National City Bicycle Master Plan

National City, California

CALIFORNIA
NATIONAL CITY
1887
INCORPORATED

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1. Executive Summary

The National City Bicycle Master Plan presents a new vision for bicycle transportation, recreation, sustainability, and quality of life in National City, California. Being a dense, urbanized community, providing a citywide system of interconnected bicycle corridors, support facilities, and programs for National City residents and guests will make bicycling more practical and desirable to a broader range of people.

Planning for a more bicycle friendly city helps to resolve multiple complex and interrelated issues, including traffic congestion, air quality, climate change, public health, and livability. By guiding the City toward the creation of a comprehensive, regionally connected bicycle network, the Bicycle Master Plan addresses many of these issues and provides a strong framework for improving bicycling through 2030 and beyond. The Plan accommodates National City residents with various skill levels and incentives for bicycling. The major components of the Plan are described below.

1.1 Goals and Policies

The goals of the Plan are:

- *A city where bicycling is a viable travel choice for users of all abilities,*
- *A safe and comprehensive local and regionally connected bikeway network,*
- *Environmental quality, public health, recreation and mobility benefits through increased bicycling.*

These goals are supported by the National City General Plan policies that will help bicycling become a more viable transportation mode for localized trips, connection to transit, commuting, and recreation.

Relationship to Existing Plans

This Plan includes a summary of legislation and other Planning or policy documents from the State of California, San Diego Association of Governments (SANDAG), and the City of National City that are most pertinent to bicycling in National City. This includes a brief synopsis of important state legislation such as California Government Code §65302 and California SB 375 as well as bike plans from neighboring jurisdictions. It also contains policies from the National City General Plan, which is currently being updated.

Public Outreach

Four public workshops were held, in addition to a community bike tour, to collect feedback from National City residents on bicycling opportunities and constraints. Participants reviewed presentations and information pertaining to bicycle facilities, programs and related amenities, and provided feedback to help identify opportunities and constraints for consideration in preparing the Bicycle Master Plan. Surveys were made available to meeting participants as well as through the project website to gather additional information. Suggestions and recommendations were considered throughout the overall development stages. This section summarizes how the public was engaged and the input that was collected.

Existing Conditions

Understanding existing bicycling conditions is critical to identifying appropriate recommendations. The Bicycle Master Plan contains a thorough review of existing land uses, topography, the roadway network, multimodal connections, programs and policies that affect bicycling in National City.

Kimball Park, one of many key destinations in National City

The Bicycle Master Plan includes an assessment of current bicycling demand and barriers in National City and estimates future demand and benefits that could be realized through implementation of this Plan. Assessing needs and potential benefits is instrumental to planning a system that will serve the needs of all user groups.

The needs analysis relies on spatial modeling techniques, points of origin and attractions, public input, bicycle collision data, and bicycle commuting statistics to gauge current demand and to establish a baseline against which progress can be measured. The analysis will assist in quantifying future demand and benefits to allow the city to prioritize projects, compete for grant funding, and justify expenditures.

Bicycle Facility Recommendations

The National City Bicycle Master Plan recommends various improvements based on public input, best practices, and analysis of existing conditions and future opportunities. The recommended improvements include bikeway network facilities, treatments at intersections and other spot locations, and bicycle support facilities. National City's temperate climate and gentle topography make it a great place to bicycle. The improved facilities outlined in this plan will help make bicycling an effective transportation option throughout National City. **Table 1-1** below summarizes the current and proposed network.

Table 1-1: Current and Proposed Network with Classifications

	Current Mileage	Proposed Mileage	Total Mileage
Class I (Bicycle Paths)	2.4	4.3	6.7
Class II (Bicycle Lanes)	1.7	16.1	17.8
Class III (Bicycle Route)	0.6	13.5	14.1
Total	**4.7**	**33.9**	**38.6**

Design Guidelines

As National City works to encourage bicycling, enhance safety and accessibility, and expand its bikeway network, it faces the challenge of implementing improvements within a dense, urban environment. When National City retrofits existing streets, there is an opportunity to incorporate bicycle facilities along with other improvements. The design guidelines discussed in this Plan provide the City a range of design options based on a comprehensive review of federal, state and regional best management practices.

Bicycle Program Recommendations

The Plan recommends several education, encouragement, monitoring, enforcement and evaluation efforts, as well as programs the City currently provides and should continue, such as the National City Safe Routes to School Program. Recommended education programs include developing a bicycle map and website, safety awareness & media campaigns, youth safety training, and adult skills education. Encouragement programs include National Bike-to-Work Day/Week/Month, car-free events, bike commute incentives, and coordination with large employers such as Naval Base San Diego. Evaluation and monitoring programs include convening a Bicycle Advisory Committee, collecting bicycle and pedestrian counts and preparing annual progress reports.

Funding

There are a variety of federal, state and regional funding sources available for bicycle projects and programs. Information is provided to assist City staff in identifying appropriate sources of funding for the projects recommended in this Plan. By adopting a Bicycle Master Plan, the City becomes eligible for a variety of funding opportunities such as the Bicycle Transportation Account, which is one of many competitive grant programs.

2. Introduction

2.1 Setting

The City of National City is situated in the southwest corner of San Diego County bordered by the San Diego Bay to the west, the City of San Diego to the north and northeast, Chula Vista to the south, and San Diego County to the southeast. A portion of unincorporated San Diego County, referred to as Lincoln Acres, lies within the City boundary. National City encompasses approximately 7.4 square miles of land and 1.9 square miles of water. With an estimated population of 56,522, it is the twelfth most populated city in San Diego County, and is also the second oldest city in the country. The City contains a mix of land uses, most prevalently residential, commercial, industrial and military. Port facilities are also an important asset for the region's economy.

A cyclist along a portion of the Bayshore Bikeway in National City

According to SANDAG's 2007 population estimate report, over 50% of the population in the City is Hispanic, and the median age is 26 years old. The median household income is $44,130 (SANDAG 2006), which can be considered low for the State of California. The topography of National City is relatively level across the majority of the city and slightly undulating east of Interstate 805. This topography combined with the grid system layout that predominates within the City's transportation network, provides excellent opportunities to develop a connected bicycle network. **Figure 2-1** displays a map of National City within the San Diego region.

2.2 Purpose of the Plan

This Bicycle Master Plan provides a broad vision, strategies and actions to improve conditions for bicycling in National City. The Plan outlines a range of recommendations to increase the number of people who bike and frequency of bicycle trips, improve safety for bicyclists, and increase public awareness and support for bicycling. The Plan provides direction for expanding the existing bikeway network, connecting gaps, and ensuring greater local and regional connectivity. In addition to providing recommendations and design guidelines for bikeways and support facilities, the Plan offers recommendations for education, encouragement, enforcement, and evaluation programs.

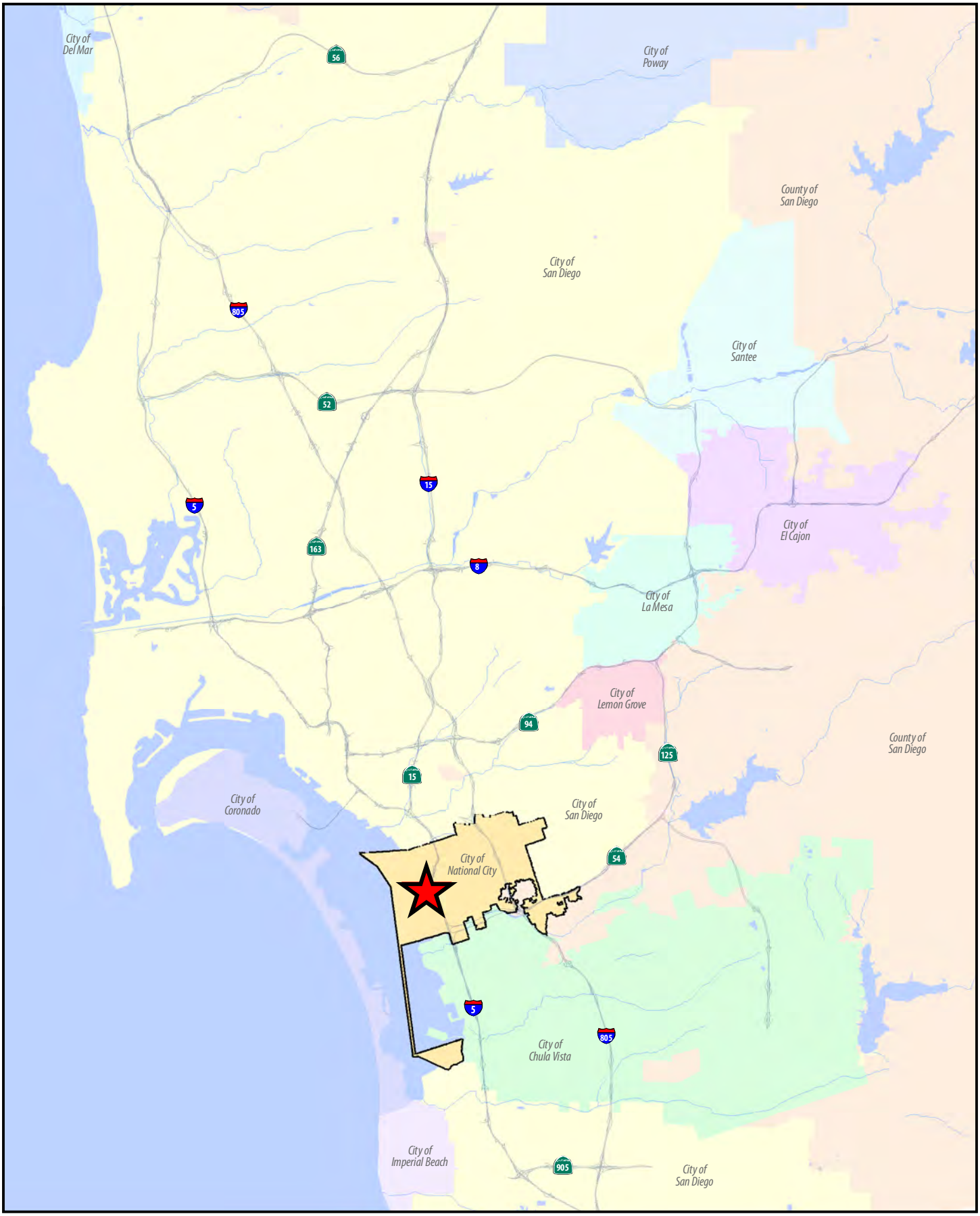


Figure 2-1: City of National City Regional Setting

City of National City Bicycle Master Plan

Source: City of National City
Date: 7/1/10

0 1 2 Miles

2.3 Why Bicycling?

The bicycle is a low-cost and effective means of transportation that is quiet, non-polluting, extremely energy efficient, healthy, and fun. Bicycling as a means of transportation has been growing in popularity as many communities work to create more balanced transportation systems by providing bicyclists with improved facilities on the roadway network. Recent national studies find that more people are willing to cycle more frequently if better bicycle facilities are provided[1,2].

The benefits of bicycling include improved air quality, better public health, and enhanced quality of life. Replacing automobile trips with bicycling can help reduce vehicle miles traveled, congestion and pollutants associated with automobiles. Physical inactivity is now widely understood to play a significant role in the most common chronic diseases in the US, including heart disease, stroke, obesity and diabetes. Creating bicycle-friendly communities is one of several effective ways to encourage active lifestyles. In addition, bicycle facilities are typically less costly than other transportation improvements and contribute to a strong sense of place. Regular bicycle commuters save money by spending "less time at the pump."

The City of National City is in a position to capitalize on its bicycle-friendly features such as its temperate climate, grid-based street network, and relatively level terrain to greatly increase the number of residents and visitors who bicycle. However, action needs to be taken to expand the bikeway network, improve end-of-trip facilities, and enhance safety through education and enforcement programs if bicycling in National City is to reach its full potential.

2.4 Plan Goals

The goals of the Bicycle Master Plan were developed in coordination with the National City General Plan Update (2011). The Goals provide context to the Plan and help strengthen additional policies that provide specific guidance for achieving an ideal bicycling environment. The goals of the Plan are:

- *A city where bicycling is a viable travel choice for users of all abilities,*
- *A safe and comprehensive local and regionally connected bikeway network,*
- *Environmental quality, public health, recreation and mobility benefits through increased bicycling.*

These goals are supported by General Plan policies (detailed below), that will help bicycling become a more viable mode of transportation in National City. The Plan leverages these policies to provide a framework for implementing on-the-ground improvements for bicyclists in National City.

[1] Dill, Jennifer, "Bicycling for Transportation and Health: The Role of Infrastructure," Journal of Public Health Policy, Volume 30, Supplement 1, 2009.
[2] League of American Bicyclist, Darren Flusche, "The Economic Benefits of Bicycle Infrastructure Investments," June 2009.

2.5 Relationship to Existing Plans and Policies

This Plan is written to be consistent with other plans and policies including: National City's General Plan Update, state policies and legislation, and other local and regional bike plans.

National City General Plan

National City is currently engaged in a general plan update, which will include a number of goals and policies that directly or indirectly affect bicycling. The implementation of the National City Bicycle Master Plan will help the City achieve many of these goals found in the Circulation Element of the General Plan Update.

- Goal C-1: Coordinated land use and circulation planning.
    - Policy C-1.1: Allow, encourage, and facilitate transit-oriented development, mixed-use, and infill projects in appropriate locations that reduce vehicular trips, especially near the 8th Street and 24th Street trolley stops, the future South Bay Bus Rapid Transit Station (BRT), and along major transportation corridors such as 8th Street, Highland Avenue, Plaza Boulevard, and 30th Street/Sweetwater Road.
    - Policy C-1.2: Require new development to provide and enhance connectivity to existing transportation facilities via the provision of key roadway connections, sidewalks and bicycle facilities.
    - Policy C-1.3: Require new development and redevelopment to provide good internal circulation facilities that meets the needs of walkers, bicyclists, children, seniors, and persons with disabilities.
- Goal C-2: A comprehensive circulation system that is safe and efficient for all modes of travel.
    - Policy C-2.1: Develop and maintain an interconnected, grid- or modified grid-based transportation system that sustains a variety of multi-modal transportation facilities.
    - Policy C-2.2: Enhance connectivity by eliminating gaps and barriers in roadway, bikeway, and pedestrian networks.
- Goal C-4: Increased use of alternative modes of travel to reduce peak hour vehicular trips, save energy, and improve air quality.
    - Policy C-4.3: Require new uses to provide adequate bicycle parking and support facilities.
    - Policy C-4.5: Encourage the use of alternative transportation modes.
    - Policy C-4.6: Prioritize attention to transportation issues around schools to reduce school-related vehicle trips.
- Goal C-7: Increased use of public transit systems.
    - Policy C-7.3: Provide multi-modal support facilities at transit stops for bicyclists and pedestrians, including children and youth, the seniors, and persons with disabilities.
- Goal C-9: A safe, comprehensive and integrated bikeway system that encourages bicycling.
    - Policy C-9.1: Expand and improve the bikeway system and facilities by establishing bike lanes, separated paths, and bicycle storage facilities at major destinations.

- Policy C-9.2: Require new development and redevelopment to provide safe, secure bicycle parking facilities.
- Policy C-9.3: Require new development and redevelopment to provide connections to existing and proposed bicycle routes, where appropriate.
- Policy C-9.4: Encourage existing businesses and new development or redevelopment projects to promote bicycling by provide bike rack facilities, personal lockers, and shower rooms.
- Policy C-9.5: Encourage bicycling through education and promotion programs in conjunction with the local school districts.
- Policy C-9.6: Keep abreast of bicycle facility innovations in other cities and regions, and seek to incorporate these into the bicycle network.

State Policies and Legislation

Bicycle Transportation Act

The California Bicycle Transportation Act (1994) is perhaps one of the most important pieces of bicycle-related legislation and requires all cities and counties to have an adopted bicycle master plan in order to be eligible to apply for Bicycle Transportation Account (BTA) funding. **Table 2-1** identifies the requirements for BTA funding and corresponding sections of this Plan that satisfy each requirement.

California Government Code §65302 (Complete Streets)

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

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

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

Deputy Directive 64 & Traffic Operations Policy Directive 09-06

Of note and related to AB 1358, the California Department of Transportation (Caltrans) adopted two policies in recent years that are relevant to bicycle planning initiatives such as this Bicycle Master Plan. Similar to AB 1358, Deputy Directive 64 (DD-64-R1) sets forth that Caltrans address the "safety and mobility needs of bicyclists, pedestrians, and transit users in all projects, regardless of funding."

In a more specific application of complete streets goals, Traffic Operations Policy Directive 09-06 presents bicycle detection requirements. For example, 09-06 requires that new and modified signal detectors provide bicyclist detection if they are to remain in operation. Further, the standard states that new and modified

bicycle path approaches to signalized intersections provide bicycle detection or a bicyclist pushbutton if detection is required.

California SB 375 – Sustainable Communities (2008)

Senate Bill (SB) 375 is intended to compliment Assembly Bill (AB) 32: The Global Warming Solutions Act of 2006 and encourage local governments to reduce emissions through improved planning. Under SB 375, the California Air Resources Board (CARB) is required to establish targets for 2020 and 2035 for each region covered by one of the State's 18 metropolitan planning organizations (MPOs). Each of California's MPOs will then prepare a "sustainable communities strategy (SCS)" that demonstrates how the region will meet its greenhouse gas (GHG) reduction target through integrated land use, housing and transportation planning. One way to help meet the emissions targets is to increase the bicycle mode share by substituting bicycle trips for automobile trips. National City's efforts to encourage bicycling and other alternative modes of transportation will contribute to the regional attainment of these targets.

In addition to these policies, the California Highway Design Manual contains bikeway design standards, while the California Manual on Uniform Traffic Control Devices (MUTCD) includes specifications for traffic control devices, signs and pavement markings that must be adhered to in California. The design guidelines in Chapter 6 adhere to these standards.

San Diego Regional Bike Plan

Developed by the San Diego Association of Governments (SANDAG), the San Diego Regional Bike Plan provides a long range vision for enhanced bike mobility in the San Diego region. The plan helps implement the bicycle portion of the Regional Transportation Plan and provides general guidelines and recommendations for creating a seamless bike network in the greater San Diego Region. The City of National City contains three segments of the proposed regional network, the Bayshore Bikeway, the Sweetwater River Bikeway, and the Mission Valley-Chula Vista Corridor. The National City Bicycle Master Plan proposes improvements in all of these corridors to help execute the regional vision.

City of Chula Vista Bicycle Master Plan

The City of Chula Vista adopted its Bicycle Master Plan in 2005 and is currently engaged in an update. The National City Bicycle Master Plan proposes continuous on-street bikeway connections between National City and existing facilities in Chula Vista. Connections include bikeways on National City Boulevard between W. 33rd Street and C Street, Highland Avenue between E. 30th Street and Fourth Avenue, and Second Avenue between E. 30th Street/Sweetwater Road and the Chula Vista border.

City of San Diego Bicycle Master Plan

The City of San Diego adopted its Bicycle Master Plan in 2002 and is currently engaged in an update. The National City Bicycle Master Plan includes connections to existing Class II bike lanes along Harbor Drive as part of the Bayshore Bikeway, as well as connections to the Class III bike route along Euclid Avenue, part of the Mission Valley-Chula Vista Corridor.

2.6 BTA Compliance

In order to meet the California Bicycle Transportation Account requirements, the National City Bicycle Master Plan includes all of the required elements, as presented in Table 2-1.

Table 2-1: National City Bicycle Master Plan BTA Compliance Checklist

BTA 891.2	Required Plan Elements	Location Within the Plan
(a)	The estimated number of existing bicycle commuters in the plan area and the estimated increase in the number of bicycle commuters resulting from implementation of the plan.	Chapter 4, Table 4-1, Table 4-2, Table 4-3, Figure 4-7
(b)	A map and description of existing and proposed land use and settlement patterns which shall include, but not be limited to, locations of residential neighborhoods, schools, shopping centers, public buildings, and major employment centers.	Chapter 3, Figure 3-1, Table 3-1, Figure 3-4, Figure 4-8
(c)	A map and description of existing and proposed bikeways.	Figure 3-2, Chapter 5, Section 5.1 ; Figure 5-1; Tables 5-1, 5-2, 5-3
(d)	A map and description of existing and proposed end-of-trip bicycle parking facilities. These shall include, but not be limited to, parking at schools, shopping centers, public buildings, and major employment centers.	Chapter 5.3, Figure 3-2, Figure 5-2
(e)	A map and description of existing and proposed bicycle transport and parking facilities for connections with and use of other transportation modes. These shall include, but not be limited to, parking facilities at transit stops, rail and transit terminals, ferry docks and landings, park and ride lots, and provisions for transporting bicyclists and bicycles on transit or rail vehicles or ferry vessels.	Chapter 3; Figure 3-2, Figure 4-8, Chapter 5, Sections 5.1.2; 5.3, Figure 5-2
(f)	A map and description of existing and proposed facilities for changing and storing clothes and equipment. These shall include, but not be limited to, locker, restroom, and shower facilities near bicycle parking facilities.	Section 3.2. Figure 3-2, Chapter 5, Section 5.3, Figure 5-2.
(g)	A description of bicycle safety and education programs conducted in the area included within the plan, efforts by the law enforcement agency having primary traffic law enforcement responsibility in the area to enforce provisions of the Vehicle Code pertaining to bicycle operation, and the resulting effect on accidents involving bicyclists.	Chapter 7
(h)	A description of the extent of citizen and community involvement in development of the plan, including, but not limited to, letters of support.	Chapter 2, Section 2.7
(i)	A description of how the bicycle transportation plan has been coordinated and is consistent with other local or regional transportation, air quality, or energy conservation plans, including, but not limited to, programs that provide incentives for bicycle commuting.	Chapter 2, Section 2.5.

BTA 891.2	Required Plan Elements	Location Within the Plan
(j)	A description of the projects proposed in the plan and a listing of their priorities for implementation.	Chapter 5, Section 5.2
(k)	A description of past expenditures for bicycle facilities and future financial needs for projects that improve safety and convenience for bicycle commuters in the plan area.	Chapter 8, Tables 8-1, 8-2 & 8-3

2.7 Public Outreach

A series of three General Plan Workshops were held in May, 2010 to collect feedback from National City residents on the City's update to the General Plan. These workshops were well attended and a brief overview presentation was given on the Bicycle Master Plan. Participants were able to review workshop boards presenting potential bicycle facilities, programs, and related amenities that could be implemented in National City. Additionally, the public was able to review a project fact sheet, complete a Bicycle Master Plan survey, review and provide input on gaps in the existing system, and help identify other opportunities and constraints that should be considered in the Plan.

A number of Bicycle Master Plan surveys, which were available in both English and Spanish, were completed at the General Plan Update workshops. Participants were excited to learn that National City was preparing a Bicycle Master Plan and had some suggestions for improving bicycling conditions in the City. The public was also invited to a community workshop on October 21, 2010 to review recommendations and provide input on the Draft Plan. Participants felt that the proposed network provided improved access to major destinations within the City. Some community members mentioned the need for increased enforcement of distracted drivers and other public safety laws to protect bicyclists. Participants also mentioned a general lack of bicycle parking in National City.

Bicycle Master Plan Survey

Hard Copies Summary

Hard copies of the survey were distributed to attendees of General Plan Workshops held in May, 2010. Because the attendees were a "captive audience," the results from their survey responses have been separated from the online survey responses. In total, 22 hardcopy surveys were completed.

Almost half of the survey respondents, (45%) ride a bicycle at least one day a month and mainly bicycle for exercise or recreation (64%).

Most respondents were very interested in

National City residents had an opportunity to review potential bicycle facilities, programs, and related amenities and provide feedback at the General Plan Update workshops in May 2010.

using bike lanes and bike boulevards and not interested in bicycling without facilities. **Figure 2-2** shows the detailed response results.

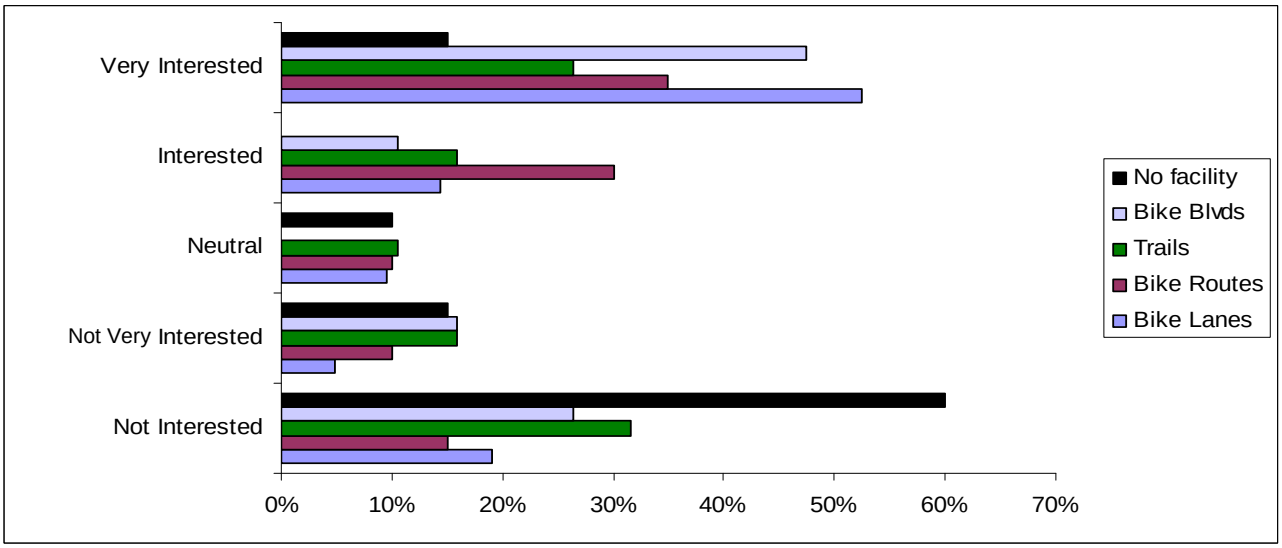


Figure 2-2: Interest in Using Bicycle Facilities

Most respondents were very interested in education and encouragement programs, specifically Safe Routes to School programs. They were also very interested in having maps and guides for bicycling around National City.

Figure 2-3 shows the detailed results of respondents' level of interest in education and encouragement programs.

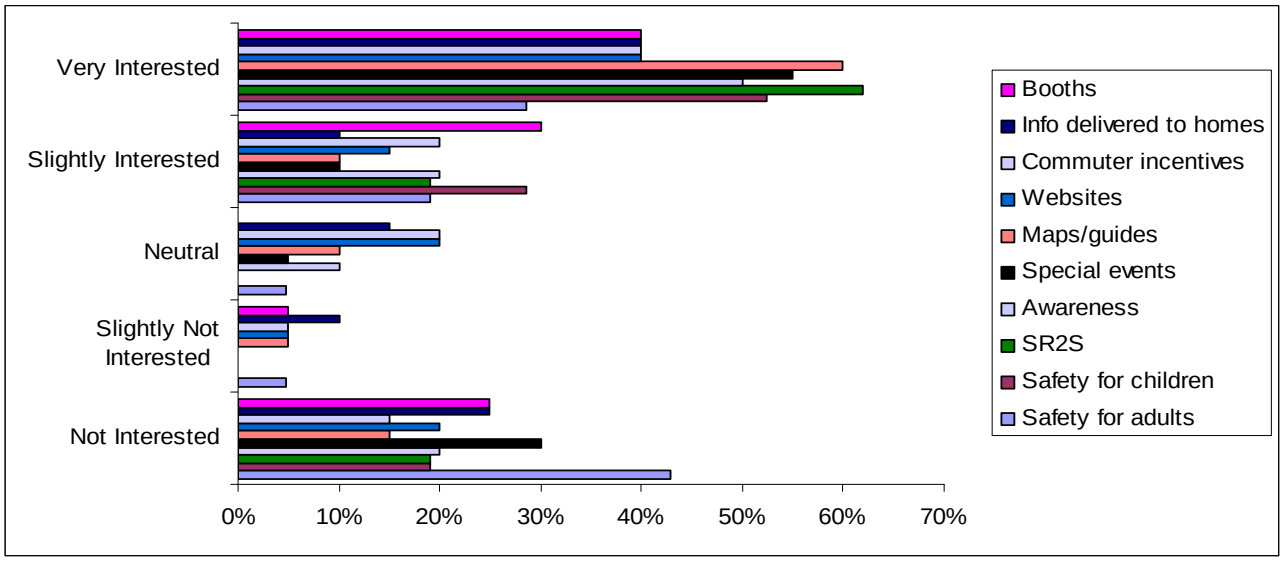


Figure 2-3: Interest in Education and Encouragement Programs

Respondents indicated they would be most likely to bicycle if lighting is provided. The other influential factors include providing access to bicycle parking and storage, and reducing traffic volumes and speeds.

Figure 2-4 shows the detailed results of the factors that influence respondents to bicycle.

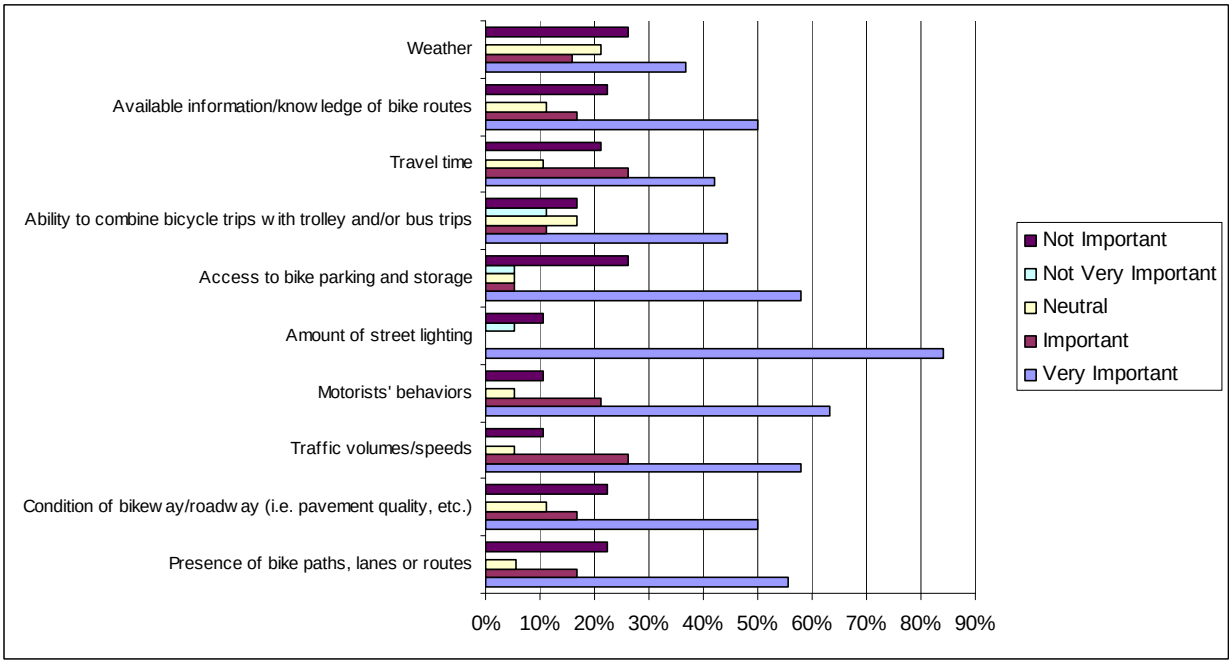


Figure 2-4: Conditions Influencing Propensity to Bicycle

Digital Copies Summary

The online survey generated 36 responses, which were collected from May 15 to August 25, 2010. The survey results are summarized below.

Seventy-four percent of respondents bicycle at least one day per month, while three percent do not bicycle at all. **Figure 2-5** shows the frequency with which respondents bicycle.

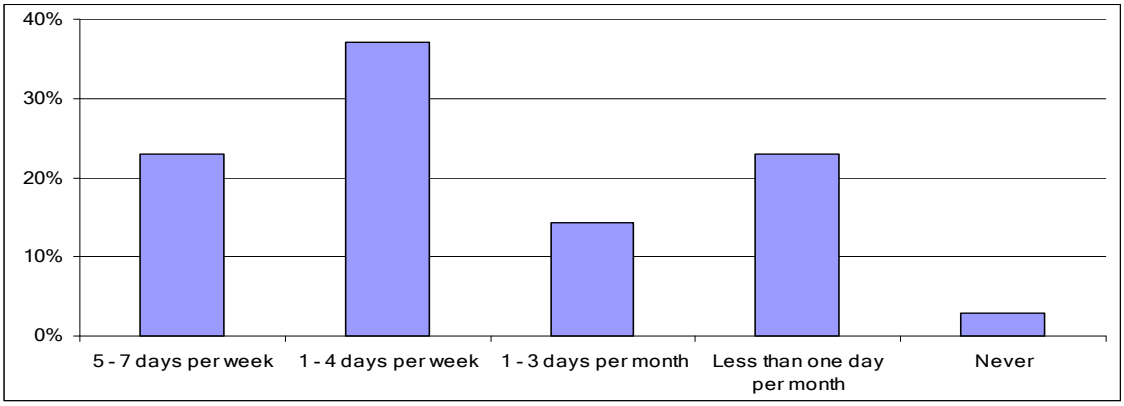


Figure 2-5: Frequency of Bicycling

Respondents (97%) overwhelmingly indicated they bicycle for exercise and recreation Thirty-three percent of respondents bicycle to shop, run errands, eat out and get to work or school. **Figure 2-6** shows the reasons why respondents bicycle.

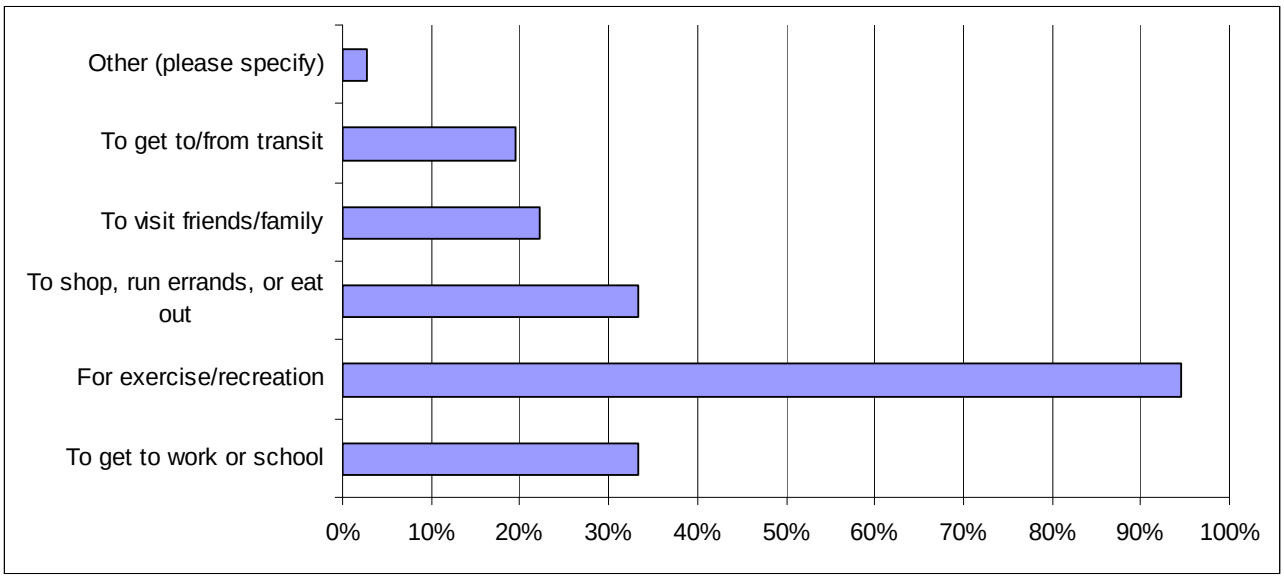


Figure 2-6: Reasons for Bicycling

Thirty-four percent of respondents bicycle 11-20 miles per one-way trip, while the majority of respondents bicycle at least six miles. **Figure 2-7** displays the average one-way trip distance of respondents' bicycle trips.

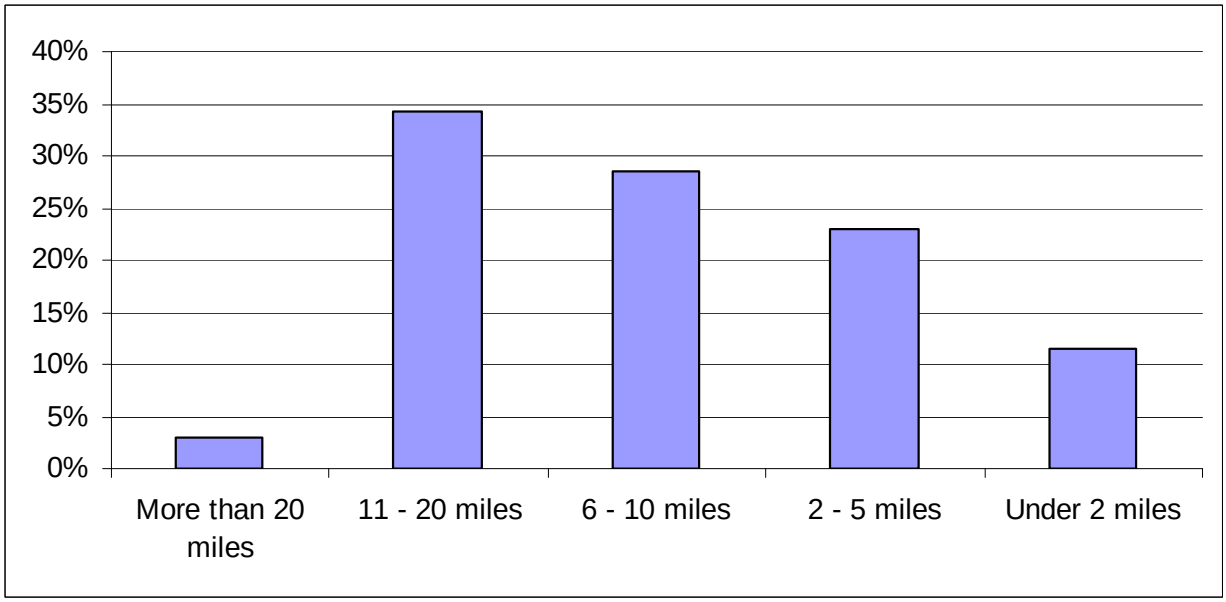


Figure 2-7: Average One-Way Distance of Bicycle Trips

Respondents were most interested in on-street bikeways, which include bike lanes, routes and boulevards. The vast majority (86%) were most interested in bike lanes. Respondents were least interested in roadways without bikeways. **Figure 2-8** shows the detailed responses to interest levels of specific bikeways.

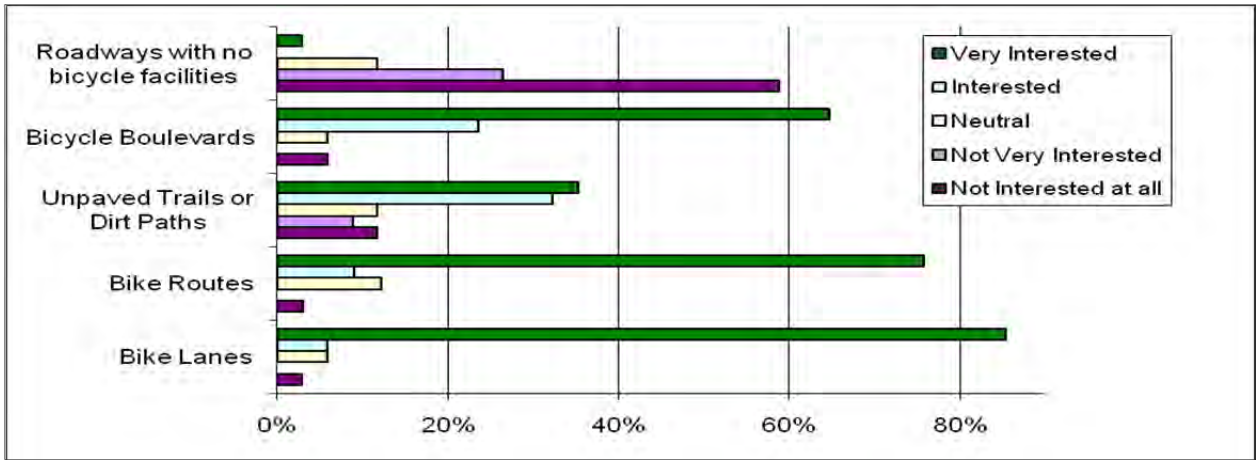


Figure 2-8: Interest in Specific Bicycle Facilities

Respondents had positive interest in most of the proposed bicycle programs. Respondents were most interested in bicycle maps and guides and public awareness campaigns. They were least interested in riding skills and safety courses for adults. Only 20 percent indicated that they were not interested in such programs. **Figure 2-9** shows the interest levels for various programs.

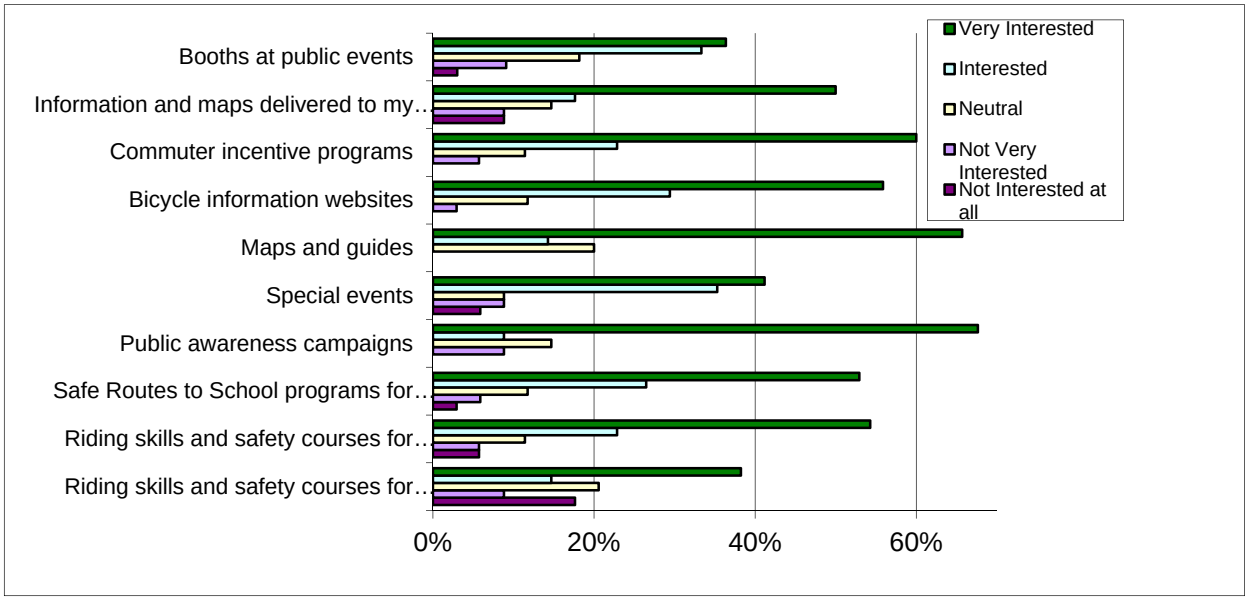


Figure 2-9: Interest in Bicycle Programs

Respondents are most likely to bicycle if motorists improve their behavior towards bicyclists. They would also bicycle more if traffic volumes/speeds are reduced and more bikeways are constructed. Considering National City's temperate climate, weather influences respondents to bicycle the least. **Figure 2-10** shows the detailed results of conditions that influence respondents' propensity to bicycle.

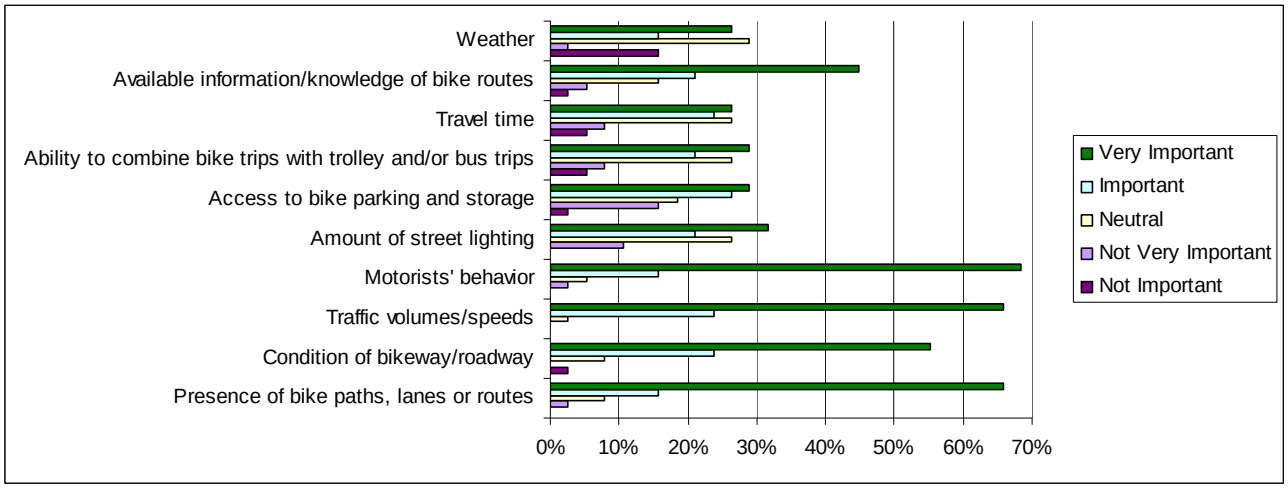


Figure 2-10: Conditions Influencing Propensity to Bicycle

Bicycle Tour

A bicycle tour was organized for Saturday, June 26, 2010 to provide interested bicyclists and National City residents an opportunity to take a bike ride and provide input to the Bicycle Master Plan development team. A small group of residents and bicycle enthusiasts participated in the bicycle tour and provided excellent feedback on the four proposed bikeways that were included in the tour. A worksheet was utilized for collecting feedback from the participants in which they were asked to rank attributes of the roadway on a scale of 1 (lowest ranking) to 5 (highest ranking). Attributes included overall safety, safety of crossing intersections/driveways, frequency of use, overall importance of creating a bikeway, and importance of

National City residents had an opportunity to participate in a bicycle tour of potential City bikeways and completed worksheets to evaluate the suitability of the roadway segments for potential bikeways.

installing bicycle parking along the corresponding roadway segments. **Table 2-2** below provides a summary of the feedback received during the bicycle tour.

Table 2-2: Summary of Bicycle Tour Feedback

Proposed Bikeway	Overall Safety of Segment	Safety of Crossings	Frequency of Use	Overall Importance of Creating Bikeway on Segment	Importance of Bike Parking on Segment	Overall Segment Ranking
4th St	4.5	3.8	3.0	5.0	3.3	19.6
18th St	3.3	3.3	3.3	4.3	3.8	18.0
Palm Ave	3.7	3.3	3.0	4.0	3.3	17.3
D Ave	3.5	3.0	3.3	3.6	3.0	16.4

As illustrated in the table above, 4th St was ranked highest among the four roadways included in the bike tour, followed by 18th St, Palm Ave and D Ave. This input will assist in prioritizing new bikeways and corresponding improvements.

Tour participants on the Interstate 805 overcrossing on E. 4th Street.

3. Existing Conditions

3.1 Land Use

National City contains a mix of land uses, most prevalently residential, commercial, transportation, industrial, and military. Approximately 13% of National City is comprised of San Diego Bay. **Figure 3-1** shows National City's existing land uses. **Table 3-1** summarizes the approximate percentage of each existing land use type in National City. The data presented in **Figure 3-1** and **Table 3-1** reflects the San Diego Association of Governments (SANDAG) 2009 Land Use shapefile used in the National City General Plan Update (2011). **Figure 3-1**, along with all other maps contained in this document, cites the data source under the map title.

Table 3-1: National City Existing Land Uses

Land Use Type	Percentage
Single Family Residential, Detached	18.4%
Transportation, Communications, Utilities	16.7%
Industrial	12.6%
Military	9.5%
Single Family Residential, Attached	5.4%
Commercial and Office	5.4%
Civic/Education	4.9%
Recreation/Open Space/Agriculture	4.7%
Multi-family Residential	3.9%
Shopping Center	2.6%
Vacant	2.3%
Mobile Home	0.5%

Source: SANDAG 2009 (Existing Land Uses)

Combined, residential uses are the most prominent (28.2%) and are found throughout the City except for in the southwestern and Bayfront areas. The majority of the 461 acres that comprise the Bayfront are occupied by the United States Navy and Port of San Diego. The City's redevelopment efforts in the Bayfront area include included a new marina at the south end of Marina Way, the widening of Bay Marina Drive with streetscape enhancements, a new hotel and restaurant sites, and restoration of Railcar Plaza and historic Santa Fe Depot. Commercial activity in National City is primarily concentrated along four major corridors: National City Boulevard, home to the "Mile of Cars", Highland Avenue, 30th Street/ Sweetwater Road, and Plaza Boulevard. In addition, Westfield's Plaza Bonita Mall, the City's largest retail center, is located in the southeast portion of National City with access from Plaza Bonita Road and Sweetwater Road. Another prominent facility, Paradise Valley Hospital, is located in the northeast portion of National City.

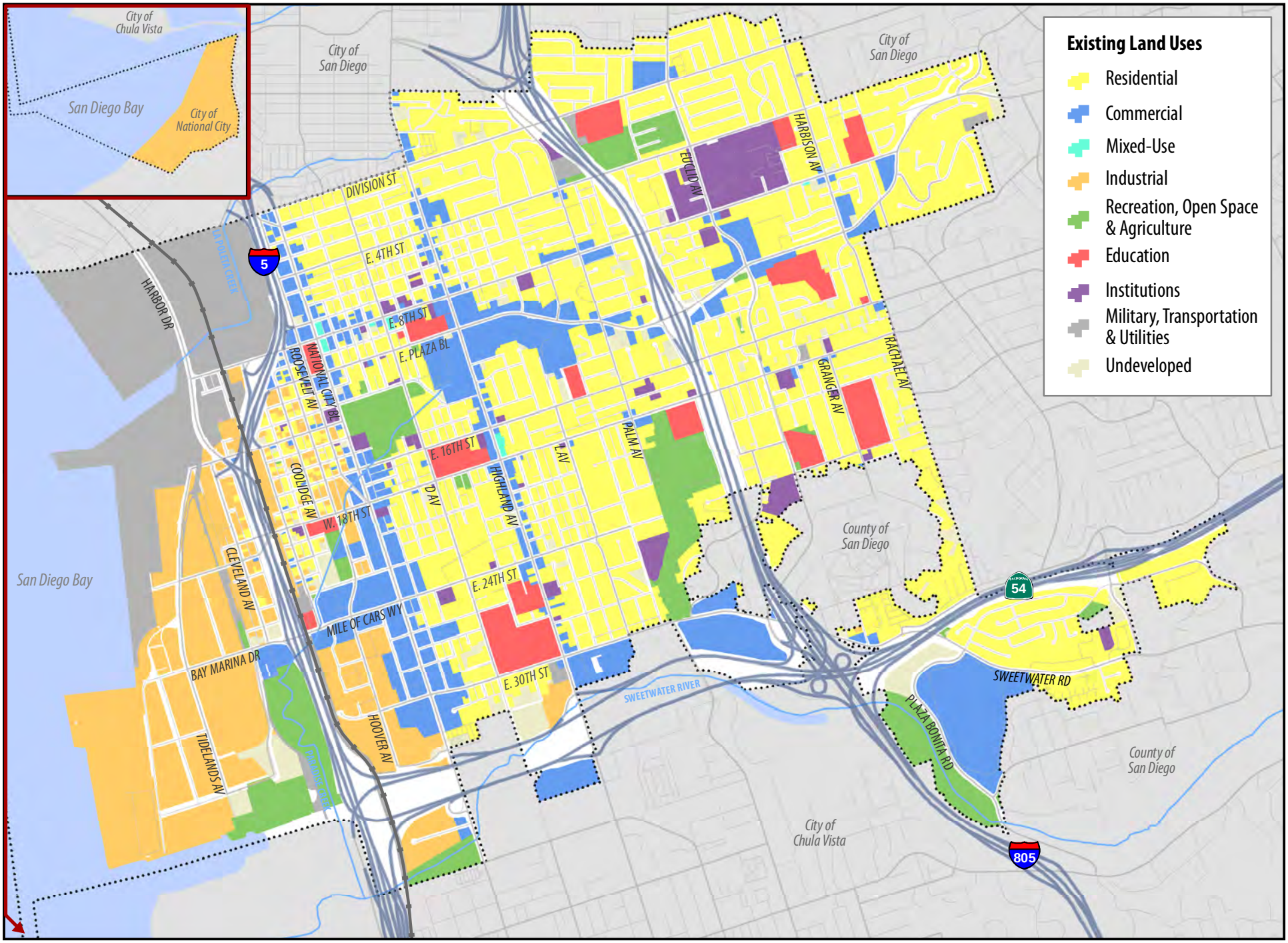


Figure 3-1: Existing Land Uses in National City

City of National City Bicycle Master Plan

Source: National City General Plan Update

Date: 7/28/10

3.2 Transportation Network

The City of National City's transportation network is comprised of diverse elements including an extensive roadway system, bus and light rail transit, bike and pedestrian facilities, and freight haul routes.

Harbor Drive bike lane

The existing roadway network in National City follows a traditional grid pattern of local streets, collectors, arterials and freeways that enhance connectivity and accessibility across the City. The three major freeways that run through the City include State Route 54, Interstate 5 and Interstate 805. These facilities provide a high level of connectivity between the City and other locations across the region and the state. The major north-south arterials that cross the City include Harbor Drive, National City Boulevard, Highland Avenue, Euclid Avenue and Plaza Bonita Road. The major east-west arterials include W. 8th Street, E. Plaza Boulevard, Paradise Valley Road, Mile of Cars Way, E. 30th Street, and Sweetwater Road. In addition, there are approximately two dozen collector streets that provide access from the arterials into the community neighborhoods and business districts.

The San Diego Metropolitan Transit System (MTS) provides the public transportation for National City. The San Diego "Blue Line" Trolley has two stops in National City, the 8th Street and 24th Street stations. Additionally, ten bus routes operate in National City, with over 200 bus stops located along these routes throughout the City.

3.3 Bicycle Facilities

This section summarizes existing bikeways, bike parking, and bicycle-related amenities that form National City's bicycle system.

Coolidge Ave bike lane

Bikeways

National City's existing bicycle network consists of approximately 2.4 miles of Class I bikeways (bike paths), 1.7 miles of Class II bikeways (bike lanes), and a 0.6-mile segment of Class III bikeway (bike route). **Figure 3-2** displays National City's 4.7 miles of existing bikeways. As shown, bike lanes exist on Harbor Drive from the City's northern border to W. 8th Street, and on portions of Plaza Bonita Road, Coolidge Avenue and Hoover Avenue. In addition, as part of National City's Bay Marina Drive Widening and Streetscape Enhancement Project, bike lanes were installed on Bay Marina Drive between Marina Way and Cleveland Avenue. A 0.6-mile segment of bike route also exists on the northern end of Plaza Bonita Road.

Three regional bikeway corridors traverse National City: the Bayshore

Bikeway, the Sweetwater River Bikeway, and the Mission Valley-Chula Vista Corridor.

Table 3-2 summarizes these three bikeway classifications as defined by "Chapter 1000 Bikeway Planning and Design" of the *California Highway Design Manual.*

Bicycle Parking and End-of-Trip Amenities

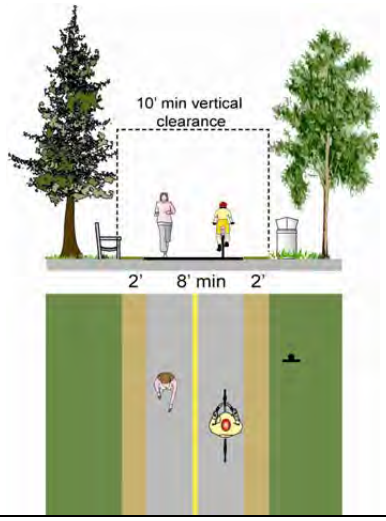
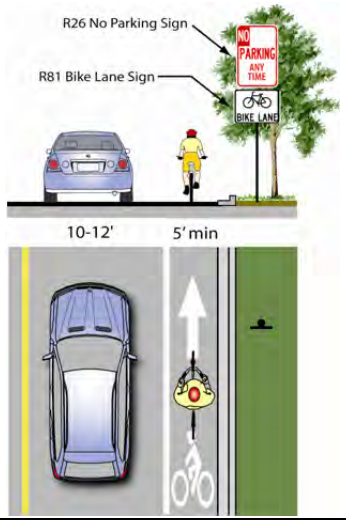
National City has limited bicycle parking facilities. Some bike parking and end-of-trip amenities such as showers and lockers are available at key employment and educational facilities, such as Southwestern Community College.

SANDAG iCommute bike lockers are available at both of National City's trolley stations. SANDAG iCommute bike lockers provide an enclosed parking space that is accessible by a mechanical or electronic key system for a monthly fee. They are available on a first-come, first-served basis. The 8th Street Trolley Station has four bike locker structures containing eight spaces. The 24th Street Trolley Station includes two bike lockers with four spaces.

iCommute bike lockers at the 8th Street Trolley Station

In addition to existing bikeways, Figure 3-2 also shows existing end of trip amenities based on available data, although short term bike parking may be provided elsewhere in the City.

Table 3-2: California Bikeway Classifications

Class Description	Example Graphic
Class I – Bike Path Bike paths, also termed shared-use or multi-use paths, are paved right-of-way for exclusive use by bicyclists, pedestrians, and those using non-motorized modes of travel. They are physically separated from vehicular traffic and can be constructed in roadway right-of-way or exclusive right-of-way. Bike paths provide critical connections where roadways are absent or are not conducive to bicycle travel.	
Class II - Bike Lane Bike lanes are defined by pavement striping and signage used to allocate a portion of a roadway for exclusive or preferential bicycle travel. Bike lanes are one-way facilities on either side of a roadway. Bike lanes can be enhanced with treatments that improve safety and connectivity by addressing site-specific issues, such as additional warning or way-finding signage.	
Class III - Bike Route Bike routes provide shared use with motor vehicle traffic within the same travel lane. Designated by signs, bike routes provide continuity to other bike facilities or designate preferred routes through corridors with high demand. Bike routes can be enhanced with treatments such as "shared lane markings" that improve driver awareness of bicyclists.	

Source: Alta Planning + Design (2010)

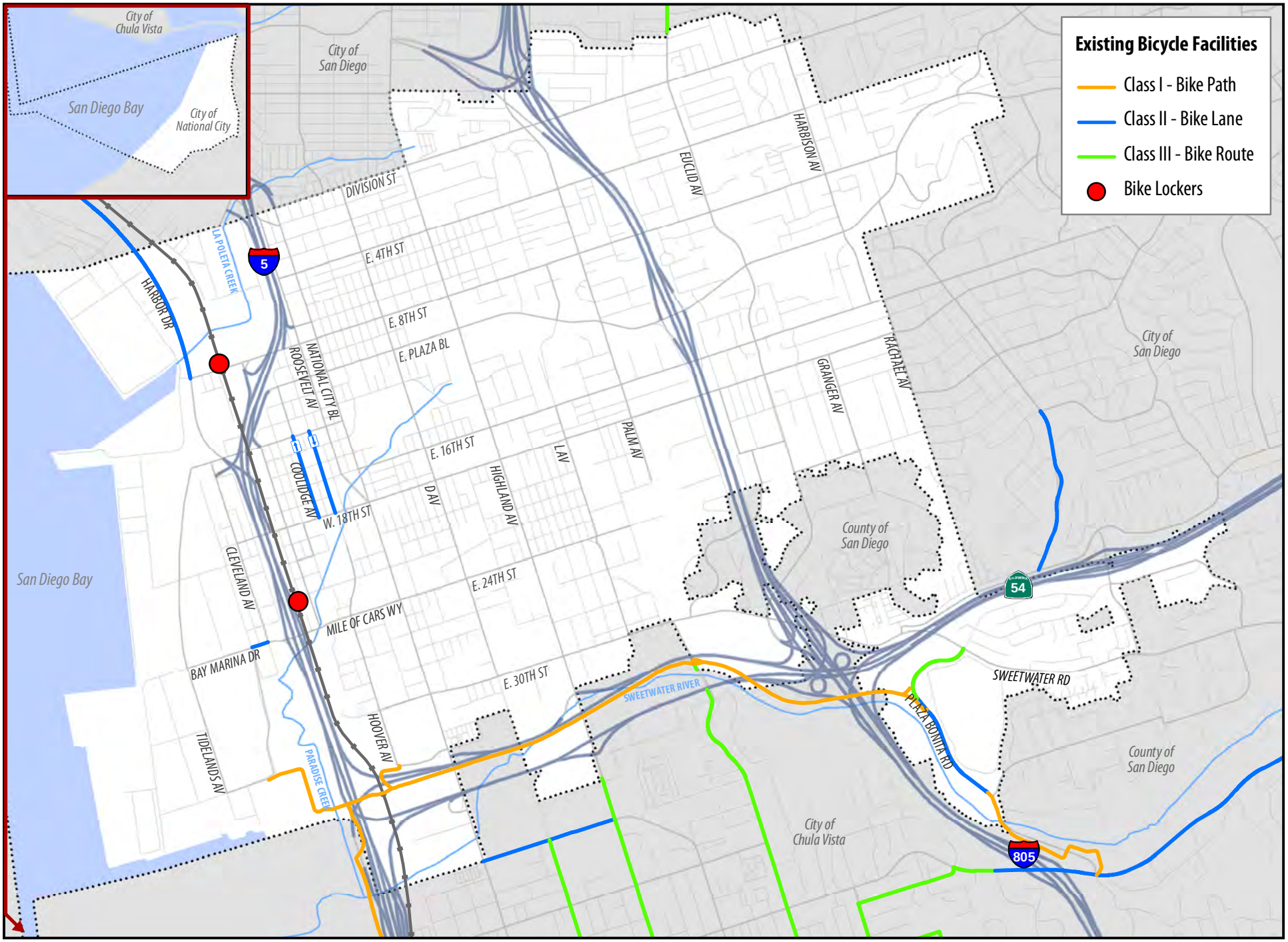


Figure 3-2: Existing Bicycle Facilities and End of Trip Facilities in National City

City of National City Bicycle Master Plan

Source: City of National City

Date: 11/1/10

0 0.25 0.5 Miles

3.4 Opportunities and Constraints

This section outlines opportunities and constraints for bicycle connectivity within National City's existing transportation network as observed during field reviews and identified through review of existing conditions data. **Figure 3-3** depicts specific opportunities and constraints, which are also discussed in the subsequent sections.

Opportunities

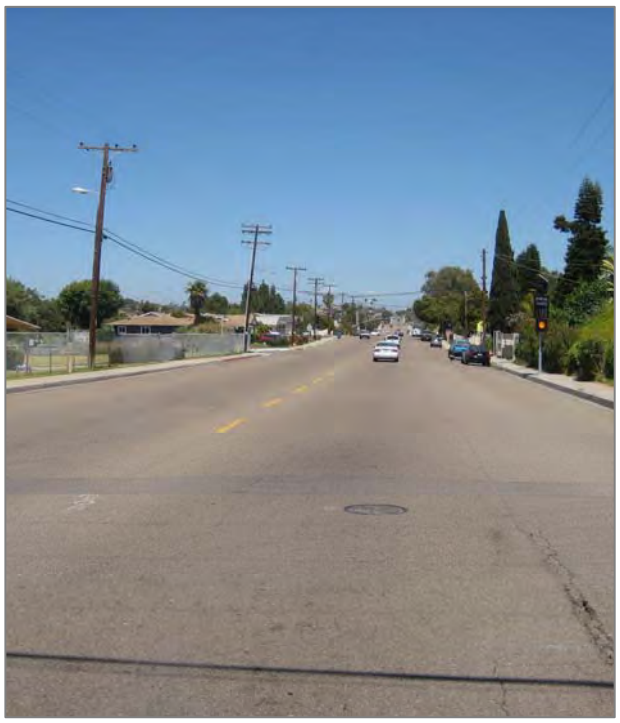
In generally, the grid layout of National City's street network and relatively flat topography support bicycling. This section describes opportunities to improve bicycling in National City.

