



**A TECHNICAL GUIDE
FOR CONDUCTING
BICYCLE SAFETY
ASSESSMENTS
FOR CALIFORNIA
COMMUNITIES**

University of California, Berkeley
Institute of Transportation Studies
Technology Transfer Program

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PREFACE

Improving bicycle safety has become increasingly important to California communities, yet remains a challenge for many agencies to accomplish. Bicycling is a distinct mode of transportation that has specific concerns related to speed regulations, collision patterns, human behavior, conflicts with other roadway users, and the potential for more fatalities and severe injuries because cyclists lack the physical protection that motorists have in vehicles. With funding from the California Office of Traffic Safety (OTS), through the National Highway Traffic Safety Administration (NHTSA), the Technology Transfer Program of the Institute of Transportation Studies at the University of California, Berkeley (Tech Transfer) began offering free Bicycle Safety Assessments (BSA) to California communities in 2013. A BSA helps identify safety concerns and offers suggestions for improvement.

This document describes the California BSA process and provides guidelines for BSA evaluators to conduct BSAs. It synthesizes current best practices and research on bicycling safety and provides guidelines for bicycling safety applications tailored to meet the needs of local communities in California. While this book targets California communities, the methods described are applicable outside California. Users of this guidebook outside of California should substitute national or locally adopted standards, practices, or references as needed. This guidebook is intended for use by transportation professionals, not the general public.

This guidebook is based on material contained in the Federal Highway Administration (FHWA) report, *Bicycle Road Safety Audit Guidelines and Prompt Lists* (http://safety.fhwa.dot.gov/ped_bike/tools_solve/fhwasa12018), incorporating elements from additional resources as deemed appropriate for California practice. It is modeled after the *Technical Guide for Conducting Pedestrian Safety Assessments for California Communities* (www.techtransfer.berkeley.edu/pedsafety/psa_handbook.pdf), produced by the University of California, Berkeley's award-winning Pedestrian Safety Assessment program.

Many individuals and agencies have contributed input and ideas to this guide. Authors include Michelle DeRobertis, Laura Melendy, Eduardo Serafin, and Afsaneh Yavari of UC Berkeley; Meghan Mitman, Miguel Nunez, and Matthew Ridgway of Fehr & Peers; Kamala Parks of Kittelson & Associates; Bruce Appleyard of CFA Consultants; and John Ciccarelli of Bicycle Solutions. We thank the following individuals for their policy-related input during the development of the BSA process: David Doucette, Ed Gebing, and Leslie Witten-Rood of the California OTS; Brian Alconcel and Beth Thomas of the California Department of Transportation (Caltrans); Aubrey Oliphint of NHTSA; David Cohen, Peter Eun, and Gabe Rousseau of the FHWA; Gordon Lum and Monique Raqueno of the city of Stockton; Chris Kluth of the San Diego Association of Governments (SANDAG); and Seleta Reynolds of the San Francisco Metropolitan Transportation Agency (SFMTA). For their valuable review of the BSA process and guidebook, special thanks go to Jill Cooper and Rock Miller of UC Berkeley, and Patrick Miller of 2M Associates. Linda Fogel provided editorial support, and Betsy Joyce gave it shape and design.

Opinions, findings, and conclusions are those of the authors and not necessarily those of the University of California or the agencies supporting or contributing to this report. No part of this publication should be construed as a standard, specification, or regulation, or as an endorsement for a commercial product, manufacturer, contractor, or consultant. Any trade names or photos of commercial products appearing in this publication are for clarity only.

1. BENEFITS OF BICYCLING: WHY SAFE ACCESS MATTERS

Improved bicycle safety and a supportive infrastructure can increase ridership, resulting in enhanced quality of life, economic benefits, and greater livability for communities. Studies have shown that safe and convenient bicycle access to local businesses brings additional customers and that bikeways can benefit tourism. Communities can experience less traffic congestion by encouraging cyclists to commute to work. A 2008 survey conducted by Portland, Oregon, revealed a large demand for bicycle commuting, with almost two-thirds of commuters “interested, but concerned” regarding bicycle commuting and would likely “ride if they felt safer on the roadways—if cars were slower and less frequent.”

Increased Health Benefits, Reduced Health Costs

The positive effects of bicycling are well known and extensively documented. Health professionals generally agree that regular bicycling can have a positive effect on a person’s well-being, leading to weight loss, lower blood pressure, increased strength and mobility, and ultimately lower healthcare costs both to individuals and society. Providing opportunities for physical activity, such as bike lanes, has been shown to increase physical activity as well as cognitive and creative health.

More Money Spent in Retail Districts

Research on the economic benefits of bicycling by various organizations and numerous state departments of transportation all echo this basic finding: Cyclists riding through retail districts stop and spend money. Several recent studies have found that pedestrians, transit passengers, and cyclists routinely visit stores along commercial strips in urban areas more often and spend more money than those who drive. A 2013 study found that bicyclists spend more on average than those who drive for all businesses, except supermarkets.

The Rails-to-Trails Conservancy (www.railstotrails.org) cites many examples throughout the country, such as:

- Trails and bikeways in Pittsburgh, Pennsylvania, contributed significantly to downtown revitalization, including millions of dollars in economic development.
- After the opening of a bikeway in Leadville, Colorado, the city reported a 19 percent increase in sales tax revenue.
- The average cyclist that stops to eat spends nearly \$18 in Ohio, \$23 in Colorado, and \$34 in California.

Added Tourism and Vitality

The Rails-to-Trails Conservancy has demonstrated that repurposing abandoned rail lines into bicycling and walking trails increases tourism dollars in each community through which the trail passes. Studies conducted by the Bikes Belong Coalition (www.bikesbelong.org) also indicate that increased bicycling has a positive economic impact, increasing a community’s livability and vitality.

1.1 LACK OF BICYCLE SAFETY HINDERS USE

Despite all the benefits that bicycling offers, traffic collision data and travel mode data indicate several safety issues for nonmotorized modes of travel. In a 2010 Caltrans statewide transportation survey on household travel, just 3.7 percent of California households commute via bicycling or walking. Yet, based on the state’s traffic collision data for 2010, the number of pedestrians and bicyclists killed represented 26.8 percent of all fatalities (623 pedestrians and 110 bicyclists). In terms of the total number of persons injured, pedestrians and bicyclists accounted for 11 percent, with 12,668 pedestrians and 12,653 bicyclists.

In 2011, bicyclist fatalities increased by 14 percent. To reverse this upward trend in traffic fatalities, the collective work to promote safety for all road users needs to continue. Improving and promoting bicycle safety, and subsequently increasing bicycling, is a top priority for many California communities.

1.2 THE NEED FOR BICYCLE SAFETY ASSESSMENTS

A Bicycle Safety Assessment (BSA) helps local agencies identify bicycle safety issues and implement effective measures to improve the safety for all users of California's roads—motorists, passengers, cyclists, and pedestrians. The BSA provides a focused, in-depth review of problem areas and offers suggestions for safety improvements.

Encouraging economic vitality is an integral part of the BSA. Illustrating the economic benefits of improving bicycle safety might motivate California communities to improve their bicycle facilities, infrastructure, and land use by applying for grants, reallocating transportation funds to bicycle projects, and creating a Bicycle Master Plan.

1.3 OBJECTIVE OF THE CALIFORNIA BSA

The objective of the California BSA is to enable California communities to:

- Improve bicycle safety at specific locations and community-wide
- Reduce the number of cyclist deaths and injuries in traffic conditions along roads and shared-use paths and at intersections.
- Create safe, comfortable, accessible, and welcoming environments for cyclists
- Enhance quality of life, livability, and economic vitality

The BSA focuses primarily on bicycle safety and accessibility needs that are related to infrastructure, engineering, and planning and policy measures. Suggestions for improving education, enforcement, and zoning might be provided as secondary considerations.

2. THE CALIFORNIA BSA PROCESS

The BSA is conducted by two evaluators who collectively have expertise over a wide range of bicycle safety–related issues. The evaluators visit the community for one day to conduct the BSA. The BSA also includes pre-visit phone interviews and email communication.

The BSA is conducted as follows:

- Identify locations in the community for evaluation
- Obtain relevant information from the responsible local agency during pre-visit interviews
- Convene a meeting with key local agency staff and other stakeholders, as identified by the responsible local agency
- Perform field audits and reviews under various conditions
- Identify best practices
- Benchmark the responsible local agency’s policies, programs, and practices on bicycle safety and accommodations
- Prepare a technical report

Each step is described in the following sections.

2.1 IDENTIFY LOCATIONS IN THE COMMUNITY FOR EVALUATION

This step consists of two parts: ranking the local agency in terms of bicycle safety performance, and identifying locations in the community for evaluations.

Ranking the Community by Bicycle Safety Performance

Typically, a local agency served by the BSA is an incorporated city. When visiting a city, the evaluators discuss how its overall bicycle safety compares with other California cities of a similar population size in terms of OTS bicycle safety ranking data. California cities are divided into six population sizing groups:

- Group A: Over 250,000
- Group B: 100,001–250,000
- Group C: 50,001–100,000
- Group D: 25,001–50,000
- Group E: 10,001–25,000
- Group F: 2,501–10,000

In ranking cities with respect to their bicycle safety performance, evaluators can use frequencies as well as rates (per 10,000 population or per million vehicle miles traveled) of the following collision parameters:

- Total bicyclists killed or injured
- Bicyclists aged 1–14 killed or injured

Identifying Locations

Evaluators work with the local agency to identify specific locations in the community for the BSA. The process can be accomplished in a number of ways, including the following.

- Analysis of Statewide Integrated Traffic Records System (SWITRS) data to identify high bicycle collision and casualty locations, intersections, and road segments (corridors).
- Review of information generated from the Transportation Injury Mapping System (TIMS) from UC Berkeley SafeTREC, available at <http://safetrec.berkeley.edu/tims>.
- Examination of bicycle collision and casualty density maps (pin maps) based on the local collision database or SWITRS.
- Suggestions from local agency staff based on their familiarity with local bicycling issues and concerns; areas of importance, such as main streets, shared-use corridors, roadway crossings, bridges and tunnels, interchanges, new redevelopment areas, or corridors; and citizens' requests and complaints.
- A street view survey using Internet tools or a windshield survey (driving review) of bicycle facilities to identify potential focus areas, conducted by the evaluators during the BSA.

2.2 OBTAIN RELEVANT INFORMATION FROM THE LOCAL AGENCY

After a BSA is officially initiated, the evaluators conduct a phone interview with the local agency staff prior to their site visit. The evaluators ask about data, documents, previous studies, and any other information relevant for the BSA, as listed in Tables 1, 2, and 3.

During the interview, the evaluators might also request information regarding the community's General Plan and Bicycle Master Plan, as well as related programs, activities, and policies.

Table 4 shows examples of interview questions. The evaluators can provide the questions prior to the interview to allow time for preparation and staff consultation. Responses are later used to benchmark the community's policies, programs, and practices on bicycle safety, as shown in Table 7.

TABLE 1: DATA REQUEST CHECKLIST

Provide the following data for the entire community or for the bicycle audit locations. Not all items might be relevant or required. If possible, include GIS layers for the requested data.

- Traffic volumes
- Bicycle volumes
- Location map of key bicycle generators or nodes (schools, universities, bike shops, parks)
- Map of existing and planned bikeways (on and off street, including trails and greenways)
- Traffic control at audit locations
- Bicycle collision and casualty density maps (pin maps), collision history, and collision reports
- Aerial photographs of audit locations
- Speed limits and speed surveys
- As-built drawings for audit locations
- Future-planned public and private development (commercial, residential, and business)
- List of programmed roadway improvements
- Information on planned developments and redevelopment areas
- Key land use features that influence bike access, such as bike parking, bike lockers, and driveways
- Transit maps, including schedules
- Truck types and volumes on key roads
- School locations and Safe Routes to School projects

TABLE 2: DOCUMENT REQUEST CHECKLIST

Not all items might be relevant or required. Evaluators will discuss the document requirements with the local agency staff based on the characteristics and conditions present in the community.

- General Plan (especially the circulation element and parks and trails elements)
- Relevant land use plans
- Zoning ordinances and maps
- Bicycle master plan or bicycle and pedestrian master plan
- Traffic calming program documentation or sample projects
- Recent development proposals
- Recent traffic studies
- Greenway master plans
- Trail master plans
- Parks and open space master plans
- Transit master plans
- Other regional transportation plans
- Community policies for approval of projects for traffic calming, bikeways, bike parking, and so on
- Land use maps (existing and planned)

TABLE 3: PARTICIPATING LOCAL MEMBERS

Provide the names of the local members who will participate in the one-day visit. Those indicated by an asterisk () are important participants. Limit local members to a maximum of 12 people. Cities may choose to include regional and state agency representatives, but their participation is not required.*

Bicycle advocacy organization members*	Name:
Bicycle or pedestrian advisory committee members	Name:
Bicycle or pedestrian coordinator*	Name:
Business owners or residents in audit locations	Name:
Business associations	Name:
Caltrans district or headquarters staff	Name:
City architect	Name:
City landscape architect	Name:
City manager or assistant	Name:
City planning department staff* (long range and development review)	Name:
Civic engagement department staff	Name:
Community development department staff	Name:
Community associations	Name:
Commute program representative	Name:
Elected officials	Name:
Employer transportation coordinators from nearby employers	Name:
Engineering and other public works department staff* (including maintenance staff)	Name:
Fire department representative	Name:
Health organizations, including EMS	Name:
Local or regional utilities companies	Name:
Neighborhood preservation or services department staff	Name:
Parking management staff	Name:
Parks and recreation staff*	Name:

TABLE 3: PARTICIPATING LOCAL MEMBERS, continued

Planning commission or board members	Name:
Police traffic safety enforcement officer* (officer on bicycle preferred)	Name:
Project development or property owners	Name:
Regional agency or MPO representative	Name:
Representatives from non-English-speaking communities	Name:
School district staff or PTA leaders	Name:
Traffic safety advisory committee members	Name:
Trails conservancy representatives (local or regional)	Name:
Transit services staff	Name:
University or college transportation staff	Name:

TABLE 4: PROGRAMS, PRACTICES, AND POLICIES: PRE-VISIT INTERVIEW

Topic	Suggested Questions
Existing Bike Network	<ul style="list-style-type: none"> • Does your existing bike network contain any of the following? <ul style="list-style-type: none"> – Bike routes – Bike boulevards – Bike lanes – Buffered bike lanes – Cycle tracks – Shared off-street paths – Exclusive off-street bike paths
Bikeway Facility Surfaces	<ul style="list-style-type: none"> • What is the condition of your bikeway facility surfaces? Rate on a scale of 1 to 5, where 1 is the worst, and 5 is the best. • Do you consider existing or proposed bikeway facilities when prioritizing roadway resurfacing projects? • Has your community adopted maintenance standards for bikeway facilities? • What are your policies and practices for removing debris (or snow, if applicable) from bikeway facilities?
Bike Network Implementation Practices	<ul style="list-style-type: none"> • Do you consider the following when evaluating the retrofit of an existing street? <ul style="list-style-type: none"> – Traffic calming to reduce vehicle speeds – Reducing the number of vehicle travel lanes – Narrowing vehicle travel lanes – Removing on-street parking – Traffic calming to restrict vehicle access while maintaining bicycle access on roadways, such as diverters or partial closures – Cyclists' level of stress on each roadway – Usability of the network by cyclists aged 8 to 80 • Do you consider the following when evaluating the retrofit of an existing shared-use facility? <ul style="list-style-type: none"> – Widening the path – Adding lighting
Intersections and Interchanges	<ul style="list-style-type: none"> • Do you continue bikeways through interchanges? • Are your actuated signalized intersections designed for the following? <ul style="list-style-type: none"> – Bicyclist detection on all actuated phases – Additional time added to the green phase to account for bicycle speeds • Are your major intersections and interchanges designed or retrofitted for the following? <ul style="list-style-type: none"> – Left-turning cyclists are considered and accommodated. – Bike lanes are located to the left of exclusive right-turn lanes. – Ramp and corner radii are 40 feet or less. – Other bicycle-friendly treatments.

