City of Redlands Bicycle Master Plan

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Prepared for:
City of Redlands

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City of REDLANDS "A City That Works"

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1. Introduction

1.1. Purpose

The City of Redlands Bicycle Master Plan provides a vision for improving the bicycling environment by providing direction for the expansion of the existing bikeway network, connection of gaps, recommendations for bicycle support facilities, and education and awareness programs. This Plan begins by evaluating the existing bicycle infrastructure, programs, and community needs related to bicycling, and guides the City of Redlands through network recommendations, funding estimates and funding sources for implementation.

The implementation of facilities and programs proposed in the Bicycle Master Plan will create a bicycle friendly environment, and thereby encourage residents and visitors to bike more frequently, which will subsequently lower greenhouse gases (GHG) and create a healthier environment for residents and visitors.

This document should also help inform the City of Redlands General Plan's Circulation Element. Upon the next Circulation Element update, the recommendations made in this Plan should be included, with the option of putting the entire document in an Appendix.

1.2. Setting

The City of Redlands is committed to the preservation of the City's historical qualities while providing modern services to more than 70,000 residents. Incorporated in November 1888, the City of Redlands is a community in a region rich in history including scenic resources with an engaged and physically active population. The City was named after the color of the regions adobe soil, and is a "big town" with a "small town" feel. Called the "Jewel of the Inland Empire" Redlands enjoys a rich blend of cultural, historical, commercial, and community resources. The unique natural setting, home to Southern California's citrus industry for more than 120 years, continues to nurture a quality of life that is prized throughout Southern California. A strong sense of community formed during those early years is still reflected in the communities' commitment to growth that complements its rich heritage.

1.3. Land Use

Redlands is a relatively old California city, incorporated in 1888. Early development occurred in a typical grid pattern in the center, which is largely residential, and then extended into a larger system of streets that are less interconnected, particularly to the south and east of the center city. The total area of Redlands is 36 square miles, per the US Census.

According to the 1995 General Plan, South Redlands has the greatest number of residential dwelling units. A map of land use patterns in Redlands is located in Appendix A.

1.4. Benefits of Bicycling

Bicycling is a low-cost and healthy transportation option that provides economic and livability benefits to communities. When residents and visitors bicycle for a trip, it alleviates congestion,

minimizes greenhouse gas emissions, and helps extend and improve the quality of people's lives. Below is a brief overview of the benefits of greater investments in bicycling.

1.4.1 Environmental Benefits

Due to emissions from "cold starts" (i.e., when a car hasn't been driven in a few hours and the engine is cool), a one-mile automobile trip emits up to 70 percent as much pollution as a 10-mile excursion. This means that when people decide to bicycle or walk even just for very short trips, they are still significantly reducing their environmental footprint.[1] Decreasing greenhouse gas emissions helps the region meet targets in new laws Assembly Bill 32, and Senate Bill 375. From reducing local levels of harmful pollutants that cause asthma and other respiratory illnesses to addressing global climate change, higher rates of bicycling provide tangible, significant air quality benefits.

Bicycling also does not pollute water as driving an automobile does. Cars leak oil, petroleum products and other toxins onto road surfaces that eventually make their way to storm drains, creeks, and large bodies of water. This "non-point source" pollution is a major threat to urban aquatic habitats, contaminates drinking water, and can cause major illness. Some toxins and metals accumulate in sea life and cause medical problems to people when eaten. Others cause explosive growth of algae, which depletes water of oxygen, killing fish and aquatic life.[2] Every bicycle trip is one less opportunity for these toxins to enter the environment, which on a large scale can make the difference in the health of local waterways and aquatic systems.

1.4.2 Economic Benefits to Cities

Bikeable neighborhoods are more livable and attractive, helping increase home values[3] and retain a more talented workforce that result in higher property tax revenues and business competitiveness. Similarly, bike lanes can improve retail business directly by drawing customers and indirectly by supporting the regional economy. Patrons who bike to local stores have been found to spend more money when visiting local businesses than patrons who drive.[4]

The League of American Bicyclists reports that bicycling makes up $133 billion of the US economy, funding 1.1 million jobs.[5] The League also estimates bicycle-related trips generate another $47 billion in tourism activity. Many communities have enjoyed a high return on their investment in bicycling. For example, the Outer Banks of North Carolina spent $6.7 million to improve local bicycle facilities, and reaped a reported benefit of $60 million of annual economic activity associated with bicycling.

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[1] Bay Area Air Quality Management District. (2007). Source Inventory of Greenhouse Gas Emissions.

[2] *City and County of Honolulu Department of Environmental Services*
[3] *Cortright, Joe for CEOs for Cities. (2009). Walking the Walk: How Walkability Raises Home Values in US Cities.*
[4] *The Clean Air Partnership. (2009). Bike Lanes, On-Street Parking and Business: A Study of Bloor Street in Toronto's Annex Neighborhood.*
[5] *Flusche, Darren for the League of American Bicyclists. (2009). The Economic Benefits of Bicycle Infrastructure Investments.*

1.4.3 Benefits to Households and Individuals

Biking is not just a form of travel; it is an important form of exercise. Many public health experts associate the rising and widespread incidence of obesity with automobile-dominant development patterns and lifestyles that limit such daily forms of physical activity.[6] This association is perhaps most apparent, and acute, with respect to children and school travel. After decades of declining rates of walking and biking – from roughly half of all non-high school students in 1968 to just 14 percent in 2009 - obesity among youth has become an epidemic.[7] In California, one in three kids age 9-17 are now at risk of becoming or are already overweight.[8]

For children, the Center for Disease Control and Prevention recommends 60 minutes of daily aerobic exercise. The CDC recommends 75 to 150 minutes of vigorous exercise, in combination with muscle strengthening exercises, for adults on a weekly basis. For many adults and children, walking or biking to work or school is a viable - if not the only -option for achieving these recommended exercise regimens.

Bicycle infrastructure also provides transportation choices to those who cannot or do not drive, including people with disabilities, youth, seniors, and people with limited incomes. Families that can replace some of their driving trips with bicycling trips spend a lower proportion of their income on transportation,[9] freeing additional income for local goods and services. For others who do not live within walking distance of their employment site, or who work a distance from transit routes, bicycling may provide the only affordable and reliable means of commuting.

1.5. Goals and Objectives

Goals set the context for planning objectives and actions to carry out the City's Bicycle Master Plan. They provide long-term vision and serve as the foundation of the plan. Goals are statements of purpose. Objectives are more specific statements of purpose, and actions describe actions the City can take to implement the goals and objectives. The goals and objectives for this Plan were created by reviewing existing conditions and determining what actions should be taken to make Redlands a more bicycle-friendly city. Many of the projects required to achieve these goals will be dependent on funding, especially from grant sources, and benchmarks will be defined by the implementation of bicycle infrastructure and ongoing education of the entire community.

Goals

- Create an environment where people can circulate without a car.
- Expand the role of bicycling as a contributor to economic vitality.
- Increase the number of non-motorized trips in Redlands by encouraging people to bicycle instead of drive.
- Decrease the number of bicyclist and pedestrian collisions, injuries and fatalities by 50 percent.

[6] *October 27, 1999 issue of the JAMA*
[7] *United States Department of Transportation, National Household Travel Survey*
[8] *The California Endowment. (No Date). Fighting California's Childhood Obesity Epidemic. http://www.calendow.org/article.aspx?id=348*
[9] *Center for Neighborhood Technology. (2005). Driven to Spend: Pumping Dollars out of Our Households and Communities.*

- Promote the health of Redlands residents by making bicycling a safe and attractive option.
- Facilitate the economic viability of Redlands by making Redlands an attractive place to live, shop and operate a business.
- Work with transit agencies (OmniTrans, Metrolink) to promote first and last mile connections.

Objectives

- Provide connections to major destination points and trip generators.
- Close gaps between existing facilities.
- Create opportunities for usage of exclusive rights-of-way (i.e. for Class I facilities).
- Analyze physical characteristics of roadways and suitability for accommodation of bicycle facilities (i.e. for Class II and III facilities).
- Improve technology to ensure that cyclists can activate traffic signals at vehicle-activated intersections.
- Provide secure and convenient bicycle parking throughout Redlands.
- Create a network of pathways so that every neighborhood is within 1/4 mile of an effective multi-use facility.
- Reduce parking requirements near transit hubs.
- Update the General Plan to include the facilities and programs proposed in this Bicycle Master Plan.

Summary of Goals, Objectives, and Benchmarks		
Goal	**Objective**	**Benchmark**
To significantly increase bicycle use across the City of Redlands over the next decade.	-	• Increase citywide workforce commuter bicycle mode to 2% by 2020 and to 5% by 2025 • Increase central city workforce commuter bicycle mode to 8% by 2020 and to 10% by 2025.
To increase bicycle safety across the city.	-	
Bicycle System		
To Provide and maintain a comprehensive bicycle system that serves all residents and neighborhoods of Redlands, and that provides facility options for all cycling skill levels.	Complete the creation of a well-connected bicycle network that is safe and convenient for all bicyclists and serves all Redlands residents and neighborhoods.	• Complete 60% of bicycle network by 2020, 70% by 2025, and 100% by 2035. • Provide connectivity at 12 network gaps by 2025. • Annually contact adjacent jurisdictions to discuss bicycle system and connectivity improvements needed to realize our proposed system. • Resolve parking in all bicycle lanes by 2025.
	Provide adequate end-of-	• Provide 200 new short-term bicycle

	trip facilities to advance bicycle transportation.	parking spaces at existing developments by 2020. • Install "Share the Road" signs on all streets that are gaps in the bicycle network by 2020.
	Work with Redland Rail to coordinate the bicycle system with transit.	• Coordinate with Redlands Rail to equip all buses, rail cars, and van pools with bicycle racks that accommodate three bicycles by 2025, where safe. • Include bicycle parking at 100% of locations meeting transit stop bicycle parking criteria to be developed by the City of Redlands and Redland Rail.
	Maintain bicycle network and facilities on a regular basis.	• Include bicycle lane maintenance within the operating budget, and continue on an ongoing basis. • Establish guidelines for maintenance of multi-use paths and bikeways that serve as bicycle commuter routes by 2020. • Add bicycle lane sweeping as a standalone item.
Education & Promotion		
To improve safety and increase bicycle ridership in Redlands through promotion, education, and encouragement.	Develop and execute promotion and encouragement programs to promote bicycling and increase awareness of bicycling among the general public	• Educate 1,000 adult bicyclists and motorists about bicycle and motorist safety each year. • Distribute 5,000 Redlands Bicycle Map Brochures each year. • Establish the City of Redland's Bicycle Program listserve and increasingly add new contacts of stakeholders. • Offer 1 annual citywide event and/or ride promoting utilitarian and recreational cycling partnership with other public agencies, and/or non-profit groups and advocacy groups.
	Promote bicycling as a mode of transportation to and from school (elementary through high school).	• Increase bicycle mode share of children commuting to school to 25% by 2025. • Educate 90% of school-aged children about bicycle safety each year. • Provide bicycle lane use education and

		bicycle safety information at all schools served by new or improved bicycle lane facility.
	Promote bicycling as a means of transportation to and for work.	• Increase number of Bike to Work Day participants to 1,000 participants. • Increase number of City of Redlands employees who commute by bicycle to 10% by 2020 and 15% by 2025. • Increase usage rate of _____ bicycle fleet by 100% by 2025.
Safety & Enforcement		
To reduce bicycle-related crashes through remedial efforts such as education of bicycle related laws and consistent enforcement of bicycle laws.	Ensure consistent interpretation of bicycle laws by Redlands Police Department and the Bicycle Program.	• Train 100% of APD law enforcement officers in bicyclist and motorist laws and bicycle issues in conjunction with the Redlands Bicycle Program.
	Strengthen efforts to enforce proper motorist and bicyclist behavior and reduce bicyclist-motorist collisions.	• Reduce to 3% the number of work-age (16+) bicycle-related crashes as share of bicycle commuters per US Census Bureau journey to work estimates by 2025.
Implementation & Funding		
To strengthen implementation efforts through funding and adopting bicycle-friendly practices and policies.	Strengthen implementation efforts to fulfill goals and objectives of this Plan.	• Establish Bicycle Program by 2025. • Complete 10% of Action Items by 2020, 40% by 2025, and 100% by 2035. • Create and execute a Bicycle Plan implementation Charter by 2020 to be signed by all applicable public, private, and non-profit organizations having a stake in the realization and implementation of this Plan.
	Identify and secure funding to implement the Redlands Non-Motorized Transportation Plan.	• Submit at least one grant application per year for Plan implementation, assuming grant availability. • Appropriate at least $3 million per year in funding for Bicycle Plan implementation starting in FY09-10 until next Bicycle Plan Update or until Plan is fully implemented. • Update the Bicycle Plan at least every ten (10) years, with interim updates every five (5) years.

1.6. Relationship to Other Plans and Policies

1.6.1 Local

City of Redlands Non-Motorized Connectivity Plan, 2013

In 2013, the City started a Non-Motorized Connectivity Plan (NMCP) that was not adopted.

City of Redlands General Plan, 1995

The City of Redlands General Plan is a set of policies for development regulations in the City and a long-term vision for the community. The plan has ten elements: Growth Management, City Design and Preservation, Land Use, Circulation, Housing, Open Space and Conservation, Health and Safety, Noise, Human Services and Economic Development. The Circulation Element includes guiding policies for bikeways to create a comprehensive network, seek assistance from major employers in promoting bicycle commuting and develop safe bike routes to schools and parks. This element also lays out specific corridors for implementation:

Class I Paths:

- Along San Timoteo Canyon Road and/or along San Timoteo Canyon Creek.
- Zanja corridor from downtown west.
- Adjacent to but outside the Santa Fe railroad right-of-way from new York Street in downtown Redlands to east of Wabash Avenue.
- Along portions of California Street and Palmetto Avenue within the East Valley Corridor.
- Along the Santa Ana River and extending the length of the City of Redlands.

Class II Bike Lanes:

- Along portions of Cypress Avenue, Fern Avenue, Terracina Drive, Barton Road/Brookside Avenue, California Street, State Street, San Bernardino Avenue and Dearborn Street.

Class III Routes

- Collectors: Highland Avenue, Sunset Drive, Alessandro Road, Alta Vista Drive, Opal Street
- Minor arterials (San Mateo Street, 5th Avenue, Sand Canyon Road, Texas Street, Church Street and Orange Street.

The General Plan also calls for increased bike storage and support facilities.

Downtown Redlands Specific Plan, 2008

The Downtown Redlands Specific Plan provides a set of standards for the development of and improvements to the northern portion of the Redlands Town Center. The goal of this plan is to create a compact, pedestrian-oriented environment north of the existing Town Center to

Interstate 10. The area will keep the character of the old Town Center, and act as a gateway from I-10. This plan does not include improvements to bicycle infrastructure, but recommends improvements to the pedestrian network, including street closures. The area for proposed improvements in the Specific Plan has recommended bicycle facilities in this BMP, therefore upon adoption of the BMP, the Specific Plan should be updated.

East Valley Corridor Specific Plan, 2010

The East Valley Corridor Specific Plan addresses the largely undeveloped area of Redlands that provides access to the East San Bernardino Valley. The Plan seeks to facilitate future industrial, commercial and residential development in this area in order to attract local businesses and strengthen the economy. In the Circulation section, Class I bike paths are planned on California Street between Palmetto Avenue and Redlands Boulevard, and Palmetto Avenue between California Street and Alabama Street. Pedestrian circulation is addressed with sidewalks being required on all public streets within the planning area, potential bus turnouts and shelters, and courtyards/plazas/open spaces between and/or adjacent to buildings.

San Bernardino County General Plan, 2007

The San Bernardino County General Plan's policies and programs were created to inform most land use decisions made in the county. The plan has eight elements: Land Use, Circulation, Housing, Open Space, Conservation, Safety, Noise and Economic Development. The Circulation Element describes the use of the County's Non-Motorized Transportation Plan and acknowledges the barriers to bicycling in the County. One goal of this plan is to create a balance between different modes of transportation and reduce automobile dependency. Programs to go along with this goal include promoting incentives for using alternative modes to get to work and provide land use patterns that are consistent with Smart Growth and New Urbanism concepts. Another goal of this plan is to encourage the use of non-motorized transportation by expanding the trails system for bicycles, pedestrians and equestrians.

SANBAG Non-Motorized Transportation Plan, 2011

In 2011, SANBAG developed a cohesive, integrated plan that incorporated non-motorized transportation planning efforts from numerous jurisdictions in the region. Although this plan covers both bicycle and pedestrian projects, the focus of the plan is the bicycle system. Staff gathered an inventory of existing bicycle facilities and gauged the need for additional facilities. Design guidelines are also provided in this plan in Appendix J. The goals of this plan are to increase bicycle and pedestrian access to destinations within and between neighborhoods, increase bicycle and pedestrian travel, establish routine accommodation for bicycles and pedestrians in transportation and land use planning, and improve safety.

SANBAG Improvement to Transit Access for Cyclists and Pedestrians, 2012

SANBAG received a grant from Caltrans under the Statewide or Urban Transit Planning Studies program for the development of this plan. The project identifies a range of physical infrastructure improvements, such as improved bicycle parking, better wayfinding signage and better connections to paths, trails and bike lanes to encourage more people to walk or bicycle to Metro link and planned E Street sbX (bus rapid transit) stations. Such infrastructure improvements will provide Metro link and sbX users with additional modal alternatives to and from the transit system, thereby decreasing automobile traffic within station catchment areas and reducing the need for automobile parking at station locations. Moreover, providing improved infrastructure within transit catchment areas will promote increased safety for pedestrians and cyclists. The Anderson sbX station in Loma Linda south of Redlands Boulevard was studied due to its potential college student users as well as regional bicycle trips from the San Timoteo Class I path. The Plan says that extending planned Class I paths could improve non-motorized circulation and provide grade-separated crossings for freeway barriers in the area. The Plan calls for coordination with the Redlands Rail project.

SANBAG Long Range Transit Plan (LRTP), 2009

The Long Range Transit Plan addresses the County's travel challenges and provides a system of transit facilities and services that can increase transit's role in the future. Given the large and diverse nature of the County, the plan is split geographically into three areas: San Bernardino Valley; Victor Valley; and rural areas. In the San Bernardino Valley, the LRTP includes major projects such the Redlands Rail system between San Bernardino and downtown Redlands, extension of the Gold Line to Montclair, with additional planning to LA/Ontario International Airport, and extensive Bus Rapid Transit network. There are many transit stations around which non-motorized facilities should be planned. The Redlands Rail has seven proposed stations within the county and an additional four potential additional/alternative stations.

Measure I 2010-2040 Strategic Plan, 2009

The SANBAG Board of Directors approved the Strategic Plan on April 1, 2009. The Strategic Plan is the reference manual and policy document for the administration of Measure I 2010-2040 programs by SANBAG and its member agencies. Measure I funds come from the 1/2 cent sales tax approved by voters in 1989 and extended by the voters to 2040 in the 2004 elections.

The report is presented in two parts and a series of appendices. Part 1 provides an overview of Measure I 2010-2040, describes the scope of each Measure I program, presents financial information, and provides an overview of the policy structure for each program. Part 2 presents the specific policies by which each Measure I program will be administered. Roadway-based non-motorized facilities are included as eligible expenditures through the Valley Major Street/Arterial program and through the Major/Local Highways programs for Mountain/Desert Subareas. In addition, planning and project development activities may be funded through the Traffic Management System programs in each subarea.

Southern California Association of Governments (SCAG) Regional Transportation Plan, 2012

SCAG adopted its Regional Transportation Plan (RTP) and Sustainability Communities Plan (SCS) in April 2012 with the goal of increasing mobility for those who live in and visit San Bernardino, Imperial, Los Angeles, Orange, Riverside, and Ventura Counties. The Plan recommends increasing regional bikeway mileage from 4,315 to 10,122 miles, as well as retrofitting sidewalks to comply with the ADA and implementing safety improvements. SCAG also recommends key bikeways to connect the region and facilitate bicycle travel.

Policies included in the RTP and SCS include addressing bicyclist and pedestrian safety, increasing bicycle and pedestrian mode share, encouraging local active transportation plans, and improving air quality in the region.

Santa Ana River Trail

The Santa Ana River Trail appears in numerous Plans throughout southern California. This trail has great importance for many regions within Southern California, with many jurisdictions including it in their documents to have their section of the trail completed.

1.6.2 State

Active Transportation Program, 2013

In September 2013, the Active Transportation Program (ATP) was created by the California Department of Transportation (Senate Bill 99, Chapter 359 and Assembly Bill 101, Chapter 354). This program consolidates existing state and federal transportation programs into one, including:

- Transportation Alternatives Program (TAP)
- Bicycle Transportation Account (BTA)
- State Safe Routes to School (SR2S)

The program is designed to increase walking and bicycling trips and safety, enhance environmental benefits from active transportation facilities, improve public health, cater to the needs of disadvantaged communities and provide a variety of projects for many types of non-motorized facility users. Table 1-1 displays the requirements for the ATP-compliant Active Transportation Plans eligible for funding.

Table 1-1: ATP Requirements

Letter	Requirement
a)	The estimated number of existing bicycle trips and pedestrian trips in the plan area, both in absolute numbers and as a percentage of all trips, and the estimated increase in the number of bicycle trips and pedestrian trips resulting from implementation of the plan.
b)	The number and location of collisions, serious injuries, and fatalities suffered by bicyclists and pedestrians in the plan area, both in absolute numbers and as a percentage of all collisions and

Letter	Requirement
	injuries, and a goal for collision, serious injury, and fatality reduction after implementation of the plan.
c)	A map and description of existing and proposed land use and settlement patterns which must include, but not be limited to, locations of residential neighborhoods, schools, shopping centers, public buildings, major employment centers, and other destinations.
d)	A map and description of existing and proposed bicycle transportation facilities.
e)	A map and description of existing and proposed end-of-trip bicycle parking facilities.
f)	A description of existing and proposed policies related to bicycle parking in public locations, private parking garages and parking lots and in new commercial and residential developments.
g)	A map and description of existing and proposed bicycle transport and parking facilities for connections with and use of other transportation modes. These must include, but not be limited to, parking facilities at transit stops, rail and transit terminals, ferry docks and landings, park and ride lots, and provisions for transporting bicyclists and bicycles on transit or rail vehicles or ferry vessels.
h)	A map and description of existing and proposed pedestrian facilities at major transit hubs. These must include, but are not limited to, rail and transit terminals, and ferry docks and landings.
i)	A description of proposed signage providing wayfinding along bicycle and pedestrian networks to designated destinations.
j)	A description of the policies and procedures for maintaining existing and proposed bicycle and pedestrian facilities, including, but not limited to, the maintenance of smooth pavement, freedom from encroaching vegetation, maintenance of traffic control devices including striping and other pavement markings, and lighting.
k)	A description of bicycle and pedestrian safety, education, and encouragement programs conducted in the area included within the plan, efforts by the law enforcement agency having primary traffic law enforcement responsibility in the area to enforce provisions of the law impacting bicycle and pedestrian safety, and the resulting effect on accidents involving bicyclists and pedestrians.
l)	A description of the extent of community involvement in development of the plan, including disadvantaged and underserved communities.
m)	A description of how the active transportation plan has been coordinated with neighboring jurisdictions, including school districts within the plan area, and is consistent with other local or regional transportation, air quality, or energy conservation plans, including, but not limited to, general plans and a Sustainable Community Strategy in a Regional Transportation Plan.
n)	A description of the projects and programs proposed in the plan and a listing of their priorities for implementation, including the methodology for project prioritization and a proposed timeline for implementation.
o)	A description of past expenditures for bicycle and pedestrian facilities and programs, and future financial needs for projects and programs that improve safety and convenience for bicyclists and pedestrians in the plan area. Include anticipated revenue sources and potential grant

Letter	Requirement
	funding for bicycle and pedestrian uses.
p)	A description of steps necessary to implement the plan and the reporting process that will be used to keep the adopting agency and community informed of the progress being made in implementing the plan.
q)	A resolution showing adoption of the plan by the city, county or district. If the active transportation plan were prepared by a county transportation commission, regional transportation planning agency, MPO, school district or transit district, the plan should indicate the support via resolution of the city(s) or county(s) in which the proposed facilities would be located.

California Government Code §65302 (Complete Streets)

California Assembly Bill (AB) 1358, also known as the Complete Streets Bill, amended the California Government Code §65302 to require that all major revisions to a city or county's Circulation Element include provisions for the accommodation of all roadway users including bicyclists and pedestrians. Accommodations include bikeways, sidewalks, crosswalks, and curb extensions. The Government Code §65302 reads:

(2) (A) Commencing January 1, 2011, upon any substantive revisions of the Circulation Element, the legislative body shall modify the Circulation Element to plan for a balanced, multimodal transportation network that meets the needs of all users of streets, roads, and highways for safe and convenient travel in a manner that is suitable to the rural, suburban, or urban context of the general plan.

(B) For purposes of this paragraph, 'users of streets, roads, and highways' means bicyclists, children, persons with disabilities, motorists, movers of commercial goods, pedestrians, users of public transportation, and seniors.

California Green Code

Part 11 of the California Building Standards Code in Title 24 of the California Code of Regulations is the California Green (CALGreen) Code. This was developed to reduce waste from construction, make buildings energy-efficient and reduce environmental impacts of construction. The CALGreen Code requirements are mandatory for all new residential and non-residential buildings.

Table 1-2 presents the bicycle parking requirements in the California Green Code.

Table 1-2: California Green Code Bicycle Parking Requirements

Category	Description
Bicycle Parking and Changing Rooms	Comply with sections 5.106.4.1 and 5.106.4.2; or meet local ordinance or the University of California Policy on Sustainable Practices, whichever is stricter.
Short-Term Bicycle	If the project is expected to generate visitor traffic, provide permanently anchored

Category	Description
Parking	bicycle racks within 100 feet of the visitors' entrance, readily visible to passers-by, for 5 percent of visitor motorized vehicle parking capacity, with a minimum of one two-bike capacity rack.
Long-Term Bicycle Parking	For buildings with over 10 tenant-occupants, provide secure bicycle parking for 5 percent of motorized vehicle parking capacity, with a minimum of one space. Acceptable parking facilities shall be convenient from the street and may include: • Covered, lockable enclosures with permanently anchored racks for bicycles • Lockable bicycle rooms with permanently anchored racks • Lockable, permanently anchored bicycle lockers

Deputy Directive 64 & Traffic Operations Policy Directive 09-06

Caltrans adopted two policies in recent years that are relevant to bicycle planning initiatives, Deputy Directive 64 and Traffic Operations Policy Directive 09-06. Similar to AB 1358, Deputy Directive 64 (DD-64-R1) sets forth that Caltrans address the "safety and mobility needs of bicyclists, pedestrians, and transit users in all projects, regardless of funding." Traffic Operations Policy Directive 09-06 is designed to ensure the provision of bicycle and motorcycle detection on all new and modified approaches to traffic-actuated signals in the state of California.

California Assembly Bill 32—California Global Warning Solutions Act, 2006

Assembly Bill (AB) 32 requires California to lower greenhouse gas emissions to 1990 levels by 2020, the equivalent of taking approximately 15 million cars off the nation's roads. To meet reduction targets, the California Air Resources Board (CARB), the lead agency responsible for implementing the act, is following a blueprint known as the AB 32 Climate Change Scoping Plan. The plan lays out the strategy and a comprehensive set of actions that include establishing targets for transportation-related greenhouse gas emissions for regions throughout California, and pursuing policies and incentives to achieve those targets.

Proposition 84, 2006

Proposition 84 expands recreational facilities to fund environmental quality projects. Grant funding ($70 million) was set aside to fund urban greening projects that reduce energy consumption, conserve water, improve air and water quality and reduce greenhouse gas emissions. Proposition 84 funds are available for the construction of the Santa Ana River Trail.

California Senate Bill 375 – Sustainable Communities, 2008

Senate Bill (SB) 375 is intended to complement Assembly Bill (AB) 32: The Global Warming Solutions Act of 2006 and encourages local governments to reduce emissions through improved planning. Under SB 375, the California Air Resources Board (CARB) is required to establish targets

for 2020 and 2035 for each region covered by one of the State's 18 metropolitan planning organizations (MPOs). Each of California's MPOs will then prepare a Sustainable Communities Strategy (SCS) that demonstrates how the region will meet its greenhouse gas (GHG) reduction target through integrated land use, housing, and transportation planning. One way to help meet the emissions targets is to increase the bicycle mode share by substituting bicycle trips for automobile trips. The City of Redlands's efforts to encourage non-motorized transportation will contribute to the regional attainment of these targets. As required by SB 375, the Southern California Association of Governments adopted a Sustainable Communities Strategy (SCS) in April 2012 in conjunction with the 2012 Regional Transportation Plan.

California Assembly Bill 1193, 2014

Assembly Bill (AB) 1193 adopted three key reforms to improve local bikeway design and construction. This bill frees communities from having bikeway designs compliant solely with the California Highway Design Manual if designs are based on standards crafted by a national association of public agency transportation officials. The bill also allows local governments to build protected cycle tracks and requires Caltrans to develop design standards for cycle tracks for inclusion into the Highway Design Manual by 2016.

California Assembly Bill 2245, 2014

AB 2245, signed by Governor Jerry Brown in 2014, streamlines California Environmental Quality Act (CEQA) reviews for bike lane projects. Planners are no longer required to conduct environmental impact reports (EIRs) for these projects, which are currently required under CEQA. Under AB 2245, cities and counties are required to prepare a traffic and safety study of the proposed bicycle lane project, file a CEQA-exemption notice with the state and County, and conduct public hearings to discuss the project's impact

California Senate Bill 1183, 2014

Senate Bill 1183 allows jurisdictions to propose a small vehicle registration fee on their local ballot to fund bike trails and paths on park district lands. The fee must be no more than five dollars and requires approval from at least 2/3 of local voters.

California Senate Bill 743, 2013

SB 743 removes Level of Service (LOS), a measure of car traffic congestion, from the methods used to analyze environmental impacts under the California Environmental Quality Act (CEQA). CEQA requires all new projects to analyze potential environmental impacts. CEQA requires mitigation when projects cause traffic delay, despite projects such as bicycle and pedestrian improvements that improve roadway conditions for others. Under SB 743, Vehicle Miles Traveled (VMT) will become mandatory in 2016 as a CEQA impact.

California Assembly Bill 1371, 2014

AB 1371, the Three Feet for Safety Act, was passed in September 2014. The bill requires vehicles to keep a three-foot buffer when passing cyclists, or to slow to a safe speed if they are prevented from keeping their distance.

California Transportation Plan, 2006

The California Transportation Plan 2025 seeks to provide for mobility and accessibility of people, goods, services, and information throughout California. It encourages consideration of bicycle and pedestrian facilities in capacity improvement projects, and promotes integration of active transportation into modeling and projection efforts.

The Plan also speaks to the public health benefits of active transportation, urging better education of youth on personal health and air quality impacts of making trips by bicycle or on foot.

1.6.3 Federal

USDOT Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations, 2010

Under this policy statement, every transportation agency, including the federal DOT, has the responsibility to improve conditions and opportunities for walking and bicycling and to integrate walking and bicycling into their transportation systems. The policy also encourages agencies to "go beyond minimum standards to provide safe and convenient facilities for these modes," citing the health, safety, environmental, transportation, and quality of life benefits that active transportation offers to individuals and communities alike.

2. Existing Conditions

2.1. Existing Bicycle Network

The City currently has approximately 18 miles of bicycle facilities including Class I multi-use paths, Class II bike lanes, and Class III bike routes. A map of the existing bicycle facilities is located in Appendix B and the mileages by facility type are shown in Table 2-1.

Table 2-1: Existing Bike Facility Mileage

Class	Miles	Lane Miles
Class I Multi-Use Path	2.08	4.16
Class II Bike Lane	7.48	14.96
Class III Bike Route	8.72	17.44
Total	18.28	36.56

The Redlands Conservancy has identified these multi-use trails that are mainly for recreation of bicyclists and hikers:

- Bluffs Trail
- East Valley Corridor Bikeway
- Oak Ridge and Oakmont Trails
- Orange Blossom Rail Trail
- Timoteo Creek Flood Control Trail
- Sylvan Park Trail
- Terrace Park Trail
- Creekside Trail
- Redlands Conservancy Carriage Trail

Design guidelines for bicycle facilities can be found in Appendix J of this document. The design guidelines will help readers understand the definitions of various facilities.

2.2. Support Facilities

2.2.1 Bicycle Parking

There are a number of excellent bike parking facilities currently located around the City. A bicycle parking map of existing facilities is included in Appendix C.

2.2.2 End-of-Trip Facilities

Several large employers in the City include 'end of trip' facilities particularly for commuter cyclists. For example, ESRI has bike lockers, showers and changing facilities available for commuter cyclists. Similarly, the university has facilities available for commuter cyclists. Neither of these facilities, however, is specifically identified as facilities for cyclists. The commuter cyclists need to understand the availability of facilities provided by the complex for other purposes. The team was not aware of any other changing facilities in the City. This presents an opportunity for a program to educate local cyclists about available locations for changing and perhaps push for more and better options, such as a Bike Station.

2.2.3 Transit Access

There are currently no major transit hubs in the City, though sidewalks and pedestrian safety measures are considered at existing transit stops. In 2016, Metrolink stops will be added within the city. The Redlands Rail is planned locally and is one of the most important opportunities for meeting the needs of local bicyclists, with as many as five stations planned in Redlands.

2.3. Existing Programs

2.3.1 Education

Redlands Police Department Bike Safety Rodeos

The Redlands Police Department's Traffic Safety Unit holds bicycle rodeos at public gatherings. The rodeos include free safety demonstrations, a bicycle safety road course, safety reading materials in English and Spanish, and instructions on properly wearing and adjusting helmets. Bicycles and helmets are given away, made possible through donations from Wal-Mart, and the Loma Linda University Medical Center Safe Kids Coalition. Children at the rodeo are encouraged to speak with the police offers, and those who do are given free tickets for prize drawings.

Redlands Children's Bicycle Health and Safety Expo

The Redlands Children's Bicycle Health and Safety Expo is an annual event hosted by the Police Department and Ride Yourself Fit. This event includes: bicycle safety and information, craft booths, music, food and free bicycle drawings. The Police Department volunteers will also provide bicycle licenses, registration and fingerprinting.

Inland Empire Bicycle Alliance (IEBA) Education Programs

Maintenance Clinics

Maintenance clinics taught by IEBA members take place at the Bike BBQ Tuesday, Wednesday and Thursday evenings from six to eight, and Saturday afternoons from noon to three. This program conducts classes to teach basic bicycle maintenance. Topics and groups already served include women-specific, Boy Scouts, Micah House and Cope Middle School.

Safe Routes to School (SRTS)

In partnership with the County of San Bernardino, the SRTS National Partnership and IEBA conduct training classes at local schools to promote walking and biking to school. Training skills and safety clinics will be conducted along with "Bike Train" instruction for parents and students.

Adult Education Classes

The Inland Empire Biking Alliance (IEBA) conducts educational courses for adults learning to bike or looking to improve their skills on the road. Courses are designed for adults of all riding abilities, teaching skills such as safety checks, fixing a flat, on-bike skills, traffic positioning and crash avoidance techniques. More advanced courses are available for adults looking to improve upon their fitness, train for long rides and riding in all weather conditions.

Youth Education Classes

The IEBA Bicycle Playground is a skills clinic for children, held at the annual Redlands Bicycle Classic. The clinic helps children develop basic training, braking, vision and balance skills.

Burrage Mansion, Rochford Foundation Buddies Program

Within the Buddies Program, IEBA conducts workshops consisting of five classes that both educate and encourage children. Children are taught basic maintenance and bicycle skills along with the ability to ride in a safe environment. At the Grove School, the Alliance conducted an 8-week comprehensive course that included bicycle maintenance, the history of biking, advocacy, traffic engineering, types and purposes of bicycles, and discussions on bicycle safety and benefits.

2.3.2 Encouragement

Redlands International Bicycle Classic

The Redlands International Bicycle Classic is an extremely popular ride that has been held for 30 years. It is the longest continuous running stage race in American bike racing. Over the course of five days, numerous races are held and a healthy

lifestyle expo is hosted in downtown Redlands on the final two days. The festival includes vendors that promote healthy living.

BikeBBQ (Bicycle Kitchen)

The Redlands BikeBBQ is a "bicycle kitchen" that provides a space, tools, and instruction for community members to learn how to work on their own bicycles. The purpose of this program is to encourage people to share their bicycling knowledge and skills within the community. In addition to their permanent space behind Augie's Coffee Shop off of Redlands Boulevard, BikeBBQ is present weekly at the Redlands Market Night event.

Redlands Interscholastic Cycling Organization

The Redlands Interscholastic Cycling Organization (RICO) is a volunteer-based umbrella group that fields Redlands area high school and middle school cross country mountain bike racing teams. RICO-trained teams compete against other schools in the SoCal league. Goals include: to foster a love of bicycling, develop the community, improve strengths and skills, and instill work ethic while having fun in an outdoor environment.

Redlands Waterbottle Transit Company

The Redlands Waterbottle Transit Company (RWBTC) started more than 25 years ago as a local bicycle club. RWBTC has more than 200 members and has remained helpful in encouraging new recreational cyclists along with conducting monthly meetings open to the public. During these public sessions, topics include nutrition, basic bicycle maintenance as well as safe and proper group riding techniques. They offer several group ride options each week for almost every level of cyclist.

Ride Yourself Fit Club

Ride Yourself Fit is a family-friendly cycling club focused on fun, fitness and fellowship. The club has a Family Ride Program, which offers several family-oriented rides on the first Sunday of each month. Bi-weekly rides ranging in various difficulty levels and training circuits are also held. In addition to the rides, Ride Yourself Fit holds special events including a holiday party, general meetings, contests, and special discounts on clothing orders.

Another group within this club is called Walk Yourself Fit, which holds weekly guided walks for all ages and fitness levels in order to promote improved fitness and health.

Moore Middle School Bike Club

A bicycle club at Moore Middle School is run and managed by the students themselves. They conduct weekly rides that are supervised by adults. The adults guide students on how to safely navigate city streets and trails as well as club group fundamentals.

Strada Corsa

A bicycle advocacy group, Strada Corsa, hosts multiple events including charity rides, tours and classes to raise funds for education and fighting child obesity. A new project the group is raising funds for is a Bike Park that will include a certified BMX track, pump track and mountain bike skills course to the Inland Empire Community.

Inland Empire Biking Alliance (IEBA) Encouragement Programs

Events

As the local advocacy group, IEBA has several events that create a larger bicycling community. Redlands events include:

- Bike Filmfest
- Cargo Bike Ride
- All Redlands Ride: Free Community ride
- Strada Rossa: Multi-surface metric century
- Great Bucket Cape: Part of Bicycle Friendly Business Programs (BFBs). Teams compete in a cargo bike scavenger hunt.
- Cape Ride: Community ride for all ages wearing capes while riding through a local community route. IEBA conducts family-friendly rides throughout the Inland Empire.

IEBA Bicycle Friendly Business Program

This program is an active partnership with local businesses to encourage more trips by bicycle for daily transportation from business owners/deliveries, employee commuting and customer service. The program provides discounts at local bike shops, adult education classes for employees, encourages cyclists to reward businesses that invest in bicycling, and special signs that inform customers of Bike Friendly Businesses. IEBA also works to have special events that bring customers to the Bike Friendly Businesses, works with local officials to overcome barriers to bike improvements and with local fabricators to provide special bike racks and lower costs.

Bicycle Valet at Events

The Bicycle Commuter Coalition of the Inland Empire (BCCIE) has provided a free bicycle valet service at the Redlands Bicycle Classic for the past 15 years. This service is also provided at events throughout the Inland Empire by IEBA.

Trainbuilding Partnership

The Redlands Conservancy and the IEBA partner with the Redlands Interscholastic Cycling Organization (RICO) to build local trails on nearby open space.

Employer Bikeshare

The IEBA and Bike BBQ run a free bike share system for their employees.

Bike Rentals

The IEBA has an online bicycle rental program through a smart phone app from SPNLSTR.com. The program launched in June 2014. Local bicycle rentals are also available at local businesses such as the Olive Ave Market.

Lights for Life

The IEBA uses volunteers, and staff to give away bike lights at chosen locations, raising awareness about the danger of biking in the dark. In addition to handing out free lights, this program provides an opportunity for IEBA to interact with those riding on the sidewalk and in opposing traffic, two additional bicycling habits that are unsafe.

Student Survival Kit

This program is directed toward students in high school and college. The IEBA provides lights, Kryptonite U-locks, bells and helmets in survival kits. This program works best as part of a larger campaign about safety and security.

2.3.3 Evaluation

IEBA Bicycle and Pedestrian Counts

The Inland Empire Bicycle Alliance (IEBA) offers services for bicycle and pedestrian counts using the Southern California Association of Governments (SCAG) guidelines from UCLA. Training and research are conducted by the organization. Included in this service are:

- SCAG recommended minimum of two hours and with a preference of a morning and evening count on the same day, for a total of at least four hours per day
- Trained staff
- Complete report

2.4. Past Expenditures

Since 2011, the City has installed seven miles of bike lanes, of which 1.4 miles are painted green. The total spent on these projects was $255,400; $114,440 of this total was spent on the painted lanes. The City also spent approximately $1,000 on the installation of bike racks.

3. Needs Analysis

3.1. Bicyclist Needs

This Plan seeks to address the needs of all bicyclists and potential bicyclists and therefore it is important to understand the needs and preferences of all types of bicyclists. Needs and preferences vary between skill levels and their trip types. In addition, the propensity to bicycle varies from person to person, providing insight into potential increases in bicycling rates. Generally, bicycling propensity levels can be classified into four categories, displayed in Figure 3-1.

- *Strong and Fearless* bicyclists will ride on almost any roadway despite the traffic volume, speed and lack of bikeway designation and are estimated to be less than one percent of the population.
- *Enthused and Confident* bicyclists will ride on most roadways if traffic volumes and speeds are not high. They are confident in positioning themselves to share the roadway with motorists and are estimated to be five percent of the population.
- *Interested but Concerned* bicyclists will ride if bicycle paths or lanes are provided on roadways with low traffic volumes and speeds. They are typically not confident riding with motorists. Interested but Concerned bicyclists are estimated to be 60 percent of the bicyclist population and the primary target group that will bicycle more if encouraged to do so.
- *No Way No How* people do not consider cycling part of their transportation or recreation options and are estimated to be 35 percent of the population.

The needs of bicyclists also vary between trip purposes. For example, people who bicycle for sport and recreational purposes may prefer long and unsignalized roadways, while bicyclists who ride with their children to school may prefer direct roadways with lower vehicular volumes and speeds. This Plan considers these differences and develops a bikeway network to serve all user types. This section describes the different types of bicyclists and the respective needs for these categories of bicyclists.

- Commuters - adults who regularly bicycle between their residences and work.
- Enthusiasts - skilled adults.
- Casual / Family / Elderly riders - adults who use bicycles for running errands, recreation, tourism, exercise, or as a family activity.
- School Children - children who bicycle to school.

An effective bicycle network accommodates bicyclists of all abilities. Casual bicyclists generally prefer roadways with low traffic volumes and low speeds. They also prefer paths that are physically separated from roadways. Because experienced bicyclists typically ride to destinations or to achieve a goal, they generally choose the most direct route, which may include roadways

with or without bike lanes. Bicyclists of all abilities and purposes ride every day in Redlands. Parents bicycle with their children to school, people bicycle to work, community members bicycle to transit stations, and recreational bicyclists ride on extended bicycle trips.

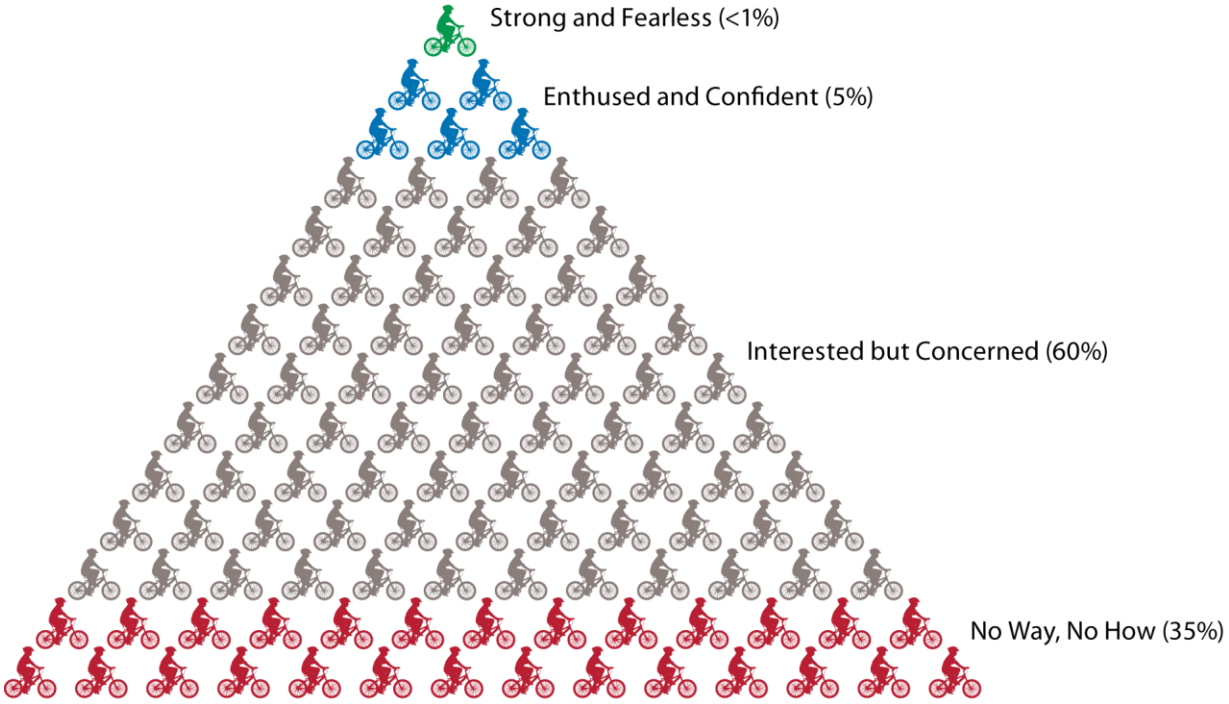


Figure 3-1: Types of Cyclists

3.2. Public Involvement

Public input on bicycling in Redlands was sought in 2013 from January through the summer. Stakeholder meetings were held in 2014 to seek input on the Citywide Bicycle Master Plan.

Community members were also able to provide comments on the recommendations online using an interactive mapping website. The website was available from September 4th to 25th, 2014. Participants were able to suggest new bikeways, bike parking locations, problem spots for bicyclists and streets that might provide access to potential destinations but are difficult to ride due to high vehicle volumes and/or speeds. This mapping exercise was extremely popular and had over 200 comments. The results of the online mapping exercise can be found in Appendix D.

