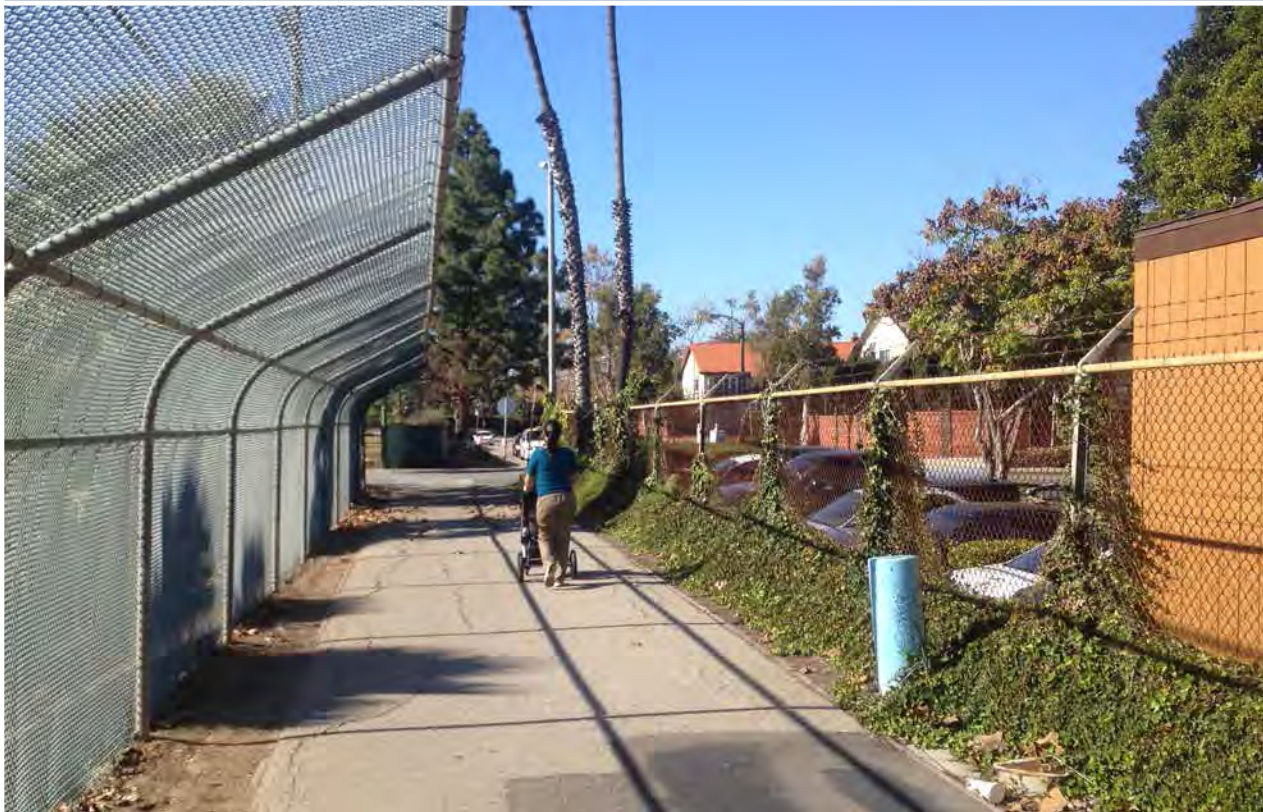
CITY OF COSTA MESA

MULTI-PURPOSE TRAILS PLAN

JUNE 2016



ACKNOWLEDGMENTS

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This is a project for the City of Costs Mesa with funding provided by the Southern California Association of Governments (SCAG) Sustainability Program. The Sustainability Program is a key SCAG initiative for implementing the Regional Transportation Plan/Sustainable Communities Strategies (RTP/SCS), combining Compass Blueprint assistance for integrated land use and transportation planning with new Green Region Initiative assistance aimed at local sustainability and Active Transportation assistance for bicycle and pedestrian planning efforts. Sustainability Projects are intended to provide SCAG-member jurisdictions the resources to implement regional policies at the local level, focusing on voluntary efforts that will meet local needs and contribute to implementing the SCS, reducing greenhouse gas (GHG) emissions, and providing the range of local and regional benefits outlined in the SCS.

The preparation of this report has been financed in part through grant(s) from the Federal Transit Administration (FTA) through the U.S. Department of Transportation (DOT) in accordance with the provisions under the Metropolitan Planning Program as set forth in Section 104(f) of Title 23 of the U.S. Code.

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CHAPTER 1

INTRODUCTION

2012-2035 Regional Transportation Plan/Sustainable Communities Strategy, Southern California Association of Governments (SCAG)

Non-motorized Routes Already in Use in Costa Mesa, Courtesy of Strava (TM) Heatmap

SCOPE

The City of Costa Mesa strives to create a balanced, inclusive, uncongested, safe and energy-efficient transportation system. In an effort to create such a system, and in compliance with the Sustainable Communities Strategy (SCS) outlined in California Senate Bill 375, the City has developed this Multi-Purpose Trails Plan, funded by the Southern California Association of Governments (SCAG) under its Active Transportation Program (ATP).

A primary objective of this plan was to determine the feasibility, both physical conditions and community support, of the implementation of a multi-use trail system within the City of Costa Mesa. The plan focused on enhancing west-east connectivity for bicyclists and pedestrians, particularly between the Santa Ana River Trail (SART) and Newport Bay as important anchors on either end. To make west-east connections, this project began with three primary corridors/areas and ten specific routes within those corridors/areas.

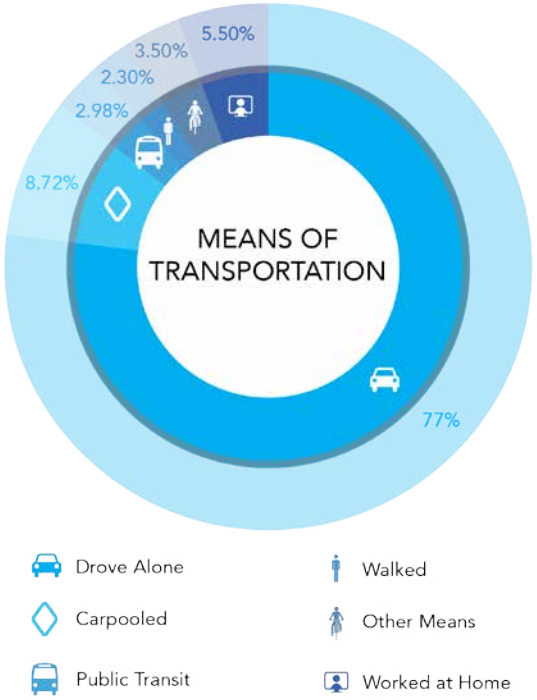
As with any project, this Multi-Purpose Trails Plan entailed both opportunities and constraints. The project represented a great opportunity to respond to community demand for safe and inviting trail and bikeway connections, especially to address intersections of major arterials. Key concerns (or constraints) for this particular project were the identification of proposed corridor private property and other potential right-of-way constraints.

Public and stakeholder input played strong roles in this project and ultimately led to the refinement, removal and addition of several routes. Input received during two public workshops and two stakeholder meetings helped to transform the ten preliminary routes to twelve community driven routes. Information on the ten initial routes is included in Chapter 2 and information on the final twelve routes is provided in Chapter 4.

STUDY AREA

The study area for this project was central Costa Mesa. This section begins with a brief discussion on the City of Costa Mesa and ends with a discussion of the study area itself.

The City of Costa Mesa covers a land area of 16 square miles in central Orange County, bounded by the cities of Huntington Beach, Santa Ana, Irvine, Fountain Valley and Newport Beach. The City's western boundary is formed by the Santa Ana River. The City is also defined by three freeways (the 55, 73 and 405). These freeways provide regional vehicular access, but also act as barriers to active transportation.



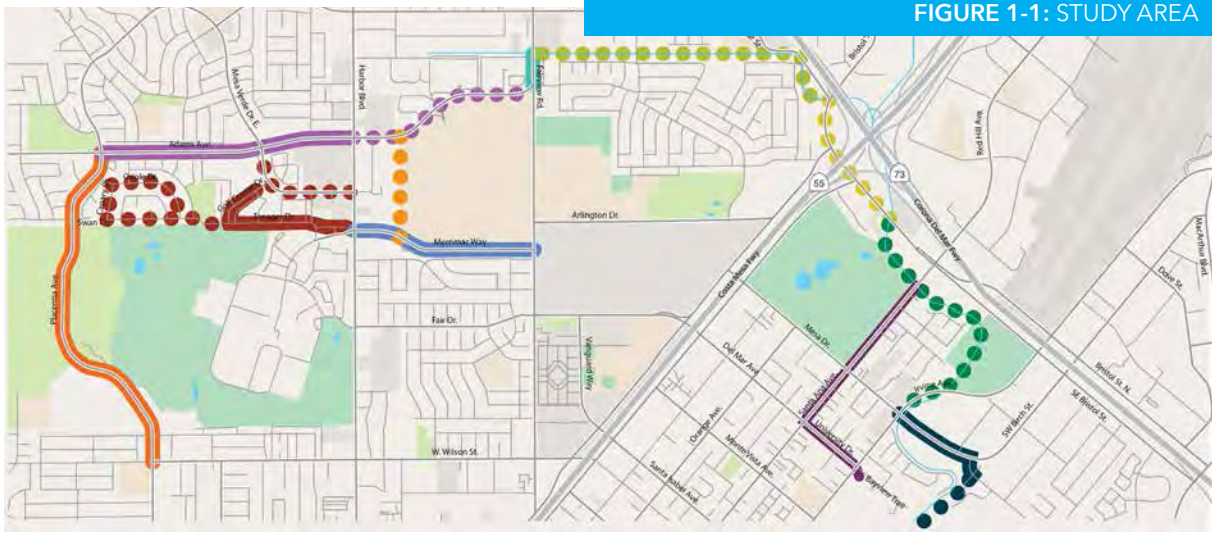


FIGURE 1-1: STUDY AREA

Costa Mesa went from a semi-rural community to a vital commercial and industrial center after its incorporation in 1953. Costa Mesa hosts three colleges, the Orange County Performing Arts Center and the Orange County Fair & Event Center. It is laid out in a fairly traditional street grid pattern and is relatively flat.

According to US Census estimates, Costa Mesa's 2014 population was 112,784. Census data concerning "means of transportation to work" show that the majority of residents (77.1 percent) traveled to and from work by driving alone. Walking and biking currently accounted for no more than 5.8 percent of commute trips in the City of Costa Mesa. Commute travel, of course, represents only a small fraction of overall travel. Actual counts of pedestrians and cyclists, at specific locations within the project area, were conducted for this plan (See Chapter 2).

The study area covers approximately the middle third of the City, connecting the Santa Ana River Trail in the west to Newport Bay in the southeast. The area was generally defined as the preliminary project corridors shown in Figure 1-1.

The study area includes a mix of uses including residential, parks and recreation, institutional (especially educational), commercial and industrial. The study area is also diverse with respect to socioeconomic traits, housing type, housing tenure, and transportation modes used.

As with most planning efforts, this project was built on foundation of previous, related efforts: existing plans; relevant legislation; benefits of cycling and walking; the "state of practice" of bicycle planning; bikeway facility types; and other important treatments. The following sections provide brief summaries of these efforts as they relate to this plan's recommendations. They are followed by a discussion about project methodology.

EXISTING PLANS

This section identifies and summarizes the pertinent references from the City's General Plan Circulation Element related to active transportation, and provides an overview the City's current bikeways network.

CITY OF COSTA MESA GENERAL PLAN

Costa Mesa's 2000 General Plan contains several elements relevant to this plan: Land Use, Circulation (including a Master Plan of Bikeways), Community Design and Open Space and Recreation. While the General Plan Update will likely include important changes, particularly to land use and mobility (see "Other Important References" at the end of this section), the 2000 Plan will govern land use and transportation decisions until the adoption of the Update and so must be considered.

City of Costa Mesa Circulation Element

While the Circulation Element implies the near-exclusive use of automobiles for transportation, it calls for the creation of a multi-modal transportation system. The Circulation Element places particular emphasis on the creation of a bicycle network and includes a Master Plan of Bikeways within it.

Circulation Element goals relevant to the Multi-Purpose Trails Plan are:

- Provide for a balanced, uncongested, safe, and energy-efficient transportation system, incorporating all feasible modes of transportation. (GOAL CIR-1)

Relevant objectives and policies from the Circulation Element include the following:

- CIR-1A: To provide specific programs and policies that address multi-modal transportation, multi-agency coordination, mitigation of traffic impacts and the balancing of land uses with transportation systems.
  - » CIR-1A.1: Develop the Master Plan of Bikeways by pursuing all funding mechanisms and incorporating bikeways into roadway and bridge widening projects. Incorporate bicycle facilities (circulation and storage) into the design and development of all new commercial and industrial projects and public facilities.
  - » CIR-1A.2: Require dedication of right-of-way in an equitable manner for completion of adopted bikeway system as condition of development of adjacent properties.
  - » CIR-1A.3: Coordinate the design and improvement of pedestrian and bicycle ways in major residential, shopping, and employment centers, parks, schools, and other public facilities, public transportation facilities, and bicycle networks with adjacent cities.
  - » CIR-1A.6: Require dedication of right-of-way, in an equitable manner, for development that increases the intensity of land use.
  - » CIR-1A.8: Encourage integration of compatible land uses and housing into major development projects to reduce vehicle use.

CITY OF COSTA MESA COMMUNITY DESIGN ELEMENT

Community Design Element goals relevant to the Multi-Purpose Trails Plan are:

- Strengthen the image of the City as experienced from sidewalks and roadways;
- Utilize Costa Mesa's edges as opportunities for enhancing the image of the City along its boundaries.

Relevant objectives and policies from the Community Design Element include the following:

- CD-1B: Encourage clear connections between districts within the City.
  - » CD-1B.1: Promote linkages between separate districts through bike trails, pedestrian paths, common medians or parkway landscaping in connecting streets, and other physical improvements as necessary. Through conditions of project approval, public improvement projects, and other measures, support the development of new connections and the enhancement of existing connections between districts.
- CD-5: Develop and implement programs that preserve and enhance the edges of Costa Mesa.
  - » CD-5.3: Develop open space corridors and trails along the edges of Costa Mesa where feasible.

RELEVANT LEGISLATION

Several pieces of legislation support increased bicycling and walking in the State of California. Much of the legislation addresses greenhouse gas (GHG) reduction and employs bicycling and walking as means to achieve reduction targets. Other legislation highlights the intrinsic worth of bicycling and walking and treats the safe and convenient accommodation of cyclists and walkers as a matter of equity. The most relevant legislation concerning bicycle and pedestrian policy, planning, infrastructure and programs are described in the following sections. All Senate Bills (SB) and Assembly Bills (AB) relate to the State of California.

STATE LEGISLATION AND POLICIES

SB-743 CEQA Reform

Just as important as the other following pieces of legislation that support increases in bicycling and walking accommodation, is one that promises to remove a longstanding roadblock to them. That roadblock is vehicular Level of Service (LOS) and the legislation with the potential to remove it is SB-743. For decades, vehicular congestion has been interpreted as an environmental impact and has often stymied on-street bicycle projects in particular. Projections of degraded Level of Service have, at a minimum, driven up project costs and, at a maximum, precluded projects altogether. SB-743 could completely remove LOS as a measure of vehicle traffic congestion that must be used to analyze environmental impacts under the California Environmental Quality Act (CEQA).

This is extremely important because adequately accommodating cyclists, particularly in built-out environments, often requires reallocation of right-of-way and the potential for increased vehicular congestion. The re-framing of Level of Service as a matter of driver inconvenience, rather than an environmental impact, allows planners to assess the true impacts of transportation projects and will help support bicycling projects that improve mobility for all roadway users. (This legislation was approved on September 27, 2013. Guidelines, currently being prepared, are likely to be adopted in 2016.)

SB-375 Redesigning Communities to Reduce Greenhouse Gases

This state bill seeks to reduce vehicle miles traveled through land use and planning incentives. Key provisions require the larger regional transportation planning agencies to develop more sophisticated transportation planning models, and to use them for the purpose of creating "preferred growth scenarios" in their regional plans that reduce greenhouse gas emissions. The bill also provides incentives for local governments to incorporate these preferred growth scenarios into the transportation elements of their general land use plans.

AB-32 Global Warming Solutions

Act AB-32 calls for the reduction of greenhouse gas emissions and codifies the 2020 emissions reduction goal. This act also directs the California Air Resources Board to develop specific early actions to reduce greenhouse gases while also preparing a plan to identify how best to reach the 2020 limit.

AB-1358 Complete Streets Act

This bill requires the legislative body of a city or county, upon revision of the circulation element of their general plan, to identify how the jurisdiction will provide for routine accommodation of all users of the roadway including drivers, pedestrians, cyclists, individuals with disabilities, seniors and public transit users. The bill also directs the OPR to amend guidelines for general plan circulation element development so that the building and operation of local transportation facilities safely and conveniently accommodate everyone, regardless of their travel mode.

AB-1193 Bikeways

This act amends various code sections, all relating to bikeways in general, specifically by recognizing a fourth class of bicycle facility, cycle tracks. However, the following may be even more significant to future bikeway development:

Existing law requires Caltrans, in cooperation with county and city governments, to establish minimum safety design criteria for the planning and construction of bikeways, and requires the department to establish uniform specifications and symbols regarding bicycle travel and traffic related matters. Existing law also requires all city, county, regional and other local agencies responsible for the development or operation of bikeways or roadways to utilize all of those minimum safety design criteria and uniform specifications and symbols.

This bill revises these provisions and required Caltrans to establish minimum safety design criteria for each type of bikeway, but also authorized local agencies to utilize different minimum safety criteria if adopted by resolution at a public meeting.

FEDERAL LEGISLATION

Safe Streets Act (S-2004/HR-2468)

HR2468 encourages safer streets through policy adoption at the state and regional levels, mirroring an approach already being used in many local jurisdictions, regional agencies and states governments. The bill calls upon all states and metropolitan planning organizations (MPOs) to adopt Safe Streets policies for federally funded construction and roadway improvement projects within two years. Federal legislation will ensure consistency and flexibility in road-building processes and standards at all levels of governance.

BENEFITS OF CYCLING AND WALKING

Numerous environmental, health and economic benefits are attributable to cycling and walking, especially as a substitute for driving a vehicle. This section summarizes these benefits from research by the Pedestrian and Bicycle Information Center (PBIC).

THE ANNUAL COST OF TRANSPORTATION

ECONOMIC BENEFITS

Cycling infrastructure and programs has increasingly been shown to deliver economic benefit to both individuals and society at large. The benefits of cycling may, in fact, outweigh its costs. Cycling, and utilitarian cycling in particular, offers somewhat obvious cost savings to individuals. Beyond the up-front cost of operating a vehicle are additional maintenance, insurance and often parking costs. According to the American Automobile Association, the annual cost of owning a car and driving 15,000 miles a year is now about $9,000.

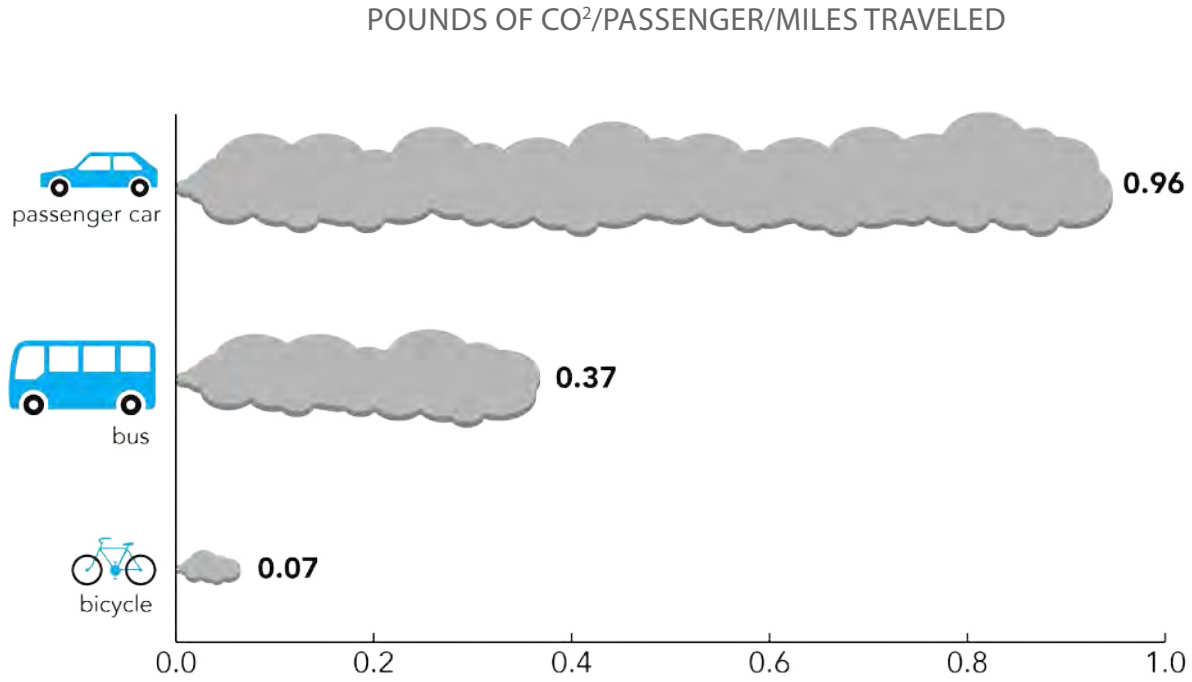
Converting even a fraction of automobile trips to cycling or walking trips can create significant transportation-related savings as a result of reduced vehicle traffic congestion. Increased cycling also translates to health-related savings, for both individuals and taxpayers, in the form of less need for preventative care. More cycling and walking have also been tied to increases in commercial and residential property values and retail sales. Shoppers who reach their destination by bicycle have been shown to make smaller purchases, but shop more often and spend more money overall. Shoppers who arrive by bicycle or on foot, by virtue of their more limited range, are also more likely to support local businesses, and do not require a vehicle parking spot.

ENVIRONMENTAL BENEFITS

Increased cycling and walking reduces fossil fuel emissions. In California, 40 percent of carbon dioxide (CO_2) emissions are produced by the transportation sector. While CO_2 is not the most harmful greenhouse gas, it is the most abundant. Even after accounting for the global warming potentials of other greenhouse gases (comparing them in terms of CO_2), 95 to 99 percent of vehicle emissions are CO_2. The Environmental Protection Agency (EPA) found that the average vehicle emits 0.95 pounds of CO_2 per mile. Therefore, almost 10 pounds of carbon dioxide emissions could be avoided each day if an individual with a five mile (each way) commute switched from driving to an active transportation mode like cycling or walking. Perhaps more compelling than reducing GHG emissions or combating the obesity epidemic is the benefits bicycling has to offer in terms of quality of life. Bicycling, and especially utilitarian bicycling, is increasingly seen as a fun, low-cost, healthy and sustainable way of getting around. How then, can we make it easier for any person to choose a bicycle for his or her daily trips?

HEALTH BENEFITS

Despite dramatic strides in recent decades through regulations and technological improvements, vehicle emissions still pose a significant threat to air quality and human health. Vehicle generated air pollution contains harmful greenhouse gas emissions including carbon dioxide, carbon monoxide, methane, nitrous oxide and volatile organic compounds. These pollutants and irritants can cause asthma, bronchitis, pneumonia and decreased resistance to respiratory infections. Taking steps to reduce these emissions is particularly important in the United States, which leads the world in petroleum consumption. The conversion of vehicular trips to cycling or walking trips offers a great opportunity to reduce emissions and improve public health.



In addition to the universal public health benefit, such as improved air quality described above, cycling and walking have the potential to positively impact personal health. A significant percentage of Americans are overweight or obese and recent projections indicate that 42 percent of the population will be obese by 2030. To combat this trend and prevent a variety of diseases and their associated societal costs, the Centers for Disease Control (CDC) suggests a minimum of 30 minutes of moderate intensity physical activity five days per week. Not only does cycling and brisk walking qualify as "moderate intensity activity," they can also be seamlessly integrated into daily routine, especially if chosen for utilitarian purposes like commuting or running errands.

Other health benefits associated with moderate activity, such as cycling or walking, include improved strength and stamina through better heart and lung function. Regular exercise reduces the risk of high blood pressure, heart attacks and strokes. In addition to heart disease, regular exercise can also help to prevent other health problems such as non-insulin dependent diabetes, osteoarthritis and osteoporosis. Lastly, exercise has been shown to improve mental health by relieving symptoms of depression, anxiety and stress.

BICYCLE FACILITY STATE OF PRACTICE

Over the past five years the state of practice for bicycle facilities in the United States has undergone a significant transformation. Much of this may be attributed to bicycling's changing role in the overall transportation system. Once viewed as an "alternative" mode, it is increasingly viewed as a legitimate transportation mode and one that should be actively promoted as a means of achieving environmental, social and economic goals. (Due to a long history of routine accommodation for pedestrians, such as sidewalks, crosswalks, dedicated signals, etc., there are relatively fewer innovations in pedestrian facilities.)

While connectivity and convenience remain essential bicycle facility quality indicators, recent research indicates the increased acceptance and practice of daily bicycling will require "low-stress" bicycle facilities. Low-stress facilities are typically understood to be those that provide separation from high volume and high speed vehicular traffic. The facility types recommended by this plan, and described in the following section, are consistent with this evolving state of practice.

BIKEWAY FACILITY TYPES

This plan includes three low-stress bikeway facility categories: off-street, on-street and shared street. These broad categories include more specific bikeway types. The category and facility type recommended depends on the context, including street type and its vehicle traffic speed and volume.

Houses with above average levels of walkability ask for **$4,000 to $34,000** more than houses with average levels

A four-mile walking trip keeps about 15 pounds of pollutants out of the air we breathe.

OFF-STREET FACILITIES

Off-street bicycle facilities include open space, shared used paths (i.e. Caltrans Class I facilities) and roadside shared use paved paths or "urban trails." These facilities are recommended where a recreational experience is desired, where a route is desired and no street exists, and where exceedingly high speed and volume vehicular traffic warrants substantial separation.

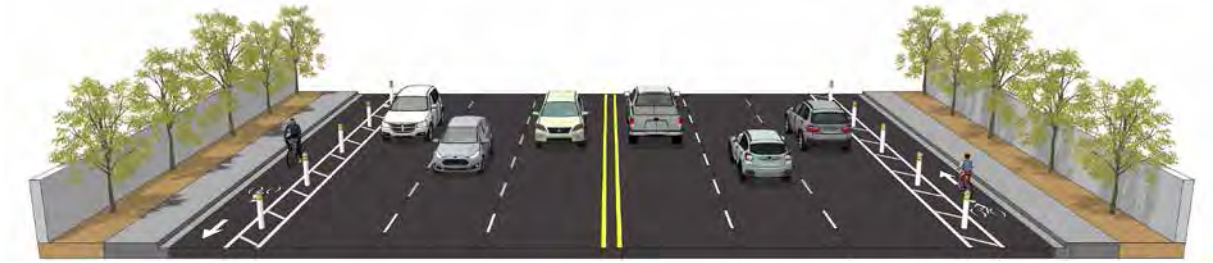
FIGURE 1-2: OFF-STREET BICYCLES FACILITIES

Local Neighborhood Access to Paths

ON-STREET FACILITIES

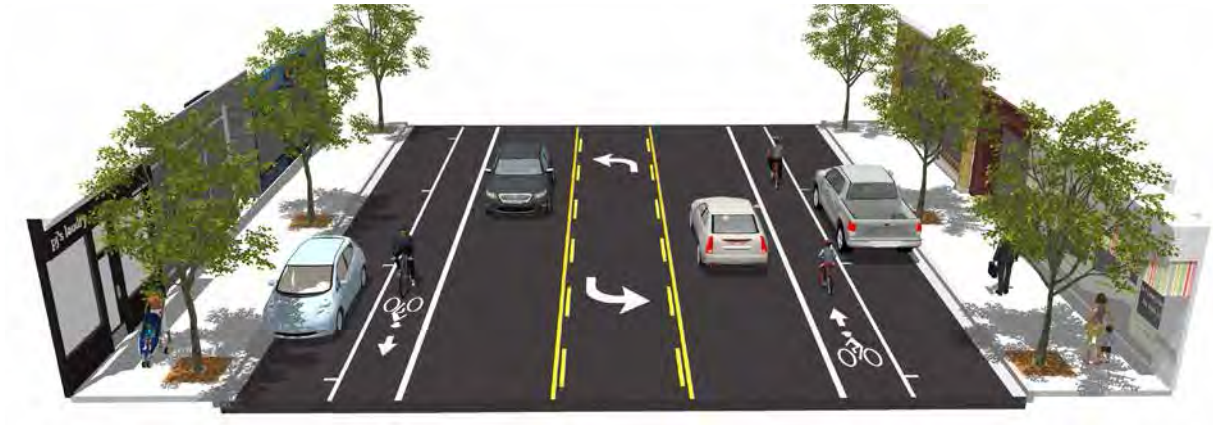
On-street facilities include striped bike lanes (i.e. Caltrans Class II facilities), buffered bike lanes and protected bike lanes (i.e. Caltrans Class IV facilities). These facilities are recommended where the desired bicycling route follows an existing street and where traffic speeds and volumes are low enough to permit an adjacent facility, but high enough to preclude a "shared" facility. As a simple rule for low-stress bike lanes, the greater the separation from vehicle traffic, the better. Buffered bike lanes are recommended anywhere roadway space allows. Protected bike lanes, separated from vehicle lanes by vertical physical barriers, are recommended where vehicle speeds and volumes are high.

FIGURE 1-3: ON-STREET BICYCLE FACILITIES



Protected Bike Lanes

Buffered Bike Lanes



Striped Bike Lanes

FIGURE 1-4: SHARED STREET BICYCLE FACILITIES

Bike Route

Neighborhood Greenway

SHARED-STREET FACILITIES

Shared-street facilities include bicycle routes (i.e. Caltrans Class III facilities) and bicycle boulevards or "neighborhood greenways." These facilities are recommended only where vehicle speeds and volumes are low enough for bicyclists and motorists to truly "share the road." In the case of bicycle boulevards, traffic calming and bicyclist priority measures may be included.

OTHER IMPORTANT TREATMENTS

With a grid street system, and a relatively flat terrain, Costa Mesa has the framework for a bicycle and pedestrian-friendly environment. Many streets already have sidewalks, especially within older neighborhoods. While many intersections are signalized and crosswalks exists, there are some roadway segments with long blocks without safe places to cross. Providing crossing treatments will help reduce jaywalking and crossing at mid-block.

PEDESTRIAN REFUGE

Refuge islands provide pedestrians and bicyclists a safe location if they must wait before completing their crossing of a multi-lane roadway.

MID-BLOCK CROSSINGS

Mid-block crossings provide convenient locations for pedestrians to cross urban thoroughfares in areas with infrequent intersection crossings or where the nearest intersection crossing creates substantial out-of-direction travel.

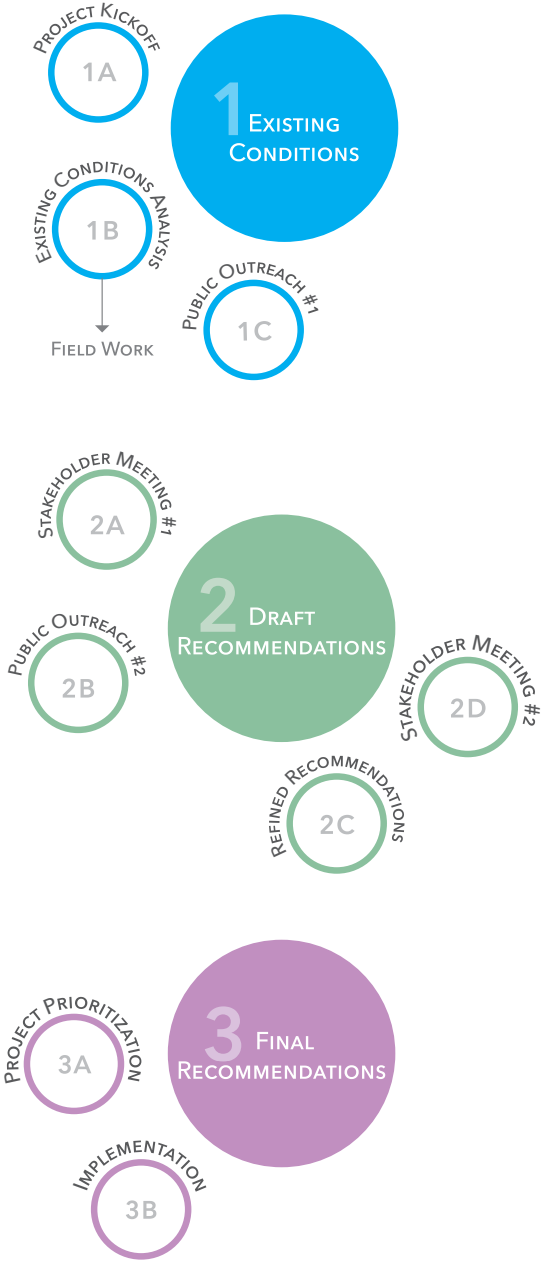
CURB EXTENSIONS

Also called bulb-outs or neck-downs, curb extensions extend the line of the curb into the travel way, reducing the width of the street. Typically occurring at intersections, they reduce the distance a pedestrian has to cross.

FIGURE 1-5: PEDESTRIAN REFUGE

FIGURE 1-6: MID-BLOCK CROSSING

FIGURE 1-7: CURB EXTENSION



METHODOLOGY

This project's process included evaluating existing conditions, opportunities and constraints, and consulting with stakeholders and the general public. Input collected was then analyzed and helped to inform and refine project recommendations. Detail regarding the unique or noteworthy aspects of the project methodology are explained in the following paragraphs.

PUBLIC OUTREACH

The process was heavily influenced, and the results significantly modified, by knowledgeable public input. In particular, while the initial scope called for evaluating ten specific routes, public input, especially during the two public workshops, supported expanding the analysis to include twelve community driven route recommendations.

MULTIPLE FACILITY SCENARIOS

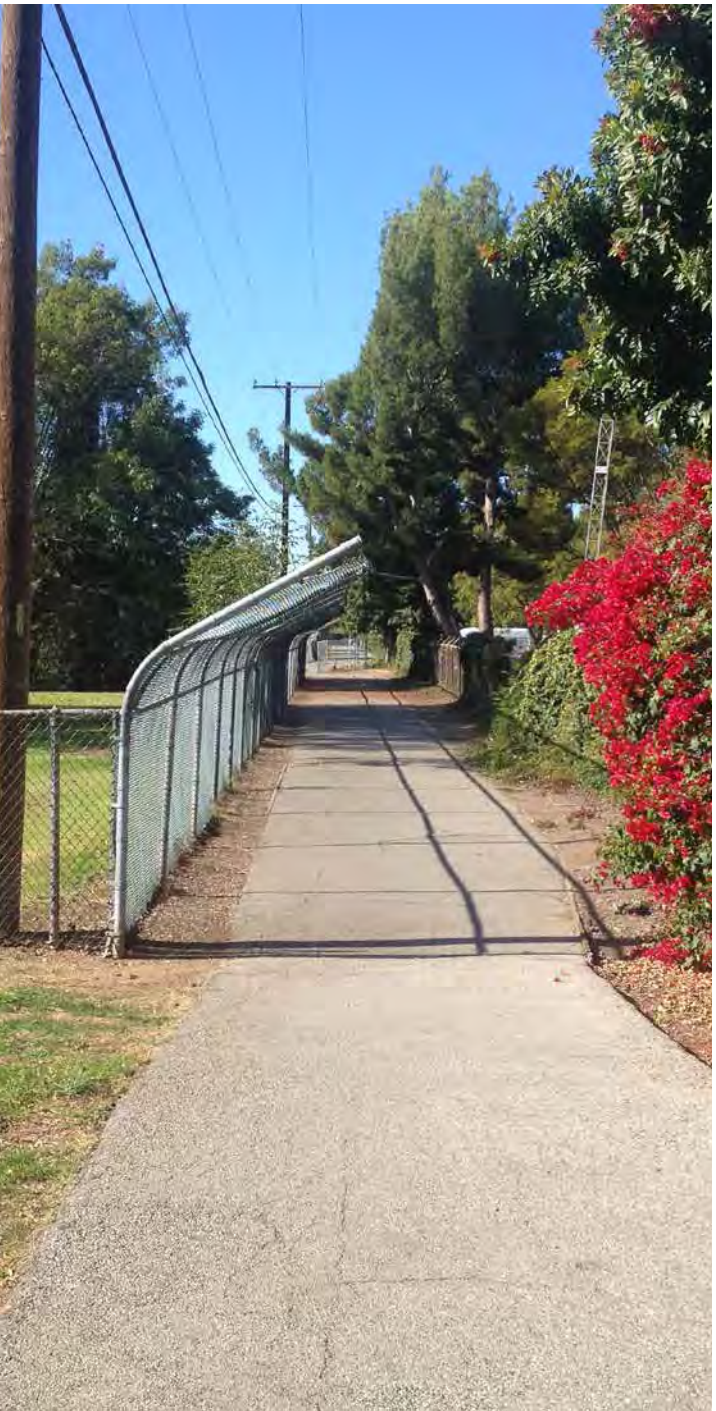
Nearly every project considered multiple scenarios. These different scenarios emerged due to trade-offs between multiple factors impacting each route/facility: level of comfort or stress, directness, anticipated use levels and feasibility. Comfort was determined by factors like the volume and speed of adjacent vehicle traffic, as well as the presence and quality of bicycle/pedestrian facilities. Directness was defined by measuring out-of-direction travel. Routes were considered "direct" so long as they were no more than 20 percent longer than the shortest route between two points of interest, such as the Santa Ana River Trail and Orange Coast College. Anticipated use levels were determined by actual counts of existing use, as well as public and stakeholder input on desired routes and facilities. Finally, feasibility is a measure of both physical and financial feasibility (available right-of-way and funds, respectively).

STAKEHOLDER COLLABORATION

Stakeholder input, particularly from City staff and the newly created Bikeability and Walkability Committee, was indispensable throughout the project process to ensure that recommendations were appropriate for current and future contexts. For example, close stakeholder collaboration was essential to information exchange regarding possible lane and road diets (lane narrowing and lane removal, respectively), which allowed for a recommendation of separated bike lanes on two project corridors.

CHAPTER 2

EXISTING CONDITIONS



EXISTING CONDITIONS ANALYSIS

This chapter summarizes existing conditions, opportunities, and constraints for the proposed alignments that comprise the multi-purpose trail plan. This work formed the foundation for the development of potential alternative alignments and conceptual designs for the proposed corridors.

The proposed bicycle facilities sought to provide improved non-motorized connections between the Santa Ana River Trail and Upper Newport Bay along the following east-west corridors: The Paularino and Santa Ana Delhi Flood Control Channels; Adams Avenue, between the bicycle trails at Fairview Park and Harbor Boulevard; and Orange Coast College campus. This study was unusual in that it began with a preselected set of routes that evolved – rather late in the study – to include new and altered routes.

This chapter presents existing conditions analysis performed for the preselected routes, and includes the following elements:

- A review of existing bicycle facilities in the City of Costa Mesa
- An overview of the preselected routes
- A summary of opportunities and constraints for all preselected routes
- Detailed analyses for each preselected route

For all routes, including new and altered routes, the following existing conditions analysis methods were also employed:

- Level of Traffic Stress ("LTS") Analysis
- Right-of-Way Feasibility ("Delta") Analysis
- Biological Resources/Air Quality Analysis

The LTS and Delta analyses, which provided information on both the optimal and the feasible facilities for each route, are described in the Chapter 4. A biological resource and air quality analysis are included in a separate document.

EXISTING FACILITIES

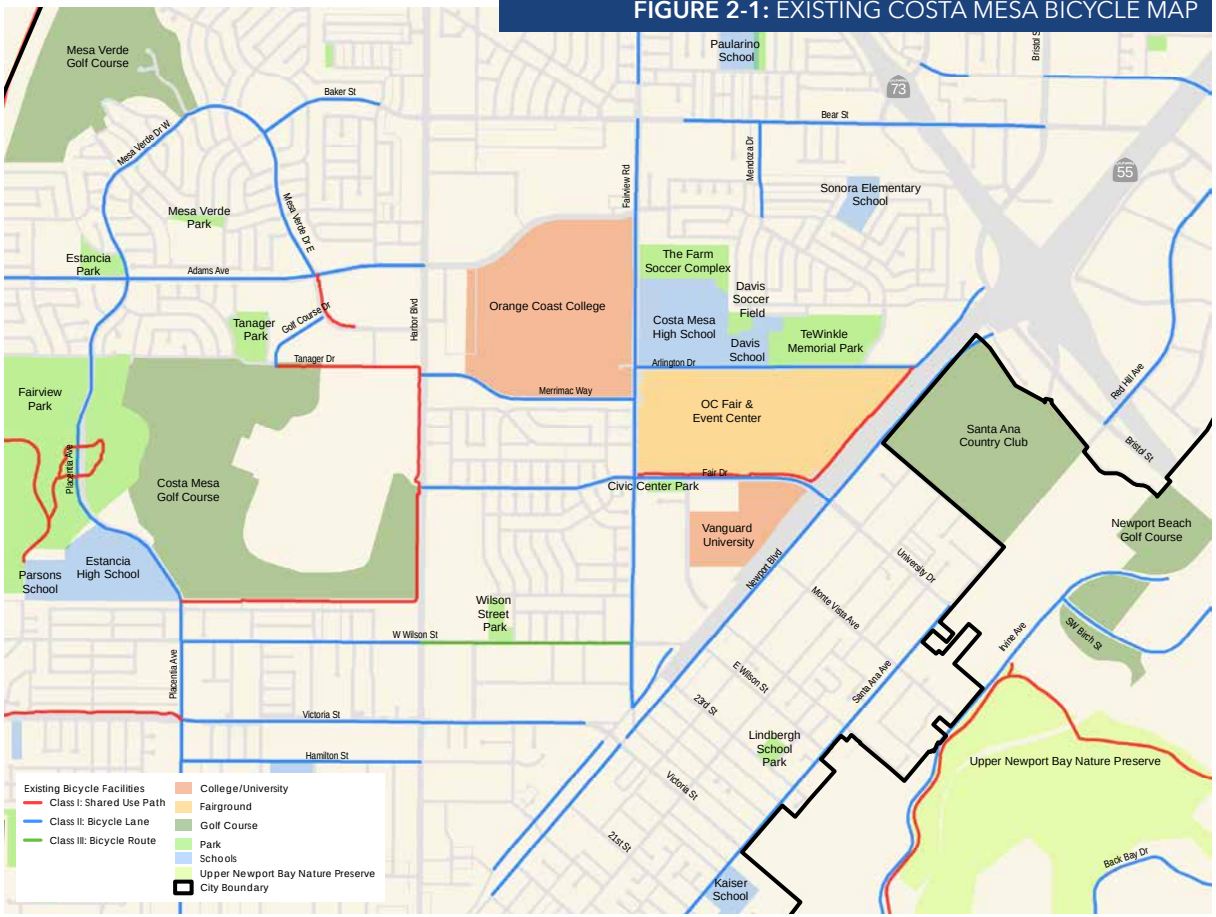
The City of Costa Mesa maintains an existing network of bicycle facilities and off-street multi-use pathways that provide recreation and commute opportunities for residents throughout the City. The City's current bicycle map is shown in Figure 2-1.

There are three bikeway classifications present in the City of Costa Mesa:

- Class I: A paved, off-street multi-use pathway that provides a completely separated right-of-way designated for the exclusive use of bicycles and pedestrians with cross flows by motor vehicles minimized.
- Class II: A striped, on-street bicycle lane that provides a restricted right-of-way designated for the exclusive or semi exclusive use of bicycles with through travel by motor vehicles or pedestrians prohibited, but with vehicle parking and cross flows by pedestrians and motor vehicles permitted.
- Class III: A signed or marked roadway permitting shared use of the right-of-way by bicyclists, pedestrians, and motor vehicles.

Class I facilities are primarily located on the edges of the City and near open space areas such as Fairview Park, the Santa Ana River, and Upper Newport Bay. Class II on-street bikeways are provided on various collector and arterial roadways located throughout the City, including Adams Avenue, Merrimac Way, Fairview Road, and Fair Drive. Class III facilities are proposed on a limited number of roadways in the City, with only one such facility within the study area (on Wilson Street).

FIGURE 2-1: EXISTING COSTA MESA BICYCLE MAP



BIKEWAY ALIGNMENT OVERVIEW

A key objective of the Multi-Purpose Trails Plan is to provide connections for bicyclists and pedestrians from east to west across the City, connecting the major regional multi-use paths along the Santa Ana River and Upper Newport Bay. The proposed multi-purpose trail alignments make use of both off-street and on-street routes to make this connection. Bikeways or multi-purpose trails are in place for portions of the proposed routes, and the new segments would help to close gaps between the existing segments and create a continuous corridor from one side of the City to the other. Table 2-1 summarizes preliminary proposed alignments.

A key element of this assessment and feasibility study was examining how existing on-street bikeway facilities can connect to potential multi-purpose trails within flood control channel rights-of-way. The available level space adjacent to the flood control channels is also important, as this area will be the space within which a potential multi-purpose could be constructed. Figure 2-2 illustrates the different elements evaluated along the proposed off-street multi-purpose trail segments.

