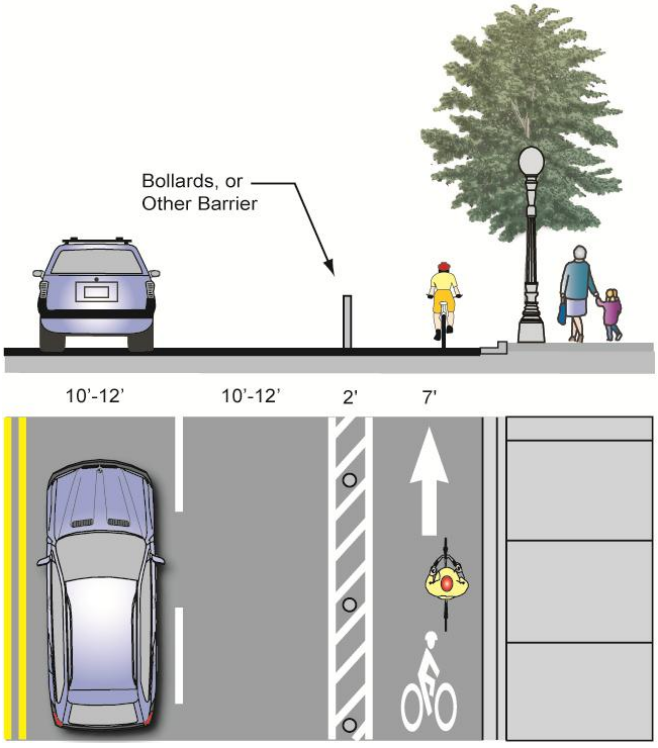
Cycletrack Width:

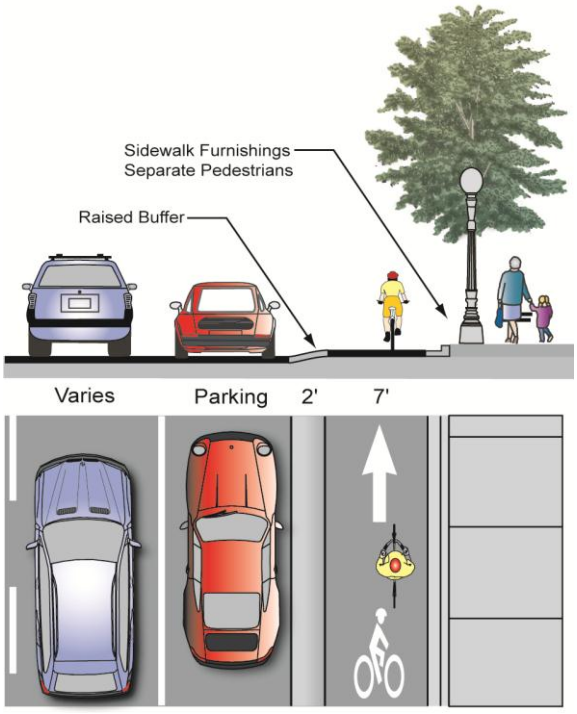
7 feet minimum to allow passing and obstacle avoidance

12 feet minimum for two-way facility

Design Example

Recommended Design





Cycletracks

Guidance

This treatment is not currently present in any State or Federal design standards

Additional Discussion – Cycletracks

Separation

Cycletracks can be separated by a barrier or by on-street parking. Cycletracks using barrier separation are typically at-grade. Openings in the barrier or curb are needed at driveways or other access points. The barrier should be dropped at intersections to allow vehicle crossing.

When on-street parking is present, it should separate the cycletrack from the roadway, the cycletrack should be placed with a 2-foot buffer between parking and the cycletrack to minimize the hazard of opening car doors to passing bicyclists.

Placement

Cycletracks should be placed along slower speed urban/suburban streets with long blocks and few driveway or midblock access points for vehicles. Cycletracks located on one-way streets will have fewer potential conflicts than those on two-way streets. A two-way cycletrack is desirable when there are more destinations on one side of a street or if the cycletrack will be connecting to a shared use path or other bicycle facility on one side of the street.

Cycletracks should only be constructed along corridors with adequate right-of-way. Sidewalks or other pedestrian facilities should not be narrowed to accommodate the cycletrack as pedestrians will likely walk on the cycletrack if sidewalk capacity is reduced. Visual and physical cues should be present that make it easy to understand where bicyclists and pedestrians should be moving.

Intersections

Cycletracks separate bicyclists and motor vehicles to a greater degree than bicycle lanes. This produces added comfort for bicyclists on the cycletrack, but it creates additional considerations at intersections that must be addressed. Right turning motorists conflicting with cycletrack users is the most common conflict. Both roadway users have to expand their visual scanning to see potential conflicts. To mitigate for this issue, several treatments can be applied at intersections:

Protected Phases at Signals. This treatment must have separate signal phases for bicyclists and will potentially increase delay. With this treatment, left and right turning movements are separated from conflicting through movements. The use of a bicycle signal head is required in this treatment to ensure all users know which signals to follow. Demand only bicycle signals can be implemented to reduce vehicle delay to prevent an empty signal phase from regularly occurring. With this scenario, a push button or imbedded loop within the cycletrack should be available to actuate the signal. If heavy bicyclist left turns are expected, this movements should be given its own signal phase and push button.

Advanced Signal Phases. Signalization utilizing a bicycle signal head can also be set to provide cycletrack users a green phase in advance of vehicle phases. The amount of time will depend on the width of the intersection.

Unsignalized Treatments. At non-signalized intersections the same conflicts exist. Warning signs, special markings and the removal of on-street parking (if present) in advance of the intersection can all raise visibility and awareness for bicyclists.

Access Management. The reduction in the number of potential conflict points can also benefit a cycletrack corridor. Medians, driveway consolidations, or restricted movements reduce the potential for conflict.

Colored Bike Lanes

Discussion

Color applied to bike lanes helps alert roadway users to the presence of bicyclists and clearly assigns right-of-way to cyclists. Motorists are expected to yield to cyclists in these areas. Some cities apply color selectively to highlight potential conflict zones, while others use it to mark all non-shared bicycle facilities in high volume traffic situations.

Color Considerations:

There are three colors commonly used in bicycle lanes: blue, green, and red. All help the bike lane stand out in merging areas. The City of Portland began using green lanes in 2008, as blue, the color used previously, is a color associated with ADA related signage on roadways. Green is the color recommended for use in San Mateo County.

Material Options:

Colored bike lanes require additional cost to install and maintain. Techniques include:

Paint – less durable and can be slippery when wet

Colored asphalt – colored medium in asphalt during construction – most durable.

Colored and textured sheets of acrylic epoxy coating.

Design Summary

Bike lane width

Appropriate for heavy auto traffic streets with bike lanes; at transition points where cyclists, motorists and/or pedestrians must weave with one another; conflict areas or intersections with a record of crashes; and to emphasize bicycle space in unfamiliar or unique design treatments.

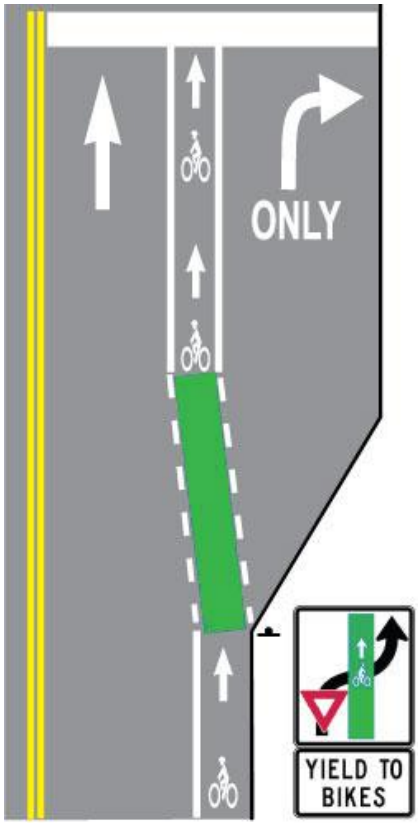
Guidance

This treatment is not currently present in any State or Federal design standards

Portland's Blue Bike Lanes:

http://www.portlandonline.com/shared/cfm/image.cfm?id=58842

Recommended Design



Design Example

Manholes & Drainage Grates

Discussion

Utility infrastructure within the roadway can present significant hazards to bicyclists. Manholes, water valve covers, drain inlets and other obstructions can present an abrupt change in level, or present a situation where the bicyclist's tire could become stuck, potentially creating an accident. As such, every effort should be made to locate such hazards outside of the likely travel path of bicyclists on new roadway construction.

For existing roadways, the roadway surface can be ground down around the manhole or drainage grate to be no more than half an inch of vertical drop. When roadways undergo overlays, this step is often omitted and significant elevation differences can result in hazardous conditions for bicyclists.