3.3. Bicycle Attractors and Generators

Bicycle attractors and generators are destinations within a city that people access regularly, which may generate more bicycle trips with improved infrastructure. These include major employers, schools, parks, shopping areas, and tourism destinations.

3.3.1 Major Employers

Major employers in Redlands include:

- Environmental Systems Research Institute (ESRI)
- University of Redlands
- Redlands Unified School District
- Redlands Community Hospital

3.3.2 Schools

The Redlands Unified School District has 26 elementary, middle, high and adult schools throughout the City. In addition to these schools, there are private schools, schools associated with religious organizations, and the University of Redlands is located within the City, generating a lot of bicycling activity.

3.3.3 Parks

Improving bicycling in Redlands provides community members with better access to parks via bicycle. Parks in the City include:

- Ed Hales Park
- Sylvan Park
- Ford Park
- Caroline Park
- Brookside Park
- Community Park
- Crafton Park
- Jennie Davis Park
- Franklin Park
- Prospect Park
- Redlands Sports Park
- San Timoteo Canyon Nature Preserve
- Simond's Parkway
- Smiley Park
- Texonia Park
- Hillside Memorial Park
- Oakmont Park
- Heritage Park
- Israel Beal Park
- Live Oak Canyon Natural Areas

3.3.4 Shopping

The following shopping centers in Redlands are key destinations for many community members, thus are important activity generators.

- Downtown Redlands
- Redlands Mall
- Citrus Plaza
- Neighborhood Centers
- Tri-City Center

3.3.5 Tourism

The following locations are generators of tourism in Redlands, and therefore provide opportunities for increasing bicycle traffic.

- Downtown Redlands
- Redlands Bowl
- Pharaoh's Adventure Park
- Redlands Sports Park
- Museums: Kimberly Crest House & Gardens, San Bernardino County Museum, The Asistencia, Historical Glass Museum, Lincoln Shrine
- Walking tours of historical sites

While assessing user groups in the region, tourists are considered casual riders based on their purpose for bicycling in the area. They often rent bicycles and may ride more slowly and need more comfortable routes as they take in scenery and learn to navigate the area.

Promoting bicycle tourism can boost local economies. Tourists who ride through the area frequent restaurants, stay at local hotels, and visit local businesses. According to surveys done in Lake Tahoe, bicycle paths and events attract users with relatively high disposable income and approximately 30 percent of path users came to the region primarily for bicycling purposes.

3.4. Bicycling Demand and Benefits Model

This model estimates the number of bicycling or walking trips currently taken in a community and provides a future estimate. The model is built on the understanding that Census journey-to-work is a readily-available statistic, but community members take many trips by bike and on foot other than commuting to work. These bicycling and walking trips could have been vehicle trips, and therefore they benefit the community by saving vehicle miles traveled (VMT), which leads to greenhouse gas emissions (GHGs).

The model uses adult commute trips from the U.S. Census Bureau's American Community Survey (ACS) journey-to-work data to extrapolate utilitarian trips. The 2009 *National Household Travel Survey* (NHTS) provides information about the ratio of work trips to other trip purposes. The model extrapolates school and college trips based on national mode split numbers for those populations.

The foundation of this analysis is the ACS 2008-2012 five-year estimate for Redlands. Model variables from the ACS include: total population, employed population, school enrollment (grades K-12 and college students), and journey-to-work mode split.

The 2009 NHTS provides a substantial national dataset of travel characteristics, particularly for trip characteristics of bicycling and walking trips. Data used from this survey include:

- Student mode split, grades K-12
- Trip distance by mode by trip purpose

- Ratio of walking/bicycling work trips to utilitarian trips
- Ratio of work trips to social/recreational trips
- Average trip length by trip purpose and mode

Several of these variables provide a way to estimate the number of walking and bicycling trips made for other reasons than work trips, such as shopping and running errands. NHTS 2009 data indicate that for every bicycle work trip, there are slightly less than two utilitarian bicycle trips made. Although these trips cannot be directly attached to a certain group of people (not all of the utilitarian bicycling trips are made by people who bicycle to work), these multipliers allow a high percentage of the community's walking and bicycling activity to be captured in an annual estimate.

The Safe Routes to School Baseline Data Report (2010) was used to determine the percent of students who walk or bicycle by the parents' estimate of distance as well as the frequently of carpooling for trip replacement.

Disclaimer

As with any model, the accuracy of the result is dependent on the accuracy of the input data and other assumptions. Effort was made to collect the best data possible for input to the model.

3.4.1 Mode Split Comparison

Table 3-1 below presents commute to work data estimates for Redlands, as well as nearby cities and comparison geographies, as reported in the 2008-2012 American Community Survey 5-year estimates. This information for Redlands is one of several inputs of the demand model.

Table 3-1: Mode Split Comparison with Neighboring Jurisdictions

Geography	Walk	Bike	Transit	Carpool	Drive Alone
Redlands	3.8%	1.4%	1.5%	8.8%	80.0%
Highland	0.8%	0.1%	1.4%	13.7%	79.6%
Loma Linda	4.6%	0.9%	0.7%	9.3%	79.9%
San Bernardino	2.2%	0.4%	3.2%	15.2%	74.4%
Yucaipa	0.8%	0.2%	1.5%	12.5%	78.5%
County of San Bernardino	2.0%	0.4%	1.9%	15.5%	91.0%
California	2.8%	1.0%	5.1%	11.5%	73.0%
United States	2.8%	0.6%	5.0%	10.0%	76.1%

Source: 2008-2012 American Community Survey 5-year estimates

Table 3-2 shows the estimated number of daily bicycling and walking trips that replace vehicle trips. Based on the model input data from NHTS 2009, the majority of trips are non-work utilitarian trips, which include medical/dental services, shopping/errands, family personal

business, meals, and other trips. These daily estimates can be extrapolated to annual trips using the total number of annual work, school, and college days in a year.

Table 3-2: Current Weekday Bicycling and Walking Trips

	Bicycling	Walking	Source
Bicycling/walking trips	851	2,309	Employed population from ACS multiplied by mode split from ACS, doubled for round-trips
Walk- or bike-to-transit trips	9	264	Number of transit commuters from ACS multiplied by transit mode split from TRCP Report 153, doubled for round-trips
K-12 bicycle/walking trips	244	3,252	School children population from ACS multiplied by mode split from SRTS Baseline Data Report (2010), doubled for round-trips
College bicycle/walking trips	267	1,087	Employed population from ACS multiplied by mode split from NHTS 2009, doubled for round-trips
Daily utilitarian trips	1,371	9,983	Bicycle/walking commute trips (above) multiplied by mode-specific utilitarian trip multiplier from NHTS 2009
Daily social/recreational trips	4,058	9,033	Bicycle/walking commute trips (above) multiplied by mode-specific social/recreational trip multiplier from NHTS 2009
Current daily walking and bicycling trips	**6,800**	**25,928**	
Annual Extrapolation			
Annual commute trips	215,860	645,823	Bicycle/walking and walk- or bike-to-transit trips multiplied by annual work days
Annual K-12 trips	43,920	585,360	K-12 bicycle/walking trips multiplied by annual K-12 school days
Annual college trips	40,050	163,050	College bicycle/walking trips multiplied by annual college class days
Annual utilitarian trips	347,774	2,792,184	Annual commute trips multiplied by mode-specific utilitarian trip multiplier

3.4.2 Trip Replacement

To estimate the total distance that residents travel to work or school by walking and bicycling, the model isolates different walking and bicycling user groups and applies trip distance information for walking or bicycling trips by mode based on NHTS 2009. Table 3-3 shows the trip replacement factors and results.

Table 3-3: Current Walking and Bicycling Trip Replacement (Annual)

	Bicycling	Walking	Source
Vehicle commute trips replaced	184,773	566,606	Redistribution of bikers/walkers using existing mode split if that mode were not available
K-12 vehicle trips replaced	18,709	284,907	SR2S Baseline Data Report, 2010
College vehicle trips replaced	32,640	140,223	NHTS 2009
Utilitarian vehicle trips replaced	297,689	2,449,692	Redistribution of bikers/walkers using existing mode split if that mode were not available
Vehicle Miles Traveled			
Commute VMT replaced	654,095	379,626	NHTS 2009 average bicycle trip distance for "Work" trips
K-12 VMT replaced	14,368	101,176	SRTS 2010, percent of students who walk or bicycle by parent's estimate of distance
College VMT replaced	48,308	78,525	NHTS 2009 average trip distance for "School/Daycare/Religious" trips
Utilitarian VMT replaced	563,625	1,633,128	Derived from NHTS 2009
Total VMT reduced	1,280,396	2,192,455	
Per capita VMT reduced	**19**	**32**	

3.4.3 Current Benefits

To the extent that bicycling and walking trips replace vehicle trips, they reduce emissions of several potentially harmful air pollutants. These benefits are shown in Table 3-4.

Table 3-4: Annual Benefits of Current Bicycling and Walking Trips

	Bicycling	Walking	Total
Yearly vehicle miles reduced	1,280,396	2,192,455	3,472,851
Air Quality Benefits			
Reduced Hydrocarbons (pounds/year)	3,839	6,574	10,413
Reduced Particulate Matter (pounds/year)	29	49	77
Reduced Nitrous Oxides (pounds/year)	2,682	4,592	7,274
Reduced Carbon Monoxide (pounds/year)	35,003	59,936	94,938
Reduced Carbon Dioxide (pounds/year)	1,041,609	1,783,575	2,825,184

Source: EPA report 420-F-05-022 "Emission Facts: Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Cars and Light Trucks." 2005.

3.4.4 Potential Future Bicycling and Walking Trips

Estimating future benefits requires additional assumptions regarding Redlands's future population and anticipated commuting patterns in 2035. Future population predictions as determined by the SCAG RTP 2012 Growth Forecasts were used in this model. Table 3-5 shows the projected future demographics used in the future analysis.

Table 3-5: Project Future Demographics

Demographics	Value	Percent of Current Population	Source
Population	87,900	127%	SCAG RTP 2012 Growth Forecasts
Employed population	60,100	44%	SCAG RTP 2012 Growth Forecasts
Total enrollment K-12	48,222	55%	Same as current model estimate
Total college/graduate	31,545	36%	Same as current model estimate

The analysis predicts that the bicycle mode split will double by 2035, due in part to bicycle network implementation and education/encouragement programs. This results in a future bicycling mode split of 2.00 percent. The results of the model are shown in Table 3-6.

Table 3-6: Estimated Future Weekday Bicycling and Walking Trips

	Bicycling	Walking	Source
Bicycling/walking trips	2,404	4,568	Employed population multiplied by mode split, doubled for round-trip
Walk- or bike-to-transit trips	18	523	Number of transit commuters multiplied by transit mode split from TCRP Report 153, doubled for round-trip
K-12 bicycle/walking trips	964	12,875	School children population multiplied by mode split, doubled for round-trip
College bicycle/walking trips	1,056	4,303	Employed population multiplied by mode split, doubled for round-trip
Daily utilitarian trips	3,873	19,750	Bicycle/walking commute trips multiplied by mode-specific utilitarian trip multiplier
Daily social/recreational trips	11,462	17,871	Bicycle/walking commute trips multiplied by mode-specific social/recreational trip multiplier
Future daily walking and bicycling trips	**19,777**	**59,889**	

3.4.5 Future Benefits

The trip replacement factors remain the same as in the model of current trips. Table 3-7 shows the air quality benefits of the future projected walking and bicycling trips.

Table 3-7: Annual Benefits of Future Bicycling and Walking

	Bicycling	Walking	Total

	Bicycling	Walking	Total
Yearly vehicle miles reduced	3,677,000	4,694,000	8,371,000
Air Quality Benefits			
Reduced Hydrocarbons (pounds/year)	11,025	14,074	25,099
Reduced Particulate Matter (pounds/year)	82	105	186
Reduced Nitrous Oxides (pounds/year)	7,702	9,831	17,532
Reduced Carbon Monoxide (pounds/year)	100,527	128,319	228,845
Reduced Carbon Dioxide (pounds/year)	2,991,475	3,818,514	6,809,989

Source: EPA report 420-F-05-022 "Emission Facts: Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Cars and Light Trucks." 2005.

3.5. Collision Analysis

California collision information is available through the California Highway Patrol (CHP) Statewide Integrated Traffic Records System (SWITRS) and the University of California, Berkeley Transportation Injury Mapping System (TIMS). This section uses data from these sources for the years 2007 to 2012.

From 2007 to 2012, there were 147 bicycle-involved collisions and 119 pedestrian-involved collisions. These collisions resulted in 150 bicyclist injuries and 121 pedestrian injuries. One bicyclist and eight pedestrian fatalities occurred in these collisions. Of the 150 injured bicyclists, six percent were severely injured, 55 percent had other visible injuries and 38 percent had complaints of pain. Of the 121 injured pedestrians, nine percent were severely injured, 40 percent had other visible injuries and 45 percent had complaints of pain. The numbers and percent of injuries are shown in Table 3-8 and Table 3-9.

Table 3-8: Bicyclist Injuries and Fatalities

Injury Type	Number of Bicyclists	Percent of Injuries	Percent of Collisions
Fatality	1	1%	1%
Severe Injury	9	6%	6%
Other Visible Injury	83	55%	56%
Complaint of Pain	57	38%	39%

Table 3-9: Pedestrian Injuries and Fatalities

Injury Type	Number of Pedestrians	Percent of Injuries	Percent of Collisions
Fatality	8	7%	7%
Severe Injury	11	9%	9%
Other Visible Injury	48	40%	40%
Complaint of Pain	54	45%	45%

The most frequent location where bicycle collisions occurred was at Citrus Avenue and Judson Street, where four collisions took place, resulting in four bicyclist injuries. This intersection is signalized, though one of the violations was due to traffic signals and signs. The most frequent locations where pedestrian collisions occurred were the intersections of Orange Street with Colton Avenue and San Bernardino Avenue, where four collisions took place each. At the intersection of Orange Street and Colton Avenue, the four collisions resulted in three pedestrian injuries and one fatality. Each of these collisions was due to pedestrian violations. At the intersection of Orange Street and San Bernardino Avenue, four pedestrians were injured. At this intersection, two violations were concerned with pedestrian right-of-way, one pedestrian violation and one due to an improper turning of a vehicle. Full lists of collisions, as well as a map depicting the collision frequency by roadway, are located in Appendix E.

4. Recommendations

4.1. Network

This section describes the proposed bicycle facilities within the City of Redlands. This Plan proposes 181 miles of bikeways. The system is envisioned to be largely accomplished alongside the City's robust resurfacing program that is currently underway, and will continue over the next several years. The vision is to stripe bike lanes on the newly resurfaced pavement. Future traffic analysis and engineering will need to be accomplished in order to identify the appropriate facility type for each roadway segment. As shown in the following Figure 4-1, each bicycle facility type will need to be matched to the existing street characteristics and desired user types. Appendix G presents a view of roadways with apparent excess capacity, which would allow higher-level facilities because of the volumes of traffic.

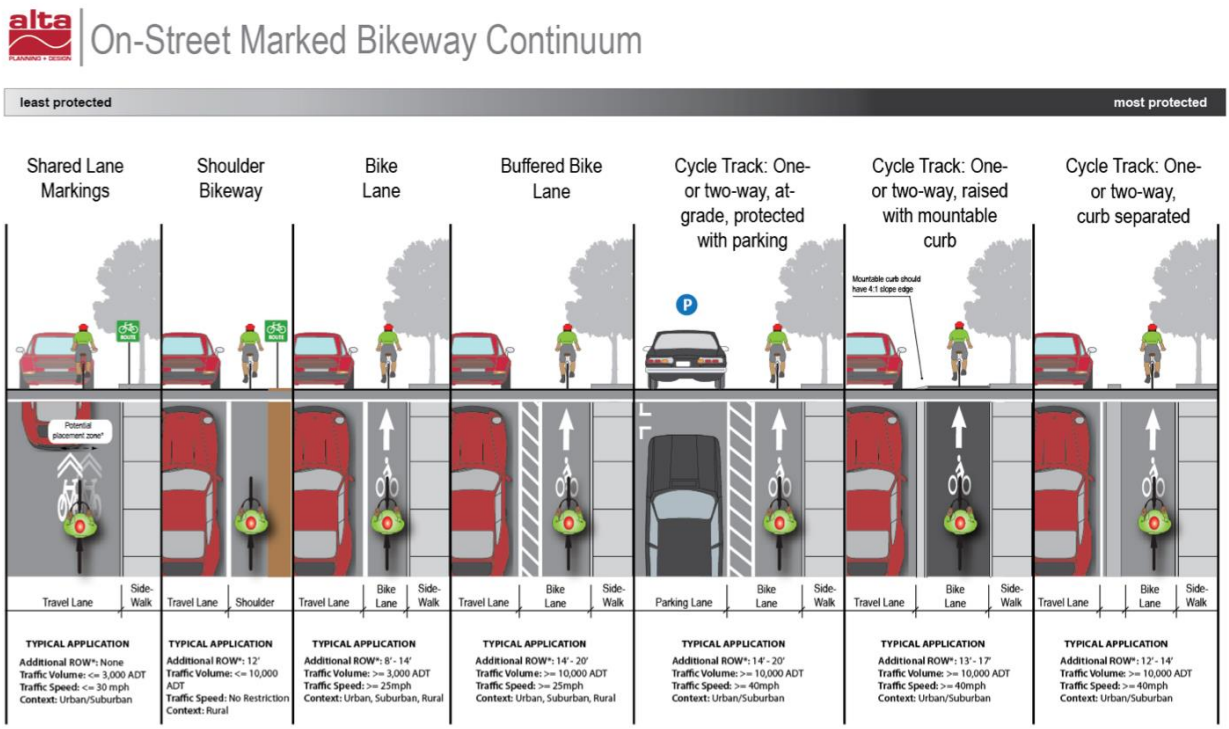


Figure 4-1: On-Street Marked Bikeway Continuum

Orange Blossom Trail

The 'backbone' of the Redlands bikeway system is the Orange Blossom Trail. The trail, as planned, stretches from the western City boundaries to the Eastern City boundaries. The trail largely follows canal and railroad corridors from west to east. Three of the four segments of the trail are currently underway – in various stages of design or construction. The last remaining segment runs from Alabama Street to Grove Street, and is a critical remaining link that should receive high priority for the Redlands network. Traffic calming devices, such as speed tables and flashing beacons, should be included with every Orange Blossom Trail crossing of City streets.

Santa Ana River Trail

The Santa Ana River Trail (SART) is a key bicycle facility in the network of bikeways in Southern California. The SART spans three counties: Orange, Riverside and San Bernardino. This facility should receive high priority in the expansion and improvement of the Redlands bicycle network. The City should work in close collaboration with the County of San Bernardino to ensure that the portion of the SART is completed within the city. Funds from Proposition 84 are available for projects that expand and improve the Santa Ana River Parkway.

Regional Connections

The Redlands network has designated bikeways of regional significance that traverse or connect to surrounding cities. Table 4-1 lists the regional connections to surrounding cities in the Redlands network.

Table 4-1: Redlands Network Regional Connections

Name	Redlands Facility	Adjacent Community Facility	Notes
Alabama Street	Planned	Alabama Street Planned Facility	Highland/San Bernardino
Orange Street	Planned	Orange Street Planned Facility	Highland
Santa Ana River Trail	Planned Class I	Planned Class I	San Bernardino/Orange Counties
San Bernardino Avenue	Planned	San Bernardino Planned Facility outside Redlands	San Bernardino to the West and Mentone/Redlands SOI to the East
Brockton Ave	Planned	Opal Avenue Planned Facility	Mentone/Redlands SOI
Colton Avenue	Planned	Nice Avenue Planned Facility	Mentone/Redlands SOI
Orange Blossom Trail	Planned Class I	Orange Blossom Trail Planned Facility	Mentone/Redlands SOI
Citrus Ave	Planned	Citrus Avenue Planned Facility	Redlands SOI
5th Ave	Planned	5th Avenue Planned Facility	Redlands SOI
Alta Vista Drive	Planned	Outer Highway 10 Planned Facility	Yucaipa
San Timoteo Creek Flood Control Trail	Planned	San Timoteo Creek Flood Control Trail Planned Facility	Loma Linda
Beaumont Ave	Planned	Beaumont Ave Existing Class II	Loma Linda
Barton Road	Existing Class II	Barton Road Existing Class II	Loma Linda
California Street	Planned	California Street Planned Facility	Loma Linda

Transit Access

Support facilities and connections to other modes of transportation are essential components of an active transportation system because they enhance safety and convenience for bicyclists and pedestrians at the end of every trip. Linking bicycling and walking with public transit overcomes common barriers such as trip distance, personal safety and security concerns, and traveling at night, in poor weather or up hills. This link also enables bicyclists and pedestrians to reach more distant locations for both recreation and utilitarian purposes. Multimodal connections can be encouraged with the following projects:

- Allowing bicycle access on all buses with bus-mounted racks
- Implementing bikeways that connect residences, employment centers, schools and shopping centers to bus stops
- Installing bike racks at bus stops and transit centers
- Installing secure bicycle lockers at transit stations or centers
- Street lighting
- Sidewalks around the station
- Intersection improvements on adjacent streets

Upon completion of the Metrolink stations in Redlands in 2016 and Redlands Rail, the City should update this Bicycle Master Plan to include recommendations specific to each station.

4.1.1 Bicycle Boulevards

Bicycle Boulevards are generally defined as low-volume, low-speed streets that have been optimized for bicycle travel using treatments such as traffic calming and traffic reduction, signage and pavement markings, and intersection crossing treatments. These treatments allow through-movements for bicyclists while discouraging similar through-trips by nonlocal motorized traffic. Table 4-2 displays Bicycle Boulevard treatments. Public input is a key component of identifying streets and treatments for Bicycle Boulevards. This Plan recommends that the City consider implementing Bicycle Boulevard treatments on low-volume roadways parallel to busy streets with high collision rates. The following is a summary of the different options or treatments to design Class III Bicycle Boulevards, designed to provide safe and comfortable options for cyclist to travel.

Table 4-2: Bicycle Boulevard Treatments

Level	Signs	Pavement Markings	Intersection Treatments	Traffic Calming	Traffic Diversion
1. Basic Bicycle Boulevard	identification	shared lane markings			
2. Enhanced Bicycle Boulevard	identification wayfinding	shared lane markings directional markings	arterial crossing improvements (high-visibility crosswalks, median islands, HAWK and standard signals)		

Level	Signs	Pavement Markings	Intersection Treatments	Traffic Calming	Traffic Diversion
3. Limited Traffic Calming	identification wayfinding	shared lane markings directional markings	arterial crossing improvements (high-visibility crosswalks, median islands, HAWK and standard signals) improve cyclist visibility (forward stop bars)	vertical speed control (speed humps/lumps/ tables) horizontal speed control (chicanes, traffic circles, curb extensions)	
4. Significant Traffic Calming	identification wayfinding	shared lane markings directional markings	arterial crossing improvements (high-visibility crosswalks, median islands, HAWK and standard signals) improve cyclist visibility (forward stop bars)	vertical speed control (speed humps/lumps/tables) horizontal speed control (chicanes, traffic circles, curb extensions) narrowings (chokers, neckdowns, pinch-points, center island narrowing)	
5. Traffic Diversion	identification wayfinding	shared lane markings directional markings	arterial crossing improvements (high-visibility crosswalks, median islands, HAWK and standard signals) improve cyclist visibility (forward stop bars)	vertical speed control (speed humps/lumps/tables) horizontal speed control (chicanes, traffic circles, curb extensions) narrowings (chokers, neckdowns, pinch-points, center island narrowing)	Full and partial closures, diagonal diverters

4.2. Support Facilities

4.2.1 Intersection Improvements

Stakeholders and members of the public noted that it is often difficult to cross arterial streets on a bicycle. Improved technology should be considered with future intersection improvements in order to ensure that bicyclists have an adequate opportunity to cross the street.

This Plan recommends that the City consider the following intersection improvements at intersections that were identified through outreach as being difficult for bicyclists, shown in Table 4-3.

Table 4-3: Intersection Comments

Intersection	Comment
Bellevue and Barton	Improve signal timing
Tennessee and Pine/Orange	Heavy traffic heading to freeway
State and 5th	Slow down traffic
Fern and Church	Light does not allow adequate time to cross the intersection
Alabama and Lugonia	Very poor lane markings, issues with right turns
Garden and Elizabeth	Dangerous intersection- many roads coming together
Garden and Rossmont	Dangerous turn across high speed traffic traveling west
Cypress and Redlands Blvd	Light does not allow enough time for bikes to cross Redlands Blvd
Palm and Redlands Blvd	Light does not allow enough time for bikes to cross Redlands Blvd
Highland and Redlands Blvd	Light does not allow enough time for bikes to cross Redlands Blvd
Wabash and Sunset	Dangerous intersection for bikes. Additional signage recommended if this becomes a bike route for cars and bikes to stop there.
Alabama St by Citrus Plaza	Bike signal heads

Bike Boxes

A bike box is a traffic control device at a signalized intersection designed to improve bicyclists' visibility and in some cases, help position bicyclists for safer travel through the intersection, as shown in Figure 4-2. The bike box requires motorists to stop a short distance before the crosswalk, creating a space for bicyclists between the cars and crosswalk. Bike boxes increase the visibility and safety of bicyclists by positioning them in clear sight of cars and ahead of turning traffic to avoid "right-hook" crashes.

While these treatments are not in the California or National MUTCD, many communities use this treatment. Bike boxes are installed in San Francisco, Long Beach and West Hollywood as well as in Portland, New York, Cambridge, Austin, Seattle and Texas.

This Plan recommends the City consider the installation of bike boxes at intersections that are difficult for bicyclists.

Figure 4-2: Bike Boxes

Detection at Signals

Traffic signals control traffic by either using timers or actuation (detection). Bicycle detection at actuated traffic signals can provide a substantial improvement for bicycle access and mobility. California Assembly Bill 1581 requires all new and replacement actuated traffic signals to detect bicyclists. Caltrans Policy Directive 09-06 clarifies the requirements and permits loop and video detection.

This Plan recommends that the City install bicycle detection at all actuated intersections along existing and proposed bikeways. Additionally, the City should consider installing bicycle detection at all actuated intersections. Where loop detection is used, a pavement stencil of the bicycle detection marking should be used to show bicyclists where to position themselves.

Green Bike Lanes through Conflict Areas

Bicyclists are especially vulnerable at complex intersections that do not dedicate space or identify a recommended travel path. Intersections typically account for the majority of reported bicycle-auto crashes. Dedicated right-turn lanes often leave bicyclists unsure of proper positioning. Additionally, at complex intersections bicyclists may not know the recommended path of travel and motorists may not know where to expect bicyclists.

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.

This Plan recommends the City consider green lanes through conflict areas on roadways with bike lanes.

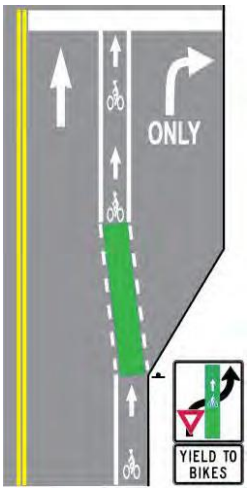


Figure 4-3: Example green lane through conflict area

4.2.2 Bicycle Parking

Lack of secure and convenient bicycle parking can deter bicycle travel. Bicyclists need parking options providing security against theft, vandalism and weather. Convenient, secure and free bicycle parking is also critically important for populations dependent on bicycling for transportation and who need to park bicycles overnight. Like automobile parking, bicycle parking is most effective when located close to trip destinations, is highly visible and provides convenient access. Bicycle parking serves an additional purpose of keeping public spaces orderly and clear of haphazardly parked bicycles. Where quality bicycle parking facilities are not provided, determined riders will lock their bicycles to street signs, utility poles or trees. This may interfere with pedestrian movements, damage street furniture and trees, or provide a false sense of security to cyclists locking to unsecured objects.

Conveniently located bicycle parking facilities provided in adequate quantities and quality will help reduce bicycle theft and minimize inappropriate parking, providing benefits to cyclists, pedestrians and motorists. Bicycle parking can be broadly defined as either short-term or long-term parking.

Short-Term Bicycle Parking

Short-term parking is meant to accommodate short-term visitors, customers, delivery persons and others expected to depart within two hours. Short-term parking is typically provided by bicycle racks. Bicycle racks should support the bicycle at two or more points and should provide a moderate level of security by allowing the bike's frame to be locked with a U-lock without lifting a wheel over the rack. Inverted U-racks offer a basic, simple and secure design for placement on sidewalks or areas where space is limited. U-racks are mounted parallel to the curb; bicycles are then locked parallel to the rack (with two bikes parked in opposing directions) providing an efficient use of space. Bicycle racks may be decorative and have a second use as public art. Another short-term bicycle parking is to convert a specific number of on-street vehicle parking spaces into a high-capacity "bike corral." One on-street parking space typically has capacity for up to ten bicycles. Corrals should be encouraged in areas with high bicycle traffic.

Additional bike racks should be provided at locations throughout the city, including parks, schools, shopping centers and Downtown. Racks that currently exist at parks and other public areas should be upgraded or replaced as needed. Racks may be updated to U-racks or lockers. The corral located at Stell Coffee should serve as a model for future corrals throughout the city. It is also recommended that the City create bicycle parking standards for all new developments.

Local businesses may be engaged in the installation of bicycle racks. The City may sell existing facilities to the businesses in an effort to make bicycle parking more consistent throughout the city. Racks near local businesses can be provided as part of an art solution. Community members and businesses can be given an opportunity to provide input on the appearance of the racks. The racks may be installed by the businesses themselves, or by the City for an additional charge.

Long-Term Bicycle Parking

Long-term parking is necessary for those expecting to leave their bike unattended for several hours or more. This parking should be provided in a secure, weather-protected manner and location. Long-term bicycle parking includes bicycle lockers, bicycle stations, or "bike huts," and serves people who intend to leave their bicycles for longer periods of time. Access to the unit is controlled via key fob or RFID card reader and can be set up for walk-up or subscriber service. Once inside, bicycles are mounted in vertical position and locked with a user supplied lock. Bike Huts are modular, resembling a typical bus stop shelter, and the base size has a holding capacity of 12 bikes. Additional four-foot modular panels can be added to increase capacity. The system includes wireless communication, video surveillance, security lighting and solar power. Size of a base model is approximately the size of one regular parking space. Bike huts can be a stand-alone unit or can become "mini-stations" when grouped with other amenities such as drinking fountain/water bottle filling station, mechanics stand, or other amenities. These high-volume parking amenities are typically found at transit stations, multifamily residential buildings and commercial buildings. These facilities provide a high level of security but are less convenient than bicycle racks.

Long-term bicycle parking facilities should be located in areas with high volumes of bicycles, including transit stations, shopping facilities, and Downtown. The implementation of Redlands Rail provides an opportunity to increase the number of people using bikes to get to transit.

4.2.3 Wayfinding

The citywide bicycle route system will need to be supplemented by a comprehensive wayfinding system. This system will allow cyclists the opportunity to select preferred routes to a variety of destinations. These signs may also include "distance to" information, which displays mileage to community destinations.

This Plan recommends installation of CA MUTCD wayfinding signs at decision points and confirmation signs that display destinations and mileage. Decision signs mark the junction of two or more bikeways. Decision signs are comprised of a Bicycle Route Guide Sign (D11-1) and a Destination Supplemental Sign (D1-1b). Decision signs are located on the near-side of intersections. They include destinations and their associated directional arrows, but not distances.

Confirmation signs confirm that a cyclist is on a designated bikeway. Each confirmation sign includes a Bicycle Route Guide Sign (D11-1) and a Destination Supplemental Sign (D1-1b). Confirmation signs are located mid-block or on the far-side of intersections. Confirmation signs include destinations and their associated distances, but not directional arrows.

Figure 4-5: Example Decision Wayfinding Signage

Figure 4-4: Example Confirmation Wayfinding Signage

Wayfinding signs may follow CA MUTCD standards, which use additional plaques that display destinations and mileage. The City would mount these plaques under existing bike route and lane signs. Alternatively, the City may decide to design guide-signs that exhibit a unique symbol of the community. These signs display a community's identity and support of bicyclists.

The City may add a graphic to the left of the "Bike Route" that symbolizes the community's unique character.

Sign Placement Principles

The following principles inform the placement of individual signs:

1. A confirmation sign will be located at the beginning of each bikeway.
2. When a bikeway turns, a turn sign will be located in advance of the turn (e.g. near-side of the intersection).

3. When bikeways intersect, a decision sign will be located on the near-side of each intersection approach.
4. To allow adequate notification of left turns, the decision or turn sign should be placed a distance before the intersection based on the number of lanes the bicyclist must merge across in order to make a legal left turn:
   a. Zero lane merge: 25'
   b. One lane merge: 100'
   c. Two lane merge: 200'
5. Confirmation signs will be located at intervals of one-half mile to one mile, based on the density of streets and intersecting bikeways. It is desirable for confirmation signs to be located following decision signs on the far-side of intersections at the first convenient location.
6. Confirmation signs should be located immediately following bikeway junctions on streets that do not have bicycle lanes or shared lane markings.

Sign Frequency

In general, there should be four to five wayfinding, two decision, and two confirmation signs for each directional mile of bikeway. The actual number of signs should be determined by the number of decision points along the signed route.

Supported Destinations

Bikeway wayfinding signage can be organized into three categories based on regional significance and travel distance:

1. Primary destinations include adjoining and/or en route jurisdictions and downtowns that are located at distances up to five miles.
2. Secondary destinations consist of transit stations and local shopping or residential districts that are located at distances up to two miles.
3. Tertiary destinations include parks, landmarks, colleges, high schools, hospitals and bikeways/trails.

4.2.4 Bicycle Stations

Bike Stations serve as one-stop bicycle service centers for bicycle commuters. They include 24-hour secure bicycle parking and may provide additional amenities such as a store to purchase items (helmets, raingear, tubes, patch kits, bike lights, and locks), bicycle repair facilities, showers and changing facilities, bicycle rentals, and information about biking. Some Bike Stations provide free bike parking, while others charge a fee or require membership.

Long Beach, CA Bike Station

Bike Stations have been installed in several cities in California, including Long Beach, San Francisco, Los Angeles, and Berkeley, as well as out of state cities of Chicago, and Seattle.

The following amenities should be considered for Bike Stations:

- Secure bicycle parking *
- Attended bicycle parking
- Bicycle rental establishment
- Accessory shop
- Bicycle repair station (self-repair stand with air source) *
- Bicycle repair shop
- Changing rooms
- Lockers *
- Shower facilities

* *basic facilities*

This Plan recommends that Bicycle Stations be built downtown, and at two future rail stations.

4.2.5 Maintenance Stations

Maintenance stations provide bicycle repair tools for bicyclists. While these tools would be available at Bike Stations as well, maintenance stations are smaller and can be implemented at more locations. This Plan recommends that the City implement maintenance stations with bicycle self-repair tools on Class I trails with high volumes of bicycle traffic, including the Santa Ana River Trail, the Orange Blossom Trail and the San Timoteo Creek Trail. Maintenance stations may also be put in parks and near schools.

4.3. Programs

Improvements to, and continued support of, education, enforcement and evaluation programs are critical to increasing the number of bicycle trips and safety. These programs can ensure that more residents know about new and improved facilities, learn the skills they need to integrate bicycling into their activities, and receive positive reinforcement about integrating bicycling into their daily lives. In essence, the new and enhanced programs market the idea of bicycling to local residents and ensure a shift to bicycling as a transportation option. This Plan supports the continuation and enhancement of the City's education, encouragement, and enforcement programs that are currently in place. The following additional programs are each designed to increase the rates of bicycling in the City, increase safety for those traveling by bicycle, and raise awareness of the benefits of bicycling. The City should use this section to consider the following programs for implementation.

4.3.1 Education

Education programs are designed to improve safety and awareness. Bicycle-related collision data shows that in addition to infrastructure improvements, education about riding on the right side of the road and how to properly ride in traffic may reduce bicycle-related collisions. This Plan recommends the implementation of the following education programs in Redlands.

Bicycle Safety and Share the Road Campaigns

Many of the bicycle safety and share the road campaigns described below are well-suited for implementation by a regional agency to coordinate efforts across multiple jurisdictions. A marketing campaign that highlights bicyclist and pedestrian safety is an important part of creating awareness of bicycling and walking. 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. A marketing campaign by a regional agency such as SANBAG can help reach a larger audience within the County. Support by cities can include concurrent promotion through social media, banners, and written media.

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 could be displayed near high-traffic corridors (e.g., on banners), printed in local publications, broadcast as radio and/or television ads and be available in Spanish and other languages.

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

Share the Road outreach is a way for cities to actively disseminate the rules of the road in person to residents. One way to conduct outreach is to conduct "checkpoints". Working with volunteers from a local advocacy group and the police department, officers could stop motorists and bicyclists to offer a brochure on the rules of the road as they pertain to motorists and bicyclists. An example of the Marin County Bicycle Coalition's Share the Road Checkpoints can be found at the link below.

http://www.marinbike.org/Campaigns/ShareTheRoad/ Index.shtml

Developed by the City of San Jose, StreetSmarts uses print media, radio spots and television spots to educate people about safe driving, bicycling and walking behavior. More information about StreetSmarts can be found at the link below.

http://www.getstreetsmarts.org/

Many other cities, counties, and states produce bicycle safety videos to educate riders and drivers. One such video from the Chicago Department of Transportation's Bicycle Program explains why cyclists should ride on the street rather than on the sidewalk. [10] A series of online videos from the City of Albuquerque, New Mexico, illustrates both the dangers of wrong-way cycling and how motorists should follow the City's 5-foot passing rule; [11] these were produced in both English and Spanish. One potential video that the City could produce is a guide for motorists on how to follow the recently adopted "Three Feet for Safety Act" in California, which requires that drivers provide at least 3 feet of clearance when overtaking and passing a bicycle that is traveling in the same

[10] *Chicago Dept. of Transportation - http://www.youtube.com/watch?v=aTZ1RtcH8_M*
[11] *City of Albuquerque, ShareTheRoadABQ.com - http://youtu.be/74-NecLRcNo, http://youtu.be/ZsxOuy67ch8, http://youtu.be/05s4XoROkdc, http://youtu.be/bE6QaKqC16Q*

direction.[12] The City of Roswell, Georgia, produced a similar video[13] to educate motorists about that state's 3-foot law. Other examples of "3 feet to pass" outreach campaigns include those by the City of Los Angeles,[14] Bicycle Colorado,[15] and bicycle advocates in Nevada's Lake Tahoe area.

Bicycle Resource Website

A common statement from bicyclists throughout Southern California is that they are unfamiliar with the rules and regulations regarding bicycling as well as the locations of effective bikeways and support facilities. The City of Redlands should work with local advocacy groups and coordinate a joint local and regional bicycle resource website dedicated to bicycling information and issues. The webpage should include:

- Bicycle parking map
- Map of bikeway implementation that is updated as new facilities are completed
- Bicycling tips including information on how to:
    - Carry items using baskets and panniers
    - Properly lock a bicycle
    - Ride in the rain with help from fenders and rain gear
    - Tips can also include information on the importance of bicycle lights and reflection
- Bikeway maintenance and repair phone number
- Bicycle event calendar
- Promotion of bicycle events
- Education and skill class information
- Laws and ordinances specific to bicycling
- Guidance on requesting new bike racks
- Information for tourists (bike rental, where to get a hard copy bikeways map)

Sample website: **http://www.bikelongbeach.org/**

Adult Bicycling Skills Classes

Community members can be given the opportunity to participate in bicycling skills classes. The most common program is the League of American Bicyclists courses (including Road I, Road II, and Commuting), taught by League Certified Instructors (LCIs). Courses cover bicycle safety checks, fixing a flat tire, on-bike skills, crash avoidance techniques, and traffic negotiation. This Plan recommends that the City invite LCIs to host adult bicycling skills classes in the City. The City may also highlight local or nearby courses on a bicycling website. The City could advertise the courses in multiple languages and use responses to the advertisement to determine the need for multi-lingual instruction. Coordinating classes with the County and adjacent cities may also help promote the event and minimize costs to the City of Redlands.

[12] *http://leginfo.ca.gov/pub/13-14/bill/asm/ab_1351-1400/ab_1371_bill_20130923_chaptered.htm*
[13] *http://www.bikeroswell.com/3-foot-law/*
[14] *http://ladotbikeblog.wordpress.com/2010/08/24/mayor-launches-give-me-3-campaign*
[15] *http://bicyclecolo.org/articles/bicycle-safety-law-tips-pg1028.htm*

In addition, the City can consider classes that are oriented toward and taught by women, in order to encourage more women to participate. Recent all-female trainings in Los Angeles County have attracted participants that may have felt intimidated taking classes among and taught by men. The women led training programs can provide a means to increase the number of women instructors to continue catering to women-only trainings.

Sample program:

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

Women on Bikes SoCal's all-female LCI trainings: http://bikeleague.org/content/first-all-female-lci-training-huge-success

Youth Bicycle Safety Education Classes

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 and/or taught as part of summer camp programs or at afterschool centers. 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. This Plan recommends the City pursue a Safe Routes to School Program that includes annual youth bicycle safety education classes.

Sample programs:

Marin County Safe Routes to School Curriculum:
http://www.saferoutestoschools.org/curriculum.html

Bicycle Transportation Alliance – Portland, OR: http://btaoregon.org/wp-content/uploads/2011/11/curriculum-BSE.pdf

Youth Bicycle Safety Clinics & Bicycle Campus

Children's bicycle safety clinics are individual events that help students develop basic bicycling techniques and safety skills through the use of a bicycle safety course. The clinics use playgrounds or parking lots set-up with stop signs, traffic cones, and other props to simulate the roadway environment. Students receive instruction on how to maneuver, observe signs and markings, and look for on-coming traffic before proceeding through intersections. Children's bicycle safety clinics also provide an opportunity for instructors to ensure children's helmets and bicycles are appropriately sized. Events can include free or low-cost helmet distribution and bike safety checks.

The City would work with elementary and middle schools, trained adult volunteers, local police, and the fire department to administer children's bicycle safety clinics. The clinics can be stand-alone events or can be incorporated into health fairs, back-to-school events, Bike to School days, and Safe Routes to School efforts.

The bicycle safety clinic can be temporary in nature, or can be located on a permanent basis at a location within the community, often referred to as a "bicycle campus." A bicycle campus is a permanent off-street learning area for people of all ages and abilities to become confident about their riding skills, and is sometimes known as a "safety village." The bicycle campus helps participants become familiar with a variety of bicycle-friendly design features and signage. These bicycle campuses are a resource for bicycle educators, schools, and other groups that wish to provide bicycle education. Local jurisdictions can utilize existing land, such as underused parking lots, to create a bicycle campus. The bicycle campus concept has been incorporated into public spaces throughout the United States with examples at fairgrounds, elementary schools, and parks.

Sample program: http://www.nhtsa.gov/Driving+Safety/Bicycles/CyclingSkillsClinic

Story about Santa Monica's Bike Campus: http://la.streetsblog.org/2012/04/20/santa-monica-opening-bike-campus-on-earth-day-sunday/

Senior Bicycle Education Classes

Senior bicycle education programs help older adults either re-learn bicycling or learn how to bicycle with less agility. Seniors who are no longer able to drive may still be able to bicycle shorter distances on either a regular two-wheeled bicycle or an adult tricycle. This Plan recommends the City collaborate with interested agencies, health departments and senior centers to evaluate interest and implement multi-lingual senior bicycle education classes, potentially including a program that acquires adult tricycles and brings them to senior centers for guided rides.

Sample program: http://www.portlandoregon.gov/transportation/article/155167

4.3.2 Encouragement

Encouragement programs focus on encouraging people to bicycle more frequently by providing incentives, recognition, or services that make bicycling a more convenient and viable transportation mode. Currently, Redlands residents benefit from education initiatives hosted by the Police Department and encouragement initiatives such as a bicycle kitchen and group rides. This Plan recommends the following programs that are designed to encourage community members of all ages and abilities to ride bicycles for transportation, recreation, and fun.

Bike Valet at City Events

Providing safe and secure bicycle parking helps encourage individuals to bicycle. Bicycle valet is similar to vehicle valet in that bicyclists drop their bikes off at a designated area to be guarded by event staff. In exchange for their bikes, bicyclists are given a number or token to provide on return so that bikes are not given to the incorrect person. San Francisco passed a city ordinance that requires all major city events to provide bike parking and pioneered an innovative tool for stacking hundreds of bicycles without racks. Temporary bicycle parking is appropriate for events with expected large attendance and at regularly occurring events like a farmers market.

Sample program: www.sfbike.org/?valet

Youth and Family-Oriented Bicycle Rides

Parents often have concerns or fears about their children riding bicycles in the roadway. Youth and family-oriented bicycle rides are large group rides geared toward kids that create safe, comfortable environments for families to ride together. This type of ride has commonly been referred to as a Kidical Mass ride. They are often hosted monthly or quarterly with a fun theme to encourage attendance. Rides do not require street closure, though the support of traffic officers is often necessary if the route includes uncontrolled, challenging crossings. Kidical Mass rides can include raffles or incentives to boost participation.

Sample programs:

- http://www.bikelongbeach.org/event/kidical-mass-10
- http://www.kidicalmass.org/about/

Bike Light Campaign

According to the California Vehicle Codes (CVC) for bicycling, a white headlight and reflectors are required by law if riding when it's dark (CVC 21201). Some jurisdictions (such as Redlands 'Lights for Life') have led visibility campaigns through law enforcement checkpoints and outreach activities. The usage of lights and reflectors at night may increase visibility and help reduce collisions.

We recommend the City encourage cyclists to wear high-visibility clothing and use daytime running lights during outreach events and in materials distributed related to bicycling. A campaign for increased visibility during nighttime is often held in the fall when daylight hours are reduced, and the program can have concurrent efforts such as banners, poster, and TV/radio advertisements.

Sample Programs:

- Get Lit Program, Portland: http://www.communitycyclingcenter.org/index.php/get-lit/
- Light Up the Night, San Francisco: http://www.sfbike.org/?lights

Bike Festivals & Family Bike Fest/Family Biking Day

Promoting bicycling through bike festivals can encourage people to want to give riding a try. Bike festivals often include booths by local organizations and agencies, exhibits, and food/beverage vendors. Long Beach, for example, hosts a free annual bike festival with live entertainment, bike valet, children's activities, and local food and beverages.

Similarly, a Family Bike Fest or Family Biking Day – such as those recently held in both Santa Monica and San Francisco – can be geared toward families and provide activities such as safety checks of children's bicycle seats or trailers, seminars on how to properly choose child bicycle frames and seats, helmet fitting stations, family bike demonstrations, bike and helmet decoration stations, and family rides that promote family bicycling for transportation and recreation. The program can also include:

- "Freedom from Training Wheels" workshop
- Bike rodeo
- How to carry kids by bicycle
- Adapted bicycles available for families to try
- Safety check
- Basic bike maintenance
- Group ride/parade

Development of family-oriented education may be a program for implementation by local bicycle advocacy groups where volunteers are readily available and willing to improve cycling conditions within the community.