TABLE 4: PROGRAMS, PRACTICES, AND POLICIES: PRE-VISIT INTERVIEW

Topic	Suggested Questions
Intersections and Interchanges (continued)	<ul style="list-style-type: none"> • Does your agency respond to bicycle detection issues? • Are signals programmed to bring up WALK or bicycle phases automatically? • Are there bicycle detectors in locations where pedestrian crossings are prohibited? • When free right turns or double-turn or triple-turn pockets are present, how are bicycle facilities accommodated? In particular: <ul style="list-style-type: none"> – Are bikeway facilities continued? – Are other treatments installed to assist cyclists? • Do you have actuated signalized intersections where shared-use paths cross streets? <ul style="list-style-type: none"> – If yes, are they designed to include loop detectors for bicycles? – If there are push buttons, are they easily accessible for cyclists?
Bike Parking	<ul style="list-style-type: none"> • Do you currently have public bike parking installed in your community? <ul style="list-style-type: none"> – If yes, what type: racks, lockers, corrals? – Where is public bike parking located (downtown, civic buildings, and so on)? • Can residents or business owners request public bike parking to be installed? • Do you have policies or practices to address vandalized or abandoned bikes? • Do you have policies or practices to address the security of parked bikes? • Have you developed a plan to install bike parking at existing developments? <ul style="list-style-type: none"> – If yes, how is it funded and implemented? • Do you allow the removal of on-street parking to install bike parking corrals? • Do you provide local or national guidelines for the proper installation of bike parking? • Do you require new commercial developments to provide bike parking? <ul style="list-style-type: none"> – If yes, do you require both short-term parking for visitors and long-term parking for employees? • Do you require access to showers, changing room facilities, or lockers? • Do you require multifamily housing developments to provide secure bike parking for residents?
Bike-Transit Coordination	<ul style="list-style-type: none"> • Are bikes allowed on transit? <ul style="list-style-type: none"> – If yes, on what types of transit (bus, rail, and so on)? • Are buses equipped with bike racks? <ul style="list-style-type: none"> – If yes, how many bikes do the racks hold? – If the racks are full, are cyclists allowed to bring the bike into the bus? • Do rail cars contain areas specified for bicycle storage? <ul style="list-style-type: none"> – If yes, must the cyclist remain with the bike during the journey?
Bicycling Supportive Amenities and Wayfinding	<ul style="list-style-type: none"> • Are bike lockers available at park-and-ride lots in your jurisdiction? • Do you have a bike network map available to the public? <ul style="list-style-type: none"> – How often is it updated? – In what formats is it available (print, online)? – How is the printed map distributed? • Is public bike parking indicated on the maps? • Is a point-to-point bike trip planning tool available in your region? • Is bike wayfinding signage installed on your network? • Is bike sharing planned or available in your community? • Do you have other amenities located along your major biking corridors? In particular: <ul style="list-style-type: none"> – Water fountains – Bike repair stations

TABLE 4: PROGRAMS, PRACTICES, AND POLICIES: PRE-VISIT INTERVIEW

Topic	Suggested Questions
Collection of Bicyclist Volumes	<ul style="list-style-type: none"> • Does your agency routinely collect bicyclist volumes? <ul style="list-style-type: none"> – If yes, what type (intersection turning movement, screenline, and so on)? – Is collected data available in GIS? • Do you require or request that pedestrian and bicyclist volumes be counted as part of intersection counts for traffic studies?
Collision History and Collision Reporting Practices	<ul style="list-style-type: none"> • What are your normal practices for reviewing bicyclist-involved collision data?
Bicyclist Traffic Control Audit (Signs, Markings, and Signals)	<ul style="list-style-type: none"> • Does your community have an inventory of bicycle-related signs, markings, and traffic signals? <ul style="list-style-type: none"> – If yes, do you have a GIS layer with the data? • Do you conduct a regular assessment of bicycle-related traffic control devices? • Do you have an internal reporting system allowing you to correct basic issues with bicycle-related traffic control devices, such as maintenance, removal, relocation, or enhancements?
Speed Limits and Speed Surveys	<ul style="list-style-type: none"> • How often do you collect speed data or review speed limits? • What is your policy or practice for setting speed limits? • Have you ever used or are familiar with USLIMITS2? • What is your practice for posting speed limits in neighborhoods? • What is the default maximum speed limit on major roadways in your community when signs are not placed? • Do you have speed limits for shared-use paths? • Along shared-use paths, do you use signs to inform cyclists to slow down for upcoming congested areas?
Traffic Signal and Stop Sign Warrants	<ul style="list-style-type: none"> • Do you use warrants for installing traffic controls that differ from the California Manual of Uniform Traffic Control Devices (MUTCD)? If yes, what are the warrants for? <ul style="list-style-type: none"> – Traffic signals – Bicycle signals – All-way stop control
Inventory of Bikeways and Parking	<ul style="list-style-type: none"> • Do you maintain an inventory of existing bikeways in GIS? <ul style="list-style-type: none"> – If not, do you have plans to do so? • Have you inventoried gaps in your bikeway network in GIS? • Have you identified areas of latent bicyclist demand, such as bike connections through cul-de-sacs, abandoned railroad tracks, and so on? • Are bikeway projects included in your capital improvement programs? • What is your annual funding level to install or complete bikeways? • Do you have an inventory of existing public bike parking?

TABLE 4: PROGRAMS, PRACTICES, AND POLICIES: PRE-VISIT INTERVIEW

Topic	Suggested Questions
Traffic Calming Program	<ul style="list-style-type: none"> • Do you have a traffic calming program? <ul style="list-style-type: none"> – If yes, what is contained in the program? – Do you have an inventory of existing locations and traffic calming measures? • How do you address citizen requests for traffic calming? • How have you funded traffic calming projects? • Do your traffic calming efforts include measures besides speed humps? • If you use traffic diverters, is bicycle access accommodated?
Bicycle Safety Audit Program	<ul style="list-style-type: none"> • Do you conduct formal or informal bicycle audits in your jurisdiction? <ul style="list-style-type: none"> – Who participates in the bicycle audits (staff, residents, and so on)? – What actions result from the bicycle audits?
Attention to Crossing Barriers	<ul style="list-style-type: none"> • Is the presence of a controlled crossing considered for bikeway facility route selection? • How are unsignalized intersections of shared-use facilities or bike paths with roadways addressed? <ul style="list-style-type: none"> – Are roadway crossings of paths marked so that bicyclists do not have to legally dismount? • How do you address bicycle access at existing crossings of barriers? In particular: <ul style="list-style-type: none"> – Grade separated roadways, like freeways – Railroad and light rail tracks – Waterways • How do you address future bicycle access across the barriers listed above? • What is your practice or policy for improving bicycle access at bridge crossings? • Do you have examples of bridges or barriers where bicycle access is inadequate or not provided?
Design and Development Standards	<ul style="list-style-type: none"> • Do you have design standards for on-street bikeway facilities, such as shared-lane markings, bicycle boulevards, bike lanes, buffered bike lanes, colored bike lanes, or cycle tracks? <ul style="list-style-type: none"> – For any of these facilities, are drainage, water quality management, and landscaping spatial needs addressed in the standards? • Do you have design standards for installing bike parking: short-term parking, long-term parking, corrals, and so on? • Do you have design standards for shared-use bikeway facilities? • Do you have development standards that encourage a bicycling environment? <ul style="list-style-type: none"> – Buildings required to front streets – Narrow vehicle lanes – Limit on number and width of driveways – Bike parking located in close proximity to destination points (buildings, parks, sport facilities, and other outdoor gathering locations)

TABLE 4: PROGRAMS, PRACTICES, AND POLICIES: PRE-VISIT INTERVIEW

Topic	Suggested Questions
General Plan: Densities and Mixed-Use Zones	<ul style="list-style-type: none"> • How does residential density vary, and where is it most concentrated? • Do you have mixed-use zones? • Do you use form-based zoning? • Does your general plan promote active transportation? <ul style="list-style-type: none"> – If yes, through what mechanisms? • Is transit-oriented development addressed in the general plan? • What are the off-street vehicle parking requirements for residential and commercial uses? • Can parking be unbundled or shared between uses?
General Plan: Attention to Bicycle Generators and Significance Standards	<ul style="list-style-type: none"> • Have you identified areas of high bicycling demand or activity in your general plan? <ul style="list-style-type: none"> – If yes, what are these bicycle generators (schools, large employers, and so on)? – How are bicyclists accommodated in these areas? • Does the plan contain a bikeway network that connects all the bicycle generators in consideration of route directness and topography? • Does the plan contain significance standards for bicycle impacts? <ul style="list-style-type: none"> – If yes, are the impacts quantifiable?
Complete Streets Policy and Traffic Impact Fee Program	<ul style="list-style-type: none"> • Do you have a Complete Streets policy that considers bicycling needs for all infrastructure projects? <ul style="list-style-type: none"> – How does this apply during the planning, design, development review, and construction phases? • Do you assess impact fees for new development programs to pay for transportation impact mitigations? <ul style="list-style-type: none"> – If yes, are these funds used for bicycle infrastructure improvement? – How are the funds distributed?
Specific Plans, Overlay Zones, and Redevelopment Areas	<ul style="list-style-type: none"> • Do you have any specific plans? <ul style="list-style-type: none"> – If yes, for which areas and how is bicycle access addressed? – How is implementation financed? • Do you have overlay zones (greenways, bicycle priority areas, and so on)? <ul style="list-style-type: none"> – If yes, for which areas and how is bicycle access addressed? – How is implementation financed? • Do you have planned unit developments? <ul style="list-style-type: none"> – If yes, for which areas? • Do you require a highly connected street system (either a grid pattern or walk and bike access through cul-de-sacs)? • Did you have any remaining designated redevelopment areas? <ul style="list-style-type: none"> – If yes, which areas? – Are you seeking alternative funding sources to complete them? • Do you have other plans that address bicycle access, such as park plans, transit plans, or school renovation plans?

TABLE 4: PROGRAMS, PRACTICES, AND POLICIES: PRE-VISIT INTERVIEW

Topic	Suggested Questions
Bicycle Master Plan	<ul style="list-style-type: none"> • Do you have a bicycle master plan? <ul style="list-style-type: none"> – If yes, when was it last updated? – Who participated in the development of the plan? • Does the bicycle master plan include shared-use paths? • Is the bicycle master plan coordinated with a trails plan? • Which funding sources are typically used to fund improvements identified in your bicycle master plan?
Funding	<ul style="list-style-type: none"> • Have you applied for grant funding for bicycle projects? • Have you completed any bicycle projects recently? If yes, describe. • How much did you spend on bicycle infrastructure improvements on average over the past 3 to 5 years?
Bicycle or Pedestrian Coordinator	<ul style="list-style-type: none"> • Do you have a bicycle or pedestrian coordinator on staff? • What percentage of time do they devote to bicycle-related work?
General Ordinances	<ul style="list-style-type: none"> • Does your community have a bicycle licensing ordinance or resolution related to the following? <ul style="list-style-type: none"> – Bike registration – Helmet use for those over 18 years old • What are your ordinances for cyclists riding on sidewalks?
Transportation Demand Management and Transit Policies	<ul style="list-style-type: none"> • Does your community have a travel demand management (TDM) program or coordinator? • Are businesses that offer free parking to employees required to offer a cash-out alternative? • Does your agency's employees or other groups have access to Bicycle Commute Reimbursement, EcoPasses, CommuterChecks, or similar programs? • Are commuter benefits required by ordinance? • Do you have a transit-first policy? • What are your policies regarding bike parking at transit stops and park-and-ride lots?
Formal Advisory Committee	<ul style="list-style-type: none"> • Do you have a committee that addresses bicycle issues or a committee that is sometimes combined with a pedestrian, parks, or recreation committee? <ul style="list-style-type: none"> – If yes, who are the committee members, and what are their duties and functions?
Public Involvement and Feedback Process	<ul style="list-style-type: none"> • Do you have mechanisms for obtaining public comments on bicycle and pedestrian issues other than public meetings? Specifically: <ul style="list-style-type: none"> – Do you have a direct link on your jurisdiction's website to a forum for public comments? – Do you have a hotline? – Do you have a smartphone application? – Do you use social media to solicit input?

TABLE 4: PROGRAMS, PRACTICES, AND POLICIES: PRE-VISIT INTERVIEW

Topic	Suggested Questions
Economic Vitality	<ul style="list-style-type: none"> • Have business improvement districts been established in your retail zones? <ul style="list-style-type: none"> – If yes, does it fund bikeway improvements or bike parking? • Do you have a façade improvement program? • What are your downtown parking policies? <ul style="list-style-type: none"> – Do they encourage non-auto access or a park-once environment?
Bicycle Safety Education Program	<ul style="list-style-type: none"> • Do you have a bicycle safety or traffic-ed curriculum in your community's schools? • Do you have a bicycle safety or traffic-ed curriculum in your community's libraries, senior centers, and so on? • Are bicycle safety brochures available? • Do you conduct bicycle safety education campaigns using social media, yard signs, bumper stickers, or radio messages? • Are motorists or bicyclists provided information or instructions specific to bicycle laws and ordinances when pulled over for traffic violations?
Proactive Approach to Institutional Coordination	<ul style="list-style-type: none"> • Within your agency, are there institutional obstacles to improving the bicycle environment, such as fire department demands for roadway space, level of service (LOS) vehicle thresholds, and so on? • Have you experienced challenges to improving the bicycle environment due to demands by other agencies? In particular: <ul style="list-style-type: none"> – Caltrans – Railroads – Transit agencies • Describe one or more of your community's most successful efforts to overcome such challenges.
Safe Routes to Schools Program	<ul style="list-style-type: none"> • Do you have an ongoing Safe Routes to Schools program (aside from grant submission cycles)? • Have you applied for Safe Routes to Schools grants? <ul style="list-style-type: none"> – If yes, did you receive funding? • Have you completed any Safe Routes to Schools projects recently? <ul style="list-style-type: none"> – If yes, describe the project locations and bicycle-related improvements.
Coordination with Schools	<ul style="list-style-type: none"> • Are new or renovated schools located within existing neighborhoods? <ul style="list-style-type: none"> – Do you use 15 mph school zones? • Does your agency staff communicate regularly with the local school districts regarding student biking access? • Do you provide incentives to schools to locate in existing neighborhoods? • Do you encourage schools to design or remodel their site to encourage biking access?

TABLE 4: PROGRAMS, PRACTICES, AND POLICIES: PRE-VISIT INTERVIEW

Topic	Suggested Questions
Bicycle Safety Enforcement	<ul style="list-style-type: none"> • Does your police department have traffic safety officers? <ul style="list-style-type: none"> – If yes, how much of their time is spent on bicycle safety-related responsibilities? • Does the police department issue bicycle-related citations? • Do you have any police patrols on foot or on bicycles? • Have officers been specifically trained on law enforcement techniques that improve bicycle safety and access? • Do you conduct bicycle-oriented enforcement activities, such as focused school drop-off enforcements? • Do you team with police from other communities for bicycle safety issues? <ul style="list-style-type: none"> – Do you share police resources? – Do you share data?
Coordination with Emergency Response and Transit Providers	<ul style="list-style-type: none"> • Are the fire or police departments involved in the planning or design of roadway or bikeway facilities? <ul style="list-style-type: none"> – Do they participate in test runs of roadway and bikeway facility designs that are aimed to reduce speed and improve bicycle access, such as fire truck access at bicycle-friendly roadway diverters? – Do they balance their response time needs with roadway and bikeway facility designs that benefit bicycle safety and access? • Are transit agencies involved in the planning or design of roadway and bikeway facilities? <ul style="list-style-type: none"> – Do they participate in test runs of roadway and bikeway facility designs that are aimed to reduce speed and improve bicycle access, such as bike lanes? – Do they balance their operating needs with roadway and bikeway facility designs that benefit bicycle safety and access?
Coordination with Health Agencies	<ul style="list-style-type: none"> • Do you coordinate with your community's health agencies on bicycle-focused issues? • Do they collect bicycle-involved collision data? • Do they promote healthy lifestyles through bicycling as a form of active transportation?

2.3 CONVENE A MEETING WITH AGENCY STAFF

On the day of the site visit, the evaluators meet with the local agency and other representatives to review the purpose and scope of the BSA, the focus area locations, and expected deliverables. Evaluators also share the initial results of the benchmarking analysis. At this meeting, the local agency can provide, or the evaluators might request, additional information. Staff can invite other local partner agencies and individuals to participate at this meeting.