Bicycle drainage grates should not have longitudinal slats that can catch a bicycle tire and potentially cause an accident. Acceptable grate designs are presented (top right) as A: patterned, B: transverse grate, or C: modified longitudinal with no more than 6" between transverse supports). Type C is the least desirable as it could still cause problems with some bicycle tires.

The drop in-inlet avoids all issues with grates in the bicyclists' line of travel, however, these drainage inlets are not recommended by Caltrans for use on California Highways.

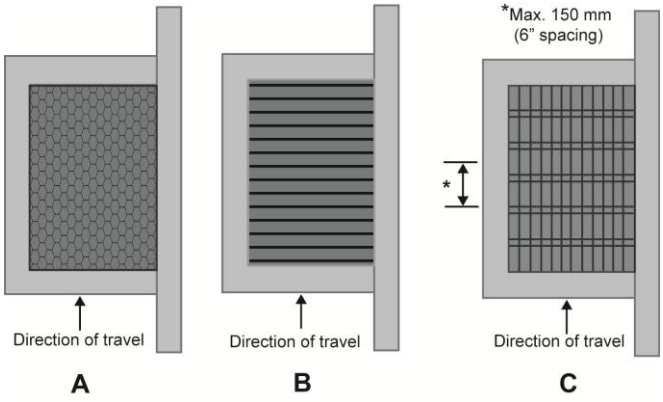
The CA MUTCD recommends providing a diagonal solid white line for hazards or obstructions in bikeways (see right).

Design Summary

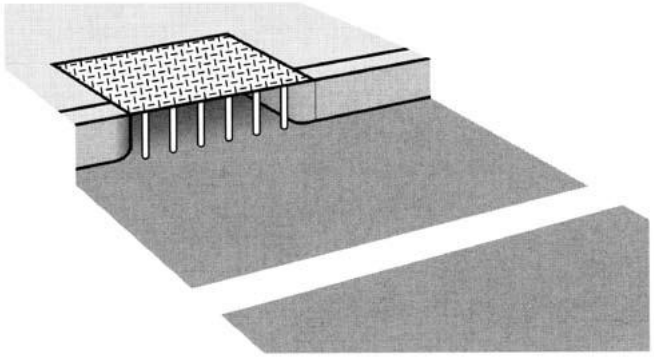
Placement:

Manholes should be placed outside of any bike lanes. Drainage grates should be of one of the types at right.

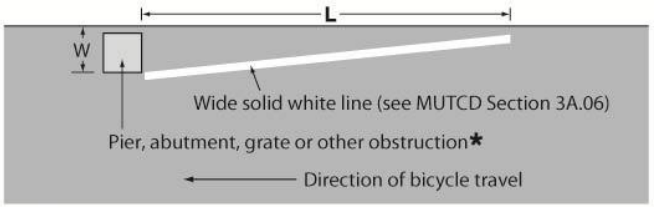
Recommended Design



Bicycle Compatible Drainage Grates



Drop-in inlet flush with in the curb face (Oregon DOT)



L = WS, where W is the offset in feet and S is bicycle approach speed in mph

* Provide an additional foot of offset for a raised obstruction and use the formula L= (W+1) S for the taper length

Figure 9C-8

Guidance

Caltrans Highway Design Manual (Chapter 1000)

MUTCD – California Supplement

AASHTO Guide for the Development of Bicycle Facilities

Cost

Striping: $2 per linear foot

Drainage grate: $500

Bicycle Access during Construction Activities

Discussion

When construction impedes a bicycle facility, the provision for bicycle access should be developed during the construction project planning. Long detour routing should be avoided because of lack of compliance.

Advance warning of the detour should be placed at appropriate locations and clear wayfinding should be implemented to enable bicyclists to continue safe operation along travel corridor.

Design Summary

Construction Detour Signs

Detours should be adequately marked with standard temporary route and destination signs (M409a and M4-9c).

The Pedestrian/Bicycle Detour sign should have an arrow pointing in the appropriate direction.

Recommended Design

M4-9a M4-9c

National MUTCD

Cost

Sign, regulation: $150 each

Guidance

MUTCD (Section 6F.53)

MUTCD – California Supplement

California Highway Design Manual

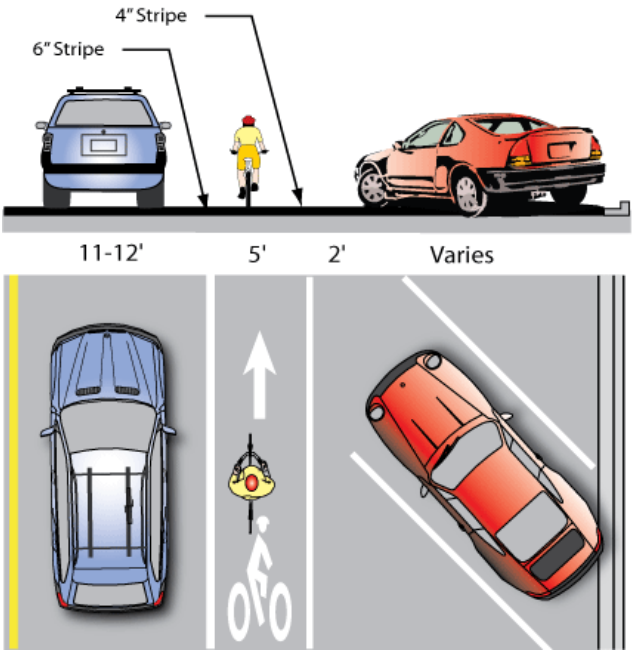
Back-In Angled Parking

Discussion

Conventional angled parking is not compatible or recommended in conjunction with high levels of bicycle traffic or with the provision of bike lanes. The use of 'back-in angled parking' or 'reverse angled parking' is recommended over head-in angled parking. This design addresses issues with angled parking and bicycle travel by improving sight distance between drivers and bicyclists and has other benefits to vehicles including: loading and unloading of the trunk occurs at the curb rather than in the street, passengers (including children) are directed by open doors towards the curb, vehicle headlights are not directed into homes and businesses, and there is no door conflict with bicyclists. Back-in angled parking is typically an easier maneuver than conventional parallel parking.

Back-in-angle parking has been implemented in over 26 cities in the United States, including Wilmington, Delaware (in place for over fifty years), Seattle (in place for over thirty years), Washington, D.C. (in place for over twenty years), and several cities in California. In cities where this type of parking has been implemented, the number of parking-related collisions has decreased since installation.

Recommended Design



Design Summary

Bike Lane Width: 5' minimum

Striping: White 4-inch stripe separates bike lane from parking bays.

Parking Stall Depth: Parking stalls are sufficiently long to accommodate most vehicles without blocking the bike lane.

Guidance

There is no currently adopted Federal or State guidance for this treatment.

Design Example

Cost

Striping: $2 per linear foot

Sign, regulation: $150 each

5.7 Intersection and Interchange Design for Bicyclists

Adequately accommodating bicyclists at traffic intersections and interchanges can be challenging for traffic engineers as the needs and characteristics of bicycles and motor vehicles vary greatly. This section contains information on detection of bicycles at signals, bicycle pavement markings at signals, and bicycle signals.

Bicycle Detection at Signalized Intersections

Discussion

Traffic Operations Policy Directive 09-06, issued August 27, 2009 by Caltrans modified CA MUTCD 4D.105 to require bicyclists to be detected at all traffic-actuated signals on public and private roads and driveways. If more than 50 percent of the limit line detectors need to be replaced at a signalized intersection, then the entire intersection should be upgraded so that every line has a limit line detection zone. Bicycle detection must be confirmed when a new detection system has been installed or when the detection system has been modified.

The California Policy Directive does not state which type of bicycle detection technology should be used. Two common types of detection are video and in pavement loop detectors.

Design Summary

Limit Lines

The Reference Bicycle Rider must be detected with 95% accuracy within a 6 foot by 6 foot Limit Line Detection Zone.

Loop Detection

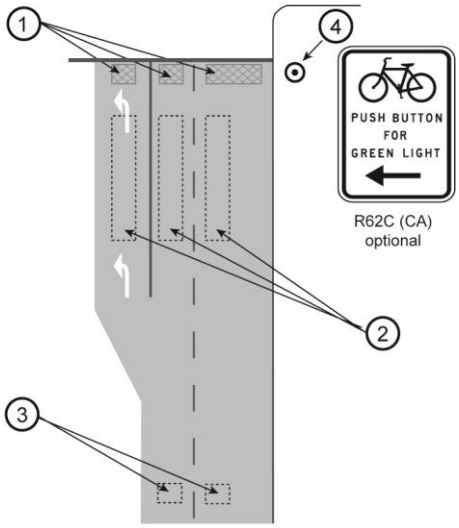
In order to minimize delay to bicyclists, it is recommended to install one loop about 100 feet from the stop bar within the bike lane, with a second loop located at the stop bar.

Details of saw cuts and winding patterns for inductive detector loop types appear on Caltrans Standard Detail ES-5B.