Roadway Characteristics

Many of National City's roadways appear to have more vehicle capacity than is currently needed. For example, many residential and collector streets have curb-to-curb widths greater than 40' feet, which is wider than is needed to support on-street parking and one travel lane in each direction. These wide roadways present an opportunity to enhance multi-modal transportation options. Bicycle facilities on these streets could be developed through relatively simple and inexpensive treatments, such as roadway restriping to accommodate bike lanes.

Regional Connectivity

In May 2010 SANDAG adopted the San Diego Regional Bicycle Plan to establish a vision for a diverse and interconnected regional bicycle system. Three of the regional corridors identified in the plan traverse National City – the Bayshore Bikeway, the Sweetwater River Bikeway, and the Mission Valley-Chula Vista Corridor.



E. 4th Street at T Avenue is 64' wide curb-to-curb

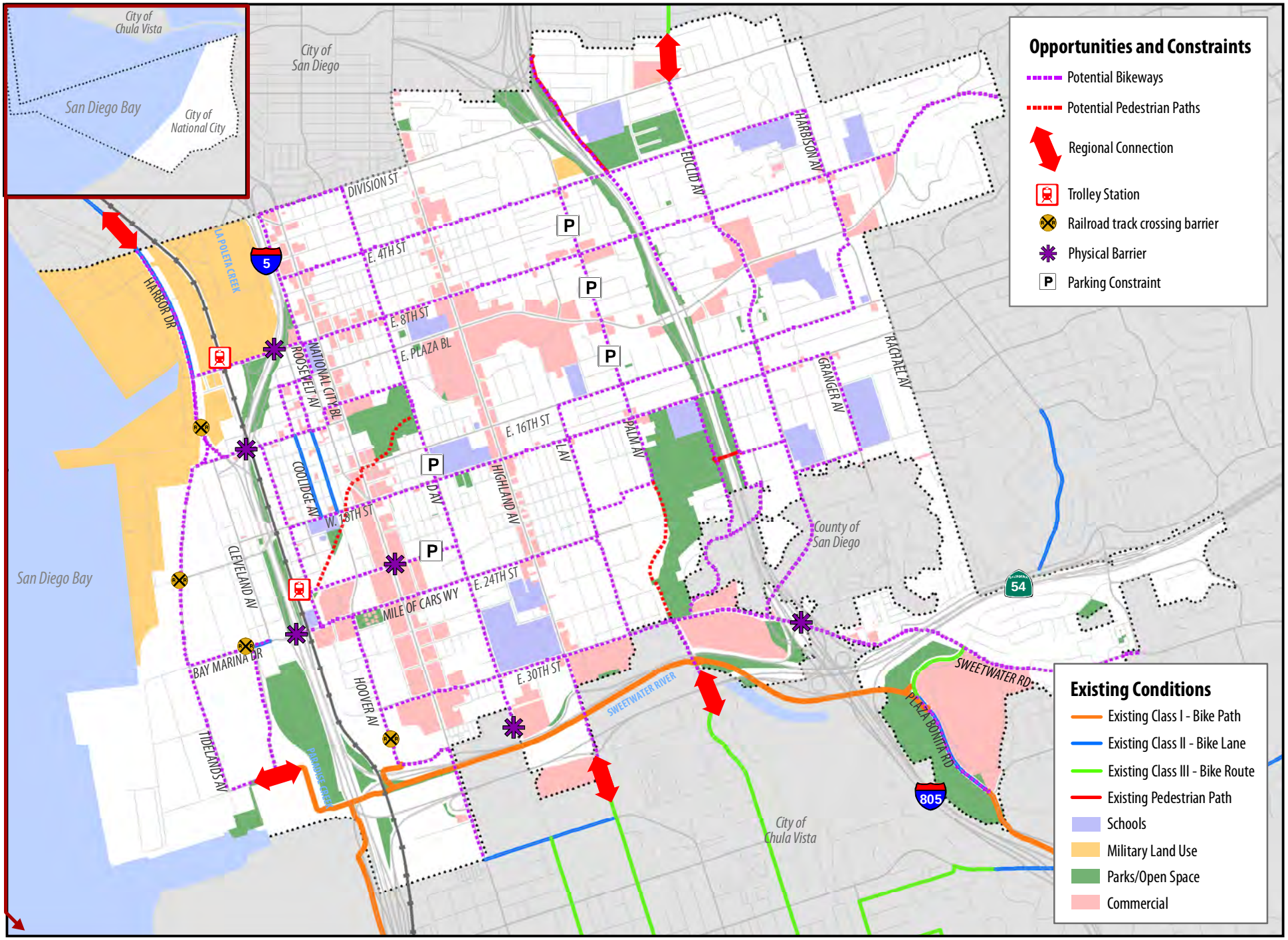


Figure 3-3: Opportunities and Constraints in National City's Bicycle Network

City of National City Bicycle Master Plan

Source: City of National City

Date: 7/1/10

0 0.25 0.5 Miles

The Bayshore Bikeway is a 26-mile loop that runs along San Diego Bay connecting the cities of San Diego, National City, Chula Vista, Imperial Beach, and Coronado. In National City, the planned alignment is along Harbor Drive, Tidelands Avenue, and W. 32nd Street, connecting with the Sweetwater River Bikeway near National City's southern border. The Sweetwater River Bikeway is complete through National City. It connects National City, unincorporated San Diego County, and Chula Vista. The Mission Valley-Chula Vista Corridor extends southbound through National City along Euclid Avenue, 18th Street, Prospect Street, Grove Street, and Sweetwater Road. Class II bike lanes are planned for the Euclid Avenue and Sweetwater Road segments and Class III bike routes are planned for the 18th Street, Prospect Street, and Grove Street segments.

Bayshore Bikeway Gordy Shields Bridge

These regional corridors provide an opportunity to connect National City to neighboring communities and allow for enhancements such as regional wayfinding signage. Identifying local bikeways and treatments to improve local access to these regional facilities provides an opportunity to support inter-community bicycle travel for residents.

Transit

The two Metropolitan Transit System (MTS) Trolley Stations in National City, the 8th Street Trolley Station and the 24th Street Trolley Station, present an opportunity to promote multimodal commuting. As noted previously, both of these transit stations have bike lockers available to the public. Opportunity exists to improve bicycle access to both stations. Roosevelt Avenue, 8th Street, 22nd Street, Wilson Avenue, and Bay Marina Drive/Mile of Cars Way/24th Street all have bikeway potential that would provide improved bicycle access to the trolley stations.

Dirt Path off of E.4th Street

MTS trolleys allow one to two bicycles per car. MTS busses accommodate two bicycles each. Providing more bike parking at trolley stations and along transit lines has the potential to increase ridership and enhance bike-transit integration.

Community Pathways

A few dirt paths in the City are possible candidates for community multi-use paths. For example, there is a partially paved path adjacent to the public water spigot on E. 4th Street. The path is primarily dirt and vegetation encroaches onto the majority of the path. Although not a City-designated path, it appears to be highly utilized and serves as a north-south connection between E. 4th Street and Division Street, and provides access to El Toyon Park from the west. Such paths can provide valuable off-street links to key attractors.

Development

As new development and redevelopment projects occur, the City has an opportunity to ensure bicycle facilities are included through the plan review process. The General Plan Update identifies in-fill, mixed-use development sites throughout National City, including the eastern portions of the City where current land uses suggest that there is lower bicycling demand compared to the western portions of the City. These planned land use changes are anticipated to generate additional bicycling demand which should be addressed in the development of the bicycle network. **Figure 3-4** displays planned land uses in National City.

Constraints

Although National City has many opportunities to improve the bicycle network, there are impediments to bicycle travel that require consideration.

System Gaps

While system gaps in National City's bicycle network represent constraints, they simultaneously present opportunities. Since National City has limited existing bicycle facilities, there is an excellent opportunity to develop a comprehensive and implementable bicycle network that is not constrained by the existing network.

Mile of Cars Way

Barriers

Several roadways in National City may present barriers to bicycle travel. These barriers can generally be categorized into three types:

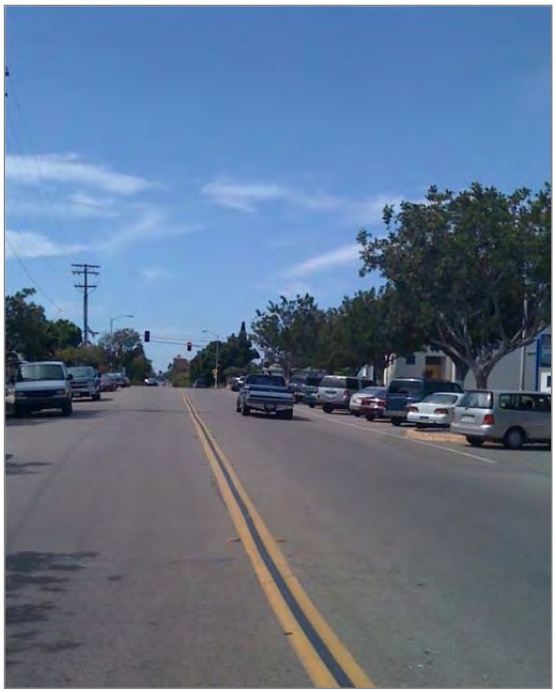
Physical barrier: This type of barrier describes a physical impediment to travel such as where a roadway terminates or where crossings can only occur at freeway interchanges. I-5 and I-805 run north-south through the City while SR-54 runs east-west across the southern border of the City. SR-54 limits local connectivity to the Sweetwater Bikeway. Future bikeways that intersect I-5 and I-805 will require special attention to the configuration and treatments at interchange crossings.

Facility barrier: This type of barrier occurs where no bicycle facilities exist. As discussed previously this type of barrier is prevalent in National City and restricts bicycle access to key community destinations.

Situational barrier: This type of barrier occurs where roadway widths, travel speeds, or other roadway characteristics make bicycle travel difficult. Plaza Boulevard and Highland Avenue are examples of situational barriers in National City.

Bicycling Culture

National City lacks comprehensive bicycle-related policies, such as establishing bicycle parking requirements. Implementation of bicycle education, encouragement, and awareness campaigns will spark community interest in bicycling. "Kimberlee's Bikes for Kids Give Away" is a well publicized encouragement event supported by the community. Institutionalizing and supporting bicycling through programmatic efforts are critical components to becoming a bicycle-friendly city.



D Avenue where diagonal parking is adjacent to National City Middle School

On-Street Parking

Along some roadways in National City the existing public right-of-way widths may not be sufficient to accommodate both bike lanes and existing on-street parking. This occurs along Palm Avenue where a bicycle connection is desirable. If on-street parking is to be maintained, bike routes with "shared lane markings' may be used. On-street diagonal parking can also serve as a constraint since drivers' visibility of bicyclists may be obscured when reversing out of a parking space. An additional buffer or back-in diagonal parking can enhance visibility. Diagonal parking exists adjacent to some bicycle attracting land uses such as National City Middle School on D Avenue.

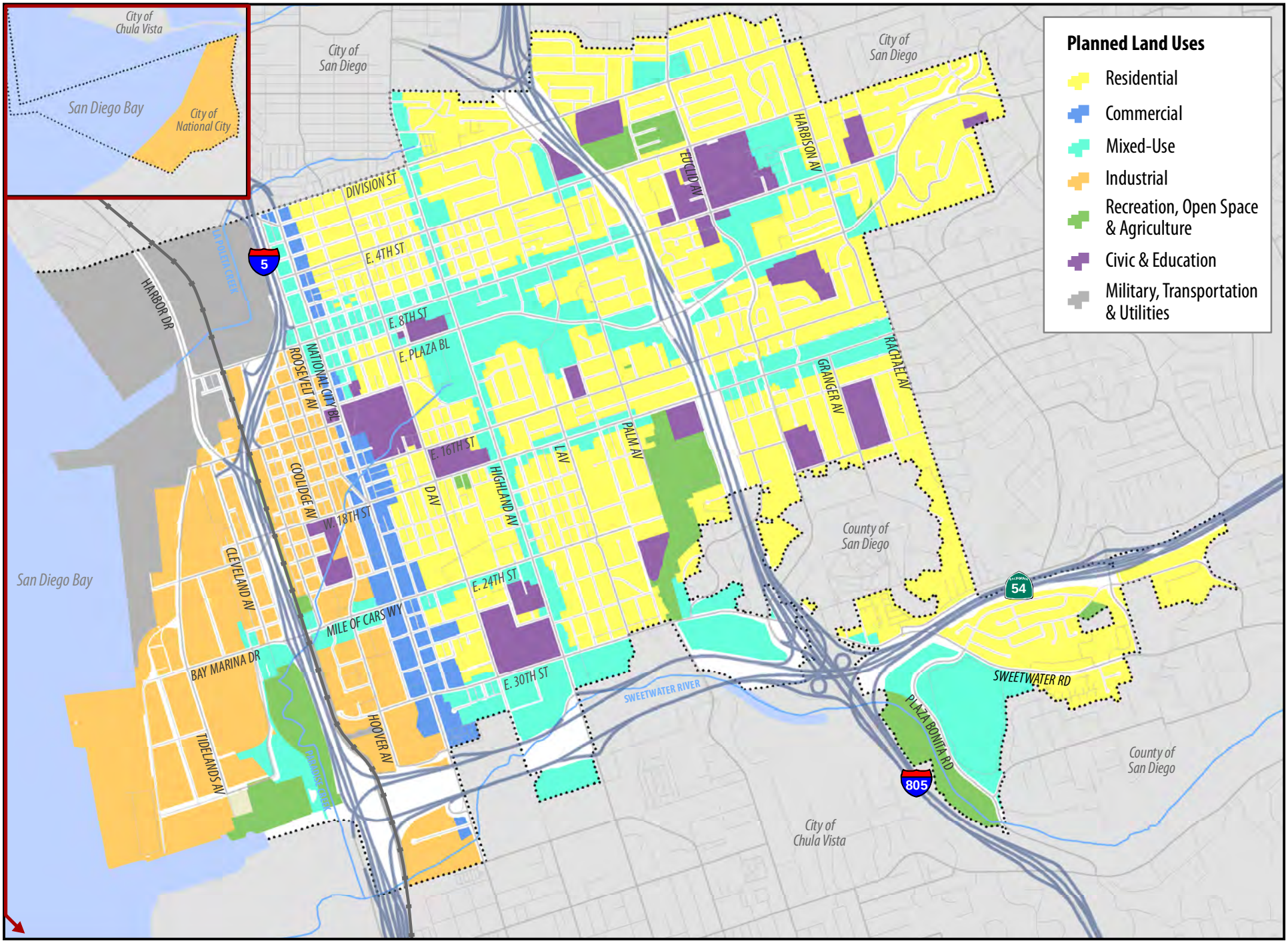


Figure 3-4: Planned Land Uses in National City

City of National City Bicycle Master Plan

Source: National City General Plan Update

Date: 1/11/11

0 0.25 0.5 Miles

4. Needs and Demand Analysis

This section presents an estimate of current and potential bicycling demand in National City based on bicycle commute statistics and an assessment of population characteristics and land uses associated with higher rates of bicycling activity. Estimating how many people currently bicycle provides an indication of current system usage and establishes a baseline against which to measure progress. This section also identifies network gaps and roadway characteristics that serve as barriers to bicycling. Assessing demand and deficiencies is critical to identifying where facilities should be constructed or improved.

The data utilized in this analysis derives from four sources: US Decennial Census (2000), US American Community Survey Census (2006-2008), SANDAG GIS shapefiles (2006, 2008, and 2009), and California Statewide Integrated Traffic Records System (SWITRS) (2002-2008). Each table and map contained in this section notes the specific source(s) and date of the data presented.

4.1 Bicycle Commuter Estimates

United States Census "Commuting to Work" data provides an indication of current bicycle system usage. A major objective of any bicycle facility enhancement or encouragement program is to increase the "bicycle mode split" or percentage of people who choose to bike rather than drive alone. **Table 4-1** presents commute to work data estimates reported by the 2006-2008 US Census American Community Survey for the City of National City and, for comparative purposes, the United States, California, and County of San Diego.

Table 4-1: Means of Transportation to Work Data

Mode	United States	California	San Diego County	National City
Bicycle	0.5%	0.9%	0.6%	0.6%
Drove Alone – car, truck or van	75.8%	72.9%	74.7%	60.7%
Carpool - car, truck or van	10.6%	12.0%	10.9%	14.0%
Transit	4.9%	5.2%	3.4%	6.9%
Walked	2.8%	2.8%	3.0%	3.7%
Other Means	1.4%	1.4%	1.3%	1.6%
Worked at Home	4.0%	4.8%	6.1%	12.5%
Total	100%	100%	100%	100%

Source: U.S. Census Bureau, 2006-2008 American Community Survey

According to the estimates shown in **Table 4-1**, 0.6 percent of National City residents commute predominately by bicycle. This estimated bicycle mode share is consistent with the county estimate, slightly lower than the state estimate and slightly higher than the national estimate. However, it is important to note that this figure likely underestimates the true amount of bicycling that occurs in National City for several reasons. First, data reflects respondents' dominant commute mode and therefore does not capture trips to school, for errands, or other bike trips that would supplant vehicular trips. Also, US Census data collection methods only enable a respondent to select one mode of travel, thus excluding bicycle trips if they constitute

part of a longer multimodal trip. In National City where there are a substantial percentage of transit commuters, bicycle commuting may be considerably underestimated if a significant number of people bicycle to and from transit stops as a part of their commute. Also, National City has a relatively low drive alone mode share, with transit use, walking, and working at home comprising greater proportions of the total working population compared to the region, state, and country, which is an indication of potential bicycle demand.

4.2 Bicycle Demand and Air Quality Benefits Analysis

This section presents an adjusted estimate of current bicycling levels within the City of National City using SANDAG and US Census data along with several adjustments for likely bicycle commuter underestimations, as discussed above. This section also presents forecasted future bicycle ridership for the planning area along with forecasted trip reduction and air quality benefits. **Table 4-2** presents estimates of current demand and corresponding air quality benefits. **Table 4-3** presents forecasted demand and corresponding air quality benefits for the year 2030.

Table 4-2: Current Demand and Air Quality Benefits Estimates

Variable	Figure	Source
Current Commuting Statistics		
Existing study area population	56,522	*2006-2008 American Community Survey, B0801 3-Year Estimates*
Existing employed population	21,598	*2006-2008 American Community Survey, B0801 3-Year Estimates*
Existing bike-to-work mode share	0.6%	*2006-2008 American Community Survey, B0801 3-Year Estimates*
Existing number of bike-to-work commuters	130	*Employed persons multiplied by bike-to-work mode share*
Existing work-at-home mode share	12.5%	*2006-2008 American Community Survey, S0801 3-Year Estimates*
Existing number of work-at-home bike commuters	675	*Assumes 25% of population working at home makes at least one daily bicycle trip*
Existing transit-to-work mode share	6.9%	*2006-2008 American Community Survey, S0801 3-Year Estimates*
Existing transit bicycle commuters	373	*Employed persons multiplied by transit mode share. Assumes 25% of transit riders access transit by bicycle. Metro Bus and Rail On-Board Surveys, 2001*
Existing school children, ages 6-14 (grades K-8)	6,895	*2006-2008 American Community Survey, S0801 3-Year Estimates*
Existing school children bicycling mode share	2.0%	*National Safe Routes to School surveys, 2003.*
Existing school children bike commuters	138	*School children population multiplied by school children bike mode share*
Existing number of college students in study area	2,481	*2006-2008 American Community Survey, B14001 3-Year Estimates*
Existing estimated college bicycling mode share	10.0%	*Review of bicycle commute share in seven university communities (source: National Bicycling & Walking Study, FHWA, Case Study No. 1, 1995).*
Existing college bike commuters	248	*College student population multiplied by college student bicycling mode share*

Variable	Figure	Source
Existing total number of bike commuters	1,563	*Total bike-to-work, school, college and utilitarian bike trips. Does not include recreation.*
Total daily bicycling trips	3,126	*Total bicycle commuters x 2 (for round trips)*
Current Estimated VMT Reductions		
Reduced Vehicle Trips per Weekday	842	*Assumes 73% of bicycle trips replace vehicle trips for adults/college students and 53% for school children*
Reduced Vehicle Trips per Year	219,632	*Reduced number of weekday vehicle trips multiplied by 261 (weekdays in a year)*
Reduced Vehicle Miles per Weekday	3,915	*Assumes average round trip travel length of 5 miles for adults/college students and 1 mile for schoolchildren*
Reduced Vehicle Miles per Year	1,021,859	*Reduced number of weekday vehicle miles multiplied by 261 (weekdays in a year)*
Current Air Quality Benefits Estimates		
Reduced Hydrocarbons (pounds/weekday)	12	*Daily mileage reduction multiplied by 1.36 grams per reduced mile*
Reduced PM10 (pounds/weekday)	0	*Daily mileage reduction multiplied by 0.0052 grams per reduced mile*
Reduced PM2.5 (pounds/weekday)	0	*Daily mileage reduction multiplied by 0.0049 grams per reduced mile*
Reduced NOX (pounds/weekday)	8	*Daily mileage reduction multiplied by 0.95 grams per reduced mile*
Reduced CO (pounds/weekday)	107	*Daily mileage reduction multiplied by 12.4 grams per reduced mile*
Reduced C02 (pounds/weekday)	3,185	*Daily mileage reduction multiplied by 369 grams per reduced mile*
Reduced Hydrocarbons (pounds/year)	3,064	*Yearly mileage reduction multiplied by 1.36 grams per reduced mile*
Reduced PM10 (pounds/year)	12	*Yearly mileage reduction multiplied by 0.0052 grams per reduced mile*
Reduced PM2.5 (pounds/year)	11	*Yearly mileage reduction multiplied by 0.0049 grams per reduced mile*
Reduced NOX (pounds/year)	2,140	*Yearly mileage reduction multiplied by 0.95 grams per reduced mile*
Reduced CO (pounds/year)	27,935	*Yearly mileage reduction multiplied by 12.4 grams per reduced mile*
Reduced C02 (pounds/year)	831,288	*Yearly mileage reduction multiplied by 369 grams per reduced mile*

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

Table 4-3: Potential Future Demand and Air Quality Benefits Estimates

Variable	Figure	Source
Future Commuting Statistics		
Future study area population	69,306	*SANDAG 2030 Regional Growth Forecast*
Future employed population	26,483	*SANDAG 2030 Regional Growth Forecast*
Future bike-to-work mode share	2.0%	*Estimate of the potential mode share increase associated with planned/proposed bikeway system improvements*
Future number of bike-to-work commuters	530	*Employed persons multiplied by bike-to-work mode share*
Future work-at-home mode share	12.5%	*Estimate based on historic work-at-home population growth (or decline) trends*
Future number of work-at-home bike commuters	828	*Assumes 50% of population working at home makes at least one daily bicycle trip*
Future transit-to-work mode share	10.0%	*Estimate of the potential mode share increase (or decrease) associated with planned/proposed bikeway system improvements and transit service improvements/reductions*
Future transit bicycle commuters	662	*Employed persons multiplied by transit mode share. Assumes 25% of transit riders access transit by bicycle*
Future school children, ages 6-14 (grades K-8)	9,875	*SANDAG 2030 Regional Growth Forecast*
Future school children bicycling mode share	4.0%	*Estimate of the potential mode share increase associated with planned/proposed bikeway system improvements*
Future school children bike commuters	395	*School children population multiplied by school children bicycling mode share*
Future number of college students in study area	3,042	*Population-based estimate*
Future estimated college bicycling mode share	15.0%	*Estimate of the potential mode share increase associated with planned/proposed bikeway system improvements*
Future college bike commuters	456	*College student population multiplied by college student bicycling mode share*
Future total number of bicycle commuters	2,871	*Total bike-to-work, school, college and utilitarian biking trips. Does not include recreation.*
Future total daily biking trips	5,741	*Total bike commuters x 2 (for round trips)*
Future Vehicle Trips and Miles Reduction		
Reduced Vehicle Trips per Weekday	1,533	*Assumes 73% of biking trips replace vehicle trips for adults/college students and 53% for school children*
Reduced Vehicle Trips per Year	400,177	*Reduced number of weekday vehicle trips multiplied by 261 (weekdays in a year)*
Reduced Vehicle Miles per Weekday	6,829	*Assumes average round trip travel length of 5 miles for adults/college students and 1 mile for schoolchildren*
Reduced Vehicle Miles per Year	1,782,322	*Reduced number of weekday vehicle miles multiplied by 261 (weekdays in a year)*

Variable	Figure	Source
	Future Air Quality Benefits	
Reduced Hydrocarbons (pounds/weekday)	20	*Daily mileage reduction multiplied by 1.36 grams per reduced mile.*
Reduced PM10 (pounds/weekday)	0	*Daily mileage reduction multiplied by 0.0052 grams per reduced mile.*
Reduced PM2.5 (pounds/weekday)	0	*Daily mileage reduction multiplied by 0.0049 grams per reduced mile.*
Reduced NOX (pounds/weekday)	14	*Daily mileage reduction multiplied by 0.95 grams per reduced mile.*
Reduced CO (pounds/weekday)	187	*Daily mileage reduction multiplied by 12.4 grams per reduced mile.*
Reduced C02 (pounds/weekday)	5,555	*Daily mileage reduction multiplied by 369 grams per reduced mile.*
Reduced Hydrocarbons (pounds/year)	5,344	*Yearly mileage reduction multiplied by 1.36 grams per reduced mile.*
Reduced PM10 (pounds/year)	20	*Yearly mileage reduction multiplied by 0.0052 grams per reduced mile.*
Reduced PM2.5 (pounds/year)	19	*Yearly mileage reduction multiplied by 0.0049 grams per reduced mile.*
Reduced NOX (pounds/year)	3,733	*Yearly mileage reduction multiplied by 0.95 grams per reduced mile.*
Reduced CO (pounds/year)	48,724	*Yearly mileage reduction multiplied by 12.4 grams per reduced mile.*
Reduced C02 (pounds/year)	1,449,929	*Yearly mileage reduction multiplied by 369 grams per reduced mile.*

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

This model is based on current projections for population growth and reasonable assumptions about future bicycle ridership. As shown, the benefits model predicts that by 2030 the total number of bicycle commuters could increase from the current estimate of 1,563 to 2,871, resulting in a substantial reduction of both Vehicle Miles Traveled (VMT) and associated emissions. This includes a yearly emissions reduction by 2030 of 3,733 pounds of smog forming N0X and 1,449,929 pounds of C02, the principle gas associated with global climate change.

4.3 Bicycle Trip Generators

Bicycle trip generators refer to population characteristics that are correlated with higher bicycling activity levels, such as high population or employment densities or high concentrations of certain sub-populations, such as transit commuters or zero-vehicle households. Population density, measured as the number of persons per acre, is a strong indicator of potential bicycle activity. Generally, higher population densities are associated with more urbanized environments, which tend to support bicycle travel through mixed land uses, interconnected street networks, and shorter trip lengths.

Figure 4-1 displays population density in National City. As shown, the northern and central portions of National City tend to have relatively higher population densities, with many areas having more than 20 persons per acre. These higher densities are partially explained by the presence of Naval Base San Diego, located adjacent to the northwestern portion of the City. Another area with significantly higher population density surrounds D Avenue between 18th Street and 24th Street, an area with multiple schools and

apartment complexes. Low population densities occur in the City's Bayfront and southwestern areas due to a higher concentration of industrial land uses.

Figure 4-2 displays employment density for the City of National City. There are several locations with high concentrations of employment, such as Naval Base San Diego, Paradise Valley Hospital, and the National School District.

Figures 4-3, 4-4, 4-5, and 4-6 display the number and percent by census block group of zero-vehicle households, bicycle, walk, and transit commuters, respectively. As shown, a few areas have significantly higher numbers of zero-vehicle households. For instance, the Naval Base Housing area, located off of Paradise Valley Road in the eastern side of the City, has more than 200 households (30 percent) without access to a vehicle despite a high population density. Thus, developing bicycle connections between military facilities provides an opportunity to promote bicycling as a transportation option for those without personal vehicles. Also, as shown, the parts of National City with the highest transit commute mode shares also have the highest walking commute mode shares.

Table 4-4 summarizes the bicycle trip generator model inputs, along with the respective points assigned to each input. **Figure 4-7** presents the results of the bicycle trip generator model, the composite of the five variables shown in **Table 4-4**, along with bicycle commuter rates.

Table 4-4: Bicycle Generator Input Variables

Bicycling Generators	Points
Population Density (persons per census block)	
> 40	6
25 – 40	4
< 25	2
Employment Density (employees per traffic analysis zone)	
> 15	6
5 – 15	4
< 5	2
Zero-Vehicle Households (percent of households by census block group)	
≥ 25	6
15 – 24.99	4
5 – 14.99	2
Bicycling Commuters (percent of commuters by census block group)	
≥ 4	6
2 - 3.99	4
1 – 1.99	2
Walk and Transit Commuters(percent of commuters by census block group)	
≥ 25	6
15 – 24.99	4
5 – 14.99	2

Source: Alta Planning + Design (2010)

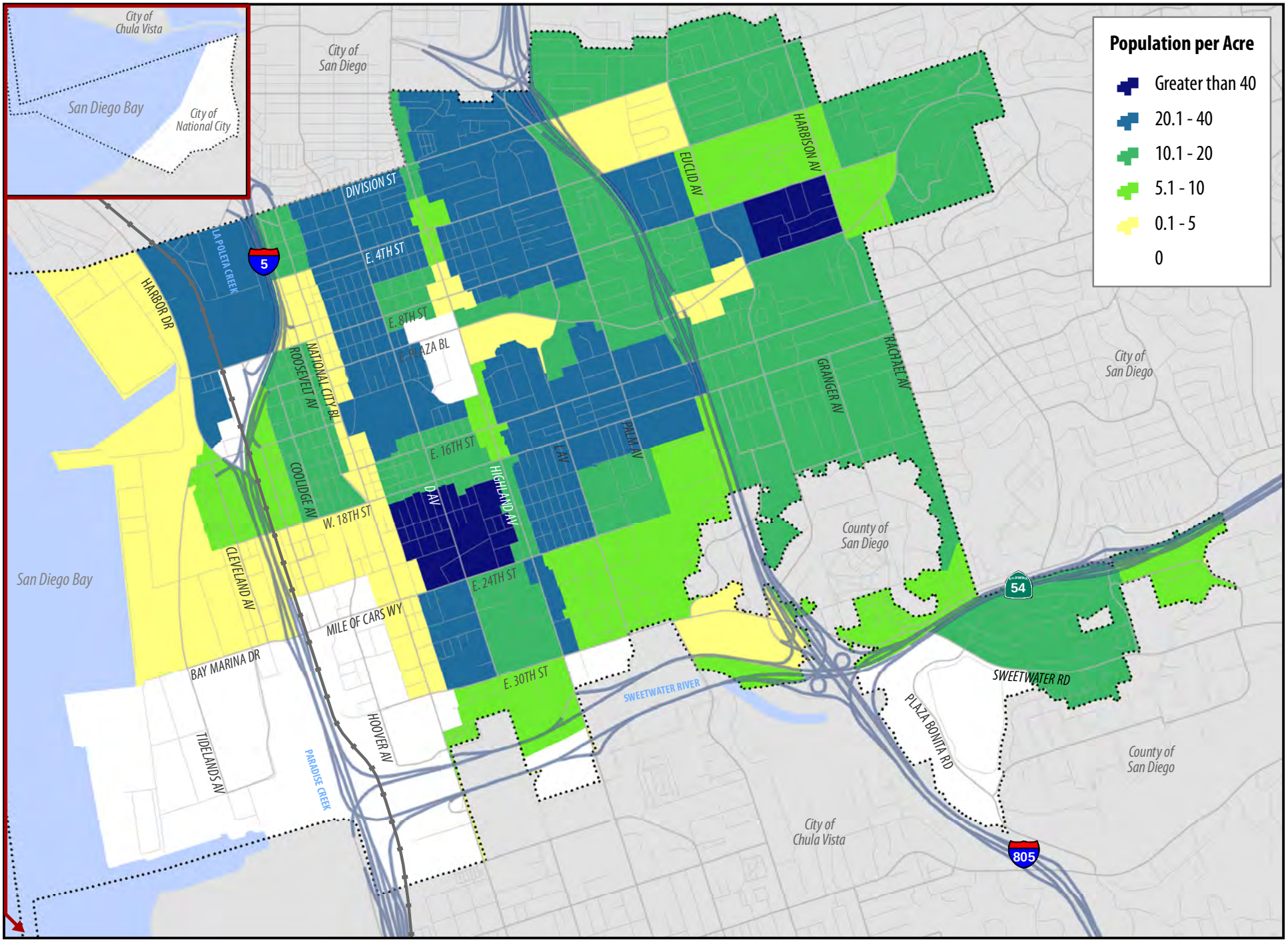


Figure 4-1: National City Population Density (2010)

City of National City Bicycle Master Plan

Source: SANDAG 2010 (Traffic Analysis Zone shapefile)

Date: 7/1/10

0 0.25 0.5 Miles

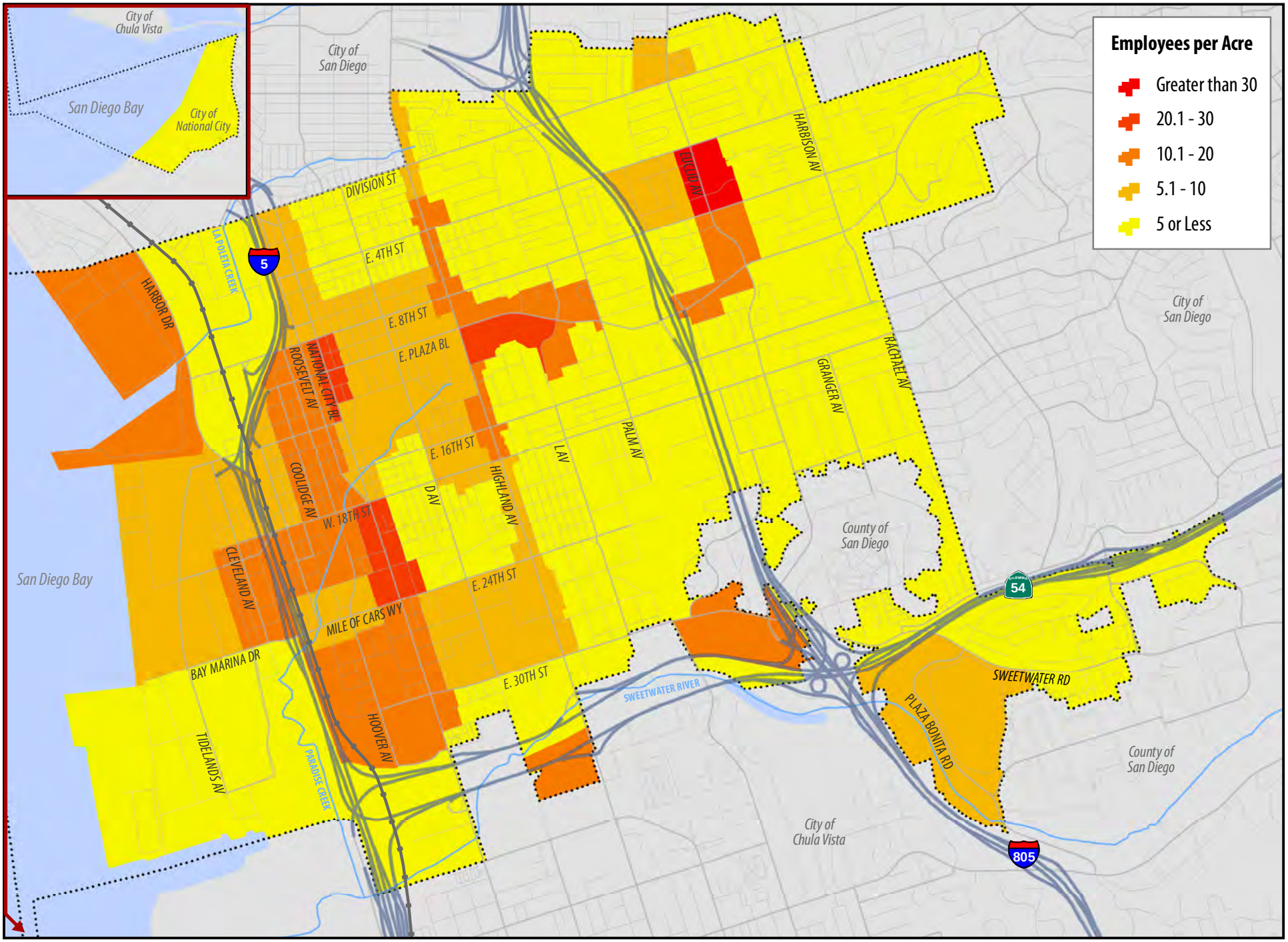


Figure 4-2: National City Employment Density (2010)

City of National City Bicycle Master Plan

Source: SANDAG 2010 (Traffic Analysis Zone shapefile)

Date: 1/11/11

0 0.25 0.5 Miles

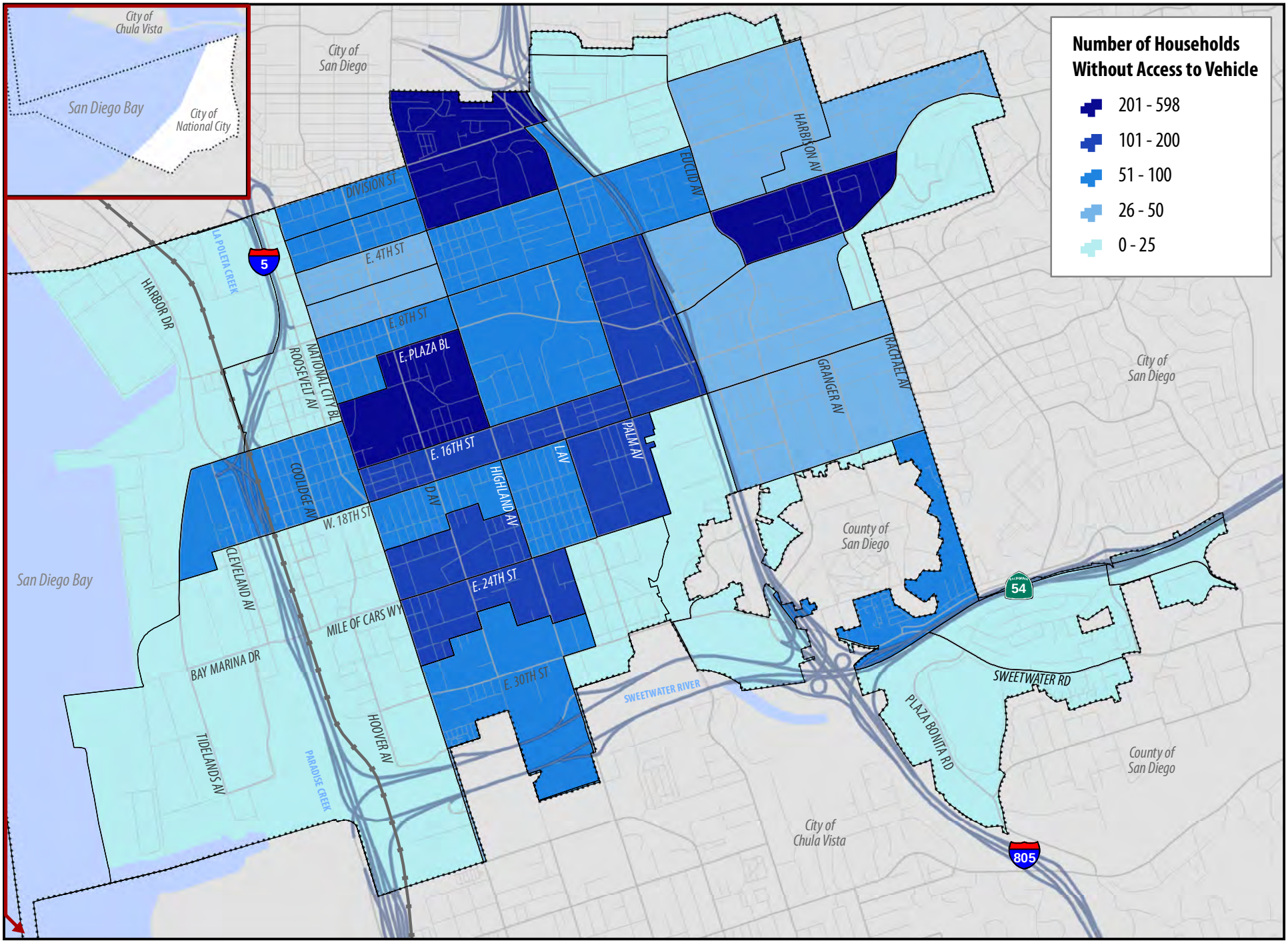


Figure 4-3: National City Zero-Vehicle Households (2000)

City of National City Bicycle Master Plan

Source: US Census 2000 (Census Block Groups)

Date: 7/1/10

0 0.25 0.5 Miles

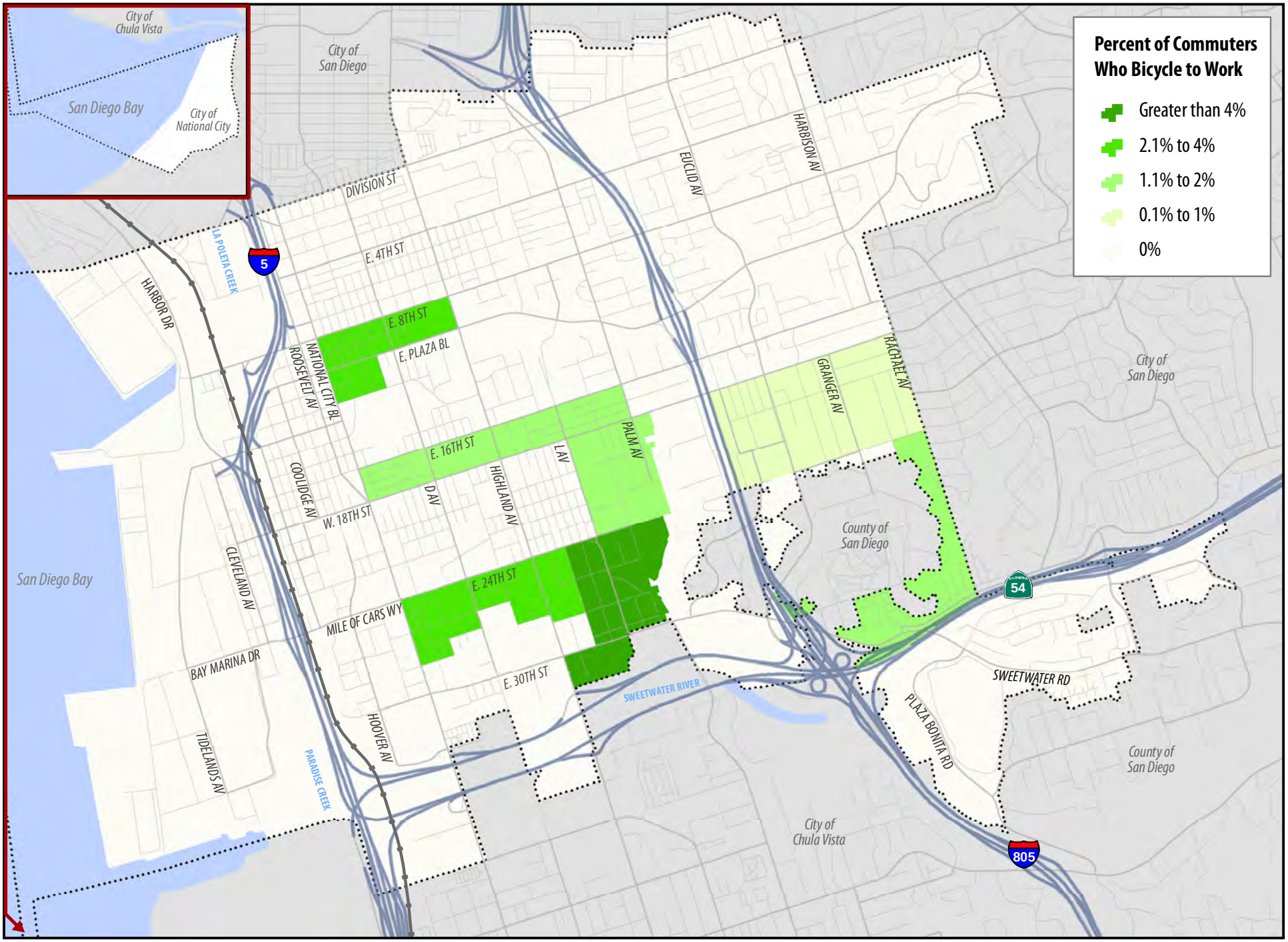


Figure 4-4: National City Bicycle Commuters as Percent of Total Commuters (2000)

City of National City Bicycle Master Plan

Source: US Census 2000 (Census Block Groups)

Date: 7/1/10

0 0.25 0.5 Miles

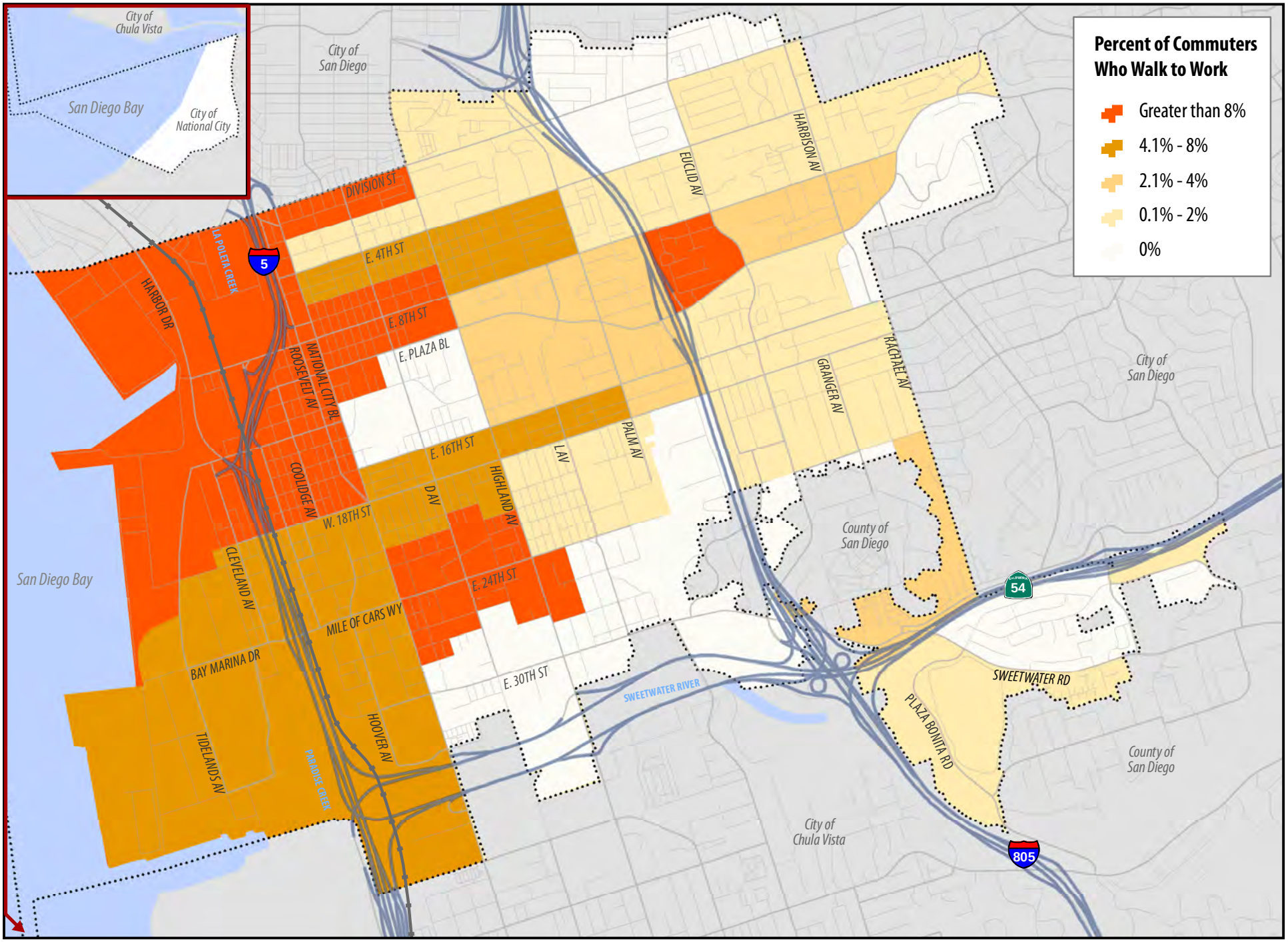


Figure 4-5: National City Walking Commuters as Percent of Total Commuters (2000)

City of National City Bicycle Master Plan

Source: US Census 2000 (Census Block Groups)

Date: 7/1/10

0 0.25 0.5 Miles

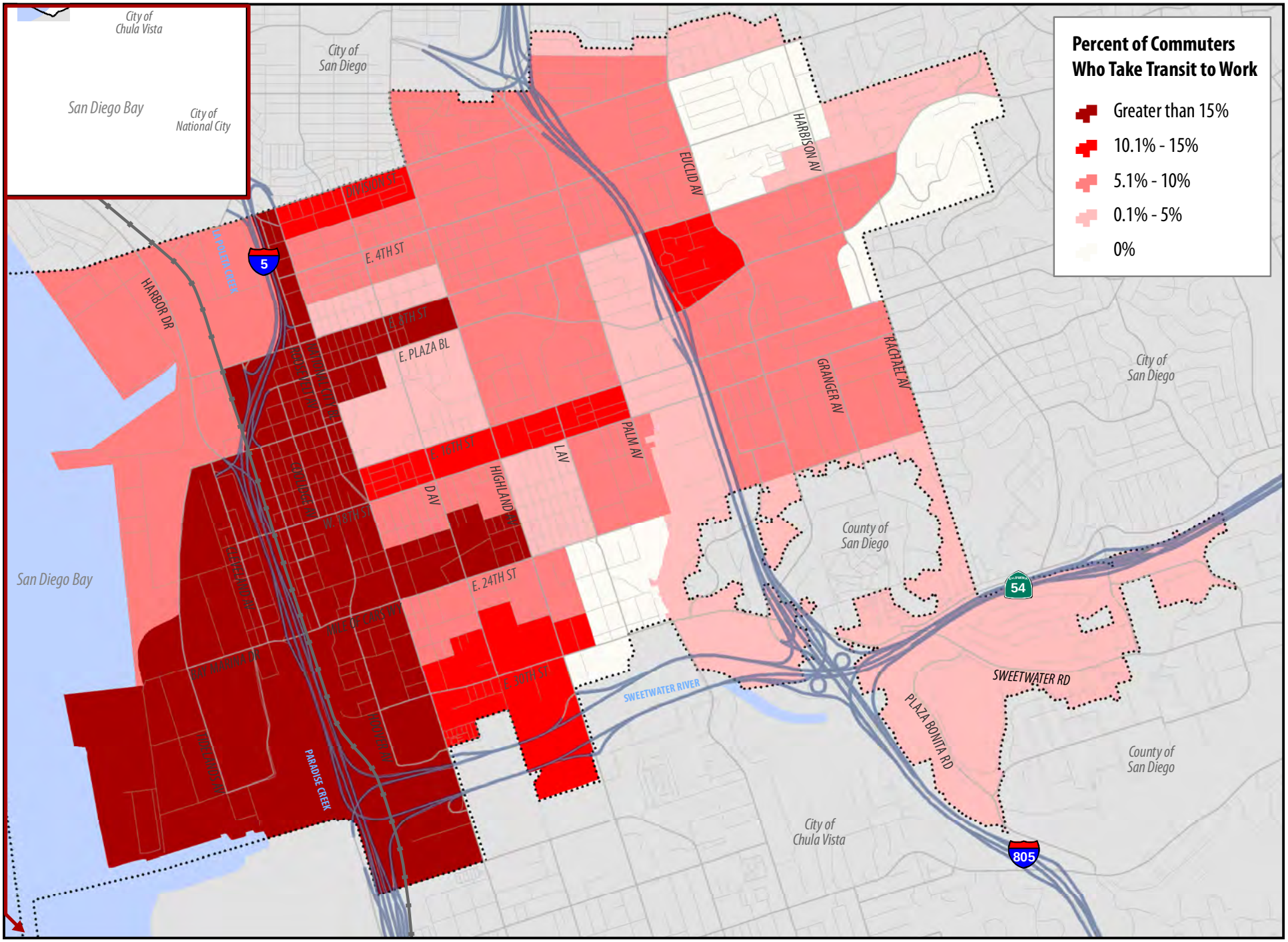


Figure 4-6: National City Transit Commuters as Percent of Total Commuters (2000)

City of National City Bicycle Master Plan

Source: US Census 2000 (Census Block Groups)

Date: 7/1/10

0 0.25 0.5 Miles

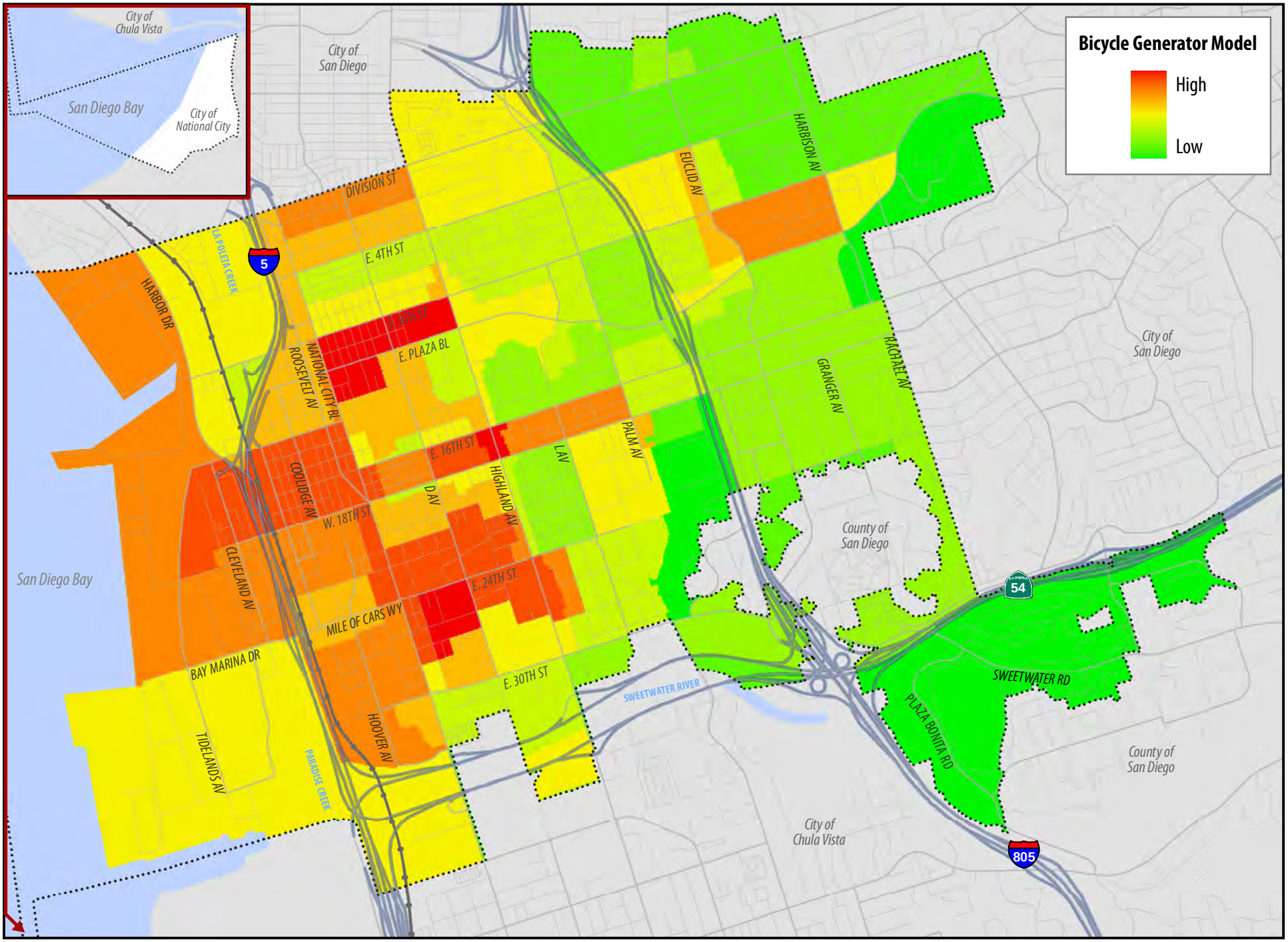


Figure 4-7: National City Bicycle Trip Generator Model Results

City of National City Bicycle Master Plan

Source: Alta Planning + Design

Date: 1/11/11

0 0.25 0.5 Miles

4.4 Bicycle Trip Attractors

Bicycle trip attractors refer to land use types with a relatively higher propensity to attract a bicycle trip, such as schools, civic facilities, transit stops, and retail. **Figure 4-8** displays bicycle attractors across National City. **Figure 4-9** presents the results of the bicycle attractor model, a synthesis of these attractors. In the model, higher values are assigned to areas closer to the respective bicycle attracting land use. **Table 4-5** summarizes the bicycle attractor model inputs and points.

Table 4-5: Bicycle Attractor Input Variables

Bicycling Attractors	Points
Regional Class I Bikeway	4
Regional Shopping Center	4
Unlinked Transit Trips (> 500)	3
Parks & Recreation	2
Retail *	1
Schools	1
Civic	1
Weighting Values Based on Distance to Attractor	
Within ¼ mile	1.50
Between ¼ and ½ mile	1.00
Between ½ and ¾ mile	0.75
Between ¾ and 1 mile	0.50

Source: Alta Planning + Design (2010)

Note: * Only a single distance-based ranking was applied to Retail Uses. The area outside of one-quarter mile of retail uses was not included as potential bicycle trip-attracting locations.

Figure 4-10 displays the results of the bicycle demand model which integrates the bicycle trip attractor model and trip generator model to highlight areas with potential bicycling demand based on land uses and population characteristics associated with higher bicycling rates. According to the demand model, there is higher demand concentrated in the western portions of the City along corridors with significant retail, civic facilities, schools, and access to regional transit and bicycle facilities.

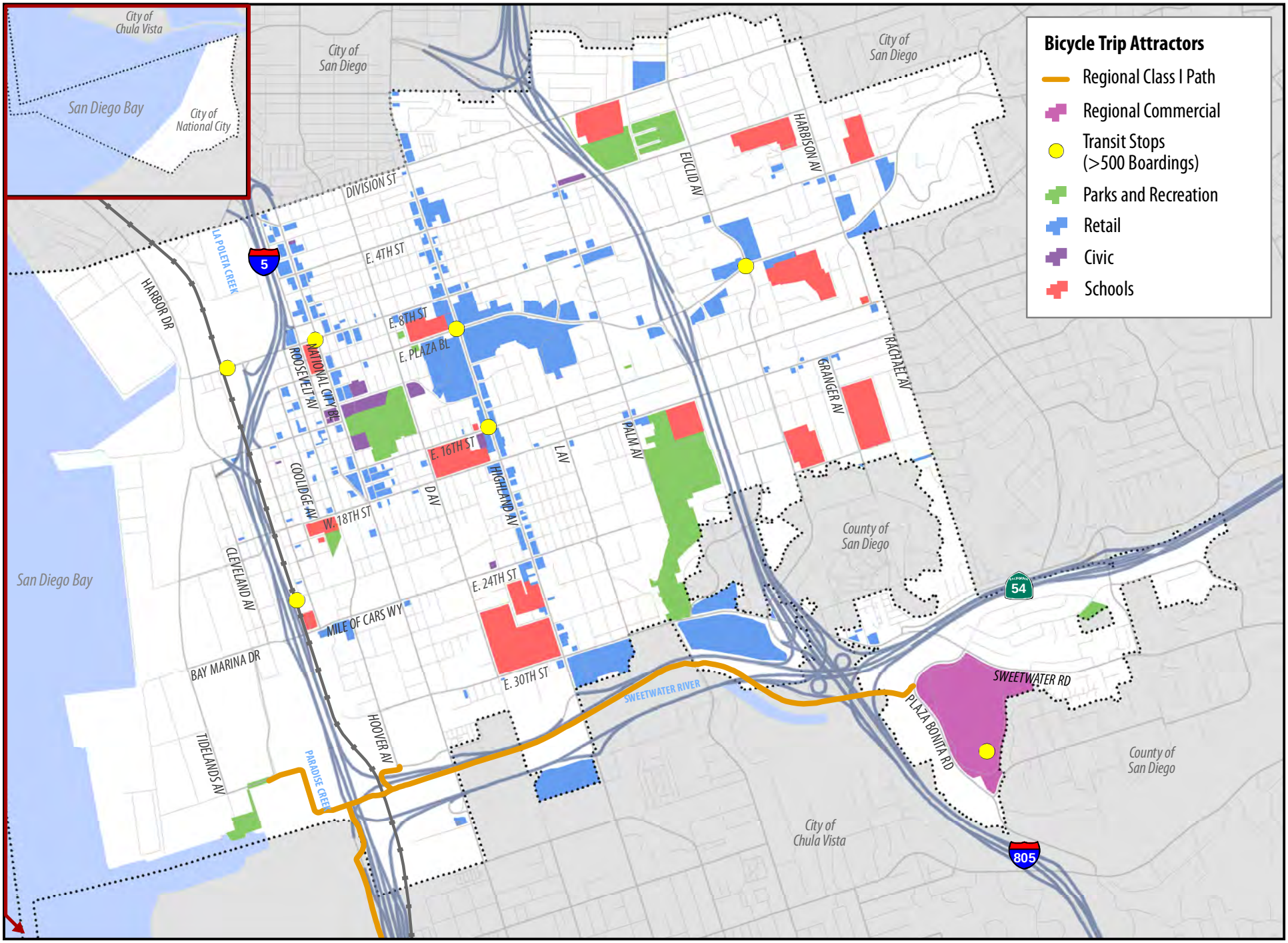


Figure 4-8: National City Bicycle Trip Attracting Land Uses

City of National City Bicycle Master Plan

Source: SANDAG 2009 (Existing Land Uses)

Date: 1/11/11

0 0.25 0.5 Miles

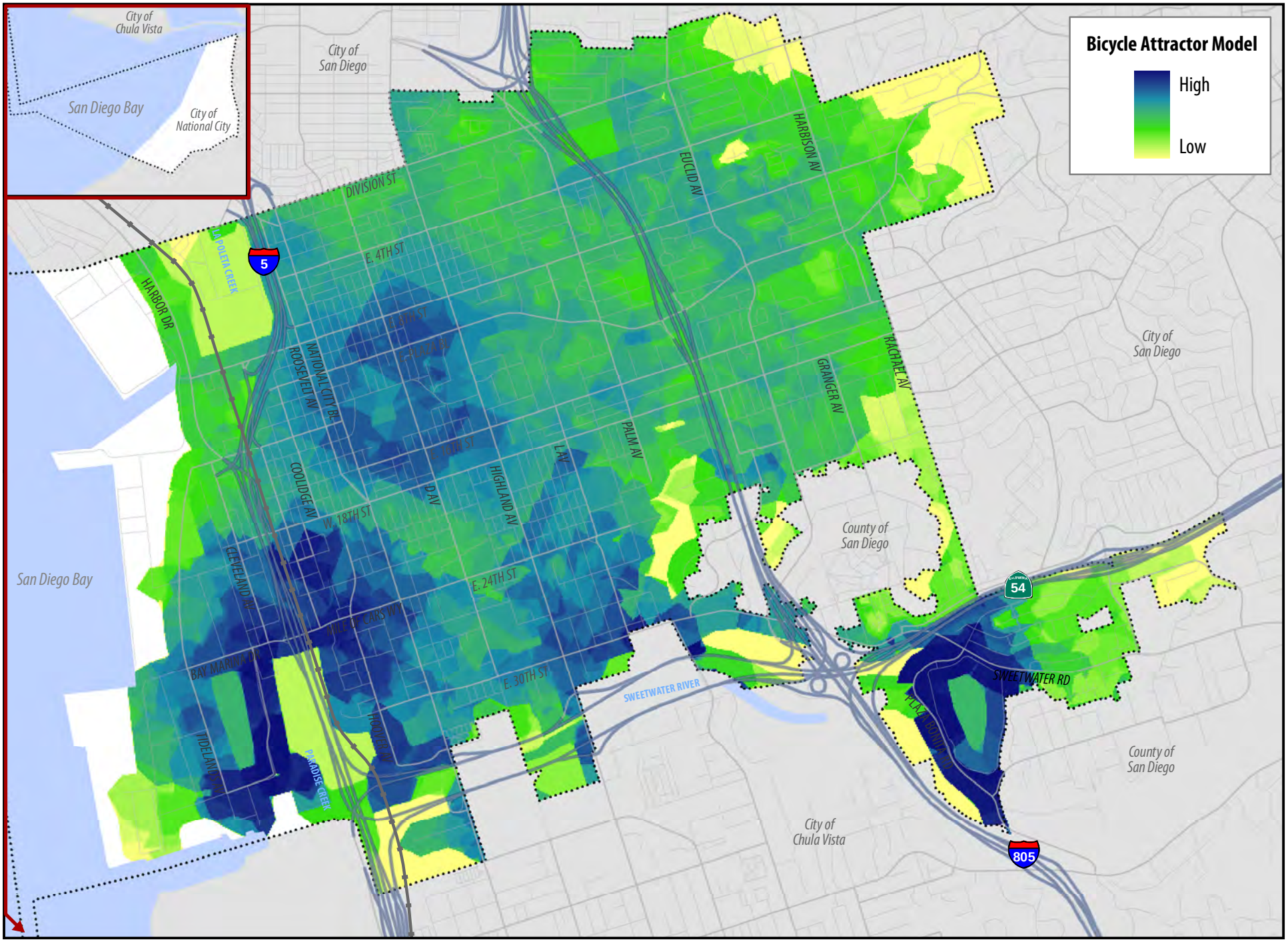


Figure 4-9: National City Bicycle Trip Attractor Model Results

City of National City Bicycle Master Plan

Source: Alta Planning + Design

Date: 1/11/11

0 0.25 0.5 Miles

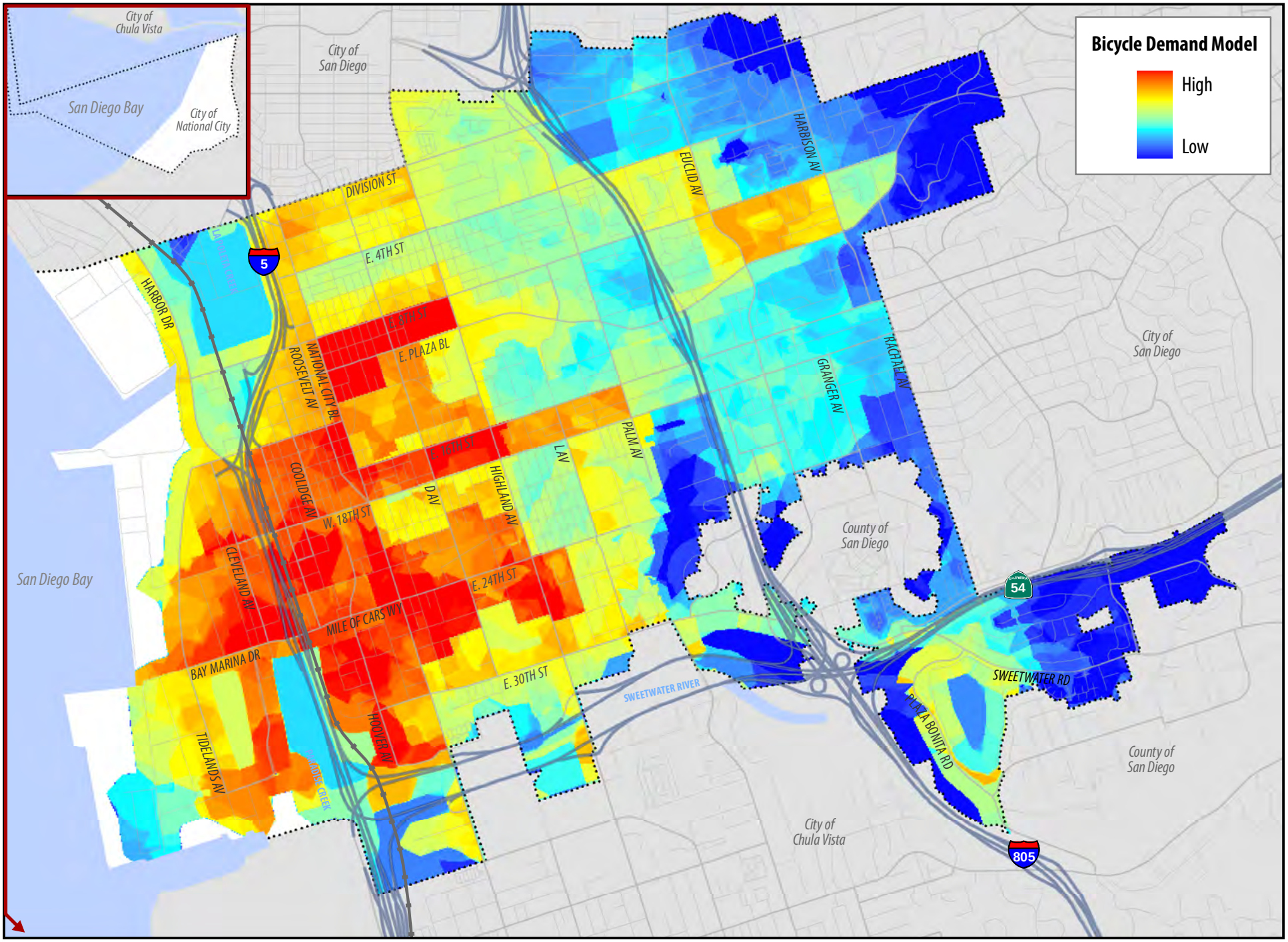


Figure 4-10: National City Bicycle Demand Model Results

City of National City Bicycle Master Plan

Source: Alta Planning + Design

Date: 7/29/10

0 0.25 0.5 Miles

4.5 Trip Detractors and Bicycle Collision Analysis

This section describes key indications of bicycling barriers, such as roadways with high vehicular traffic volumes and speeds, freeway on/off ramps, steep terrain, and bicycle collision locations.