Sample programs:

- http://downtownlongbeach.org/Latest-News-Detail/Bike-Fest-of-Long-Beach
- http://www01.smgov.net/bikesm/
- http://www.sfbike.org/?family_day

Launch Party for New Bikeways

When a new bikeway is built, some residents will become aware of it and use it, while others may not realize that they have improved bikeway options available. A launch party/campaign is a good way to inform residents about a new bikeway and can also be an opportunity to share other bicycling materials (such as maps and brochures) and answer resident questions about bicycling. It can 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. In Vancouver, when a new bikeway is built, the City 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 participated in project planning and implementation.

This Plan recommends the City host launch parties for all high priority projects recommended in this plan, as well as inform the public of all new bikeways through the bicycling website and other appropriate outreach methods.

Bicycle Friendly Community Designation

The League of American Bicyclists (LAB) recognizes communities that improve bicycling conditions through education, encouragement, enforcement and evaluation programs. Communities can achieve platinum, gold, silver, or bronze status or an honorary mention. Bicycle friendliness can indicate that a community is healthy and vibrant. Like good schools and attractive downtowns, bicycle friendliness can increase property values, spur business growth and increase tourism.

For more info: http://www.bikeleague.org/content/communities

Commuter Incentive Programs

A Commuter Incentive Program encourages people to commute by non-motorized transportation and to make the general public aware that bicycling and walking are practical modes of transportation.

Employers may consider promoting Bike Month (May) and Bike to Work Day. Bike to Work Day is typically the third Thursday in May. The Bay Area's traffic management organization, 511.org, organizes Bike to Work Day throughout the region. One of their most popular events are energizer stations, where volunteers set up a table with promotional items, coffee and snacks along popular bicycle commuting routes during the morning and afternoon commute hours. Businesses and organizations in Redlands may host Bike to Work events and promote biking to work during Bike Month.

San Luis Obispo (SLO) Regional Rideshare organizes the "Commute for Cash Challenge" every October as part of "Rideshare Month" in which commuters log the miles that they commute using alternative transportation for a chance to win prizes. This program could serve as a starting point for a more permanent commuter incentive program during the rest of the year.

Sample programs include:

- OCTA Share the Ride: http://www.octa.net/Share-the-Ride/
- SLO Council of Governments Regional Rideshare: http://rideshare.org/NewHome.aspx

Safe Routes to School Program

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 funded by a state or regional grant and facilitated by a coalition of city government, school and school district officials, and teachers, parents, students, and neighbors. A Safe Routes to School program typically would cover elementary and middle schools within the community. The City has received funding in the past and should continue to pursue grant funding to develop and implement a Safe Routes to School Plan that develops infrastructure recommendations to improve access to schools and non-infrastructure recommendations to educate and encourage walking and bicycling to schools. Creation of a local coalition is useful to provide continuity in Safe Routes to School efforts and ensure encouragement activities occur annually despite the transition of champions (typically parents) when children graduate to higher grades.

Sample program: http://www.alamedacountysr2s.org/

Bicycle Friendly Business Districts

Local businesses have the potential to encourage bicycling by providing their patrons that commute by bicycle with discounts and other amenities. Jurisdictions can work with businesses to

create “Bicycle Friendly Business” programs that honor businesses that support bicycling. Some programs assign a gold, silver, or bronze designation to businesses that apply for the program based on the level of benefits they provide bicyclists. The League of American Bicyclists has a Bicycle Friendly Business program as part of its Bicycle Friendly Communities designation, which is a good model to follow. The City of Long Beach’s program provides cargo bikes for businesses to make deliveries, and businesses provide shopping and dining discounts on Saturdays. This program could be implemented through the local Business Improvement Districts or Business Associations.

Sample programs:

- http://www.bikeleague.org/programs/bicyclefriendlyamerica/bicyclefriendlybusiness/about.php
- http://www.bikelongbeach.org/welcome/bike-share-program/bicycle-friendly-business-district-program

Bicycle Hubs

An effective way to encourage riding is by providing a hub with support facilities for cyclists. The facilities might include free maintenance equipment, air and water, maps of bikeways, and restroom facilities. Recently a gas station in the City of Fullerton installed maintenance equipment for bicyclist use and pumps specifically for bicycle tires, and a “fix-it” station was installed on the campus of California State University, Fullerton in Fall 2012. The City of Cambridge, for example, has free bicycle maintenance stations in several trip-generating locations. These stations include items such as tire gauges, pumps, and tools for small bicycle repairs. Bicycle maintenance stations are an inexpensive alternative to providing stand-alone bicycle repair shops. The City might consider housing or commercial development projects of certain size and use to provide facilities on-site as a method to encourage and support bicycling to and adjacent their business.

Sample programs:

- http://news.fullerton.edu/2012fa/Bike-Fixit-Stations.asp
- http://articles.latimes.com/2012/may/17/business/la-fi-autos-flex-fuel-20120517
- http://www.boston.com/yourtown/news/cambridge/2011/03/cambridge_installs_free_bike_m.html

Media Outlets

Local media have a high level of interest in stories related to public welfare, community successes and bicycle safety. There are many opportunities for local agencies to gain publicity for bicycle-related programs and safety issues. Developing and maintaining relationships with local media outlets can assist with publicizing bicycle encouragement and safety programs.

A cost-effective way for the City to promote bicycling as an effective and enjoyable way to travel is to use existing television public service announcements (PSAs) made available through the National Highway Traffic Safety Administration (NHTSA), Safe Kids Coalition, and the California

Office of Traffic Safety (OTS). These agencies provide existing award-winning television public service announcements on the following topics:

- Bicycle education for seniors
- Bicycle education for the general public
- Bicycle education for children and their families
- Driver education on bicyclists
- Drivers running red lights

The media is also an effective tool for promoting bicycle-related efforts through press releases and invitations to staged publicity-related events. Positive stories such as ribbon cuttings or community events can encourage residents to participate as well as increase awareness and support for on-going efforts.

Individualized Marketing Campaign

Building bicycling and walking infrastructure is essential to effecting mode shift, but it is not enough to attract large numbers of new users. The City of Portland, OR, was one of the pioneers of individualized marketing programs in the US. For a decade now, the City has selected a residential target area ranging between 20,000 and 37,000 households, and used a combination of direct mail outreach, customized travel information packets, incentive gifts, and themed guided walks and bicycle rides to engage residents and encourage them to drive less and walk/bicycle more. The program has consistently garnered over 20% participation, and resulted in approximately 10% reduction in drive-alone trips in the target area. More recently, similar projects in Alameda, CA, St. Paul, MN, and Cambridge, MA have used similar strategies to engage residents on active transportation and single occupancy vehicle reduction.

Bicycle Coordinator

To take full advantage of bicycle planning efforts, and to assist with implementation of the many projects and programs recommended in this plan and other local plans, the City may wish to consider filling this position full- or part-time.

- Reviewing development of proposals to ensure bike requirements are incorporated
- Developing and implementing educational and promotional programs
- Researching sources of funding and writing project proposals
- Conducting annual bicycling counts
- Serving as the City contact for bicycling inquiries and complains
- Coordinating with neighboring cities, the County, and other agencies to implement policies, programs and projects

Open Streets/Ciclovía Events

Open (or “Car-free”) Streets events have many names: Sunday Parkways, Ciclovías, Summer Streets, and Sunday Streets. The events are periodic street “openings” (i.e., “open” to users besides just cars; usually on Sundays) 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. Open Streets events 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. Events can be weekly events or one-time occasions, and are generally very popular and well attended.

Ideally, these events would provide access to civic, cultural, and/or commercial destinations. For future expansion of the program, organizers could consider lessons learned and best practices from other communities. Some recommendations include:

- Make sure that there are programmed, family-friendly activities along the route; an "open street" alone is not sufficient to draw participants (and especially not on a repeat basis).
- These events lend themselves to innovative partnerships and public/private funding. Health care providers whose mission includes facilitating physical activity are often major sponsors. Businesses may also support the event if it brings customers to their location.
- The cost of organizing the event can be mitigated through volunteer participation, as this type of event lends itself to enthusiastic volunteer support. However, this will require a high level and quality of volunteer recruitment and management to be sustainable in the long run.
- Police costs to manage the road closure will be one of the largest costs. Work with the police to develop a long-term traffic closure management strategy that uses police resources where needed but also allows well-trained volunteers to participate in managing road closures.

Sample programs include:

- CicLAvia, Los Angeles: http://www.ciclavia.org/about/
- Sunday Streets, San Francisco: http://sundaystreetssf.com/
- Summer Streets, New York City: http://www.nyc.gov/html/dot/summerstreets/html/home/home.shtml

The Open Streets Guide has further information: http://openstreetsproject.org/blog/2012/02/21/open-streets-project-releases-best-practices-guide/

Bicycle Tourism

To encourage visitors and tourists to consider bicycling in the City, bicycling-related resources could be incorporated into tourism information. The City's website could include a calendar specific to bicycling events and group rides such as the Emerald Necklace Scenic Tour, locations of bicycle rental and repair shops, and a map of the City's bikeways. For visitors who are already interested in bicycling in Redlands, bicycle rental businesses can distribute bicycle network maps or links to mobile maps and riding guidance upon renting. The website should include information about the Santa Ana River Trail, with a map of the entire facility throughout Southern California

as well as the completed sections within Redlands. The Redlands Bowl may post on their website information about bicycling to the event, as well as provide bicycle parking for attendees.

Bicycle Maps

In order to generate interest and encourage those who might not know about the City's bicycle routes to use the facilities, bicycle facility maps may be utilized. These should be available in hard copies and online, using the suggested informational website. Many people who do not bicycle are unaware of the facilities that are available to them. As the bicycle network is implemented, it would be beneficial to update the map and highlight new facilities.

Bike Sharing

Bike sharing is a system that allows users to check out bikes from publicly accessible stations and return them to other locations within the service area. Such systems have become increasingly popular throughout North America, with successful programs implemented in San Francisco (Bay Area Bike Share), New York City, Washington, D.C., Boston, Minneapolis, and Montreal. Locally, the City of Anaheim recently tested bike share, and OCTA and the City of Fullerton currently are demonstrating bike share through the Bike Link program with stations in the downtown and at the two colleges within the City. Future bike share programs are being planned for several cities across the country, including multiple cities within Los Angeles County, San Diego, and Seattle.

Sample programs:

- OCTA/Fullerton Bike Link: http://www.octa.net/Share-the-Ride/Bike/BikeShare/Overview/
- Bay Area Bike Share: https://bayareabikeshare.com/

4.3.3 Enforcement

Enforcement programs enforce legal and respectful use of the transportation network. The following outlines recommended enforcement programs to educate both bicyclists and motorists about the rules and responsibilities they have on the road.

Speed Radar Trailer/ Feedback Signs

Speed radar trailers help reduce traffic speeds and enforce speed limits in areas with speeding problems. Police set up an unmanned trailer that displays the speed of approaching motorists along with speed limit sign. Speed trailers may be effective on busier arterial roads without bikeway facilities or near schools with reported speeding.

Speed trailers work as both an educational and enforcement tool. By itself, the unmanned trailer educates motorists about their current speed in relation to the speed limit. Speed trailers can transport easily to streets where local residents complain about speeding problems.

The Redlands Police Department can station officers near the trailer to issue speeding citations when speeding continues to occur. It is recommended that City staff provide the management role for this program, working with the public to determine which locations are in most need. This

program can be administered randomly, cyclically, or as demand necessitates because of the speed trailers' portability.

Bicycle Patrol Units

On-bike officers are an excellent tool for community and neighborhood policing because they are more accessible to the public and able to mobilize in areas where patrol cars cannot. Bike officers undergo special training in bicycle safety and bicycle-related traffic laws and are therefore especially equipped to enforce laws pertaining to bicycling. This would not only enforce safe driving, but safe bicycling as well. Additional bicycle officers can help educate bicyclists and motorists through enforcement and also serve as excellent outreach personnel to the public at parades, street fairs, and other gatherings.

4.3.4 Evaluation and Policy

In order to track the progress of the Redlands Bicycle Master Plan, it is critical that the City monitor and evaluate changes in bicycling. It is also a useful way to communicate success with elected officials as well as local residents. Recommended methods to document the performance of new facilities and programs are presented below.

Bicycle Counts and Survey Program

Evaluation programs measure and evaluate the impact of projects, policies, and programs. Data collected through these efforts can serve as a baseline each year and would be a key part of an annual performance report. Typical evaluation programs range from a simple year over year comparison of US Census Journey to Work data to bicycle counts and community surveys. Bicycle counts and community surveys act as methods to evaluate not only the impacts of specific bikeway improvement projects but can also function as way to measure progress towards City goals such as increased bicycle travel for trips one mile or less.

This Plan recommends an annual bicycle-related community survey and an annual bicycle count program. The community survey will allow Redlands to be on the pulse of its bicycle environment, knowing the top concerns as generated by community input. Before/after counts provide invaluable evaluation information about bicycle activity corresponding with physical improvements to the bicycle environment.

Mapping Bikeway Investments

Often, residents and decision-makers do not have ready access to information about the construction and location of new bikeways. After completing this Plan, the City of Redlands could create a map reporting tool specifically to report on the progress of planned bikeway implementation. The map can be updated on an ongoing basis.

Sample program: http://www.bicyclela.org/maps_main.htm

Bicycle Report Card

The City could produce an annual report or 'report card' on bicycling. Annual reports developed from count and survey efforts can help the City measure its success toward the goals of this Plan as well as rate the overall quality or effectiveness of the ongoing efforts to increase bicycling in the City. In addition to bicycle counts, the City could include measurements such as crash rates (both on- and off-road), fatality and injury rates, and school bicycling mode share. The report card can summarize recent efforts and success in obtaining funding for additional improvements and programs.

Complete Streets Policy

A "complete street" is a roadway that has been designed to serve all users, including those in motor vehicles, on bicycles, on foot, or traveling by transit. Complete streets provide safety and mobility for the widest range of the population, including seniors, youth, and the disabled. Many communities around the U.S. have adopted Complete Streets Policies that call for roadway projects to result in complete streets.

According to the National Complete Streets Coalition (www.completestreets.org), an ideal policy would include the following elements:

- Includes a vision for how and why the community wants to complete its streets
- Specifies that 'all users' includes pedestrians, bicyclists and transit passengers of all ages and abilities, as well as trucks, buses and automobiles.
- 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.
- Encourages street connectivity and aims to create a comprehensive, integrated, connected network for all modes.
- Is adoptable by all agencies to cover all roads.
- Directs the use of the latest and best design criteria and guidelines while recognizing the need for flexibility in balancing user needs.
- Directs that complete streets solutions will complement the context of the community.

Redlands could use the Complete Streets Policy Workbook (see link below) to create a locally-appropriate Complete Streets policy. The Policy itself need not be cumbersome in its language; however, the real "teeth" associated with the Policy is the subsequent development of design guidelines and development code that will meet the goals established in the policy.

Complete Streets Policy Workbook:
http://www.smartgrowthamerica.org/documents/cs/resources/cs-policyworkbook.pdf

Sample Programs:

- City of San Clemente Complete Streets Policy: http://bit.ly/1cigoFg

- City of Baldwin Park Complete Streets Policy: www.smartgrowthamerica.org/documents/cs/policy/cs-ca-baldwinpark-policy.pdf

Bicycle Parking Policy and Enforcement

Lack of good or sufficient bicycle parking can make bicycling for transportation much more difficult. We recommend the City of Redlands include/update bicycle parking requirements in its development code to ensure they meet or exceed the guidelines put forth by the Association of Pedestrian and Bicycle Professionals' *Bicycle Parking Guidelines, 2nd Edition* (http://www.apbp.org/?page=publications). The code should require sufficient high-quality bicycle parking, installed correctly, based on land use classification.

Developer bicycle parking code requirements are only effective if they are enforced, however. If widespread violations occur without consequence, adequate bicycle parking will not be available to building users. Therefore, code enforcement practices might also be examined and updated if needed to ensure compliance before an occupancy permit is issued.

The City can also adopt a policy to encourage the installation of high-capacity "Bike Corrals" that can fit several bicycles in popular commercial districts. One possible arrangement is for the City to install the bike corrals at the request of businesses that agree to maintain and clean the corral area. The City of Los Angeles has received Federal funds to install bike racks on sidewalks through the "Request a Rack" program when requested by stakeholders.

Sample programs:

- San Francisco: http://www.sfbike.org/?access
- Los Angeles: http://ladotbikeblog.wordpress.com/bike-corrals/
- Los Angeles: http://www.bicyclela.org/RackRequest.htm

Bike Counters/Bicycle Barometers

U.S. cities are starting to install bike counters (sometimes called "bicycle barometers") at key locations with high bicycle use. These counters automatically log every bicycle trip and display it on a public-facing board. One benefit of bike counters is providing highly accurate count data to the City – data that is collected at all times of day and all times of year. Another benefit is providing data to the general public about actual bicycle usage, which is often much higher than drivers estimate. This can help counteract the impression that bikeway investments are benefitting only a few people. Bicycle barometers can be permanent or temporary in nature, and can be used to provide data to interested stakeholders about bicycle traffic. The County of Los Angeles recently purchased portable bike counters for collection of data for 7-day counts rotating throughout the county to evaluate current activity.

4.4. Maintenance

Maintenance issues that may appear minor to motorists, such as overhanging vegetation or debris in the side of the road, can pose safety hazards to pedestrians and bicyclists or make a route

inaccessible. The City should establish a maintenance schedule for bicycle and pedestrian infrastructure based on best practices, and make this schedule available to the community. While the City currently does maintenance on an as-needed basis, a schedule specific to bicycle and pedestrian infrastructure should be created.

Table 4-4 presents a suggested maintenance schedule.

Table 4-4: Maintenance Schedule

Item	Responsible Party	Frequency
Bicycle Facility Maintenance		
On-street pavement marking replacement	City	1-3 years
Clean drainage system	City	Annually
Pavement sweeping	City	Monthly
Pavement sealing and potholes	City	As needed, with citywide pavement resurfacing schedule
Tree Maintenance on bicycle routes	City	Annually
Pedestrian Facility Maintenance		
Sidewalks in non-residential areas: Cracking and ADA accessibility issues	Adjacent property owners	Ongoing
Sidewalks in residential areas: Cracking and ADA accessibility issues	City	Ongoing
Curb ramps: bring to ADA compliance during reconstruction, particularly where the ramp meets the roadway	City	Ongoing
Landscaping: Maintain 8 feet clear overhead	City	1-4 years
Multi-Use Path Maintenance		
Sign replacement/repair	City	1-3 years
Pavement marking replacement	City	1-3 years
Pavement sealing and potholes	City	5-15 years/30-40 for concrete
Sweeping	City	Monthly-Quarterly (weekly on major routes)
Irrigate/water plants	City	As required
Planted tree, shrub and grass trimming/fertilization	City	5 months-1 year
Maintain furniture	City	Annually

5. Implementation

This section outlines the prioritization methodology for bicycle recommendations in Redlands. The purpose of the ranking process is to create a prioritized list of projects for implementation. The project list and rankings are flexible concepts that serve as guidelines to the implementation process. The list may change over time due to changing bicycling patterns, implementation opportunities and constraints, and the development of other transportation system facilities.

5.1. Project Prioritization

Evaluation criteria are important for providing the City with a clearly-defined implementation "roadmap." Criteria were developed to evaluate specific projects against one another, and to ultimately prioritize recommendations to best meet Redlands' existing and future system needs. A list of the prioritized projects can be found in Appendix H.

Table 5: Project Prioritization Chart

Goal	Measurement	Data Input	Source	Tier 1	Tier 2	Tier 3
Increase the proportion of trips accomplished by biking and walking	Proximity to trip attractors	Schools, parks, transit stops, city services	Provided by City	Within ¼ mile of 5+ attractors	Within ½ mile of 5+ attractors	Not within ½ mile of 5+ attractors
	Proximity to trip generators	Housing density	ACS 5-year estimates	Within highest 2 sextiles	Within middle 2 sextiles	Within lowest 2 sextiles
	Connectivity	Existing bikeways	Provided by City	Within ¼ mile of bikeway	Within ½ mile bikeway	Not within ½ mile of bikeway
Increase the safety and mobility of non-motorized users	Crash data	Crashes involving bikes/peds	SWITRS	Within ¼ mile of 5+ crashes	Within ½ mile of 5+ crashes	Not within ½ mile of 5+ crashes
Advance the active transportation efforts of regional agencies to achieve GHG reduction goals	Low-stress facilities	Proposed bikeway facility types	Bicycle Master Plan	Project is a Class I multi-use path or bicycle boulevard	Project is a bike lane	Project is a Class III bikeway
Ensure that disadvantaged communities fully share in the benefits of the plan	Disadvantaged community	Household income	ACS 5-year estimates	80% less than statewide median	Between 80 and 100% of statewide median	Above statewide median
		Free & reduced lunch	CA Dept of Education	75%+ receive free/reduced meals	50%+ receive free/reduced meals	Less than 50% receive free/reduced meals

5.2. Cost Estimates

Planning-level cost estimates for each bicycle facility type, as well as the cost to implement the proposed network in Redlands, is displayed in Table 5-6. The costs in this table do not include right-of-way acquisition, if any.

Table 5-6: Planning-Level Cost Estimates for Bicycle Facilities

Facility	Unit Cost	Proposed Miles	Cost per Mile	Estimated Cost
Class I Bike Path	Paving, striping, and signage	33 miles	$800,000/mile	$26.4m
Class II & III Bikeways	Striping, and signage	148 miles	$35,000/mile	$5.2m
Totals				$31.6m

Although much of the maintenance required for on-street bikeways can be seamlessly incorporated into present roadway maintenance activities, there may be additional costs to ensure that facilities remain safe and accessible. Table 5-7 describes typical maintenance activities for the existing and proposed facility types recommended in this Plan and provides estimated annual maintenance costs. These costs can be an important consideration for municipal budgets because outside funding for capital improvements is generally more readily available than outside funding for maintenance.

Table 5-7: Recommended Annual Operation and Maintenance Cost Estimates

Facility Type	Unit Cost	Length (Miles)	Annual Cost	Notes
Class I Maintenance	$8,500 mile/year	33	$280,500	Lighting and removal of debris and vegetation overgrowth
Class II & III Maintenance	$2,000 mile/year	148	$296,000	Repainting lane stripes and stencils, sign replacement as needed
Annual Cost			***$576,500***	

5.3. Implementation Steps

Most recommended projects will require further exploration and analysis by the City before they can be implemented. While this Plan identifies recommended treatments for specific projects, all design level issues will be determined during project implementation by the City. Unanticipated opportunities and challenges may arise during the City's analysis, design and funding of each project, and as a result, the specific designs recommended in this Plan may change. Project implementation typically includes the following steps:

1. Preparation of a Feasibility Study involving a conceptual design (with consideration of possible alternatives and environmental issues), public input and cost estimate for individual projects as needed.

2. Securing, as necessary, outside funding and any applicable environmental approvals. Potential funding sources may be found in Chapter 6.
3. Additional public outreach including, not limited to, community meetings, newspaper and radio announcements.
4. Approval of the project by the Planning Commission and City Council, including the commitment by the latter to provide for any unfunded portions of project costs.
5. Completion of final plans, specifications and estimates, advertising for bids, receipt of bids and award of contract(s).
6. Project construction.

6. Funding

This chapter describes various sources of funding available to plan and construct bicycle and pedestrian facilities, including those related to school access and area improvement, as well as sources to provide education or encouragement programs.

Projects such as those described in this Plan can be funded through multiple sources, and not all sources apply to all projects. Many sources require a local funding match and most are competitive based on project merit and adherence to grant criteria.

This chapter covers federal, state, regional, local sources of funding, as well as some non-traditional funding sources that have been used by local agencies to fund bicycle, pedestrian, and safe routes to school infrastructure and programs.

To support City efforts to find outside funding sources to implement projects and programs, a summary by source type is provided below. Table 6-1 through Table 6-4 list these and other funding sources and summarize important funding source components, such as funding amount available, application deadlines, and local match requirement.

6.1. Federal and National Sources

Surface Transportation Program (STP)

The Surface Transportation Program (STP) provides states with flexible funds which may be used for a variety of highway, road, bridge, and transit projects. A wide variety of bicycle and pedestrian improvements are eligible, including on-street bicycle facilities, off-street trails, sidewalks, crosswalks, bicycle and pedestrian signals, parking, and other ancillary facilities. Modification of sidewalks to comply with the requirements of the Americans with Disabilities Act (ADA) is also an eligible activity. Unlike most highway projects, STP-funded bicycle and pedestrian facilities may be located on local and collector roads which are not part of the Federal-aid Highway System. Fifty percent of each state's STP funds are sub-allocated geographically by population. These funds are funneled through Caltrans to the MPOs in the state. The remaining 50% may be spent in any area of the state.

Highway Safety Improvement Program (HSIP)

MAP-21 doubles the amount of funding available through the Highway Safety Improvement Program (HSIP) relative to SAFETEA-LU. HSIP provides $2.4 billion nationally for projects and programs that help communities achieve significant reductions in traffic fatalities and serious injuries on all public roads, bikeways, and walkways. MAP-21 preserves the Railway-Highway Crossings Program within HSIP but discontinues the High-Risk Rural roads set-aside unless safety statistics demonstrate that fatalities are increasing on these roads. HSIP is a data-driven funding program and eligible projects must be identified through analysis of crash experience, crash potential, crash rate, or other similar metrics. Infrastructure and non-infrastructure projects are eligible for HSIP funds. Bicycle and pedestrian safety improvements, enforcement activities,

traffic calming projects, and crossing treatments for active transportation users in school zones are examples of eligible projects. All HSIP projects must be consistent with the state's Strategic Highway Safety Plan.

Last updated in 2006, the California SHSP is located here:
http://www.dot.ca.gov/hq/traffops/survey/SHSP/SHSP_Final_Draft_Print_Version.pdf

Pilot Transit-Oriented Development Planning

MAP-21 establishes a new pilot program to promote planning for Transit-Oriented Development. At the time of writing the details of this program are not fully clear, although the bill text states that the Secretary of Transportation may make grants available for the planning of projects that seek to "facilitate multimodal connectivity and accessibility," and "increase access to transit hubs for pedestrian and bicycle traffic."

Congestion Mitigation and Air Quality Improvement Program (CMAQ)

Congestion Mitigation and Air Quality Improvement funds are programmed by USDOT for projects that are likely to contribute to the attainment of a national ambient air quality standard, and provide congestion mitigation. These funds can be used for a variety of non-motorized transportation projects, particularly those that are developed primarily for transportation purposes. The funds can be used either for construction of bicycle transportation facilities and pedestrian walkways, or for non-construction projects related to safe bicycle and pedestrian use (maps, brochures, etc.). The projects must be tied to a plan adopted by the State of California and the Regional Government Agency.

Partnership for Sustainable Communities

Founded in 2009, the Partnership for Sustainable Communities is a joint project of the Environmental Protection Agency (EPA), the U.S. Department of Housing and Urban Development (HUD), and the U.S. Department of Transportation (USDOT). The partnership aims to "improve access to affordable housing, more transportation options, and lower transportation costs while protecting the environment in communities nationwide." The Partnership is based on five Livability Principles, one of which explicitly addresses the need for bicycle and pedestrian infrastructure ("Provide more transportation choices: Develop safe, reliable, and economical transportation choices to decrease household transportation costs, reduce our nation's dependence on foreign oil, improve air quality, reduce greenhouse gas emissions, and promote public health").

The Partnership is not a formal agency with a regular annual grant program. Nevertheless, it is an important effort that has already led to some new grant opportunities (including the TIGER grants). The City of Redlands should track Partnership communications and be prepared to respond proactively to announcements of new grant programs.

More information: http://www.epa.gov/smartgrowth/partnership/

Federal Transit Act

Section 25 of the 1964 Urban Mass Transportation Act states that: "For the purposes of this Act a project to provide access for bicycles to mass transportation facilities, to provide shelters and parking facilities for bicycles in and around mass transportation facilities, or to install racks or other equipment for transporting bicycles on mass transportation vehicles shall be deemed to be a construction project eligible for assistance under sections 3, 9 and 18 of this Act." The Federal share for such projects is 90 percent and the remaining 10 percent must come from sources other than Federal funds or fare box revenues. Typical funded projects have included bike lockers at transit stations and bike parking near major bus stops. To date, no projects to provide bikeways for quicker, safer or easier access to transit stations have been requested or funded.

Community Transformation Grants

Community Transformation Grants administered through the Center for Disease Control support community-level efforts to reduce chronic diseases such as heart disease, cancer, stroke, and diabetes. Active transportation infrastructure and programs that promote healthy lifestyles are a good fit for this program, particularly if the benefits of such improvements accrue to population groups experiencing the greatest burden of chronic disease.

More info: http://www.cdc.gov/communitytransformation/

Other Federal Bicycle and Pedestrian Infrastructure Funding Options

As part of the federal Recovery Act of 2009, States will receive $53.6 billion in state fiscal stabilization funding. States must use 18.2 percent of their funding – or $9.7 billion – for public safety and government services. An eligible activity under this section is to provide funding to K-12 schools and institutions of higher education to make repairs, modernize and make renovations to meet green building standards. The Leadership in Energy and Environmental Design (LEED) Green Building Rating System, developed by the U.S. Green Building Council (USGBC), addresses green standards for schools that include bicycle and pedestrian facilities and access to schools.

Another $5 billion is provided for the Energy Efficiency and Conservation Block Grant Program. This provides formula funding to cities, counties and states to undertake a range of energy efficiency activities. One eligible use of funding is for bicycle and pedestrian infrastructure.

More info: http://www2.ed.gov/policy/gen/leg/recovery/factsheet/stabilization-fund.html

http://www1.eere.energy.gov/wip/eecbg.html

6.2. State Sources

Active Transportation Program (ATP)

The Active Transportation Program, as discussed in this document, provides funding for construction, planning and design of facilities for pedestrians, bicyclists and other non-motorized

forms of transportation. The first round of funding provided over $200 million to jurisdictions throughout the state. The next call for projects is anticipated for Spring of 2015.

State Highway Account

Section 157.4 of the Streets and Highways Code requires Caltrans to set aside $360,000 for the construction of non-motorized facilities that will be used in conjunction with the State highway system. The Office of Bicycle Facilities also administers the State Highway Account fund. Funding is divided into different project categories. Minor B projects (less than $42,000) are funded by a lump sum allocation by the CTC and are used at the discretion of each Caltrans District office. Minor A projects (estimated to cost between $42,000 and $300,000) must be approved by the CTC. Major projects (more than $300,000) must be included in the State Transportation Improvement Program and approved by the CTC. Funded projects have included fencing and bicycle warning signs related to rail corridors.

Climate Ready Grant Program - California State Coastal Conservancy

Climate Ready grants are intended to encourage local governments and non-governmental organizations to advance planning and implementation of on-the-ground actions that reduce greenhouse gas emissions and lessen the impacts of climate change on California's coastal communities. The grant program makes eligible "development of multi-use trails with clearly identified GHG reduction goals; (and) protecting and managing open space lands with clearly identified GHG reduction goals." A total of $1,500,000 is available on a competitive basis, with a minimum award of $50,000 and a maximum of $200,000. The size of awarded grants will be based on each project's needs, its overall benefits, and the extent of competing demands for funds.

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. Bicycle 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.

6.3. Regional & Local Sources

Developer Impact Fees

As a condition for development approval, municipalities can require developers to provide certain infrastructure improvements, which can include bikeway projects. These projects have commonly provided Class 2 facilities for portions of on street, previously planned routes. They can also be used to provide bicycle parking or shower and locker facilities. The type of facility that should be required to be built by developers should reflect the greatest need for the particular project and its local area. Legal challenges to these types of fees have resulted in the requirement to illustrate a clear nexus between the particular project and the mandated improvement and cost.

New Construction

Future road widening and construction projects are one means of providing on street bicycle facilities. To ensure that roadway construction projects provide bike lanes where needed, it is important that the review process includes input pertaining to consistency with the proposed system. In addition, California's 2008 Complete Streets Act and Caltrans's Deputy Directive 64 require that the needs of all roadway users be considered during "all phases of state highway projects, from planning to construction to maintenance and repair."

More info: http://www.dot.ca.gov/hq/tpp/offices/ocp/complete_streets.html

Restoration

Cable TV and telephone companies sometimes need new cable routes within public rights of way. Recently, this has most commonly occurred during expansion of fiber optic networks. Since these projects require a significant amount of advance planning and disruption of curb lanes, it may be possible to request reimbursement for affected bicycle facilities to mitigate construction impacts. In cases where cable routes cross undeveloped areas, it may be possible to provide for new bikeway facilities following completion of the cable trenching, such as sharing the use of maintenance roads.

6.4. Private Sources

Private funding sources can be acquired by applying through the advocacy groups such as the League of American Bicyclists and the Bikes Belong Coalition. Most of the private funding comes from foundations wanting to enhance and improve bicycle facilities and advocacy. Grant applications will typically be through the advocacy groups as they leverage funding from federal, state and private sources. Below are several examples of private funding opportunities available.

Bikes Belong Grant Program

The Bikes Belong Coalition of bicycle suppliers and retailers has awarded $1.2 million and leveraged an additional $470 million since its inception in 1999. The program funds corridor improvements, mountain bike trails, BMX parks, trails, and park access. It is funded by the Bikes Belong Employee Pro Purchase Program.

More information: http://www.bikesbelong.org/grants/

Bank of America Charitable Foundation, Inc.

The Bank of America Charitable Foundation is one of the largest in the nation. The primary grants program is called Neighborhood Excellence, which seeks to identify critical issues in local communities. Another program that applies to greenways is the Community Development Programs, and specifically the Program Related Investments. This program targets low and moderate income communities and serves to encourage entrepreneurial business development.

More information: http://www.bankofamerica.com/foundation

Robert Wood Johnson Foundation

The Robert Wood Johnson Foundation was established as a national philanthropy in 1972 and today it is the largest U.S. foundation devoted to improving the health and health care of all Americans. Grant making is concentrated in four areas:

- To assure that all Americans have access to basic health care at a reasonable cost
- To improve care and support for people with chronic health conditions
- To promote healthy communities and lifestyles
- To reduce the personal, social and economic harm caused by substance abuse: tobacco, alcohol, and illicit drugs

More information: http://www.rwjf.org/applications/

Community Action for a Renewed Environment (CARE)

CARE is a competitive grant program that offers an innovative way for a community to organize and take action to re-duce toxic pollution in its local environment. Through CARE, a community creates a partnership 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 $90,000 and $275,000.

More information: http://www.epa.gov/care/

Corporate Donations

Corporate donations are often received in the form of liquid investments (i.e. cash, stock, bonds) and in the form of land. Employers recognize that creating places to bike and walk is one way to build community and attract a quality work force. Bicycling and outdoor recreation businesses often support local projects and programs. Municipalities typically create funds to facilitate and simplify a transaction from a corporation's donation to the given municipality. Donations are mainly received when a widely supported capital improvement program is implemented. Such donations can improve capital budgets and/or projects.

6.5. Other Sources

Local sales taxes, fees and permits may be implemented as new funding sources for bicycle projects. However, any of these potential sources would require a local election. Volunteer programs may be developed to substantially reduce the cost of implementing some routes, particularly multi use paths. For example, a local college design class may use such a multi-use route as a student project, working with a local landscape architectural or engineering firm. Work parties could be formed to help clear the right of way for the route. A local construction company may donate or discount services beyond what the volunteers can do. A challenge grant program with local businesses may be a good source of local funding, in which the businesses can "adopt" a route or segment of one to help construct and maintain it.

Table 6-1: Federal Funding Sources

FEDERAL SOURCES					
Grant Source	**Annual Total**	**Agency**	**Application Deadline**	**Match Required**	**Remarks**
Surface Transportation Program (STP)	$10 billion nationally	FHWA	Not available	Not available	A wide variety of bicycle and pedestrian improvements are eligible, including on-street bicycle facilities, off-street trails, sidewalks, crosswalks, bicycle and pedestrian signals, parking, and other ancillary facilities.
Highway Safety Improvement Program (HSIP)	$2.4 billion nationally; $75 million in California in 2011	FHWA/Caltrans	October	10%	Projects must address a safety issue and may include education and enforcement programs. This program includes the Railroad-Highway Crossings and High Risk Rural Roads programs.
Pilot Transit-Oriented Development Planning Program	$10 million nationally	Federal Transit Administration	Not available	Not available	Makes eligible planning efforts that seek to increase access to transit hubs for pedestrian and bicycle traffic.
Congestion Mitigation and Air Quality Improvement Program (CMAQ)	$445-467 million annually between FY2012 and FY2014 (California).	FHWA / Caltrans	Not available	20%	The amount of CMAQ funds depends on the state's population share and on the degree of air pollution.
Partnership for Sustainable Communities	$68 million nationally	HUD/DOT/EPA	Ongoing	20%	Funding for preparing or implementing regional plans for sustainable development.
Federal Transit Act	Not available	FTA	Not available	10%	Typical funded projects have included bike lockers at transit stations and bike parking near major bus stops. To date, no projects to provide bikeways for quicker, safer or easier access to transit stations have been requested or funded.
Rivers, Trails, and Conservation Assistance Program (RTCA)	Staff time is awarded for technical assistance	National Parks Service	August 1st for the following fiscal year	Not applicable	RTCA staff provides technical assistance to communities so they can conserve rivers, preserve open space, and develop trails and greenways.
Community Transformation Grants	$35 million in 2012 (California)	Centers for Disease Control and Prevention	N/A	N/A	Funds to implement broad, sustainable strategies that will reduce health disparities and expand preventive health care services.
Transportation Investment Generating Economic Recovery Program (TIGER)	$131 million through 2013 (California)	FHWA	October	20%	Can be used for innovative, multi-modal and multi-jurisdictional transportation projects that promise significant economic and environmental benefits to an entire metropolitan area, a region, or the nation. These include bicycle and pedestrian projects. Project minimum is $10 million.
Bus and Bus Facilities Program: State of Good Repair	$650 million in 2012	Federal Transit Administration	March	10%	Can be used for projects that provide access for bicycles to public transportation facilities, to provide shelters and parking facilities for bicycles in or around public transportation facilities, or to install equipment for transporting bicycles on public transportation vehicles.
Bus Livability	$125 million in 2012	Federal Transit	March	10%	Can be used for bicycle and pedestrian support facilities, such

FEDERAL SOURCES					
Grant Source	**Annual Total**	**Agency**	**Application Deadline**	**Match Required**	**Remarks**
Initiative		Administration			as bicycle parking, bike racks on buses, pedestrian amenities, and educational materials.

Table 6-2: State Funding Sources

STATE SOURCES					
Grant Source	**Annual Total**	**Agency**	**Application Deadline**	**Match Required**	**Remarks**
Active Transportation Program	Varies	Caltrans	May	None	Combines former BTA, State SR2S and Transportation Alternatives Program (TAP). Second call for projects anticipated for Spring 2015.
State Highway Account	$360,000	Caltrans	Not available	Not available	Dedicated set aside for construction of non-motorized facilities that will be used in conjunction with the State highway system.
Office of Traffic Safety Program (OTS)	Varies annually	Caltrans	January	None	Funds safety improvements to existing facilities, safety promotions including bicycle helmet giveaways and studies to improve traffic safety.
Community Based Transportation Planning Grants	$3 million, each project not to exceed $300,000	Caltrans	March/April	10%	Eligible projects that exemplify livable community concepts including enhancing bicycle and pedestrian access.
Petroleum Violation Escrow Account (PVEA)	Varies annually	Caltrans, California Community Services and Development Air Resources Board	March	None	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.
Environmental Justice: Context-Sensitive Planning	$3 million, each grant not to exceed $250,000	Caltrans	March/April	10% (up to one half of local match may be in-kind)	Funds projects that foster sustainable economies, encourage transit oriented and mixed use development, and expand transportation choices, including walking and biking. Projects can be design and education, as well as planning.
Environmental Enhancement and Mitigation Program (EEM)	$10 million; annual project average of $250,000	California Natural Resources Agency	September/October (sign up on website for notification)	None required, but favored	Funds may be used for land acquisition. Individual grants limited to $350,000.
State Gas Tax (local share)	Varies	Allocated by State Auditor-Controller	Varies	None	Major Projects, i.e., at least $300,000.
State Highway Operations and Protection Program (SHOPP)	$1.69 million statewide annually through FY 2013/14	Caltrans	Not Available	Not Available	Capital improvements and maintenance projects that relate to maintenance, safety and rehabilitation of state highways and bridges.

Table 6-3: Regional and Local Funding Sources

REGIONAL & LOCAL SOURCES					
Grant Source	**Annual Total**	**Agency**	**Application Deadline**	**Match Required**	**Remarks**
TDA Article 3 funds	Not available	SANBAG	Not applicable	50%	Provides grants to states and local agencies, individuals and nonprofit organizations for projects that incorporate urban design, historic preservation, planning, architecture, landscape architecture and other community improvement activities, including greenway development. Grants to organizations and agencies must be matched by a 50% local contribution. Agencies can receive up to $50,000.
Parking Meter Districts	Varies	City	Annual Budget	N/A	Parking Meter Districts can use parking meter revenues for streetscape improvements such as pedestrian facilities, landscaping & lighting.
Developer Fees or Exactions	Project-specific	Cities	Varies	None	Mitigation required during land use approval process.

Table 6-4: Private Funding Sources

PRIVATE SOURCES					
Grant Source	**Annual Total**	**Organization**	**Application Deadline**	**Match Required**	**Remarks**
Bikes Belong	$160,000 in 2012	Bikes Belong Coalition	Three times per year	50%	Bikes Belong provides grants for up to $10,000 with a 50% match that recipients may use towards paths, bridges and parks, as well as programs.
Bank of America Charitable Foundation	$200 million in 2012	Bank of America Charitable Foundation	May	N/A	Funds initiatives that drive economic development and contribute to the vitality and livability of communities.
Robert Wood Johnson Foundation	Varies	Robert Wood Johnson Foundation	Varies	N/A	One focus of the Foundation is “to promote healthy communities and lifestyles.” Most grants are in the $100,000 to $300,000 range, and run from one to three years.
Community Action for	Varies	US EPA	March	Not	Grant program to help community organize and take action to

PRIVATE SOURCES					
Grant Source	**Annual Total**	**Organization**	**Application Deadline**	**Match Required**	**Remarks**
a Renewed Environment (CARE)				Available	reduce toxic pollution in its local environment
SRAM Cycling Fund	$1.2 million nationally	SRAM	Ongoing	None	Bicycle organization that donates funds to Bikes Belong, Safe Routes to School, and other bicycle associations to enhance lobbying and advocacy efforts.
Surdna Foundation	Project-specific	Surdna Foundation	Ongoing	None	The Surdna Foundation makes grants to nonprofit organizations in the areas of environment, community revitalization, effective citizenry, the arts, and the nonprofit sector.
Kaiser Permanente Community Health Initiatives	$54 million nationally	Kaiser Permanente	Ongoing	None	Numerous programs to help with Healthy Initiatives, including the Healthy Eating Active Living (HEAL) initiative to address obesity.
Health Foundations	Varies	Various foundations	Ongoing	Varies	Focus pedestrian improvements for an obesity prevention strategy. Examples include California Wellness Foundation, Kaiser & California Endowment.
Donations	Varies	Depends on nature of project	Ongoing	Varies	Corporate or individual donations, sponsorships, merchandising or special events.
In-kind Services	Varies	Depends on nature of project	Ongoing	Varies	Donated labor & materials for facility construction or maintenance such as tree planting programs or trail construction.

Appendix A: Land Use Map

REDLANDS GENERAL PLAN

Adopted October 17, 1995 Resolution 5221

GP FIG. 4.1

Planning Area Boundary and City Limit

Planning Area Boundary

Part of Resource Preservation

Legend

- Rural Living — On Slopes under 15 percent: Up to 0.4 units per gross acre (2.5 gross acres per unit); On Slopes of 15 to 30 percent: Up to 0.2 units per gross acre (5 gross acres per unit)
- Very Low Density Residential — On Slopes under 15 percent: 0 to 2.7 units per gross acre; On Slopes of 15 to 30 percent: Up to 1 unit per 2.5 acres
- Low Density Residential — 0 to 6.0 units per gross acre
- Low Medium Density Residential — 0 to 8.0 units per gross acre
- Medium Density Residential — 0 to 15.0 units per gross acre, plus State-mandated density bonus where applicable
- High Density Residential — 0 to 27.0 units per gross acre
- Housing Conservation Element
- Office — "M" designates medical offices only
- Commercial — "N" designates Neighborhood Shopping
- Commercial/Industrial
- Light Industrial
- Public/Institutional
- Parks/Golf Courses
- Agriculture
- Flood Control/Construction Aggregates Conservation/Habitat Preservation
- Resource Conservation
- Resource Preservation
- Circles indicate proposed general location of use

- Freeway
- Major Arterial
- Minor Arterial
- Collector
- Linear Park
- Rail Corridor
- Major Arterial (Proposed)
- Minor Arterial (Proposed)
- Collector (Proposed)
- Scenic Drive (Proposed)
- Southeast Area Boundary
- Cemetary
- Airport
- CG City Grove
- E Elementary School
- HS High School
- JHS Junior High School
- NH Natural Habitat
- PO Post Office

N, W, E, S

General Plan Amendments Since October 1995 (GPA No.54)

File Number	Resolution or Ordinance Number	File Number	Resolution or Ordinance Number	File Number	Resolution or Ordinance Number
GPA No. 63	Res. 5396	GPA No. 80	Res. 5962	GPA No. 2009-3-A	Res. 6676
GPA No. 64	Res. 5410	GPA No. 82	Res. 5997	GPA No. 2010-1-A	Res. 6958
GPA No. 65	Res. 5732	GPA No. 83	Res. 6102	GPA No. 2010-3-A	Res. 6980
GPA No. 66(b)	Res. 5483	GPA No. 84	Res. 6068	GPA No. 129	Res. 7146
GPA No. 66(e)	Res. 5496	GPA No. 85	Res. 6069		
GPA No. 66(g)	Res. 5468	GPA No. 87	Res. 6070		
GPA No. 66(h)	Res. 5489	GPA No. 89	Res. 6149		
GPA No. 66(j)	Res. 5491	GPA No. 91	Res. 6151		
GPA No. 66(l)	Res. 5493	GPA No. 95	Res. 6220		
GPA No. 66(m)	Res. 5494	GPA No. 2004-1-C	Res. 4784		
GPA No. 67(c)	Res. 5563	GPA No. 2004-3-B GPA No. 2006-3-E	Res. 6316		
GPA No. 67(d)	Res. 5564	GPA No. 2005-1-C GPA No. 2006-1-C	Res. 6363		
GPA No. 67(e)	Res. 5565	GPA No. 2006-2-B	Res. 6391		
GPA No. 67(f)	Res. 5566	GPA No. 2005-3-A	Res. 6435		
GPA No. 68	Res. 5590	GPA No. 2006-1-A GPA No. 2006-1-C	Res. 6501		
GPA No. 71	Res. 5765	GPA No. 2006-2-1	Res. 6534		
GPA No. 73	Res. 5906	GPA No. 2006-3-1	Res. 6558		
GPA No. 74	Res. 5895	GPA No. 2007-1-1	Res. 6566		
GPA No. 77	Res. 5907	GPA No. 2007-2-A-E	Res. 6620		
GPA No. 78	Res. 5896	GPA No. 2009-1-A	Res. 6790		
GPA No. 79	Res. 6022	GPA No. 2009-2-A	Res. 6872		

0 750 1,500 3,000 4,500 6,000 Feet

City of REDLANDS "A CITY THAT WORKS"

Source: City of Redlands, ESRI, County of San Bernardino

Map Created: April 5, 2013

Planning Area Boundary and City Limit

Appendix B: Existing Bicycle Network

Existing Bike Trails

Legend

Code

- Class I
- Class II
- Class II - Green Paint
- Class III

This map was produced by the City of Redlands, Geographic Information System.
The City of Redlands assumes no warranty or legal responsibility for the information contained on this map.
The data used to generate this map is dynamic in nature, therefore the information shown may or may not be the most current.