NOTE: In California, Caltrans "Type C" and "Type D" quadruple loop detectors have been proven to be the most effective at detecting bicycles at signalized intersections.

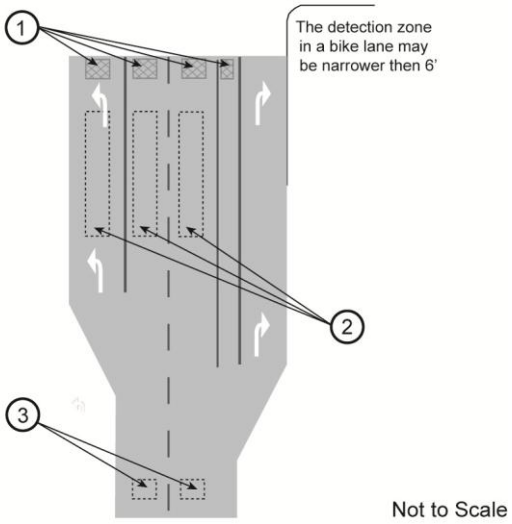
Recommended Design

A. Intersection with a wide right/through lane



1. Typical technology-neutral limit line detection locations. See Section 4D.105(CA).
2. Typical presence detection locations. See Section 4D.103(CA).
3. Typical advance detection locations.
4. A bicyclist pushbuttion may be used to activate a traffic signal to supplement the required limit line detection. A pushbutton should be located so it is convenient to use by bicyclists. See Section 9B.1 for bicycle regulatory signs.

B. Intersection with a Bike Lane and right-turn lane



Source: Traffic Operations Policy Directive 09-06

Video Detection – Designs not available

Bicycle Detection at Signalized Intersections

Design Example	Recommended Design
 **Type "C" loop detector in use in California** (Pavement stencil shown does not meet CAMUTCD)	

Discussion	Recommended Design
Caltrans Highway Design Manual (Chapter 1000) Caltrans Standard Plans (1999) ES-5B MUTCD – California Supplement AASHTO Guide for the Development of Bicycle Facilities Caltrans Traffic Operation Policy Directive 09-06	Bicycle Loop Detector: $1,000-$2,500 each

Loop Detector Pavement Markings and Signage

Discussion

Bicycle Detector Pavement Markings guide bicyclists to position themselves at an intersection to trigger signal actuation. Frequently these pavement markings are accompanied by signage that can provide additional guidance (see right).

Design Summary

Locate Bicycle Detector Pavement Marking over center of quadrupole loop detector if in bike lane, or where bicycle can be detected in a shared lane by loop detector or other detection technology.

Design Example

Guidance

Caltrans Highway Design Manual (Chapter 1000)

Caltrans Standard Plans (1999) ES-5B

MUTCD – California Supplement

AASHTO Guide for the Development of Bicycle Facilities

Cost

Bicycle Loop Detector, Install stencils: $100 per intersection leg

Recommended Design

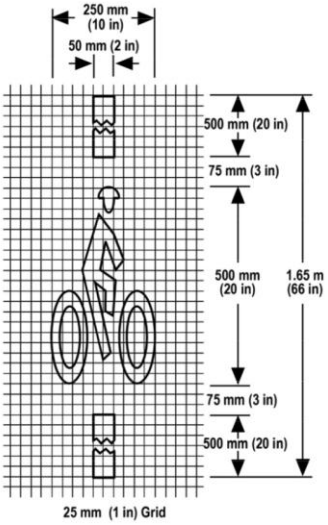


Figure 9C-7 – CAMUTCD

Accompanying Signage (R10-22)

Bicycle Push Buttons

Discussion

Bicycle push buttons can also provide signal actuation and timing adjustments for bicyclists. Push buttons are recommended for use with shared-use paths or other unique interactions with bicycle facilities.

Push buttons are generally unsuitable for conventional bike lane situations as the bicyclist would have to leave the roadway to activate the signal. An acceptable situation exists where a push button can be located closer to the bike lane if no vehicle right turn lane is present so that the bicyclist does not have to dismount to reach the signal.

Design Summary

Bicycle push buttons may be used where a push button detector has been installed exclusively to activate a green phase for bicyclists.

The R62C sign should be installed near the edge of the sidewalk, in the vicinity of where bicyclists will be crossing the street.

Design Example

Guidance

Caltrans Highway Design Manual (Chapter 1000)

MUTCD – California Supplement

AASHTO Guide for the Development of Bicycle Facilities

Cost

Push Button: $600-$1,390 each

Recommended Design

R62C sign

Bike Lane at Intersection with Right Turn Only Lane

Discussion

A bicyclist continuing straight through an intersection from the right of a right turn lane would be inconsistent with normal traffic behavior and would violate the expectations of right-turning motorists. Specific signage, pavement markings and striping are recommended to improve safety for bicyclists and motorists.

The appropriate treatment for right-turn only lanes is to place a bike lane pocket between the right-turn lane and the right-most through lane or, where right-of-way is insufficient, to drop the bike lane entirely approaching the right-turn lane. The design (right) illustrates a bike lane pocket, with signage indicating that motorists should yield to bicyclists through the merge area.

Dropping the bike lane is not recommended, and should only be done when a bike lane pocket cannot be accommodated.

Travel lane reductions may be required to achieve this design.

Some communities have experimented with colored bicycle lanes through the weaving zone. See Portland's Blue Bike Lanes: http://www.portlandonline.com/shared/cfm/image.cfm?id=58842.

Where the right turn only lane is separated with a raised island, the island should be designed to allow adequate width to stripe the bike lane up to the intersection.

Design Summary

Bike Lane Placement

A through bicycle lane shall not be positioned to the right of a right turn only lane.

Bike Lane Width

Bike Lane through merge area of 5 feet is required.

Bike Lane Striping

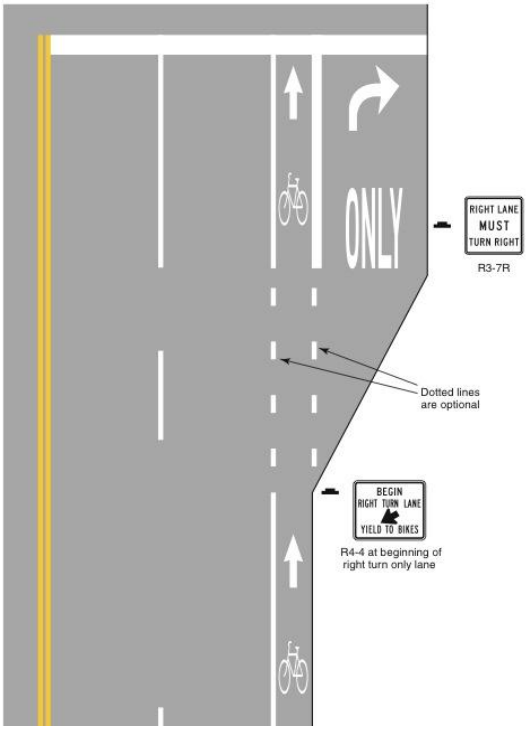
When the right through lane is dropped to become a right turn only lane, the bicycle lane markings should stop at least 100 feet before the beginning of the right turn lane. Through bicycle lane markings should resume to the left of the right turn only lane (MUTCD).

Where motorist right turns are permitted, the solid bike lane shall either be dropped entirely, or dashed beginning at a point between 100 and 200 feet in advance of the intersection.

Signage

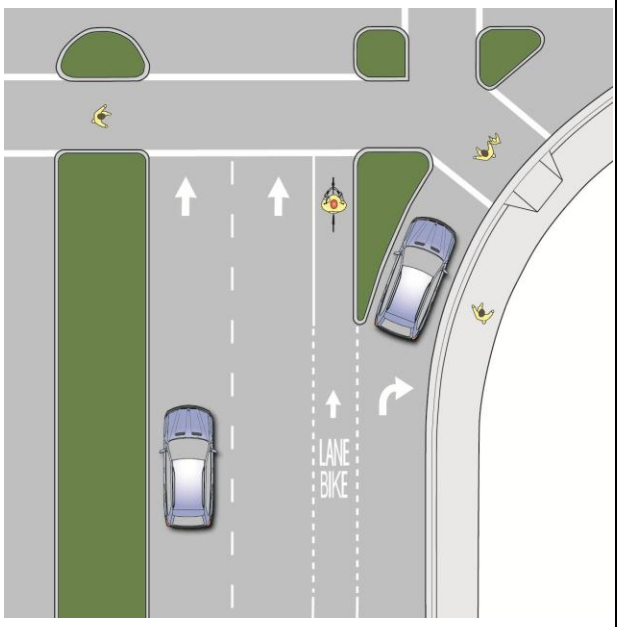
Refer to CA MUTCD.