TABLE 2-1: PROPOSED BIKEWAY ALIGNMENTS

SEGMENT	LIMITS	EXISTING BICYCLE FACILITIES	PROPOSED BICYCLE FACILITIES	LENGTH (MILES)
Placentia Avenue	Wilson Street to Adams Avenue	Class II	Class II	1.30
Adams Avenue	Placentia Avenue to Fairview Road	None/Class II	Class II	1.65
Tanager Drive/ Golf Course Drive	Canary Drive To Harbor Boulevard	None/Class I	Class I & III	0.90
Merrimac Way	Harbor Boulevard to Fairview Road	Class II	Class II	0.65
Fairview Road	Adams Avenue to Paularino Channel	Class II	Class II	0.10
Paularino Channel	Fairview Road to Bristol Street/ Bear Street	None	Class I	1.20
Bristol Street	Bear Street to Paularino Channel	None	Class II	0.50
Paularino Channel	Bristol Street to Birch Street	None	Class I	1.00
Mesa Drive	Paularino Channel to Bayview Trail	Class II	Class I & II	0.65
Santa Ana Avenue/ University Avenue	Paularino Channel to Bayview Trail	None/Class II	Class II	0.95

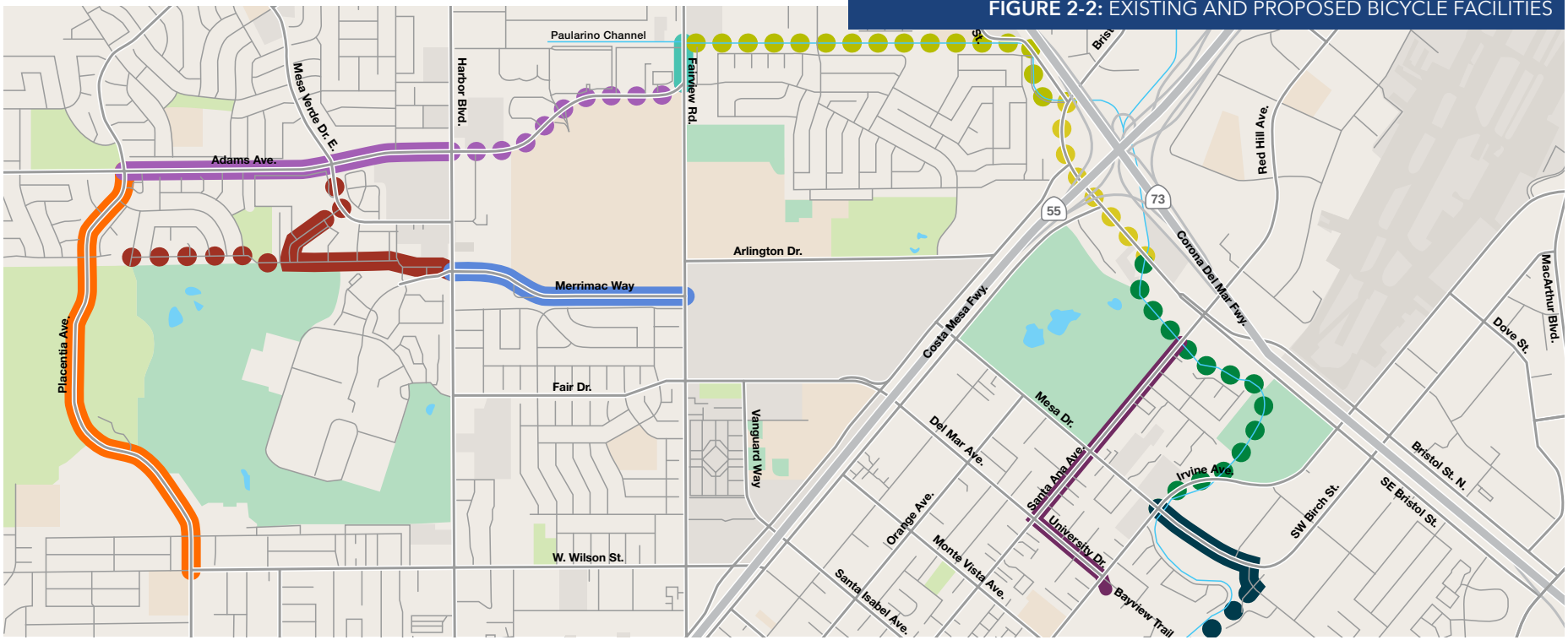
OPPORTUNITIES AND CONSTRAINTS

The review of the physical conditions along and adjacent to the proposed multi-purpose trail alignments are summarized on the following pages. Field reviews of the proposed corridor were conducted to identify conditions in the field, photograph key features, and verify current conditions and measurements. The primary opportunities associated with the proposed alignments include use of and connections with existing on-street and off-street bicycle facilities within the City of Costa Mesa, as well as connections to major regional multi-purpose trails located along the western and eastern edges of the City. The proposed alignments also provide access to several significant destinations within the City, including Orange Coast College, the Orange County Fairgrounds, and Costa Mesa and Estancia High Schools.

The proposed alignments also make use of several existing on-street Class II bikeways to facilitate connections between the proposed Class I off-street segments. Portions of the multi-use trails proposed along existing flood control channels look to make use of existing paved or gravel maintenance roads adjacent to the channels. Key constraints for the proposed alignments include major street crossings, both at existing signalized intersections and in mid-block locations, and limited right-of-way or channel capacity for grade-separated crossings along the flood control channel near mid-block roadway crossings.

These observations formed the basis of the technical review for the proposed alignments, the alignment development process, and conceptual design efforts.

FIGURE 2-2: EXISTING AND PROPOSED BICYCLE FACILITIES



SEGMENT 1: PLACENTIA AVENUE (WILSON AVENUE TO ADAMS AVENUE)

Background

There is an existing Class II bicycle lane on Placentia Avenue throughout the length of this segment. In selected portions of the segment, this Class II bicycle lane is enhanced with a striped buffer in place of the standard six inch bicycle lane stripe that is typically applied for a Class II facility. Placentia Avenue is a four lane Primary Arterial with an average daily traffic volume between 11,000 and 12,000 vehicles in this segment. This segment also includes a short section of proposed Class I bikeway west of Placentia Avenue along the Fairview Channel, which would provide a linkage from Placentia Avenue into Fairview Park and the Santa Ana River Trail.

Opportunities

- The existing Class II buffered bicycle lanes provide a good existing facility for use by cyclists
- There is an extensive network of paved and unpaved multi-purpose trails within Fairview Park that provide recreational opportunities and connections to the Santa Ana River Trail

Constraints

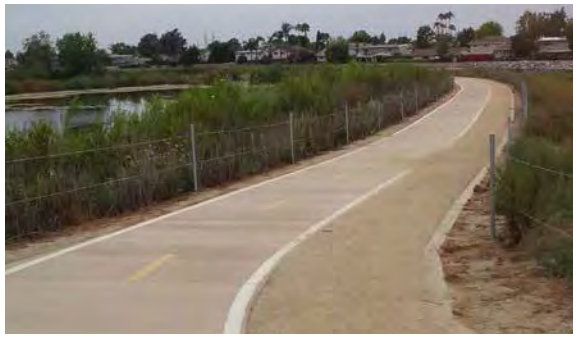
- The connection between the proposed Fairview Channel segment and northbound Placentia Avenue currently does not have a crosswalk or other form of traffic markings or control
- There is no existing paved connection between Placentia Avenue and Tanager Drive
- While there is a striped buffer adjacent to the existing bicycle lanes, and the bicycle lanes meet the minimum standard width of five feet including gutter, this configuration is increasingly considered suboptimal

Key Issues

- The connection to a multi-purpose trail along Fairview Channel may create a need for a mid-block crossing of Placentia Avenue to facilitate a connection to the northbound bicycle lane
- A concept for connecting Placentia Avenue to Tanager Drive would help in linking this corridor to Harbor Boulevard via a route with lower traffic volumes and speeds when compared to Adams Avenue

Location Map


Existing Class II buffered bike lane on Placentia Avenue


Existing multi-purpose trail in Fairview Park

SEGMENT 2: ADAMS AVENUE (PLACENTIA AVENUE TO FAIRVIEW ROAD)

Background

There are existing Class II bicycle lanes on Adams Avenue west of Harbor Boulevard. East of Harbor Boulevard, there are no bicycle facilities provided. Adams Avenue is a six-lane arterial street for a majority of this segment. Between Pinecreek Drive and Fairview Road, there are only two westbound lanes and on-street parking is permitted on the north side of the street. Adams Avenue is designated as a six-lane Major Arterial by the City of Costa Mesa and carries between 28,000 and 36,000 vehicles per daily within the study segment. Adams Avenue provides connections to Estancia Park, Mesa Verde Shopping Center, and Orange Coast College.

Opportunities

- There are existing Class II striped bicycle lanes between Placentia Avenue and Harbor Boulevard
- The topography along Adams Avenue is generally flat and conducive to travel by active transportation modes
- There are several signalized intersections along the corridor to facilitate street crossings and access to land uses on both sides of the street

Constraints

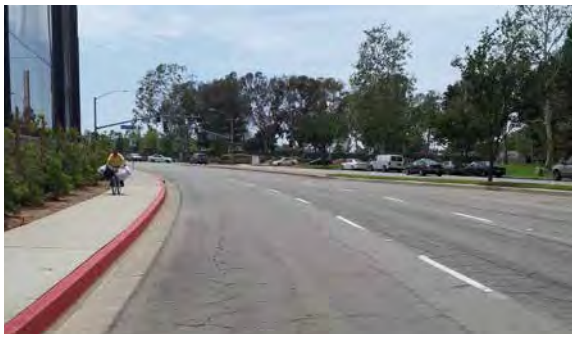
- There are no bicycle facilities provided east of Harbor Boulevard, and the existing roadway width and presence of on-street parking present challenges for the implementation of a striped bicycle lane
- The intersection of Adams Avenue and Harbor Boulevard has high traffic volumes and limited guidance for cyclists to traverse the intersection

Key Issues

- The existing on-street bicycle lane along Adams Avenue does not extend east of Harbor Boulevard, and the existing roadway cross-section does not allow for a simple implementation of an on-street bikeway in this portion of the segment
- Connections to Orange Coast College are important for this segment given the status of this use as a major regional destination

Location Map


Existing Class II bicycle lane west of Harbor Boulevard


No on-street bicycle lanes east of Harbor Boulevard

SEGMENT 3: TANAGER DRIVE/GOLF COURSE DRIVE/MESA VERDE DRIVE EAST (PLACENTIA AVENUE TO HARBOR BOULEVARD)

Background

This segment includes several different routes that together provide a connection between Fairview Park, Adams Avenue, and Harbor Boulevard. The proposed route follows Tanager Drive from its western terminus at Canary Drive to Golf Course Drive. There are then two spurs with the route, one to the north along Golf Course Drive and Mesa Verde Drive East to access Adams Avenue and a second to the east following an existing off-street multi-use trail to Harbor Boulevard. Tanager Drive is a residential street, while Golf Course Drive is a local two-lane roadway with an existing Class II striped bicycle lane. Mesa Verde Drive East is designated as a four-lane Primary Arterial and does not provide on-street bicycle lanes in this segment.

Opportunities

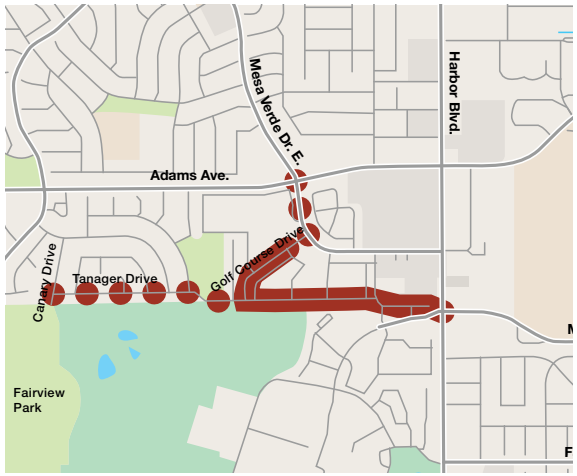
- The existing paved multi-use trail between Golf Course Drive and Harbor Boulevard provides an off-street connection parallel to Adams Avenue

Constraints

- There are no existing paved connections between the western terminus of Tanager Drive and Placentia Avenue
- Tanager Drive is a residential street and the residents fronting this street may not be supportive of a bicycle facility designation along the roadway
- There are no existing bicycle facilities on Mesa Verde Drive East

Key Issues

- The existing bicycle facilities present in this segment help to facilitate key connections, but do not provide connectivity throughout the segment in the existing condition
- There are short gaps at the western end of Tanager Drive and along Mesa Verde Drive East that would need to be closed to provide continuous multi-use facility in this segment



Location Map


Tanager Drive is a low-speed residential street


Existing multi-purpose trail connecting Tanager Drive to Harbor Boulevard

SEGMENT 4: MERRIMAC WAY (HARBOR BOULEVARD TO FAIRVIEW ROAD)

Background

Merrimac Way is a four lane Primary Arterial with existing Class II bicycle lanes striped between Harbor Boulevard and Fairview Road. This roadway forms the southern boundary of Orange Coast College and provides a connection from Harbor Boulevard to the Orange County Fairgrounds. Daily traffic volumes on Merrimac Way are about 10,000 vehicles.

Opportunities

- The existing Class II bicycle lane serves as a connection between the off-street multi-use trail in Segment 3 that extends west of Harbor Boulevard and the Class II bicycle lane on Fairview Road.
- Merrimac Way is a primary connection to Orange Coast College
- The existing speed limit on Merrimac Way is 35 miles per hour (lower vehicle speeds are more conducive to encouraging bicycle activity)

Constraints

- While the existing striped bicycle lanes meet the minimum standard width of five feet including gutter, this configuration is increasingly considered suboptimal
- This corridor does not provide as direct of a connection to the Paularino Channel as does the Adams Avenue corridor

Key Issues

- Merrimac Way provides excellent connections to Orange Coast College
- The roadway serves as a potential parallel alternative to Adams Avenue between Harbor Boulevard and Fairview Road

Location Map

Existing Class II bicycle lane on Merrimac Way

Merrimac Way runs adjacent to Orange Coast College

SEGMENT 5: FAIRVIEW ROAD (ADAMS AVENUE TO BAKER STREET)

Background

This is a short segment that would connect Adams Avenue to the Paularino Channel. Fairview Road is a six-lane Major Arterial, with a daily traffic volume of 43,000 vehicles. Fairview Road is a major access route between Interstate 405 and Orange Coast College and the Orange County Fairgrounds. There are existing Class II striping bicycle lanes along Fairview Road in this segment.

Opportunities

- The existing Class II bicycle lanes help to provide the connection between Adams Avenue and the Paularino Channel

Constraints

- Connections between the channel east of Fairview Road and the southbound bicycle lane made require a mid-block crossing to be installed
- While the existing Class II bicycle lanes on Fairview Road meet the minimum standard width of five feet including gutter, this configuration is increasingly considered suboptimal
- Existing traffic speeds on Fairview Road are higher than is typically desirable at 40 miles per hour

Key Issues

- This short segment of Fairview Road provides an important connection for the proposed corridor alignment
- Street crossings at the Paularino Channel will need to be reviewed to determine if these crossings occur at-grade mid-block, or if a grade-separated crossing can be provided along the channel

Location Map


Fairview Road and Adams Avenue intersection


Existing Class II striped bicycle lane on Fairview Road

SEGMENT 6: PAULARINO CHANNEL (FAIRVIEW ROAD TO BRISTOL STREET)

Background

The Paularino Channel is an existing open flood control channel owned and maintained by the Orange County Flood Control District (OC Flood). The channel has an existing maintenance road located along its south and west sides that is mostly paved and runs adjacent to the channel. The channel runs east to west between Fairview Road and Bear Street, then turns south and connects to the intersection of Bristol Street and Bear Street. The proposed alignment in this segment would follow the existing maintenance road, which would be improved and modified into a paved off-street multi-purpose trail. Street crossings would occur at Mendoza Drive and St. Clair Street.

Opportunities

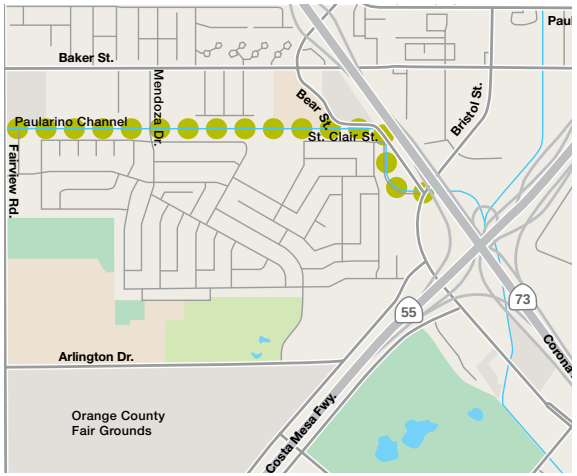
- The existing maintenance road is paved for most of its length and offers sufficient width, greater than 12 feet, to accommodate a paved off-street multi-purpose trail
- The two street crossings occur at lower volume local streets that would be easier for cyclists to cross than would a multi-lane roadway
- There are existing Class II bicycle lanes on Mendoza Drive that provides a connection north to Baker Street

Constraints

- The flood channel corridor runs adjacent to single family residential neighborhoods and most of this segment is located along the back fence line of residential properties
- The narrow condition of the channel precludes grade-separated street crossings within this segment

Key Issues

- The existing maintenance road along the Paularino Channel provides sufficient width for an off-street multi-purpose trail
- Key considerations will be to determine the interest of OC Flood in permitting the installation of a multi-use trail and the potential impacts to adjacent residential uses



Location Map


Maintenance road runs adjacent to residential uses along the channel


Maintenance road not paved but provides sufficient width for a multi-purpose trail

SEGMENT 7: BRISTOL STREET (BEAR STREET TO PAULARINO CHANNEL)

Background

Bristol Street is a six lane Major Arterial with no existing bicycle facilities in this segment. The roadway has an average daily traffic volume of 20,000 to 23,000 vehicles. This segment serves as a connection between two segments on the Paularino Channel because the channel is covered and located below the SR-55/SR-73 interchange within this section of the alignment.

Opportunities

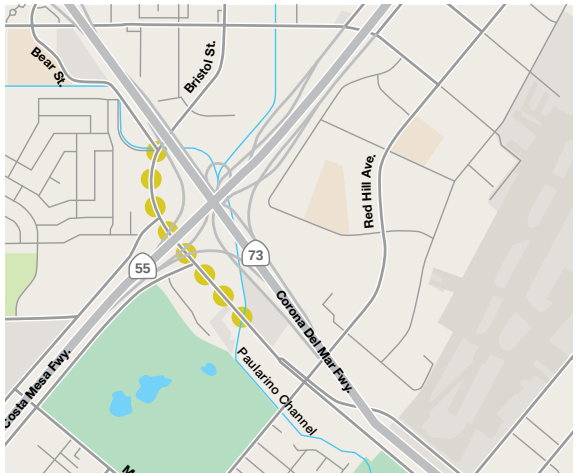
- The existing roadway width appears to be sufficient to accommodate Class II bicycle lanes
- The current traffic volumes are low for a major arterial, creating potential for conversion of traffic lanes to bicycle lanes

Constraints

- There is currently no mid-block crossing at the southern connection to the Paularino Channel

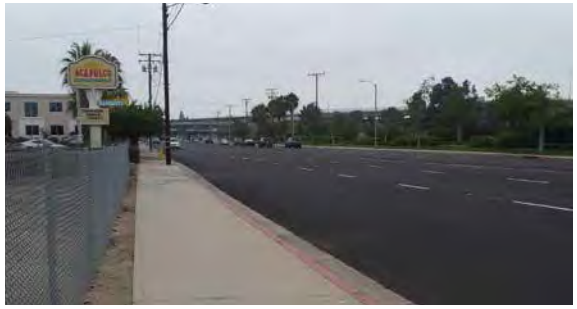
Key Issues

- The low traffic volumes create an opportunity for Class II bicycle lanes to be installed
- The southern connection to the Paularino Channel would require improved conditions for mid-block crossing of Bristol Street



Location Map

No striped bicycle lanes are provided on Bristol Street



The existing shoulder lane is generally wide enough to accommodate a bicycle lane

SEGMENT 8: PAULARINO CHANNEL (BRISTOL STREET TO MESA DRIVE)

Background

This segment is a continuation of an alignment along the Paularino Channel, which returns to being an open flood control channel south of Bristol Street. The channel has an existing maintenance road located this time along its north and east sides that runs adjacent to the channel. The maintenance road is paved north of Santa Ana Avenue and unpaved south of this roadway. There are no bicycle facilities along this maintenance road. The maintenance road has roughly 9 to 14 feet of usable right-of-way width within this segment. Street crossings occur at Santa Ana Avenue and Irvine Avenue.

Opportunities

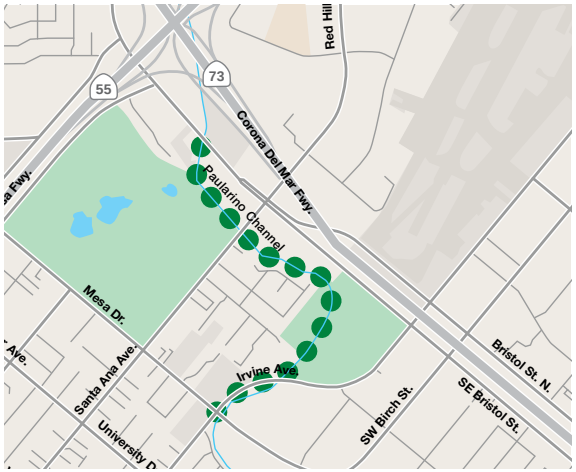
- The existing maintenance road provides an opportunity for an off-street paved multi-purpose trail
- The maintenance road is not located adjacent to single family residences in this segment
- Portions of the maintenance road are already being used as unpaved multi-purpose trails near the Newport Beach Golf Course
- There is an existing underpass below Irvine Avenue for the golf course that could be shared with the multi-purpose trail to facilitate a crossing of this roadway

Constraints

- The channel width at Santa Ana Avenue does not appears to be sufficient to accommodate an underpass at this location
- The maintenance road is narrow through the golf course and may not provide sufficient width for a standard Class I pathway for its entire length in this section

Key Issues

- The maintenance road along this segment of the Paularino Channel presents an opportunity for a Class I paved multi-purpose trail
- A mid-block crossing at Santa Ana Avenue may be challenging given current traffic volumes



Location Map


Unpaved maintenance road near Santa Ana Avenue


Unpaved multi-purpose trail near Newport Beach Golf Course

SEGMENT 9: MESA DRIVE (PAULARINO CHANNEL TO BAYVIEW TRAIL)

Background

This section of Mesa Drive provides a connection between the Paularino Channel and the Bayview Trail. The alignment would follow Mesa Drive between Irvine Avenue and Birch Street, then turning west to run along an existing unpaved stretch adjacent to the channel between Birch Street and the Bayview Trail. Mesa Drive has an existing Class II bicycle lane within this segment. The roadway is four lanes and is designated as a Secondary Arterial by the City of Costa Mesa. The average daily traffic volume on the roadway is 7,000 vehicles.

Opportunities

- The existing Class II bicycle lanes provide a connection between the Paularino Channel and the potential alignment to the Bayview Trail
- The existing traffic signals at Irvine Avenue and Birch Street help to facilitate street crossings on Mesa Drive

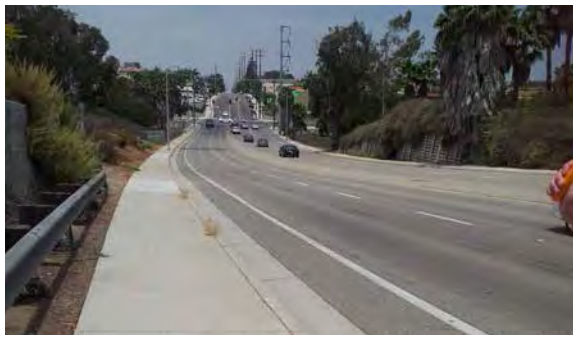
Constraints

- The proposed alignment between Birch Street and the Bayview Trail is unpaved and located adjacent to natural areas

Key Issues

- The segment includes both on-street and off-street sections and provides an important connection between the Paularino Channel and the Bayview Trail

Location Map



Existing Class II bicycle lane on Mesa Drive

West of Birch Street, Mesa Drive does not have an existing bicycle lane

SEGMENT 10: SANTA ANA AVENUE/UNIVERSITY DRIVE (PAULARINO CHANNEL TO BAYVIEW TRAIL)

Background

This segment is an alternative to the Paularino Channel route south of Santa Ana Avenue. This alignment would be on-street along Santa Ana Avenue and Del Mar Avenue/University Drive, linking the channel to the Bayview Trail near the intersection of University Drive and Irvine Avenue. Santa Ana Avenue is a Secondary Arterial with three travel lanes (two westbound and one eastbound) between Bristol Street and Mesa Drive and two travel lanes west of Mesa Drive. On-street parking is permitted on both sides of the street west of Mesa Drive and on the south side of the street west of Mesa Drive. A Class II bicycle lane is provided in the eastbound direction east of Mesa Drive. University Avenue is a two-lane street, designated as a Primary Arterial. Class II bicycle lanes are provided on the roadway. Daily traffic volumes on Santa Ana Avenue range from 7,000 to 10,000 vehicles. University Drive traffic volumes are 6,000 vehicles daily.

Opportunities

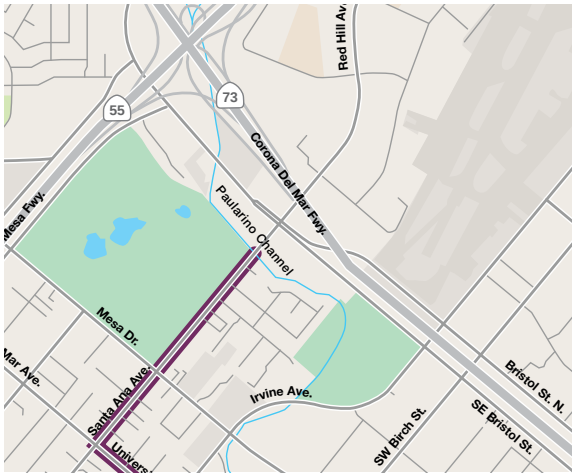
- The traffic volumes on Santa Ana Avenue are low for a four-lane roadway, creating an opportunity for reducing the number of traffic lanes to provide bicycle lanes
- Low traffic volumes on University Drive also facilitate and encourage bicycle travel
- Low speed limits (30 miles per hour) on Santa Ana Avenue (west of Mesa Drive) and University Drive are conducive to bicycling

Constraints

- East of Mesa Drive, on-street parking on Santa Ana Avenue constrains the roadway, prohibiting the provision of Class II bicycle lanes on both sides of the street
- Santa Ana Avenue has a high speed limit of 45 miles per hour between Mesa Drive and Bristol Street

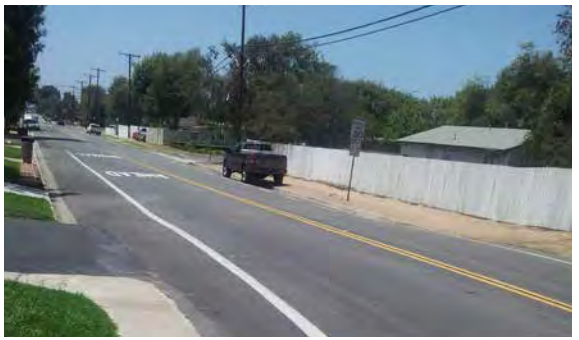
Key Issues

- The low traffic volumes on these two streets help to encourage bicycle activity
- On-street parking and high traffic speeds on Santa Ana Avenue can be discouraging to cyclists



Location Map


Existing Class II Bicycle lane on Santa Ana Avenue


Class II bicycle lane on University Drive

TRAFFIC CONDITIONS

Traffic counts were conducted for the weekday AM and PM peak periods on Thursday, September 25, 2014 at seven intersections and one roadway segment along the proposed multi-purpose trail route. These counts included collection of data for automobile traffic movements, as well as pedestrian and bicycle movements. As seen in Figure 2-3, the traffic count locations were:

1) Placentia Avenue & Adams Avenue
2) Mesa Verde Drive East & Adams Avenue
3) Pine Creek Drive & Adams Avenue
4) Fairview Road & Adams Avenue
5) Harbor Boulevard & Merrimac Way
6) Fairview Road & Fair Drive
7) Bristol Street & Bear Street
8) Santa Ana Avenue at Paularino Channel

Count locations were reviewed with and approved by the City of Costa Mesa. The lane geometry present at each intersection is shown in Figure 2-4, existing automobile traffic volumes for the AM and PM peak hour are shown in Figure 2-5, and pedestrian and bicycle count volumes are shown in Figure 2-6.

Table 2-2 summarizes the existing level of service at each of the intersections where traffic counts were collected. In addition to the seven intersections listed in the table, peak hour traffic volumes were also collected for Santa Ana Avenue as the roadway crosses the Paularino Channel southwest of Bristol Street. The observed peak hour volumes range from 1,055 vehicles in the AM peak hour and 1,074 vehicles in the PM peak hour.

All seven of the studied intersections currently operate at an acceptable level of service per the city's guidelines, which identify level of service "D" or better as acceptable. High peak hour traffic volumes (defined as being greater than 300 vehicles per lane, per hour) were observed on Adams Avenue, Harbor Boulevard, and Fairview Road.

TABLE 2-2: INTERSECTION LEVEL OF SERVICE SUMMARY

INTERSECTION		CONTROL	AM PEAK HOUR		PM PEAK HOUR	
			V/C	LOS	V/C	LOS
1	Placentia Ave & Adams Ave	Signal	0.648	B	0.729	C
2	Mesa Verde E & Adams Ave	Signal	0.580	A	0.712	C
3	Pine Creek Dr & Adams Ave	Signal	0.542	A	0.562	A
4	Fairview Rd & Adams Ave	Signal	0.718	C	0.654	B
5	Harbor Blvd & Merrimac Way	Signal	0.402	A	0.572	A
6	Fairview Rd & Fair Dr	Signal	0.426	A	0.580	A
7	Bristol St & Bear St	Signal	0.389	A	0.439	A

FIGURE 2-3: TRAFFIC COUNT LOCATIONS

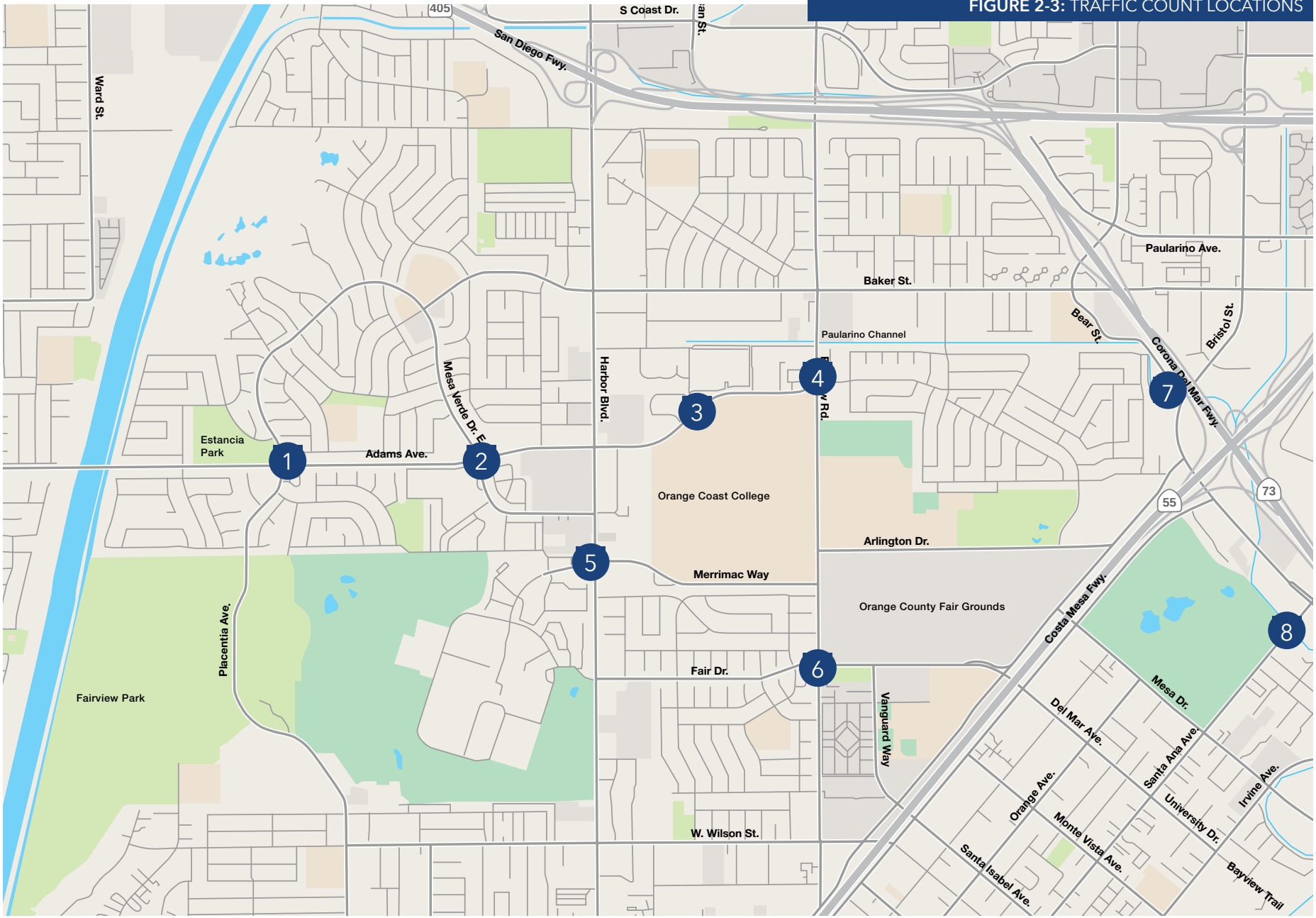
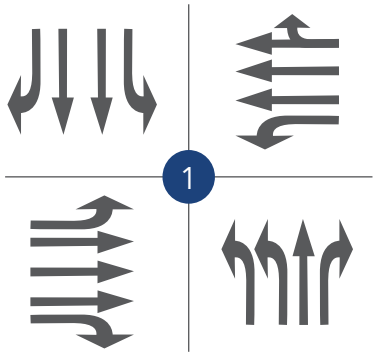
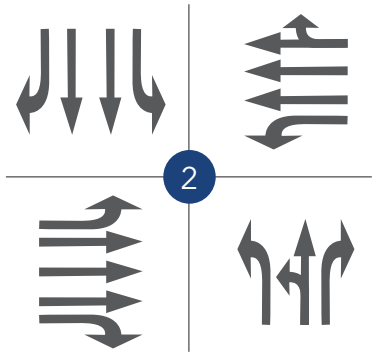


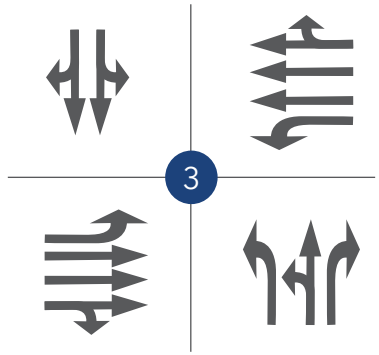
FIGURE 2-4: LANE GEOMETRY



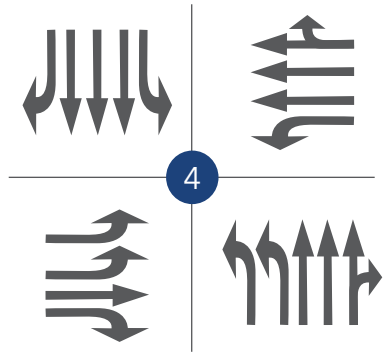
N/S: Placentia Ave
E/W: Adams Ave



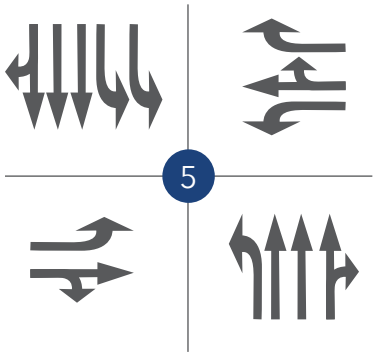
N/S: Mesa Verde Dr East
E/W: Adams Ave



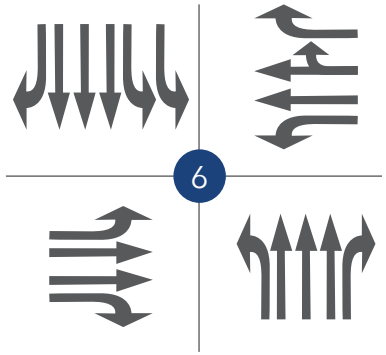
N/S: Pine Creek Dr
E/W: Adams Ave



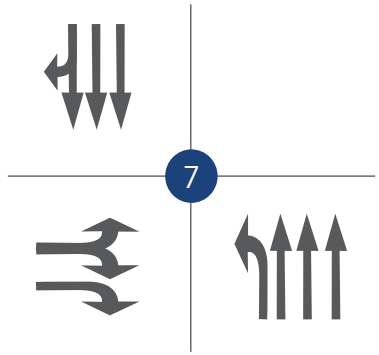
N/S: Fairview Rd
E/W: Adams Ave



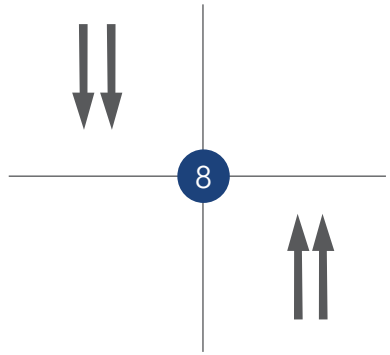
N/S: Harbor Blvd
E/W: Merimac Way



N/S: Fairview Rd
E/W: Fair Dr



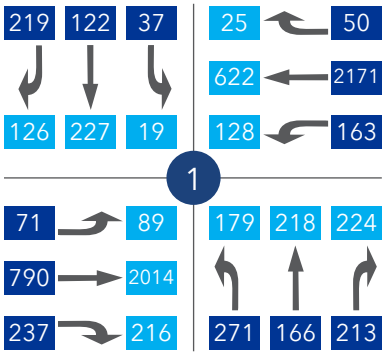
N/S: Bristol St
E/W: Bear St



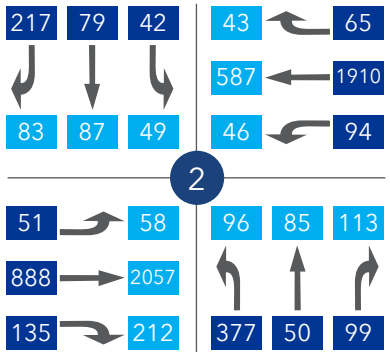
N/S: Santa Ana Ave
E/W: Paularino Channel

FIGURE 2-5: MOTOR VEHICLE TRAFFIC COUNTS

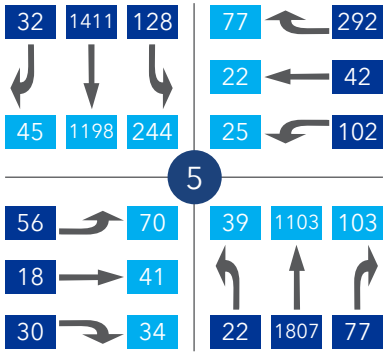
LEGEND
AM # PM



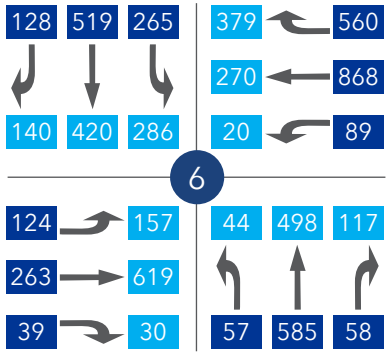
N/S: Placentia Ave
E/W: Adams Ave



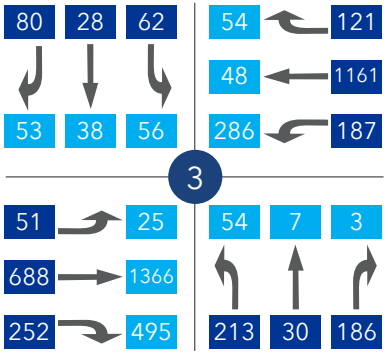
N/S: Mesa Verde Dr East
E/W: Adams Ave



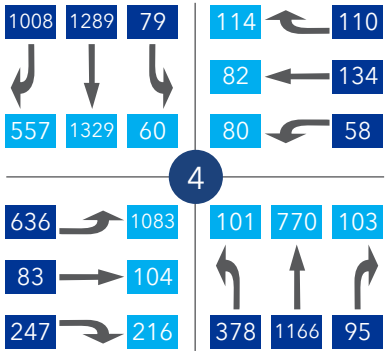
N/S: Harbor Blvd
E/W: Merimac Way



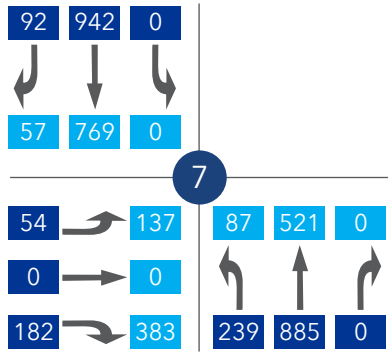
N/S: Fairview Rd
E/W: Fair Dr



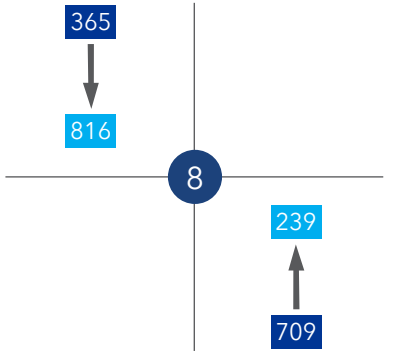
N/S: Pine Creek Dr
E/W: Adams Ave



N/S: Fairview Rd
E/W: Adams Ave

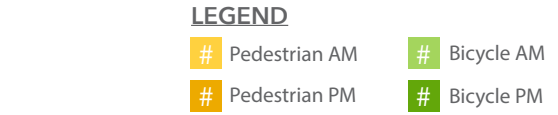


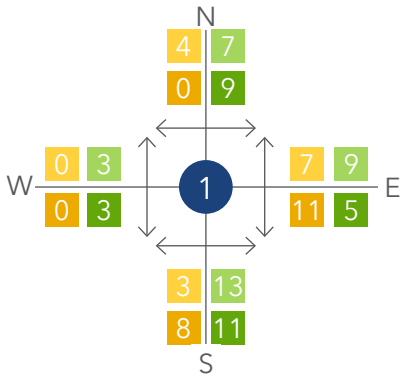
N/S: Bristol St
E/W: Bear St



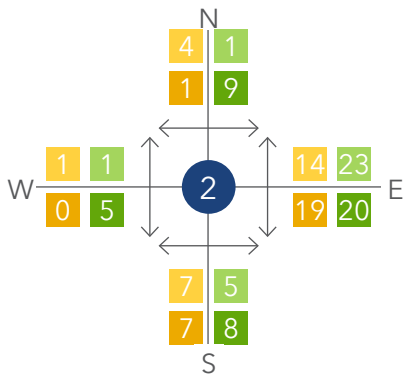
N/S: Santa Ana Ave
E/W: Paularino Channel

FIGURE 2-6: PEDESTRIAN AND BICYCLE COUNT VOLUMES

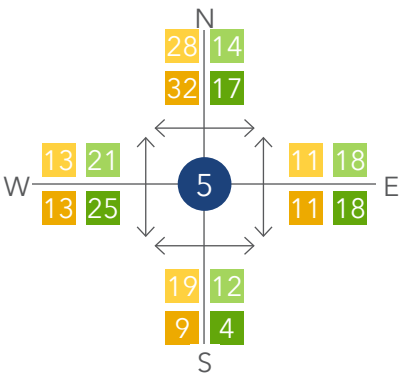




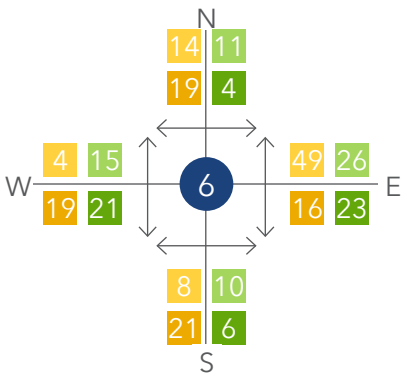
N/S: Placentia Ave
E/W: Adams Ave



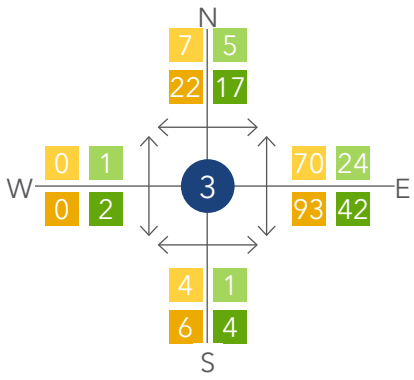
N/S: Mesa Verde Dr East
E/W: Adams Ave



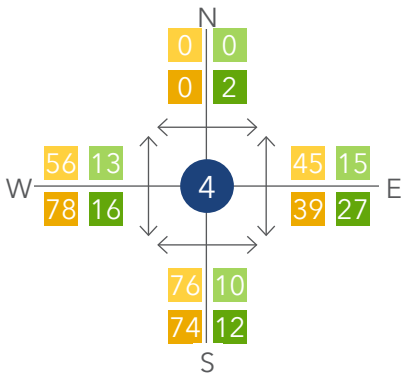
N/S: Harbor Blvd
E/W: Merimac Way



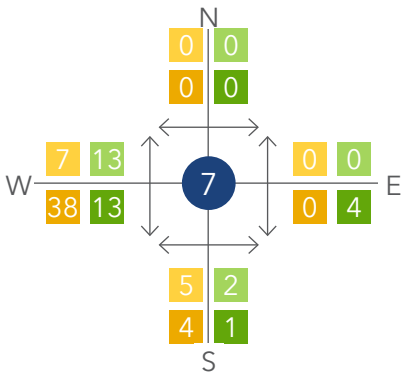
N/S: Fairview Rd
E/W: Fair Dr



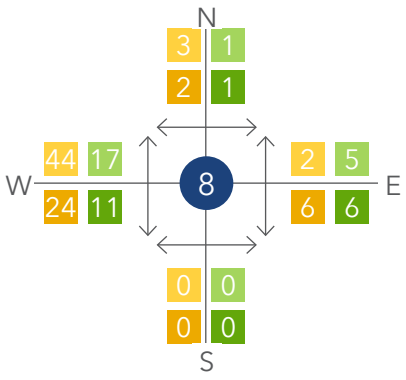
N/S: Pine Creek Dr
E/W: Adams Ave



N/S: Fairview Rd
E/W: Adams Ave



N/S: Bristol St
E/W: Bear St



N/S: Santa Ana Ave
E/W: Paularino Channel

CHAPTER 3

COMMUNITY INPUT

OUTREACH PLAN

To guarantee that interested residents and stakeholders had the opportunity to contribute to the project in a meaningful way, a stakeholder engagement plan was developed. This strategy ensured that the outreach efforts were consistent with the City's goals for an inclusive and transparent process. The intent of this outreach plan was to identify specific ways to address issues and concerns early, to provide clear responses to specific issues, and to define methods, such as public workshops, to help disseminate information and to collect local knowledge about the project.

This Stakeholder Engagement Plan included:

1. Stakeholder Database
2. Engagement Materials
3. Project Website and Web-based User Survey
4. Project Blog
5. Three Workshops
6. City and Stakeholder Meetings

The planning process integrated public and stakeholder engagement through the entire planning process and built support for the projects around a shared vision.

STAKEHOLDER DATABASE

The following is a list of stakeholder groups that contributed to the planning process.