2.4 PERFORM FIELD AUDITS AND REVIEWS

The evaluators conduct the field audits and reviews at the identified locations. The review format and participants selected are based on the method applicable for the geographic location and characteristics of the focus areas. During the audit, the evaluators consider the following major themes:

- **Needs of cyclists**—Do bicycle facilities address the needs of cyclists at all ability levels?
- **Connectivity and convenience of bicycle facilities**—Are safe, continuous, and convenient facilities provided along bicycle routes throughout the study area?
- **Traffic**—Are design, posted, and operating traffic speeds compatible with bicycle safety?
- **Behavior**—Do motorists expect cyclists in the roadway and look for cyclists coming from all directions at intersections? Do cyclists abide or disregard rules of the road, such as stopping at red lights and stop signs?
- **Construction**—Have the effects of construction on bicycle safety and accessibility been addressed adequately?
- **School presence**—Is the safety of children in school zones adequately considered?

The following field audits and reviews are available, and each is described in this section.

- Walking audit
- Bicycling audit
- Bicycle collision audit
- Nighttime audit
- Corridor analysis audit
- Safe Routes to School audit
- Bicycle support facilities audit
- Virtual biking audit
- Network development audit
- Economic vitality walking audit
- Windshield audit
- Proposed development audit
- Intercept survey
- Focus group interviews

Where possible, the BSA includes a bicycling or walking audit of the focus areas as well as a windshield audit of the larger areas. A walking or bicycling audit is considered the most effective method to observe issues and problems and identify improvement opportunities. The other field review methods are performed based on the scope of the BSA, the evaluators' judgment and time availability, and the availability of participants during the one-day visit.

Walking Audit

A walking audit of bikeway facilities is appropriate for examining an intersection or cluster of intersections, a short corridor or road segment, an entire neighborhood that is to be traffic-calmed, a school area, or a bicycle zone or node. Before the audit, either the local agency or the evaluators develop a walking audit route map to determine the focus, such as collision hot spots or high-speed arterials. Stops are planned for every 200–400 feet along the route. A sample route map is shown in Figure 1.

A Walking and Bicycling Audit Checklist, as shown in Table 5, is an important tool to guide the audit. The evaluators can tailor the checklist to fit the needs of the focus area. The FHWA Bicycle Road Safety Audit Guidelines and Prompt List in Appendix A can also be used.

During the audit, positive practices are observed, and issues and areas for improvement are noted. Observations are made on how motorists, transit vehicles, and pedestrians are behaving around cyclists. Notes are taken on cyclists' behavior, especially at intersections. For each focus area, the team discusses ways to address bicycle safety concerns. The walking audit is highly interactive, with many observations and “teachable moments” explored during the walk. It is a means for the staff to see through the eyes of the cyclist.

Photographs are taken throughout the audit. The Caltrans photo log (<http://video.dot.ca.gov/photolog>) and Google StreetView images can be used to view the focus areas before and after the audit.

When feasible, a walking audit concludes with a debrief session. Observations are noted on aerial photographs or the route map, as illustrated in Figure 2. The debriefing could also be used as an opportunity to validate the location of key bicycle generators and bicycling desire lines to connect the generators or nodes.



The materials required for the walking audit are:

- Bicycle and Walking Audit Checklist
- Audit route map
- Aerial photograph of each focus area
- Clipboards, pens, post-its, camera, measuring tape or wheel, and safety vests

Audit participants could include those who can provide information on the focus areas, such as bicycle destinations, collision history, and common “near misses,” demographics and other relevant neighborhood information, and current city policies and practices. Persons who are—or will be—responsible for planning or implementing safety improvement measures can also be included.

Potential participants include:

- Elected officials
- Bicycle or pedestrian coordinator
- Police traffic safety enforcement officer
- Engineering or public works department staff
- ADA coordinator
- Transit services staff (if transit is present in the focus area)
- Business leaders or residents in focus areas
- Business associations
- Residents or neighborhood associations
- Downtown or neighborhood planners or redevelopment agency staff
- User group or advocacy group representatives (such as a bicycling or traffic calming advocacy group)
- School officials and PTA leaders
- Parks and recreation staff
- Parking management staff
- Health agencies and organizations including emergency medical services
- City or county department of public health staff

FIGURE 1: SAMPLE AUDIT ROUTE MAP



TABLE 5: SAMPLE BICYCLE AND WALKING AUDIT CHECKLIST**Great Places**

- Is there street activity (sidewalk cafes, vendors, bicycle amenities, wayfinding, etc.)?
- Are activities and uses, such as newspaper racks or sidewalk cafes, organized?
- Is traffic calmed with bulbouts, roundabouts, chicanes, etc.?
- Are links to transit provided?
- Are medium- to high-density land uses present?
- Is the street network a grid?
- Are street widths between two and four lanes?
- Is street parking back in or head out?
- Do motorists have visibility when exiting the parking space?
- Is there a buffer zone between on-street parking and bicycle travel lanes to protect cyclists from “dooring”?
- Is a bike lane used on the street?
- Is there public art?
- Do buildings provide a sense of enclosure (positioned near or at the sidewalk)?
- Do buildings provide sufficient transparency (70%–90% window glazing and set proximate to the street)?
- How many people do you see in this space?
- Is there a tree canopy or other means to achieve shade and create a sense of place?
- Is there an absence or minimal number of interrupting driveways? If there are driveways, are they designed for safe use by cyclists traveling in bicycle lanes or on the roadway?

Good Streets

- Are lanes narrow (10–11 feet) and appropriate for the area type (neighborhood, commercial, downtown, etc.)?
- Is the riding surface smooth, stable, and free of debris? Is drainage adequate, and are drainage grates designed for cyclists?
- Are bicycle accommodations (bicycle lanes, signs, etc.) provided on both sides?
- Are the provisions for cyclists suitable given the characteristics of the roadway or path (speed, volume, traffic, and functional classification)?
- Are bicycle facilities continuous?
- Are transition areas designed with logical termini or do they end abruptly, potentially contributing to sudden and difficult merges, mid-block crossings, or behaviors such as wrong-way riding?
- On one-way streets, are motorists’ speeds supportive of bicycling?
- Is through access provided for bicycles at cul-de-sacs or streets with restricted vehicular access?

Good Intersections

- Are intersections compact?
- Are intersection accommodations designed to reduce conflicting movements and communicate proper bicycle positioning through the crossing?
- At intersections with heavy right-turning traffic volumes, do facilities help reduce the risk of right-turning vehicles colliding with bicycles that might be in the vehicle’s right-rear blind spot?
- Are there medians to protect left-turning bicyclists?
- At signalized intersections:
 - Are bike boxes provided?
 - Are advance limit lines provided?
 - Are conflicts in crosswalks limited by prohibiting right turns on red or with protected left-turn phases?
 - Are countdown signals provided?

FIGURE 2: GRAPHICAL PRESENTATION OF ISSUES AND SOLUTIONS



Bicycling Audit

The bicycling audit is an alternative or addition to the walking audit. It examines the same issues and behaviors as the walking audit, but is conducted while riding a bicycle to enable evaluators and audit participants to experience bikeway facility conditions first hand. Stops are planned along the route to allow participants to discuss their observations. Prior to conducting the audit, the bicycle route must be reviewed for safety, and some focus areas might not be safe or appropriate for bicycling.

The materials required for the bicycling audit are:

- Road-safe bicycles, helmets, bicycle lights, and safety vests for each participant
- Bicycle and Walking Audit Checklist
- Audit route map
- Aerial photograph of each focus area
- Clipboards, pens, post-its, camera, and measuring tape or wheel
- Backpacks or means of holding audit materials (when possible, materials should be designed for ease of use while bicycling, such as index card-sized materials)

The bicycling audit could include the same participants as a walking audit, although the bicycling audit might not be suitable for all participants due to physical limitations or lack of experience, comfort, or the equipment necessary to participate. Inability to participate can be addressed by offering a supplemental walking audit. Those bicycling should complete a liability waiver before the audit.

Bicycle Collision Audit

In a bicycling collision audit, the locations of bicycle collisions are mapped and analyzed to identify hot spots. Information about the collision type, primary collision factors, severity, and so on can also be incorporated into the analysis. The audit then closely examines the designated hot spots either on foot or bicycle, similar to a walking or bicycling audit.

Participants are provided a bicycle collision map and an aerial map with the most current collision data available. A collision map is shown in Figure 3. Figure 4 shows an aerial map of a hot spot location.

The materials required for the bicycle collision audit are:

- Collision map and aerial photograph of each focus area
- Clipboards, pens, post-its, camera, measuring tape or wheel, and safety vests

Potential participants are the same as bicycling and walking audit participants.

FIGURE 3: COLLISION MAP

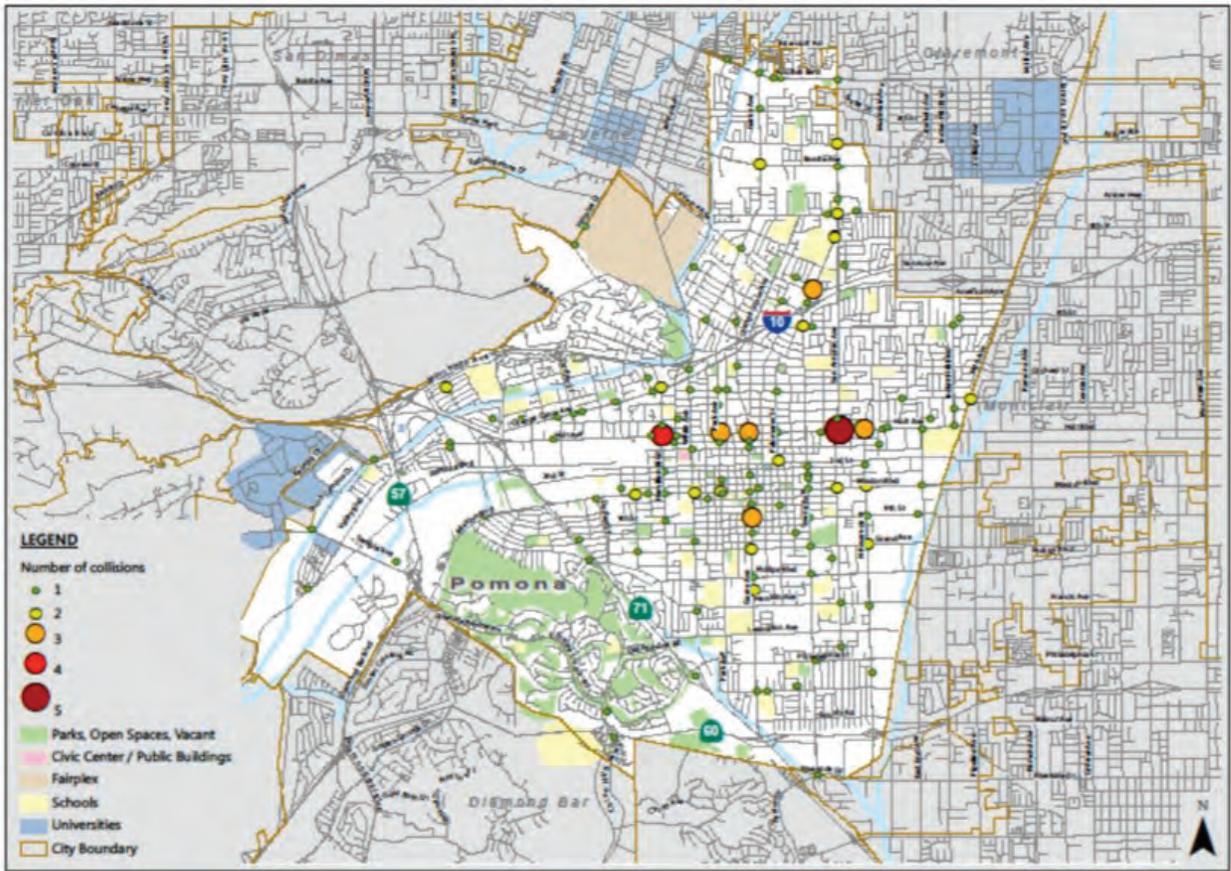


FIGURE 4: AERIAL MAP OF A HOT SPOT LOCATION



Nighttime Audit

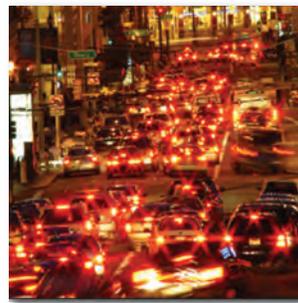
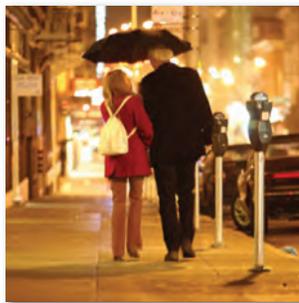
A nighttime audit is conducted when bicycle collision data indicates that collisions in a focus area are occurring after dark or during sunrise or sunset times or if nighttime bicycling activity is high in the focus area. The Bicycling and Walking Audit Checklist can be followed, with particular emphasis on nighttime issues, such as lighting or activities that generate cyclists, like movie theaters and bars. Evaluators can conduct the audit by observing conditions at the focus area from a parked vehicle, on foot, or on a bicycle. The audit might include observations of impaired or distracted bicyclists and their behavior and apparel (whether visible at night), as well as impaired or distracted motorists.

The materials required for the nighttime audit are:

- Bicycle and Walking Audit Checklist
- Audit route map
- Aerial photograph of each focus area
- Clipboards, pens, post-its, camera, measuring tape or wheel, safety vests, safety caps, and flashlights

Note: Safety vests must be reflective and are not an optional item.

The nighttime audit is usually in addition to a daytime walking or bicycling audit, so it might only be necessary for the evaluators to participate.



Corridor Analysis Audit

A corridor analysis audit is a holistic assessment of one or multiple streets within a community. The analysis looks at the length of the corridor and focuses on areas where collisions or other incidents occur frequently and where there are changes in traffic patterns. It considers school zones, bicycle generators, such as shopping centers or restaurants, and other areas.

Whereas a walking or biking audit of bicycle facilities might visit several locations citywide, the corridor analysis audit focuses on a specific geography. In addition to examining bikeway facility conditions, it is often helpful to consider bicycle parking and other support facilities. The analysis usually includes an opportunity for stakeholder input, such as city staff or members of the public. A bicycle corridor map is shown in Figure 5, and Figure 6 shows a map after stakeholder input. Figure 7 is an example of a bicycle corridor map with suggested improvements.

The materials required for the corridor analysis audit are:

- Corridor maps
- Aerial photograph of each focus area
- Clipboards, pens, post-its, camera, measuring tape or wheel, and safety vests

Potential participants are the same as bicycling and walking audit participants.