Recommended Design



Bike Lane Next to a Right Turn Only Lane

Bike Lane Next to a Right Turn Only Lane Separated by a Raised Island



Bike Lane at Intersection with Right Turn Only Lane

Guidance
Caltrans Highway Design Manual (Chapter 1000)
MUTCD – California Supplement Section 9C.04
AASHTO Guide for the Development of Bicycle Facilities

Bicycle Boxes

Discussion

A bike box is generally a right angle extension to a bike lane at the head of a signalized intersection. The bike box allows bicyclists to get to the front of the traffic queue on a red light and proceed first when that signal turns green. The bike box can also act as a storage area if heavy bicycle traffic exists. On a two-lane roadway the bike box can also facilitate left turning movements for bicyclists. Motor vehicles must stop behind the white stop line at the rear of the bike box.

Bike Boxes should be located at signalized intersections only, and right turns on red should be prohibited unless a separate right turn pocket is provided to the right of the bike box.

Bike boxes can be combined with dashed lines through the intersection for green light situations to remind vehicles to be aware of bicyclists traveling straight. Bike Boxes have been installed with striping only or with colored treatments to increase visibility.

Design Summary

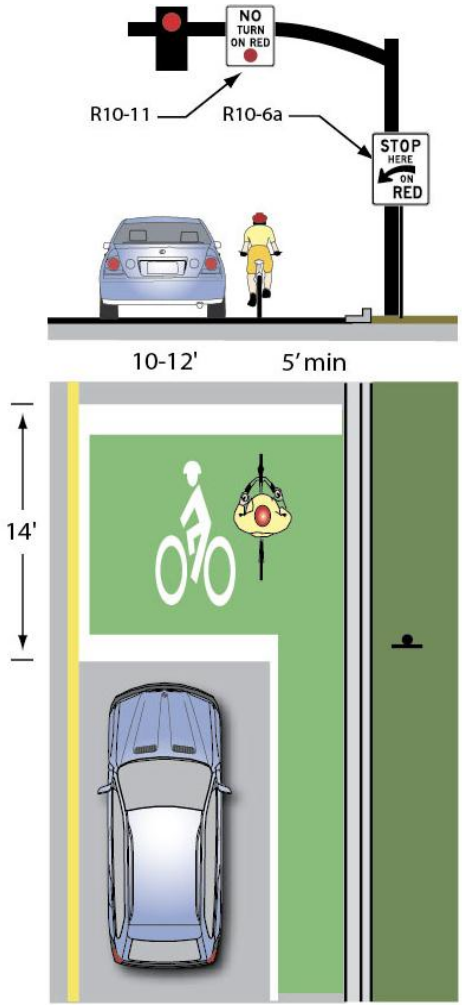
Bike Box Dimensions

The Bike Box should be 14-feet deep to allow for bicycle positioning.

Signage

Appropriate signage as recommended by the MUTCD applies. Signage should be present to prevent 'right turn on red' and to indicate where the motorist must stop.

Recommended Design



Design Example

Guidance

This treatment is not currently present in any State or Federal design standards

Interchange Design

Discussion

Interchanges often provide the only bicycle access across a highway within one or more miles, but are not always designed to provide comfortable or safe bicycle access. The best interchange configurations for bicyclists are those where the ramp intersects the crossroad at a 90 degree angle and where the intersection is controlled by a stop or signal. These characteristics cause motorists to slow down before turning, increasing the likelihood that they will see and yield to nonmotorists. If an impact occurs, severity is lessened by slower speeds.

The Caltrans Highway Design Manual classifies interchanges into 13 different types. As illustrated to the right, six of these types have ramp intersection designs that meet the crossroad at 90 degrees and are STOP-controlled or signalized. These interchanges generally incorporate diamond-type ramps or J loop ramps.

On high traffic bicycle corridors non-standard treatments may be desirable over current practices outlined in Figure 9C-103 in the CA MUTCD. Dashed bicycle lane lines with or without colored bike lanes may be applied to provide increased visibility for bicycles in the merging area.

Design Summary

Alignment

Ramps intersection the crossroad at a 90 degree angle.

The intersection is stop- or signal-controlled.

Bike lane/shared roadway width

The minimum shoulder width through the interchange area is four feet, or five feet if a gutter exists.

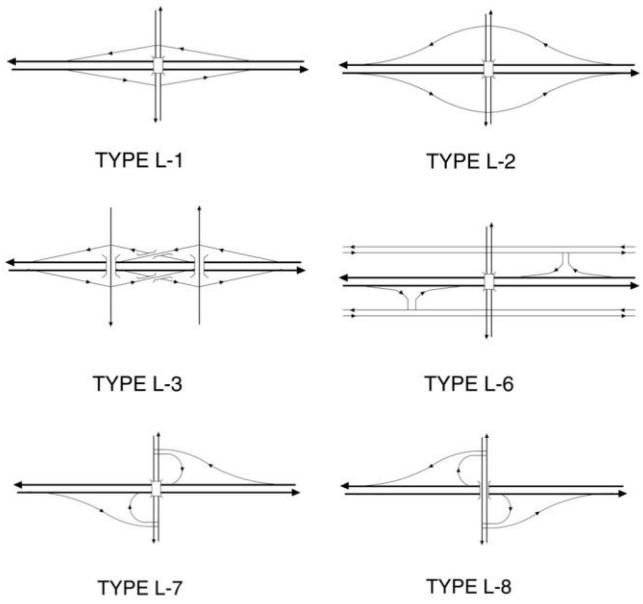
Guidance

Caltrans Highway Design Manual (Chapter 500)

MUTCD – California Supplement Section 9C.04 and Figure 9C-103

AASHTO Guide for the Development of Bicycle Facilities, p. 62

Recommended Design



Interchange types that accommodate bicyclists

Source: Figure 502.2 Caltrans Highway Design Manual

Accommodating Bicyclists at On and Off-Ramps

Discussion

When crossing free-flow ramps, pedestrians and bicyclists face challenges related to motorists not yielding, high motor vehicle speeds, limited visibility, and the absence of bicycle or pedestrian facilities. Bicyclists additionally face challenges related to unclear path of travel.

Treatments for addressing pedestrian and bicyclist concerns at on- and off-ramps range from using striping and signage to make motorists more aware of and more likely to yield to pedestrians and bicyclists, to reconstructing the intersection to eliminate all free-flow turning movements and reconfiguring intersections so that on and off ramps meet the crossroad at or near 90 degrees.

Design Summary

Signage

Install warning signage at all uncontrolled crossings.

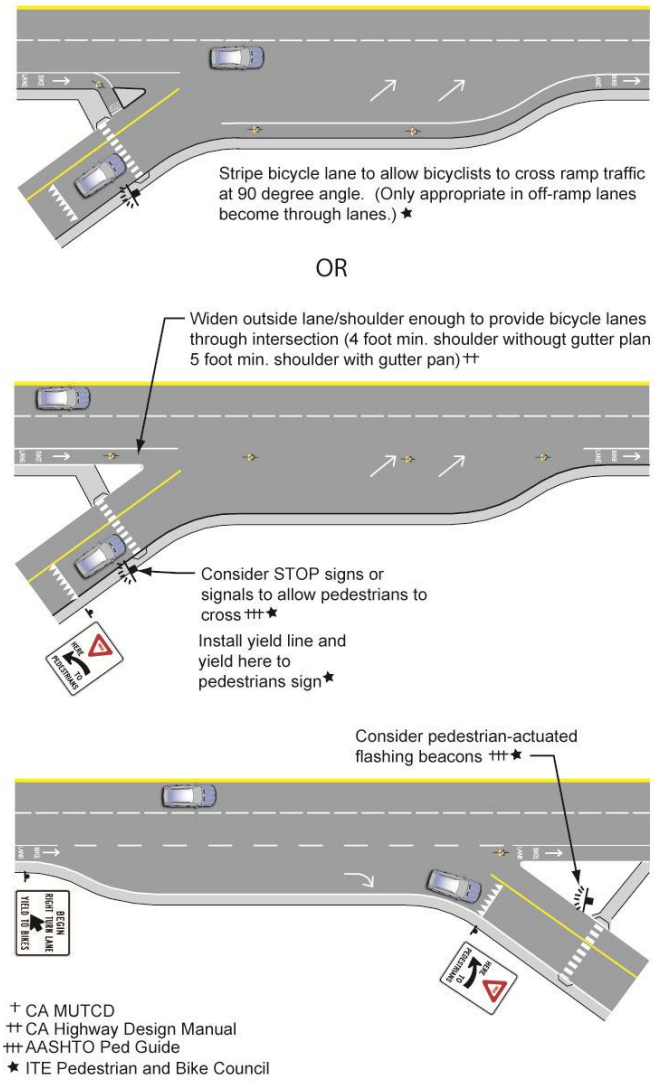
Striping

Stripe high-visibility crosswalks at all intersections. Stripe on- and off-ramps so that through-moving bicyclists do not need to weave across turning motorists, but instead can travel straight. Where bicyclists weave across a vehicle lane, drop the bicycle lane to encourage the bicyclist to use their judgment when deciding when to weave. Where bicyclists travel between moving vehicles for more than 200 feet, install a painted or raised buffer. Install yield lines at all uncontrolled crossings.