- City of Costa Mesa Staff
- Orange Coast College
- Orange County Bicycle Coalition
- Fairview Park Citizens Advisory Committee
- Costa Mesa Foundation
- Newport Mesa Unified School District
- Coast Community College District
- Caltrans
- OC Flood Control District
- Orange County Parks
- City of Newport Beach
- Costa Mesa Police Department

ENGAGEMENT MATERIALS

Engagement materials were developed, including fact sheets that provided a project introduction and overview, and a general project announcement in postcard and poster size. Project updates were continuously provided to the public by posting workshop materials online, uploading visualizations in Google Earth KMZ format for the public to download and explore, and sharing other information. Engagement materials also included a project website and wed-based user survey.

Moving Costa Mesa through a balanced, inclusive, uncongested, safe and energy-efficient system.

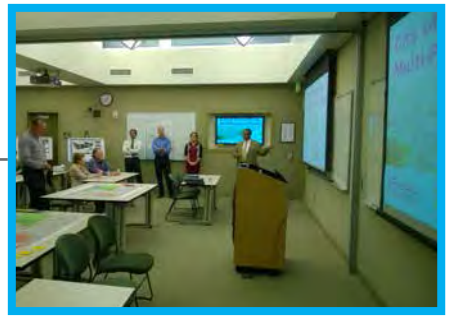
WORKSHOPS

Two public workshops were conducted in February and March 2015 to encourage community members and stakeholders to provide their feedback. Both workshops had a similar format, beginning with a brief presentation followed by an open house setting where participants shared their thoughts related to bicycle and pedestrian issues and solutions in Costa Mesa.

COMMUNITY WORKSHOP PROCESS

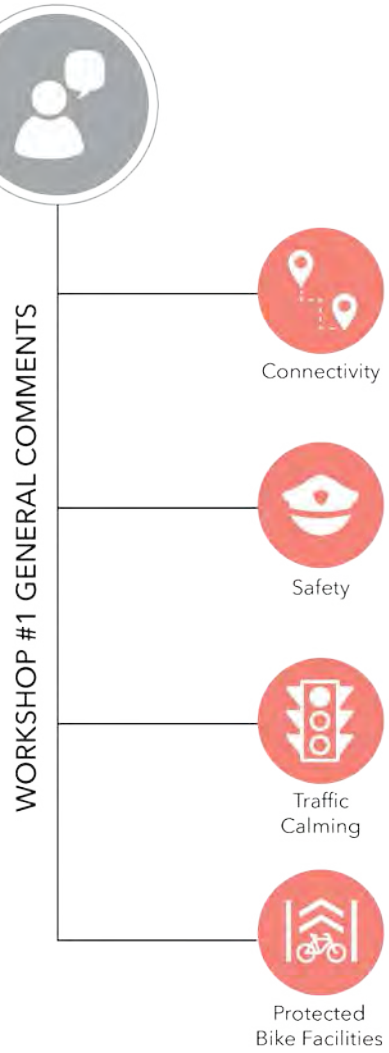
1 Introduction

2 Presentation



3 Exercises

Workshop Materials



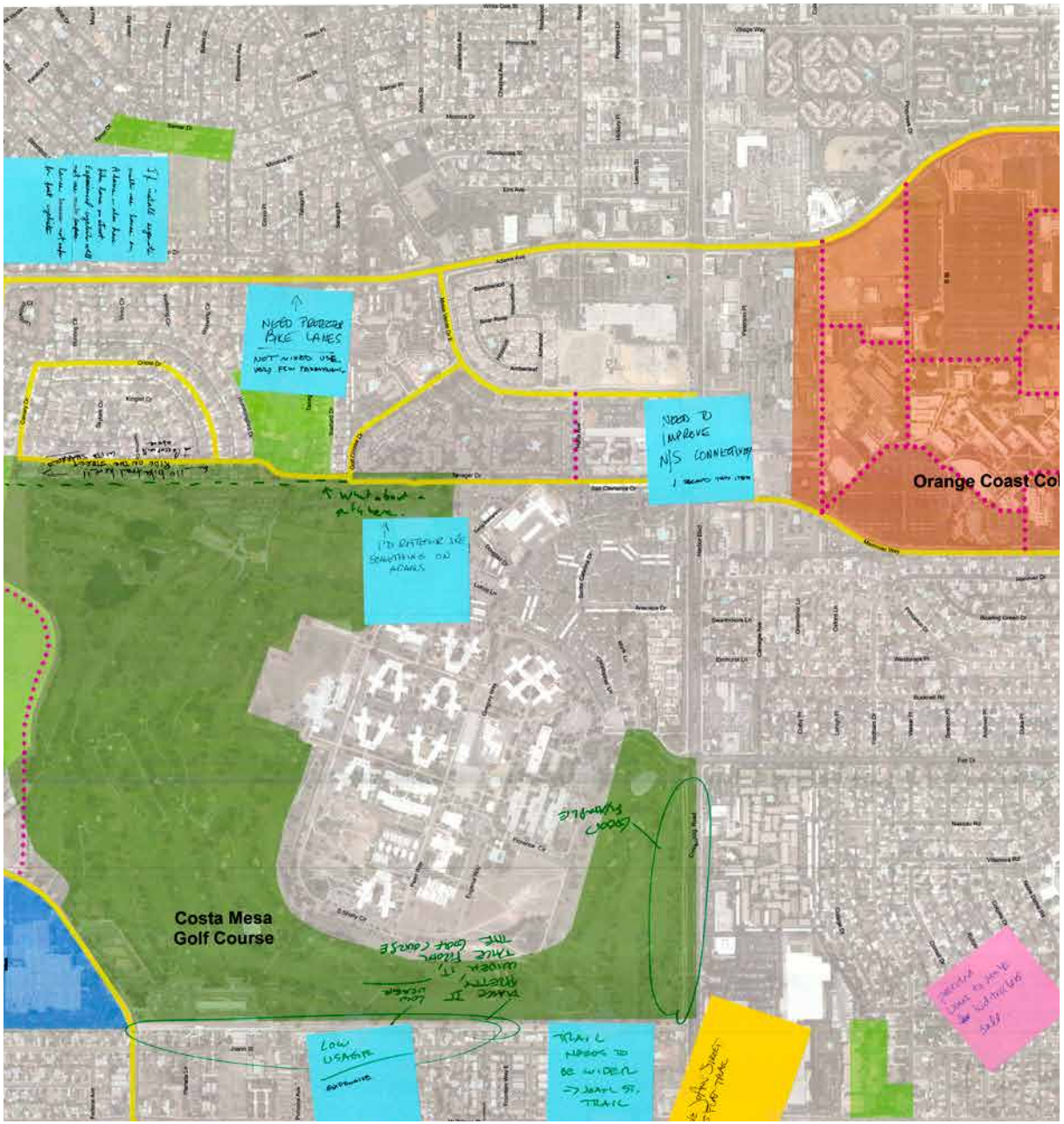
WORKSHOP #1

The first public workshop provided an opportunity to introduce the project and present an overview of the western study corridors. An "Urban Trails Presentation" was provided, as well as a review of the western study corridors. Additionally, detailed large-scale segment maps with aerial photo backgrounds were used for the mapping exercises. Participants were invited to provide their comments by attaching notes or by writing directly on the maps (See example on following page). Comments received at this first workshop were later categorized as location-specific or general. The following paragraphs provide a summary of both types of comments.

Location-specific comments pertained to selected project routes, other routes within the study area and even routes beyond the study area. The hottest topic for the first workshop was a proposed Class I path along the northern edge of the Costa Mesa Golf Course. Residents were divided, in support and opposition for this facility. Community members also mentioned Adams Avenue as an important but "high-stress" route for city cyclists, particularly OCC students. They suggested that a dedicated bicycle facility, sufficiently separated from traffic, be provided on Adams Avenue. Fairview Road and Harbor Drive were two other major arterials identified as important, though high stress, connections that would benefit from separated bicycle facilities. The Joann Street bike path was mentioned by several residents as a community amenity, but one that could use safety (lighting) and operational (widening) improvements. Others said it was underutilized and a waste of money. Strong support was shown for improving Placentia Avenue (by buffering the existing bike lanes) and Wilson Street (by removing some on-street parking to accommodate Class II bike lanes). Though outside of the study area, several attendees mentioned W 19th Street as a popular bicycle route that was ripe for improvements.

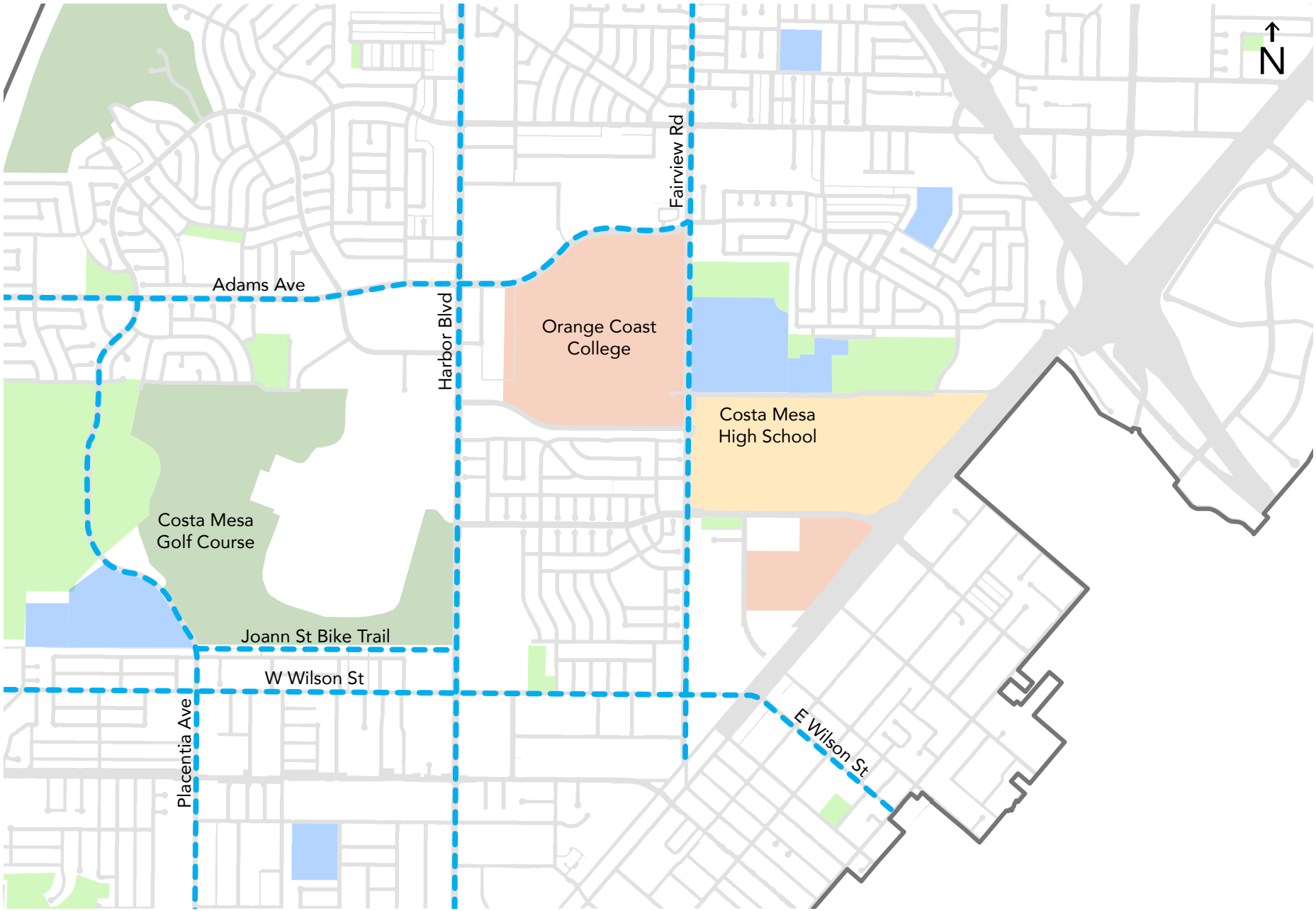
General comments fell – more or less – into four categories: connectivity, safety, traffic calming and protected bike facilities.

Residents expressed a need for increased (low-stress) north-south connectivity, particularly across Newport Boulevard. They also made suggestions regarding safer street design, including designing streets to be safer to begin with (narrower streets and lanes) and retrofitting unsafe streets (through traffic calming and protected bike facilities).

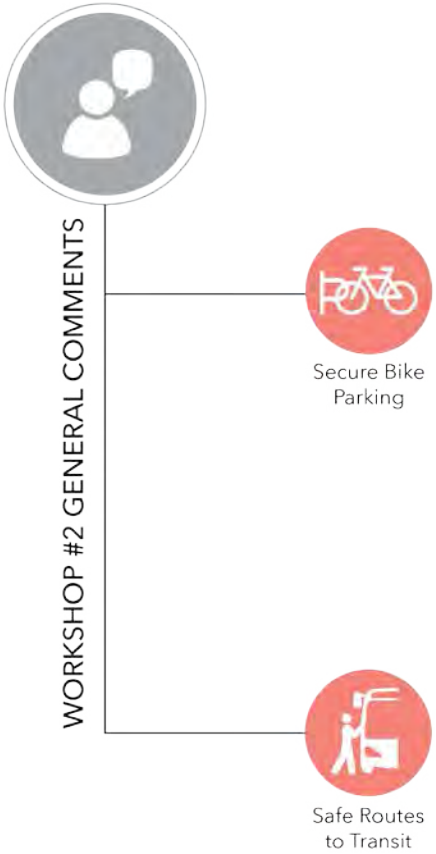


Public Workshop #1 Input

Public Workshop #1 Exercises



Draft Recommendations for Workshop #2



WORKSHOP #2

The focus of the second workshop was a presentation of draft recommendations and solicitation of further input. The workshop began with a summary of the public input received during Workshop #1. This was followed by a brief presentation covering existing conditions, opportunities, constraints and key issues for the nine preliminary projects, as well as a discussion on the multiple benefits of multi-use paths (economic, health, safety, etc.). Input received during Workshop #2 helped shape preliminary alternative concepts. As with the first workshop, comments received at this second workshop could be categorized as location-specific or general. The following paragraphs provide a summary of both types of comments.

Location-specific comments pertained to selected project routes, other routes within the study area and even routes beyond the study area. Community members mentioned both Adams Avenue and Fairview Road as important non-motorized routes, but also noted challenges related to high speed and high volume traffic. They suggested addressing these challenges with dedicated bicycle facilities, protected from adjacent vehicular traffic. Residents also identified the following routes as good for bicycling, and good bicycle boulevard or neighborhood greenway candidates: Santa Isabella Avenue and Vanguard Way. Community sentiment was mixed regarding Class I paths along the Paularino (flood control) Channel and through the Newport Beach Golf Course. Some residents viewed the proposed paths as "good uses of space," while others cited personal safety concerns. Lastly, workshop participants identified the following routes as good, if improved through calming traffic and facility enhancements: Mendoza Drive, Mesa Drive, Victoria Street and W. Wilson Street.

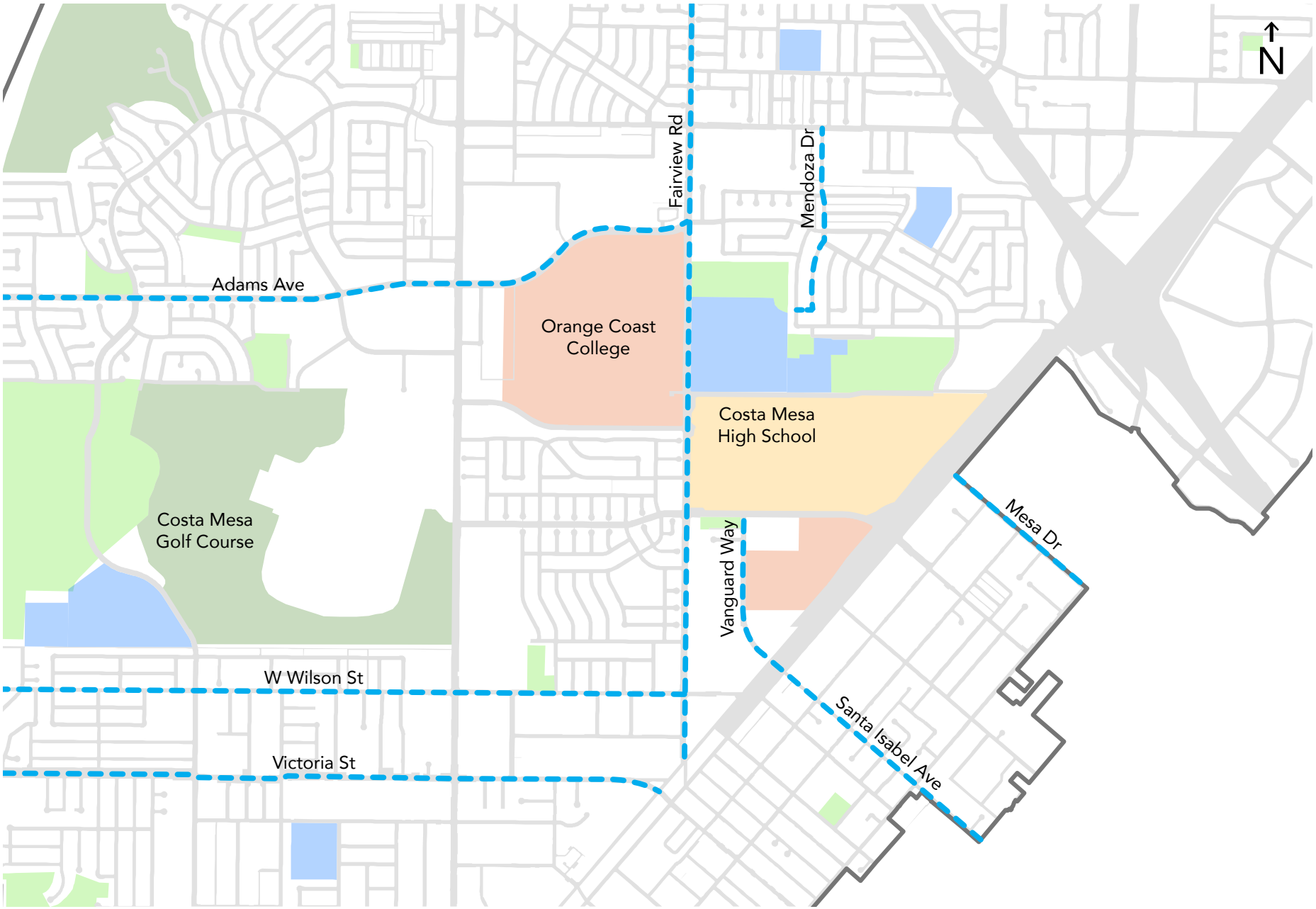
General comments fell – more or less – into two categories: secure bike parking and Safe Routes to Transit. Attendees noted the need for more bike racks at recreation centers (TeWinkle Memorial Park and Costa Mesa Tennis Center), the OC Fair Grounds, City Hall and all other destinations that bicyclists might reasonably frequent. Community members also noted the need for safe routes to transit, and even formulated the following goals:

- Get to the train station from Costa Mesa in 30 minutes
- Convenient non-motorized access to the Irvine shuttle from the airport

Following the second workshop, a stakeholder meeting was scheduled to obtain additional feedback needed to finalize project alternatives.

Public Workshop #2 Exercises

Public Workshop #2 Input



Draft Recommendations for Workshop #2

Stakeholder Meeting

STAKEHOLDER MEETINGS

The Outreach Plan originally called for a series of standalone Stakeholder Meetings. However, the concurrent formation of the City of Costa Mesa's Bikeability and Walkability Committee presented a great alternative for stakeholder input. Rather than host standalone stakeholder meetings, this project solicited stakeholder input in conjunction with existing Committee meetings. The City and consultant team provided brief presentations on the project, including project goals, project process and draft project routes, and then opened the floor to questions and discussion. Input from the stakeholder meetings was fairly similar in comparison to that obtained during Workshops #1 and #2, likely due, in part, to many stakeholders' participation in those workshops. Recurring themes of the stakeholder meetings included the need for separated bicycle facilities "like in Northern Europe" and the need for facilities to separate bicyclists and pedestrians where volumes were expected to be high.

CHAPTER 4

RECOMMENDED FACILITIES

RECOMMENDATIONS

This chapter presents and discusses the projects recommended to improve bicycling and walking in the City of Costa Mesa.

The project types recommended by this plan are some of the most powerful methods to improve bicycling and walking. According to the League of American Bicyclists (LAB), "The most visible and perhaps most tangible evidence of a great place for bicycling is the presence of infrastructure that welcomes and supports it. Survey after survey shows that the physical environment is a key determinant in whether people will get on a bike and ride." This chapter begins with a discussion of how projects were developed and assessed for feasibility. It then offers descriptions of each facility type recommended, a summary of project recommendations and cut sheets for each recommended project.

It is important to note that the success of recommended projects is closely tied to programs and adopted standards, codes and policies. Though beyond the scope of this particular plan, Education, Encouragement, Enforcement and Evaluation and Planning programs can be used to leverage investments in these projects. Similarly, the effectiveness of bike programs is maximized by actual project implementation. Likewise, changes to City standards, codes and policies may be needed to implement bike facilities, and project implementation may, in turn, facilitate changes to City standards, codes and policies.

PROJECT DEVELOPMENT AND FEASIBILITY ASSESSMENT

Bicycle (and pedestrian) projects were developed according to the goal of creating a comprehensive and low-stress non-motorized network. Project development considered the following factors:

- Existing and Future Conditions
- Existing and Projected Use: Current Bicycle/Pedestrian Counts and Activity Centers/Attractors
- Public and Stakeholder Input
- Level of Traffic Stress (i.e. anticipated stress, based on vehicle speeds and volumes, as well as type of bicycle facility provided)
- Feasibility (e.g. available right-of-way, project cost, etc.)

Facility types, as well as spot improvements, were recommended for specific streets and corridors. Recommended bike facility types include Multi-Use Paths (Class I), Buffered Bike Lanes (enhanced Class II), Bike Routes (Class III), Cycle Tracks (now designated Class IV) and Bike Boulevards (referred to in this report as Class V). Further information on project development, by facility type, is provided in the following sections.

CLASS I MULTI-USE PATHS

Multi-use paths were typically recommended along existing roadways (Adams Avenue and Merrimac Way), as extra-wide paved pathways, and along a flood control channel (the Paularino Channel) to provide low-stress connections. A short segment of multi-use path was also recommended through Fairview Park to close the gap in an otherwise connected, low-stress network. Roadside multi-use paths were recommended due to: (a) the importance of the corridors as non-motorized routes, (b) the existing "high-stress" conditions for both cyclists and pedestrians, and (c) the lack of available curb-to-curb right-of-way to provide separate (low-stress) bicycle and pedestrian facilities.

The minimum width for a multi-use path was considered to be 10 feet for this plan, with at least two feet of clearance from obstructions on each side. Considering the existing conditions, most were relatively unconstrained. For projects on roadway segments where there appeared to be constraining factors, horizontal clearance was measured first using high-resolution aerial photos, and later supplemented with on-site field work and consultation with City staff. (Typical costs per mile can vary a great deal due to potential right-of-way acquisition or other possible major expenses.)

Class 1 Multi-Use Path

CLASS II BICYCLE LANES

Bicycle lanes played a very minor role in the overall non-motorized network recommended for Costa Mesa, with only one short bicycle lane segment recommended on E Wilson Street.

Bike lanes are a portion of the traveled way designated for preferential use by bicyclists. Bike lanes are created with a solid stripe, stencils and signage. Bike lanes should be provided far enough from the curb to avoid debris and drainage grates and far enough from other vehicles to avoid conflicts. Standard width for a Class II bike lane is five feet, ideally measured from the gutter pan edge outward. In constrained scenarios, the gutter pan may contribute to the width, but it should be noted that this creates a seam, and potential safety issues.

Bike lanes have the following advantages:

- They enable cyclists to ride at a constant speed, especially when traffic in the adjacent travel lanes speeds up or slows down (stop-and-go).
- They enable bicyclists to position themselves where they will be visible to motorists.
- They encourage cyclists to ride on the traveled way rather than the sidewalk.

There are no hard and fast mandates for providing bike lanes, but as a general rule, most jurisdictions consider bike lanes on roads with traffic volumes in excess of 3,000-5,000 ADT or traffic speeds of 30 mph or greater. In cases with considerably higher volume and speeds, further separation (i.e. a buffered bike lane or cycle track) may be warranted.

Bicycle Lane

Buffered Bicycle Lane

Bicycle Route

CLASS II (BUFFERED) BICYCLE LANES

Buffered bike lanes were recommended along collector and arterial streets, where anticipated use (by all transportation modes), as well as stress levels, would be high and where available right-of-way existed (Mesa Verde Drive, Merrimac Way, Vanguard Way and Del Mar Avenue). Buffered bike lanes require a minimum width of six feet (five foot travel lane; one foot buffer), but would ideally by eight feet wide (five foot travel lane; three foot buffer).

The exact configuration of buffered bike lanes, particularly the location of the buffer(s), depends on context. If provided alongside a parking lane, and there is only space to buffer on one side, parking lane buffering is recommended over travel lane buffering as parking lane-related collisions ("dooring") far outnumber travel lane-related collisions. If feasible, buffer the bike lane on both sides, as shown in the accompanying photo. This provides additional comfort to cyclists and effectively calms traffic.

The decision to recommend buffered bike lanes over cycle tracks, in some cases, was driven primarily by feasibility (i.e. available right-of-way: eight feet). Because feasibility is based on City standards and current use, both of which may change, this plan recommends the future upgrade of buffered bicycle lanes to cycle tracks, wherever possible.

CLASS III BICYCLE ROUTES

Bicycle routes played a minor role in the overall non-motorized network recommended for Costa Mesa. This facility type was, in fact, only recommended in two places: on a very short connector segment of a local neighborhood street (Harla Avenue) and on Adams Avenue to fill a gap -- created due to constrained right-of-way -- in the multi-use path.

Note that shared lane markings or "sharrows" can be installed along these routes, provided actual speeds are less than 35 mph. (This would apply then to the facility on Harla Avenue, but not the one on Adams Avenue.) Additional factors to consider when applying this treatment include adjacent land use, on-street vehicle parking, connecting bicycle facilities and traffic volumes. The installation of sharrows has proven most effective when accompanied by education and encouragement campaigns. For instance, many cyclists and drivers do not know that sharrow placement (at approximately the center of the lane) is intended to promote safer sharing by:

- Making cyclists more visible
- Guiding cyclists away from the "door zone"
- Directing drivers to make safer/wider passes

CLASS IV CYCLE TRACKS

Cycle tracks were recommended along collector and arterial streets, where anticipated use (by all transportation modes), as well as stress levels, would be higher and where available right-of-way existed (Placentia Avenue, Fairview Road, Santa Ana Avenue and Bristol Street). Cycle tracks require a minimum width of eight feet (five foot travel lane; three feet buffer), but would ideally by 10 feet wide (seven foot travel lane; three foot buffer).

Because cycle tracks are typically placed on the inside of a parking lane, separated from the moving vehicular traffic, only door-side buffering is required. While a 5 foot bike lane is sufficiently wide, it should be noted that greater lane width allows for more comfortable and social riding, particularly where expected volumes are high. The decision to recommend cycle tracks over buffered bike lanes, in some cases, was driven primarily by feasibility (i.e. available right-of-way: eight feet).

BICYCLE BOULEVARDS

This project recommended a total of seven bicycle boulevards (on Canary Drive/Tanager Drive/Golf Course Drive/Oriole Drive, Peterson Place, El Camino Drive/Mendoza Drive, Wilson Street, Vanguard Way/Santa Isabella Avenue, Del Mar Avenue/University Drive and Santa Ana Avenue). This facility type is essentially an enhanced Class III bicycle route, which takes advantage of existing low-speed, local streets that parallel busier arterial streets and provide reasonably direct access to parks, schools and neighborhood attractors. Depending on existing conditions, the creation of bicycle boulevards may entail anything from simple confirmation and wayfinding signage/symbols to significant traffic calming (volume and speed reduction) and landscaping.

This plan recommends traffic calming features for each bicycle boulevard project (traffic circle, speed humps, etc.), as appropriate. It should be noted, however, that all bicycle boulevards require additional planning and engineering prior to implementation. Example issues to be addressed by further study include, but are not limited to, specific bicycle and pedestrian safety improvements at intersections and crossings, signage and wayfinding, traffic calming measures, impacts to vehicular traffic flow, and right-of-way acquisition. Lastly, as a relatively new facility type, education and enforcement related to these facilities is also recommended to maximize their (safe) use.

Cycle Track

Bicycle Boulevard

RECOMMENDED BIKEWAY PROJECTS

This master plan recommends a total of 13 miles (12 projects) of new or enhanced bicycle and pedestrian facilities, of which 37 percent are multi-use paths, 33 percent are bicycle boulevards, 16 percent are cycle tracks, 10 percent are buffered bike lanes, two percent are bike lanes and two percent are bike routes. The predominance of physically separated and traffic calmed routes, among all recommendations, is consistent with best practices in low-stress network connectivity. Taken together, these projects form an improved low-stress network for central Costa Mesa.

All recommended projects are presented in the following pages as cut sheets, including brief project descriptions, overall project cost, additional project metrics (Delta Table) and project maps with recommended corridor and spot improvements.

The Delta Table provides project length, project extent and "Delta" value (for bike lanes and cycle tracks) for each project. Delta values provide an indication of available right-of-way (ROW) to install a given facility type while preserving vehicle travel lanes, turn lanes, medians and parking. A positive Delta value, color-coded green, indicates a ROW surplus. A negative Delta value, color-coded red, indicates a ROW deficit. A neutral Delta value, color-coded blue, indicates sufficient ROW.

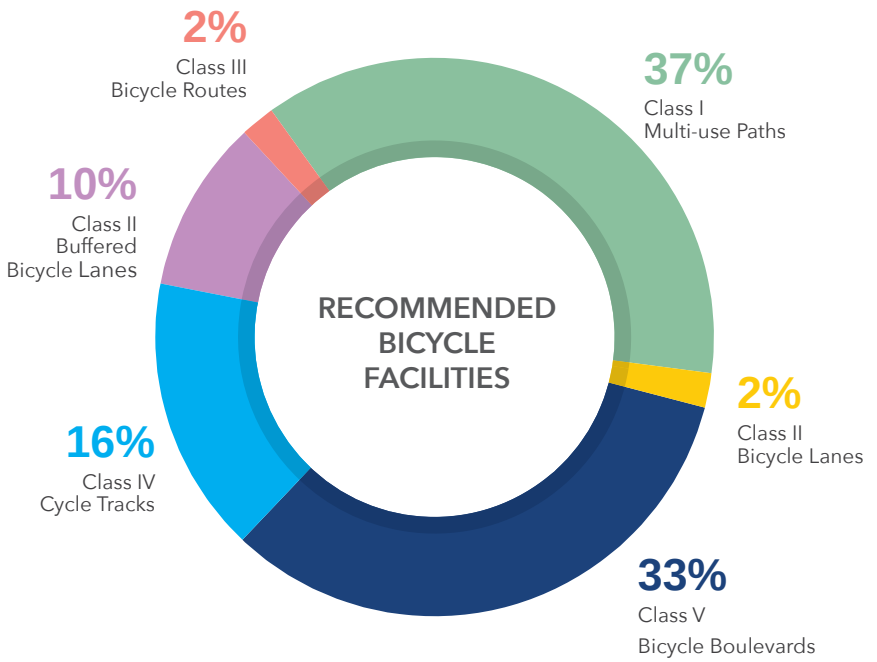
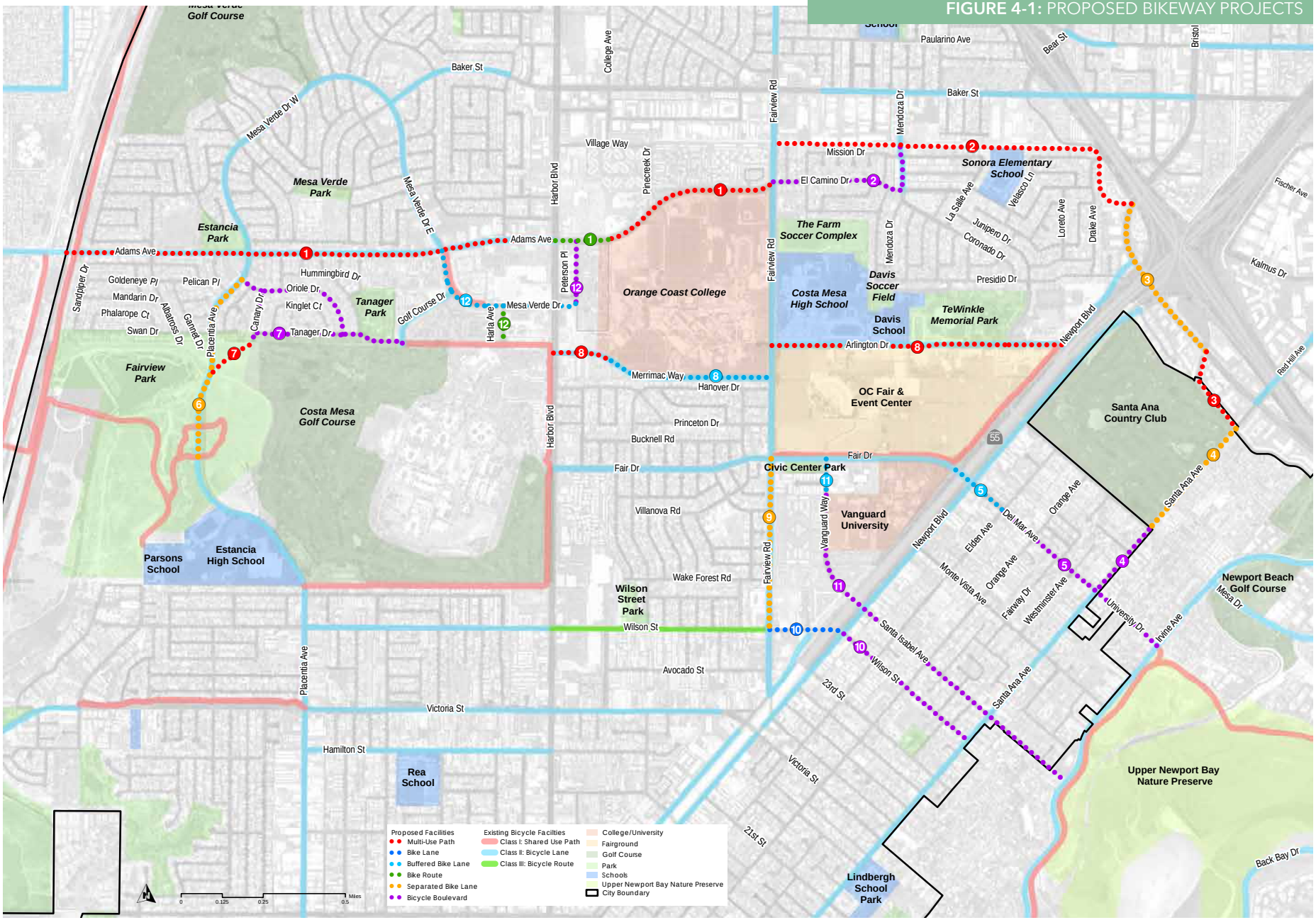


FIGURE 4-1: PROPOSED BIKEWAY PROJECTS



PROJECT 1

Project 1 is primarily a multi-use (bicycle/pedestrian/skate) path along the southern edge of Adams Avenue, from the western City limit to Fairview Road. This project includes one 'bike route' segment (a shared street, marked by signage only), from Harbor Boulevard east to the western edge of the Orange Coast College (OCC) campus. Sidewalk widening is recommended along the bike route segment as many facility users will prefer the sidewalk to 'sharing the road.' Since this facility is a fully (traffic) separated facility, it will remain so at intersections employing enhanced crosswalk treatments. It is recommended that intersection conflicts between through and turning movements be mitigated through signal timing, rather than geometric measures. Specific treatments include the following: enhanced crossings along Adams Avenue as it intersects Albatross Drive, Longwood Court, Mesa Verde Drive E, Harbor Boulevard and Pinecreek Drive; an enhanced (widened) sidewalk along the bike route portion, as mentioned above; and a bike/pedestrian signal at the intersection of Adams Avenue and Fairview Road.

PROJECT COST

$1,759,403

(See Appendix A for detailed cost estimate)

PROJECT LENGTH

2.21 Miles

TABLE 4-1: PROJECT 1 SPECIFICATIONS

STREET/PATH SEGMENT	FROM STREET (N/W)	TO STREET (S/E)	BICYCLE FACILITY CLASS	LENGTH (MILES)	DELTA VALUE	NOTES
Adams Avenue	Mid Bridge	Harbor Boulevard	Multi-Use Path	1.49	N/A	Off-street facility; No ROW required
	Harbor Boulevard	Ramp	Bike Route	0.16		Shared street facility; No ROW required
	Peterson Place	Fairview Road	Multi-Use Path	0.56		Off-street facility; No ROW required

BICYCLE FACILITIES LEGEND

Existing Bicycle Facilities
- Multi Use Path (Class I)
- Bicycle Lane (Class II)
- Bicycle Lane (Class II)

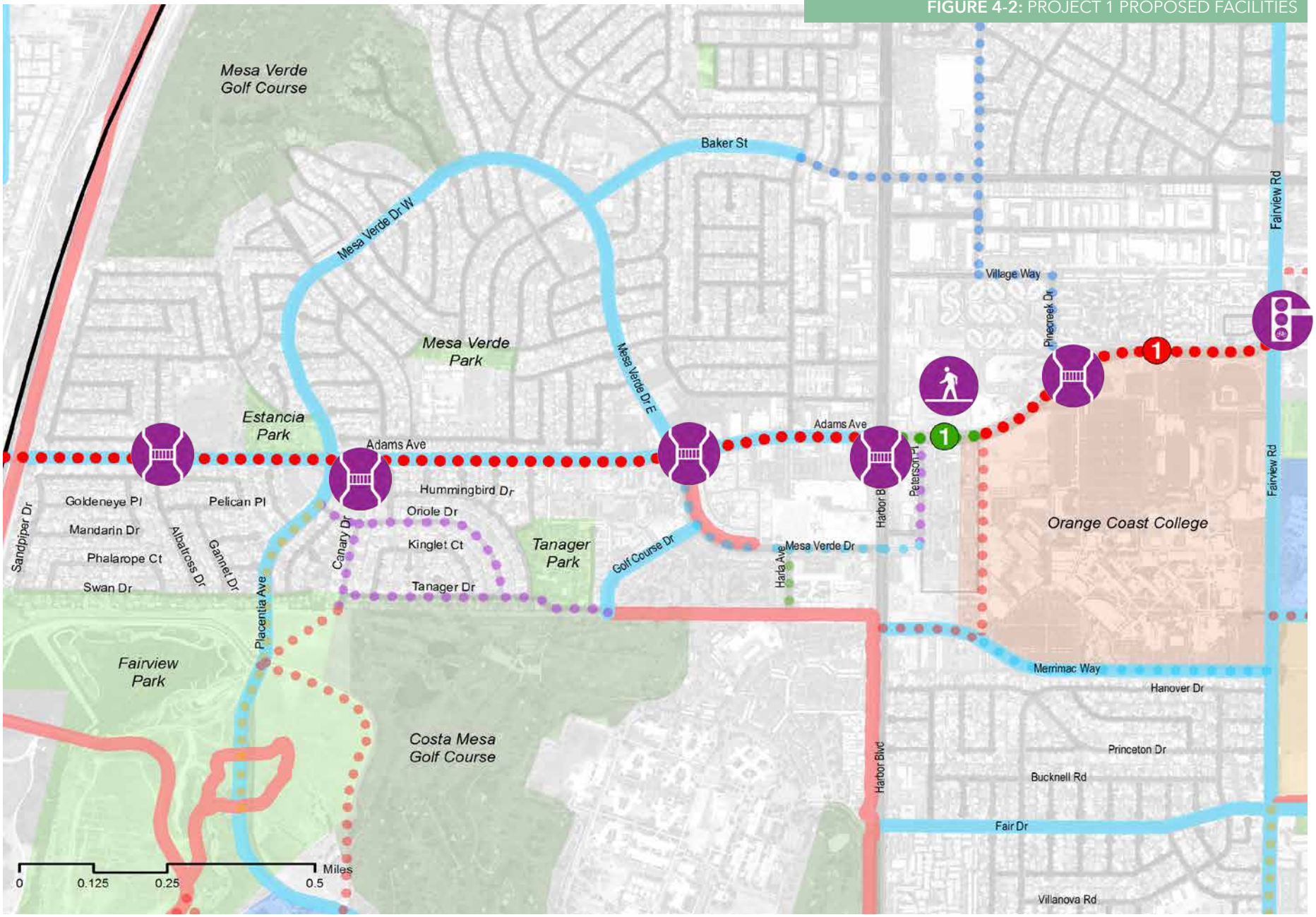
Proposed Bicycle Facilities
- Multi Use Path
- Bicycle Lane
- Buffered Bicycle Lane
- Bike Route
- Separated Bike Lane
- Bicycle Boulevard

Land Uses
- College/University
- Fairground
- Golf Course
- Park
- School
- City Boundary

BICYCLE AND PEDESTRIAN TREATMENTS

Bike/ Pedestrian Signal | Enhanced Crossing | Enhanced Sidewalk

FIGURE 4-2: PROJECT 1 PROPOSED FACILITIES



PROJECT 2

Project 2 provides routes for west-east connection, south of Baker Street, from Fairview Road to Bristol Street. Project 2 is primarily a multi-use (bike/walk/skate) path along the Paularino Channel, but also includes traffic calmed neighborhood routes on El Camino and Mendoza Drives. Specific treatments include the following: enhanced crossings along the Paularino Channel at Fairview Road and St. Clair Street; a bike/pedestrian signal at the intersection of El Camino Drive and Fairview Road; traffic calming measures at El Camino Drive and Monterey Avenue, El Camino Drive and Mendoza Drive, and Mendoza Drive and Mission Drive; and wayfinding signage at the intersection of the multi-use path and Bristol Avenue.

PROJECT COST

$1,639,703

(See Appendix A for detailed cost estimate)

PROJECT LENGTH

1.76 Miles

TABLE 4-2: PROJECT 2 SPECIFICATIONS

STREET/PATH SEGMENT	FROM STREET (N/W)	TO STREET (S/E)	BICYCLE FACILITY CLASS	LENGTH (MILES)	DELTA VALUE	NOTES
Class I	Fairview Drive	Bristol Street	Multi-Use Path	1.22	N/A	Off-street facility; No ROW required
El Camino Drive	Fairview Road	Mendoza Drive	Bicycle Boulevard	0.40		Shared street facility; No ROW required
Mendoza Drive	Valencia Street	Mission Drive		0.14		

BICYCLE FACILITIES LEGEND

Existing Bicycle Facilities
- Multi Use Path (Class I)
- Bicycle Lane (Class II)
- Bicycle Lane (Class II)

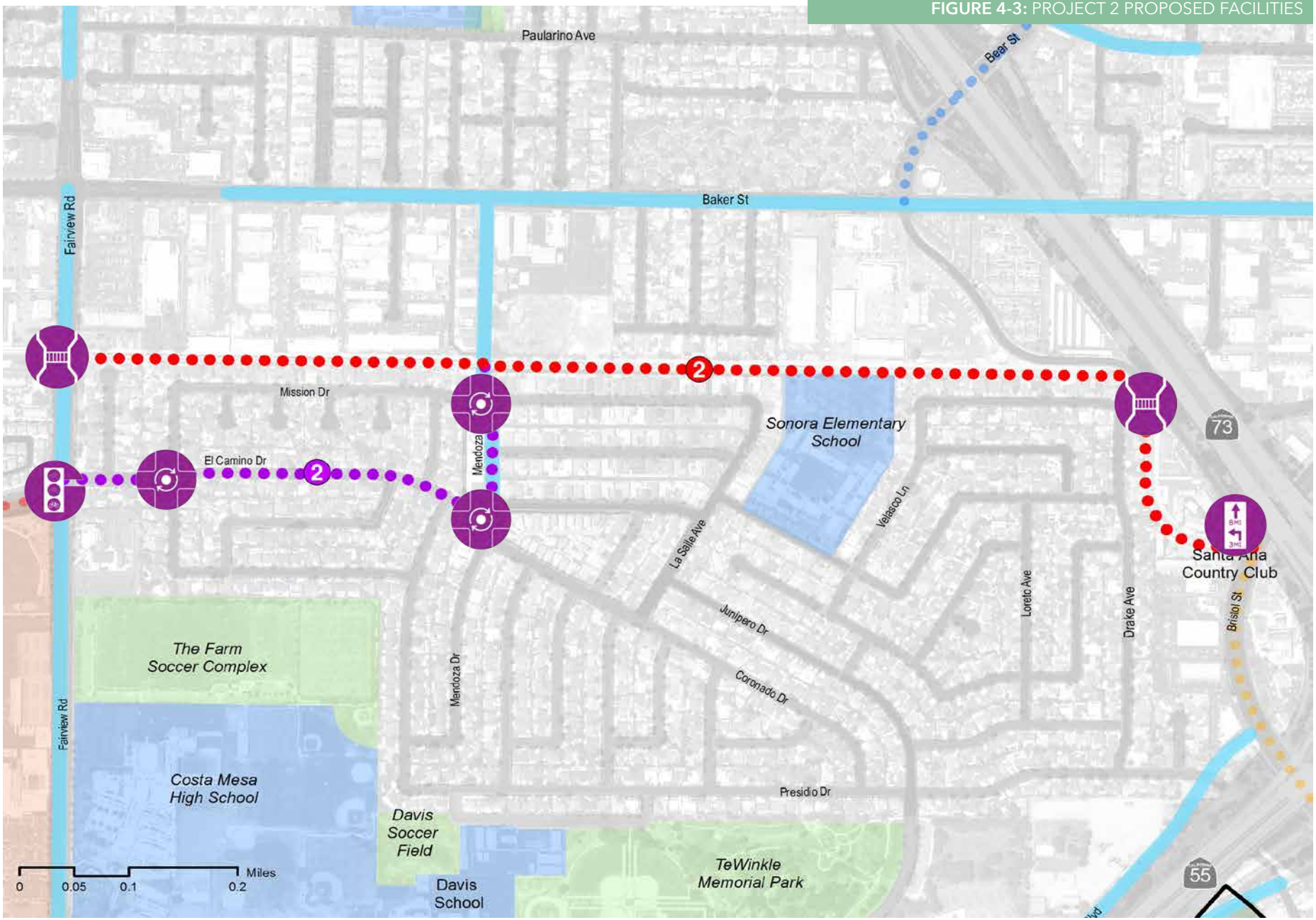
Proposed Bicycle Facilities
- Multi Use Path
- Bicycle Lane
- Buffered Bicycle Lane
- Bike Route
- Separated Bike Lane
- Bicycle Boulevard

Land Uses
- College/University
- Fairground
- Golf Course
- Park
- School
- City Boundary

BICYCLE AND PEDESTRIAN TREATMENTS

Bike/ Pedestrian Signal | Enhanced Crossing | Traffic Calming | Wayfinding

FIGURE 4-3: PROJECT 2 PROPOSED FACILITIES



PROJECT 3

Project 3 is a two-way 'protected' bike lane (protected from adjacent vehicle travel lanes by vertical barriers) along Bristol Street, from SR 73 to Santa Ana Avenue. This project also includes a short segment of multi-use (bike/pedestrian/skate) path at its southern end. Specific treatments include the following: wayfinding signage at the intersections of the multi-use path and Bristol Street (locations at both ends of this segment), and the multi-use path and Santa Ana Avenue; enhanced crossings at the intersections of the multi-use path and Bristol Street, and the multi-use path and Santa Ana Avenue; traffic calming (road diet) along Bristol Street to accommodate protected bike lanes; enhanced (widened) sidewalk on Bristol Street, under the SR55 interchange; and a bike/pedestrian signal at the intersection of the multi-use path and Santa Ana Avenue.