FIGURE 5: BICYCLE CORRIDOR MAP PRIOR TO ANALYSIS



FIGURE 6: MAP WITH STAKEHOLDER INPUT

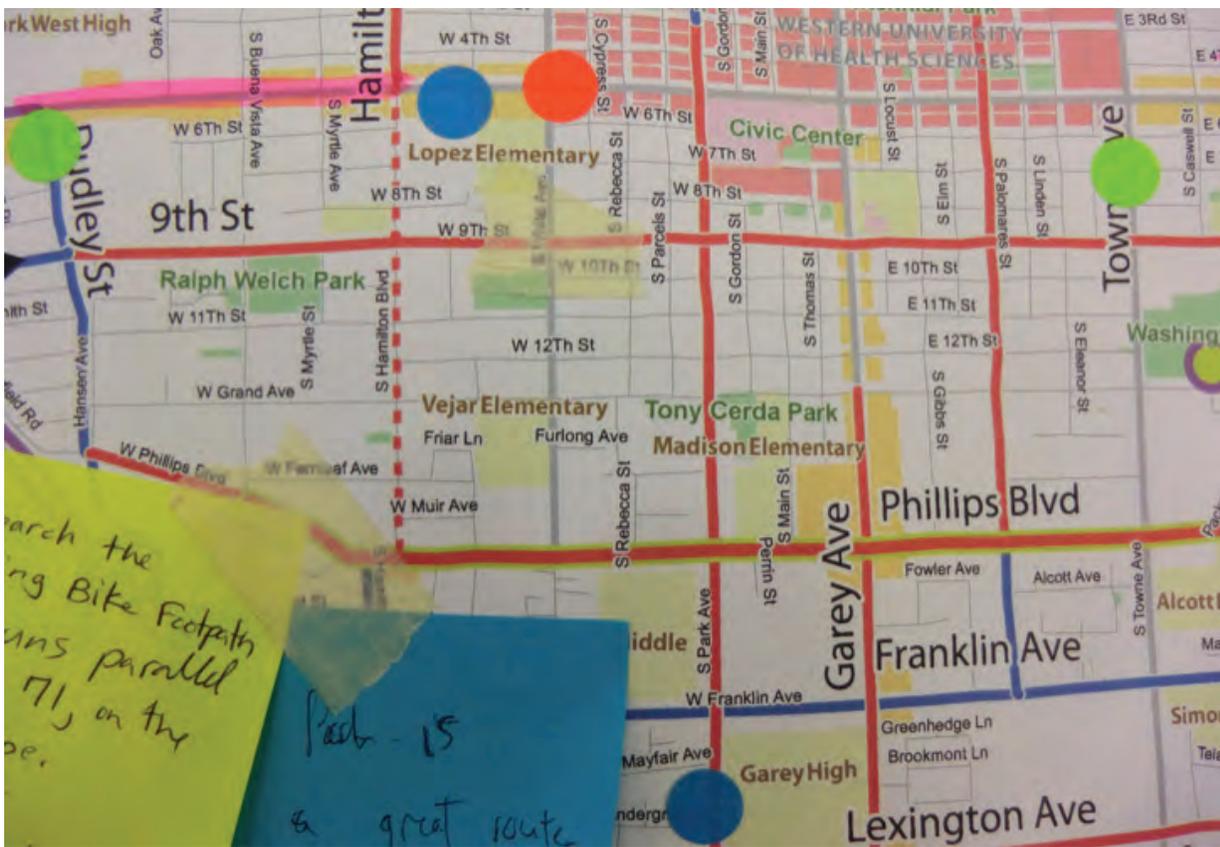


FIGURE 7: BICYCLE CORRIDOR ANALYSIS MAP POST ANALYSIS



City of Chula Vista
Naples Street Walking Audit
August 2008

Safe Routes to School Audit

A Safe Routes to School (SR2S) audit specifically examines bicycle facilities in school zones, nearby neighborhoods, and along an existing SR2S identified by the agency. A bicycling or walking audit is conducted in the focus areas identified by the community prior to the BSA. City staff are provided with conceptual improvement plans focusing on school areas, on-site circulation, and school bicycle parking, as shown in Figure 8.

The materials required for the SR2S audit are:

- School or SR2S map
- Aerial photograph of each focus area
- Clipboards, pens, post-its, camera, measuring tape or wheel, and safety vests

Potential participants are the same as bicycling and walking audit participants, with an emphasis on school staff. Students might also participate.

FIGURE 8: SCHOOL-AREA IMPROVEMENT CONCEPT PLAN



Bicycle Support Facilities Audit

A bicycle support facilities audit examines the provision and distribution of bike support facilities at focus areas, such as transit centers, schools, and other large bicycle generators. Examples of bicycle support facilities include bicycle parking, stations, lockers, and showers. The location of bicycle support facilities are included on a bicycle plan map and provided to the agency staff.

The materials required for the bicycle support facilities audit are:

- ❑ Bicycle support facilities inventory map
- ❑ Aerial photograph of each focus area
- ❑ Clipboards, pens, post-its, camera, measuring tape or wheel, and safety vests

Potential participants are the same as bicycling and walking audit participants, with a focus on transit provider staff.



Before a bicycle support facilities audit. Ad hoc bicycle parking impedes pedestrian flow on the sidewalk.



One vehicle parking space has been converted to bicycle parking with room for eight bicycles.

Virtual Biking Audit

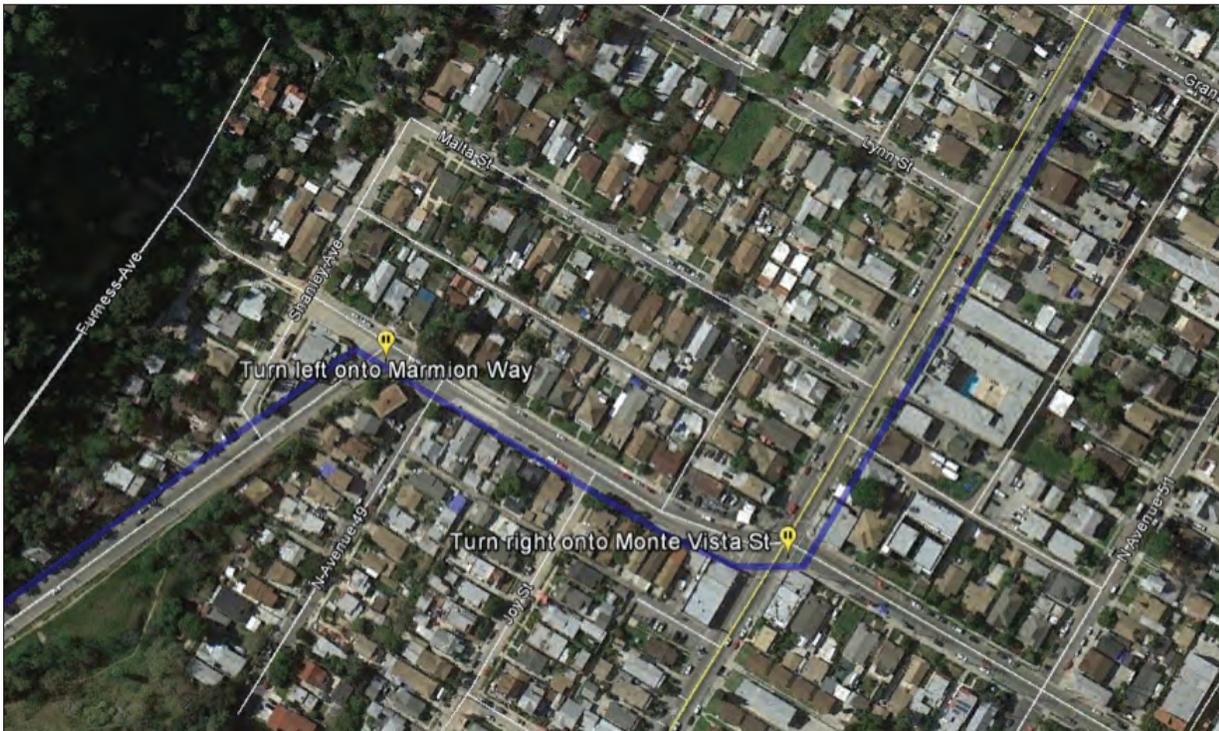
In this audit, a virtual tour of bicycle corridors or a network is presented to city staff using a tool such as Google Earth or video from a helmet-mounted camera. Areas of concern are identified and discussed. A virtual biking audit is most useful as a supplement to a bicycling or walking audit.

The materials required for the virtual biking audit are:

- ❑ Virtual biking tour, computer, and projector
- ❑ Aerial photograph of each focus area

Potential participants are the same as bicycling and walking audit participants.

FIGURE 9: VIRTUAL BIKING AUDIT TOUR IMAGE



Network Development Audit

A network development audit combines many of the features of a bicycle collision audit, a corridor analysis, and a bicycle support facilities audit in the context of an existing or proposed bicycle network plan. Evaluators review whether the plan can be improved to provide for a wider range of cyclists and additional support facilities.

If a plan does not exist, evaluators might work with city staff to develop an initial plan, although this might not be feasible during the one-day site visit.

The materials required for the network development audit are:

- Maps showing the existing network, support facilities, land uses and popular destinations, and bicycle collisions

Potential participants are the same as bicycling and walking audit participants.

FIGURE 10: BICYCLE DESTINATIONS MAP

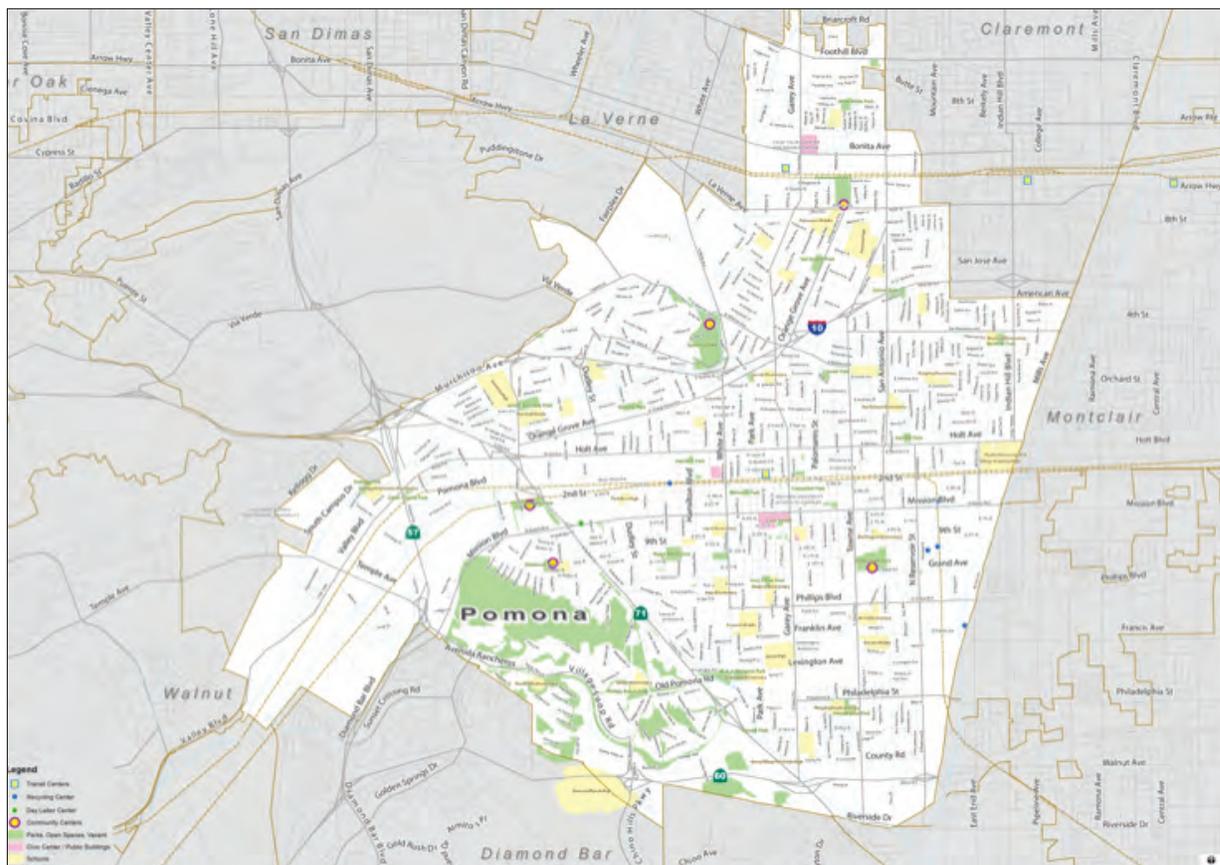


FIGURE 11: BICYCLE SUPPORT FACILITIES MAP

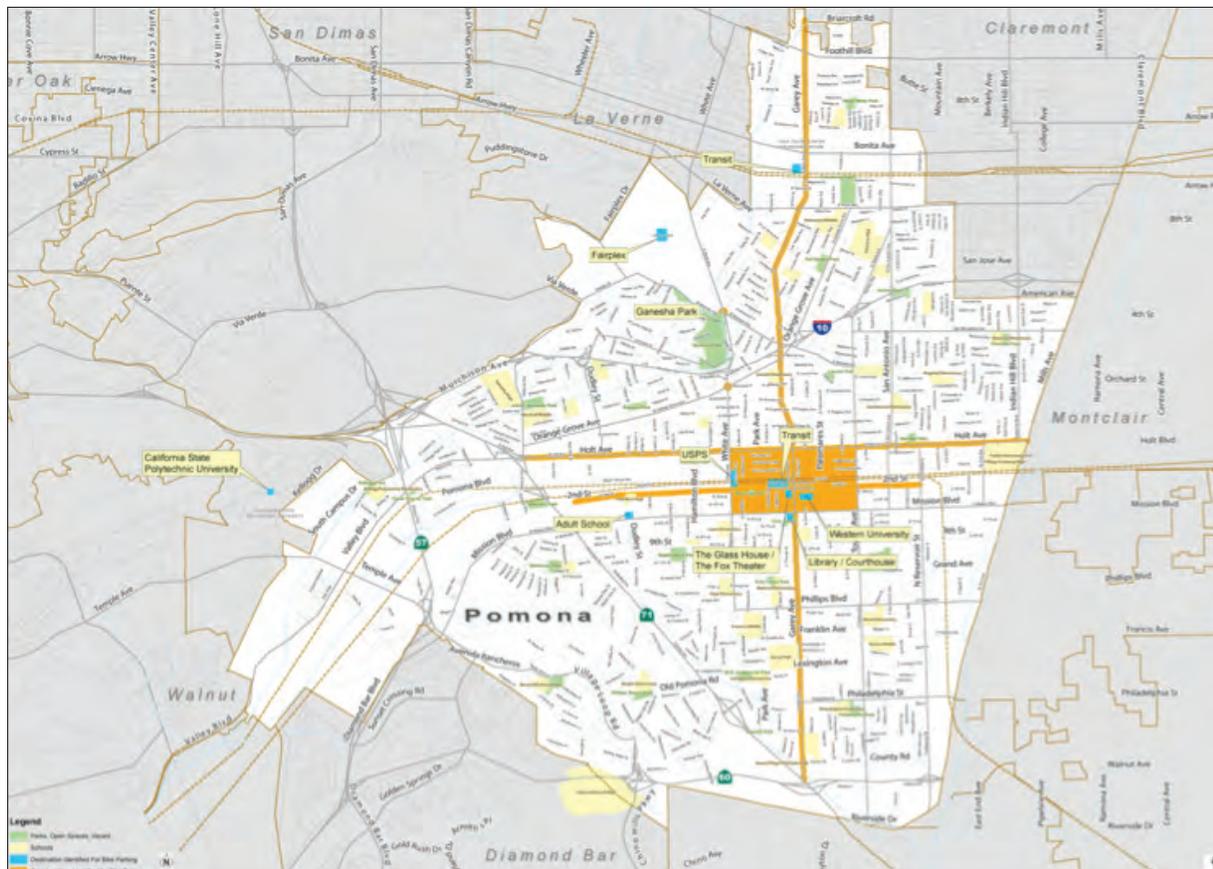
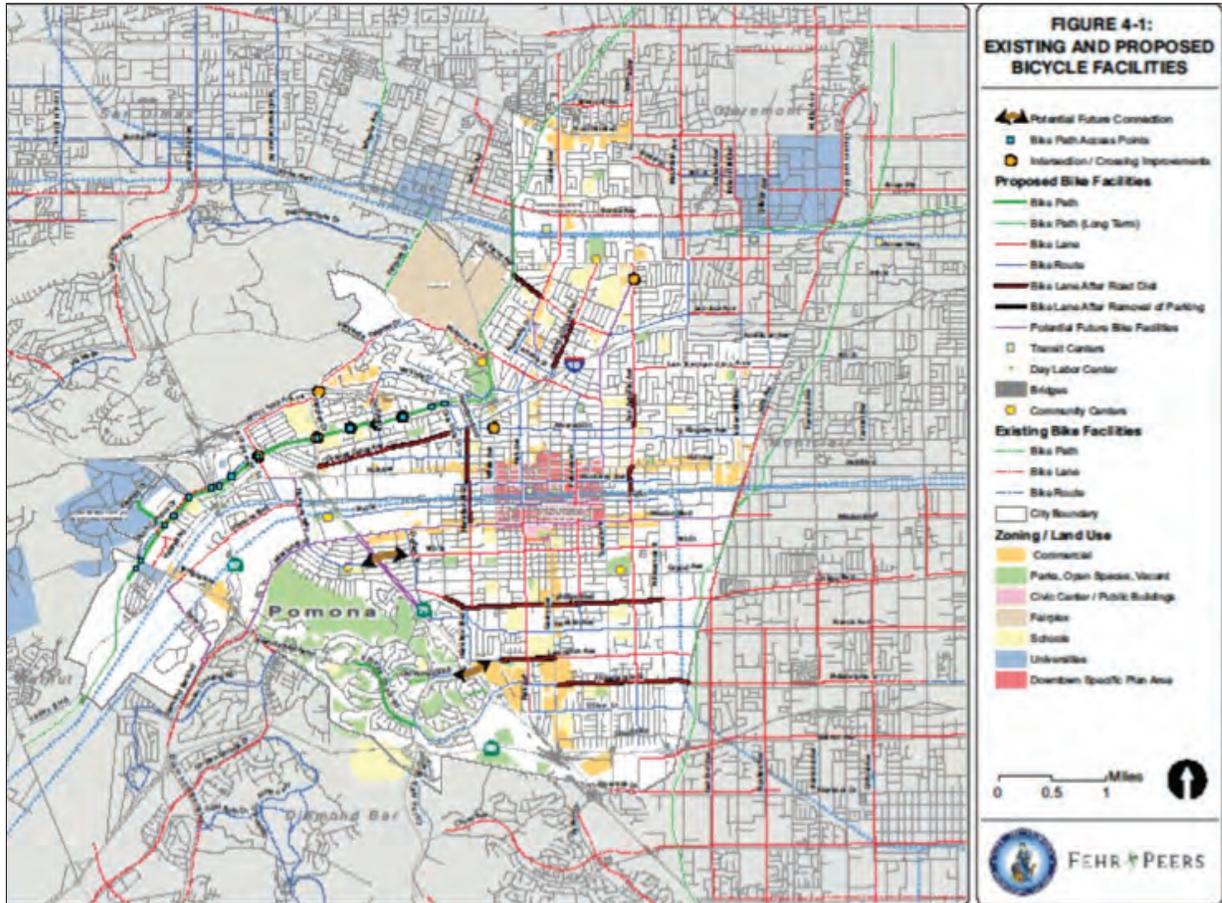