Bicycle Trip Detractors

Figures 4-11, 4-12, and 4-13 display roadway characteristics that negatively impact the quality of the bicycling environment and may deter people from bicycling in certain locations, particularly locations with steep terrain, freeway barriers, high traffic volumes, and high traffic speeds. Detracting characteristics are key considerations in planning future bicycle facilities.

Bicycle Collisions

Table 4-6 presents the number of traffic collisions and collisions involving bicyclists in the City of National City for five consecutive years: 2004, 2005, 2006, 2007 and 2008. This information was obtained from the California Highway Patrol's SWITRS website, which provides collision information by jurisdiction. As the table shows, no fatal bicycle-related collisions were reported in National City during the five year period. On average, about 4% of collisions resulting in injuries involved bicyclists. There is little variation in bicycle-involved collision rates over the five-year period, with the annual proportion ranging from 3.6% to 4.9% of the total collisions resulting in injury. The 4.1% average is comparable to the countywide average of 4.6%. However, countywide, 3.4% (45) of fatal collisions involved bicyclists compared to no fatal collisions in National City.

Table 4-6: National City Bicycle-Involved Collisions 2004 - 2008

Year	Total Collisions		Total Bicycle-Related Collisions		Bicycle-Related Percent of Total	Bicycle-Related Percent of Total
	Fatal	Injury	Fatal	Injury	Fatal	Injury
2004	1	447	0	16	0%	3.6%
2005	9	406	0	20	0%	4.9%
2006	5	361	0	13	0%	3.6%
2007	7	313	0	12	0%	3.8%
2008	3	232	0	11	0%	4.7%
Total	**25**	**1,759**	**0**	**72**	**0%**	**4.1%**

Source: Statewide Integrated Traffic Records System (SWITRS)

Safety is a major concern for both existing and potential bicyclists. Identifying bicycle collision sites can assist in developing improvements or determining more appropriate routes for bicyclists to use. **Figure 4-14** displays bicycle collision locations in National City from January 2002 to January 2007. As shown, bicycle-involved collisions occurred at various intersections throughout the City. The greatest number of bicycle collisions, five, occurred at the intersection of Highland Avenue and Plaza Boulevard.

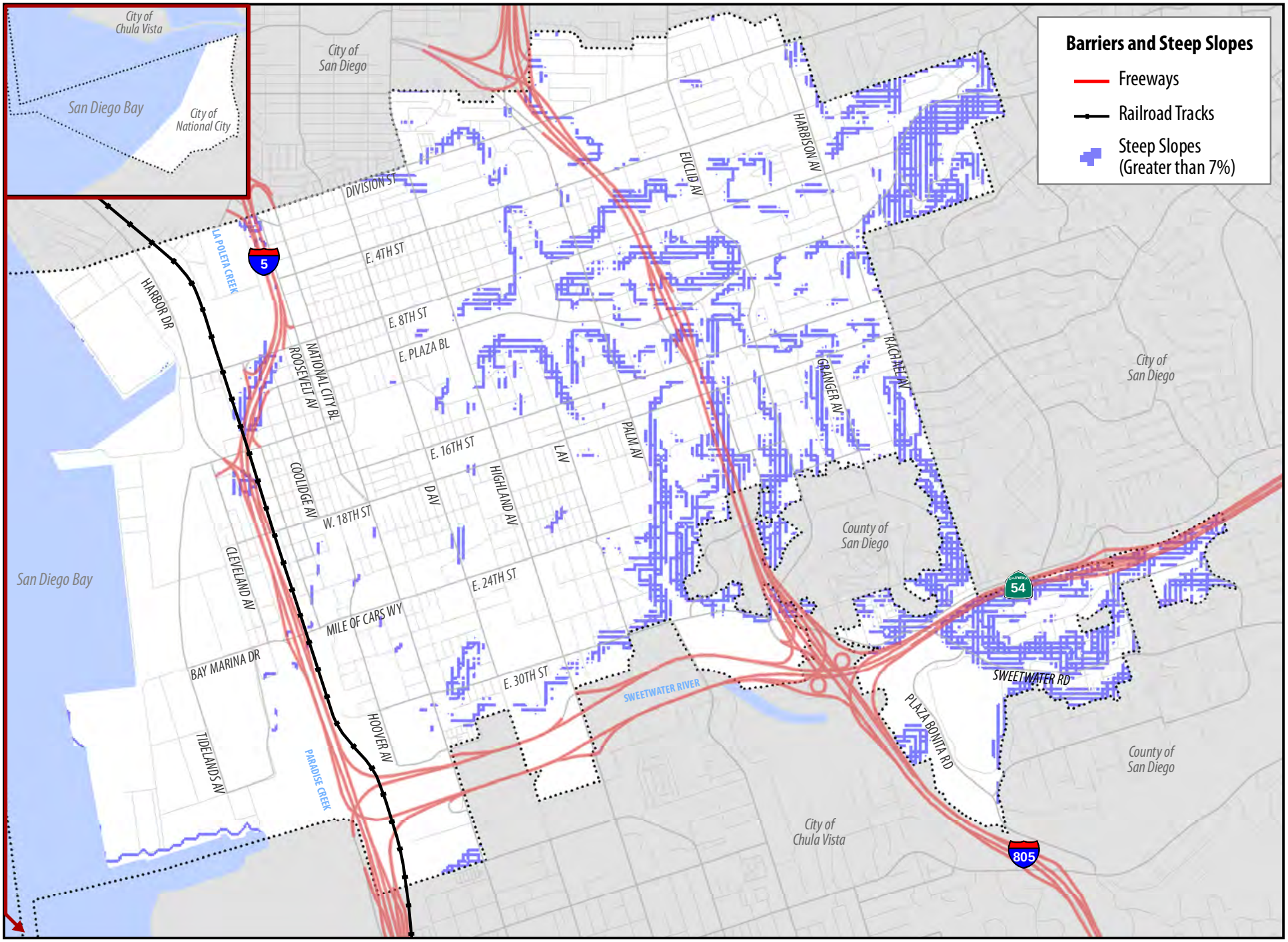


Figure 4-11: National City Barriers and Steep Slopes

City of National City Bicycle Master Plan

Source: SANDAG (2008); Alta Planning + Design (2010)

Date: 7/29/10

0 0.25 0.5 Miles

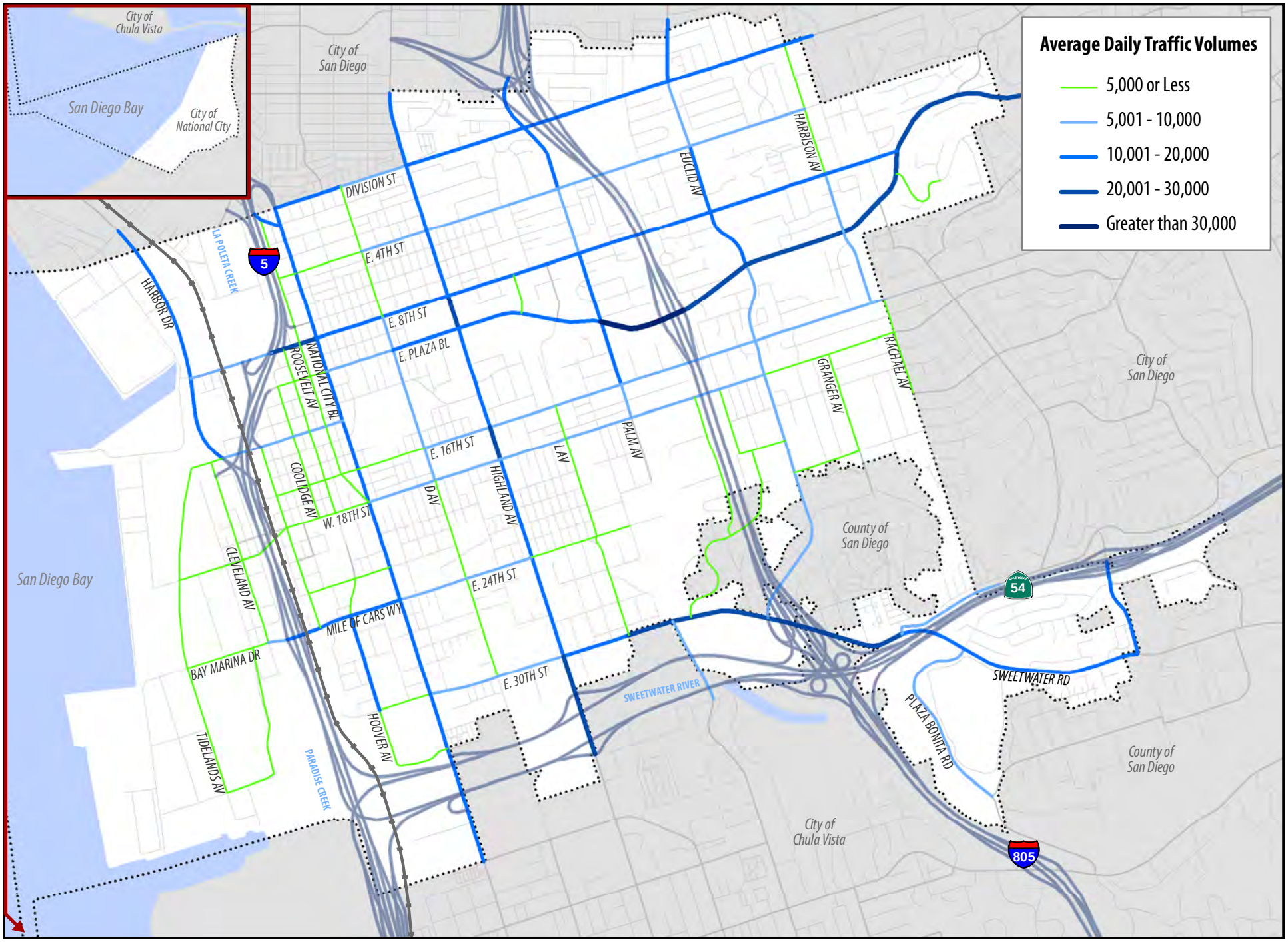


Figure 4-12: National City Average Daily Traffic Volumes (2010)

City of National City Bicycle Master Plan

Source: City of National City (2010)

Date: 1/1/11

0 0.25 0.5 Miles

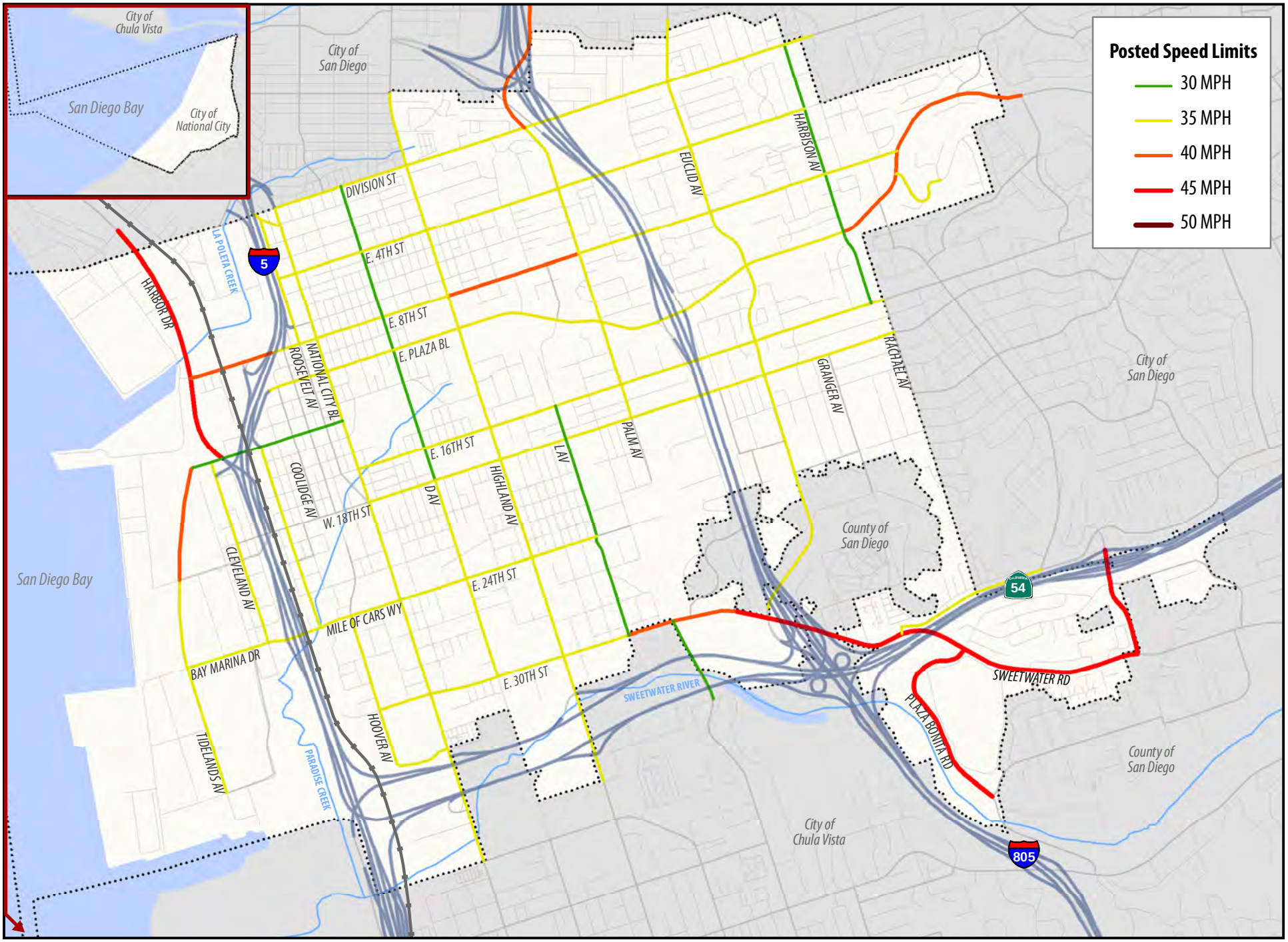


Figure 4-13: National City Posted Speed Limits (2010)

City of National City Bicycle Master Plan

Source: City of National City (2010)

Date: 7/29/10

0 0.25 0.5 Miles

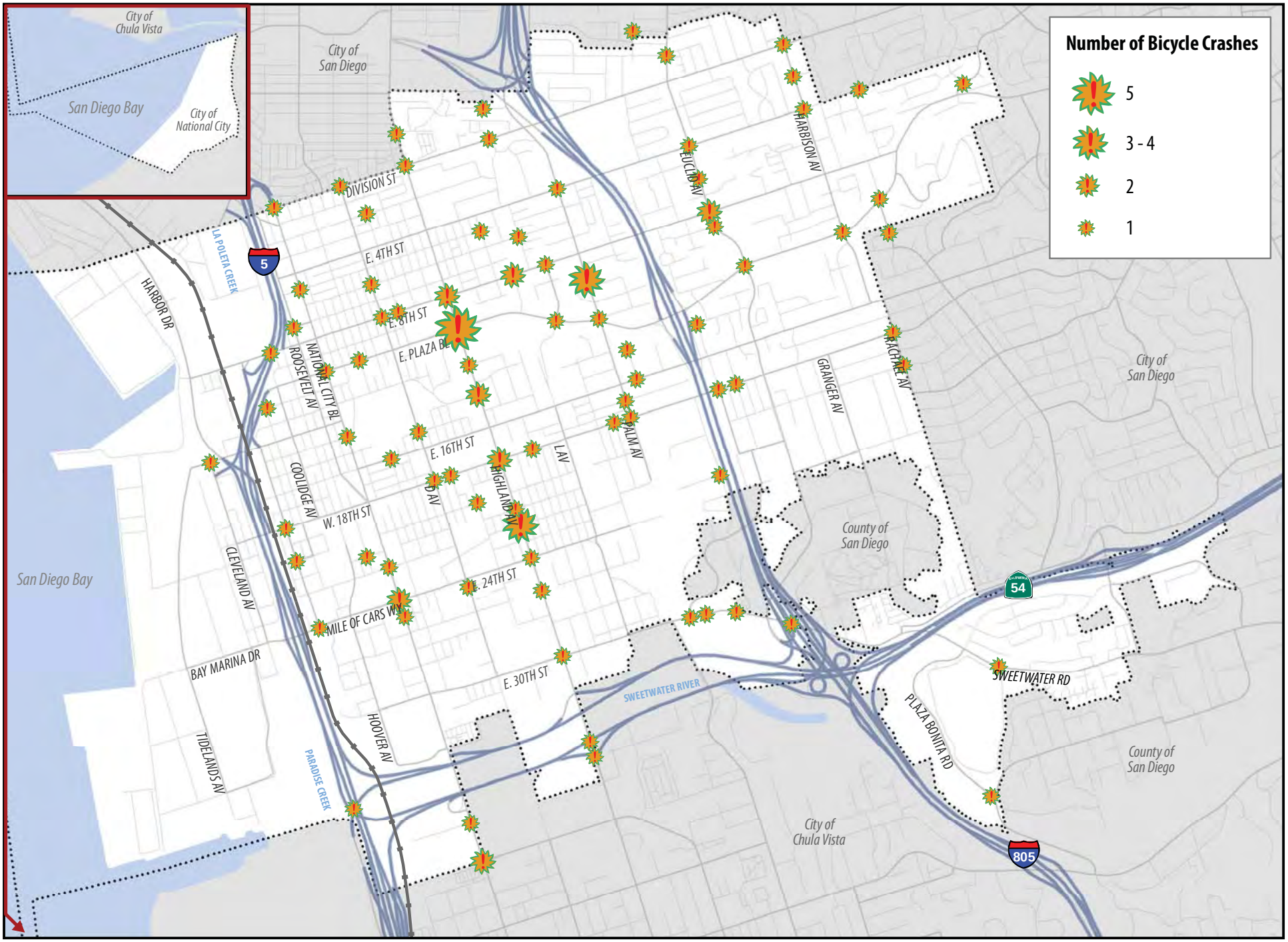


Figure 4-14: Bicycle Collisions in National City (2002 - 2007)

City of National City Bicycle Master Plan

Source: SWITRS

Date: 7/1/10

0 0.25 0.5 Miles

4.6 Bikeway Gaps

This section describes existing bicycle system gaps in National City that warrant consideration for bicycle facilities.

Bikeway Gap Types

Bikeway gaps exist in various forms, ranging from short "missing links" on a specific street or path corridor, to larger geographic areas with few or no bicycle facilities. Gaps can be organized based on length and other characteristics. This document classifies bikeway gaps into five main categories, described below:

Spot gaps: Spot gaps refer to point-specific locations lacking dedicated bicycle facilities or other treatments to accommodate safe and comfortable bicycle travel. Spot gaps primarily include intersections and other vehicle/bicycle conflict areas posing challenges for riders. Examples include bike lanes on a major street "dropping" to make way for right turn lanes at intersections, or a lack of intersection crossing treatments for bicyclists on a route or path as they approach a major street.

Connection gaps: Connection gaps are missing segments (1/4 mile long or less) on a clearly defined and otherwise well-connected bikeway. Major barriers standing between bicycle destinations and clearly defined routes also represent connection gaps. Examples include bike lanes on a major street "dropping" for several blocks to make way for on-street parking, a discontinuous off-street path, or a freeway standing between a major bicycle route and a school.

Lineal gaps: Similar to connection gaps, lineal gaps are ½- to one-mile long missing link segments on a clearly defined and otherwise well-connected bikeway.

Corridor gaps: Corridor gaps are missing links longer than one mile. On a clearly defined and otherwise well-connected bikeways. These gaps will sometimes encompass an entire street corridor where bicycle facilities are desired but do not currently exist.

System gaps: Larger geographic areas (e.g., a neighborhood or business district) where few or no bikeways exist would be identified as system gaps. System gaps exist in areas where a minimum of two intersecting bikeways would be required to achieve the target network density.

With very few and disconnected on-street bikeways, National City's existing bicycle network contains several system gaps. National City lacks north-south connections through the west, central, and east areas of the City. East-west bicycle corridors are also lacking, except for the Sweetwater River Bikeway that transverses the City along its southern border. The Sweetwater River Bikeway, however, is not easily accessible from National City's street network. Thus, the chief priority in addressing National City's gaps is to identify potential corridors that provide safe continuity across the City and to key bicycle attracting land uses, such as schools, retail, employment, parks and recreational centers. In doing so, it is important to avoid creating potential spot, connection, lineal, and corridor gaps. For example, proposing bike lanes along 22nd Street would require identifying possible crossing treatments at National City Boulevard so that the intersection doesn't serve as a spot gap.

Field reviews were conducted in May 2010 to survey, measure, and photograph potential bikeways. The primary corridors field-reviewed were:

- 4th Street from Roosevelt Avenue to the City's eastern boundary
- Civic Center Drive from I-5 to National City Boulevard
- 18th Street from Wilson Avenue to Palm Avenue
- 22nd Street from the 24th Street Trolley Station to D Avenue
- D Avenue from 4th Street to its southern terminus
- Palm Avenue from 4th Street to its southern terminus at Las Palmas Park
- Bay Marina Drive/Mile of Cars Way/24th Street from Tidelands Avenue to D Avenue
- Marina Way from Bay Marina Drive to W. 32nd Street.

Field review notes are summarized in **Appendix A.**

5. Recommended Network and Facility Improvements

The recommended improvements for the National City Bicycle Master Plan includes bikeway network facilities, intersection and other spot improvements, and bicycle support facilities. National City's temperate climate and gentle topography make it a great place to bicycle. The improved facilities outlined below will help make bicycling an effective transportation option throughout National City.

5.1 Bikeways

A comprehensive evaluation of existing conditions, including opportunities and constraints, was completed to identify locations for future bikeways and support facilities. The final recommended network provides for a well-connected system, Citywide. Improvement recommendations are based on best practices and are supplemented by:

- Review of existing planning efforts
- Staff / public input
- Field work and data analysis
- Local and regional network connections

Recommended Network

National City's current bikeway network includes 2.4 miles of Class I bikeways (bike paths), 1.7 miles of Class II bikeways (bike lanes), and a 0.6 mile segment of Class III bikeway (bike route). This plan proposes an additional 4.3 miles of Class I bikeways, 16.1 miles of Class II bikeways, and 13.5 miles of Class III bikeways. These additional facilities provide north-south and east-west corridors through the City as well as connections to regional facilities such as the Bayshore Bikeway and the Sweetwater River Bikeway. A comprehensive bikeway network improves bicyclists' level of safety, convenience, and access to key destinations. It is important to note that bicyclists are legally entitled to ride on all City streets whether or not the streets are part of a designated bikeway network. **Figure 5-1** shows the proposed bicycle network with classifications for National City. The recommendations were developed based on the following guidelines:

- **Needs of various user groups** – Facility addressing the needs of various types of bicyclists.
- **Existing bicycling patterns** – Preferred bicycling patterns, identified by the community in public workshops, and City staff.
- **Connectivity** – Increased system connectivity by providing bikeway connections to major destinations and to regional bikeways.
- **Traffic volumes and travel speeds** – Traffic volumes and travel speeds were taken into account in determining types of alignment and facilities. Preference was given to streets with lower average daily traffic volumes and speeds.
- **Existing roadway width and right-of-way** – Available right-of-way determines the type of facility and feasibility.
- **Public input** – Public input on needs and recommendations.

Bicycle Paths

Table 5-1 lists the recommended Class I Bicycle Path projects for National City. A bicycle path provides for bicycle travel on a paved right-of-way completely separated from streets or highways. These four recommended facilities will provide opportunities for recreational bicycling as well as for commuting. The recommended network includes segments of the Bayshore Bikeway and Sweetwater River Bikeway.

Table 5-1: Proposed Class I Bikeways

Location	From	To	Mileage
Harbor Drive / Tidelands Avenue / 32nd Street (Bayshore Bikeway)	Northern City Limit	Marina Way (Sweetwater River Bikeway)	2.3
Interstate 805 Corridor	Northern City Limit	12th Street	1.1
Marina Way	Bay Marina Drive	32nd Street	0.5
Plaza Bonita Road	Sweetwater River Bikeway	Bonita Mesa Road	0.4
		TOTAL	**4.3**

Bicycle Lanes

Table 5-2 outlines the recommended Class II Bicycle Lane projects for National City. Bike lanes provide a signed, striped, and stenciled lane for one-way travel on both sides of a street or highway. Class II bikeways are typically recommended where traffic volumes require channelization of motorized and non-motorized users in order to enhance safety.

Table 5-2: Proposed Class II Bikeways

Location	From	To	Mileage
Euclid Avenue	Northern City Limit	Sweetwater Road	2.3
30th St / Sweetwater Road	Highland Avenue	Plaza Bonita Center Way	2.2
4th Street	Roosevelt Avenue	Harbison Avenue	2.0
D Avenue	4th Street	32nd Street	1.8
18th Street	Wilson Avenue	Palm Avenue	1.3
Hoover Avenue / 33rd Street / National City Boulevard	Mile of Cars Way	Southern City Limit	1.2
Cleveland Avenue	Civic Center Drive	Bay Marina Drive	0.7
Wilson Avenue	Civic Center Drive	W. 22nd Street	0.7
Civic Center Drive / Roosevelt Avenue / 12th Street	Wilson Avenue	D Avenue	0.6
Highland Avenue	30th Street	Southern City Limit	0.5
Paradise Valley Road	8th Street	Eastern City Limit	0.5
Roosevelt Avenue	Main Street	8th Street	0.5
8th Street	Harbor Drive	Roosevelt Avenue	0.4
Coolidge Avenue (N) / Hoover Avenue (S)	Plaza Boulevard	18th Street	0.4
22nd Street	Wilson Avenue	National City Boulevard	0.3
Harbor Drive	8th Street	Civic Center Drive	0.3
Bay Marina Drive	Tidelands Avenue	Marina Way	0.2
2nd Avenue	Sweetwater Road	0.1 miles south of Sweetwater Road	0.1
Bay Marina Drive / Mile of Cars Way	Cleveland Avenue	Interstate 5	0.1
		TOTAL	**16.1**

Bicycle Routes

Table 5-3 includes recommended Class III Bicycle Routes for National City. Class III facilities are appropriate where there is limited available right-of-way for a dedicated lane or shoulder widening but the route is an integral part of the bicycle network. All proposed Class III segments should be signed with Caltrans standard bicycle route signs. Where on-street parallel parking is present, shared-lane markings may be placed. Section 6.5.4 provides guidance on bike routes and shared lane markings.

Table 5-3: Proposed Class III Bikeways

Location	From	To	Mileage
8th Avenue	Roosevelt Avenue	Paradise Valley Road	2.3
12th Street / Grove Street / Prospect Street	Interstate 805	Sweetwater Road	1.6
Palm Avenue / 22nd Street / Roselawn Street	4th Street	L Avenue	1.4
16th Street	L Avenue	Earle Drive	1.1
Mile of Cars Way / 24th Street	Interstate 5	L Avenue	1.1
L Avenue	16th Street	30th Street	0.9
18th Street	Palm Avenue	Granger Avenue	0.8
Harbison Avenue / Earle Drive	4th Street	16th Street	0.8
30th Street	Hoover Avenue	Highland Avenue	0.7
Newell Street	18th Street	Grove Street	0.5
Granger Avenue	18th Street	24th Street	0.4
22nd Street	National City Boulevard	D Avenue	0.3
Division Street	Roosevelt Avenue	D Avenue	0.3
2nd Avenue	0.1 miles south of Sweetwater Road	Southern City Limit	0.2
22nd Street	Grove Street	Euclid Avenue	0.2
24th Street	Euclid Avenue	Granger Avenue	0.2
Civic Center Drive	Tidelands Avenue	Wilson Avenue	0.2
D Avenue	Division Street	4th Avenue	0.2
Roosevelt Avenue / Plaza Boulevard	8th Street	Coolidge Avenue (N) / Hoover Avenue (S)	0.2
Wilson Avenue	22nd Street	Mile of Cars Way	0.1
		TOTAL	**13.5**

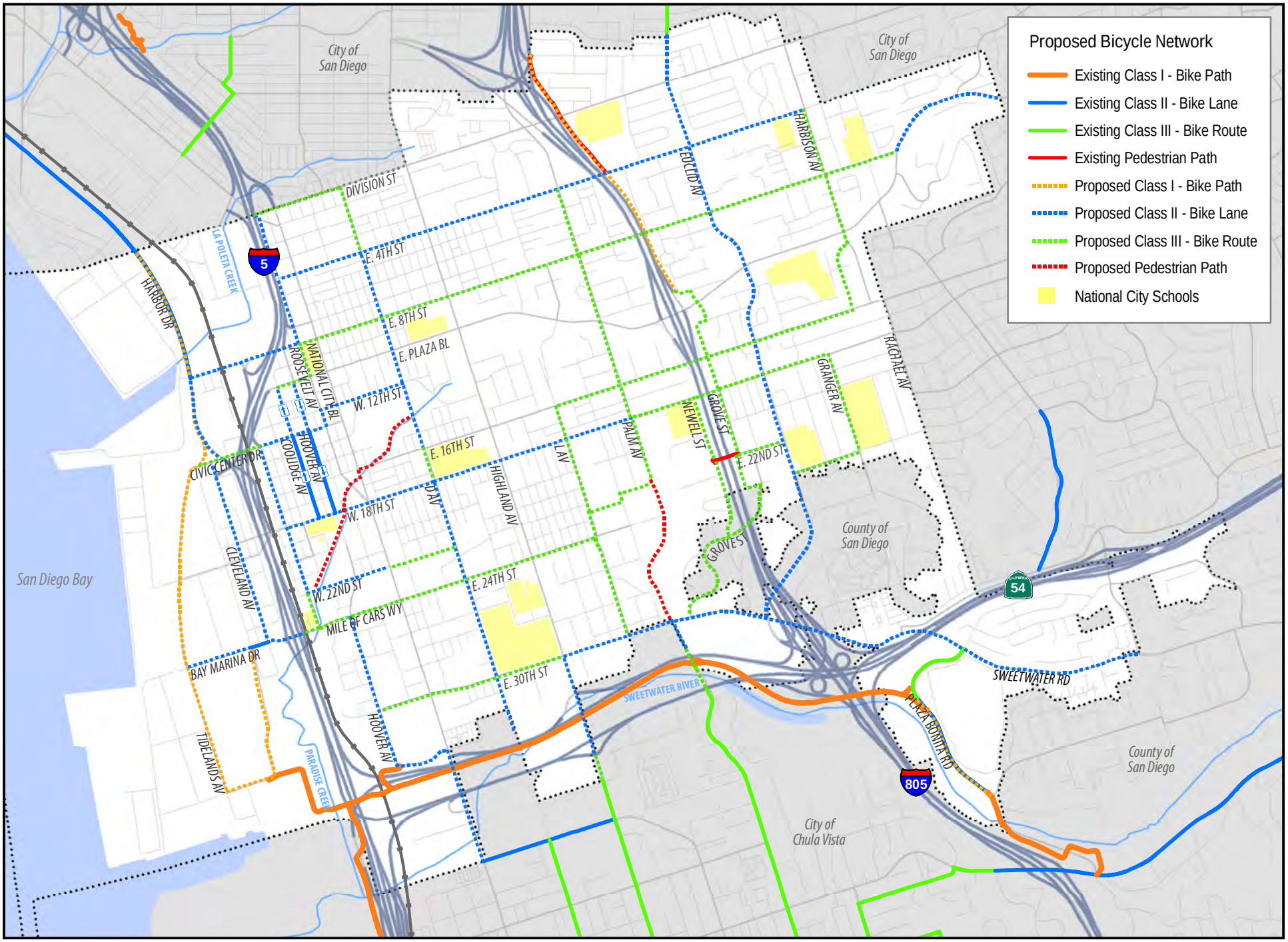


Figure 5-1: Proposed Bicycle Network with Classifications

City of National City Bicycle Master Plan

Source: Alta Planning + Design (2010)

Date: 1/11/11

5.2 Route Selection and Prioritization

This section outlines the prioritization methodology and route selection criteria for the bikeway recommendations for the National City Bicycle Master Plan. The intent of the ranking process is to create a prioritized list of projects for implementation. The project list and ranking are flexible concepts that serve as guidelines. The list may change over time because of changing bicycling patterns, implementation opportunities and constraints, and the development of other transportation system facilities. National City should review the project list at regular intervals to ensure it reflects the most current priorities, needs, and opportunities for implementing the bicycle network in a logical and efficient manner.

The proposed bikeway projects have been ranked using the criteria presented in **Table 5-4** below. The evaluation criteria include the following:

- Bicycle propensity model results
- Collisions/safety
- Staff / public input
- Project feasibility
- Local connections
- Regional connections

The maximum potential score for each criteria is ten points, except for the bicycle propensity model results criteria which has a maximum of twenty points. Based on the nature of the criteria, the project score is either within a range, or assigned either a zero *or* ten. For example, collision scores range from zero to ten based on the number of collisions per mile. By contrast, connectivity to local or regional bikeways is either "yes" or "no" and therefore receives either zero or ten points. The maximum potential score for each project is eighty (80) points, which is the sum of the maximum potential scores of all project criteria.

Table 5-4: Project Ranking Criteria

Criteria	Description	Points
Bicycle Propensity Model Results	The results from the bicycle propensity model will be used to assist in ranking the various bikeway projects. Bikeways that serve areas that scored the highest in the bicycle propensity model will receive the most points, whereas bikeways that serve areas with low model results will receive minimal points for this evaluation criteria.	0 to 20
Collisions / Safety	This ranking is based on SWITRS data identifying corridors with a high number of bicycle collisions within a quarter mile buffer. The greater the number of collisions per mile, the greater the need to provide safety enhancements. Numbers of collisions per project mile will be calculated for all bikeways based on the following formula: [(# of collisions per mile/highest # of collisions per mile)*10]. Projects will be scored on a scale ranging from zero to ten.	0 to 10
Public Input	Projects identified by the public as important at public meetings and by communications with the City staff will receive ten points for this criteria. Projects are scored by either a "yes", they have received public comment, or "no", they have not.	Yes=10 No=0
Staff Input	Projects identified by City staff as key initiatives will receive ten points for this criteria. If not identified as a key initiative, the project will receive zero points for this criteria.	Yes=10 No=0
Project Feasibility	Project Cost: Project cost affects the ability of the City to construct the bikeway. Projects that are lower cost have higher scores. Projects are scored based upon the following five cost ranges: A: $0-$50,000 B: $50,001-$125,000 C: $125,001-$400,000 D: $400,001-$1,000,000 E: Greater than $1,000,000	A=5 B=4 C=3 D=2 E=1
	Parking Impacts: Parking displacement affects the ability of the City to construct the bikeway. If a proposed bikeway project has no parking impacts it receives five points, and if the project displaces parking it receives zero points.	Yes=5 No=0
Local Connections	Projects that connect to existing or proposed bikeways in National City will receive ten points for this criteria. Projects are scored by either a "yes" or "no".	Yes=10 No=0
Regional Connections	Projects that connect to existing or proposed neighboring city, county or regional bikeways will receive ten points for this criteria. Projects are scored by either a "yes" or "no".	Yes=10 No=0
	Maximum Potential Overall Score:	80

Based on overall project score and relative equal distribution of the number of projects across each tier recommended projects are grouped into either Tier 1, Tier 2, or Tier 3 priority levels. **Table 5-5** describes the

three tiers including score ranges and recommended implementation timelines. It shall be noted that projects listed as Tier 2 or Tier 3 may be completed ahead of the implementation timeframes if resources are available.

Table 5-5: Tier Categories

Tier	Score Range	Description and Recommended Timeline
Early Action		Early Action projects are high priority projects that have already been programmed, have regional significance and are ready for construction
Tier 1	50.1 - 80.0	Tier 1 projects have the highest potential and are intended for implementation within 1-5 years.
Tier 2	35.1 - 50.0	Tier 2 projects are intended for implementation within 6-10 years.
Tier 3	20.0 – 35.0	Tier 3 projects are intended for implementation within 11–20 years.

To assist with the implementation of proposed bikeways, National City's proposed network has been prioritized using the methodology described above. Table 5-6 presents the results from the project prioritization of all proposed bikeway projects in National City.

Table 5-6: Project Prioritization

Priority Level	Location	From	To	Class	Miles	Total Points
Early Action	Harbor Drive / Tidelands Avenue / 32nd Street (Bayshore Bikeway)	Northern City Limit	Marina Way (Sweetwater River Bikeway)	1	2.3	
Early Action	Interstate 805 Corridor	Northern City Limit	12th Street	1	1.1	-
Early Action	Plaza Bonita Road	Sweetwater River Bikeway	Bonita Mesa Road	1	0.4	
Tier 1	Marina Way	Bay Marina Drive	32nd Street	1	0.5	66.4
Tier 1	18th Street	Wilson Avenue	Palm Avenue	2	1.3	65.7
Tier 1	4th Street	Roosevelt Avenue	Harbison Avenue	2	2.0	64.7
Tier 1	D Avenue	4th Street	32nd Street	2	1.8	60.4
Tier 1	30th Street	Hoover Avenue	Highland Avenue	3	0.7	58.6
Tier 1	18th Street	Palm Avenue	Granger Avenue	3	0.8	57.7
Tier 1	Highland Avenue	30th Street	Southern City Limit	2	0.5	57.0
Tier 1	Harbor Drive	8th Street	Civic Center Drive	2	0.3	54.8
Tier 1	D Avenue	Division Street	4th Avenue	3	0.2	51.5
Tier 1	Hoover Avenue / 33rd Street / National City Boulevard	Mile of Cars Way	Southern City Limit	2	1.2	51.4
Tier 1	8th Avenue	Roosevelt Avenue	Paradise Valley Road	3	2.3	50.6
Tier 2	Roosevelt Avenue	Main Street	8th Street	2	0.5	49.5

Priority Level	Location	From	To	Class	Miles	Total Points
Tier 2	30th St	Highland Avenue	Plaza Bonita Center Way	2	2.2	49.4
Tier 2	Cleveland Avenue	Civic Center Drive	Bay Marina Drive	2	0.7	47.7
Tier 2	Roosevelt Avenue / Plaza Boulevard	8th Street	Coolidge Avenue (N) / Hoover Avenue (S)	3	0.2	47.6
Tier 2	Coolidge Avenue (N) / Hoover Avenue (S)	Plaza Boulevard	18th Street	2	0.4	47.4
Tier 2	16th Street	L Avenue	Earle Drive	3	1.1	44.4
Tier 2	2nd Avenue	Sweetwater Road	0.1 miles south of Sweetwater Road	2	0.1	44.0
Tier 2	8th Street	Harbor Drive	Roosevelt Avenue	2	0.4	42.3
Tier 2	Civic Center Drive	Tidelands Avenue	Wilson Avenue	3	0.2	42.1
Tier 2	Palm Avenue / 22nd Street /Roselawn Street	4th Street	L Avenue	3	1.4	41.6
Tier 2	Euclid Avenue	Northern City Limit	Sweetwater Road	2	2.3	40.1
Tier 2	Wilson Avenue	22nd Street	Mile of Cars Way	3	0.1	39.5
Tier 2	Civic Center Drive / Roosevelt Avenue / 12th Street	Wilson Avenue	D Avenue	2	0.6	39.1
Tier 2	Paradise Valley Road	8th Street	Eastern City Limit	2	0.5	36.8
Tier 2	2nd Avenue	0.1 miles south of Sweetwater Road	Southern City Limit	3	0.2	35.4
Tier 3	12th Street / Grove Street / Prospect Street	Interstate 805	Sweetwater Road	3	1.6	34.9
Tier 3	Harbison Avenue/Earle Drive	4th Street	16th Street	3	0.8	34.9
Tier 3	Wilson Avenue	Civic Center Drive	W. 22nd Street	2	0.7	34.7
Tier 3	22nd Street	National City Boulevard	D Avenue	3	0.3	34.6
Tier 3	22nd Street	Wilson Avenue	National City Boulevard	2	0.3	34.1
Tier 3	Mile of Cars Way / 24th Street	Interstate 5	L Avenue	3	1.1	33.9
Tier 3	Division Street	Roosevelt Avenue	D Avenue	3	0.3	32.9
Tier 3	22nd Street	Grove Street	Euclid Avenue	3	0.2	32.2
Tier 3	L Avenue	16th Street	30th Street	3	0.9	25.7
Tier 3	Bay Marina Drive / Mile of Cars Way	Cleveland Avenue	Interstate 5	2	0.1	24.8
Tier 3	Bay Marina Drive	Tidelands Avenue	Marina Way	2	0.2	23.8
Tier 3	Newell Street	18th Street	Grove Street	3	0.5	22.6
Tier 3	Granger Avenue	18th Street	24th Street	3	0.4	21.7
Tier 3	24th Street	Euclid Avenue	Granger Avenue	3	0.2	20.9

5.3 End of Trip and Support Facilities

Although the proposed network of routes, lanes, and paths will go a long way towards achieving the goals of making bicycling a viable mode of travel in National City, additional support is required. Support facilities and connections to other modes of transportation are essential components of a bicycle system. Support facilities, such as bicycle parking racks, and showers and lockers for employees, further enhance safety and convenience for bicyclists. With nearly all utilitarian and many recreational bike trips, bicyclists need secure, well-located bicycle parking. However, very little bicycle parking is currently provided in National City. A comprehensive bicycle parking strategy is one of the most important things that a jurisdiction can apply to immediately enhance the bicycling environment. Improved bicycle connections with public transit will make it easier for residents to get around the City and the region, while reducing the propensity for automobile use.

The proposed bikeway network interacts with City streets at a number of signalized intersections. Enhancements should be made to ensure that signals will change for bicyclists and give them adequate time to clear the intersection.

Multi-Modal Connections

Improving non-motorized access to transit is an important part of making bicycling a part of daily life in National City. Linking bicycles with public transit overcomes barriers such as trip distance, personal safety and security concerns, and riding at night, in poor weather, or up hills. This link also enables bicyclists to reach more distant locations for both recreation and utilitarian purposes.

The proposed network includes links to the San Diego Trolley at the 8th Street and 24th Street Stations. Both stations are located greater than one-quarter mile (which is normally considered reasonable walking distance) from key destinations, such as the Plaza Bonita Mall. Both stations also have connecting bus service. This underscores the importance of providing improved bicycling connectivity to greatly increase the potential number of riders with access to bus stops and the trolley stations.

The proposed network also crosses several major bus corridors including Highland Avenue, Plaza Boulevard, and Euclid Avenue. The Plan includes bikeway recommendations to improve access to a future Bus Rapid Transit Station at Plaza Boulevard and Interstate 805.

Parking

The bicycle parking recommendations were developed based upon proximity to land uses that attract bicycle trips, including transit hubs and activity centers. Bicycle parking has been recommended for implementation at the following locations in National City:

- Public transit stations
- Recreation areas
- Schools
- Commercial/office areas
- Civic/government buildings

It is recommended that more secure bicycle parking options, such as bicycle lockers, be provided at particularly high-activity locations such as transit stations. **Figure 5-2** summarizes suggested locations where parking should be provided. For guidance on bicycle parking design, installation standards and types of short and long-term bicycle parking options, please refer to Section 6.8.

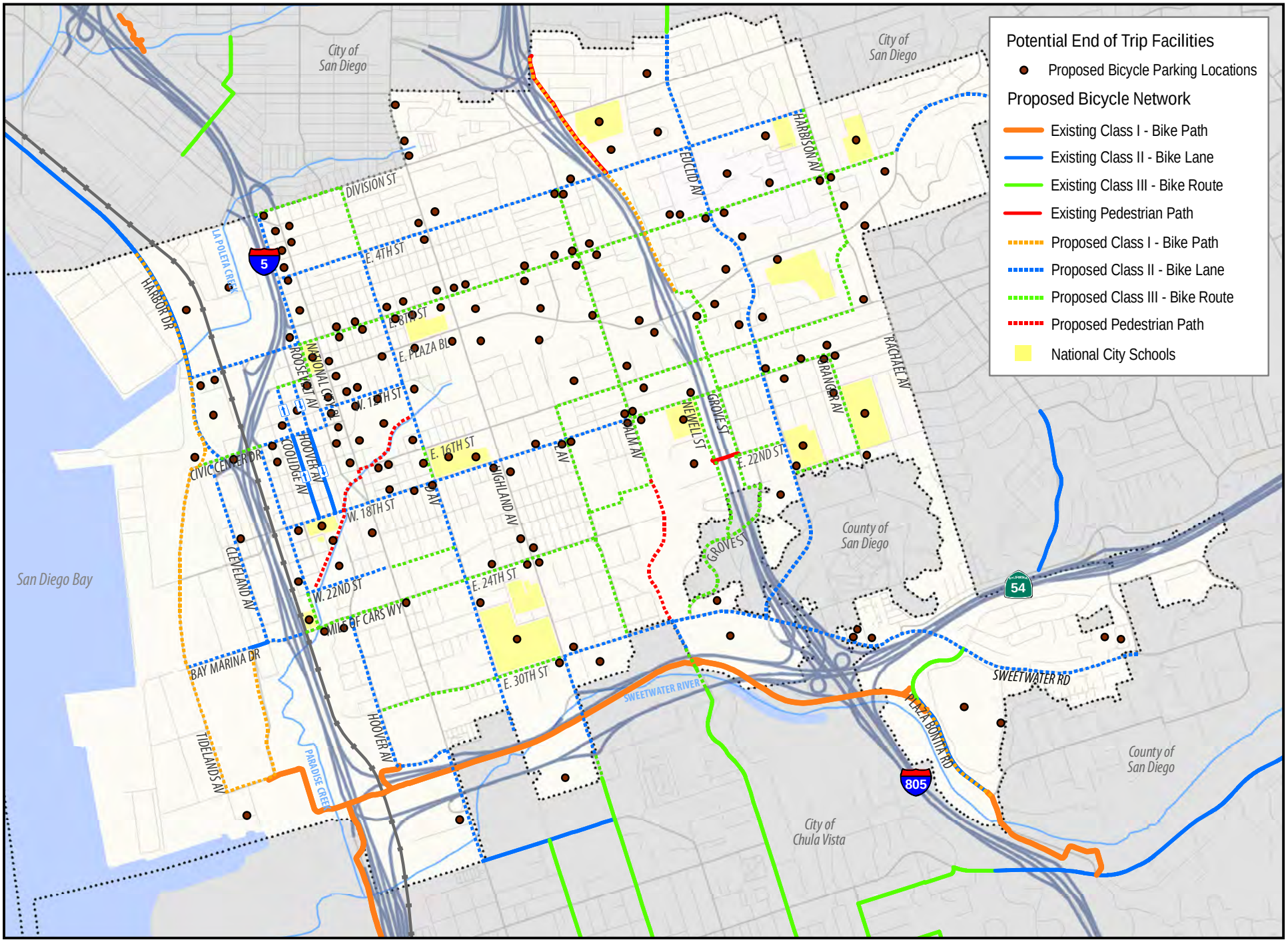


Figure 5-2: Potential End of Trip Facilities

City of National City Bicycle Master Plan

Source: Alta Planning + Design

Date: 1/11/11

0 0.25 0.5 Miles

Signals

The proposed network includes a number of signalized intersections which can prove challenging to bicyclists. At signalized intersections bicyclists should be able to trigger signals when cars are not present, without having to dismount and use a pedestrian push button to cross. Section 6.5 includes design guidelines for signals. **Table 5-7** summarizes existing and proposed signalized intersections within the City, including cost estimates to install bicycle loop detection. **Figure 5-3** shows the location of existing and future traffic signals in National City.

Table 5-7: Signalized Intersections

Type	Number	Cost
National City - Existing	73	$219,000
National City - Future	2	$6,000
Caltrans - Existing	14	$42,000*
Caltrans - Future	4	$12,000*

***Note: Costs and implementation of bicycle detection at Caltrans- maintained intersections in National City will need to be coordinated through Caltrans.**

The above estimates are based on a generalized cost of $3,000 per intersection to install bike induction loops. Video detection of bicyclists is becoming more common and could be implemented as a pilot project.

5.4 Priority Project Sheets

Project description sheets have been prepared for four high priority projects identified through the project prioritization process. These project description sheets were prepared based on field measurements, review of best management practices, and application of engineering design standards. The sheets provide recommendations and discussion of facility improvements and safety enhancements, conceptual exhibits, and preliminary construction cost estimates. **Figures 5-4** through **5-7** present the project sheets, while **Tables 5-8** through **5-11** summarize cost estimates for each of the respective projects.

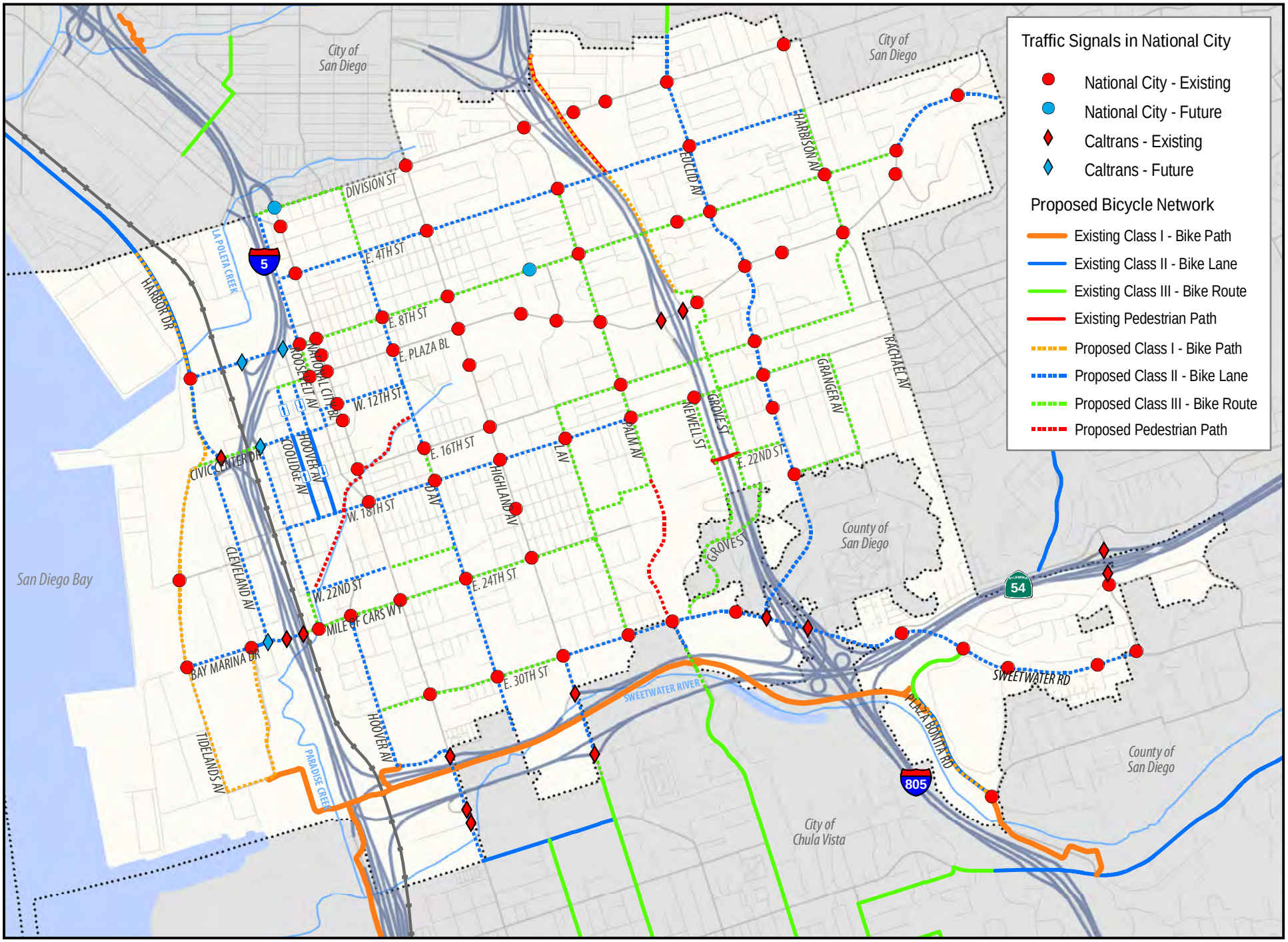


Figure 5-3: Traffic Signals in National City

City of National City Bicycle Master Plan

Source: City of National City (2010)

Date: 1/11/11

0 0.25 0.5 Miles

Figure 5-4: Project Sheet #1

Project 1: 4th Street Complete Street	Recommendations and Cost Estimate
Bike lanes and traffic calming are proposed on 4th Street from Roosevelt Avenue to Harbison Avenue. 4th Street is a wide two lane east-west collector street with on-street parallel parking. The speed limit on 4th Street is 35 mph and the average daily traffic is between 5,000 and 10,000. The existing curb-to-curb width west of Palm Avenue is 48' feet and varies between 52' and 64' east of Palm Avenue. The wide roadway widths can accommodate bike lanes throughout the corridor without impacting existing parallel parking. Bike lanes and traffic calming measures are proposed along the corridor to improve bicycle connectivity to destinations including El Toyon Park, Paradise Valley Hospital, the new Senior Housing development, and San Diego Academy.	• 2 miles of Class II Bike Lanes • Bicycle loop detectors at all signalized intersections • Curb Extensions with high visibility crosswalks Cost estimate: $680,800

Design Treatment: Curb Extension	Design Guidelines & Standards
Curb extensions reduce the distance of pedestrian crossings by extending the sidewalk out to align with the edge of the parking lane. Placed at intersections or at mid-block crosswalk locations, curb extensions and high-visibility crosswalks both calm traffic and also increase the visibility of pedestrians waiting to cross the street. Curb extensions should only extend across the parking lane and not obstruct bicyclists' path of travel or the travel lane.	• Bike Lane Adjacent to On-Street Parallel Parking 1.3.11 • Bicycle Signal Actuation 1.3.2.1 • Road Diet Parking Reduction 1.3.3.3 • On-Street Bikeway Signage 3.1.2

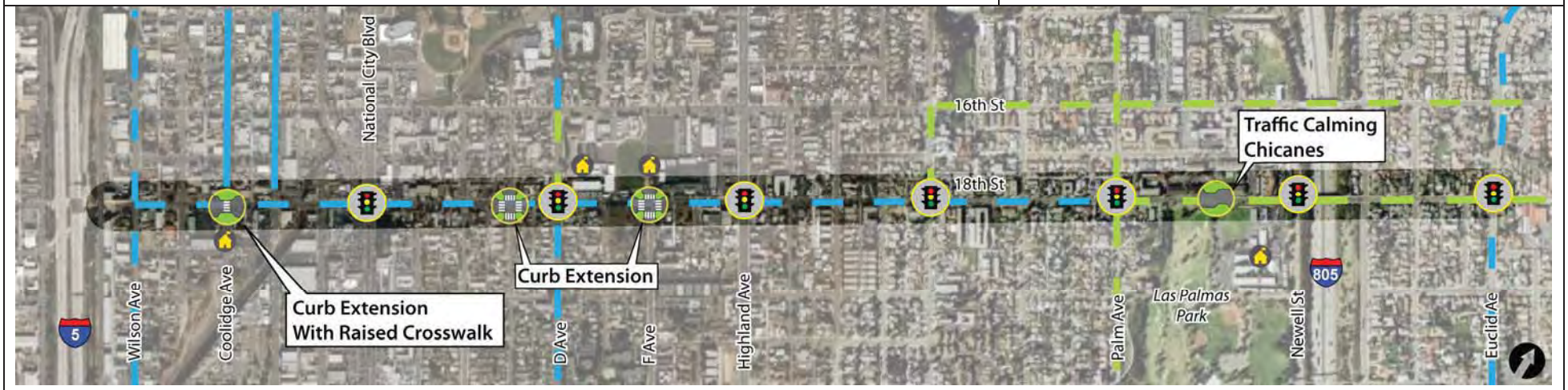
Table 5-8: Project #1 Cost Estimate

4th Street Complete Street Preliminary Estimate of Probable Cost				
Bike Path Improvements	**Quantity**	**Unit**	**Unit Price**	**Item Total**
Curb Extensions at Intersections	6	EA	$80,000	$480,000
Bicycle Loop Detection at Signalized Intersections	4	EA	$3,000	$12,000
Signing, Striping and Pavement Markings	1	LS	$100,000	$100,000
Sub-Total				*$592,000*
Contingency 15%				*$88,800*
Construction Estimate Total				**$680,800**

Source: City of National City (December 2010)

Figure 5-5: Project Sheet #2

Project 2: 18th Street Complete Street	Improvement Recommendations and Cost Estimate
Bike lanes and traffic calming are proposed on 18th Street from Wilson Avenue to Euclid Avenue. 18th Street is a two lane east-west collector street with on-street parallel parking. The speed limit on 18th Street is 35 mph for most of the corridor and the average daily traffic is between 5,000 and 10,000. The existing curb-to-curb width between Wilson Avenue and Palm Avenue varies between 48' and 64'. Major destinations along 18th Street include Kimball Elementary School, National City Middle School, John A. Otis Elementary School, Las Palmas Elementary School and Las Palmas Park. The existing roadway widths, conditions and connectivity to bicycle-attracting land uses indicate that this portion of 18th Street is a good candidate for bike lanes. The existing curb-to-curb width reduces to 40' or less, east of Palm Avenue, suggesting a transition to a bike route.	• 1.3 miles of Class II Bike Lanes • Raised crosswalk near Kimball Elementary School • Bicycle loop detectors at all signalized intersections • Curb extensions with high visibility crosswalks • Traffic calming chicanes Cost estimate: $461,150



Design Treatment: Raised Crosswalk	Design Guidelines & Standards
On roadways with low to moderate traffic volumes, a raised crosswalk reduces vehicle speed and enhances pedestrian visibility and safety. These crosswalks are raised above the roadway pavement (similar to speed humps) to an elevation that matches the adjacent sidewalk. The top of the crosswalk is flat and typically made of asphalt, patterned concrete, or brick pavers. Detectable warning pads are used at the sidewalk/street boundary to assist visually impaired pedestrians.	• Bike Lane Adjacent to On-Street Parallel Parking 1.3.11 • Bicycle Signal Actuation 1.3.2.1 • Road Diet Parking Reduction 1.3.3.3 • On-Street Bikeway Signage 3.1.2