PROJECT COST

$517,111

(See Appendix A for detailed cost estimate)

PROJECT LENGTH

0.82 Miles

TABLE 4-3: PROJECT 3 SPECIFICATIONS

STREET/PATH SEGMENT	FROM STREET (N/W)	TO STREET (S/E)	BICYCLE FACILITY CLASS	LENGTH (MILES)	DELTA VALUE	NOTES
Bristol St	Bear Street	Newport Boulevard	Separated Bike Lane	0.19	9	Facility feasible pending "road diet" (i.e. lane reduction), which the City has endorsed
	Newport Boulevard	SB55 Fwy Ramp		0.05	5	
	SB55 Fwy Ramp	SB55 Freeway		0.01	-2	
	SB55 Freeway	NB55 Freeway		0.02	-1	
	NB55 Freeway	NB55 Fwy Ramp to SB73 Fwy		0.04	2	
	NB55 Fwy Ramp to SB73 Fwy	Newport Boulevard		0.03	-2	
	Newport Boulevard	Unknown		0.21	5	
Flood Control Path	Unknown	Santa Ana Avenue	Multi-Use Path	0.27	N/A	Off-street facility; No ROW required

Feasible Project Infeasible Project

BICYCLE FACILITIES LEGEND

Existing Bicycle Facilities
- Multi Use Path (Class I)
- Bicycle Lane (Class II)
- Bicycle Lane (Class II)

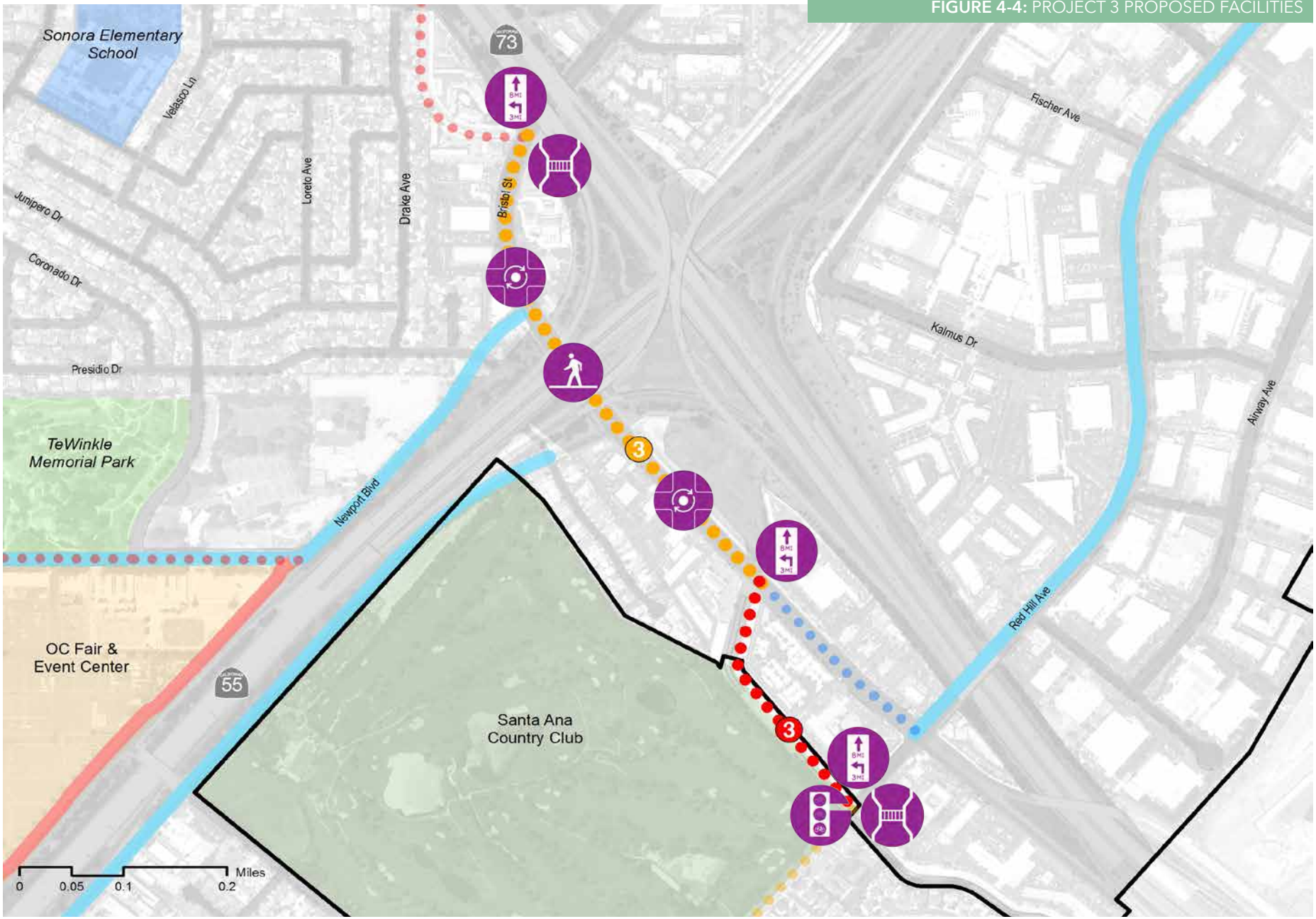
Proposed Bicycle Facilities
- Multi Use Path
- Bicycle Lane
- Buffered Bicycle Lane
- Bike Route
- Separated Bike Lane
- Bicycle Boulevard

Land Uses
- College/University
- Fairground
- Golf Course
- Park
- School
- City Boundary

BICYCLE AND PEDESTRIAN TREATMENTS

Bike/ Pedestrian Signal | Enhanced Crossing | Enhanced Sidewalk | Traffic Calming | Wayfinding

FIGURE 4-4: PROJECT 3 PROPOSED FACILITIES



PROJECT 4

Project 4 is a hybrid project along Santa Ana Avenue. It includes a 'protected' bike lane (protected from adjacent vehicle travel lanes by vertical barriers) along the southeast corner of the Santa Ana Country Club. It also includes a traffic calmed neighborhood route from the edge of the park southwest to Del Mar Avenue. Specific treatments include the following: wayfinding signage, an enhanced crossing and a bike/pedestrian signal at the intersection of the multi-use path and Santa Ana Avenue; traffic calming measures along Santa Ana Avenue at Mesa Drive and Del Mar Avenue/University Drive.

PROJECT COST

$252,317

(See Appendix A for detailed cost estimate)

PROJECT LENGTH

0.66 Miles

TABLE 4-4: PROJECT 4 SPECIFICATIONS

STREET/PATH SEGMENT	FROM STREET (N/W)	TO STREET (S/E)	BICYCLE FACILITY CLASS	LENGTH (MILES)	DELTA VALUE	NOTES
Santa Ana Avenue	Bristol Street	Mesa Drive	Separated Bike Lane	0.41	-4	Facility feasible pending "road diet" (i.e. lane reduction), which the City has endorsed
	Mesa Drive	University Drive	Bicycle Boulevard	0.25	N/A	Shared street facility; No ROW required

Infeasible Project

BICYCLE FACILITIES LEGEND

Existing Bicycle Facilities
- Multi Use Path (Class I)
- Bicycle Lane (Class II)
- Bicycle Lane (Class II)

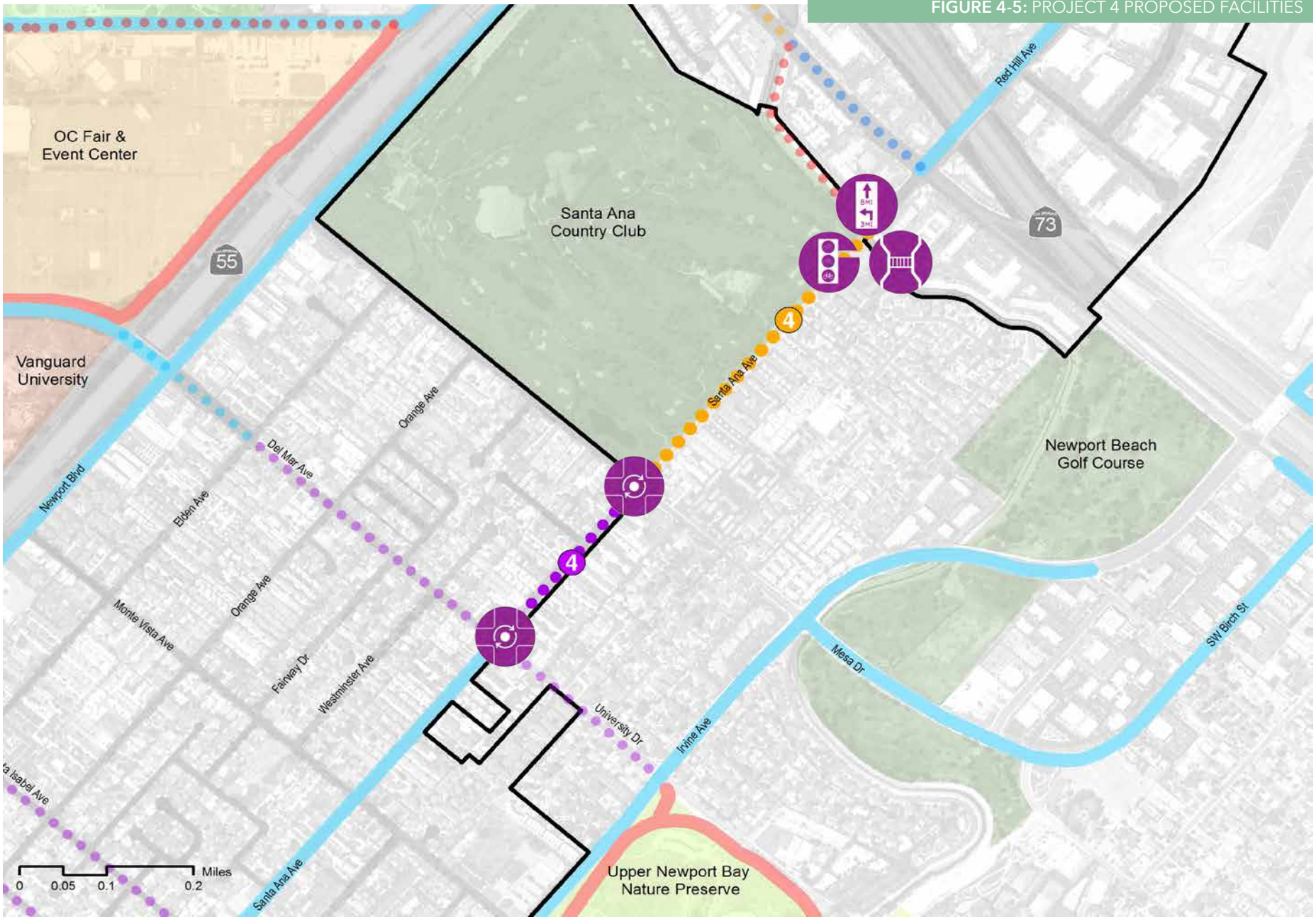
Proposed Bicycle Facilities
- Multi Use Path
- Bicycle Lane
- Buffered Bicycle Lane
- Bike Route
- Separated Bike Lane
- Bicycle Boulevard

Land Uses
- College/University
- Fairground
- Golf Course
- Park
- School
- City Boundary

BICYCLE AND PEDESTRIAN TREATMENTS

Bike/ Pedestrian Signal | Enhanced Crossing | Traffic Calming | Wayfinding

FIGURE 4-5: PROJECT 4 PROPOSED FACILITIES



PROJECT 5

Project 5 is a hybrid project connecting the Orange County Fairgrounds to Newport Bay, using Del Mar Avenue and University Drive. Along Del Mar Avenue, buffered bike lanes (standard five foot bike lanes, with excess space used as a buffer from adjacent vehicle travel lanes) are recommended. Along University Drive, a traffic calmed neighborhood route is recommended. Specific treatments include the following: traffic calming measures all along Del Mar Avenue/University Drive; and bike boxes and wayfinding signage at the intersection of University Drive and Irvine Avenue.

PROJECT COST

$210,361

(See Appendix A for detailed cost estimate)

PROJECT LENGTH

0.82 Miles

TABLE 4-5: PROJECT 5 SPECIFICATIONS

STREET/PATH SEGMENT	FROM STREET (N/W)	TO STREET (S/E)	BICYCLE FACILITY CLASS	LENGTH (MILES)	DELTA VALUE	NOTES
Del Mar Avenue	Newport Boulevard	SB55 Freeway	Buffered Bicycle Lane	0.03	6	Class II exists; Opportunity to buffer
	SB55 Freeway	NB55 Freeway		0.02	6	
	NB55 Freeway	Newport Boulevard		0.03	35	
	Newport Boulevard	Elden Avenue		0.13	7	
	Elden Avenue	Santa Ana Avenue	Bicycle Boulevard	0.38	N/A	Shared street facility; No ROW required
University Drive	Santa Ana Avenue	Irvine Avenue		0.25		

Feasible Project

BICYCLE FACILITIES LEGEND

Existing Bicycle Facilities
- Multi Use Path (Class I)
- Bicycle Lane (Class II)
- Bicycle Lane (Class II)

Proposed Bicycle Facilities
- Multi Use Path
- Bicycle Lane
- Buffered Bicycle Lane
- Bike Route
- Separated Bike Lane
- Bicycle Boulevard

Land Uses
- College/University
- Fairground
- Golf Course
- Park
- School
- City Boundary

BICYCLE AND PEDESTRIAN TREATMENTS

Bike Box

Traffic Calming

Wayfinding

FIGURE 4-6: PROJECT 5 PROPOSED FACILITIES

PROJECT 6

Project 6 is an enhancement project to a portion of the existing bike lanes on Placentia Avenue. Existing bike lanes on Placentia Avenue, from Oriole Drive to Fairview Park, will be upgraded to 'protected' bike lanes (protected from adjacent vehicle travel lanes by vertical barriers). Specific treatments include the following: wayfinding signage, bike/pedestrian signals and enhanced crossings at Placentia Avenue and Oriole Drive, and Placentia Avenue and the proposed (Fairview Park) multi-use path; and enhanced crossings (only) at Placentia Avenue and the existing Fairview Park path (two locations).

PROJECT COST

$1,090,185

(See Appendix A for detailed cost estimate)

PROJECT LENGTH

0.60 Miles

TABLE 4-6: PROJECT 6 SPECIFICATIONS

STREET/PATH SEGMENT	FROM STREET (N/W)	TO STREET (S/E)	BICYCLE FACILITY CLASS	LENGTH (MILES)	DELTA VALUE	NOTES
Placentia Avenue	Oriole Drive	Tern Circle	Separated Bike Lane	0.06	8	Buffered Lanes exist; Opportunity to provide "better" buffering
	Tern Circle	Swan Circle		0.14	8	
	Swan Circle	Fairview Park		0.40	15	

Feasible Project

BICYCLE FACILITIES LEGEND

Existing Bicycle Facilities
- Multi Use Path (Class I)
- Bicycle Lane (Class II)
- Bicycle Lane (Class II)

Proposed Bicycle Facilities
- Multi Use Path
- Bicycle Lane
- Buffered Bicycle Lane
- Bike Route
- Separated Bike Lane
- Bicycle Boulevard

Land Uses
- College/University
- Fairground
- Golf Course
- Park
- School
- City Boundary

BICYCLE AND PEDESTRIAN TREATMENTS

Bike/ Pedestrian Signal | Enhanced Crossing | Wayfinding

FIGURE 4-7: PROJECT 6 PROPOSED FACILITIES

PROJECT 7

Project 7 provides a route from Placentia Avenue east to an existing multi-use path (along the Costa Mesa Golf Course beginning at Golf Course Drive). The project primarily uses traffic calmed neighborhood routes on Canary, Tanager and Oriole Drives, but also recommends a multi-use (bike/walk/skate) path from southern end of Canary Drive south to Placentia Avenue. Specific treatments include the following: wayfinding signage, bike/pedestrian signals and enhanced crossings at Placentia Avenue and Oriole Drive, and Placentia Avenue and the proposed (Fairview Park) multi-use path; and traffic calming measures at Oriole Drive and Canary Drive, and along Tanager Drive at Canary, Oriole and Golf Course Drives.

PROJECT COST

$551,525

(See Appendix A for detailed cost estimate)

PROJECT LENGTH

1.19 Miles

TABLE 4-7: PROJECT 7 SPECIFICATIONS

STREET/PATH SEGMENT	FROM STREET (N/W)	TO STREET (S/E)	BICYCLE FACILITY CLASS	LENGTH (MILES)	DELTA VALUE	NOTES
Class I	Canary Drive	Placentia Avenue	Multi-Use Path	0.16	N/A	Off-street facility; No ROW required
Canary Drive	Tanager Drive	Class I	Bicycle Boulevard	0.03		Shared street facility; No ROW required
Tanager Drive	Canary Drive	Golf Course Drive		0.46		
Golf Course Drive	Parking Lot	Tanager Drive		0.01		
Canary Drive	Oriole Drive	Tanager Drive		0.13		
Oriole Drive	Placentia Avenue	Tanager Drive		0.40		

BICYCLE FACILITIES LEGEND

Existing Bicycle Facilities
- Multi Use Path (Class I)
- Bicycle Lane (Class II)
- Bicycle Lane (Class II)

Proposed Bicycle Facilities
- Multi Use Path
- Bicycle Lane
- Buffered Bicycle Lane
- Bike Route
- Separated Bike Lane
- Bicycle Boulevard

Land Uses
- College/University
- Fairground
- Golf Course
- Park
- School
- City Boundary

BICYCLE AND PEDESTRIAN TREATMENTS

Bike/ Pedestrian Signal | Enhanced Crossing | Traffic Calming | Wayfinding

FIGURE 4-8: PROJECT 7 PROPOSED FACILITIES

PROJECT 8

Project 8 connects Harbor Boulevard to Fairview Road along the southern edges of the OCC and Costa Mesa High School campuses. This project recommends the following: a multi-use (walk/bike/skate) path along Merrimac Way from Harbor Boulevard to the western edge of the OCC campus; buffered bike lanes (standard five foot bike lanes with excess space used as a buffer from adjacent vehicle travel lanes) from the western edge of the OCC campus to Fairview Road; and a multi-use (walk/bike/skate) path from Fairview Road to Newport Boulevard. Specific treatments include the following: enhanced crossings along Merrimac Way, at Harbor Boulevard and the western entrance of Orange Coast College, and Fairview Road and Arlington Drive; a bike/pedestrian signal at Merrimac Way and the western entrance of Orange Coast College; traffic calming (lane diet) along Merrimac to accommodate buffered bike lanes; and bike boxes at the intersection of Fairview Road and Arlington Drive.

PROJECT COST

$1,637,017

(See Appendix A for detailed cost estimate)

PROJECT LENGTH

1.58 Miles

TABLE 4-8: PROJECT 8 SPECIFICATIONS

STREET/PATH SEGMENT	FROM STREET (N/W)	TO STREET (S/E)	BICYCLE FACILITY CLASS	LENGTH (MILES)	DELTA VALUE	NOTES
Merrimac Way	San Clemente Drive	West Campus	Multi-Use Path	0.19	N/A	Off-street facility; No ROW required
	West Campus	Fairview Road	Buffered Bicycle Lane	0.50	-4	Facility feasible pending "lane diet" (i.e. lane narrowing), which the City has endorsed
Arlington Drive	Fairview Road	Newport Boulevard	Multi-Use Path	0.88	N/A	Off-street facility; No ROW required

Infeasible Project

BICYCLE FACILITIES LEGEND

Existing Bicycle Facilities
- Multi Use Path (Class I)
- Bicycle Lane (Class II)
- Bicycle Lane (Class II)

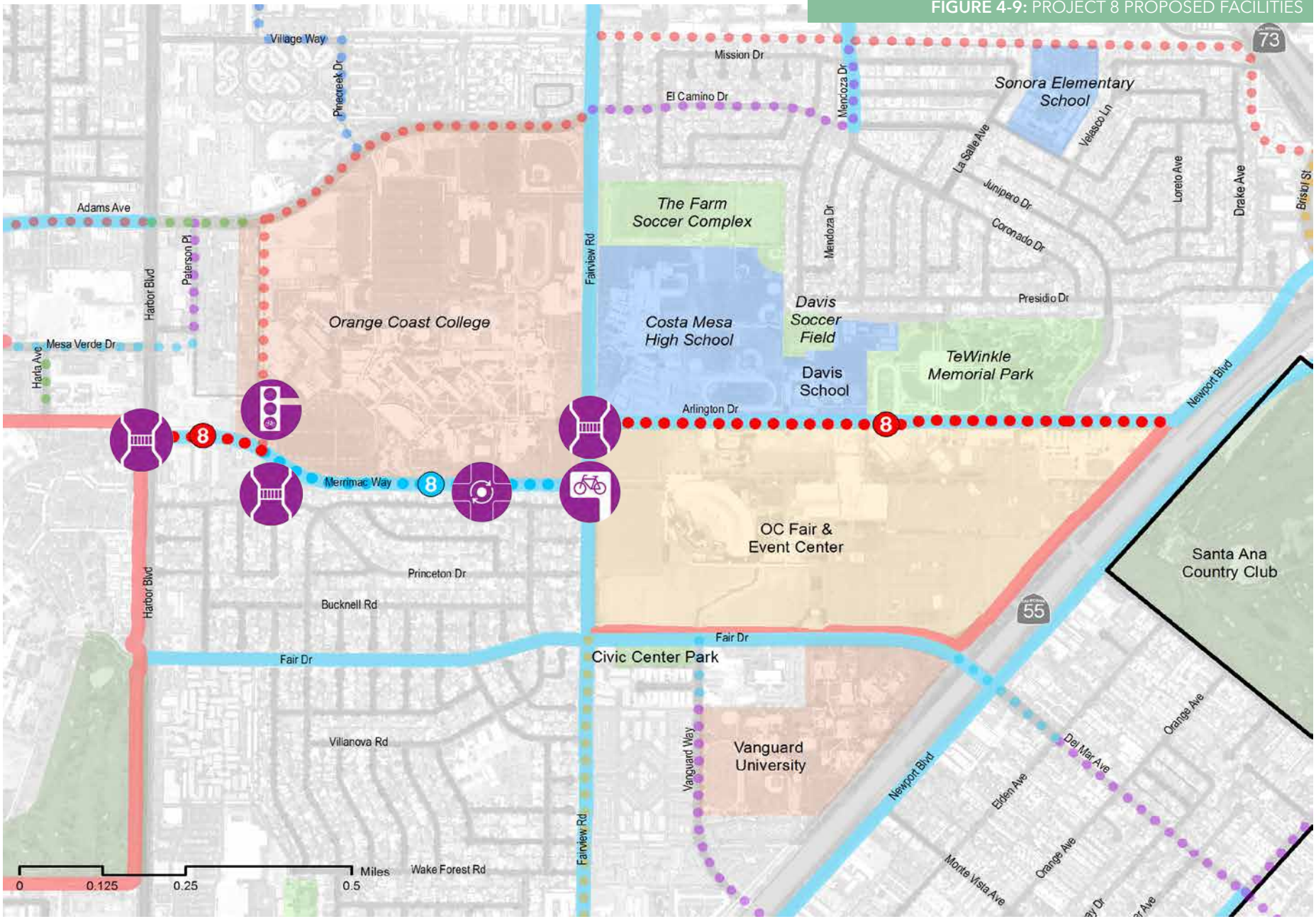
Proposed Bicycle Facilities
- Multi Use Path
- Bicycle Lane
- Buffered Bicycle Lane
- Bike Route
- Separated Bike Lane
- Bicycle Boulevard

Land Uses
- College/University
- Fairground
- Golf Course
- Park
- School
- City Boundary

BICYCLE AND PEDESTRIAN TREATMENTS

Bike Box | Bike/ Pedestrian Signal | Enhanced Crossing | Traffic Calming

FIGURE 4-9: PROJECT 8 PROPOSED FACILITIES



PROJECT 9

Project 9 provides 'protected' bike lanes (protected from adjacent vehicle travel lanes by vertical barriers) along Fairview Road, from Fair Drive south to W Wilson Street. Recommended intersection treatments differ based on context (e.g. bike boxes at the low (vehicular) volume intersection of Fairview Road and W Wilson Street; "protected" crossings, alongside sharrows, at the high (vehicular) volume intersection of Fairview Road and Fair Drive). Specific treatments include the following: enhanced crossings on Fairview Road at Fair Drive and Wilson Street; traffic calming (road diet) along Fairview Road to accommodate protected bike lanes; and bike boxes at the intersection of Fairview Road and W Wilson Street.

PROJECT COST

$259,528

(See Appendix A for detailed cost estimate)

PROJECT LENGTH

0.52 Miles

TABLE 4-9: PROJECT 9 SPECIFICATIONS

STREET/PATH SEGMENT	FROM STREET (N/W)	TO STREET (S/E)	BICYCLE FACILITY CLASS	LENGTH (MILES)	DELTA VALUE	NOTES
Fairview Road	Fair Drive	Fairview Way	Separated Bike Lane	0.04	22	Facility feasible pending "road diet" (i.e. lane reduction), which the City has endorsed
	Fairview Way	Fairwinds Lane		0.05	3	
	Fairwinds Lane	Loyola Road		0.07	-1	
	Loyola Road	Valley Forge Road		0.06	-1	
	Valley Forge Road	Wake Forest Road		0.15	1	
	Wake Forest Road	W Wilson Street		0.15	-3	

Feasible Project Infeasible Project

BICYCLE FACILITIES LEGEND

Existing Bicycle Facilities
- Multi Use Path (Class I)
- Bicycle Lane (Class II)
- Bicycle Lane (Class II)

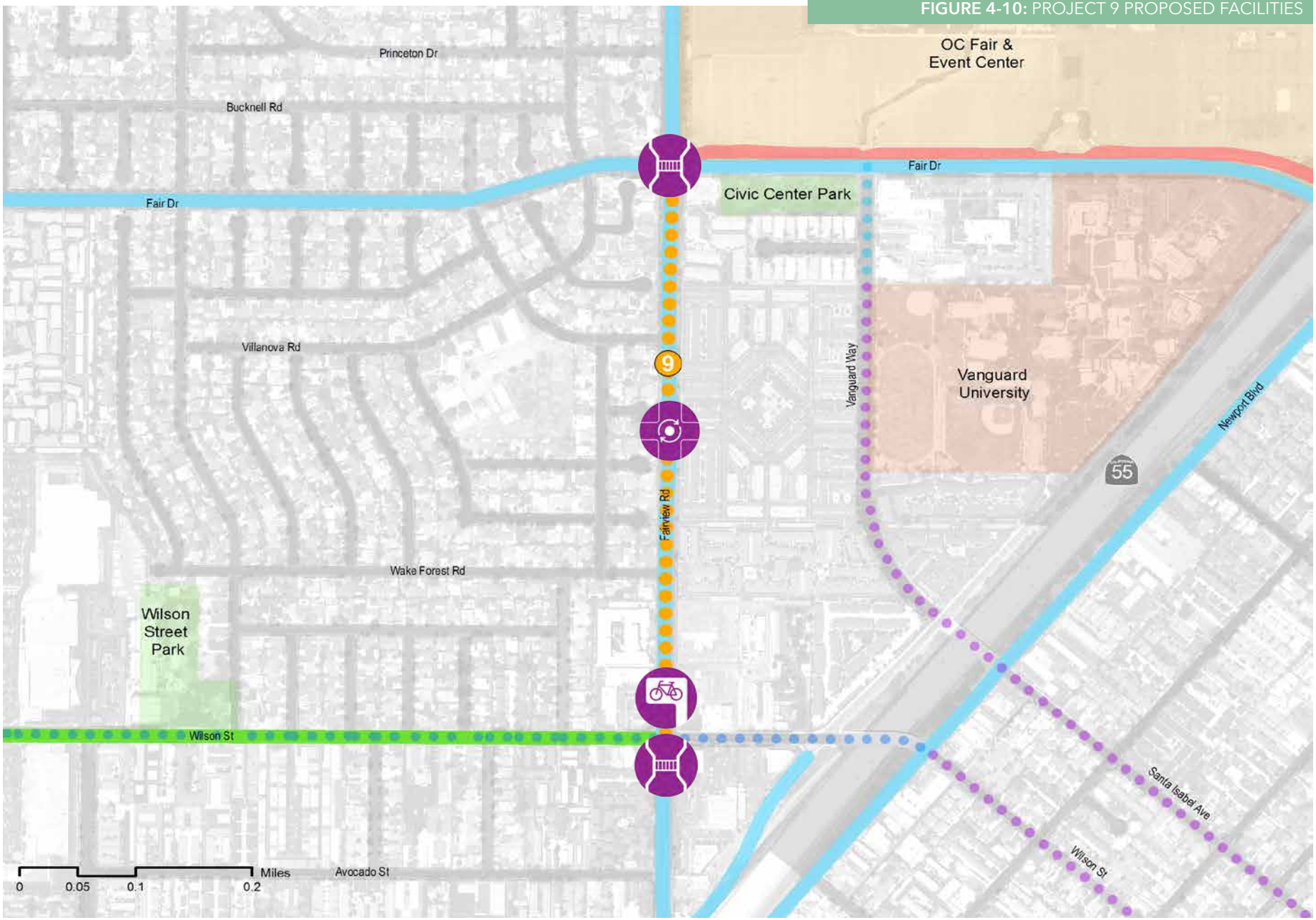
Proposed Bicycle Facilities
- Multi Use Path
- Bicycle Lane
- Buffered Bicycle Lane
- Bike Route
- Separated Bike Lane
- Bicycle Boulevard

Land Uses
- College/University
- Fairground
- Golf Course
- Park
- School
- City Boundary

BICYCLE AND PEDESTRIAN TREATMENTS

Bike Box Enhanced Crossing Traffic Calming

FIGURE 4-10: PROJECT 9 PROPOSED FACILITIES



PROJECT 10

Project 10 provides a connection from Fairview Road to Santa Ana Avenue, across Newport Boulevard. Bike lanes (five feet wide) are recommended from Fairview road to Newport Boulevard and a traffic calmed neighborhood route is recommended from Newport Boulevard to Santa Ana Avenue. Specific treatments include the following: bike boxes along W/E Wilson Street at Fairview Road, SB Newport Boulevard, NB Newport Boulevard and Santa Ana Avenue; and traffic calming measures on E Wilson Street at Elden Avenue and Orange Avenue.

PROJECT COST

$433,678

(See Appendix A for detailed cost estimate)

PROJECT LENGTH

0.73 Miles

TABLE 4-10: PROJECT 10 SPECIFICATIONS

STREET/PATH SEGMENT	FROM STREET (N/W)	TO STREET (S/E)	BICYCLE FACILITY CLASS	LENGTH (MILES)	DELTA VALUE	NOTES
W Wilson Street	Fairview Road	Newport Boulevard	Bicycle Lane	0.14	-6	Facility feasible pending (City-planned) roadway widening Plans include Class II Bicycle Lanes only; width will be insufficient to buffer
	Newport Boulevard	SB55 Freeway Victoria Off Ramp		0.03	-4	
	SB55 Freeway Victoria Off Ramp	SB55 Freeway		0.01	-1	
	SB55 Freeway	NB55 Freeway		0.02	-1	
E Wilson Street	NB55 Freeway	Newport Boulevard		0.03	-10	
	Newport Boulevard	Santa Ana Avenue	Bicycle Boulevard	0.50	N/A	Shared street facility; No ROW required

Infeasible Project

BICYCLE FACILITIES LEGEND

Existing Bicycle Facilities
- Multi Use Path (Class I)
- Bicycle Lane (Class II)
- Bicycle Lane (Class II)

Proposed Bicycle Facilities
- Multi Use Path
- Bicycle Lane
- Buffered Bicycle Lane
- Bike Route
- Separated Bike Lane
- Bicycle Boulevard

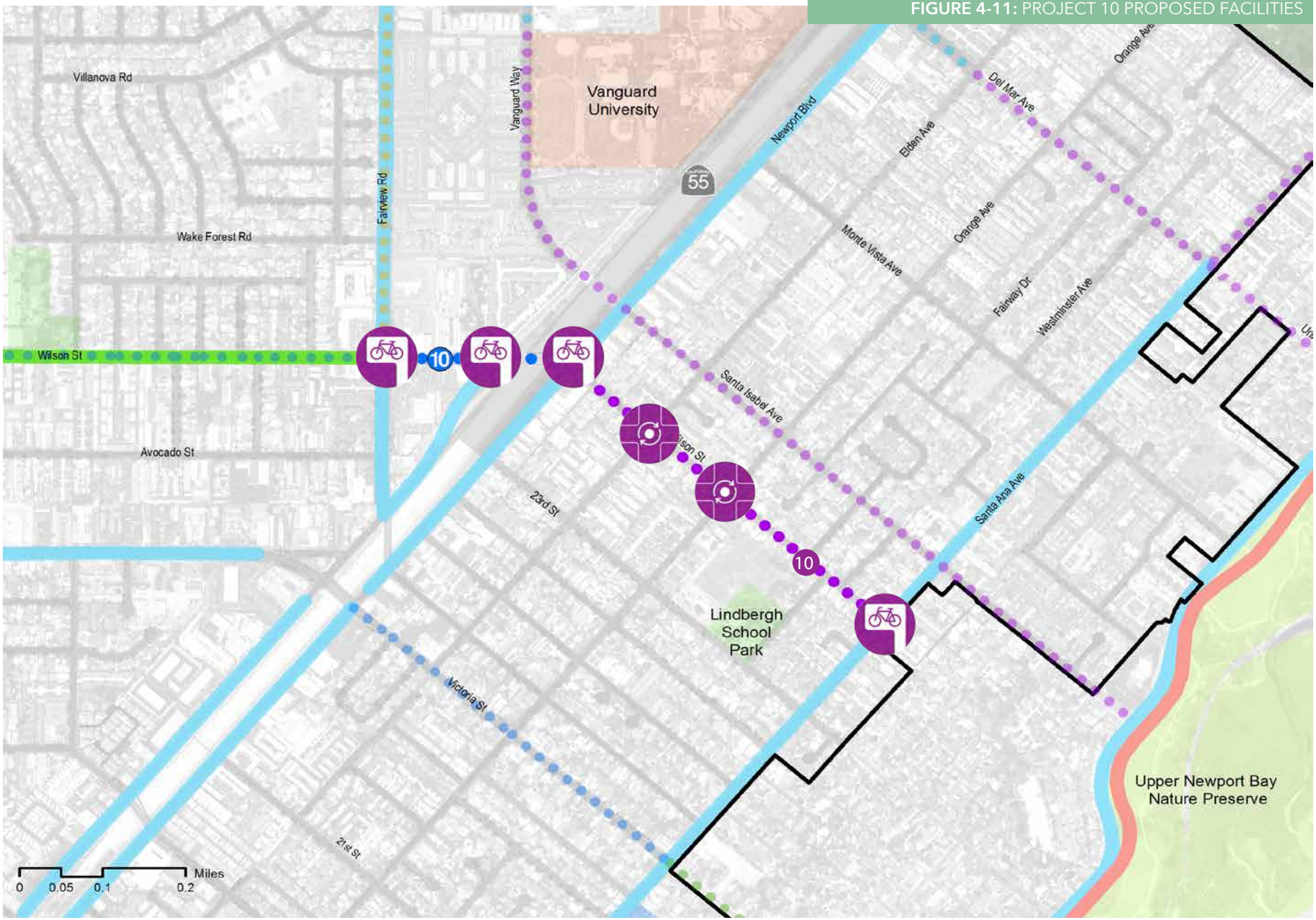
Land Uses
- College/University
- Fairground
- Golf Course
- Park
- School
- City Boundary

BICYCLE AND PEDESTRIAN TREATMENTS

Bike Box

Traffic Calming

FIGURE 4-11: PROJECT 10 PROPOSED FACILITIES



PROJECT 11

Project 11 provides a connection between the Orange County Fairgrounds and Newport Bay. The project mostly consists of traffic calmed neighborhood routes, but also includes buffered bike lanes (standard five foot bike lanes, with excess space used as a buffer from adjacent vehicle travel lanes). Buffered bike lanes are recommended on Vanguard Way, from Fair Drive to Santa Isabel Avenue. Traffic calmed neighborhood routes are recommended on Vanguard Way/Santa Isabel Avenue, from Vanguard Place to Irvine Avenue. Specific treatments include the following: bike boxes along Vanguard Way/Santa Isabel Avenue at Fair Drive, SB Newport Boulevard and NB Newport Boulevard; traffic calming measures along Vanguard Way/Santa Isabel Avenue at Morristown Lane, Brookline Lane, Elden Avenue, Orange Avenue and Santa Ana Avenue; and shared lane markings or "bike sharrows" on Vanguard Way/Santa Isabel Avenue between SB Newport Boulevard and NB Newport Boulevard.

PROJECT COST

$126,006

(See Appendix A for detailed cost estimate)

PROJECT LENGTH

1.31 Miles

TABLE 4-11: PROJECT 11 SPECIFICATIONS

STREET/PATH SEGMENT	FROM STREET (N/W)	TO STREET (S/E)	BICYCLE FACILITY CLASS	LENGTH (MILES)	DELTA VALUE	NOTES
Vanguard Way	Fair Drive	Clearbrook Lane	Buffered Bicycle Lane	0.08	6	Opportunity to provide buffered bike lanes
	Clearbrook Lane	Vanguard Place		0.03	12	
	Vanguard Place	Santa Isabel Avenue	Bicycle Boulevard	0.32	N/A	Shared street facility; No ROW required
Santa Isabel Avenue	Newport Boulevard	Irvine Avenue		0.88		

Feasible Project

BICYCLE FACILITIES LEGEND

Existing Bicycle Facilities
- Multi Use Path (Class I)
- Bicycle Lane (Class II)
- Bicycle Lane (Class II)

Proposed Bicycle Facilities
- Multi Use Path
- Bicycle Lane
- Buffered Bicycle Lane
- Bike Route
- Separated Bike Lane
- Bicycle Boulevard

Land Uses
- College/University
- Fairground
- Golf Course
- Park
- School
- City Boundary

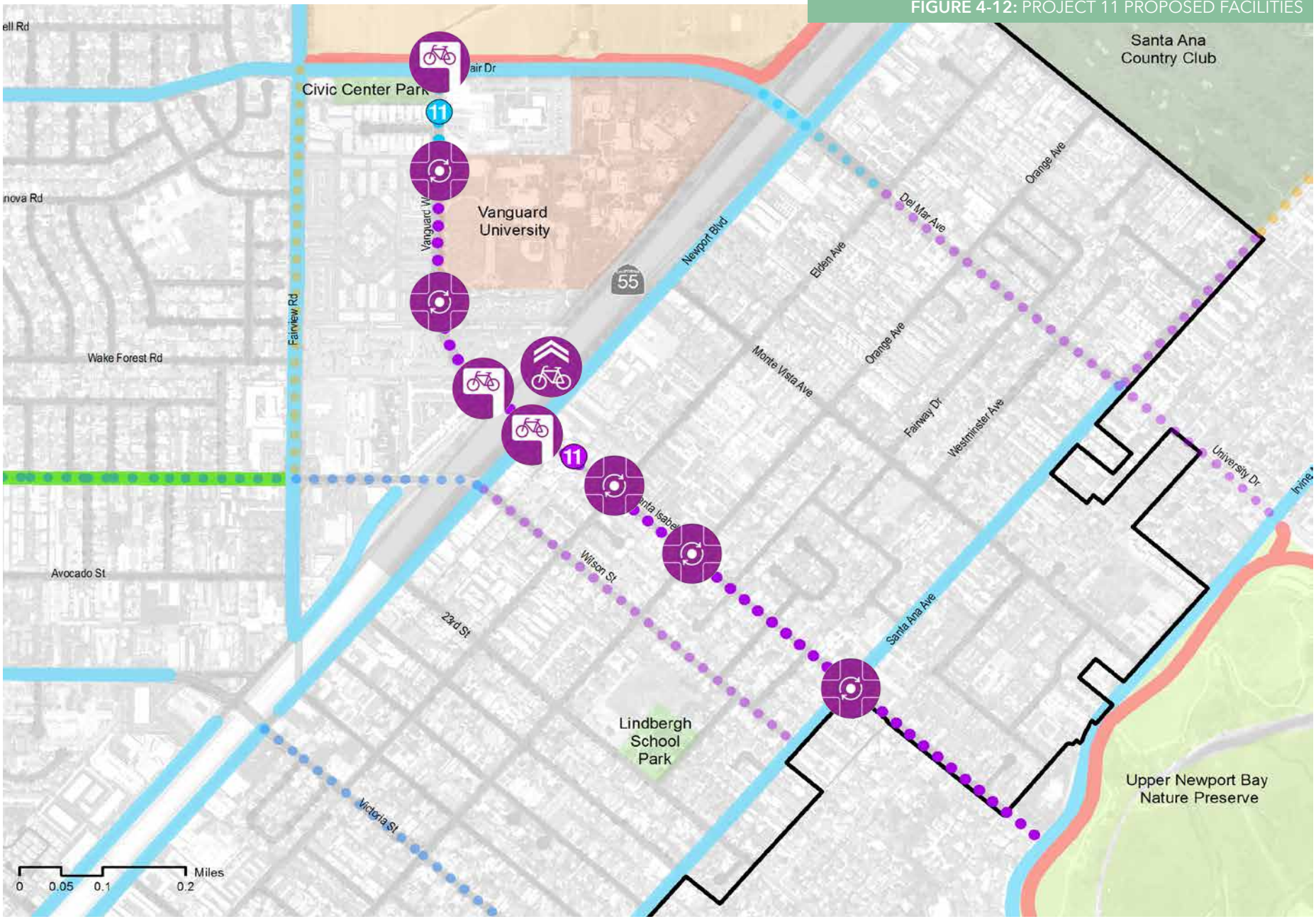
BICYCLE AND PEDESTRIAN TREATMENTS

Bike Box

Bike Sharrow

Traffic Calming

FIGURE 4-12: PROJECT 11 PROPOSED FACILITIES



PROJECT 12

Project 12 provides an alternate route to Adams Avenue on Mesa Verde Drive E, Harla Avenue and Peterson Place. Buffered bike lanes (standard five foot bike lanes, with excess space used as a buffer from adjacent vehicle travel lanes) are recommended on Mesa Verde Drive E and Peterson Place, where excess paved area exists. The remainder of Peterson Place, from Adams Avenue south to Mesa Verde Drive E, is recommended as a traffic calmed neighborhood route. Harla Avenue, a dead-end street, is recommended as a bike route (a shared street, marked by signage only). Specific treatments include the following: enhanced crossings at Mesa Verde Drive E and Adams Avenue, and Mesa Verde Drive E and Harbor Boulevard; wayfinding signage at Mesa Verde Drive E and Harla Avenue, and Mesa Verde Drive E and Peterson Place; and a bike box at Mesa Verde Drive E and Harbor Boulevard.