FIGURE 12: EXISTING AND PROPOSED BICYCLE FACILITIES MAP



Economic Vitality Walking Audit

As a component of the standard bicycling or walking audit, the group can identify opportunities for improving the bikeability and economic vitality of the area. Items to consider are:

- Buildings that could be enhanced through façade improvement programs
- Redevelopment sites for mixed-use development with ground-floor retail
- Adding streetscapes and street furniture
- Sidewalk cafes
- Relocating parking behind buildings
- Increasing “eyes on the street”
- Parking management strategies to reduce cruising for parking and establishing a “park once” environment
- Connecting commercial areas to open space (waterfront, parks, and so on)
- Traffic calming
- Wayfinding enhancements and establishing a sense of place
- Transit-oriented development
- Bringing “pedals to the pavement” in the evenings, on weekends, mid-day, and so on (land use mix of theaters, restaurants, gyms, residential, and offices)

Applicable participants include staff from the redevelopment agency, property owners or developers, residents, and business owners, as identified by the local agency.

Windshield Audit

During a windshield audit, roadway and bikeway facility conditions are observed while driving through the focus areas. This method is appropriate for areas that are geographically dispersed or too large to observe on foot or bicycle. It also provides an important view of the focus areas from the driver’s perspective. The Bicycling and Walking Audit Checklist is used throughout the driving tour, as applicable.

The materials required for the windshield audit are:

- Bicycling and Walking Audit Checklist
- Windshield Audit Route Map and driving directions
- Aerial photograph of each focus area
- Vehicle, clipboards, pens, post-its, camera, measuring tape or wheel, and safety vests

In addition to the participants for the standard bicycling or walking audit, each vehicle should have a non-participant driver. Ideally, all participants should travel in the same vehicle to facilitate group discussions during the audit.

Proposed Development Audit

This audit reviews the site plans for a proposed development. The review considers potential bikeability issues associated with the site plan, such as bicycle facilities, street width, driveway and garage placements, street connectivity, transit, accessibility, proximity of parks and schools to all homes, mix of uses, and cul-de-sacs. When feasible, the development audit is supplemented with a walking or bicycling audit to view the existing conditions of the development site. This audit can also be paired with a network development audit.

The materials required for the development audit are:

- Site plans for the proposed development
- Pens and post-its

Potential participants are those familiar with city policies and practices related to infrastructure improvements, short-range planning, and the proposed development, including:

- City traffic engineer
- City planner
- City bicycle or pedestrian coordinator
- Community development department staff
- Neighborhood services staff
- Project developer

Existing Site Audit

An existing site audit reviews the site layouts for existing land use. The review considers potential bikeability issues, such as bicycle facilities, street width, driveway and garage placements, street connectivity, transit, accessibility, proximity of parks and schools to all homes, mix of uses, and cul-de-sacs. When feasible, the site audit is supplemented with a walking or bicycling audit. This audit can also be paired with a network development audit.

The materials required for the site audit are:

- Site plans
- Pens and post-its

Potential participants are those familiar with city policies and practices related to infrastructure improvements and land use, including:

- City traffic engineer
- City planner
- City bicycle or pedestrian coordinator
- Community development department staff
- Neighborhood services staff
- School officials and PTA leaders
- Parks and recreation staff

Intercept Survey

Intercept surveys with bicyclists, pedestrians, and motorists can be conducted during a standard walking or bicycling audit when additional information is needed. The decision to conduct an intercept survey can be made in advance or on the spot. These brief surveys address issues such as:

- Why is a cyclist riding on the sidewalk and not in the roadway?
- Why is a cyclist riding in a motor vehicle lane when there are dedicated bicycle travel lanes next to on-street parking spaces? Does proximity to on-street parking factor in the decision not to use the bicycle lane?
- If a cyclist is riding in the wrong direction on a bicycle facility, where did the cyclist enter and where will the cyclist leave the facility?

The materials required for an intercept survey are clipboards, pens, and business cards.

Focus Group Interviews

Focus group or small group interviews can be conducted before or after a standard walking or bicycling audit to obtain additional information regarding the context, constraints, and opportunities for a focus area. To allow sufficient time for this activity, the scope and duration of the walking or bicycling audit would likely need to be reduced.

The materials required for the interviews are:

- Meeting room for the size of the focus group (10–15 people)
- Flip chart and markers, tape, and name tags
- Aerial photograph of the focus area
- Pens and post-its
- Camera, computer, and projector (as needed)

Walking or bicycling audit participants can be invited to participate in the focus group, especially those responsible for planning or implementing pedestrian improvement measures. Focus group representatives can include:

- School district representatives
- PTA representatives
- Senior citizens or their advocates (such as AARP)
- Disabled citizens or their advocates
- Representatives from non-English-speaking communities (and a translator if necessary)
- Representatives of civic, neighborhood, or business associations

Behavioral Audit

A behavioral audit examines the behavioral traits and interaction of cyclists, pedestrians, transit passengers, and motorists. This type of audit is best suited for downtown areas, transit stations, retail districts, schools and universities, and other locations that experience high levels of multimodal activity. It could also be considered for locations with a high number of collisions. The audit is conducted prior to the BSA in the focus areas identified by the community.

The audit involves stationing participants in close proximity to each other and the evaluation site to observe how people behave in the street. Observations might include conflicts between modes, interaction between land uses, visibility, illegal or reckless actions, and perceived comfort. The agency staff is provided with notes from the observations and appropriate strategies and actions for improvement.

The materials required for the behavioral audit are:

- ❑ Bicycling and Walking Audit Checklist
- ❑ Aerial photograph of each focus area
- ❑ Clipboards, pens, post-its, camera, measuring tape or wheel, and safety vests

Potential participants include those familiar with city policies and practices related to infrastructure improvements, short-range planning, and knowledge of the historical conditions at the sites being assessed.

2.5 SUGGEST IMPROVEMENTS

The evaluators suggest site-specific and community-wide bikeway facility improvements based on the findings from the field audits, reviews, and data analysis. Table 6 describes various measures that can be implemented to improve bicycle safety.

Some improvements are bicycle-specific, while others are aimed at calming or ameliorating road designs that encourage faster motor vehicle traffic. Slowing traffic in the vicinity of cyclists improves safety in two ways: It lowers the rate of bicycle and motor vehicle collisions, and it reduces the severity of the collisions when they do occur.

The evaluators also consult published standards, best practices, and safety resources, as shown in Appendix B.

TABLE 6: BICYCLE IMPROVEMENT MEASURES

LINKS and ROADWAY SEGMENTS			
Measure	Description	Benefits	Application
Road design and operations to slow traffic			
Traffic calming	Measures such as narrowed roads, speed humps, and other obstructions placed in roadways to force motorists to slow down or reduce motor vehicle traffic.	Reduces motor vehicle speeds, which improves safety for all modes and increases cyclist's comfort.	Urban and suburban settings. Recommended for major urban streets with prevailing speeds of 35 mph and higher, major suburban streets 45 mph or higher, and local streets with over 30 mph.
Bicycle boulevard	Minor street on which traffic control changes are made to encourage cycling, such as removing unwarranted stop signs along the bike route or providing crossing assistance at major arterials (see examples in the "Intersection Design for Motor Vehicles" section of of this table).	Allows cyclists to maintain their travel speeds, reducing travel time. Provides cyclists with a low-volume, low-speed street. Motorists reduce speed due to traffic calming devices and are aware that it is a bicycling-priority street.	On minor streets with less than 3,000 vehicles per day (vpd). Especially useful when the bike route is parallel to and within .25 miles of a major arterial with many desirable destinations.
Signal coordination at 15–25 mph (green wave)	Signal timing along a corridor is set so that traffic that has a green light at the first intersection subsequently receives a green light at all downstream intersections if they travel at the designated speed.	Encourages motorists to travel at slower speeds, providing a more comfortable experience for cyclists and increasing overall traffic safety. Also allows cyclists to hit the green lights so that they can maintain their travel speed and reduce travel time.	Urban settings, typically downtown and other areas with short blocks and traffic signals at every intersection.
Woonerf (living street)	Shared space where all modes share the physical right of way, often with no sidewalks, no lane striping, and little if any signage.	Access for motor vehicles is maintained, unlike a pedestrian zone, but speeds are constrained to 5 mph by design and the presence of other modes. Safety for all modes is improved.	Low-volume residential streets where families can gather and children can play. Also commercial areas with high pedestrian volumes, cyclists, and transit.
Road design to provide bicycling infrastructure			
Bike lane	One-way painted lane, a minimum of 4 feet wide, for the exclusive use of cyclists. A bike lane can be added to an existing street by either narrowing the width of the travel lanes, removing a parking lane or travel lane (road diet), or widening the entire roadway.	Provides cyclists with their own travel lane so that they can safely pass and be passed by motor vehicles.	Roadways with over 4,000 vpd. If less, consider bicycle boulevards.

TABLE 6: BICYCLE IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Road diet (lane reduction)	One to two travel lanes are replaced with bike lanes, and in most cases, also adding left-turn lanes at intersections or a two-way left-turn lane in the center. Variations include widening sidewalks or replacing parallel parking with angled or perpendicular parking.	Improves traffic safety for all modes by reducing the number of motoring lanes that pedestrians must cross, giving cyclists a designated lane, and providing a left-turn pocket for motorists, which reduces rear-end collisions and improves visibility to oncoming traffic.	Classic application is a four-lane undivided roadway with less than 15,000–17,000 average daily traffic. Also applies to three-lane roadways and to five- or six-lane undivided roadways.
Buffer adjacent to a bike lane	Buffer area of 3–5 feet placed on one or both sides of the bike lane.	Right-side buffer between the bike lane and on-street parking removes cyclists from the door zone. Left-side buffer between the bike lane and adjacent travel lane provides greater separation from passing motor vehicles.	Particularly beneficial in the following conditions: <ul style="list-style-type: none"> • Right-side: On streets with parallel parking, particularly in cities with a collision history of dooring. • Left-side: On streets with prevailing speeds of 40 mph and higher.
Cycle track	Bikeway within the roadway right of way that is separated from traffic lanes and the sidewalk by a parking lane, street furniture, curbs, or other physical means.	Reduces sidewalk riding, and provides greater separation between motorists and cyclists.	Urban settings with parallel sidewalks and heavy traffic.
Other traffic control devices			
Except Bicycles placard	Regulatory sign for use with other regulatory signs.	Increases or maintains the access and circulation capabilities of cyclists.	Used at locations where the indicated restriction does not apply to cyclists, such as No Left Turn or Do Not Enter.
Sharrow	Pavement marking that indicates the location within the travel lane that cyclists are expected to occupy.	Encourages cyclists to ride outside of the door zone. Studies have shown that sharrows reduce the incidence of cyclists riding on the sidewalk and toward oncoming traffic.	City streets with two or more lanes, where the rightmost lane is too narrow for a motor vehicle to safely pass a cyclist within the travel lane.
Bike Lanes May Use Full Lane sign	Regulatory sign (MUTCD R4-11).	Indicates that cyclists can travel in the center of a narrow lane.	City streets with two or more lanes, where the rightmost lane is too narrow for a motor vehicle to safely pass a cyclist within the travel lane.

TABLE 6: BICYCLE IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Share the Road sign	Warning sign and placard (MUTCD W-11/ W16-1p).	Informs motorists to expect cyclists on the roadway.	Two-lane roads, particularly in rural areas, where shoulders are less than 4 feet.
Bike Directional sign	Informational sign indicating place names and directional arrows, with distances as a recommended option (MUTCD D1-2C).	Informs cyclists of the most common destinations served by the bike route.	Particularly useful to direct cyclists to a facility, such as a bike bridge or a bicycle-friendly street, to access a major destination that might not be easily apparent.
New infrastructure to improve bicycling connectivity			
Shared-use path	Paved pathway on dedicated right of way for the exclusive use of nonmotorized traffic.	Provides additional connectivity and route options that otherwise would not be available to cyclists.	Wherever a continuous right of way exists. Typically found along an active or abandoned railroad, shorelines, creeks, and river levees.
Pathway connection	Short pathway segment for nonmotorized traffic, such as one that joins the ends of two cul-de-sacs or provides other connectivity not provided by the road network.	Provides shortcuts for cyclists that reduce travel distance and travel time.	Varies by community. Should be required at the end of every newly constructed cul-de-sac.
Bicycle overpass or underpass	Bridge or tunnel built for the exclusive use of nonmotorized traffic. Typically built where at-grade crossings cannot be provided, such as to cross freeways, rivers, creeks, and railroad tracks, or a major arterial where a bike path must cross a major roadway.	Complements a local roadway system that is discontinuous due to manmade or natural barriers. Reduces the distance traveled by cyclists, and provides a safer conflict-free crossing, particularly if it is an alternative to a freeway interchange.	Grade separation is most feasible and appropriate when it provides direct access to major bicycling destinations, such as a school or college, employment site, or transit station, or reduces travel distance by one or more miles.

TABLE 6: BICYCLE IMPROVEMENT MEASURES**NODES and INTERSECTIONS**

Measure	Description	Benefits	Application
Intersection design for motor vehicles			
Reduced curb radius	Reduces the radius of a curb to require motorists to make tighter right turns at slower speeds.	Reduces the speed of right-turning traffic, enabling cyclists a safer weave across the path of right-turning motorists. Reduces the chance of a right-hook collision in which a cyclist is to the right of a right-turning motorist.	Suitable for downtown settings, at all cross streets with minor streets, all residential streets, and all roadways that are not designated truck routes.
Removal or control of free right-turn lane	Redesigns a separate right-turn lane that continues as its own lane after the turn to eliminate the free turn. A short-term solution is to control the turning movement with a stop sign or signal control and to redesign the island.	Forces through cyclists on the cross street to end up between two lanes of through motor vehicle traffic.	All locations that have free right-turn lanes, except those leading onto freeway on-ramps.
Removal or redesign of right-turn slip lane (channelized right-turn lane)	Eliminates or redesigns a right-turn slip lane, which is separated from the rest of the travel lanes by either pavement striping or a raised island designed to facilitate fast right turns where right-turning vehicles are often not subject to the traffic signal or stop sign.	Reduces the speed of right-turning traffic, enabling through cyclists a safer weave across the path of right-turning motorists.	All locations with a channelized right turn.
Removal of optional right-turn lane in combination with a right-turn-only lane	Converts an optional right-turn lane to a through-only lane.	Improves bicycle safety because cyclists have no way of knowing how to correctly position themselves in the optional right-turn lane.	All locations that have an optional right-turn lane in combination with a right-turn-only lane per HDM 403.6(1), except on freeways.
Redesigned ramp terminus	Redesigns high-speed, free-flow freeway ramps that intersect local streets as standard intersections with signal control.	Improves bicycle and pedestrian safety where local streets intersect freeway ramps.	All freeway interchanges with high-speed ramps.