Beacons

Install pedestrian-actuated beacons at all uncontrolled crossings.

Recommended Design



Signage and Striping Treatments for Free-Flow Ramp

Accommodating Bicyclists at On and Off-Ramps

Guidance

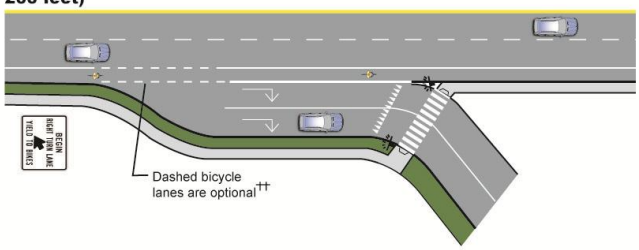
Caltrans Highway Design Manual (Chapter 500)

MUTCD – California Supplement Section 9C.04 and Figure 9C-103

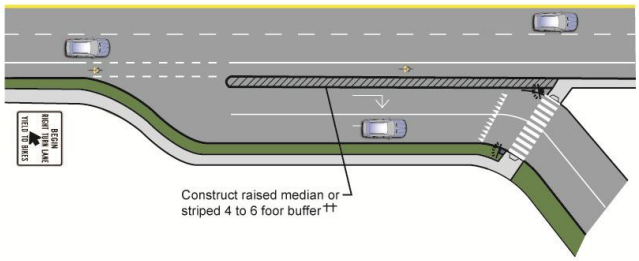
AASHTO Guide for the Development of Bicycle Facilities, p. 62

Recommended Design (continued)

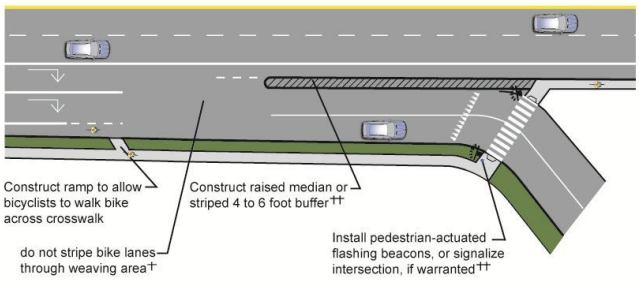
Short Dual Right Turn On-Ramp (right turn lanes less than or equal to 200 feet)††



Long Dual Right Turn On-Ramp (right turn lanes greater than 200 feet)††



Long Dual Trap Right Turn Lane (right turn lanes greater than 200 feet)††



Figures adapted from ITE Pedestrian and Bike Council

+ CA MUTCD
†† ITE Pedestrian and Bike Council

Treatments for Dual-Lane On-Ramps

Accommodating Bicyclists at Single Point Urban Interchanges

Discussion

A Single Point Interchange (SPI) combines two diamond ramp intersections into a single at-grade intersection. Most SPI's operate with a three-phase signal, and due to the size of the intersection, long clearance intervals are required for all movements. These intersections can be efficient at moving high volumes of motor vehicle traffic, particularly left turns. However, the signal timing and intersection configuration required to provide the efficient movement of motor vehicles adversely affects pedestrians and bicyclists.

Compact SPI's can be configured to mitigate some of the bicyclist issues. In its June 2001 Design Memorandum, "Single Point Interchange Design, Planning, and Operations Guidelines," Caltrans requires that "If an SPI alternative other than a Compact SPI is chosen, a separate bicycle facility shall be constructed in conjunction with the SPI." Note that even if a separate facility is provided, the SPI should still meet bicyclist signal timing guidance provided in Traffic Operations Policy Directive 09-06.

Design Summary

If "moderate to heavy bicycle use is expected" or if bicycle signal timing guidance in TOPD 09-06 cannot be met, route bicyclists to a different interchange type.

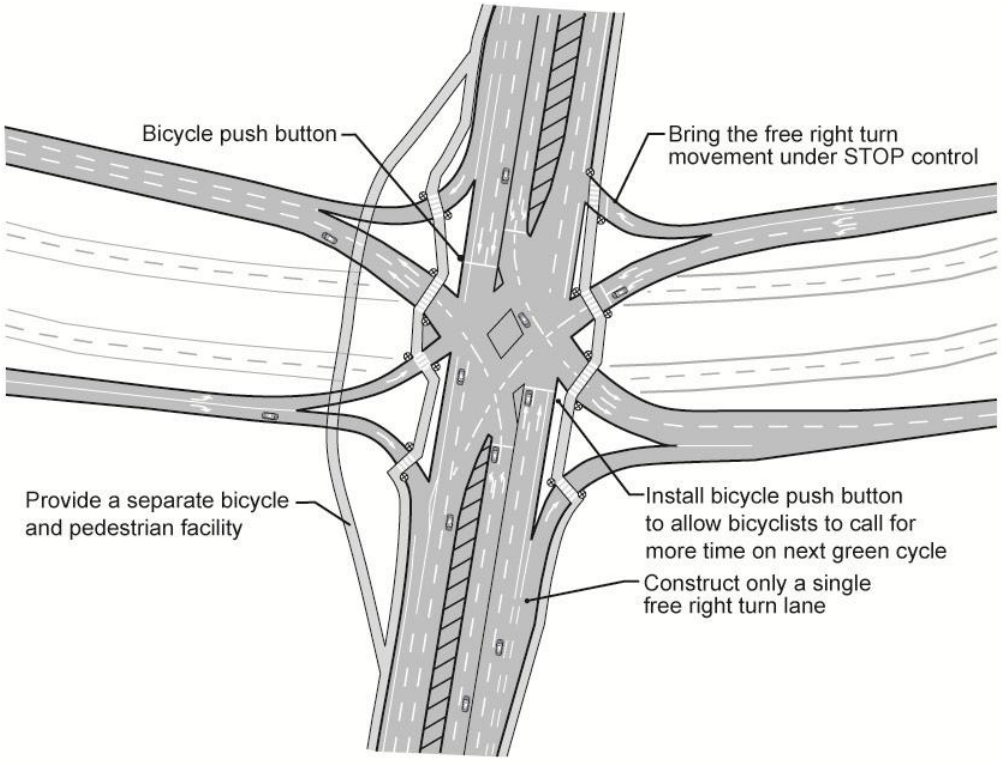
Separate bicycle facilities are recommended for non-compact SPIs.

Provide a separate undercrossing or overcrossing in the immediate vicinity of the interchange. "If it is anticipated that in the future the right turn move at a Compact SPI will be signalized, a separate bicycle facility should be incorporated into the current project."

Install bicycle push buttons to allow bicyclists to call for more time on next green cycle and/or a detection system that detects bicyclists and automatically adjusts signal timing to allow the bicyclist enough time to clear the intersection per TOPD 09-06.

Free right turn movements should be under STOP, YIELD, or signal control.

Recommended Design



Bicycle and Pedestrian Overcrossing Design

Discussion	Guidance
Overcrossings require a minimum of 17 feet of vertical clearance to the roadway below versus a minimum elevation differential of around 12 feet for an undercrossing. This results in potentially greater elevation differences and much longer ramps for bicycles and pedestrians to negotiate. See following page for additional discussion.	Caltrans Highway Design Manual (Chapters 200 & 1000) Caltrans Bridge Design Specifications MUTCD – California Supplement AASHTO Guide for the Development of Bicycle Facilities AASHTO Guide Specifications for Design of Pedestrian Bridges

Design Summary

Width

8 feet minimum, 14 feet preferred. If overcrossing has any scenic vistas additional width should be provided to allow for stopped path users. A separate 5 foot pedestrian area may be provided for facilities with high bicycle and pedestrian use.

Height

10 feet headroom on overcrossing; clearance below will vary depending on feature being crossed.

Signage & Striping

The overcrossing should have a centerline stripe even if the rest of the path does not have one.

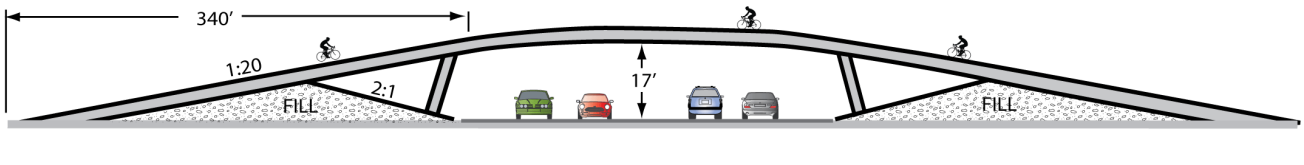
ADA Compliance

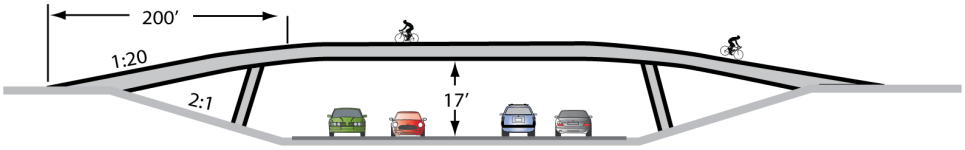
Either ramp slopes to 5% (1:20) with landings at 400 foot intervals or ramp slopes of 8.33% (1:12) with landings every 30 feet.