PROJECT COST

$76,170

(See Appendix A for detailed cost estimate)

PROJECT LENGTH

0.83 Miles

TABLE 4-12: PROJECT 12 SPECIFICATIONS

STREET/PATH SEGMENT	FROM STREET (N/W)	TO STREET (S/E)	BICYCLE FACILITY CLASS	LENGTH (MILES)	DELTA VALUE	NOTES
Mesa Verde Drive E	Adams Avenue	Unknown	Buffered Bicycle Lane	0.10	2	Mesa Verde Drive E has the minimal amount of "excess" right-of-way required for buffered bike lanes. Depending on existing conditions (e.g. vehicle and bicycle volumes), the City may choose to implement either buffered bike lanes (as recommended here) or wider standard bike lanes.
	Unknown	Golf Course Drive		0.03	2	
	Golf Course Drive	Unknown		0.07	2	
	Unknown	Ashwood		0.05	2	
	Ashwood	Harla Avenue		0.05	2	
	Harla Avenue	Harbor Boulevard		0.16	2	
	Harbor Boulevard	Peterson Place		0.07	14	Parking permitted only along 2 lane portion
Peterson Place	Adams Avenue	Peterson Place	Bicycle Boulevard	0.19	N/A	Shared street facility; No ROW required
Harla Avenue	Mesa Verde Drive East	Tanager Drive	Bike Route	0.11	N/A	

Feasible Project

BICYCLE FACILITIES LEGEND

Existing Bicycle Facilities
- Multi Use Path (Class I)
- Bicycle Lane (Class II)
- Bicycle Lane (Class II)

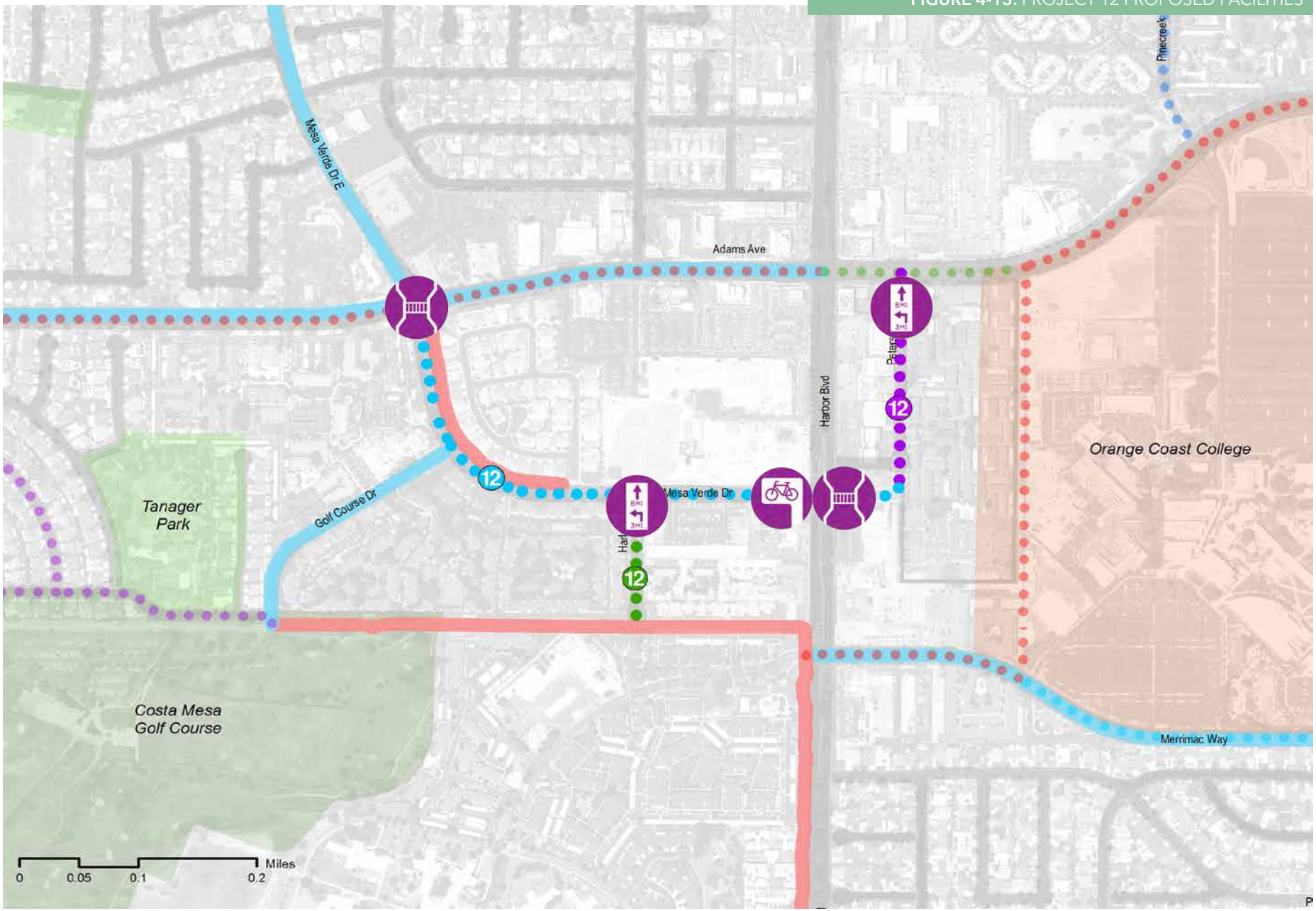
Proposed Bicycle Facilities
- Multi Use Path
- Bicycle Lane
- Buffered Bicycle Lane
- Bike Route
- Separated Bike Lane
- Bicycle Boulevard

Land Uses
- College/University
- Fairground
- Golf Course
- Park
- School
- City Boundary

BICYCLE AND PEDESTRIAN TREATMENTS

Bike Box | Enhanced Crossing | Wayfinding

FIGURE 4-13: PROJECT 12 PROPOSED FACILITIES



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CHAPTER 5

IMPLEMENTATION & FUNDING

IMPLEMENTATION

Bikeway facility implementation is generally not governed by a specific timeline since the availability of funds for implementation is variable and often tied to the priorities of the City's capital projects. Plan implementation is also necessarily multi-faceted. Besides adoption of goals and policies, it often includes carrying out programs and pursuing project funding, whether through the City's capital improvements project process or grant funding. The plan addresses goals, policies, programs and projects that may not be feasible to implement immediately, but are included to inspire long-term actions.

Following plan adoption, the next tasks may include grant writing to fund projects and programs, amending City standards and design guidelines for consistency, including projects in the City's ongoing capital improvements programs, and implementing goals and policies in the everyday City and law enforcement management processes, whether in site plan review, street engineering decisions or traffic enforcement. Recommendations include projects and education and outreach programs that can be implemented by the City, schools, volunteers and law enforcement, but implementation ultimately rests on the community and City's desire to make this plan's recommendations a reality.

IMPLEMENTATION STEPS

Implementation of some bikeways, such as multi-use paths, bicycle boulevards, and other innovative techniques described in this plan, will require a capital improvement project processes. These additional processes could include identifying funding, public review, environmental review, and plan preparation. Other bikeway improvements can be integrated into planned construction, such as resurfacing, reconstruction, or utility work.

The majority of bikeway facilities are provided on streets in the form of shared roadways or bicycle lanes. Shared roadways usually require little change to existing roadways, except for directional signs, pavement markings and minor changes in traffic control devices. Each project will need a varying level of additional study and analysis before installation. Depending upon the project's complexity, some can be done by City staff, while more complex projects may be contracted out to specialist consultants.

Potential Implementation Steps include:

1) Preliminary design and/or technical traffic studies
2) Parking study if parking removal is recommended
3) Construction drawings and detailed cost estimates
4) Funding (CIP, grant, etc.)
5) Recommendations for further environmental studies (if needed)
6) Construction

PROJECT PHASING

Projects listed as short-term are those relatively easy to implement. These projects typically have low construction costs, would not necessitate the acquisition of right-of-way, and/or would require only a categorical exemption under the California Environmental Quality Act (CEQA) guidelines. An example of a potential short-term project could include restriping a roadway to include a buffer to remedy a door zone bicycle lane or creating accessible connections to an existing facility like the Santa Ana River Trail.

Mid-term projects are projects that will require a small amount of further study or a higher cost than projects that require only typical resurfacing and striping. The long-term projects involve pursuing grant funding opportunities or further study for the implementation of larger, and potentially costlier improvements. Examples of long-term projects include Class 1 multi-use path recommendations or Class IV separated bike lanes.

POTENTIAL FUNDING SOURCES

Federal, State and local government agencies invest billions of dollars every year in the nation's transportation system. Only a fraction of that funding is used in development projects, policy development and planning to improve conditions for cyclists and walkers. Even though appropriate funds are limited, they are available, but desirable projects sometimes go unfunded because communities may be unaware of a fund's existence, or may apply for the wrong type of grants. Also, the competition between municipalities for the available funding is often fierce.

Whenever federal funds are used for bicycle and pedestrian projects, a certain level of State and/or local matching funding is generally required. State funds are often available to local governments on the similar terms. Almost every implemented bicycle and pedestrian program and facility in the United States has had more than one funding source and it often takes a good deal of coordination to pull the various sources together.

The most commonly employed active transportation project funding sources have been sales tax revenues, federally funded transportation projects, State grants and community partnerships. Of the federal project funding, the most common has been highway programs, Transportation Investment Generating Economic Recovery (TIGER) discretionary funds and community development block grants (CDBG), while state funding has come primarily from dedicated funds. Local funding has often occurred through general fund and developer impact fees, occasionally sales taxes and bonds, and tax incremental financing (TIF). Some private foundations also fund active transportation projects.

FEDERAL SOURCES

The previous federal transportation funding authorization, MAP-21 (Moving Ahead for Progress in the 21st Century), has been replaced with a new funding mechanism. In late 2015, Congress passed the Fixing America's Surface Transportation (FAST) Act, which President Obama signed into law. The FAST Act is a five-year, $305 billion transportation bill and is the first law enacted in over ten years that provides long-term funding certainty for surface transportation, meaning States and local governments can move forward with critical transportation projects with the confidence that they will have a long-term federal partner. Many transportation funding programs were given new names.

The following list identifies the most relevant potential federal funding programs:

1) National Highway Performance Program: $22 billion (FY 2016)
2) Surface Transportation Program (STP): Wayfinding signage, trail traffic counters, bike parking, bus bike racks, etc.
    - Surface Transportation Block Grant Program: $10 billion
    - Surface Transportation Block Grant Program Set Aside: $820 million
3) Transportation Alternatives Program (TAP):
    - Pedestrian and Bicycle Projects (80%): Trails/ Sidewalks/Traffic Calming/Safety/ADA
    - Safe Routes to School (10%): Infrastructure, Awareness campaigns, Education
    - Historic Projects/Environment (10%)
4) Congestion Mitigation and Air Quality Improvement (CMAQ): $2.26 billion
5) Highway Safety Improvement Program (HSIP): $2.1 billion

Notably, the FAST Act requires all design for National Highway System roadways to take into account access for all modes of transportation. It also permits local governments to use their own adopted design guides if they are the lead project sponsor, even if it differs from their state guidelines.

Bicycle and Pedestrian Program

The Federal Highway Administration (FHWA) Bicycle and Pedestrian Program promotes safe, comfortable, and convenient walking and bicycling for people of all ages and abilities, through funding, policy guidance, program management and resource development. Each State has a State Bicycle and Pedestrian Coordinator, and each FHWA Division office has an FHWA Bicycle and Pedestrian Coordinator point of contact.

The Transportation Alternatives Program (TAP) is probably the best known and most popular federal funding source for pedestrian and bicycle infrastructure. The accompanying matrix is based on a table provided on the FHWA website that summarizes potential eligibility for pedestrian and bicycle projects under Federal Transit and Federal Highway programs. This original table should be consulted as the starting point for investigating federal funding opportunities since it is likely to be the most up-to-date potential eligibility information source (http://www.fhwa.dot.gov/environment/bicycle_pedestrian/funding/funding_opportunities.cfm).

Specific program requirements must be met and eligibility must be determined on a case-by-case basis. Additional detail on the most popular programs are listed following the table.

Besides TAP, FHWA funds eligible pedestrian and bicycle projects primarily through the Congestion Mitigation and Air Quality Improvement (CMAQ) Program, Surface Transportation Program (STP), Highway Safety Improvement Program (HSIP), National Highway Performance Program (NHPP), and Federal Lands and Tribal Transportation Programs (FLTTP).

Each of these programs has different requirements, so to be eligible, pedestrian and bicycle projects must meet program requirements. For examples:

- FTA transit funds may be used for bike lanes and sidewalks if they provide direct access to transit.
- CMAQ funds must be used for projects that benefit air quality.
- HSIP projects must address a highway safety problem.
- NHPP-funded projects must benefit National Highway System (NHS) corridors.

Because bicycle and pedestrian elements are often included in large roadway projects funded through these programs, FHWA division offices can assist in determining options for using multiple funding sources to fund a specific single project. For example, pedestrian and bicycle facilities may be included on rehabilitated, reconstructed or new bridges to improve the overall active transportation network.

Funding is also available for non-infrastructure projects. For instance, NHTSA provides funding for behavioral safety aspects, education and enforcement, in coordination with State highway safety offices.

National Highway System (NHS)

FHWA guidelines allow NHS capacity and safety needs to be addressed through a mix of on-system and parallel system network streets if a portion of the local network is part of the Federal-aid highway system. All other roads that have a functional classification higher than local road or rural minor collector are eligible for Federal-aid funding through STP. Projects on local roads and rural minor collectors may be eligible, in some cases. STP, TAP and HSIP funds may also be used for bicycle and pedestrian projects along any public road or trail, with no location restrictions.

For more information, visit the following webpages:

- Bicycle and Pedestrian Funding Opportunities: www.fhwa.dot.gov/environment/bicycle_pedestrian/funding/funding_opportunities.cfm
- Federal-Aid Highway Program Funding for Pedestrian and Bicycle Facilities and Programs: http://www.fhwa.dot.gov/environment/bicycle_pedestrian/funding/bipedfund.cfm
- FTA Bicycles and Transit Information: http://www.fta.dot.gov/13747_14399.html
- Final Policy Statement on Eligibility of Pedestrian and Bicycle Improvements under Federal Transit Law: https://www.federalregister.gov/articles/2011/08/19/2011-21273/final-policy-statement-on-the-eligibility-of-pedestrian-and-bicycle-improvements-under-federal
- CMAQ Program: http://www.fhwa.dot.gov/environment/air_quality/cmaq/
- STP Eligibility: http://www.fhwa.dot.gov/map21/factsheets/stp.cfm
- STP Guidance: http://www.fhwa.dot.gov/map21/guidance/guidestprev.cfm
- TAP Guidance: http://www.fhwa.dot.gov/map21/guidance/guidetap.cfm
- HSIP Guidance: http://www.fhwa.dot.gov/map21/guidance/guidehsip.cfm

Recreational Trails Program

The California State Parks and Recreation Department administers Recreational Trails Program (RTP) funds. The RTP can be used to fund recreational trails, including bicycle and pedestrian paths.

Safe Routes to School Programs

The California Department of Transportation (Caltrans) administers two separate Safe Routes to School programs. The first is the State-legislated program referred to as "SR2S" and the second is a federal program referred to as "SRTS." Both programs are intended to achieve the same basic goal of increasing the number of children walking and biking to school by making it safer for them to do so. SR2S is now a part of the Active Transportation Grant program (ATP) described under "State Sources."

The SRTS Program funds non-motorized facilities that improve access to schools through the Caltrans Safe Routes to School Coordinator. Eligible applicants include State, local and regional agencies experienced in meeting federal transportation requirements. Nonprofit organizations, school districts, public health departments and Native American Tribes must partner with a city, county, MPO, or RTPA to serve as the responsible agency for their project.

Eligible projects include stand-alone infrastructure or non-infrastructure projects. Projects must be completed within four years after project is amended into the FTIP. Targeted beneficiaries are children in grades K-8. No local match is required.

Housing and Urban Development (HUD) - Community Development Block Grants (CDBG)

The CDBG entitlement program allocates annual grants to larger cities and urban counties to develop viable communities by providing decent housing, a suitable living environment, and opportunities to expand economic opportunities, principally for low- and moderate- income persons. Bicycle and pedestrian facilities are eligible uses of these funds.

Land and Water Conservation Fund (LWCF)

The U.S. Recreation and Heritage Conservation Service and the California Department of Parks and Recreation (CDPR) jointly administer this funding source. The Land and Water Conservation Fund is a 50 year old budget neutral program that reinvests a portion of the royalties from offshore oil and gas leasing into recreation and conservation priorities. The program has a tremendous track record of success and broad bipartisan support, and has been used to expand protected areas and improve recreation facilities in every state. Projects acquired or developed under the LWCF program must be primarily for recreational use and not transportation purposes, and the lead agency must guarantee to maintain the facility in perpetuity for public recreation.

States receive individual allocations of LWCF grant funds based upon a national formula, with state population being the most influential factor. States initiate a statewide competition for the amount available annually. Applications are evaluated using criteria including priority status within the State Comprehensive Outdoor Recreation Plan (SCORP). The CDPR selects which projects to submit to the National Park Service (NPS) for approval. Final approval is based on the amount of funds available that year, which is determined using a population-based formula. Trails are the most commonly approved project.

Though it was allowed to expire at the end of September, 2015, widespread public outcry is credited with helping to goad Congress into voting to reauthorize the LWCF with almost 200 co-sponsors in late 2015. It is now funded for three years at $450 million, 50 percent more than previously.

Department of the Interior - National Park Service - Rivers, Trails, and Conservation Assistance Program (RTCA)

This program is the National Park Service's community assistance arm. The RTCA provides technical assistance to communities to preserve open space and develop trails. RTCA funds can not be used for infrastructure. Assistance is specifically for construction plans, engaging public participation and identifying other sources of funding for conservation and outdoor recreation projects. A local example is the Murrieta Creek Regional Trail, for which the NPS is a prime partner agency.

TABLE 5-1: BICYCLE AND PEDESTRIAN FUNDING OPPORTUNITIES - FEDERAL SOURCES

		Funding Source												
		TIGER	FTA	ATI	CMAQ	HSIP	NHPP NHS	STP	TAP TE	RTP	SRTS	PLAN	402	FLTTP
Activity	Access enhancements to public transportation*	x	x	x		x	x	x	x	x	x			x
	ADA/504 Self Evaluation/Transition Plan	x						x	x	x		x		x
	Bicycle and/or pedestrian plans	x	x					x	x	x		x		x
	Bicycle lanes on road	x	x	x	x	x	x	x	x					x
	Bicycle parking	x	x	x	x		x	x	x	x	x			x
	Bike racks on transit	x	x	x	x			x	x					x
	Bicycle share (capital and equipment; not operations)	x	x	x	x		x	x	x					x
	Bicycle storage or service centers	x	x	x	x			x	x					x
	Bridges/overcrossings for bicyclists and/or pedestrians	x	x	x	x	x	x	x	x	x	x			x
	Bus shelters and benches	x	x	x	x			x	x					x
	Coordinator positions (State or local/Limit 1 per State)	x			x			x	x		x			
	Crosswalks (new or retrofit)	x	x	x	x	x	x	x	x	x	x			x
	Curb cuts and ramps	x	x	x	x	x	x	x	x	x	x			x
	Counting equipment	x	x	x		x	x	x	x	x	x	x		x
	Bicyclists/pedestrians data collection and monitoring	x	x	x		x	x	x	x	x	x	x		x
	Helmet promotion (for bicyclists)							x	x		x		x	
	Landscaping, streetscaping**	x	x	x				x	x					x
	Lighting (pedestrian and bicyclist scale)***	x	x	x		x	x	x	x	x	x			x
	Maps (for bicyclists and/or pedestrians)		x	x	x			x	x		x	x		
	Paved shoulders for bicyclist and/or pedestrian use	x	x		x	x	x	x	x		x			x
	Police patrols							x	x		x		x	

TABLE 5-1: BICYCLE AND PEDESTRIAN FUNDING OPPORTUNITIES - FEDERAL SOURCES (CONT.)

		Funding Source												
		TIGER	FTA	ATI	CMAQ	HSIP	NHPP NHS	STP	TAP TE	RTP	SRTS	PLAN	402	FLTTP
Activity	Recreational trails	x						x	x	x				x
	Safety brochures, books							x	x		x	x	x	
	Safety education positions							x	x		x		x	
	Separated bicycle lanes	x	x	x	x	x	x	x	x		x			x
	Shared use paths/transportation trails	x	x	x	x	x	x	x	x	x	x			x
	Sidewalks (new or retrofit)	x	x	x	x	x	x	x	x	x	x			x
	Signs/signals/signal improvements	x	x	x	x		x	x	x		x			x
	Signed bicycle or Pedestrian routes	x	x	x	x		x	x	x		x			x
	Spot improvement programs	x	x			x		x	x	x	x			x
	Stormwater impacts related to pedestrian/bicycle projects	x	x	x		x	x	x	x	x	x			x
	Traffic calming	x	x			x	x	x	x		x			x
	Trail bridges	x			x	x	x	x	x	x	x			x
	Trail/highway intersections	x			x	x	x	x	x	x	x			
	Training				x			x	x	x	x	x	x	
	Tunnels/undercrossings for bicyclists/pedestrians	x	x	x	x	x	x	x	x	x	x			x

*Includes benches and bus pads
**Bicycle and/or pedestrian route; transit access; related amenities (benches, water fountains)
***Associated with pedestrian/bicyclist project

STATE SOURCES

Caltrans - Active Transportation Program (ATP)

The ATP program was created to encourage increased use of active modes of transportation, and it is by far the most significant source of funds dedicated to increasing bicycling and walking in California. Its $120 million per year represents approximately one percent of the state's annual transportation budget. This is a competitive program to increase biking and walking trips, safety and mobility, to support regional agency GHG reduction, enhance public health, benefit disadvantaged communities, and include a broad spectrum of projects.

ATP funds bike and pedestrian infrastructure projects, educational and promotional efforts, safe routes to school projects, and active transportation planning. The state awards half of the funds through a competitive grants process. Forty percent goes to metropolitan agencies to distribute and ten percent goes to rural areas. At least 25 percent of all funds must benefit residents in disadvantaged communities.

This program consolidates existing Federal and State transportation programs, including the Transportation Alternatives Program (TAP), Bicycle Transportation Account (BTA), and State Safe Routes to School (SR2S), into a single program focusing on making California a national leader in active transportation. The SR2S component of the ATP addresses eligible infrastructure projects within two miles of a grade school or middle school and must be completed within four years after project funds are allocated to the agency. Targeted beneficiaries must be children in grades K-12.

The ATP is administered by the Division of Local Assistance, Office of Active Transportation and Special Programs. As of March 2015, no local match is required.

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 California Transportation Commission (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.

Transportation Development Act Article 3 (SB-821)

TDA Article 3 funds, also known as the Local Transportation Fund (LTF), can be used by cities for the planning and construction of bicycle and pedestrian facilities and associated activities. These can include engineering expenses leading to construction, right-of-way acquisition, and construction or reconstruction, as well as retrofitting existing bicycle and pedestrian facilities to comply with ADA requirements, route improvements like signal controls for cyclists, bicycle loop detectors and rubberized rail crossings. Also eligible are intersection improvements and the purchase and installation of facilities such as bicycle parking, benches, drinking fountains, rest rooms, showers adjacent to paths and employment centers, park-and-ride lots, and transit terminals accessible to the general public.

TDA funds are based on State sales tax. By law, the County Auditor's office estimates the apportionment for the upcoming fiscal year.

Sustainable Transportation Planning Grant Program

Sustainable Transportation Planning Grants are awarded by Caltrans to help a jurisdiction improve sustainable transportation. These grants may be used for a wide range of transportation planning purposes that address local and regional transportation needs and issues. Implementation is intended to ultimately lead to the adoption, initiation and programming of transportation improvements.

Office of Traffic Safety - Pedestrian and Bicycle Safety Program

The California Office of Traffic Safety (OTS) seeks to reduce motor vehicle fatalities and injuries through a highway safety program. Priority areas include police traffic services, alcohol and other drugs, occupant protection, pedestrian and bicycle safety, emergency medical services, traffic records, roadway safety, and community-based organizations. OTS grants have funded traffic safety rodeos for elementary, middle and high schools, and community groups to increase awareness among various age groups. To boost compliance with the law and decrease injuries, this has included properly fitting and distributing helmets to children in need. Court diversion courses have been

established in communities for those violating the bicycle helmet law. Other programs target high-risk populations and areas with multicultural public education addressing safer driving, biking and walking behaviors.

AB-2766 Subvention Program

AB-2766 Clean Air Funds are generated by a surcharge on automobile registration. Air quality management districts allocate funds to cities according to their proportion of the region's population for projects that improve air quality. Projects can include the design, development and installation of designated bicycle routes, bikeways/ bike paths and associated bike trail improvements, such as facilities that safely link residential areas and major activity centers and are physically separated from motor vehicle traffic. Another eligible category is bicycle facilities that promote and support non-motorized travel, such as bicycle racks, lockers, signals and bus racks, including installation of bike storage units within park and ride facilities, or at trailheads.

Per Capita Grant Program

The Per Capita Grant Program is administered by the California Department of Parks and Recreation and is intended to maintain a high quality of life for California's growing population by providing a continuing investment in parks and recreational facilities. Specifically, it supports the acquisition and development of neighborhood, community and regional parks and recreation lands and facilities in urban and rural areas. Per Capita grant funds can only be used for capital outlay, such as bike paths and trails. Regional park districts are eligible recipients.

TABLE 5-2: BICYCLE AND PEDESTRIAN FUNDING OPPORTUNITIES - STATE SOURCES

		Funding categories										
		Infrastructure	Amenities	Planning	Programs	Safety	SRTS	Mode share	Air Quality	Public Health	Parks and Recreation	Disadvantaged Communities
Funding Sources	Caltrans ATP	x		x	x	x	x	x	x	x		x
	State Highway Account	x				x		x				
	Transportation Development Act Article 3 (SB-821)	x	x	x								
	Sustainable Transportaiton Planning Grant Program			x				x	x			
	Office of Traffic Safety - Pedestrian and Bicycle Safety Program				x	x				x		x
	AB 2766 Subvention Program	x	x	x				x	x			
	Per Capita Grant Program	x									x	
	Roberti-Z'Berg-Harris (RZH) Grant Program - Proposition 40	x									x	x

Roberti-Z'Berg-Harris (RZH) Grant Program – Proposition 40

Funds for this grant program are allocated for projects pursuant to the Roberti-Z'berg-Harris Urban Open Space and Recreational Grant Program for a variety of uses related to parks and recreation. Project receive high priority that satisfy the most urgent park and recreation needs, with emphasis on unmet needs in the most heavily populated and most economically disadvantaged areas within each jurisdiction. Funding is intended to supplement local expenditures for park and recreation facilities. Bike paths and recreational trails are eligible uses of these funds.

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 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 to 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.

Impact Fees and Developer Mitigation

Local jurisdictions have the option to create their own impact fee and mitigation requirements. Impact fees may be assessed on new development to pay for transportation projects, typically tied to vehicle trip generation rates and traffic impacts generated by a proposed project. A developer may reduce the number of trips (and hence impacts and cost) by paying for on- or off-site bikeway improvements that will encourage residents to bicycle rather than drive. In-lieu parking fees may also be used to contribute to the construction of new or improved bicycle parking facilities. Establishing a clear nexus or connection between the impact fee and the project's impacts is critical.

Benefit Assessment Districts

Bike paths, bicycle lanes, bicycle parking, and related facilities can be funded as part of a local benefit assessment district. However, defining the boundaries of the benefit district may be difficult since the bikeways will have citywide or regional benefit. Sidewalks, trails, intersection crossings and other pedestrian improvements can also be funded through benefit assessment districts.

Business Improvement Districts (BIDs)

Bicycle and pedestrian improvements can often be included as part of larger efforts of business improvement and retail district beautification. Similar to benefit assessment districts, business improvement districts (BIDs) collect levies on businesses to fund area-wide improvements that benefit businesses and improve access for customers. These districts may include provisions for bicycle improvements such as bicycle parking or shower and clothing locker amenities, sidewalk improvements and pedestrian crossing enhancements.

User Fees

Bicycle lockers and automated bicycle parking could be paid for with user fees. Since it is difficult to know how much revenue such a fee would generate, this funding source would likely require an alternative backup source.

Property Taxes and Bonds

Cities and counties may sell bonds to fund bikeways and pedestrian facilities, as well as amenities related to these facilities. A supermajority of two-thirds of voters in the jurisdiction must vote to levy property taxes to repay the bonds.

Resurfacing and Repaving

Local jurisdictions can take advantage of opportunities to add bicycle lanes and other markings when streets are resurfaced or repaved. This requires close coordination between the planning or community services and public works departments so that low cost bicycle upgrades opportunities are not missed during normal street maintenance projects.

New Construction

Future road widening and construction projects are a means of providing bicycle lanes, pedestrian improvements and trails. To ensure that roadway construction projects provide appropriate measures where needed, it is important that an effective review process or ordinance be in place to ensure that new roads meet the standards and guidelines presented in this master plan. Developers may also be required to dedicate land toward the widening of roadways to provide for enhanced bicycle mobility.

General Funds

Cities and counties may spend general funds as they see fit. Any bicycle, pedestrian or trail project could be funded through general funds and matched with other funds.

Parking Meter Revenues

Cities can fund various improvements through parking meter revenues. The ordinance that governs the use of the revenues would specify eligible uses. Cities have the option to pass ordinances that specify bicycle or pedestrian facilities as eligible expenditures.

Adopt-a-Path Program

Path and trail maintenance can be paid for from private funds in exchange for recognition, such as donor signs along a route. This is often administered through a special account into which donors can pay.

Other Local Sources

Local sales taxes and fees may be implemented as new funding sources for bicycle projects. However, either 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 architecture 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 5-3: BICYCLE AND PEDESTRIAN FUNDING OPPORTUNITIES - LOCAL SOURCES

		Funding categories				
		Infrastructure	Amenities	Maintenance	Mode share	Parks and Recreation
Funding Sources	Developer Impact Fees	x		x	x	x
	Impact Fees and Developer Mitigation	x				x
	Benefit Assessment Districts	x	x	x		
	Business Improvement Districts (BIDs)			x		
	User Fees				x	x
	Property Taxes and Bonds	x	x	x		
	Resurfacing and Repaving	x				
	New construction	x				
	General Funds					
	Parking Meter Revenues					
	Adopt-a-Path Program					

PRIVATE SOURCES

Private funding may be available through advocacy groups or foundations wanting to enhance and improve public health or bicycle facilities and advocacy. Grant applications are typically intended to leverage supplemental funding in support of other federal, State and private sources.

Kaiser Permanente Foundation

The Kaiser Permanente Foundation manages numerous programs to support their Community Health Initiatives. The most applicable is the Medical Center Local Grantmaking Program, whose current funding priorities include addressing obesity and overweight through opportunities for physical activity and service infrastructure for improved community collaboration concerning the impact of the built environment.

TABLE 5-4: BICYCLE AND PEDESTRIAN FUNDING OPPORTUNITIES - PRIVATE AND NON-PROFIT SOURCES

		Funding Categories							
		Infrastructure	Amenities	Programs	Safety	Mode Share	Environment/Air Quality	Public Health	Parks and Recreation
Funding Sources	Kaiser Permanente Foundation	x		x				x	x
	People for Bikes	x	x	x		x			x
	Advocacy Advance	x		x		x			
	American Hiking Association	x	x		x		x		x

GRANT SOURCES AVAILABLE TO NON-PROFIT ADVOCACY ORGANIZATIONS

Advocacy Advance

Advocacy Advance's Rapid Response Grants help State and local organizations take advantage of unexpected opportunities to win, increase, or preserve funding for biking and walking. These grants are for short-term campaigns that will increase or preserve investments in active transportation in communities where program choices are being made on how to spend federal, State, and local funding. Applications are accepted on a rolling basis. Advocacy Advance's "Big Idea" Grants is another program intended to help with unforeseen opportunities, short-term campaigns or to push campaigns into the end zone to win funding for biking and walking infrastructure and programs.

For either program, the grantee must be an Alliance for Biking and Walking and a League of American Bicyclists member and be a 501(c)(3) or 501(c)(4), with an immediate opportunity and a specific timeframe for a campaign to raise additional federal, State or local funding for biking and walking infrastructure and/or programs, or proposes a winnable, replicable campaign with measurable results.

People for Bikes

People for Bikes' Community Grants Program typically focuses grant funding on bicycle infrastructure such as paths, lanes, trails and bridges, mountain bike facilities, bike parks and pump tracks, BMX facilities, and end-of-trip facilities such as bicycle parking. Grant funding is also available for other types of non-capital advocacy projects, such as programs that transform city streets, including Ciclovías and initiatives to increase ridership or investment in bicycle infrastructure. Most California grants have been for advocacy efforts in support of constructing Class I facilities.

American Hiking Association

These grants are available to AHS Alliance members who are a also 501(c)(3) certified. Hikers are the primary constituency, but multi-purpose trail uses are also eligible. Grants focus on supporting other funds acquisition, including conservation easements that will result in access improvements, improved user safety and/or avoidance of environmental damage. Higher preference is often given to projects with volunteer labor contributions.

APPENDICES

APPENDIX A:

COST ESTIMATES FOR RECOMMENDED BIKEWAY PROJECTS

PROJECT 1 COST ESTIMATE:
ADAMS AVENUE FROM WESTERN CITY LIMIT TO FAIRVIEW ROAD

ITEM	QUANTITY	UNIT*	UNIT COST	COST	NOTES
Removal/Relocation					
Remove Curb and Gutter	10,229	LF	$4.00	$40,916.00	Assumed for full length of planned multi-use path.
Sign Relocation	13	EA	$50.00	$650.00	Those that impede sidewalk widening or multi-use path traffic flow.
Cabinet/Signal Equipment Removal	8	EA	$7,500.00	$60,000.00	Those that impede sidewalk widening or multi-use path traffic flow.
Tree Removal/Relocation	90	EA	$450.00	$40,500.00	Those that impede sidewalk widening or multi-use path traffic flow.
Utility Pole Relocation	34	EA	$7,000.00	$238,000.00	Power and light poles.
Roadway Excavation	10,229	LF	$18.00	$184,122.00	3' Deep and 4' Wide. Assumed to be required for full length of planned multi-use path construction.
Installation/Construction					
Driveway	1,550	SF	$12.00	$18,600.00	Cost of signage shown under 'Sign on New Pole' below.
Curb and Gutter	10,229	LF	$25.00	$255,725.00	
Raised Pedestrian Crossing	1	EA	$7,500.00	$7,500.00	$6,000 (2005); applied rate of inflation from 2005-2015 to update value.
Curb Extension (Bulb-Out)	2	EA	$24,500.00	$49,000.00	Lump sum cost for 6' wide bulbout, and 20' length; includes disabled access ramp.
Signalizing Fairview Road **	1	LS	$11,300.00	$11,300.00	Includes all components in order to signalize right turn. See note below.
PCC Sidewalk (4" Thick, 4' Wide)	10,229	LF	$36.00	$368,244.00	Assume sidewalk is widened for entire length of multi-use path; widened an average of 4' throughout.
Curb Corner Ramp (ADA)	13	EA	$3,500.00	$45,500.00	Include warning surface half-dome.
Curb Mid-Block Ramp (ADA)	1	EA	$3,700.00	$3,700.00	Include warning surface half-dome. For transition from Bike Route to multi-use path at OCC.
Pedestrian Refuge Island	1	EA	$12,000.00	$12,000.00	$10,000 (2005); rate of inflation applied. Island for intersection at Longwood Ct.
Signing/Striping					
Continental Crosswalk	202	LF	$7.80	$1,575.60	Based on continental crosswalk with 1' bars with 1' spacing between.
Sign on Existing Pole	4	EA	$175.00	$700.00	"Bike Route" + "Begin" and "Bike Route" + "End" signs.
Sign on New Pole	10	EA	$375.00	$3,750.00	Driveway signage (1 sign/driveway); Longwood Ct. exit taken to be driveway as well.
Centerline Striping (Class I)	10,229	LF	$1.00	$10,229.00	Assumed for entire length of multi-use path.
Pavement Markings (Green Paint)	275	SF	$5.00	$1,375.00	Green paint for driveway crossings.
Slurry Seal	0	SF	$1.00	$-	
			SUBTOTAL	$1,353,386.60	
Contingency	20%	%	$270,677.32	$270,677.32	
Design Support During Construction	10%	%	$135,338.66	$135,338.66	
			TOTAL	$1,759,402.58	

*SF = Square Foot, LF = Linear Foot, LM = Linear Mile, EA = Each, LS = Lump Sum, PI = Per Intersection

** Signalizing Fairview Road: The signalization cost is taken to include the cost of two Type-1 signal poles ($8,000), two APS units ($1,800), and two

PROJECT 2 COST ESTIMATE:
EL CAMINO DRIVE, MENDOZA DRIVE, AND PAULARINO CHANNEL

ITEM	QUANTITY	UNIT*	UNIT COST	COST	NOTES
Installation/Construction					
Traffic Circle (Small)	3	EA	$20,000.00	$60,000.00	1-lane approaches.
Curb Corner Ramp (ADA)	1	EA	$3,500.00	$3,500.00	Include warning surface half-dome. Enhanced ramp for St. Clair St. - Bear St. intersection.
Chicanes **	1	LS	$21,392.00	$21,392.00	Include cost of curb and gutter ($10,150) and landscaping ($11,242).
Class I Path Construction	1.17	LM	$1,000,000.00	$1,170,000.00	
Signing/Striping					
Continental Crosswalk	185	LF	$7.80	$1,443.00	Based on continental crosswalk with 1' bars with 1' spacing between.
Sign on Existing Pole	8	EA	$175.00	$1,400.00	"Bike Route" + "Begin" and "Bike Route" + "End" signs.
Sharrows (Spaced 250' Apart)	11	EA	$325.00	$3,575.00	Along bike route segment (2,755' in length).
Slurry Seal	0	SF	$1.00	$-	
			SUBTOTAL	$1,261,310.00	
Contingency	20%	%	$252,262.00	$252,262.00	
Design Support During Construction	10%	%	$126,131.00	$126,131.00	
			TOTAL	$1,639,703.00	

*SF = Square Foot, LF = Linear Foot, LM = Linear Mile, EA = Each, LS = Lump Sum, PI = Per Intersection

** Chicanes: The cost of chicanes is taken to include the cost of curb and gutter installation ($4.00/LF) and landscaping ($3.50/SF).

PROJECT 3 COST ESTIMATE:
BRISTOL STREET FROM BEAR STREET TO NEWPORT BOULEVARD AND PAULARINO CHANNEL

ITEM	QUANTITY	UNIT*	UNIT COST	COST	NOTES
Removal/Relocation					
Remove 4" Striping	2,743	LF	$1.00	$2,743.00	Removal of existing lane striping.
Installation/Construction					
Class I Path Construction			$1,000,000.00	$250,000.00	
Traffic Delineator Post			$75.00	$41,175.00	Spaced 5' apart.
Signing/Striping					
Bike Lane Striping (Extra buffer)	2,743	LF	$20.00	$54,860.00	Price doubled to account for striping needed to fill space between roadway and cycle track.
Bike Lane Symbol w/ Arrow	10	EA	$245.00	$2,450.00	Assumed to be placed on far and near sides of intersections.
Sign on Existing Pole	4	EA	$175.00	$700.00	"Bike Route" + "Begin" and "Bike Route" + "End" signs.
Pavement Markings (Green Paint)	9,170	SF	$5.00	$45,850.00	Green paint for driveway crossings.
Slurry Seal	0	SF	$1.00	$-	
			SUBTOTAL	$397,778.00	
Contingency	20%	%	$79,555.60	$79,555.60	
Design Support During Construction	10%	%	$39,777.80	$39,777.80	
			TOTAL	$517,111.40	

*SF = Square Foot, LF = Linear Foot, LM = Linear Mile, EA = Each, LS = Lump Sum, PI = Per Intersection

PROJECT 4 COST ESTIMATE:
SANTA ANA AVENUE FROM BRISTOL STREET TO UNIVERSITY DRIVE

ITEM	QUANTITY	UNIT*	UNIT COST	COST	NOTES
Removal/Relocation					
Remove 4" Striping	416	LF	$1.00	$416.00	
Remove 12" Striping	725	LF	$3.55	$2,573.75	Removal of double-yellow filed under this category to be conservative.
Remove Arrow/Word/Symbol	10	EA	$100.00	$1,000.00	
Installation/Construction					
Pedestrian Hybrid Beacon (PHB)	1	EA	$89,500.00	$89,500.00	
Traffic Circle (Small)	1	EA	$20,000.00	$20,000.00	1-lane approaches.
Traffic Delineator Post	428	EA	$75.00	$32,100.00	Spaced 5' apart.
Signing/Striping					
12" Paint (Solid)	152	LF	$2.60	$395.20	Installation of double-yellow filed under this to be conservative.
Bike Lane Striping (Extra buffer)	2,142	LF	$20.00	$42,840.00	Price doubled to account for striping needed to fill space between roadway and bike track.
Bike Lane Symbol w/ Arrow	12	EA	$245.00	$2,940.00	Assumed to be placed on far and near sides of intersections.
Sign on Existing Pole	4	EA	$175.00	$700.00	"Bike Route" + "Begin" and "Bike Route" + "End" signs.
Sharrows (Spaced 250' Apart)	5	EA	$325.00	$1,625.00	Along bike route segment (1,246' in length).
Slurry Seal	0	SF	$1.00	$-	
			SUBTOTAL	$194,089.95	
Contingency	20%	%	$38,817.99	$38,817.99	
Design Support During Construction	10%	%	$19,409.00	$19,409.00	
			TOTAL	$252,316.94	

*SF = Square Foot, LF = Linear Foot, LM = Linear Mile, EA = Each, LS = Lump Sum, PI = Per Intersection

PROJECT 5 COST ESTIMATE:
SANTA ANA AVENUE FROM BRISTOL STREET TO UNIVERSITY DRIVE

ITEM	QUANTITY	UNIT*	UNIT COST	COST	NOTES
Removal/Relocation					
Remove 4" Striping	1,614	LF	$1.00	$1,614.00	
Remove Arrow/Word/Symbol	14	EA	$100.00	$1,400.00	
Installation/Construction					
Speed Bump	2	EA	$4,250.00	$8,500.00	
Traffic Circle (Small)	2	EA	$20,000.00	$40,000.00	1-lane approaches.
Traffic Circle (Large)	1	EA	$30,000.00	$30,000.00	2-lane approaches for Elden Avenue intersection.
Radar Speed Display Sign	2	EA	$18,300.00	$36,600.00	$15,000 (2005); rate of inflation applied.
Signing/Striping					
Bike Box **	2	EA	$708.50	$1,417.00	
Bike Lane Striping (Extra buffer)	1,784	LF	$20.00	$35,680.00	Price doubled to account for striping needed to fill space between roadway and bike track.
Bike Lane Symbol w/ Arrow	4	EA	$245.00	$980.00	Assumed to be placed on far and near sides of intersections.
Sign on Existing Pole	8	EA	$175.00	$1,400.00	"Bike Route" + "Begin" and "Bike Route" + "End" signs.
Sharrows (Spaced 250' Apart)	13	EA	$325.00	$4,225.00	Along bike route segment (3,090' in length).
Slurry Seal	0	SF	$1.00	$-	
			SUBTOTAL	$161,816.00	
Contingency	20%	%	$32,363.20	$32,363.20	
Design Support During Construction	10%	%	$16,181.60	$16,181.60	
			TOTAL	$210,360.80	

*SF = Square Foot, LF = Linear Foot, LM = Linear Mile, EA = Each, LS = Lump Sum, PI = Per Intersection

** Bike Box: The bike box quantity is to include all components within the shaded region of the bike box; these components are the "Bikes Wait Here" text, the bike symbol, and turning arrows.

PROJECT 6 COST ESTIMATE:
SANTA ANA AVENUE FROM BRISTOL STREET TO UNIVERSITY DRIVE

ITEM	QUANTITY	UNIT*	UNIT COST	COST	NOTES
Removal/Relocation					
Remove Curb and Gutter	300	LF	$4.00	$1,200.00	Assumed for full length of planned multi-use path.
Sidewalk Removal (6')	280	LF	$120.00	$33,600.00	
Remove 4" Striping	6,080	LF	$1.00	$6,080.00	Distance doubled to account for striping in both directions.
Remove 12" Striping	3,040	LF	$3.55	$10,792.00	Removal of double-yellow filed under this to be conservative.
Remove Bike Lane Striping	6,080	LF	$3.00	$18,240.00	Removal of bike lane striping, including buffer; distance doubled to account for both directions.
Cabinet/Signal Equipment Relocation	1	EA	$7,500.00	$7,500.00	Those that impede sidewalk widening or multi-use path traffic flow.
Installation/Construction					
Curb and Gutter	793	LF	$25.00	$19,825.00	
PCC Sidewalk (4" Thick, 4' Wide)	8,460	LF	$36.00	$304,560.00	Assume sidewalk is widened an average of 4' throughout; includes ramps to bridge and jug-handles.
Curb Mid-Block Ramp (ADA)	9	EA	$3,700.00	$33,300.00	Include warning surface half-dome. For ramps to bridge and one jug-handle crossing.
Asphalt Pavement (6" Deep)	490	SF	$4.45	$2,180.50	
Landscaping	47	SF	$3.50	$164.50	
Traffic Delineator Post	1,010	EA	$75.00	$75,750.00	Spaced 5' apart.
Signing/Striping					
12" Paint (Solid)	312	LF	$2.60	$811.20	Installation of double-yellow filed under this category to be conservative.
4" Paint (Dashed)	6,080	LF	$0.70	$4,256.00	Assumed for entire length of project (3,040') in both directions.
4" Paint (Double-yellow)	3,040	LF	$2.00	$6,080.00	Assumed for entire length of project (3,040').
Bike Lane Striping (Extra buffer)	3,040	LF	$20.00	$60,800.00	Price doubled to account for striping needed to fill space between roadway and bike lanes.
Bike Lane Symbol w/ Arrow	3	EA	$245.00	$735.00	Assumed to be placed on far and near sides of intersections.
Sign on New Pole	6	EA	$375.00	$2,250.00	Signs for ramps to bridge and jug-handle crossings.
Pavement Markings (Text)	4	EA	$300.00	$1,200.00	
Slurry Seal	249,280	SF	$1.00	$249,280.00	Assumed for entire length of project (3,040') by average road width (82').
			SUBTOTAL	$838,604.20	
Contingency	20%	%	$167,720.84	$167,720.84	
Design Support During Construction	10%	%	$83,860.42	$83,860.42	
			TOTAL	$1,090,185.46	

*SF = Square Foot, LF = Linear Foot, LM = Linear Mile, EA = Each, LS = Lump Sum, PI = Per Intersection

PROJECT 7 COST ESTIMATE:
CANARY DRIVE, TANAGER DRIVE, GOLF COURSE DRIVE, AND ORIOLE DRIVE

ITEM	QUANTITY	UNIT*	UNIT COST	COST	NOTES
Installation/Construction					
Pedestrian Hybrid Beacon (PHB)	2	EA	$89,500.00	$179,000.00	
Traffic Circle (Small)	4	EA	$20,000.00	$80,000.00	1-lane approaches.
Class I Path Construction	0.16	LM	$1,000,000.00	$160,000.00	
Signing/Striping					
Sign on Existing Pole	4	EA	$175.00	$700.00	"Bike Route" + "Begin" and "Bike Route" + "End" signs.
Sharrows (Spaced 250' Apart)	14	EA	$325.00	$4,550.00	Along bike route segment (3,545' in length).
Slurry Seal	0	SF	$1.00	$-	
			SUBTOTAL	$424,250.00	
Contingency	20%	%	$84,850.00	$84,850.00	
Design Support During Construction	10%	%	$42,425.00	$42,425.00	
			TOTAL	$551,525.00	

*SF = Square Foot, LF = Linear Foot, LM = Linear Mile, EA = Each, LS = Lump Sum, PI = Per Intersection

PROJECT 8 COST ESTIMATE:
MERRIMAC WAY/ARLINGTON DRIVE FROM SAN CLEMENTE DRIVE TO NEWPORT BOULEVARD

ITEM	QUANTITY	UNIT*	UNIT COST	COST	NOTES
Removal/Relocation					
Remove Curb and Gutter	2,015	LF	$4.00	$8,060.00	Assumed for full length of planned multi-use path.
Sidewalk Removal (6')	50	LF	$120.00	$6,000.00	
Sign Relocation	18	EA	$50.00	$900.00	Those that impede sidewalk widening or multi-use path traffic flow.
Cabinet/Signal Equipment Relocation	2	EA	$7,500.00	$15,000.00	Those that impede sidewalk widening or multi-use path traffic flow.
Tree Removal/Relocation	3	EA	$450.00	$1,350.00	Those that impede sidewalk widening or multi-use path traffic flow.
Utility Pole Relocation	2	EA	$7,000.00	$14,000.00	Power and light poles.
Roadway Excavation					
Pedestrian Hybrid Beacon (PHB)	1	EA	$89,500.00	$89,500.00	
Driveway	6,850	SF	$12.00	$82,200.00	
Curb and Gutter	130	LF	$25.00	$3,250.00	
PCC Sidewalk (4" Thick, 4' Wide)	2,370	LF	$36.00	$85,320.00	Assume sidewalk is widened for entire length of multi-use path; widened an average of 4' throughout.
Curb Mid-Block Ramp (ADA)	2	EA	$3,700.00	$7,400.00	Include warning surface half-dome. For transition from Bike Route to multi-use path at OCC.
Class I Path Construction	0.69	LM	$1,000,000.00	$690,000.00	
Signing/Striping					
12" Paint (Solid)	120	LF	$2.60	$312.00	Installation of double-yellow filed under this category to be conservative.
Bike Box **	1	EA	$708.50	$708.50	
Bike Lane Striping (Extra buffer)	10,200	LF	$20.00	$204,000.00	Price doubled to account for striping needed to fill space between roadway and bike track.
Bike Lane Symbol w/ Arrow	5	EA	$245.00	$1,225.00	Assumed to be placed on far and near sides of intersections.
Continental Crosswalk	619	LF	$7.80	$4,828.20	Based on a continental crosswalk with 1' bars with 1' spacing between.
Sign on New Pole	6	EA	$375.00	$2,250.00	Jug-handle crossing sign and driveway signs between Harbor Blvd. and OCC.
Sharrows (Spaced 250' Apart)	22	EA	$325.00	$7,150.00	Assumed for bike boulevard and bike route.
Pavement Markings (Text)	2	EA	$300.00	$600.00	
Slurry Seal	0	SF	$1.00	$-	
			SUBTOTAL	$1,259,243.70	
Contingency	20%	%	$251,848.74	$251,848.74	
Design Support During Construction	10%	%	$125,924.37	$125,924.37	
			TOTAL	$1,637,016.81	

*SF = Square Foot, LF = Linear Foot, LM = Linear Mile, EA = Each, LS = Lump Sum, PI = Per Intersection

** Bike Box: The bike box quantity is to include all components within the shaded region of the bike box; these components are the "Bikes Wait Here" text, the bike symbol, and turning arrows.