TABLE 6: BICYCLE IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Intersection design treatments, bicycling specific			
Bicycle signal detection and pavement markings	Signal detectors located in all lanes with dedicated signal phasing and pavement markings indicating where cyclists should position their bicycles in each lane to activate the detector.	Enables cyclists to be detected by traffic signals when motor vehicles are not present to trigger the signal.	Per CA MUTCD 4D.105 and CVC 21450.5, all new and modified traffic detection installations must detect cyclists. All other traffic-actuated signals should be retrofitted to detect cyclists as soon as feasible.
Bicycle signal timing	Provides signal timing to account for the speed of cyclists to cross an intersection.	Reduces the probability of a cyclist still being in an intersection when the signal changes and cross traffic enters the intersection.	Particularly important on a minor street approach to a major arterial because the width of the arterial requires a longer time interval to cross.
Bicycle signal head	Traffic signal indicator in the shape of a bicycle, with full red, yellow, green capability.	Provides bicycle-only movement where appropriate, given the geometry and phasing of the particular intersection.	Where intersection geometry is such that a bicycle-only phase is required or would improve safety. See also CA MUTCD for warrants for bicycle signal heads.
Widening of bike lane at intersection approach	Widens the bike lane and narrows the motor vehicle lane within 200 feet of an intersection. For example, a 5-foot bike lane and 12-foot motor vehicle lane become a 7-foot bike lane and 10-foot motor vehicle lane.	Encourages right-turning motorists to enter the bike lane to turn right, as required by the California Vehicle Code (CVC), reducing the chance of a right-hook collision in which a through cyclist remains to the right of a right-turning motorist.	On roads with bike lanes approaching an intersection without a right-turn-only lane and there is noncompliance with right-turning vehicles merging into the bike lane, as required by the CVC and Uniform Vehicle Code (UVC).
Bike lane inside right-turn-only lane	Provides a bike lane line inside and on the left side of a right-turn-only lane.	Encourages cyclists to ride on the left side of the right-turn-only lane, reducing the chance of a right-hook collision.	On roads with bike lanes approaching an intersection with a right-turn-only lane and not enough roadway width to provide a bike lane to the left of the right-turn lane.

TABLE 6: BICYCLE IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Bike box	Designates an area between an advance stop line and a marked crosswalk to provide a space for cyclists to wait for a green light in front of the queued motor vehicle traffic. Sometimes painted green.	Reduces conflicts between bicyclists and right-turning traffic at the onset of the green signal phase. Also reduces motor vehicle and cyclist encroachment in a crosswalk during a red signal phase.	Locations with high bicycle traffic as well as high pedestrian volumes. Note: Not approved for use under the MUTCD. Currently used in projects with approved "Request to experiment."
Marked crosswalk with an area for cyclists separate from pedestrians	Marked crosswalk that has two distinct areas: one for pedestrians and one for cyclists.	Reduces conflicts between cyclists and pedestrians by indicating the part of the crosswalk intended for the two different modes.	At a typical intersection, cyclists would not be riding within the crosswalk, so this measure is intended for those locations where the intersection design tracks cyclists into a crosswalk, such as at a mid-block bike path crossing or a cycle track.
Marked crosswalk for shared-use path	Marked crosswalk with curb cuts the width of the shared-use path.	Reduces conflicts by not funneling all path users into a narrow channel typical of ADA curb-cut standards.	At a typical intersection or road crossing involving a shared-use path, cyclists ride within the designated crosswalk.
Pedestrian countdown signal	Displays a countdown of the number of seconds remaining for the pedestrian crossing interval. In some jurisdictions, the countdown includes the walk phase. In others, the countdown is displayed only during the flashing Don't Walk phase.	Although designed for pedestrians, this measure also assists cyclists in knowing how much time is left to cross the intersection.	The 2012 MUTCD requires all pedestrian signals to incorporate countdown signals within 10 years.

TABLE 6: BICYCLE IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Geometric countermeasures to assist crossing a major street			
Median refuge island	Raised island placed in the center of a roadway to separate opposing lanes of traffic, with ramps for cyclists and ADA accessibility.	Allows cyclists to cross one direction of traffic at a time, and allows drivers to see cyclists crossing from the center more easily.	Recommended for multilane roads at uncontrolled crossings where a minimum 8-foot wide by 15-foot long median can be provided.
Staggered refuge pedestrian island	Similar to a traditional median refuge island, except that the crosswalk is staggered so that a pedestrian first crosses half the street and then must walk toward oncoming traffic to reach the second half of the crosswalk. The path must be designed for accessibility by including rails and truncated domes to direct sight-impaired pedestrians along the path of travel.	Forces cyclists and pedestrians to face oncoming motorists, increasing their awareness of traffic. Can also improve motorists visibility to persons and cyclists in the crosswalk.	Best used on multilane roads with obstructed pedestrian visibility or with off-set intersections.
Raised crosswalk or speed table	A crosswalk whose surface is elevated above the travel lanes to the same level as the approaching sidewalk. For cyclists, a typical location is a bike path crossing, where the bike path elevation remains constant while roadway cross traffic experiences a speed-hump effect.	Attracts drivers' attention to the fact that nonmotorized users might be crossing the roadway, and slows traffic by providing a speed-hump effect.	Appropriate for multilane roadways, roadways with lower speed limits that are not emergency routes, and roadways with high levels of pedestrian activity, such as near schools and shopping malls.
Traffic control countermeasures to assist crossing a major street			
Traffic signal or all-way stop sign	Conventional traffic control devices with warrants for use based on the MUTCD.	Provides the gap needed in traffic flow so that cyclists can cross the street, reducing bicycle-vehicle conflicts and risk-taking by cyclists to cross roadway.	Must meet warrants based on traffic, pedestrian, and bicycle volumes, collision history, or other factors.
Modern roundabout	Traffic circle combined with a splitter island on all approaches. Entering traffic must yield to traffic within the roundabout. Typically designed for traffic speed within the roundabout between 15 and 23 mph.	Slows traffic on the cross street so that cyclists can more easily cross.	A roundabout is a better alternative than all-way stop signs when the side street volume is approximately 30% of the total intersection traffic volume and the total peak hour volume is less than 2,300 vehicles per hour.

TABLE 6: BICYCLE IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Hybrid beacon	Pedestrian-cyclist actuated signal that combines a flasher and a traffic control signal. When actuated, the signal displays a yellow warning light, followed by a solid red light. During the crossing interval, the motorist sees a flashing red, wig-wag pattern. When the crossing interval ends, the beacon stops.	Provides gaps in traffic flow. Reduces conflicts with motorists and slows traffic speeds. Can be timed separately for cyclists and pedestrians.	Useful in areas where it is difficult for cyclists and pedestrians to find gaps in traffic to cross safely, but where normal signal warrants are not satisfied. Appropriate for multilane roadways.
Rectangular rapid flashing beacon (stutter flash)	Warning sign that also contains rapid flashing LED lamps. Beacons can be activated with a push button or by cyclist or pedestrian detection.	Initial studies suggest that the stutter flash is effective based on motorists' increased yielding behavior. Solar panels reduce energy costs associated with the device.	Locations not controlled by other measures. Appropriate for multilane roadways. Interim approval by FHWA.
In-roadway warning lights	Both sides of a crosswalk are lined with pavement markers, often containing an amber LED strobe light. Lights can be activated with a push button or by cyclist or pedestrian detection.	Provides a dynamic visual cue of an uncontrolled crosswalk. Especially effective at night and in bad weather when visibility is low.	Best in locations with low bicycle ridership on the cross street because the raised markers present a hazard. Might not be appropriate in areas with heavy winter weather due to high maintenance costs or locations with bright sunlight.
Bicycle or trail crossing sign	Warning sign and placard (MUTCD W11-1 or W11-15/W11-15p).	Alerts motorists to a location where cyclists or pedestrians might be crossing the roadway at an uncontrolled location.	Usually placed at a bike path crossing of a roadway. At a typical pedestrian crosswalk at an intersection, use the pedestrian warning sign (W11-2).
In-street pedestrian crossing sign	Regulatory pedestrian signage posted on lane edge lines and road center lines. Reminds motorists of laws regarding right of way at an unsignalized pedestrian crossing. If applicable, STATE LAW can appear at the top of the sign. The legend STOP FOR or YIELD TO can be used in conjunction with the appropriate symbol (MUTCD R1-6).	Highly visible to motorists and has a positive impact on safety at crosswalks.	Mid-block crosswalks, unsignalized intersections, low-speed areas, and two-lane roadways.

TABLE 6: BICYCLE IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Advanced yield lines	Standard white stop or yield limit lines are placed 20–50 feet in advance of marked, uncontrolled crosswalks.	Increases cyclists' visibility to motorists, reduces the number of vehicles encroaching on the crosswalk, and improves general bicycling conditions on multilane roadways.	Useful in areas where cyclist visibility is low and in areas with aggressive drivers, because advance limit lines help prevent drivers from encroaching on the crosswalk. Addresses multiple-threat collisions on multilane roads.
Transit			
Bike racks on buses	Rack on the front of the bus that typically holds two or three bicycles.	Increases the trip length distance that a cyclist can make.	Appropriate for all buses. Most urban transit agencies have implemented this measure.
Bikes allowed inside buses when bike rack is full	Passengers are allowed to bring bicycles inside the bus when the bike rack is full and there is room inside.	Prevents cyclists from having to wait for the next bus if the bike rack is full, yet there is room inside the bus.	Appropriate for all buses. Must be approved by the specific transit agency. Most urban transit agencies have implemented this measure.
Folding bikes allowed inside buses	Treats a folding bicycle as luggage, thereby allowing it inside the bus at all times.	Removes cyclists' uncertainty as to whether they will be able to take their bike on the bus.	Appropriate for all buses. Must be approved by the specific transit agency. Most urban transit agencies have implemented this measure.

2.6 BENCHMARKING POLICIES, PROGRAMS, AND PRACTICES

NHSTA uses benchmarking as a tool to evaluate safety programs. To create a benchmark, the BSA evaluators analyze the local agency's responses to the pre-visit survey. The community's bicycle policies, programs, and practices are then compared with national best practices, as shown in Table 7.

The benchmarking analysis categorizes the community's programs, practices, and policies into three groups:

- Key strength: Area where the community is exceeding national best practices
- Enhancement: Area where the community is meeting best practices
- Opportunity: Area where the community appears not to meet best practices

The community may select strategies for implementation based on local priorities.

TABLE 7: POLICY, PROGRAMS, AND PRACTICES BENCHMARKS

Topic	Key Strength	Enhancement	Opportunity
Existing Bike Network	Includes innovative features, such as cycle tracks, bicycle boulevards, colored bike lanes, or buffered bike lanes.	Includes bicycle paths, lanes, and routes.	Includes only bicycle routes or no designation.
Roadway Surfaces	Roadway resurfacing projects and debris removal are prioritized for bicycle routes.	Roadway surface is acceptable on bicycle routes, and routine maintenance, including debris removal, occurs.	Roadway surface conditions are poor on some bicycle facilities, and maintenance is not prioritized for bicycle facilities.
Shared-Use Path Clearances	The path corridor has recently been audited with remedial actions made to accommodate clearance standards, mark obstructions, or otherwise warn bicyclists of limited lane width conditions.	Path clearance standards generally met with only minor modifications required.	Path corridor does not meet overall clearance standards or contains numerous obstructions.
Bike Network Implementation Practices	Age 8-to-80 bicyclist considerations are applied, or the level of traffic stress is considered.	Some traffic calming measures are implemented in conjunction with bikeway installation.	Treatments are implemented where they fit within the right of way and vehicle LOS is not affected.
Intersections and Interchanges	Colored bike lanes and other innovative treatments, including geometric enhancements, are provided at intersections and interchanges.	Bike treatments are installed at some intersections and interchanges.	Bike treatments are not installed at intersections or interchanges.
Bicycle Parking	A bicycle parking ordinance is enforced for all development, and a program is in place to install and maintain public bike parking in existing development.	A bicycle ordinance for off-street parking is in place, but no program to install parking for existing development.	No bike parking ordinance or program in place.
Bicycle and Transit Coordination	Bicycles are accommodated on all transit vehicles with no restrictions and with overflow capacity available.	Bicycles are accommodated on buses only, with accommodation limited to rack capacity.	Bicycles are not accommodated on transit.
Bicycle-Supportive Amenities and Wayfinding	Supportive amenities, such as parking, routing, wayfinding, water fountains, and repair stations, are found community-wide.	Some supportive amenities are found in key areas.	Bicycle-supportive amenities are not provided in the community.

TABLE 7: POLICY, PROGRAMS, AND PRACTICES BENCHMARKS

Topic	Key Strength	Enhancement	Opportunity
Collection of Bicyclist Volumes	Collects bicyclist volumes routinely with intersection counts or has a GIS database of counts.	Collects some bicyclist volumes, but not routinely.	Does not collect bicycle volumes.
Collision History and Collision Reporting Practices	Creates annual reports, or employs other comprehensive monitoring practices.	Reviews data only following fatalities or other high-profile incidents.	Does not have set practices for data review.
Bicyclist Traffic Control Audit (Signs, Markings, and Signals)	Maintains a full inventory of bicycle facility signs, markings, and signals.	Maintains a partial inventory of bicycle facility signs, markings, and signals.	Does not have an inventory of signs, markings, and signals.
Speed Limits and Speed Surveys	Employs a comprehensive practice to proactively review speed limits (such as USLIMITS2), and considers lower speed limits if allowable. Considers traffic calming before raising speed limits in bicycle zones.	Reviews data only in response to reported concerns or frequent collisions.	Does not have set practices for speed limit reviews.
Traffic Signal and Stop Sign Warrants	Uses relaxed warrants for traffic signals and all-way stops where appropriate.	Uses relaxed warrants for traffic signals or all-way stops where appropriate.	Uses MUTCD warrants.
Inventory of Bikeways and Parking	Maintains an inventory of missing and existing bikeways and parking in GIS, and includes projects in the capital improvement plan.	Maintains an inventory of bikeway gaps and opportunity areas.	Does not have an inventory of missing or existing bikeways or parking.
Traffic Calming Programs	Has a significant traffic calming program with a dedicated funding source.	Has a traffic calming program, but no dedicated funding source.	Does not have a traffic calming program, or the program includes only speed humps.
Bicycle Safety Audit Program	Has ongoing programs that include bicycling audits.	Has some programs, and might have conducted a bicycling audit.	Does not have bicycle safety audit programs.
Attention to Crossing Barriers	Has a recently updated policy and comprehensive inventory of barriers. Has design guidelines for addressing barriers.	Has no policy, but has identified some barriers and taken steps to improve bicycle access.	Does not have a policy or practice for addressing bicycle crossings at railroads, freeways, and so on.

TABLE 7: POLICY, PROGRAMS, AND PRACTICES BENCHMARKS

Topic	Key Strength	Enhancement	Opportunity
Design and Development Standards	Local standards that include landscaping have been developed, and development is required to be oriented toward cyclists.	Local standards reference national best practices.	No standards.
General Plan: Densities and Mixed-Use Zones	Has moderate to high densities in the central business plan and mixed-use zones.	Has moderate densities with separate uses.	Has low densities with separate uses.
General Plan: Attention to Bicycle Generators and Significance Standards	Bicycle nodes are identified, and quantifiable significance criteria are in place.	Bicycle nodes are identified, but bicycle accommodations are not.	Bicycling nodes are not identified.
Complete Streets Policy and Traffic Impact Fee Program	Has a Complete Streets policy that applies to the development review process, and assesses multimodal impact fees.	Has a Complete Streets policy for public works projects only.	Does not have a Complete Streets policy.
Specific Plans, Overlay Zones, and Redevelopment Areas	Bicycle-oriented design, bikeability, or placemaking is stressed in the plans.	Plans require cyclist accommodations.	Plans do not address cyclist needs.
Bicycle Master Plan	Has an updated plan coordinated with other elements of the General Plan, and bicycle projects have been recently completed.	Has a bicycle master plan, but it might be outdated or no recent projects from the plan have been completed.	Does not have a bicycle master plan.
Funding	Has a dedicated annual funding stream for bicycle projects and local grant matches.	Depends on grant funding for projects, and is successful in obtaining grants.	Only moderately successful in obtaining grant funding, or has trouble spending funds when given grants.
Bicycle or Pedestrian Coordinator	Has a coordinator on staff who manages a community bicycle program.	Occasionally uses a contract coordinator.	Does not have a coordinator.
General Ordinances	Ordinances mandate helmet usage and bike registration for all bicyclists.	Ordinances mandate that only children use helmets or all bikes be registered, or no bikes are allowed on sidewalks under any circumstances.	Ordinances do not mandate helmet use or bike registration, and bikes on sidewalks are considered as appropriate.