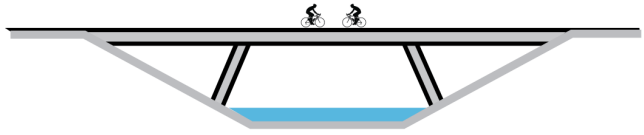
Lighting

See page H-7.

Recommended Design







Not to scale

Minimum Clearance:	
Local Roadway:	17 feet
Freeway:	18.5 feet
Heavy Rail Line: (not electrified)	23 feet

Bicycle and Pedestrian Overcrossing Design

Additional Discussion – Grade Separated Overcrossing

Ramp Considerations:

Overcrossings for bicycles and pedestrians typically fall under the Americans with Disabilities Act (ADA), which strictly limits ramp slopes to 5% (1:20) with landings at 400 foot intervals, or 8.33% (1:12) with landings every 30 feet.

Overcrossing Use:

Overcrossings should be considered when high volumes of bicycles and pedestrians are expected along a corridor and:

Vehicle volumes/speeds are high.

The roadway is wide.

An at-grade crossing is not feasible.

Crossing is needed over a grade-separated facility such as a freeway or rail line.

Advantages of Grade Separated Overcrossing

Improves bicycle and pedestrian safety while reducing delay for all users.

Eliminates barriers to bicyclists and pedestrians.

Disadvantages / Potential Hazards

If crossing is not convenient or does not serve a direct connection it may not be well utilized.

Overcrossings require at least 17 feet of clearance to the roadway below involving up to 400 feet or greater of approach ramps at each end. Long ramps can sometimes be difficult for the disabled.

Potential issues with vandalism, maintenance.

High cost.

Bicycle and Pedestrian Undercrossing Design

Discussion

See following page for discussion.

Design Summary

Width

14 feet minimum to allow for access by maintenance vehicles if necessary

Greater widths may increase security

Height

10'

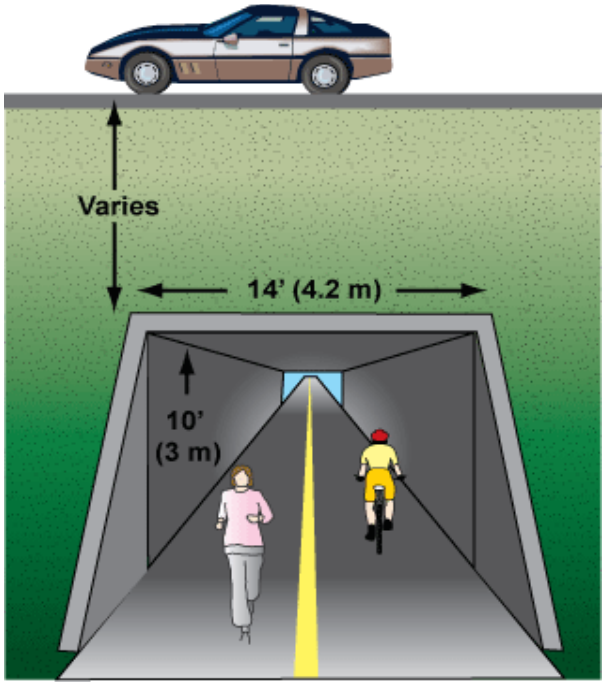
Signage & Striping

The undercrossing should have a centerline stripe even if the rest of the path does not have one.

Lighting

Lighting should be considered during design process for any undercrossing with high anticipated use or in culverts or tunnels.

Recommended Design



Design Example

Guidance

AASHTO Guide for the Development of Bicycle Facilities

Caltrans Highway Design Manual (Chapter 1000)

Bicycle and Pedestrian Undercrossing Design

Additional Discussion – Grade Separated Undercrossing

General Notes On Grade-Separated Crossings

Bicycle/pedestrian overcrossings and undercrossings provide critical non-motorized system links by joining areas separated by any number of barriers. Overcrossings and undercrossings address real or perceived safety issues by providing users a formalized means for traversing "problem areas" such as deep canyons, waterways or major transportation corridors. In most cases, these structures are built in response to user demand for safe crossings where they previously did not exist. For instance, an overcrossing or undercrossing may be appropriate where moderate to high pedestrian/ bicycle demand exists to cross a freeway in a specific location, or where a flood control channel separates a neighborhood from a nearby bicyclist destination. These facilities also overcome barriers posed by railroads, and are appropriate in areas where frequent or high-speed trains would create at-grade crossing safety issues, and in areas where trains frequently stop and block a desired pedestrian or bicycle crossing point. They may also be an appropriate response to railroad and other agency policies prohibiting new at-grade railroad crossings, as well as efforts to close existing at-grade crossings for efficiency, safety, and liability reasons.

Overcrossings and undercrossings also respond to user needs where existing at-grade crossing opportunities exist but are undesirable for any number of reasons. In some cases, high vehicle speeds and heavy traffic volumes might warrant a grade-separated crossing. Hazardous pedestrian/bicycle crossing conditions (e.g., few or no gaps in the traffic stream, conflicts between motorists and bicyclists/pedestrians at intersections, etc.) could also create the need for an overcrossing or undercrossing.

Undercrossing Use

Undercrossings should be considered when high volumes of bicycles and pedestrians are expected along a corridor and:

Vehicle volumes/speeds are high.

The roadway is wide.

An at-grade crossing is not feasible.

Crossing is needed under another grade-separated facility such as a freeway or rail line.

Advantages of Grade Separated Undercrossing

Improves bicycle and pedestrian safety while reducing delay for all users.

Eliminates barriers to bicyclists and pedestrians.

Undercrossings require 10' of overhead clearance from the path surface. Undercrossings often require less ramping and elevation change for the user versus an overcrossing, particularly for railroad crossings.

Disadvantages / Potential Hazards

If crossing is not convenient or does not serve a direct connection it may not be well utilized.

Potential issues with vandalism, maintenance.

Security may be an issue if sight lines through undercrossing and approaches are inadequate. Undercrossing width greater than 14 feet, lighting and /or skylights may be desirable for longer crossings to enhance users' sense of security.

High cost.

5.8 Design of Interpretive and Wayfinding Signage

Wayfinding Signage - General

Discussion

The 2000 Comprehensive Bicycle Route Plan recommended wayfinding signage and bicycle signal detection along the 37.4-mile North-South Bike Route corridor in the eastern part of the County paralleling El Camino Real.

Wayfinding signage acts as a "map on the street" for cyclists, pedestrians, and trail users. Signage and wayfinding is an important component for trail users. Visitors who feel comfortable and empowered will keep coming back to an area, and an effective wayfinding system is key to creating that comfort level. Wayfinding also plays an important role in trail use safety, connecting users with emergency services.

Wayfinding signs are typically placed at key locations leading to and along bicycle facilities, including where multiple routes intersect and at key bicyclist "decision points." Wayfinding signs displaying destinations, distances and "riding time" can dispel common misperceptions about time and distance while increasing users' comfort and accessibility to the priority street network. Wayfinding signs also visually cue motorists that they are driving along a bicycle route and should correspondingly use caution. Note that too many road signs tend to clutter the right-of-way, and it is recommended that these signs be posted at a level most visible to bicyclists and pedestrians, rather than per vehicle signage standards.

Design Summary

If used, Bicycle Route Guide (D11-1) signs should be provided at decision points along designated bicycle routes, including signs to inform bicyclists of bicycle route direction changes. Bicycle Route Guide signs should be repeated at regular intervals so that bicyclists entering from side streets will have an opportunity to know that they are on a bicycle route.

Similar guide signing should be used for shared roadways with intermediate signs placed for bicyclist guidance.

Signage should be focused along major routes near key destinations.

Signage should be oriented toward both commuter and recreational cyclists.

Destination signage should be easy to read. Signage should be installed on existing Bike Route or Bike Lane signs where possible to avoid sign clutter.

Recommended Design

D11-1 Sign

D1-1b (L)

D1-1b (R)

D1-1c

Design Example

City of Berkeley, CA Wayfinding Sign

Wayfinding Signage - General	
Guidance	**Cost**
Caltrans Highway Design Manual (Chapter 1000) MUTCD, Section 9B.20 MUTCD – California Supplement, Section 9B.19 through 21 AASHTO Guide for the Development of Bicycle Facilities	Sign, regulatory: $150 - $250 per sign

5.9 Facilities Provided with New and Existing Development

This section provides design guidelines for facilities provided by new and existing development including bicycle parking, lockers, showers, and sidewalks. These facilities enhance the bicycle and pedestrian environment and are important aspects of a complete network.