PROJECT 9 COST ESTIMATE:
FAIRVIEW ROAD FROM FAIR DRIVE TO WEST WILSON STREET

ITEM	QUANTITY	UNIT*	UNIT COST	COST	NOTES
Removal/Relocation					
Remove 4" Striping	15,270	LF	$1.00	$15,270.00	Includes removal of bike lane and lane striping in both directions along entire length of project.
Remove Arrow/Word/Symbol	10	EA	$100.00	$1,000.00	
Installation/Construction					
Traffic Delineator Post	1,018	EA	$75.00	$76,350.00	Spaced 5' apart.
Signing/Striping					
Bike Box *	2	EA	$708.50	$1,417.00	
Bike Lane Striping (Extra buffer)	5,090	LF	$20.00	$101,800.00	Price doubled to account for striping needed to fill space between roadway and bike track.
Continental Crosswalk	109	LF	$7.80	$850.20	Based on continental crosswalk with 1' bars with 1' spacing between. (N-S only @ W Wilson St.)
Pavement Markings (Green Paint)	590	SF	$5.00	$2,950.00	Green paint for driveway crossings.
Slurry Seal	0	SF	$1.00	$-	
			SUBTOTAL	$199,637.20	
Contingency	20%	%	$39,927.44	$39,927.44	
Design Support During Construction	10%	%	$19,963.72	$19,963.72	
			TOTAL	$259,528.36	

*SF = Square Foot, LF = Linear Foot, LM = Linear Mile, EA = Each, LS = Lump Sum, PI = Per Intersection

** Bike Box: The bike box quantity is to include all components within the shaded region of the bike box; these components are the "Bikes Wait Here" text, the bike symbol, and turning arrows.

PROJECT 10 COST ESTIMATE:
EAST/WEST WILSON STREET FROM FAIRVIEW ROAD TO SANTA ANA AVENUE

ITEM	QUANTITY	UNIT*	UNIT COST	COST	NOTES
Removal/Relocation					
Remove Curb and Gutter	377	LF	$4.00	$1,508.00	Assumed for full length of planned multi-use path.
Remove 4" Striping	910	LF	$1.00	$910.00	
Remove 12" Striping	345	LF	$3.55	$1,224.75	Removal of double-yellow filed under this category to be conservative.
Remove Arrow/Word/Symbol	14	EA	$100.00	$1,400.00	
Installation/Construction					
Pedestrian Hybrid Beacon (PHB)	1	EA	$89,500.00	$89,500.00	At Santa Ana Ave.
Curb and Gutter	430	LF	$25.00	$10,750.00	
Modify Controller	1	EA	$7,500.00	$7,500.00	Cost of signal modification for lead bike/pedestrian intervals.
Traffic Circle (Small)	2	EA	$20,000.00	$40,000.00	1-lane approaches.
PCC Sidewalk (4" Thick, 4' Wide)	2,930	LF	$36.00	$105,480.00	Bulb-outs.
Curb Corner Ramp (ADA)	11	EA	$3,500.00	$38,500.00	
Signing/Striping					
12" Paint (Solid)	345	LF	$2.60	$897.00	Installation of double-yellow filed under this category to be conservative.
4" Paint (Solid)	710	LF	$1.20	$852.00	
4" Paint (Dashed)	305	LF	$0.70	$213.50	
Bike Box **	6	EA	$708.50	$4,251.00	
Bike Lane Striping	2,040	LF	$10.00	$20,400.00	
Bike Lane Symbol w/ Arrow	4	EA	$245.00	$980.00	Assumed to be placed on far and near sides of intersections.
Continental Crosswalk	174	LF	$7.80	$1,357.20	Based on continental crosswalk with 1' bars with 1' spacing between. (E-W only @ W Wilson St.)
Sign on Existing Pole	8	EA	$175.00	$1,400.00	"Bike Lane" + "Begin" and "Bike Lane" + "End" signs.
Sharrows (Spaced 250' Apart)	10	EA	$325.00	$3,250.00	Along bike route segment (2,460' in length).
Pavement Markings (Green Paint)	645	SF	$5.00	$3,225.00	Green paint for driveway crossings.
Slurry Seal	0	SF	$1.00	$-	
			SUBTOTAL	$333,598.45	
Contingency	20%	%	$66,719.69	$66,719.69	
Design Support During Construction	10%	%	$33,359.85	$33,359.85	
			TOTAL	$433,677.99	

*SF = Square Foot, LF = Linear Foot, LM = Linear Mile, EA = Each, LS = Lump Sum, PI = Per Intersection

** Bike Box: The bike box quantity is to include all components within the shaded region of the bike box; these components are the "Bikes Wait Here" text, the bike symbol, and turning arrows.

PROJECT 11 COST ESTIMATE:
VANGUARD WAY/SANTA ISABEL AVENUE FROM FAIR DRIVE TO IRVINE AVENUE

ITEM	QUANTITY	UNIT*	UNIT COST	COST	NOTES
Installation/Construction					
Speed Bump	3	EA	$4,250.00	$12,750.00	
Traffic Circle (Small)	3	EA	$20,000.00	$60,000.00	1-lane approaches.
Signing/Striping					
Bike Box **	5	EA	$708.50	$3,542.50	
Bike Lane Striping (Extra buffer)	535	LF	$20.00	$10,700.00	Price doubled to account for striping needed to fill space between roadway and bike track.
Bike Lane Symbol w/ Arrow	3	EA	$245.00	$735.00	Assumed to be placed on far and near sides of intersections.
Sign on Existing Pole	8	EA	$175.00	$1,400.00	"Bike Route" + "Begin" and "Bike Route" + "End" signs.
Sharrows (Spaced 250' Apart)	24	EA	$325.00	$7,800.00	Along bike route segment (2,460' in length).
Slurry Seal	0	SF	$1.00	$-	
		SUBTOTAL		$96,927.50	
Contingency	20%	%	$19,385.50	$19,385.50	
Design Support During Construction	10%	%	$9,692.75	$9,692.75	
		TOTAL		$126,005.75	

*SF = Square Foot, LF = Linear Foot, LM = Linear Mile, EA = Each, LS = Lump Sum, PI = Per Intersection

** Bike Box: The bike box quantity is to include all components within the shaded region of the bike box; these components are the “Bikes Wait Here” text, the bike symbol, and turning arrows.

PROJECT 12 COST ESTIMATE:
MESA VERDE DRIVE EAST/PETERSON PLACE FROM ADAMS AVENUE TO ADAMS AVENUE (LOOP)/HARLA AVENUE

ITEM	QUANTITY	UNIT*	UNIT COST	COST	NOTES
Removal/Relocation					
Remove 4" Striping	5,140	LF	$1.00	$5,140.00	
Remove Arrow/Word/Symbol	7	EA	$100.00	$700.00	
Signing/Striping					
Bike Box **	2	EA	$708.50	$1,417.00	
Bike Lane Striping (Extra buffer)	2,140	LF	$20.00	$42,800.00	Price doubled to account for striping needed to fill space between roadway and bike track.
Bike Lane Symbol w/ Arrow	8	EA	$245.00	$1,960.00	Assumed to be placed on far and near sides of intersections.
Continental Crosswalk	218	LF	$7.80	$1,700.40	Based on continental crosswalk with 1' bars with 1' spacing in between.
Sign on Existing Pole	6	EA	$175.00	$1,050.00	"Bike Route" + "Begin" and "Bike Route" + "End" signs.
Sign on New Pole	5	EA	$375.00	$1,875.00	Wayfinding signage.
Sharrows (Spaced 250' Apart)	6	EA	$325.00	$1,950.00	Along bike route segment (2,460' in length).
Slurry Seal	0	SF	$1.00	$-	
			SUBTOTAL	$58,592.40	
Contingency	20%	%	$11,718.48	$11,718.48	
Design Support During Construction	10%	%	$5,859.24	$5,859.24	
			TOTAL	$76,170.12	

*SF = Square Foot, LF = Linear Foot, LM = Linear Mile, EA = Each, LS = Lump Sum, PI = Per Intersection

** Bike Box: The bike box quantity is to include all components within the shaded region of the bike box; these components are the “Bikes Wait Here” text, the bike symbol, and turning arrows.

APPENDIX B:

PRELIMINARY DESIGNS FOR BICYCLE FACILITIES ON ADAMS AVENUE

FIGURE A-1: ADAMS AVENUE EXISTING CONDITIONS

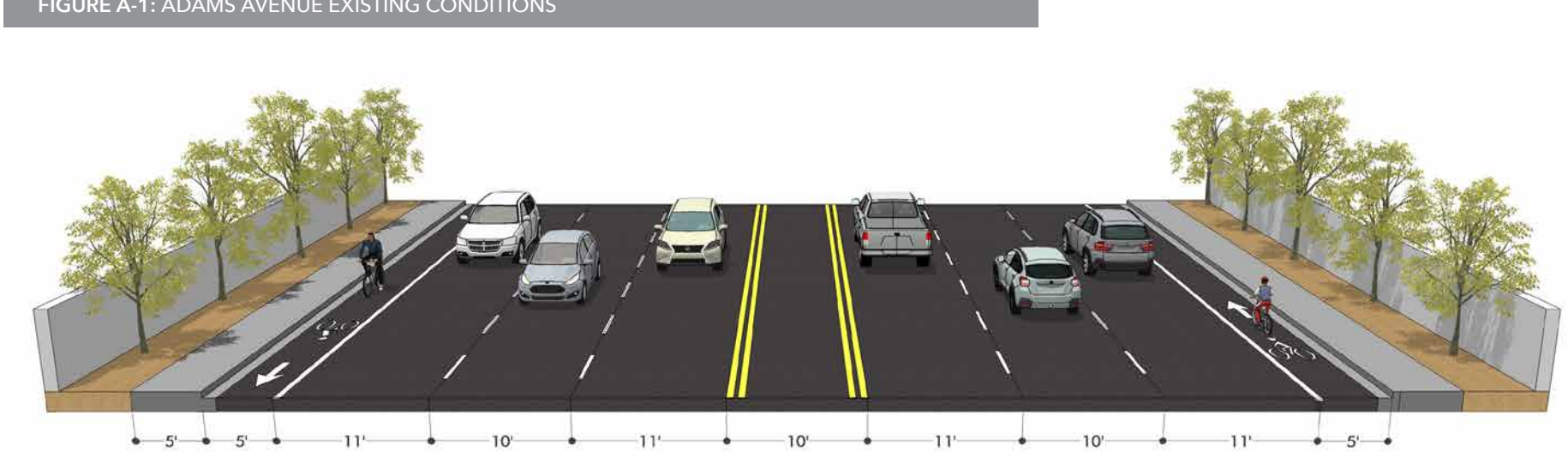


FIGURE A-2: ALTERNATIVE DESIGN 1 - BIKE LANES WITH DELINEATORS & STRIPING (NOT SELECTED)

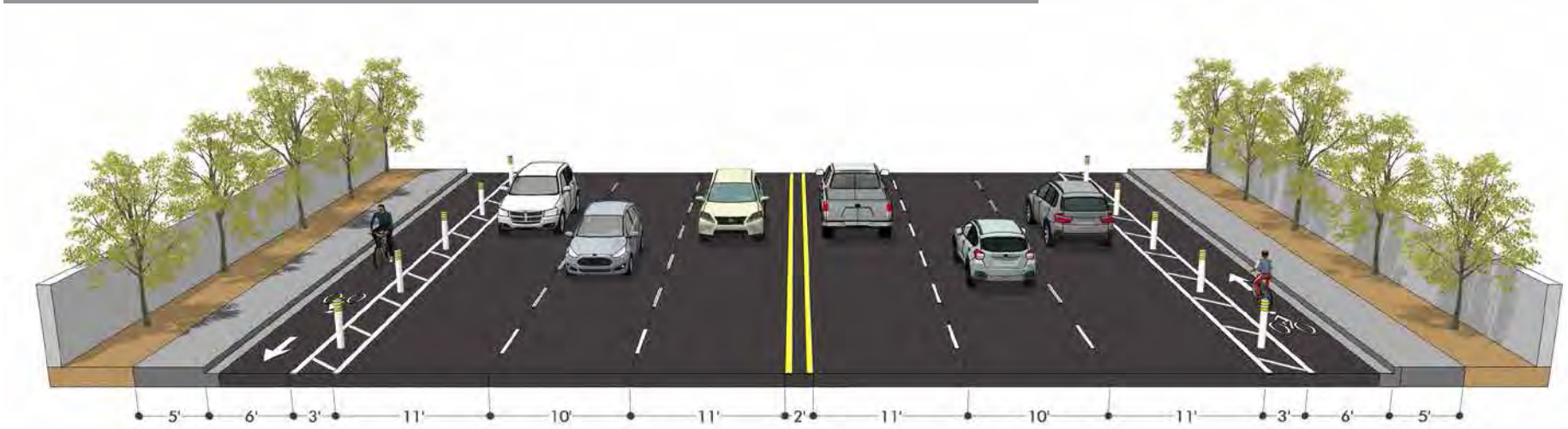


FIGURE A-3: ALTERNATIVE DESIGN 2 - BIKE LANES WITH RAISED BUFFER (NOT SELECTED)

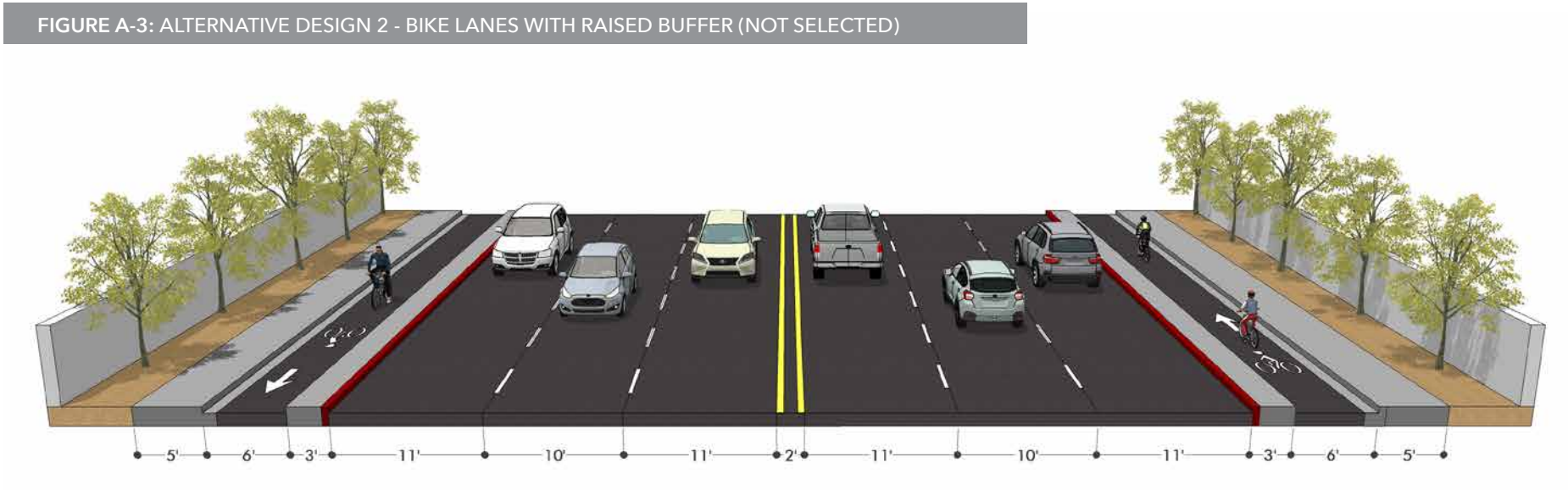


FIGURE A-4: ALTERNATIVE DESIGN 3 - RAISED BIKE LANES WITH BUFFER (NOT SELECTED)

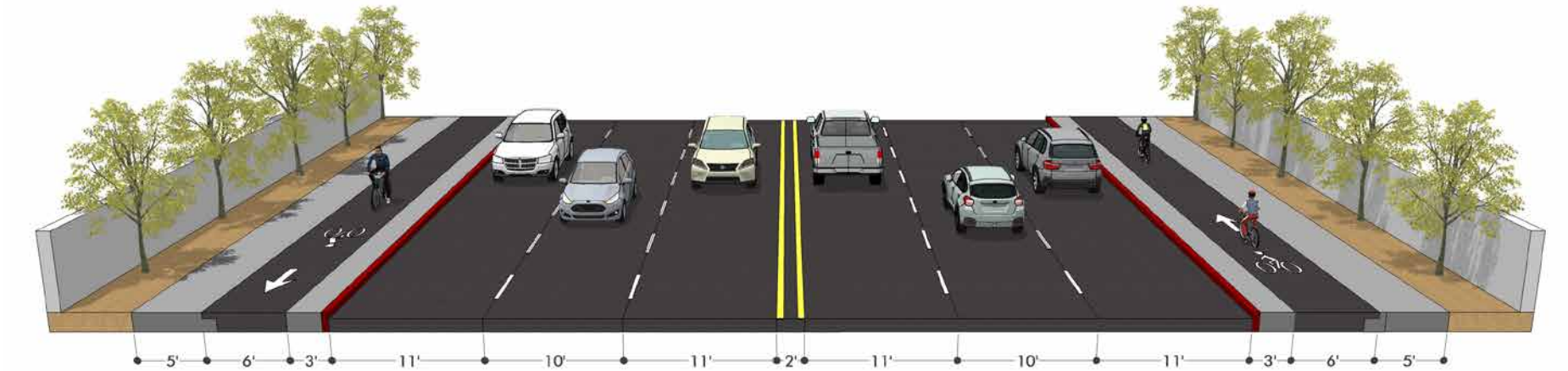
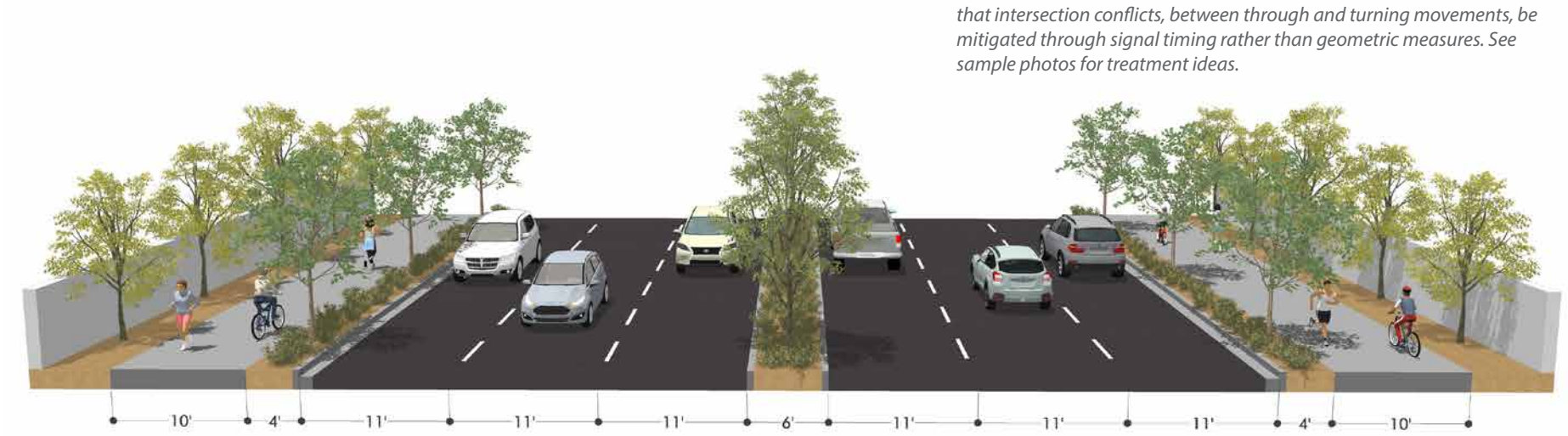


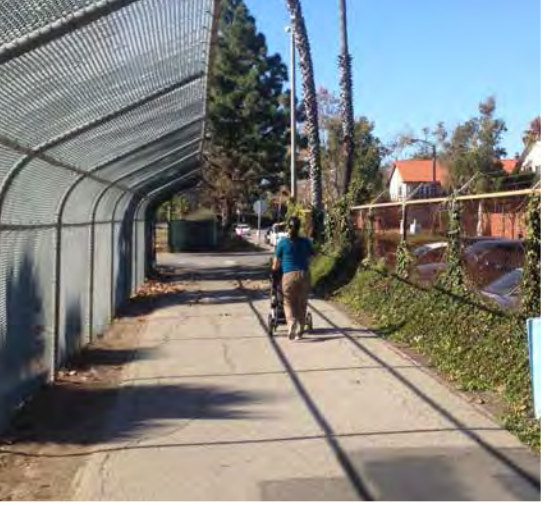
FIGURE A-5: ALTERNATIVE 4 - ADAMS AVENUE URBAN TRAIL (SELECTED)

Since this facility is a fully (traffic) separated facility, it will remain so at intersections, using enhanced crosswalk treatments. It is recommended that intersection conflicts, between through and turning movements, be mitigated through signal timing rather than geometric measures. See sample photos for treatment ideas.



Sample treatment for an Urban Trail crossing at a signalized intersection. Photo source: Richard Layman (Indianapolis Cultural Trail, Indianapolis, IN)

Sample treatment for an Multi-Use Path crossing at a stop-controlled intersection. Photo source: John Holloway (Inland Rail Trail, San Marcos, CA)



CITY OF COSTA MESA

MULTI-PURPOSE TRAILS PLAN

APPENDIX C: DESIGN GUIDELINES FOR BICYCLE FACILITIES

TABLE OF CONTENTS

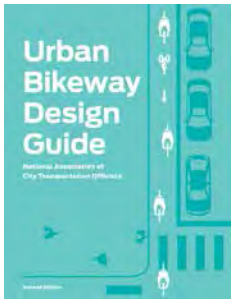
INTRODUCTION

This appendix is intended to assist in the selection and design of bicycle facilities by compiling best practices from public agencies and municipalities nationwide. There are no 'hard and fast' rules for determining the most appropriate type of bicycle facility for a particular location – roadway speeds, volumes, right-of-way width, presence of parking, adjacent land uses, and expected bicycle user types are all critical elements of this decision. Studies find that the most significant factors influencing bicycle use are motor vehicle traffic volumes and speeds. Additionally, most bicyclists prefer facilities separated from motor vehicle traffic or located on local roads with low motor vehicle traffic speeds and volumes. Because off-street pathways are physically separated from the roadway, they are perceived as safe and attractive routes for bicyclists who prefer to avoid motor vehicle traffic.

Consistent use of treatments and application of bikeway facilities allow users to anticipate whether they would feel comfortable riding on a particular facility, and plan their trips accordingly. 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.

Several agencies and organizations provide design standards for bike facilities in the US. The most commonly used manuals that outline these standards are described in the following pages. These standards are referenced throughout the guidelines and should be the first source of information when seeking to implement any of the treatments featured here.

NATIONAL STANDARDS



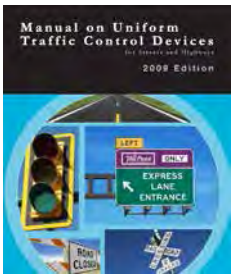
NACTO Urban Bikeway Design Guide (2014)

The National Association of City Transportation Officials' (NACTO) 2014 Urban Bikeway Design Guide is the newest publication of nationally recognized bikeway design standards and offers guidance on current design state of the practice. Its intent 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. Additional information is available at http://nacto.org/publication/urban-bikeway-design-guide/.

Public Rights-of-Way Accessibility Guidelines and ADA Standards for Accessible Design (2010)

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 Public Rights-of-Way Accessibility Guidelines (https://www.access-board.gov/guidelines-and-standards/streets-sidewalks/public-rights-of-way/proposed-rights-of-way-guidelines) and the 2010 ADA Standards for Accessible Design (https://www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-ada-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.

Some 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.

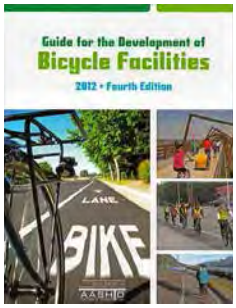


FHA Manual on Uniform Traffic Control Devices (2009)

The Federal Highway Administration's Manual on Uniform Traffic Control Devices (MUTCD) defines the standards used by roadway managers nationwide to install and maintain traffic control devices on all public streets, highways, bikeways and private roadways open to public traffic. The document can be viewed at http://mutcd.fhwa.dot.gov/pdfs/2009r1r2/pdf_index.htm. The FHWA MUTCD forms the basis of the California MUTCD (http://www.dot.ca.gov/hq/traffops/engineering/mutcd/).

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, such as whether it can be implemented or is currently experimental. See Bicycle Facilities and the Manual on Uniform Traffic Control Devices.

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 an online 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 at http://mutcd.fhwa.dot.gov/orsearch.asp.



AASHTO Guide for the Development of Bicycle Facilities (2012)

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 guide can be purchased at https://bookstore.transportation.org/collection_detail.aspx?ID=116.

STATE STANDARDS AND GUIDELINES

California Highway Design Manual (2015)

This manual establishes uniform policies and procedures to carry out highway design functions for the California Department of Transportation. The 2015 edition incorporated bikeway guidance consistent with the new Design Information Bulletin 89 entitled "Class IV Bikeway Guidance (Separated Bikeways/Cycle Tracks). The manual also incorporates design for Complete Streets to address the Department Directive 64 R-1. Addition information is available at http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm.

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. The complete document can be seen at http://www.dot.ca.gov/hq/traffops/engineering/investigations/docs/intersection-guide-bicycles-pedestrians.pdf.

Main Streets: Flexibility in Design & Operations (2005)

This Caltrans booklet is an informational guide that reflects many of the recent updates to the Caltrans manuals and policies that improve multimodal access, livability and sustainability within the transportation system. The document will help users locate information about standards and procedures descried in the Caltrans Highway Design Manual (HDM), the California Manual on Uniform Traffic Control Devices (California MUTCD) and the Project Development Procedures Manual (PDPM). The complete document can be seen at https://www.nh.gov/dot/org/projectdevelopment/highwaydesign/contextsensitivesolutions/documents/CalTrans-Main-streets-flexibility-in-design.pdf.

New Legislation Allowing Safety Standards Other Than Caltrans HDM

AB-1193, signed into law in September 2014, allows local agencies to adopt, by resolution, safety standards for bikeways other than Caltrans' Highway Design Manual. According to the Legislative Analyst, AB-1193 "allows local governments to deviate from state criteria when designing bikeways, but does not give them complete control. Cities and counties that elect to use design criteria not contained within the HDM would have to ensure that the alternative criteria have been reviewed and approved by a qualified engineer, are adopted by resolution at a public meeting and adhere to guidelines established by a national association of public agency transportation officials, such as the National Association of City Transportation Officials." The bill also expands the definition of bikeways to include cycle tracks or separated bikeways, also referred to as "Class IV bikeways," which promote active transportation and provide a right-of-way designated exclusively for bicycle travel adjacent to a roadway and which are protected from vehicular traffic. Types of separation include, but are not limited to, grade separation, flexible posts, inflexible physical barriers, or on-street parking.

NCHRP Legal Research Digest 53: Liability Aspects of Bikeways (2010)

This digest is a useful resource for city staff considering innovative engineering solutions to localized issues. The document addresses the liability of public entities for bicycle collisions on bikeways as well as on streets and highways. The report will be useful to attorneys, transportation officials, planners, maintenance engineers and all persons interested in the relative rights and responsibilities of drivers and bicyclists on shared roadways. The full document can be seen at http://www.bikeleague.org/sites/default/files/bikeleague/bikeleague.org/programs/bicyclefriendlyamerica/communities/pdfs/nchrp_liability_aspects_of_bikeways.pdf.

BICYCLE FACILITY STANDARDS COMPLIANCE

Some of these bicycle facilities covered by these guidelines are not directly referenced in the current versions of the AASHTO Guide or the California MUTCD, although many of the elements of these treatments are found within these documents. An "X" marking in the following table identifies the inclusion of a particular treatment within the national and state design guides. 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.

FACILITY TYPE	CALIFORNIA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (2014)	AASHTO GUIDE FOR THE DEVELOPMENT OF BICYCLE FACILITIES (2012)	NACTO URBAN BIKEWAY DESIGN GUIDE (2014)
Signed Shared Roadway	X	X	
Marked Shared Roadway	X	X	X
Bicycle Boulevard		X	X
Bicycle Lane	X	X	X
Buffered Bicycle Lane	X	X	X
Cycle Tracks		Called "one-way sidepath"	X
Bike Box	X		X
Bike Lanes at Right Turn Only Lanes	X	X	X
Colored Bike Lanes in Conflict Areas	FHWA Interim Approval Granted	X	X
Combined Bike Lane/Turn Lane	X		X
Two-Staged Turn Queue Boxes			
Intersection Crossing Markings	X	X	X
Wayfinding Sign Types & Placement	X	X	X
Wayfinding Sign Placement	X	X	X
Shared-Use Path	X	X	X
Active Warning Beacons	X	X	X
Pedestrian Hybrid Beacons	X	X	X

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.

TOPICS IN THIS SECTION:

Signed Shared Roadway (Class III)


Marked Shared Roadway (Enhanced Class III)

Bicycle Boulevard (Enhanced Class III)

SIGNED SHARED ROADWAY

Description

Class 3 facilities are generally located on roadways with lower speeds and lower traffic volumes. Class 3 facilities are designated as roadways with no striped bicycle lanes, but include signage to indicate the roadway is a bicycle route. Shared roadways 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

"Bike Route" sign (D11-1) is intended for use where no unique designation of routes is desired. However, when used alone, this sign conveys very little information.

A "Share the Road" sign (W16-1p) may be used in conjunction with a bicycle warning sign (W11-1) to warn drivers to watch for slower forms of transportation

Directional changes should be signed with appropriate arrow sub-plaques or directional signage

"May Use Full Lane" sign (R4-11) sign may be used:

- Where there are no bicycle lanes or adjacent shoulders usable by cyclists
- Where travel lanes are too narrow for cyclists and motor vehicles to safely operate side-by-side
- Where it is important to inform all road users that cyclists may occupy the travel lane

Discussion

A Bicycle May Use Full Lane sign (R4-11) may be used on a lane that is too narrow for a bicycle and an automobile to share the road side by side within the same lane).

Materials and Maintenance

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

Additional References and Guidelines

- AASHTO Guide for the Development of Bicycle Facilities 2012
- California MUTCD 2014

MUTCD D11-1

MUTCD R4-11


MUTCD W11-1

MUTCD W16-1p

MARKED SHARED ROADWAY

Description

The shared lane marking (SLM) or "Sharrow" is commonly used where vehicle parking is provided adjacent to the travel lane. The center of the marking should be located a minimum of 11 feet from the curb face or edge of the road. If used on a street without on-street parking that has an outside travel lane less than 14 feet wide, the centers of the Shared Lane Markings should be at least four feet from the face of the curb, or from the edge of the pavement where there is no curb. (Note that these criteria are evolving and that it is now common practice to place SLMs in the center of the rightmost travel lane.)

Guidance

Shared lane markings may be considered in the following situations:

- On roadways with speeds of 40 mph or less (CA MUTCD).
- On constrained roadways too narrow to stripe with bicycle lanes.
- To delineate space within a wide outside lane where cyclists can be expected to ride.
- On roadways where it is important to increase vehicle driver awareness of cyclists.
- On roadways where cyclists tend to ride too close to parked vehicles.

Discussion

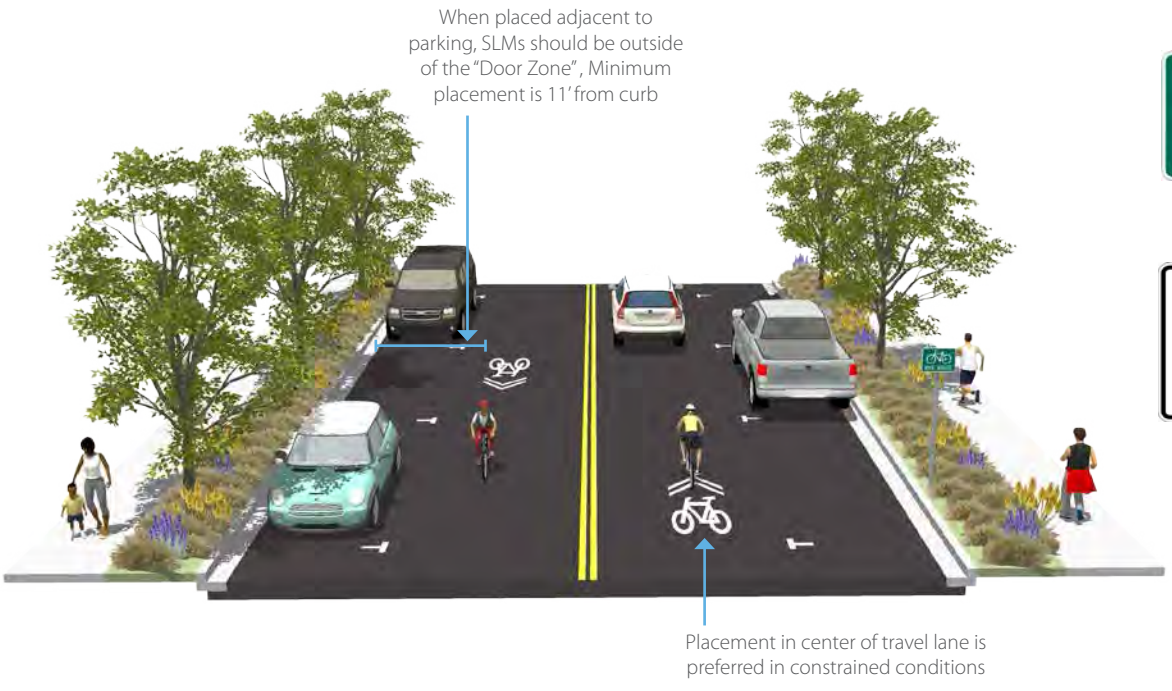
Bike Lanes should be considered on roadways with outside travel lanes wider than 15 feet, or where other lane narrowing or removal strategies may provide adequate road space. SLMs shall not be used on shoulders, on designated Bike Lanes, or to designate Bicycle Detection at signalized intersections.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

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.

Additional References and Guidelines

- Caltrans HDM Chapter 300
- California MUTCD 2014
- NACTO Urban Bikeway Design Guide 2014
- Model Design Manual of Living Streets 2011
- FHWA MUTCD Interim Approval for Optional Use of Green Colored Pavement for Bike Lanes (IA-14)



MUTCD D11-1

MUTCD R4-11

BICYCLE BOULEVARD

Description

Bicycle boulevards are low-volume, low-speed streets modified to enhance bicyclist comfort 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.

Guidance

- Signs and pavement markings are minimum treatments necessary to designate a street as a bicycle boulevard.
- Bicycle boulevards should have a maximum posted speed of 25 mph. Use traffic calming to maintain an 85th percentile speed below 22 mph.
- Implement volume control treatments based on bicycle boulevard context, using engineering judgment. Target motor vehicle volumes range from 1,000 to 3,000 vehicles per day.
- Intersection crossings should be designed to enhance safety and minimize delay for bicyclists, discouraging similar through-trips by non-local motorized traffic.

Discussion

The term "bicycle boulevard" implies a facility that encourages bicycle usage while reducing motor vehicle volumes and/or speeds to a greater extent than on a typical Class III route. Methods used may include preferential treatment such as turn restrictions, contra-flow access through one-way streets, exclusive traffic signal phases, or the reorientation of stop sign control to favor the bicycle boulevard. Traffic calming techniques may include curb extensions, chokers, traffic circles, roundabouts, speed humps, turn restrictions or barricades.

Materials and Maintenance

Vegetation should be regularly trimmed to maintain visibility and attractiveness.

Additional References and Guidelines

- Caltrans HDM Chapter 300
- California MUTCD 2014
- NACTO Urban Bikeway Design Guide, 2014
- AASHTO Guide for the Development of Bicycle Facilities 2012
- FHWA Mini-Roundabouts 2010

Partial Closures and other volume management tools limit the number of cars traveling on the bicycle boulevard

Enhanced Crossings: Use signals, beacons, and road geometry to increase safety at major intersections

Curb Extensions: shorten pedestrian crossing distance

Pavement Markings: Shared lane markings are MUTCD compliant and are used in many jurisdictions to mark bicycle boulevards

Mini Traffic Circles: slow drivers in advance of intersections

SEPARATED BIKEWAYS

Designated exclusively for bicycle travel, separated bikeways are segregated from vehicle travel lanes by striping (Class II), or physical measures such as bollards or curbs (Class I Cycle Tracks). 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.

TOPICS IN THIS SECTION:

Bicycle Lane (Class II)


Buffered Bicycle Lanes (Enhanced Class II)


Cycle Tracks (Class IV)

BICYCLE LANE (CLASS II)

Description

This facility provides an exclusive lane for one-way bicycle travel on a street or highway, installed along streets in corridors where there is significant bicycle demand, and where there are distinct needs that can be served by them. On streets with on-street parking, bicycle lanes are located between the parking area and the traffic lanes and used in the same direction as motor vehicle traffic.

In cases where angled or perpendicular parking are provided alongside bicycle lanes, "back-in/head-out" parking is preferred to conventional "head-in/back-out" parking due to improved visibility.

Most people 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

Provide a minimum width of five feet for bicycle lanes located between parking and traffic lanes (six feet preferred).

- Provide a minimum width of four feet if no gutter exists. With a normal two foot gutter, minimum bicycle lane width is five feet.
- Wider bike lanes (up to seven feet) may be preferred alongside arterials with high travel speeds. (Greater widths may encourage motor vehicle use of bike lane.)

Site bike lane a sufficient distance from parked vehicles to prevent conflicts and increase comfort.

- Alongside parallel parking, a distance of 14.5 feet from the curb face to the edge of bike lane is preferred (12 feet minimum).
- Alongside back-in angle parking, a distance of 16 feet from the curb face to the edge of the bike lane is preferred.

When approaching an intersection with right turn only lanes, the bike lane should be transitioned to a through bike lane to the left of the right turn only lane.

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. Consider Buffered Bicycle Lanes when further separation is desired.

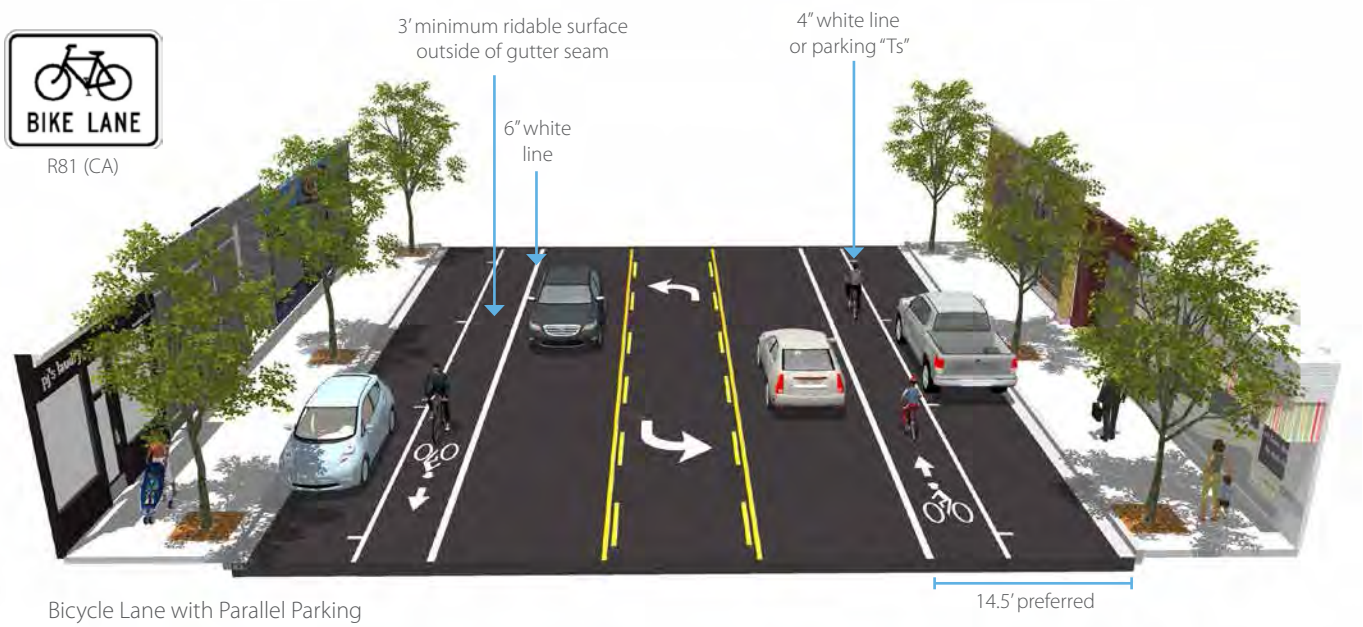
When implementing back-in angle parking, in conjunction with bike lanes, increase compliance (i.e. proper use of the parking spaces) through appropriate signage and enforcement.

Materials and Maintenance

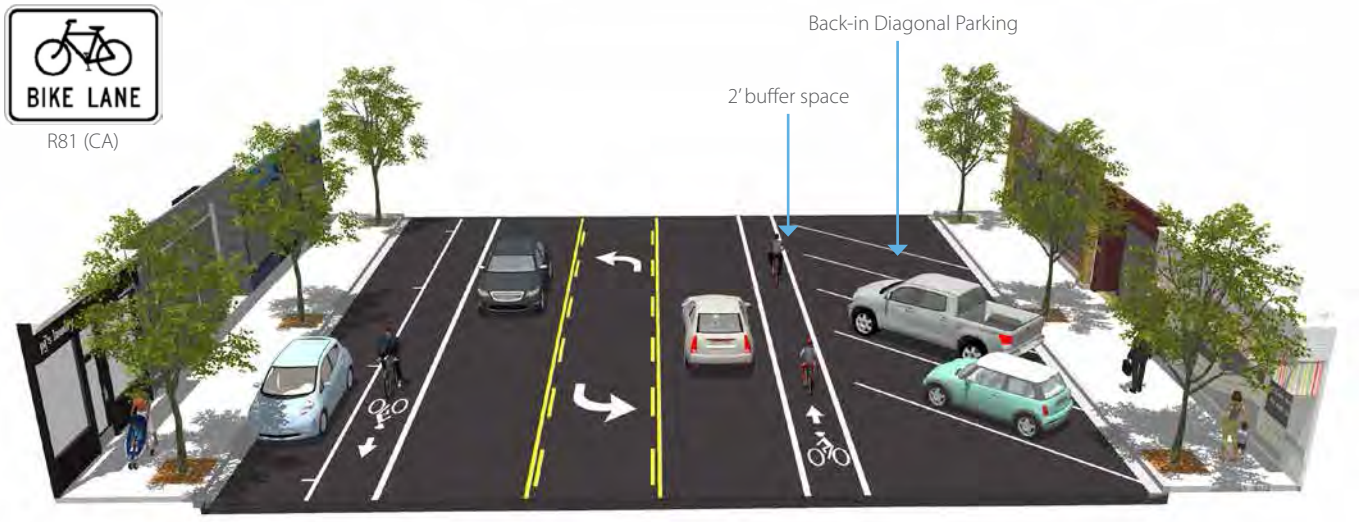
Paint can wear more quickly in high traffic areas or in winter climates. Bicycle lanes should be cleared of snow through routine snow removal operations.

Additional References and Guidelines

- AASHTO Guide for the Development of Bicycle Facilities 2012
- California MUTCD 2014
- NACTO Urban Bikeway Design Guide 2014
- Caltrans California HDM 2012
- Back-in/Head-out Angle Parking, Nelson/Nygaard Consulting Associates 2005
- City of Los Angeles Bicycle Plan Update



Bicycle Lane with Parallel Parking



Bicycle Lane with Back-in Diagonal Parking

BUFFERED BICYCLE LANE (ENHANCED CLASS II)

Description

Buffered Bike Lanes are defined in the Urban Bikeway Guide as "conventional bike lanes paired with a buffered space separating the bike lane from the adjacent motor vehicle travel lane and/or parking lane." Buffered bike lanes are allowed as per California 2014 MUTCD guidelines for buffered preferential lanes (section 3D-01).

Conventional bike lanes typically provide 5 to 6 foot wide space between the curb and travel lane. However, many bicyclists are uncomfortable riding this close to moving traffic particularly on higher speed and/or higher volume roadways. A recent study from Portland Sate titled "Evaluation of innovative bicycle facilities," shows that bicyclists feel a lower risk of being "doored" in a buffered bike lane and nearly nine in ten bicyclists prefer buffered lanes to standard lanes. Seven in ten bicyclists indicated they would go out of their way to ride on a buffered bike lane over a standard lane.