North

Scale

0 920 1,840 2,760

Feet

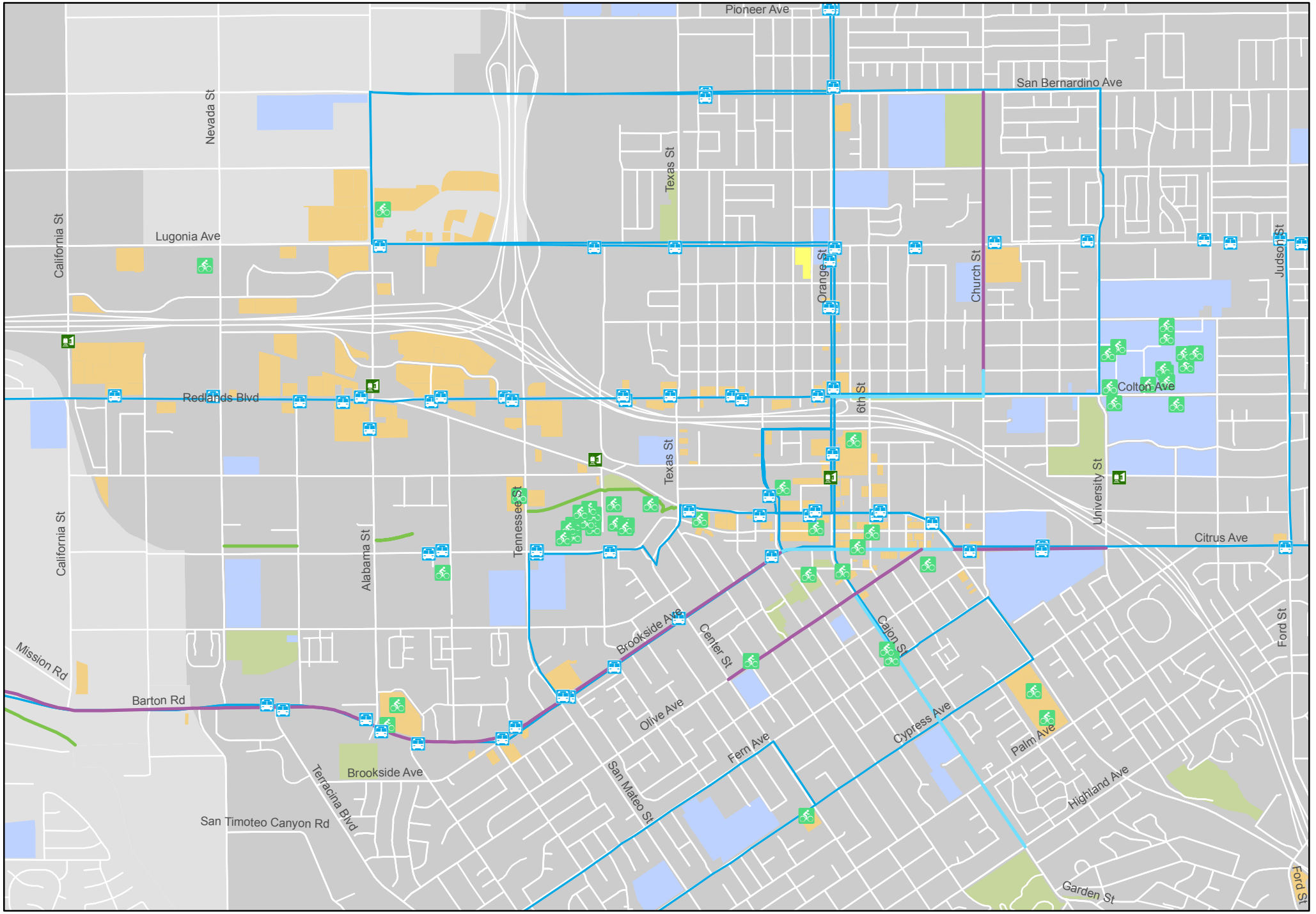
City of Redlands
Department of Innovation & Technology
Geographic Information Systems

City of REDLANDS "A City That Works"

May 6, 2014

wo1197ExistingBikeTrails_May_2014.mxd

Appendix C: Existing Bicycle Parking



Existing Bicycle Parking

Future_Rail_Stops
Bus_Stops
BicycleRacks
Schools
Retail
Community Center
County
City of Redlands

Existing Bike Facilities
Class I
Class II
Class III

Streets

0 0.3 0.6 Miles

Data obtained from:
City of Redlands
Map created May, 2014

Appendix D: Online Map Outreach Results

The following table contains comments from the online outreach exercise. These comments were narrowed down to those that had specific recommendations able to be re-created in a map. The numbers column on the far left corresponds to the map located after this table.

#	Facility	Comment	Type
1	Not specified	Olive Avenue between Citrus Ave and Center St works well for both motor vehicles and bicycles. Continuing this layout from Center St to Terracina Bl would work well.	Corridor
2	Sunset Sharrows	Sunset is one of the premier cycling routes in Redlands. It is narrow but can be ridden in a safe manner. Most drivers are courteous and careful. But sharrows would be a great idea and enhance the notification	Corridor
3	Park	Might as well run them all the way from California St. to at least Tennessee St. and sharrows after that.	Corridor
4	6th Street	I agree--please add a bike route to 6th street--it's less traveled and would be much safer with a dedicated bike lane.	Corridor
5	Brockton	A through route for bikes/peds* only, not for cars. Cars would no longer be able to driver the entire length of Brockton.	Corridor
6	Fern	The short section of Fern between Terracina and San Timoteo Cyn Rd is extremely hazardous for cyclists. The road needs to be widened or a separate bike path constructed.	Corridor
7	Redlands Blvd	Do away with one traffic lane and make it a system of opposing one-way 'bike boulevards' for cars that riders could use in either direction. Traffic would only be able to travel east from Orange to 5th St. and only west from 6th to 5th	Corridor
8	I-10	In the absence of or until this gets developed, Caltrans needs to allow bicycles to use use I-10 from at least Wabash to Yucaipa Blvd.	Corridor
9	Sunset	So many people bike & walk/jog up on Sunset Dr. It would be great (and MUCH SAFER!) if there was a bike lane that ran the length of this scenic historic street!	Corridor
10	Lugonia	Dirt sidewalks and atrocious road widths need improvement in the worst way.	Corridor
11	Creekside to Oakmont Connector Trail	A natural surface connector trail from Creekside Trail / San Timoteo Nature Sanctuary to Oakmont Park would be a fantastic addition to the Emerald Necklace network.	Corridor
12	Deer Trail	This Historic Natural Surface Trail would serve as a great hiking/mountain biking connector between the San Timoteo Nature Sanctuary and Carolyn Park, please work with the property owners to develop dedicated access.	Corridor

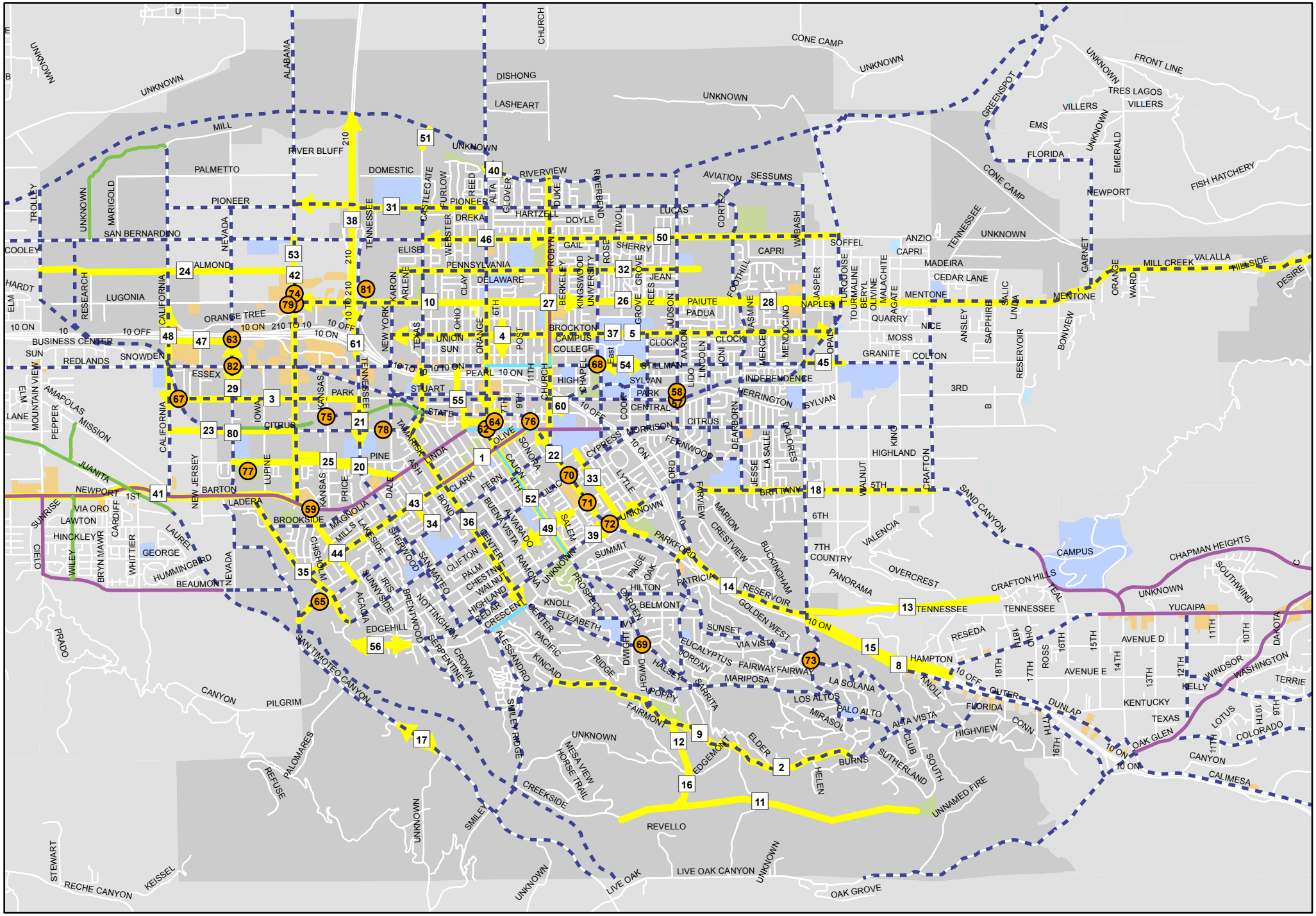
#	Facility	Comment	Type
13	Wabash to Crafton Hills Connector Trail	A natural surface trail along the wildlife corridor from the Wabash overpass to Crafton Hills would be a fantastic part of the Emerald Necklace Trails and Open Space network.	Corridor
14	Golden West Class I Trail	Building a Class 1 and Natural Surface trail beneath the powerlines here extending from Redlands Blvd to Wabash overpass would be a nice option and would connect Ford Park with Crystal Springs.	Corridor
15	Silver Springs Historic Trail	Building a Class 1 + natural surface Trail here would provide an invaluable link from Redlands to Yucaipa without having to climb Wabash. It is historic, beautiful, and already exists, just work with the property owner for formal access.	Corridor
16	Allessandro Trail	Making a natural surface or Class 1 trail from Sunset to Creekside would greatly improve the safety of those walking and biking to access San Tim Nature Sanctuary.	Corridor
17	San Timoteo bike lane/shoulder improvements	Paving the gravel shoulders which are already there would be a great help for cyclists/bike commuters when riding solo. Also, until that is done, replace the "share the road" sign with a sign reading "Cyclists Use Full Lane".	Corridor
18	Class II bike lanes on 5th to Sand Canyon	Why was this not done during all that repaving? Please add ASAP this road has poor sight lines with the rollers.	Corridor
19	Orange Avenue Bike Blvd	There probably is no room for a bike lane or cycletrack due to proximity to the creek, but maybe some traffic calming elements between Kansas and Tennessee Streets could be used to create a 'bike boulevard' experience to discourage heavy traffic	Corridor
20	Creek Trail	Beautiful creek going from Brookside to at least Alabama. Would be a fantastic multi-use trail!	Corridor
21	Tennessee/San Mateo St. road diet	Tennessee is in desperate need of a road diet. I don't know if it could be done, but a dedicated and buffered bike lane in both direction would let a lot of families allow their kids to ride bikes along here.	Corridor
22	Redlands Blvd	Redlands Blvd needs help	Corridor
23	W. Citrus Ave	Cycle track great, bike lanes good. Starting at California and continuing east.	Corridor
24	Almond Ave painted bike lane	Connecting the Orange Blossom Trail directly with Citrus Plaza.	Corridor
25	Orange Ave bike lane	Bike lanes on Orange Ave from Nevada to Tennessee, and repave Orange Ave by Heritage Park	Corridor
26	Lugonia Ave bike lanes	Bike lanes on Lugonia Ave, both directions, from Orange to Bryant St/Ranger Station	Corridor

#	Facility	Comment	Type
27	Church Street Connector	Church Street should be developed to provide a premier bikeway connecting the north side of town and the River Trail directly to downtown.	Corridor
28	CA-38 parallel path	Pursuant to CA Streets & Highways Code 887.8(b), any expansion of CA-38 requires that it include a parallel path for non-motorized travel.	Corridor
29	North / South bike arterial	One of the few roads that allows an easy way to cross the freeway. The road surface on Nevada between Industrial and Redlands Blvd is in desperate need of repair. The Postal Service trucks have destroyed the tarmac.	Corridor
30	State St. @ Redlands Mall	Reconnect State St. as a through route for bicycles and pedestrians only.	Corridor
31	Pioneer by the high school	This area is extremely narrow with no sidewalks--the streets need to be widened to allow for bike lanes and sidewalks, particularly because the high school is there.	Corridor
32	Pennsylvania Greenway	Develop Pennsylvania Avenue as a bike boulevard/neighborhood greenway that allows bikes/peds to travel the entire length but uses traffic calming to keep speeds low	Corridor
33	Roosevelt Greenway	Another good candidate for a bike blvd. Connects park and school along with running parallel to a major arterial.	Corridor
34	Nanette Bike Blvd	This road is perectly set up for an easy transition to a bike Blvd. Just widen path to accommodate bikes	Corridor
35	Terracina Protected bikeway	Terracina is overly wide and very few driveways. Good candidate for a cycletrack, parking protected.	Corridor
36	Center St (southbound)	This road has a history of collisions and unsafe speeds. The roadway needs to be shrunk using a cycletrack with parking protection. Also the left hand turn onto the short section heading to Esri is a free for all.	Corridor
37	Brockton Bike Boulevard Brockton Bike Blvd	Develop Brockton as a 'bike boulevard' with traffic diverters at major streets to make it a through route for cars only.	Corridor
38	CA-210	Pursuant to CA Streets & Highways Code 887.8(b), any expansion of CA-210 requires that it include a parallel path for non-motorized travel.	Corridor
39	Highland Greenway	'Bike boulevard' with reduced traffic volume and calmed to allow a stress-free connection to the park and across the freeway.	Corridor
40	Connector Riverview to Orange via Israel Beal Park	The park provides a great opportunity for enhanced filtered permeability by providing connection between Riverview Dr. and the bikewyays on Orange St. via the Israel Beal Park.	Corridor

#	Facility	Comment	Type
41	Barton Rd between Brookside Ave and City limits	Protected bike lanes are great as long as they are appropriately maintained. Barton Road between Brookside Ave and the city limits needs some attention.	Corridor
42	Alabama St	This street is a mess already, and could really use a road diet. Definitely in need of bike lanes (and sidewalks!)	Corridor
43	Olive Ave	Road diet, bike lane	Corridor
44	Bellevue Ave	The street is overbuilt and is extremely wide with no markings. Many people driving 40+mph up and down the street, completely disregarding the stop signs. This is a highly used bike route for many, including children during school.	Corridor
45	Orange Blossom Trail-REVH Connector	A cycletrack (on each side of the road) connecting the Orange Blossom Trail with Redlands East Valley High is needed. A cycletrack (on each side of the road) connecting the Orange Blossom Trail with Redlands East Valley High is needed.	Corridor
46	San Bernardino Ave. near CVHS	Children use this stretch of road to travel to and from school, yet it doesn't even have sidewalks. Those are needed along with cycletracks.	Corridor
47	Rail w/ Trail	A trail running alongside the Redlands Rail tracks would provide a great connection between Nevada and California Streets and better access to/from New Jersey St.	Corridor
48	California St.	Any plans to widen California St. need to include a cycletrack as part of the project.	Corridor
49	Palm Ave route	Palm cuts across town as much as Higland and Cypress. Palm could end up lonely and inadequate. It's only fair.	Corridor
50	San Bernardino Ave. from Mtn. View to Orange St	A cycletrack on San Bernardino Ave. would be welcomed from Mt. View to at least Orange St.	Corridor
51	Texas St. Connector	Link from SART to Texas St to access town from trail, developing Texas as more of a bike blvd and route from Citrus Valley High via SART	Corridor
52	Orange St. N-S Connector	A Class I (or substantially equivalent) connector to provide a passage between Highland and Redlands, especially for students of Citrus Valley High School. Also needs to provide enhanced access to the Santa Ana River Trail.	Corridor
53	Alabama St. N-S Connector	A Class I (or substantially similar) path on at least one side of Alabama St. That provides an important link to San Bernardino/Highland and also provides a seamless connection with the Santa Ana River Trail.	Corridor

#	Facility	Comment	Type
54	Colton Ave. @ UofR	Reconfigure Colton Ave. to be local access only or a 'bike boulevard' and discourage through traffic from driving through campus.	Corridor
55	Eureka Bikeway	Close the underpass to motor vehicles and develop the rest of Eureka from I-10 to Citrus/RHS as a 'bike boulevard'.	Corridor
56	Smiley Heights	A bike lane along Smiley Heights Dr would be nice.	Corridor
57	Orange Blossom Trail Crossing Judson St	Some sort of protected crossing needs to be installed at the crossing of the Orange Blossom Trail at Judson Street. My suggestion would be flashing lights	Crossing
58	Judson Bike Lane railroad crossing	Bike Lane newly established on Judson has a dangerous, unlevel crossing over old unused railroad tracks South of Sylvan Blvd in both North and South directions.	Crossing
59	Bellevue and Barton	Not safe for bicyclists, adjust green light timing for Bellevue, video detection would improve detection of cyclists stopped on Bellevue	Crossing
60	OBT extension to RHS Stadium	Work with RHS to create a Class 1 Bike link to the RHS stadium. There is room behind the district Facilities Yard that connects directly to the North parking lot which then connects to the stadium.	
61	Tennessee St I-10 Overpass	Dangerous, create separated path going over the freeway	Crossing
62	West side of Citrus at Orange, eastbound	When bicycling straight through the intersection, there is no separation from traffic turning right onto Orange, and no indication to the bicyclist whether to wait all the way over to the right, or else between two lanes of traffic.	Crossing
63	Railroad crossing on Nevada at Industrial	This crossing needs improvement. The pavement is poor and the crossing should be widened, especially in light of all the Postal Service trucks that use this road.	Crossing
64	State and 5th Parking	Can we use this space for a bike friendly rack? Not like the one in front of WFB that damages wheels.	Bicycle Parking
65	Fern behind Redlands Community Hospital	This is really narrow and curvy--signs/sharrows would be appropriate here.	Signage
66	Alabama and Lugonia SE corner	Simply re-striping the S.E. corner of Alabama & Lugonia with a right turn only lane, a bike lane, a straight lane would do wonders for cyclist safety at this intersection. But if you wanted to design a protected bike lane I wouldn't complain.	Crossing
67	Orange Blossom Trail at W. Park Ave	Design the intersection in such a way that the Trail is able to continue without having to stop.	Crossing
68	Colton at University	Roundabout with cycletrack adjoined to the perimeter.	Crossing

#	Facility	Comment	Type
69	Garden and Elizabeth	Dangerous intersection - many roads coming together. Dangerous intersection - many roads coming together.	Crossing
70	Cypress and Redlands Blvd	Light does not allow enough time for bikes to cross Redlands Blvd	Crossing
71	Palm and Redlands Blvd	Light does not allow enough time for bikes to cross Redlands Blvd	Crossing
72	Highland and Redlands Blvd	Light does not allow enough time for bikes to cross Redlands Blvd	Crossing
73	Wabash and Sunset	Dangerous intersection for bikes, additional signage recommended if this becomes a route	Crossing
74	Alabama St by Citrus Plaza	Bike signal heads	Crossing
75	Orange Blossom Trail at Kansas St	Provide a seamless connection between Kansas St. and the Orange Blossom Trail so that Trail users face minimal stops and access to it by riders on Kansas is easy and intuitive. Another comment mentioned a bike/ped bridge.	Crossing
76	Redlands Blvd and State St	Bike/ped improvements are desperately needed at this intersection. At the very least, a median refuge island. Also, 10th st. should end at State St. and close off the no-man's land in front of the church to traffic going through.	Crossing
77	Heritage Park bike racks	Add several bike racks around the park	Bicycle Parking
78	State Street bike parking	Bicycle parking on State St. is almost non-existent. There are a token few down towards the WFB, but they are wheel eaters. How about asking cyclists what kind of bike rack to use instead of some clerk ordering from a catalog?	Bicycle Parking
79	Citrus Plaza bike parking	Ther needs to be far more visible bike parking at Citrus Plaza. A "bike corral" in the food court area near Barnes and Noble would be good as well.	Bicycle Parking
80	Grove School access	A protected bikeway connecting The Grove school with the Orange Blossom Trail along Nevada St.	
81	Redlands Crossing bike parking	This development needs to include 'bike corrals' at several key areas within the project that are close to the entrances of all stores and restaurants.	Bicycle Parking
82	New York St	I agree, I think New York or Nevada would be good	
83	Brookside Ave	continue the green-lanes and green-boxes to the end of town. the loma linda-redlands route is heavily travelled.	Painted lanes/bike boxes



Redlands Outreach Results

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0 0.75 1.5 Miles

Comment Type

- Corridor Comment
- Corridor Comment- limits not specified
- Point Comment

Bikeways

- Class I
- Class II
- Class II - Green Paint
- Class III
- Planned

Land Uses

- Schools
- Retail
- Community Center
- County
- City of Redlands

Data obtained from:
City of Redlands
Map created October, 2014

Appendix E: Bicycle and Pedestrian Collisions

Bicycle-Involved Collision Locations

Intersection	Number of Collisions
5th St And Citrus Av	1
5th St And Redlands Bl	1
6th St And Citrus Av	1
6th St And Redlands Bl	1
6th St And The Terrace	1
8Th St And Redlands Bl	1
Alabama St And Barton Rd	1
Alabama St And Industrial Park Av	2
Alabama St And Redlands Bl	1
Alessandro Rd And La Hermosa	1
Alta Vista Dr And Highview Av	1
Alta Vista Dr And South Av	2
Barton Rd And Kansas St	1
Barton Rd And Nevada	1
Barton Rd And Terracina	1
Brockton Av And Church St	3
Brockton Av And Grove St	1
Brockton Av And Oxford St	1
Brockton Av And Tribune St	1
Brookside Av And Bellevue Av	1
Brookside Av And Center St	1
Brookside Av And Hastings St	1
Brookside Dr And Eureka St	1
Cajon St And Cypress Av	1
Cajon St And Summit Av	1
California St And Park Av	1
Cambridge Av And Lincoln Av	1
Carlotta Ct And Texas St	1
Center St And Highland Av	1
Center St And Olive St	1
Central Av And Church St	1
Central Av And Grove St	1
Church St And Colton Av	1
Citrus Av And Central Av	1
Citrus Av And Eureka St	2
Citrus Av And Judson Av	1
Citrus Av And Judson St	4

Intersection	Number of Collisions
Citrus Av And Lincoln St	2
Citrus Av And Wabash Av	1
Clark St And Myrtle St	1
Clifton Av And S San Mateo St	1
College Av And Occidental Dr	1
Colton Av And 6th St	1
Colton Av And Division St	1
Colton Av And Lincoln Av	1
Colton Av And New York St	1
Colton Av And Orange St	3
Colton Av And Tri City Ctr	2
Colton Av And Tribune St	1
Cornell Av And Edwards St	1
Cypress Av And Rt 10	1
E Citrus Av And E Redlands Bl	1
E Citrus Av And Wabash St	1
E Lugonia Av And Church St	1
E Redlands Blvd And State St	1
Eureka St And Pearl Av	1
Fern Av And Lakeside Av	1
Fern Av And Redlands Bl	1
Fern Av And Terracina Bl	1
Ford St And Patricia Dr	1
Garden Dr And Canyon	1
Garden St And Franklin Av	1
Grove St And Sylvan Bl	1
Highland Av And Center St	1
Judson St And Laramie St	1
Kansas St And Parker Ct	1
Lugonia Av And Church St	1
Lugonia Av And Grove St	1
Lugonia Av And Judson St	1
Lugonia Av And Texas St	2
Lugonia Av And University Av	1
Lugonia Av And University St	1
Lugonia Av And Wabash St	1
Mariposa Dr And Dwight	1

Intersection	Number of Collisions
N Orange St And Lugonia Av	1
North Dearborn St And San Bernardino Av	1
Olive Av And Center St	1
Olive Av And Citrus Av	1
Olive Av And Eureka St	1
Olive Av And Parkwood Dr	1
Orange St And Colton Av	1
Orange St And Pearl	1
Orange St And Pioneer Av	1
Park Av And Alabama St	1
Pennsylvania Av And Columbia St	1
Pennsylvania Av And Kingswood Dr	1
Pennsylvania Av And Washington St	1
Pioneer Av And Webster St	1
Powell Dr And Laramie St	1
Redlands Bl And 5Th St	1
Redlands Bl And 6Th St	1
Redlands Bl And Alabama St	1
Redlands Bl And California St	1
Redlands Bl And Citrus Av	1
Redlands Bl And Clark St	1
Redlands Bl And Fern Av	1
Redlands Bl And Iowa Av	1
Redlands Bl And Kansas St	1
Redlands Bl And Palm Av	1
Rt 10 And 6th St	1
Rt 38 And University St	1
S Center St And Fern	1
San Bernardino Av And California St	2
San Bernardino Av And Church St	1
San Bernardino Av And Orange St	1
San Timoteo Canyon Rd And Fern St	1
State St And Eureka St	1
Stewart St And 6th St	1
Sun Av And Calhoun St	1
Sunset Dr And Palo Alto	1
Sunset Dr And Valle Vista Dr	1
Sylvan Bl And Grove St	1
Sylvan Bl And University St	1
Tennessee St And Park Av	1
Tennessee St And Pine Av	1
Terracina Bl And Barton Rd	1
Terracina Bl And Olive Av	1
Texas St And Colton Av	1
Texas St And Stuart Av	1
University St And Campus Av	1
University St And Citrus Av	2
University St And Lugonia Av	1
W Lugonia Av And Church St	1
W Redlands Bl And Nevada St	1
W Sun Av And Orange St	1
W Sunset Dr And Crown St	1
Wabash Av And Brockton St	1
Wabash Av And Somerset Ln	1
Walnut Av And Ramona Dr	1
West Highland Av And W Highland Av 38	1
West Redlands Bl And New Jersey St	1
West Sunset Dr And Mariposa Dr	1
Total	**147**

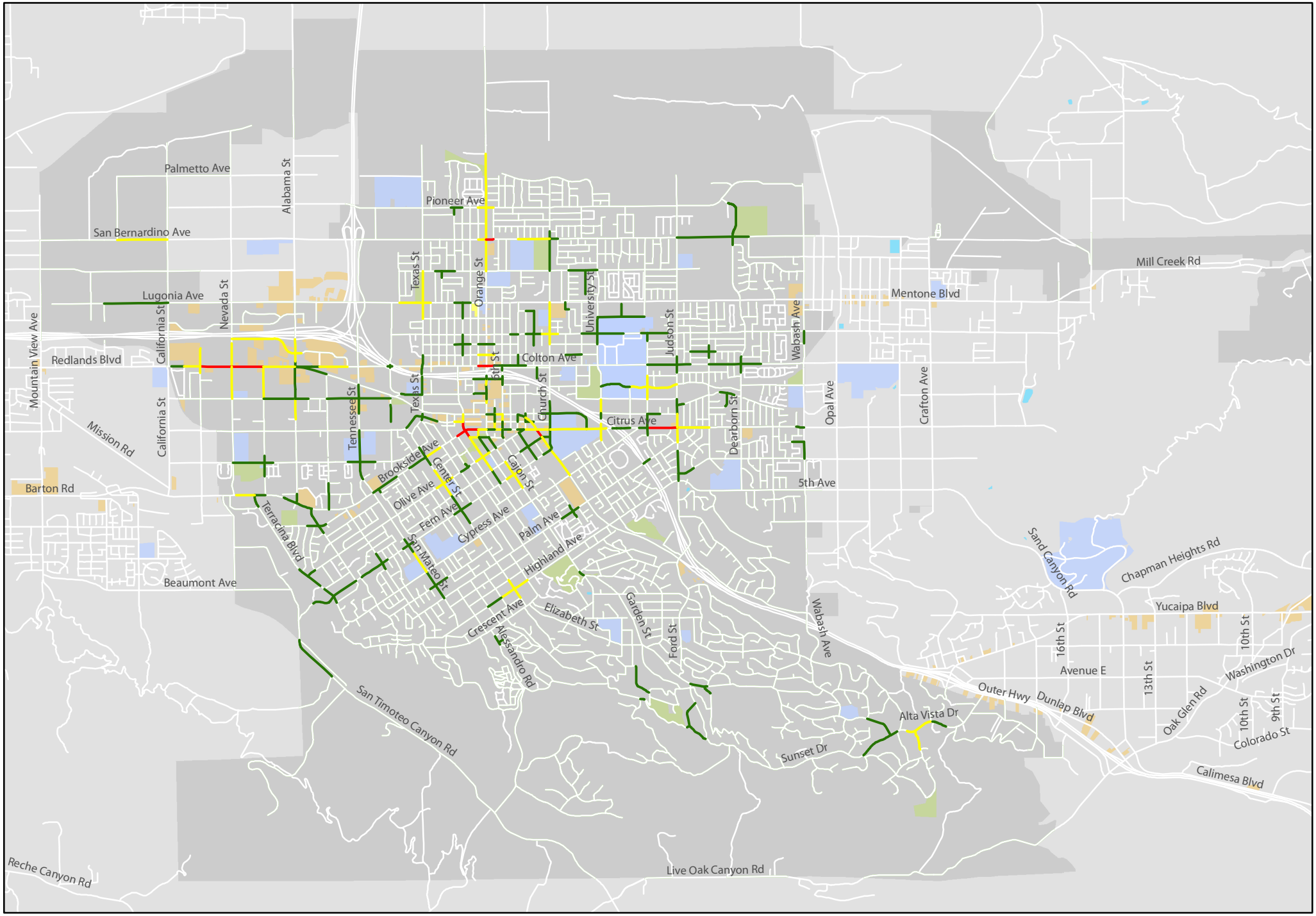
Pedestrian-Involved Collision Locations

Intersection	Number of Collisions
11th St And The Terrace	1
4th St And Citrus Av	2
805 Campus Av And Church St	1
Alabama St And Industrial Park Av	1
Alabama St And Park Av	1
Barton Rd And Nevada St	1
Brockton And Colgate	1
Brockton Av And University St	1
Brookside Av And Center St	2
Brookside Av And Fort St	1
Cajon St And Olive Av	1
Cajon St And W Fern Av	1
California Bl And Power Pole #4372687E	1
Center St And Chestnut St	1
Center St And Fern Av	1
Central Av And Church St	1
Church St And Citrus Av	1
Church St And Lugonia Av	1
Citrus Av And 5th St	1
Citrus Av And Central Av	2
Citrus Av And Church St	1
Citrus Av And Cook St	1
Citrus Av And Eureka St	1
Citrus Av And Grove St	1
Citrus Av And Orange St	1
Citrus Av And Redlands Bl	1
Citrus Av And University Pl	1
Colton Av And Alta St	1
Colton Av And Dearborn St	1
Colton Av And Judson St	1
Colton Av And Tri City Center Dr	1
Courier Av And Post St	1
Creekside Dr And Alessandro Rd	1
Cypress Av And Center St	1
E Colton Av And Judson St	1
E Lugonia And Orange St	1
E Redlands Bl And 5Th St	1
Eureka St And Brookside Av	1

Intersection	Number of Collisions
Eureka St And Clark St	1
Eureka St And Vine Av	1
Fern Av And Cajon St	1
Fern Av And San Mateo St	1
Ford St And Citrus Av	1
Ford St And Highland Av	1
Highland Av And Pacific St	1
Iowa St And Orange Av	1
Judson St And Colton Av	1
Judson St And Lugonia Av	1
Judson St And Palm Av	1
Lugonia Av And Barbra Ln	1
Lugonia Av And California St	1
Lugonia Av And Church St	1
Lugonia Av And New York St	1
Lugonia Av And Ohio St	1
Lugonia Av And University St	1
N Redlands Bl And New Jersey St	1
New York St And Park Av	1
Olive Av And Center St	1
Olive Av And Sonora St	1
Olive St And Eureka St	1
Orange St And Colton Av	4
Orange St And Oriental Av	1
Orange St And Pioneer Av	1
Orange St And Redlands Bl	1
Orange St And San Bernardino Av	4
Orange St And Shoppers Ln	1
Orange St And Stuart Av	1
Orange St And Sun Av	3
Orange St And Union Av	3
Orange St And Union St	1
Palm Av And Hibiscus Dr	1
Park Av And Division St	1
Pearl Av And Orange St	2
Redlands Bl And 9Th St	1
Redlands Bl And California St	1
Redlands Bl And Citrus Av	1

Intersection	Number of Collisions
Redlands Bl And Clark St	1
Redlands Bl And Colton Av	1
Redlands Bl And Iowa St	3
Redlands Bl And Kendall St	1
Redlands Bl And Nevada St	2
Redlands Bl And New Jersey St	1
Rt 10 And California St	1
Rt 10 And Wabash Av	1
Rt 38 And Colton Av	1
Rt 38 And Pecos St	1
San Bernardino Av And Church Av	1
San Mateo St And Cypress Av	2
San Timoteo Canyon Rd And Refuse Rd	1

Intersection	Number of Collisions
State St And Center St	1
State St And Eureka St	1
Stillman Av And Dearborn St	1
Stuart Av And Texas St	1
Tennessee St And State St	1
Texas St And Sun St	1
Union Av And Ohio St	1
University St And Citrus Av	1
University St And Park Av	2
Vine St And 4Th St	1
West Crescent Av And Alessandro Rd	1
Total	**119**



Collisions Involving Bicyclists & Pedestrians 2007-2012

0 0.75 1.5 Miles

Collision Frequency
- Low
- Moderate
- High

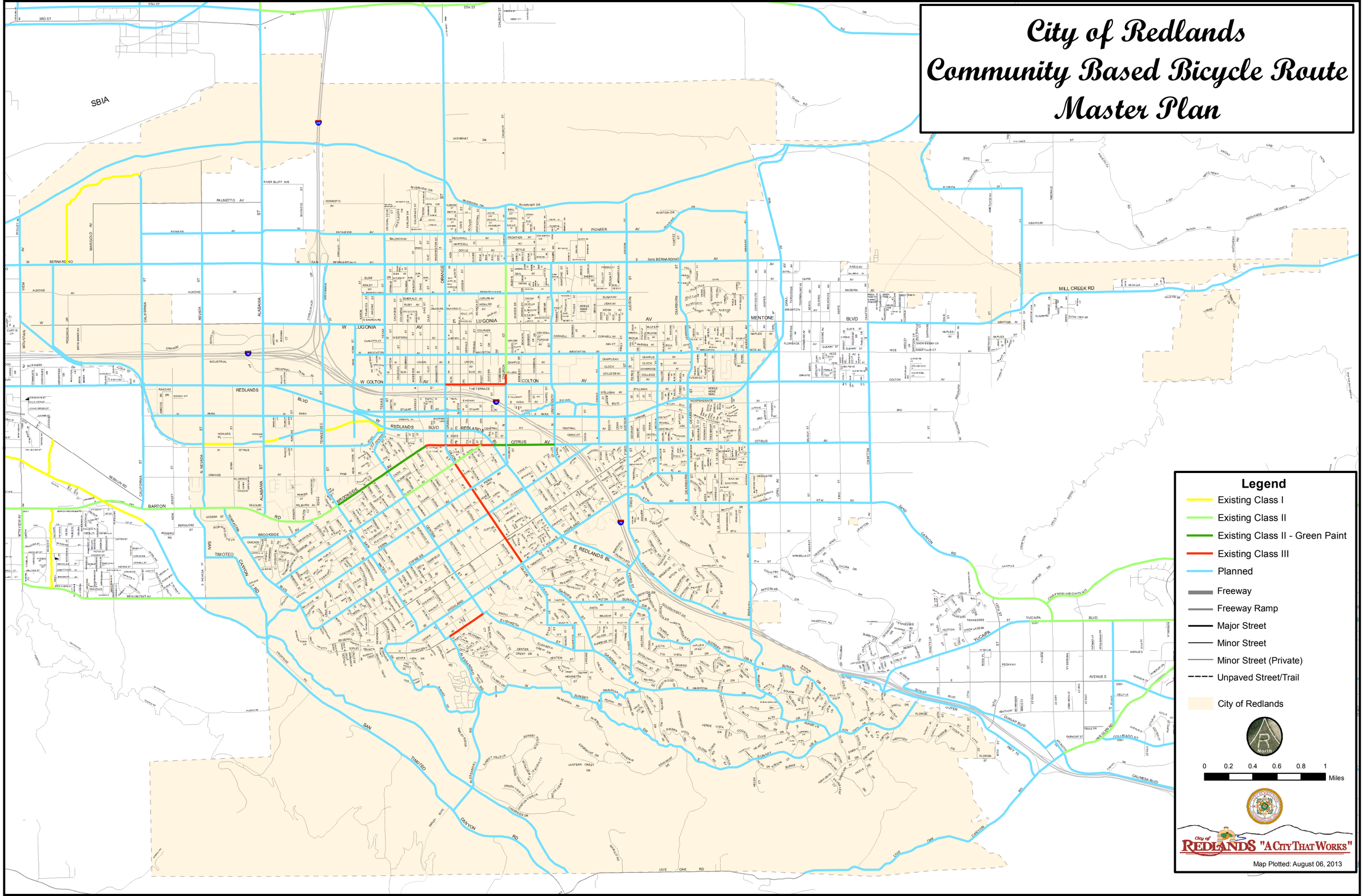
- Schools
- Retail
- Community Center

Boundaries
- County
- City of Redlands

Data obtained from: City of Redlands
Map created May, 2014

Appendix F: Bikeway Network and Support Facilities

City of Redlands
Community Based Bicycle Route Master Plan



Legend

- Existing Class I
- Existing Class II
- Existing Class II - Green Paint
- Existing Class III
- Planned
- Freeway
- Freeway Ramp
- Major Street
- Minor Street
- Minor Street (Private)
- Unpaved Street/Trail
- City of Redlands

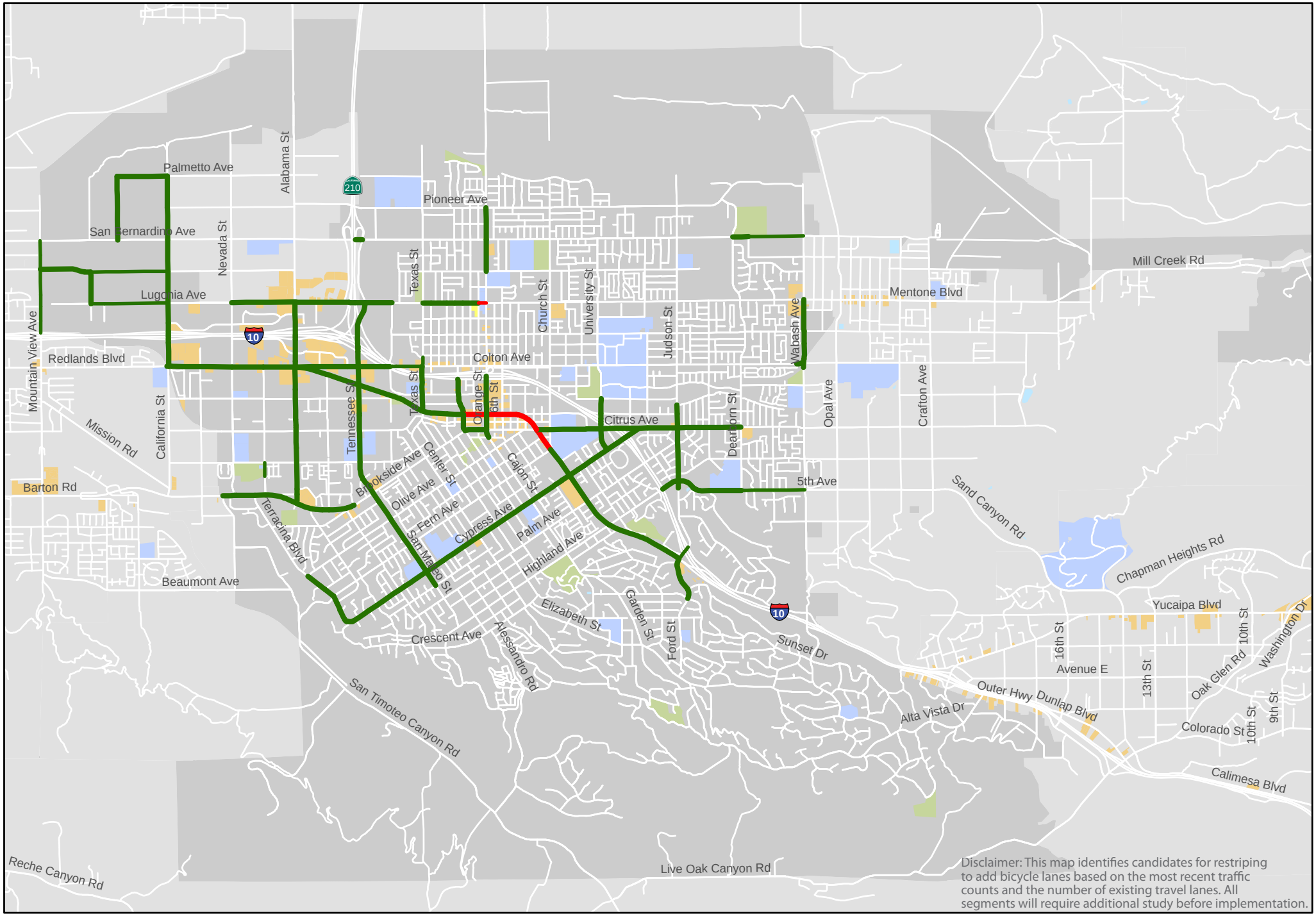
North

0 0.2 0.4 0.6 0.8 1 Miles

City of Redlands "A City That Works"

Map Plotted: August 06, 2013

Appendix G: Candidates for Restriping to Add Bicycle Lanes



Candidates for Restriping to Add Bicycle Lanes

0 0.75 1.5 Miles

3-lane roads

- Candidate for restriping (< 15,000ADT)
- Unlikely candidate for restriping (> 15,000ADT)

4-lane roads

- Candidate for restriping (< 20,000ADT)
- Unlikely candidate for restriping (> 20,000ADT)

Schools
Retail
Community Center
Parks
County
City of Redlands

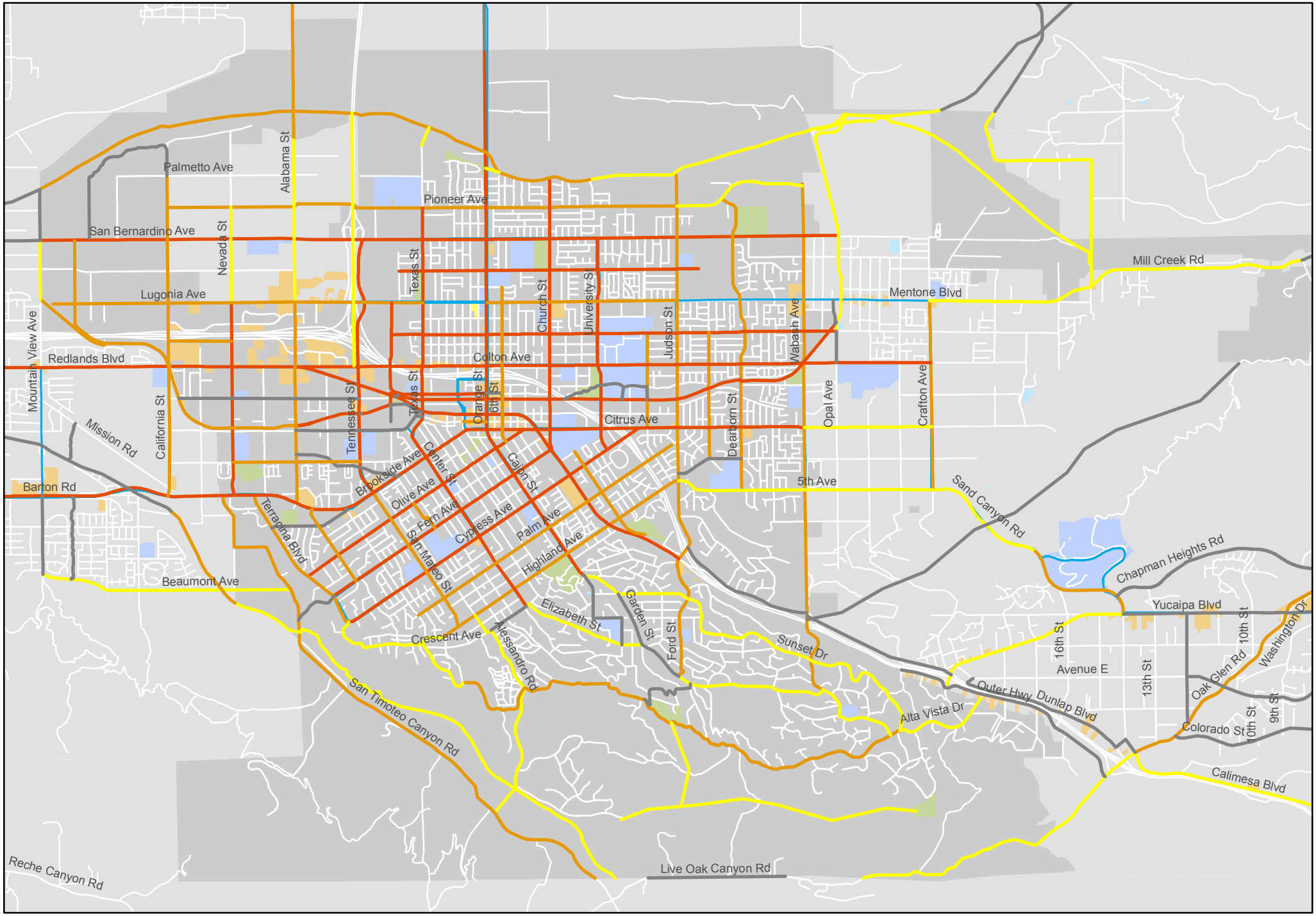
Data obtained from:
City of Redlands
Map created May, 2014