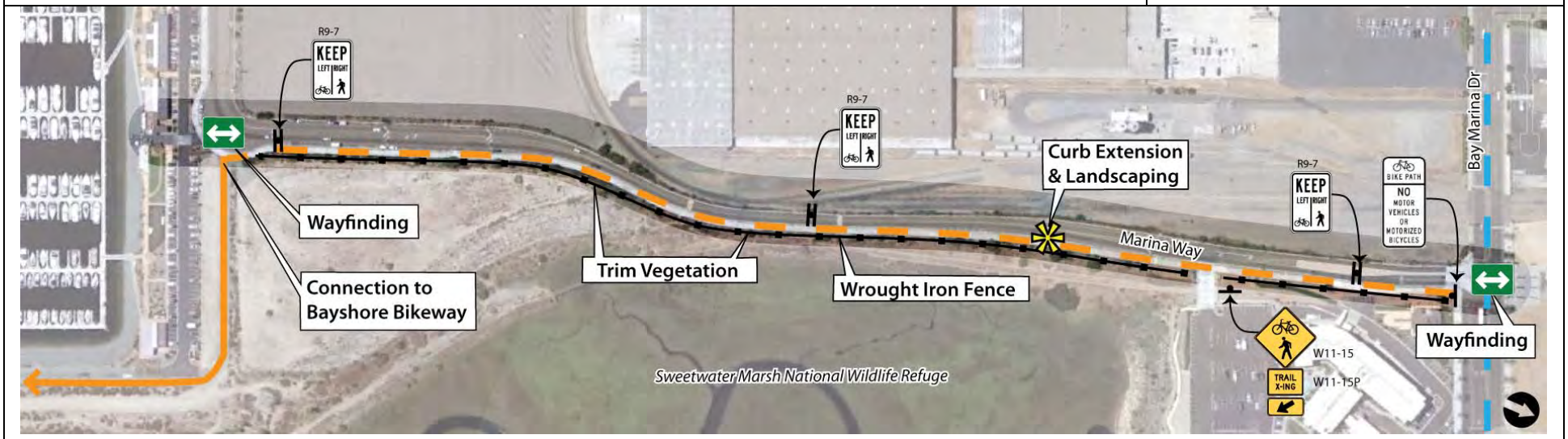
Table 5-9: Project #2 Cost Estimate

18th Street Complete Street Preliminary Estimate of Probable Cost				
Bike Path Improvements	**Quantity**	**Unit**	**Unit Price**	**Item Total**
Curb Extensions at Intersections	2	EA	$80,000	$160,000
Curb Extensions with Raised Crosswalk	1	EA	$100,000	$100,000
Chicanes	1	LS	$60,000	$60,000
Bicycle Loop Detection at Signalized Intersections	7	EA	$3,000	$21,000
Signing, Striping and Pavement Markings	1	LS	$60,000	$60,000
Sub-Total				*$401,000*
Contingency 15%				*$60,150*
Construction Estimate Total				**$461,150**

Source: City of National City (December, 2010)

Figure 5-6: Project Sheet #3

Bicycle Project #3: Marina Way Bike Path	Improvement Recommendations and Cost Estimate
On the east side of Marina Way, a 12' wide concrete sidewalk connects Bay Marina Drive south to the Bayshore Bikeway. The existing clear width along the sidewalk is constrained on the east side by a fence adjacent the Sweetwater Marsh National Wildlife Refuge and on the west side by light posts along Marina Way. The 12' wide sidewalk meets the minimum design standards for a Class I shared use path (8' wide path with 2' wide shoulders). Maintenance is required to trim adjacent vegetation and remove sand on the sidewalk to maintain a clear path. Improvements should also be made to improve the user experience and aesthetic appeal. Examples include replacing the various fence types with a consistent wrought iron fence and planting shade trees where adequate width is available. Retrofitting the existing street lights with additional pedestrian scale lights will improve night time visibility. A curb extension can also provide space to plant additional landscaping and provide a small trail wayside	• Trail wayside curb extension • Clear vegetation and sand from Bike Path • Drought-tolerant landscaping • Pedestrian level lighting • Consistent wrought iron fence • Install signage/wayfinding **Cost estimate: $342,700**



Design Treatment: Class I Proposed Cross Section	Design Guidelines & Standards
This cross section meets the minimum design standards for creating a shared use path based on Caltrans Highway Design Manual guidelines. The 12' sidewalk width allows for 2' shoulders.	• Trails Along Roadways 2.1.3 • Path Amenities 2.3 • Bollards 2.3.2 • Fencing 2.3.3 • Landscaping 2.3.4 • Multi-use Trail Signage 3.1.1

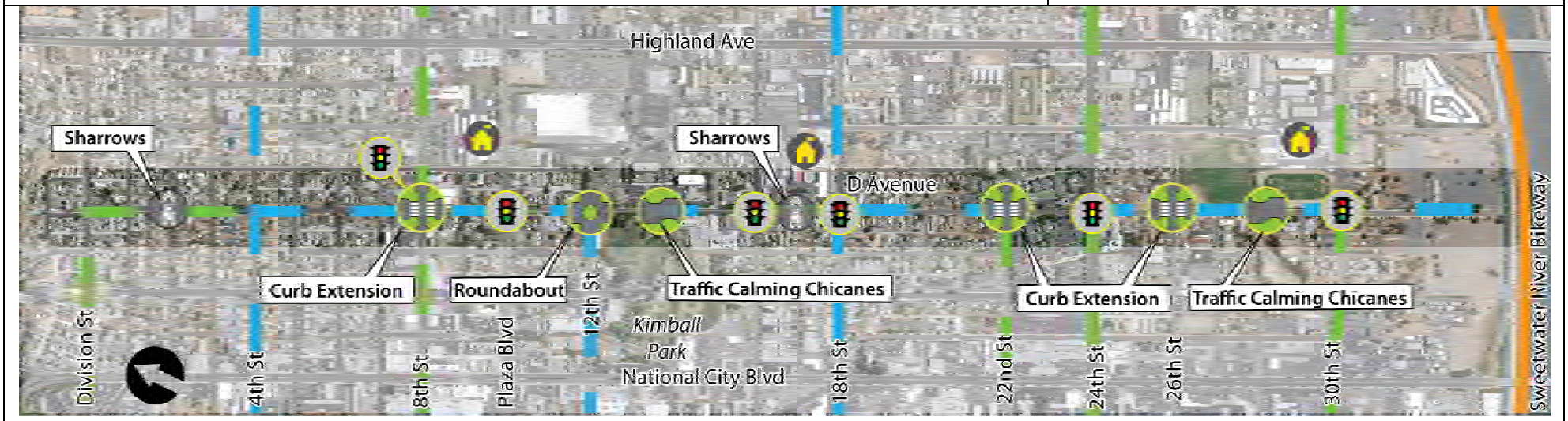
Table 5-10: Project #3 Cost Estimate

Marina Way Path Improvements Preliminary Estimate of Probable Cost				
Bike Path Improvements	**Quantity**	**Unit**	**Unit Price**	**Item Total**
Curb Extensions	1	LS	$40,000	$40,000
Pedestrian Lighting	20	EA	$5,000	$100,000
Wrought Iron Fence	1,600	LF	$30	$48,000
Landscaping	1	LS	$80,000	$80,000
Signing, Striping and Pavement Markings	1	LS	$30,000	$30,000
Sub-Total				*$298,000*
Contingency 15%				*$44,700*
Construction Estimate Total				**$342,700**

Source: City of National City (December 2010)

Figure 5-7: Project Sheet #4

Project #4: D Avenue Complete Street	Recommendations and Cost Estimate
Bike lanes and traffic calming are proposed on D Avenue from Division Street to its southern terminus, just south of 30th Street. D Avenue is a north-south two lane collector roadway situated between two parallel major arterial corridors, National City Boulevard and Highland Avenue. The speed limit on D Avenue is 35 mph for most of the corridor and the average daily traffic is between 5,000 and 7,000 vehicles per day. The typical curb-to-curb width of D Avenue is approximately 48', which allows for bike lanes without altering on-street parking. A two-block segment between 16th Street and 18th Street, next to National City Middle School, has a wider cross-section with diagonal parking along the east side of the street. The diagonal parking limits the ability to stripe bike lanes along this short segment without changing the conditions of the roadway. Therefore, a bike route with sharrows is recommended for this segment. D Avenue is largely residential in character, though there are several community destinations along the corridor such as Kimball Park, Sweetwater High School and National City Middle School.	• 1.5 miles of Class II Bike Lanes • 0.35 miles of Class III Bike Route with sharrows • Curb extensions with high visibility crosswalks • Traffic calming chicanes • Bicycle loop detectors at all signalized intersections • Roundabout at 12th Street **Cost estimate $1,101,700*** *$500,000 Safe Routes to School grant to fund roundabout



Potential Connection with Sweetwater River Bike Path	Design Guidelines & Standards
Chicanes are a series of raised or delineated curb extensions on alternating sides of a street forming an S-shaped curb line. Chicanes reduce vehicle speeds through narrowing travel lanes and deflecting traffic. Chicanes can also be achieved by establishing on-street parking on alternate sides of the street. These treatments are most effective on streets with narrower cross-sections.	• Bike Lane Adjacent to On-Street Parallel Parking 6.5.3.1.1 • Bike Lane Signage and Pavement Markings 6.5.3 • Bicycle Signal Actuation 5.5.3.2.1 • Bicycle Route Signage and Pavement Markings 6.5.4 and 6.5.4.2 • Short-Term Bicycle Parking 6.8.1.1

Table 5-11: Project #4 Cost Estimate

D Avenue Complete Street Preliminary Estimate of Probable Cost				
Improvements	**Quantity**	**Unit**	**Unit Price**	**Item Total**
Curb Extensions at Intersections	3	EA	$80,000	$240,000
Chicanes	1	LS	$100,000	$100,000
Roundabout*	1	EA	$500,000	$500,000
Bicycle Loop Detection at Signalized Intersections	6	EA	$3,000	$18,000
Signing, Striping and Pavement Markings	1	LS	$100,000	$100,000
Sub-Total				*$958,000*
Contingency 15%				*$143,700*
Construction Estimate Total				**$1,101,700**

** Funded through Safe Routes to School Grant*

Source: City of National City (December 2010)

5.5 Other Potential Projects

I-805 Corridor Bike Path

The north-south I-805 corridor which currently runs through the eastern portion of National City creates a barrier to bicycle access. Caltrans has plans to widen the I-805 corridor through National City to include HOV/Managed Lanes and Bus Rapid Transit (BRT) service with a station at Plaza Boulevard. This project provides an opportunity to develop an improved multi-use path parallel to I-805 on the east side of the freeway between the northern city limits and E. 12th Street, just north of Plaza Boulevard. National City would need to coordinate this project with Caltrans to create a Class I bicycle path through this corridor as much of the right-of-way is within Caltrans' jurisdiction.

Paradise Creek Path

Although not classified as a bikeway, the Paradise Creek path provides an important link to schools, parks and transit for non-motorized users through the core of the City and helps support transit-oriented development. The proposed path follows Paradise Creek from the Kimball Park area, southwest across National City Boulevard and past Kimball Elementary School, ending near the 24th Street Trolley Station. A transit-oriented development is planned just east of the trolley station, providing an opportunity to incorporate portions of the path into the project.

D Avenue / Sweetwater Bikeway Connection

The Sweetwater River Bikeway is a major regional corridor; however its utility is limited for many bicyclists in National City due to its lack of connectivity with City streets. D Avenue is planned as a significant north-south bike corridor, from Division Street south to 32nd Street. Commercial redevelopment is planned a few blocks south of 30th Street along D Ave, which presents both a challenge and opportunity for improving facilities in the area. The site is split between the City of National City and the City of Chula Vista and is separated from the Sweetwater River Bikeway by SR-54.

The crossing of SR-54 presents some engineering challenges. The Sweetwater Bikeway occupies a relatively narrow portion of the riverbank adjacent to the freeway right of way, so it may be difficult to accommodate the long transitions needed for an overcrossing structure. An undercrossing is infeasible due to the grades required and sub-surface infrastructure.

As an alternative to a crossing structure, a bike route through the redevelopment project site should be considered. The bike route would transverse the project's frontage road, connecting facilities on D Avenue to those at National City Boulevard and 33rd Street.

2nd Avenue / Sweetwater Bikeway Connection

There is currently a connection from the Sweetwater Bikeway to the east side of 2nd Ave, allowing bicyclists to head north along 2nd Ave into National City. For bicyclists heading south along 2nd Ave, there is no access to the bikeway other than a narrow, unpaved trail, which is separated from the roadway by a guardrail. A paved path could be constructed at the location through grading, vegetation removal, and partial removal of the guardrail, similar to the path provided on the east side of 2nd Avenue.

6. Design Guidelines

The design guidelines presented hereafter provide an exhaustive range of options for bicycle and trail treatments. Design guidelines are intended to be flexible and should be applied with professional judgment by designers, planners and engineers. These guidelines do not specify what the City will implement on any given project, but rather provide a framework. Specific national and state guidelines are identified in this document, as well as a compilation of best practices.

The following key principles should be observed:

- **The bicycle and trail network should enhance safety**. Bicycle routes, pathways, and crossings, should be designed, built and maintained to be free of hazards and to minimize conflicts with external factors such as noise, vehicular traffic and protruding architectural elements.
- **The bicycle and trail network should be accessible.** Bicycle routes, pathways and crossings should ensure the mobility of all users by accommodating the needs of people regardless of age or ability.
- **The bicycle and trail network should connect to key destinations**. Convenient connections should be established between homes, schools, shopping districts, public services, recreational areas and transit.
- **The bicycle and trail network should be clearly identified and easy to use.** Bicycle routes, pathways and crossings should be signed and striped such that users can easily find a direct route to a destination to minimize delays.
- **Bicycle and trail improvements should be economical.** Improvements should be designed to achieve the maximum benefit for their cost, including implementation and maintenance costs to reduce reliance on more expensive, less environmentally friendly modes of transportation. Where possible, improvements in the public right-of-way should stimulate, reinforce and connect with adjacent private improvements.

6.1 National and State Guidelines / Best Practices

The following is a list of references and sources utilized to develop design guidelines for the National City Bicycle Master Plan. Many of these documents are available to the public online and provide a wealth of information and resources.

Federal Guidelines

- American Association of State Highway and Transportation Officials. (2001). *AASHTO Policy on Geometric Design of Streets and Highways*. Washington, DC. www.transportation.org
- American Association of State Highway and Transportation Officials. (1999). *AASHTO Guide for the Development of Bicycle Facilities*. Washington, DC. www.transportation.org
- Federal Highway Administration. (2009). *Manual on Uniform Traffic Control Devices (MUTCD)*. Washington, DC. http://mutcd.fhwa.dot.gov
- United States Access Board. (2007). *Public Rights-of-Way Accessibility Guidelines (PROWAG)*. Washington, D.C. http://www.access-board.gov/PROWAC/alterations/guide.htm

State and Local Guidelines

- California Department of Transportation. (2006). *Highway Design Manual* (HDM), *Chapter 1000: Bikeway Planning and Design.* http://www.dot.ca.gov/hq/oppd/hdm/pdf/chp1000.pdf
- California Department of Transportation. (2010). *California Manual of Uniform Traffic Control Devices for Streets and Highways, Part 9: Traffic Controls for Bicycle Facilities* http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/pdf/camutcd2010/CAMUTCD2010.pdf
- California Department of Transportation. (2005) *Pedestrian and Bicycle Facilities in California: A Technical Reference and Technology Transfer Synthesis for Caltrans Planners and Engineers.* http://www.dot.ca.gov/hq/traffops/survey/pedestrian/TR_MAY0405.pdf
- National City. *National City General Plan Update (2011). http://www.ci.national-city.ca.us/index.aspx?page=160*
- San Diego Association of Governments (SANDAG). *San Diego Regional Bicycle Plan.* http://www.altaprojects.net/sandag/Main.html

Best Practices

- Alta Planning + Design and the Initiative for Bicycle & Pedestrian Innovation (IBPI). (2009). *Fundamentals of Bicycle Boulevard Planning & Design.* http://www.ibpi.usp.pdx.edu/media/BicycleBoulevardGuidebook.pdf
- Association of Pedestrian and Bicycle Professionals (APBP). (2010). *Bicycle Parking Design Guidelines, 2nd Edition.*
- City of Berkeley. (2000). *Bicycle Boulevard Design Tools and Guidelines.* http://www.ci.berkeley.ca.us/contentdisplay.aspx?id=6652
- City of Chicago and the Pedestrian and Bicycle Information Center (PBIC). (2002). Bike *Lane Design Guide.* http://www.activelivingresources.org/assets/chicagosbikelanedesignguide.pdf
- City of Portland Bureau of Transportation. (2010). *Portland Bicycle Master Plan for 2030.* http://www.portlandonline.com/transportation/index.cfm?c=44597
- Federal Highway Administration. (2005). *Report HRT-04-100, Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations.* http://www.tfhrc.gov/safety/pubs/04100/
- Federal Highway Administration. (2001). *Designing Sidewalks and Trails for Access.* http://www.fhwa.dot.gov/environment/sidewalk2/contents.htm
- Institute of Transportation Engineers Pedestrian and Bicycle Council. (2003). *Innovative Bicycle Treatments.*
- King, Michael, for the Pedestrian and Bicycle Information Center. (2002). *Bicycle Facility Selection: A Comparison of Approaches.* Highway Safety Research Center, University of North Carolina – Chapel Hill. http://www.bicyclinginfo.org/pdf/bikeguide.pdf
- Oregon Department of Transportation. (1995). *Oregon Bicycle and Pedestrian Plan.* http://www.oregon.gov/ODOT/HWY/BIKEPED/planproc.shtml
- Rosales, Jennifer. (2006). *Road Diet Handbook: Setting Trends for Livable Streets.*

All bikeway facilities are required, at a minimum, to meet the design guidelines outlined in the Caltrans Highway Design Manual, Chapter 1000 and in the California MUTCD. When considering design treatments not approved by the California MUTCD or the Highway Design Manual, National City must follow the protocol for testing innovative treatments specified by the State.

6.2 The Bicycle as a Design Vehicle

Similar to motor vehicles, bicyclists and their bicycles come in a variety of sizes and configurations. There are a variety of vehicle types, such as conventional bicycles, tandem bicycles, and recumbent bicycles. The behavioral characteristics and comfort levels of the bicyclists riding the vehicles also varies. When designing a bicycle facility consideration should be given to vehicle types and skill levels of the bicyclists projected to use the facility.

Physical Dimensions

The operating space and physical dimensions of a typical adult bicyclist are shown in **Figure 6-1**. Clear space is required for the bicyclist to be able to operate within a facility. This is why the minimum operating width is greater than the physical dimensions of the bicyclist. Although four feet is the minimum acceptable operating width, five feet or more is recommended. Outside of the design dimensions of a typical bicycle there are many commonly used pedal driven cycles and accessories that should be considered when planning and designing bicycle facilities.

Table 6-1 summarizes the typical dimensions for most commonly used bicycle design vehicles.

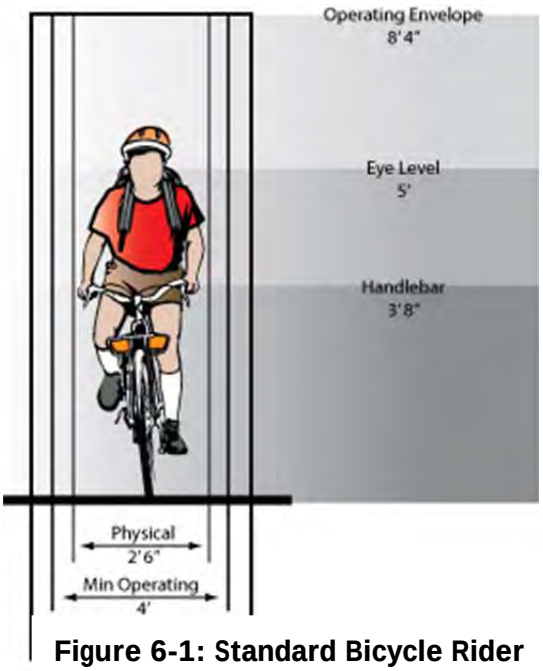


Figure 6-1: Standard Bicycle Rider Dimensions

Table 6-1: Bicycle as Design Vehicle – Typical Dimensions

Bicycle Type	Feature	Typical Dimensions
Upright Adult Bicyclist	Physical width	2 ft 6 in
	Operating width (Minimum)	4 ft
	Operating width (Preferred)	5 ft
	Physical length	5 ft 10 in
	Physical height of handlebars	3 ft 8 in
	Operating height	8 ft 4 in
	Eye height	5 ft
	Vertical clearance to obstructions (tunnel height, lighting, etc).	10 ft
	Approximate center of gravity	2 ft 9 in to 3 ft 4 in
Recumbent Bicyclist	Physical length	7 ft
	Eye height	3 ft 10 in
Tandem Bicyclist	Physical length	8 ft
Bicyclist with child trailer	Physical length	10 ft
	Physical width	2 ft 6 in
Hand Bicyclist	Eye height	2 ft 10 in
Inline Skater	Operating width (sweep width)	5 ft

The most common types of bicycles, including tandem bicycles, recumbent bicycles, and trailer accessories, are depicted in **Figure 6-2**.

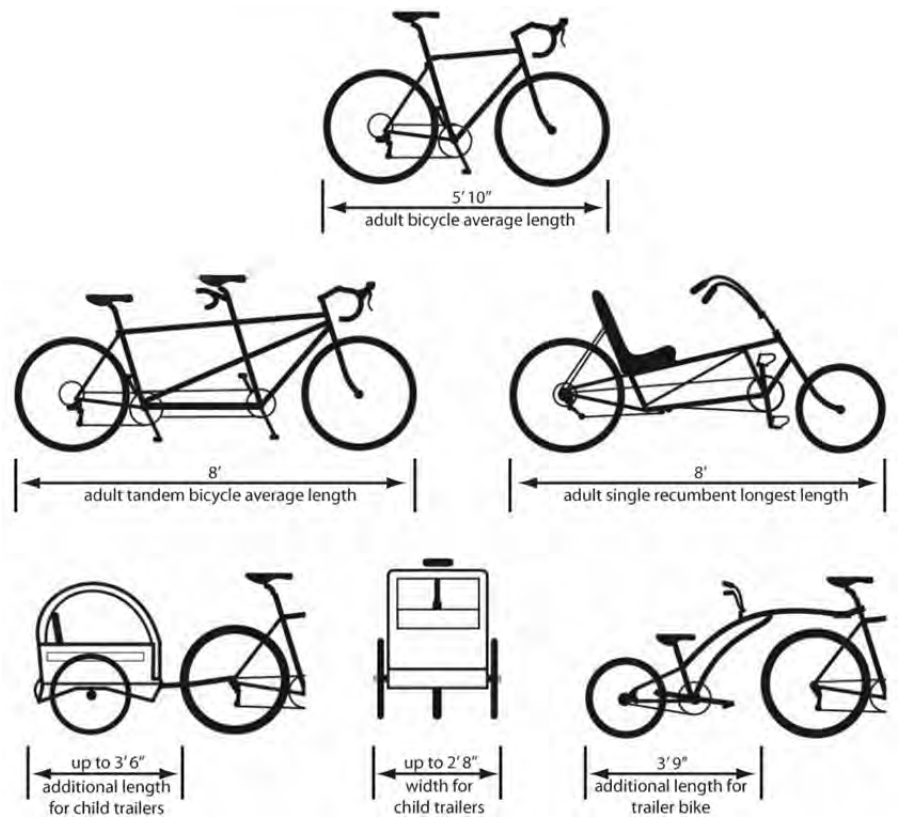


Figure 6-2: Various Bicycle Dimensions

Design Speed

The speed that various types of bicyclists can be expected to maintain under various conditions can also have influence over the design of facilities such as shared use paths. **Table 6-2** provides typical speeds of various types of bicyclists for a variety of conditions.

Table 6-2: Bicycle as Design Vehicle – Design Speed Expectations

Bicycle Type	Feature	Typical Speed
Upright Adult Bicyclist	Paved level surfacing	15 mph
	Crossing Intersections	10 mph
	Downhill	30 mph
	Uphill	5-12 mph
Recumbent Bicyclist	Paved level surfacing	18 mph

Types of Bicyclists

The skill level of the bicyclist also impacts speeds and behavioral characteristics. There are several systems of classification currently in use within the bicycle planning and engineering professions. Classification systems are helpful in understanding the characteristics and infrastructure preferences of different bicyclists. However, it should be noted that classifications may change in type or proportion over time as infrastructure and culture evolve. Often times an instructional course can instantly change a less confident bicyclist into one that can comfortably and safely share the roadway with vehicular traffic. Bicycle infrastructure should be planned and designed to accommodate as many user types as possible. Consider separate or parallel facilities to provide a comfortable experience for the greatest number of bicyclists.

A classification system that is currently in use in the Pacific Northwest and also under consideration for the upcoming update of the *AASHTO Guide for the Development of Bicycle Facilities* provides the following bicycle user types:

- **Strong and Fearless** (Very low percentage of population) – Characterized by bicyclists that will typically ride anywhere regardless of roadway conditions or weather. These bicyclists can ride faster than other user types, prefer direct routes and will typically choose roadway connections, even if shared with vehicles, over separate bicycle facilities such as multi-use pathways.
- **Enthused and Confident** (5-10% of population) – This user group encompasses the "intermediate" bicyclists who are typically comfortable riding on all types of bicycle facilities, but usually prefer low traffic streets or multi-use pathways when available. These bicyclists may deviate from a more direct route in favor of a preferred facility type. This group includes commuters, recreationalists, racers, and utilitarian bicyclists.
- **Interested But Concerned** (approximately 60% of population) – This user group comprises the majority of the cycling population and represents bicyclists who typically only ride a bicycle on low traffic streets or multi-use paths under favorable conditions and weather. These bicyclists perceive vehicular traffic and speeds as barriers to increased bicycling. These bicyclists may become "Enthused and Confident" through encouragement, education and experience.
- **No Way, No How** (approximately 30% of population) – Persons in this category are not bicyclists, and oppose riding in traffic. Some people in this group may eventually give cycling a second look and may progress to the user types above. However, the majority of people in this group will never ride a bicycle regardless of improvements to facilities, or public outreach efforts.

6.3 Routine Accommodation of Bicyclists (Complete Streets)

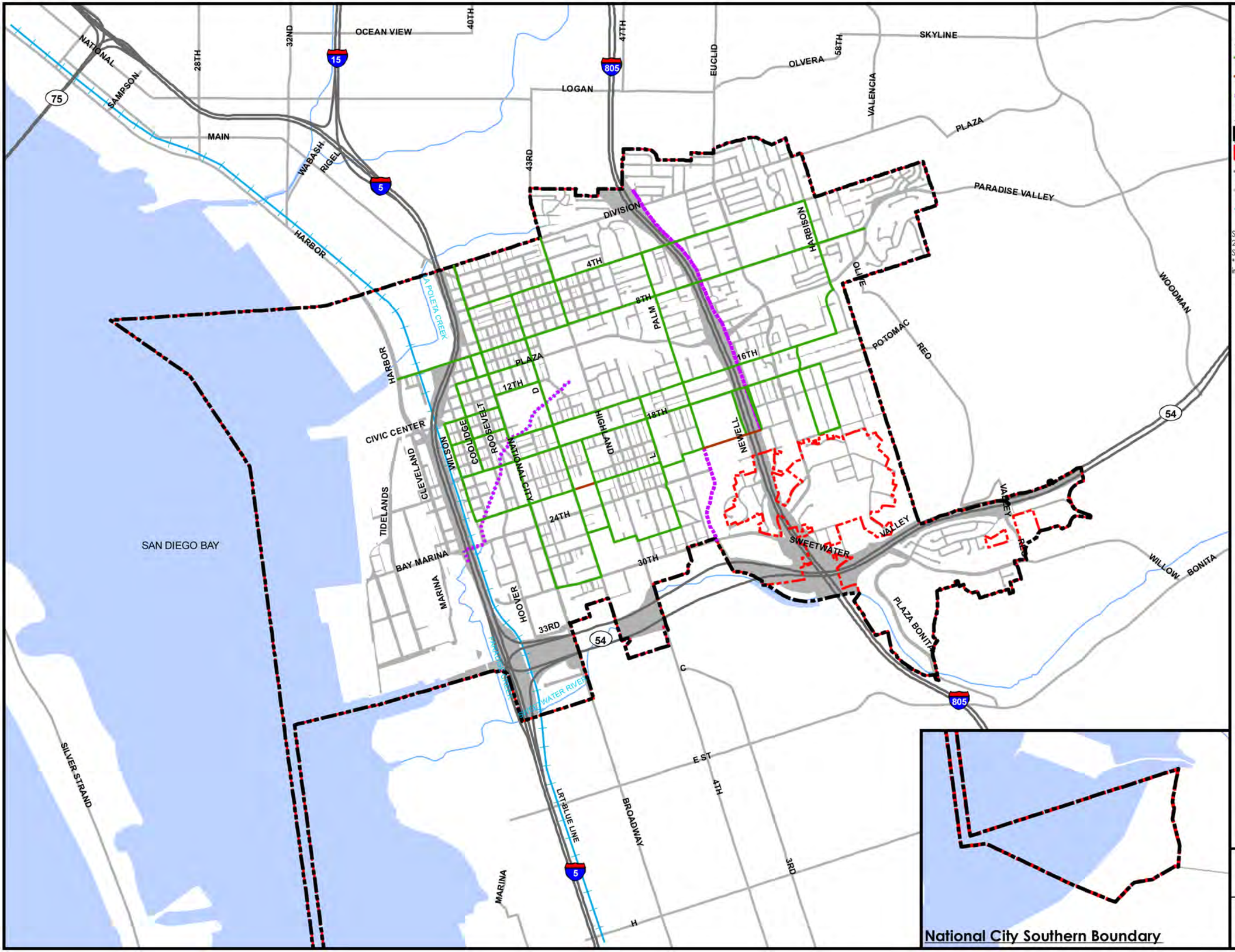
Bicyclists have legal access to all public streets in National City. While this Plan identifies a specific subset of streets to be designated as bikeways, many bicyclists will need to use other streets to reach their destinations. Therefore, it is important that all roadways be designed to accommodate bicyclists. The California Complete Streets Act of 2008 (AB 1358) mandates that cities plan for all users of roadways.

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

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

6.4 Community Corridors

The recent update of the *National City General Plan* includes a variety of roadway cross-sections designed to better accommodate pedestrians and bicyclists. Referred to as "Community Corridors", these roadways represent "complete streets", with emphasis on traffic calming, streetscape enhancements, and improved walkability / bicycle access. **Figure 6-3** illustrates the proposed Community Corridor network. **Figures 6-4** through **6-16** illustrate options for reconfiguring roadways to enhance bicycle access. In many cases, it may be necessary to use minimum travel and turn lane widths in order to accommodate bike lanes. Whether or not minimum lane widths are acceptable should be determined on a case-by-case basis through sound engineering judgment and analysis of various site-specific factors including traffic speeds, parking demand and turnover, bus and truck volumes, etc.



Legend

Community Corridors

- Combination of Modes
- Non-Motorized Only
- Proposed Recreational Trails

Base Layers

- National City Planning Area Boundary
- National City Boundary
- Freeways
- Roads
- Railroad

Source: City of National City (City Boundary,2009), SANDAG (Railroad, 2008; Streams,2003). San Diego LAFCO (Planning Area Boundary,2009), SanGIS (Lakes,2006; Roads,2008)

*Portions of this derived product contains geographic information copyrighted by SanGIS. All Rights Reserved.

Figure 6.3
Community Corridors

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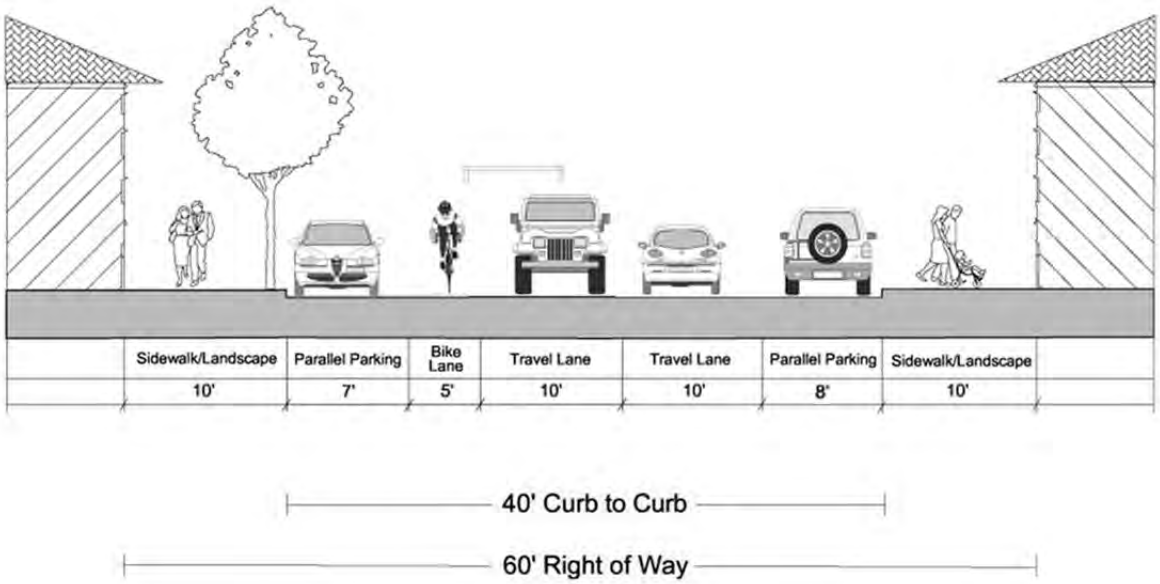


Figure 6-4: Bike Lane with Parallel Parking on Both Sides (40' Roadway)

Source: National City General Plan Update (2011)

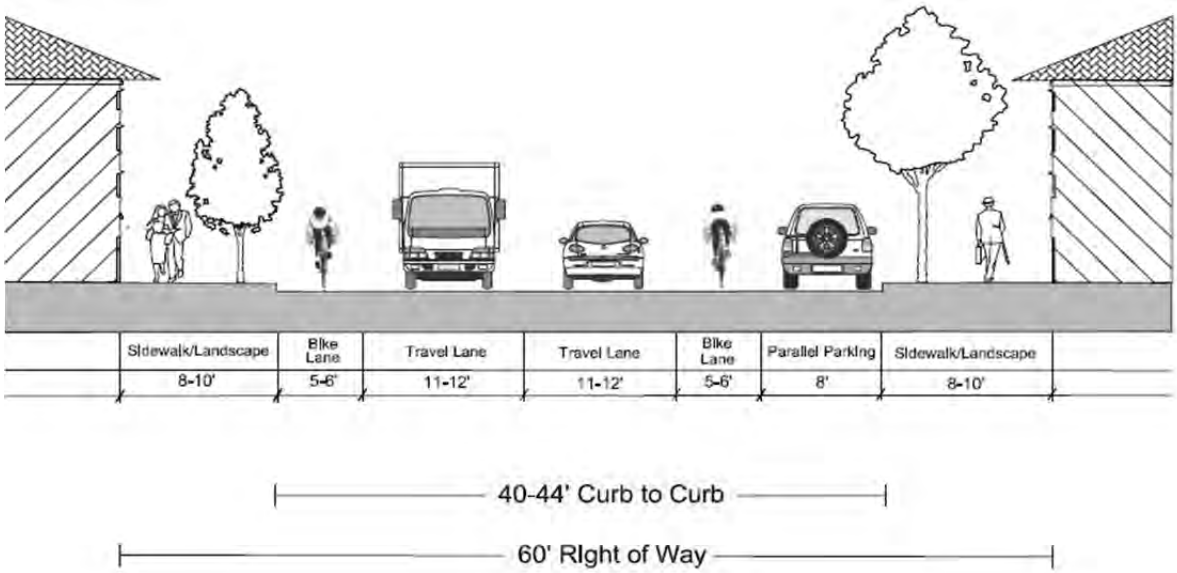


Figure 6-5: Bike Lanes with Parallel Parking on One Side (40'- 44' Roadway)

Source: National City General Plan Update (2011)

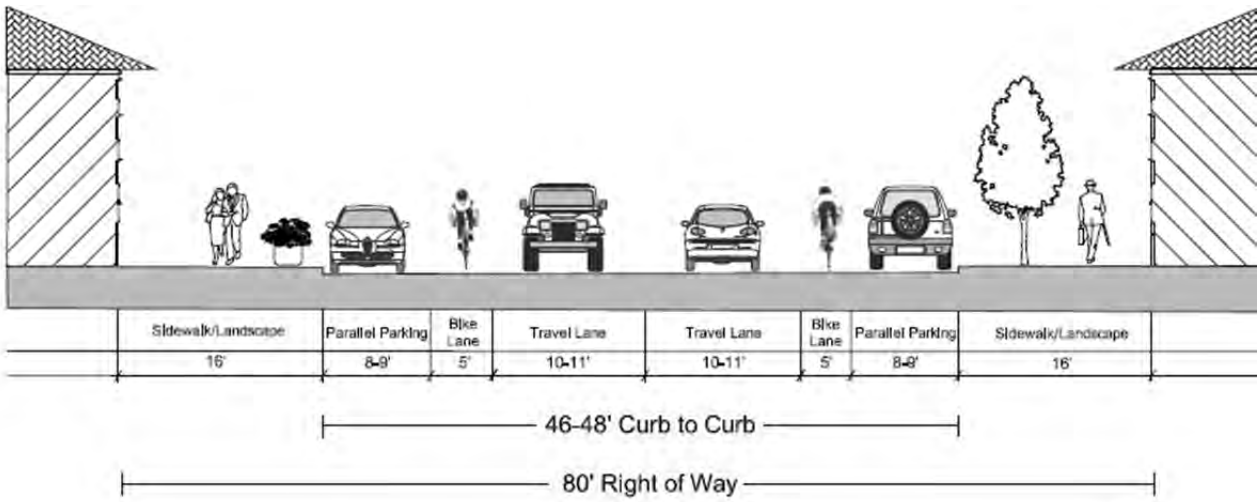


Figure 6-6: Bike Lanes with Parallel Parking on Both Sides (46'-48' Roadway)

Source: National City General Plan Update (2011)

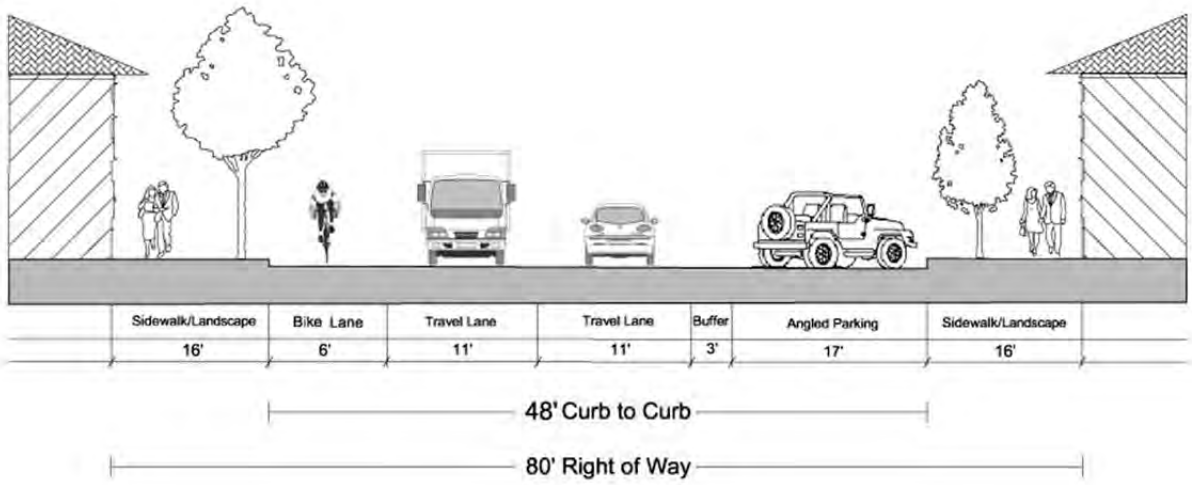


Figure 6-7: Bike Lane with Angled Parking on one Side (48' Roadway)

Source: National City General Plan Update (2011)

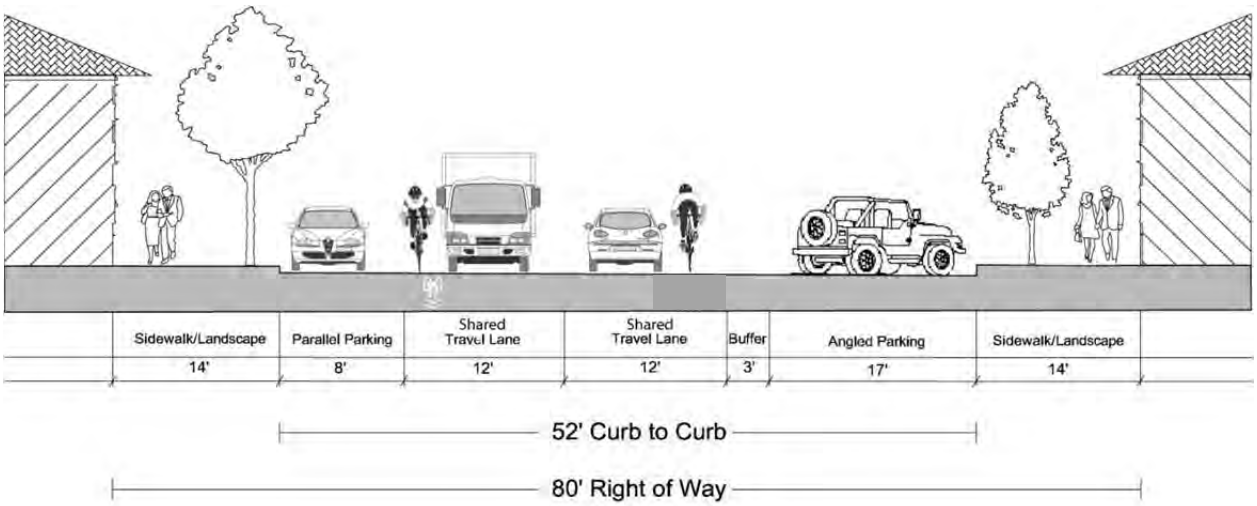


Figure 6-8: Shared Lanes with Angled and Parallel Parking (52' Roadway)

Source: Alta Planning + Design (2010)

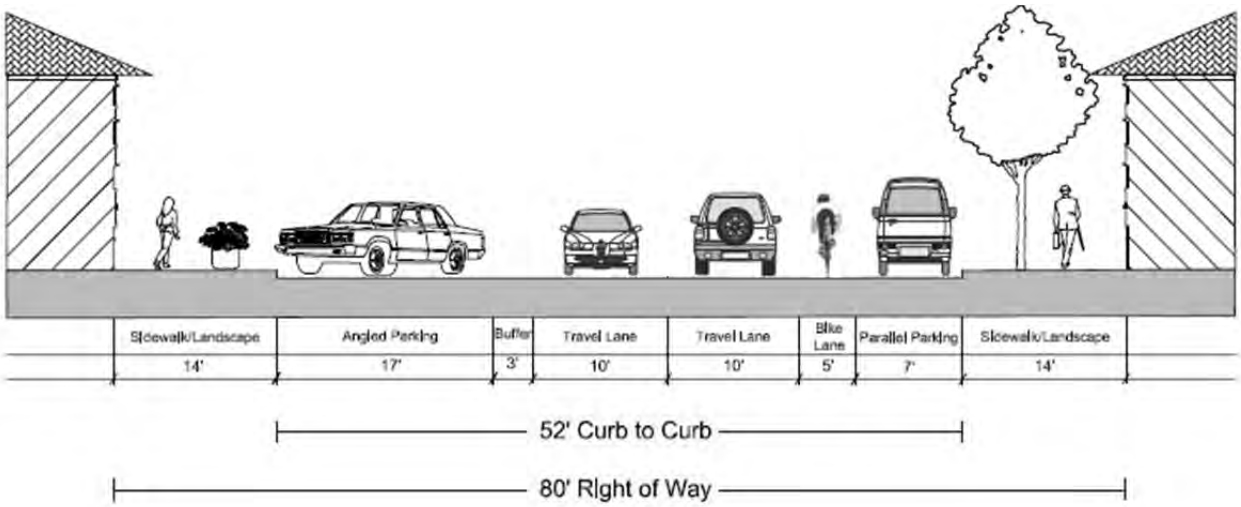


Figure 6-9: Bike Lane with Angled and Parallel Parking (52' Roadway)

Source: National City General Plan Update (2011)

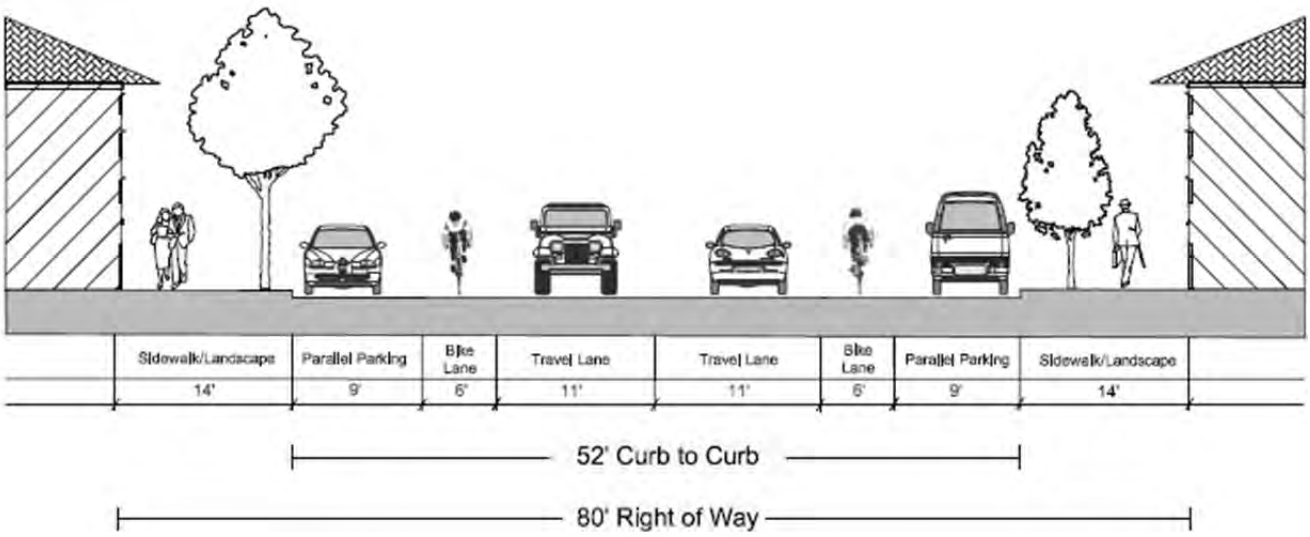


Figure 6-10: Bike Lanes with Parallel Parking on Both Sides (52' Roadway)

Source: National City General Plan Update (2011)

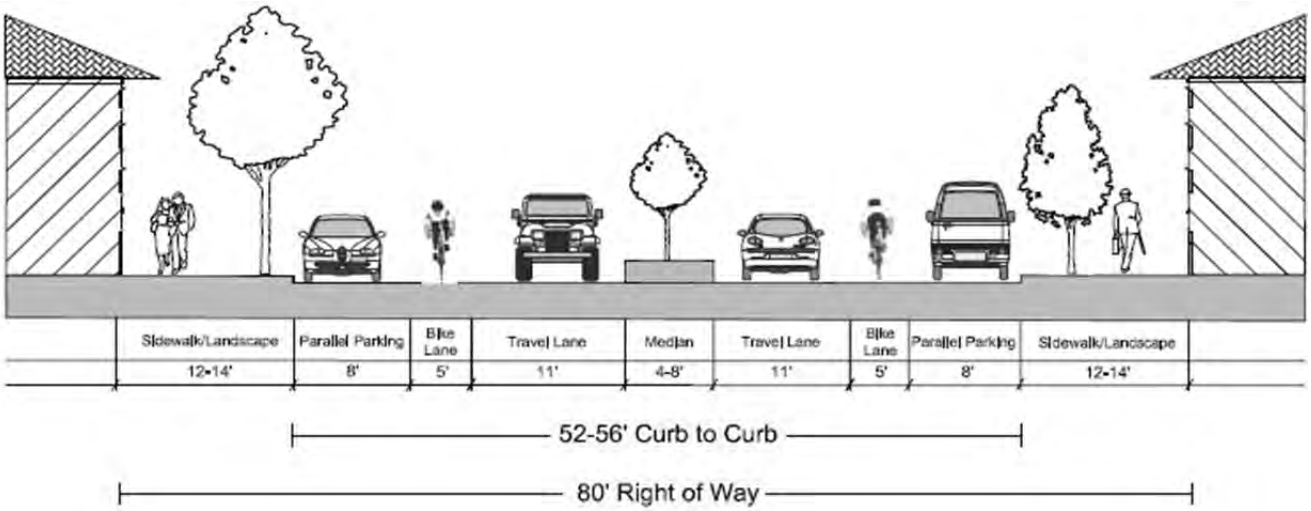


Figure 6-11: Bike Lanes with Median and Parallel Parking on both Sides (52'-56' Roadway)

Source: National City General Plan Update (2011)

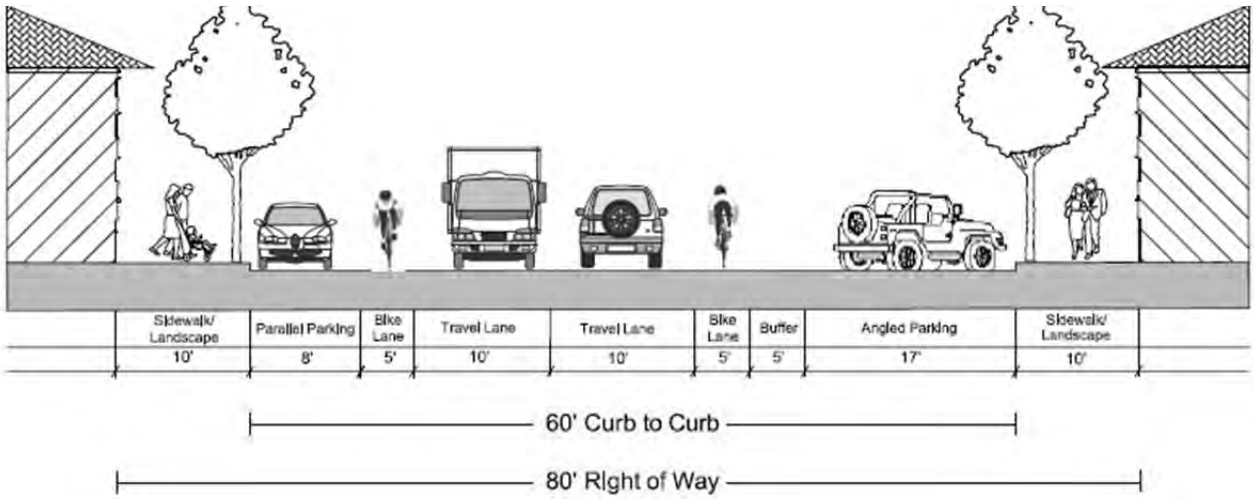


Figure 6-12: Bike Lanes with Angled and Parallel Parking (60' Roadway)

Source: National City General Plan Update (2011)

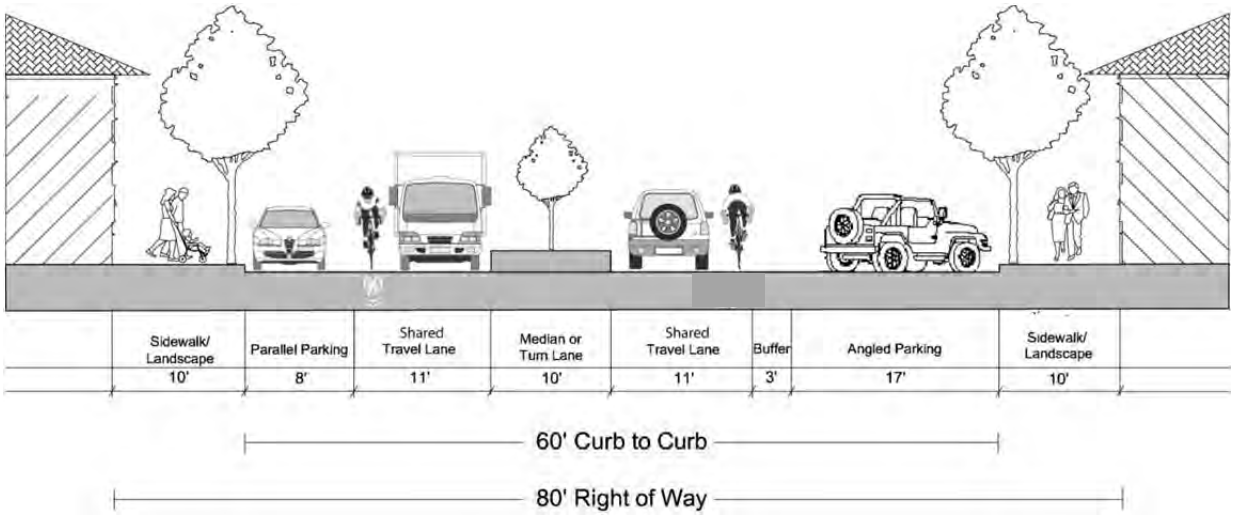


Figure 6-13: Shared Lanes with Median and Angled and Parallel Parking (60' Roadway)

Source: Alta Planning + Design (2010)

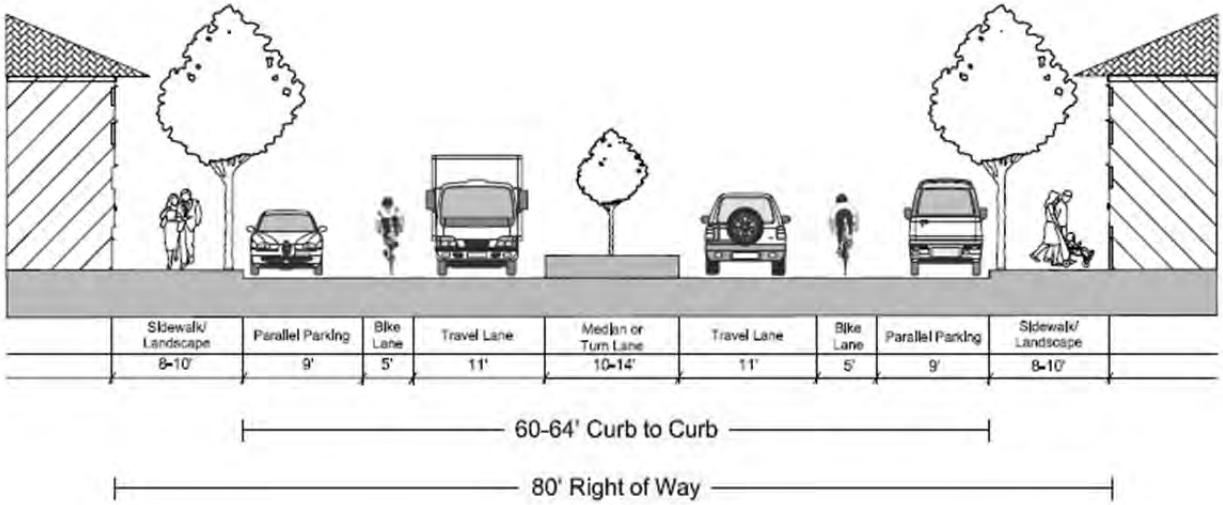


Figure 6-14: Bike Lanes with Median and Parallel Parking on Both Sided (60'-64' Roadway)

Source: National City General Plan Update (2011)

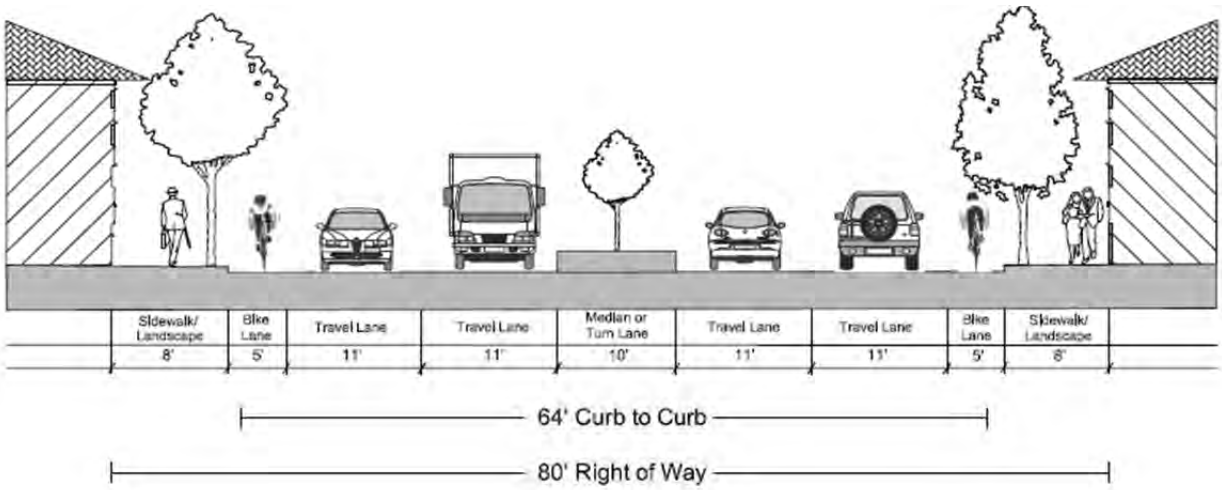


Figure 6-15: Bike Lanes and Median without Parking (64' Roadway)

Source: National City General Plan Update (2011)

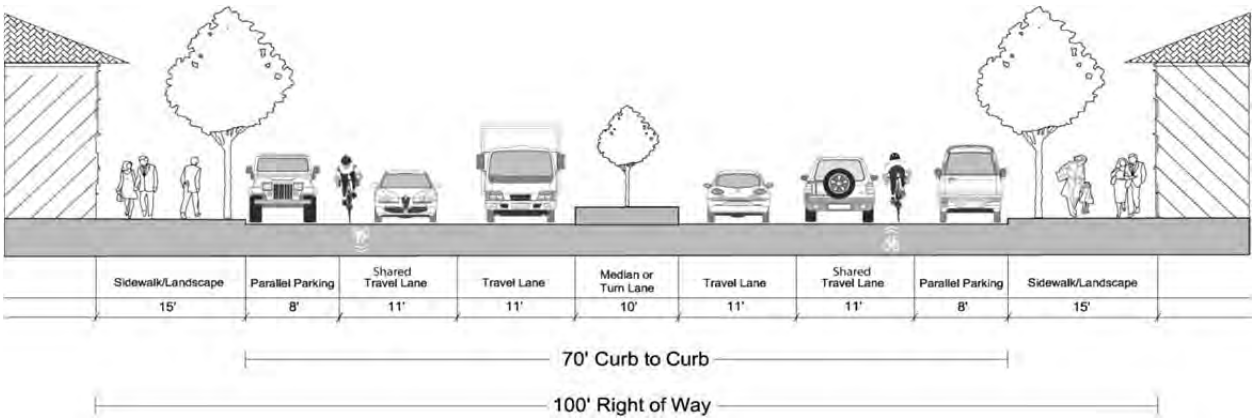


Figure 6-16: Shared Lanes with Median and Parallel Parking on Both Sides (70' Roadway)

Source: Alta Planning + Design (2010)

6.5 On–Street Bicycle Facility Design Guidelines

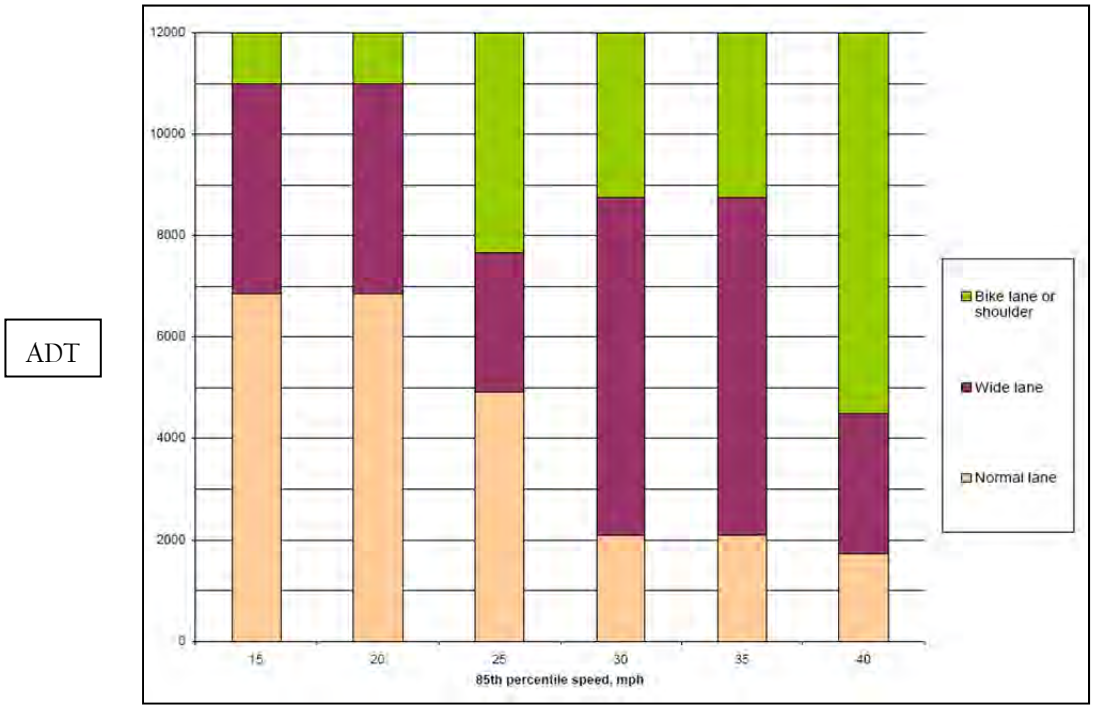
There are a variety of bicycle facilities and treatments available based on the desired level of protection or separation from automobile traffic. This section summarizes best practices for on-street bicycle facility design.

Facility Selection

There are a variety of techniques for selecting the appropriate type of facility or treatment. Roadway characteristics typically considered include:

- Motor vehicle speeds and volumes
- Presence of heavy vehicles / trucks
- Roadway width
- Parking
- Demand for bicycle facilities / user preference
- Land use - urban or rural context

A 2002 study compared bikeway dimension standards for ten different communities in North America. The goal of the study was to survey the various approaches available and provide a best practices approach for designing bicycle facilities. The study included a comparison with European standards and found that, "North Americans rely much more on wide lanes for bicycle accommodation than their counterparts overseas." The table below shows the results of the analysis, which recommends use of bike lanes or shoulders, wide lanes, or normal lanes based on variations in traffic volumes and speeds.



North American bicycle facility selection chart.

(King, Michael. (2002). Bicycle Facility Selection: A Comparison of Approaches. Pedestrian and Bicycle Information Center and Highway Safety Research Center, University of North Carolina – Chapel Hill.)

6.5.1 Shared Roadways

Shared Roadways Guidelines

Design Summary

Use D11-1 Bike Route Sign at:

- Beginning or end of Bike Route (with applicable M4 series sign below).
- Entrance to bike path (Class I) – optional.
- At major changes in direction or at intersections with other bike routes (with applicable M7 series sign below).
- At intervals along bike routes not to exceed ½ mile (0.8 km).

Discussion

Class III bicycle facilities (Caltrans designation) are defined as facilities shared with motor vehicles, identified exclusively by signage and / or shared lane markings. They 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. Shared roadways often have a centerline stripe only, and no designated shoulders. Shared lane markings in addition to signage may be more appropriate for roadways with narrow travel lanes and parking.

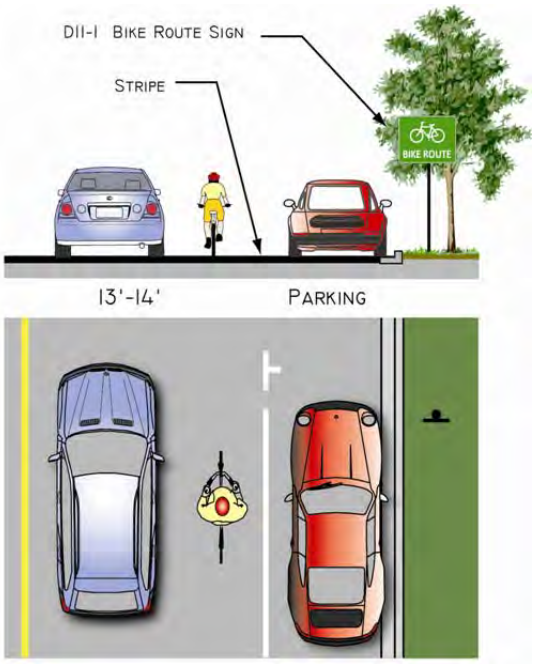
Shared roadways provide key connections to destinations and trails where providing additional separation is not possible.