The NACTO Urban Bikeway Design guides list several advantages of buffered lanes including:

- Providing a "shy" distance between motor vehicles and bicyclists.
- Providing space for bicyclists to pass another bicyclist without encroaching into the adjacent motor vehicle travel lane.
- Encouraging bicyclists to ride outside the door zone when buffer is between parked cars and the bike lane.
- Providing a greater space for bicycling without making the bike lane appear so wide that it might be mistaken for a travel or parking lane.
- Appealing to a wider cross-section of bicycling users.
- And encouraging bicycling by contributing to the perception of safety among users of the bicycle network.

There are three types of buffers:

- Parking or side or curb buffer
- Travel lane side buffer
- Combined side or double buffer

Parking Side or Curb Buffers

Parking or curb side buffers provide space between the bicyclist and parked cars or the gutter pan. This (1) reduces the potential for a bicyclist to strike a car door being opened by a driver, (2) eliminates use of the gutter pan as part of the bike lane, and (3) moves the bicyclist out of the blind spots of motorists approaching on the side streets or driveways.
The limitation to the parking side or curb side buffer is that they do not provide the "shy space" that makes bicyclists feel more comfortable, but they do reduce the risk of dooring and the use of the gutter pan as part of the bike lane.

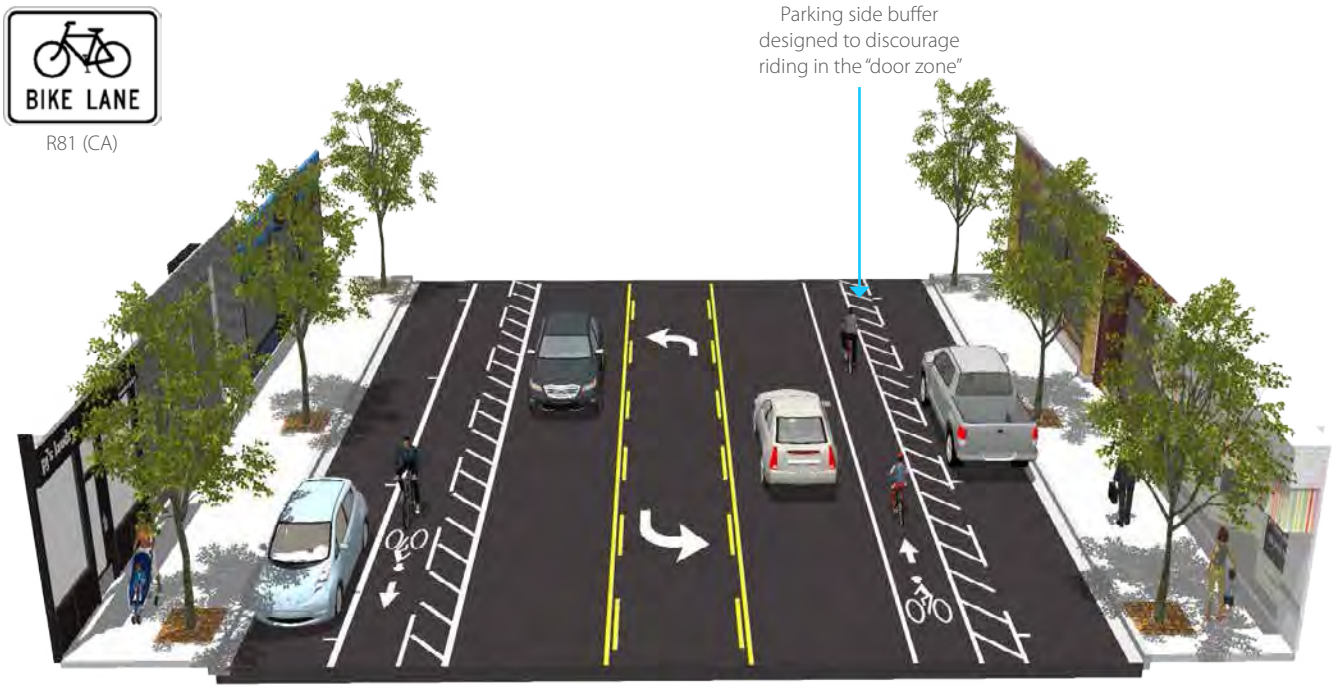
Travel Side Buffer

Travel side buffers provide space between the bicyclist and motor vehicles in the travel lane. High speed, high volume roadways make many bicyclists uncomfortable. Recent studies from the Portland State have shown that a simple buffer substantially increases the level of comfort for most bicyclists.
Combined side or double sided buffer:
The combined side or double sided buffer offers the advantage of guiding the bicyclists away from the door zone while providing a perceived safer distance between the bicyclist and the motor vehicles.

Guidance

According to California MUTCD 2014- Section 3D Buffered bike lanes are considered "allowable" treatments. Signage and dimensional guidelines are the same as for Class 2 bicycle lanes. Additional guidance is included in the NACTO Urban Bikeway Design Guide.

- Bike lane word and/or symbol shall be used (MUTCD Figure 9C-3).
- The buffer shall have interior diagonal cross hatching or chevron markings if it is 3 feet in width or wider.
- The buffer shall be marked with 2 white lines. The California MUTCD 2014 standards (Section 3D.01) are such that for a bicyclist to be allowed to cross a double white line it must be dashed (these are the same standards applied to buffered HOV Lanes). Thus it is recommended that the inside line be dashed instead of solid.
- Buffers should be at least 24 inches wide.



Bicycle Lanes with travel side (left) and parking side (right) buffers

Discussion

Add diagonal striping on the outer buffer adjacent to the traffic lanes every 10 feet. However longitudinal spacing should be determined by engineering judgment considering factors such as speed and desired visual impacts.

- On-street parking remains adjacent to the curb.
- A travel lane may need to be eliminated or narrowed to accommodate buffers.

Materials and Maintenance

Paint can wear more quickly in high traffic areas or in winter climates. Bicycle lanes should be cleared of snow through routine snow removal operations.

Additional References and Guidelines

- NACTO Urban Bikeway Design Guide 2014
- CA MUTCD 2014

CYCLE TRACK (CLASS IV)

Description

Cycle tracks, which were recently designated as Class IV facilities in California, are 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. These differ from buffered lanes in that the bicyclist is separated from the travel lanes by a physical barrier.

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.

Over the past five years more than 100 new separated bike facilities have been added in the US. This relatively new type of facility has been shown to be effective in increasing the number of bicyclists using the street, increasing safety for bicyclists, pedestrians, and motorists and increasing access to local businesses (Lessons from the Green Lanes: Evaluating Protected Bike Lanes in the US, National Institute for Transportation and Communities, 2014)

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.

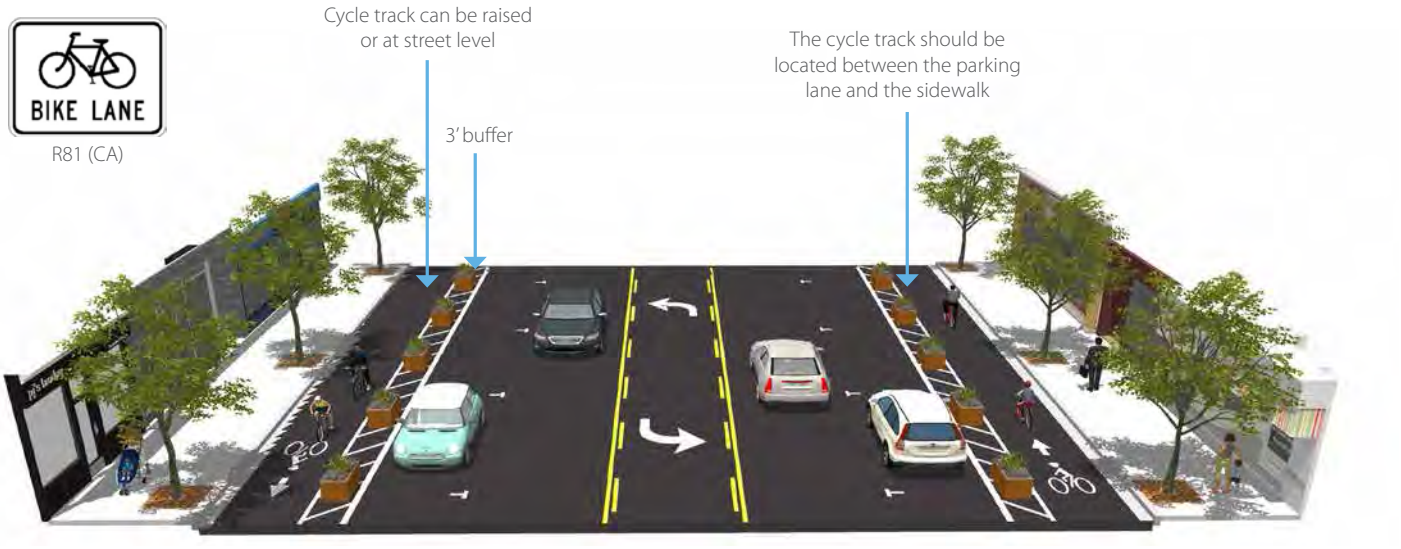
Guidance

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

NACTO Guidelines recommend a 7 foot minimum to allow passing, 5 foot minimum width in constrained locations. Note: In accordance with AB 1193, signed in 2014, the local agency must pass a resolution to adopt NACTO Guidelines in lieu of the Caltrans Highway Design Manual if the one-way cycle track width is less than 9 feet.

- One way cycle tracks can be either conventional flow (i.e., go the same direction as the adjacent traffic) or contra-flow (opposite direction of adjacent traffic flow, such as to the left side of traffic on a one-way street).



One-way Cycle Track

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. Note: In accordance with AB 1193, signed in 2014, the local agency must pass a resolution to adopt NACTO Guidelines in lieu of the Caltrans Highway Design Manual if the two-way cycle track width is less than 12 feet.

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.

Materials and Maintenance

Depending on the width, barrier-separated and raised cycle tracks may require smaller equipment for sweeping. In cities with winter climates, barrier separated and raised cycle tracks may require special equipment for snow removal.

Additional References and Guidelines

- NACTO Urban Bikeway Design Guide 2014
- Lessons from the Green Lanes: Evaluating Protected Bike Lanes in the US, National Institute for Transportation and Communities 2014

Two-way Cycle Track

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.

There are three types of shared-use paths described in this section:

1) Paths in River and Utility Corridors (Class I)
2) Paths in Abandoned Rail Corridors (Class I)
3) Paths in Active Rail Corridors (Class I)

TOPICS IN THIS SECTION:

General Design Practices

Paths in River and Utility Corridors

Paths in Abandoned Rail Corridors

Paths in Active Rail Corridors

Local Neighborhood Accessways

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. Paths should generally provide directional travel opportunities not provided by existing roadways.

Guidance

Width

- 9 feet is the minimum allowed by the HDM for a one-way Class I multi-use path consisting of a 5-foot paved width with 2-foot shoulders on each side.
- 12 feet is the minimum allowed by the HDM for a two-way Class I multi-use path consisting of two 4-foot lanes and 2-foot shoulders on each side. On structures, the clear width of a Class I multi-use path between railings shall not be less than 10 feet.

Lateral Clearance

- The minimum separation between the edge of pavement of a one-way or a two-way multi-use path and the edge of the travel way of a parallel road or street shall be 5 feet plus the standard shoulder width. Prior to 2012, the Highway Design Manual allowed a narrower separation if a physical barrier is included. Since 2012, however, a physical barrier would not result in a reduced separation.

Overhead Clearance

- The minimum vertical clearance allowed by the HDM to obstructions across the width of a multi-use path is 8 feet, and 7 feet over the shoulder.

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

The AASHTO Guide for the Development of Bicycle Facilities generally recommends against the development of shared use paths along roadways.

Materials and Maintenance

Asphalt is the most common surface for Class I paths. The use of concrete for paths has proven to be more durable over the long term.

Additional References and Guidelines

- AASHTO, Guide for the Development of Bicycle Facilities 2012
- California MUTCD 2014
- Caltrans, California HDM 2012

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 power line 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, and must conform to the Caltrans Highway Design Manual if designated as a Class I multi-use path. If additional width allows, wider paths, and landscaping are desirable.
- Any access point to the path should be well-defined with appropriate signage designating the pathway as a bicycle and pedestrian facility and prohibiting motor vehicles.
- Public access to the path may be prohibited during canal/flood control channel or other utility maintenance activities or inclement weather or the prediction of storm conditions

Discussion

Similar to railroads, public access to flood control channels or canals is undesirable by all parties. Appropriate fencing may be required 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.

Materials and Maintenance

For paths that are susceptible to flooding or ponding, permeable pavement is an option to reduce water collection.

Additional References and Guidelines

- AASHTO. Guide for the Development of Bicycle Facilities. 2012.
- California MUTCD. 2014.
- Flink, C. Greenways. 1993.

PATHS IN ABANDONED RAIL CORRIDORS

Description

Commonly referred to as Rails-to-Trails or Rail-Trails, these projects convert vacated rail corridors into off-street paths. Rail corridors offer several advantages, including relatively direct routes between major destinations and generally flat terrain. Gradual railroad grades makes rails-to-trails attractive to many users, and easier to adapt to ADA guidelines.

Guidance

Shared-use paths in abandoned rail corridors should meet or exceed general design practices. If additional width allows, wider paths and landscaping are desirable. In full conversions of abandoned rail corridors, the sub-base, superstructure, drainage, bridges, and crossings are already established. Design becomes a matter of working with the existing infrastructure to meet the needs of a rail-trail.

Discussion

It is often impractical and costly to add material to existing railroad bed fill slopes. This results in trails that meet minimum path widths, but often lack preferred shoulder and lateral clearance widths.

Materials and Maintenance

For paths that are susceptible to flooding or ponding, permeable pavement is an option to reduce water collection.

Additional References and Guidelines

- AASHTO Guide for the Development of Bicycle Facilities 2012
- California MUTCD 2014
- Flink, C. Greenways, 1993

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

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. Furthermore, the railroad operators have their own deign criteria regarding separation from multi-use paths.

Discussion

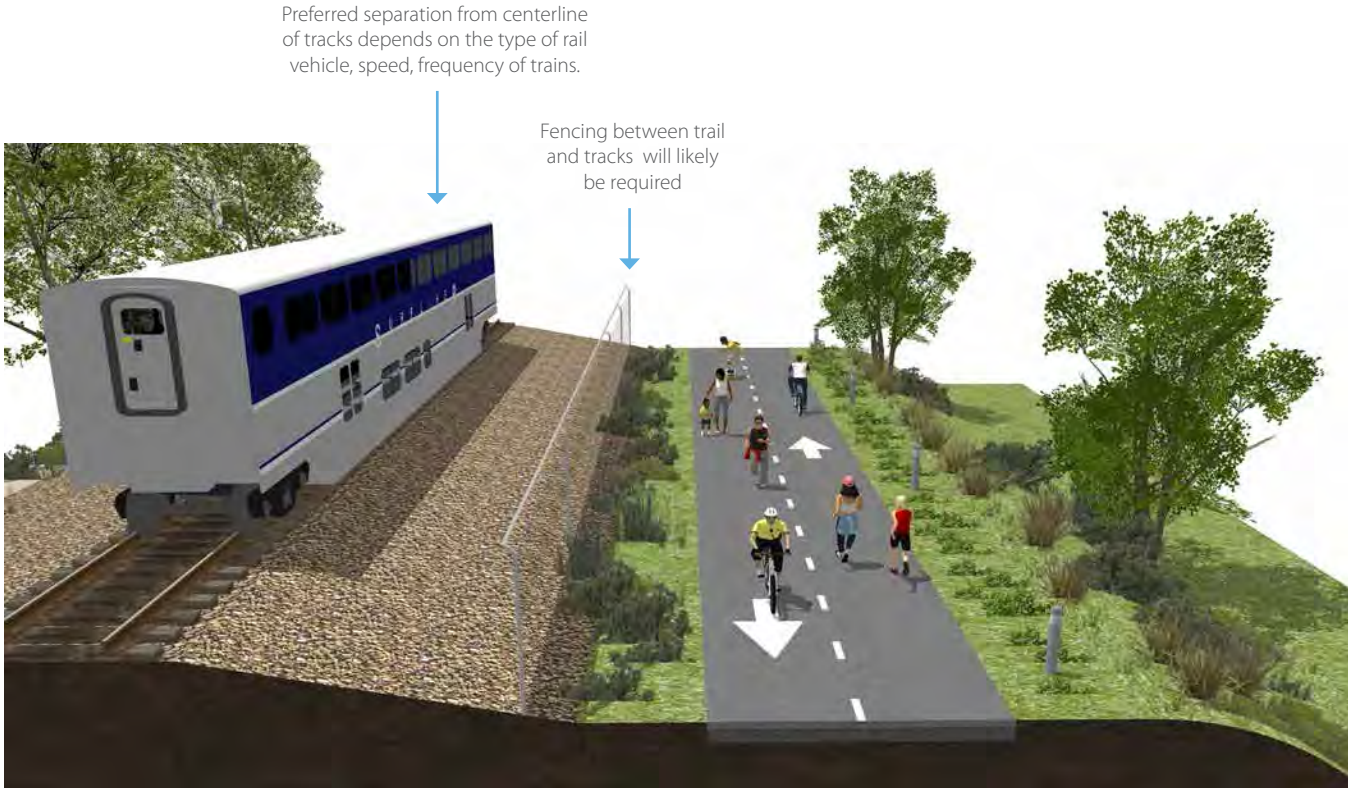
Railroads typically require fencing with all rail-with-trail projects. Concerns with trespassing and security can vary with the amount of train traffic on the adjacent rail line and the setting of the bicycle path, i.e. whether the section of track is in an urban or rural setting.

Materials and Maintenance

For paths that are susceptible to flooding or ponding, permeable pavement is an option to reduce water collection.

Additional References and Guidelines

- AASHTO Guide for the Development of Bicycle Facilities 2012
- California MUTCD 2014
- FHWA Rails-with-Trails: Lessons Learned 2002



LOCAL NEIGHBORHOOD ACCESSWAYS

Description

Neighborhood accessways provide residential areas with direct bicycle and pedestrian access to parks, trails, green spaces, and other recreational areas. They most often serve as small trail connections to and from the larger trail network, typically having their own rights-of-way and easements.
Additionally, these smaller trails can be used to provide bicycle and pedestrian connections between dead-end streets, cul-de-sacs, and access to nearby destinations not provided by the street network.

Guidance

- Neighborhood access should remain open to the public
- Trail pavement shall be at least 8 feet wide to accommodate emergency and maintenance vehicles, meet ADA requirements and be considered suitable for multi-use
- Trail widths should be designed to be less than 8 feet wide only when necessary to protect large mature native trees over 18 inches in caliper, wetlands or other ecologically sensitive areas.
- Access trails should slightly meander whenever possible

Discussion

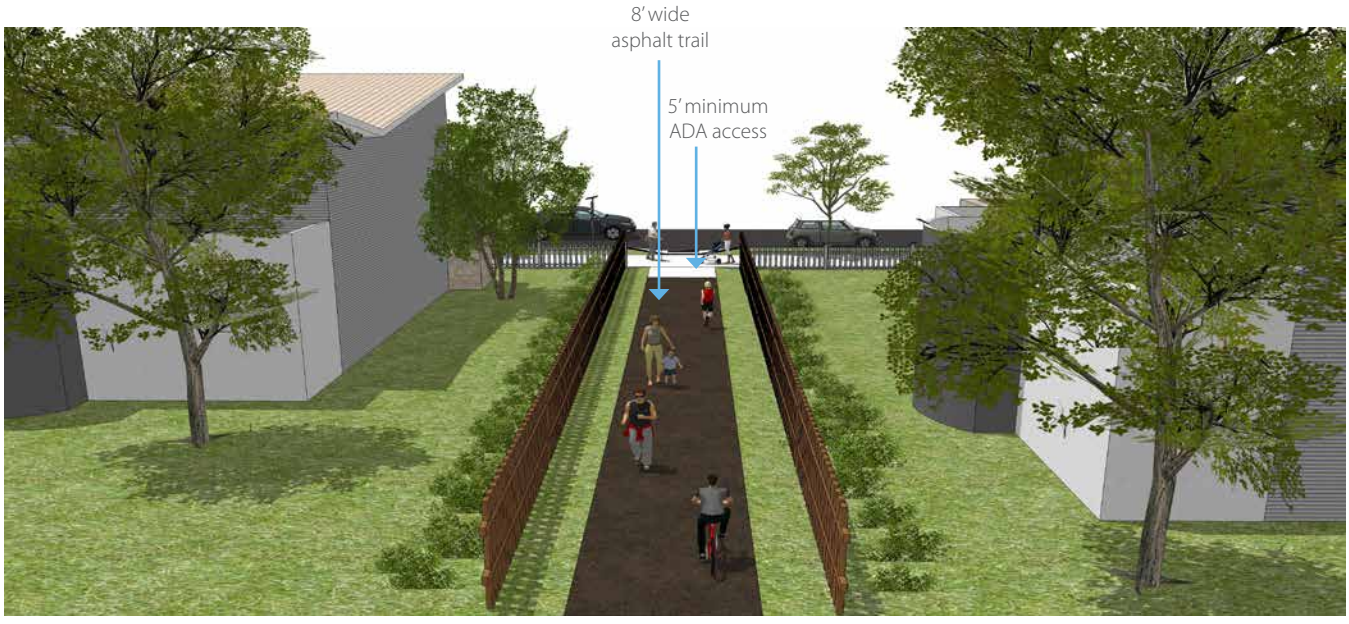
Neighborhood access should be designed into new subdivisions at every opportunity and should be required by City/County subdivision regulations.

Materials and Maintenance

For paths that are susceptible to flooding or ponding, permeable pavement is an option to reduce water collection.

Additional References and Guidelines

- AASHTO Guide for the Development of Bicycle Facilities 2012
- California MUTCD 2014



BIKEWAYS AT INTERSECTIONS AND CROSSINGS

Separated Bikeways at Intersections

Intersections are junctions at which different modes of transportation meet and facilities overlap. 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 other vulnerable road users) 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.

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. In addition to guidance presented in this section, see previous entries for Active Warning Beacons and Pedestrian Hybrid Beacons for other methods for enhancing trail crossings. There are eleven types of intersection/crossing treatments described in this section.

TOPICS IN THIS SECTION:

Protected Intersections

Two-Stage Queue Boxes

Bike Boxes

Jug Handles

Bike Lanes and Right Turn Only Lanes

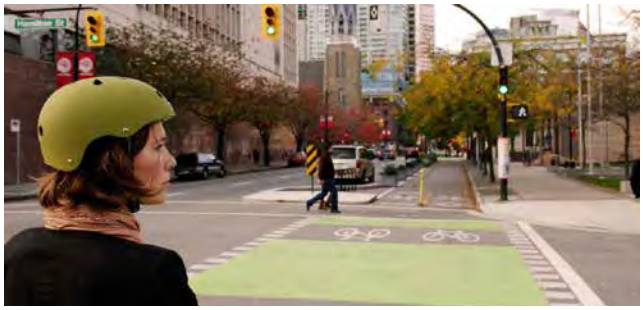
Marked/Unsignalized Crossings

Shared Right Turn Lane

Signalized Crossings

Colored Bike Lanes in Conflict Areas

Overcrossings



Intersection Crossing Markings

PROTECTED INTERSECTION

Description

Developed in The Netherlands, communities across the US are implementing protective treatments for intersections similar to that for protected bike lanes. Protected intersections are important because they maintain the integrity (low-stress experience) of their adjoining protected bike lanes leading by fully separating cyclists from motor vehicles.

Guidance

Hallmark features of these protected intersections include a two-stage crossing supported by the following:

- An advance queuing space protected by small, paved and raised barriers.
- Colored bicycle markings, along crosswalks, through intersections to direct cyclists and alert motorists
- A special signal phase for bicycles (Exclusive Bicycle Phase or Leading Bicycle Interval preferred)
- A red phases for cyclists and motorists, as appropriate, to prevent turning conflicts.
- Integrating with pedestrian crosswalks to avoid bike and pedestrian conflicts.

Discussion

Although mostly experimental in the U.S., they are appropriate to pair with protected bike lanes / cycle tracks. Protected bike lanes at intersections require deliberate design solutions. Protected intersections offer the highest level of clarity and ease of use through design.

Materials and Maintenance

This intersection treatment will require a significant amount of concrete or other durable material, for barriers, and paint or thermoplastic for pavement markings. This treatment also requires bicycle signal heads and phasing. Of all of these features, it is probably the pavement markings that will require the most maintenance.

Additional References and Guidelines

NACTO Urban Bikeway Design Guide 2014

FHWA MUTCD Interpretations, Experimentations, Changes and Interim Approval (IA-14) 2011

TWO-STAGE QUEUE BOXES

Description

A two-stage turn box offers bicyclists a safe way to make left turns at multi-lane signalized intersections from a right side cycle track or bike lane. Bicyclists are often reluctant to weave into traffic to turn left. A two-stage left turn box allows bicyclists to continue straight while the traffic signal displays green for the original direction of travel, during one stage of a traffic signal, and then wait for the second stage when the cross street receives a green light to complete the move.

Guidance

Required design elements include:

- A dedicated queuing area, protected by parked cars or curb extensions, if possible.
- Bicycle symbol and left turn arrow pavement markings; Green paint is optional
- "Right turn on red" prohibition for unprotected queuing areas (to avoid conflicts)
- Leading Bicycle Interval (LBI) signal phasing, if feasible

Discussion

While two stage turns may increase bicyclist comfort in many locations, this configuration typically results in higher average signal delay for bicyclists versus a vehicular style left turn maneuver.

A two-stage turn box to facilitate a jughandle turn at a T-interection is presently allowed in the Federal and California MUTCD. (A two-stage turn box for use other than for a jughandle turn at a T-intersection is experimental.)

Materials and Maintenance

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

Additional References and Guidelines

NACTO Urban Bikeway Design Guide 2014

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.

Discussion

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.

Materials and Maintenance

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

Additional References and Guidelines

- NACTO Urban Bikeway Design Guide 2014
- FHWA MUTCD Interpretations, Experimentations, Changes and Interim Approval (IA-14) 2011

Guidance

Bike boxes are currently experimental treatments and require more data before an official ruling is made by the FHWA. Obtaining experimental approval is a 4-6 week process and evaluation of the treatment is performed for a minimum of one year.

- 10-16 foot depth. Deeper boxes show less encroachment by motor vehicles.
- A "Stop Here on Red" sign should be posted 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.
- Requires permission to experiment from the Federal Highways Administration.

JUG HANDLES

Description

A jug handle is a change in the outer curb lane or striping that allows a cyclist to reposition their direction to take advantage of bike traffic signals, bike crosswalks and actuators that allow for a left turn movement from the right side of the street.

Guidance

- Install jug handles in areas where through traffic is at a speed or volume that it is difficult for all but the most skilled cyclists to make left turns when they are traveling on the right side of the road.
- Design jug handle to start a left hand split from the bike lane early enough to allow slowing and a hard left turn for the cyclist to reposition themselves at a right angle to their previous direction.
- Place a raised median diverter to separate the through movements by other bikes and vehicles, providing a safe haven for cyclists who are waiting for signals to change.
- Use stripes, chevrons, lane markings and green paint with stencil arrow directions to clarify the movement as best as possible if a raised median is not possible.
- Provide a special bike crosswalk that is separated from pedestrian crosswalks.
- Install special bike signals, instructions and actuators that can sense the cyclist or be activated to complete the movement.

Discussion

Because this treatment allows cyclists to make a protected left turn, rather than simply merging with vehicular traffic, it will appeal to a broader range of cyclists (those who identify as "interested, but concerned"). A two-stage turn box to facilitate a jughandle turn at a T-interection is presently allowed in the Federal and California MUTCD.

Materials and Maintenance

This intersection treatment will require a significant amount of concrete or other durable material, for barriers, and paint or thermoplastic for pavement markings. This treatment also requires bicycle signal heads and phasing. Of all of these features, it is probably the pavement markings that will require the most maintenance.

Additional References and Guidelines

- NACTO Urban Bikeway Design Guide 2014
- FHWA MUTCD Interpretations, Experimentations, Changes and Interim Approval (IA-14) 2011

BIKE LANES AND RIGHT TURN ONLY LANES

Description

The appropriate treatment at right-turn lanes is to place the bike lane between the right-turn lane and the right-most through lane or, where right-of-way is insufficient, to use a shared bike lane/turn lane. The design (right) illustrates a bike lane pocket, with signage indicating that motorists should yield to bicyclists through the conflict area.

Guidance

At auxiliary right turn only lanes (add lane):

- Continue existing bike lane width; standard width of 5 to 6 feet or 4 feet in constrained locations.
- Use signage to indicate that motorists should yield to bicyclists through the conflict area.
- Consider using colored conflict areas to promote visibility of the mixing zone. Where a through lane becomes a right turn lane:
- Do not define a dotted line merging path for bicyclists.
- Drop the bicycle lane in advance of the merge area.
- Use shared lane markings to indicate shared use of the lane in the merging zone
- Colored pavement may be used in the weaving area to increase visibility and awareness of potential conflict

Discussion

For other potential approaches to providing accommodations for bicyclists at intersections with turn lanes, please see combined bike lane/turn lane, bicycle signals, and colored bike facilities.

Materials and Maintenance

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

Additional References and Guidelines

- AASHTO Guide for the Development of Bicycle Facilities 2012
- California MUTCD 2014
- NACTO Urban Bikeway Design Guide 2014
- Caltrans California HDM 2012
- Caltrans Complete Intersections 2010

MUTCD R4-4

SHARED RIGHT TURN LANE

Description

The combined bicycle/right turn lane places a standard-width bike lane on the left side of a dedicated right turn lane. A dotted line delineates the space for bicyclists and motorists within the shared lane. This treatment includes signage advising motorists and bicyclists of proper positioning within the 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.

- Bike Lane pocket should have a minimum width of 4 feet with 5 feet preferred.
- A dotted 4 inch line and bicycle lane marking should be used to clarify bicyclist positioning within the combined lane, without excluding cars from the suggested bicycle area.
- A "Right Turn Only" sign with an "Except Bicycles" plaque may be needed to make it legal for through bicyclists to use a right turn lane.

Discussion

Unless the FHWA resumes granting permission to experiment with a combined bike lane/turn lane, this treatment will not be recommended.

Materials and Maintenance

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

Additional References and Guidelines

- NACTO Urban Bikeway Design Guide 2014
- AASHTO Guide for the Development of Bicycle Facilities 2012

COLORED BIKE LANES IN CONFLICT AREAS

Description

The Federal Highway Administrative (FHWA) has granted the State of California approval for optional use of green colored pavement in marked bicycle lanes and in extensions of bicycle lanes through intersections and other traffic conflict areas. It should be noted that the green colored pavement as described under this approval is used for two different situations: first, to denote a lane that is exclusively used for bicyclists and second, to advise motorists and bicyclists that they are sharing the same patch of pavement and should be aware of each other's presence.
Local agencies have adopted different philosophies on the usage of green colored pavement, with some agencies using green paint in bicycle exclusive zones and others restricting its use to conflict zones. Best practices favor the latter application.

Guidance

Jurisdiction must notify Caltrans where the treatment is being installed as part of FHWA's conditions to maintain an inventory list.

In conflict areas:

- Continue existing bike lane width: 5 to 6 feet; 4 feet, in constrained locations.
- Use color to promote visibility of the conflict area
- Use signage to indicate that motorists should yield to bicyclists through the conflict area.

Discussion

The best practices for green colored pavement are still evolving. As of this date, more agencies use green colored pavement for conflict zones than for exclusive bicyclist lanes. The amount of green paint used by such agencies varies dramatically. Some agencies fill the entire conflict zone with solid green paint, while others use a pattern of green stripes. Some agencies use green colored pavement across every driveway, alley and cross streets, while others reserve the use of green colored pavement for conflict zones that merit special attention. The precise design of green colored pavement remains at the discretion of the local agencies.

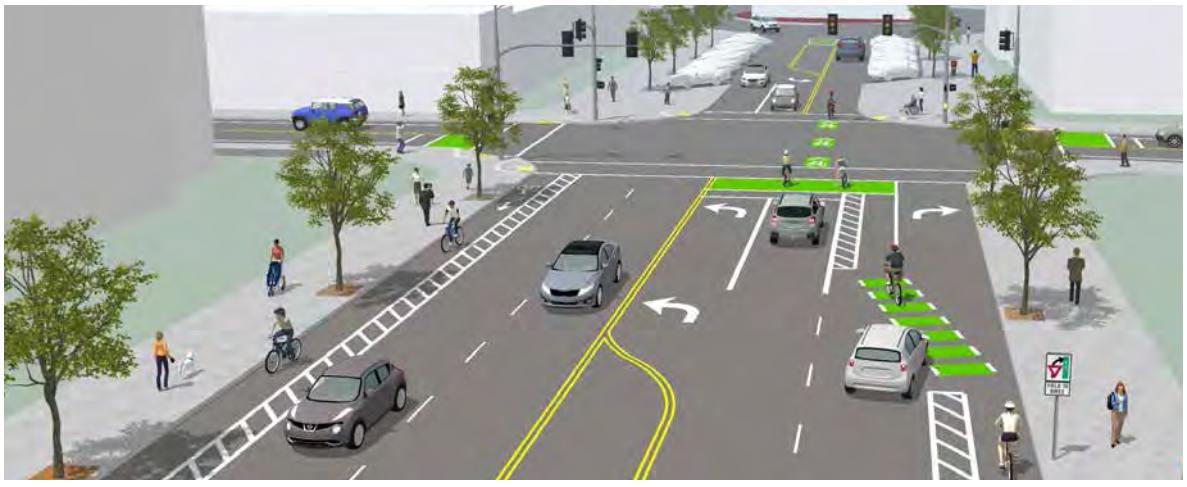
It should be noted that the combination of a shared lane marking ("sharrow") within green colored pavement, is no longer approved for new experimentation by the FHWA. However, the FHWA may accept for experimentation the use of green colored pavement as a "background conspicuity enhancement".

Materials and Maintenance

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

Additional References and Guidelines

- AASHTO Guide for the Development of Bicycle Facilities 2012
- California MUTCD 2014
- NACTO Urban Bikeway Design Guide 2014
- Caltrans California HDM 2012
- Caltrans Complete Intersections 2010



MUTCD R4-4


(optional)

INTERSECTION CROSSING MARKINGS

Description

Bicycle pavement markings through intersections indicate the intended path of bicyclists through an intersection or across a driveway or ramp. They guide bicyclists on a safe and direct path through the intersection and provide a clear boundary between the paths of through bicyclists and either through or crossing motor vehicles in the adjacent lane.

Guidance

- See MUTCD Section 3B.08: "dotted line extensions"
- Crossing striping shall be at least six inches wide when adjacent to motor vehicle travel lanes.
- Dotted lines should be two-foot lines spaced two to six feet apart.
- Chevrons, shared lane markings, or colored bike lanes in conflict areas may be used to increase visibility within conflict areas or across entire intersections.

Discussion

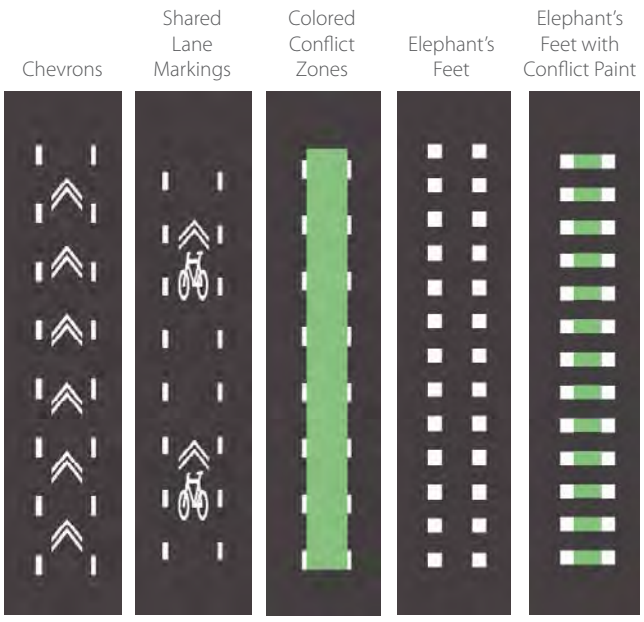
Additional markings such as chevrons, shared lane markings, or colored bike lanes in conflict areas are strategies currently in use in the United States and Canada. Cities considering the implementation of markings through intersections should standardize future designs to avoid confusion.

Materials and Maintenance

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

Additional References and Guidelines

- AASHTO Guide for the Development of Bicycle Facilities 2012
- California MUTCD 2014
- NACTO Urban Bikeway Design Guide 2014



MARKED/UNSIGNALIZED MID-BLOCK CROSSINGS

Description

A marked/unsignalized mid block 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. The City of Chino does not support a mid-block crossing that is unprotected.
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

- Maximum travel speed: 35 MPH
- Maximum traffic volumes:
  - » < 9,000-12,000 Average Daily Traffic (ADT) volume
  - » Up to 15,000 ADT on two-lane roads, preferably with a median
  - » Up to 12,000 ADT on four-lane roads with median
- Minimum line of sight:
  - » 25 MPH zone: 155 feet
  - » 35 MPH zone: 250 feet
  - » 45 MPH zone: 360 feet

Discussion

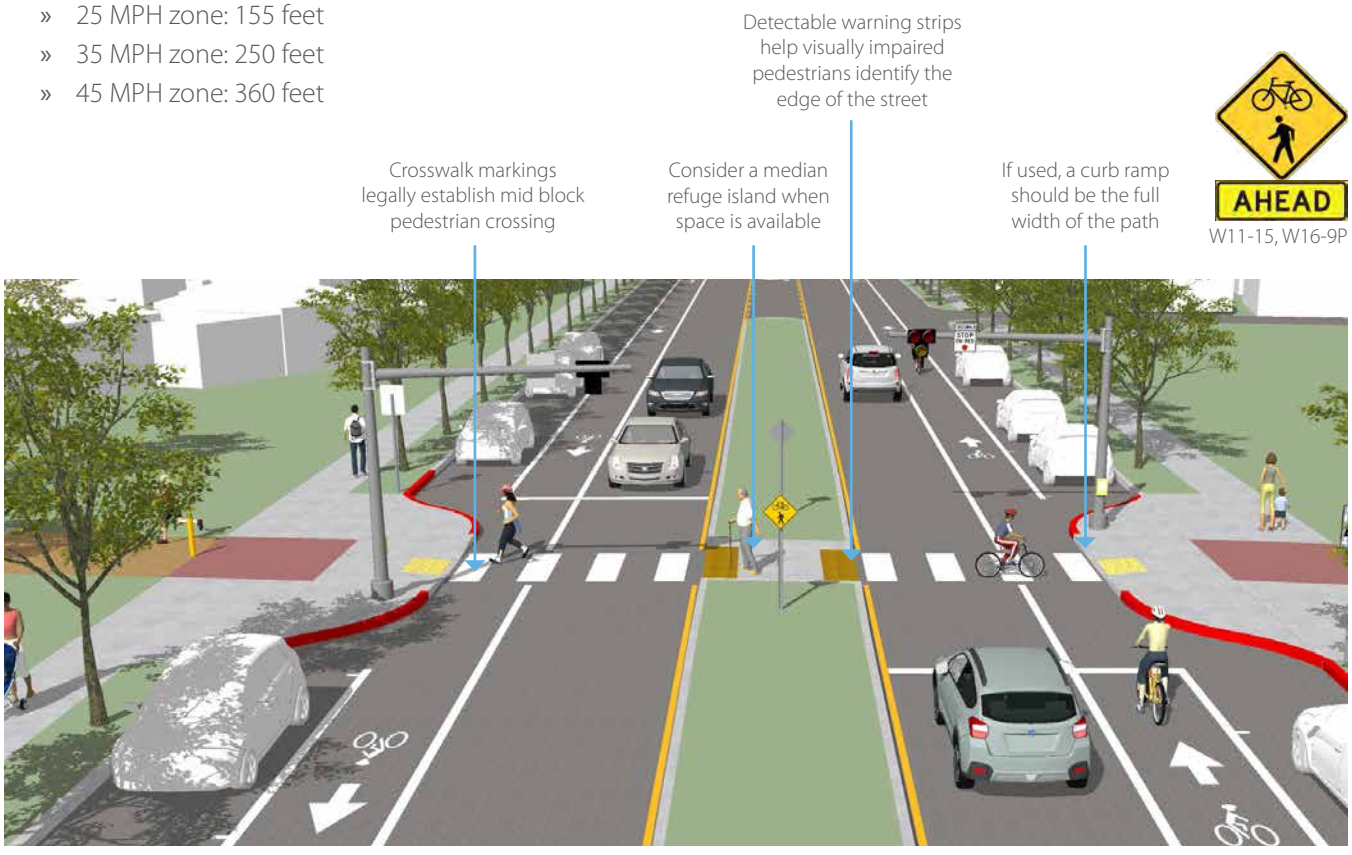
Unsignalized crossings of multi-lane arterials over 15,000 ADT may be possible with features such as sufficient crossing gaps (more than 60 per hour), median refuges, and/or active warning devices like rectangular rapid flash beacons.

Materials and Maintenance

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

Additional References and Guidelines

- AASHTO Guide for the Development of Bicycle Facilities 2012
- California MUTCD 2014
- Caltrans California HDM 2012



SIGNALIZED CROSSINGS

Description

Path crossings within approximately 300 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

Mid block crosswalks shall not be signalized if they are located within 300 feet from the nearest traffic control signal and should not be controlled by a traffic control signal if the crosswalk is located within 100 feet from side streets or driveways that are controlled by STOP signs or YIELD signs. 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 judgment and the context of the location should be taken into account when choosing the appropriate allowable setback.

Materials and Maintenance

If a sidewalk is used for crossing access, it should meet ADA guidelines.

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
- California MUTCD 2014

OVERCROSSINGS

Description

Bicycle/pedestrian overcrossings provide critical non-motorized system links by joining areas separated by barriers such as deep canyons, waterways or major transportation corridors. In most cases, these structures are built in response to user demand for safe crossings where they previously did not exist.
Grade-separated crossings may be needed where existing bicycle/pedestrian crossings do not exist, where ADT exceeds 25,000 vehicles, and where 85th percentile speeds exceed 45 miles per hour.

Guidance

- Roadway: 17 feet
- Freeway: 18.5 feet
- Heavy Rail Line: 23 feet
- 10 foot minimum width between railings, 14 feet preferred. If overcrossing has any scenic vistas additional width should be provided to allow for stopping. A separate 5 foot pedestrian area may be provided for facilities with high bicycle and pedestrian use.
- 10 foot headroom on overcrossing; clearance below will vary depending on feature being crossed.

Discussion

Overcrossings for bicycles and pedestrians typically fall under the Americans with Disabilities Act (ADA), which strictly limits ramp slopes of 8.33% (1:12) with landings every 30 feet. Title 24 of the California Code of Regulations requires gradients up to 5% (1:20) with 5-foot landings at 400 foot intervals.

Materials and Maintenance

Potential issues with vandalism. Overcrossings can be more difficult to clear of snow than undercrossings.

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

SIGNALIZATION AND SIGNAGE

Signals may be necessary as part of the construction of a protected bicycle facility such as a cycle track with potential turning conflicts, or to decrease vehicle or pedestrian conflicts at major crossings. An intersection with bicycle signals may reduce stress and delays for a crossing bicyclist, and discourage illegal and unsafe crossing maneuvers. Determining which type of signal or beacon to use for a particular intersection depends on a variety of factors including speed limits, Average Daily Traffic (ADT), anticipated bicycle crossing traffic, and the configuration of planned or existing bicycle facilities.

Signs throughout the city should indicate to bicyclists the direction of travel, location of destinations, and travel time and distance to those destinations. Signs will increase users' comfort and accessibility to the bicycle systems. Signage can serve as both wayfinding and safety by familiarizing users with the bicycle network, identifying the best routes to destinations, and clarifying time and distance to various locations.

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

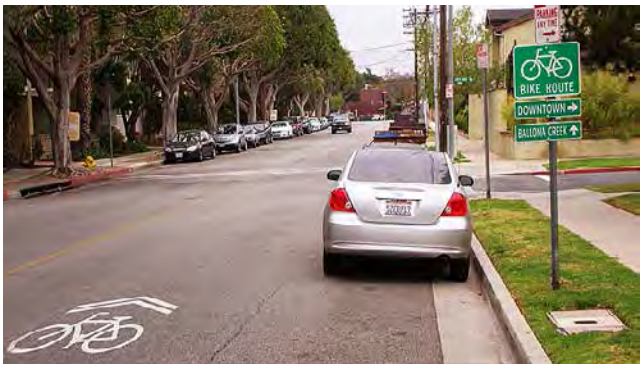
Bicycle wayfinding signs also visually cue motorists that they are driving along a bicycle route and should use caution.

TOPICS IN THIS SECTION:

Bicycle Detection and Actuation

Bicycle Signal Heads

Wayfinding Signage



Wayfinding Signage Placement

BICYCLE DETECTION AND ACTUATION

Description

Push Button Actuation: A bicyclist pushbutton may be used to supplement the required limit line detectors. These buttons should be mounted in a location that permits their activation by a bicyclist without having to dismount.

Loop Detectors or Video Detectors: For signalized intersection movements that do not normally receive a green light unless actuated by a car or pedestrian, the California Vehicle Code requires installation of detectors capable of detecting bicyclists at the limit line. This is most commonly handled with either inductive loop detectors or with video detection. Traffic actuated signals should be sensitive to bicycles, should be located in the bicyclist's expected path, and stenciling should direct the bicyclist to the point where the bicycle will be detected. 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.

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). The requirement for bicycle detection at all new and modified approaches to traffic signals is included in the CA MUTCD 2014.

Materials and Maintenance

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

Additional References and Guidelines

- AASHTO. Guide for the Development of Bicycle Facilities. 2012.
- NACTO. Urban Bikeway Design Guide. 2014.
- California MUTCD. 2014.
- Caltrans. Policy Directive 09-06. 2009.
- Caltrans. Complete Intersections. 2010.

BICYCLE SIGNAL HEADS

Description

The California MUTCD authorizes the use of bicycle signal heads only at the locations that meet Caltrans Bicycle Signal Warrants. FHWA's Interim Approval IA-I6, dated December 24, 2013, specifies a more detailed application of bicycle signal indications. Bicycle signal heads may be used for a movement that is not in conflict with any simultaneous motor vehicle movements at a signalized intersection, including right or left turns on red. The bicycle movement may not be modified by lane-use signs, turn prohibition signs, pavement markings, separate turn signal indications, or other traffic control devices.
The size of signal lenses may be 4 inches, 8 inches, or 12 inches, with the 4-inch lens size reserved only for supplemental near side mountings.