Appendix H: Prioritized Projects

Project	From	To	Miles	Facility Type	Final Score
Pennsylvania Av	Karon	Judson	2.19	street	12
Colton Av	Mountain View Av	Crafton Ave	5.00	street	12
Orange Blossom Trail	Alabama	Grove	3.00	rail trail	12
Orange St	Citrus	city limits	2.99	street	12
Church St	Fern Av	Riverview Dr	2.15	street	12
University St	Cypress	San Bernadino Av	1.68	street	12
San Bernadino Av	Mountain View Av	Opal Av	6.29	street	11
Stuart Av	New York St	Orange St	0.70	street	11
Redlands Blvd	Mountain View Av	Ford St	5.05	street	11
Citrus Av	Eureka St	Wabash Av	2.67	street	11
W Olive Av	Terracina Blvd	Citrus	2.06	street	11
New York St			0.77	street	11
Texas St	Brookside	Pioneer	2.02	street	11
Cajon St	Garden St	Citrus	1.40	street	11
Brocton Av	New York St	Opal Av	3.50	street	10
Orange Blossom Trail	Grove	Opal Av	1.70	rail trail	10
Barton Rd	Mountain View Av	San Mateo St	3.19	street	10
Brookside Av	San Mateo St	Eureka St	0.87	street	10
Fern Av	Terracina Blvd	Redlands	2.04	street	10
Cypress Av	Terracina Blvd	Citrus	2.75	street	10
Nevada St	Barton	Lugonia	1.52	street	10
Tennessee St	Brookside	San Bernadino Av	2.05	street	10
Center St	Crescent	Brookside	1.42	street	10
Redlands Blvd	Ford St	Fern Av	1.37	street	10
Pioneer Av	California	Judson	4.04	street	9
Orange Blossom Trail	California St	Alabama	1.33	canal trail	9
Highland Av	Terracina Blvd	Ford St	2.24	street	9
California Av	Redlands	Palmetto +	1.56	street	9
San Mateo St	Highland Av	Brookside	1.26	street	9
Grove St	Citrus	Brockton	0.75	street	9
Ford St	Mariposa Dr	Santa Ana River Trail	4.07	street	9
California Av	Barton	Redlands	0.96	street	8
Alabama St	Barton	Lugonia	1.58	street	8
6th St	Olive	Delaware	1.22	street	8
Orange Ave	Nevada	Tennessee	1.00	street	8
State St	Orange	Eureka	.18	street	8
Nanette	Olive	Fern	.27	street	8
Lugonia Av	Alabama	Texas	1.01	street	7
Bellevue Ave	Barton	Fern	.67	Street	7

San Timoteo Canyon Rd	Live Oak Rd	Barton Rd	4.58	street	7
Terracina Blvd	Cypress	Barton Rd	1.27	street	7
Wabash Av	Sunset Ln	Sessums Dr	4.08	street	7
Santa Ana River Trail west	Mountain View Av	Orange St	3.71	river trail	6
Orange Blossom Trail	Mountain View Av	California St	1.23	canal trail	6
Alabama St	River Bluff	3rd St (Highland)	1.19	street	6
Dearborn	5th	Pioneer	2.39	street	6
Roosevelt Rd	Home Pl	Ford Park	.88	street/trail	6
Rail ROW	Nevada	California	.49	rail trail	6
Palm Ave	Silverwood Pl	Ford St	2.52	street	5
Santa Ana River Trail middle (Riverview Dr)	Orange St	Riverbend Dr	0.93	street	5
Unknown corridor on Redlands parcel	Orange Blossom Trail	San Bernadino Blvd	0.94		5
San Timoteo Creek Trail	Nevada St	California St	0.90	river trail	5
Sunset Dr So	Sunset Dr No	Crown St	4.13	street	5
Lincoln St	Highland Av	Brockton	0.99	street	5
Oak Glen Rd	Hwy 10	Yucaipa (city)	3.76	street	5
Sand Canyon Rd	Yucaipa Blvd	Crafton Ave	0.98	street	5
Crafton Rd	5th	Mentone Blvd	1.49	street	5
Creekside Trail	San Timoteo Nature Preserve	Oakmont Park	2.37	trail	4
Deer Trail	San Timoteo Nature Preserve	Carolyn Park	.69	trail	4
Mentone Blvd	Crafton Av	Amethyst St	0.92	street	4
Citrus Av	Wabash Av	Crafton Ave	1.01	street	4
Beaumont Av	Mountain View Av	Nevada St	1.53	street	4
Beaumont Av	Nevada St	Timoteo Canyon Rd	0.44	street	4
5th Av	Ford St	Wabash Av	1.02	street	4
San Timoteo Creek Trail	Live Oak Rd	Nevada St	3.93	river trail	4
Nevada St	Lugonia	Pioneer	0.75	street	4
Alabama St	Lugonia	River Bluff	1.28	street	4
Alessandro Rd	San Timoteo Canyon Rd	Highland Av	1.81	street	4
Elizabeth St	Garden St	Crescent	0.99	street	4
Sunset Dr No	Sunset Dr So	Garden St	2.95	street	4
Opal Av	Brockton	Santa Ana River Trail	1.90	street	4
Calimesa Blvd			2.26	street	4
Yucaipa Blvd	Hwy 10	Sand Canyon Rd	1.59	street	4
Sand Canyon Rd	Crafton Av	Campus Dr	1.00	street	3
Israel Beal Connector	Riverview Dr	Orange St	.11	trail	3

Mountain View Rd	Orange Blossom Trail	San Bernadino Blvd	0.46	street	3
Texas Street Connector	Santa Ana River Trail	Texas St	.14	Trail	3
Garden St	Sunset Dr No	Cajon St	0.31	street	3
Live Oak Canyon Rd	city limits	Hwy 10	2.53	street	3
Santa Ana River Trail west	Riverbend Dr	Crafton Ave (extended)	2.88	river trail	2
5th Av	Wabash Av	Crafton Ave	1.01	street	2
Alta Vista Dr	Hwy 10	Sunset Dr No	0.78	street	2
Serpentine Dr	Crown St	Highland Av	0.68	street	2
Sunset Ln	Sunset Dr So	Wabash Av	0.74	street	2
CA-210	Santa Ana River Trail	Colton Av	1.99	street	2
Smiley Heights Dr	Terracina	Serpentine	.79	street	2
Sessums Dr	Judson	Wabash Av	1.07	street	1
Mill Creek Rd	Amethyst St	Bryant St	2.10	street	1
Mariposa Dr	Wabash Av	Ford St	1.19	street	1
Garnet	Mill Creek Rd	city limits	0.38	street	1
Garnet	city limits	Florida St	0.62	street	1
Florida St	Garnet	Greenspot Rd	0.75	street	1
Greenspot Rd	Florida St	city limits	0.42	street	1
Park	Tennessee	Kansas	.25	street	0
Crafton Hills Connector	Crafton Hills Ridge	Wabash	4.02	trail	0
Silver Springs Historic Trail	Wabash	Yucaipa	1.23	trail	0
Creek Trail	Brookside	Alabama	.84	river trail	0
Garden St	Ford St	Garden St	0.39	street	0
Live Oak Canyon Rd	city limits	city limits	1.08	street	0



Prioritized Projects

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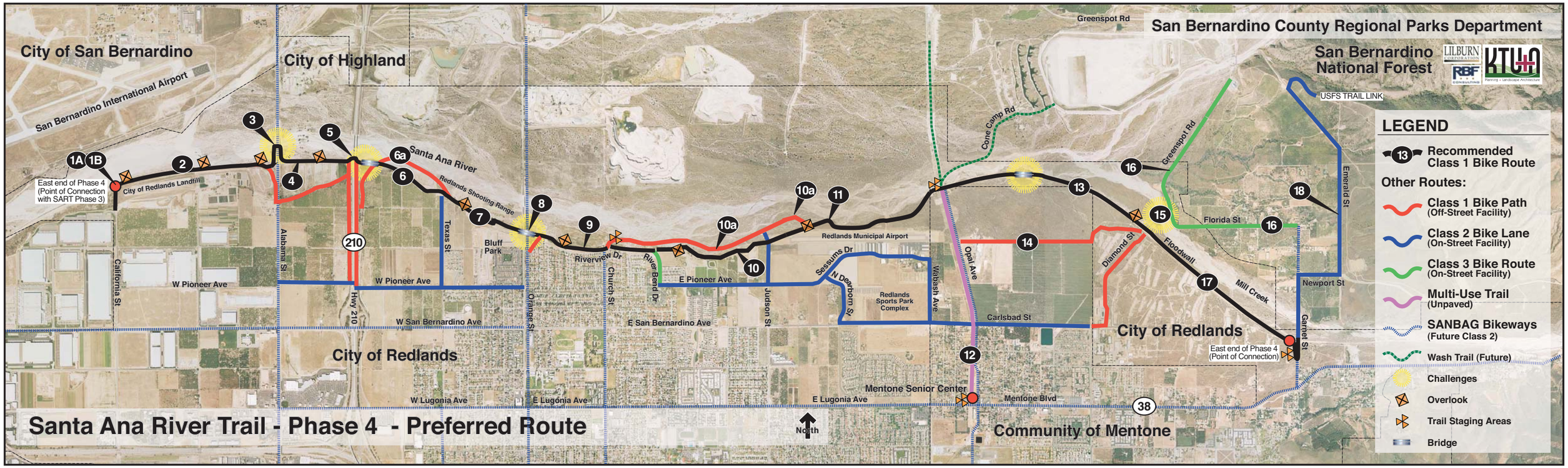
0 0.75 1.5 Miles

- Not Prioritized
- 3 years
- 2 years
- 1 year
- Schools
- Retail
- Community Center
- County
- City of Redlands

Data obtained from:
City of Redlands
and through online outreach
Map created January, 2015

Appendix I: Santa Ana River Trail



Revised June 22, 2009

Appendix J: Design Guide

Bicycle Facility Design Guidelines

for the City of Redlands Bicycle Master Plan

February 2015

PREPARED BY:
Alta Planning + Design
625 Broadway, Suite 1001
San Diego, CA 92101

alta
PLANNING + DESIGN

Contents

Introduction

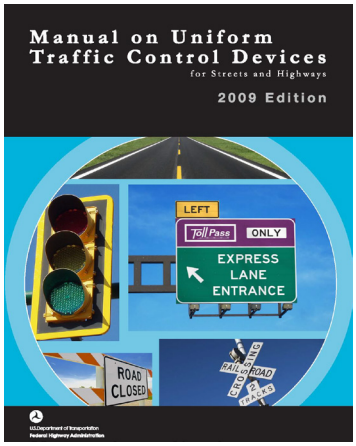
These guidelines are intended to assist the City of Redlands in the selection and design of bicycle facilities. The following sections pull together best practices by facility type from public agencies and municipalities nationwide. Within the design guidance, treatments are covered within a single sheet tabular format relaying important design information and discussion, example photos, schematics (if applicable), and existing summary guidance from current standards. Existing standards are referenced throughout and should be the first source of information when seeking to implement any of the treatments featured here.

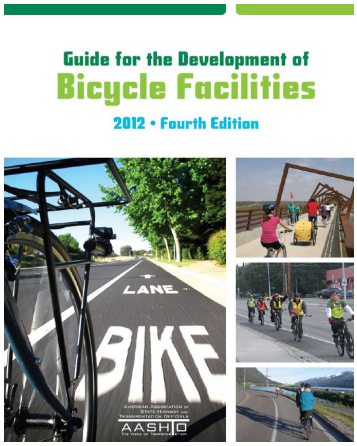
Guiding Principles

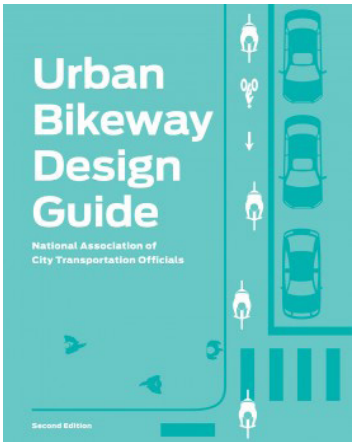
The following are guiding principles for these design guidelines:

- **The bicycling environment should be safe.** All bicycling routes should be physically safe and perceived as safe by all users. Safe means minimal conflicts with external factors, such as noise, vehicular traffic and protruding architectural elements. Safe also means routes are clear and well marked with appropriate pavement markings and directional signage.
- **The bicycle network should be accessible.** Shared-use paths, bike routes and crosswalks should permit the mobility of residents of all ages and abilities. The bicycle network should employ principles of universal design. Bicyclists have a range of skill levels, and facilities should be designed with a goal of providing for inexperienced/recreational bicyclists (especially children and seniors) to the greatest extent possible.
- **Bicycle network improvements should be economical.** Bicycle improvements should achieve the maximum benefit for their cost, including initial cost and maintenance cost, as well as a reduced reliance on more expensive modes of transportation. Where possible, improvements in the right-of-way should stimulate, reinforce and connect with adjacent private improvements.
- **The bicycle network should connect to places people want to go.** The bicycle network should provide continuous direct routes and convenient connections between destinations such as homes, schools, shopping areas, public services, recreational opportunities and transit. A complete network of on-street bicycling facilities should connect seamlessly to existing and proposed shared-use paths to complete recreational and commuting routes.
- **The bicycling environment should be clear and easy to use.** Shared-use paths and crossings should allow all people to easily find a direct route to a destination with minimal delays, regardless of whether these persons have mobility, sensory, or cognitive disability impairments. All roads are legal for the use of bicyclists (except freeways, from which bicyclists are prohibited unless a separate facility on that right of way is provided). This means that most streets are bicycle facilities and should be designed, marked and maintained accordingly.
- **The bicycling environment should be attractive and enhance community livability.** Good design should integrate with and support the development of complementary uses and should encourage preservation and construction of art, landscaping and other items that add value to communities. These components might include open spaces such as plazas, courtyards and squares, and amenities like street furniture, banners, art, plantings and special paving. These along with historical elements and cultural references, should promote a sense of place. Public activities should be encouraged and the municipal code should permit commercial activities such as dining, vending and advertising when they do not interfere with safety and accessibility.
- **Design guidelines are flexible and should be applied using professional judgment.** This document references specific national guidelines for bicycle facility design, as well as a number of design treatments not specifically covered under current guidelines. Statutory and regulatory guidance may change. For this reason, the guidance and recommendations in this document function to complement other resources considered during a design process, and in all cases sound engineering judgment should be used.

National Standards







The Federal Highway Administration's **Manual on Uniform Traffic Control Devices** (MUTCD) defines the standards used by road managers nationwide to install and maintain traffic control devices on all public streets, highways, bikeways, and private roads open to public traffic. The MUTCD is the primary source for guidance on lane striping requirements, signal warrants, and recommended signage and pavement markings.

To further clarify the MUTCD, the FHWA created a table of contemporary bicycle facilities that lists various bicycle-related signs, markings, signals, and other treatments and identifies their official status (e.g., can be implemented, currently experimental). See **Bicycle Facilities and the Manual on Uniform Traffic Control Devices.**[1]

Bikeway treatments not explicitly covered by the MUTCD are often subject to experiments, interpretations and official rulings by the FHWA. The **MUTCD Official Rulings** is a resource that allows website visitors to obtain information about these supplementary materials. Copies of various documents (such as incoming request letters, response letters from the FHWA, progress reports, and final reports) are available on this website.[2]

American Association of State Highway and Transportation Officials (AASHTO) **Guide for the Development of Bicycle Facilities**, updated in June 2012 provides guidance on dimensions, use, and layout of specific bicycle facilities. The standards and guidelines presented by AASHTO provide basic information, such as minimum sidewalk widths, bicycle lane dimensions, detailed striping requirements and recommended signage and pavement markings.

The National Association of City Transportation Officials' (NACTO) 2012 **Urban Bikeway Design Guide**[3] is the newest publication of nationally recognized bicycle-specific design standards, and offers guidance on the current state of the practice designs. The NACTO Urban Bikeway Design Guide is based on current practices in the best cycling cities in the world. The intent of the guide is to offer substantive guidance for cities seeking to improve bicycle transportation in places where competing demands for the use of the right of way present unique challenges. All of the NACTO Urban Bikeway Design Guide treatments are in use internationally and in many cities around the US.

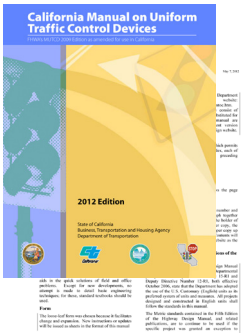
Some of these treatments are not directly referenced in the current versions of the AASHTO Guide or the MUTCD, although many of the elements of these treatments are found within these documents. In all cases, engineering judgment is recommended to ensure that the application makes sense for the context of each treatment, given the many complexities of urban streets.

1 *Bicycle Facilities and the Manual on Uniform Traffic Control Devices. (2011). FHWA. http://www.fhwa.dot.gov/environment/bikeped/mutcd_bike.htm*

2 *MUTCD Official Rulings. FHWA. http://mutcd.fhwa.dot.gov/orsearch.asp*

3 *http://nacto.org/cities-for-cycling/design-guide/*

State Standards

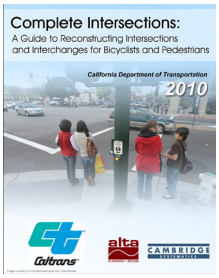


California Manual on Uniform Traffic Control Devices (MUTCD) (2012)

The California MUTCD 2012 an amended version of the FHWA MUTCD 2009 edition modified for use in California. While standards presented in the CA MUTCD substantially conform to the FHWA MUTCD, the state of California follows local practices, laws and requirements with regards to signing, striping and other traffic control devices.

California Highway Design Manual (HDM) (2012)

This manual establishes uniform policies and procedures to carry out highway design functions for the California Department of Transportation. The 2012 edition incorporated Complete Streets focused revisions to address the Department Directive 64 R-1.

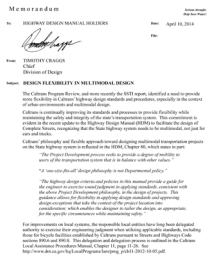


Complete Intersections: A Guide to Reconstructing Intersections and Interchanges for Bicyclists and Pedestrians (2010)

This California Department of Transportation reference guide presents information and concepts related to improving conditions for bicyclists and pedestrians at major intersections and interchanges. The guide can be used to inform minor signage and striping changes to intersections, as well as major changes and designs for new intersections.

Main Street, California: A Guide for Improving Community and Transportation Vitality (2013)

This Caltrans informational guide reflects California's current manuals and policies that improve multimodal access, livability and sustainability within the transportation system. The guide recognizes the overlapping and sometimes competing needs of main streets.


Memorandum

HIGHWAY DESIGN MANUAL HOLDERS

April 10, 2014

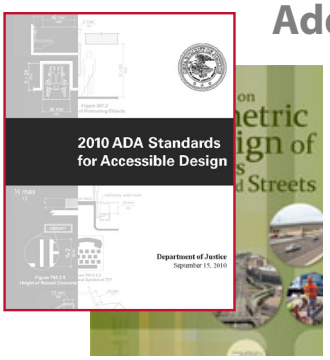
TIMOTHY CRAGGS
Chief
Division of Design

DESIGN FLEXIBILITY IN MULTIMODAL DESIGN

Caltrans Memo: Design Flexibility in Multimodal Design. April 2014.

This April 2014 memorandum encourages flexibility in highway design. The memo stated that "Publications such as the National Association of City Transportation Officials (NACTO) "Urban Street Design Guide" and "Urban Bikeway Design Guide," ... are resources that Caltrans and local entities can reference when ma king planning and design decisions on the State highway system and local streets and roads."

Additional US Federal Guidelines



Meeting the requirements of the Americans with Disabilities Act (ADA) is an important part of any bicycle and pedestrian facility project. The United States Access Board's proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way[4] and the 2010 ADA Standards for Accessible Design[5] (2010 Standards) contain standards and guidance for the construction of accessible facilities. This includes requirements for sidewalk curb ramps, slope requirements, and pedestrian railings along stairs.

The 2011 AASHTO: A Policy on Geometric Design of Highways and Streets commonly referred to as the "Green Book," contains the current design research and practices for highway and street geometric design.

4 http://www.access-board.gov/prowac/

5 http://www.ada.gov/2010ADAstandards_index.htm

ON STREET BICYCLE FACILITIES

Design Needs of Bicyclists

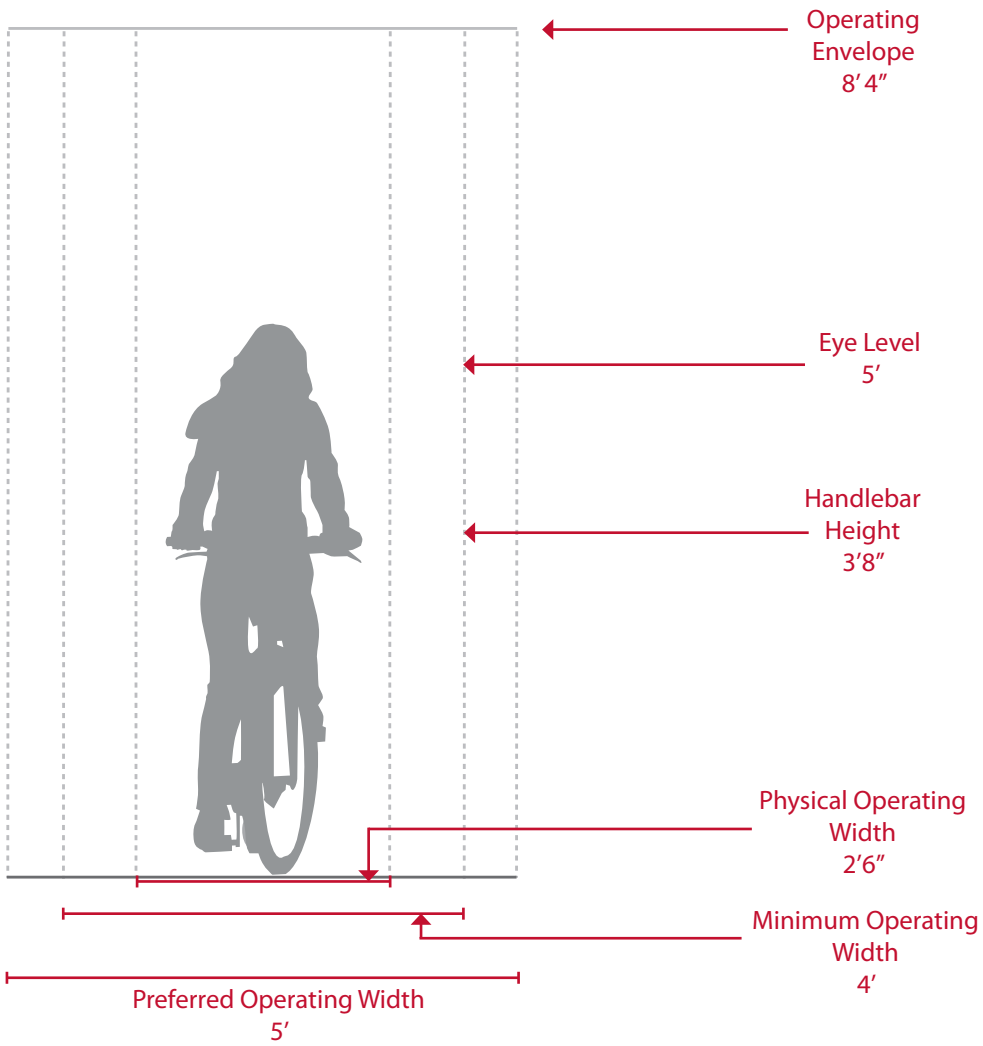
The purpose of this section is to provide the facility designer with an understanding of how bicyclists operate and how their bicycle influences that operation. Bicyclists, by nature, are much more affected by poor facility design, construction and maintenance practices than motor vehicle drivers. Bicyclists lack the protection from the elements and roadway hazards provided by an automobile's structure and safety features. By understanding the unique characteristics and needs of bicyclists, a facility designer can provide quality facilities and minimize user risk.

Bicycle as a Design Vehicle

Similar to motor vehicles, bicyclists and their bicycles exist in a variety of sizes and configurations. These variations occur in the types of vehicle (such as a conventional bicycle, a recumbent bicycle or a tricycle), and behavioral characteristics (such as the comfort level of the bicyclist). The design of a bikeway should consider reasonably expected bicycle types on the facility and utilize the appropriate dimensions.

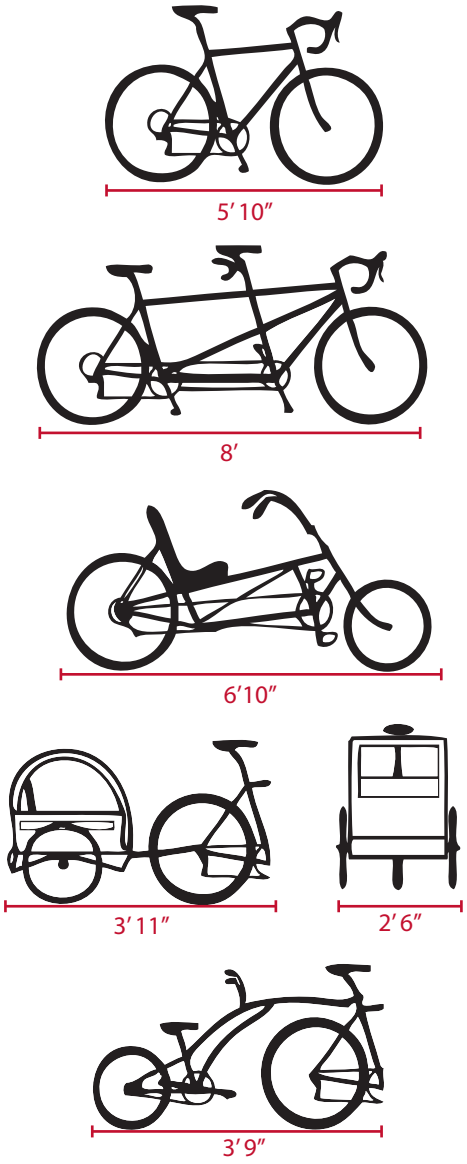
The figure below illustrates the operating space and physical dimensions of a typical adult bicyclist, which are the basis for typical facility design. Bicyclists require clear space to operate within a facility. This is why the minimum operating width is greater than the physical dimensions of the bicyclist. Bicyclists prefer five feet or more operating width, although four feet may be minimally acceptable.

Standard Bicycle Rider Dimensions



Source: AASHTO Guide for the Development of Bicycle Facilities, 4th Edition. 2012.

In addition to the design dimensions of a typical bicycle, there are many other commonly used pedal-driven cycles and accessories to consider when planning and designing bicycle facilities. The most common types include tandem bicycles, recumbent bicycles, and trailer accessories. The figure and table below summarize the typical dimensions for bicycle types.



Bicycle as Design Vehicle - Typical Dimensions

Source: AASHTO *Guide for the Development of Bicycle Facilities*, 4th Edition *AASHTO does not provide typical dimensions for tricycles.

Design Speed Expectations

The expected speed that different types of bicyclists can maintain under various conditions also influences the design of facilities such as shared-use paths. The table to the right provides typical bicyclist speeds for a variety of conditions.

Path designers should tailor the curvature and sight distance needs based on the typical speed of the fastest expected user. See data tables in the AASHTO Guide for the Development of Bicycle Facilitate and the California Highway Design Manual for detailed guidance.

Bicycle as Design Vehicle - Typical Dimensions

Bicycle Type	Feature	Typical Dimensions
Upright Adult Bicyclist	Physical width	2 ft 6 in
	Operating width (Minimum)	4 ft
	Operating width (Preferred)	5 ft
	Physical length	5 ft 10 in
	Physical height of handlebars	3 ft 8 in
	Operating height	8 ft 4 in
	Eye height	5 ft
	Vertical clearance to obstructions (tunnel height, lighting, etc)	10 ft
	Approximate center of gravity	2 ft 9 in - 3 ft 4 in
Recumbent Bicyclist	Physical length	8 ft
	Eye height	3 ft 10 in
Tandem Bicyclist	Physical length	8 ft
Bicyclist with child trailer	Physical length	10 ft
	Physical width	2 ft 6 in

Bicycle as Design Vehicle - Design Speed Expectations

Bicycle Type	Feature	Typical Speed
Upright Adult Bicyclist	Paved level surfacing	8-15 mph
	Downhill	20-30+ mph
	Uphill	5 -12 mph
Recumbent Bicyclist	Paved level surfacing	11-18 mph

*Tandem bicycles and bicyclists with trailers have typical speeds equal to or less than upright adult bicyclists.

Types of Bicyclists

It is important to consider bicyclists of all skill levels when creating a non-motorized plan or project. Bicyclist skill level greatly influences expected speeds and behavior, both in separated bikeways and on shared roadways. Bicycle infrastructure should accommodate as many user types as possible, with decisions for separate or parallel facilities based on providing a comfortable experience for the greatest number of people.

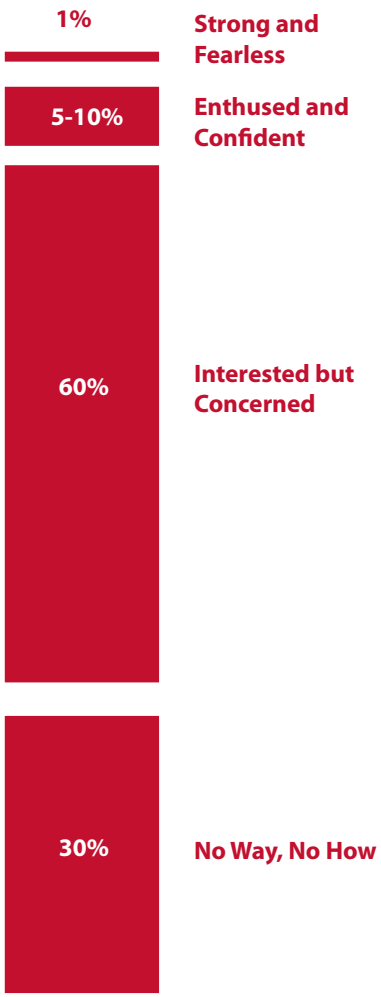
The bicycle planning and engineering professions currently use several systems to classify the population which can assist in understanding the characteristics and infrastructure preferences of different bicyclists. The current AASHTO Guide to the Development of Bicycle Facilities encourages designers to identify their rider type based on the trip purpose (Recreational vs Transportation) and on the level of comfort and skill of the rider (Causal vs Experienced). A more detailed framework for understanding of the US population's relationship to transportation focused bicycling is illustrated in the figure below. Developed by planners in Portland, OR[1] and supported by research[2], this classification provides the following alternative categories to address varying attitudes towards bicycling in the US:

- **Strong and Fearless** (approximately 1% of population) – Characterized by bicyclists that will typically ride anywhere regardless of roadway conditions or weather. These bicyclists can ride faster than other user types, prefer direct routes and will typically choose roadway connections -- even if shared with vehicles -- over separate bicycle facilities such as shared-use paths.

- **Enthused and Confident** (5-10% of population) - This user group encompasses bicyclists who are fairly comfortable riding on all types of bikeways but usually choose low traffic streets or shared-use paths when available. These bicyclists may deviate from a more direct route in favor of a preferred facility type. This group includes all kinds of bicyclists such as commuters, recreationalists, racers and utilitarian bicyclists.

- **Interested but Concerned** (approximately 60% of population) – This user type comprises the bulk of the cycling population and represents bicyclists who typically only ride a bicycle on low traffic streets or shared-use paths under favorable weather conditions. These bicyclists perceive significant barriers to their increased use of cycling, specifically traffic and other safety issues. These people may become "Enthused & Confident" with encouragement, education and experience.

- **No Way, No How** (approximately 30% of population) – Persons in this category are not bicyclists, and perceive severe safety issues with riding in traffic. Some people in this group may eventually become more regular cyclists with time and education. A significant portion of these people will not ride a bicycle under any circumstances.



Typical Distribution of Bicyclist Types

1 *Roger Geller, City of Portland Bureau of Transportation. Four Types of Cyclists. http://www.portlandonline.com/transportation/index.cfm?&a=237507. 2009.*

2 Dill, J., McNeil, N. *Four Types of Cyclists? Testing a Typology to Better Understand Bicycling Behavior and Potential.* 2012.

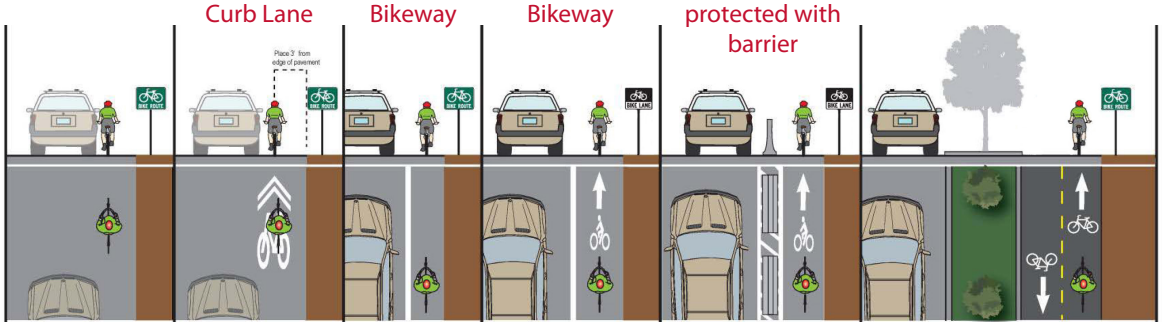
Facility Continua

The following continua illustrate the range of bicycle facilities applicable to various roadway environments, based on the roadway type and desired degree of separation. Engineering judgment, traffic studies, previous municipal planning efforts, community input and local context should be used to refine criteria when developing bicycle facility recommendations for a particular street. In some corridors, it may be desirable to construct facilities to a higher level of treatment than those recommended in relevant planning documents in order to enhance user safety and comfort. In other cases, existing and/or future motor vehicle speeds and volumes may not justify the recommended level of separation, and a less intensive treatment may be acceptable.

Least Protected → Most Protected

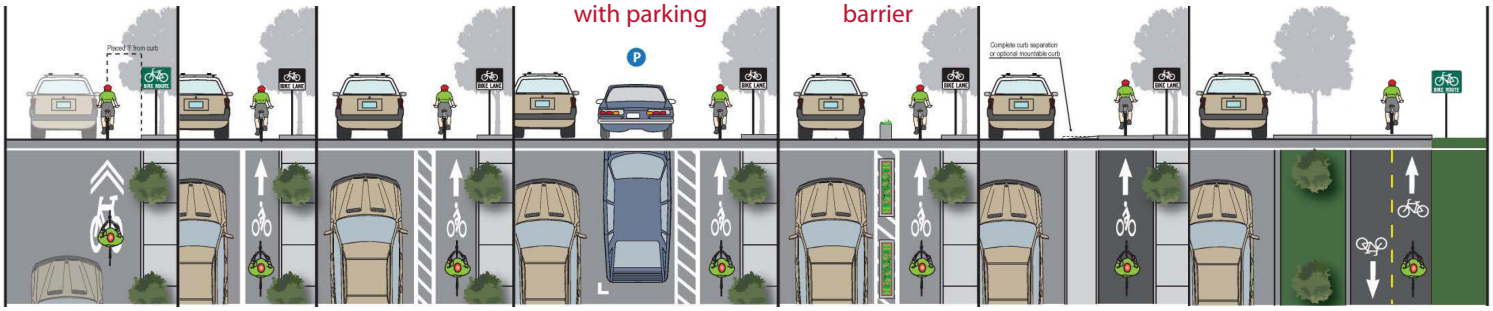
Arterial/Highway Bikeway Continuum (without curb and gutter)

Shared Lane | Marked Wide Curb Lane | Shoulder Bikeway | Wide Shoulder Bikeway | Cycle Track: protected with barrier | Shared-Use Path



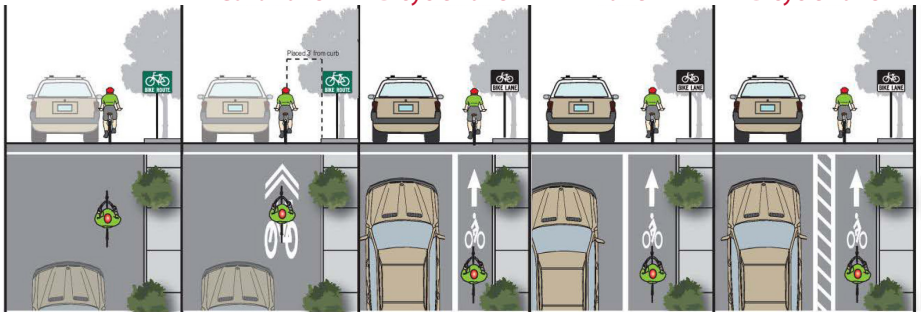
Arterial/Highway Bikeway Continuum (with curb and gutter)

Marked Wide Curb Lane | Conventional Bicycle Lane | Buffered Bicycle Lane | Cycle Track: at-grade, protected with parking | Cycle Track: protected with barrier | Cycle Track: curb separated | Shared-Use Path: curb separated



Collector Bikeway Continuum

Shared Lane | Marked Wide Curb Lane | Conventional Bicycle Lane | Wide Bicycle Lane | Buffered Bicycle Lane



Class III Shared Roadways

On shared roadways, bicyclists and motor vehicles use the same roadway space. These facilities are typically used on roads with low speeds and traffic volumes, however they can be used on higher volume roads with wide outside lanes or shoulders. 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.

Shared roadways employ a large variety of treatments from simple signage and shared lane markings to more complex treatments including directional signage, traffic diverters, chicanes, chokers, and/or other traffic calming devices to reduce vehicle speeds or volumes.

Signed Shared Roadway


Marked Shared Roadway

Signed Shared Roadway

Description

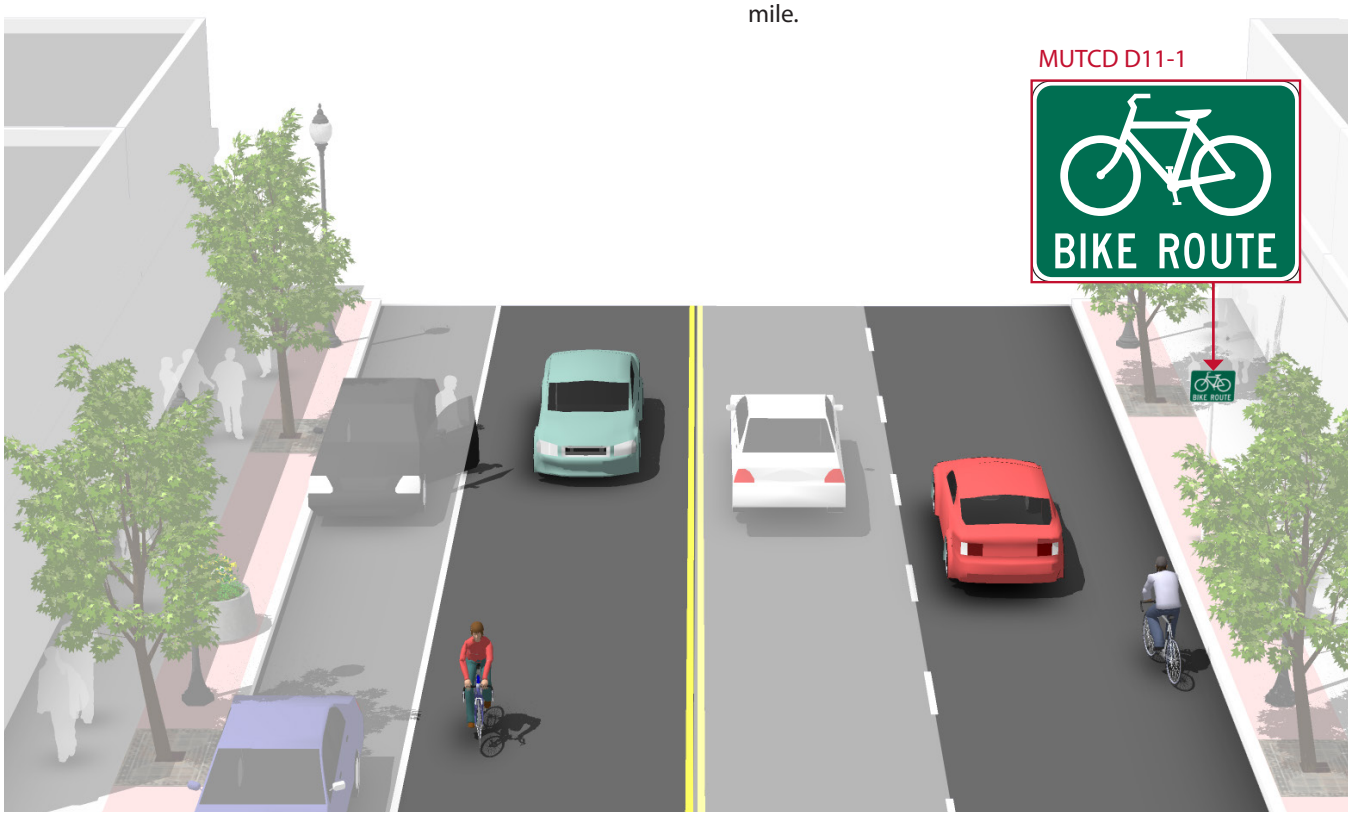
Signed shared roadways are facilities shared with motor vehicles. They are typically used on roads with low speeds and traffic volumes, however can be used on higher volume roads with wide outside lanes or shoulders. A motor vehicle driver will usually have to cross over into the adjacent travel lane to pass a bicyclist, unless a wide outside lane or shoulder is provided.

Guidance

Lane width varies depending on roadway configuration.

Bike route signage (D11-1) 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. Commonly, this includes placement at:

- Beginning or end of Bicycle Route.
- At major changes in direction or at intersections with other bicycle routes.
- At intervals along bicycle routes not to exceed ½ mile.



Discussion

Signed shared roadways serve either to provide continuity with other bicycle facilities (usually bike lanes) or to designate preferred routes through high-demand corridors.

This configuration differs from a bicycle boulevard due to a lack of traffic calming, wayfinding, pavement markings and other enhancements designed to provide a higher level of comfort for a broad spectrum of users.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
Caltrans. *CA-MUTCD. 2012.*
Caltrans. *California HDM.* 2012.

Materials and Maintenance

Maintenance needs for bicycle wayfinding signs are similar to other signs, and will need periodic replacement due to wear.

Marked Shared Roadway

Description

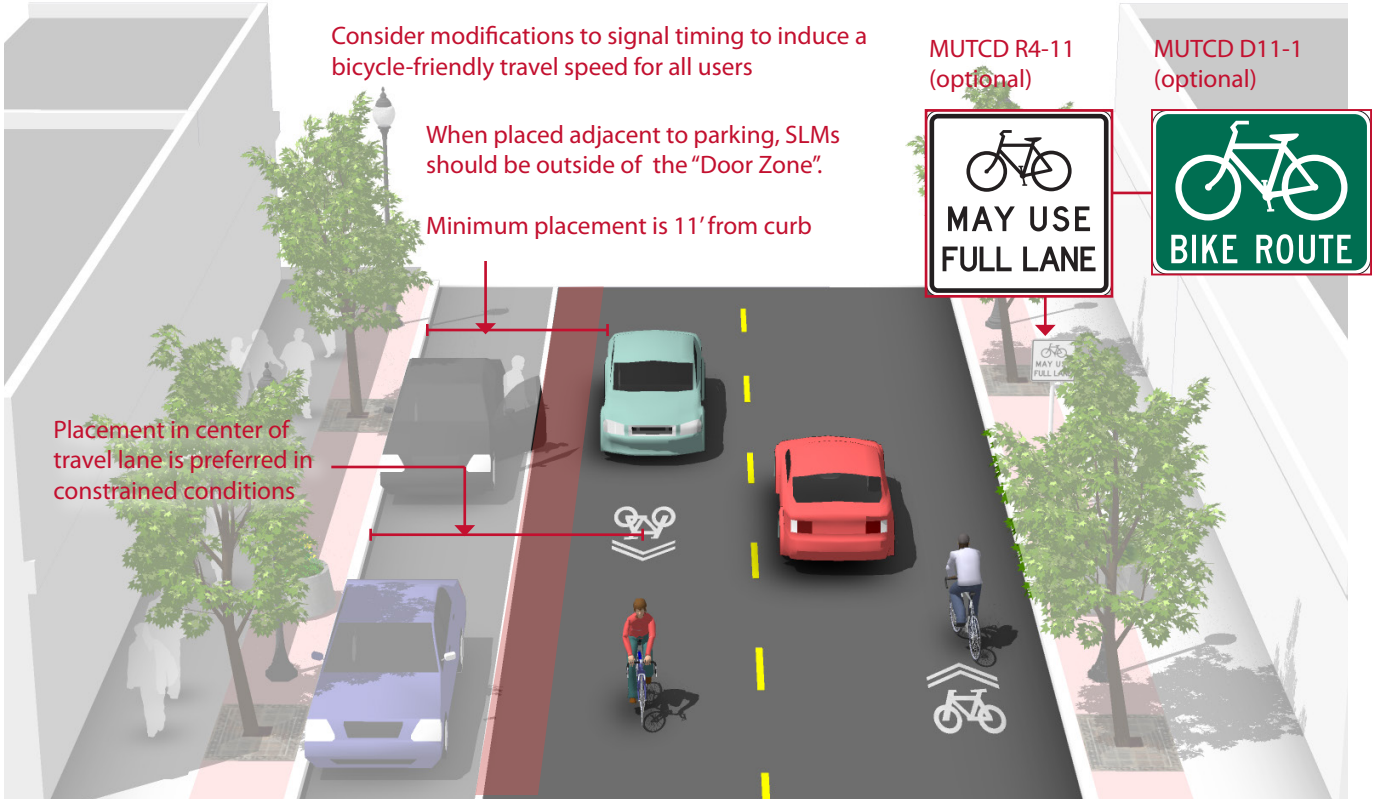
A marked shared roadway is a general purpose travel lane marked with shared lane markings (SLM) used to encourage bicycle travel and proper positioning within the lane.