TABLE 7: POLICY, PROGRAMS, AND PRACTICES BENCHMARKS

Topic	Key Strength	Enhancement	Opportunity
Transportation Demand Management (TDM) and Transit Policies	Has a transit-first policy, extensive TDM programs, and enforces parking cash out.	Has basic voluntary TDM programs, such as Commuter Checks or Guaranteed Ride Home.	Does not have a TDM program or policy.
Formal Advisory Committee	Has a formal, active bicycle committee.	Has an ad hoc bicycle committee.	Does not have a bicycle committee.
Public Involvement and Feedback Process	Uses social media or other technology and brings workshops or materials to other meetings to encourage a wide range of participants in public involvement.	Has a public feedback process (web-enabled).	Does not have a formal public involvement or feedback process for bicycle planning or safety.
Economic Vitality	Has several business improvement districts (BIDs), an established façade improvement program, or aggressive downtown parking policies.	Has a BID, façade improvement program, or downtown parking policies.	Does not have BIDs, façade improvement program, or downtown parking policies.
Bicycle Safety Education Program	In addition to a bicycle safety curriculum in schools, provides brochures or conducts education campaigns.	Has a bicycle safety curriculum in schools or community centers.	Does not have bicycle safety education program.
Proactive Approach to Institutional Coordination	Has identified obstacles and proactively implemented efforts to overcome barriers.	Has identified obstacles.	Does not have any identified obstacles.
Safe Routes to Schools	Has an ongoing Safe Routes to Schools program and funding for recent projects.	Has a Safe Routes to Schools program, but has not obtained funding for recent projects.	Does not have a Safe Routes to Schools program and has not obtained recent funding.
Coordination with Schools	Has a policy to encourage neighborhood-sized schools and coordinates with schools for bicycle improvements.	Does not have a policy to encourage neighborhood-sized schools, but coordinates with local schools for bicycle improvements.	Does not have a policy to encourage neighborhood-sized schools, does not coordinate with local schools, and recent schools have been “mega schools” on the periphery.

TABLE 7: POLICY, PROGRAMS, AND PRACTICES BENCHMARKS

Topic	Key Strength	Enhancement	Opportunity
Enforcement	Police department conducts sustained bicycle safety-related enforcement efforts, including bicycle-related citations, patrols on bikes, traffic safety officer on staff, and resource sharing with neighboring cities.	Police department conducts some bicycle safety-related enforcement activities.	Police department does not conduct bicycle safety-related enforcement activities or does not have a traffic safety officer.
Coordination with Emergency Response and Transit Providers	Emergency responders and transit providers are involved in all aspects of bicycle facility planning and design (including pilot testing), and they balance response times with bicycle safety.	Emergency responders and transit providers are involved in some aspects of bicycle facility planning and design.	Emergency responders and transit providers are not involved in bicycle facility planning and design.
Health Agency Coordination	Coordinates with health agencies in the planning of bicycle facilities or programs and the collection of collision data.	Health agencies have programs to promote healthy lifestyles through active transportation.	Health agencies are not involved in bicycle safety or active transportation.

2.7 PREPARE THE TECHNICAL REPORT

After the community visit, the evaluators prepare a technical report describing their findings and suggestions. The report offers insights on collision hot spots as well as key bicycling network enhancements. The report might also include:

- Items that can be implemented immediately
- Suggestions for prioritizing the greatest safety and overall bikeability
- Comparison of bikeability opportunities with cities in its class
- Suggestions for future policies for new development and redevelopment
- Community-wide policies, programs, and practices

Many improvement measures included in the report provide a basis for the community to apply for grants to implement the suggestions or conduct further studies. The report also includes the list of resources and reference documents in Appendix C.

APPENDIX A: TOPICS AND DETAILED PROMPT LISTS FOR FIELD REVIEWS

The following matrix and prompt lists are adapted from the *FHWA Bicycle Road Safety Audit Guidelines and Prompt Lists*. The detailed prompt lists on the following pages expand on each topic identified in the matrix.

MATRIX OF TOPICS FOR FIELD REVIEW

Subtopic	BSA Zones				
	A. Street or Path	B. Structures	C. Intersections, Crossings, and Interchanges	D. Transitions	E. Transit
1. Presence and Availability	Are cyclists accommodated?	Are cyclists accommodated?	Are cyclists accommodated?	Are cyclists accommodated?	Are cyclists accommodated?
2. Design and Placement	Are design features present that adversely impact the use of the facility by cyclists?	Are bridges and tunnels designed with adequate bicycle accommodations on both sides? Does the gradient of the bicycle accommodations impact the use of the facility?	Are intersection and interchange accommodations designed to reduce conflicting movements and communicate proper bicycle positioning through the crossing?	Are transition areas designed with logical termini or do they end abruptly, potentially contributing to sudden and difficult merges, mid-block crossings, or behaviors such as wrong-way riding?	Are transit facilities designed and placed to minimize conflicts with other modes?
3. Operations	Are there suitable provisions for cyclists, given the characteristics of the roadway or path (speed, volume, traffic, and functional classification)? Do access management practices detract from bicycle safety?	Are there suitable provisions for cyclists, given the characteristics of the roadway or path (speed, volume, traffic, and functional classification)? Do access management practices detract from bicycle safety?	Do traffic operations during peak periods create a safety concern for cyclists?	Do shared roadway geometrics change substantially or frequently?	Are transit facilities designed and placed to minimize conflicts with other transport modes?
4. Quality and Conditions	Is the riding surface smooth, stable, and free of debris, and is drainage adequate? Are drainage grates designed for cyclists?	Is the grating and bridge surfaces designed for cyclists? Is drainage adequate to accommodate cyclists? Are there longitudinal or transverse joints that may cause cyclists problems?	Are there obstacles at crossings? Are the manhole covers properly designed?	Is there an abrupt change in the riding surface?	Are transit stops maintained during periods of inclement weather?
5. Obstructions	Are there horizontal or vertical obstructions (temporary or permanent) along the bicycle facility?	Is there adequate horizontal and vertical clearance?	If bollards or other physical terminal devices are used, is the risk of occasional motorized vehicles greater than the risk of a fixed object within the travel way?	If bollards or other physical terminal devices are used, is the risk of occasional motorized vehicles greater than the risk of a fixed object within the travel way?	Is the waiting area free of temporary and permanent obstructions that constrict its width or block access to the bus stop?

MATRIX OF TOPICS FOR FIELD REVIEW, CONT.

Subtopic	BSA Zones				
	A. Street or Path	B. Structures	C. Intersections, Crossings, and Interchanges	D. Transitions	E. Transit
6. Roadside	Is the clear zone for cyclists' operating space adequate?	Are railings, guardrails, parapets, and other structures installed at an appropriate height and shy distance?	If bollards or other physical terminal devices are used, is the risk of occasional motorized vehicles greater than the risk of a fixed object within the travel way?	If bollards or other physical terminal devices are used, is the risk of occasional motorized vehicles greater than the risk of a fixed object within the travel way?	Are bicycle facilities connected and convenient for transit users?
7. Continuity and Connectivity	Are bicycle facilities continuous? Do bicycle facilities provide adequate connectivity to major destinations?	Are bicycle facilities continuous or do they end abruptly, such as at an intersection, bridge, or tunnel?	Are bicycle facilities continuous, or do they end abruptly at crossings, intersections, or interchanges?	Is there a safe way for cyclists from both directions to access connections or continue to other destinations along the street network?	Are crossings convenient and free of potential hazards for cyclists?
8. Lighting	Is the riding surface adequately lit?	Are bridges and tunnels adequately lit?	Are the paths leading to a transition adequately lit?	Are the paths leading to a transition adequately lit?	Are transit access ways and facilities adequately lit?
9. Visibility	Is the visibility of cyclists using the facility adequate from the perspective of all road users?	Can cyclists see approaching vehicles and pedestrians, and vice versa?	Can cyclists see approaching vehicles and pedestrians at all legs of an intersection or crossing, and vice versa?	Is the visibility of cyclists as they make the transition from one facility or roadway geometry to another adequate from the perspective of all road users?	Is the visibility of cyclists using the facility adequate from the perspective of all road users?
10. Signs and Pavement Markings	Are signs and markings along the riding surface visible, well maintained, easily understood, and adequate?	Are adequate warning signs posted at entrances?	Do signs and markings along the bicycle facility clearly indicate the cyclist path and right-of-way at intersections?	Are signs and markings at transition areas appropriate?	Are signs and markings at designated areas for cyclists using transit appropriate?
11. Signals	If bicycle signalization and detection are present, are they properly positioned, functioning, and effective?	If bicycle signalization and detection are present, are they properly positioned, functioning, and effective?	If bicycle signalization and detection are present, are they properly positioned, functioning, and effective?	If bicycle signalization and detection are present, are they properly positioned, functioning, and effective?	If bicycle signalization and detection are present, are they properly positioned, functioning, and effective?
12. Human Factors and Behavior	Does the traffic signal design accommodate all users? What are all roadway users (vehicles, bicyclists, pedestrians, transit, etc.) doing with regards to bicycle traffic, and vice versa?	Does the traffic signal design accommodate all users? What are all roadway users (vehicles, bicyclists, pedestrians, transit, etc.) doing with regards to bicycle traffic, and vice versa?	Does the traffic signal design accommodate all users? What are all roadway users (vehicles, bicyclists, pedestrians, transit, etc.) doing with regards to bicycle traffic, and vice versa?	Does the traffic signal design accommodate all users? What are all roadway users (vehicles, bicyclists, pedestrians, transit, etc.) doing with regards to bicycle traffic, and vice versa?	Does the traffic signal design accommodate all users? What are all roadway users (vehicles, bicyclists, pedestrians, transit, etc.) doing with regards to bicycle traffic, and vice versa?

Master and Detailed Prompt Lists for Field Reviews

This prompt list addresses street usage and applies to the Street or Path category in the Matrix of Topics for Field Review.

STREET OR PATH

Subtopic	Detailed Prompt
<p>A.2: Are design features present that adversely impact the use of the facility by cyclists?</p>	<p>A.2.1 Do accommodations for cyclists conform to the state of practice, guidelines, and relevant standards, or are there more advanced designs that would better support and enhance conditions for cycling?</p> <p>A.2.2 Are there adequate cycling provisions on both sides or directions of the roadway?</p> <p>A.2.3 Does the design consider prevailing speeds of cyclists and comfort?</p> <p>A.2.4 Would bicycle lanes or separated facilities improve conditions for cyclists and if so, is there adequate separation between vehicular and bicycle traffic?</p> <p>A.2.5 Is there adequate space and accommodation for bicycles?</p> <p>A.2.6 Could the gradient impact cyclists?</p> <p>A.2.7 Do traffic calming measures and traffic management practices allow for safe and efficient cycling operation?</p> <p>A.2.8 Do rumble strips present a detrimental surface condition to bicycles?</p> <p>A.2.9 Does parking adversely affect cycling safety?</p>
<p>A.3: Are there suitable provisions for cyclists given the characteristics of the roadway or path (speed, volume, traffic, and functional classification)? Do access management practices consider cycling safety?</p>	<p>A.3.1 Is the type of cycling accommodation appropriate for the roadway context?</p> <p>A.3.2 Is the type of cycling accommodation appropriate for the primary or intended users?</p> <p>A.3.3 Are driveways designed with cyclists in mind?</p>
<p>A.4: Is the riding surface smooth, stable, and free of debris, and is drainage adequate? Are drainage grates or manholes located in the cyclists' path of travel?</p>	<p>A.4.1 Are cross-slopes adequate for prevailing speeds by cyclists?</p> <p>A.4.2 Does debris accumulate in the area used (or intended for use) by cyclists?</p> <p>A.4.3 Is vegetation narrowing the rideable width or affecting the surface quality?</p> <p>A.4.4 Are there potholes or other surface defects?</p> <p>A.4.5 Are drainage grates or manholes located in the cyclists' path of travel?</p> <p>A.4.6 Are there longitudinal joints or cracks that could trap a wheel?</p> <p>A.4.7 Does ponding of water occur in the cyclists' path of travel?</p>
<p>A.5: Are there horizontal or vertical obstructions (temporary or permanent) along the facility?</p>	<p>A.5.1 Are sign faces, including temporary construction or detour signs, mounted away from the operating space?</p> <p>A.5.2 Do vegetation or other obstructions encroach into the cycling operating space?</p>

STREET OR PATH (continued)

Subtopic	Detailed Prompt
A.6: Is the clear zone for cyclists' operating space adequate?	<p>A.6.1 Are clear zones along paths adequate?</p> <p>A.6.2 Do slopes in the clear zone pose a safety issue?</p>
A.7: Are bicycle accommodations continuous? Do bicycle accommodations provide adequate connectivity to major destinations?	<p>A.7.1 Are cycling routes or facilities continuous?</p> <p>A.7.2 Are there frequent changes in the geometrics or accommodations provided for cyclists?</p> <p>A.7.3 Is access provided to primary destinations?</p>
A.8: Is the riding surface adequately lit?	
A.9: Is the visibility of cyclists using the facility adequate from the perspective of all road users?	<p>A.9.1 Is sight distance an issue?</p> <p>A.9.2 Are cyclists riding at the edge of the road or path obscured by vegetation along the roadway edge?</p>
A.10: Are signs and markings along the riding surface visible, well-maintained, easily understood, and adequate?	<p>A.10.1 Are signage and pavement markings clear and consistent along the path or roadway?</p> <p>A.10.2 Is the spacing and location of signage and pavement markings adequate to communicate the intended use?</p>
A.11: Refer to B.11 and C.11 for traffic signal and detection position, function, and effectiveness considerations.	<p>A.11: Refer to B.11 and C.11 for traffic signal and detection position, function, and effectiveness considerations.</p>

Master and Detailed Prompt Lists for Field Reviews

This prompt list addresses structures that affect bicycle safety and applies to the Structures category in the Matrix of Topics for Field Review.

STRUCTURES

Subtopic	Detailed Prompt
B.2: Are the bridges/tunnels designed with adequate bicycle accommodations on both sides? Does the gradient of the cycling accommodations impact the use of the facility?	B.2.1 Are two-way bicycle accommodations provided?
	B.2.2 Does the gradient of the cycling accommodations impact the use of the facility?
B.3: See prompts in A.3 for potential operational considerations affecting the safety of cyclists.	
B.4: Does the grating/bridge surface pose a hazard to bicyclists? Is drainage adequate to accommodate bicyclists? Are there longitudinal or transverse joints that may cause cyclists problems?	B.4.1 Is the riding surface smooth, and does it provide adequate skid resistance?
	B.4.2 Is drainage adequate, and is the surface free of debris?
	B.4.3 Are there longitudinal or transverse joints that may cause cyclists problems?
B.5: Is there adequate horizontal and vertical clearance?	
B.6: Are railings, guardrail, and/or parapets and other structures installed at an appropriate height and shy distance? Are there features that can pose a risk to cyclists?	
B.7: Are bicycle accommodations continuous, or do they end abruptly at bridge/tunnel crossings?	
B.8: Are bridges and tunnels adequately lit?	
B.9: Can cyclists see approaching vehicles/pedestrians, and vice versa?	
B.10: Are adequate warning signs posted at entrances?	
B.11: If bicycle traffic signalization and detection are present, are they properly positioned, functioning, and effective?	

Master and Detailed Prompt Lists for Field Reviews

This prompt list addresses the Intersections, Crossings, and Interchanges category in the Matrix of Topics for Field Review.