Guidance

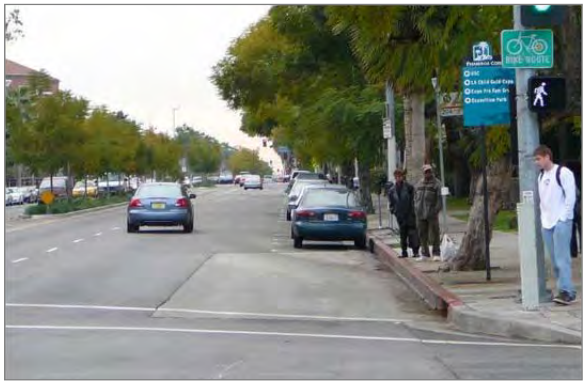
- From Caltrans *Highway Design Manual (HDM)* Chapter 1000:

  "Class III bikeways (bike routes) are intended to provide continuity to the bikeway system. Bike routes are established along through routes not served by Class I or II bikeways, or to connect discontinuous segments of bikeway (normally bike lanes). Class III facilities are shared facilities, either with motor vehicles on the street, or with pedestrians on sidewalks, and in either case bicycle usage is secondary. Class III facilities are established by placing Bike Route signs along roadways."

- AASHTO Guide for the Development of Bicycle Facilities.
- California *MUTCD*, Part 9.



Shared roadway recommended configuration.



This bike route in the City of Los Angeles provides a wide outside lane adjacent to on-street parking.

D11-1 "Bike Route" sign should be used along designated shared roadways.

6.5.2 Wide Curb Lane / Shared Lane Markings

Wide Curb Lane/Shared Lane Markings Guidelines

Design Summary

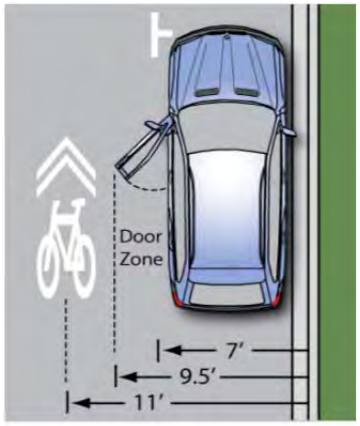
- Outside lane widths of 15-16′ are appropriate where vehicle speeds are 40 mph or greater, where average daily traffic (ADT) volumes equal or exceed 10,000, or where bicyclists require additional maneuvering space.
- Outside lane widths of 14′ are appropriate where vehicle speeds are 35 mph or less, and ADT volumes are below 10,000.
- Outside lanes of 16′ or greater are not recommended, because drivers may try to form two travel lanes and not provide adequate clearance for passing bicyclists.
- Use D11-1 "Bike Route" Sign as specified for shared roadways.
- Shared lane markings may be used. Place in a linear pattern along a corridor :
    - Immediately after an intersection and spaced at intervals of 250 feet thereafter (2010 California MUTCD),
    - At least 11′ from face of curb (or shoulder edge) on streets with on-street parking (2010 California MUTCD),
    - At least 4′ from face of curb (or shoulder edge) on streets without on-street parking,
    - Shared lane markings should not be placed on roadways with a speed limit over 40 MPH (2010 California MUTCD).

Wide curb lanes can include shared lane pavement markings to increase visibility.

Discussion

A wide outside lane can be used on roadways where bike lanes might otherwise be used, but the existing road width does not allow for restriping. The wide lane allows motor vehicles to pass bicycles while providing the recommended three feet of clearance.

Shared lane marking stencils (also called "sharrows") have been introduced for use in California as an additional treatment for Class III facilities. The stencil can serve a number of purposes, such as making motorists aware of bicycles potentially in their lane, showing bicyclists the direction of travel, and, with proper placement, reminding bicyclists to bike further from parked cars to prevent "dooring" collisions.



Shared lane marking placement guidance for streets with on-street parking.

Guidance

- Use of shared lane markings was adopted by Caltrans in 2005 as California MUTCD Section 9C.103 and Figure 9C-107.
- AASHTO Guide for the Development of Bicycle Facilities.
- Caltrans Highway Design Manual (Chapter 1000).

6.5.3 Bike Lanes

Bike Lanes Guidelines

Design Summary

Width varies depending on roadway configuration, see following pages for design examples. Five to eight feet is standard, measured from edge of gutter pan.
Striping:

- Separating vehicle lane from bike lane (typically left sideline): 6 inches.
- Separating bike lane from parking lane (if applicable): 4 inches.
- Dashed white stripe when:
  - Vehicle merging area (optional): Varies.
  - Approach to intersections: 100-200 feet.
  - Delineate conflict area at intersections (optional): Length of conflict area.

Signing: use R-81 Bike Lane Sign at:

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

Pavement markings: the preferred pavement marking for bike lanes is the bike lane stencil with directional arrow to be used at:

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

Approved R-81 Sign.

Approved California Bike lane stencils (either is optional, as is arrow).

Discussion

Bike lanes or Class II bicycle facilities (Caltrans designation) are defined as a portion of the roadway that has been designated by striping, signage, and pavement markings for the preferential or exclusive use of bicyclists. Bike lanes are generally found on major arterial and collector roadways and are 5-8 feet wide. Bike lanes can be found in a large variety of configurations, and can have special characteristics including coloring and placement if beneficial.
Bike lanes enable bicyclists to ride at their preferred speed without interference from prevailing traffic conditions and facilitate predictable behavior and movements between bicyclists and motorists. Bicyclists may leave the bike lane to pass other bicyclists, make left turns, avoid obstacles or debris, and to avoid conflicts with other roadway users.

Additional Guidance

- AASHTO *Guide for the Development of Bicycle Facilities.*
- Caltrans *Highway Design Manual* (Chapter 1000).
- California *MUTCD*.
- Additional standards and treatments for bike lanes are provided in the following pages.

Bike Lane Adjacent to On-Street Parallel Parking

Design Summary

Bike Lane Width:

- 5′ recommended when parking stalls are marked.
- 4′ minimum in constrained locations.
- 8′ maximum (greater widths may encourage vehicle loading in bike lane).

Shared bike and parking lane width:

- 12′ for a shared lane adjacent to a curb face.
- 11′ minimum for a shared bike/parking lane where parking is permitted but not marked on streets without curbs.
- If the parking volume is substantial or turnover is high, an additional 1 to 2 feet of width is desirable

Discussion

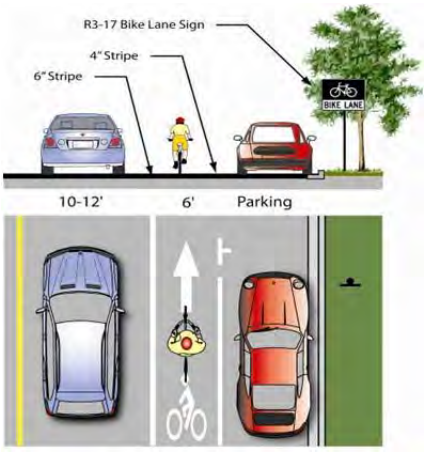
Bike lanes adjacent to on-street parallel parking are common in the U.S. A suddenly-opened vehicle door presents a hazard for bicyclists using this type of facility, especially when adequate separation from parked vehicles is not provided. Conversely, wide bike lanes may encourage the bicyclist to ride farther to the right (door zone) to maximize distance from passing traffic. Wide bike lanes may also cause confusion with unloading vehicles in busy areas where parking is typically full.

Treatments to encourage bicyclists to ride away from the 'door zone' include:

- Installing parking "T's" and smaller bike lane stencils placed to the left (see graphic at top).
- Using diagonal stripes to encourage bicyclists to ride on the left side of the bike lane (shown middle; this treatment is not standard and should be studied before use).
- Provide a buffer zone (preferred design; shown bottom). Bicyclists traveling in the center of the bike lane will be less likely to encounter open car doors. Motorists have space to stand outside the bike lane when loading and unloading.

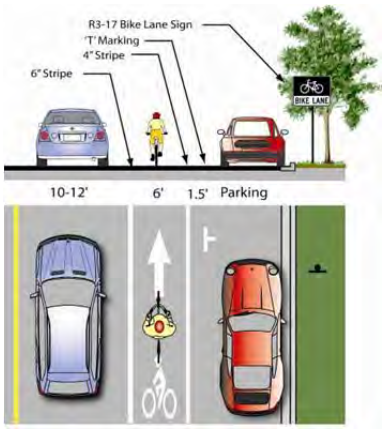
Guidance

- AASHTO *Guide for the Development of Bicycle Facilities.*
- Caltrans Highway Design Manual (Chapter 1000).
- California *MUTCD*



Parking 'T' bike lane design.

Diagonal stripe bike lane design (maximum width).



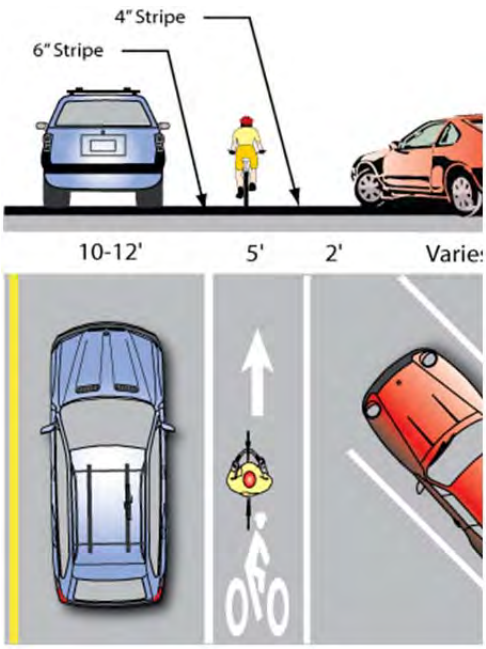
Parking buffer bike lane design.

Bike Lane Adjacent to On-Street Diagonal Parking

Design Summary

Bike Lane Width:

- 5' minimum.
- White 4" stripe separates bike lane from parking bays.
- Parking bays are sufficiently long to accommodate most vehicles (vehicles do not block bike lane).



Recommended bike lane adjacent to on-street diagonal parking design.

Discussion

In areas with high parking demand such as urban commercial areas, diagonal parking can be used to increase parking supply. Conventional "head-in" diagonal parking is not recommended in conjunction with high levels of bicycle traffic or with the provision of bike lanes as drivers backing out of conventional diagonal parking spaces have poor visibility of approaching bicyclists.

The use of 'back-in diagonal parking' or 'reverse angled parking' is recommended over head-in diagonal parking. This design addresses issues with diagonal parking and bicycle travel by improving sight distance between drivers and bicyclists and has other benefits to vehicles including: loading and unloading of the trunk occurs at the curb rather than in the street, passengers (including children) are directed by open doors towards the curb, no door conflict with bicyclists. While there may be a learning curve for some drivers, using back-in diagonal parking is typically an easier maneuver than conventional parallel parking.

'Back-in' diagonal parking enhances safety for bicyclists by improving drivers' visibility as they exit the parking space.

Guidance

- Slated for inclusion in the upcoming update of the AASHTO *Guide for the Development of Bicycle Facilities*.

Bike Lane without On-Street Parking

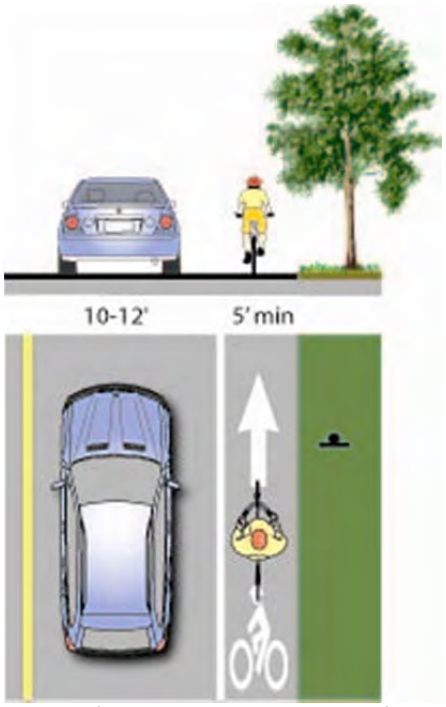
Design Summary

Bike lane width:

- 4′ minimum when no curb & gutter is present (rural road sections).
- 5′ minimum when adjacent to curb and gutter (3′ more than the gutter pan width if the gutter pan is wider than 2′).
- 6′ recommended where right-of-way allows.

Maximum Width:

- 8′ adjacent to arterials with high travel speeds (45 mph+).



Recommend bike lane without on-street parking design.

Discussion

Wider bike lanes are desirable in certain circumstances such as on higher speed arterials (45 mph+) where a wider bike lane can increase separation between passing vehicles and bicyclists. Wide bike lanes are also appropriate in areas with high bicycle use. A bike lane width of six to eight feet makes it possible for bicyclists to ride side-by-side or pass each other without leaving the bike lane, increasing the capacity of the lane. Appropriate signing and stenciling is important with wide bike lanes to ensure motorists do not mistake the lane for a vehicle lane or parking lane.

Where on-street parking is not allowed adjacent to a bike lane, bicyclists do not require additional space to avoid opened car doors.

Guidance

- AASHTO *Guide for the Development of Bicycle Facilities*.
- Caltrans *Highway Design Manual* (Chapter 1000).
- California *MUTCD*.

Bike Lane Intersection Treatments

Bicycle Signal Actuation

Design Summary

At signalized intersections, bicyclists should be able to trigger signals when cars are not present. Requiring bicyclists to dismount to press a pedestrian button is inconvenient and requires the bicyclist to merge into traffic at an intersection. It is particularly important to provide bicycle actuation in a left-turn only lane where bicyclists regularly make left turn movements.

Discussion

Loop Detectors

Bicycle-activated loop detectors are installed within the roadway to allow the presence of a bicycle to trigger a change in the traffic signal. This allows the bicyclist to stay within the lane of travel and avoid maneuvering to the side of the road to trigger a push button.
Many demand-actuated signals use loop detectors embedded in the roadway pavement, which can be attuned to be sensitive enough to detect any type of metal, including bicycle frames. Identify with the "Bicycle Detector Symbol" shown in Figure 9C-7(CA) in the CA-MUTCD.

Detection Cameras

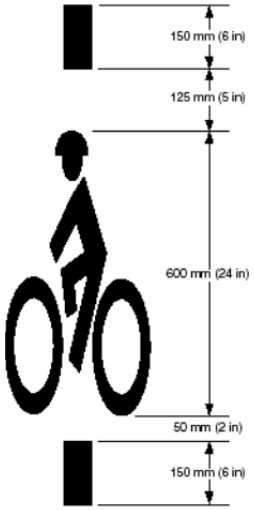
Video detection cameras can also be used to determine when a vehicle is waiting for a signal. These systems use digital image processing to detect a change in the image at the location. Cameras can detect bicycles, although bicyclists should wait in the center of the lane, where an automobile would usually wait, in order to be detected. Video camera system costs range from $20,000 to $25,000 per intersection. Detection cameras are currently used for bicyclists in the City of San Luis Obispo, CA, where the system has proven to detect pedestrians as well.

Remote Traffic Microwave Sensor Detection (RTMS)

RTMS is a system developed in China, which uses frequency modulated continuous wave radio signals to detect objects in the roadway. This method is marked with a time code which gives information on how far away the object is. The RTMS system is unaffected by temperature and lighting, which can affect standard detection cameras.

Guidance

- Additional technical information is available at:
- www.humantransport.org/bicycledriving/library/signals/detection.htm
- ITE Guidance for Bicycle—Sensitive Detection and Counters: http://www.ite.org/councils/Bike-Report-Ch4.pdf



Recommended loop detector marking design.

Example bicycle actuator marking.

Instructional Sign (MUTCD Sign R10-15).

Bike Lane Intersection Treatments

Bike Lanes at Channelized Intersection with Right Turn Pocket

Design Summary

- Shared turn lane width – min. 12 feet
- Bike lane pocket width – min. 4 feet

Discussion

This treatment is recommended at intersections lacking sufficient space to accommodate a standard bike lane and right turn lane. The shared bicycle/right turn lane places a standard-width bike lane on the left side of a dedicated right turn lane. A dashed stripe delineates the space for bicyclists and motorists within the shared lane. This treatment includes signage advising motorists and bicyclists of proper positing within the lane.
According to the CA MUTCD and Chapter 1000 of the Caltrans HDM, the appropriate treatment for right-turn only lanes is to place a bike lane pocket between the right-turn lane and the right-most through lane or, where right-of-way is insufficient, to drop the bike lane entirely approaching the right-turn lane. Dropping the bike lane is not recommended, and should only be done when a bike lane pocket cannot be accommodated.
Colored bike lanes can help distinguish the bike lane in the merging area (see colored bike lane guidelines).

Advantages:

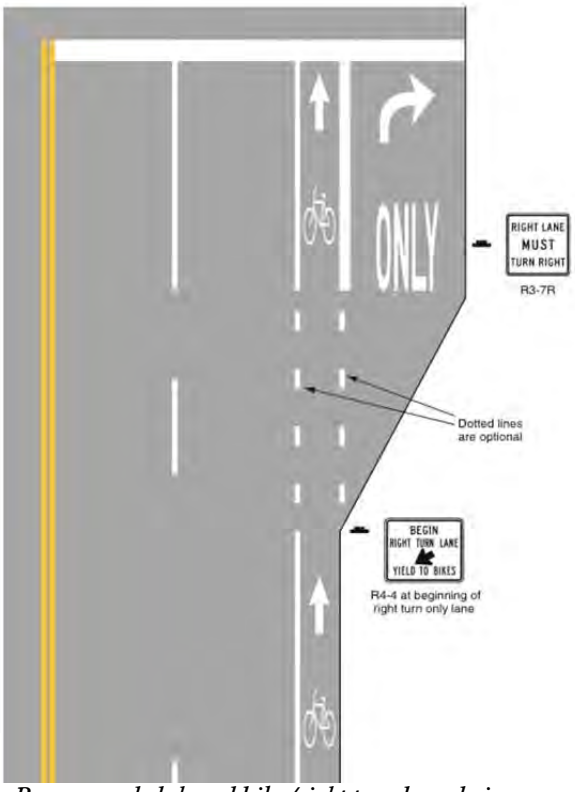
- Aids in correct positioning of bicyclists at intersections with a dedicated right-turn lane without adequate space for a dedicated bike lane.
- Encourages motorists to yield to bicyclists when using the right turn lane.
- Reduces motor vehicle speed within the right-turn lane.

Disadvantages:

- May not be appropriate for intersections with large percentages of right-turning heavy vehicles.

Guidance

- This treatment has been implemented in San Francisco, CA and Eugene, OR.
- AASHTO *Guide for the Development of Bicycle Facilities.*
- Caltrans *Highway Design Manual* (Chapter 1000).
- California *MUTCD*, Part 9.



Recommended shared bike/right turn lane design.

Shared bike-right turn lanes require warning signage as well as pavement markings.

Bike Lane Intersection Treatments

Bike Lanes at Double Right Turn Intersections

Design Summary

- Bike lane pocket width – min. 4 feet; 5 feet preferred.

Discussion

Double right turn lanes or an inside through/right combination lane should be avoided, because merging across two lanes is challenging for bicyclists. Existing double-turn lanes along bicycle routes should be studied for potential conversion to single-turn lanes.

In situations where the double-turn lane cannot be removed, proper bicyclist lane positioning should be encouraged to prevent vehicles in the outside right turn lane from turning into a bicyclist. This can be accomplished via pavement markings and signage by:

- Providing a shared outside turn lane with a bike lane (Option A). This positions bicyclists in the through/turn lane while providing clearer delineation than the "shared lane" approach (Option B).
- Using the shared lane markings to position bicyclists in the center of the through right-turn lane (Option B).
- Colored bike lanes can also help distinguish the bike lane in the merging area.

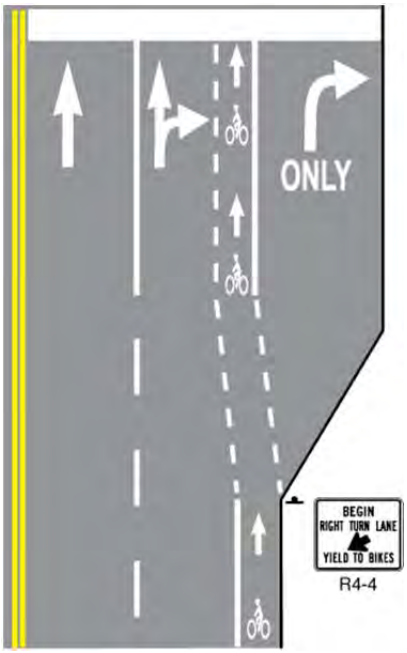
However, many bicyclists may be uncomfortable with double right-turn lanes regardless of the treatment and accommodation. This treatment is not suitable for intersections with high bicycle volumes. The outside right-turn lane should be eliminated or an alternate route should be provided in such cases.

In addition, Option B may be inconsistent with the 2010 California MUTCD and require special permission for use. The CA-MUTCD states,

> *A dashed line across the right-turn-only lane should not be used on extremely long lanes, or where there are double right-turn-only lanes. For these types of intersections, all striping should be dropped to permit judgment by the bicyclists to prevail.*

Guidance

- California *MUTCD*, Part 9.
- Previously implemented in San Francisco, CA and Portland, OR.



Option A 'Shared Outside Lane'

Option B 'Shared Lane Marking'

Bike Lane Intersection Treatments

Bike Lanes at Interchanges

Design Summary

- Follow guidelines from previous sections for bike lanes and intersection treatments.

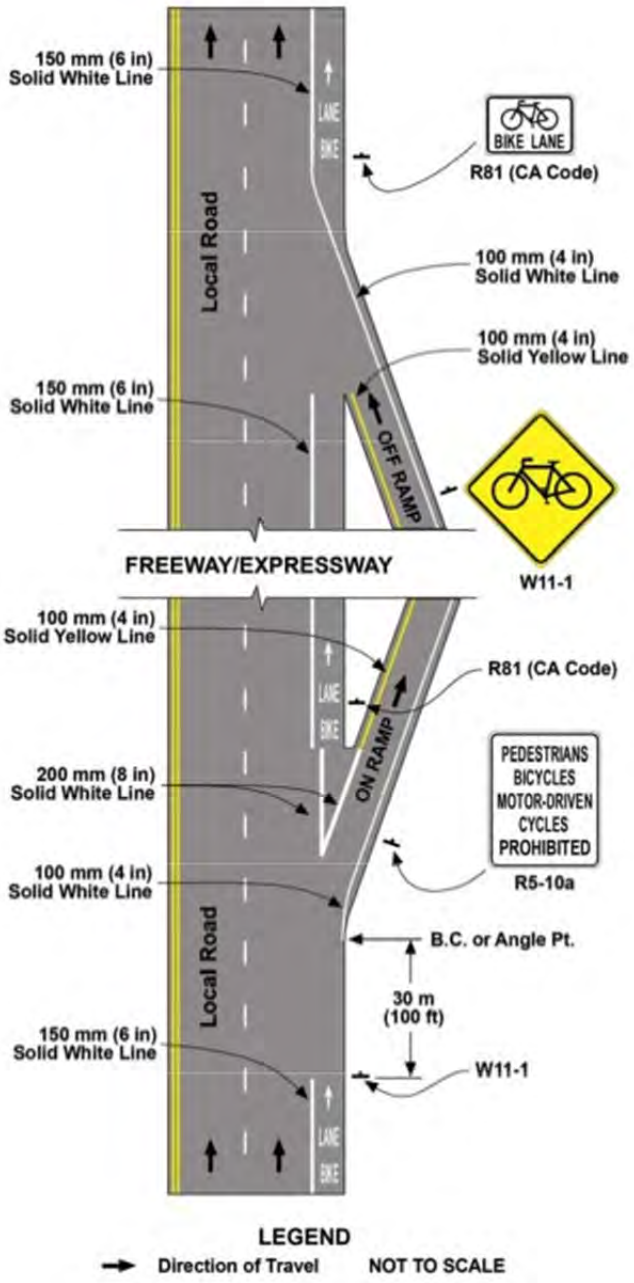
Discussion

At highway interchanges, motor vehicles often make turns at higher speeds than on surface roads. Bike lanes through interchange areas should clearly warn motorists to expect bicyclists, and signage should alert bicyclists that they should not turn to enter the highway.
Figure 9C-104 (right) depicts the current guidance provided by the California MUTCD. On high-traffic / bicycle corridors non-standard treatments may be desirable. Dashed bicycle lane lines with or without colored bike lanes may be applied to provide increased visibility for bicycles in the merging area.

The use of double-turn lanes should be discouraged because of the difficulties they present for pedestrians and bicyclists (see previous treatment). Existing double-turn lanes should be studied and converted to single-turn lanes, unless found to be absolutely necessary for traffic operations. In situations where the double-turn lane cannot be avoided, the options above can be used to better accommodate bicyclists.

Guidance

- AASHTO *Guide for the Development of Bicycle Facilities*.
- Caltrans *Highway Design Manual* (Chapter 1000).
- California *MUTCD*, Part 9.



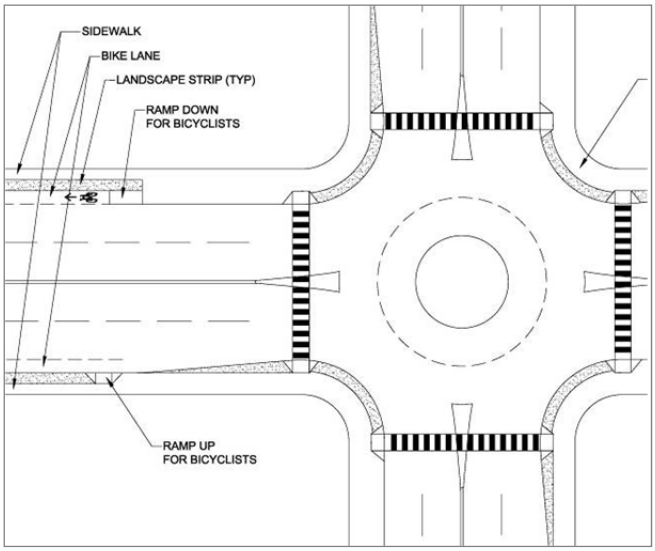
California MUTCD Figure 9C-104 provides guidance for continuing bike lanes through intersection areas.

Bike Lane Intersection Treatments

Bike Lanes at Roundabouts

Design Summary

- Reduce the speed differential between circulating motorists and bicyclists (25 mph maximum circulating design speed).
- Design approaches/exits to the lowest speeds possible to reduce the potential for collisions with pedestrians.
- Encourage bicyclists navigating the roundabout to "take the lane," similar to motor vehicles.
- Maximize yielding rate of motorists to pedestrians and bicyclists at crosswalks.
- Provide separated facilities for bicyclists who prefer not to navigate the roundabout on the roadway.
- Indicate to drivers and bicyclists the proper way to transverse the roundabout through appropriate use of signage, pavement markings and geometric design elements.
- Indicate to drivers, bicyclists and pedestrians the right-of-way rules through appropriate use of signage, pavement markings and geometric design elements.



Recommended bike lane design at roundabout design.

Discussion

Research indicates that while single-lane roundabouts may benefit bicyclists and pedestrians by slowing traffic, multi-lane roundabouts may present conflicts for these users. Multi-lane roundabouts pose the following challenges to bicyclists riding in a bike lane as they approach the roundabout:

- Bicyclists must take the lane before they enter the roundabout to avoid becoming caught in a "right hook," a situation in which a motorist turns right, across the path of a bicyclist traveling straight. Entry leg speeds must be slow enough for bicyclists to be able to take the lane safely.
- Theoretically, once motor vehicle volumes reach a certain magnitude, there are insufficient gaps in traffic to accommodate a bicyclist.
- Bicyclists must be able to correctly judge the speed of circulating motorists to find a gap that is large enough for them to safely enter the roundabout. This task is particularly difficult if the circulating motorists are traveling at a much higher speed than the bicyclists. For example, if circulating speeds in a roundabout exceed 25 mph, drivers behind a bicyclist may become impatient and decide to pass the bicyclist, then turn in front of them, increasing the potential for a collision.
- As a circulating bicyclist approaches an entry lane, a driver waiting to enter must notice the bicyclist, properly judge the bicyclist's speed, and yield if necessary. In locations where there are few bicyclists, motorists may not be expecting bicyclists to approach the roundabout. If a bicyclist is hugging the curb, they may be outside the motorist's line of sight.

Guidance

- UC Berkeley Traffic Safety Center for Caltrans (2009). *Identifying Factors that Determine Bicyclist and Pedestrian-Involved Collision Rates and Bicyclist and Pedestrian Demand at Multi-Lane Roundabouts.*

Retrofitting Existing Streets with Bike Lanes

Roadway Widening

Design Summary

Bike Lane Width:

- 4 feet minimum (see bike lane guidance).
- 5 – 6 feet preferred.

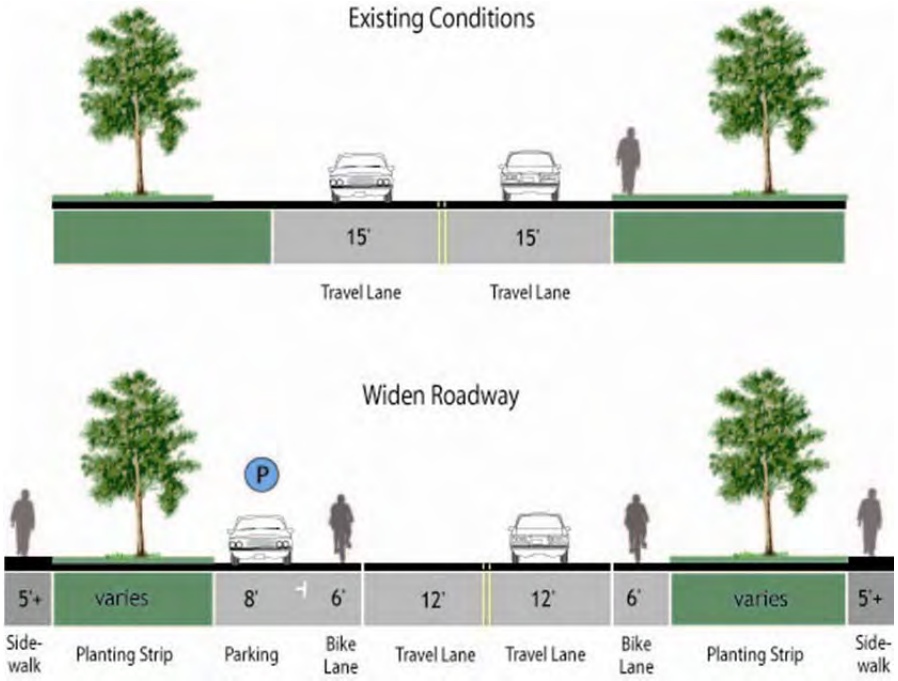
Discussion

Bike lanes may be accommodated on streets with excess right-of-way through shoulder widening. Although street widening incurs higher expenses when compared to re-striping projects, bike lanes can be added to streets currently lacking curbs, gutters and sidewalks without major infrastructure reconstruction.

Roadway widening is preferred on roads lacking curbs, gutters and sidewalks

Guidance

- AASHTO *Guide for the Development of Bicycle Facilities.*
- Caltrans *Highway Design Manual* (Chapter 1000).
- Rosales, Jennifer. (2006). *Road Diet Handbook: Setting Trends for Livable Streets*.



Example of roadway widening to accommodate bike lanes and sidewalks.

Retrofitting Existing Streets with Bike Lanes

Lane Narrowing (Road Diet 1)

Design Summary

- Vehicle lane: before 12′ to 15′; after: 10′ to 11′.
- Bike lane width: see bike lane design guidance.

Discussion

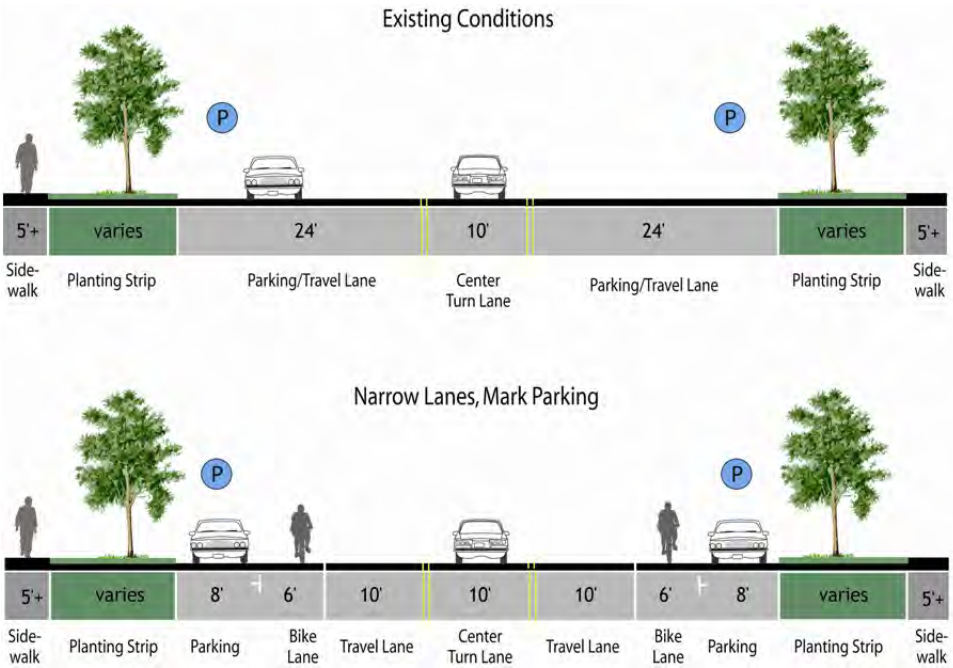
Also called a 'Road Diet', lane narrowing utilizes roadway space that exceeds minimum standards to create the required width to provide bicycle lanes. Many roadways have lanes that are wider than currently established minimums contained in the AASHTO *Policy on the Geometric Design of Highways and Streets* and the Caltrans HDM. Most standards allow for the use of 11′ and sometimes 10′ travel lanes.

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

This street in Portland, Oregon previously had 13' lanes, which were narrowed to accommodate bike lanes without removing travel lanes.

Guidance

- AASHTO *Guide for the Development of Bicycle Facilities.*
- Caltrans Highway Design Manual (Chapter 1000).
- Rosales, Jennifer. (2006). *Road Diet Handbook: Setting Trends for Livable Streets.*



Example of vehicle travel lane narrowing to accommodate bike lanes.

Retrofitting Existing Streets with Bike Lanes

Lane Reconfiguration (Road Diet 2)

Design Summary

- Vehicle lane width depends on project. Lane narrowing may not be needed if a lane is removed.
- Bike lane width: see bike lane design guidance.

Discussion

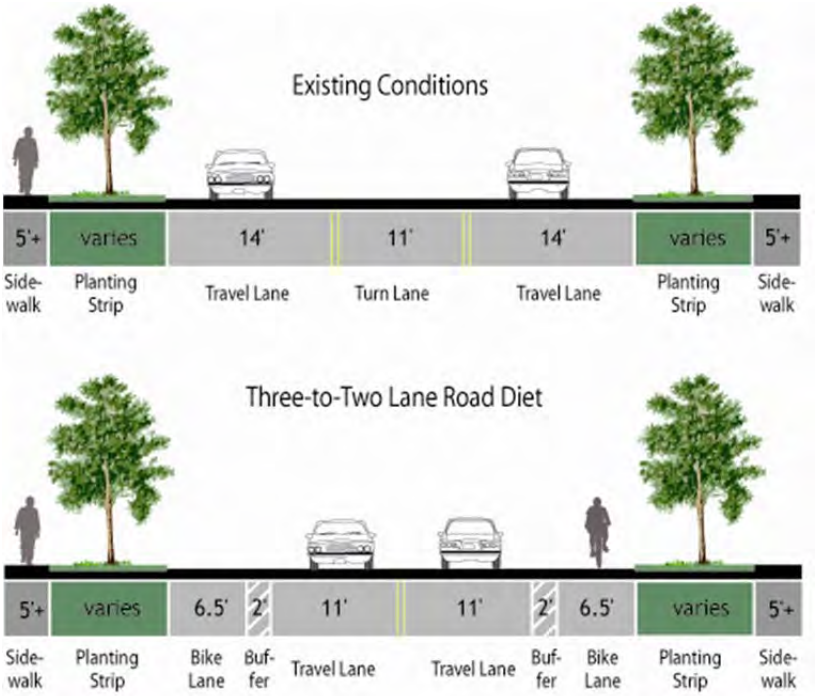
The removal of a single travel lane will generally provide sufficient space for bike lanes on both sides of a street. Streets with excess vehicle capacity provide opportunities for bike lane retrofit projects. Depending on a street's existing configuration, traffic operations, and user needs, various lane reduction configurations may be applied. For instance, a four-lane street (with two travel lanes in each direction) could be modified to include one travel lane in each direction, a center turn lane, and bike lanes. Prior to implementing this measure, a traffic analysis should be performed to identify potential impacts.

Design Example

This road was re-striped to convert four vehicle travel lanes into three travel lanes with bike lanes.

Guidance

- Slated for inclusion in the update to the AASHTO *Guide for the Development of Bicycle Facilities*.
- Rosales, Jennifer. (2006). *Road Diet Handbook: Setting Trends for Livable Streets*.



Example of vehicle travel lane reconfiguration to accommodate bike lanes

Retrofitting Existing Streets with Bike Lanes

Parking Reduction (Road Diet 3)

Design Summary

- Vehicle lane width depends on project. Lane narrowing may not be needed depending on the width of the parking lane to be removed.
- Bike lane width: see bike lane design guidance.

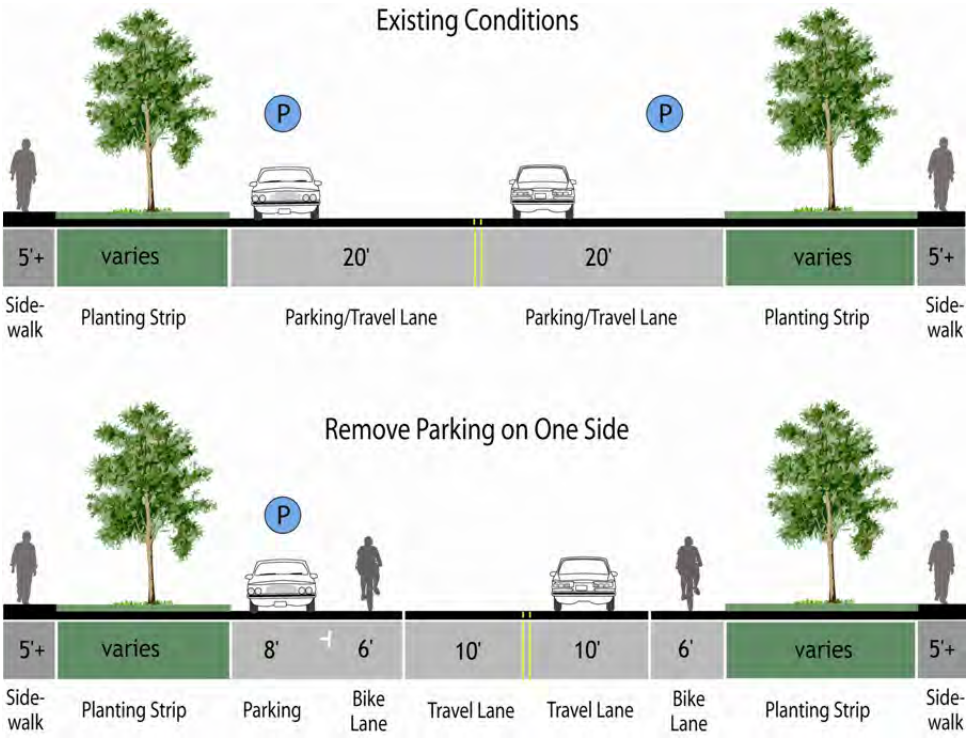
Some streets may not require parking on both sides

Discussion

Bike lanes could replace one or more on-street parking lanes on streets where excess parking exists and/or the importance of bike lanes outweighs parking demand. For instance, parking may be needed on only one side of a street (as shown below and at right). Eliminating or reducing on-street parking also improves sight distance for bicyclists in bike lanes and for motorists on approaching side streets and driveways. Prior to reallocating on-street parking for other uses, a parking study should be performed to gauge demand and to evaluate impacts to people with disabilities.

Guidance

- Rosales, Jennifer. (2006). *Road Diet Handbook: Setting Trends for Livable Streets*.



Example of parking removal to accommodate bike lanes.

6.5.4 Bicycle Routes/Bicycle Boulevards

Bicycle Routes/Bicycle Boulevards

Design Summary

- Roadway width varies depending on roadway configuration.
- Use D11-1 "Bike Route" signs as specified for shared roadways.
- Shared lane markings may be applied per Section 6.4.2.
- Intersection treatments, traffic calming, and traffic diversions can be applied to improve the bicycling environment, as discussed in the following pages.

Discussion

Bicycle boulevards are low-volume streets where motorists and bicyclists share the same space. Treatments for bicycle boulevards include five "application levels" based on their level of physical intensity, with Level 1 representing the least physically-intensive treatments that can be implemented at relatively low costs.

Traffic calming and other treatments are applied along the corridor to reduce vehicle speeds such that motorists and bicyclists travel at similar speeds, creating a more comfortable environment for all users. Bicycle boulevards incorporate treatments to facilitate convenient crossings where the route crosses a major street. They work best in well-connected street grids where riders can follow reasonably direct and logical routes and when higher-order parallel streets exist to serve through vehicle traffic.

Bicycle boulevards/bike routes can be enhanced with shared lane markings, directional signage, traffic diverters, chicanes, chokers, and other traffic calming measures to reduce vehicle speeds and/or volumes. The level of treatment provided at a specific location depends on several factors, discussed in the following pages.

Guidance

- Bicycle boulevards have been implemented in Berkeley, Emeryville, Palo Alto, San Luis Obispo, and Pasadena, CA; Portland and Eugene, OR; Vancouver, BC; Tucson, AZ; Minneapolis, MN; Ocean City, MD; and Syracuse, NY.
- Alta Planning + Design and IBPI. *Bicycle Boulevard Planning and Design Handbook.* www.ibpi.usp.pdx.edu/guidebook.php
- City of Berkeley. (2000). *Bicycle Boulevard Design Tools and Guidelines*. http://www.ci.berkeley.ca.us/contentdisplay.aspx?id=6652
- AASHTO *Guide for the Development of Bicycle Facilities.*
- California *MUTCD.*

Recommended design for bike routes/ bicycle boulevards.

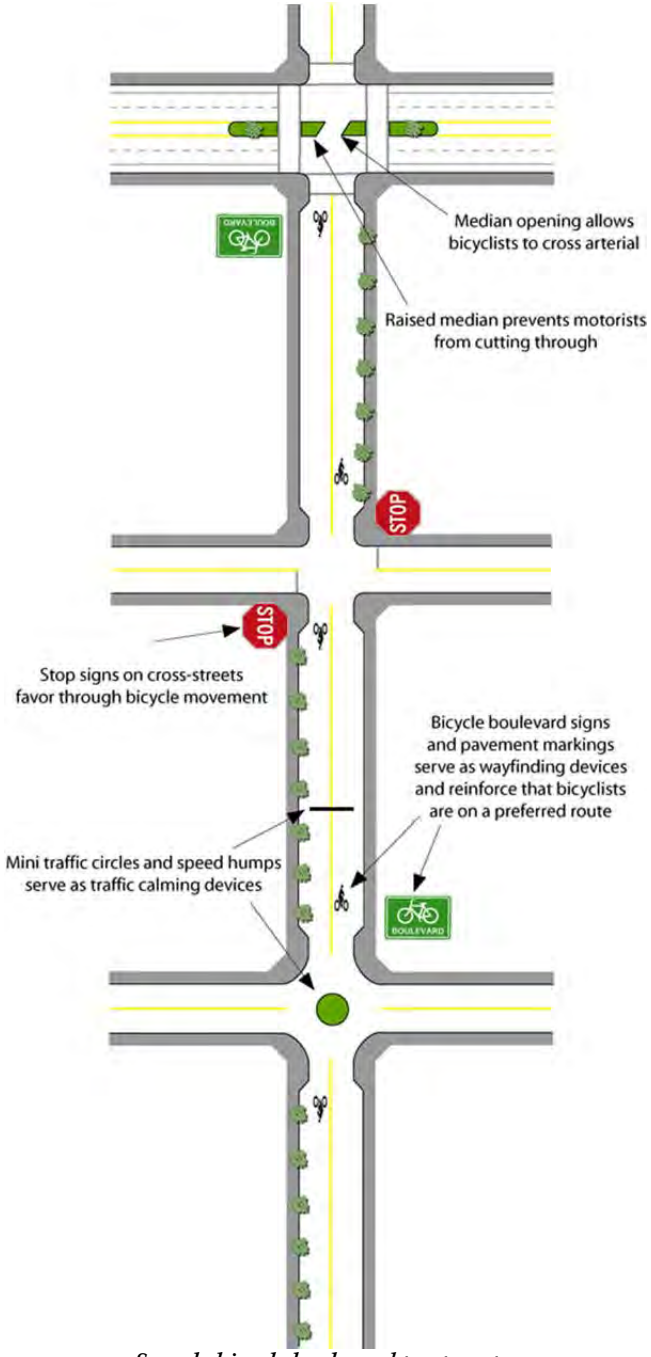
Bicycle boulevards are designed for low-speed / volume streets to provide a comfortable and pleasant experience for bicyclists.

Bicycle Routes/Bicycle Boulevards

Discussion (continued)

Bicycle boulevards serve a variety of purposes:

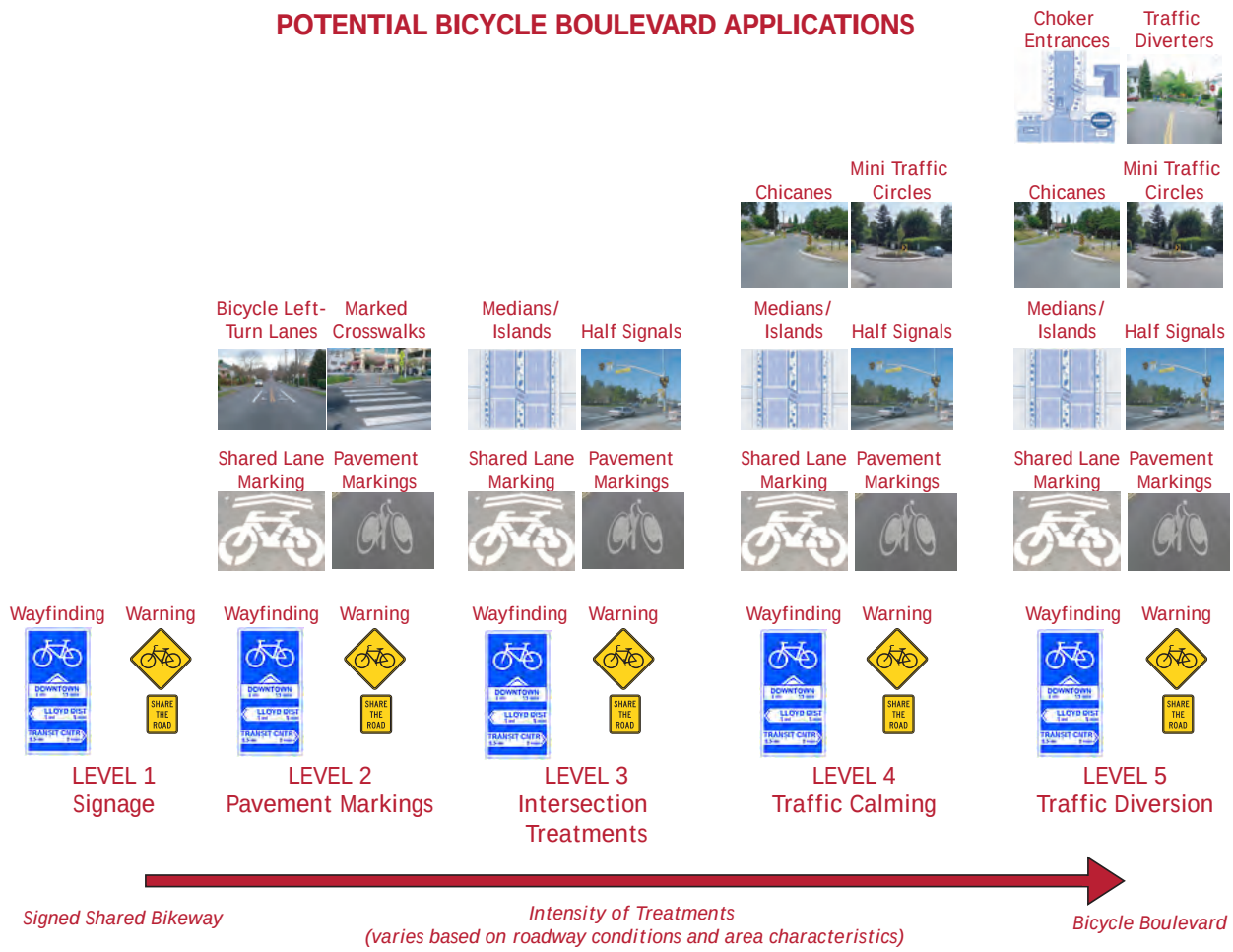
- Parallel major streets lacking dedicated bicycle facilities:
  - Higher-order streets typically include major bicyclist destinations (e.g., commercial and employment areas). However, these corridors often lack bike lanes or other dedicated facilities creating an uncomfortable, unattractive and potentially challenging riding environment. Bicycle boulevards serve as alternate parallel facilities that allow bicyclists to avoid major streets for longer trips.
- Parallel major streets with bicycle facilities that are uncomfortable for some users:
  - Some users may not feel comfortable using bike lanes on major streets due to high traffic volumes and vehicle speeds, conflicts with motorists entering and leaving driveways, and/or conflicts with buses loading and unloading passengers. Children and less-experienced riders may find these environments especially challenging. Utilizing lower-order streets, bicycle boulevards provide alternate route choices for these types of bicyclists. It should be noted that bike lanes on major streets provide important access to key land uses, and the major street network often provides the most direct routes between major destinations. For these reasons, bicycle boulevards should complement a bike lane network and not serve as a substitute.
- Ease of implementation on most local streets:
  - Bicycle boulevards incorporate cost-effective and less physically-intrusive treatments than bike lanes and cycle tracks. Relatively inexpensive treatments such as new signage, pavement markings, and striping can be applied to enhance bicyclists' mobility and safety. Other potential treatments such as curb extensions, medians, and signal modifications can be implemented at reasonable costs, with consideration for emergency vehicle access.
- Benefits beyond an improved bicycling environment:
  - Residents living on bicycle boulevards benefit from reduced vehicle speeds and through traffic. Pedestrians and other users can also benefit from bicycle boulevards through improved crossings at intersections.



Sample bicycle boulevard treatments.

Bicycle Routes/Bicycle Boulevards

Bicycle Boulevard Application Levels



This section describes various treatments commonly used for developing Bicycle Boulevards. The treatments fall within five basic "application levels" based on their level of physical intensity, with Level 1 representing the least physically-intensive treatments that could be implemented at relatively low costs. Identifying appropriate application levels for individual Bicycle Boulevard corridors provides a starting point for selecting appropriate site-specific improvements. The five Bicycle Boulevard application levels are as follows:

- Level 1: Signage
- Level 2: Pavement Markings
- Level 3: Intersection Treatments
- Level 4: Traffic Calming
- Level 5: Traffic Diversion

It should be noted that corridors targeted for higher-level applications would also receive relevant lower-level treatments. For instance, a street targeted for Level 3 applications should also include Level 1 and 2 applications as necessary. Also, it may not be necessary to apply all treatments for a specific level. National City should gather input from the bicycling community and neighborhood groups during the planning stages.

Level 1: Bike Route/Boulevard Signing

Design Summary

- Signage is a cost-effective, yet highly-visible treatment that can improve the riding environment on a bicycle boulevard.
- Consistent signage and pavement markings should be applied.

Discussion

Wayfinding Signs
Wayfinding signs are typically placed at key locations leading to and along bicycle boulevards, including where multiple routes intersect and at key bicyclist "decision points." Wayfinding signs displaying destinations, distances and "riding time" can dispel common misperceptions about time and distance while increasing users' comfort and accessibility to the boulevard network.

Wayfinding signs also visually cue motorists that they are driving along a bicycle route and should correspondingly use caution. Note that too many signs tend to clutter the right-of-way, and it is recommended that these signs be posted at a level most visible to bicyclists and pedestrians, rather than per vehicle signage standards.

Additional guidance for wayfinding signage is provided in Section 6.7 Wayfinding Standards and Guidelines

Warning signs
Warning signs advising motorists to "share the road" and "watch for bicyclists" may also improve bicycling conditions on shared streets. These signs are especially useful near major bicycle trip generators such as schools, parks and other activity centers. Warning signs should also be placed on major streets approaching bicycle boulevards to alert motorists of bicyclist crossings.

Guidance

- Alta Planning + Design and IBPI. *Bicycle Boulevard Planning and Design Handbook.* www.ibpi.usp.pdx.edu/guidebook.php
- City of Berkeley. (2000). *Bicycle Boulevard Design Tools and Guidelines*.
- AASHTO *Guide for the Development of Bicycle Facilities.*
- California *MUTCD*, Part 9.

Level 2: Bike Route/Boulevard Pavement Markings

Design Summary

- The shared lane marking (see 6.5.2) is the only wayfinding / bicycle boulevard pavement marking approved by the California MUTCD.

Discussion

Directional Pavement Markings

Directional pavement markings (also known as "bicycle boulevard markings" or "breadcrumbs") lead bicyclists along a boulevard and reinforce that they are on a designated route. Markings can take a variety of forms, such as small bicycle symbols placed every 600-800 feet along a linear corridor, as previously used on Portland, Oregon's bicycle boulevard network.

Recently, jurisdictions have been using larger, more visible pavement markings. Shared lane markings may be used as bicycle boulevard markings. Portland, OR is moving towards this option. See shared lane marking guidelines for additional information on this treatment.

In Berkeley, California, non-standard pavement markings include larger-scale lettering and stencils to clearly inform motorists and bicyclists of a street's function as a bicycle boulevard.

On-Street Parking Delineation

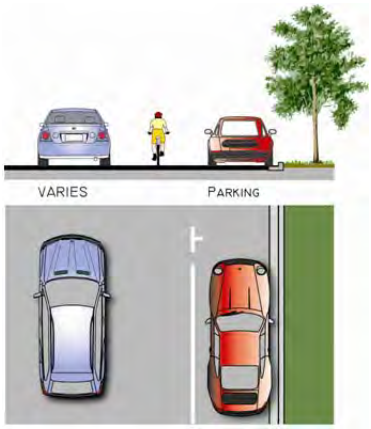
Delineating on-street parking spaces with paint or other materials clearly indicates where a vehicle should be parked, and can discourage motorists from parking their vehicles too far into the adjacent travel lane. This helps bicyclists by maintaining a wide enough space to safely share a travel lane with moving vehicles while minimizing the need to swerve farther into the travel lane to maneuver around parked cars. In addition to benefiting bicyclists, delineated parking spaces also promote the efficient use of on-street parking by maximizing the number of spaces in high-demand areas.

Guidance

- Alta Planning + Design and IBPI. *Bicycle Boulevard Planning and Design Handbook.* www.ibpi.usp.pdx.edu/guidebook.php
- City of Berkeley. (2000). *Bicycle Boulevard Design Tools and Guidelines*.
- AASHTO *Guide for the Development of Bicycle Facilities.*
- California *MUTCD*.

Bicycle boulevard directional marker.

Shared lane markings also provide directional support for bicyclists.



Example of on-street parking delineation.

Level 3: Bike Routes/Boulevards at Minor Unsignalized Intersections

Design Summary

- Encourage use of bicycle boulevards, enhance bicyclist safety and reduce bicycle travel time by eliminating unnecessary stops and improving intersection crossings.

Discussion

Stop Sign on Cross-Street
Unmarked intersections are concerning for bicyclists, because cross-traffic may not be looking for bicyclists. Stop signs are a relatively inexpensive treatment to minimize bicycle and cross-vehicle conflicts. However, placing stop signs at all intersections along bicycle boulevards may be unwarranted as a traffic control measure. Yield signs should be considered if stop signs are not warranted.

Curb Extensions and High-Visibility Crosswalks
This treatment is appropriate near activity centers with large amounts of pedestrian activity, such as schools or commercial areas. Curb extensions should only extend across the parking lane and not obstruct bicyclists' path of travel or the travel lane. Curb extensions and high-visibility crosswalks both calm traffic and increase the visibility of pedestrians waiting to cross the street.

Bicycle Forward Stop Bar
A second stop bar for bicyclists placed closer to the centerline of the cross street than the first stop bar increases the visibility of bicyclists waiting to cross a street. This treatment is typically used with other crossing treatments (i.e. curb extension) to encourage bicyclists to take full advantage of crossing design. They are appropriate at unsignalized crossings where fewer than 25 percent of motorists make a right turn movement.

Guidance

- Alta Planning + Design and IBPI. *Bicycle Boulevard Planning and Design Handbook.* www.ibpi.usp.pdx.edu/guidebook.php
- City of Berkeley. (2000). *Bicycle Boulevard Design Tools and Guidelines*.
- AASHTO *Guide for the Development of Bicycle Facilities.*
- California *MUTCD*, Part 9.

Stop signs effectively minimize conflicts along bicycle boulevards.

Curb extensions can be a good location for pedestrian amenities, including street trees.

Bicycle forward stop bars encourage bicyclists to wait where they are more visible.

Level 3: Bike Routes/Boulevards at Major Unsignalized Intersections

Design Summary

- Increase crossing opportunities with medians and refuge islands.
- Instructional and regulatory signage should be considered with installation of a bicycle signal. Instructional signage is not standard in the State of California. Part 4 of the California MUTCD covers bicycle signals.

Medians on bicycle boulevards should provide space for a bicyclist to wait.

Discussion

Medians/Refuge Islands
At uncontrolled intersections at major streets, a crossing island can be provided to allow bicyclists to cross one direction of traffic at a time when gaps in traffic allow. The bicycle crossing island should be at least 8' wide to be used as the bike refuge area. Narrower medians can accommodate bikes if the holding area is at an acute angle to the major roadway. Crossing islands can be placed in the middle of the intersection, prohibiting left and through vehicle movements.

Bicycle Signals
Bicycle signals are an approved traffic control device in the State of California after the technology was studied and approved after years of service in the City of Davis. A bicycle signal provides an exclusive signal phase for bicyclists traveling through an intersection. This takes the form of a new signal head installed with red, amber, and green bicycle indications. Bicycle signals can be actuated with bicycle sensitive loop detectors, video detection, or push buttons.

Where few crossing gaps exist and major street traffic does not typically stop for pedestrians and bicyclists waiting to cross, "half signals" can be installed to improve the crossing environment. Half signals include pedestrian and bicycle activation buttons and may also include loop detectors on the bicycle boulevard approach. Many of these models have been used successfully for years overseas, and their use in the U.S. has increased dramatically over the last decade.

Half-signals for bicyclists should be clearly marked to minimize confusion.

Guidance

Note: While bicycle signals are approved for use in California, information should be provided such that at intersections with bicycle signals, bicycles should only obey the bicycle signal heads.

- Alta Planning + Design and IBPI. *Bicycle Boulevard Planning and Design Handbook.* www.ibpi.usp.pdx.edu/guidebook.php
- City of Berkeley. (2000). *Bicycle Boulevard Design Tools and Guidelines*.
- AASHTO *Guide for the Development of Bicycle Facilities.*
- California *MUTCD.*

Example of instructional signage from Portland, OR.

Level 3: Bike Routes/Boulevards at Offset Intersections

Design Summary

- Installing turning lanes or pockets at offset intersections provides bicyclists with a refuge to make a two-step turn.
- Bike left turn lanes – 5 feet wide minimum, with a total of 11 feet required for both turn lanes and center striping.

Example of a bicycle left-turn lane.

Discussion

Offset intersections can be challenging for bicyclists, who need to transition onto the busier cross-street in order to continue along the boulevard.

Bicycle Left-Turn Lane

Similar to medians/refuge islands, bicycle left-turn lanes allow the crossing to be completed in two phases. A bicyclist on the boulevard can execute a right-hand turn onto the cross-street and then wait in a delineated left-turn lane for a gap in oncoming traffic.

This bike-only left-turn pocket guides bicyclists along a popular bike route.

Bicycle Left -Turn Pocket

A bike-only left-turn pocket permits bicyclists to make left turns while restricting vehicle left turns. If the intersection is signal-controlled, a left arrow signal may be appropriate, depending on bicycle and vehicle volumes. Signs should be provided prohibiting motorists from turning. Ideally, the left turn pocket should be protected by a raised curb, but the pocket may also be defined by striping if necessary. Because of the restriction on vehicle left-turning movements, this treatment also acts as traffic diversion.

Guidance

- Alta Planning + Design and IBPI. *Bicycle Boulevard Planning and Design Handbook.* www.ibpi.usp.pdx.edu/guidebook.php
- AASHTO *Guide for the Development of Bicycle Facilities.*

Level 4: Bicycle Boulevard Traffic Calming

Design Summary

- Traffic calming treatments are intended to reduce vehicle speeds, enabling motorists and bicyclists to safely co-exist on the same facility.

Discussion

Chicanes
Chicanes are a series of raised or delineated curb extensions on alternating sides of a street forming an S-shaped curb, which reduce vehicle speeds through narrowed travel lanes and horizontal deflection. Chicanes can also be achieved by establishing on-street parking on alternating sides of the street. These treatments are most effective on streets with narrower cross-sections.

Mini Traffic Circles
Mini traffic circles are raised or delineated islands placed at intersections, reducing vehicle speeds through tighter turning radii and narrowed vehicle travel lanes (see right). These devices can effectively slow vehicle traffic while facilitating all turning movements at an intersection. Mini traffic circles can also include a paved apron to accommodate the turning radii of larger vehicles like fire trucks or school buses.

Speed Humps
Shown right, speed humps are rounded raised areas of the pavement requiring approaching motor vehicles to reduce speeds. These devices also discourage through vehicle travel on a bicycle boulevard when a higher-order, parallel route exists. Speed humps should never be constructed so steep that they may cause a bicyclist to lose control or be distracted. In some cases, a gap may be provided allowing bicyclists to continue on the level roadway surface, while still requiring vehicles to slow down to cross the barrier.

Curb Extensions and High-Visibility Crosswalks
See previous discussion in section Level 3: Bike Routes/Boulevards at Minor Unsignalized Intersections.

Guidance

- Alta Planning + Design and IBPI. *Bicycle Boulevard Planning and Design Handbook.* www.ibpi.usp.pdx.edu/guidebook.php
- City of Berkeley. (2000). *Bicycle Boulevard Design Tools and Guidelines*.
- AASHTO *Guide for the Development of Bicycle Facilities.*

Chicanes require all vehicles to slow down.

Traffic circles provide an opportunity for landscaping, but visibility should be maintained.

Speed humps are a common traffic calming treatment.

Level 5: Bicycle Boulevard Traffic Diversion

Design Summary

- Traffic diversion treatments maintain through bicycle travel on a street while physically restricting through vehicle traffic.
- Traffic diversion is most effective when higher-order streets can sufficiently accommodate the diverted traffic associated with these treatments.

Discussion

Choker Entrances
Choker entrances are intersection curb extensions or raised islands allowing full bicycle passage while restricting vehicle access to and from a bicycle boulevard. When approaching a choker entrance at a cross-street, motorists on the bicycle boulevard must turn onto the cross-street while bicyclists may continue forward. These devices can be designed to permit some vehicle turning movements from a cross-street onto the bicycle boulevard, while restricting other movements.

Traffic Diverters
Similar to choker entrances, traffic diverters are raised features directing vehicle traffic off the bicycle boulevard while permitting through bicycle travel.
Advantages:

- Provides safe refuge in the median of the major street so that bicyclists only have to cross one direction of traffic at a time; works well with signal-controlled traffic platoons coming from opposite directions.
- Provides traffic calming and enhances safety by preventing left turns and/or through traffic from using the bicycle boulevard.

Disadvantages:

- May increase travel time for motorists and potentially result in loss of parking.
- Crossing island requires maintenance.