In constrained conditions, the SLMs are placed in the middle of the lane. On a wide outside lane, the SLMs can be used to promote bicycle travel to the right of motor vehicles.

In all conditions, SLMs should be placed outside of the door zone of parked cars.

Guidance

- Lower than 35 mph speed limit preferred.
- In extreme circumstances, SLMs may be placed on roadways above 35 mph.
- In constrained conditions, preferred placement is in the center of the travel lane to minimize wear and promote single file travel.
- Minimum placement of SLM marking centerline is 11 feet from edge of curb where on-street parking is present, 4 feet from edge of curb with no parking.



Discussion

If collector or arterial, this should not be a substitute for dedicated bicycle facilities if space is available.

Bike Lanes should be considered on roadways with outside travel lanes wider than 15 feet, or where other lane narrowing or removal strategies may provide adequate road space. SLMs shall not be used on shoulders, in designated bike lanes, or to designate bicycle detection at signalized intersections. (MUTCD 9C.07)

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
Caltrans. *CA-MUTCD. 2012.*
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

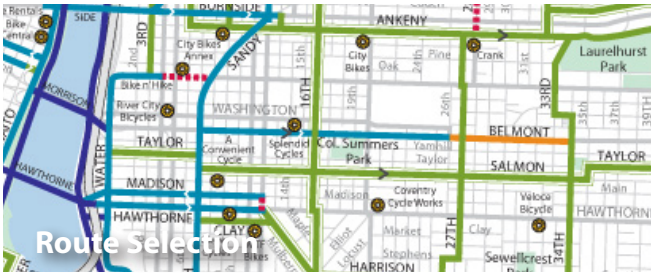
Placing SLMs between vehicle tire tracks will increase the life of the markings and minimize the long-term cost of the treatment.

Bicycle Boulevards

Bicycle boulevards are low-volume, low-speed streets modified to enhance bicyclist by using treatments such as signage, pavement markings, traffic calming and/or traffic reduction, and intersection modifications. These treatments allow through movements of bicyclists while discouraging similar through-trips by non-local motorized traffic.

Jurisdictions throughout the country use a wide variety of strategies to determine where specific treatments are applied. While no federal guidelines exist, several best practices have emerged for the development of bicycle boulevards. At a minimum, bicycle boulevards should include distinctive pavement markings and wayfinding signs. They can also use combinations of traffic calming, traffic diversion, and intersection treatments to improve the bicycling environment. The appropriate level of treatment to apply is dependent on roadway conditions, particularly motor vehicle speeds and volumes.

Traffic conditions on bicycle boulevards should be monitored to provide guidance on when and where treatments should be implemented. When motor vehicle speeds and volumes or bicyclist delay exceed the preferred limits, additional treatments should be considered for the bicycle boulevard.



Bicycle Boulevard Route Selection

Description

Bicycle boulevards should be developed on streets that improve connectivity to key destinations and provide a direct route for bicyclists. Local streets with existing traffic calming, traffic diversions, or signalized crossings of major streets are good candidates, as they tend to be existing bicycle routes and have low motor vehicle speeds and volumes. Other streets where residents have expressed a desire for traffic calming are also good options.

Bicycle boulevards parallel to commercial streets improve access for "interested but concerned" bicyclists and complement bike lanes on major roadways.

Guidance

- Streets are signed at 25 mph or less to improve the bicycling environment and decrease the risk and severity of crashes.
- Traffic volumes are limited to 3,000 vehicles per day (ideally less than 1,500) to minimize passing events and potential conflicts with motor vehicles.
- Use of streets that parallel major streets can discourage non-local motor vehicle traffic without significantly impacting motorists.
- Use of streets where a relatively continuous route for bicyclists exists and/or where treatments can provide wayfinding and improve crossing opportunities at offset intersections.
- Use of streets where bicyclists have right-of-way at intersections or where right-of-way is possible to assign to bicyclists.

In Portland, OR, the bicycle network includes a high density of bicycle boulevards parallel to streets with bike lanes.

- MULTI-USE PATH
  Closed to motor vehicles
- MULTI-USE PATH (unpaved)
- BIKE BOULEVARDS / NEIGHBORHOOD GREEN STREETS
  pavement markings & directional signs to guide cyclists
- SHARED ROADWAY
  on lower traffic street
- BIKE LANE
  or wide shoulder, usually on higher traffic streets
- SHARED ROADWAY WITH WIDER OUTSIDE LANE
  on moderate and higher traffic street

Discussion

Bicycle boulevards should form a continuous network of streets or off-street facilities that accommodate bicyclists who are less willing to ride on streets with motorized traffic. Most bicycle boulevards are located on residential streets, though they can also be on commercial or industrial streets. Due to the presence of trucks and commercial vehicles, as well as the need to maintain good traffic flow and retain motor vehicle parking, bicycle boulevards on commercial or industrial streets can tolderate higher automobile speeds and volumes than would be desired on neighborhood streets. Vertical traffic calming can minimize impacts to large vehicles and parking.

Additional References and Guidelines

Alta Planning + Design and IBPI. *Bicycle Boulevard Planning and Design Handbook.* 2009.
City of Berkeley. *Bicycle Boulevard Design Tools and Guidelines.* 2000.
City of Emeryville. *Bicycle Boulevard Treatments.* 2011.

Materials and Maintenance

Repaving, street sweeping and other maintenance should occur with higher frequency than on other local streets.

Bicycle Boulevard Basic Treatments

Description

Signs and pavement markings are the minimum treatments necessary to designate a street as a bicycle boulevard. Together, they visibly designate a roadway to both bicyclists and motorists. Signs, and in some cases pavement markings, provide wayfinding to help bicyclists remain on the designated route.

Guidance

Pavement Markings

Place symbols every 250-800 feet along a linear corridor, as well as after every intersection.

On narrow streets where a motor vehicle cannot pass a bicyclist within one lane of traffic, place stencils in the center of the travel lane.

A bicycle symbol can be placed on a standard road sign, along with distinctive coloration.

Signs

Some cities have developed unique logos or colors for wayfinding signs that help brand their bicycle boulevards.

Be consistent in content, design, and intent; colors reserved by the Manual on Uniform Traffic Devices (MUTCD) for regulatory and warning road signs are not recommended.

Signs can include information about intersecting bikeways and distance/time information to key destinations.

Discussion

Wayfinding signs displaying destinations, distances, and "riding time" can dispel common misperceptions about time and distance while increasing users' comfort and accessibility to the bicycle boulevard network. Bicycle boulevards frequently include offset intersections or 'jog' onto another street. Signs and pavement markings can help bicyclists remain on the route. In addition, fewer businesses or services are located along local streets, and signs inform bicyclists of the direction to key destinations, including commercial districts, transit hubs, schools and universities, and other bikeways.

Additional References and Guidelines

City of Milwaukie. *Milwaukie Bicycle Wayfinding Signage Plan.* 2009.
City of Oakland. *Design Guidelines for Bicycle Wayfinding Signage.* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Pavement markings should be repainted and signs replaced as needed. Wayfinding signs should be regularly updated with new major destinations and bikeways.

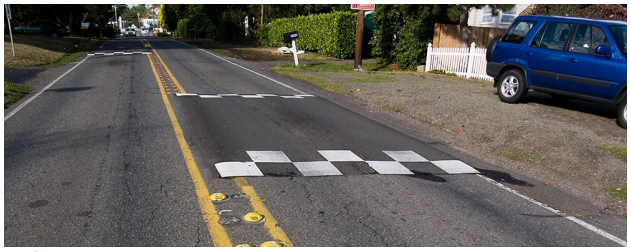
Bicycle Boulevard Vertical Traffic Calming

Description

Motor vehicle speeds affect the frequency at which automobiles pass bicyclists as well as the severity of crashes that can occur. Maintaining motor vehicle speeds closer to those of bicyclists' greatly improves bicyclists' comfort on a street. Slower vehicular speeds also improve motorists' ability to see and react to bicyclists and minimize conflicts at driveways and other turning locations.

Vertical speed control measures are composed of slight rises in the pavement, on which motorists and bicyclists must reduce speed to cross.


Speed Hump


Offset Speed Hump


Temporary Speed Cushion

Raised Crosswalk

Guidance

- Bicycle boulevards should have a maximum posted speed of 25 mph. Use traffic calming to maintain an 85th percentile speed below 22 mph.
- Speed humps are raised areas usually placed in a series across both travel lanes. A 14' long hump reduces impacts to emergency vehicles. Speed humps can be challenging for bicyclists, gaps can be provided in the center or by the curb for bicyclists and to improve drainage. Speed humps can also be offset to accommodate emergency vehicles.
- Speed lumps or cushions have gaps to accommodate the wheel tracks of emergency vehicles.
- Speed tables are longer than speed humps and flat-topped. Raised crosswalks are speed tables that are marked and signed for a pedestrian crossing.
- For all vertical traffic calming, slopes should not exceed 1:10 or be less steep than 1:25. Tapers should be no greater than 1:6 to reduce the risk of bicyclists losing their balance. The vertical lip should be no more than a 1/4" high.

Discussion

Emergency vehicle response times should be considered where vertical deflection is used. Because emergency vehicles have a wider wheel base than passenger cars, speed lumps/cushions allow them to pass unimpeded while slowing most other traffic. Alternatively, speed tables are recommended because they cannot be straddled by a truck, decreasing the risk of bottoming out. Traffic calming can also deter motorists from driving on a street. Monitor vehicle volumes on adjacent streets to determine whether traffic calming results in inappropriate volumes. Traffic calming can be implemented on a trial basis.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
Alta Planning + Design and IBPI. *Bicycle Boulevard Planning and Design Handbook.* 2009.
BikeSafe. *Bicycle countermeasure selection system.*
Ewing, Reid. *Traffic Calming: State of the Practice.* 1999.
Ewing, Reid and Brown, Steven. *U.S. Traffic Calming Manual.* 2009.
NACTO. *Urban Street Design Guide.* 2013.

Materials and Maintenance

Traffic calming should be designed to minimize impacts to snowplows. Vegetation should be regularly trimmed to maintain visibility and attractiveness.

Bicycle Boulevard Horizontal Traffic Calming

Description

Horizontal traffic calming devices cause drivers to slow down by constricting the roadway space or by requiring careful maneuvering.

Such measures may reduce the design speed of a street, and can be used in conjunction with reduced speed limits to reinforce the expectation of lowered speeds.

Guidance

- Maintain a minimum clear width of 20 feet (or 28 feet with parking on both sides), with a constricted length of at least 20 feet in the direction of travel.
- Chicanes are a series of raised or delineated curb extensions, edge islands, or parking bays on alternating sides of a street forming an "S"-shaped curb, which reduce vehicle speeds by requiring motorists to shift laterally through narrowed travel lanes.
- Pinchponts are curb extensions placed on both sides of the street, narrowing the travel lane and encouraging all road users to slow down. When placed at intersections, pinchpoints are known as chokers or neckdowns. They reduce curb radii and further lower motor vehicle speeds.
- Traffic circles are raised or delineated islands placed at intersections that reduce vehicle speeds by narrowing turning radii and the travel lane. Traffic circles can also include a paved apron to accommodate the turning radii of larger vehicles like fire trucks or school buses.

Temporary Curb Extension

Chicane

Choker or Neckdown

Pinchpoint with Bicycle Access

Discussion

Horizontal speed control measures should not infringe on bicycle space. Where possible, provide a bicycle route outside of the element so bicyclists can avoid having to merge into traffic at a narrow pinch point. This technique can also improve drainage flow and reduce construction and maintenance costs. Traffic calming can also deter motorists from driving on a street. Monitor vehicle volumes on adjacent streets to determine whether traffic calming results in inappropriate volumes. Traffic calming can be implemented on a trial basis.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
Alta Planning + Design and IBPI. *Bicycle Boulevard Planning and Design Handbook.* 2009.
BikeSafe. *Bicycle countermeasure selection system.*
Ewing, Reid. *Traffic Calming: State of the Practice.* 1999.
Ewing, Reid and Brown, Steven. *U.S. Traffic Calming Manual.* 2009.
NACTO. *Urban Street Design Guide.* 2013.

Materials and Maintenance

Traffic calming should be designed to minimize impacts to snowplows. Vegetation should be regularly trimmed to maintain visibility and attractiveness.

Bicycle Boulevard Traffic Diversion

Description

Motor vehicle traffic volumes affect the operation of a neighborhood greenway. Higher vehicle volumes reduce bicyclists' comfort and can result in more conflicts.

Implement volume control treatments based on the context of the neighborhood greenway, using engineering judgment. Target motor vehicle volumes range from 1,000 to 3,000 vehicles per day, above which the route should be striped as a bike lane or considered a signed shared roadway.

Guidance

- Traffic diversion treatments reduce motor vehicle volumes by completely or partially restricting through traffic on a neighborhood greenway.
- Partial closures allow full bicycle passage while restricting vehicle access to one way traffic at that point.
- Diagonal diverters require all motor vehicle traffic to turn.

Median diverters (see Major Intersection Treatments) restrict through motor vehicle movements while providing a refuge for bicyclists to cross in two stages.

- Street closures create a "T" that blocks motor vehicles from continuing on a neighborhood greenway, while bicycle travel can continue unimpeded. Full closures can accommodate emergency vehicles with the use of mountable curbs (maximum of six inches high).

Partial Closure

Diagonal Diverter


Median Diverter


Full Closure

Discussion

Neighborhood greenways on streets with volumes higher than 3,000 vehicles per day are not recommended, although a segment of a neighborhood greenway may accommodate more traffic for a short distance if necessary to complete the corridor. Providing additional separation with a bike lane, cycle track or other treatment is recommended where traffic calming or diversion cannot reduce volumes below this threshold.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
Alta Planning + Design and IBPI. *Bicycle Boulevard Planning and Design Handbook.* 2009.
Ewing, Reid. *Traffic Calming: State of the Practice.* 1999.
Ewing, Reid and Brown, Steven. *U.S. Traffic Calming Manual.* 2009.
Oregon Department of Transportation. *Right-In Right-Out Channelization.* 1998.

Materials and Maintenance

Depending on the diverter type, these treatments can be challenging to keep clear of snow and debris. Vegetation should be regularly trimmed to maintain visibility and attractiveness.

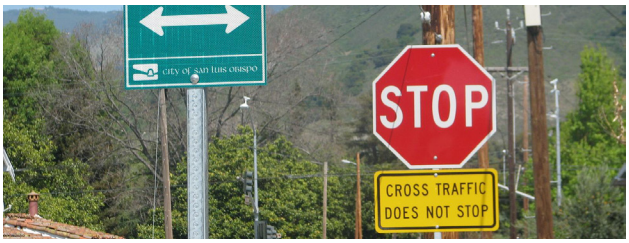
Bicycle Boulevard Minor Intersection Treatments

Description

Treatments at minor roadway intersections are designed to improve the visibility of a bicycle boulevard, raise awareness of motorists on the cross-street that they are likely to encounter bicyclists, and enhance safety for all road users.

Guidance

- On the bicycle boulevard, the majority of intersections with minor roadways should stop-control cross traffic to minimize bicyclist delay. This will maximize bicycling efficiency.
- If a stop sign is present on the bicycle boulevard, a second stop bar for bicyclists can be placed closer to the centerline of the cross street than the motorists' stop bar to increase the visibility of bicyclists waiting to cross the street.
- Curb extensions can be used to move bicyclists closer to the centerline to improve visibility and encourage motorists to let them cross.



Stop Signs on Cross-Street


Bicycle Forward Stop Bar


Curb Extension

Discussion

Stop signs increase bicycling time and energy expenditure, frequently leading to non-compliance by bicyclists and motorists, and/or use of other less desirable routes. Bicycle boulevards should have fewer stops or delays than other local streets. A typical bicycle trip of 30 minutes can increase to 40 minutes if there is a STOP sign at every block (*Berkeley Bicycle Boulevard Design Tools and Guidelines*). If several stop signs are turned along a corridor, speeds should be monitored and traffic-calming treatments used to reduce excessive vehicle speeds on the bicycle boulevard.

Additional References and Guidelines

City of Berkeley. *Bicycle Boulevard Design Tools and Guidelines.* 2000.
City of London Transport for London. *Advanced stop lines (ASLS) background and research studies.*
Transportation Research Board. *Improving Pedestrian Safety at Unsignalized Crossings.* NCHRP Report # 562. 2006.

Materials and Maintenance

Vegetation in traffic circles and curb extensions should be regularly trimmed to maintain visibility and attractiveness. Repaint bicycle stop bars as needed.

Bicycle Boulevard Major Intersection Treatments

Description

The quality of treatments at major street crossings can significantly affect a bicyclist's choice to use a bicycle boulevard, as opposed to another road that provides a crossing treatment.

Guidance

- Bike boxes increase bicyclist visibility to motorists and reduce the danger of right "hooks" by providing a space for bicyclists to wait at signalized intersections.
- Median islands provided at uncontrolled intersections of bicycle boulevards and major streets allow bicyclists to cross one direction of traffic at a time as gaps in traffic occur.
- Hybrid beacons, active warning beacons and bicycle signals can facilitate bicyclists crossing a busy street on which cross-traffic does not stop.
- Select treatments based on engineering judgment; see National Cooperative Highway Research Program (NCHRP) Report # 562 *Improving Pedestrian Safety at Unsignalized Crossings* (2006) for guidance on appropriate use of crossing treatments. Treatments are designed to improve visibility and encourage motorists to stop for pedestrians; with engineering judgement many of the same treatments are appropriate for use along bicycle boulevards.

Bike Box

Median Island

Hybrid Beacon

Rectangular Rapid Flash Beacon (RRFB)

Discussion

Bicycle boulevard retrofits to local streets are typically located on streets without existing signalized accommodation at crossings of collector and arterial roadways. Without treatments for bicyclists, these intersections can become major barriers along the bicycle boulevard and compromise safety.

Additional References and Guidelines

Transportation Research Board. *Improving Pedestrian Safety at Unsignalized Crossings.* NCHRP Report # 562. 2006.
Federal Highway Administration. *Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations.* FHWA-RD-04-100. 2004.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Maintain signs, markings, and other treatments and replace as needed. Monitor intersections for bicyclist delay to determine if additional treatments are warranted.

Class II Bikeways

Designated exclusively for bicycle travel, separated bikeways are segregated from vehicle travel lanes by striping, and can include pavement stencils and other treatments. Separated bikeways are most appropriate on arterial and collector streets where higher traffic volumes and speeds warrant greater separation.

Separated bikeways can increase safety and promote proper riding by:

- Defining road space for bicyclists and motorists, reducing the possibility that motorists will stray into the bicyclists' path.
- Discouraging bicyclists from riding on the sidewalk.
- Reducing the incidence of wrong way riding.
- Reminding motorists that bicyclists have a right to the road.


Bicycle Lane without Parking


Bicycle Lane and Parallel Parking


Bicycle Lane and Diagonal Parking


Buffered Bike Lane


Cycle Track

Bike Lane without On-Street Parking

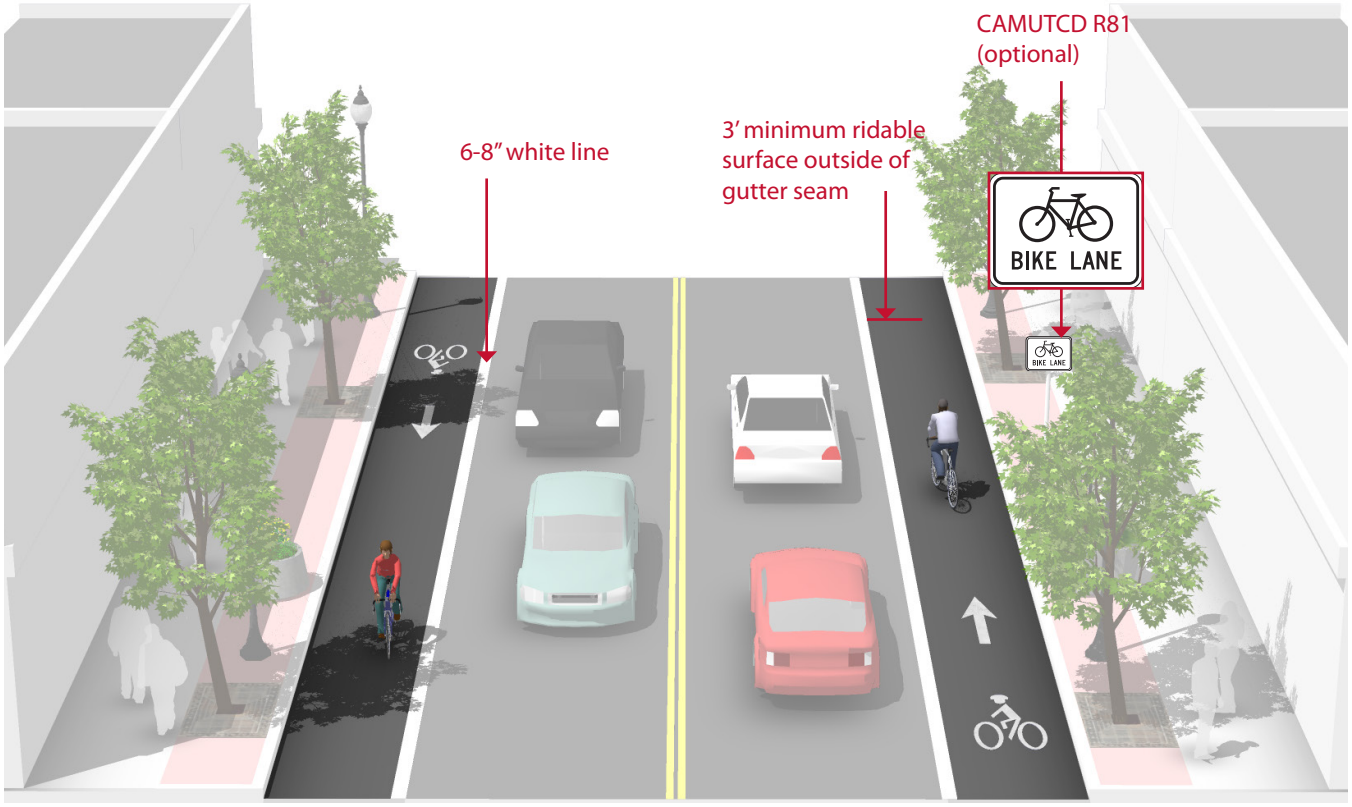
Description

Bike lanes designate an exclusive space for bicyclists through the use of pavement markings and signage. The bike lane is typically located on the right side of the street, between the adjacent travel lane and curb, and is used in the same direction as motor vehicle traffic.

A bike lane width of 7 feet makes it possible for bicyclists to ride side-by-side or pass each other without leaving the bike lane, thereby increasing the capacity of the lane.

Guidance

- 4 foot minimum when no curb and gutter is present.
- 5 foot minimum when adjacent to curb and gutter or 3 feet more than the gutter pan width if the gutter pan is wider than 2 feet.
- 7 foot maximum width for use adjacent to arterials with high travel speeds. Greater widths may encourage motor vehicle use of bike lane. Configure as buffered bicycle lanes when a wider facility is desired.



Discussion

Wider bicycle lanes are desirable in certain situations such as on higher speed arterials (45 mph+) where use of a wider bicycle lane would 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. Consider buffered bicycle lanes when further separation is desired.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
Caltrans *CA-MUTCD. 2012.*
NACTO. *Urban Bikeway Design Guide.* 2012.
Caltrans. *California HDM.* 2012.

Materials and Maintenance

Paint can wear more quickly in high traffic areas. Bicycle lanes should be cleared of debris through routine street cleaning operations and on an as-needed basis.

Bike Lane Adjacent to On-Street Parallel Parking

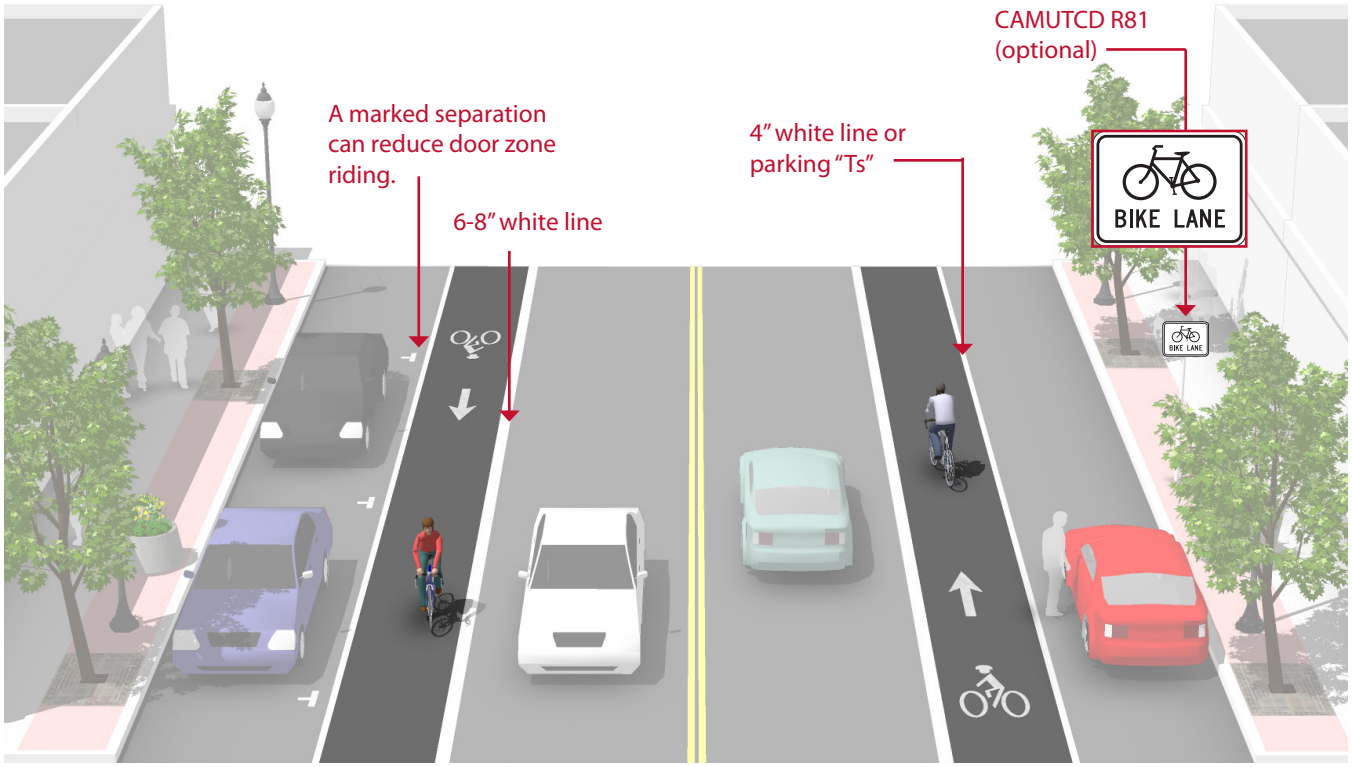
Description

Bike lanes designate an exclusive space for bicyclists through the use of pavement markings and signage. The bike lane is located adjacent to motor vehicle travel lanes and is used in the same direction as motor vehicle traffic. Bike lanes are typically on the right side of the street, between the adjacent travel lane and curb, road edge or parking lane.

Many bicyclists, particularly less experienced riders, are more comfortable riding on a busy street if it has a striped and signed bikeway than if they are expected to share a lane with vehicles.

Guidance

- 12 foot minimum from curb face to edge of bike lane.
- 14.5 foot preferred from curb face to edge of bike lane.
- 7 foot maximum for marked width of bike lane. Greater widths may encourage vehicle loading in bike lane. Configure as buffered bicycle lanes when a wider facility is desired.



Discussion

The bike lane should have sufficient width to allow bicyclists to stay out of the door zone while not encroaching into the adjacent vehicular lane.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
Caltrans *CA-MUTCD. 2012.*
NACTO. *Urban Bikeway Design Guide*. 2012.
Caltrans. *California HDM.* 2012.

Materials and Maintenance

Paint can wear more quickly in high traffic areas. Bicycle lanes should be cleared of debris through routine street cleaning operations and on an as-needed basis.

Bike Lanes and Diagonal Parking

Description

In certain areas with high parking demand such as urban commercial areas, diagonal parking can be used to increase parking supply.

Back-in diagonal parking improves sight distances between drivers and bicyclists when compared to conventional head-in diagonal parking. Back-in parking is best paired with a dedicated bicycle lane.

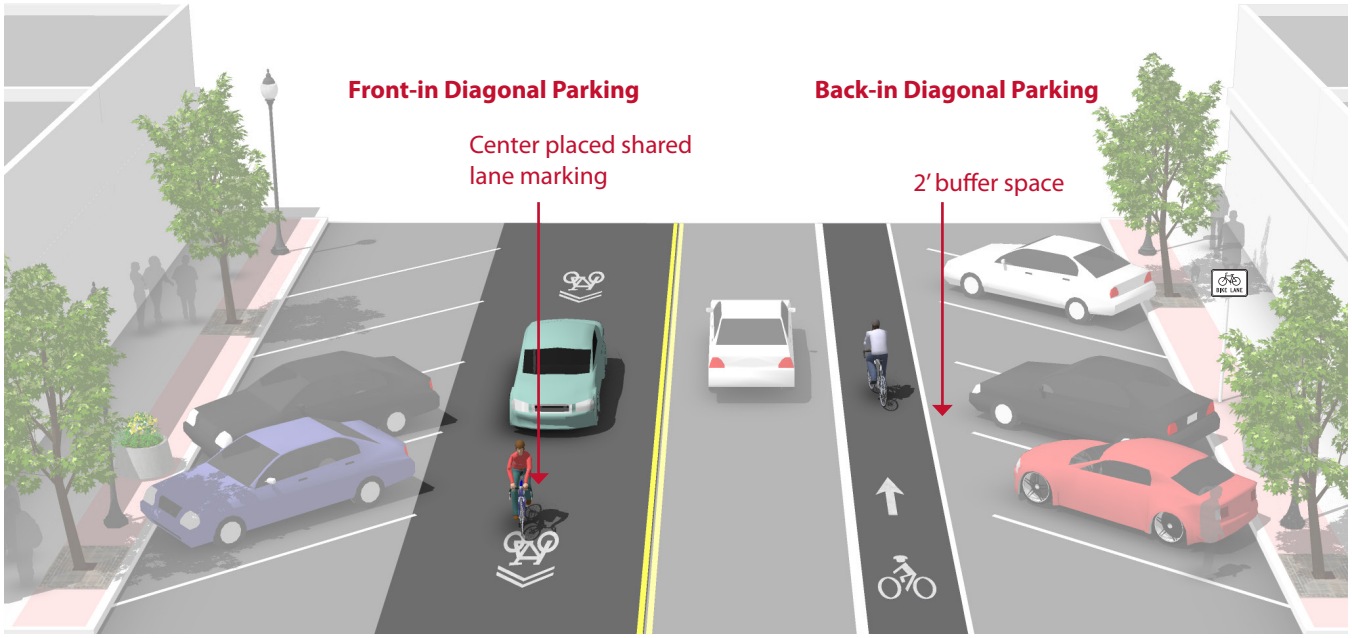
Guidance

Front-in Diagonal Parking

- Shared lane markings are the preferred facility with front-in diagonal parking

Back-in Diagonal Parking

- 5 foot minimum marked width of bike lane
- Parking bays are sufficiently long to accommodate most vehicles (so vehicles do not block bike lane)



Discussion

Conventional front-in diagonal parking is not compatible or recommended with the provision of bike lanes, as drivers backing out of conventional diagonal parking have limited visibility of approaching bicyclists. Under these conditions, shared lane markings should be used to guide bicyclists away from reversing automobiles.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
Caltrans. *Main Street, California.* 2013.

Materials and Maintenance

Paint can wear more quickly in high traffic areas. Bicycle lanes should be cleared of debris through routine street cleaning operations and on an as-needed basis.

Buffered Bike Lane

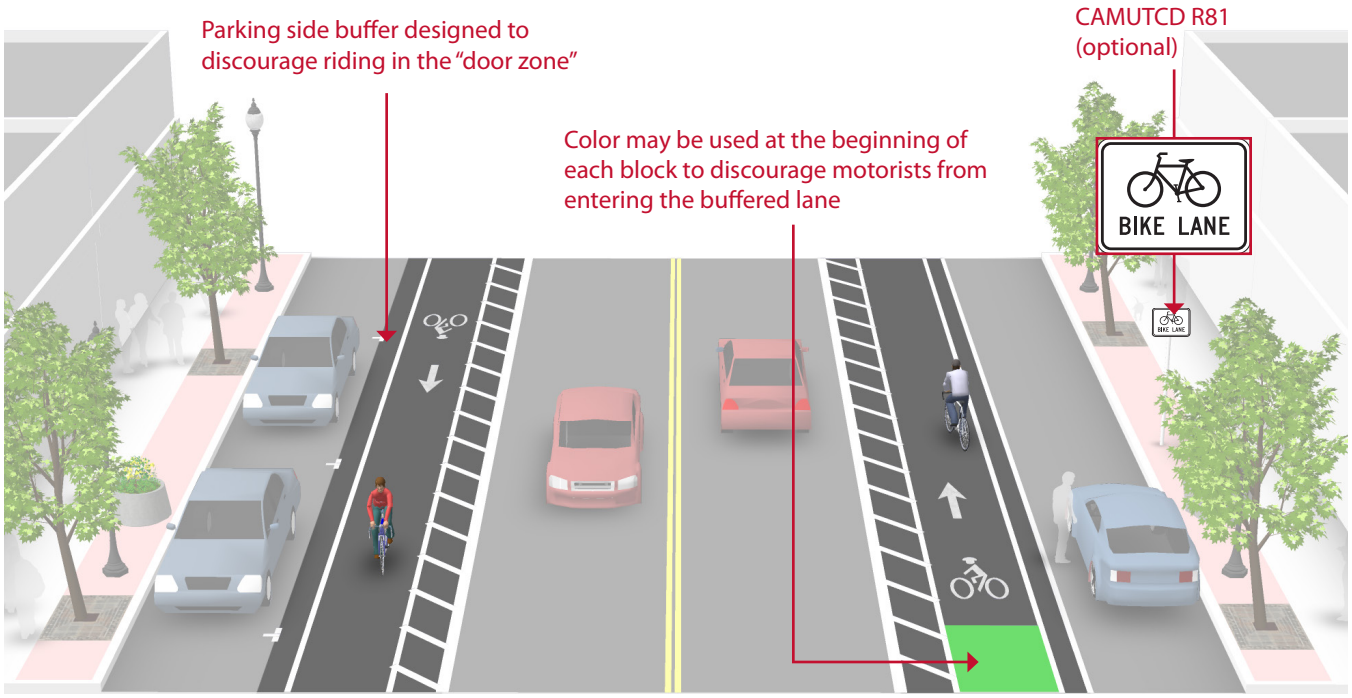
Description

Buffered bike lanes are conventional bicycle lanes paired with a designated buffer space, separating the bicycle lane from the adjacent motor vehicle travel lane and/or parking lane. Buffered bike lanes follow general guidance for buffered preferential vehicle lanes as per MUTCD guidelines (section 3D-01).

Buffered bike lanes are designed to increase the space between the bike lane and the travel lane and/or parked cars. This treatment is appropriate for bike lanes on roadways with high motor vehicle traffic volumes and speed, adjacent to parking lanes, or a high volume of truck or oversized vehicle traffic.

Guidance

- The minimum bicycle travel area (not including buffer) is 5 feet wide.
- Buffers should be at least 2 feet wide. If 3 feet or wider, mark with diagonal or chevron hatching. For clarity at driveways or minor street crossings, consider a dotted line for the inside buffer boundary where cars are expected to cross.
- Buffered bike lanes can buffer the travel lane only, or parking lane only depending on available space and the objectives of the design.



Discussion

Frequency of right turns by motor vehicles at major intersections should determine whether continuous or truncated buffer striping should be used approaching the intersection. Commonly configured as a buffer between the bicycle lane and motor vehicle travel lane, a parking side buffer may also be provided to help bicyclists avoid the 'door zone' of parked cars.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices. (3D-01).* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.
Caltrans *CA-MUTCD.* 2012

Materials and Maintenance

Paint can wear more quickly in high traffic areas. Bicycle lanes should be cleared of debris through routine street cleaning operations and on an as-needed basis.

Cycle Tracks

Guidance

Cycle tracks should ideally be placed along streets with long blocks and few driveways or mid-block access points for motor vehicles.

One-Way Cycle Tracks

- 7 foot recommended minimum to allow passing. 5 foot minimum width in constrained locations.

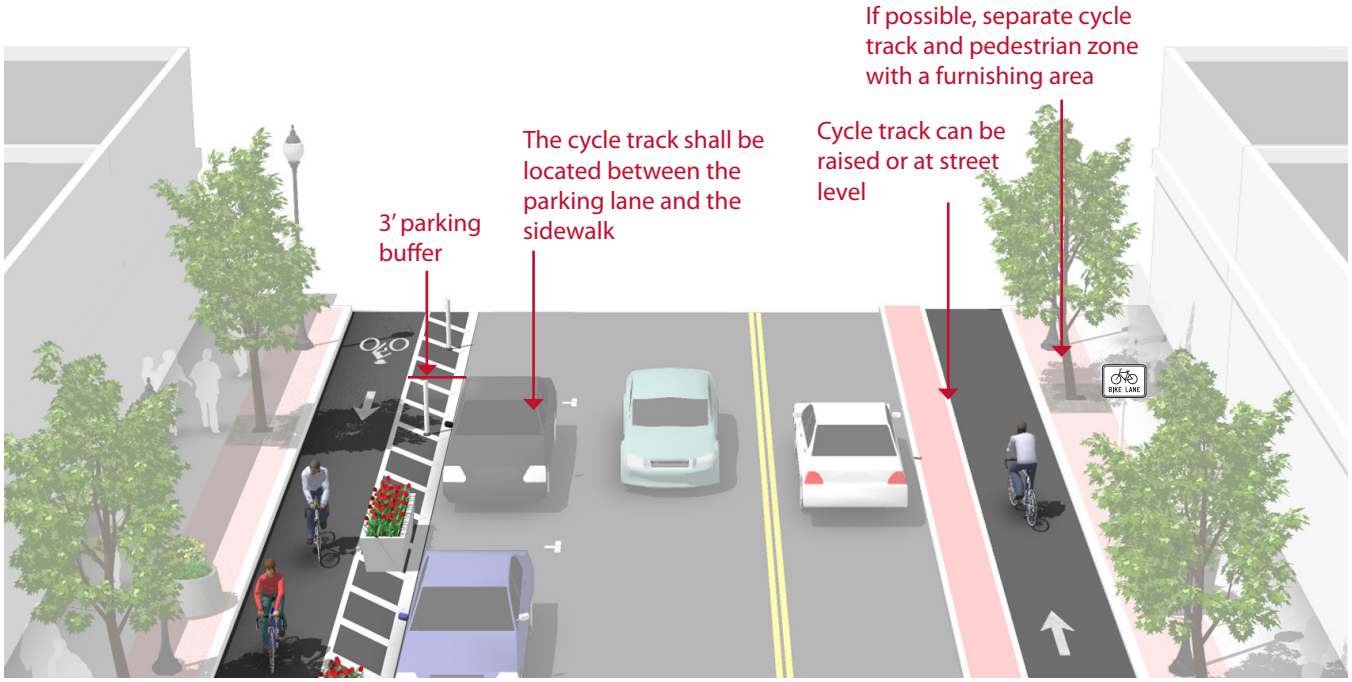
Two-Way Cycle Tracks

- Cycle tracks located on one-way streets have fewer potential conflict areas than those on two-way streets.
- 12 foot recommended minimum for two-way facility. 8 foot minimum in constrained locations

Description

A cycle track is an exclusive bike facility that combines the user experience of a separated path with the on-street infrastructure of a conventional bike lane. A cycle track is physically separated from motor traffic and distinct from the sidewalk. Cycle tracks have different forms but all share common elements—they provide space that is intended to be exclusively or primarily used by bicycles, and are separated from motor vehicle travel lanes, parking lanes, and sidewalks.

Raised cycle tracks may be at the level of the adjacent sidewalk or set at an intermediate level between the roadway and sidewalk to separate the cycle track from the pedestrian area.



Discussion

Special consideration should be given at transit stops to manage bicycle and pedestrian interactions. Driveways and minor street crossings are unique challenges to cycle track design. Parking should be prohibited within 30 feet of the intersection to improve visibility. Color, yield markings and "Yield to Bikes" signage should be used to identify the conflict area and make it clear that the cycle track has priority over entering and exiting traffic. If configured as a raised cycle track, the crossing should be raised so that the sidewalk and cycle track maintain their elevation through the crossing.

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Barrier separated and raised cycle tracks may require special equipment for sweeping and maintenance.

Separated Bikeways at Intersections

An intersection facilitates the interchange between bicyclists, motorists, pedestrians and other modes in order to advance traffic flow in a safe and efficient manner. Designs for intersections with bicycle facilities should reduce conflict between bicyclists and vehicles by heightening the level of visibility, denoting clear right-of-way and facilitating eye contact and awareness with other modes. Intersection treatments can improve both queuing and merging maneuvers for bicyclists, and are often coordinated with timed or specialized signals.

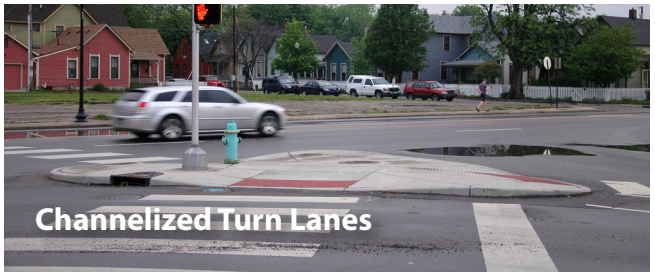
The configuration of a safe intersection for bicyclists may include elements such as color, signage, medians, signal detection and pavement markings. Intersection design should take into consideration existing and anticipated bicyclist, pedestrian and motorist movements. In all cases, the degree of mixing or separation between bicyclists and other modes is intended to reduce the risk of crashes and increase bicyclist comfort. The level of treatment required for bicyclists at an intersection will depend on the bicycle facility type used, whether bicycle facilities are intersecting, and the adjacent street function and land use.


Bike Box


Colored Bike Lanes in Conflict Areas

Combined Bike Lane/ Turn Lane


Two Stage Turn Boxes


Channelized Turn Lanes


Bicyclists at Single Lane Roundabouts

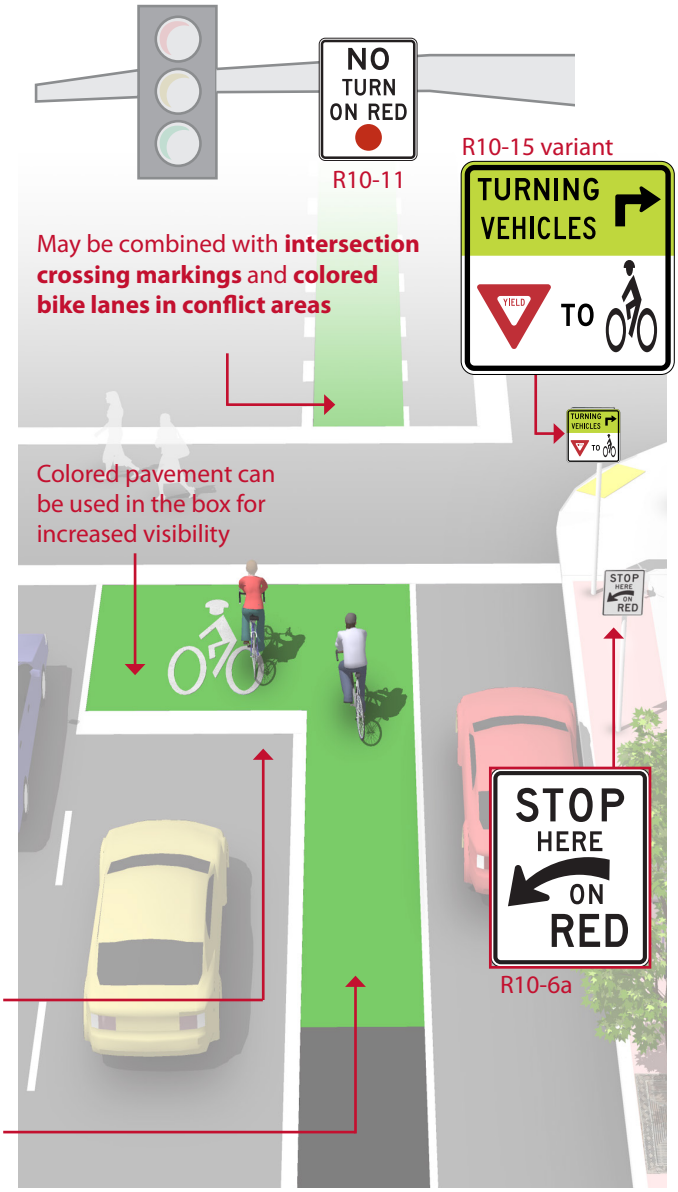
Bike Box

Description

A bike box is a designated area located at the head of a traffic lane at a signalized intersection that provides bicyclists with a safe and visible space to get in front of queuing motorized traffic during the red signal phase. Motor vehicles must queue behind the white stop line at the rear of the bike box.

Guidance

- 14' minimum depth
- A "No Turn on Red" (MUTCD R10-11) sign shall be installed overhead to prevent vehicles from entering the Bike Box.
- A "Stop Here on Red" sign should be post-mounted at the stop line to reinforce observance of the stop line.
- A "Yield to Bikes" sign should be post-mounted in advance of and in conjunction with an egress lane to reinforce that bicyclists have the right-of-way going through the intersection.
- An ingress lane should be used to provide access to the box.
- A supplemental "Wait Here" legend can be provided in advance of the stop bar to increase clarity to motorists.



Discussion

Bike boxes are considered experimental by the FHWA.
Bike boxes should be placed only at signalized intersections, and right turns on red shall be prohibited for motor vehicles. Bike boxes should be used in locations that have a large volume of bicyclists and are best utilized in central areas where traffic is usually moving more slowly. Prohibiting right turns on red improves safety for bicyclists yet does not significantly impede motor vehicle travel.

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide.* 2012.
FHWA. Interim Approval (IA-14) has been granted. Requests to use green colored pavement need to comply with the provisions of Paragraphs 14 through 22 of Section 1A.10. 2011.

Materials and Maintenance

Because the effectiveness of markings depends entirely on their visibility, maintaining markings should be a high priority.