End of trip bicycle facilities including bicycle parking, lockers and showers are a key element of a bicycle network. Every bicycle trip not only includes travel between destinations, it includes parking at the origin and destination. Shower and locker facilities at large commercial developments encourage bicycling by providing storage space for clothing and an opportunity to freshen up before work. Employees who exercise on their lunch break can also benefit from shower and locker facilities.

Sidewalk provision policies as a condition of development are also key to ensure a complete pedestrian network. Dedicated pedestrian facilities can make San Mateo County's streets more vibrant and active and thereby encourage people to walk by providing an experience that is safe, comfortable and attractive.

Recommendations in this section are based on national best practices, Association of Bicycle and Pedestrian Professionals Draft Bike Parking Guide (2009), and C/CAG San Mateo County policies.

Recommended Rates of Bicycle Parking

Design Summary

All bicycle parking facilities should be dedicated for the exclusive use of bicycles.

Short-term bicycle parking serves users who will park for less than two hours, typically for shopping and recreation. This type of parking should be convenient. Short-term parking is typically provided with bicycle racks (see table below).

It is recommended that local jurisdictions develop bicycle parking plans for district-wide short-term parking in commercial districts.

Long-term bicycle parking should serve users who park their bicycles for a period longer than two hours. This type of parking should provide a high level of security. Long-term parking is typically provided with bicycle lockers and bicycle cages (see table below).

The requirements below are minimums. Actual use of areas may indicate additional parking capacity is needed. Both short-term and long-term parking should be required.

Land Use or Location	Physical Location	Short-Term Bicycle Parking Capacity	Long-Term Bicycle Parking Capacity
Multi-Family Residential (with private garage for each unit)	Near building entrance with good visibility	0.05 spaces for each bedroom (2 spaces minimum for whole complex)	0
Multi-Family Residential (without private garage for each unit)	Near building entrance with good visibility	0.05 spaces for each bedroom (2 spaces minimum)	0.50 spaces for each bedroom (2 spaces minimum)
Park	Adjacent to restrooms, picnic areas, fields and other attractions	Minimum of 8 spaces	0
Schools	Near office entrance with good visibility	1 per 20 students of planned capacity (2 spaces minimum)	1 per 20 employees (minimum of 2 spaces)
Public Facilities (city hall, libraries, community centers)	Near main entrance with good visibility	1 per 10,000 square feet (minimum of 2 spaces)	1 per 10 employees (minimum of 2 spaces)
Commercial, retail and industrial developments over 10,000 gross square feet	Near main entrance with good visibility	1 per 5,000 square feet (minimum of 2 spaces)	1 per 12,000 square feet (minimum of 2 spaces)
Shopping Centers over 10,000 gross square feet	Near main entrance with good visibility	1 per 5,000 square feet (minimum of 2 spaces)	1 per 12,000 square feet (minimum of 2 spaces)
Commercial Districts	Near main entrance with good visibility	1 per 5,000 square feet (minimum of 2 spaces)	1 per 12,000 square feet (minimum of 2 spaces)
Transit Stations	Near platform or security guard	Minimum of 8 spaces	Spaces for 3.5% of projected maximum daily ridership (minimum of 2 spaces)

Recommended Rates of Bicycle Parking

Discussion

Bicycle Parking Manufactures:

Palmer: www.bikeparking.com

Park-a-Bike: www.parkabike.com

Dero: www.dero.com

Creative Pipe: www.creativepipe.com

Cycle Safe: www.cyclesafe.com

Guidance

Association of Bicycle and Pedestrian Professionals Bicycle Parking Guidelines (2nd edition 2010)

City of Oakland, CA Bicycle Parking Ordinance (2008)

Cost

Bicycle racks: $150-$200 each

Bicycle lockers: $1,350-$2,000 each

Recommended Design

Design Example

Short-Term and Long-Term Bicycle Parking at the North Hollywood Orange Line transit station.

Bicycle Rack Design

Design Summary

Bicycle racks should be a design that is intuitive and easy to use.

A standard inverted-U style rack is recommended for San Mateo County.

Bicycle racks should be securely anchored to a surface or structure.

The rack element (part of the rack that supports the bicycle) should keep the bicycle upright by supporting the frame in two places without the bicycle frame touching the rack. The rack should allow one or both wheels to be secured.

Avoid use of multiple-capacity "wave" style racks. Users commonly misunderstand how to correctly park at wave racks, placing their bikes parallel to the rack and limiting capacity to 1 or 2 bikes.

Position racks so there is enough room between parked bicycles. Racks should be situated on 36" minimum centers.

A five-foot aisle for bicycle maneuvering should be provided and maintained beside or between each row of bicycle racks.

Empty racks should not pose a tripping hazard for visually impaired pedestrians. Position racks out of the walkway's clear zone.

For sidewalks with heavy pedestrian traffic, at least seven feet of unobstructed right-of-way is required.

Racks should be located close to a main building entrance, in a lighted, high-visibility area protected from the elements.

Discussion

Bicycle Parking Manufactures:

Palmer: www.bikeparking.com

Park-a-Bike: www.parkabike.com

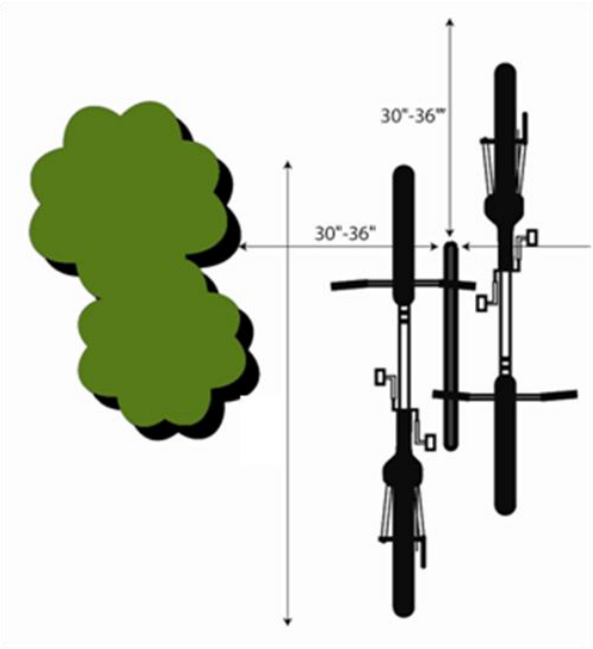
Dero: www.dero.com

Creative Pipe: www.creativepipe.com

Cycle Safe: www.cyclesafe.com

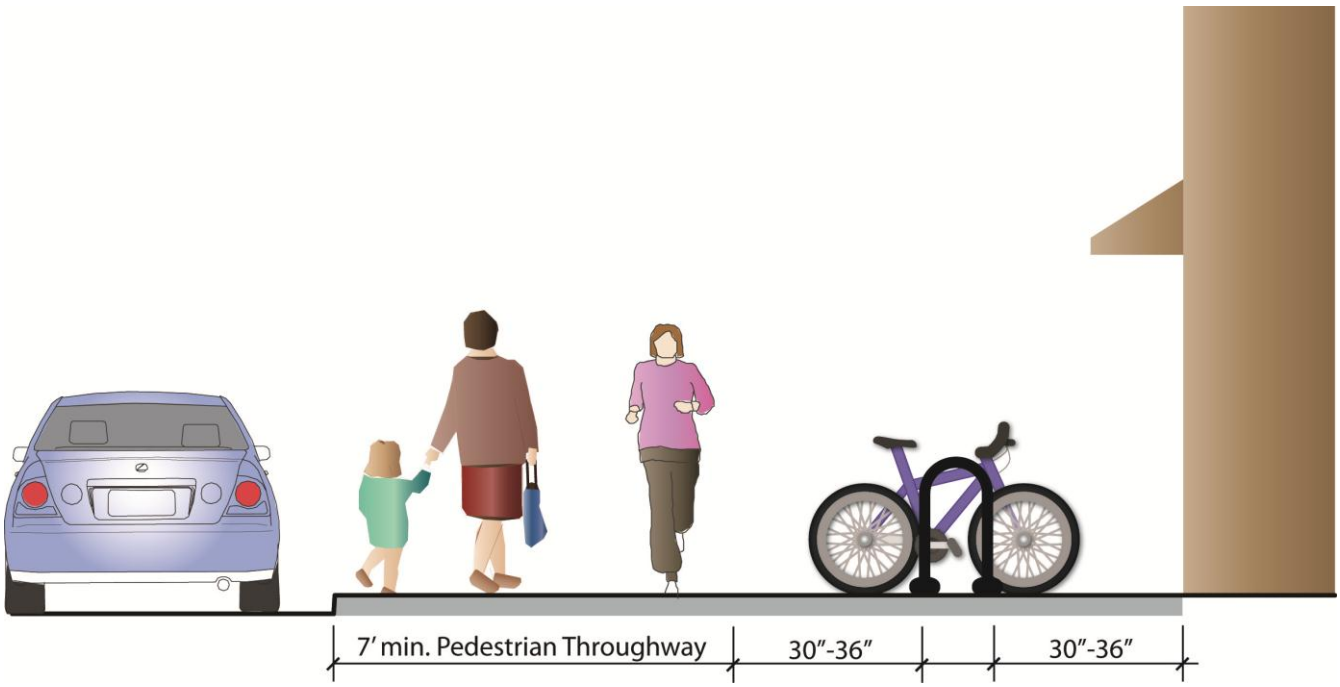
Recommended Design

Inverted-U Bicycle Rack



Bicycle Rack Design

Recommended Design (continued)



Design Example

Short-term bicycle parking showing recommended clearances (non-local)

Guidance

Association of Bicycle and Pedestrian Professionals Bicycle Parking Guidelines (2nd edition 2010)

City of Oakland, CA Bicycle Parking Ordinance (2008)

Cost

Bicycle racks: $150-$200 each

Bicycle Locker Design

Design Summary

Bicycle lockers should be a design that is intuitive and easy to use.