Guidance

- Alta Planning + Design and IBPI. *Bicycle Boulevard Planning and Design Handbook.* www.ibpi.usp.pdx.edu/guidebook.php
- City of Berkeley. (2000). *Bicycle Boulevard Design Tools and Guidelines*.
- AASHTO *Guide for the Development of Bicycle Facilities.*

Choker entrances prevent vehicular traffic from turning from a major street onto a traffic-calmed bicycle boulevard.

Traffic diverters prevent through-vehicle traffic, as well as cross-traffic.

6.6 Off–Street Bicycle Facility Design Guidelines

Off-Street Facility Design Guidelines

A Class I facility allows for two-way, off-street bicycle traffic and may also be used by pedestrians, skaters, wheelchair users, joggers and other non-motorized modes. These facilities are frequently found in parks, along rivers, and in greenbelts or utility corridors where there are few conflicts with motorized vehicles. Class I facilities can also include amenities such as lighting, signage, and fencing (where appropriate). In California, design of Class I facilities is dictated by Chapter 1000 of the Highway Design Manual.

Shared-use paths can provide a desirable facility particularly for novice riders, recreational trips, and bicyclists of all skill levels preferring separation from traffic. Shared-use paths will generally provide new travel opportunities.

Shared-use paths serve bicyclists and pedestrians and provide additional width over a standard sidewalk. Facilities may be constructed adjacent to roads, through parks, or along linear corridors such as active or abandoned railroad lines or waterways. Regardless of the type, paths constructed next to the road must have some type of vertical (e.g., curb or barrier) or horizontal (e.g., landscaped strip) buffer separating the path from adjacent vehicle travel lanes.

Elements that enhance shared-use path design include:

- Providing frequent access points from the local roadway network; if access points are spaced too far apart, users will have to travel out of direction to enter or exit the path, which will discourage use.
- Placing directional signs to direct users to and from the path.
- Designing a strong enough structural section to allow heavy maintenance equipment to use the path without causing it to deteriorate.
- Limiting the number of at-grade crossings with streets or driveways.
- Terminating the path where it is easily accessible to and from the street system, preferably at controlled intersections or at the beginning of a dead-end street. If not properly designed, the point where the path joins the street network can put pedestrians and bicyclists in a position where motor vehicle are not expecting to see them.
- Identifying and addressing potential safety and security issues up front.
- Whenever possible, and especially where heavy use can be expected, separate bicycle and pedestrian ways should be provided to reduce conflicts.
- Providing accessible parking spaces at trailheads and access points.

Shared-use paths (also referred to as "trails" and "multi-use paths") are often viewed as recreational facilities, but they are also important corridors for utilitarian trips.

6.6.1 Shared-Use Path Design

Shared-Use Path Design

Design Summary

- Width standards:
  - 8 feet is the minimum allowed for a two-way multi-use path and is only recommended for lower facility use.
  - 10 feet is recommended in most situations and will be adequate for moderate to heavy use.
  - 12 feet is recommended for heavy use situations with high concentrations of multiple users such as joggers, bicyclists, rollerbladers and pedestrians.
- Lateral Clearance: 2' or greater shoulder on both sides (required by Caltrans' HDM, Chapter 1000).
- Overhead Clearance: 10' minimum recommended.
- Maximum design speed: 20 mph; speed bumps or other surface irregularities should never be used to slow bicycles.
- Recommended maximum grade: 5%; steeper grades can be tolerated for short distances (see guidelines following).

Discussion

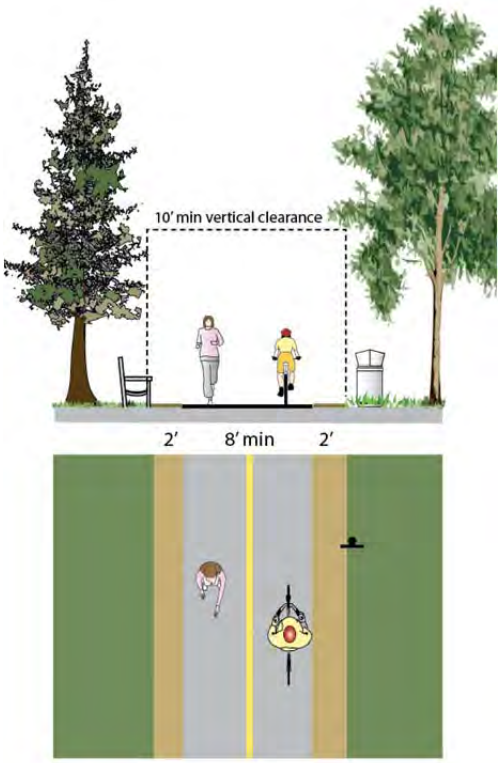
A hard surface should be used for multi-use trails. Concrete, while more expensive than asphalt, is the hardest of all trail surfaces and lasts the longest. However, joggers and runners prefer surfaces such as asphalt or decomposed granite due to its relative "softness". While most asphalt is black, dyes (such as reddish pigments) can be added to increase the aesthetic value of the trail itself.

When concrete is used the trail should be designed and installed using the narrowest possible expansion joints to minimize the amount of 'bumping' bicyclists experience on the trail.

Shared-use paths should be designed according to ADA standards. Constructing trails may have limitations that make meeting ADA standards difficult and sometimes prohibitive. Prohibitive impacts include harm to significant cultural or natural resources, a significant change in the intended purpose of the trail, construction methods that do not comply with federal, state or local regulations, or presence of terrain characteristics that prevent compliance.

Guidance

- U.S. Access Board, *Public Rights-of-Way Accessibility Guidelines* (PROWAG).
- FHWA (2001). *Designing Sidewalks and Trails for Access*.
- AASHTO *Guide for the Development of Bicycle Facilities*.



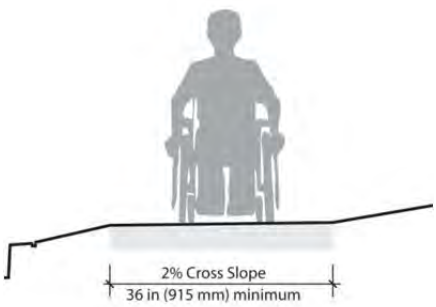
Recommended shared-use path design.

The Cedar Lake Regional Trail in Minneapolis, MN has sufficient width to accommodate a variety of users.

Trail Accessibility

Design Summary

- Where less than 5', a 3' minimum clear width passing space should be provided at least every 100'.
- Cross slope should not exceed 5%.
- Provide signs indicating the length of the accessible trail segment.
- Provide curb ramps at roadway crossings and curbs. Tactile warning strips and audible crossing signals are recommended.



ADA clearance requirement.

Discussion

Slopes should not exceed 5%. However certain conditions may require the use of steeper slopes. For conditions exceeding a 5% slope, the recommendations are as follows:

- Up to an 8.3% slope for a 200 feet maximum run; landings or resting intervals must be provided every 20'.
- Up to a 10% slope for a 30 feet maximum run; resting intervals spaced at 30 feet minimum.
- Up to 12.5 % slope for 10 feet maximum run; resting intervals spaced at 10 feet minimum.

The trail surface shall be firm and stable. The Forest Service Accessibility Guidelines defines a firm surface as a trail surface that is not noticeably distorted or compressed by the passage of a device that simulates a person who uses a wheelchair. Where rights-of-way are available, paths which exceed a 5% slope can be made more accessible by creating side paths that meander away from the primary path.

Shared-use paths surfacing materials affects which types of users can benefit from the facility.

Guidance

- *American with Disabilities Act* (ADA) for accessible trails.
- FHWA. (2001)*.Designing Sidewalks and Trails for Access,* Chapter 14 Shared Use Path Design, Section 14.5.1: Grade.
- Forest Service Accessibility Guidelines

Managing Multiple Users

Design Summary

- Barrier separation – vegetated buffers or barriers, elevation changes, walls, fences, railings and bollards.
- Distance separation – differing surfaces.
- User behavior guidance signage.

Discussion

On trails that have high bicycle and pedestrian use, conflicts can arise between faster-moving bicyclists and slower bicyclists, as well as pedestrians and other users. As this is a common problem in more urban areas, a variety of treatments have been designed to alleviate congestion and minimize conflicts.

Centerline Striping

On trails of standards widths, striping the centerline identifies which side of the trail users should be on.

Physical Separation

Differing surfaces suitable to each user group foster visual separation and clarity of where each user group should be. When trail corridors are constrained, the approach is often to locate the two different trail surfaces side by side with no separation.

Offsetting of the pedestrian path should be provided if possible. Otherwise, physical separation should be provided in the form of a small hump or other crossable barrier. The bicycle path should be located on whichever side of the path will result in the fewest number of anticipated pedestrian crossings. For example, the bike path should not be placed adjacent to large numbers of destinations. Site analysis of each project is required to determine expected pedestrian behavior.

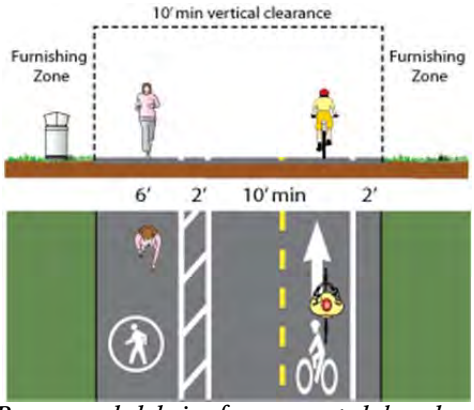
Trail Etiquette Signage

Informing trail users of acceptable trail etiquette is important when multiple user types are anticipated. Yielding the right-of-way is a courtesy and a necessary part of a safe trail experience involving multiple trail users. Trail right-of-way information should be posted at trail access points and along the trail. The message must be clear and easy to understand. Where appropriate, trail etiquette systems should instruct trail users to the yielding of bicyclists to pedestrians and equestrians and the yielding of pedestrians to equestrians.

Guidance

- California *MUTCD*, Part 9. Section 9C.03 contains additional information about centerline striping on a trail.

Centerline striping and directional arrows encourage bicyclists to provide space for other trail users to pass.



Recommended design for a separated shared-use path.

A commonly used multi-use trail etiquette sign.

Trails Along Roadways

Design Summary

- 5' minimum buffer should separate the path from the edge of the roadway, otherwise a physical barrier should be installed.

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

- The path will generally be separated from all motor vehicle traffic.
- Bicycle and pedestrian use is anticipated to be high.
- To provide continuity with an existing path through a roadway corridor.
- The path can be terminated at each end onto streets or trails with good bicycle and pedestrian facilities.
- There is adequate access to local cross-streets and other facilities along the route.
- Any needed grade separation structures do not add substantial out-of-direction travel.
- The total cost of providing the proposed path is proportionate to the need, compared to the cost of providing on-street facilities.

Trails directly adjacent to roadways can be challenging for users at roadway intersections.

Discussion

Concerns about shared use paths directly adjacent to roadways (e.g., with minimal or no separation) are:

- Half of bicycle traffic may ride against the flow of vehicle traffic, contrary to the rules of the road.
- When the path ends, bicyclists riding against traffic tend to continue to travel on the wrong side of the street, as do bicyclists who are accessing the path. Wrong-way bicycle travel is a major cause of crashes.
- At intersections, motorists crossing the path often do not notice bicyclists approaching, especially where sight distances are poor.
- Bicyclists are required to stop or yield at cross-streets and driveways, unless otherwise posted.
- Stopped vehicles on a cross-street or driveway may block the path.
- Because of the proximity of vehicle traffic to opposing bicycle traffic, barriers are often necessary to separate motorists from bicyclists. This type of improvement increases construction and maintenance costs.
- Paths directly adjacent to high-volume roadways diminish users' experience by placing them in an uncomfortable environment.

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

Guidance

- Both the California *Highway Design Manual* Chapter 1000, and the AASHTO G*uide for the Development of Bicycle Facilities* recommend against the development of multi-use paths directly adjacent to roadways, without providing adequate buffers/barriers between path users and motorists.

6.6.2 Path/Roadway Crossings

Path/Roadway Crossings

Design Summary

At-grade path/roadway crossings will generally fit into one of four basic categories:

- Type 1: Marked/Unsignalized Crossings - Include trail crossings of residential, collector, and sometimes arterial streets or railroad tracks. May include flashing beacons and other treatments to enhance visibility.
- Type 2: Route Users to Existing Signalized Intersections - Trails that emerge near existing signalized intersections may be routed to these locations, provided that sufficient protection is provided at the existing intersection.
- Type 3: Signalized/Controlled Crossings – Include trail crossings that require signals or other control measures due to high traffic volumes, speeds, and trail usage.
- Type 4: Grade-Separated Crossings - Bridges or under-crossings provide the maximum level of safety but are also generally the most expensive to build and maintain.

An offset crossing forces pedestrians to turn and face the traffic they are about to cross.

Discussion

While at-grade crossings create conflicts between path users and motorists, well-designed crossings have not historically presented safety issues for path users. This is evidenced by the thousands of successful paths around the United States with at-grade crossings. In most cases, at-grade path crossings can be properly designed to meet existing traffic safety standards.

Evaluation of path crossings involves analysis of vehicular and anticipated path user traffic patterns, including

- Vehicle speeds
- Street width
- Sight distance
- Traffic volumes (average daily traffic and peak hour traffic)
- Path user profile (age distribution, destinations served)

Crossing features for all roadways should include warning signs for both vehicles and path users. Consideration must be given for proper warning distance based on vehicle speeds and line of sight. Signs must be clearly visible to drivers. Treatments such as flashing lights, enhanced roadway striping and changes in pavement texture can improve driver awareness of the crossing. Signing for path users must include a standard "STOP" sign and pavement markings, sometimes combined with other features such as bollards or a deflection in the pathway to slow bicyclists.

Guidance

- Federal Highway Administration (FHWA) Report (2002), *Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations.*
- California *Highway Design Manual,* Chapter 1000.
- AASHTO *Guide for the Development of Bicycle Facilities.*

Path/Roadway Crossings

Guidance (continued)

Recommendations for installing marked crosswalks and other needed pedestrian improvements at uncontrolled locations.[3]

Roadway Type	Vehicle ADT ≤ 9,000			Vehicle ADT > 9,000 to 12,000			Vehicle ADT > 12,000 to 15,000			Vehicl ADT > 15,000		
	Speed Limit (mph)**											
	30	35	40	30	35	40	30	35	40	30	35	40
2 Lanes	1	1	1/1+	1	1	1/1+	1	1	1+/3	1	1/1+	1+/3
3 Lanes	1	1	1/1+	1	1/1+	1/1+	1/1+	1/1+	+/3	1/1+	1+/3	+/3
Multi-Lane (4 +) w/ raised median***	1	1	1/1+	1	1/1+	1+/3	1/1+	1/1+	1+/3	1+/3	1+/3	1+/3
Multi-Lane (4 +) w/o raised median	1	1/1+	1+/3	1/1+	1/1+	1+/3	1+/3	1+/3	1+/3	1+/3	1+/3	1+/3

1 = Type 1 crossing treatment; 1+= Type 1 "Enhanced"; 3 = Type 3 crossing treatment

*General Notes: Crosswalks should not be installed at locations that could present an increased risk to pedestrians, such as where there is poor sight distance, complex or confusing designs, a substantial volume of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices. Adding crosswalks alone will not make crossings safer, nor will they necessarily result in more vehicles stopping for pedestrians. Whether or not marked crosswalks are installed, it is important to consider other pedestrian facility enhancements (e.g., raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic-calming measures, curb extensions), as needed, to improve the safety of the crossing. These are general recommendations; good engineering judgment should be used in individual cases for deciding which treatment to use.
For each pathway-roadway crossing, an engineering study is needed to determine the proper location. For each engineering study, a site review may be sufficient at some locations, while a more in-depth study of pedestrian volume, vehicle speed, sight distance, vehicle mix, etc. may be needed at other sites.

** Where the speed limit exceeds 40 mph marked crosswalks alone should not be used at unsignalized locations.

*** The raised median or crossing island must be at least 4 ft (1.2 m) wide and 6 ft (1.8 m) long to adequately serve as a refuge area for pedestrians in accordance with MUTCD and AASHTO guidelines. A two-way center turn lane is not considered a median.

[3] *This table is based on information contained in the U.S. Department of Transportation and Federal Highway Administration Study, "Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations," February 2002.*

Type 1: Marked/Unsignalized Crossings

Design Summary

- A marked/unsignalized crossing (Type 1) consists of a marked crosswalk and signage placed across the major roadway. The approach to designing crossings at mid-block/uncontrolled locations depends on an evaluation of vehicular traffic, line of sight, path traffic, use patterns, vehicle speeds, roadway type and width, and other factors such as proximity to schools.

Maximum recommended traffic volumes:

- ≤9,000-12,000 Average Daily Traffic (ADT) volumes.
- Up to 15,000 ADT on two-lane roads, preferably with a median refuge.
- Up to 15,000 ADT on four-lane roads with a median refuge.

Maximum travel speed:

- 35 MPH.

Minimum line of sight:

- 25 MPH zone: 155 feet.
- 30 MPH zone: 200 feet.
- 35 MPH zone: 250 feet.

Type 1 crossings include signage and pavement markings.

Discussion

If well-designed, crossings of multi-lane, higher-volume arterials over 15,000 ADT may be unsignalized with features such as a combination of the following: proper sight distance, sufficient crossing gaps (more than 60 per hour), median refuges, and active warning devices such as, flashing beacons or in-pavement flashers. These are referred to as "Type 1 Enhanced" (Type 1+).

On two-lane residential and collector roads below 15,000 ADT with speed limits of 35 MPH or less, crosswalks pavement markings, and warning signs ("Ped/Bike Xing") should be provided for motorists, and stop signs should be used on the path approach. Curves in paths that orient the path user toward oncoming traffic are helpful in slowing path users and making them aware of oncoming vehicles. Care should be taken to keep vegetation and other obstructions out of the sight line for motorists and path users. Engineering judgment should be used to determine the appropriate level of traffic control and design.

On roadways with low to moderate traffic volumes, a raised crosswalk reduces vehicle speeds and enhances pedestrian visibility and safety. These crosswalks are raised above the roadway pavement (similar to speed humps) to an elevation that matches the adjacent sidewalk. The top of the crosswalk is flat and typically made of asphalt, patterned concrete, or brick pavers. Detectable warning pads are used at the sidewalk/street boundary to assist visually impaired pedestrians.

Guidance

- Federal Highway Administration (FHWA) Report (2002), *Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations.*
- California *Highway Design Manual,* Chapter 1000.
- AASHTO *Guide for the Development of Bicycle Facilities.*

Type 1: Marked/Unsignalized Crossings

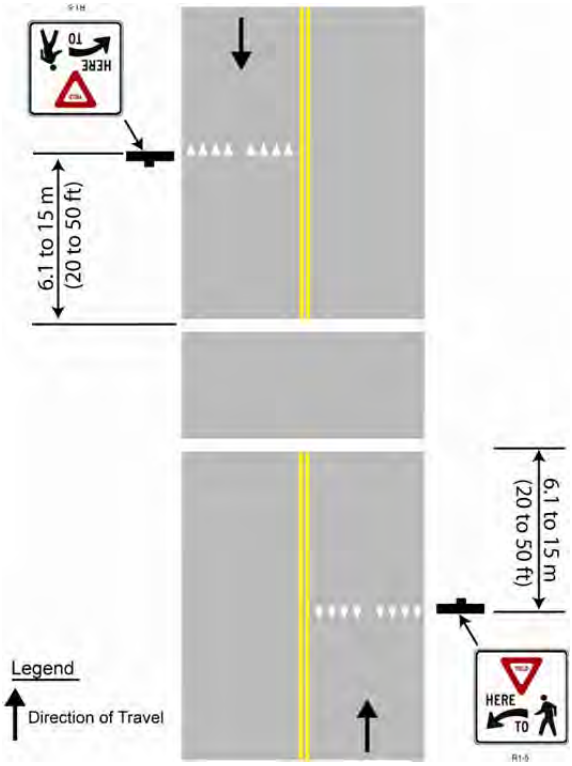
Uncontrolled Mid-Block Crossing

Design Summary

- Installed where there is a high demand for crossing and no nearby existing signalized crossings.
- If yield lines are used for vehicles, they shall be placed 20–50' in advance of the nearest crosswalk line to indicate the point at which to yield and 'Yield Here to Pedestrians' signs shall be placed adjacent to the yield line.
- The Bicycle Warning (W11-1) sign may be used to alert road users of unexpected entries into the roadway by bicyclists.
- A ladder-style crosswalk may be used to enhance visibility.
- Warning signs and markings on the path should be installed.

Discussion

The California MUTCD recommends the use of yield lines and "Yield Here to Pedestrians" signs at uncontrolled crossings of a multi-lane roadway. The Federal MUTCD includes a trail crossing sign (W11-15 and W11-15p), which may be used where both bicyclists and pedestrians cross the roadway, such as at an intersection with a shared-use path.



Recommended design from CA-MUTCD, Figure 3B-15

Recommended signage from FHWA-MUTCD, Figure 9B-3

Guidance

- California *MUTCD*, Part 9.
- FHWA-MUTCD, Part 9.
- AASHTO *Guide for the Development of Bicycle Facilities*.

Type 2: Route Users to Existing Signalized Intersections

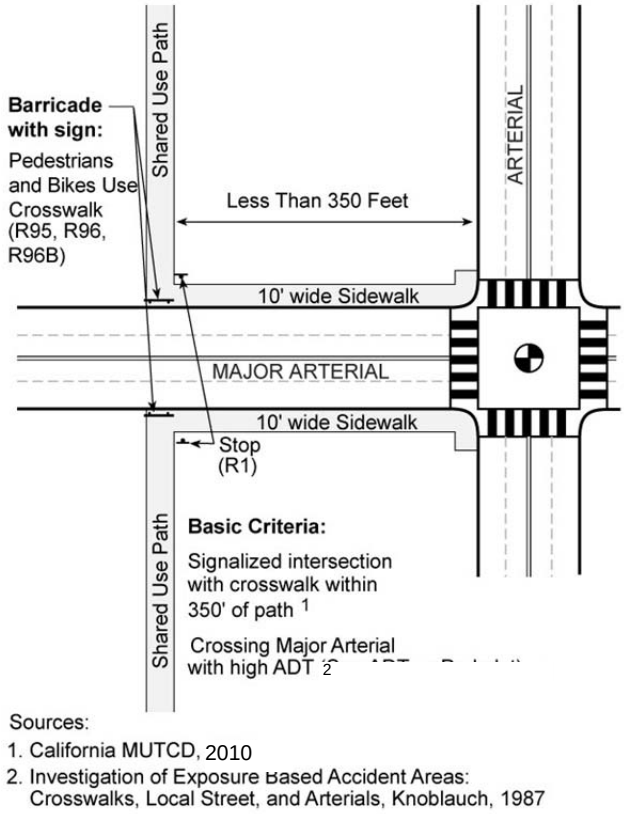
Design Summary

- A path should cross at a signalized intersection if there is a signalized intersection within 350 feet of the path and the crossroad is a high-volume arterial.
- Intersection warning signs (W2-1 through W2-5) may be used on the path to indicate the presence of an intersection and the potential for turning or entering traffic. A trail-sized stop sign (R1-1) should be placed about 5 feet before the intersection.

This option eliminates conflicting vehicle traffic by redirecting path users.

Discussion

Shared-use paths within 350 feet of an existing signalized intersection with pedestrian actuation are typically diverted to the signalized intersection to enhance safety. For this option to be effective, barriers and signage should be implemented to direct shared-use path users to the signalized crossings.



Recommended diversion of shared-use path to existing signalized intersection where path is within 350 feet of signalized intersection.

Guidance

- California *Highway Design Manual,* Chapter 1000.
- California *MUTCD*, Part 9.
- AASHTO *Guide for the Development of Bicycle Facilities.*
- AASHTO *Policy on the Geometric Design of Highways and Streets*.
- FHWA-RD-87-038 *Investigation of Exposure-Based Pedestrian Accident Areas: Crosswalks, Sidewalks, Local Streets, and Major Arterials.*

Type 3: Signalized/Controlled Crossings

Design Summary

- Use when greater than 300 feet from an existing signalized crossing.
- Use where the 85th percentile travel speeds are greater than 40 MPH and/or ADT exceeds 15,000 vehicles
- Section 4C.05 in the CA MUTCD describes minimum pedestrian volume requirements (referred to as warrants) for a mid-block pedestrian-actuated signal.
- Stop lines at midblock signalized locations should be placed at least 40' in advance of the nearest signal indication.

Discussion

New signalized crossings may be recommended for crossings that meet pedestrian, school, or modified warrants, are located more than 300 feet from an existing signalized intersection, where 85th percentile travel speeds are 40 MPH and above and/or ADT exceeds 15,000 vehicles. Each crossing, regardless of traffic speed or volume, requires an engineering survey to identify sight distance, potential impacts on traffic progression, timing with adjacent signals, capacity, and safety.

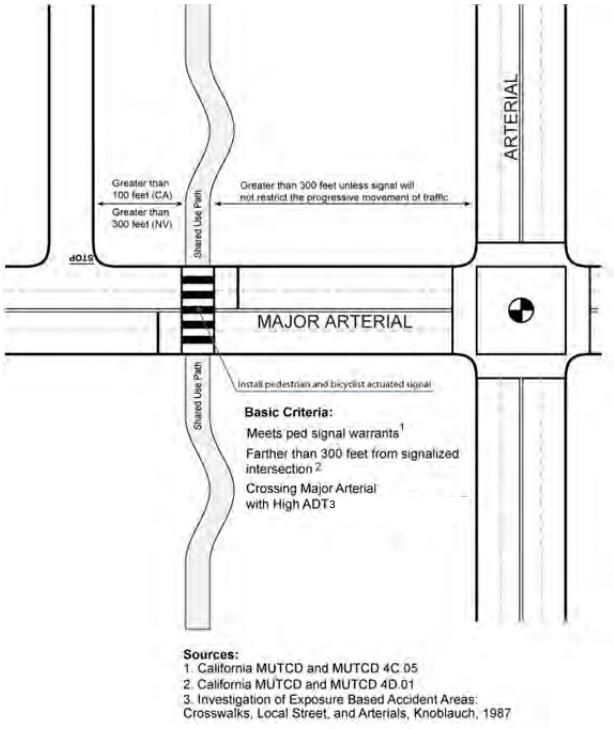
Shared-use path signals are normally activated by push buttons, but also may be triggered by motion detectors. The maximum delay for activation of the signal should be two minutes, with minimum crossing times determined by the width of the street. The signals may rest on flashing yellow or green for motorists when not activated, and should be supplemented by standard advanced warning signs. As described earlier in this chapter, various types of pedestrian signals, such as "half signals" may be used at Type 3 crossings.

<u>Signalized Mid-Block Crossing</u>
Warrants from the CA MUTCD combined with sound engineering judgment should be applied when determining the type of traffic control device to be installed at path-roadway intersections. Pedestrian volume warrants can be applied for bicyclists.

<u>Experimental Treatment</u>
A Toucan crossing (derived from: "two can cross") may be considered where pedestrians and bicyclists cross together.

Guidance

- MUTCD – California, Part 3 and 9 and Section 4C.05 and 4D
- AASHTO Guide for the Development of Bicycle Facilities, Chapter 2



CA-MUTCD guidance for a signalized mid-block crossing.

Type 3 Crossing

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

Type 4: Grade Separated Undercrossing

Design Summary

- 14' minimum width to allow for access by maintenance vehicles if necessary.
- 10' minimum overhead height.
- The undercrossing should have a centerline stripe even if the rest of the path does not have one.
- Lighting and/or skylights may be desirable for longer crossings to enhance users' sense of security.

Discussion

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

- Vehicle volumes/speeds are high.
- The roadway is wide.
- A signal is not feasible.
- Crossing is needed under a grade-separated facility such as a freeway or rail line.

Advantages:

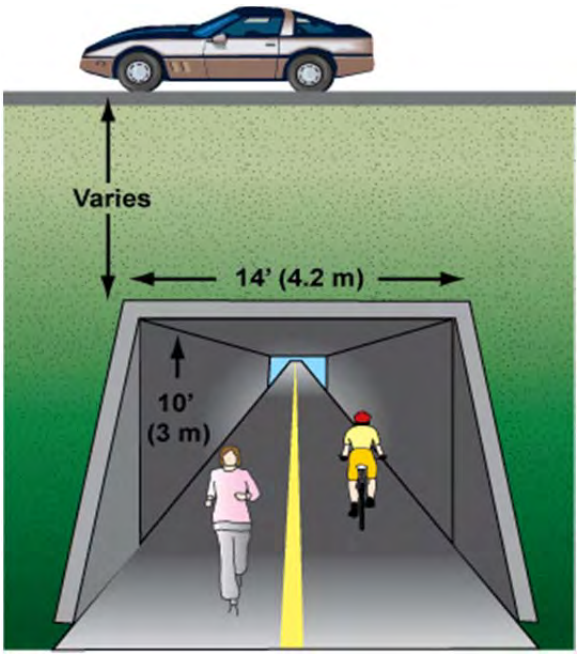
- Improves bicycle and pedestrian safety while reducing delay for all users.
- Eliminates barriers to bicyclists and pedestrians
- Undercrossings often require less ramping and elevation change for the user versus an overcrossing, particularly for railroad crossings.

Disadvantages:

- If crossing is not convenient or does not serve a direct connection it may not be well utilized.
- Potential issues with vandalism, maintenance.
- Security may be an issue if lighting and sight lines through the undercrossing and approaches are inadequate.
- Higher costs associated with grade-separation.

Guidance

- AASHTO *Guide for the Development of Bicycle Facilities*.
- Caltrans *Highway Design Manual* (Chapter 1000).



Recommended undercrossing design.

Undercrossings provide key connections and allow path users to avoid at-grade crossings of major streets or avoid barriers such as freeways and raillines.

Type 4: Grade Separated Overcrossing

Design Summary

- 10′ minimum width, 12′ preferred.
- If overcrossing has scenic vistas additional width should be provided to allow for path users to stop.
- A separate 6′ pedestrian area may be provided in locations with high bicycle and pedestrian use.
- Minimum of 17′ of vertical clearance to the roadway below.
- 10′ headroom on overcrossing.
- The overcrossing should have a centerline stripe even if the rest of the path does not have one.
- Ramp slopes should be ADA-accessible: 5% (1:20) grade with landings at 400′ intervals, or 8.3% (1:12) with landings every 20.′

Overcrossings are frequently used over a major roadway.

Discussion

Overcrossings require a minimum of 17 feet of vertical clearance to the roadway below versus a minimum elevation differential of approximately 12 feet for an undercrossing. This results in longer ramps for bicycles and pedestrians to negotiate.

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

- Vehicle volumes/speeds are high
- The roadway is wide
- A signal is not feasible
- Crossing is needed over a grade-separated facility such as a freeway or rail line.

Advantages:

- Improves bicycle and pedestrian safety while reducing delay for all users.
- Eliminates barriers to bicyclists and pedestrians

Disadvantages:

- If crossing is not convenient or does not serve a direct connection it may not be well utilized
- Overcrossings require at least 17 feet of clearance to the roadway below involving up to 400 feet or greater of approach ramps at each end.
- Potential issues with vandalism, maintenance.
- Higher costs associated with grade-separation.

Guidance

- AASHTO *Guide for the Development of Bicycle Facilities*.
- Caltrans *Highway Design Manual* (Chapter 1000).

6.6.3 Path Amenities

Path Amenities Guidelines

Design Summary

A variety of amenities can make a path inviting to the user. Costs vary depending on the design and materials selected for each amenity. Amenities shall be designed and located so as not to impede accessibility.

Discussion

Benches
Providing benches at key rest areas and viewpoints encourages people of all ages to use the trail by ensuring that they have a place to rest along the way. Benches can be simple (e.g., wood slates) or more ornate (e.g., stone, wrought iron, concrete).

Benches and rest areas encourage trail use by seniors and families with children.

Restrooms/Drinking Fountains
Restrooms benefit path users, especially in more remote areas where other facilities do not exist. Restrooms can be sited at trailheads along the path system. Drinking fountains should be provided at restrooms to allow trail users to rehydrate and recover.

Bathrooms are recommended for longer trails and in more remote areas.

Bicycle Racks/Parking
Bicycle racks allow recreational users to safely park their bikes if they wish to stop along the way, particularly at parks and other desirable destinations. Bicycle parking allows trail users to store their bicycles safely for a short time. Bicycle parking should be provided if a trail transitions to an unpaved pedestrian-only area.

Trash Receptacles
Trash receptacles should be placed at access points. Litter should be picked up once a week and after any special events held on the trail, except where specially designed trash cans have been installed. If maintenance funds are not available to meet trash removal needs, it is best to remove trash receptacles.

Art installations can provide a sense of place for the trail.

Kiosks/Wayfinding Signs
Informational kiosks with maps at trailheads and signage for key destinations can provide valuable information for trail users. See Section 6.7 Wayfinding Standards and Guidelines for additional discussion of trail signage.

Art
Local artists can be commissioned to provide art for the pathway system, creating a sense of place. Pathway art can be functional as well as aesthetic, providing places to sit and play.

Guidance

- AASHTO *Guide for the Development of Bicycle Facilities.*

Pedestrian-Scale Lighting

Design Summary

- Depending on the location, average maintained horizontal illumination levels of 5 lux to 22 lux should be considered (AASHTO).
- Where security problems exist, higher illumination levels may be considered.
- Light standards (poles) should meet the recommended horizontal and vertical clearances.

Discussion

Pedestrian-scale lighting enhances safety and enables the facility to be used year-round, particularly on winter afternoons. Lights should not have a visible source, either to the trail users or to neighboring residences, as they can blind users and pollute the night sky. Low level lighting, such as very short poles or bollards, are often problematic, due to their easy access for vandalism. In some areas, street lighting provides sufficient light for trail users. If pedestrian-scale lighting is desired, some neighborhood friendly options include:

- In-ground lighting – dim lights which indicate the extent of the path.
- Bollards – low-level lighting; can be susceptible to vandalism.
- Solar lighting – best used in situations where running power to the trail would be costly or undesirable.

Pedestrian-scale lighting can have screens to minimize glare. In addition, lights can be programmed to dim or turn off later in the night. A guideline for lighting a pedestrian way is illumination of between 0.5 foot-candle to 1 foot-candle.

Recommended pedestrian-scale lighting.

Guidance

- AASHTO *Guide for the Development of Bicycle Facilities*.
- Caltrans *Highway Design Manual* (Chapter 1000).

Bollards

Design Summary:

- Where removable bollards are used, the top of the mount point should be flush with the path's surface so as not to create a hazard.
- Posts should be permanently reflectorized for night time visibility and painted a bright color for improved daytime visibility.
- Striping an envelope around the post is recommended.
- When more than one post is used, an odd number of posts at 5 feet spacing is desirable.
- Recommended bollard height is 4 feet.

Bollards deter motorists from driving on the trail.

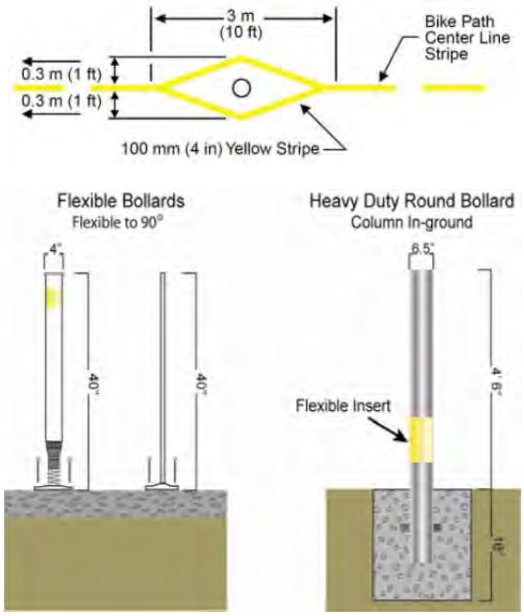
Discussion

Bollards are posts that can be used to block vehicle access to the path and can provide information such as mile markings, wayfinding for key destinations, or small area maps. Minimize the use of bollards to avoid creating obstacles for bicyclists. The California MUTCD explains, "Such devices should be used only where extreme problems are encountered" (Section 9C.101). Instead, design the path entry and use signage to alert drivers that motor vehicles are prohibited.

Flexible bollards and posts are designed to give way on impact and can be used instead of steel or solid posts. These bollards are typically made of plastic that is bolted to the roadway, and bend and return to their original position when hit. They are intended to deter vehicular access, but allow access for emergency vehicles and maintenance equipment.

Bollards are typically installed using one of two methods: 1) The bollard is set into a concrete footing in the ground; and 2) the bollard is attached to the surface by mechanical means (mechanical anchoring or chemical anchor).

Where used, bollards should have high-visibility, reflective tape or paint. Bollards should be placed in the middle of the path, with sufficient space for path users of all abilities, using a variety of mobility devices, to pass. They can create bottlenecks with path users at intersections, and should be used with caution.



Recommended bollard designs.

Guidance

- AASHTO *Guide for the Development of Bicycle Facilities*.
- Caltrans *Highway Design Manual* (Chapter 1000).
- California *MUTCD*, Part 9.

Fencing

Design Summary:

- Height: 4.5 ft (minimum)
- Fencing provides access control, visual screening, and channeling of path users.

Post and wire fence.

Discussion

Fencing is a means of enhancing safety for both trail users and neighboring residents by deterring unwanted access onto or off of the trail. However, fencing both sides of the trail right of way can result in a "tunnel" effect with the perception of being trapped, resulting in a detrimental effect on the trail user experience. Additionally, solid fencing could inhibit community surveillance of the trail and should be discouraged.

Fencing should not be a barrier to wildlife passage across the corridor. A small six inch gap between the bottom of the fence and the ground should allow smaller wildlife to pass.

Fencing that allows a balance between the need for privacy, while simultaneously allowing informal surveillance of the trail should be encouraged. If fencing is requested purely for privacy reasons, vegetative buffers should be considered.

Open boundaries can be created where users may be entering the trail.

Some factors to consider when deciding on fencing necessity and styles include:

- Cost: Fencing and other barriers, depending on the type of materials used and the length, can be costly.
- Security: Fencing between the path and adjacent land uses can protect the privacy and security of the property owners.
- Fencing height: The height and design of a fence influences whether lateral movement will be inhibited. Heavy-duty fencing such as wrought iron or other styles of fencing that are difficult to climb are often more expensive.
- Noise and dust: Trail corridors adjacent to busy roadways, freeways or rail lines may be subject to noise, dust, and vibration. Methods of reducing this impact include the addition of vegetation or baffles to fencing barriers.

Guidance

- AASHTO *Guide for the Development of Bicycle Facilities*.
- Caltrans *Highway Design Manual* (Chapter 1000).

Landscaping

Design Summary:

Safety and security concerns on a trail can be addressed through Crime Prevention Through Environmental Design (CPTED) guidelines. The four principles of CPTED are:

- Natural surveillance – maintain sight lines and visibility to deter criminal activities.
- Natural access control – use of fences, lighting, signage and landscaping to clearly define where people and vehicles are expected to be.
- Territorial reinforcement – use of physical designs such as pavement treatments, landscaping, and signage to develop a sense of proprietorship over the trail.
- Maintenance - if graffiti or vandalism occurs and is not addressed in a timely manner, it can send the message that no one is watching or that no one cares.

Plantings adjacent to the trail can be attractive, but should be managed to maintain visibility and keep the path clear.

Discussion

Whether natural or planted, vegetation can serve as both a visual and physical barrier between a roadway and a path, make the path more attractive, and provide shelter from the sun. The density and species of plants in a vegetative barrier determine how effective the barrier can be in deterring potential trespassers. A dense thicket can be, in some cases, just as effective as a fence (if not more so) in keeping trail users off restricted areas. Even tall grasses, although less effective than trees and shrubs, can discourage trail users from venturing into these areas. Planted barriers typically take a few years before they become effective barriers. Separation of the path may need to be augmented with other temporary barriers until planted trees and hedges have sufficiently matured.

All proposed trailside, trailhead and screen landscaping should consist of an approved native and drought-tolerant plant palette. A preliminary plant palette should be designed in conjunction with local botanical expertise, biological expertise, and landscape architectural consultation.

Guidance

- Trail landscaping guidelines are not discussed in great detail within the AASHTO Guide or Caltrans Highway Design Manual, Chapter 1000, but are briefly referenced as a buffer or retaining mechanism.

Trailheads

Design Summary:

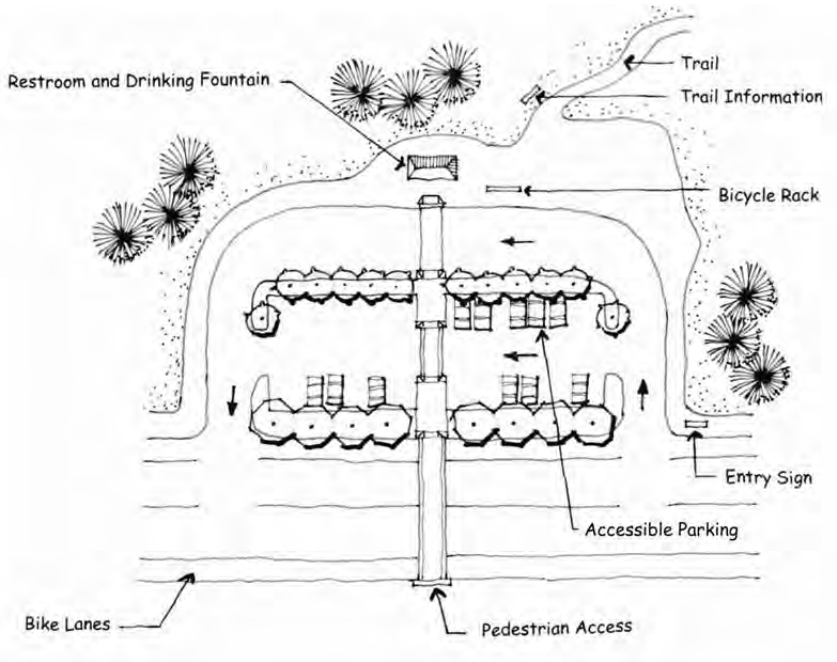
- Major trailheads should include automobile and bicycle parking, trail information (maps, user guidelines, wildlife information, etc.), trash receptacles and restrooms.
- Minor trailheads can provide a subset of these amenities.

Discussion

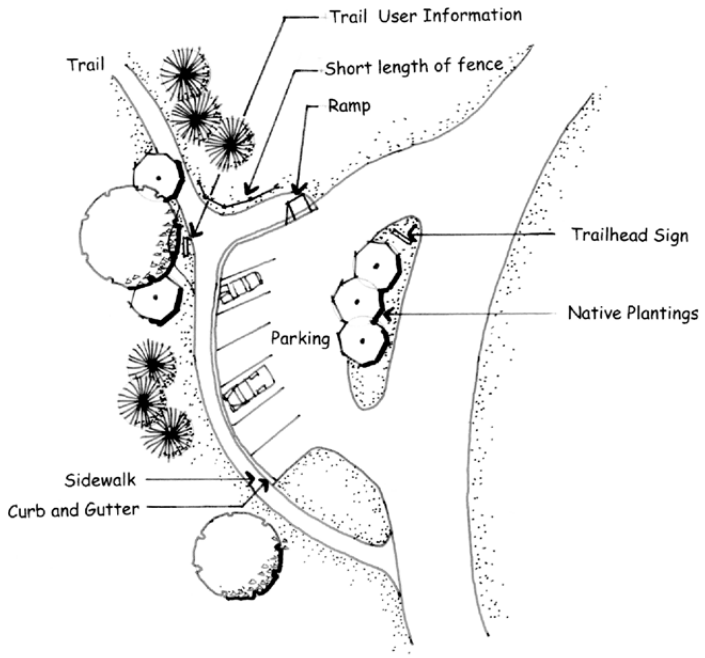
Good access to a path system is a key element for its success. Trailheads (formalized parking areas) serve the local and regional population arriving to the path system by car, transit, bicycle or other modes. Trailheads provide essential access to the shared-use path system and include amenities such as, parking for vehicles and bicycles, restrooms (at major trailheads), and posted maps. Trailheads with a small parking area should also include bicycle parking and accessible parking. Neighborhood access can be provided from local streets crossing the trail. Parking does not need to be provided, and in some cases "No Parking" signs are desirable to minimize impacts to the neighborhood.

Guidance

- AASHTO *Guide for the Development of Bicycle Facilities*.



Example major trailhead.



Example minor trailhead.

6.7 Wayfinding Standards and Guidelines

Wayfinding Standards and Guidelines

Design Summary:

Types of signage include:

- **Regulatory signs -** indicate to bicyclists the traffic regulations which apply at a specific time or place on a bikeway.
- **Warning signs -** indicate upcoming changes in the roadway or path enviroment that requires caution and may require a reduction in speed.
- **Guide and information signs -** indicate information for route selection, locating off-road facilities, or identifying geographical features or points of interest.

MUTCD Sign R5-6 is a regulatory sign that designates where bicycling is prohibited.

Discussion

The ability to navigate through a region is enhanced by landmarks, natural features, and other visual cues. Signs placed at strategic locations can indicate to pedestrians and bicyclists their direction of travel, location of key destinations, and travel time/distance to those destinations.

Warning signs are yellow, such as this combination of W11-15 and W11-15P from the MUTCD

Guidance

- AASHTO *Guide for the Development of Bicycle Facilities.*
- Caltrans *Highway Design Manual* (Chapter 1000).
- California *MUTCD*, Part 9.

Wayfinding signs are green, and include directional arrows. (MUTCD sign D1-3C).

Multi-Use Trail Signage

Design Summary:

- Signage style and imagery should be consistent throughout the trail to provide the trail user with a sense of continuity, orientation, and safety.
- Do not over sign the trail. Where possible, incorporate signage into trailside vertical elements such as bollards.

Discussion

Directional Signage
Directional signage provides orientation to the trail user and emphasizes trail continuity. Street names should be called out at all trail intersections with roadways. In addition to providing a distance reference, mileage markers are attractive to users who target exercise for set distances.

Directional signing may be useful for pathway users and motorists alike. For motorists, a sign reading "Path Xing" along with a City emblem or logo helps warn drivers and promote use of the path itself. The directional signing should impart a unique theme so path users know which path they are following and where it goes. The theme can be conveyed in a variety of ways such as, engraved stone, medallions, bollards, and mile markers.

Directional signage should identify key destinations along the trail route and include schools, parks, municipal centers, connecting trails, and other points of interest.

Trail Etiquette Signage
Establishing goals and policies sets a common framework for understanding trail rules and regulations. Rights and responsibilities of trail usage should be stated at main trail access points. Once rules and regulations are established, the trail managing agency has a means of enforcement. Local ordinances may be adopted to help enforce trail policies. Penalties such as fines or community service may be imposed in response to non-compliance.

Interpretive Signage
Interpretive signage enriches the trail user experience, focuses attention on the unique attributes of the local community, and provides educational opportunities. Natural and cultural resources in trail corridors, including historic signs and photos, boat ramps, and wildlife may provide opportunities for interpretation.

Guidance

- AASHTO *Guide for the Development of Bicycle Facilities.*
- Caltrans Highway Design Manual (Chapter 1000).
- California *MUTCD*, Part 9.

Sample trail directional sign.

Directional and shared-use path etiquette signage.

On-Street Bikeway Signage

Design Summary:

Destinations for on-street bikeway signage may include:

- Other bikeways
- Commercial centers
- Parks and trails
- Public transit stations
- Civic/community destinations
- Hospitals
- Schools

Wayfinding signage concept MUTCD signs D1-3C.

Recommended uses for on-street signage include:

- **Confirmation signs** - confirm that a bicyclist is on a designated bikeway. Confirmation signs can include destinations and their associated distances, but not directional arrows.
- **Turn signs** - indicate where a bikeway turns from one street onto another street. Turn signs are located on the near-side of intersections.
- **Decision signs** - mark the junction of two or more bikeways. Decision signs are located on the near-side of intersections. They can include destinations and their associated directional arrows, but not distances.

Discussion

Signage can provide wayfinding and enhance safety by:

- Familiarizing users with the pedestrian and bicycle network,
- Helping users identify the best routes to key destinations,
- Addressing misperceptions about time and distance,
- Helping overcome a "barrier to entry" for infrequent bicyclists or pedestrians (e.g., "interested but concerned" bicyclists).

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

Wayfinding that includes distance and time can aid bicyclists in route finding.

Signs are typically placed at key locations leading to and along bicycle routes, including the intersection of multiple routes. Too many road signs tend to clutter the right-of-way. It is recommended that bikeway signs be posted at a level most visible to bicyclists and pedestrians, rather than per vehicle signage standards. Additional recommended guidelines include:

- **Place the closest destination to each sign in the top slot.** Destinations that are further away can be placed in slots two and three. This allows the nearest destination to 'fall off' the sign and subsequent destinations to move up the sign as the bicyclist approaches.
- **Use pavement markings to help reinforce routes and directional signage.** Markings, such as bicycle boulevard symbols, may be used in addition to or in place of directional signs along bike routes. Pavement markings can help bicyclists navigate difficult turns and provide route reinforcement.

Guidance

- City of Oakland. (2009). *Design Guidelines for Bicycle Wayfinding Signage.*
- City of Portland (2002). *Bicycle Network Signing Project.*

6.8 Bicycle Parking

Bicycle Parking

Design Summary

- Short-term parking accommodates visitors, customers, messengers and others expected to depart within two hours. This parking requires approved standard rack(s), appropriate location and placement, and weather protection.
- Long-term parking accommodates employees, students, residents, commuters, and others expected to park more than two hours. This parking is to be provided in a secure, weather-protected manner and location.

Discussion

Bicycle Rack Placement Guidelines

Design Issue	Recommended Guidance
Minimum Rack Height	To increase visibility to pedestrians, racks should have a minimum height of 33 inches or be indicated or cordoned off by visible markers.
Signing	Where bicycle parking areas are not clearly visible to approaching bicyclists, signs at least 12 inches square should direct them to the facility. The sign should include the name, phone number, and location of the person in charge of the facility, where applicable.
Lighting	Lighting of not less than one foot-candle illumination at ground level should be provided in all bicycle parking areas.
Frequency of Racks on Streets	In popular retail areas, two or more racks should be installed on each side of each block. This does not eliminate the inclusion of requests from the public which do not fall in these areas. Areas officially designated or used as bicycle routes may warrant the consideration of more racks.
Location and Access	Access to facilities should be convenient; where access is by sidewalk or walkway, ADA-compliant curb ramps should be provided where appropriate. Parking facilities intended for employees should be located near the employee entrance, and those for customers or visitors near main public entrances. (Convenience should be balanced against the need for security if the employee entrance is not in a well traveled area). Bicycle parking should be clustered in lots not to exceed 16 spaces each. Large expanses of bicycle parking make it easier for thieves to be undetected.
Locations within Buildings	Provide bike racks within 50 feet of the entrance. Where a security guard is present, provide racks behind or within view of a security guard. The location should be outside the normal flow of pedestrian traffic.
Locations near Transit Stops	To prevent bicyclists from locking bikes to bus stop poles (which can create access problems for transit users, particularly those who are disabled) racks should be placed in close proximity to transit stops where there is a demand for short-term bike parking.
Locations within a Campus-Type Setting	Racks are useful in a campus-type setting at locations where the user is likely to spend less than two hours, such as classroom buildings. Racks should be located near the entrance to each building. Where racks are clustered in a single location, they should be surrounded by a fence and watched by an attendant. The attendant can often share this duty with other duties to reduce or eliminate the cost of labor being applied to bike parking duties; a cheaper alternative to an attendant may be to site the fenced bicycle compound in a highly visible location on the campus. For long-term parking needs of employees and students, attendant parking and/or bike lockers are recommended.
Retrofit Program	In established locations, such as schools, employment centers, and shopping centers, the City should conduct bicycle audits to assess bicycle parking availability and access, and add additional bicycle racks where necessary.

Guidance

- AASHTO *Guide for the Development of Bicycle Facilities*.
- Caltrans *Highway Design Manual (*Chapter 1000).
- California *MUTCD*, Part 9.

Short-Term Bicycle Parking

Design Summary:

- See dimensions below.

Discussion

Short-term bicycle parking facilities include racks which permit the locking of the bicycle frame and at least one wheel to the rack, and support the bicycle in a stable position without damage to wheels, frame or components. Short-term bicycle parking is currently provided at no charge at various locations in National City. Such facilities should continue to be free, as they provide minimal security, but encourage cycling and promote proper bicycle parking.

The majority of short-term bicycle parking is provided via a 'staple' on the sidewalk, located within the buffer zone.

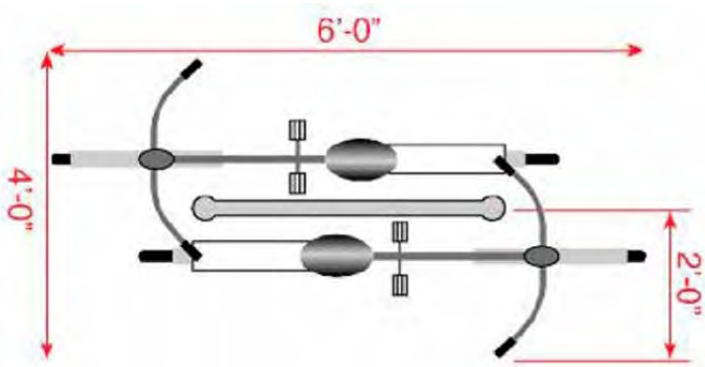
Art racks can be an attractive way of providing bicycle parking facilities. Costs can be subsidized by businesses sponsoring racks that compliment their business (e.g., a pair of glasses for an optician).

Guidance

- AASHTO Guide for the Development of Bicycle Facilities.
- Caltrans Highway Design Manual (Chapter 1000).
- California MUTCD, Part 9.

Standard bicycle 'staple' rack.

Art racks can be an attractive way of marketing bicycle parking.



Staple rack parking configuration.

Long-Term Bicycle Parking

Design Summary:

- Dimensions and configuration depends on the type of parking.

Discussion

Long-term bicycle parking facilities are intended to provide secure, long-term bicycle storage. Long-term facilities protect the entire bicycle, its components and accessories, against theft and inclement weather, including snow and wind-driven rain. Examples include lockers, check-in facilities, monitored parking, restricted access parking, and personal storage.

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. Potential locations for long-term bicycle parking include transit stations, large employers and institutions where people use their bikes for commuting, and not consistently throughout the day.

Bike lockers at a transit station.

Guidance

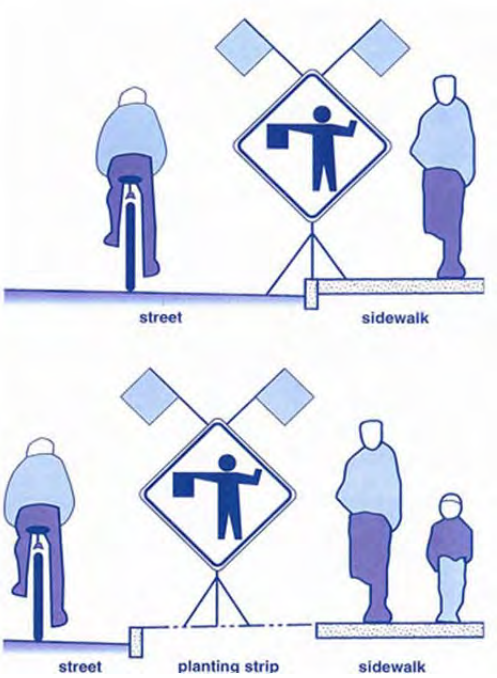
- AASHTO Guide for the Development of Bicycle Facilities.
- Caltrans *Highway Design Manual* (Chapter 1000).
- California *MUTCD*, Part 9.

6.9 Maintenance and Construction

Bicycle Access through Construction Zones

Design Summary:

- Bicyclists should not be led into conflicts with work site vehicles, equipment, moving vehicles, open trenches or temporary construction signage.
- Efforts should be made to re-create a bike lane (if one exists) to the left of the construction zone. If this is not possible, then a standard-width travel lane should be considered.
- Construction signage actions:
  - Place in a location that does not obstruct the path of bicyclists or pedestrians (see graphic).
  - Detour and/or closure signage related to bicycle travel should be included on all bikeways where construction activities occur. Signage should also be provided on all other impacted roadways.
- Recommendations for bicycle travel over steel plates:
  - Ensure that steel plates do not have a vertical edge greater than ¼" without an asphalt lip.
  - Use non-skid steel plates without a raised steel bar.
  - Require temporary asphalt (cold mix) around plates to create a smooth transition.
  - Use steel plates only as a temporary measure during construction, not for extended periods.
  - Use warning signage where steel plates are in use.



Recommended signage placement.

Discussion

Safety of all roadway users must be considered during road construction and repair. Wherever bicycles are allowed, measures should be taken to provide for the continuity of a bicyclist's trip through a work zone area. Detouring pedestrians and bicyclists to another street when travel vehicle lanes remain open should be avoided unless necessary to maintain safety. Contractors performing work for the City should be made aware of the needs of bicyclists and be properly trained in how to safely route bicyclists through or around work zones.

Steel Plates

Steel plates used to cover trenches typically have a 1" to 2" vertical transition on the edges, which can puncture a hole in a bicycle tire and cause a bicyclist to lose control. Bicyclists are often left on their own to merge with vehicles in the adjacent travel lane. Although it is common to use steel plates during non-construction hours, they can be slippery, particularly when wet. Use of temporary asphalt on edges and advanced warning signs can enhance safety for bicyclists.

Guidance

- Caltrans Highway Design Manual (Chapter 1000).
- California *MUTCD*, Part 9.

Bikeway Maintenance

Design Summary:

- Guidelines for regularly maintaining bicycle facilities are provided to the right.

Discussion

Sweeping

Bicyclists often avoid shoulders and bike lanes filled with gravel, broken glass and other debris; they will ride in the travel lane to avoid these hazards, 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 properly picked up or swept.

Action items involving sweeping activities include:

- 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.
- Provide extra sweeping in the fall where leaves accumulate.

Recommended Walkway and Bikeway Maintenance Activities

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

Roadway Surface

Bicycles are more sensitive to subtle changes in roadway surface than motor vehicles. Some paving materials are smoother than others, and compaction/uneven settling can affect the surface after trenches and 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, the City should use the smallest chip size and ensure that the surface is as smooth as possible to improve safety and comfort for bicyclists.

Recommended action items involving maintaining the roadway surface include:

- On all bikeways, use the smallest possible chip for chip sealing bike lanes and shoulders.
- 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.
- Ensure that on new roadway construction, the finished surface on bikeways does not vary more than ¼".
- Maintain a smooth surface on all bikeways that is free of potholes.
- Maintain pavement to ensure that any ridges at the gutter-to-pavement transition and adjacent to railway crossings are within ¼" of the pavement surface.
- Inspect the pavement 2 to 4 months after trenching construction activities are completed to ensure that excessive settlement has not occurred.

Bikeway Maintenance

Discussion (continued)

Gutter-to-Pavement Transition

On streets with concrete curbs and gutters, 10"-20" 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. It is at this location that water can erode the transition, creating potholes and a rough surface for travel. The pavement on many streets is not flush with the gutter, creating a vertical transition between these segments. This area can buckle over time, creating a hazardous environment for bicyclists. Since it is the most likely place for bicyclists to ride, this issue is significant for bike travel.

Action items related to maintaining a smooth gutter-to-pavement transition include:

- Ensure that gutter-to-pavement transitions have no more than a ¼" vertical transition.
- Examine pavement transitions during and after roadway construction projects, including maintenance activities.

Drainage Grates

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 stormwater system. Many grates are designed with linear parallel bars spread wide enough for a bicycle tire to become caught, which may cause the bicyclist to tumble over the handlebars and sustain potentially serious injuries. The City should consider the following:

- Continue to require all new drainage grates to be bicycle-friendly; use 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 rebar horizontally across the grate is not an alternative to replacement.

Pavement Overlays

Pavement overlays represent good opportunities to improve conditions for bicyclists. A ridge should not be left in the area where bicyclists ride (this occurs where an overlay extends part-way into a shoulder bikeway or bike lane). Overlay projects offer opportunities to widen a roadway, or to re-stripe a roadway with bike lanes. Action items related to pavement overlays include:

- Extend the overlay over the entire roadway surface to avoid leaving an abrupt edge.
- If there is adequate shoulder or bike lane width, it may be appropriate to stop at the shoulder or bike lane stripe, provided no abrupt ridge remains.
- Ensure that inlet grates, manhole and valve covers are within ¼" of the pavement surface and are made or treated with slip resistant materials.
- Pave gravel driveways to property line to prevent gravel from spilling onto shoulders or bike lanes.

Signage

Signage is critical for safe and comfortable use of the bicycle and pedestrian network. Signage is vulnerable to vandalism and wear, and requires regular maintenance and replacement as needed. The City should consider the following:

- Inspect regulatory, warning and wayfinding signage along bikeways for signs of vandalism/graffiti and normal wear;
- replace signage along the bikeway network as-needed.
- Perform a regularly-scheduled check on the status of signage for compliance with federal, state and regional guidelines, with follow-up as necessary.
- Create a Maintenance Management Plan (see below).

Bikeway Maintenance

Discussion (continued)

Landscaping

Bikeways can become inaccessible due to overgrown vegetation. All landscaping needs to be designed and maintained to ensure compatibility with the use of the bikeways. After a flood or major storm, bikeways should be checked along with other roads, and fallen trees or other debris should be removed promptly. Landscaping maintenance action items include:

- Ensure that shoulder plants do not hang into or impede passage along bikeways.
- After major incidents, remove fallen trees or other debris from bikeways as quickly as possible.

Maintenance Management Plan

Bikeway users need accommodation during construction and maintenance activities when bikeways may be closed or unavailable. Users must be warned of bikeway closures and given adequate detour information to bypass the closed section. Users should be warned through the use of standard signing in advance of each affected section (e.g., "Bicycle Lane Closed," "Trail Closed"), including information on alternate routes and dates of closure. Alternate routes should consider travel time, roadway and traffic characteristics, and include proper bikeway signage.

Action items related to a Maintenance Management Plan include the following:

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

Guidance

- Caltrans Highway Design Manual (Chapter 1000).
- California *MUTCD*, Part 9.

7. Recommended Programs: Education, Encouragement, Enforcement, & Evaluation

Improvements to bicycle facilities in National City should be complemented by programs designed to promote and encourage bicycling. The following narrative presents recommendations for education, encouragement, enforcement, and evaluation programs intended to promote bicycling and encourage the use of the infrastructure improvements set forth in the National City Bicycle Master Plan.

7.1 Safe Routes to School Toolkit

Safe Routes to School (SR2S) is a program with a simple goal: helping more children get to school safely by walking and bicycling. Envision active kids using safe streets, helped by engaged adults (from teachers to parents to police officers), surrounded by responsible drivers.

Students enjoy the walk to school

Safe Routes to School programs use a variety of strategies to make it easy, fun and safe for children to walk and bike to school. These strategies are often called the "Five Es."

Education: programs designed to teach children about traffic safety, bicycle and pedestrian skills, and traffic decision-making.

Encouragement: programs that make it fun for kids to walk and bike. These programs may be challenges, incentive programs, regular events (e.g. "Walk and Bike Wednesdays") or classroom activities.

Engineering: physical projects that are built to improve walking and bicycling conditions.

Enforcement: law enforcement strategies to improve driver behavior near schools.

Evaluation: strategies to help understand program effectiveness, identify improvements, and ensure program sustainability.

Who is This Toolkit For?

This Toolkit is for any adult who wants to improve traffic safety and air quality around schools, help children be more physically active and "ready to learn" and improve our neighborhoods.

Whether you are a parent, a teacher, a school administrator, a neighbor, a public health professional, city staff, or a city official, this Toolkit will provide you with facts and figures, as well as ideas, inspiration and proven techniques. This Toolkit covers the Why, Who and How of Safe Routes to School.

A young student gets some exercise on his way home from school

History of the Safe Routes to School Movement

Based on the success of programs in New York, California and Florida, Safe Routes to School became a nationwide effort in 2005, when Congress included a national SR2S program in the reauthorization of federal highway legislation. The program distributed $612 million in dedicated SR2S funds around the nation. As a result, every state has a SR2S coordinator and a grant program.

Students learn pedestrian safety lessons

The movement developed from a staggering decline over time in the proportion of schoolchildren walking and bicycling to school. In 1969, over 40% of schoolchildren walked or bicycled to school. Today, that number has dropped to 13%, and it continues to decline[4]. As fewer kids biked and walked, more were bused and, increasingly, driven to school. Further, children suffer from a variety of problems related to physical inactivity, and over 25% of morning rush-hour traffic is parents driving children to school. Traffic safety and air quality have declined near schools.