Colored Bike Lanes in Conflict Areas

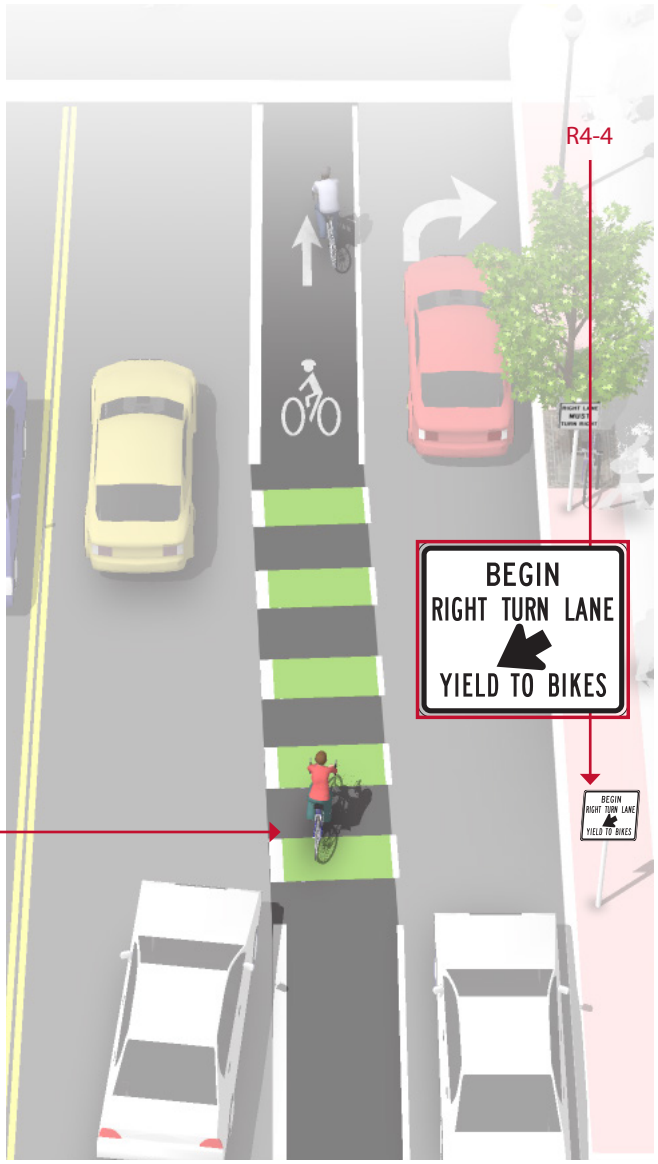
Description

Colored pavement within a bicycle lane increases the visibility of the facility and reinforces priority of bicyclists in conflict areas.

The design (right) illustrates a through bike lane to the left of a right turn only lane with signage indicating that motorists should yield to bicyclists through the conflict area.

Guidance

- Green colored pavement was given interim approval by the Federal Highways Administration in March 2011. See interim approval for specific color standards.
- The colored surface should be skid resistant and retro-reflective.
- A "Yield to Bikes" sign should be used at intersections or driveway crossings to reinforce that bicyclists have the right-of-way in colored bike lane areas.



Discussion

Evaluations performed in Portland, OR, St. Petersburg, FL and Austin, TX found that significantly more motorists yielded to bicyclists and slowed or stopped before entering the conflict area after the application of the colored pavement when compared with an uncolored treatment.

Additional References and Guidelines

FHWA. Interim Approval (IA-14) has been granted. Requests to use green colored pavement need to comply with the provisions of Paragraphs 14 through 22 of Section 1A.10. 2011.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

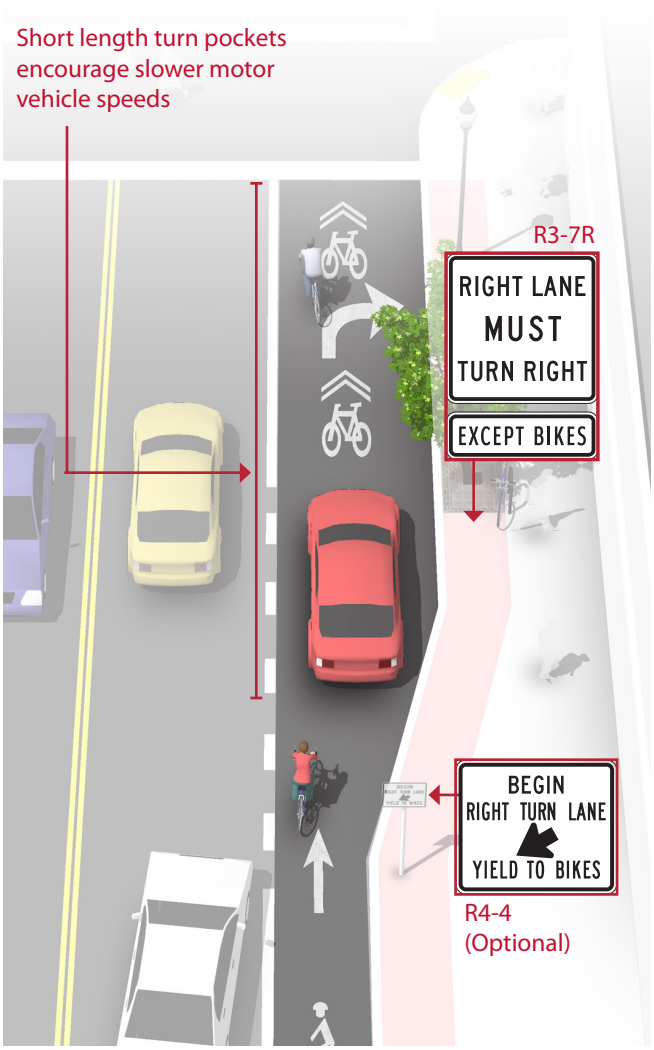
Because the effectiveness of markings depends entirely on their visibility, maintaining markings should be a high priority.

Combined Bike Lane / Turn Lane

Description

The combined bicycle/right turn lane places shared lane markings within a right turn only lane.

This treatment is recommended at intersections lacking sufficient space to accommodate both a standard through bike lane and right turn lane.



Guidance

- Maximum shared turn lane width is 13 feet; narrower is preferable.
- Shared Lane Markings should indicate preferred positioning of bicyclists within the combine lane.
- A "RIGHT LANE MUST TURN RIGHT" sign with an "EXCEPT BIKES" plaque may be needed to make it legal for through bicyclists to use a right turn lane.
- The BEGIN RIGHT TURN LANE YIELD TO BIKES (R4-4) sign may be used where motor vehicles entering an exclusive right-turn lane must weave across bicycle traffic in bicycle lanes. The R4-4 sign should not be used when bicyclists need to move left because of a right-turn lane drop situation. Refer CA-MUTCD Section 9B.05.

Discussion

Case studies cited by the Pedestrian and Bicycle Information Center indicate that this treatment works best on streets with lower posted speeds (30 MPH or less) and with lower traffic volumes (10,000 ADT or less). May not be appropriate for high-speed arterials or intersections with long right turn lanes. May not be appropriate for intersections with large percentages of right-turning heavy vehicles.

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide*. 2012.

Materials and Maintenance

Locate markings out of tire tread to minimize wear. Because the effectiveness of markings depends on their visibility, maintaining markings should be a high priority.

Two-Stage Turn Box

Description

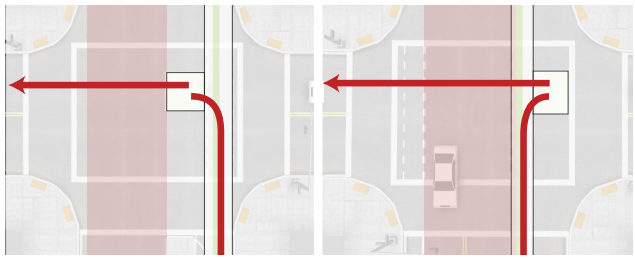
Two-stage turn boxes offer bicyclists a safe way to make left turns at multi-lane signalized intersections from a right side bike lane or cycle track.

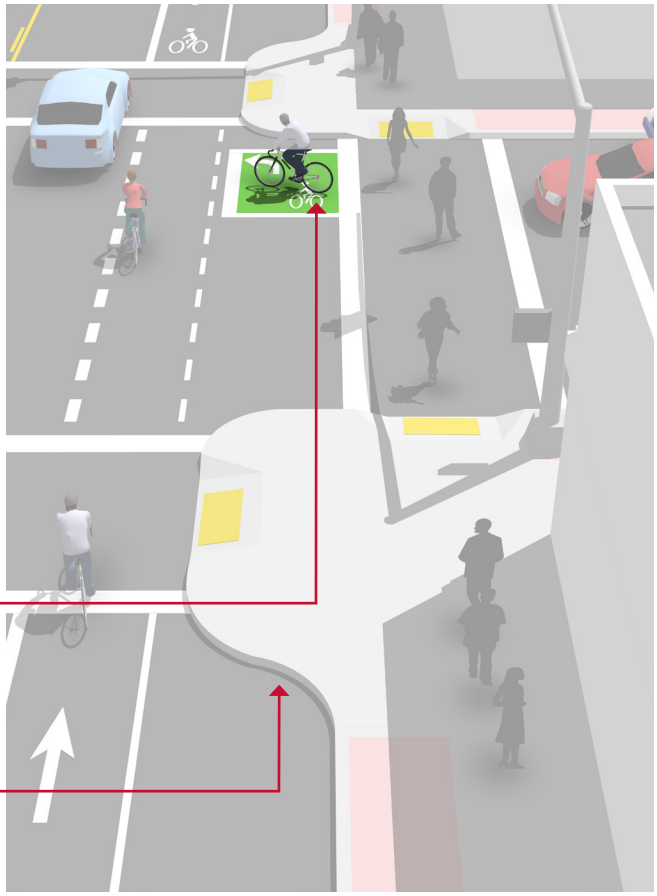
On right side bike lanes, bicyclists are often unable to merge into traffic to turn left due to high traffic volumes and speeds. On cycle tracks, bicyclists cannot merge due to physical separation.

In both cases, the provision of two-stage left turn boxes is important to allow for access and mobility on the bike network.

Cycle track turn box protected by physical buffer:

Bike lane turn box protected by parking lane:





Guidance

- The queue box shall be placed in a protected area. Typically this is within an on-street parking lane or cycle track buffer area.
- 6 Foot minimum depth of bicycle storage area. 8' feet preferred.
- Bicycle stencil and turn arrow pavement markings shall be used to indicate proper bicycle direction and positioning.
- A "No Turn on Red" (MUTCD R10-11) sign should be installed on the cross street to prevent vehicles from entering the turn box.

Consider using colored pavement inside the box to further define the bicycle space

Turns from a bicycle lane should be protected by a curb extension

Discussion

Two-Stage Turn boxes are considered experimental by FHWA, unless configured as a "jug handle" turn integrated into the sidewalk.
While two stage turns may increase bicyclist comfort in many locations, this configuration will typically result in higher average delay for turning bicyclists due to the need to receive two separate green signal indications (one for the through street, followed by one for the cross street) before proceeding.

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide*. 2012.

Materials and Maintenance

Paint can wear more quickly in high traffic areas or in winter climates.

Channelized Turn Lanes

Description

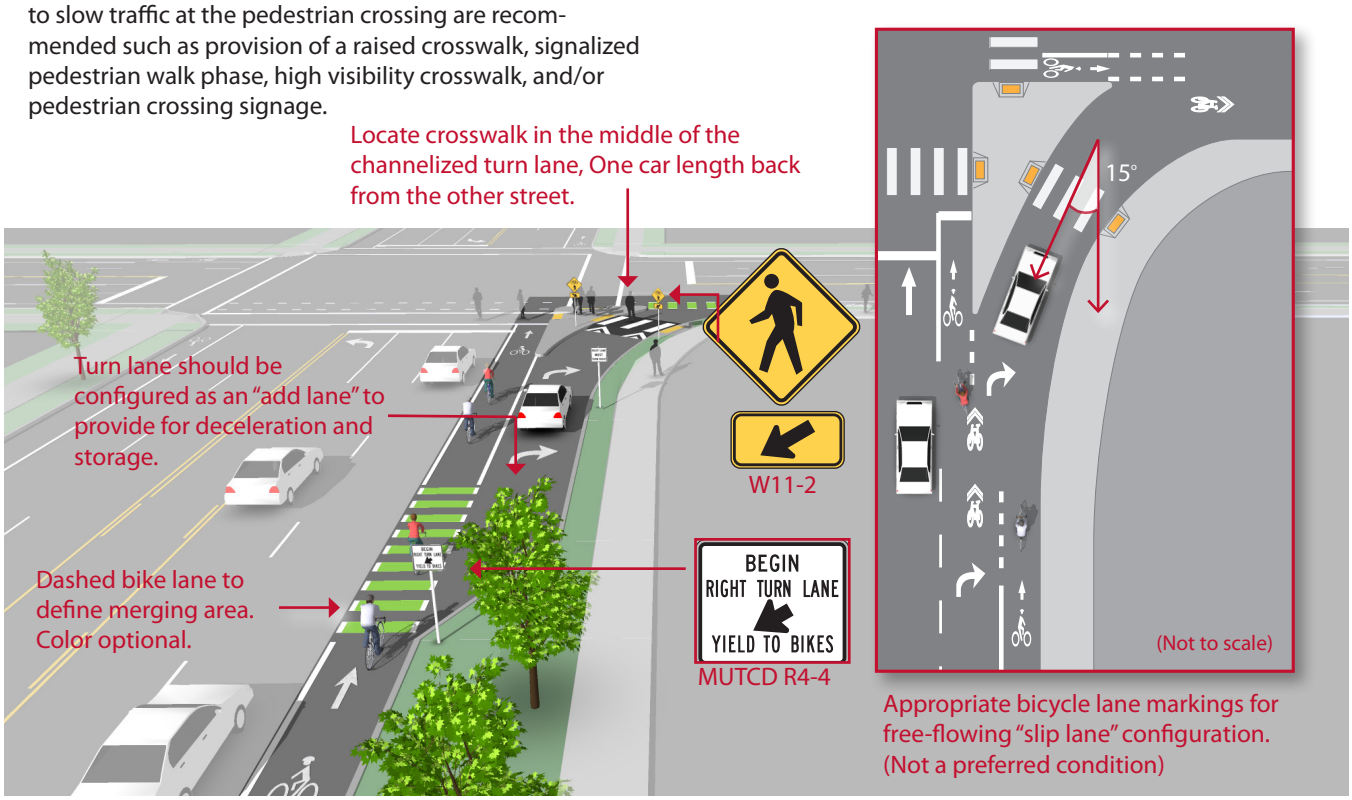
In some intersections of arterials streets, design vehicle requirements or intersection angles may result in wide turning radii at corners. Configuring the intersection as a channelized (or free-right) turn lane with a raised refuge island can improve conditions for pedestrians trying to cross the street.

Similar to a median refuge island, the raised refuge island can reduce crossing distances, allow staged crossing of the roadway, and improve visibility of pedestrians crossing the roadway.

To improve safety and comfort for pedestrians, measures to slow traffic at the pedestrian crossing are recommended such as provision of a raised crosswalk, signalized pedestrian walk phase, high visibility crosswalk, and/or pedestrian crossing signage.

Guidelines

- The preferred angle of intersection between the channelized turn lane and the roadway being joined is no more than 15 degrees to allow for simultaneous visibility of pedestrians and potential roadway gaps.
- Design with a maximum 30-35 foot turning radius.
- Signing: Pedestrian crossing sign assembly (W11-2) or Yield (R1-2) to encourage yielding. Yield to Bikes (R4-4) or similar if bike lanes are present.
- Raised crossings in the channelized turn lane may slow driver speed through the turning area.



Discussion

This design requires trucks to turn into multiple receiving lanes, and may not be appropriate on the approach to streets with one through lane.

Channelized turn lanes can be very challenging for blind pedestrians. NCHRP 674 identified the use of sound strips (a full lane rumble strip-like device) in conjunction with flashing beacons to increase yielding compliance.

Additional References and Guidelines

TRB. *NCHRP 674 Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Vision Disabilities.* 2011.
ITE. *Designing Walkable Urban Thoroughfares.* 2010.
Caltrans. *CA-MUTCD.* 2012
Caltrans. *Complete Intersections.* 2010.

Materials and Maintenance

Signage and striping require routine maintenance.

Bicycles at Signals and Beacons

Designs for bicycles at signalized crossings should allow bicyclists to trigger signals an safely maneuver the crossing.

Warning beacons can be utilized at unsignalized intersection crossings. Push buttons, signage, and pavement markings may be used to supplement these facilities for both bicyclists and motorists.

Bicycle Detection and Actuation

Hybrid Beacons for Bike Route Crossings

Bicycle Detection and Actuation

Description

Push Button Actuation

User-activated button mounted on a pole facing the street.

Loop Detectors

Bicycle-activated loop detectors are installed within the roadway to allow the presence of a bicycle to trigger a change in the traffic signal. This allows the bicyclist to stay within the lane of travel without having to maneuver to the side of the road to trigger a push button.

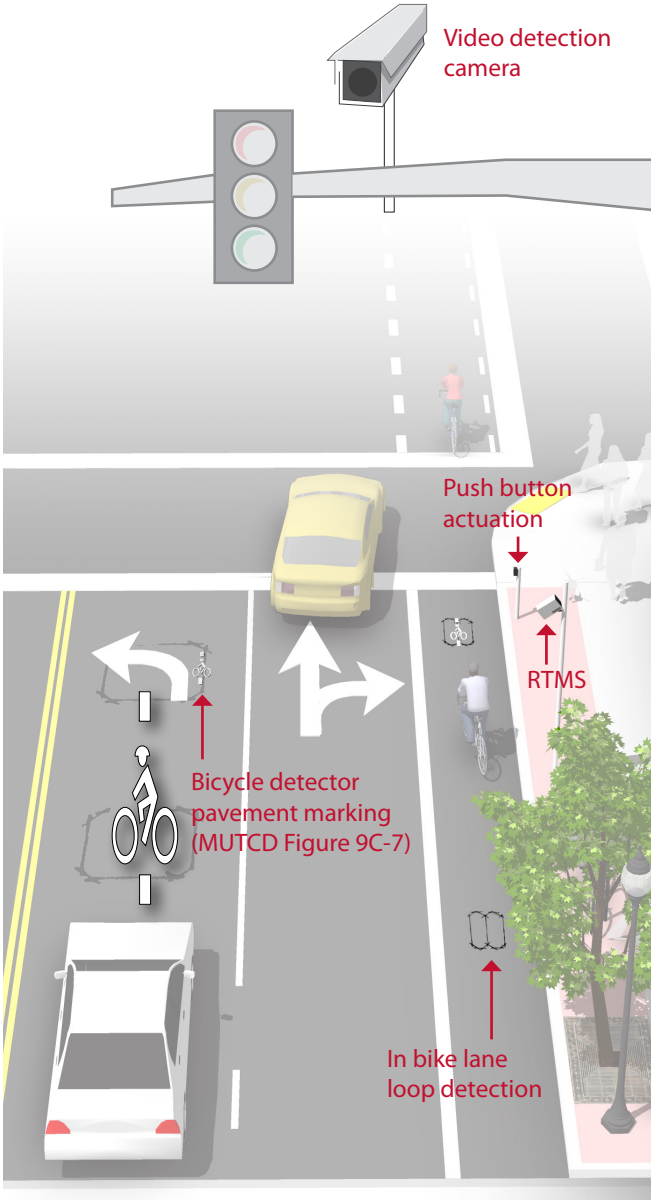
Loops that are sensitive enough to detect bicycles should be supplemented with pavement markings to instruct bicyclists how to trip them.

Video Detection Cameras

Video detection systems use digital image processing to detect a change in the image at a location. These systems can be calibrated to detect bicycles. Video camera system costs range from $20,000 to $25,000 per intersection.

Remote Traffic Microwave Sensor Detection (RTMS)

RTMS is a system which uses frequency modulated continuous wave radio signals to detect objects in the roadway. This method marks the detected object with a time code to determine its distance from the sensor. The RTMS system is unaffected by temperature and lighting, which can affect standard video detection.



Discussion

Proper bicycle detection should meet two primary criteria: 1) accurately detects bicyclists and 2) provides clear guidance to bicyclists on how to actuate detection (e.g., what button to push, where to stand).

Bicycle loops and other detection mechanisms can also provide bicyclists with an extended green time before the light turns yellow so that bicyclists of all abilities can reach the far side of the intersection.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
Caltrans *CA-MUTCD. 2012.*
NACTO. *Urban Bikeway Design Guide.* 2012.
Caltrans. *Policy Directive 09-06.* 2009.
Caltrans. *Complete Intersections.* 2010.

Materials and Maintenance

Signal detection and actuation for bicyclists should be maintained with other traffic signal detection and roadway pavement markings.

Hybrid Beacons for Bike Route Crossings

Description

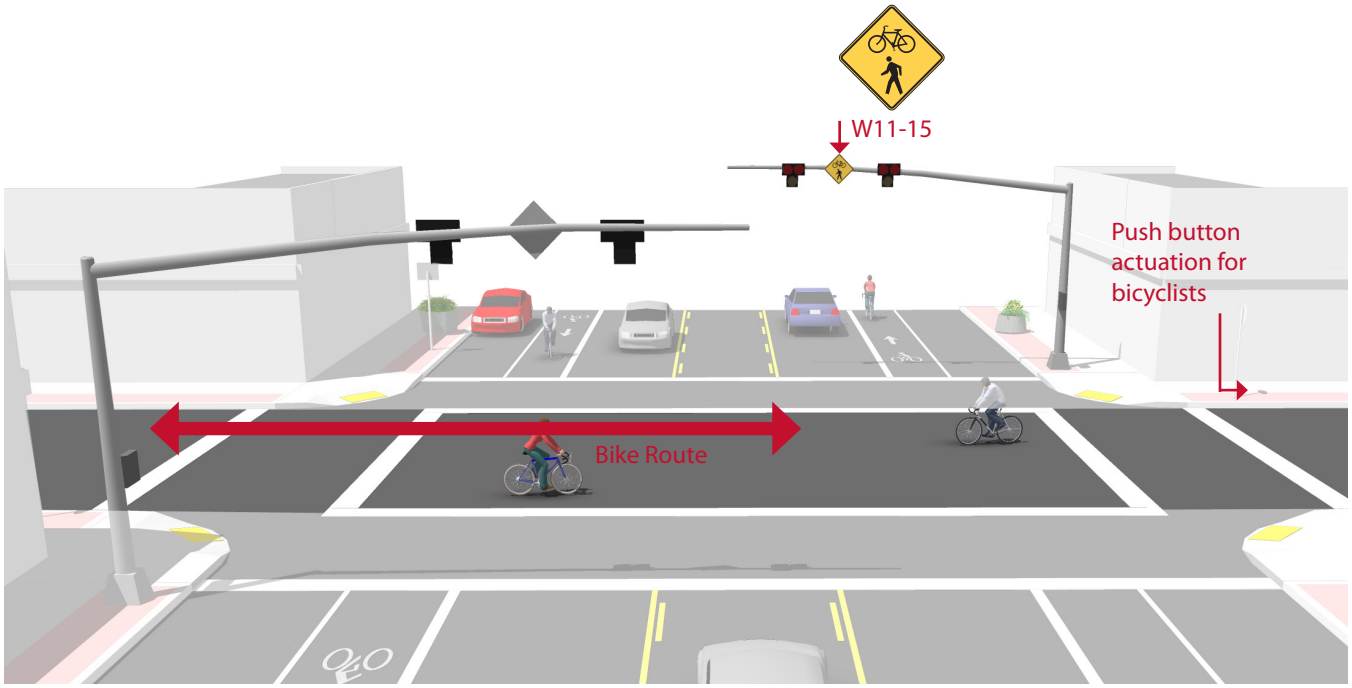
A hybrid beacon, formerly known as a High-intensity Activated CrosswalK (HAWK), consists of a signal-head with two red lenses over a single yellow lens on the major street, and pedestrian signal heads for the minor street. There are no signal indications for motor vehicles on the minor street approaches.

in addition to paths crossing roadways between traffic signals (i..e. midblock), hybrid beacons may be used at minor road / major road intersections where a normal traffic signal warrant is not met.

Guidance

Hybrid beacons may be installed without meeting traffic control signal warrants if roadway speed and volumes are excessive for comfortable user crossing.

- If installed within a signal system, signal engineers should evaluate the need for the hybrid signal to be coordinated with other signals.
- Parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the marked crosswalk to provide adequate sight distance.



Discussion

The hybrid beacon can significantly improve the operation of a bicycle route, particularly along bicycle boulevard corridors. Because of the low traffic volumes on these facilities, intersections with major roadways are often unsignalized, creating difficult and potentially unsafe crossing conditions for bicyclists.

Each crossing, regardless of traffic speed or volume, requires additional review by a registered engineer to identify sight lines, potential impacts on traffic progression, timing with adjacent signals, capacity and safety.

Additional References and Guidelines

FHWA. *Pedestrian Hybrid Beacon Guide.* 2014.
NACTO. *Urban Bikeway Design Guide.* 2012.
Caltrans. *CA-MUTCD. 2012.*

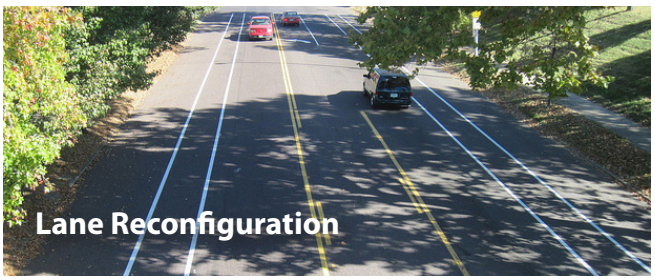
Materials and Maintenance

Hybrid beacons are subject to the same maintenance needs and requirements as standard traffic signals. Signing and striping need to be maintained to help users understand any unfamiliar traffic control.

Retrofitting Existing Streets to add Bikeways

Most major streets are characterized by conditions (e.g., high vehicle speeds and/or volumes) for which dedicated bike lanes are an appropriate facility to accommodate safe and comfortable riding. Although opportunities to add bike lanes through roadway widening may exist in some locations, many major streets have physical and other constraints that would require street retrofit measures within existing curb-to-curb widths.

Although largely intended for major streets, these measures may be appropriate for any roadway where bike lanes would be the best accommodation for bicyclists.



Lane Narrowing

Description

Lane narrowing utilizes roadway space that exceeds minimum standards to provide the needed space for bike lanes. Many roadways have existing travel lanes that are wider than those prescribed in local and national roadway design standards, or which are not marked. Most standards allow for the use of 11 foot and sometimes 10 foot wide travel lanes to create space for bike lanes.

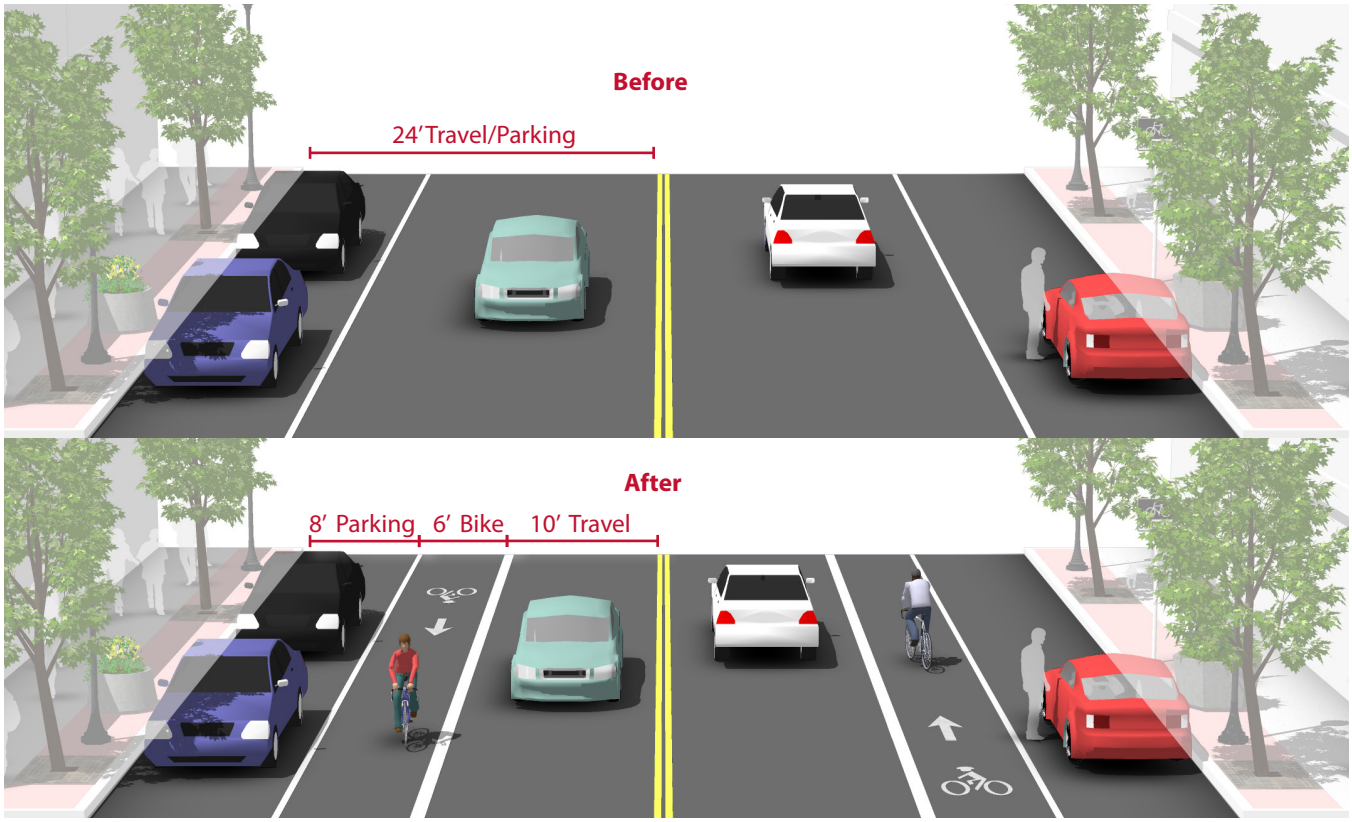
Guidance

Vehicle lane width:

- Before: 10-15 feet
- After: 10-11 feet

Bicycle lane width:

- Guidance on bicycle lanes applies to this treatment.



Discussion

Special consideration should be given to the amount of heavy vehicle traffic and horizontal curvature before the decision is made to narrow travel lanes. Center turn lanes can also be narrowed in some situations to free up pavement space for bike lanes.

AASHTO supports reduced width lanes in *A Policy on Geometric Design of Highways and Streets: "On interrupted-flow operation conditions at low speeds (45 mph or less), narrow lane widths are normally adequate and have some advantages."*

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
AASHTO. *A Policy on Geometric Design of Highways and Streets.* 2004.
NACTO. *Urban Street Design Guide.* 2013.
Caltrans. *Main Street, California.* 2013.

Materials and Maintenance

Repair rough or uneven pavement surface. Use bicycle compatible drainage grates. Raise or lower existing grates and utility covers so they are flush with the pavement.

Lane Reconfiguration

Description

The removal of a single travel lane will generally provide sufficient space for bike lanes on both sides of a street. Streets with excess vehicle capacity provide opportunities for bike lane retrofit projects.

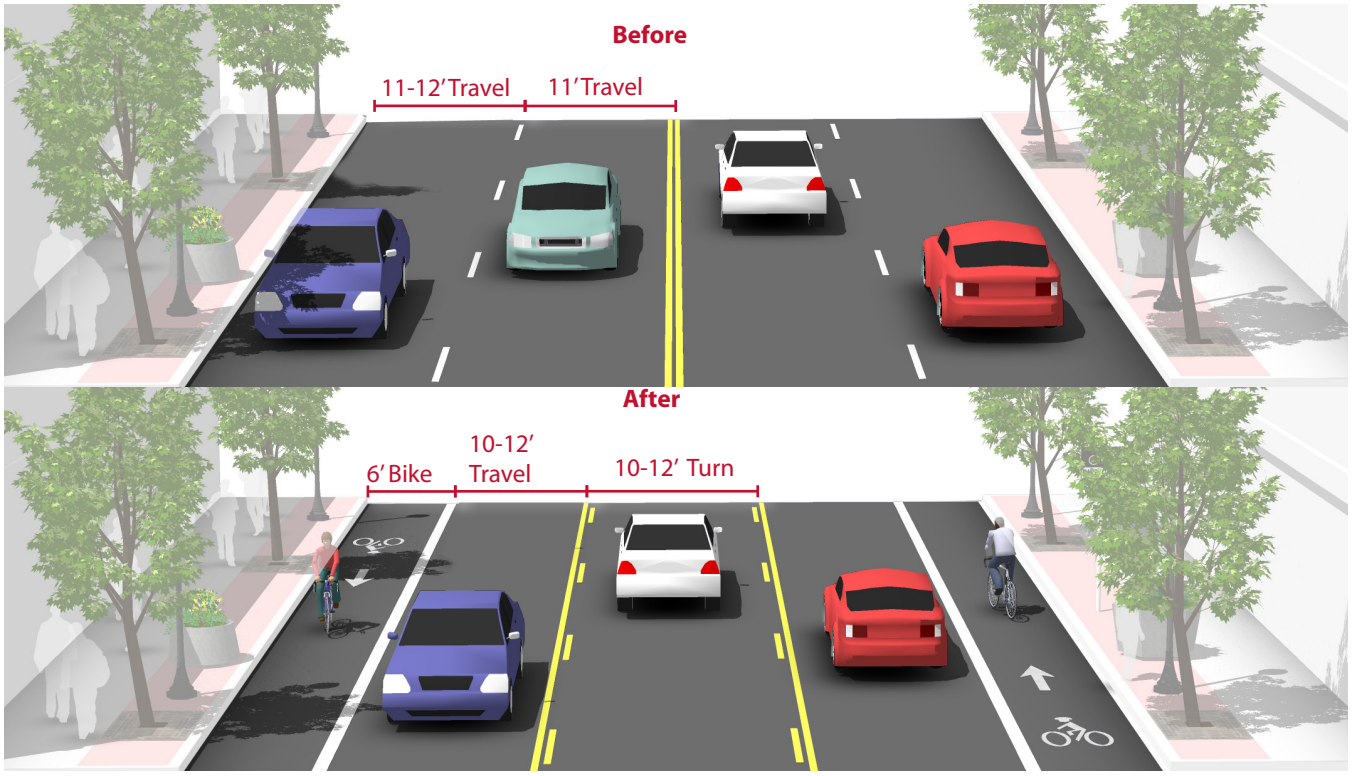
Guidance

Vehicle lane width:

- Width depends on project. No narrowing may be needed if a lane is removed.

Bicycle lane width:

- Guidance on bicycle lanes applies to this treatment.



Discussion

Depending on a street's existing configuration, traffic operations, user needs and safety concerns, various lane reduction configurations may apply. For instance, a four-lane street (with two travel lanes in each direction) could be modified to provide one travel lane in each direction, a center turn lane, and bike lanes. Prior to implementing this measure, a traffic analysis should identify potential impacts.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Evaluation of Lane Reduction "Road Diet" Measures on Crashes.* Publication Number: FHWA-HRT-10-053. 2010.
NACTO. *Urban Street Design Guide.* 2013.
Caltrans. *Main Street, California.* 2013.

Materials and Maintenance

Repair rough or uneven pavement surface. Use bicycle compatible drainage grates. Raise or lower existing grates and utility covers so they are flush with the pavement.

Bicycle Parking

Bicyclists expect a safe, convenient place to secure their bicycle when they reach their destination. This may be short-term parking of 2 hours or less, or long-term parking for employees, students, residents, and commuters.

Bicycle Racks


On Street Bike Corall

Bicycle Racks

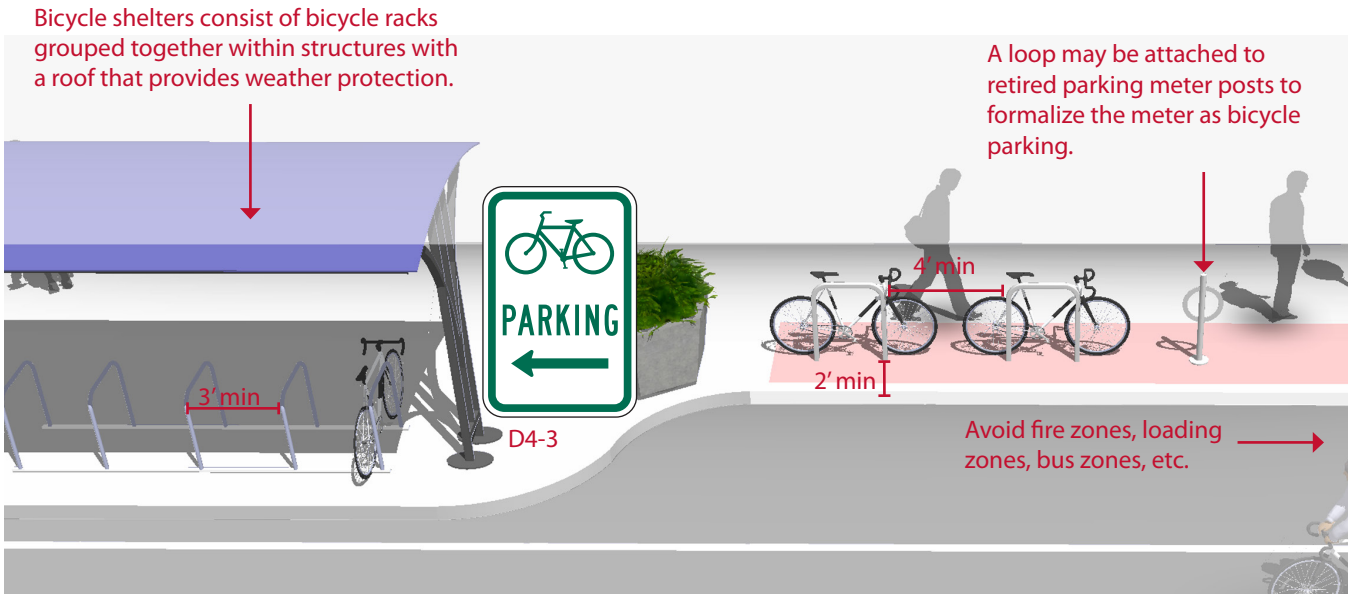
Description

Short-term bicycle parking is meant to accommodate visitors, customers, and others expected to depart within two hours. It should have an approved standard rack, appropriate location and placement, and weather protection. The Association for Pedestrian and Bicycle Professionals (APBP) recommends selecting a bicycle rack that:

- Supports the bicycle in at least two places, preventing it from falling over.
- Allows locking of the frame and one or both wheels with a U-lock.
- Is securely anchored to ground.
- Resists cutting, rusting and bending or deformation.

Guidance

- 2' minimum from the curb face to avoid 'dooring.'
- Close to destinations; 50' maximum distance from main building entrance.
- Minimum clear distance of 6' should be provided between the bicycle rack and the property line.
- Should be highly visible from adjacent bicycle routes and pedestrian traffic.
- Locate racks in areas that cyclists are most likely to travel.



Discussion

Where the placement of racks on sidewalks is not possible (due to narrow sidewalk width, sidewalk obstructions, street trees, etc.), bicycle parking can be provided in the street where on-street vehicle parking is allowed in the form of on-street bicycle corrals.

Some types of bicycle racks may meet design criteria, but are discouraged except in limited situations. This includes undulating "wave" racks, schoolyard "wheel bender" racks, and spiral racks.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
APBP. *Bicycle Parking Guide 2nd Edition.* 2010.

Materials and Maintenance

Use of proper anchors will prevent vandalism and theft. Racks and anchors should be regularly inspected for damage. Educate snow removal crews to avoid burying racks during winter months.

On-Street Bicycle Corral

Description

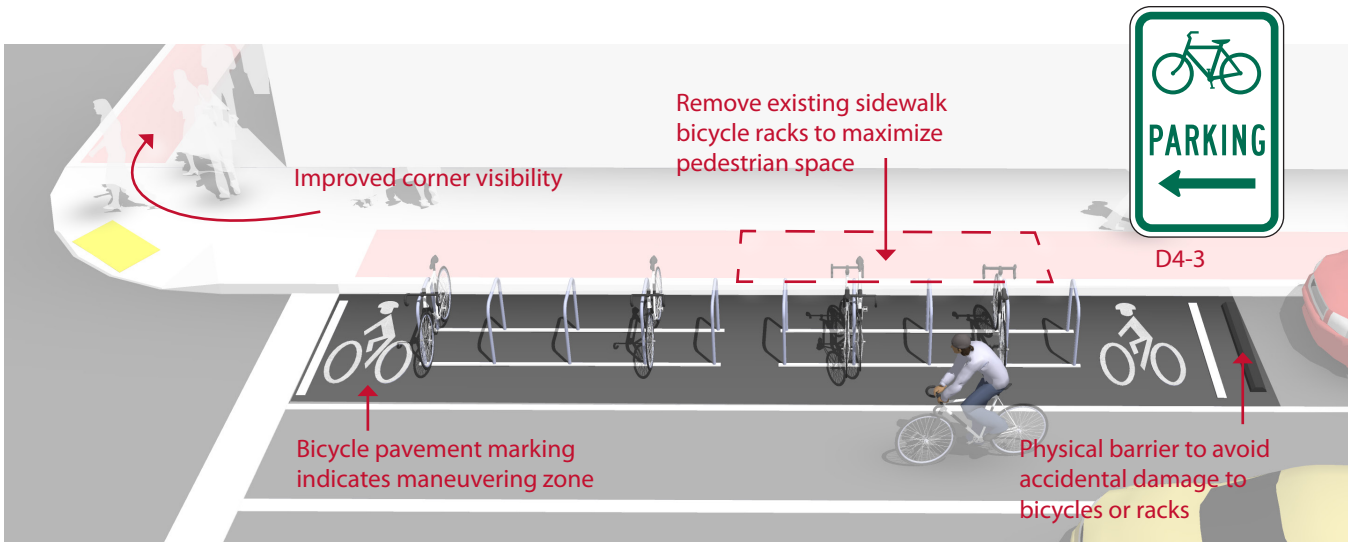
Bicycle corrals (also known as on-street bicycle parking) consist of bicycle racks grouped together in a common area within the street traditionally used for automobile parking. Bicycle corrals are reserved exclusively for bicycle parking and provide a relatively inexpensive solution to providing high-volume bicycle parking. Bicycle corrals can be implemented by converting one or two on-street motor vehicle parking spaces into on-street bicycle parking. Each motor vehicle parking space can be replaced with approximately 6-10 bicycle parking spaces.

Bicycle corrals move bicycles off the sidewalks, leaving more space for pedestrians, sidewalk café tables, etc. Because bicycle parking does not block sightlines (as large motor vehicles would do), it may be possible to locate bicycle parking in 'no-parking' zones near intersections and crosswalks.

Guidance

See the previous page for sidewalk bicycle rack placement and clear zones.

- Bicyclists should have an entrance width from the roadway of 5' – 6'.
- Can be used with parallel or angled parking.
- Parking stalls adjacent to curb extensions are good candidates for bicycle corrals since the concrete extension serves as delimitation on one side.



Discussion

In many communities, the installation of bicycle corrals is driven by requests from adjacent businesses, and is not a city-driven initiative. In such cases, the city does not remove motor vehicle parking unless it is explicitly requested. In other areas, the city provides the facility and business associations take responsibility for the maintenance of the facility. Communities can establish maintenance agreements with the requesting business. Bicycle corrals can be especially effective in areas with high bicycle parking demand or along street frontages with narrow sidewalks where parked bicycles would be detrimental to the pedestrian environment.

Additional References and Guidelines

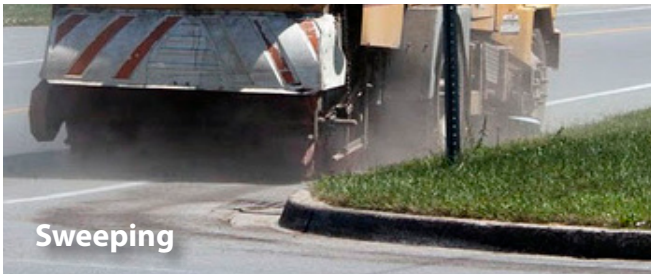
APBP. *Bicycle Parking Guide 2nd Edition.* 2010.

Materials and Maintenance

Physical barriers may obstruct drainage and collect debris. Establish a maintenance agreement with neighboring businesses. In snowy climates the bicycle corral may need to be removed during the winter months.

Bikeway Maintenance

Regular bicycle facility maintenance includes sweeping, maintaining a smooth roadway, ensuring that the gutter-to-pavement transition remains relatively flat, and installing bicycle-friendly drainage grates. Pavement overlays are a good opportunity to improve bicycle facilities. The following recommendations provide a menu of options to consider to enhance a maintenance regimen.


Sweeping


Gutter to Pavement Transition


Maintenance Management Plan

Recommended Walkway and Bikeway Maintenance Activities

Maintenance Activity	Frequency
Inspections	Seasonal – at beginning and end of Summer
Pavement sweeping/ blowing	As needed, with higher frequency in the early Spring and Fall
Pavement sealing	5 - 15 years
Pothole repair	1 week – 1 month after report
Culvert and drainage grate inspection	Before Winter and after major storms
Pavement markings replacement	As needed
Signage replacement	As needed
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

Sweeping

Description

Bicyclists often avoid shoulders and bike lanes filled with gravel, broken glass and other debris; they will ride in the roadway to avoid these hazards, potentially causing conflicts with motorists. Debris from the roadway should not be swept onto sidewalks (pedestrians need a clean walking surface), nor should debris be swept from the sidewalk onto the roadway.

Guidance

- Establish a seasonal sweeping schedule that prioritizes roadways with major bicycle routes.
- Sweep walkways and bikeways whenever there is an accumulation of debris on the facility.
- In curbed sections, sweepers should pick up debris; on open shoulders, debris can be swept onto gravel shoulders.
- Pave gravel driveway approaches to minimize loose gravel on paved roadway shoulders.
- Perform additional sweeping in the Spring to remove debris from the Winter, and in the Fall in areas where leaves accumulate .

Gutter to Pavement Transition

Description

On streets with concrete curbs and gutters, 1 to 2 feet of the curbside area is typically devoted to the gutter pan, where water collects and drains into catch basins. On many streets, the bikeway is situated near the transition between the gutter pan and the pavement edge. This transition can be susceptible to erosion, creating potholes and a rough surface for travel.

The pavement on many streets is not flush with the gutter, creating a vertical transition between these segments. This area can buckle over time, creating a hazardous condition for bicyclists.

Guidance

- Ensure that gutter-to-pavement transitions have no more than a ¼" vertical transition.
- Examine pavement transitions during every roadway project for new construction, maintenance activities, and construction project activities that occur in streets.
- Inspect the pavement 2 to 4 months after trenching construction activities are completed to ensure that excessive settlement has not occurred.
- Provide at least 3 feet of pavement outside of the gutter seam.