Guidance

California MUTCD Bicycle Signal Warrant is based off bicyclist volumes, collision history, or geometric warrants:

- Those with high volume of bicyclists at peak hours
- Those with high numbers of bicycle/motor vehicle crashes, especially those caused by turning vehicle movements
- Where a multi-use path intersects a roadway
- At locations to facilitate a bicycle movement that is not permitted for a motor vehicle

Discussion

For improved visibility, smaller (4 inch lens) near-sided bicycle signals should be considered to supplement far-side signals.

Materials and Maintenance

Bicycle signal heads require the same maintenance as standard traffic signal heads, such as replacing bulbs and responding to power outages.

Additional References and Guidelines

- FHWA Interim Approval IA-I6, 2013.
- California MUTCD. 2014.

ACTIVE WARNING BEACONS

Description

Active warning beacons are user actuated illuminated devices designed to increase motor vehicle yielding compliance at crossings of multi lane or high volume roadways. Types of active warning beacons include conventional circular yellow flashing beacons, in roadway warning lights, or Rectangular Rapid Flash Beacons (RRFB). RRFBs have blanket approval in California per FHWA MUTCD IA11.

Guidance

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

Discussion

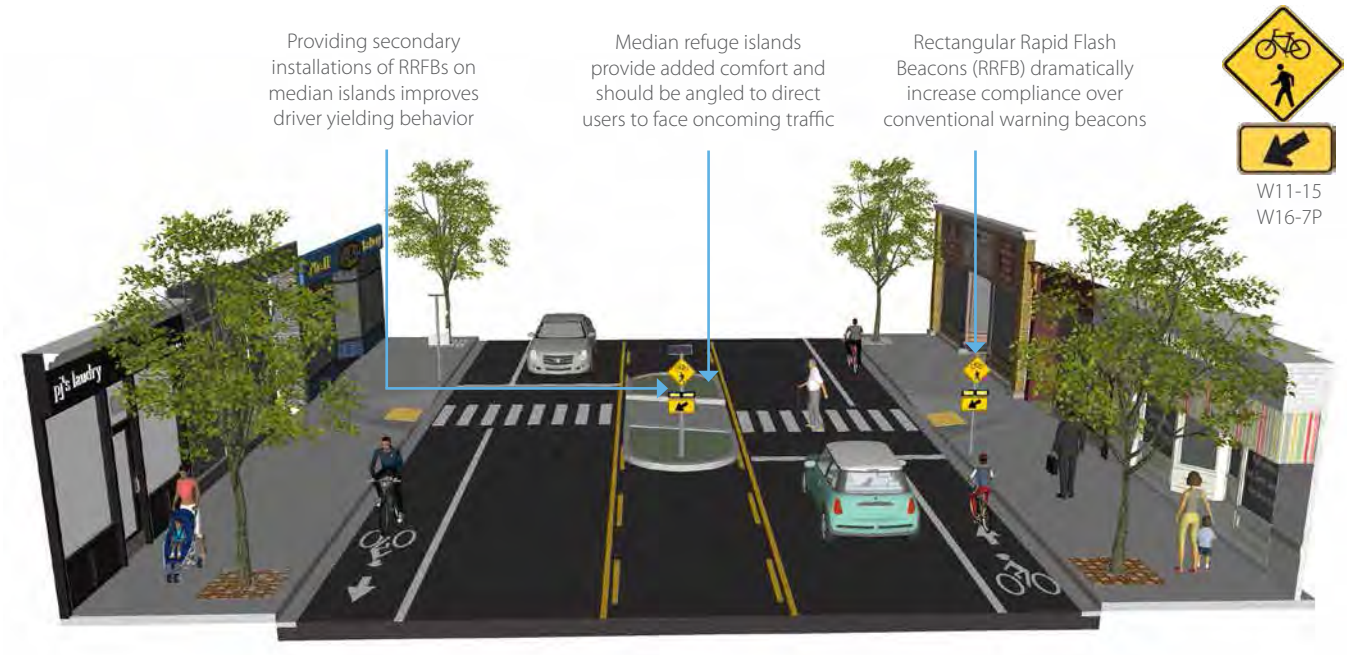
Rectangular rapid flash beacons have the highest compliance of all the warning beacon enhancement options. A study of the effectiveness of going from a no-beacon arrangement to a two-beacon RRFB installation increased yielding from 18 percent to 81 percent. A four-beacon arrangement raised compliance to 88 percent.

Materials and Maintenance

Depending on power supply, maintenance can be minimal. If solar power is used, RRFBs can run for years without issue.

Additional References and Guidelines

- NACTO Urban Bikeway Design Guide 2014
- California MUTCD 2014
- FHWA Interim Approval (IA-11) 2008
- Caltrans Complete Intersections 2010



PEDESTRIAN HYBRID BEACONS

Description

A pedestrian hybrid beacon, previously 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 and/or bicycle signal heads for the minor street. There are no signal indications for motor vehicles on the minor street approaches. Pedestrian hybrid beacons are used to improve non-motorized crossings of major streets in locations where side-street volumes do not support installation of a conventional traffic signal or where there are concerns that a conventional signal will encourage additional motor vehicle traffic on the minor street. Hybrid beacons may also be used at mid-block crossing locations.

Guidance

- Pedestrian hybrid beacons may be installed without meeting traffic signal control warrants. The need should be considered on the basis of an engineering study that considers speed, major-street volumes and gaps.
- If installed within a signal system, signal engineers should evaluate the need for the pedestrian hybrid beacon 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.

Discussion

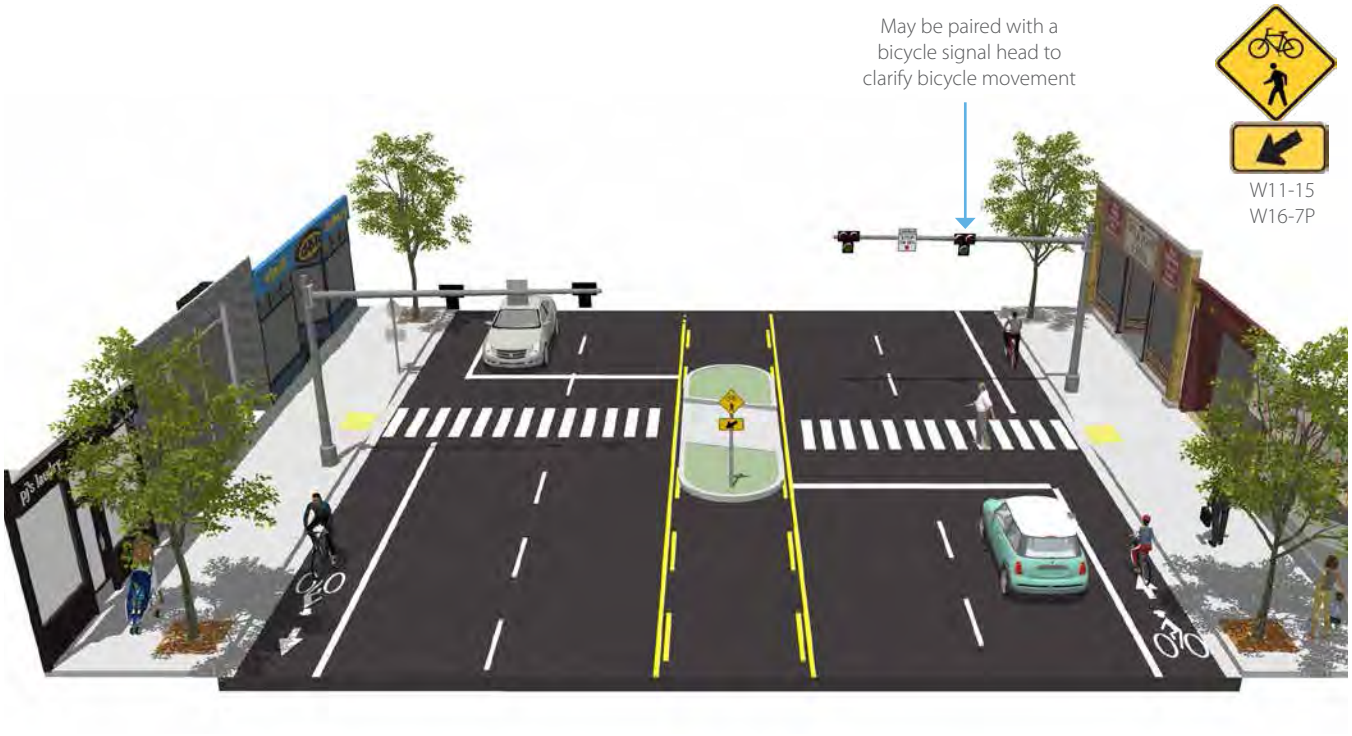
An alternative to a pedestrian hybrid beacon is a standard signal face that displays a flashing red indication during the pedestrian clearance phase. The advantage of a standard signal face is that it displays no dark indications that could be interpreted by a motorist to be a symptom of a power outage that requires coming to a stop.

Materials and Maintenance

Signing and striping need to be maintained to help users understand any unfamiliar traffic control.

Additional References and Guidelines

- California MUTCD. 2014.



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 including confirmation signs, turn signs, and decisions, signs.

Guidance

Confirmation Signs

- Indicate to bicyclists that they are on a designated bikeway. Make motorists aware of the bicycle route.
- May 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.
- Destinations and arrows are required, distances are optional but recommended.
- The inclusion of bicycle travel time is nonstandard, but is recommended.

Discussion

There is no standard color for bicycle wayfinding signage. 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.

Materials and Maintenance

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

Additional References and Guidelines

- AASHTO Guide for the Development of Bicycle Facilities 2012
- California MUTCD 2014
- NACTO Urban Bikeway Design Guide 2014

WAYFINDING SIGN PLACEMENT

Description

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. 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.

Guidance

Confirmation Signs

Every one-quarter to one-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.

Decisions Signs

- Near-side of intersections in advance of a junction with another bicycle route.
- Along a route to indicate a nearby destination.

Discussion

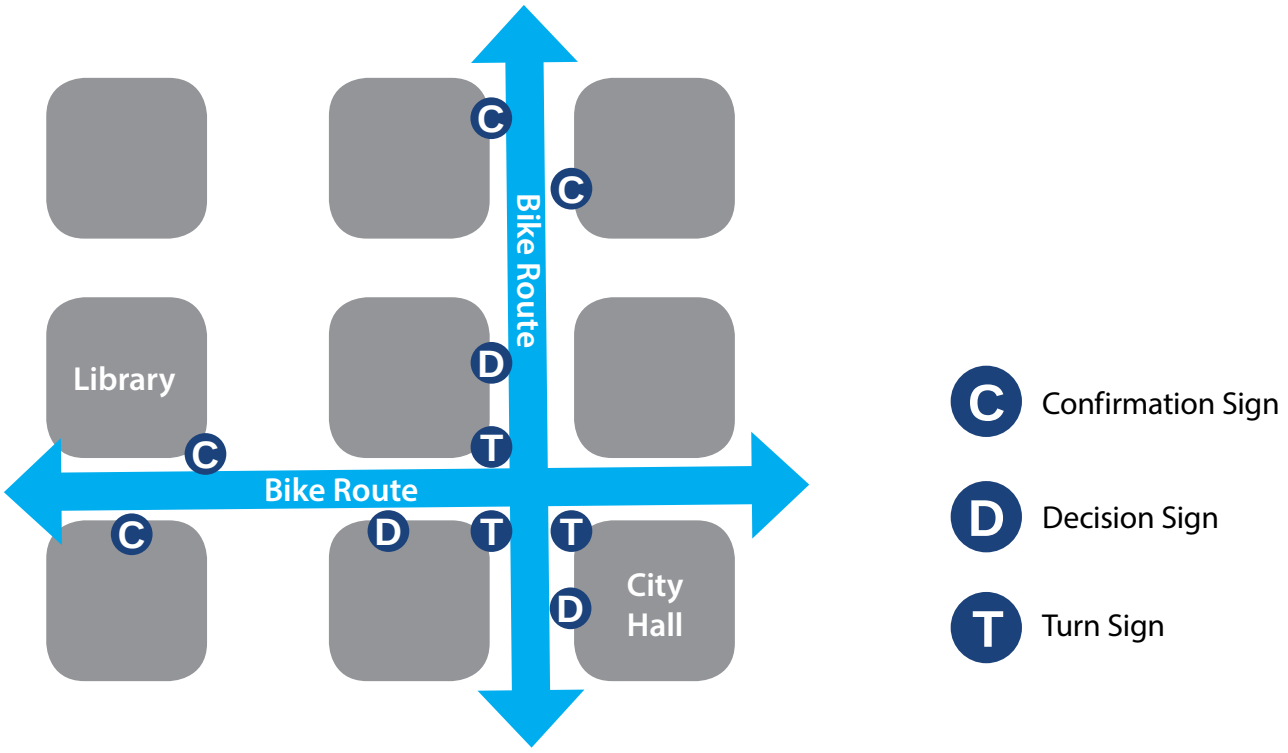
It can be useful to classify a list of destinations for inclusion on the signs based on their relative importance to users throughout the area. A particular destination's ranking in the hierarchy can be used to determine the physical distance from which the locations are signed.

Materials and Maintenance

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

Additional References and Guidelines

- AASHTO Guide for the Development of Bicycle Facilities 2012
- California MUTCD 2014
- NACTO Urban Bikeway Design Guide 2014



BICYCLE SUPPORT FACILITIES

Bicycle Parking

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

Access to Transit

Safe and easy access to bicycle parking facilities is necessary to encourage commuters to access transit via bicycle. Providing bicycle access to transit and space for bicycles on buses and rail vehicles can increase the feasibility of transit in lower-density areas, where transit stops are beyond walking distance of many residences. People are often willing to walk only a quarter- to half-mile to a bus stop, while they might bike as much as two or more miles to reach a transit station.

TOPICS IN THIS SECTION:

Bicycle Parking

On-Street Bicycle Corral

Bicycle Lockers

Secure Parking Areas (SPA)

Access to Transit

BICYCLE RACKS

Description

Secure bicycle parking at likely destinations is an integral part of a bikeway network. Adequate bicycle parking should be incorporated into any new development or redevelopment project. Bicycle parking should be given a balanced level of importance when considering car parking improvements or development. In commercial areas where bicycle traffic is more prevalent, as well as parks and shopping centers, increased bicycle parking is recommended.

Bicycle rack type plays a major role in the utilization of the bicycle racks. Only racks that support the bicycle at two points and allow convenient locking should be used. 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

- Do not bend wheels or damage other bicycle parts
- Accommodate high security U-shaped bicycle locks
- Accommodate securing the frame and wheels
- Does not trip pedestrians
- Are easily accessed yet protected from motor vehicles
- Are covered if users will leave their bicycles for long periods
- Locate racks in areas that cyclists are most likely to travel

Discussion

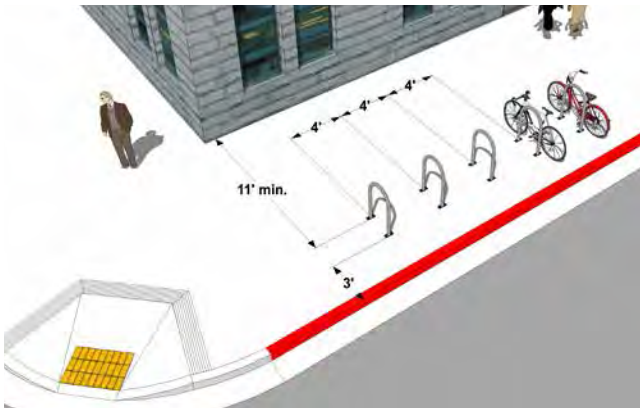
Where bicycle parking is very limited, an occasional parking space could be converted into a bicycle corral to increase the attraction of cycling to the commercial district instead of driving there. See bike corrals.

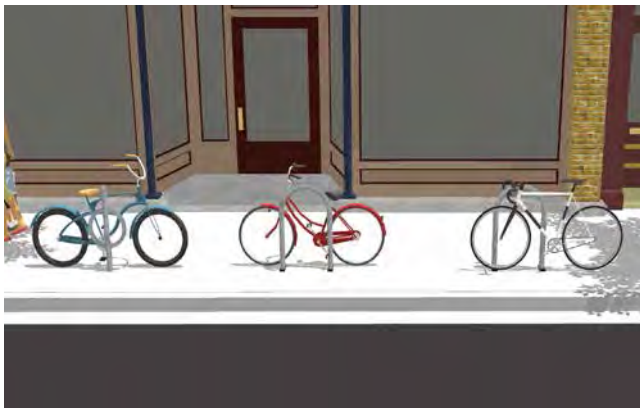
Materials and Maintenance

Use of proper anchors will prevent vandalism and theft.

Additional References and Guidelines

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





BICYCLE LOCKERS

Description

Bicycle parking facilities intended for long-term parking must protect against theft of the entire bicycle and its components and accessories.
Three common ways of providing secure long-term bicycle parking are:

- Fully enclosed lockers accessible only by the user, either coin-operated, or by electronic, on-demand locks operated by "smartcards" equipped with touch-sensitive embedded RFID chips.
- A continuously monitored facility that provides at least medium-term type bicycle parking facilities generally available at no charge
- Restricted access facilities in which short-term type bicycle racks are provided and access is restricted only to the owners of the bicycles stored there

Perhaps the easiest retrofit is the bicycle locker. Generally, they are as strong as the locks on their doors and can secure individual bicycles with their panniers, computers, lights, etc, left in place. Some bicycle locker designs can be stacked to double the parking density.

Guidance

Minimum dimensions: width (opening) 2.5 feet; height 4' feet; depth 6 feet.

- Four foot side clearance and 6 foot end clearance.
- Seven foot minimum distance between facing lockers.
- Locker designs that allow visibility and inspection of contents are recommended for security.
- Access is controlled by a key or access code.

Discussion

Long-term parking facilities are more expensive to provide than short-term facilities, but are also significantly more secure. Although many bicycle commuters would be willing to pay a nominal fee to guarantee the safety of their bicycle, long-term bicycle parking should be free wherever automobile parking is free.

Materials and Maintenance

Regularly inspect the functioning of moving parts and enclosures. Change keys and access codes periodically to prevent access to unapproved users.

Additional References and Guidelines

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

ON-STREET BICYCLE CORRAL

Description

Bicycle corrals are generally former vehicle parking stalls converted to bicycle parking. Most have been on-street con¬versions, but they are now being incorporated into shopping center parking lots as well. Corrals can accommodate up to 20 bicycles per former vehicle parking space. On-street bicycle corrals provide many benefits where bicycle use is high and/ or growing: Businesses - Corrals provide a much higher customer to parking space ratio and advertise "bicycle friendliness." They also allow more outdoor seating for restaurants by moving the bicycle parking off the sidewalk. Some cities have instituted programs that allow local businesses to sponsor or adopt a bicycle corral to improve bicycle parking in front of their business.

Pedestrians: Corrals clear the sidewalks and those installed at corners also serve as curb extensions

Cyclists: Corrals increase the visibility of cycling and greatly expand bicycle parking options

Vehicle drivers: Corrals improve visibility at intersections by preventing large vehicles from parking at street corners and blocking sight lines

Guidance

- Bicyclists should have an entrance width from the roadway of 5 feet – 6 feet
- Desirable to put bicycle corrals near intersections
- 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
- Can be customized and have been designed and fabricated to complement specific locations

Discussion

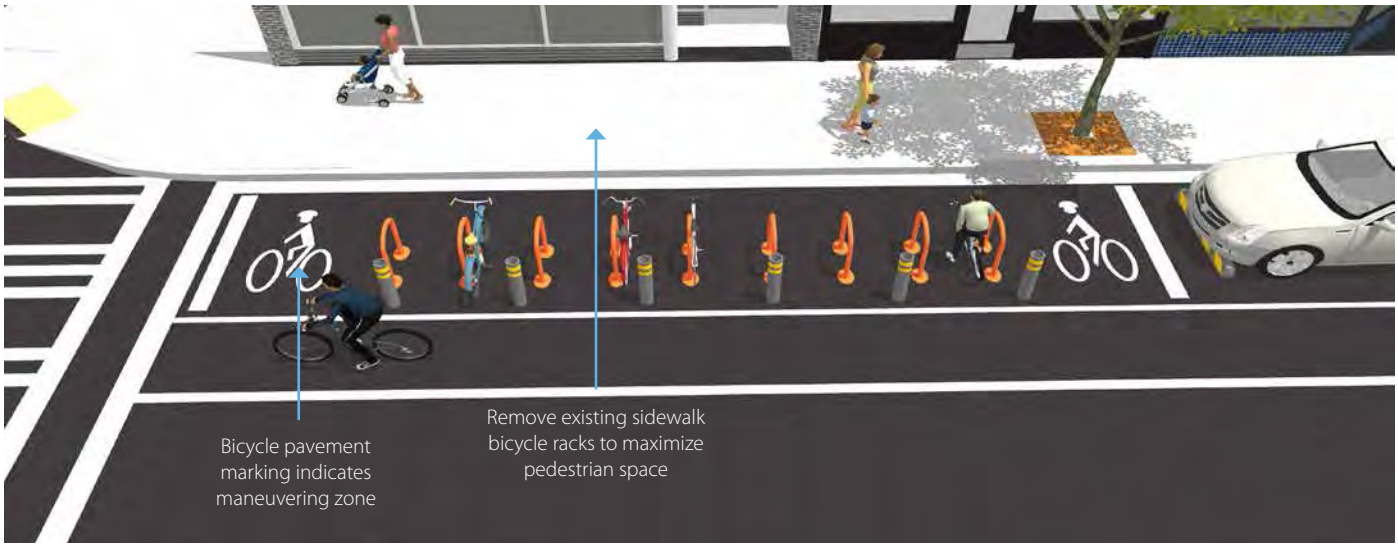
In many communities, the installation of bicycle corrals is driven by requests from adjacent businesses, and is not a city-driven initiative. In other areas, the city provides the facility and business associations take responsibility for the maintenance of the facility.

Materials and Maintenance

Physical barriers may obstruct drainage and collect debris. Establish a maintenance agreement with neighboring businesses.

Additional References and Guidelines

- APBP Bicycle Parking Guide 2nd Edition 2010



SECURE PARKING AREAS (SPA)

Description

A Secure Parking Area for bicycles, also known as a Bike SPA or Bike & Ride (when located at transit stations), is a semi-enclosed space that offers a higher level of security than ordinary bike racks. Accessible via key-card, combination locks, or keys, Bike SPAs provide high-capacity parking for 10 to 100 or more bicycles. Increased security measures create an additional transportation option for those whose biggest concern is theft and vulnerability.

Guidance

Key features may include:

- Closed-circuit television monitoring
- Double high racks & cargo bike spaces
- Bike repair station with bench
- Bike tube and maintenance item vending machine
- Bike lock "hitching post" – allows people to leave bike locks
- Secure access for users

Discussion

Long-term parking facilities are more expensive to provide than short-term facilities, but are also significantly more secure. Although many bicycle commuters would be willing to pay a nominal fee to guarantee the safety of their bicycle, long-term bicycle parking should be free wherever automobile parking is free.

Materials and Maintenance

- Regularly inspect the functioning of moving parts and enclosures. Change keys and access codes periodically to prevent access to unapproved users.

Additional References and Guidelines

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

BIKE FIX-IT STATIONS

Description

A Bike Fix-it Station is a public work stand complete with tools to perform basic bike repairs and maintenance including fixing a flat to adjusting brakes. While there are several stand designs, they all provide an ergonomic work environment for any rider. The tools are attached to the stand via stainless steel gauge cables to prevent theft. Hanging the bike from the arm hangar allows the pedals and wheels to move freely while making adjustments to the bike.

Guidance

- The stations are best placed in public areas where there is a significant amount of bicycle traffic or at any trail head seeing frequent ridership.
- Wall Setbacks:
  - » Minimum of 48 inches from side of station to wall or other objects
  - » Minimum of 12 inches from back of station to wall or other objects
- Street or Trail Setback
  - » Minimum of 60 inches from perpendicular street/ trail
  - » Minimum of 96 inches from parallel street/trail

Discussion

The station has universal bike mounting that is also ADA compliant. Eight common bike tools are tethered to the station by stainless steel cables. The station itself is powder coated galvanized, stainless steel that is anchored into concrete or another proper base material specified by vendor. The station can be color customized from a variety of colors available by vendor. Many stations have a QR code with repair instructions should the rider need additional information.

Materials and Maintenance

The stations are made for outdoor use and are sealed from the elements. Some vendors provide a warranty for service and repair should vandalism or mechanical failure occur.

BICYCLE ACCESS TO TRANSIT

Description

Safe and easy access to transit stations and secure bicycle parking facilities is necessary to encourage commuters to access transit via bicycle. Bicycling to transit reduces the need to provide expensive and space consuming car parking spaces. Many people who ride to a transit stop will want to bring their bicycle with them on the transit portion of their trip, so buses and other transit vehicles should be equipped accordingly.
For staircases at bus or rail transit stations, bicycle access could be facilitated with bicycle staircase side ramps. These consist of narrow channels just wide enough to accommodate bicycle tires, installed below the handrails of staircases. Cyclists could place their bicycles onto the side ramps and walk them up or down the stairs, with the bicycles rolling within the channels.

Guidance

- Provide direct and convenient access to transit stations and stops from the bicycle and pedestrian networks.
- Provide maps, wayfinding signage and pavement markings from the bicycle network to transit stations.

Bicycle Parking

- The route from bicycle parking locations to station/ stop platforms should be well-lit and visible.
- Signing should note the location of bicycle parking, rules for use, and instructions as needed.
- Provide safe and secure long-term parking such as bicycle lockers at transit hubs. Parking should be easy to use and well maintained.

Discussion

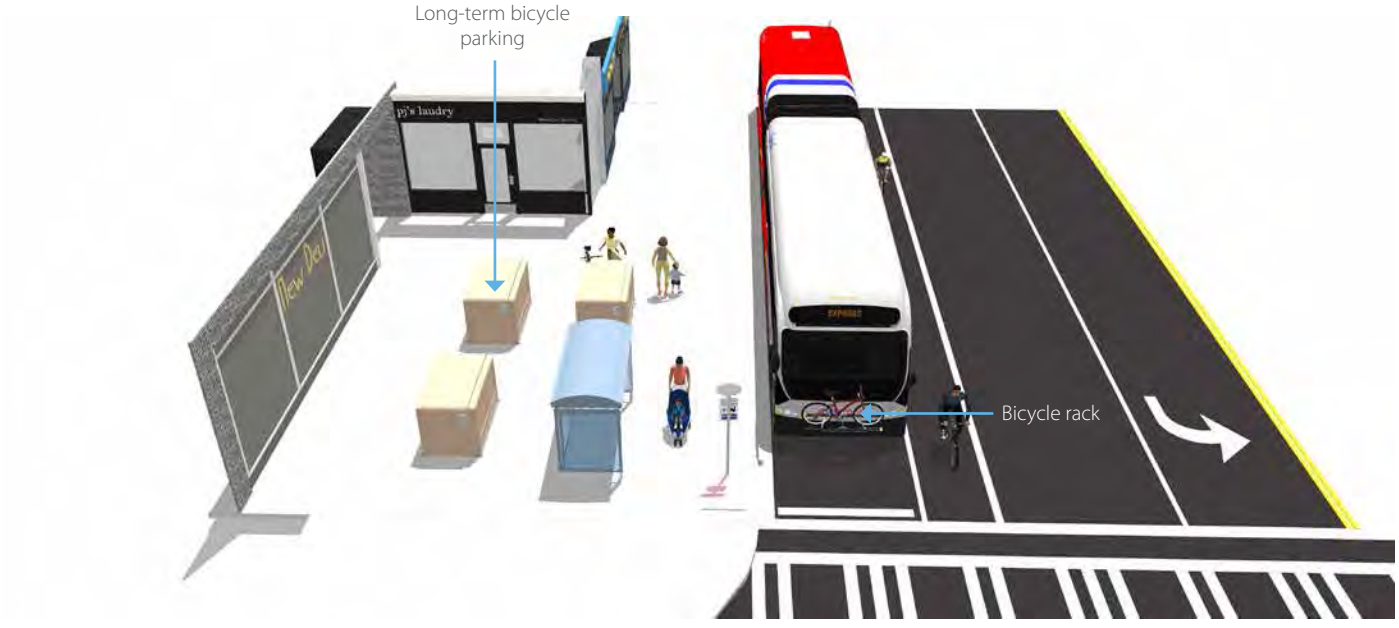
Providing bicycle routes to transit helps combine the long-distance coverage of bus and rail travel with the door-to-door service of bicycle riding. Transit use can overcome large obstacles to bicycling, including distance, hills, riding on busy streets, night riding, inclement weather, and breakdowns.

Materials and Maintenance

Regularly inspect the functioning of long-term parking moving parts and enclosures.

Additional References and Guidelines

- APBP Bicycle Parking Guide 2nd Edition 2010
- FHWA University Course on Bicycle and Pedestrian Transportation
- Lesson 18: Bicycle and Pedestrian Connections to Transit, 2006



BIKEWAY FACILITY 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 enhancing a maintenance regimen.

TOPICS IN THIS SECTION:

Sweeping


Gutter to Pavement Transition


Roadway Surface


Drainage Grates

Pavement Markings

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. A regularly scheduled inspection and maintenance program helps ensure that roadway debris is regularly picked up or swept.

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.
- Perform additional sweeping in the Fall in areas where leaves accumulate.

Note- some separated bike facilities (cycle tracks) that employ curbs or other physical barriers for separation may be too narrow for a standard street sweeper, which requires a 10-foot clearance. If this is the case, arrangements need to be made for smaller equipment to be used on a regular basis to keep the facility clean.

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. These areas can also be prone to retaining standing water during and after rains.

Guidance

- Ensure that gutter-to-pavement transitions have no more than a ¼" inch 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 two to four months after trenching construction activities are completed to ensure that excessive settlement has not occurred.
- Provide at least three feet of pavement outside of the gutter seams.
- When adding new bike facilities such as separated lanes, roundabouts, and traffic circles, check for potential drainage issues. Installing bioswales to capture runoff and avoid standing water in bike lanes is becoming a standard part of building bike facilities in bike-friendly communities.

ROADWAY SURFACE

Description

Bicycles are much more sensitive to subtle changes in roadway surface than are motor vehicles. Various materials are used to pave roadways, and some are smoother than others. Compaction is also an important issue after trenches and other construction holes are filled. Uneven settlement after trenching can affect the roadway surface nearest the curb where bicycles travel. Sometimes compaction is not achieved to a satisfactory level, and an uneven pavement surface can result due to settling over the course of days or weeks. When resurfacing streets, use the smallest chip size and ensure that the surface is as smooth as possible to improve safety and comfort for bicyclists.

Guidance

Maintain a smooth pothole-free surface.

- Ensure that on new roadway construction, the finished surface on bikeways does not vary more than ¼ inch.
- Maintain pavement so ridge buildup does not occur at the gutter-to-pavement transition or adjacent to railway crossings.
- Inspect the pavement two to four months after trenching construction activities are completed to ensure that excessive settlement has not occurred.
- If chip sealing is to be performed, use the smallest possible chip on bike lanes and shoulders. Sweep loose chips regularly following application.
- During chip seal maintenance projects, if the pavement condition of the bike lane is satisfactory, it may be appropriate to chip seal the travel lanes only. However, use caution when doing this so as not to create an unacceptable ridge between the bike lane and travel lane.

DRAINAGE GRATES

Description

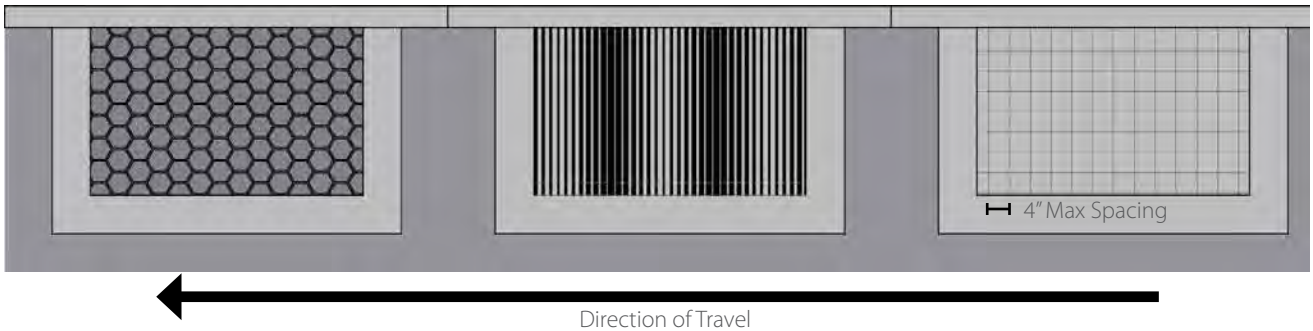
Drainage grates are typically located in the gutter area near the curb of a roadway. Drainage grates typically have slots through which water drains into the municipal storm sewer system. Many older grates were designed with linear parallel bars spread wide enough for a tire to become caught so that if a bicyclist were to ride on them, the front tire could become caught in the slot. This would cause the bicyclist to tumble over the handlebars and sustain potentially serious injuries.

Guidance

Require all new drainage grates be bicycle-friendly, including grates that have horizontal slats on them so that bicycle tires and assistive devices do not fall through the vertical slats.

- Create a program to inventory all existing drainage grates, and replace hazardous grates as necessary – temporary modifications such as installing re-bar horizontally across the grate should not be an acceptable alternative to replacement.

Drainage Grate Designs



PAVEMENT MARKINGS

Description

Pavement markings -- in the form of paint, durable liquid markings or thermoplastics -- are an essential component of the majority of bicycle facilities previously described. Pavement markings serve many functions, including the communication of:

- Legitimate use
  - » Exclusive bicycle use
  - » Shared bicycle/automobile or bicycle/pedestrian use
- Safe lane positioning
  - » Outside of the "door zone"
- Safe intersection positioning
  - » Outside of the "right hook" zone
- Effective intersection position
  - » On top of in-ground sensors
- Wayfinding
  - » Confirmation signage
  - » Directional signage
- Placemaking
  - » Network branding
  - » Route branding
  - » Community participation, as in "intersection murals"

A note on construction and maintenance:
Bicycle facilities also sometimes seem to "disappear" after roadway construction occurs. When any roadwork repairs are done by the city or other agencies, the roadway must be restored to its previous state or upgraded, if applicable. For example, a road that previously had bike lanes should be reconstructed with bike lanes or "better" (e.g. buffered bike lanes, protected bike lanes, etc.).

Guidance

Colored Pavement: Waterbourne Paints

Over the past 10 years, transportation agencies in the United States have gradually replaced conventional solvent paints with waterbourne paints that have low Volatile Organic Compounds (VOC) and other newer pavement marking materials. Waterbourne traffic paints are the most widely used and least expensive pavement marking material available. Glass beads are either pre-mixed into the paint or dropped onto the waterbourne paint to provide retro-reflectivity.

Waterbourne paints generally provide equal performance on asphalt and concrete pavements but have the shortest service life of all pavement marking materials. This paint type tends to wear off rapidly and lose retro-reflectivity quickly after being exposed to factors such as high traffic volumes. Although still a widely used material, waterbourne paint is also used as an interim marking material until they can apply something more durable.

Colored Pavement: Regular Solvent Paint

This type of paint can be used universally for just about any pavement needing paint and is the least expensive. Sometimes additives such as reflective glass beads for reflectivity and sand for skid resistance are widely used to mark road surfaces. This is typically considered a non-durable pavement marking and is easily worn by vehicle tires and often requires annual re-application.

Durable Liquid Pavement Markings

Durable Liquid Pavement Markings (DLPM) include epoxy and Methyl Methacrylate (MMA). Epoxy paint has traditionally been viewed as a marking material that provides exceptional adhesion to both asphalt and concrete pavements when the pavement surface is properly cleaned before application. The strong bond that forms between epoxy paints and both asphalt and concrete pavement surfaces results in the material being highly durable when applied on both pavement surfaces. These markings are highly durable and can be sprayed or extruded but generally require long no-track times.

Thermoplastics

Thermoplastics are a durable pavement marking material composed of glass beads, pigments, binders (plastics and resins) and fillers. There are two types of thermoplastics: hydrocarbon and alkyd. Hydrocarbon thermoplastics are made from petroleum-derived resins; and alkyd thermoplastics are made from wood-derived resins. One of the added advantages of using thermoplastic is that the material can be re-applied over older thermoplastic markings, thereby refurbishing the older marking as well as saving on the costs of removing old pavement markings. Although thermoplastic materials usually perform very well on all types of asphalt surfaces, there have been mixed results when they have been applied on concrete pavements.

Use of Green Paint

One significant change is the FHWA's interim approval for the use of green colored pavement within bicycle lanes in mixing or transition zones, such as at intersections and in other potential conflict zones where motor vehicles may cross a bicycle lane. They are intended to warn drivers to watch for and to yield to cyclists when they encounter them within the painted area. FHWA studies have also shown that green bicycle lanes improve cyclist positioning as they travel across intersections and other conflict areas.

Jurisdictions within the State must notify Caltrans before proceeding with green bicycle lane projects because the agency is required to maintain an inventory, but since Caltrans has requested to participate in this interim approval, the process has been streamlined because FHWA experimental treatment protocol is no longer required.

Materials and Maintenance

Waterbourne and Regular Paint

- Paints last 9-36 months
- Inexpensive
- Quick-drying
- Longer life on low-volume roads
- Easy clean-up and disposal
- Short life on high-volume roads
- Subject to damage from sand/abrasives
- Pavement must be warm or it will not adhere

Epoxy

- Lasts for 4 years
- Longer life on low-volume roads
- More retro-reflective
- Slow drying
- Requires coning and/or flagging during application
- Heavy bead application-may need to be cleaned off of roadway
- High initial cost
- Subject to damage from sand/abrasives

Thermoplastic

- Lasts for 3-6 years
- Long life on low-volume roads
- Retro-reflective
- No beads needed
- Any temperature for application
- Recommended use for symbols and spot treatments
- Subject to damage from sand/abrasives
- Cost prohibited if used for large scale applications
- Shown to wear quickly in conflicts areas
- Life of pavement marking will depend on traffic volume, road condition and application time of year

Additional References and Guidelines

- NACTO Urban Bikeway Design Guide 2014
- FHWA Durability and Retro-Reflectivity of Pavement Markings (Synthesis Study) 2008

RETROFITTING EXISTING STREETS

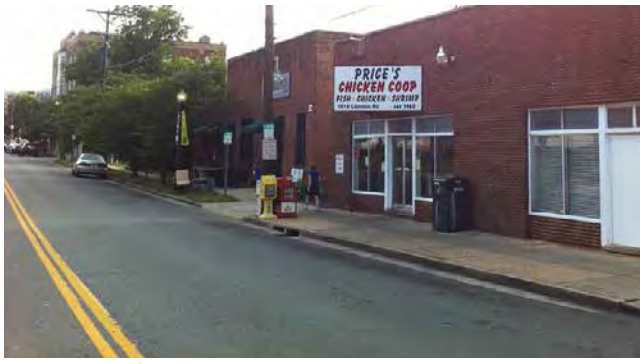
Most major streets are characterized by conditions (e.g., high vehicle speeds and/or volumes) for which dedicated bike lanes are the most appropriate facility to accommodate safe and comfortable riding. Although opportunities to add bike lanes through roadway widening may exist in some locations, many major streets have physical and other constraints that would require street retrofit measures within existing curb-to-curb widths. As a result, much of the guidance provided in this section focuses on effectively reallocating existing street width through striping modifications to accommodate dedicated bike lanes.

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

TOPICS IN THIS SECTION:

Multi-modal Level of Service

Lane Narrowing



Lane Reconfiguration

MULTIMODAL LEVEL OF SERVICE

Description

Multimodal Level of Service (MMLOS) methods are used to inventory and evaluate existing conditions, or to forecast future conditions for roadway users under different design scenarios. While automobile-oriented LOS measures vehicle delay, Bicycle, Pedestrian and Transit LOS is oriented toward user comfort.

MMLOS scores different modes independently, but their results are interdependent, allowing an understanding of trade-offs between modes for different street designs. A compatible A-F scoring system makes comparison between modes simple.

There are a variety of Multimodal or Bicycle/Pedestrian LOS tools available for use. Different tools require different data and may present different or conflicting results. Despite potential limitations of MMLOS methodology, the results help jurisdictions better plan for all road users.

Guidance

MMLOS modeling is an emerging practice, and current methods may be improved on or revised. The knowledge of local residents and planners should be used to verify MMLOS model results.

The 2000 Highway Capacity Manual includes dated LOS models for bicycle and pedestrian users. Methods presented in this edition and should not be used. The current standard for MMLOS calculation is described in the 2010 Highway Capacity Manual (HCM 2010). This method has limitations, particularly for Bicycle LOS modeling. See Discussion below.

Consider using an alternative MMLOS method/tool if HCM 2010 is not appropriate for you community. Other multimodal "Service Quality" tools include:

- Florida DOT LOSPLAN
- LOS+
- Mineta Level of Traffic Stress (LTS) Analysis. (Bicycle only scoring)

Discussion

Limitations of the HCM 2010 model for Bicycle LOS calculations include:

- Gradients are not included in calculations.
- The presence of contemporary facility types included in this guide, such as shared lane markings, bike boxes or cycle tracks are not included, although the Florida LOSPLAN update does features cycle tracks.
- Scoring is for a "typical" adult bicyclist, and weighs the presence of a bike lane very heavily. Results may not be appropriate in communities that seek to encourage bicycle travel by people of varying ages and abilities where bike lanes may not be adequate.

Additional References and Guidelines

- Transportation Research Board. Highway Capacity Manual. 2010.
- Florida Department of Transportation. LOSPLAN. 2012. http://www.dot.state.fl.us/planning/systems/sm/los/los_sw2m2.shtm
- Fehr&Peers. LOS+ Multi-Modal Roadway Analysis Tool. http://www.fehrandpeers.com/losplus/
- Mineta Transportation Institute. Low-Stress Bicycling and Network Connectivity. 2011. http://transweb.sjsu.edu/project/1005.html

LANE NARROWING ("LANE DIET")

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. The City's Circulation Element identifies 12 foot through lanes. When then the need arises, 10 foot travel lanes may be re-striped to create space for bike lanes.

Guidance

- Width depends on project. No narrowing may be needed if a lane is removed.
- 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 certain situations to provide space for bike lanes.

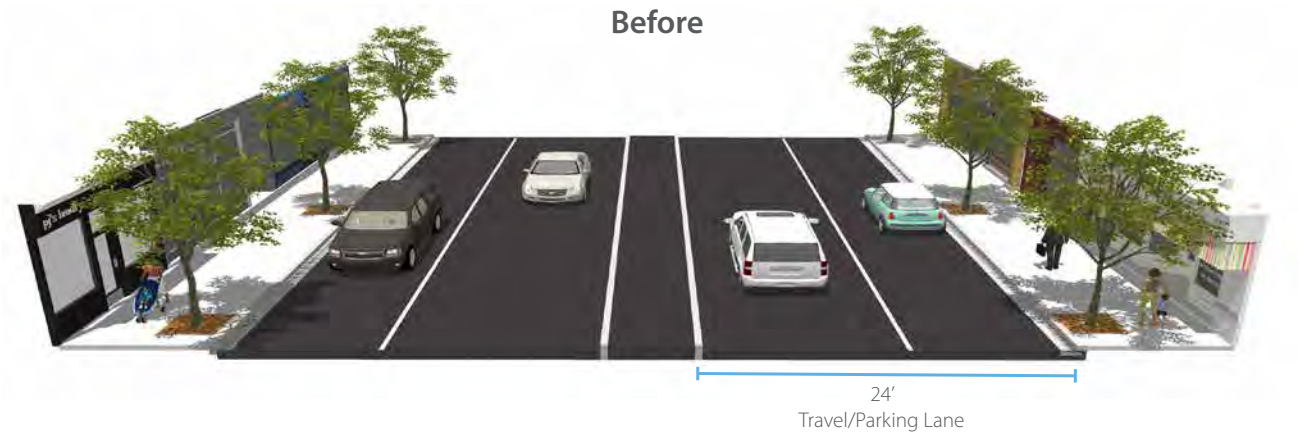
Materials and Maintenance

Repair rough or uneven pavement surface.

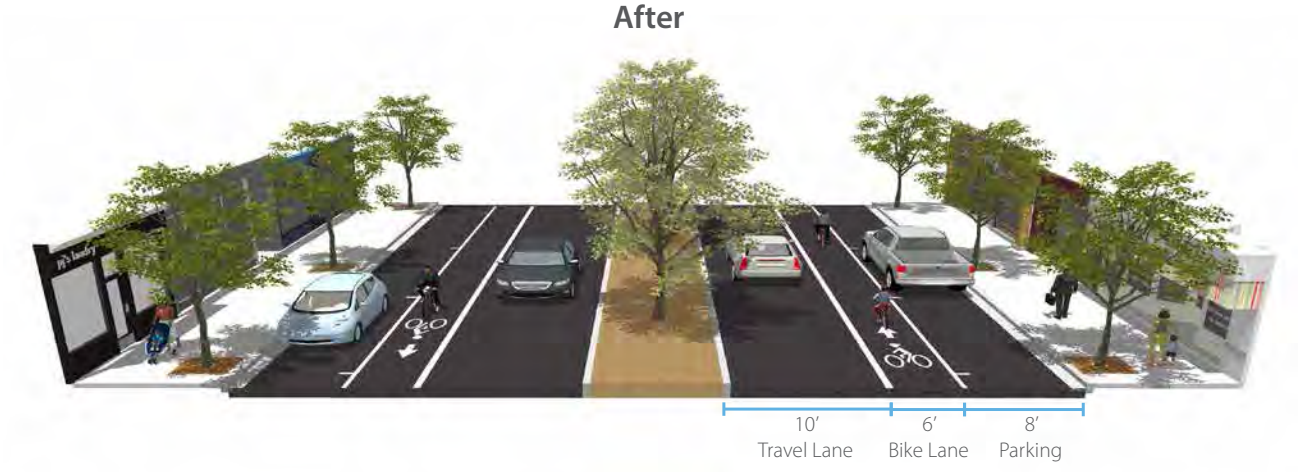
Additional References and Guidelines

- AASHTO Guide for the Development of Bicycle Facilities 2012
- AASHTO A Policy on Geometric Design of Highways and Streets 2004
- Caltrans California HDM 2012
- Caltrans Main Streets 2005

Before



After



LANE RECONFIGURATION ("ROAD DIET")

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

- Reduced vehicle lane widths should be 10-11 feet
- Refer to "Bicycle Lane" guidelines for bicycle lane widths

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.

Materials and Maintenance

Repair rough or uneven pavement surface.

Additional References and Guidelines

- AASHTO. Guide for the Development of Bicycle Facilities. 2012.
- FHWA. Evaluation of Lane Reduction "Road Diet" Measures on Crashes. 2010.
- Caltrans. Main Streets. 2005.