In the 1970s and 1980s, numerous European and British communities began to notice that children were no longer walking and bicycling to school. The first Safe Routes to School programs inspired similar programs in Australia, Canada and the United States. In the US, the first SR2S programs were implemented in New York City, Florida, Marin County (CA) and Arlington (MA).

Benefits of Walking and Bicycling to School

Active kids are healthy kids, and walking or bicycling to school is an easy way to make sure that children get daily physical activity. Benefits to children include:

- Increased physical fitness and cardiovascular health
- Increased ability to focus on school
- A sense of independence and confidence

SR2S also benefits neighborhoods:

- Improved air quality as fewer children are driven to school
- Decreased crashes and congestion as fewer children are driven to school
- More community involvement as parents, teachers and neighbors get involved and put "eyes on the street"

Schools also benefit:

- Fewer discipline problems because children arrive "ready to learn"
- Fewer private cars arriving to drop off and pick up children

[4] McDonald, N. (2007). Active Transportation to School: Trends Among U.S. Schoolchildren, 1969-2001. American Journal of Preventative Medicine. 32(6) 509-516.

- Opportunities to integrate walking, bicycling and transportation topics into curriculum (e.g. "Walk & Bike Across America," mapping lessons, graphs and charts of distance walked or biked)

7.1.1 Overview of National City's Existing Efforts

To date, National City has completed a number of engineering related improvements near schools to improve walking and bicycling conditions for school children. Completed improvements include the installation of 37 vehicle speed feedback sign and flashing beacon combination units, three vehicle speed feedback sign trailer units, 26 pole-mounted flashing beacons, six in-roadway lighted crosswalk systems, pedestrian countdown signal modules for 18 intersections, school zone signing and striping enhancements, and pedestrian ramp and sidewalk improvements for 14 schools Citywide. Remaining planned infrastructure improvements include traffic calming and streetscape enhancements along various corridors near schools throughout the City.

In order for the Safe Routes to School efforts in National City to be well-rounded and as robust as possible, infrastructure improvements should be complemented with school, local agency and/or parent-led efforts in the other 4 "Es": education, encouragement, enforcement and evaluation. The following Toolkit provides ideas and resources for implementing programs that will give parents and schoolchildren the information, confidence, and encouragement they need to make walking and bicycling to school a reality.

7.1.2 Education

Safe Routes to School refers to a variety of multi-disciplinary programs aimed at increasing the number of students walking and bicycling to school. Education programs are an essential component of a Safe Routes to School program. Education programs generally include outreach to students, parents and guardians, and motorists. Students are taught bicycle, pedestrian and traffic safety skills. Parents and motorists receive information on transportation options and driving safely near schools.

Bicycle safety education

Safety Education

Pedestrian and bicycle safety education aims to ensure that each child understands basic traffic laws and safety rules. Pedestrian safety education teaches children basic traffic safety rules, sign identification and decision-making tools. Pedestrian training is typically recommended for first- and second-graders and teaches basic lessons such as "look left, right, and left again," "walk with your approved walking buddy," "stop, look, and listen," and "lean and peek around obstacles before crossing the street." Trained safety professionals can administer pedestrian safety in the classroom or physical education class. Classroom teachers may use established pedestrian safety curriculum, such as the curriculum taught by the Bicycle Transportation Alliance[5] to make sure children know how and where to walk and cross the street.

[5] Bicycle Transportation Alliance safety courses: http://www.bta4bikes.org/at_work/pedsafetyeducation.php)

Bicycle safety training is normally appropriate beginning in or after the third grade and helps children understand that they have the same responsibilities as motorists to obey traffic laws. The League of American Bicyclists offers an extensive bicycle safety curriculum called Kids II. This seven-hour class is aimed at 5th and 6th grade students and teaches necessary bicycle riding skills and how to pick safe bicycling routes. The curriculum is designed to have a League Certified Instructor (LCI) teach the class. This program or a similar program can be used to teach children where and how to ride a bicycle.

Safe Moves (http://www.safemoves.org/) is a local resource in pedestrian and bicycle safety education for children.

Safe Crossing Lesson

Bicycle Rodeos

Bicycle Rodeos are family-friendly events that incorporate a bicycle safety check, helmet fitting, instruction about the rules of the road and an obstacle course. Adult volunteers can administer rodeos, or they may be offered through the local Police or Fire Department. Bicycles rodeos can be incorporated into health fairs, back to school events and Walk and Bike to School days. Rodeos also provide an opportunity to check children's bikes and instruct them on proper helmet use.

Classroom Lessons and Activities

A variety of existing lessons and classroom activities are available to help teach students about walking, bicycling, health and traffic safety. These can include lessons given by law enforcement officers or other trained professionals or as a lesson plan developed by teachers. Example topic lessons are: Safe Street Crossing, Helmet Safety, Rules of the Road for Bicycles, and Health and Environmental Benefits of Walking and Biking.

The lessons should be grade-appropriate and can be incorporated into the subjects of health, environment, social science, math and physics. Sample lesson plans are available at a number of Safe Routes to School program websites, including the National Highway Traffic Safety Administration[6].

School Zone Traffic Safety Campaign

A School Zone Traffic Safety Campaign creates awareness of students walking and bicycling to school. A safety campaign is an effective way to reach the general public and encourage drivers to slow down and look for students walking and biking to school.

A School Zone Traffic Safety Campaign uses signs and banners located near schools (for example, in windows of businesses, yards of people's homes and print publications) to remind drivers to slow down and use caution in school zones. This campaign can be kicked off at the start of each school year or in conjunction with special events, such as Walk and Bike to School Month, which takes place in October.

Banners and signs can be effective tools to remind motorists about traffic safety in school zones. Large banners can be hung over or along roadways near schools with readable letters cautioning traffic to slow down, stop at stop signs or watch for students in crosswalks with memorable messages such as: "*Give Our Kids a Break*," and "*Drive 25, Keep Kids Alive*".

[6] National Highway Traffic Safety Administration: http://www.nhtsa.gov/people/injury/pedbimot/bike/Safe-Routes-2002/classact.html

Bus Safety Campaign

Many schools use buses to transport students who are too far away to walk to school. School buses are large and restrict sight lines for drivers, pedestrians and bicyclists. It is difficult for drivers and students to see each other around school buses. Schools can implement a bus safety campaign that reminds students to walk and ride cautiously around buses and to wave and communicate to the bus driver.

Bus safety campaign

7.1.3 Encouragement

Encouragement programs focus on bringing the fun back to walking and bicyling while increasing public awareness of the benefits of walking and biking to school. Events and activities help increase the number of students walking and biking to school. The activities often include a variety of special events and contests, outreach campaigns and presentations to school and community groups. Encouragement programs can be used to educate parents, school personnel, students and the community about the health and safety benefits of a successful Safe Routes to School program.

Encouragment programs do not need much funding, but their success depends on a school champion or group of volunteers for sustained support.

Walk and Bike to School Day/Week/Month

Walk and Bike to School Day/Week/Month are special events encouraging students to try walking or bicycling to school. The most well-known of these is International Walk to School Day, a major annual event that attracts millions of participants in over 30 countries in October.

Walk and Bike to School Day celebrations

Walk and bike to school days can be held yearly, monthly, or even weekly, depending on the level of support and participation from students, parents and school and local officials. Some schools organize more frequent days – such as weekly Walking/Wheeling Wednesdays or Walk and Roll Fridays – to give people an opportunity to enjoy the event on a regular basis. Parents and other volunteers accompany the students, and staging areas can be designated along the route to school where groups can gather and walk or bike together. These events can be promoted through press releases, articles in school newsletters and posters and flyers for students to take home and circulate around the community.

International Walk to School Day: http://www.walktoschool-usa.org/.

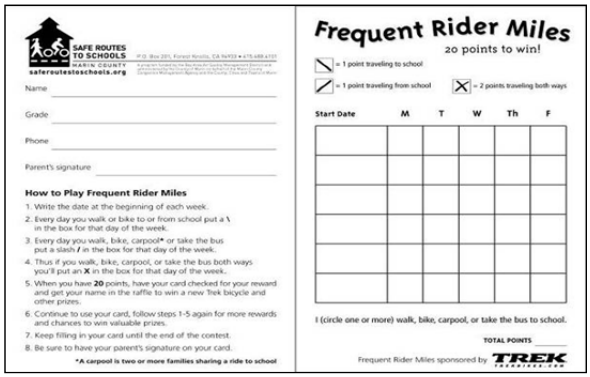
Suggested Route to School Maps

Suggested Route to School maps show stop signs, signals, crosswalks, sidewalks, trails, overcrossings, paseos and crossing guard locations around a school. These can be used by families to identify the best way to walk or bike to school.

Liability concerns are sometimes cited by cities or school districts as reasons not to publish walking route maps. While no walking route will ever be completely free of pedestrian safety concerns, a well-defined walking route should provide the greatest physical separation between walking students and traffic, expose students to the lowest traffic speeds and have the fewest roadway crossings.

Friendly Walking/Biking Competitions (Incentive Programs)

Contests and incentive programs reward students by tracking the number of times they walk, bike, carpool or take transit to school. Contests can be individual, classroom competitions or inter-school competitions. Local businesses may be willing to provide incentive prizes for these activities. Students and classrooms with the highest percentage of students walking, biking or carpooling compete for prizes and "bragging rights." Small incentives, such as shoelaces, stickers and bike helmets, can be used to increase participation. It can also be effective to allow different grades and schools (high school vs. grade school vs. middle school) to compete against each other in a mobility challenge.


SAFE ROUTES TO SCHOOLS MARIN COUNTY
saferoutestoschoolsmc.org

Name
Grade
Phone
Parent's signature

How to Play Frequent Rider Miles
1. Write the date at the beginning of each week.
2. Every day you walk or bike to or from school put a \ in the box for that day of the week.
3. Every day you walk, bike, carpool* or take the bus put a slash / in the box for that day of the week.
4. Thus if you walk, bike, carpool, or take the bus both ways you'll put an X in the box for that day of the week.
5. When you have 20 points, have your card checked for your reward and get your name in the raffle to win a new Trek bicycle and other prizes.
6. Continue to use your card, follow steps 1-5 again for more rewards and chances to win valuable prizes.
7. Keep filling in your card until the end of the contest.
8. Be sure to have your parent's signature on your card.

*A carpool is two or more families sharing a ride to school

Frequent Rider Miles
20 points to win!
\ = 1 point traveling to school
/ = 1 point traveling from school
X = 2 points traveling both ways

Start Date	M	T	W	Th	F

I (circle one or more) walk, bike, carpool, or take the bus to school.

TOTAL POINTS

Frequent Rider Miles sponsored by TREK

Example of a Frequent Rider Miles sheet

Each of the examples of programs below can be modified for students who live too far away from school to walk or bike. Modification can include walking or biking at lunch time or gym class. Also, students can count the miles walked or biked with parents and guardians outside of the school day.

Example of a Pollution Punchcard

Examples of walking and biking competitions include:

On-campus walking clubs (mileage clubs) - Children are issued tally cards to keep track of "points" for each time they walk, bike, bus or carpool to or from school. When they earn a specified number of points they get a small prize and are entered in a raffle for a larger prize. At the end of the school year, there is a drawing for major prizes.

Pollution Punchcard - This year-round program is designed to encourage school children and their families to consider other options for getting to school, such as biking, walking, carpooling and public transportation. Every time a student walks, bikes or carpools to school, a parent volunteer or school representative stamps or punches the card. Then students receive a reward when the punch card is complete.

Walk and Bike Challenge Week/Month - This month-long encouragement event is generally held in conjunction with National Bike Month in May. Students are asked to record the number of times they walk and bike during the program. The results are tallied and competing schools or classrooms compare results. Students

who are unable to walk or bike to school, because they live too far away, can participate by either walking during a lunch or gym period or getting dropped off near the school and walking with their parents the last several blocks.

Physical activities before school are part of the friendly competitions

Golden Sneaker Award - Each class keeps track of the number of times the students walk, bike, carpool or take the bus to school and compiles these figures monthly. The class that has the most participation gets the Golden Sneaker Award. The award can be created by taking a sneaker, mounting it to a board like a trophy, and spray painting it gold.

Walk Across America/California/Pacific Crest Trail - This is a year-round program and is designed to encourage school children to track the number of miles they walk throughout the year. Students will be taught how to track their own mileage through learning about how many steps or blocks are in a mile and will also learn about places in the United States on their way. Teacher or volunteer support is required.

Each of these programs can use incentives to increase participation and reward the students for their efforts. Examples of incentives include:

- Shoelaces
- Dog tags
- Pedometers
- Reflective zipper pulls
- Bicycle helmets
- Raffle tickets for a bicycle from a local bike shop
- Early dismissal
- Extra recess time
- Pizza parties

Bicycles around a school campus

Back-to-School Blitz

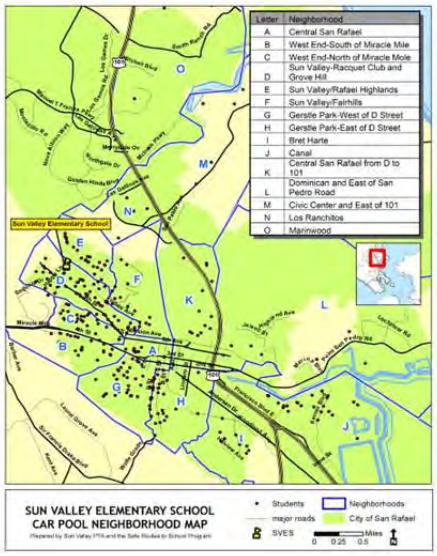
Families set transportation habits during the first few weeks of the school year, and many families are not aware of the many transportation options available to them. Because of this, most families will develop the habit of driving to school. A "Back to School Blitz" can be used at the beginning of the school year to promote bus, carpool, walking and bicycling as school transportation options.

The "Back to School Blitz" includes many of the other programs in this Toolkit, including Suggested Route Maps, articles in school newsletters and enforcement activity. Additional elements include:

A packet given to each family containing information about school transportation options, including:

- Cover letter signed by the principal encouraging parents to create transportation habits with students that promote physical activity, reduce congestion, increase school safety and improve air quality

- School transportation maps or suggested routes to school maps that include bicycling and walking routes, transit and school bus stops, drop-off and parking areas and bike parking locations
- Transit schedules
- Pledge forms about reducing the number of times that families drive to school; entries go into a raffle for a prize donated by local businesses



A schoolpool map from Marin County shows area neighborhoods and student household locations

In addition to the packet, the following strategies can be included:

- Table at back-to-school night with materials and trained volunteers who can answer questions about transportation issues
- Post "schoolpool map" showing all student households as dots; parents then check the corresponding school directory listing to see families located in their neighborhood who are interested in walking, biking and carpooling to school together. Only families who opt into the directory are listed.
- Article in first school newsletter about transportation options and resources
- Enforcement activities, such as school zone speed and crosswalk enforcement
- Strict enforcement of parking policies during first month of school (and throughout the year if possible)

Students show their coloring job of a street scene

Stop and Walk

This year-round campaign is designed to encourage parents to stop several blocks from school and walk the rest of the way to school. Not all students are able to walk or bike to school. They may live too far away from school to walk or their route to school may include hazardous traffic situations, such as a high-speed arterial road with limited crossing opportunities. This type of campaign is used to allow students who are unable to walk or bike to school a chance to participate in school walking programs. It also helps reduce traffic congestion at the school.

The program can be included as a part of other encouragment activities, such as the Golden Sneaker Award, Walk Across California and the Mileage Clubs. An additional benefit to implementing a "Stop and Walk" program is reduced traffic volume directly surrounding a school. Reducing the number of motor vehicles in the school environment increases traffic safety and encourages walking and biking to school.

Walking School Buses

Parents and guardians often cite distrust of strangers and the dangers of traffic as reasons why they do not allow their students to walk to school. Walking School Buses are a way to make sure that children have adult supervision as they walk to school. Walking School Buses are formed when a group of children walk together to

school and are accompanied by one or two adults (usually parents or guardians of the children on the "bus"). As the walking school bus continues on the route to school they pick up students at designated meeting locations.

Students participate in a walking school bus

Walking school buses can be informal arrangements between neighbors with children attending the same school or official school-wide endeavours with trained volunteers and structured meeting points with a pick-up timetable. More information about Walking School Buses is available in section 7.1.8. Additionally, a Walking School Bus "how to" guide is available from the National Center for Safe Routes to School[7].

Bike Trains

A bicycle train is very similar to a walking school bus. Groups of students accompanied by adults bicycle together on a pre-planned route to school. Routes can originate from a particular neighborhood or, in order to include children who live too far to bicycle, begin from a park, parking lot or other meeting place. They may operate daily, weekly or monthly. Bike trains help address parents' concerns about traffic and personal safety while providing a chance for parents and children to socialize and be active.

Students participate in a bike train

Bike trains are best suited for older students that have undergone bicycle safety training. Also, helmets and parent waivers should be required before participating in a bike train.

7.1.4 Engineering Tools

The environment near the school is often a determining factor when a parent or guardian decides whether or not to allow their child to walk or bicycle to school. There are a variety of engineering solutions available to enhance pedestrian and bicyclist safety and comfort near schools. Engineering improvements are implemented to slow cars, increase the visibility of students walking and biking, and make it easier for students to cross the street. While some engineering efforts can be costly, many, such as posting signs and striping crosswalks or bike lanes, are relatively inexpensive.

Example of a bulb-out at an intersection

[7] National Center for Safe Routes to School "how to" guide: http://www.saferoutesinfo.org/guide/walking_school_bus/index.cfm

Lower-Cost Pedestrian and Bicycle Safety Enhancements

Although it may be appropriate for younger children to bicycle on the sidewalk, and it is legal in National City, designated on-street bicycle facilities can provide a space for older or more experienced children to bicycle on-street. As older children become more confident in their cycling skills and ride at faster speeds, designated on-street facilities may help to reduce bicycle/pedestrian conflicts on congested walkways near schools and increase visibility for students arriving by bike. Use of on-street facilities is more appropriate for children with better bike handling skills, as they need to know how to stay within the bike lane (if striped) or to the right of traffic (on signed routes), obey stop signs and other traffic signals, and watch for traffic pulling out of side streets or driveways.

Other types of improvements for pedestrian and bicycle safety include:

Bicycle Lanes and Routes

Bicycle lanes are a striped portion of the roadway that designates an area specifically for bicyclists, making them more visible to motorists. Bicycle lanes are better suited for older and more experienced children who have learned the skills needed for bicycle handling, avoiding road hazards and following the rules of the road. Bike lanes can be striped on any street that meets the width requirements and has the characteristics of a good bicycle route. Bike routes provide for shared use of the travel lane with motor vehicles and are identified by signing and/or shared lane markings only.

Bike Lanes

Secure Bicycle Parking

Providing a secure and convenient location for bicycle parking is one way to help encourage more children to bicycle to school. Good bike parking is located conveniently (near the school entrance, for example), and protects bicycles from vandalism/theft, damage and weather.

High-Visibility School Zone Signage

Signs inform street users about what to expect from the street surroundings. School zone signs notify motorists that they are entering an environment where there are vulnerable road users such as children. The City is required to follow guidelines listed in the California Manual on Uniform Traffic Control Devices (MUTCD) when installing signs. Key school zone sign assemblies include the School Warning, School Crosswalk Warning, School Speed Limit and School Advance Warning. One way of increasing the visibility of school area signage is through the use of fluorescent, yellow-green signs.

High visibility school zone signs

Sidewalks

Sidewalks create a designated space for pedestrians. A complete sidewalk network is an important component of the transportation system for students. An incomplete sidewalk network or sidewalks in disrepair create a hazard for students walking and biking and may force students to walk in the roadway.

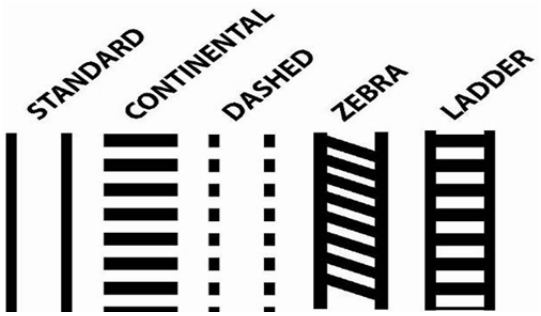
Sidewalk near school

Trails and Paseos

Trails, pathways and paseos are often viewed as recreational facilities, but they can also serve an important function as a walking and bicycling corridor to school. Multi-use pathways and paseos are designed to serve both bicyclists and pedestrians, and provide additional width over a standard sidewalk. Pathways may be constructed adjacent to roads, through parks or open space areas, along creeks, or along linear corridors, such as abandoned railroad lines. Regardless of the type, pathways constructed next to the road should have some type of buffer to separate the path area from the adjacent travel lane.

High-Visibility Crosswalk Striping

High-visibility striping makes crosswalks more noticable to motorists. According to the California MUTCD, crosswalks located on roads within a certain distance of a school may be painted yellow. Several different crosswalk striping patterns can be used – the most common types of crosswalk striping patterns are shown in the diagram to the right. The standard crosswalk striping pattern consists of two parallel lines, called the "transverse" pattern. A number of "high-visibility" patterns are also avalilable, such as the ladder, zebra and continental patterns, which add bars for increased visibility.



High-visibility crosswalk striping

High-visibility markings should be considered for all high-volume crossings near schools, and where the conditions warrant an increased visibility marking (e.g. a mid-block location). Standardizing crosswalk markings helps both motorists and pedestrians recognize designated crossings.

Pedestrian-Scale Lighting

Safe sidewalks are essential components of good pedestrian environments, and well-lit environments convey a feeling of comfort and safety, particularly at night. Lighting should illuminate the sidewalk and roadway crossings to increase pedestrian visibility. Lighting is also an important element for multi-use pathways, at underpasses and at other isolated locations. Lower-level pedestrian-scale lights can be mounted separtely or on typical street light poles to extend over the sidewalk to increase pedestrian visiblity to road users and enhance visibility along the walking path.

Advance Stop Bars and Yield Lines at Mid-Block Crosswalks

Advance stop bars and yield lines enhance pedestrian safety by prompting motor vehicles to stop/yield well in advance of marked crosswalks, thereby providing a clearer line of sight to pedestrians entering the crosswalk. Without an advance stop bar or yield line, drivers may decide to stop right at the crosswalk, which may obstruct visibility for vehicles traveling in the inside lane of a multi-lane roadway, increasing the possibility of a vehicle-pedestrian collision. Stop bars are used at "signalized" mid-block crosswalks and should be accompanied by a "Stop Here for Pedestrians" sign. Yield lines, also known as "shark teeth" due to their triangular shape, are used at "unsignalized/uncontrolled" mid-block crosswalks and should be accompanied by a "Yield Here to Pedestrian" sign.

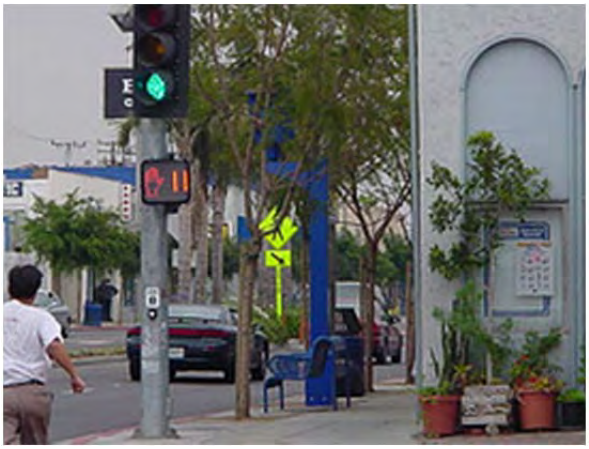
Advance Stop Bars

Advanced stop bars and yield lines should be placed between 20 and 50 feet in advance of the crosswalk based on roadway conditions.

Traffic Signal Enhancements

Pedestrian Countdown Signals

Pedestrian countdown signals provide pedestrians information about how much time they have left to cross the street. Young pedestrians are still learning the skills needed to be a safe pedestrian. Without proper information, a flashing hand can confuse some child pedestrians and lead to running in the crosswalk in order to complete the crossing before the signal changes. Countdown signals help children make good decisions about whether or not to enter the crosswalk by displaying to them how much time they have left to cross the street.



Example of a countdown signal head

Leading Pedestrian Interval

A Leading Pedestrian Interval (LPI) is an option that can be added to a traffic signal. An LPI gives pedestrians a walk signal before the motorists get a green light, which makes pedestrians more visible to motorists and therefore makes motorists more likely to yield to them.

Pedestrian-Only Signals

One type of pedestrian-only signal is called a HAWK (High-intensity Activated crosswalk). It can be used at mid-block crossings with high pedestrian volumes or at intersections that do not already have a traffic signal. Pedestrians use a push button to activate the warning signal and motorists receive a flashing red light and then a solid red light. When the motorists have a solid red light, pedestrians then see a white "walk" symbol, letting them know they are allowed to cross the street. After pedestrians have finished crossing the street, motorists then

receive a blinking red light that lets them know that they may proceed when safe. The HAWK signal has been implemented in a number of cities and is soon to be included in federal guidelines for pedestrian traffic signals.

Loop Detectors/Video Detectors for Bicycles

Where a minor road crosses a major road at a signalized intersection, the light on the minor road will turn green when a vehicle is present, if proper detection has been installed. Often, the devices that detect vehicles (loop detectors or video detectors) don't detect smaller objects, like bicycles. These devices should be calibrated to detect bicyclists.

Loop detectors are in-pavement devices used at intersections that are actuated by the presence of a vehicle in the roadway to allow the vehicle to "trip" the signal and receive a green light. When a bicyclist stops over a properly calibrated loop detector, the detector uses a magnetic field to detect the metal frame of the bicycle and turns the signal green.

Video detectors are mounted on a traffic signal standard and can typically detect bicycles over a larger area, as compared to loop detectors. Video detectors, when positioned properly, will also turn the light green for a bicyclist.

Grade-Separated Crossings

Occasionally, it may be necessary to raise or lower a pedestrian crossing above or below the existing street level, using a pedestrian bridge or underpass. Due to their high costs, grade-separated crossings should only be considered when there are no alternative routes, such as at a freeway, major highway, rail line or waterway, and pedestrian/bicycle demand is high. Even in these cases, pedestrian-only grade-separated crossings should be built only after careful consideration. Those that require significant elevation change, such as to cross over a freeway, may be a challenge to construct due to ADA requirements for slopes and vehicle transitions. Ultimately, pedestrian facilities should be incorporated into existing and new vehicle crossings where feasible.

Crossing over a freeway

Traffic Calming

Traffic calming measures are "physical" improvements to roadways and/or intersections intended to enhance pedestrian and bicyclist safety by slowing vehicles through narrowing the roadway cross-section and/or horizontal deflection, and reducing cut-through traffic on local neighborhood streets.

Types of traffic calming include:

Medians and Pedestrian Refuge Islands

Medians and pedestrian refuge islands are located at an intersection or in the middle of a block. Medians are curbed areas in the center of the roadway that reduce the roadway width and reduce the speed of traffic. Pedestrian refuge islands are medians with a cut-out ("refuge") for pedestrians. Pedestrian refuge islands are often used with a marked crosswalk and are a minimum of four feet wide. They enhance pedestrian safety by creating a

curb-protected location in the middle of the street. This allows pedestrians to cross one lane of traffic at a time. These are best used on higher volume streets with high visibility crosswalks and signs.

Example of a Pedestrian Refuge Island

Curb Extensions/Bulb-outs

Curb extensions, often referred as bulb-outs, have many benefits for pedestrians. They force vehicles to slow down by narrowing the roadway cross section, shorten the street crossing distance for pedestrians, provide additional space at corners, allow pedestrians to see and be seen before entering the crosswalk, and simplify the placement of curb ramps.

Speed Tables and Speed Cushions

Speed tables and cushions slow vehicles by forcing them to go over a raised surface. Speed tables are longer and wider than jarring speed bumps found in locations like parking lots. They are generally used on lower volume streets and may not be permitted or advised on larger or higher-volume streets.

Chicanes

Chicanes are two curb extensions or roadside islands that create a serpentine path for autos. Street traffic must slow down in order to effectively maneuver around the in-street barriers. Chicanes are typically used on collectors and local streets near school sites.

Pinch Points

Pinch points are very similar to chicanes. Chicanes are offset curb extensions, while pinch points are paired curb extensions or roadside islands used create a single auto lane. Pinch points slow traffic by reducing the width of the street. Pinch points are appropriate for neighborhood streets.

Example of a Chicane

Traffic Circles

Traffic circles are in-street speed reduction devices used at intersections, typically in residential neighborhoods. They slow traffic because vehicles must "deflect" to go around them. Traffic circles can be used to visually enhance the street using plantings or public art.

Single Lane Roundabouts

Roundabouts can be used at intersections as an alternative to traffic signals, particularly if signal warrants are not met. They reduce the speed of traffic while maintaining traffic flow for all approaches. They also provide refuge islands making it easier for pedestrians to cross. They can be used on low and high traffic volume roads. Pedestrian safety is improved due to decreased vehicle speeds.

7.1.5 Enforcement Tools

Enforcement tools are aimed at ensuring compliance with traffic and parking laws in school zones. Enforcement activities help to reduce common poor driving behavior, such as speeding, failing to yield to pedestrians, turning illegally, parking illegally and other violations. Enforcement strategies, in conjunction with education efforts, are intended to clearly demonstrate what is expected of drivers of motor vehicles and to hold them accountable for the consequences of their actions. While most enforcement is the responsibility of police and other law enforcement, there are numerous complementary strategies that can be undertaken by school officials, crossing guards, parents and volunteers.

Students help with a Share the Road campaign

School Safety Patrols and Crossing Guards

School safety patrols are trained student volunteers responsible for enforcing drop-off and pick-up procedures. Student safety patrols may also assist with street crossing; they do not stop vehicular traffic, but rather look for openings and then direct students to cross. According to the National Safe Routes Clearinghouse, "student safety patrols... [increase] safety for students and traffic flow efficiency for parents. Having a student safety patrol program at a school requires approval by the school and a committed teacher or parent volunteer to coordinate the student trainings and patrols."

Crossing guards help students navigate busy roads near schools

Crossing guards are trained adults, paid or volunteer, who are legally empowered to stop traffic to assist students with crossing the street.

Crosswalk Sting

In a crosswalk sting operation, the local police department targets motorists who fail to yield to pedestrians in school crosswalks. A plain-clothes "decoy" police officer ventures into a crosswalk or crossing guard-monitored location, and motorists who do not yield are given a citation by a second officer stationed nearby. The police department or school district may alert the media to crosswalk stings to increase public awareness of the issue of crosswalk safety, and news cameras may accompany the police officers to report on the sting.

School Parking "Citations"

If parking problems exist at a school, such as parents leaving vehicles unattended in loading zones or "double-parking" on local streets, school staff may issue parking "citations" to educate parents about appropriate parking procedures. These "citations" are actually warnings designed to look like actual police tickets, intended to educate

parents about how parking in improper zones can create safety hazards or disrupt traffic flow for other parents during the pick-up/drop-off period.

Similarly, license plate numbers of offending vehicles can be recorded and sent to the local law enforcement agency, which then sends a letter to the registered vehicle owner informing them that the vehicle was observed violating a traffic law. Although not a formal citation, the letter explains that local residents are concerned about safety in school zones and encourages the motorist to obey all traffic laws.

Other informal enforcement programs include posting "cell free zone" signs in school zones during drop-off and pick-up, and sending drop-off and pick-up procedures home with students at the beginning of the year and after returning from school vacations.

Neighborhood Speed Watch

In areas where speeding problems have been identified by residents, a Neighborhood Speed Watch can be used to warn motorists that they are exceeding the speed limit. Local law enforcement can deploy radar speed feedback trailers that flash warning messages to drivers exceeding the speed limit.

Yard signs can also be incorporated into the speed watch program. Participating residents post signs stating that children live in the neighborhood and it is necessary to slow down for their safety.

Radar Speed Feedback Trailers

Radar speed feedback trailers can be used to reduce speeds and enforce speed limit violations in known speeding areas. In areas with speeding problems, police set up an unmanned trailer that displays the speed of approaching motorists along with a speed limit sign. The trailers can also be programmed to flash warning messages to drivers exceeding the speed limit (or a predetermined threshold).

Example of a radar speed feedback trailer

Radar speed feedback trailers can be used as both an educational and enforcement tool. By itself, the unmanned trailer serves as effective education to motorists about their current speed compared to the speed limit. As an alternative enforcement measure, the police department may choose to station an officer near the trailer to issue citations to motorists exceeding the speed limit. Because they can be easily moved, radar speed trailers are often deployed on streets where local residents have complained about speeding problems. If frequently left in the same location without officer presence, motorists may learn that speeding in that location will not result in a citation and the strategy can lose its benefits. For that reason, radar speed trailers should be moved frequently.

Radar Speed Feedback Sign

A permanent radar speed feedback sign can be used to display approaching vehicle speeds and speed limits on roadways near school sites. The unit is a fixed speed limit sign with a built-in radar display unit that operates similar to a radar trailer unit. Flashing beacons can be used in combination with the sign to provide additional warning to drivers. In order to maximize effectiveness, the flashing beacons should be set to only activate during peak school commute hours or when children may be present.

Roadways approaching the school site are the most appropriate location to display speeds, instead of streets along the school frontage that will likely have lower speeds due to pick-up/drop-off traffic.

Example of a permanent radar speed feedback sign

7.1.6 Evaluation

Evaluation of the Safe Routes to School program is important to understand the effectiveness of the program, identify improvements that are needed and ensure that the program can continue in the long-term. Evaluation can measure shifts in travel behavior, changes in attitudes toward biking and walking, awareness of the Safe Routes to School program, grant money received and projects completed.

School Site Audit

A school site audit, sometimes called a walking audit or walkabout, is an evaluation of the pedestrian and bicycling conditions around the school environment. Typically school site audits are conducted by a local school group or task force on foot, by walking the routes that the students use to get to school. A site audit may also be conducted on bicycle in order to better evaluate bicycling conditions.

The goal of a site audit is to document conditions that may discourage walking and bicycling to school, and to identify solutions to improve those conditions. The audit should involve an assessment of the built environment around a school (e.g., streets, sidewalks, pathways, crosswalks and intersections, bike routes, traffic controls), drop-off and pick-up operations (e.g. presence of designated loading areas), as well as behaviors of students, parents, and motorists that could contribute to hazardous conditions for bicyclists or pedestrians (e.g. speeding, jaywalking, failure to yield to pedestrians).

A School Site Audit checklist[8] form asks for detailed information related to: 1) Student Drop-Off and Pick-Up Areas; 2) Bus Loading Zones; 3) Sidewalks and Bicycle Routes; 4) Intersections and Crosswalks near the School Property; 5) Sight Distance; and 6) Traffic Signs and Signals, Speed Controls and Pavement Markings. The local school task force can use the School Site Audit checklist as a basis for conducting their walkabout.

Along with the checklist, an aerial map of the school area is helpful for the site audit. Aerial photos can be marked up with identified issues and suggested improvements.

Program Evaluation

There are many different education, encouragement, and enforcement programs that can be implemented in a school environment to help increase the number of students walking and biking to school. Not every program is the correct fit for every school. It is important to evaluate programs in the context of the school environment prior to deciding what would be a good choice for each school. Once the programs have been implemented it is necessary to evaluate what worked well and where improvements can be made. Below are some suggested steps for proceeding with the program evaluation process.

Program evaluation can be administered by following these steps:

[8] Sample School Site Audit checklist: http://www.walkinginfo.org/library/details.cfm?id=12

1. Survey local traffic conditions and issues (much of this information can be found from the school site audit),
2. Determine the goals of the program,
3. Identify methods to implement the programs,
4. Determine success benchmarks to evaluate the effectiveness of the program,
5. Interview program administrators (teachers, volunteers) and participants (students) to discuss what worked well and what did not.

Perform Annual Hand Tally and Parent Surveys

Since 2005, the Federal Safe Routes to School program has set aside federal funding to help states, cities, towns and schools increase the number of students walking and biking to school. One requirement of receiving this money is that schools must perform annual hand tally and parent surveys so that the national program can track the effectiveness of the various programs across the country.

The National Center for Safe Routes to School has developed a recommended methodology, survey and count forms and reporting forms[9]. A teacher administers the hand tally survey to the students in the classroom. The parent surveys are either mailed or sent home with students to give to parents or guardians.

7.1.7 Policies

The policies in this chapter focus on methods to ensure that vehicle traffic, busing and transit, and walking and bicycling to school is conducted in the safest and most efficient way possible. Many of the identified policies focus on vehicle pick-up and drop-off activities. Implementing policies can often be low cost, although they may involve a greater outlay of staff resources and new procudures may take time to gain acceptance.

Signs outside the school inform parents about pick-up and drop-off procedures

Parent Drop-off/Pick-up Operations

Creation of a parent drop-off/pick-up "loop" can help maximize capacity and safety and minimize delay in drop-off and pick-up operations. The loop can be either a dedicated lane just for pick-up/drop-off, or a portion of the larger parking lot that has been marked with cones to serve as the pick-up/drop-off loop. Having supervisors present can help to ensure that loading/unloading moves forward smoothly, efficiently and safely.

[9] National Center for Safe Routes to School recommended data collection methodology: http://www.saferoutesinfo.org/guide/evaluation/index.cfm

Valet Drop-off

Valet drop-off is a technique to improve traffic flow within the drop-off and pick-up loop by assisting students into and out of vehicles. A "valet" is present at the pick-up/drop-off area to open car doors and assist students into and out of arriving vehicles, improving traffic flow. The valet system eliminates the need for parents to get out of the vehicle to open the door for a child and remove bags or other items. The valet system is typically staffed by school staff or parent volunteers, who can quickly and efficiently move children into and out of vehicles and hold onto backpacks, umbrellas and other items. Some schools use older grade students as valets, for example 5th or 6th graders help younger students. However, student volunteers must get out of class early to prepare for pickup.

Students assist with the drop-off process

A supplement to the valet system is a nameplate in the vehicle window that identifies what student needs to be picked up. This allows the valet to find students and bring them to the vehicle as it arrives.

Platooning Drop-off/Pick-up System

In a platooning system, all vehicles are unloaded/loaded simultaneously, then proceed to the exit. If a vehicle unloads or loads more efficiently than the vehicle in front of it, the rear vehicle must wait for the lead vehicle to finish the unloading/loading, then follow it out of the loop. This tool is best used to control the parent inclination to always drop-off and pick-up the student directly in front of the school. Often additional curb loading is available downstream of the school and is severely underutilized, creating excess congestion and delay prior to entering the loop. At least two monitors are needed to effectively operate the vehicle platoon – one at the loop entrance to direct the maximum number of vehicles into the loop for a single cycle, and a second to ensure that the lead vehicle proceeds to the front-most loading stall.

Cones mark the dedicated bus zone

Dedicated Bus Zones

Establishing separate areas for vehicular and bus traffic can help improve traffic flows in the pick-up/drop-off area. Conflicts often occur when private vehicles and buses arrive at the same time and in the same location. Separating traffic often necessitates establishing an on-street bus zone, dedicated solely to buses. Private vehicles should not be allowed to load/unload in the bus zone. Bus zones need to be large enough to accommodate all the buses that might be parking there at one time. Sometimes it is possible to stagger the arrival times of the buses, thus requiring less space. The zones must be clearly marked and there should be adequate sidewalk space for students to wait for the bus.

Staggered Bell Times

Staggered bell times can help to disperse the traffic peak at schools with a large student population or when two or more schools are in close proximity to one another. For a single school application, students' start and end time

should be grouped by grade levels. The start times of these groups should be at least 15 minutes apart. This allows the vehicles from the first group to leave the school or be completely out of the area by the time the second group arrives. With multiple schools, staggering the bell times can be coordinated among two or more schools to ensure that significant levels of vehicles do not use competing transportation facilities simultaneously.

7.1.8 Detailed Implementation Example

Establishing a Walking School Bus

How does the Walking School Bus program work?

A walking school bus is a group of children walking to school with one or more adults. The "bus" follows the same route every time and picks up children from their homes at designated times.

Children like the Walking School Bus because it gives them active social time before the school day begins (or, as one participating child put it, "it's like recess before school!"). Adults like the walking school bus because they feel more comfortable with children walking when there are trained, trustworthy adult escorts. Teachers and principals like the walking school bus because it helps kids arrive ready to concentrate on school.

Pedestrian Safety Training (walking school bus)

How can we get started with a Walking School Bus?

Ideally, the program should run every day so families can count on it. However, it is possible to start small by selecting one or two days per week, and/or by targeting specific neighborhoods (e.g. a housing development close to the school) as a way to begin developing the program. You might even start with a special one-time walking school bus, such as for International Walk to School day in October.

A walking school bus can be an informal effort led by a few parents in one neighborhood. For a school-wide program, however, it is important to designate a coordinator. In some cases a dedicated volunteer coordinator can be successful, but it is highly recommended that this be a paid position to ensure consistency and reliability.

Some programs only travel "to school", because many children have after-school programs or go somewhere other than their home after school, or may not have a parent waiting for them at home.

One way to increase participation is to designate a "bus stop" where families who live far from the school can drop off children to join the bus. A park or community center (with parking facilities) is ideal for this purpose.

What planning needs to happen?

The school walking school bus coordinator should begin by assessing both resources (such as parent volunteers) and interest. A school-wide survey (paper and/or electronic) distributed to parents can help to identify interested households and volunteers. Sample survey:
http://www.dot.state.co.us/BikePed/WalkToSchool/Walk%20to%20School%20Survey.pdf

When interested households have been identified, the school coordinator should map out draft walking routes. Walking routes should be sited on streets with complete pedestrian facilities, prioritizing safe crossings and lower traffic speeds and volumes, as well as low-crime streets. Stops may either be at each child's house (which is more convenient for parents but may take longer) or at gathering points (e.g. one meeting place per block, as well as gathering spaces at parks). Finalized routes and stop locations should be mapped out for parent and volunteer reference.

Once routes have been developed and the number of children on each route has been determined, the coordinator should decide how many adults will be needed for each route. The US Center for Disease Control recommends one adult per three children for children ages 4 to 6 and one adult per six children for older elementary children ages 7 to 9.

Walking school bus organizers should work closely with the school district to address liability concerns. The school district risk management specialist should be able to figure out if the program can be covered under the existing liability coverage, and, if not, what options exist. Partnership with a third party (such as the PTA or the City) may also allow access to existing liability coverage. Parents should also sign permission slips and liability waivers (the exact language should be determined by the risk manager).

Who are the bus "drivers"?

Bus "drivers" (aka route leaders) are usually volunteers, but it is important to make sure that the volunteers are dedicated, responsible, and well-supported. Some communities have had outstanding success partnering with a local college or university, where volunteers are recruited at the beginning of the semester each year. While students do not receive payment, they do receive college credit, which can increase their commitment to the program. An active senior group may also be a good partner organization to find volunteers who are available during the day. Interested parents are also natural volunteers. It is also an option to pay route leaders a small stipend (as some crossing guard programs do).

The school coordinator should screen each potential volunteer through an interview and criminal background check. All route leaders must also attend a detailed training covering:

- The goals and outline of the walking school bus program
- Expectations for route leaders
- Traffic safety and group management techniques
- Emergency procedures (including injury protocol and what to do if a route leader cannot serve on a given day)
- Alternate school schedule and inclement weather policy
- What to do if a child is late or if a child's behavior is inappropriate
- Any tracking protocols that should be followed (such as a daily attendance worksheet)

The coordinator should also provide first aid kits and safety vests to each volunteer, along with the route map and parent contact information for each participating family.

What can kids and families expect?

Outreach begins two weeks after the start of school. Strategies to promote the program include:

- Sending home materials with other school orientation materials
- Reaching out to/through the PTAs
- Hosting a booth at back to school night
- Distributing newspaper/radio ads
- Creating an easy-to-use website where families can sign up online

Parents need to sign a permission slip, emergency contact form, and liability waiver for their child to participate in the program. Once families are signed up, the route leader (who has passed a criminal background check and received training) calls the family to introduce him- or herself. Parents get to know the ride leader, and they also know that if the bus gets canceled for any reason, or if there will be a substitute "driver," they will receive a prompt call from the school coordinator. Some routes, especially larger ones, are shared by several leaders.

Parents also receive an information packet containing the route map, their nearest stop, expectations for child behavior, protocol for if a child is late to a stop, what to do if their child will not attend on a given day, and alternate school schedule and inclement weather policy. They will also receive phone numbers for their route leader(s) and the school coordinator.

7.2 Other Education and Encouragement Programs

In addition to the City's Safe Routes to School Program, there are a variety of other programs the City should consider to educate and encourage bicycling.

Develop and Launch a Bicycle Safety Awareness Media Campaign	
Target audience	General public
Primary agency	City of National City
Potential partners	Regional bicycling groups, e.g., San Diego County Bicycle Coalition (SDCBC) ; Caltrans
Purpose	Increase awareness of bicycling; promote safety
Time frame	Late spring or early summer, or in conjunction with Bike to Work Day or back to school
Sample program	Sonoma County (CA) Transit: http://www.sctransit.com/bikesafe/bikes.htm

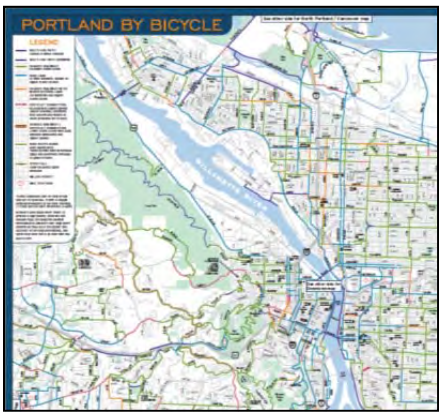
A marketing campaign that highlights bicyclist safety is an important part of creating awareness of bicycling in National City. This type of high-profile campaign is an effective way to reach the general public, highlight bicycling as a viable form of transportation, and reinforce safety for all road users. Two-thirds (66.7%) of respondents to the National City Bicycle Master Plan online survey responded that they were "very interested" in this type of program.

A well-produced safety campaign will be memorable and effective. One good example is the Sonoma County Transit "You've got a friend who bikes!" campaign. It combines compelling ads with an easy-to-use website focused at motorists, pedestrians and bicyclists. This type of campaign is particularly effective when kicked off in conjunction with other bicycling/walking events or back to school in the fall.

It is recommended that the City develop and launch a safety awareness campaign similar to Sonoma County Transit, with additional messages related specifically to safety and "sharing the road." The safety and awareness messages should be displayed near high-traffic corridors (e.g., using signs or banners), printed in local publications, and broadcast as radio and/or television ads.

Create Bicycle Maps	
Target audience	Current and potential bicyclists
Primary agency	City of National City
Potential partners	National City Chamber of Commerce, SDCBC, local bike shops
Purpose	Assist bicyclists in wayfinding by offering a map with clear symbols and graphics, destinations and services attractive for bicyclists, and a good selection of routes
Time frame	One-time, with regular updates; can happen at any time
Sample programs	Sample bike maps: ▪ Des Moines Regional Trails Map (online): http://www.dsmbikecollective.org/node/74/zoomify ▪ Des Moines Regional Trails Map (PDF): http://www.dsmbikecollective.org/dmbcfiles/maps/DM_Regional_Trails_Map.pdf ▪ Long Beach, CA: http://admin.longbeach.gov/civica/filebank/blobdload.asp?BlobID=27418

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



Among respondents to the National City Bicycle Master Plan, bike maps and guides were rated as the most desirable non-infrastructure bicycle program, with more than two-thirds (67.7%) of respondents reporting that they were "very interested." As the on- and off-street bikeway system is further developed, the City (possibly in collaboration with other local jurisdictions) should create an attractive and effective local bike map. The Bicycle Advisory Committee, once established, may be able to help identify and confirm commonly used routes in addition to priority bike routes.

Once a bike map is produced, the map should be made available online

and distributed to residents by mail, at local bike shops, and/or at community events such as those recommended here. The bike map can also be promoted through flyers in utility bills, city newsletters, and other community media outlets. The map should be updated every few years to incorporate new bikeways or other changes.

Develop a National City "Bike Central" Website	
Target audience	Current and potential bicyclists
Primary agency	City of National City
Potential partners	Regional and state bicycling groups, e.g. San Diego County Bicycle Coalition, California Bicycle Coalition
Purpose	Make bicycling information easier to find by providing resources, maps, safety information, events, group listings, and more in one central place.
Time frame	Ongoing
Sample programs	Bike Long Beach (CA) Website: http://www.bikelongbeach.org/

Many current and potential bicyclists do not know where to turn to find out about bicycling laws, events, maps, tips, and groups. The majority (57.6%) National City Bicycle Master Plan survey respondents reported being "very interested" in bicycling information websites, and another 14.7% said they were "interested." The City of National City should develop a "one-stop shopping" website with comprehensive bicycling information.

The National City "Bike Central" website should include:

- A list of all local and regional bicycling groups, including clubs, racing teams, and advocacy groups
- Information about the Bicycle Advisory Committee (including how to get involved, meeting times and dates, agendas and minutes)
- Information about current projects and how to get involved (e.g. public meetings, comment periods)
- Maps and other resources for National City and the region (links to online maps and brochures, project contacts, and how to request mailed materials)
- Links to laws and statutes relating to bicycling
- Bicycling tips and safety information
- Links to all relevant local jurisdictions and their bicycling contacts
- Information about bicycling events (rides, classes, volunteer opportunities)
- A list of local bike shops, including phone numbers and addresses

The website may also feature:

- Events calendar
- Request form for route planning assistance
- Message boards

- Blog featuring stories and news
- Photo galleries from events and submitted by readers
- Popular ride routes

A one-stop bike website will not be difficult to set up, but it will only be successful if the site is both easy to use and updated regularly. All website content should be reviewed regularly for accuracy. The bicycle community can assist in keeping the site up to date. The City should consider adding a standing agenda item for the Bicycle Advisory Committee to discuss the website in order to hear about new content that should be added or out-of-date content that should be updated or removed.

Youth Bike Safety Education	
Target	School-age children
Primary agency	City of National City/National School District
Potential partners	Parent groups at schools, community volunteers
Purpose	In-school and/or after-school on-bike skills and safety training
Time frame	Ongoing
Sample programs	LAB's Kids I and Kids II curriculum: http://www.bikeleague.org/programs/education/courses.php#kids1 BTA's Bike Safety Education Program: http://www.bta4bikes.org/resources/educational.php

Nearly every child in America can look forward to in-depth training before receiving a driver's license. Bicycles are also vehicles that are used on the roads, but most Americans do not receive any training about the rules of the road, how bicycles work, or how to ride a bicycle on the roadway. More than three-quarters (76.4%) of the Bicycle Master Plan survey respondents reported being interested in bicycling skills and safety courses for youth.

The City of National City should launch an on-bike education program for kids. Curriculum should cover:

- Parts of a bicycle
- How a bike works
- Flat fixing
- Rules of the road
- Right of way
- Road positioning
- On-bike skills lessons (braking, turning, steering)
- On-bike community ride

At the time that this program is planned, the City should decide whether to start a program from scratch or modify an existing program. Two excellent model programs are the League of American Bicyclists' Kids I and Kids

II classes, and the Bicycle Transportation Alliance's Bike Safety Education Program (see "sample program" links, above, for more information).

Adult Cycling Skills Education	
Target audience	Parents, schoolchildren, administrators, city planners & engineers
Primary agency	City of National City
Potential partners	Regional bicycling groups, e.g. SDCBC; local League Certified Instructors (LCIs)
Purpose	Educate adults on safe bicycling skills; encourage bicycling
Time frame	Flexible (one-time or on-going)
Sample programs	League of American Bicyclists skills courses: http://bikeleague.org/programs/education/courses.php

Most bicyclists learn to ride a bike when they are children, and do not have the opportunity to learn riding skills or safe road positioning. Adult bike skills training is an excellent way to improve both bicycling confidence and safety. Any training should include a significant on-bike section.

The League of American Bicyclists has developed a comprehensive bicycle skills curriculum that is considered the national standard for adults seeking to improve their on-bike skills. Various classes are offered, including basic and advanced on-road skills, and commuting (as well as driver education and youth courses). Local League Certified Instructors (LCIs) can be found on the League of American Bicyclists' website.

Launch Parties for New Bicycle Facilities	
Target audience	General public, particularly residents living near a newly-completed facility
Primary agency	City of National City
Potential partners	Regional bicycling groups, local bike shops
Purpose	Inform residents about new bicycle facilities to encourage use and promote awareness
Time frame	As new bikeways are built
Sample program	When a new bikeway is built, the City of Vancouver throws a neighborhood party to celebrate. Cake, t-shirts, media and festivities are provided and all neighbors are invited as well as city workers (engineers, construction staff, and planners) who worked on it.

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

information about bicycling (such as an increase in bicycling or walking mode share or user counts, Bicycle Friendly Community designation, etc.).

Host National Bike-to-Work Day/Week/Month Activities	
Target audience	Current and potential bicyclists
Primary agency	City of National City
Potential partners	SANDAG's iCommute program, SDCBC, National City Chamber of Commerce, local bike shops, large employers
Purpose	Encourage bicycling to work and other destinations by hosting group rides and events and offering incentives and rewards
Time frame	Annually in May
Sample programs	League of American Bicyclists: http://www.bikeleague.org/programs/bikemonth/ Bike Month NYC: http://bikemonthnyc.org/index.php

Bicycling to work (and to other destinations) is a great way to get exercise, save money, reduce pollution, and have fun. Cities and towns across the country participate in National Bike Month and Bike-to-Work Day/Week. The League of American Bicyclists (LAB) hosts a website for event organizers. The website contains information on nationwide and local events, an organizing handbook, and promotional materials.

It is recommended that the City work with SANDAG to begin Bike-to-Work Day/Week/Month activities in National City, with the support of regional bicycling groups, such as the San Diego County Bicycle Coalition, and local bike shops. These events and activities can target the US Naval Base, large employers, and the general public by providing information and incentives in easily accessible ways. These types of activities are likely to be popular among those who already commute by bike or are interested in giving bike commuting a try. More than 80% of Bicycle Master Plan survey respondents said they were interested in commuter incentive programs.

Possible activities to promote Bike-to-Work Week/Month/Day include:

- Bike to Work Day events: morning commute energizer stations with food, encouragement, information, and sponsored goodies for participants; rally or celebration with raffles, food, and vendors.
- Group rides to the business center with the mayor and/or local celebrities.
- Discounts at local businesses for bicycle commuters.
- Bike vs. Bus vs. Car challenge. This is a fun competition to determine which transportation mode arrives at the city center in the least amount of time.
- Commuter Challenge in which local companies

participate by recording the number of employees who bike to work over a given time period. The percentage of bicycle commuters are then compared between participating companies and recognition is awarded through press, trophies or plaques, and a final award party or event.

- Family or themed rides, such as a Mother's Day Ride or a ride to visit local parks or cultural destinations.
- Bike commuting workshops held by local groups or volunteers.

Establish a "Create a Commuter" Bike Program for Adults	
Target audience	Low-income residents
Primary agency	City of National City
Potential partners	Local bike groups, such as Kimberlee's Bikes for Kids; local resident groups
Purpose	Empower low-income residents to bicycle for transportation
Time frame	Ongoing
Sample program	Community Cycling Center "Create a Commuter" Program, Portland, OR: http://www.communitycyclingcenter.org/index.php/programs-for-adults/create-a-commuter/

National City has a very successful bike giveaway program for children, Kimberlee's Bikes for Kids, but does not have a similar program for adults. A "Create a Commuter" program provides basic bicycle safety education and fully-outfitted commuter bicycles to low-income or other adults striving to connect to work, workforce development, or other daily needs by bicycle.

Bicycles can be donated by members of the community and refurbished with volunteer or local group support. Participants are outfitted with everything a bicycle commuter would need including fenders, front and rear lights, locks, pumps, patch kits, tools, and racks.

The program can work with local social service agencies or service providers to identify candidates. Candidates should complete a half-day bicycle safety education and commuting basics course before receiving their bicycle.

The course should cover the following topics:

- Mechanical skills
- Safety checks
- Parts identification
- Cleaning and basic maintenance
- Safe riding skills and making safe decisions on the road
- Laws and rules of the road
- Helmet fitting
- Group riding skills
- Map reading
- Hand signals

Host Bike Programs for US Naval Personnel/Staff and their Families	
Target audience	US Naval Personnel, Staff, and Families
Primary agency	City of National City
Potential partners	US Navy housing and service groups, regional bicycling groups
Purpose	Encourage Naval personnel, staff, and families to bicycle for transportation and recreation; provide bicycling education for military and civilians
Time frame	One-time or ongoing, particularly as new personnel, staff, and families move to National City

Bicycling programs targeted toward US Naval personnel, staff, and families residing in National City can encourage these individuals and families to choose bicycling for transportation and recreation. The programs can provide important bicycling information, such as maps or safety guidelines, or access to bicycles through giveaways or loan programs. The City should work with the appropriate agencies or groups to reach this population.

Activities may include:

- Bicycle skills/safety course for children and adults
- Summer bike camps for children and stay-at-home parents
- Distribution of bicycling maps, brochures, and incentives to homes
- Basic bike maintenance workshops
- Group rides or other community bicycling events
- Information about transporting children or cargo
- Bicycle safety checks, helmet giveaways, bike giveaways or loaner program

Hold a Summer Streets Car-Free Street Event	
Target audience	General public
Primary agency	City of National City
Potential partners	Local and regional bicycling groups, e.g. SDCBC; local volunteers
Purpose	Encourage walking and biking by providing a car-free street event
Time frame	Generally in the summer and on a Sunday; can be a one time event, annual, or multiple times per year
Sample programs	New York City Summer Streets: http://www.nyc.gov/html/dot/summerstreets/html/home/home.shtml http://www.streetsblog.org/2008/08/11/streetfilms-summer-streets-2008/ (video) Portland Sunday Parkways: http://www.portlandonline.com/Transportation/index.cfm?c=46103 http://www.streetfilms.org/portlands-sunday-parkways/ (video)

These programs have many names: Summer Streets, Sunday Parkways, Ciclovias, or Sunday Streets. Summer Streets are periodic street closures (usually on Sundays) that create a temporary park that is open to the public for walking, bicycling, dancing, hula hooping, roller skating, etc. They have been very successful internationally and

are rapidly becoming popular in the United States. They promote health by creating a safe and attractive space for physical activity and social contact, and are cost-effective compared to the cost of building new parks for the same purpose. These events can be seasonal (i.e., once a month in the summer, annual, or one-time events), and are generally very popular and well-attended. Summer Streets events often include guided rides and walks with themes, such as walks for seniors, women's or family rides, or bike rides with the Mayor/City Council.

7.2.1 Bicycle Sharing Program

Public bike sharing systems are comprehensive mobility systems that use a fleet of bicycles and stations spread over an area to provide inexpensive and accessible transportation to urban communities. They have been described as a "system of individual public transport" and are well-suited to short trips, typically three miles or less. Bike sharing systems are energy efficient and zero emission as well as quick and cost-effective to implement as compared to other transportation infrastructure. They can operate alone or to extend the reach of mass transit systems.

Montreal's bike share system, which debuted in 2009, features 2,400 bicycles at 300 stations throughout the city.

Bike share programs can provide safe and convenient access to bicycles for short trips, transit-work trips, and/or tourist trips. The international community has experimented with bike share programs for nearly 40 years. Until recently, bike share programs worldwide have experienced low to moderate success because of theft and vandalism. In the last five years, innovations in technology that cause increased accountability have given rise to a new generation of technology-driven bike share programs. These new bike share programs can dramatically increase the visibility of cycling and lower barriers to use by requiring only that the user have a desire to bike and a smart card, credit card or cell phone.

This section contains an overview of bike share systems and summarizes key elements necessary for success.

Benefits of Bike Share Systems

Bike share programs, such as systems in Montreal, Minneapolis, Melbourne, Barcelona, Paris and Lyon, help increase bicycling mode share, complete gaps in the public transit system, reduce a city's travel-related carbon footprint and provide additional 'green' jobs related to system management and maintenance. In the United States, new bicycle share programs were implemented in 2010 in Denver, CO (http://www.denverbikesharing.org/), Minneapolis, MN (https://www.niceridemn.org/) and Washington, DC (http://www.capitalbikeshare.com/). Several other cities, including San Francisco, CA, Boston, MA and New York City, NY are planning to implement bicycle share programs within the next year, while countless other cities are considering bicycle share programs.

Transportation Carbon Intensity Reduction

Public bike systems reduce carbon intensity by reducing the number of automobile trips. This is achieved through a direct replacement of automobile trips with bicycling trips as well as by extending the reach of the transit system to make it more attractive than travelling by car. European cities with public bike systems have recorded up to a 10% direct replacement of automobile trips as well as an increase in transit ridership. Given that North

American cities utilize automobiles for a much higher percentage of short-distance trips than European cities there is potential for even higher automobile trip reduction.

Unlike many other transportation demand management (TDM) measures that reduce automobile trip-making, there is actually a net increase in the number of trips made with a public bike system in place. Because they are essentially zero-emission, this is achieved without any additional contribution to CO_2 or other greenhouse gas emissions.

Urban Mobility Spectrum[10]

Bicycle sharing provides an effective substitute for short distance trips made by automobiles in urban areas (i.e., trips less than three miles). This represents a large share of all trip-making. Short-distance automobile trips:

- Make up much of the congestion on urban arterials,
- Contribute disproportionately to urban emissions (see below),
- Contribute to automobile crashes.

Short-distance automobile trips represent the most carbon-intense portion of the drive cycle. In fact, cold starts are believed to generate approximately 60% more CO_2 emissions than warm starts and even more than general driving. Short distance trips tend to occur in congested areas with high concentrations of traffic control, which require idling and low-speed operation – both of which have a more pronounced effect on emissions than un-congested driving conditions.

Bike share systems are not perfect. Poor design, inadequate supply of bicycles and a lack of maintenance are among the potential pitfalls faced when building and implementing a bike share system.

Public bike systems are holistic mobility solutions that provide environmental, economic, and social benefits. Their potential to reduce carbon intensity by shifting automobile trips to other modes is just one of many benefits. See summary in **Table 7-1.**

Table 7-1: Benefits of Bike Sharing Systems

Category	Benefit	Description
Mobility	Trip Distance	Fills the gap between trips too long for walking but not long enough to justify waiting for transit (1-5 kilometers)
	Travel Option	Provides a low-cost, accessible system to encourage personal mobility
	Increased Mobility	Encourages trips that would not have otherwise been taken with no additional transportation infrastructure (e.g., approximately 3% of bike share trips in Lyon would not have otherwise been made)
	Transit Integration	Improves transportation options for the first and last leg of a transit trip, therefore extending the reach of the transit system
		Increases transit ridership and diversifies service options meaning more and varied service can be offered by transit
	Congestion / Travel Time	Travel time on the bicycle network is more reliable than driving (congestion effects) or transit (schedule)

[10] Adapted from Call-a-Bike Factsheet on website: http://www.callabikeinteraktiv.de/kundenbuchung. February 2008.

Category	Benefit	Description
Energy / Environment	Emissions	Replaces auto trips (likely more than 10%) with zero emission mode of travel
	Station Design	Employs solar technology, etc.
	Resource Sharing	Average of 20 registered users per bike
		Number of subscribers / population
Economic	Implementation	Quick and cost-effective to implement compared to other modes (e.g. new transit line, road widening, etc.)
	Job Creation	Creates "green" jobs – short-term during implementation and long-term during operation
	Local Business	Increased business for local retail
Society	Health	Bicycling improves individual health resulting in reduced health care costs
	Cost to Individual	Purchase, storage and maintenance of bicycles is borne by system operator
		Cost-effective compared to transit and automobile
	Behavioral Change	Encourages wider behavior change and increased use of bicycles in general. Positive effects on allocation of road space, improved bicyclist safety (in numbers)

Key Elements of Bike Share Systems

Bike Fleet

Fleet bikes should be distinctive, designed for easy city use, and clearly branded to increase their visibility. Bikes typically come with full fenders, chain guards and, in some cases, a locking mechanism attached to the bike's frame. In most systems, bikes come equipped with a Radio Frequency Identification (RFID) tag, used to locate the bike within the system. This function is typically used in fleet management, utilization analysis, and identification of lost or stolen bikes.

Fleet bikes, such as those used in the Deutsche Bahn Call-a-Bike system, should be easily distinguishable.