Maintenance Management Plan

Description

Bikeway users need accommodation during construction and maintenance activities when bikeways may be closed or unavailable. Users must be warned of bikeway closures and given adequate detour information to bypass the closed section. Users should be warned through the use of standard signing approaching each affected section (e.g., "Bike Lane Closed,""Trail Closed"), including information on alternate routes and dates of closure. Alternate routes should provide reasonable directness, equivalent traffic characteristics, and be signed.

Guidance

- Provide fire and police departments with map of system, along with access points to gates/bollards
- Enforce speed limits and other rules of the road
- Enforce all trespassing laws for people attempting to enter adjacent private properties

Bikeway Signing

The ability to navigate through a city is informed by landmarks, natural features and other visual cues. Signs throughout the city should indicate to bicyclists:

- Direction of travel
- Location of destinations
- Travel time/distance to those destinations

These signs will increase users' comfort and accessibility to the bicycle systems.

Signage can serve both wayfinding and safety purposes including:

- Helping to familiarize users with the bicycle network
- Helping users identify the best routes to destinations
- Helping to address misperceptions about time and distance
- Helping overcome a "barrier to entry" for people who are not frequent bicyclists (e.g., "interested but concerned" bicyclists)

A community-wide bicycle wayfinding signage plan would identify:

- Sign locations
- Sign type – what information should be included and design features
- Destinations to be highlighted on each sign – key destinations for bicyclists
- Approximate distance and travel time to each destination

Bicycle wayfinding signs also visually cue motorists that they are driving along a bicycle route and should use caution. Signs are typically placed at key locations leading to and along bicycle routes, including the intersection of multiple routes. 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 rather than per vehicle signage standards.

Wayfinding Sign Types


Wayfinding Sign Placement

Wayfinding Sign Types

Description

A bicycle wayfinding system consists of comprehensive signing and/or pavement markings to guide bicyclists to their destinations along preferred bicycle routes. There are three general types of wayfinding signs:

Confirmation Signs

Indicate to bicyclists that they are on a designated bikeway. Make motorists aware of the bicycle route.

Can include destinations and distance/time. Do not include arrows.

Turn Signs

Indicate where a bikeway turns from one street onto another street. Can be used with pavement markings.

Include destinations and arrows.

Decisions Signs

Mark the junction of two or more bikeways.

Inform bicyclists of the designated bike route to access key destinations. Includes destinations and arrows and distances.

Travel times are optional but recommended.

Discussion

Section 1A.12 of the MUTCD establishes the general meaning for signage colors. Green is the color used for directional guidance and is the most common color of bicycle wayfinding signage in the US, including those in the MUTCD.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Maintenance needs for bicycle wayfinding signs are similar to other signs and will need periodic replacement due to wear.

Wayfinding Sign Placement

Confirmation Signs

Every ¼ to ½ mile on off-street facilities and every 2 to 3 blocks along on-street bicycle facilities, unless another type of sign is used (e.g., within 150 ft of a turn or decision sign). Should be placed soon after turns to confirm destination(s). Pavement markings can also act as confirmation that a bicyclist is on a preferred route.

Turn Signs

Near-side of intersections where bike routes turn (e.g., where the street ceases to be a bicycle route or does not go through). Pavement markings can also indicate the need to turn to the bicyclist.

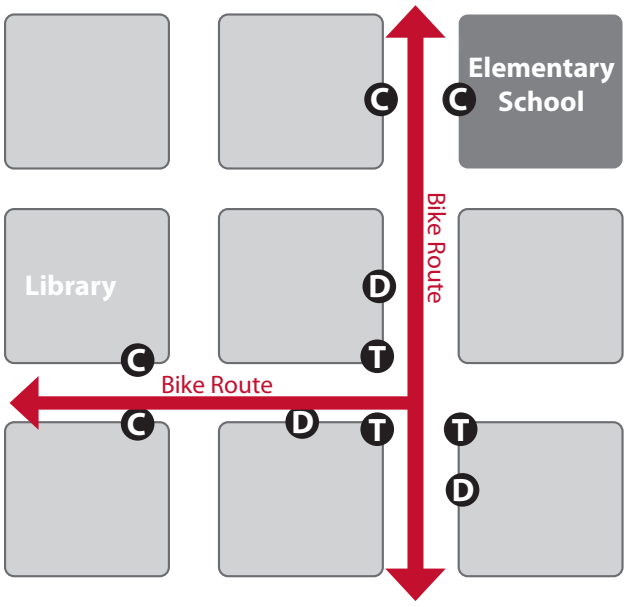
Guidance

Signs are typically placed at decision points along bicycle routes – typically at the intersection of two or more bikeways and at other key locations leading to and along bicycle routes.

Decisions Signs

Near-side of intersections in advance of a junction with another bicycle route.

Along a route to indicate a nearby destination.



Discussion

It can be useful to classify a list of destinations for inclusion on the signs based on their relative importance to users throughout the area. A particular destination's ranking in the hierarchy can be used to determine the physical distance from which the locations are signed. For example, primary destinations (such as the downtown area) may be included on signage up to 5 miles away. Secondary destinations (such as a transit station) may be included on signage up to two miles away. Tertiary destinations (such as a park) may be included on signage up to one mile away.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Maintenance needs for bicycle wayfinding signs are similar to other signs and will need periodic replacement due to wear.

OFF STREET BICYCLE FACILITIES

Class I Shared-Use Paths

A shared-use path 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. Path facilities can also include amenities such as lighting, signage, and fencing (where appropriate).

Key features of shared-use paths include:

- Frequent access points from the local road network.
- Directional signs to direct users to and from the path.
- A limited number of at-grade crossings with streets or driveways.
- Terminating the path where it is easily accessible to and from the street system.
- Separate treads for pedestrians and bicyclists when heavy use is expected.

The geometric design of shared-use paths should be designed to support the speed and volume of expected user types. Bicyclist speeds can vary significantly depending on path grade. The table below lists typical bicyclists speeds.

Bicycle Design Speed Expectations

Bicycle Type	Feature	Typical Speed
Upright Adult Bicyclist	Paved level surfacing	8-15 mph
	Downhill	20-30+ mph
	Uphill	5 -12 mph
Recumbent Bicyclist	Paved level surfacing	11-18 mph

Source: AASHTO *Guide for the Development of Bicycle Facilities*, 4th Edition


General Design Practices


Shared-Use Paths in Active Rail Corridors

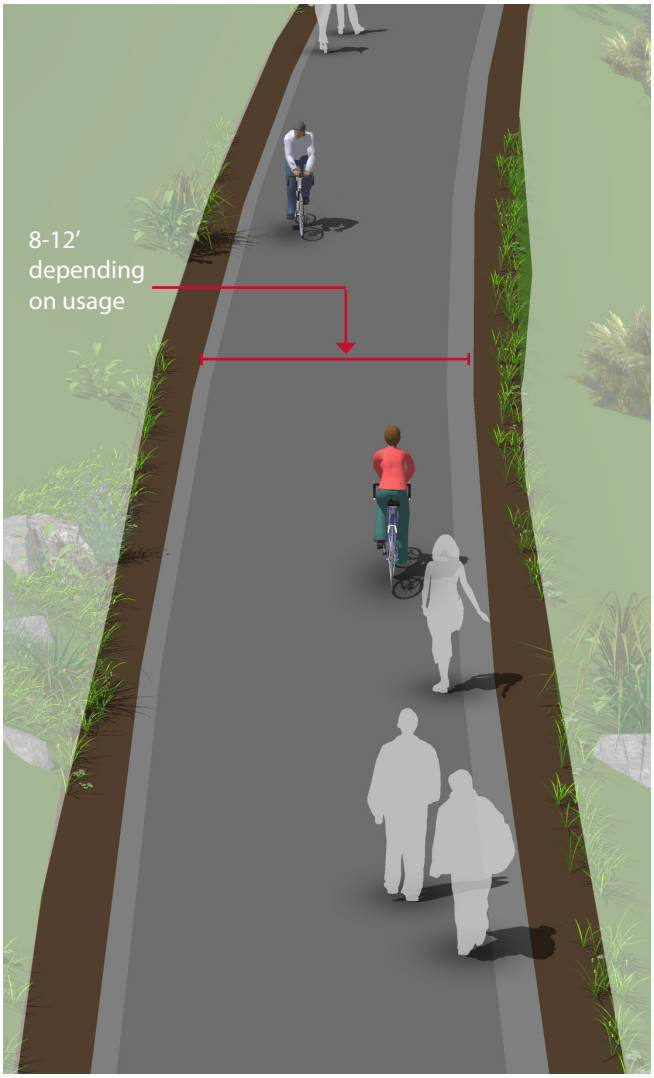

Shared-Use Paths in River and Utility Corridors


Shared-Use Paths along Roadways

General Design Practices

Description

Shared-use paths can provide a desirable facility, particularly for recreation, and users of all skill levels preferring separation from traffic. Bicycle paths should generally provide directional travel opportunities not provided by existing roadways.



Guidance

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. A separate track (5' minimum) can be provided for pedestrian use.

Lateral Clearance

- A 2 foot or greater shoulder on both sides of the path should be provided. An additional foot of lateral clearance (total of 3') is required by the MUTCD for the installation of signage or other furnishings.
- If bollards are used at intersections and access points, they should be colored brightly and/or supplemented with reflective materials to be visible at night.

Overhead Clearance

- Clearance to overhead obstructions should be 8 feet minimum, with 10 feet recommended.

Striping

- When striping is required, use a 4 inch dashed yellow centerline stripe with 4 inch solid white edge lines.
- Solid centerlines can be provided on tight or blind corners, and on the approaches to roadway crossings.

Discussion

Terminate the path where it is easily accessible to and from the street system, preferably at a controlled intersection or at the beginning of a dead-end street.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
Caltrans *CA-MUTCD.* 2012.
Flink, C. *Greenways: A Guide To Planning Design And Development.* 1993.
Caltrans. *California HDM.* 2012.

Materials and Maintenance

Asphalt is the most common surface for bicycle paths. The use of concrete for paths has proven to be more durable over the long term. Saw cut concrete joints rather than troweled improve the experience of path users.

Shared-Use Paths in Active Rail Corridors

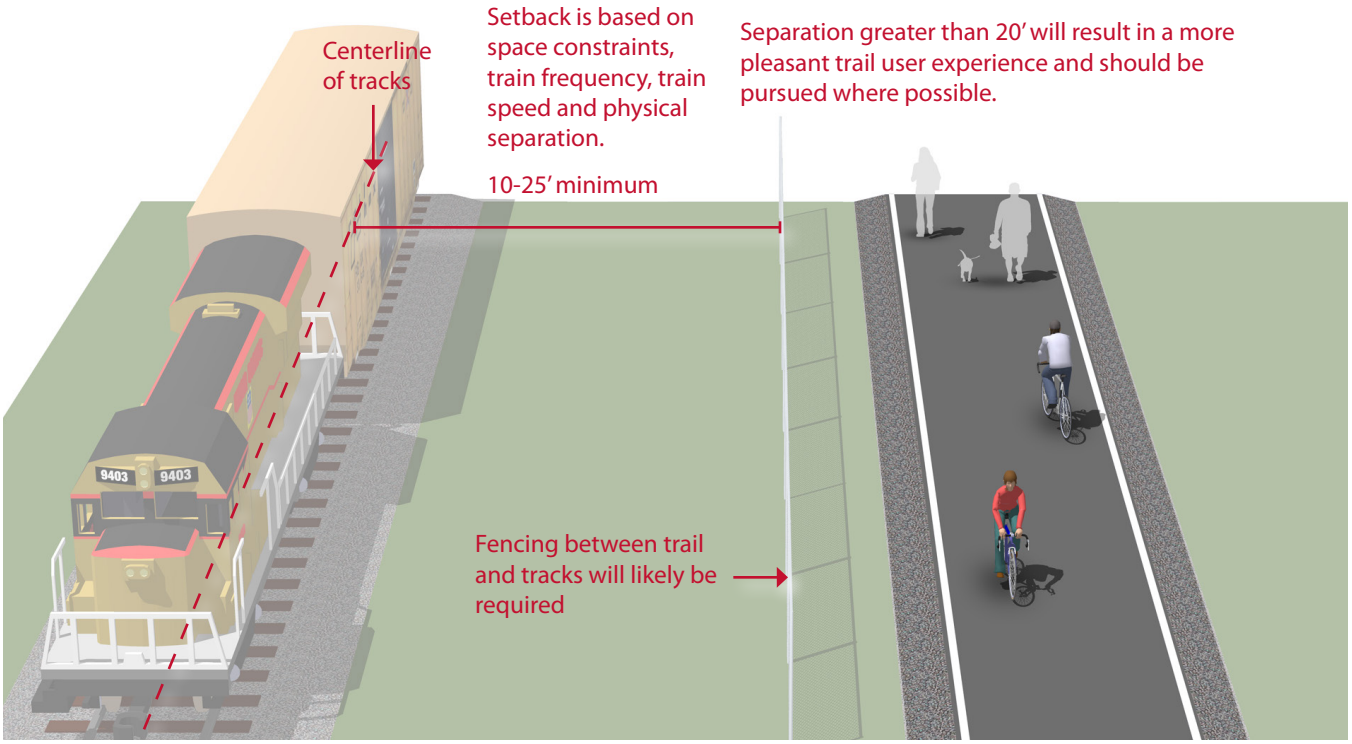
Description

Rails-with-Trails projects typically consist of paths adjacent to active railroads. It should be noted that some constraints could impact the feasibility of rail-with-trail projects. In some cases, space needs to be preserved for future planned freight, transit or commuter rail service. In other cases, limited right-of-way width, inadequate setbacks, concerns about safety/trespassing, and numerous mid-block crossings may affect a project's feasibility.

Guidance

Shared-use paths in utility corridors should meet or exceed general design standards. If additional width allows, wider paths, and landscaping are desirable.

If required, fencing should be a minimum of 5 feet in height with higher fencing than usual next to sensitive areas such as switching yards. Setbacks from the active rail line will vary depending on the speed and frequency of trains, and available right-of-way.



Discussion

Railroads may require fencing with rail-with-trail projects. Concerns with trespassing and security can vary with the volume and speed of train traffic on the adjacent rail line and the setting of the shared-use path, i.e. whether the section of track is in an urban or rural setting.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
Caltrans *CA-MUTCD.* 2012.
FHWA. *Rails-with-Trails: Lessons Learned.* 2002.
California Public Utilities Commission. General Orders.

Materials and Maintenance

Asphalt is the most common surface for bicycle paths. The use of concrete for paths has proven to be more durable over the long term. Saw cut concrete joints rather than troweled improve the experience of path users.

Shared-Use Paths in River and Utility Corridors

Description

Utility and waterway corridors often offer excellent shared-use path development and bikeway gap closure opportunities. Utility corridors typically include powerline and sewer corridors, while waterway corridors include canals, drainage ditches, rivers, and beaches. These corridors offer excellent transportation and recreation opportunities for bicyclists of all ages and skills.

Guidance

Shared-use paths in utility corridors should meet or exceed general design practices. If additional width allows, wider paths, and landscaping are desirable.

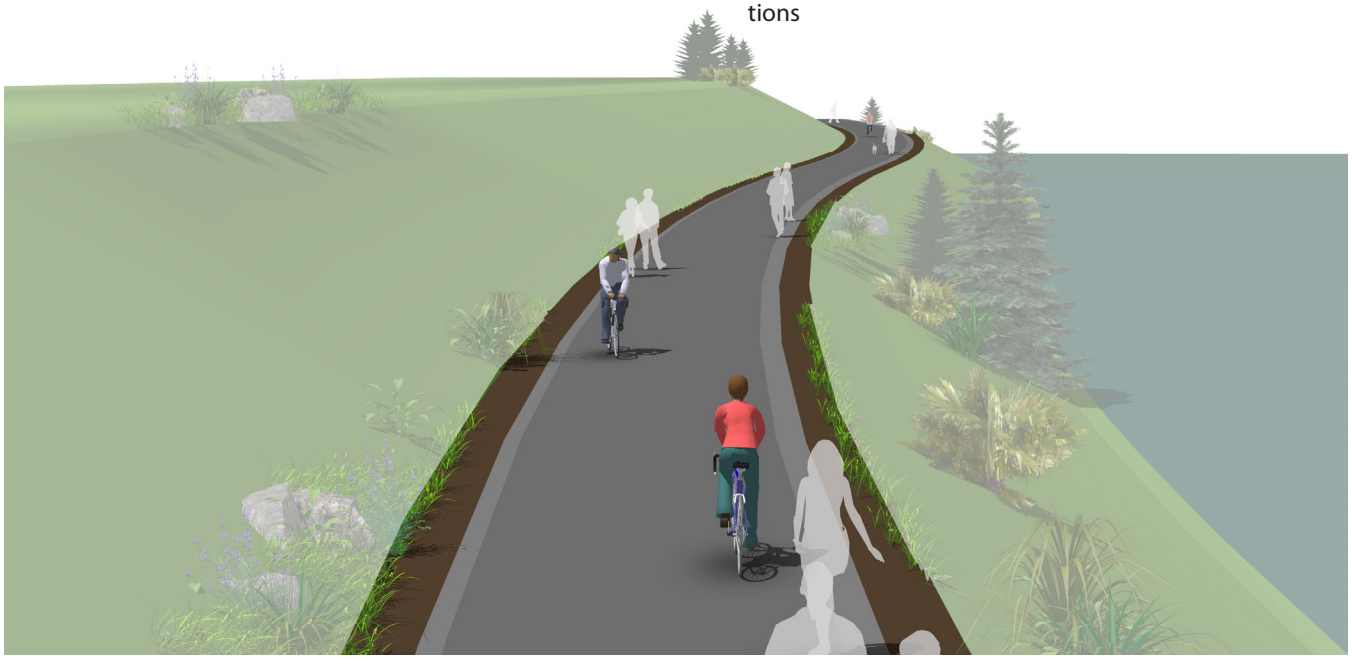
Access Points

Any access point to the path should be well-defined with appropriate signage designating the pathway as a bicycle facility and prohibiting motor vehicles.

Path Closure

Public access to the shared-use path may be prohibited during the following events:

- Canal/flood control channel or other utility maintenance activities
- Inclement weather or the prediction of storm conditions



Discussion

Similar to railroads, public access to flood control channels or canals may be undesirable. Hazardous materials, deep water or swift current, steep, slippery slopes, and debris all may constitute risks for public access. Appropriate fencing may be desired to keep path users within the designated travel way. Creative design of fencing is encouraged to make the path facility feel welcoming to the user.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
Caltrans *CA-MUTCD. 2012.*
Flink, C. *Greenways: A Guide To Planning Design And Development.* 1993.

Materials and Maintenance

Asphalt is the most common surface for bicycle paths. The use of concrete for paths has proven to be more durable over the long term. Saw cut concrete joints rather than troweled improve the experience of path users.

Shared-Use Paths Along Roadways

Description

Shared-use paths along roadways, also called sidepaths, are a type of path that run adjacent to a street.

Because of operational concerns it is generally preferable to place paths within independent rights-of-way away from roadways. However, there are situations where existing roads provide the only corridors available.

Along roadways, 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 where bicyclists enter or leave the path.

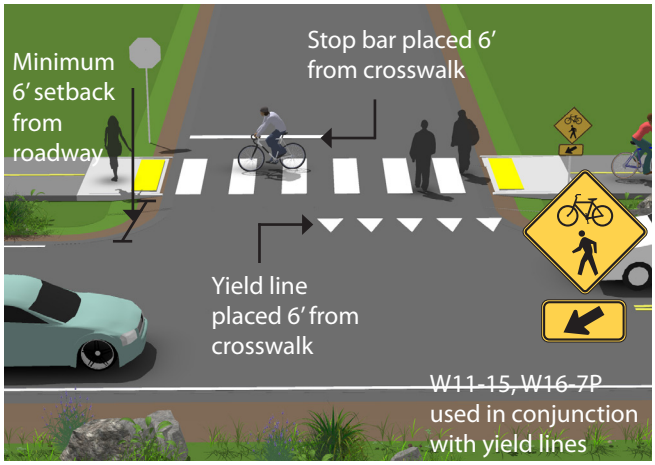
The AASHTO Guide for the Development of Bicycle Facilities cautions practitioners of the use of two-way sidepaths on urban or suburban streets with many driveways and street crossings.

In general, there are two approaches to crossings: adjacent crossings and setback crossings, illustrated below.

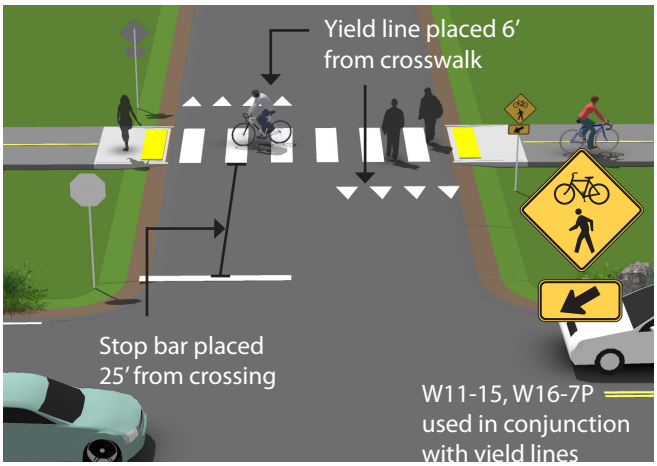
Guidance

- Guidance for sidepaths should follow that for general design practises of shared-use paths.
- A high number of driveway crossings and intersections create potential conflicts with turning traffic. Consider alternatives to sidepaths on streets with a high frequency of intersections or heavily used driveways.
- Where a sidepath terminates special consideration should be given to transitions so as not to encourage unsafe wrong-way riding by bicyclists.
- Crossing design should emphasize visibility of users and clarity of expected yielding behavior. Crossings may be STOP or YIELD controlled depending on sight lines and bicycle motor vehicle volumes and speeds.

Adjacent Crossing - A separation of 6 feet emphasizes the conspicuity of riders at the approach to the crossing.



Setback Crossing - A set back of 25 feet separates the path crossing from merging/turning movements that may be competing for a driver's attention.



Discussion

Sidepaths differ from Cycle Tracks because of lack of separation from pedestrians, lack of bicycle-specific accommodation at intersections, and often lack of consideration at driveways or minor street crossings. When right of way is available, cycle track installations are preferred to sidepaths.
To reduce potential conflicts in some situations, it may be better to place one-way sidepaths on both sides of the street.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
NACTO. *Urban Bikeway Design Guide.* See entry on Raised Cycle Tracks. 2012.

Materials and Maintenance

Asphalt is the most common surface for bicycle paths. The use of concrete for paths has proven to be more durable over the long term. Saw cut concrete joints rather than troweled improve the experience of path users.

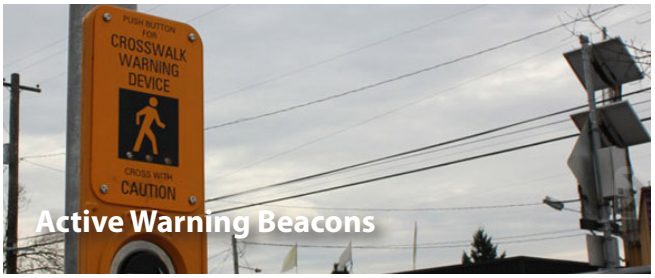
Path/Roadway Crossings

At-grade roadway crossings can create potential conflicts between path users and motorists, however, well-designed crossings can mitigate many operational issues and provide a higher degree of safety and comfort for path users. This is evidenced by the thousands of successful facilities around the United States with at-grade crossings. In most cases, at-grade path crossings can be properly designed to provide a reasonable degree of safety and can meet existing traffic and safety standards. Path facilities that cater to bicyclists can require additional considerations due to the higher travel speed of bicyclists versus pedestrians.

Consideration must be given to adequate warning distance based on vehicle speeds and line of sight, with the visibility of any signs absolutely critical. Directing the active attention of motorists to roadway signs may require additional alerting devices such as a flashing beacon, roadway striping or changes in pavement texture. Signing for path users may include a standard "STOP" or "YIELD" sign and pavement markings, possibly combined with other features such as bollards or a bend in the pathway to slow bicyclists. Care must be taken not to place too many signs at crossings lest they begin to lose their visual impact.

A number of striping patterns have emerged over the years to delineate path crossings. A median stripe on the path approach will help to organize and warn path users. Crosswalk striping is typically a matter of local and State preference, and may be accompanied by pavement treatments to help warn and slow motorists. In areas where motorists do not typically yield to crosswalk users, additional measures may be required to increase compliance.


Marked/Unsignalized Crossings



Active Warning Beacons


Route Users to Existing Signals


Pedestrian Hybrid Beacon Crossing


Full Traffic Control Signal Crossing

Marked/Unsignalized Crossings

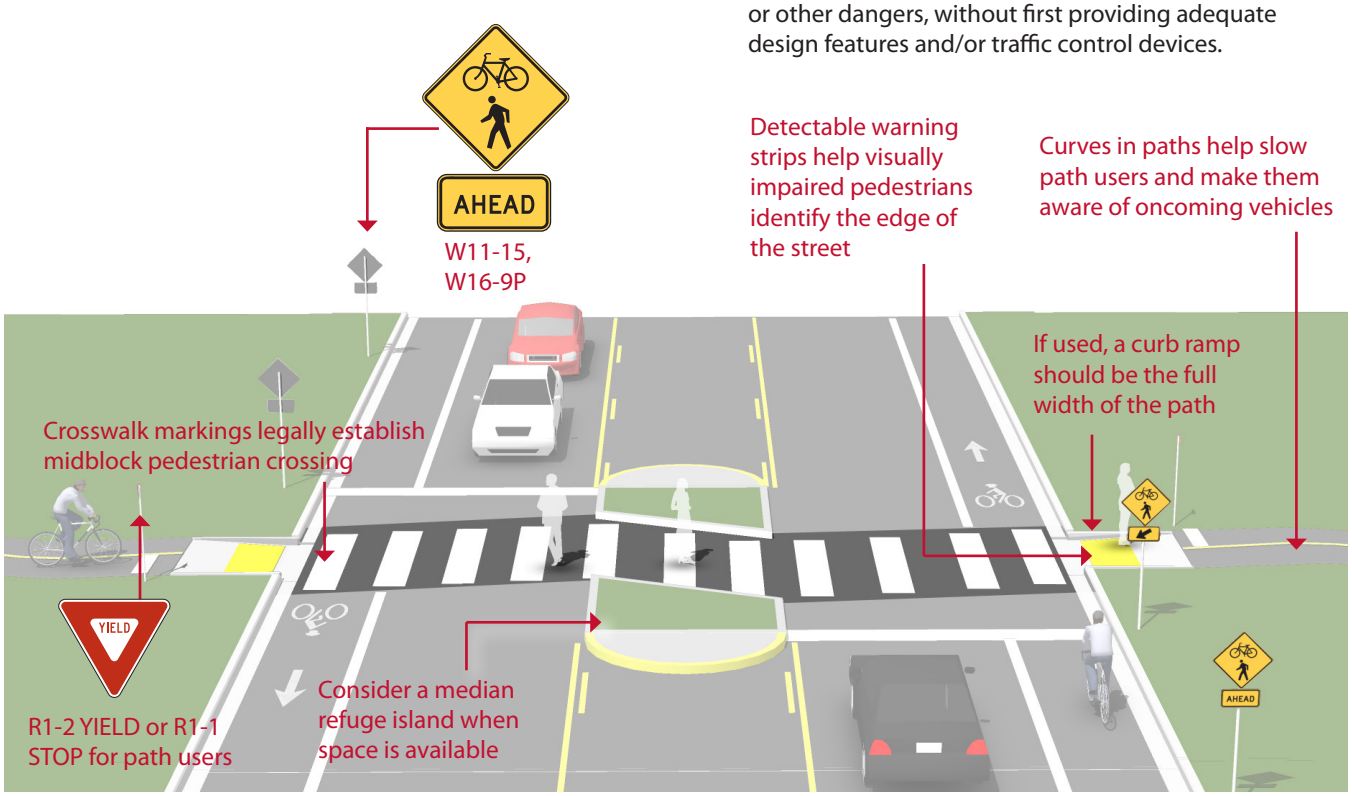
Description

A marked/unsignalized crossing typically consists of a marked crossing area, signage and other markings to slow or stop traffic. The approach to designing crossings at mid-block locations depends on an evaluation of vehicular traffic, line of sight, pathway traffic, use patterns, vehicle speed, road type, road width, and other safety issues such as proximity to major attractions.

When space is available, using a median refuge island can improve user safety by providing pedestrians and bicyclists space to perform the safe crossing of one side of the street at a time.

Guidance

- Refer to the FHWA report, "Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations" for specific volume and speed ranges where a marked crosswalk alone may be sufficient.
- Where the speed limit exceeds 40 miles per hour, marked crosswalks alone should not be used at unsignalized locations.
- 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.



Discussion

The assignment of right of way at path crossings requires a detailed understanding of user volumes, travel speeds, and approach sight distance. Installing unwarranted controls on path approaches can lead to a loss of respect for traffic control at more critical locations. Good engineering judgment should be used for deciding which treatment to use.

In conventional intersection design, right of way is assigned to the higher volume or higher speed approach. In many cases, path volumes will exceed that of minor crossed streets, and right of way may be assigned to the path traffic. In crossings with appropriate sight distances, "YIELD" control of the path or road can be an effective solution for users as it encourages caution without being overly restrictive. For further discussion see chapter 5 in the AASHTO *Guide for the Development of Bicycle Facilities.*

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012. Ch 5.
Caltrans *CA-MUTCD.* 2012
Caltrans. *California HDM.* 2012.

Materials and Maintenance

Locate markings out of wheel tread when possible to minimize wear and maintenance costs.

Active Warning Beacons

Description

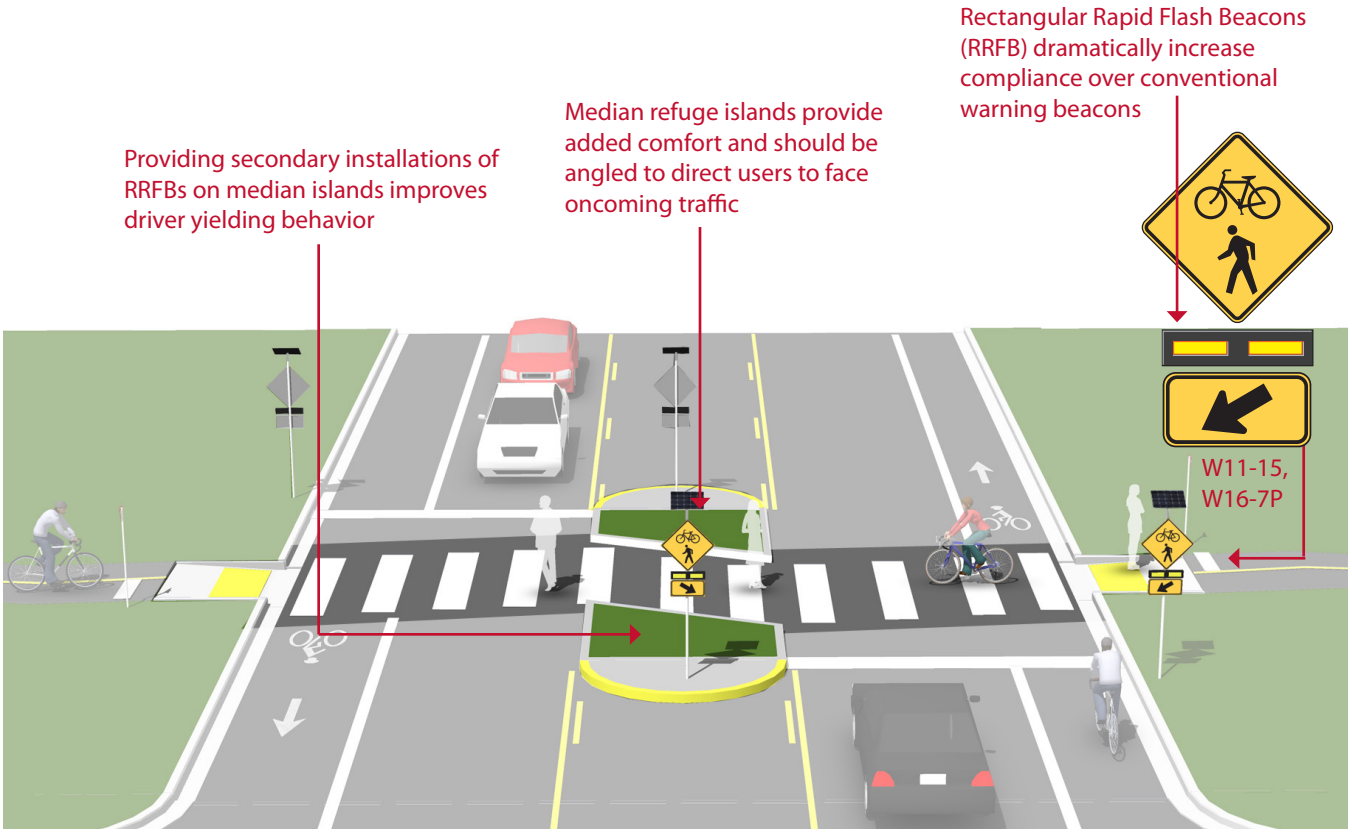
Enhanced marked crossings are unsignalized crossings with additional treatments designed to increase motor vehicle yielding compliance on multi-lane or high volume roadways.

These enhancements include pathway user or sensor actuated warning beacons, Rectangular Rapid Flash Beacons (RRFB) shown below, or in-roadway warning lights.

Guidance

Guidance for marked/unsignalized crossings applies.

- Warning beacons shall not be used at crosswalks controlled by YIELD signs, STOP signs, or traffic control signals.
- Warning beacons shall initiate operation based on user actuation and shall cease operation at a predetermined time after the user actuation or, with passive detection, after the user clears the crosswalk.



Discussion

Rectangular rapid flash beacons show the most increased compliance of all the warning beacon enhancement options.

A study of the effectiveness of going from a no-beacon arrangement to a two-beacon RRFB installation increased yielding from 18 percent to 81 percent. A four-beacon arrangement raised compliance to 88%. Additional studies of long term installations show little to no decrease in yielding behavior over time.

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide*. 2012.
Caltrans *CA-MUTCD. 2012.*
FHWA. *MUTCD - Interim Approval for Optional Use of Rectangular Rapid Flashing Beacons (IA-11)*. 2008.

Materials and Maintenance

Locate markings out of wheel tread when possible to minimize wear and maintenance costs. Signing and striping need to be maintained to help users understand any unfamiliar traffic control.

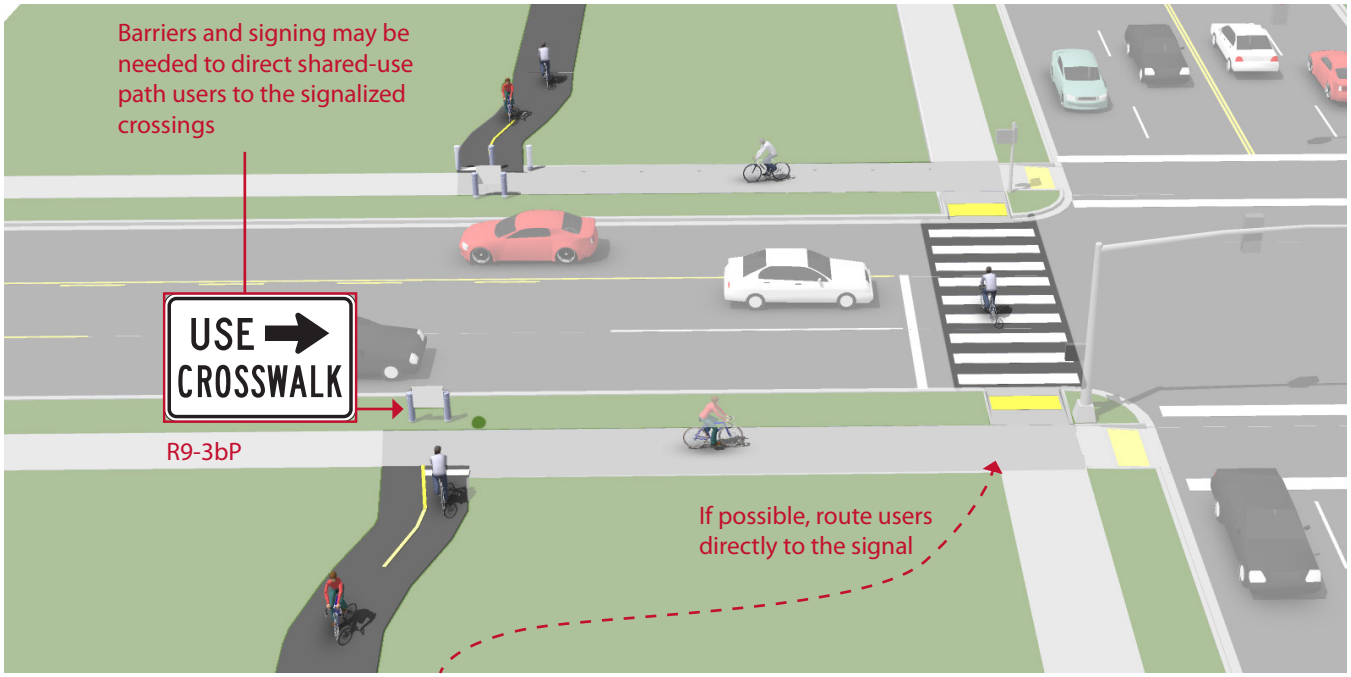
Route Users to Signalized Crossings

Description

Path crossings within approximately 400 feet of an existing signalized intersection with pedestrian crosswalks are typically diverted to the signalized intersection to avoid traffic operation problems when located so close to an existing signal. For this restriction to be effective, barriers and signing may be needed to direct path users to the signalized crossing. If no pedestrian crossing exists at the signal, modifications should be made.

Guidance

Path crossings should not be provided within approximately 400 feet of an existing signalized intersection. If possible, route path directly to the signal.



Discussion

In the US, the minimum distance a marked crossing can be from an existing signalized intersection varies from approximately 250 to 660 feet. Engineering judgement and the context of the location should be taken into account when choosing the appropriate allowable setback. Pedestrians are particularly sensitive to out of direction travel and jaywalking may become prevalent if the distance is too great.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
AASHTO. *Guide for the Planning, Design, and Operation of Pedestrian Facilities.* 2004.

Materials and Maintenance

If a sidewalk is used for crossing access, it should be kept clear of snow and debris and the surface should be level for wheeled users.

Pedestrian Hybrid Beacon Crossings

Description

Pedestrian hybrid beacons provide a high level of comfort for crossing users through the use of a red-signal indication to stop conflicting motor vehicle traffic.

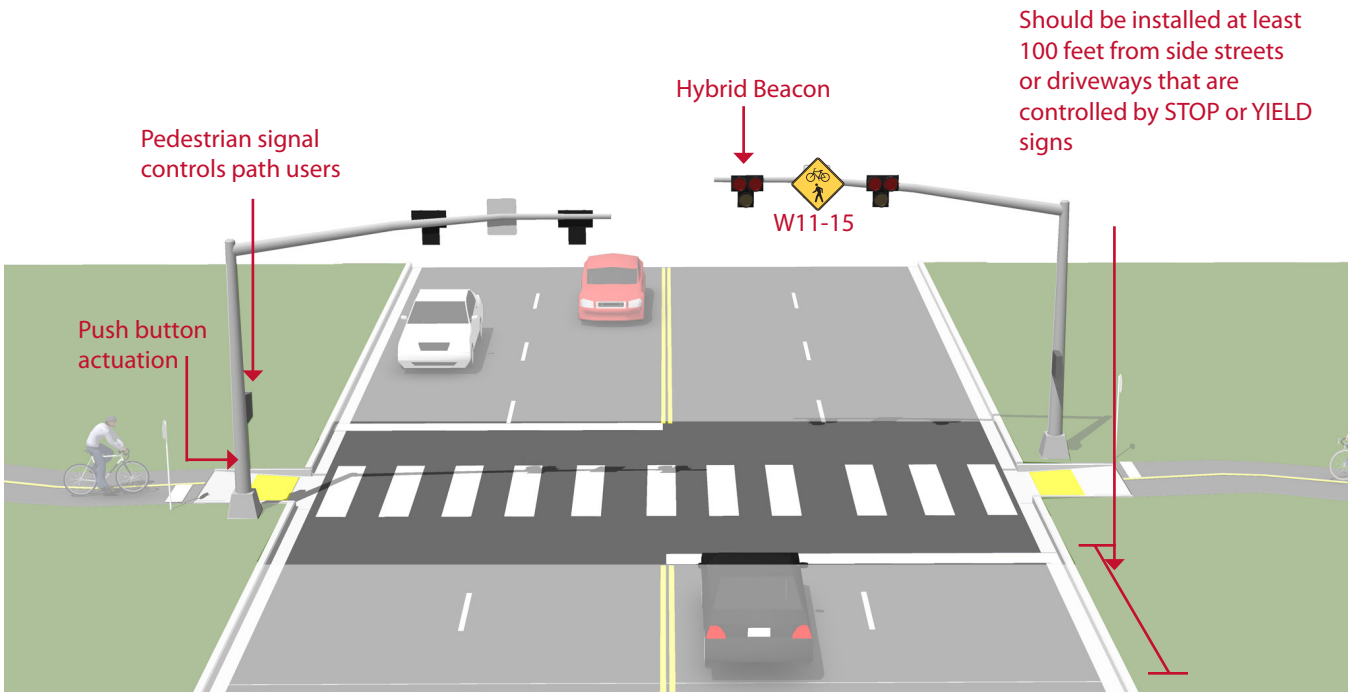
Hybrid beacon installation faces only cross motor vehicle traffic, stays dark when inactive, and uses a unique 'wig-wag' signal phase to indicate activation. Vehicles have the option to proceed after stopping during the final flashing red phase, which can reduce motor vehicle delay when compared to a full signal installation.

Guidance

Hybrid beacons (illustrated here) may be installed without meeting traffic signal control warrants if roadway speed and volumes are excessive for comfortable path crossings.

FHWA does not allow bicycle signals to be used with Hybrid beacons, though some cities have done so successfully.

To maximize safety when used for bicycle crossings, the flashing 'wig-wag' phase should be very short and occur after the pedestrian signal head has changed to a solid "DON'T WALK" indication as bicyclists can enter an intersection quickly.



Discussion

Shared-use path signals are normally activated by push buttons but may also be triggered by embedded loop, infrared, microwave or video detectors. The maximum delay for activation of the signal should be two minutes, with minimum crossing times determined by the width of the street.

Each crossing, regardless of traffic speed or volume, requires additional review by a registered engineer to identify sight lines, potential impacts on traffic progression, timing with adjacent signals, capacity and safety.

Additional References and Guidelines

FHWA. *Pedestrian Hybrid Beacon Guide.* 2014.
NACTO. *Urban Bikeway Design Guide.* 2012.
Caltrans *CA-MUTCD. 2012.*

Materials and Maintenance

Hybrid beacons are subject to the same maintenance needs and requirements as standard traffic signals. Signing and striping need to be maintained to help users understand any unfamiliar traffic control.

Full Traffic Signal Crossings

Description

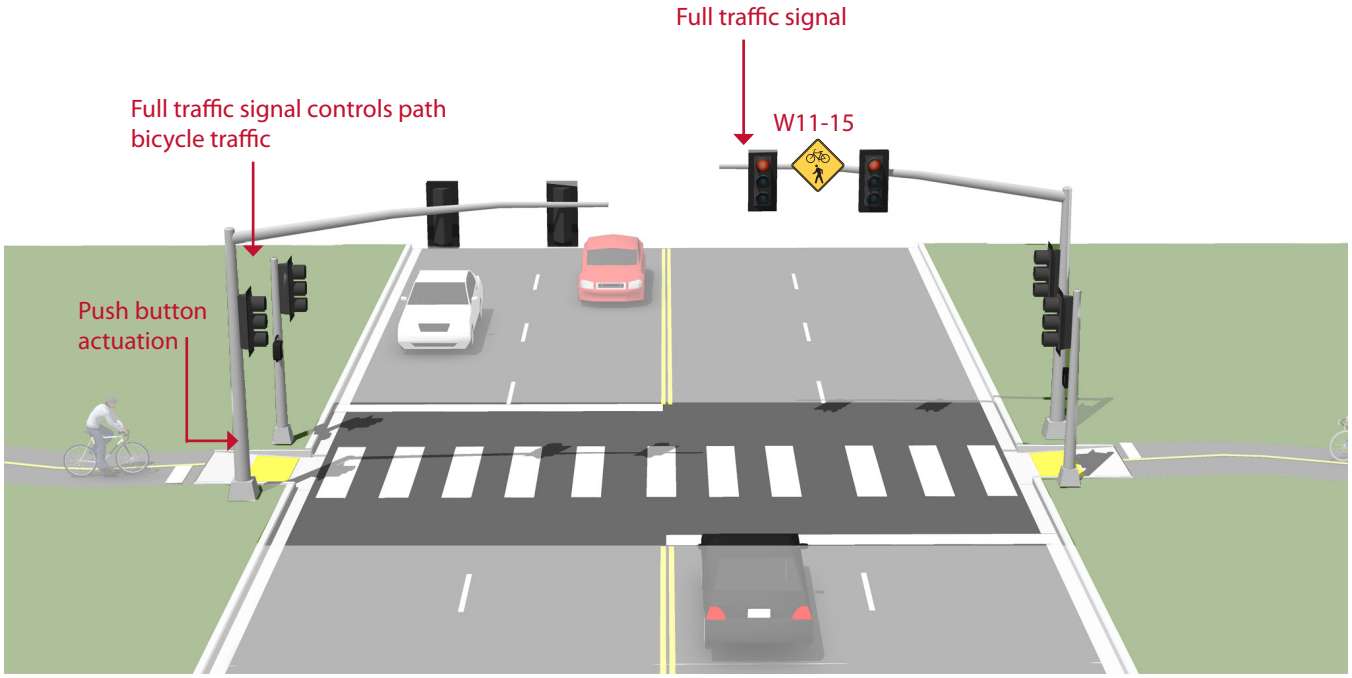
Signalized crossings provide the most protection for crossing path users through the use of a red-signal indication to stop conflicting motor vehicle traffic.

A full traffic signal installation treats the path crossing as a conventional 4-way intersection and provides standard red-yellow-green traffic signal heads for all legs of the intersection.

Guidance

Full traffic signal installations must meet MUTCD pedestrian, school or modified warrants. Additional guidance for signalized crossings:

- Located more than 300 feet from an existing signalized intersection
- Roadway travel speeds of 40 MPH and above
- Roadway ADT exceeds 15,000 vehicles



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Each crossing, regardless of traffic speed or volume, requires additional review by a registered engineer to identify sight lines, potential impacts on traffic progression, timing with adjacent signals, capacity and safety.

Additional References and Guidelines

Caltrans *CA-MUTCD. 2012.*
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Traffic signals require routine maintenance. Signing and striping need to be maintained to help users understand any unfamiliar traffic control.