Bicycle lockers should be securely anchored to a surface or structure.

Bicycle lockers should be constructed to provide protection from theft, vandalism and weather.

A five-foot aisle for bicycle maneuvering should be provided and maintained beside or between each row of bicycle lockers.

Lockers should be located close to a main building entrance, in a lighted, high-visibility area protected from the elements. Long-term parking should always be protected from the weather.

Discussion

Bicycle Parking Manufactures:

Palmer: www.bikeparking.com

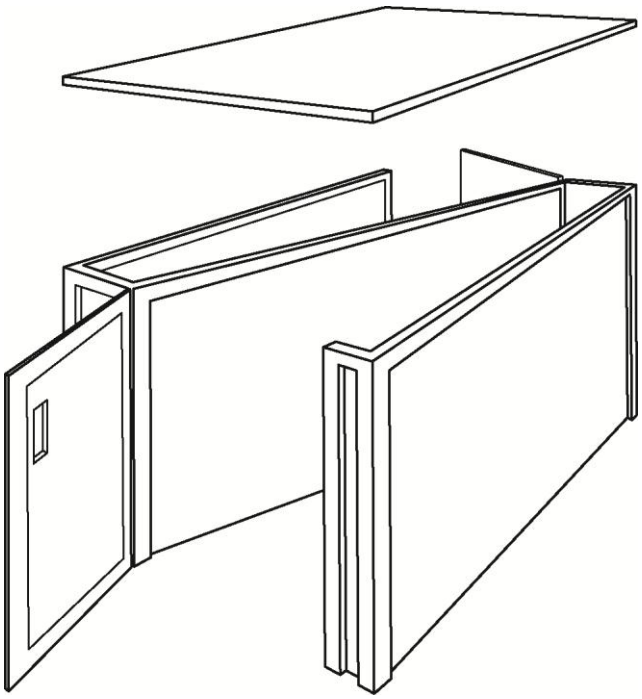
Park-a-Bike: www.parkabike.com

Dero: www.dero.com

Creative Pipe: www.creativepipe.com

Cycle Safe: www.cyclesafe.com

Recommended Design



Design Example

Guidance

Association of Bicycle and Pedestrian Professionals Bicycle Parking Guidelines (2nd edition, 2010)

City of Oakland, CA Bicycle Parking Ordinance (2008)

Cost

Bicycle lockers: $1,350-$2,000 each

Showers and Lockers

Design Summary

Two showers per gender should be provided for the first 150,000 square feet of commercial development, plus one shower per gender for each additional 150,000 square feet.

Four lockers should be provided per shower.

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Discussion

Shower and locker facilities at large commercial developments encourage bicycling by providing storage space for clothing and an opportunity to freshen up before work. Employees who exercise on their lunch break can also benefit from shower and locker facilities.

Guidance

Association of Bicycle and Pedestrian Professionals Bicycle Parking Guidelines (2nd edition, 2010)

City of Oakland, CA Bicycle Parking Ordinance (2008)

Cost

Costs vary.

Design Example

5.10 Maintenance Standards

Like all roadways, bicycle and pedestrian facilities require regular maintenance. This includes sweeping, re-striping, maintaining a smooth roadway, ensuring that the gutter-to-pavement transition remains relatively flat, and installing bicycle-friendly drainage grates. Shared use paths also require regular plant trimming. The following recommendations are provided as a maintenance guideline for San Mateo County to consider as it augments and enhances its maintenance capabilities.

Shared Use Path Maintenance Standards

Recommended Standards Summary

Maintenance Activity	Frequency
Surface gap repair	As needed (see additional guidance below)
Inspections	Monthly
Pavement sweeping/blowing	As needed, weekly in Fall
Pavement markings replacement	1 – 3 years
Signage replacement	1 – 3 years
Shoulder plant trimming (weeds, trees, brambles)	Twice a year; middle of growing season and early Fall
Tree and shrub plantings, trimming	1 – 3 years
Major damage response (washouts, fallen trees, flooding)	As soon as possible

SURFACE GAP REPAIR

Path Surface

The surface of the pedestrian access route shall be firm, stable and slip resistant (Draft Guidelines for Public Rights of Way, Section R301.5).

Vertical Changes in Level

Changes in level up to ¼ inch may be vertical and without edge treatment. Changes in level between ¼ inch and ½ inch shall be beveled with a slope no greater than 1:2. Changes in level greater than ½ inch shall be accomplished by means of a ramp that complies with ADAAG Section 4.7 or 4.8 (ADAAG Section 4.5.2).

Surface discontinuities shall not exceed ½ inch maximum. Vertical discontinuities between ¼ inch and ½ inch maximum shall be beveled at 1:2 minimum. The bevel shall be applied across the entire level change (Draft Guidelines for Public Rights of Way, Section R301.5.2).

Gaps and Elongated Openings

If gratings are located in walking surfaces, then they shall have spaces no greater than ½ inch wide in one direction. If gratings have elongated openings, then they shall be placed so that the long dimension is perpendicular to the dominant direction of travel (ADAAG Section 4.5.4).

Walkway Joints and Gratings. Openings shall not permit passage of a sphere more than ½ inch in diameter. Elongated openings shall be placed so that the long dimension is perpendicular to the dominant direction of travel (Draft Guidelines for Public Rights of Way, Section R301.7.1).

Shared Use Path Maintenance Standards

Discussion

Basic Maintenance

Path pavement should be repaired as need to avoid safety issues and to ensure ADA compliance.

Paths should be swept regularly.

Shoulder vegetation should be cleared and trimmed regularly.

Long-Term Maintenance

Paths should be slurry sealed, at minimum, 10 years after construction.

Paths should receive an overlay, at minimum, 15 years after construction.

Agencies or districts with dedicated funding for maintenance generally provide more maintenance activities.

Guidance

ADAAG

Draft Guidelines for Public Rights of Way (2005)

Cost

$1,000-14,000 per mile per year

Maintenance Challenges

Most agencies pay for sidewalk and path maintenance out of their maintenance and operations budget. This funding is generally enough to provide seasonal maintenance, but is not enough to fund long-term preventative maintenance, such as overlays.

Grant funding is not generally available for maintenance activities.

Design Example

On-Street Facility Maintenance Standards

Recommended Standards Summary

Maintenance Activity	Frequency
Inspections	Seasonal – at beginning and end of Summer
Pavement sweeping/blowing	As needed, weekly in Fall
Pavement sealing, potholes	5 - 15 years
Culvert and drainage grate inspection	Before Winter and after major storms
Pavement markings replacement (including crosswalks)	1 – 3 years
Signage replacement	1 – 3 years
Shoulder plant trimming (weeds, trees, brambles)	Twice a year; middle of growing season and early Fall
Tree and shrub plantings, trimming	1 – 3 years
Major damage response (washouts, fallen trees, flooding)	As soon as possible

NOTE: Caltrans recommends tolerance of surface discontinuities no more than ½ inch wide when parallel to the direction of travel on bike lanes (Class II) and bike routes (Class III).

Discussion	Cost
Basic Maintenance Bicyclists often avoid shoulders and bike lanes filled with sanding materials, gravel, broken glass and other debris; they will ride in the roadway to avoid these hazards, causing conflicts with motorists. A regularly scheduled inspection and maintenance program helps ensure that roadway debris is regularly picked up or swept. Roadways should also be swept after automobile collisions. **Long-Term Maintenance** Roadway surface is a critical issue for bicyclists' quality. Bicycles are much more sensitive to subtle changes in roadway surface than are motor vehicles. Examine pavement quality and transitions during every roadway project for new construction, maintenance activities, and construction project activities that occur in streets.	myriad

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