Parking and Locking Mechanisms

Bikes lock to either a rack or kiosk where users collect and drop bikes using a smart card or credit card. Card-access systems are found throughout the world. These systems are generally simple to operate, making them accessible to the general public.

Kiosks should be secure, intuitive, and well-lit, and should display information about costs and registration. The kiosks should denote availability of bikes through indications of status (typically red or green light). Most systems can show availability of bikes online or on a mobile device. They should also provide a map of other nearby stations and directions on bike check-out and return methods.

The Melbourne bike share program can be accessed with a credit card.

Station Design, User Interface and Check-in/Check-out Protocols

All bike share programs require a user interface to collect and retrieve bicycles through a check-in/check-out system. The interface should be simple and easy to understand (e.g., give instructions and diagrams and offer multiple languages). Stations should provide clear instructions on how to access and return a bicycle. Other recommended elements include:

- Cost and pricing information
- Contact information to report damaged bikes or stations
- Maps of nearby stations and recommended bicycle routes
- Damage-resistant locking mechanisms
- Quick access to avoid queues and maximize safety

The best systems will offer multiple options to register and pay for bike check out (e.g., smart card or credit card). Programs using a smart card system generally do not provide users with a lock. If users have registered for the service with a credit card, they can simply swipe the appropriate card and go. Many systems also allow the user to have short term (daily or weekly) access to the system at station locations.

Check-in/check-out procedures at a card-access kiosk. Instructions are available in several languages.

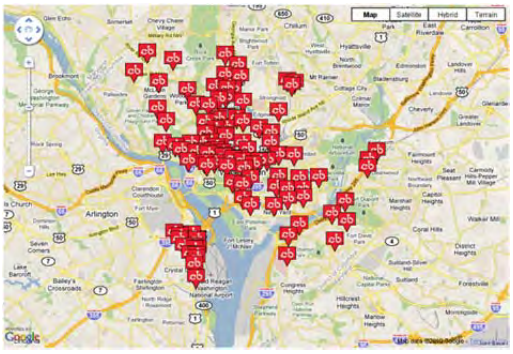
Station Networks

Station networks should be designed with regard to anticipated users and trip types. For example, some systems in the Netherlands target rail commuters who need a bike to get from the rail station to work. In Paris, stations are placed to create a citywide network with stations available about every 300 - 500 meters. A good station network will:

- Place bikes at easily-found, high-traffic locations
- Connect to public transit stops and stations
- Serve the needs of recreation and utilitarian trips
- Appeal to the targeted population by placing stations near desirable destinations
- Include sufficient stalls at each station to exceed anticipated demand under normal conditions
- Take terrain into consideration (most cyclists prefer to avoid hilly terrain when possible)
- Have stations placed within a reasonable travel distance of each other (difficulty created by inconvenient rental/return locations could contribute to underutilization of the system)

Newer "fourth generation" systems are taking advantage of solar and wireless technology to provide flexibility for adjusting the number and location of stations (as well as making station siting and installation easier and more cost-effective).

The map above shows station locations in a small portion of Paris. The map below shows all the stations in Washington D.C. In Paris, the stations are placed evenly throughout the city; in D.C the stations are placed near transit stations and key travel destinations.



Maintenance and Management

A key aspect of any bike share program is system and fleet maintenance and management. These activities can help keep the bike share system in top operating order and provide sufficient bikes to accommodate normal demand.

Status Information System

A status information system will allow operators to:

- Track bike status (e.g., track a bike's location and whether it is in or out of service)
- Track bike location and usage history
- Track station usage
- Track each user's usage statistics and billing information

The bike system status information allows system operators to track management, develop and refine bike redistribution strategies, track maintenance, and perform other critical system activities. Some systems may also handle billing and subscription related activities.

Bicycle Redistribution Mechanism

Users need a high level of confidence that a bicycle will be available at the station of their choice and that a return dock will be available when they are done with the bike. User patterns do not evenly redistribute bikes – stations at the base of a hill will end up with more bikes than ones at the top of a hill, for example, and transit stations may run out of bikes during early morning commute hours, while the evening hours will likely see the opposite result: a lack of empty parking spots to return bikes.

Maintenance and management are a key part of bike share systems, as in this photo of bike redistribution from Barcelona.

In order to meet user expectations and keep the system balanced, bicycles will have to be redistributed from one station to another from time to time. Past performance of systems in Lyon and Paris indicates that many locations experience peak times of use when a rack will be either completely full or completely empty, making the check-out or return of bikes impossible. Information about bicycle demand should be gathered through Radio Frequency Identification (RFID) tags and any other means used to track bicycle locations. GPS units are not widely used yet, but large-scale deployment is anticipated over the next one to two years. Redistribution may require attention throughout the day as activity patterns shift. Areas likely to require redistribution include:

- Transit stations
- Large employment centers
- Colleges and universities
- Stations located at the top or bottom of large hills (e.g., people may decide to walk or take transit up the hill rather than take the bike)

Fleet and Station Maintenance

Bike fleet maintenance includes common activities such as filling tires with air and tuning up bike gears. Station maintenance may include repairing electronic or communication components, cleaning stations from soil and graffiti and replacing damaged touch screens. Bikes and stations not kept in good repair can create safety and liability issues.

Most 3rd generation systems, including Paris, Montreal, and Minneapolis (Minnesota), have sophisticated backend systems so that operators can monitor required bike and station maintenance in real time. Others systems, such as the Bycyklen stations in Copenhagen, have little to no automation and require regular inspection to ensure that stations and bicycles remain in good repair.

Bike fleets and stations will require both scheduled (preventative) maintenance and as-needed maintenance as issues arise. A bike share program should include a plan for fleet and station maintenance. Suggested plan elements include:

- A method for users to report bike damage, necessary repairs or vandalism
- A schedule for regular station inspection and/or maintenance
- A clearly identified party or group in charge of fleet or system maintenance
- A funding source or identified method to pay for scheduled and as-needed maintenance required to keep bicycles and stations in working order

Cost, Funding and Operational Models

Costs associated with bike share systems fall into four categories:

- Direct capital costs (e.g., bikes and terminals)
- Direct operating costs (e.g., administration, maintenance, and electricity to power terminals)
- Associated capital costs (e.g., streetscape improvements)
- Associated operating costs (e.g., the existing bikeway network, bicycle maintenance, bicycle redistribution, insurance costs)

The bike share system in Montreal is partially owned by the City and managed by Bixi.

It is common for a government agency to undertake operation of a bike share system with an operating partner, as most bike share systems are not financially self-sustaining. Funding for public bike share commonly comes through a combination of advertisements, user fees, and public government funds, and many systems operate as a public-private partnership. As an example, the Bixi system in Montreal is partially owned by the City and managed entirely by Bixi.

Earlier European bike share systems were developed by outdoor advertising companies such as JC Decaux and Clear Channel Communications. In Paris, advertiser JC Decaux funds the entire system and relies upon revenue from billboard space (granted to the company by the city) and bike rentals to pay the bills. If advertising rights are included as part of the partnership agreement, the region should consider what type of proposals are acceptable, including limitations on content, ad placement, and duration of advertising rights. Municipal codes and provincial

laws sometimes place restrictions on where advertising may occur, which could impact the use of this funding mechanism.

This funding model is not being adopted in North America. In fact, Washington DC recently replaced its 100-bike DC Smartbike system operated by Clear Channel Communications, with a publicly funded system that is ten times as large, called Capital Bikeshare. It is widely felt among cities that such a model better incentivizes the operator for good performance and allows for greater accountability to the municipalities.

Most North American cities are now funding start-up and operating costs with a combination of public funding, sponsorship, and user fees. Different sponsorship models for bike share systems are developing every day, with examples from London (25 million pounds for naming rights by Barclays Bank), Toronto (unknown amount of funds by ING Bank), and Minneapolis (one million USD for bike fender sponsorship by Blue Cross Blue Shield insurance company). More models and pricing examples for sponsorship will surely develop even within the next year, as we are just at the beginning of a completely new market.

There are not yet enough data to accurately project when bike share systems will become financially self-sustaining from user fees alone. Early projections indicate a time frame of approximately three years.

System costs vary widely based on program scope and size. The start-up and launch costs for most third generation systems are approximately $5,000 per bike for the whole system, and operating costs are approximately $2,000 per year per bike.

Lessons Learned

The history of bike share programs in the United States and Europe provides an understanding of lessons learned and barriers overcome by technology.

First and Second Generation Bike Share Systems

First-generation bike share programs began in 1968 in Amsterdam and subsequently spread to other cities throughout the world. Program organizers assembled a fleet of bikes and gave them a distinguishing feature, such as painting them white. Bikes were left around the city in key locations for free use. Theft and poor organization were the key reasons given for program failure in many first-generation bicycle programs.

The coin deposit required by the Bycyklen system does not always provide enough incentive for the user to return the rented bike.

Second-generation systems attempted to minimize theft and increase organization by modifying bikes to require a minimal check-out deposit payable at designated bike pick-up/drop-off stations. Like first-generation systems, bikes were still painted or otherwise branded to ensure that each vehicle was recognized as part of the bike share system. Bikes were also equipped or retrofitted with a locking mechanism that allowed them to be checked out and returned. An example of this system is the Copenhagen Bycyklen, founded in 1995, which required a coin deposit to release the bicycle for use. However, the return of the required deposit does not always present the user with enough incentive to return the bike, and theft remains a common problem. It was estimated that 300 bikes (about 15% of the Bycyklen fleet) were lost to theft in 1996.

The primary problem in historic systems is that users do not feel a sufficient sense of accountability, which results in:

- Little or no reason for borrowers to return bicycles to designated locations
- Bicycles in poor condition due to lack of user regard
- Bicycle theft
- Bicycles in poor condition due to lack of maintenance
- Inadequate or no funding to maintain or advertise the system

Characteristics of Successful Technology-Driven Bike Share Programs

Third and Fourth Generation Bike Share System

The third generation of bike share systems is characterized by credit card transactions and RFID chips. These crucial technology upgrades allow user identification and a security deposit to ensure accountability towards theft and vandalism.

The so-called "fourth generation" has been coined to characterize modular systems that do not require excavation because they use solar power and wireless communication, as opposed to hardwired installation. This system was pioneered by the Montreal Bixi system. The system is actually completely taken in for the winter. Even with this technology available, some cities, such as London, have chosen to utilize a hardwired system.

Match the Bike Share System to Key Target Groups and Existing Conditions

Systems experiencing higher levels of success have identified key target groups and tailored their bike share programs accordingly.

Many practitioners mention that bike share systems targeted at the general population work best in moderate to large cities with a minimum population of about 200,000 people. Other case studies have shown that smaller cities have achieved success with systems targeted at a specific population demographic, such as rail commuters. Other bike share programs have targeted university students or employees of one or more large companies. Smart Card systems may be appropriate in areas where local users will be able to pick up and return bikes at different locations within the city.

The Velib system in Paris launched with a large fleet of 10,000 bicycles at 750 stations.

Initial Bike Roll-out

Case studies suggest that a system must have enough critical mass at roll-out to attract users to the system. For example, the Paris program began operation with nearly half its fleet (10,000 bikes at 750 stations). Spring or summer is an ideal time to roll-out a bike share system, as it reduces weather-related barriers to bicycle travel. Starting a bike share program in conjunction with another event will help draw attention to the program.

Provide a Mechanism for Bike Redistribution

It is important for users to be able to rely on the availability of a bike to rent and to find space for a return. Bike redistribution is likely to be most necessary at particular stations, related to travel patterns. Over time, usage

trends can be identified and a bike redistribution mechanism developed to help balance the locations of high demand and availability. In addition, the number and location of docking stations can be adjusted to better meet real-life demand patterns.

Price Bicycle Rental Affordably

Pricing rental on a graduated scale will encourage prompt return of bicycles and reinforce the idea of user accountability. The Montreal Bixi system is free for the first half-hour, and then charges about 1.50 CAD for the second half hour, $3.00 for the third half hour, and $6.00 for the fourth half hour and each additional half hour.

Allowing free rental for the first thirty minutes encourages users to try the system. In Paris and Lyon, this policy has resulted in about 95% of rides being free. A system run by advertiser JC Decaux in Brussels is considered to have poor ridership, in part due to a lack of free service. Even in the now-defunct Washington DC Smartbike system, which gave users 3 hours free, the average trip time was less than 30 minutes. Graduated pricing is also used so as not to compete with private bicycle hire businesses.

Ensure User Accountability

Most successful systems ensure user accountability by providing an incentive to return the bike and treat it well during use. Systems enforce a varying amount of accountability. In systems that require a user to register prior to use, the system operator can bill users for bicycle damages or unreturned bikes. Pre-registration presents a barrier to spontaneous use, however, and will usually rule out use by tourists.

In some programs rental time is restricted to a maximum (typically three hours). If a bicycle is not returned within the allotted window, the user (identified by their check-out code) is fined a set amount, or simply charged for the cost of the bike. This system can be frustrating to users unless stations are frequent and easy-to-find.

The least stringent accountability system is associated with the Copenhagen Bycyklen system. Users receive their coin deposit back, but have very little incentive to return the bike to a designated location.

Create a System Optimized for the Average Bicycle Trip Length

Cities such as Montreal, Paris, and Lyon have been very successful in creating systems where bicycles serve as a major source of public transit within the core downtown area, aimed at trips under five kilometers and lasting fewer than 30 minutes. As the first half hour of bike rental is free in these systems, users are provided with an incentive to use the system for short trips. As users become accustomed to using the bikes, they may begin to use them for longer trips.

By locating stations at major public transit hubs, bike share systems can become part of the greater transit system.

Extension of Public Transit System

To function as an effective part of the public transit system, bike share programs should conform to the same standards as other modes for dependability, affordability, and convenience. Recommendations and system characteristics that will help to ensure success include:

- Frequently spaced, convenient stations that take terrain and other environmental factors into account
- Bikes that are consistently and readily available at transit transfer points (e.g., train stations and other transit hubs) to ensure a reliable linkage between other modes of public transit and the bike share system

- Bikes available at key trip start and end points in the downtown area (sports stadiums, train stations, major employment centers, and parks)
- A bike redistribution system to ensure availability of bikes at all station locations
- Unlimited hours of service or hours of service that match those of local transit providers
- Rental window of a suitable duration to allow bicycle use for utilitarian trips (e.g., permitting two or three hour rentals facilitates using a bicycle for a trip to a meeting across town or to the grocery store)

7.3 Other Enforcement and Evaluation Programs and Policies

As previously discussed, the City's Safe Routes to School (SRTS) Program includes enforcement and evaluation techniques. In addition to the SRTS program, this section discusses other programs and policies that will help develop more bicycling opportunities in National City.

Convene a Permanent Bicycle Advisory Committee	
Target audience	Citizen advocates
Primary agency	City of National City
Potential partners	Regional bicycling groups, such as San Diego County Bicycle Coalition (SDCBC)
Purpose	Advise City on bicycling issues
Time frame	Ongoing
Sample program	Beaver Creek, OH: http://ci.beavercreek.oh.us/boards-commissions/bikeway-advisory/

Many states, regional agencies, and cities have an official Bicycle Advisory Committee made of citizen volunteers, appointed by City Council or the appropriate body, to advise on bicycling issues. An advisory committee establishes the City's commitment to making bicycling safer and more desirable and has the potential to assist the City in getting funding for bicycle-related projects.

The Bicycle Advisory Committee (BAC) should be composed of representatives from all bicycle stakeholder groups. The role of the BAC should include some or all of the following:

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

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

Develop and Adopt a Complete Streets Policy	
Target audience	City of National City planners and engineers
Primary agency	City of National City
Potential partners	Caltrans, SANDAG, regional transportation and health advocacy groups
Purpose	Adopt policy language that creates streets for all users, including drivers, walkers, bicyclists, and transit riders
Time frame	One-time; can happen at any time
Sample programs	Sample policies and real-life examples: http://www.completestreets.org/

Local governments adopt Complete Streets policies in order to direct transportation planners and engineers to consistently design roadways with all users in mind (e.g., motorists, transit riders, pedestrians, bicyclists, older people, children, and people with disabilities). Once a policy is in place, training is recommended for professionals whose work will be affected by the policy (e.g., planners and engineers).

Guidance from the Complete Streets Coalition:

The Principle:

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

Elements of a Good Complete Streets Policy:

- Specifies that 'all users' includes pedestrians, bicyclists, transit vehicles and users, and motorists, of all ages and abilities.
- Aims to create a comprehensive, integrated, connected network.
- Recognizes the need for flexibility: that all streets are different and user needs will be balanced.
- Applies to both new and retrofit projects, including design, planning, maintenance, and operations, for the entire right-of-way.
- Makes any exceptions specific and sets a clear procedure that requires high-level approval of exceptions.
- Directs the use of the latest and best design standards.
- Directs that complete streets solutions fit within the context of the community.
- Establishes performance standards with measurable outcomes.

Perform Annual Bicycle Counts	
Target audience	N/A
Primary agency	City of National City
Potential partners	Regional bicycling groups, local volunteers
Purpose	Track bicycling trends and measure success of the Bicycle Master Plan implementation
Time frame	Annually
Model program	National Bicycle & Pedestrian Documentation Project: http://bikepeddocumentation.org/

Many jurisdictions do not perform regular bicycle counts. As a result, they do not have a mechanism for tracking bicycling trends over time, or for evaluating the impact of projects, policies, and programs.

It is recommended that the City of National City perform and/or coordinate annual counts of bicyclists (and ideally pedestrians, as well) on both on- and off-street facilities according to national practices. The National Bicycle and Pedestrian Documentation Project has developed a recommended methodology, survey and count forms, and reporting forms. This approach may be modified to serve the needs and interests of individual jurisdictions.

The City should manage tracking, analysis, and reporting. Counts can be done manually by staff/volunteers or using video or a variety of other technologies.

Coordinate Enforcement Actions	
Target audience	Motorists and bicyclists
Primary agency	City of National City law enforcement
Potential partners	Caltrans
Purpose	Deter unsafe behaviors by motorists and bicyclists by enforcing traffic laws
Time frame	Can be ongoing or concentrated into short “stings” or campaigns

Enforcement actions can include motor vehicle speed enforcement, radar speed feedback sign deployment, bicycle light enforcement, crosswalk enforcement, and other actions.

Speeding vehicles put bicyclists and pedestrians at risk and discourage non-motorized transportation. Targeted speed enforcement activities can address these issues. Law enforcement agencies can enforce speed limits on designated bikeways, near schools, and in response to resident complaints. These campaigns are ideal for a Safe Routes to School Program. A radar speed feedback sign request program will deploy radar speed feedback trailer units at the request of neighborhood associations and schools. The trailer units can be deployed temporarily, supplemented by radar enforcement, and then moved to another location.

8. Costs and Funding

8.1 Network Costs

The cost of the proposed network, not including the early action projects, is just over $3.1 Million. This is based on preliminary cost estimates for the top four projects and a planning level analysis based on average regional costs for the rest of the proposed network. Class II Bike Lanes and Class III Bike Routes which only require signage and striping/pavements markings are more affordable to implement. **Table 8-1** shows unit costs for each class of bikeway. **Table 8-2** shows the priority level and cost for each segment.

Table 8-1: Unit Costs by Classification

Facility	Cost per Mile
Class 1 – Bike Path	$2,640,000
Class 2 – Bike Lane	$30,000
Class 3 – Bike Route	$15,000

Source: San Diego Regional Bicycle Plan (SANDAG, 2010)

Table 8-2: Priority and Cost by Segment

Priority Level	Street	From	To	Class	Miles	Total Estimated Cost
Tier 1	Marina Way	Bay Marina Drive	32nd Street	1	0.5	$342,700*
Tier 1	4th Street	Roosevelt Avenue	Harbison Avenue	2	2.0	$680,800*
Tier 1	18th Street	Wilson Avenue	Euclid Avenue	2 and 3	1.8	$461,150*
Tier 1	D Avenue	Division Street	0.2 miles south of 30th Street	2 and 3	2.1	$1,101,700*
Tier 1	Highland Avenue	30th Street	Chula Vista City Limit	2 and 3	0.5	$13,500
Tier 2	Hoover Avenue/33rd Street/National City Boulevard	Mile of Cars Way	Chula Vista City Limit	2	1.2	$36,000
Tier 2	30th Street/Sweetwater Road	Hoover Avenue	Plaza Bonita Center Way	2 and 3	2.9	$76,500
Tier 2	Cleveland Avenue	Civic Center Drive	Bay Marina Drive	2	0.7	$21,000
Tier 2	Roosevelt Avenue/Plaza Boulevard/Coolidge Avenue (N)/Hoover Avenue (S)	Main Street	Civic Center Drive	2	1.1	$30,000
Tier 2	Harbor Drive	8th Street	Civic Center Drive	2	0.3	$9,000
Tier 2	2nd Avenue	Sweetwater Road	Chula Vista City Limit	2 and 3	0.3	$6,000

Priority Level	Street	From	To	Class	Miles	Total Estimated Cost
Tier 2	Palm Avenue/22nd Street/Roselawn Street	4th Street	L Avenue	3	1.4	$21,000
Tier 2	16th Street	L Avenue	Earle Drive	3	1.2	$18,000
Tier 2	8th Avenue	Harbor Drive	San Diego City Limit	2 and 3	3.2	$61,500
Tier 3	Euclid Avenue	San Diego City Limit	Sweetwater Road	2	2.3	$69,000
Tier 3	Civic Center Drive/Roosevelt Avenue/12th Street	Tidelands Avenue	D Avenue	2 and 3	0.9	$22,500
Tier 3	Wilson Avenue	Civic Center Drive	Mile of Cars Way	2 and 3	0.7	$19,500
Tier 3	Harbison Avenue/Earle Drive	4th Street	16th Street	3	0.8	$12,000
Tier 3	22nd Street/Prospect Street/Grove Street	Euclid Avenue	Sweetwater Road	3	1.0	$15,000
Tier 3	22nd Street	Wilson Avenue	D Avenue	2 and 3	0.6	$13,500
Tier 3	Grove Street	12th Street	22nd Street	3	0.7	$10,500
Tier 3	Bay Marina Drive/Mile of Cars Way/24th Street	Tidelands Avenue	L Avenue	2 and 3	1.5	$28,500
Tier 3	L Avenue	16th Street	30th Street	3	0.9	$13,500
Tier 3	18th Street/Granger Avenue/24th Street	Euclid Avenue (N)	Euclid Avenue (S)	3	1.0	$15,000
Tier 3	Newell Street	18th Street	Grove Street	3	0.5	$7,500
				Total		**$3,105,350**

**Project includes other enhancements; see detailed project sheets in section 5.4*

8.2 Funding Sources

There are a variety of potential funding sources including local, state, regional and federal funding programs as well as private sector funding that can be used to construct the proposed improvements. Most of the federal, state and regional programs are competitive and involve the completion of extensive applications with clear documentation of the project need, costs and benefits. In regard to funding opportunities, the following should be noted:

- Funding sources are highly competitive, with many agencies competing for the same "pots" of money.
- Funding is limited; capital funding needs far outweigh available funding every year.
- Applying for funding is a time-consuming and staff-intensive process.
- Collaboration and partnerships with local agencies and community groups is key.

Table 8-3 summarizes available funding sources and identifies eligibility requirements for each. The following

discussion is provided to assist National City staff in identifying appropriate sources of funding for the projects recommended in this plan.

8.3 Federally-Administered Funding

The primary federal source of surface transportation funding—a portion of which can be used to fund bicycle and pedestrian facilities—is SAFETEA-LU, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users. SAFETEA-LU is the fourth iteration of the transportation vision established by Congress in 1991 with the Intermodal Surface Transportation Efficiency Act. Also known as the federal transportation bill, the $286.5 billion SAFETEA-LU bill was passed in 2005 and authorizes Federal surface transportation programs until 2009. Congress is expected to approve a new transportation bill in 2011.

SAFETEA-LU funding is administered through the state (Caltrans and the State Resources Agency) and regional planning agencies. Most, but not all, of these funding programs are oriented toward transportation versus recreation, with an emphasis on reducing auto trips and providing inter-modal connections. SAFETEA programs require a local match up to 20 percent. SAFETEA funding is intended for capital improvements and safety and education programs relate to the surface transportation system.

To be eligible for Federal transportation funds, states are required to develop a State Transportation Improvement Program (STIP) and update it at least every four years. A STIP is a multi-year capital improvement program of transportation projects, and serves to coordinate transportation-related capital improvements of Metropolitan Planning Organizations (MPOs) such as SANDAG, and states.

In California, the STIP includes projects on and off the State Highway System and is funded with revenues from the Transportation Investment Fund and other funding sources. The California STIP is typically updated every two years. To be included in the STIP, projects must be included in the Interregional Transportation Improvement Plan (ITIP), prepared by Caltrans or the Regional Transportation Improvement Plans (RTIPs), prepared by MPOs and regional agencies. Bicycle and pedestrian projects are eligible for inclusion.

The following programs are administered by the Federal government.

Transportation, Community and System Preservation Program

The Transportation, Community and System Preservation (TCSP) Program provides federal funding for transit oriented development, traffic calming and other projects that improve the efficiency of the transportation system, reduce the impact on the environment, and provide efficient access to jobs, services and trade centers. The program provides communities with the resources to explore the integration of their transportation system with community preservation and environmental activities. TCSP Program funds require a 20 percent match. Congress appropriated $204 million to this program in Fiscal Year 2009. Funding has been extended under a continuing resolution for Fiscal Year 2010.

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

Rivers, Trails and Conservation Assistance Program

The Rivers, Trails and Conservation Assistance Program (RTCA) is a National Parks Service program which provides technical assistance via direct staff involvement, to establish and restore greenways, rivers, trails, watersheds and open space. The RTCA program provides only for planning assistance—there are no implementation monies available. Projects are prioritized for assistance based upon criteria which include

conserving significant community resources, fostering cooperation between agencies, serving a large number of users, encouraging public involvement in planning and implementation, and focusing on lasting accomplishments.

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

Federal Safe Routes to School Program

Authorized under Section 1404 of SAFETEA-LU, the Safe Routes to School (SRTS) Program came into effect in August 2005. SRTS funds both infrastructure and non-infrastructure projects within 2 miles of K-8 schools. Consistent with other federal-aid programs Caltrans is responsible for the development and implementation of grant funds made available to the state through this program. Expected outcomes of the program include

- Increased bicycle, pedestrian, and traffic safety around schools;
- More children walking and bicycling to and from schools;
- Decreased traffic congestion around schools;
- Reduced childhood obesity;
- Improved air quality, community safety and security, and community involvement;
- Improved partnerships among schools, local agencies, parents, community groups and non-profit organizations.

Program funds can be used for construction or for education, encouragement, enforcement and evaluation activities. Although federal SRTS funding is set to expire soon, reauthorization is likely. State funding is also available.

8.4 State-Administered Funding

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

Bicycle Transportation Account

The Bicycle Transportation Account (BTA) provides state funding for local projects that improve the safety and convenience of bicycling for transportation. Because of its focus on transportation, BTA projects, including trails, must provide a transportation link. Funds are available for both planning and construction. Caltrans administers BTA funds, requiring eligible cities and counties to adopt a Bicycle Transportation Master Plan. City Bicycle Transportation Plans must be approved by the local MPO prior to Caltrans approval. Out of $7.2 million available statewide for FY 11/12, the maximum amount available for individual projects is $1.8 million.

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

California Safe Routes to School (SR2S) Program

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

The State of California SR2S Program expires December 21, 2012, requires a 10 percent local match, is eligible to cities and counties, and targets children in grades K-12. The fund is primarily for construction, but up to 10 percent of the program funds can be used for education, encouragement, enforcement and evaluation activities.

Cycle 9 provides $24.25 million statewide for FY 10/11, with a maximum of $450,000 available for individual projects.

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

Congestion Mitigation and Air Quality Improvement Program

Congestion Mitigation and Air Quality Improvement Program (CMAQ) funds are directed to transportation projects and programs that contribute to the attainment or maintenance of National Ambient Air Quality Standards in non-attainment or air quality maintenance areas for ozone, carbon monoxide, or particulate matter under provisions in the Federal Clean Air Act. Caltrans administers CMAQ funds, which may be used for bicycle and pedestrian projects and programs. Approximately $1.7 billion is available nationwide per year. SANDAG administers the program for the San Diego region, which received $31.3 million in project funding for FY 2010.

Online resource: http://www.dot.ca.gov/hq/transprog/federal/cmaq/cmaq_fy1014.pdf

Recreational Trails Program

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

- Maintenance and restoration of existing trails;
- Purchase and lease of trail construction and maintenance equipment;
- Construction of new trails, including unpaved trails;
- Acquisition of easements or property for trails;
- State administrative costs related to this program (limited to seven percent of a State's funds); and
- Operation of educational programs to promote safety and environmental protection related to trails (limited to five percent of a State's funds).

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

California Conservation Corps

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

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

Transportation Planning Grant Program

The Transportation Planning Grant Program, administered by Caltrans, provides two grants that can be used to construct and plan bicycle and pedestrian facilities.

The Community-Based Transportation Planning Grant funds projects that exemplify livable community concepts, including bicycle and pedestrian improvement projects. Eligible applicants include local governments, MPOs and RPTAs. A 20 percent local match is required and projects must demonstrate a transportation component or

objective. There is $3 million available annually statewide with a maximum grant award of $300,000 per individual projects.

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

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

Petroleum Violation Escrow Account (PVEA)

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

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

8.5 Regional Agency-Administered Funding

Regional bicycle and pedestrian grant programs come from a variety of sources, including SAFETEA-LU, the State budget and vehicle registration fees. The San Diego Association of Governments (SANDAG) is the Regional Transportation Planning Agency (RTPA) for the San Diego region. It is also in charge of housing allocations and maintaining federally mandated air quality standards, both of which influence and are influenced by bicycling. As the RTPA, SANDAG administers funding for bicycle facilities and programs.

Regional Surface Transportation Program

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

Online resource: http://www.sandag.org/index.asp?classid=13&fuseaction=home.classhome

TransNet

In 1987, San Diego County voters approved a one half-cent sales tax for transportation funding, including bicycle facilities. In November 2004, voters extended this sales tax through 2048. The local sales tax extension will generate approximately $14 billion for transportation improvements for the tax duration. As a requirement of the sales tax ordinance, SANDAG allocates a minimum of one million dollars per year for regional bicycle facilities. For FY 2011, SANDAG has allocated just over four million dollars for bicycle facilities.

Transportation Development Act

The Transportation Development Act (TDA) provides a one quarter-cent State sales tax for public transit and non-motorized transportation projects. SANDAG Board of Directors allocates TDA funds to local agencies. Of the allocated amount, local agencies may use five percent to supplement funding from other sources for bicycle safety education programs. Funded bicycle facilities must serve commuting bicyclists (i.e. access employment centers, commercial areas and transit). Agencies may also use TDA funds for the development of comprehensive bicycle plans.

TransNet/TDA Bicycle, Pedestrian and Neighborhood Safety Grant Program

The TransNet/TDA Bicycle, Pedestrian and Neighborhood Safety Grant Program derives its funding from two percent of the TransNet regional sales tax revenue, projected to be just over four million dollars for FY 2011. SANDAG Board of Directors allocates this funding to local agencies via a competitive process on an annual basis.

Online resource: http://www.sandag.org/index.asp?projectid=354&fuseaction=projects.detail

8.6 Local Agency-Administered and Non-Traditional Funding Sources

Community Development Block Grants

The Community Development Block Grants (CDBG) program provides money for projects that support low and moderate income residents. Federal CDBG grantees may "use CDBG funds for activities that include (but are not limited to): acquiring real property; reconstructing or rehabilitating housing and other property; building public facilities and improvements, such as streets, sidewalks, community and senior citizen centers and recreational facilities, paying for planning and administrative expenses, such as costs related to developing a consolidated Plan and managing CDBG funds; provide public services for youths, seniors, or the disabled; and initiatives such as neighborhood watch programs." California received a $42.8 million allocation for all CDBG programs in FY 2010. The maximum grant amount is $800,000 for up to two eligible projects or $400,000 for a public service program.

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

Assessment Districts

Local government entities can form an assessment district to fund the construction and maintenance of public facilities, including bicycle facilities. The process begins with property owners who want an improvement signing a petition. The proposed district includes all property owners who will benefit from the proposed improvement. A public hearing is held, and if a majority of property owners approve, the assessment district is established. Once the assessment district is approved, property owners within the assessment district are levied a special assessment in proportion to the share of the benefit they receive from the improvement.

Business Improvement Districts

Business improvement districts (BIDs) are public/private partnerships used to promote individual business districts through a variety of means, including the construction and maintenance of streetscape improvements, paths, and bicycle facilities. A city, county or joint powers authority can establish a BID and levy annual assessments on businesses within its boundaries. To establish a BID, a public hearing must be held, and a majority of businesses must agree to the BID. In forming a BID, the boundaries and the improvements and activities to be financed are established.

Developer Fees, Exactions and Impact Fees

With the increasing support for "routine accommodation" and "complete streets," requirements for new development to contribute towards the expansion of transportation facilities, provides opportunities to efficiently construct pedestrian and bicycle facilities. If a significant nexus to justify the improvements exists, local governments can require such improvements as a condition of project approval.

Chapter 4.52 of the City of National City Municipal Code sets forth Transportation Development Impact Fee requirements by land use.

Online resource: http://library2.municode.com/default-test/home.htm?infobase=16516&doc_action=whatsnew

Mello-Roos Community Facilities Act

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

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

Volunteer and Public-Private Partnerships

Local schools or community groups could maintain bikeways as a project for the year, possibly working with a local designer or engineer. A challenge grant program with local businesses may be a source of local funding, where corporations 'adopt' a bikeway and help construct and maintain the facility.

Table 8-3: Funding Sources

Grant Source	Due Date	Fund Source(s)	Annual Total	Matching Require-ment	Eligible Applicants	Eligible Bikeway Projects			Comments
						Commute	Recrea-tion	Planning/ Education	
Federally-Administered Funding									
Transportation, Community and System Preservation (TCSP) Program	--	FHWA	$204 m nation-wide	20%	state, local, MPOs	--	--	X	Projects that improve system efficiency, reduce, environmental impacts of transportation, etc. Contact K. Sue Kiser, Regional FHWA office, (916) 498-5009
Rivers, Trails and Conservation Assistance (RTCA) Program	--	NPS	--	--	Governments, communities	X	X	--	RTCA staff provides technical assistance to communities to conserve rivers, preserve open space, and develop trails and greenways. Contact NPS at (202) 354-6900.
Federal Safe Routes to School (SRTS) Program	Early 2011	Caltrans	$46 m	--	state, city, county, MPOs, RTPAs and other organizations that partner with one of the above	X	--	X	Construction, education, encouragement and enforcement program to encourage walking and bicycling to school. Contact Caltrans District 11 Transportation Planning and Local Assistance office at (619) 688-6699.

Grant Source	Due Date	Fund Source(s)	Annual Total	Matching Require-ment	Eligible Applicants	Eligible Bikeway Projects			Comments
						Commute	Recrea-tion	Planning/ Education	
State-Administered Funding									
Bicycle Transportation Account (BTA)	March 2011	Caltrans	$7.2 m	min. 10% local match on construction	city, county	X	--	X	State-funded. Projects that improve safety and convenience for bicycle commuters. Contact Ken McGuire, Caltrans, (916) 653-2750
California Safe Routes to School (SR2S) Program	June-July	Caltrans	$24 m	10%	city, county	X	X	X	Primarily construction program to enhance safety of pedestrian and bicycle facilities. Contact Caltrans District 11, (619) 688-6699
Congestion Mitigation and Air Quality (CMAQ) Program	NA	San Diego County, Caltrans	$31.3 m	None	Local and state governments within federally certified jurisdictions	X	--	--	Only air quality nonattainment and maintenance areas for ozone, carbon monoxide and certain PM-10 projects are eligible.
Recreational Trails Program (RTP)	Oct. 1	State DPR	$1.3 m	12% match	jurisdictions, special districts, non profits with management responsibilities over the land	--	X	--	For recreational trails to benefit bicyclists, pedestrians, and other users; contact State Dept. of Parks & Rec. , Statewide Trails Coordinator, (916) 653-8803
California Conservation Corps (CCC)	On-going	California Conservation Corps	Labor	None	Federal and state agencies, city, county, school district, NPO, private industry	X	X	--	Contact the Corps at (916) 341-3100.

Grant Source	Due Date	Fund Source(s)	Annual Total	Matching Require-ment	Eligible Applicants	Eligible Bikeway Projects			Comments
						Commute	Recrea-tion	Planning/ Education	
Community Based Transportation Planning Grant Program	March 30th	Caltrans	$4.5 m	20% local	MPO, RPTA, city, county	X	--	--	Projects that exemplify livable community concepts. Contact Leigh Levine, Caltrans, (916) 651-6012
Petroleum Violation Escrow Account (PVEA)	On-going	Caltrans	$0.5 m	--	city, county, transit operators	X	X	--	Bicycle and trail facilities have been funded with this program. Contact Caltrans Federal Resource Office, (916) 654-7287
Funding Administered by Regional Agencies									
Regional Surface Transportation Program (RSTP)	varies by RPTA	San Diego County, Caltrans	$320 m	11.47% non-federal match	cities, counties, transit operators, Caltrans, and MPOs	X	X	--	RSTP funds may be exchanged for local funds for non-federally certified local agencies; local match may not be required if project improves safety. Contact Cathy Gomes, Caltrans, (916) 654-3271.
Funding Administered by Local Agencies									
Transportation Development Act (TDA) Article 3 (2% of total TDAs for Bikeway projects)	January	SANDAG	Per capita	None	City, county, joint powers agency	X	--	--	Projects must be included in either a detailed circulation element or plan included in a general plan or an adopted comprehensive bikeway plan and must be ready to implement within the next fiscal year.

Grant Source	Due Date	Fund Source(s)	Annual Total	Matching Require-ment	Eligible Applicants	Eligible Bikeway Projects			Comments
						Commute	Recrea-tion	Planning/ Education	
TransNet/TDA	--	SANDAG	$4 m	None	City, county	X		--	Funds must be for bicycle facilities serving commuters. Contact Chris Kluth, SANDAG at (619) 699-1952
Non-Traditional Funding Sources									
Community Development Block Grants (CDBG)	February	U.S. Dept. of Housing and Urban Development (HUD)	--	None	City, county	X	X	--	Funds local community development activities such as affordable housing, anti-poverty programs, and infrastructure development.
Assessment Districts	--	City, county, joint powers authority	--	--	Neighborhoods, communities	X	X	X	Only those who benefit from the improvement may be taxed. Taxes should be tied to the amount of benefit received.
Business Improvement Districts	--	City, county, joint powers authority	--	--	City, county, joint powers authority, private industry	X	X	--	A public-private partnership in which businesses in a defined area pay an additional tax or fee in order to fund improvements within the district's boundaries.
Developer Fees or Exactions (developer fee for street improvements - DFSI); Impact Fees	--	City, county	--	--	--	X	X	--	Mitigation required during land use approval process

Grant Source	Due Date	Fund Source(s)	Annual Total	Matching Require-ment	Eligible Applicants	Eligible Bikeway Projects			Comments
						Commute	Recrea-tion	Planning/ Education	
Mello-Roos Community Facilities Act	--	City, county, special district, school district, joint powers authority	--	--	city, county, special district, school district, joint powers of authority	X	X	X	Property owners within the district are responsible for paying back the bonds.
Volunteer and Public-Private Partnerships	--	--	--	--	Public agency, private industry, schools, community groups	X	X	X	Community-based initiative to implement improvements.

Appendix A: Field Review Notes

3920 Conde Street, Suite B
San Diego, CA 92110
619-269-5982
www.altaplanning.com

TO: Stephen Manganiello, City of National City

FROM: Sam Corbett, Alta Planning + Design

DATE: May 21, 2010

RE: National City Bicycle Master Plan Field Review Notes

The following are field notes recorded during the first field review of potential bikeways in National City completed on May 12, 2010.

- D Avenue is 48' wide curb-to-curb between 7th Street and 8th Street with parallel parking on both sides of the street. The roadway appears to have relatively low traffic volumes and low on-street parking utilization mid-day on a weekday. The roadway width, conditions, and location suggests that D Avenue is a good candidate for bike lanes.

D Avenue between 7th Street and 8th Street

- 4th Street is 47' wide curb-to-curb between D Avenue and E Avenue, 48' wide between K Avenue and L Avenue, and 64' wide between Palm Avenue and O Avenue. The roadway widths could accommodate bike lanes along the corridor without impacting existing parallel parking. With 64' curb-to-curb width between Palm Avenue and O Avenue, there is sufficient room for bicycle facilities and traffic calming enhancements. Curb extensions on the T Avenue/4th Street and U Avenue/4th Street intersections are feasible without impacting bike lanes.

4th Street at T Avenue

- A partially paved path exists adjacent to the public water spigot on 4th Avenue. The path is primarily dirt and vegetation encroaches on the majority of the path. Although not a City-designated or maintained path, it appears to be highly utilized and serves as a north-south connection between 4th Street and Division Street and provides access to El Toyon Park from the west.

- Palm Avenue is 39' wide curb-to-curb between 4th and 6th Street, 40' wide curb-to-curb south of Plaza Boulevard, and 38' wide curb-to-curb south of 18th Street. Palm Avenue terminates adjacent to Las Palmas Park. Due to the widths of the roadway, on-street parking would need to be removed to accommodate bike lanes. Class III bike route is an option for Palm Avenue however sharrows and other possible improvements should be considered to enhance the Class III facility.

- N Avenue is 39' wide curb-to-curb

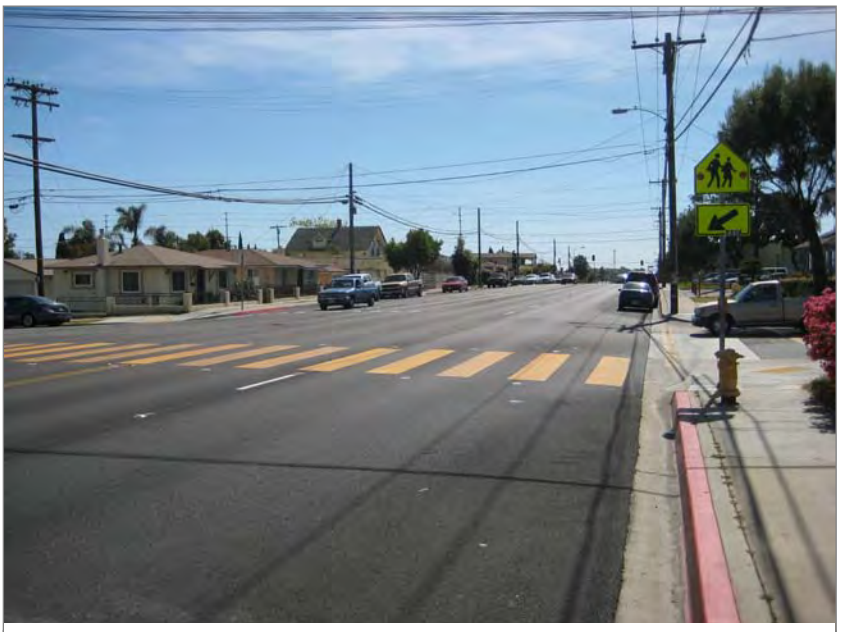
Path off of 4th Street

Palm Avenue South of 18th Street

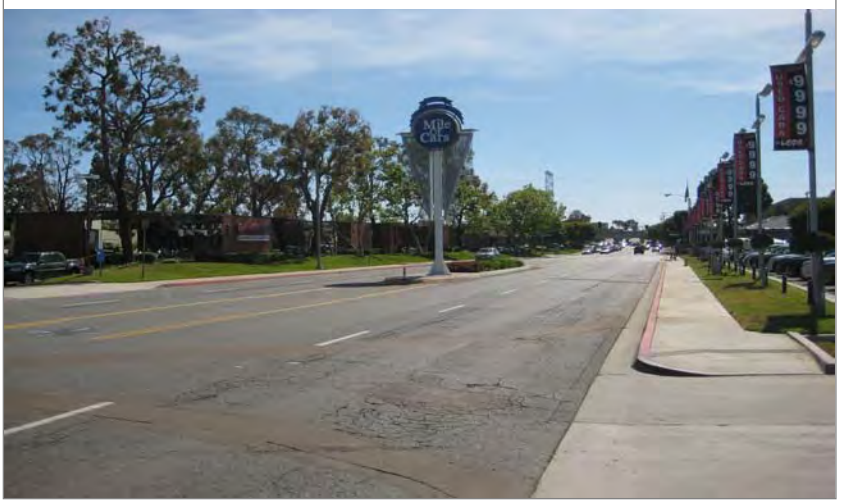
Palm Avenue at Las Palmas Park

N Avenue

- 24th Street is 44' wide curb-to-curb east of Highland Avenue and 64' wide curb-to-curb west of Highland Avenue. In addition to greater width, 24th Street west of Highland Avenue seems to experience higher traffic volumes. It has four travel lanes and parallel parking on both sides of the roadway. Traveling westbound it becomes increasingly auto-oriented and changes names to Mile of Cars Way at National City Boulevard. Mile of Cars Way extends west to I-5 where the road changes names again to Bay Marina Dr. There is existing bike lane on Bay Marina Dr between Cleveland Avenue and the railroad tracks. Bike lanes are under construction along Cleveland Avenue. Bay Marina Dr is 64' wide curb-to-curb west of Marina Way providing ample room to incorporate bike lanes to connect the Bayshore Bikeway with a potential Class I bike path along Marina Way. The complex I-5 freeway interchange at Bay Marina Way to the east of Marina Way is a consideration when determining if bike lanes on Bay Marina Dr between Marina Way and the Bayshore Bikeway are desirable. There is concern with providing a facility that terminates near a difficult location that cyclists may need to cross to leave or access the bicycle facility. Bicycle attracting land uses reside on the east side of the freeway, such as the 24th Street trolley station. Caltrans' plans for the improvement of the I-5 interchange on Bay Marina Dr/Mile of Cars Way include Class II bike lanes on Bay Marina Dr from Cleveland Ave to the I-5 northbound on/off ramps, which will improve bicycle access and safety through this area.



24th Street just west of Highland Avenue



Mile of Cars Way

3920 Conde Street, Suite B
San Diego, CA 92110
619-269-6043
www.altaplanning.com

TO: Stephen Manganiello, City of National City

FROM: Sam Corbett, Alta Planning + Design

DATE: June 4, 2010

RE: National City Bicycle Master Plan Field Review Notes

The following are field notes recorded during the second field review of potential bikeways in National City completed on May 25, 2010. **Figure 1-1** displays the roadways field-checked for bikeway potential.

D Avenue

- D Avenue is 47' - 48' wide curb-to-curb between E. 30th Street and Ornell Drive with parallel parking on both sides of the street and relatively low parking utilization during mid-day on a weekday. Sweetwater Union High School parallels D Avenue between E. 26th Street and E. 30th Street. D Avenue dead-ends just prior to SR-54, which represents a constraint to connecting a future D Avenue bikeway with the Sweetwater River Bikeway.

D Avenue just north of E. 30th Street

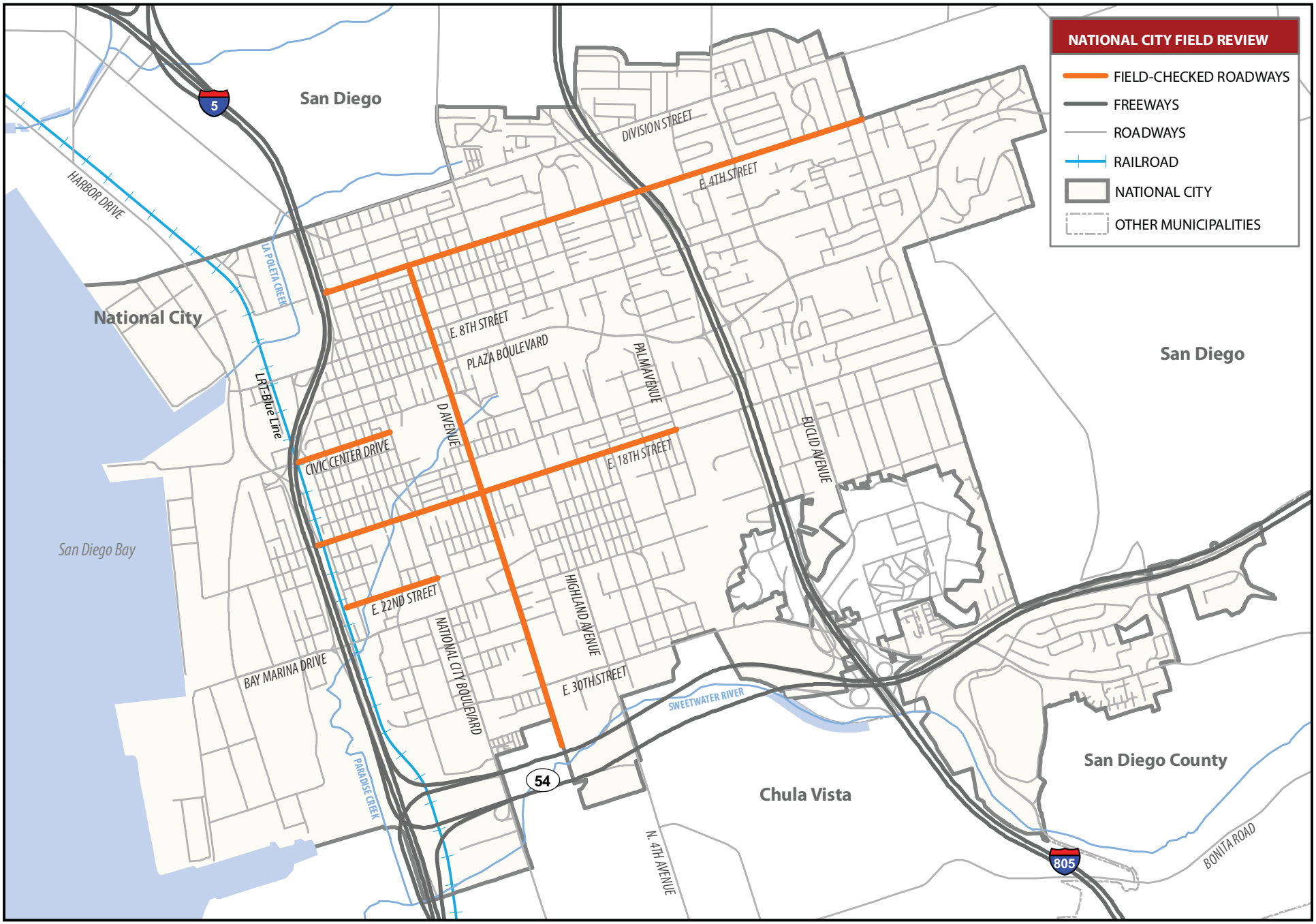
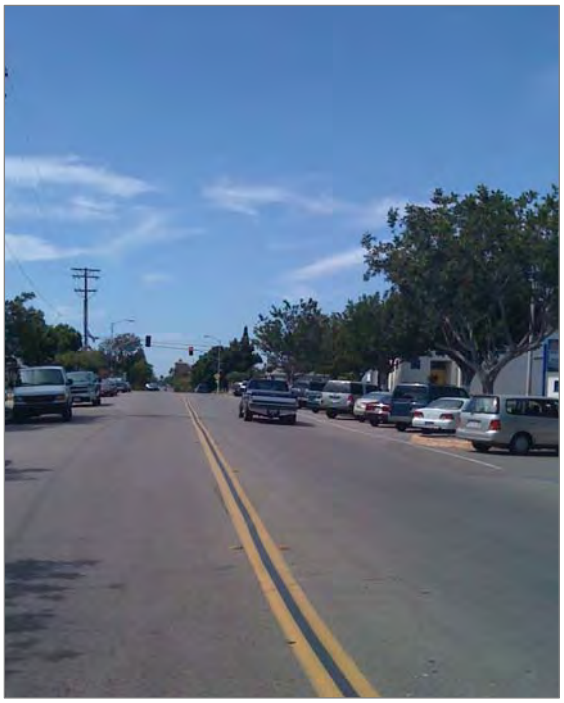


Figure 1-1: Roadways Field-Checked for Bikeway Potential

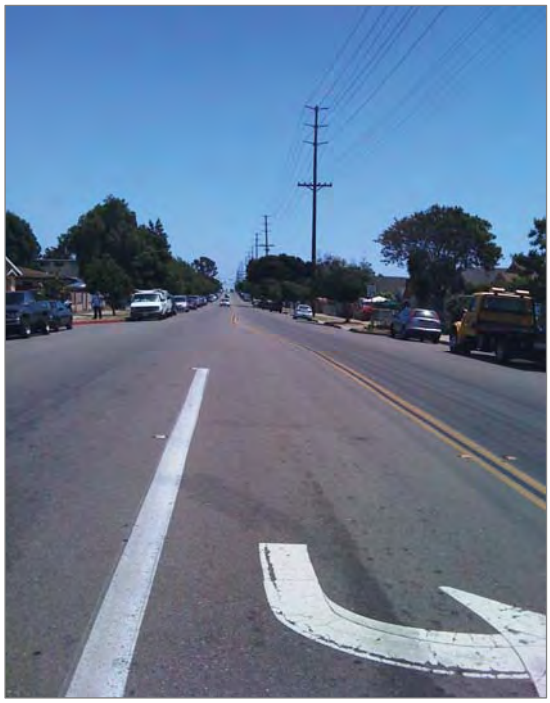
City of National City
Bicycle Master Plan
Source: SANDAG; SanGIS; Alta Planning + Design
Author: Bridget Enderle
Date: 6/3/10

0 0.25 0.5 Miles

- D Avenue at its intersection with E. 22nd Street is also 47' wide curb-to-curb however it widens to 63' wide just south of the D Avenue/E. 18th Street intersection.



D Avenue where adjacent to National City Middle School



D Avenue where it widens at the D Avenue/E. 18th Street Intersection

- D Avenue north of E. 18th Street is 62' wide curb-to-curb with parallel parking on the west side of the street and diagonal parking on the east side of the street beginning at the southern border of National City Middle School and ending at the D Avenue/E. 16th Street intersection.

- D Avenue reduces to 47' wide curb-to-curb between Plaza Boulevard and E. 16th Street.

- D Avenue is 48' wide curb-to-curb between 7th Street and 8th Street with parallel parking on both sides of the street. The roadway appears to have relatively low traffic volumes and low on-street parking utilization mid-day on a weekday. The roadway width, conditions, and location suggests that D Avenue is a good candidate for bike lanes.

Recommendation: Install Class II bikeway (bike lanes) along D Avenue from E. 4th Street to E. 30th Street except for the segment between E. 16th and E. 18th Streets where Class III (bike route) with sharrows are recommended due to diagonal parking on the east side of the street.

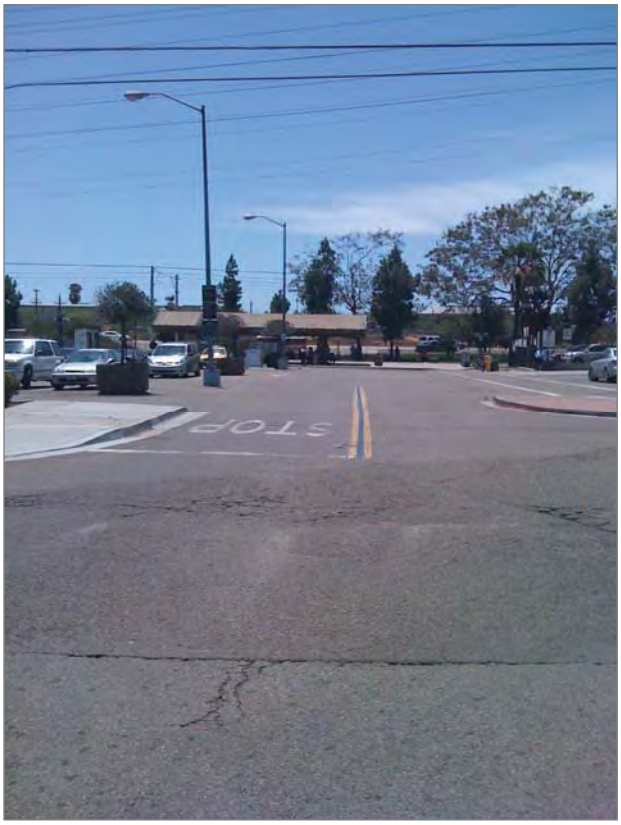
<u>E. 22nd Street</u>

- E. 22nd Street provides access to the north end of the 24th Street Trolley Station. It is 51' wide curb-to-curb east of Wilson Avenue. This segment of E. 22nd Street may serve as a good route alternative to Mile of Cars Way due to its lower traffic volumes and lower on-street parking activity.

- E. 22nd Street reduces in width to 46' wide curb-to-curb west of National City Boulevard.

- Crossing National City Boulevard is difficult for bicyclists traveling along E. 22nd Street even during non-peak hours due to high traffic volumes along National City Boulevard, presence of on-street parking which blocks line of sight, and the lack of signalization at the National City Boulevard/E. 22nd Street intersection.

E. 22nd Street east of Wilson Avenue



E. 22nd Street access to the 24th Street MTS Trolley Station

- E. 22nd Street is 39' wide curb-to-curb with high on-street parking utilization between National City Boulevard and D Avenue.

Recommendation: Consider installing bike lanes along E. 22nd Street between the 24th Street Trolley Station and National City Boulevard and bike route with sharrows between National City Boulevard and D Avenue to connect the potential E. 22nd Street and D Avenue bike facilities. Identify potential crossing treatments at the National City Boulevard/E. 22nd Street intersection.

E. 22nd Street east of National City Boulevard

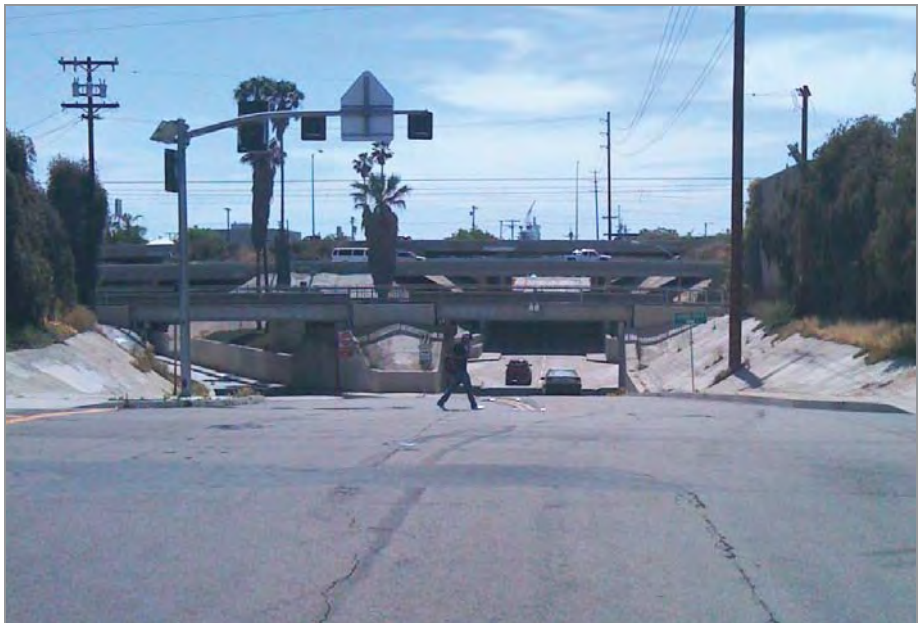
<u>E. 18th Street</u>

- An I-5 off-ramp exists west of Wilson Avenue along E. 18th Street. E. 18th Street is 51' wide curb-to-curb around the Wilson Avenue/E.

18th Street intersection.

- E. 18th Street is 47' wide curb-to-curb just east of National City Boulevard. The National City Boulevard/E. 18th Street intersection is signalized making it easier to cross for bicyclists than it is at the National City Boulevard/E. 22nd Street intersection.
- E. 18th Street is 63' wide curb-to-curb west of C Avenue.
- E. 18th Street is 61' wide curb-to-curb at the E. 18th Street/D Avenue intersection. Between D and E Avenue, E. 18th Street reduces to 46' wide. The pavement is in poor condition on this segment.
- Just east of Highland Drive and west of Palm Avenue, E. 18th Street is 47' wide curb-to-curb.
- The roadway widths, conditions, and connectivity to bicycle-attracting land uses indicate that E. 18th Street is a good candidate for bike lanes.

Recommendation: Install bike lanes along E. 18th Street between Wilson Avenue and Palm Avenue.



E. 18th Street at Wilson Avenue and the I-5 Off-Ramp

<u>Coolidge Avenue</u>

- Residents along Coolidge Avenue place their trash containers in the bike lane for City pick-up, thereby obstructing bicyclists' use of the lanes.

Trash cans blocking the Coolidge Avenue bike

Recommendation: Implement a policy of tagging obstructing trash containers with notices alerting residents not to place containers in bike lanes. If the problem persists, trash containers should not be emptied.

Civic Center Drive

- Civic Center Drive is 51' wide curb-to-curb between Coolidge Avenue and the rail tracks. There is also an I-5 NB on-ramp and freeway overpass at the rail tracks.
- Civic Center Drive is 52' wide just west of National City Boulevard.

Civic Center Drive near Coolidge Avenue

Rail tracks intersection with Civic Center Drive

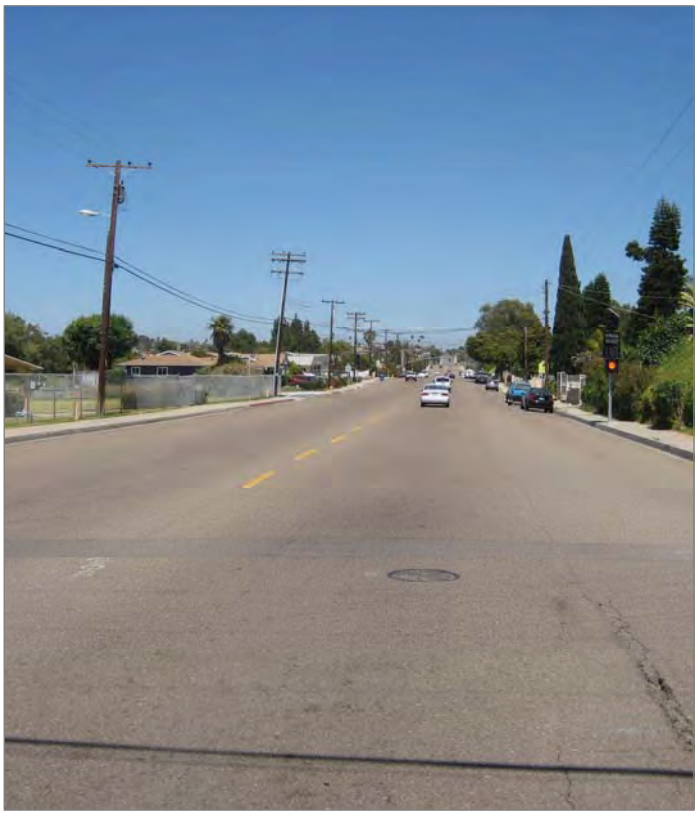
Recommendation: Install bike lanes along Civic Center Drive from Wilson Avenue to National City Boulevard. Assess the possibility of extending the potential Civic Center Drive bike lanes to the Bayshore Bikeway (Harbor Drive and Tidelands Avenue). This would likely require crossing treatments at the rail tracks, I-5, and possibly the intersection of Harbor Drive and Civic Center Drive.

E. 4th Street

- E. 4th Street is 48' wide curb-to-curb just west of D Avenue and 50' wide curb-to-curb just west of National City Boulevard.
- The National City Boulevard/E. 4th Street intersection is signalized.
- 4th Street is 47' wide curb-to-curb between D Avenue and E Avenue, 48' wide between K Avenue and L Avenue, and 64' wide between Palm Avenue and O Avenue.
- The roadway widths could accommodate bike lanes along the corridor without impacting existing parallel parking. With 64' curb-to-curb width between Palm Avenue and O Avene, there is sufficient room for bicycle facilities and traffic calming enhancements. Curb extensions on the T Avenue/4th Street and U Avenue/4th Street intersections are feasible without impacting bike lanes.

Recommendation: Install bike lanes along the entire extent of E. 4th Street within National City city limits.

E. 4th Street just east of Roosevelt Avenue



E. 4th Street at T Avenue

Appendix B: Acknowledgments

Acknowledgments for Preparation of the National City Bicycle Master Plan

This effort would not have been possible without the support of City Council. A special thanks to Council member Rosalie Zarate for years of dedication towards encouraging the implementation of bicycle facilities, plans and programs for the safety and enjoyment of National City residents and guests.

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