INTERSECTIONS, CROSSINGS, AND INTERCHANGES

Subtopic	Detailed Prompt
C.2: Are intersections/ interchange accommodations designed to reduce conflicting movements and communicate proper bicycle positioning through the crossing?	C.2.1 Are accommodations properly designed and placed on intersection approaches?
	C.2.2 Are there difficulties for cyclists caused by intersection geometry or lane use assignments?
	C.2.3 Are cyclists safely accommodated on each approach to an intersection?
	C.2.4 Where pedestrian accommodations are present, are cyclists adversely affected?
	C.2.5 Are there any unique intersection characteristics that may pose a problem for cyclists?
	C.2.6 Do at-grade railroad crossings safely accommodate bicyclists?
	C.2.7 Do facilities avoid or minimize the need for the cyclist to slow down or stop unnecessarily?
C.3: Do traffic operations (especially during peak periods) create a safety concern for cyclists?	C.3.1 Are there sufficient gaps in traffic or gaps created by geometry or traffic controls for bicycle crossings?
	C.3.2 What traffic movements increase bicycle/other road user crash risk?
C.4: Are there any obstacles at crossings? Are the manhole covers properly designed?	
C.5 - C.6: If bollards or other physical terminal devices are used, is the risk of occasional motorized vehicles greater than the risk of a fixed object within the travel way?	
C.7: Are bicycle accommodations continuous, or do they end abruptly at crossings/ intersections/interchanges?	

INTERSECTIONS, CROSSINGS, AND INTERCHANGES (continued)

Subtopic	Detailed Prompt
C.8: Are the intersection/transition and paths leading to the transition adequately lit?	
C.9: Can cyclists see approaching vehicles/pedestrians at all legs of an intersection/crossing, and vice versa?	
C.10: Do signs and markings along the cycling facility clearly indicate the cyclist path and right-of-way at intersections?	
C.11: Does the traffic signal design accommodate all users?	C.11.1 Are signals, bicycle detection, and bicycle push buttons properly located and functioning? Do problems result from inconsistent bicycle detection types?
	C.11.2 Are there conflicting traffic movements during bicycle crossing phases?
	C.11.3 Do traffic signal clearance intervals safely accommodate cyclists?

Master and Detailed Prompt Lists for Field Reviews

This prompt list addresses the Transitions category in the Matrix of Topics for Field Review.

TRANSITIONS

Subtopic	Detailed Prompt
<p>D.2: Are transition areas designed appropriately with logical termini or do they end abruptly, potentially contributing to sudden and difficult merges, uncontrolled crossings, or behaviors such as wrong-way riding?</p>	
<p>D.3: Do shared roadway geometrics change substantially or frequently?</p>	
<p>D.4: Is there an abrupt change in riding surface?</p>	
<p>D.5 - D.6: If physical terminal or transition devices are used, are they needed and is there sufficient width on either side? (See C.5 - C.6)</p>	
<p>D.7: Is there a safe way for cyclists from both directions to access connections or continue to other destinations along the street network?</p>	
<p>D.8: Are the intersection/ transition and paths leading to the transition adequately lit? (See C.8)</p>	
<p>D.9: Is the visibility of cyclists as they make the transition from one facility or roadway geometry to another adequate from the perspective of all road users?</p>	
<p>D.10 - D.11: Are signs and markings at transition areas appropriate?</p>	

Master and Detailed Prompt Lists for Field Reviews

This prompt list addresses the Transit category in the Matrix of Topics for Field Review.

TRANSIT

Subtopic	Detailed Prompt
E.2 - E.3: Are transit facilities designed and placed to minimize conflicts with other modes?	E.2.1 Are transit stop locations appropriate for cyclists?
	E.2.2 Do transit facilities provide adequate separation between cyclists and other modes of travel?
	E.2.3 Do waiting areas at transit stops provide sufficient space for cyclists?
	E.2.4 Do paths accessing transit stops minimize conflicts between cyclists and other modes of travel?
E.4: Are transit stops maintained during periods of inclement weather?	E.4.1 Is snow removed from waiting areas at transit stops? Is there sufficient storage area for removed snow?
	E.4.2 Have the effects of weather been adequately considered?
E.5: Is the waiting area free of temporary/permanent obstructions that constrict its width or block access to the bus stop?	
E.6: Are bicycle accommodations connected and convenient for transit users?	
E.7: Are crossings convenient and connected to continuous facilities for cyclists?	
E.8: Are transit access ways and facilities adequately lit?	
E.9: Is the visibility of cyclists using the facility adequate from the perspective of all road users?	
E.10: Are signs and markings at designating areas for cyclists using transit appropriate?	

APPENDIX B: BEST PRACTICES RESOURCES CORRESPONDING TO TOPICS IN THE FIELD REVIEW

In the following tables, bicycle safety standards, tools, best practices, and safety resources have been mapped to the applicable cells in the matrix of topics for field review.

MATRIX OF BEST PRACTICES CORRESPONDING TO TOPICS IN THE FIELD REVIEW

Topic	Subtopic	Bicycle Safety Assessment (BSA) Zones		
		A. Street Cross Section	B. Intersections and Interchanges	C. Non-roadway ROW, including Shared-Use Paths
Bicycle Facilities	Presence, Design, and Placement	S1, S3, S4, T1, T4, P2, P4, P5, P7, P8, P9, P10, P11, P13, P15, P16, P17, P18, R2, R3, R4, R5, R6	S1, S4, T2, T4, P2, P4, P5, P7, P8, P9, P10, P11, P13, P14, P15, P16, P17, P18, R6	S3, S4, T4, P2, P3, P4, P5, P6, P9, P12, P13, R6
	Quality, Construction, and Obstructions	S1, S4, T1, T4, P2, P4, P5, P8, P9, P11, P13, P15, R6	S1, S4, T2, T4, P1, P2, P4, P5, P8, P9, P11, P13, P14, P15, R6	S4, T4, P1, P2, P3, P4, P5, P9, P12, P13, R6
	Continuity and Connectivity	P2, P4, P5, P8, P9, P10, P13, P15, P16, P17, P18	P2, P4, P5, P7, P8, P9, P10, P13, P14, P15, P16, P17, P18	P2, P4, P5, P9, P12, P13
Traffic	Access Management	S1, S4, T4, P2, P5, P11, P13, P15, P17, P18, R5	S4, P2, P13, P14, P15	P13
	Traffic Speed and Characteristics	S1, S4, T1, T4, P2, P4, P5, P8, P10, P11, P13, P15, P16, P17, P18, R1, R2, R3, R4, R5, R6	S1, S4, T2, T4, P1, P2, P4, P5, P7, P8, P10, P11, P13, P14, P15, P16, P17, P18, R1, R5, R6	S3, S4, T4, P1, P2, P4, P5, P6, P12, P13, R1, R6
Traffic Control Devices	Signs and Pavement Markings	S1, S3, S4, P2, P4, P5, P8, P9, P10, P11, P13, P15, P17, R2, R3, R4, R6	S3, S4, P1, P2, P4, P5, P7, P8, P9, P10, P11, P13, P14, P15, P17, R6	S3, S4, P1, P2, P3, P4, P5, P6, P9, P12, P13, R6
	Signals	S3, S4, P2, P4, P5, P8, P10, P11, P13, P15, P17, R5, R6	S3, S4, T2, T4, P2, P4, P5, P7, P8, P10, P11, P13, P14, P15, P17, R5, R6	S3, P2, P5, P6, P13, R6

RELEVANT STANDARDS, TOOLS, BEST PRACTICES, AND SAFETY RESOURCES

Standards

-
- S1 AASHTO, *A Policy on Geometric Design of Highways and Streets*, 6th Edition (2011)
https://bookstore.transportation.org/collection_detail.aspx?ID=110
- S2 *Manual on Uniform Traffic Control Devices (MUTCD)*
<http://mutcd.fhwa.dot.gov>
- S3 *California Manual on Uniform Traffic Control Devices*
www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/ca_mutcd2012.htm
 Outside of California, refer to S2 or your state's approved alternate
- S4 *Caltrans Highway Design Manual*
www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm
-

Level of Service Tools and Quantitative Assessments

-
- T1 Bicycle Level of Service calculator
www.bikelib.org/roads/blos/blosform.htm
- T2 *Pedestrian and Bicycle Intersection Safety Indices (2007)*
www.fhwa.dot.gov/publications/research/safety/pedbike/06130/06130.pdf
- T3 Pedestrian and Bicycle Crash Analysis Tool
www.walkinginfo.org/facts/pbcat/index.cfm?pc/pbcat.htm
- T4 *Multimodal Level of Service Analysis for Urban Streets*
http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_616.pdf
-

Best Practices

-
- P1 FHWA, *Designing Sidewalks and Trails for Access, Part II, Best Practices Guide*
www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/sidewalk2/index.cfm
- P2 AASHTO, *Guide for the Development of Bicycle Facilities*
https://bookstore.transportation.org/collection_detail.aspx?ID=116
- P3 Association of Pedestrian and Bicycle Professionals, *Bicycle Parking Guidelines*
www.apbp.org/?page=Publications
- P4 ITE, *Traffic Control Devices Handbook*, Chapter 14: Bicycle Facilities
www.ite.org/emodules/scriptcontent/Orders/ProductDetail.cfm?pc=IR-112A
- P5 *Santa Clara Valley Transportation Authority Bicycle Technical Guidelines: A Guide for Local Agencies in the Planning, Design and Maintenance of Bicycle Facilities and Bicycle-Friendly Roadways*
www.vta.org/bike_information/bicycle_technical_guidelines.html
- P6 Contra Costa County, *Trail Design Resources Handbook*
www.co.contra-costa.ca.us/depart/cd/transportation/trl_rvw/new/ccc_tdrh.pdf
- P7 Caltrans, *Complete Intersections: A Guide to Reconstructing Intersections and Interchanges for Bicyclists and Pedestrians (2010)*
www.dot.ca.gov/hq/traffops/survey/pedestrian/Complete-Intersections-A-Guide-to-Reconstructing-Intersections-and-Interchanges-for-Bicyclists-and-Pedestrians.pdf

- P8 IBPI/Portland State University & Alta Planning + Design, *Fundamentals of Bicycle Boulevard Planning & Design*
www.pdx.edu/ibpi/bicycle-boulevard-planning-design-guidebook
- P9 Caltrans & Alta Planning + Design, *Pedestrian and Bicycle Facilities in California – A Technical Reference and Technology Transfer Synthesis for Caltrans Planners and Engineers*
www.dot.ca.gov/hq/traffops/survey/pedestrian/TR_MAY0405.pdf
- P10 National Association of City Transportation Officials, *Urban Bikeway Design Guide*
<http://nacto.org/cities-for-cycling/design-guide>
- P11 Los Angeles County, *Model Design Manual for Living Streets*
www.modelstreetdesignmanual.com
- P12 Bondurant, Julie, Laura Thompson, et al, *Trail Planning for California Communities*, Solano Press Books (2009)
www.americantrails.org/views/Trail-planning-guide-Calif.html
- P13 CROW, *Design Manual for Bicycle Traffic*
www.crow.nl/publicaties/design-manual-for-bicycle-traffic
- P14 ITE, *Draft Recommended Practice on Accommodating Pedestrians and Bicyclists at Interchanges*
www.walkinginfo.org/training/pbic/lc_webinar_06-25-2013.cfm
- P15 ITE, *Separated Bikeways*, Interim Report
www.ite.org/emodules/scriptcontent/Orders/ProductDetail.cfm?pc=IR-135
- P16 ITE, *Planning Urban Roadway Systems*
www.ite.org/emodules/scriptcontent/orders/ProductDetail.cfm?pc=RP-015C
- P17 AASHTO, *Guide for Achieving Flexibility in Highway Design*
https://bookstore.transportation.org/item_details.aspx?ID=103
- P18 *Complete Streets: Best Policy and Implementation Practices*
www.planning.org/apastore/Default.aspx?p=4060

Safety Resources

- R1 Landis, Petritsch, & Huang, *Characteristics of Emerging Road and Trail Users and Their Safety*
www.fhwa.dot.gov/publications/research/safety/O4104/
- R2 Potts, Harwood, & Richard, *Relationship of Lane Width to Safety for Urban and Suburban Arterials*
www.smartgrowthamerica.org/documents/cs/resources/lanewidth-safety.pdf
- R3 Transportation Research Board, *Effective Utilization of Street Width on Urban Arterials*
<http://trid.trb.org/view/1990/M/312924>
- R4 Petritsch, Theo, *Lane Width Impacts on Safety and Capacity*
www.sprinkleconsulting.com
- R5 Thomas, Beth and Michelle DeRobertis, *Cycle Track Literature Review, Accident Analysis and Prevention*, Volume 52, pp 219-227, March 28, 2013
www.sciencedirect.com/science/journal/00014575/52
- R6 BIKESAFE: Bicycle Countermeasure Selection System
www.bicyclinginfo.org/bikesafe
- R7 Minnesota Local Road Research Board, *Commuter Bicyclist Behavior and Facility Disruption*
www.lrrb.org/pdf/200715.pdf

APPENDIX C: BICYCLE SAFETY RESOURCE LIST

Evaluators must include the following resource list as an appendix to all BSA reports.

- Pedestrian and Bicycle Information Center
www.bicyclinginfo.org
- NHTSA, Traffic Safety Fact Sheet on bicycle safety
www-nrd.nhtsa.dot.gov/Pubs/811743.pdf
- National Center for Safe Routes to School
www.saferoutesinfo.org
- FHWA, Bicycle Facilities and the MUTCD
www.fhwa.dot.gov/environment/bicycle_pedestrian/guidance/design_guidance/mutcd_bike.cfm
- FHWA, MUTCD Official Rulings
<http://mutcd.fhwa.dot.gov/orsearch.asp>
- FHWA, MUTCD Interim Approvals
http://mutcd.fhwa.dot.gov/res-interim_approvals.htm
- FHWA, Accessibility Guidance for Bicycle and Pedestrian Facilities, Recreational Trails, and Transportation Enhancement Activities
www.fhwa.dot.gov/environment/recreational_trails/guidance/accessibility_guidance/guidance_accessibility.cfm
- FHWA, Bollards, Gates and Other Barriers
www.fhwa.dot.gov/environment/recreational_trails/guidance/accessibility_guidance/bollards_access.cfm
- FHWA, Road Safety Audits: Case Studies
http://safety.fhwa.dot.gov/rsa/case_studies
- FHWA, Bicycle Road Safety Audit Guidelines and Prompt Lists
http://safety.fhwa.dot.gov/ped_bike/tools_solve/fhwasa12018
- FHWA, On-Demand Bicycle Safety Training Courses
www.bicyclinginfo.org/training/ondemand-training.cfm
- California Strategic Highway Safety and Implementation Plans
www.dot.ca.gov/SHSP/
- California Traffic Control Devices Committee
www.dot.ca.gov/hq/traffops/signtech/newtech
- Caltrans Complete Streets
www.dot.ca.gov/hq/tpp/offices/ocp/complete_streets.html
- ITE/FHWA, Traffic Calming: State of the Practice
www.ite.org/traffic/tcstate.asp
- Pedestrian and Bicycle Crash Analysis Tool
www.walkinginfo.org/facts/pbcat/index.cfm
- OTS, Collision Rankings for Cities and Counties
www.ots.ca.gov/Media_and_Research/Rankings/default.asp
- UC Berkeley, Transportation Injury Mapping System
<http://tims.berkeley.edu/index.php>

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Nabors, Dan, et al. 2007. *Pedestrian road safety audit guidelines and prompt lists*. FHWA-SA-07-007. <http://drusilla.hsrb.edu/cms/downloads/PedRSA.reduced.pdf>.

Pedestrian and Bicycle Crash Analysis Tool. www.walkinginfo.org/facts/pbcat/index.cfm?pc/pbcat.htm.

Pedestrian and Bicycle Information Center. *El Cajon's road diet case study*. www.walkinginfo.org/library/details.cfm?id=3967.

Transportation Research Board. 2008. *Multimodal level of service analysis for urban streets*. NCHRP Report 616. http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_616.pdf.

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Zegeer, Charles V., et al. *Safety effects of marked versus unmarked crosswalks at uncontrolled locations*. Report HRT-04-100. www.fhwa.dot.gov/publications/research/safety/04100/04100.pdf.



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BIKE

